OS-299 (5-21)

pennsylvania
DEPARTMENT OF TRANSPORTATION
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TRANSMITTAL LETTER

PUBLICATION:
Publication 218M

DATE:
2/14/2023

SUBJECT:

Standards for Bridge Design
April 2016 Edition
Change 6

INFORMATION AND SPECIAL INSTRUCTIONS:

Incorporate the attached revisions into the April 2016 Edition of Publication 218M.

These revisions introduce the PA 3-Rail Bridge Barrier which replaces the Structure Mounted Guide Rail.

These standards may be used immediately and can be adopted as soon as practical on all new and existing designs without affecting letting schedules and in conjunction with the current Publication 408 Specifications. Projects with T.S.&L. submissions after March 31, 2023 and projects let after October 6, 2023 must incorporate these new standards.

A description of the changes made to the 2016 Edition since Change 5 of November 23, 2022 are listed in the attached multi-sheet Table. On the standards, pink highlighting indicates Change 6 revisions to details and notes.

Comments or questions concerning this Publication may be directed to the Bridge Office.

CANCEL AND DESTROY THE FOLLOWING:

Existing BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work.

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APPROVED FOR ISSUANCE BY:

MICHAEL B. CARROLL
Acting Secretary of Transportation

BY:

Jonathan R. Fleming
Chief Executive
Highway Administration

PUBLICATION #218M
SEPTEMBER 2016 EDITION
CHANGE NO. 6

The major revisions for each Standard Drawing are presented below. Since minor changes are not indicated, it is strongly advised that all recipients thoroughly examine the changes and revisions incorporated in this release.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M	1 of 12	REFERENCE DRAWINGS: • Added BD-609M – PA 3-RAIL BRIDGE BARRIER • Added BC-706M – PA 3-RAIL BRIDGE BARRIER
BD-601M	2 of 12	No Changes.
BD-601M	3 of 12	No Changes.
BD-601M	4 of 12	No Changes.
BD-601M	5 of 12	Added details for the new PA 3-Rail Bridge Barrier.
BD-601M	6 of 12	No Changes.
BD-601M	7 of 12	No Changes.
BD-601M	8 of 12	No Changes.
BD-601M	9 of 12	No Changes.
BD-601M	10 of 12	No Changes.
BD-601M	11 of 12	No Changes.
BD-601M	12 of 12	No Changes.
BD-609M	All Sheets	New Standard for the PA 3-Rail Bridge Barrier.
BD-631M	All Sheets	TITLE BLOCK: Revised “BUREAU OF PROJECT DELIVERY” to “BRIDGE OFFICE” SIGNATURE BLOCKS: • Revised “ACT. DIR. , BUR. OF PROJECT DELIVERY” to “ACTING CHIEF ENGINEER, HIGHWAY ADMIN.”
BD-631M	1 of 2	NOTES: • Note 3: Revised “WORK QUALITY” to “PERFORM WORK”. • Note 10: Revised “STRUCTURE MOUNTED GUIDE RAIL” to “PA 3-RAIL BRIDGE BARRIER”. REFERENCE DRAWINGS: • BD-632M: Removed “STANDARD”

PUBLICATION #218M
SEPTEMBER 2016 EDITION
CHANGE NO. 6

BD-631M	2 OF 2	SECTION B-B THRU CULVERT: • Revised the 3’-6” dimension to “3’-6” MIN. UNLESS NON-ERODIBLE ROCK IS ENCOUNTERED”
BD-632M	1 of 16	DETAIL B: • Revised “FOR BARRIER DETAILS, SEE BD-601M, BD-610M, BD-617M OR BD-618M BASED ON BARRIER TYPES.” to “FOR BARRIER DETAILS, SEE BD-601M, BD-610M, BD-617M OR BD-618M BASED ON BARRIER TYPE. FOR PA 3-RAIL BRIDGE BARRIER DETAILS, SEE SHEET 2.”. NOTES: • Added Note 21: “THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3.”. REFERENCES DRAWINGS: • Added BD-609M – PA 3-RAIL BRIDGE BARRIER • Added BC-706M – PA 3-RAIL BRIDGE BARRIER
BD-632M	2 of 16	Added details for the new PA 3-Rail Bridge Barrier.
BD-632M	3 of 16	TYPICAL CULVERT HEADWALL DETAILS: • Remove “NOTE: FOR TYPICAL WING DETAILS SEE SHEET 6”. NOTE: • Remove Note 1: “1. FOR ADDITIONAL END BARRIER TRANSITION, SEE BD-601M AND BD-624M.
BD-632M	4 of 16	No Changes.
BD-632M	5 of 16	No Changes.
BD-632M	6 of 16	No Changes.
BD-632M	7 of 16	No Changes.
BD-632M	8 of 16	No Changes.
BD-632M	9 of 16	Added details for the new PA 3-Rail Bridge Barrier.
BD-632M	10 of 16	No Changes.
BD-632M	11 of 16	No Changes.
BD-632M	12 of 16	No Changes.

PUBLICATION #218M
SEPTEMBER 2016 EDITION
CHANGE NO. 6

BD-632M	13 of 16	No Changes.
BD-632M	14 of 16	No Changes.
BD-632M	15 of 16	No Changes.
BD-632M	16 of 16	No Changes.
BD-637M	All Sheets	TITLE BLOCK: Revised “BUREAU OF PROJECT DELIVERY” to “BRIDGE OFFICE” SIGNATURE BLOCKS: • Revised “ACT. DIR. , BUR. OF PROJECT DELIVERY” to “ACTING CHIEF ENGINEER, HIGHWAY ADMIN.”
BD-637M	1 of 6	DESIGN NOTES: • Note 10: Revise “SHEET 4” to “SHEET 5”. • Note 16: Revised to “THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3 AND MAY BE USED ON STRUCTURES ON NON-NHS ROADWAYS ONLY. WHERE BRIDGE BARRIERS WITH DESIGNATIONS GREATER THAN TL-3 ARE PROVIDED, A SEPARATE DESIGN IS REQUIRED.”. REFERENCE DRAWINGS: • RC-50M: Revised title to “GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”. • RC-52M: Revised to “RC-52M” to “RC-51M” and “TYPE 2” to “TYPE 31”. • BD-609M: Revised to “PA 3-RAIL BRIDGE BARRIER”. • BC-706M: Revised to “PA 3-RAIL BRIDGE BARRIER”.
BD-637M	2 of 6	No Changes.
BD-637M	3 of 6	No Changes.
BD-637M	4 of 6	No Changes.
BD-637M	5 of 6	No Changes.
BD-637M	6 of 6	No Changes.

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TRANSMITTAL LETTER

PUBLICATION:
Publication 218M

DATE:
11/23/2022

SUBJECT:

Standards for Bridge Design
April 2016 Edition
Change 5

INFORMATION AND SPECIAL INSTRUCTIONS:

Incorporate the attached revisions into the April 2016 Edition of Publication 218M.

These standards may be used immediately and can be adopted as soon as practical on all new and existing designs without affecting letting schedules and in conjunction with the current Publication 408 Specifications. All projects with T.S.&L. submissions after February 28, 2023 must incorporate these new standards.

A description of the changes made to the 2016 Edition since Change 4 of June 1, 2021 are listed in the attached multi-sheet Table. On the standards, light orange highlighting indicates Change 5 revisions to details and notes.

Comments or questions concerning this Publication may be directed to the Bridge Office.

CANCEL AND DESTROY THE FOLLOWING:

Existing BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work.

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APPROVED FOR ISSUANCE BY:

YASSMIN GRAMIAN, P.E.
Secretary of Transportation

BY:

Jonathan R. Fleming
Chief Executive
Highway Administration

Standard	Sheet	Description of Changes
BD-601M	1 of 12	LEGEND: revised all deck slab lap splice lengths given in legend ⑪. *[e-Notification No. 79, dated 6/21/2021]*
		REFERENCE DRAWINGS: Removed BD-609M and BC-706M.
	2 of 12	NOTE 2: Added barrier lap splice lengths for lightweight concrete.
	3 of 12	NOTE 2: Added barrier lap splice lengths for lightweight concrete.
	4 of 12	TYPICAL SIDEWALK DETAIL: Updated barrier name from “Typical” to “42” F-Shape” in call-out.
		ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER DETAIL: Removed dimension of top longitudinal bar spacing for consistency with other barrier details.
		NOTE 2: Added barrier lap splice lengths for lightweight concrete.
	5 of 12	TITLE BLOCK: Replaced PA STRUCTURE MOUNTED GUIDE RAIL with PA 3-RAIL BRIDGE BARRIER in sheet title.
		Removed all details and notes from sheet.
		Added large note clarifying that sheet has been intentionally left blank because the PA Structure Mounted Guide Rail is being discontinued and replacement PA 3-Rail Bridge Barrier still pending.
BD-610M	2 of 10	SECTION A-A: Updated rail tube designation from TS to HSS in call-out.
BD-613M	1 of 7	SOLE AND MASONRY PLATE OREINTATION OPTIONS: Added asterisk (✱) note with consideration to facilitate future replacement of masonry plate.
	5 of 7	▲ NOTE: Added text to note concerning locations of tapped screws to avoid interference with stainless steel sheet.
	6 of 7	▲ NOTE: Added text to note concerning locations of tapped screws to avoid interference with stainless steel sheet.
	7 of 7	▲ NOTE: Added text to note concerning locations of tapped screws to avoid interference with stainless steel sheet.
BD-616M	1 of 2	GENERAL NOTE 1: Removed year of AASHTO LRFD spec. and spelled out DM-4.
		GENERAL NOTE 8: Replaced note with reference to applicable AASHTO and DM-4 articles for the design of the splices
		GENERAL NOTE 9: Replaced the equations and variable definitions with reference to applicable AASHTO article.
		FLANGE SPLICE DETAIL – TYPE 1, VIEW A-A: Added bolt pattern which was inadvertently deleted in previous change.
		WEB SPLICE DETAIL: Added bolt pattern which was inadvertently deleted in previous change.
	2 of 2	WEB SPLICE DETAIL: Added bolt pattern which was inadvertently deleted in previous change.
		FLANGE SPLICE DETAIL – TYPE 2, VIEW X-X: Added bolt pattern which was inadvertently deleted in previous change.
BD-617M	1 of 9	TYPICAL PA TYPE 10M BRIDGE BARRIER ELEVATION: Extended rails to 4″ from end of barrier and dded dimension to and call-out of post CL (both ends).
		VERTICAL V-NOTCH DETAIL: Corrected depiction of bolt and v-notch locations.
		SECTION A-A: Updated rail tube designation from TS to HSS in call-out.
	2 of 9	HORIZONTAL REINFORCEMENT: Revised incompatible 1′-4″ dimension to 1′-2″
BD-620M	1 of 6	LATERAL STABILITY BRACING DESIGN CRITERIA, NOTE 7: Replaced second sentence to indicate design loading of interior girders.
	4 of 6	TOP FLANGE LATERAL BRACING CONNECTIONS: Revised note to change the preferred arrangement from attaching the lateral bracing. *[e-Notification No. 74, dated 9/19/2019]*
BD-622M	1 of 10	Added GENERAL NOTE 3 and TABLE 1 to clarify when safety wings are required.
		TYPICAL PLAN (SKEWS < 75°): Added reference to new Table 1 in safety wing call-out.
	2 of 10	Renumbered TABLE 1 to TABLE 2 and updated all references to table.
		All Details: Made construction joint at bottom of pavement structure or approach slab OPTIONAL.

Standard	Sheet	Description of Changes
BD-622M (cont.)	3 of 10	ELEVATION: Removed section cuts J-J and L-L.
	4 of 10	ELEVATION: Removed section cuts J-J and L-L.
	5 of 10	ELEVATION: Removed section cuts J-J and L-L.
	6 of 10	Deleted SECTION J-J and SECTION L-L.
		All Sections: Made construction joint at bottom of pavement structure or approach slab OPTIONAL.
		SECTION H-H: Corrected bar mark from 404 to 403.
		SECTION K-K: Corrected location of the 404 longitudinal bars to be inside the 407 vertical rebar.
		SECTION M-M: Corrected depicted vertical location of top pair of 404 longitudinal bars.
		Renumbered TABLE 2 to TABLE 3.
	7 of 10	Renumbered TABLE 3 to TABLE 4, TBALE 4 to TABLE 5 and TABLE 5 to TABLE 6 and updated all references to the tables.
	9 of 10	SECTION R-R: Revised detail to add optional construction joint at bottom of pavement structure or approach slab, to terminate rear face batter at this new construction joint, and to provide reinforcement of the concrete between construction joints.
		SECTION R-R: Repurposed the 2” dimension to indicate the location of the upper V-notch instead of the rebar cover to the construction joint.
		TYPICAL ELEVATION and SECTION Q-Q: Relocated the lower V-notch on the wingwall to coincide with the new optional construction joint at the bottom of pavement structure or approach slab.
BD-624M	1 of 4	Added GENERAL NOTE 3 and TABLE 1 to clarify when safety wings are required.
		TYPICAL PLAN (SKEWS < 75°): Added reference to new Table 1 in safety wing call-out.
	2 of 4	Renumbered TABLE 1 to TABLE 2 and updated all references to table.
		All Details: Made construction joint at bottom of pavement structure or approach slab OPTIONAL.
	3 of 4	SECTION R-R: Revised detail to add optional construction joint at bottom of pavement structure or approach slab, to terminate rear face batter at this new construction joint, and to provide reinforcement of the concrete between construction joints.
		SECTION R-R: Repurposed the 2” dimension to indicate the location of the upper V-notch instead of the rebar cover to the construction joint.
		TYPICAL ELEVATION and SECTION Q-Q: Relocated the lower V-notch on the wingwall to coincide with the new optional construction joint at the bottom of pavement structure or approach slab.
BD-627M	8 of 8	PAVEMENT RELIEF JOINT, PLAN and SECTION E-E: Increased pavement relief joint and open joint in barrier from 1′-0″ to 2′-0″ for consistency with revisions to BD-628M.
BD-628M	General	Removed contraction joints as an option for the approach slab longitudinal joints.
		Removed paving notch joint seal details (Detail H on Sheet 10 and Detail J on Sheet 11), notes, and callouts and now reference BC-766M which has updated details.
		Updated terminology from “2-ply bit. paper” to “2-ply asphalt-saturated paper”.
		Increased width of pavement relief joints from 1′-0″ to 2′-0″.
		Removed drain pipes through sleeper slabs beneath neoprene strip seal dams.
	2 of 35	INSTRUCTIONS TO DESIGNER, NOTE 9: Moved “Compression Seals or Inverted V Joint Seals” from the fourth bullet (incidental costs) to the third bullet (separate pay items & quantities)
		INSTRUCTIONS TO DESIGNER, NOTE 21 (new): Added note regarding use of a Geosynthetic Stabilized Bridge Approach as shown on new RC-15M and new Pub. 408, Section 224.
		APPROACH SLAB SELECTION CRITERIA TABLE, NOTE 2: Updated “Bridge Design and Technology Division” to “Bridge Office”.
	3 of 35	PAVING NOTCH FORMING DETAILS: Separated Type 1 and Type 3 approach slabs into two details.

Standard	Sheet	Description of Changes
BD-628M (cont.)	3 of 35 (cont.)	PAVING NOTCH FORMING DETAILS, TYPE 1 APPROACH SLABS: Removed anything specific to Type 3 approach slabs. Replaced “Seal Height Plus 1” callout with “Sawed Seal Groove as shown in BC-766M”. Added MIN. to 1/4″ offset of face of formed opening. Added “Formed Basic Joint” callout.
		PAVING NOTCH FORMING DETAILS, TYPE 2 APPROACH SLABS: Replaced “Seal Height Plus 1” callout with “Sawed Seal Groove as shown in BC-766M”. Added MIN. to 1/4″ offset of face of formed opening. Added “Formed Basic Joint” callout.
		Added PAVING NOTCH FORMING DETAILS, TYPE 3 APPROACH SLABS
		Deleted JOINT PREPARATION NOTES.
	5 of 35	PLAN 2, TYPE 1 AND TYPE 2: In longitudinal joint callouts, removed “optional” and condensed call-out (2 instances). Removed reference to sheet 9 in sleeper slab callout. Revised sleeper slab width from 6′-0″ to 7′-0″ when adjacent to pavement relief joint.
		Renamed DETAIL B to DETAIL A and renamed DETAIL C to DETAIL B.
		DETAIL A – CONSTRUCTION JOINT: Removed details of joint seal and revised callout to reference BC-752M, Detail A.
		DETAIL B – CONTRACTION JOINT: Revised depiction and call-out of joint groove.
		Replaced JOINT SEALING DETAIL with new DETAIL C depicting shallow tooled/sawcut groove.
		NOTE 6: Removed reference to Section 501.2 and subsection (d) of 705.4.
	6 of 35	PLAN 3, TYPE 1 AND TYPE 2: In longitudinal joint callouts, removed “optional” and added contraction joint option (2 instances). Revised sleeper slab width from 6′-0″ to 7′-0″ when adjacent to pavement relief joint.
	7 of 35	PLAN 4, TYPE 1 AND TYPE 2: In longitudinal joint callouts, removed “optional” and added contraction joint option (2 instances). Revised sleeper slab width from 6′-0″ to 7′-0″ when adjacent to pavement relief joint.
		NOTE 4: Revised opening from 1′-0″ to 2′-0″ adjacent to pavement relief joint.
	8 of 35	SECTION E-E: In longitudinal joint callouts, removed “optional” and condensed call-out (4 instances).
	9 of 35	TYPE 1 AND TYPE 4 APPROACH SLAB – DETAIL 3: Increased width of pavement relief joint from 1′-0″ to 2′-0″ and increased width of sleeper slab by 1′-0″.
	10 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 4: Revised joint seal callout to reference BC-766M instead of Detail H. Removed dimensions locating paving notch joint along roadway surface.
		TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 4: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimensions locating paving notch joint along roadway surface.
		OPTIONAL BACKWALL: Moved horizontal dimension of paving notch to below notch.
		Deleted DETAIL H (both for Neoprene Compression Seal and for Inverted V Joint Seal) and DETAIL H NOTES which are now covered on BC-766M.
		Deleted NOTE 3 regarding joint seals which is now covered by BC-766M.
	11 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 5: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimensions locating paving notch joint along roadway surface.
		TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 5: Revised joint seal callout to reference BC-766M instead of Detail J. Removed dimensions locating paving notch joint along the roadway surface.
		Deleted DETAIL J (both for Neoprene Compression Seal and for Inverted V Joint Seal) and DETAIL J NOTE which are now covered on BC-766M.
		Deleted NOTE 2 regarding joint seals which is now covered by BC-766M.
	12 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 6: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface.

Standard	Sheet	Description of Changes
BD-628M (cont.)	12 of 35 (cont.)	TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 6: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface.
	13 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 7: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface.
		TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 7: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface.
	14 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 8: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface.
		TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 8: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface.
	15 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 9: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface.
		TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 7: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface.
	16 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 10: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
		TYPE 2 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 10: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
	17 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 11: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
		TYPE 2 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 11: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
	18 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 12: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
		TYPE 2 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 12: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
	19 of 35	PLAN 1, TYPE 3: Revised sleeper slab width from 8′-6″ to 9′-6″ when adjacent to pavement relief joint. Corrected depiction of joints and rebar in the area of the barriers.
	20 of 35	PLAN 2, TYPE 3: Revised sleeper slab width from 8′-6″ to 9′-6″ when adjacent to pavement relief joint. Corrected depiction of joints and rebar in the area of the barriers.
		NOTE 4: Revised opening from 1′-0″ to 2′-0″ adjacent to pavement relief joint.
	21 of 35	PLAN 3, TYPE 3: Revised sleeper slab width from 8′-6″ to 9′-6″ when adjacent to pavement relief joint. Corrected depiction of joints and rebar in the area of the barriers.
	22 of 35	TYPE 3 AND 5 APPROACH SLAB – DETAIL 13: Removed drain pipe through sleeper slab.
		TYPE 3 AND 5 APPROACH SLAB – DETAIL 14: Removed drain pipe through sleeper slab.
		TYPE 3 AND 5 APPROACH SLAB – DETAIL 15: Increased width of pavement relief joint from 1′-0″ to 2′-0″ and increased width of sleeper slab by 1′-0″. Removed drain pipe through sleeper slab.

Standard	Sheet	Description of Changes
BD-628M (cont.)	23 of 35	TYPE 5 APPROACH SLAB – DETAIL 18: Increased width of pavement relief joint from 1′-0″ to 2′-0″ and increased width of sleeper slab by 1′-0″.
	24 of 35	TYPE 3 APPROACH SLAB – DETAIL 19 and TYPE 3 APPROACH SLAB – DETAIL 20 and ALTERNATE REBAR DETAIL: Revised joint depiction. Revised joint callout to reference Detail S on Sheet 35 instead of Detail H on Sheet 10. Added horizontal paving notch dimension to neoprene sponge and added dimension of neoprene sponge height.
		Deleted NOTE 5.
	25 of 35	TYPE 3 APPROACH SLAB – DETAIL 21 and TYPE 3 APPROACH SLAB – DETAIL 22: Revised joint depiction. Revised joint seal callout to reference Detail S on Sheet 35 instead of Detail H on Sheet 10. Added horizontal paving notch dimension to neoprene sponge and added dimension of neoprene sponge height.
		Deleted NOTE 5.
	26 of 35	PLAN 1, TYPE 4: Revised sleeper slab width from 6′-0″ to 7′-0″ when adjacent to pavement relief joint. Corrected depiction of joint to bend at gutterline.
	27 of 35	PLAN 2, TYPE 4: Revised sleeper slab width from 6′-0″ to 7′-0″ when adjacent to pavement relief joint. Corrected depiction of joint to bend at gutterline.
	27 of 35	PLAN 3, TYPE 4: Corrected depiction of joint to bend at gutterline.
	30 of 35	TYPE 4 APPROACH SLAB – DETAIL 24: Revised joint depiction. Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10.
		Deleted NOTE 5.
	32 of 35	TYPE 4 APPROACH SLAB – DETAIL 26: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Added horizontal paving notch dimension to neoprene sponge and added dimensions of neoprene sponge thickness and height.
		Deleted NOTE 4.
	33 of 35	TOOTH DAM SUPPORT PLAN: Corrected depiction of joint to bend at gutterline.
	34 of 35	Renamed SECTION A-A to SECTION Z-Z and updated references.
	35 of 35	PLAN, TYPE 5: Revised sleeper slab width from 6′-0″ to 7′-0″ when adjacent to pavement relief joint and from 8′-6″ to 9′-6″ at strip seals adjacent to concrete pavement.
		Renamed DETAIL A to DETAIL Q and updated references.
		Renamed DETAIL O to DETAIL S and updated references.
BD-629M	10 of 15	COLUMNS: Revised class of splice from Class C to Class B (2 instances)
	12 of 15	DRILLED SHAFTS: Revised class of splice from Class C to Class B (4 instances)
BD-632M	General	Removed details, depictions and references to the PA Structure Mounted Guide Rail which is being discontinued. Sheets 2 and 9 (formerly 8) are retained but intentionally left blank until the replacement PA 3-Rail Bridge Barrier is released.
		Re-assigned letters to cut sections throughout the standard so they appear in alphabetical order without any duplications. Updated all references to these sections.
		With added sheet 4, renumbered subsequent sheets and updated the total number of sheets in all Title Blocks. Updated all references to the renumbered sheets.
	1 of 16	NOTE 3: Revised language of note requiring conformity with Publication 408.
		NOTE 9: Revised “allowable design foundation pressure” to “factored bearing resistance”.
		NOTE 11: Updated reference from “Sheet 5” to “Sheet 6”.
		NOTE 17: Revised SAFETY WINGS to BARRIER TRANSITION.
		Deleted NOTE 18 regarding Test Level designation of PA Structure Mounted Guide Rail which is being discontinued. Renumbered subsequent notes.
		DESIGN DATA FOR C-I-P BOX CULVERT: Revised Note 4 to clarify that the yield strength is for **plain** welded wire fabric and to increase the required strength.
		DESIGN DATA FOR C-I-P BOX CULVERT: Added Note 5 to provide the required yield strength for **deformed** welded wire fabric.

Standard	Sheet	Description of Changes
BD-632M (cont.)	1 of 16 (cont.)	DESIGN DATA FOR C-I-P BOX CULVERT - INSTRUCTIONS: Added item K to indicate that additional welded wire fabric information is on sheet 5.
		SECTION ALONG CL CULVERT: Removed depiction of structure mounted guiderail and revised barrier curb dimension/callout to a general barrier callout.
		DETAIL B: Removed depiction of structure mounted guide rail, including curb reinforcement, to make detail applicable to multiple barrier types. Removed mention of railings, guide rail, and BD-609M from callout. Removed curb height callout.
		DETAIL B: Removed NOTE referencing sheet 2 for PA Structure Mounted Guide Rail details.
		DETAIL B: Added (VARIES) to wearing course callout and added asterisk (✱) note providing maximum and minimum wearing course thickness at gutterline.
		DETAIL B: Revised headwall reinforcement callout from “#6” to “Headwall reinforcement #6 min. or as required by design”.
		DETAIL B: Removed S7 bars.
		APRON SECTION: Revised “Center of Apron” to “Mid-Height of Slab” in wire fabric call-out. Replaced depth call-out with reference to Legend Note 2. Added “Cutoff Wall” to cutoff wall call-out and added reference to Legend Note 3.
		Renamed existing LEGEND to ABBREVIATIONS.
		Added new LEGEND with three notes.
		REFERENCE DRAWINGS: Removed BD-609M, BC-706M, and BC-739M. Added RC-50M, BD-622M and BD-624M.
	2 of 16	TITLE BLOCK: Removed HEADWALL DETAILS from sheet title.
		Moved TYPICAL HEAD WALL SECTIONS to sheet 3.
		Moved PAVEMENT NOTCH DETAILS to sheet 3.
		Removed PA STRUCTURE MOUNTED GUIDE RAIL ELEVATION ALONG TOP OF SLAB OF CULVERT and SECTION A-A.
		Added large note clarifying that sheet has been intentionally left blank because the PA Structure Mounted Guide Rail is being discontinued and replacement PA 3-Rail Bridge Barrier still pending.
	3 of 16	TITLE BLOCK: Added HEADWALL DETAILS to sheet title.
		Moved TYPICAL HEADWALL ELEVATION – FLARED SAFETY WING, SECTION B-B, and SECTION C-C to new sheet 4.
		Moved TYPICAL HEADWALL SECTIONS here from sheet 3. Replaced E#4 @ 12″ bar callout with barrier callout referencing BD-601M.
		Moved PAVEMENT NOTCH DETAIL here from sheet 3.
	4 of 16 (NEW)	Moved TYPICAL HEADWALL ELEVATION – BARRIER TRANSITION, SECTIONS B-B and SECTION C-C here from sheet 3. Revised elevation title to BARRIER TRANSITION SUPPORT WALL. Revised elevation and Section C-C for new MASH-compliant F-shape barrier end transition. Revised Section B-B to be applicable for multiple barrier types.
		LEGEND: Added legend to supplement the elevation view and Section B-B. Note 4 provides a list of applicable standards for the reinforcement details of different barrier types. Note 5 allows a buried barrier moment slab to be used in lieu of the barrier transition support wall.
	5 of 16 (formerly 4 of 15)	NOTE 2: Updated ASTM references.
		NOTE 5: Revised language of note requiring conformity with Publication 408.
		NOTE 13: Revised note to require waterproofing membrane over entire top of the box culvert.
		NOTES: Added Notes 30, 31 and 32 concerning mud slabs.
		BOX DETAILS – WELDED WIRE FABRIC: Added reference to new Notes 30 - 32 in bedding depth call-out.
		DESIGN DATA: Added required compressive strength of baffles/weirs and mud slabs, revised the yield strength of plain WWF, and added the required yield strength of deformed WWF.

Standard	Sheet	Description of Changes
BD-632M (cont.)	6 of 16 (formerly 5 of 15)	Rearranged details on sheet.
		PRECAST CULVERT WITH PRECAST END SECTION: Replaced cutoff wall depth dimension text with reference to Legend Note 2. Added callout of cutoff wall.
		PRECAST CULVERT WITH PRECAST END SECTION: Added third galvanized connection strap with reference to note on sheet 8. Added reference to BC-798M in connection strap callout.
		PRECAST CULVERT WITH PRECAST END SECTION: Added reference to Note 30 on Sheet 5 to bedding callout.
		PRECAST CULVERT WITH PRECAST END SECTION, NOTES: In second bullet, revised “Rock Protection” to “Scour Protection” and added “Precast” to referenced detail title.
		PRECAST CULVERT WITH PRECAST END SECTION, NOTES: Deleted third bullet (now part of callout in detail) and added new bullet referencing Note 10 on Sheet 8 when slab thicknesses are less than 13″.
		Added LEGEND with Note 2 for depth of cutoff wall and Note 3 regarding alternate cutoff wall.
		KEYED JOINT and SHIP LAP JOINT: Added callouts for “Precast Box” and the “Joint”.
	7 of 16 (formerly 6 of 15)	PRECAST CULVERT WITH CAST-IN-PLACE WINGWALLS - PROFILE: Added scour protection dimension/call-out. Added reference to Legend Note 4 at depression call-out. Shortened cutoff wall call-outs by referencing Legend Notes 2 and 3.
		Added LEGEND with NOTES 2 for depth of cutoff wall, NOTE 3 to reference alternate cutoff wall, and NOTE 4 for streambed material depth on top of rock lining.
		ALTERNATE CUTOFF WALL WITH GROUTED ROCK - DETAIL D (WITHOUT APRON) and DETAIL E (WITHOUT APRON): Revised depiction and call-outs while conceptually remaining the same.
	8 of 16 (formerly 7 of 15)	POST-TENSIONING NOTE 3: In second bullet, added reference to new Note 10 when slab thicknesses are less than 13″.
		POST-TENSIONING NOTES: Added Note 10 concerning the use of a third galvanized tie strap.
		POST-TENSION END SECTION – SPAN > 12 FEET and POST-TENSION END SECTION – SPAN ≤ 12 FEET: Added third galvanized tie strap with reference to new Note 10. Added reference to BC-798M in connection strap callout.
		SECTION H-H and SECTION J-J: Revised chamfer callout to provide minimum and maximum dimensions.
	9 of 16 (formerly 8 of 15)	TITLE BLOCK: Removed HEADWALL DETAILS from sheet title.
		Removed all details, notes, and legend from sheet.
		Added large note clarifying that sheet has been intentionally left blank because the PA Structure Mounted Guide Rail is being discontinued and replacement PA 3-Rail Bridge Barrier still pending.
	11 of 16 (formerly 10 of 15)	TITLE BLOCK: In sheet title revised 4% to 2%.
		DESIGN NOTES: Added Note 12 regarding the PA Fish & Boat Commission’s Alternate Double Weir Baffle design.
	12 of 16 (formerly 11 of 15)	TITLE BLOCK: In sheet title revised 4% to 2%.
		DESIGN NOTES: Added Note 12 referencing Note 12 on Sheet 11 regarding the PA Fish & Boat Commission’s Alternate Double Weir Baffle design.
	14 of 16 (formerly 13 of 15)	TITLE BLOCK: In sheet title revised 4% to 2%.
		DESIGN NOTES: Added Note 12 regarding the PA Fish & Boat Commission’s Alternate Double Weir Baffle design.
	15 of 16 (formerly 14 of 15)	General: Re-designated the squared segment joints as “Standard” and the skewed segment joints as “Alternate” with new Design Note 1 clarifying squared joints as the preference. Reorganized and reworked entire sheet.
		Removed the DESIGN INSTRUCTIONS table.
		Renamed SKEW ANGLE ≥ 75 DEGREES to ALTERNATE SKEWED SEGMENT JOINTS, PLAN VIEW – SKEW ANGLE ≥ 75 DEGREES. Added minimum segment length callout, end section callout, and line for edge of end section.

Standard	Sheet	Description of Changes
BD-632M (cont.)	15 of 16 (formerly 14 of 15) (cont.)	Renamed SKEW ANGLE < 75 DEGREES – OPTION 1 to ALTERNATE SKEWED SEGMENT JOINTS, PARTIAL PLAN VIEW – SKEW ANGLE < 75 DEGREES. Revised to only show one intermediate and one end joint. Added callout for squared wall faces at joints, end section callout, and line for edge of end section.
		Renamed SKEW ANGLE < 75 DEGREES – OPTION 2 to STANDARD SQUARED SEGMENT JOINTS, PLAN VIEW. Added minimum intermediate segment length callout, end section callout, and line for edge of end section.
		ALTERNATE END SEGMENTS DETAIL: Added detail showing layout when two or more segments are used to transition from squared segment joints to a skewed culvert end.
		STAGED CONSTRUCTION JOINT DETAIL: Added detail showing layout when there is a staged construction joint in the culvert.
		ALTERNATE STAGED CONSTRUCTION JOINT DETAIL: Added detail showing layout when two or more segments are used to transition from squared segment joints to a skewed construction joint.
		Renamed DESIGN EXAMPLE – BOX CULVERT (STEEL FORM) – MINIMUM SKEW ANGLE to FABRICATION LIMITATIONS. Split the design example into a notation list and an Example Calculation. Made improvement for clarity and to cover the case of a segment with two skewed faces. Added a simple plan of a segment with two skewed faces.
		DESIGN NOTES: Added four notes to cover segment joint preferences and parameters.
		Added note to allow fabricator to pursue any option shown on standard (not just that shown on contract plans) at the shop drawing stage.
	16 of 16 (formerly 15 of 15)	TYPICAL PLAN, SECTION W-W, and SECTION V-V: Added tie bars to connect the concrete wedges to the end section slab. Added welded wire fabric to the exposed faces of the wedges.
		SECTION W-W: Corrected depiction to be consistent with the Typical Section and Section V-V. Corrected the vertical location of the tie bars. Added dimensioning for tie bar vertical placement. Moved streambed to top of slab dimension to Section V-V.
		SECTION V-V: Removed tie bar callout. Moved dimensioning for tie bar vertical placement to Section W-W. Corrected the vertical location of the tie bars. Added streambed to top of slab dimension.
BD-651M	2 of 2	TENDON AND DIAPHRAGM REQUIREMENTS FOR ADJACENT BOX BEAMS BRIDGES – SPANS UP TO 75′: Revised intermediate diaphragm to be oriented with skew instead of perpendicular to beam
		TENDON AND DIAPHRAGM REQUIREMENTS FOR ADJACENT BOX BEAMS BRIDGES – SPANS GREATER THAN 75′: Revised intermediate diaphragms to be oriented with skew instead of perpendicular to beam; added (TYP.) to maximum void length.
		TENDON AND DIAPHRAGM REQUIREMENTS FOR ADJACENT BOX BEAMS BRIDGES – NOTES: Shortened Note 1 to removed mention of the orientation of diaphragms.
		TENDON AND DIAPHRAGM REQUIREMENTS FOR ADJACENT BOX BEAMS BRIDGES – NOTES: Added Note 4 to indicate that no intermediate diaphragm is required for spans ≤ 40 ft.
BD-653M	1 of 2	Added new CLIPPED FLANGE DETAIL
		NOTE 4: Added note 4 to reference BD-662M for additional clipped flange details
		DETAIL A – WITH PAVING NOTCH AND WITHOUT BACKWALL: Added callout to see newly Added Clipped Flange Detail
		DETAIL C – WITH BACKWALL: Added callout to see newly added Clipped Flange Detail
	2 of 2	ELASTOMERIC BEARING PAD ARRANGEMENTS (I-BEAM AND PA BULB TEE BEAMS): Added callout to see newly added Clipped Flange Detail on sheet 1.
		ALTERNATE BEARING PAD ARRANGEMENTS (I-BEAM AND PA BULB TEE BEAMS): Added callout to see newly added Clipped Flange Detail on sheet 1.
BD-660M	1 of 2	NOTE 5: Added sentence to prohibit the shortening of S7 bars in the acute corner of skewed deck slabs.
BD-661M	1 of 8	ADJACENT BOX BEAMS PLAN-TYPICAL BEAM: Revised intermediate diaphragm to show geometry at skews above and below 75° and to be consistent with BC-775M.

Standard	Sheet	Description of Changes
BD-661M(cont.)	1 of 8 (cont.)	ELEVATION A-A: Tendon pocket and splice chuck pocket added at tendon holes.
	3 of 8	STRAND CONFINEMENT NOTES: Updated referenced DM-4 article.
		STRAND PATTERN NOTES: Added Note 3 and 4 to clarify tendon pocket's and splice chuck pocket's impact on available prestressing strand locations.
BD-666M	1 of 1	General: Updated this standard to better reflect current strengthening practices and to be consistent with current ACI guide and upcoming AASHTO specification changes.
		DESIGN NOTE 5: Updated reference of ACI 440-2R document to the latest 2017 version.
		DESIGN NOTE 8: Removed this note, not necessary. Renumbered subsequent notes.
		GENERAL NOTE 1: Revised A SURFACE MOUNTED to AN EXTERNALLY BONDED.
		Deleted ELEVATION - FLEXURE STRENGTHENING OF ADJACENT BOX BEAM (SPREAD BOX BEAM SIMILAR) and ELEVATION - FLEXURE STRENGTHENING OF I-BEAM.
		Added ELEVATION - TYPICAL FLEXURE STRENGTHENING OF CONCRETE BEAM to replace the two deleted elevations with a new detail that is consistent with current ACI guide and upcoming AASHTO specification changes.
		SECTION - FLEXURE STRENGTHENING OF I-BEAM: Revised to only place CRFP on the underside of the beam, reflecting current strengthening practices. Added callout concerning CRFP orientation, strip width and number of plies.
		SECTION - FLEXURE STRENGTHENING OF BOX BEAM: Revised the CFRP sheet maximum width, indicated that the FRP cut-off dimension to beam edge as per design and added callout concerning CRFP orientation, strips width and number of plies.
		ELEVATION - SHEAR STRENGTHENING OF SPREAD BOX BEAM: Revised U-wrap strip maximum width and updated callout concerning strip spacing, width and number of plies.
BD-667M	General	Throughout the standard, replaced specific lap splice lengths and development lengths with generic callouts so that standard cannot become out-of-date/inconsistent with latest BC-736M.
		With added sheet 4, renumbered subsequent sheets and updated the total number of sheets in all Title Blocks. Updated all references to the renumbered sheets.
	1 OF 10	GENERAL NOTE 8: Updated development and lap lengths to match current requirements by replacing table with reference to BC-736M. Carried this change through numerous details by replacing specific lap length with generic dimension.
		GENERAL NOTES 19 and 24: Revised notes to remove prohibition on adjacent box beams for integral abutments.
		GENERAL NOTE 30: Revised note to instruct designer to place redecking note on integral abutment bridge plans.
	2 of 10	Removed specific lap splice lengths (2 instances) and revised ✱ note to remove specific girder spacing threshold that corresponds to a specific lap splice length.
		PARTIAL SECTION THRU ABUTMENT, CONCRETE GIRDER: In pile cap, added missing reinforcement bars below box beam and removed bars that do not exist at pile location.
		Renamed SECTION G-G to SECTION F-F.
	3 of 10	SHEET TITLE: Added SPREAD BEAMS to sheet title to differentiate from new sheet 4 for adjacent beams.
		Removed specific lap splice lengths and specific dimensions based on lap splice lengths (7 instances)
		SECTION A-A - GIRDER WITH PILE: Revised approach slab tie bar to match how the bar is shown in the details on sheet 8 (formerly 7); removed bar size and spacing from callout.
		SECTION B-B - NO GIRDER, NO PILE: Revised approach slab tie bar to match how the bar is shown in the details on sheet 8 (formerly 7).
		SECTION C-C - GIRDER WITHOUT PILE: Revised approach slab tie bar to match how the bar is shown in the details on sheet 8 (formerly 7).
		SECTION D-D – PILE WITHOUT GIRDER: Revised approach slab tie bar to match how the bar is shown in the details on sheet 8 (formerly 7).

Standard	Sheet	Description of Changes
BD-667M (cont.)	4 of 10 (NEW)	Added new sheet to provide details like those on sheet 3 but specific to adjacent box beams.
	5 of 10 (formerly 4 of 9)	SECTION E-E: Revised shape of the #8 bar at front corner to show the required 90° hook for development instead of a 9″ min. lap splice with the #5 bar.
	6 of 10 (formerly 5 of 9)	Removed specific lap splice lengths (5 instances)
	8 of 10 (formerly	Removed specific development lengths (once in each section) and lap splice lengths (Legend note ⑦).
	7 of 9)	SECTION THRU END DIAPHRAGM BETWEEN BEAMS – GIRDER DEPTH ≥ 2′-0″: Added waterstop to match BD-628M. Added dimension to locate placement of approach slab tie bars. Removed girder to clarify that this detail is applicable between beams.
	8 of 10 (cont.)	SECTION THRU END DIAPHRAGM AT BEAMS – GIRDER DEPTH ≥ 2′-0″: Added waterstop to match BD-628M. Added haunch depth to height of slab. Changed callout to indicate that the additional #8 bar runs entire "width of approach slab", not "length of end diaphragm" which is discontinuous at beams.
		SECTION THRU END DIAPHRAGM BETWEEN BEAMS – GIRDER DEPTH < 2′-0″: Added waterstop to match BD-628M. Generalized dimension that locates approach slab tie bar placement to allow for greater flexibility of deck thickness and avoidance of waterstop. Changed bend angle of approach slab tie bar and reversed direction of its hook for better placement geometry. Removed girder to clarify this detail is applicable between beams.
		SECTION THRU END DIAPHRAGM AT BEAMS – GIRDER DEPTH < 2′-0″: Added waterstop to match BD-628M. Added haunch depth to height of slab.
		DETAIL A: Added waterstop to match BD-628M. Increased minimum clearance from 1″ to 2″ from rear face of integral abutment to approach slab tie bar for consistency with BD-628M.
BD-668M	1 of 3	TYPICAL PRECAST CHANNEL SECTIONS: Revised shape of reinforcement bar projecting out of the beam into the barrier to match revised Bar Detail this sheet. Added 2" CLR. cover call-out on bottom of channel.
		BAR DETAIL: Added 90° hook to end of leg and revised horizontal length of leg prior to bend.
	3 of 3	TYPICAL PRECAST CHANNEL SECTION WITH 42″ VERTICAL WALL CONCRETE BARRIER: Revised shape of reinforcement bar projecting out of the beam into the barrier to match revised Vertical Barrier Bar Detail this sheet. Added 1½″ clearance callout to top and bottom faces of the beam top flange. Added 2" CLR. cover call-out on bottom of channel.
		TYPICAL PRECAST CHANNEL SECTION WITH PA TYPE 10M BRIDGE BARRIER: Revised shape of reinforcement bar projecting out of the beam into the barrier to match revised PA Type 10M Barrier Bar Detail this sheet. Added 1½″ clearance callout to top and bottom faces of the beam top flange. Added 2" CLR. cover call-out on bottom of channel.
		VERTICAL BARRIER BAR DETAIL: Added 90° hook to end of leg and revised horizontal length of leg prior to bend.
		PA TYPE 10M BARRIER BAR DETAIL: Added 90° hook to end of leg and revised horizontal length of leg prior to bend.
BD-697M	5 of 5 (NEW)	Added sheet 5 for GRS-IBS Caution Tape Placement. *[e-Notification No. 77, dated 12/21/2020]*
		NOTE 3: Modified and provided additional caution tape requirements. Removed image of caution tape.

OS-299 (5-21)

pennsylvania
DEPARTMENT OF TRANSPORTATION
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TRANSMITTAL LETTER

PUBLICATION:
Publication 218M

DATE:
6/1/2021

SUBJECT:

Standards for Bridge Design
April 2016 Edition
Change 4

INFORMATION AND SPECIAL INSTRUCTIONS:

Incorporate the attached new standard BD-663M into the April 2016 Edition of Publication 218M.

BD-663M "Concrete Deck Slab Design & Details for Flex Beam Bridges" is being issued to provide a low-cost system for rapid replacement of deficient short span highway bridges.

This new standard may be used immediately.

Comments or questions concerning this Publication may be directed to the Bureau of Project Delivery, Bridge Design and Technology Division.

CANCEL AND DESTROY THE FOLLOWING:

n/a

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APPROVED FOR ISSUANCE BY:

YASSMIN GRAMIAN, P.E.
Secretary of Transportation

BY:

Brian G. Thompson, P.E.
Director, Bureau of Project Delivery,
Highway Administration

OS-299 (7-08)

pennsylvania
DEPARTMENT OF TRANSPORTATION

TRANSMITTAL LETTER

PUBLICATION:

Publication 218M
April 2016 Edition
Change No. 3

DATE:

February 19, 2021

SUBJECT:

Revisions to
Standards for Bridge Design
April 2016 Edition

INFORMATION AND SPECIAL INSTRUCTIONS:

Incorporate the attached revisions into the April 2016 Edition of Publication 218M.

These standards are being issued to address bridge barriers and transitions to bridge barriers that are compliant with the AASHTO Manual for Assessing Safety Hardware (MASH 2016).

These standards may be used immediately and can be adopted as soon as practical on new and existing designs without affecting letting schedules. However, projects with T.S.&L. submissions after July 1, 2021 and projects let after April 1, 2022 shall incorporate these standards.

A description of the changes made to the 2016 Edition since Change 2 dated August 30, 2019 are listed in the attached multi-sheet Table. On the standards, light blue highlighting indicates Change 3 revisions. Highlighting of Change 1 and Change 2 revisions has been omitted for clarity.

Comments or questions concerning this Publication may be directed to the Bureau of Project Delivery, Bridge Design and Technology Division.

CANCEL AND DESTROY THE FOLLOWING:

Existing BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work.

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APPROVED FOR ISSUANCE BY:

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Secretary of Transportation

BY:

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Director, Bureau of Project Delivery,
Highway Administration

PUBLICATION #218M
SEPTEMBER 2016 EDITION
CHANGE NO. 3

The major revisions for each Standard Drawing are presented below. Since minor changes are not indicated, it is strongly advised that all recipients thoroughly examine the changes and revisions incorporated in this release.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M	OLD 1 of 11 NEW 1 of 12	Revised number of sheets from 11 to 12. TITLE BLOCK: • Revised “SHEET 1 OF 11” to “SHEET 1 OF 12”. NOTES: • Added “GENERAL” to “NOTES”. • Note 2: Revised “INTEGRAL SIDEWALKS” to “TYPICAL SIDEWALKS”. • Note 2: Revised “RAISED OR ALTERNATE SIDEWALK” to “RAISED SIDEWALK OR ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER”. • Note 4 – Added CONCRETE COVERS as follows: BARRIER 2½” to 2” and SIDEWALK TOP COVER 2” to 2½”. • Note 4 – BAR SIZE: Revised ③ to ⑱. • Note 4 – Revised BAR SPACINGS: MINIMUM TRANSVERSE REINFORCEMENT SPACING 5” to 5½”. • Note 5: Removed “SEE DESIGN MANUAL PART 4, SECTION D 5.4.3.1.”. • Note 6: Added “SEE DESIGN MANUAL PART 4, SECTION D5.4.3.1”. • Note 7: Revised “SHEETS 9 AND 10” to “SHEETS 10 AND 11”. • Note 10: Revised “SHEET 8” to “SHEET 9”. • Note 16: Revised to “THE 42” AND 45” F-SHAPE CONCRETE BARRIERS AND DECK SLABS, INCLUDING OVERHANGS, ARE DESIGNATED AS MASH TL-5. THE 42” F-SHAPE CONCRETE BARRIER IS DESIGNATED AS TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE HEIGHT OF THE BARRIER BELOW 42”. THE ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-2. THE 50” SPLIT CONCRETE MEDIAN BARRIER AND 50” CONCRETE MEDIAN BARRIER ARE DESIGNATED AS MASH TL-4. THE 32” SPLIT CONCRETE MEDIAN BARRIER, 32” F-SHAPE CONCRETE BARRIER AND 32” CONCRETE MEDIAN BARRIER ARE DESIGNATED AS MASH TL-3.”. • Note 20: Revised “SHEETS 9 AND 10” to “SHEETS 10 AND 11”. • Removed Note 22. • Note 23: Revised note “23” to “22”. Revised “SHEETS 6 AND 7” to “SHEETS 7 AND 8”. • Note 24: Revised note “24” to “23”. • Note 25: Revised note “25” to “24”. Revised to “THE SLAB REINFORCEMENT SHOWN ON SHEETS 10 AND 11 IS APPLICABLE FOR THE BARRIERS SHOWN ON SHEET 2, 3, 4, AND 5, PA TYPE 10M, PA BRIDGE BARRIER AND CONCRETE VERTICAL WALL BRIDGE BARRIERS AND BARRIERS WITH FENCES AND HANDRAILS. REDESIGN OF THE DECK IS REQUIRED WHEN OTHER ATTACHMENTS SUCH AS LIGHT POLES AND SIGN STRUCTURES ARE USED. SEE NOTE 25 FOR MODIFICATIONS REQUIRED WHEN SOUND BARRIERS ARE USED.”
BD-601M (cont.)	OLD 1 of 11 NEW 1 of 12 (cont.)	• Note 26: Revised note “26” to “25”. Revised “SHEET 4” to “SHEET 2”. Revised “WEIGHT OF SOUND BARRIER PLUS THE WEIGHT OF BARRIER AND DECK SLAB IN EXCESS OF THE TYPICAL BARRIER OF ≤ 600LB. PER FOOT OF LENGTH.” to “WEIGHT OF SOUND BARRIER PLUS THE WEIGHT OF BARRIER AND DECK SLAB MINUS 650 LB. MAY NOT BE IN EXCESS 600LB. PER FOOT OF LENGTH.”. Revised “SHEETS 9 AND 10” to “SHEETS 10 AND 11”. • Note 27: Revised note “27” to “26”. Revised note to: · 45” F-SHAPE CONCRETE BARRIER 700 LB./FT, · 42” F-SHAPE CONCRETE BARRIER 650 LB./FT, · 32” F-SHAPE CONCRETE BARRIER 520 LB./FT, · 50” SPLIT CONCRETE MEDIAN BARRIER 750 LB./FT, · 32” SPLIT CONCRETE MEDIAN BARRIER 520 LB./FT, · 50” CONCRETE MEDIAN BARRIER 960 LB./FT, · 32” CONCRETE MEDIAN BARRIER 700 LB./FT, · CONCRETE MOUNTABLE DIVISOR TYPE A 260 LB./FT, TYPE B 280LB.FT, · SPLIT CONCRETE MOUNTABLE DIVISOR TYPE A 130 LB./FT, TYPE B 140 LB./FT, · 42” VERTICAL WALL CONCRETE BARRIER ON ALTERNATE SIDEWALK (WITHOUT RAILING) 530 LB./FT • Note 28: Revised note “28” to “27”. Revised “SHEET 9” to “SHEET 10”. Revised “SHEET 10” to “SHEET 11”. • Note 29: Revised note “29” to “28”. • Note 30: Revised note “30” to “29”. LEGEND: • Revised ① to ⑯. • Revised ② to ⑰. Revised “SHEET 8” to “SHEET 9”. • Revised ③ to ⑱. • Revised ④ to ⑲. Removed “STANDARD DRAWING”. • Revised ⑤ to ⑪. • Revised ⑥ to ④. • Revised ⑦ to ⑳. • Added legend note ①. Moved from sheet 2. • Added legend note ②. Moved from sheet 2. • Added legend note ③. Moved from sheet 2. • Added legend note ⑤. Moved from sheet 2. • Added legend note ⑥. Moved from sheet 2. • Added legend note ⑦. Moved from sheet 4. • Added new legend note: “⑧ FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP. (SEE NOTE 24)”. • Added new legend note: “⑨ FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHEET 2.”. • Added legend note ⑩. Moved from sheet 3. • Added legend note ⑫. Moved from sheet 4.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 1 of 11 NEW 1 of 12 (cont.)	• Added new legend note: "⑬ WHEN A TRAFFIC BARRIER IS MOUNTED ON THE DECK BETWEEN TWO GIRDERS, PROVIDE TOP AND BOTTOM REINFORCEMENT AREA IN THE DECK IN THE BAY WHERE THE BARRIER EXISTS, AT LEAST EQUAL TO THE OVERHANG TOP REINFORCEMENT AREA AS SHOWN ON SHEETS 10 OR 11. IF S7 BARS ARE REQUIRED THEY SHOULD MATCH THE SPACING OF THE S2 BARS ON THE TOP MAT AND S1 BARS ON THE BOTTOM MAT.". • Added new legend note: "⑭ TO BE USED WHEN MATCHING DETAIL IS SPECIFIED IN APPROACH ROADWAY.". • Added new legend note: "⑮ TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS.". • The following notes were transferred to sheet 1 and re-numbered: 8, (also changed reference to see note 24), 9 (changed reference to sheet 2), 10, 11, 12, 14, 15, 16, 17 (also changed reference to sheet 9), 13, 18, 19, 20. TYPICAL SLAB PANEL 1: • Moved detail to sheet 2. • Revised reference note "29" to "28" (2 locations). • Revised reference note "30" to "29" (3 locations). • Revised "SHEET NO. 8" to "SHEET NO. 9". • Revised ① to ⑯ (2 locations). • Revised ② to ⑰. • Revised ④ to ⑲. • Revised ⑤ to ⑪. • Revised ⑥ to ④ (2 locations). • Revised "(SEE SHEETS 9 AND 10)" to (SEE SHEETS 10 AND 11)". • Added ⑧ to "TYPICAL SLAB PANEL 1". • Added "SEE NOTE 27" to "SIMPLE AND CONTINUOUS COMPOSITE POSITIVE MOMENT REGIONS". • Removed "FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP (SEE NOTE 28)". TYPICAL SLAB PANEL 2: • Moved detail to sheet 2. • Revised reference note "29" to "28" (2 locations). • Revised reference note "30" to "29" (3 locations). • Revised "SHEET NO. 8" to "SHEET NO. 9". • Revised ① to ⑯ (3 locations). • Revised ② to ⑰. • Revised ③ to ⑱ (2 locations). • Revised ④ to ⑲. • Revised ⑤ to ⑪. • Revised ⑥ to ④ (2 locations). • Revised ⑦ to ⑳ (2 locations). • Revised "(SEE SHEET 10)" to "(SEE SHEET 11)".

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 1 of 11 NEW 1 of 12 (cont.)	Added: • "CONTRACT DRAWING NOTE: "1. THE FOLLOWING NOTE IS TO BE PLACED ON THE CONTRACT DRAWINGS WHEN THE 42" F-SHAPE CONCRETE BARRIER IS USED: THE 42" F-SHAPE CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE BARRIER HEIGHT BELOW 42"." REFERENCE DRAWINGS: • Removed "BC-718M ALTERNATE RAILING DETALS". • Removed "BC-739M BRIDGE BARRIER TO GUIDE RAIL TRANSITION". • Added "RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS". • Added "BD-622M R.C. ABUTMENTS WITH BACKWALL". • Added "BD-624M R.C. ABUTMENTS WITHOUT BACKWALL".
	OLD 2 of 11 NEW 2 of 12	TITLE BLOCK: • Revised "SHEET 2 OF 11" to "SHEET 2 OF 12". Added "45" F-SHAPE CONCRETE BARRIER DETAIL ⑧⑨". TYPICAL CONCRETE BARRIER DETAIL: • Revised "TYPICAL CONCRETE BARRIER DETAIL" to "42" F-SHAPE CONCRETE BARRIER DETAIL ⑧⑨" • Moved "FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP." to LEGEND Sheet 1. Legend number ⑧. • Added R=1". • Removed "(TYP.)" from ¾" x ¾" CHAMFER and R=1". • Removed 5½" dimension between top bars. • Revised * to ⑦. • Revised "(SEE SHEET 9)" to "(SEE SHEETS 10 AND 11)". ALTERNATE CONCRETE BARRIER DETAIL: • Revised "ALTERNATE CONCRETE BARRIER DETAIL" to "32" F-SHAPE CONCRETE BARRIER DETAIL". • Moved "FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP." to LEGEND Sheet 1. Legend number ⑧. • Added R=1". • Removed "(TYP.)" from ¾" x ¾" CHAMFER and R=1". • Removed 5½" dimension between top bars. • Revised * to ⑦. • Revised "(SEE SHEET 9)" to "(SEE SHEETS 10 AND 11)". TYPICAL SLAB PANEL 1: • Moved from sheet 1. TYPICAL SLAB PANEL 2: • Moved from sheet 1.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 2 of 11 NEW 2 of 12 (cont.)	45” F-SHAPE CONCRETE BARRIER WITH STRUCTURE MOUNTED SOUND BARRIER DETAIL: • Moved from sheet 4. NOTES: • Note 1: Added “AND LEGEND”. SPLIT CONCRETE GLARE SCREEN MEDIAN BARRIER DETAIL: • Moved to sheet 3. • Revised “SPLIT CONCRETE GLARE SCREEN MEDIAN BARRIER DETAIL” to “50” SPLIT CONCRETE MEDIAN BARRIER DETAIL ⑧⑨⑭”. • Removed “TO BE USED WHEN CONCRETE GLARE SCREEN IS SPECIFIED IN APPROACH ROADWAY.”. • Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number ⑧. • Added R=1”. • Removed “(TYP.)” from ¾” x ¾” CHAMFER and R=1”. • Removed $4^{5}/_{8}$” dimension between top bars. • Revised * to ⑦ (2 locations). • Revised “(SEE SHEET 9)” to “(SEE SHEETS 10 AND 11)”. ALTERNATE SPLIT CONCRETE MEDIAN BARRIER DETAIL: • Moved to sheet 3. • Revised “ALTERNATE SPLIT CONCRETE MEDIAN BARRIER DETAIL” to “32” SPLIT CONCRETE MEDIAN BARRIER DETAIL ⑧⑨⑭”. • Removed “TO BE USED WHEN CONCRETE MEDIAN BARRIER IS SPECIFIED IN APPROACH ROADWAY.”. • Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number ⑧. • Added R=1”. • Removed “(TYP.)” from ¾” x ¾” CHAMFER and R=1”. • Removed 6½” dimension between top bars. • Revised * to ⑦ (2 locations). • Revised “(SEE SHEET 9)” to “(SEE SHEETS 10 AND 11)”. TYPICAL OVERHANG REINFORCEMENT: • Moved to sheet 3. LEGEND: • Legend ①: Moved to sheet 1. Added “FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS SHOWN ON BD-622M AND BD-624M.”. • Legend ②: Moved to sheet 1. • Legend ③: Moved to sheet 1. • Removed “④ BEGIN S3 AND S3’ BARS AT LOCATION OF DESIGN SECTION FOR NEGATIVE MOMENT. (SEE SHEET 8 FOR LOCATIONS).”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 2 of 11 NEW 2 of 12 (cont.)	• Legend ⑤: Moved to sheet 1. Revised “SHEET 6” to “SHEET 7”. • Legend ⑥: Moved to sheet 1.
	OLD 3 of 11 NEW 3 of 12	TITLE BLOCK: • Revised “SHEET 3 OF 11” to “SHEET 3 OF 12”. 50” SPLIT CONCRETE MEDIAN BARRIER DETAIL: • Moved from sheet 2. 32” SPLIT CONCRETE MEDIAN BARRIER DETAIL: • Moved from sheet 2. CONCRETE MEDIAN BARRIER DETAIL: • Revised “CONCRETE MEDIAN BARRIER DETAIL” to “32” CONCRETE MEDIAN BARRIER DETAIL ⑧⑨⑭⑮”. • Moved “FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHT 1.” to LEGEND Sheet 1. Legend number ⑨. Revised “SHT 1” to “SHEET 2”. • Removed “TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS AND WHEN CONCRETE MEDIAN BARRIER IS SPECIFIED IN APPROACH ROADWAY.” • Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number ⑧. • Removed 9½” dimension between top bars. • Revised ⑥⑦ to ⑩⑫ (2 locations). • Revised “S7 SEE NOTE 22 ON SHT. 1” to “S7 ③⑬”. CONCRETE GLARE SCREEN BARRIER DETAIL: • Revised “CONCRETE GLARE SCREEN BARRIER DETAIL” to “50” CONCRETE MEDIAN BARRIER DETAIL ⑧⑨⑭⑮”. • Moved “FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHT 1.” to LEGEND Sheet 1. Legend number ⑨. Revised “SHT 1” to “SHEET 2”. • Removed “TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS AND WHEN CONCRETE MEDIAN BARRIER IS SPECIFIED IN APPROACH ROADWAY.” • Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number ⑧. • Revised ⑥⑦ to ⑩⑪ (2 locations). • Revised “S7 SEE NOTE 22 ON SHT. 1” to “S7 ③⑬”. NOTES: • Note 1: Added “AND LEGEND”. • Note 2: Removed. • Note 3: Revised note “3” to “2”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 3 of 11 NEW 3 of 12 (cont.)	SPLIT CONCRETE DIVISOR DETAIL: • Moved to sheet 4. • Revised “SPLIT CONCRETE DIVISOR DETAIL” to “SPLIT CONCRETE MOUNTABLE DIVISOR DETAIL⑧⑨⑭⑮”. • Moved “FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHEET 1.” to LEGEND Sheet 1. Legend number ⑨. Revised “SHEET 1” to “SHEET 2”. • Replaced “MEDIAN” to “TRAFFIC” • Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number ⑧. • Revised * to ⑦ (2 locations). • Revised “SEE NOTE 2” to ⑥. • Revised “(SEE SHEET 9)” to “(SEE SHEETS 10 AND 11)”. CONCRETE DIVISOR DETAIL: • Moved to sheet 4. • Revised “CONCRETE DIVISOR DETAIL” to “CONCRETE MOUNTABLE DIVISOR DETAIL ⑧⑨⑭⑮”. • Moved “FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHEET 1.” to LEGEND sheet 1. Legend number ⑨. Revised “SHEET 1” to “SHEET 2”. • Moved “TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS.” To LEGEND sheet 1. Legend number ⑮. • Replaced “MEDIAN” to “TRAFFIC” • Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number ⑧. • Added S1 and S2. • Moved “UNDERSIDE OF DECK SLAB MAY BE CONSTRUCTED LEVEL.” to LEGEND sheet 1. Legend number ⑦. LEGEND: • Revised ⑥ to ⑩. Moved to sheet 1. • Removed ①②③④⑤⑦.
	OLD 4 of 11 NEW 4 of 12	TITLE BLOCK: • Revised “SHEET 4 OF 11” to “SHEET 4 OF 12”. CONCRETE MOUNTABLE DIVISOR DETAIL: • Moved from sheet 3. SPLIT CONCRETE MOUNTABLE DIVISOR DETAIL • Moved from sheet 3. INTEGRAL SIDEWALK DETAIL: • Revised “INTEGRAL SIDEWALK DETAIL” to “TYPICAL SIDEWALK DETAIL”. • Added “(45” F-SHAPE CONCRETE BARRIER SIMILAR)”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 4 of 11 NEW 4 of 12 (cont.)	• Revised “VEHICULAR WIDTH” to “ROADWAY”. • Revised ⑦ to ⑫. • Revised ⑥ to ⑦. • Added ⑥. RAISED SIDEWALK DETAIL: • Added ⑧⑨. • Removed “TYPICAL OR ALTERNATE” from “SEE SHEET 2 TYPICAL OR ALTERNATE BARRIER REINFORCEMENT)”. • Removed “NOTE: ALTERNATE BARRIER REQUIRES ALTERNATE RAILING, BC-718M”. • Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number ⑧. • Added “42” F-SHAPE CONCRETE BARRIER SHOWN, 32” AND 45” F-SHAPE CONCRETE BARRIER SIMILAR)”. • Revised ⑦ to ⑫. • Revised ⑧ to ⑩ (2 locations). • Revised ⑤ to ⑪ (3 locations). • Revised ⑥ to ⑦. • Added ⑥ to “DRIP NOTCH”. • Added ⑩ to “L”. ALTERNATE SIDEWALK DETAIL: • Revised “ALTERNATE SIDEWALK DETAIL” to “ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER DETAIL ⑧⑨⑭”. • Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number ⑧. • Revised “¾” x ¾” CHAMFER (TYP.)” to R=1” at front face of barrier. • Added “¾” x ¾” CHAMFER” to rear face of barrier. • Removed “WITH OR WITHOUT RAILING” from 3’-6”. • Revised ⑤ to ⑪ (2 locations). • Revised ⑥ to ⑦. • Added ⑥ to “DRIP NOTCH”. NOTES: • Note 1: Added “AND LEGEND”. • Note 2: Removed. • Note 3: Revised note “3” to “2”. LEGEND: • Moved to sheet 1. • Removed ①②③④⑤⑧. • Revised ⑥ to ⑦. Moved to sheet 1. • Revised ⑦ to ⑫.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 4 of 11 NEW 4 of 12 (cont.)	CONCRETE BARRIER WITH STRUCTURE MOUNTED SOUND BARRIER DETAIL: • Moved to sheet 2. • Revised “CONCRETE BARRIER WITH STRUCTURE MOUNTED SOUND BARRIER DETAIL” to “45” F-SHAPE CONCRETE BARRIER WITH STRUCTURE MOUNTED SOUND BARRIER DETAIL ⑧⑨”. • Revised “PROTECTIVE FENCE” to “ALUMINUM” and removed “AND RAILINGS”. • Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number ⑧. • Added “(42” F-SHAPE CONCRETE BARRIER SIMILAR)”. • Added R=1”. • Removed “(TYP.)” from ¾” x ¾” CHAMFER and R=1”. • Revised 2’-8” to 2’-11”. • Revised 3’-6” to 3’-9”. • Added ⑤ to ①. • Revised ⑥ to ⑦. • Added ⑥ to “DRIP NOTCH”. • Revised “(SEE SHEET 9)” to “(SEE SHEETS 9 AND 10)”.
	OLD 5 of 11 NEW 5 of 12	TITLE BLOCK: • Revised “SHEET 5 OF 11” to “SHEET 5 OF 12”. REINFORCEMENT BAR DETAILS: • Added “CURB” to REINFORCEMENT BAR DETAILS. • Added “#4” (2 locations). ANCHOR BOLT BAR DETAIL: • Added “#6”. SECTION A-A: • Added ⑦.
	NEW 6 of 12	New Sheet. F-SHAPE CONCRETE BARRIER TRANSITIONS. Added “F-SHAPE TO F-SHAPE CONCRETE BARRIER TRANSITION”.
	OLD 6 of 11 NEW 7 of 12	TITLE BLOCK: • Revised “SHEET 6 OF 11” to “SHEET 7 OF 12”. BARRIERS, SPLIT GLARE SCREEN AND SPLIT MEDIAN BARRIERS (2 locations): • Revised “BARRIERS, SPLIT GLARE SCREEN AND SPLIT MEDIAN BARRIERS” to “F-SHAPE BARRIERS AND SPLIT MEDIAN BARRIERS” (2 locations). • Revised “CURB” to “GUTTERLINE”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 6 of 11 NEW 7 of 12 (cont.)	BARRIERS WITH SOUND BARRIERS AND ALUMINUM PROTECTIVE BARRIER: • Revised “BARRIERS WITH SOUND BARRIERS AND ALUMINUM PROTECTIVE BARRIER” to “F-SHAPE BARRIERS WITH SOUND BARRIERS AND ALUMINUM PROTECTIVE BARRIER”. • Revised “CURB” to “GUTTERLINE”. ALTERNATE SIDEWALK: • Revised “ALTERNATE SIDEWALK” to “ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER”. • Revised “*DETAIL FOR SIDEWALK WIDTHS OF 8’-0” AND LESS” to “*DETAILED FOR SIDEWALK DEPTH OF 8””. TABLE 1: • Revised “BARRIERS, SPLIT MEDIAN AND SPLIT GLARE SCREEN MEDIAN BARRIERS” to “F-SHAPE BARRIERS AND SPLIT MEDIAN BARRIERS”. TABLE 2: • Added “45” F-SHAPE CONCRETE BARRIER” with corresponding dimensions. • Revised “TYPICAL BARRIER” to “42” F-SHAPE CONCRETE BARRIER”. • Revised “ALTERNATE BARRIER AND SPLIT MEDIAN BARRIER” to “32” F-SHAPE CONCRETE BARRIER AND 32” SPLIT MEDIAN BARRIER”. • Revised “SPLIT GLARE SCREEN MEDIAN BARRIER” to “50” SPLIT CONCRETE MEDIAN BARRIER”.
	OLD 7 of 11 NEW 8 of 12	TITLE BLOCK: • Revised “SHEET 7 OF 11” to “SHEET 8 OF 12”. SPLIT CONCRETE DIVISOR: • Revised “SPLIT CONCRETE DIVISOR” to “SPLIT CONCRETE MOUNTABLE DIVISOR”. CONCRETE DIVISOR: • Revised “CONCRETE DIVISOR” to “CONCRETE MOUNTABLE DIVISOR”. MEDIAN BARRIER: • Revised “MEDIAN BARRIER” to “32” CONCRETE MEDIAN BARRIER”. • Revised “CURB” to “GUTTERLINE”. GLARE SCREEN MEDIAN BARRIER: • Revised “GLARE SCREEN MEDIAN BARRIER” to “50” CONCRETE MEDIAN BARRIER”. • Revised “CURB” to “GUTTERLINE”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 8 of 11 NEW 9 of 12	TITLE BLOCK: • Revised “SHEET 8 OF 11” to “SHEET 9 OF 12”. TABLE 1: MINIMUM HAUNCH THICKNESS: • Removed sheet “1”.
	OLD 9 of 11 NEW 10 of 12	TITLE BLOCK: • Revised “SHEET 9 OF 11” to “SHEET 10 OF 12”. DESIGN NOTES: • Note 3: Revised “25, 26, AND 27” to “24, 25 AND 26”. • Note 4: Removed sheet “1”. • Added note: “5. THE TOP MAT REINFORCING PROVIDED IN THE TABLES ON THIS SHEET CORRELATE WITH THE TRANSVERSE BARS AS THE TOP BAR IN THE MAT.”. • Note 5: Revised note “5” to “6”.
	OLD 10 of 11 NEW 11 of 12	TITLE BLOCK: • Revised “SHEET 10 OF 11” to “SHEET 11 OF 12”. DESIGN NOTES: • Note 3: Revised “25, 26, AND 27” to “24, 25, AND 26”. • Note 4: Revised to “FOR LOCATION OF REINFORCEMENT BARS IN THE BOTTOM MAT, SEE SHEETS 2, 3 AND 4. FOR LOCATION OF DIMENSION “L”, SEE SHEETS 2, 3, AND 4.”. • Added note: “5. THE TOP MAT REINFORCING PROVIDED IN THE TABLES ON THIS SHEET CORRELATE WITH THE LONGITUDINAL BARS AS THE TOP BAR IN THE MAT. THIS CONFIGURATION IS NOT GRAPHICALLY DEPICTED IN THIS STANDARD EXCEPT IT IS SHOWN IN THE DETAIL TITLED “TYPICAL SLAB PANEL 2” ON SHEET 2.”. • Note 5: Revised note “5” to “6”. TABLE 1: • Revised S2 @ S=4’-7” from #5 @9½” to #5 @7½”. TABLE 2: • Revised S2 @ S=10’-9” from #6 @6” to #6 @5½”. TABLE 3: • Revised S2 @ S=4’-3” from #5 @11” to #5 @10½”. • Revised S2 @ S=9’-6” from #6 @6” to #6 @5½”. • Revised S2 @ S=9’-10” from #6 @6” to #6 @5½”. • Revised S2 @ S=10’-2” from #6 @6” to #6 @5½”. • Revised S2 @ S=10’-5” from #6 @6” to #6 @5½”. TABLE 4: • Revised S2 @ S=6’-6” from #5 @9” to #5 @8½”. • Revised S2 @ S=6’-10” from #5 @9” to #5 @7½”. • Revised S_o @ S=8’-10” from 4’-8” to 4’-11”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 11 of 11 NEW 12 of 12	TITLE BLOCK: • Revised “SHEET 11 OF 11” to “SHEET 12 OF 12”. PLAN: • Revised section callout “A-A” to “B-B”. REINFORCEMENT TABLE: • Added “LENGTH 45” F-SHAPE” with corresponding dimensions. • Added “X 45” F-SHAPE” with corresponding dimensions. • Revised “TYPICAL” to “42” F-SHAPE” (2 locations). • Revised “ALTERNATE” to “32” F-SHAPE” (2 locations). NOTES: • Note 1: Revised “WORK QUALITY” to “PERFORM WORK”. SECTION A-A: • Revised “SECTION A-A” to “SECTION B-B”. • Revised “TYP.” to “F-SHAPE”. BARRIER TYPE TABLE: • Added “45” F-SHAPE CONCRETE BARRIER” with corresponding dimensions. • Revised “TYPICAL” to “42” F-SHAPE CONCRETE BARRIER”. • Revised “ALTERNATE” to “32” F-SHAPE CONCRETE BARRIER”.
BD-610M	OLD 1 of 17 NEW 1 of 10	Total number of sheets revised from 17 to 10. TITLE BLOCK: • Revised “BARRIER DETAILS” to “BARRIER DETAILS – 1”. • Revised “SHT 1 OF 17” to “SHT 1 OF 10”. NOTES: • Note 1: Revised to “THE PA BRIDGE BARRIER IS DESIGNATED AS MASH TL-5.” • Note 2: Revised “WORK QUALITY” to “PERFORM WORK”. • Note 5: Removed “SHEET 2”. • Note 8: Removed. • Note 9: Revised note “9” to “8”. • Note 10: Revised note “10” to “9”. Added “MASH” to TL-5 BARRIER RATING. • Added note – “10. PROVIDE POST SPACINGS ON THE CONTRACT PLANS.”. • Added note – “11. FOR DETAILS OF THE PA BRIDGE BARRIER ON SUBSTRUCTURE UNITS, SEE THE APPROPRIATE SUBSTRUCTURE DETAILS AND REINFORCEMENT IN BD-622M AND BD-624M. FOR DETAILS AT THE END OF BARRIER, SEE SHEETS 3 AND 4.”. • Added new note – “12. FOR SECTION A-A, SEE SHEET 2.”. • Added new note – “13. PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL SHEET 2.”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 1 of 17 NEW 1 of 10 (cont.)	TYPICAL PA BRIDGE BARRIER ELEVATION: • Revised elevation for new MASH Barrier and New MASH End Transition. • Removed “(WITHOUT INLET PLACEMENT SHOWN; WITH INLET PLACEMENT SIMILAR, SEE SHEET 11)”. • Removed “RAILING” in LEGEND ① (2 locations). • Added “③ PLACE 1-#4 VERTICAL BAR AT CL POST.”. • Added “④ WITHIN 10’-0” ON BOTH SIDES OF AN OPEN JOINT IN THE BARRIER WALL, REDUCE SPACING OF REINFORCEMENT TO #4 @ 12” MAX. PLACE REINFORCEMENT 3” FROM ANY JOINT.”. SECTION A-A: • Moved to sheet 2. • Added “BARRIER WALL” to 1’-6”. • Revised “RAILING POST W 8 x 31” to “POST W 8 x 31”. • Added 1” horizontal front face dimension. • Revised “ANCHOR PLATE ¼”x11½”x1’-3”” to “10¼”x1’-3”x¼” ANCHOR PLATE”. • Revised “③” to “④”. • Added “WALL” to note ④. • Moved ④ to LEGEND. • Added “TRANSVERSE REINFORCEMENT SHOWN ON TOP. LONGITUDINAL REINFORCEMENT SIMILAR.”. • Removed “SHEET 3” from BC-713M Notes (3 locations). • Added “CLR” To 2½”. • Added “CLR” to 3”. DETAIL A: • Moved to sheet 2. • Added “OR ¾” x ¾” CHAMFER” to 1”R. • Added 1’-6” dimension. REFERENCE DRAWINGS: • Removed “BC-712M THRIE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION”. • Added “BD-667M INTEGRAL ABUTMENT”. • Revised “GUIDE RAIL TRANSITION AT END OF STRUCTURE” to “GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”.
	OLD 2 of 17	Removed sheet.
	NEW 2 of 10	New sheet. BARRIER DETAILS – 2. SECTION A-A: • Moved from sheet 1. DETAIL A: • Moved from sheet 1. Added “CLEAR ROADWAY WIDTH DETAIL”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	NEW 2 of 10 (cont.)	Added “VERTICAL V-NOTCH DETAIL”. Added “LEGEND”. Added “NOTES”.
	OLD 3 of 17	Removed sheet.
	NEW 3 of 10	New sheet. END OF BARRIER DETAILS – 1. Added “PA BRIDGE BARRIER END TRANSITION ELEVATION”. Added “SECTION B-B” Added “HORIZONTAL REINFORCEMENT”. Added “SECTION C-C” Added “HORIZONTAL REINFORCEMENT”. Added “LEGEND”. Added “NOTES”.
	OLD 4 of 17	Removed sheet.
	NEW 4 of 11	New Sheet. END OF BARRIER DETAILS – 2. Added “SECTION D-D” Added “VERTICAL REINFORCEMENT”. Added “SECTION E-E” Added “SECTION F-F”. Added “LEGEND”. Added “NOTES”.
	OLD 5 of 17	Removed sheet.
	OLD 6 of 17	Removed sheet.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 7 of 17	Removed sheet.
	OLD 8 of 17	Removed sheet.
	OLD 9 of 17	Removed sheet.
	OLD 10 of 17	Removed sheet.
	OLD 11 of 17	Removed sheet.
	OLD 12 of 17 NEW 5 of 10	TITLE BLOCK: • Revised “MISCELLANEOUS DETAILS” to “SIDEWALK DETAILS”. • Revised “SHT 12 OF 17” to “SHT 5 OF 10”. TYPICAL SIDEWALK DETAIL: • Revised “BARRIER” to “1’-6” BARRIER WALL”. • Added “1.5% SLOPED TOWARD BARRIER (BRIDGE OVER ROADWAY) ⑩”. • Added “1.5% SLOPED AWAY FROM BARRIER (OTHER CONDITIONS)”. • Removed “3’-6” MIN.”. • Added “PEDESTRIAN RAILING, SIDEWALK PROTECTIVE FENCE OR BARRIER. FOR ADDITIONAL DETAILS, SEE BC-701M, BC-711M, AND BC-716M.”. • Added ⑨. RAISED SIDEWALK DETAIL: • Revised “BARRIER” to “1’-6” BARRIER WALL”. • Added “1”∅ SIDEWALK RAIL ROD (TYP.), FOR DETAILS, SEE BC-713M”. • Added “1.5% SLOPED TOWARD BARRIER (BRIDGE OVER ROADWAY) ⑩”. • Added “1.5% SLOPED AWAY FROM BARRIER (OTHER CONDITIONS)”. • Removed “3’-6” MIN.”. • Added “PEDESTRIAN RAILING, SIDEWALK PROTECTIVE FENCE OR BARRIER. FOR ADDITIONAL DETAILS, SEE BC-701M, BC-711M, AND BC-716M.”. • Added ⑨. ALTERNATE SIDEWALK DETAIL: • Added “BARRIER WALL” to 1’-6”. • Added “ROADWAY”. • Added “1”∅ SIDEWALK RAIL ROD (TYP.) FOR DETAILS, SEE BC-713M”. • Added “TRANSVERSE REINFORCEMENT SHOWN ON TOP. LONGITUDINAL REINFORCEMENT ON TOP SIMILAR.”. • Added “1” RAD.”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 12 of 17 NEW 5 of 10 (cont.)	• Added 1” horizontal dimension at front face sidewalk. • Added 0”. • Added ⑨. TABLE 1: • Added title, “VERTICAL REINFORCEMENT DIMENSION TABLE”. REINFORCEMENT BAR NOTES: • Note 4: Removed. NOTES: • Note 1: Revised “SHEET 1” to “SHEET 2”. Added “LEGEND”.
	OLD 13 of 17 NEW 6 of 10	TITLE BLOCK: • Revised “MISCELLANEOUS DETAILS” to “ADJACENT BOX BEAM DETAILS – 1”. • Revised “SHT 13 OF 17” to “SHT 6 OF 10”. 36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER: • Added “BARRIER WALL” to 1’-6”. • Revised ③ to ⑬. • Revised ② to ⑫. 36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING SIDEWALK: • Added “TYPICAL” to title. • Revised ① to ⑪. • Revised “BARRIER” to “1’-6” BARRIER WALL”. • Revised ③ to ⑬. • Revised “**” to ⑩. • Removed 3’-6” dimension. • Removed “** DRAIN RUNOFF THROUGH CONCRETE CURB WITH CURB DRAIN. SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1” ABOVE GUTTERLINE IN INCREASED COVER FOR TRANSVERSE DECK REINFORCEMENT BARS.”. LEGEND: • Revised ① to ⑪. • Revised ② to ⑫. • Revised ③ to ⑬. • Added “⑩ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1” ABOVE GUTTERLINE ELEVATIONS. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.”. NOTES: • Note 1: Revised “SHEET 1” to “SHEET 2”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 14 of 17 NEW 7 of 10	TITLE BLOCK: • Revised “MISCELLANEOUS DETAILS” to “ADJACENT BOX BEAM DETAILS – 2”. • Revised “SHT 14 OF 17” to “SHT 7 OF 10”. 36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK: • Added “BARRIER WALL” to 1’-6”. • Removed “W8x31”. • Revised ① to ⑬. • Revised ② to ⑭ (2 locations). LEGEND: • Revised ① to ⑬. • Revised ② to ⑭. NOTES: • Note 1: Revised “SHEET 1” to “SHEET 2”. • Note 2: Revised note “2” to “4”. • Note 3: Revised note “3” to “2”. • Note 4: Revised note “4” to “3”
	OLD 15 of 17 NEW 8 of 10	TITLE BLOCK: • Revised “MISCELLANEOUS DETAILS” to “BOX CULVERT DETAILS”. • Revised “SHT 15 OF 17” to “SHT 8 OF 10”. AT GRADE SECTION AT C.I.P. R.C. CULVERT: • Added “BARRIER WALL” to 1’-6”. • Revised “#5 @ 9” ②” to “#5 @ 9” ”. AT GRADE SECTION AT PRECAST R.C. CULVERT: • Removed linework of wing cutoff wall and bedding. • Added “BARRIER WALL” to 1’-6”. • Removed ③. • Revised ② to ⑯. • Revised ① to ⑮. • Revised vertical reinforcement details. • Added “MECHANICAL SPLICE AS PER PUBLICATION 35 BULLETIN 15 SECTION 1002.2(c). (TYP.)”. VERTICAL REINFORCEMENT: • Moved “CAST IN PLACE CULVERT” to title. • Removed “(FOR DIMENSIONS “B” & “C”, SEE TABLE 1)”. • Revised 7¾” to 6¾”. • Revise 4” to 5”. • Revised “RAD. 2” to “RAD. 2½” ”. • Revised “C” to “1’-1¾” + T”. • Revised “B” to “1’- $4^{7}/_{8}$” + T”. • Added #5.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 15 of 17 NEW 8 of 10 (cont.)	NOTES: • Note 1: Revised “SHEET 1” to “SHEET 2”. Removed “VERTICAL REINFORCEMENT – PRECAST CULVERT”. Removed “TABLE 1”. Added “PRECAST CULVERT VERTICAL REINFORCEMENT”. Added “LEGEND”: • Revised ① to ⑮. Revised 2’-0” MAX. to 11” MAX. • Revised ② to ⑯. • Removed ③.
	OLD 16 of 17 NEW 9 of 10	TITLE BLOCK: • Revised “SHT 16 OF 17” to “SHT 9 OF 10”. SECTION J-J: • Revised to show new MASH barrier end transition. • Revised “#6 @ 8” MAX.” to “#8 @ 6” MAX.”. • Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEET 3 AND 4)”. SECTION L-L: • Revised to show new MASH barrier end transition. • Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEET 3 AND 4)”. TYPICAL PLAN • Revised to show new MASH barrier end transition. • Revised 3’-8” to 3’-3¾”. • Revised “FOR RAILING POST SPACING SEE BC-713M” to “FOR POST SPACING SEE SHEET 1”. • Added “WINGWALL” to 1’-8¼”. • Added “1'-6" BARRIER WALL”. • Revised ③ to ⑳. • Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEET 3 AND 4)”. DETACHED WINGWALL PLAN: • Revised 3’-8” to 3’-3¾”. • Revised “FOR RAILING POST SPACING SEE BC-713M” to “FOR POST SPACING SEE SHEET 1” (2 locations). • Added “WINGWALL” to 1’-8¼”. • Added “1'-6" BARRIER WALL”. • Revised ③ to ⑳. • Revised ④ to ⑲. • Revised ①② to ⑰⑱. • Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEET 3 AND 4)”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 16 of 17 NEW 9 of 10 (cont.)	LEGEND: • Revised ① to ⑰. • Revised ② to ⑱. • Removed "③ SECTION SHOWN WITHOUT INLET PLACEMENT. WHEN AN INLET IS PLACED AT THE END OF A BARRIER WALL, PROVIDE A TRANSITION TO MATCH THE CONCERT INLET CURB. FOLLOW DETAILS ON SHEETS 3 AND 11 FOR BARRIER WALL AND BEVEL DETAILS.". • Revised ④ to ⑲. • Added "⑳ SECTION SHOWN WITHOUT CURB, WITH CURB FOLLOW DETAILS ON SHEET 3 AND 4.". SECTION K-K: • Revised section to show approach slab and corresponding notes. • Added Barrier Wall outline. • Added "BARRIER WALL" to 1'-6" dimension. • Added "MIN." to 2'-2". • Added "OPTIONAL CONSTR. JOINT". • Added "SEE BD-628M SHEET 35, SECTION B-B FOR ADDITIONAL DETAILS.". • Added "1" CLOSED CELL NEOPRENE SPONGE". • Added "APPROACH SLAB". • Revised "#4 BARRIER WALL REINFORCEMENT SEE SHEET 1 FOR SPACING" to "#4 BARRIER WALL REINFORCEMENT SEE SHEET 3 AND 4 FOR SPACING AND DETAILING". SECTION N-N: • Revised section to show approach slab and corresponding notes. • Added Barrier Wall outline. • Added "BARRIER WALL" to 1'-6" dimension. • Added "MIN." to 2'-2". • Added "OPTIONAL CONSTR. JOINT". • Added "SEE BD-628M SHEET 35, SECTION B-B FOR ADDITIONAL DETAILS.". • Added "1" CLOSED CELL NEOPRENE SPONGE". • Added "APPROACH SLAB". • Revised "#4 BARRIER WALL REINFORCEMENT SEE SHEET 1 FOR SPACING" to "#4 BARRIER WALL REINFORCEMENT SEE SHEET 3 AND 4 FOR SPACING AND DETAILING". NOTES: • Added note – "2. FOR ADDITIONAL NOTES, SEE SHEET 1.". Removed "LONGITUDINAL REINFORCEMENT". Removed "VERTICAL CURB REINFORCEMENT". Removed "REINFORCEMENT BAR NOTES".

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 17 of 17 NEW 10 of 10	TITLE BLOCK: • Revised "SHT 17 OF 17" to "SHT 10 OF 10". PLAN: • Revised section marks "R-R" to "G-G". ELEVATION: • Added "PUB. 408". SECTION R-R: • Revised SECTION R-R to "SECTION G-G". • Revised "1½" MIN." to "2" MIN.". • Added ½" horizontal dimension. NOTES: • Note 1: Revised "WORK QUALITY" to "PERFORM WORK". • Added Note 10 – "FOR LIGHTING POLE LOCATIONS WITHIN A SPAN, THE LUMINAIRE DEFLECTION MUST BE EVALUATED FOR DYNAMIC EFFECTS.".
BD-615M	ALL	Standard Discontinued
BD-617M	OLD 1 of 16 NEW 1 OF 9	Total number of sheets revised from 16 to 9. TITLE BLOCK: • Revised "SHT 1 OF 16" to "SHT 1 OF 9". NOTES: • Note 1: Revised to "THE PA TYPE 10M BARRIER IS DESIGNATED AS MASH TL-4." • Note 2: Revised "WORK QUALITY" to "PERFORM WORK". • Note 5: Removed. • Added note – "5. USE f'c = 3.5 KSI CLASS AA CONCRETE FOR BARRIER WALL.". • Note 8: Revised "MEETING THE REQUIREMENTS OF SECTION 705, PUBLICATION 408" to "AS SPECIFIED IN PUBLICATION 408, SECTION 705.8(b)". • Note 14: Added "SEE BC-709M, SHEET 1, FOR RAIL JOINT DETAILS.". • Note 15: Revised "FOUR" to "THREE". Removed "RAISED SIDEWALK 10M" barrier weight. Revised the following barrier weights: TYPICAL 10M 375 LB./FT. SIDEWALK 10M 385 LB./FT. ALT. SIDEWALK 10M 385 LB./FT. • Added new note – "16. FOR DETAILS OF THE PA TYPE 10M BRIDGE BARRIER ON SUBSTRUCTURE UNITS, SEE THE APPROPRIATE SUBSTRUCTURE DETAILS AND REINFORCEMENT IN BD-622M AND BD-624M. FOR DETAILS AT THE END OF BARRIER, SEE SHEET 2 & 3.". • Added new note – "17. PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL THIS SHEET.".

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 1 of 16 NEW 1 OF 9 (cont.)	TYPICAL PA TYPE 10M BRIDGE BARRIER ELEVATION: • Revised elevation for new MASH Barrier and New MASH End Transition. • Removed "(WITHOUT INLET PLACEMENT SHOWN; WITH INLET PLACEMENT SIMILAR, SEE SHEET 10)". • Removed "RAILING" in ① (2 locations). Moved note to LEGEND. • Moved note ② to LEGEND. REINFORCEMENT BAR NOTES: • Note 4: Revised note to "EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).". DETAIL A: • Added 1'-6" horizontal dimension. • Revised 1'-1" to "1'-5" BARRIER WALL". VERTICAL REINFORCEMENT: • Revised 7 ¾" to 11 ½". • Revised 5" to 9". • Revised 11" to 1'-3". • Removed ¼" slope in top of bar. Make horizontal. SECTION A-A: • Revised 2'-11" to 3'-3" barrier height. • Revised 1'-1" to "1'-5" BARRIER WALL". • Added "BARRIER WALL" to 1'-6". • Added $6^{5}/_{8}$" horizontal dimension. • Added 4" horizontal dimension. • Removed "RAILING" from W 8 x 18 POST. • Added "CLIPPED" to HARDENED WASHERS. • Added a second row of anchor bolts and replaced anchor bar with an anchor plate. • Revised "ANCHOR BAR 2"X$^{3}/_{8}$"X6" (GALVANIZED) SECURED WITH DOUBLE NUTS" to "6"X6"X ¼" ANCHOR PLATE (GALVANIZED) SECURED WITH DOUBLE NUTS, (SEE BC-709M)" • Added 2 ½" CLR. (in 2 locations). Added "LEGEND". Added "VERTICAL V-NOTCH DETAIL". REFERENCE DRAWINGS: • Removed "BC-708M THRIE-BEAM TO PA TYPE 10M BARRIER TRANSITION CONNECTION". • Added "RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS". • Added "RC-51 TYPE 31 STRONG POST GUIDE RAIL".
	OLD 2 of 16	Removed Sheet.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 3 of 16	Removed Sheet.
	NEW 2 of 9	New sheet added. END OF BARRIER DETAILS – 1. Added "PA TYPE 10M BARRIER END TRANSITION ELEVATION". Added "SECTION B-B". Added "SECTION C-C". Added "HORIZONTAL REINFORCEMENT". Added "CLEAR ROADWAY WIDTH DETAIL". Added "THRIE-BEAM GUIDE RAIL RECESS AND BOLT HOLE DETAIL". Added "NOTES". Added "LEGEND".
	OLD 4 of 16	Removed Sheet.
	NEW 3 of 9	New sheet added. END BARRIER DETAILS – 2. Added "SECTION D-D". Added "VERTICAL REINFORCEMENT". Added "SECTION E-E". Added "SECTION F-F". Added "NOTES". Added "LEGEND".
	OLD 5 of 16	Removed Sheet.
	OLD 6 of 16	Removed Sheet.
	OLD 7 of 16	Removed Sheet.
	OLD 8 of 16	Removed Sheet.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 9 of 16	Removed Sheet.
	OLD 10 of 16	Removed Sheet.
	OLD 11 of 16 NEW 4 of 9	TITLE BLOCK: • Revised “SHT 11 OF 16” to “SHT 4 OF 9”. INTEGRAL SIDEWALK DETAIL: • Revised “INTEGRAL SIDEWALK DETAIL” to “TYPICAL SIDEWALK DETAIL”. • Revised “3’-6” MIN.” to “3’-10” MIN.”. • Added 3’-3” vertical dimension. • Added “1’-5” BARRIER WALL”. • Revised “VEHICULAR WIDTH” to “ROADWAY”. • Revised “BARRIER” to “1’-6” BARRIER WALL”. • Added ⑧. • Added “1.5% SLOPED TOWARD CONC. BARRIER (BRIDGE OVER ROADWAY) ⑦”. • Added “1.5% SLOPED AWAY FROM CONC. BARRIER (OTHER CONDITIONS)”. • Added a second row of anchor bolts and replaced anchor bar with an anchor plate. ALTERNATE SIDEWALK DETAIL: • Revised 3’-6” to 3’-10”. • Revised 2’-11” to 3’-3”. • Revised 1’-1” to “1’-5” BARRIER WALL”. • Revised “VEHICULAR WIDTH” to “ROADWAY”. • Revised “BARRIER” to “1’-6” BARRIER WALL”. • Added a second row of anchor bolts and replaced anchor bar with an anchor plate. • Added ⑧. Added “NOTES”. Added “LEGEND”. Removed “RAISED SIDEWALK DETAIL”.
	OLD 12 of 16 NEW 5 of 9	TITLE BLOCK: • Revised “SHT 12 OF 16” to “SHT 5 OF 9”. 36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER: • Revised 2’-11” to 3’-3”. • Revised 1’-1” to “1’-5” BARRIER WALL”. • Revised “VEHICULAR WIDTH” to “ROADWAY”. • Revised “BARRIER” to “1’-6” BARRIER WALL”. • Added a second row of anchor bolts and replaced anchor bar with an anchor plate.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 12 of 16 NEW 5 of 9 (cont.)	• Added “2 ½” CLR.”. • Revised ② to ⑩. • Revised ③ to ⑪. 36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING SIDEWALK: • Added “TYPICAL” to title. • Revised “3’-6” to “3’-10”. • Added 3’-3” vertical dimension. • Added “1’-5” BARRIER WALL”. • Revised “VEHICULAR WIDTH” to “ROADWAY”. • Revised “BARRIER” to “1’-6” BARRIER WALL”. • Revised ** to ⑦. • Removed “** DRAIN RUNOFF THROUGH CONCRETE CURB WITH CURB DRAIN. SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1” ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR TRANSVERSE DECK REINFORCEMENT BARS.”. • Added a second row of anchor bolts and replaced anchor bar with an anchor plate. • Added “2 ½” CLR.”. • Removed 2’-11” vertical dimension. • Revised ③ to ⑪. • Revised ① to ⑨. • Removed “(RAISED SIDEWALK DETAIL SIMILAR)”. VERTICAL REINFORCEMENT (left): • Removed ¼” slope in top of bar. Made top of bar horizontal. • Revised 11¼” to 1’-3”. • Revised 4¼” to 8”. • Revised 8” to 12”. • Revised 11” to 1’-3”. VERTICAL REINFORCEMENT (right): • Removed ¼” slope in top of bar. Made top of bar horizontal. • Revised 11” to 1’-3”. • Revised 8” to 12”. • Revised 8¼” to 12”. LEGEND: • Revised ① to ⑨. • Revised ② to ⑩. • Revised ③ to ⑪. • Added “⑦ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN THE SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1” ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.”. Added “NOTES”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 13 of 16 NEW 6 of 9	TITLE BLOCK: • Revised “SHT 13 OF 16” to “SHT 6 OF 9”. 36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK: • Revised “3’-6” to “3’-10”. • Added 3’-3” vertical dimension. • Revised 1’-1” to “1’-5” BARRIER WALL”. • Revised “VEHICULAR WIDTH” to “ROADWAY”. • Revised “BARRIER” to “1’-6” BARRIER WALL”. • Added a second row of anchor bolts and replaced anchor bar with an anchor plate. • Added “2 ½” CLR.”. • Removed “W8x18”. • Revised ① to ⑪. • Added ⑫ (2 locations). VERTICAL REINFORCEMENT: • Removed ¼” slope in top of bar. Made top of bar horizontal. • Revised 11” to 1’-3”. • Revised 10¼” to 1’-1½”. • Revised 10½” to 1’-1½”. LEGEND: • Revised ① to ⑪. • Added “⑫ FOR DIMENSIONS, SEE BD-601M, SHEET 4.”. Added “NOTES”.
	OLD 14 of 16 NEW 7 of 9	TITLE BLOCK: • Revised “SHT 14 OF 16” to “SHT 7 OF 9”. SECTION – C.I.P.: • Added “BARRIER WALL” to 1’-6”. • Revised 2’-11” to 3’-3”. • Revised 1’-1” to “1’-5” BARRIER WALL”. • Added a second row of anchor bolts and replaced anchor bar with an anchor plate. SECTION – PRECAST: • Added “BARRIER WALL” to 1’-6”. • Revised 2’-11” to 3’-3”. • Revised 1’-1” to “1’-5” BARRIER WALL”. • Added a second row of anchor bolts and replaced anchor bar with an anchor plate. • Removed “1’-0” BEDDING MINIMUM”. OPTIONAL ANCHOR BOLT DETAIL: • Revised 1’-4” to 1’-8”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 14 of 16 NEW 7 of 9 (cont.)	C.I.P. CULVERT: • Removed ¼” slope in top of bar. Made top of bar horizontal. • Revised 11” to 1’-3”. • Revised 9” to 1’-1”. • Revised 9¼” to 1’-1”. PRECAST CULVERT VERTICAL REINFORCEMENT: • Revised 11” to 1’-3” (2 locations). • Revised 2½” to 3” (2 locations). NOTES: • Added note – “3. FOR ADDITIONAL NOTES, SEE SHEET 1.”.
	OLD 15 of 16 NEW 8 of 9	TITLE BLOCK: • Revised “SHT 15 OF 16” to “SHT 8 OF 9”. TYPICAL ELEVATION: • Added a second row of anchor bolts and replaced anchor bar with an anchor plate. SECTION J-J: • Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEETS 2 AND 3)”. • Revised “#6 @ 8” MAX.” to “#8 @ 6” MAX.”. SECTION L-L: • Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEETS 2 AND 3)”. TYPICAL PLAN: • Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEETS 2 AND 3)”. • Revised barrier end for new MASH barrier end transition. • Revised ③ to ⑯. • Removed “1’-5 ¾” WITHOUT INLET PLACEMENT 2’-8” WITH INLET PLACEMENT” to 3’-3”. • Added “STEEL I-GIRDERS SHOWN; P/S CONCRETE GIRDERS SIMILAR. PIPE PILES SHOWN; H PILES SIMILAR.”. DETACHED WINGWALL PLAN: • Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEETS 2 AND 3)”. • Revised barrier end for new MASH barrier end transition. • Revised ③ to ⑯. • Removed “1’-5 ¾” WITHOUT INLET PLACEMENT 2’-8” WITH INLET PLACEMENT” to 3’-3”. • Revised ④ to ⑮. • Revised ①② to ⑬⑭.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 15 of 16 NEW 8 of 9 (cont.)	SECTION K-K: • Revised “VARIES” to “1’-6” BARRIER WALL”. • Revised “#4 CURB REINFORCEMENT SEE SHEET 1 FOR SPACING” to “#4 BARRIER REINFORCEMENT SEE SHEET 2 AND 3 FOR SPACING AND DETAILING”. SECTION N-N: • Revised “VARIES” to “1’-6” BARRIER WALL”. • Revised “#4 CURB REINFORCEMENT SEE SHEET 1 FOR SPACING” to “#4 BARRIER REINFORCEMENT SEE SHEET 2 AND 3 FOR SPACING AND DETAILING”. Removed “VERTICAL CURB REINFORCEMENT”. Added “LEGEND”: • Revised ① to ⑬. Revised “SHEET 4” to “SHEETS 5 AND 6”. • Revised ② to ⑭. • Removed note ③. • Revised ④ to ⑮. • Added “⑯ SECTION SHOWN WITHOUT CURB, WITH CURB FOLLOW DETAILS ON SHEET 2 AND 3.”. NOTES: • Added note – “2. FOR ADDITIONAL NOTES, SEE SHEET 1.”.
	OLD 16 of 16 NEW 9 of 9	TITLE BLOCK: • Revised “SHT 16 OF 16” to “SHT 9 OF 9”. PLAN: • Revised section mark “Q-Q” to “G-G”. • Added “BARRIER WALL” to 1’-6”. NOTES: • Note 1: Revised “WORKMANSHIP” to “PERFORM WORK”. ELEVATION: • Revised 1’-1” to “1’-5” BARRIER WALL”. • Added “PUB. 408, SECTION”. SECTION Q-Q: • Revised “SECTION Q-Q” to “SECTION G-G”. • Added a second row of anchor bolts and replaced anchor bar with an anchor plate. • Revised 1’-1” to “1’-5” BARRIER WALL”. REINFORCEMENT BAR NOTES: • Note 2: Revised “ALL REINFORCEMENT BARS SHALL BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M	OLD 1 of 12 NEW 1 of 9	Total number of sheets revised from 12 to 9. TITLE BLOCK: • Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER” to “VERTICAL WALL CONCRETE BARRIER”. • Revised “SHT 1 OF 12” to “SHT 1 OF 9”. TYPICAL VERTICAL WALL BARRIER DETAIL – TL5: • Revised “TYPICAL VERTICAL WALL BARRIER DETAIL – TL5” to “42” VERTICAL WALL CONCRETE BARRIER DETAIL”. • Removed $6^{3}/_{8}$” dimension. • Relocated “2” CLR.” and added “(TYP.)”. • Removed “(TYP.)” from ¾”x¾” CHAMFER. • Added “R=1””. ALTERNATE VERTICAL WALL BARRIER DETAIL – TL4: • Revised “ALTERNATE VERTICAL WALL BARRIER DETAIL – TL4” to “32” VERTICAL WALL CONCRETE BARRIER DETAIL”. • Removed $5^{3}/_{8}$” dimension. • Removed “(TYP.)” from ¾”x¾” CHAMFER. • Added “R=1””. TABLE 1: • Revised “TYP. VERTICAL WALL” to “42” VERTICAL WALL CONCRETE”. • Revised “ALT. VERTICAL WALL” to “32” VERTICAL WALL CONCRETE”. • Dimension C: Revised for 42” VERTICAL WALL from 4” to 3”. • Dimension D: Revised for 42” VERTICAL WALL from 6½” to 5½”. REINFORCEMENT BAR NOTES: • Note 4: Revised “PROVIDE REINFORCEMENT BARS, EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(C).” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1 (c).”. LEGEND: • Note ①: Added “FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS ON SHEETS 2-6.”. NOTES: • Note 1: Revised “WORK QUALITY” to “PERFORM WORK”. • Note 2: Removed. • Note 3: Removed. • Note 4: Revised as the following: · “TYP. VERTICAL WALL” to “42” VERTICAL CONCRETE WALL”. · “ALT. VERTICAL WALL” to “32” VERTICAL CONCRETE WALL”. · “SIDEWALK VERTICAL WALL” to “SIDEWALK VERTICAL CONCRETE WALL”. · “RAISED SIDEWALK VERTICAL WALL” to “RAISED SIDEWALK VERTICAL CONCRETE WALL”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	OLD 1 of 12 NEW 1 of 9 (cont.)	• Note 5: Removed. • Note 6: Removed. • Note 7: Removed. • Added Note 2: “THE 42” VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-5. THE 42” VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE HEIGHT OF THE BARRIER BELOW 42”.”. • Added Note 3: “THE 32” VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-3.” • Added Note 5: “FOR DETAILS OF THE 42” AND 32” VERTICAL WALL CONCRETE BARRIER ON SUBSTRUCTURE UNITS, SEE THE APPROPRIATE SUBSTRUCTURE DETAILS IN BD-622M AND BD-624M.”. Added: • “CONTRACT DRAWING NOTE: THE FOLLOWING NOTE IS TO BE PLACED ON THE CONTRACT DRAWINGS WHEN THE 42” VERTICAL WALL CONCRETE BARRIER IS USED: THE 42” VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE BARRIER HEIGHT BELOW 42”.”. Added “CLEAR ROADWAY WIDTH DETAIL”. REFERENCE DRAWINGS: • Removed “BC-703M THRIE-BEAM TO VERTICAL WALL BRIDGE BARRIER TRANSITION CONNECTION”. • Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”. Removed “PLAN VIEW FOR TYP. VERTICAL WALL TO TYP. BRIDGE BARRIER TRANSITION”. Removed “ELEVATION VIEW FOR TYP. VERTICAL WALL TO TYP. BRIDGE BARRIER TRANSITION”. Removed “ELEVATION VIEW FOR ALTERNATE VERTICAL WALL TO ALTERNATE BRIDGE BARRIER TRANSITION”.
	OLD 2 of 12	Removed sheet.
	OLD 3 of 12	Removed sheet.
	OLD 4 of 12	Removed sheet.
	OLD 5 of 12	Removed sheet.
	OLD 6 of 12	Removed sheet.
	OLD 7 of 12	Removed sheet.
	OLD 8 of 12	Removed sheet.
	OLD 9 of 12	Removed sheet.
	NEW 2 of 9	New sheet added. BARRIER END TRANSITION – 1. Added “32” VERTICAL WALL CONCRETE BARRIER END TRANSITION”. • “PLAN” and “ELEVATION” views. Added “42” VERTICAL WALL CONCRETE BARRIER END TRANSITION”. • “PLAN” and “ELEVATION” views. Added “SECTION A-A”. Added “LEGEND”.
	NEW 3 of 9	New sheet added. BARRIER END TRANSITION – 2. Added “42” VERTICAL WALL CONCRETE BARRIER END TRANSITION”. • “PLAN” and “ELEVATION” views. Added “SECTION G-G”. Added “LEGEND”. Added “NOTES”.
	NEW 4 of 9	New sheet added. BARRIER END TRANSITION – 3. Added “32” VERTICAL WALL CONCRETE BARRIER END TRANSITION”. • “PLAN” and “ELEVATION” views. Added “SECTION H-H”. Added “LEGEND”. Added “NOTES”.
	NEW 5 of 9	New sheet added. END TRANSITION REINFORCEMENT – 1. Added “SECTION B-B”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	NEW 5 of 9 (cont.)	Added “SECTION C-C”. Added “SECTION D-D”. Added “SECTION E-E”. Added “SECTION F-F”. Added “415” bar diagram. Added “416” bar diagram. Added “417” bar diagram. Added “418” bar diagram. Added “419” bar diagram. Added “LEGEND”.
	NEW 6 of 9	New sheet added. END TRANSITION REINFORCEMENT – 2. Added “413” bar diagram. Added “414” bar diagram. Added “LEGEND”.
	OLD 10 of 12 NEW 7 of 9	TITLE BLOCK: • Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER SIDEWALK DETAILS” to “VERTICAL WALL CONCRETE BARRIER SIDEWALK DETAILS”. • Revised “SHT 10 OF 12” to “SHT 7 OF 9”. INTEGRAL SIDEWALK DETAIL: • Revised “INTEGRAL” to “TYPICAL”. • Revised “VEHICULAR WIDTH” to “ROADWAY”. • Added “1.5%, SLOPED TOWARD BARRIER ⑬ (BRIDGE OVER ROADWAY)” and “1.5% SLOPED AWAY FROM BARRIER (OTHER CONDITIONS)”. • Revised ① to ⑫. • Added “②”. RAISED SIDEWALK DETAIL: • Revised “VEHICULAR WIDTH” to “ROADWAY”. • Added “1.5%, SLOPED TOWARD BARRIER ⑬ (BRIDGE OVER ROADWAY)” and “1.5% SLOPED AWAY FROM BARRIER (OTHER CONDITIONS)”. • Revised ① to ⑫. • Added “②”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	OLD 10 of 12 NEW 7 of 9 (cont.)	Added “LEGEND”. • Revised ① to “⑫ 42” VERTICAL WALL CONCRETE BARRIER SHOWN. IF 32” VERTICAL WALL CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF BARRIER AND RAILING MUST BE 3’-6” MINIMUM ON SIDEWALK SIDE OF RAILING.”. • Added “② UNDERSIDE OF DECK MAY BE CONSTRUCTED LEVEL.”. • Added “⑬ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIERS OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT THE REAR FACE OF THE BARRIER 1” ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAIN PER BC-751M.”.
	OLD 11 of 12 NEW 8 of 9	TITLE BLOCK: • Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER ADJACENT BOX BEAM DETAILS” to “VERTICAL WALL CONCRETE BARRIER ADJACENT BOX BEAM DETAILS”. • Revised “SHT 11 OF 12” to “SHT 8 OF 9”. 36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER: • Removed detail “AT BARRIER TERMINATION SECTION”. • Removed title “AT TYPICAL BARRIER SECTION”. • Revised ③⑤ to ⑮⑰. • Revised ④ to ⑯. • Removed ⑥ at OVERHANG LIMITED TO 4” MAX. • Revised “VEHICULAR WIDTH” to “ROADWAY”. • Revised “#5” to “#6”. • Revised longitudinal reinforcement callout from #6 to #5. • Revised “1½” CLR. ⑤” to “2” CLR. (TYP.)”. • Revised “TYP. VERTICAL WALL BARRIER SHOWN, ALT. VERTICAL WALL BARRIER SIMILAR)” to “(42” VERTICAL WALL CONCRETE BARRIER SHOWN, 32” VERTICAL WALL CONCRETE BARRIER SIMILAR)”. 36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING SIDEWALK: • Added “TYPICAL” to “36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING SIDEWALK”. • Revised “VEHICULAR WIDTH” to “ROADWAY”. • Revised “#5” to “#6”. • Revised longitudinal reinforcement callout from #6 to #5 • Removed ⑥. • Revised “1½” CLR. (TYP.) ⑤” to “2” CLR. (TYP.)”. • Revised ③⑤ to ⑮⑰. • Revised ④ to ⑯. • Revised ② to ⑭. • Revised ** to ⑬. • Removed “** DRAIN RUNOFF THROUGH CONCRETE CURB WITH CURB DRAIN. SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1” ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	OLD 11 of 12 NEW 8 of 9 (cont.)	IN INCREASED COVER FOR TRANSVERSE DECK REINFORCEMENT BARS.”. VERTICAL REINFORCEMENT: (2 locations) • Revised “4” FOR TYP. VERTICAL WALL BARRIER 3” FOR ALT. VERTICAL WALL BARRIER” to 3”. LEGEND: • Note ① added “FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS ON SHEETS 2-6.”. • Revised ② to ⑭. • Revised ③ to ⑮. • Revised ④ to ⑯. • Revised ⑤ to “⑰ FOR 32” VERTICAL WALL CONCRETE BARRIER USE #4 @ 12”.” • Removed ⑥. • Revised ⑦ to ⑫. Revised “IF ALTERNATE VERTICAL WALL BARRIER IS USED, THE COMBINED HEIGHT OF BARRIER AND RAILING MUST BE 3’-6” MIN. ON SIDEWALK SIDE OF RAILING. ALTERNATE RAILING DETAILS ON BC-718M MAY BE USED IN PLACE OF BC-720M TO OBTAIN MINIMUM HEIGHT.” to “42” VERTICAL WALL CONCRETE BARRIER SHOWN. IF 32” VERTICAL WALL CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF BARRIER AND RAILING MUST BE 3’-6” MIN. ON SIDEWALK SIDE OF RAILING.”. • Added “⑬ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIERS OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT THE REAR FACE OF THE BARRIER 1” ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAIN PER BC-751M.”. NOTES: • Note 1: Added “CONCRETE”.
	OLD 12 of 12 NEW 9 of 9	TITLE BLOCK: • Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER LIGHTING POLE ANCHORAGE DETAILS” to “VERTICAL WALL CONCRETE BARRIER LIGHTING POLE ANCHORAGE DETAILS”. • Revised “SHT 12 OF 12” to “SHT 9 OF 9”. REINFORCEMENT BAR NOTES: • Note 2: Revised “ALL REINFORCEMENT BARS SHALL BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).”. PLAN: • Revised section marks “Q-Q” to “J-J”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	OLD 12 of 12 NEW 9 of 9 (cont.)	REINFORCEMENT BAR TABLE: • Revised “AT TYP. VERT. WALL BARRIER” to “42” VERTICAL WALL CONCRETE BARRIER” (2 locations). • Revised “AT ALT. VERT. WALL BARRIER” to “32” VERTICAL WALL CONCRETE BARRIER” (2 locations). ELEVATION: • Revised leaders for “405” and “406”. SECTION Q-Q: • Revised “Q-Q” to “J-J”. NOTES: • Note 1: Revised “WORK QUALITY” to “PERFORM WORK”. • Note 10: Added “CONCRETE”.
BD-622M	OLD 1 of 5 NEW 1 of 10	Revised number of sheets from 5 to 10. TITLE BLOCK: • Revised “SHEET 1 of 5” to “SHEET 1 of 10”. GENERAL NOTES: • Note 2: Revised “BARRIER TRANSITION” to “SAFETY WING”. ABUTMENT WITH FLARED WINGS: • Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”. TYPICAL PLAN (SKEWS < 75º): • Removed 10º flare and updated with new MASH barrier end transition (2 locations). • Corrected linework to show barrier turning at gutterline. • Added “SAFETY WING” callout. • Revised “FOR BARRIER AND BRIDGE TERMINAL CONNECTION DETAILS, SEE BD-601M AND BC-739M.” to “F-SHAPE CONCRETE BARRIER SHOWN. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M. (TYP.)”. DETAIL A: • Removed 10º flare and updated with new MASH barrier end transition. DETAIL B: • Removed 10º flare and updated with new MASH barrier end transition. NOTE: • Added “BELOW GUTTERLINE”. SECTION A-A: • Removed 10º flare and updated with new MASH barrier end transition (2 locations).

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	OLD 1 of 5 NEW 1 of 10 (cont.)	SECTION B-B: • Removed 10º flare and updated with new MASH barrier end transition (2 locations). REFERENCE DRAWINGS: • Removed “BC-739M BRIDGE BARRIER TO GUIDE RAIL TRANSITION”. • Added “BD-610M PA BRIDGE BARRIER”. • Added “BD-617M PA TYPE 10M BRIDGE BARRIER”. • Added “BC-618M VERTICAL WALL CONCRETE BARRIER”. • Added “BC-734M ANCHOR SYSTEMS”. • Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”.
	OLD 2 of 5 NEW 2 of 10	TITLE BLOCK: • Revised “FLARED WINGS LAYOUT AND DETAILS” to “SAFETY WING DETAILS”. • Revised “SHEET 2 of 5” to “SHEET 2 of 10”. SECTION C-C: • Revised section to remove 10º flare and updated for new MASH barrier end transition. ALTERNATE SECTION C-C: • Revised section to remove 10º flare and updated for new MASH barrier end transition. SECTION D-D: • Removed barrier details. This makes the section generic for all barriers. • Added ①. • Revised “CONSTR. JT” to “V-NOTCH & OPTIONAL CONSTR. JOINT (RAKED FINISH)”. • Revised “OPTIONAL CONSTR. JT.” to “CONSTR. JOINT & V-NOTCH”. • Added 1’-8 ¼” dimension. • Revised “#6” to “#6 @ 12 E.F.”. • Revised “BOTTOM OF PAVEMENT STRUCTURE OR APPROACH SLAB” to “BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB”. • Removed “OPTIONAL” from CONSTR. JOINT at BOTTOM OF PAVEMENT STRUCTURE OR 1” BELOW APPROACH SLAB location. • Added "MIN. LAP" to 2'-2". • Added “F.F” and “R.F.”. SECTION E-E: • Revised SECTION E-E” to “SECTION F-F”. • Removed barrier details. This makes the section generic for all barriers. • Added ①. • Revised “CONSTR. JT” to “V-NOTCH & OPTIONAL CONSTR. JOINT (RAKED FINISH)”. • Revised “#6” to “#6 @ 12 E.F.”. • Revised “BOTTOM OF PAVEMENT STRUCTURE OR APPROACH SLAB” to “BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	OLD 2 of 5 NEW 2 of 10 (cont.)	• Revised “OPTIONAL CONSTR. JT.” to “CONSTR. JOINT & V-NOTCH”. • Added "MIN. LAP" to 2'-2". • Added bend bar below BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB with 1'-2" MIN. lap. • Added “F.F” and “R.F.”. NOTES: • Note 5: Removed. • Note 6: Revised note “6” to “5”. Added “LEGEND”. Added “SECTION E-E”. Added “TABLE 1”. Removed “ALTERNATE BARRIER REINFORCEMENT SECTION”.
	OLD 3 of 5	Removed sheet.
	NEW 3 of 10	New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 1. Added “45” F-SHAPE CONCRETE BRIDGE BARRIER END TRANSITION REINFORCEMENT DETAIL”: • “PLAN” and “ELEVATION” views. Added “THRIE-BEAM TERMINAL CONNECTOR BOLT HOLE DETAIL”. Added “LEGEND”. Added “NOTES”.
	NEW 4 of 10	New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 2. Added “42” F-SHAPE CONCRETE BRIDGE BARRIER TRANSITION REINFORCEMENT DETAIL”: • “PLAN” and “ELEVATION” views. Added “LEGEND”. Added “NOTES”.
	NEW 5 of 10	New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 3. Added “32” F-SHAPE CONCRETE BRIDGE BARRIER END TRANSITION REINFORCEMENT DETAIL”: • “PLAN” and “ELEVATION” views. Added “LEGEND”. Added “NOTES”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	NEW 6 of 10	New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 4. Added “SECTION H-H”. Added “SECTION J-J”. Added “SECTION K-K”. Added “SECTION L-L”. Added “SECTION M-M”. Added “SECTION G-G”. Added “TABLE 2”. Added “LEGEND”. Added “NOTES”.
	NEW 7 of 10	New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 5. Added bar diagram “412”. Added “TABLE 3”. Added bar diagram “411”. Added “TABLE 4”. Added bar diagram “406”. Added bar diagram “407”. Added bar diagram “408”. Added bar diagram “409”. Added “TABLE 5”.
	NEW 8 of 10	New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 6. Added bar diagram “403”. Added bar diagram “404”. Added “LEGEND”.
	OLD 4 of 5 NEW 9 of 10	TITLE BLOCK: • Revised “SHEET 4 of 5” to “SHEET 9 of 10”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	OLD 4 of 5 NEW 9 of 10 (cont.)	TYPICAL PLAN (SKEWS < 75º): • Removed 10º flare and updated with new MASH barrier end transition (2 locations). • Revised “FOR 10º END FLARE DETAILS, SEE SHEETS 1, 2 AND 3.” to “F-SHAPE CONCRETE BARRIER SHOWN. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M.”. • Revised section cut “J-J” to “Q-Q”. • Revised section cut “K-K” to “R-R”. SECTION K-K: • Revised “SECTION K-K” to “SECTION R-R”. • Added “45” F-SHAPE CONCRETE BARRIER SHOWN. 32” AND 42” F-SHAPE CONCRETE BARRIER SIMILAR.” • Revised “CONSTR. JT.” to “V-NOTCH & OPTIONAL CONSTR. JOINT (RAKED FINISH)”. • Revised “#4 @ 6” ” to “#4 @ 12” (SEE NOTE 3)”. • Added “MIN.” to 2’-2”. • Added “OR APPROACH SLAB” to V-NOTCH @ BOTT. OF DECK. SECTION J-J: • Revised “SECTION J-J” to “SECTION Q-Q”. • Revised barrier for new barrier end transition. • Revised “V-NOTCH AND OPTIONAL CONSTR. JT. @ GUTTERLINE” to “V-NOTCH AND OPTIONAL CONSTR. JT.”. • Revised “V-NOTCH AND CONSTR. JT. @ GUTTERLINE” to “V-NOTCH AND CONSTR. JT.”. • Revised “V-NOTCH @ BOTTOM OF DECK” to “V-NOTCH @ BOTTOM OF DECK OR APPROACH SLAB”. • Added break line. TYPCIAL ELEVATION: • Revised section cut “H-H” to “P-P”. • Revised section cut “G-G” to “N-N”. TYPICAL CORNER DETAIL FOR EXPANSION DAM (SKEWS < 75º): • Revised “TYPICAL” to “45” F-SHAPE”. • Revised “ALTERNATE” to “32” AND 42” F-SHAPE CONCRETE”. • Removed $3^{3}/_{8}$” and 1’-0” dimensions. ABUTMENT WITH U-WINGS: • Revised “SECTION G-G” to “SECTION N-N”. • Revised “SECTION H-H” to “SECTION P-P”. • Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”. • Modified SECTION H-H to correct corner details (2 locations). NOTES: • Note 3: Revised “SPACING OF BARRIER REINFORCEMENT SHOWN IS FOR U-WING LENGTHS OF 20’-0” OR LESS. FOR U-WING LENGTHS GREATER THAN 20’-0”, SPACING OF REINFORCEMENT SHOWN IS

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	OLD 4 of 5 NEW 9 of 10 (cont.)	FOR A DISTANCE OF 10’-0” FROM EACH END OF AN EXPANSION JOINT. FOR U-WING SECTIONS BETWEEN THE 10’-0” SECTION, THE VERTICAL REINFORCEMENT SPACING MAY BE INCREASED TO 12” to “WITHIN 10’-0” ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS SHOWN ON SHEETS 3-8.”.
	OLD 5 of 5 NEW 10 of 10	TITLE BLOCK: • Revised “SHEET 5 of 5” to “SHEET 10 of 10”. TYPICAL PLAN (SKEWS < 75º): • Revised section cut “J-J” to “Q-Q”. • Revised section cut “K-K” to “R-R”. • Removed 10º flare and updated with new MASH barrier end transition. • Revised “FOR 10º END FLARE DETAILS, SEE SHEETS 1, 2 AND 3.” to “F-SHAPE CONCRETE BARRIER SHOWN. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M.”. TYPICAL ELEVATION: • Revised section cut “M-M” to “T-T”. • Revised section cut “L-L” to “S-S”. ABUTMENT WITH U-WINGS: • Revised “SECTION L-L” to “SECTION S-S”. • Revised “SECTION M-M” to “SECTION T-T”. • Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”. • Modified SECTION S-S to correct corner details (2 locations). ABUTMENT PLAN – WITH BACKWALL (SKEWS < 75º) U- WINGS FOR ADJACENT BEAMS: • Revised “STYROFOAM” to “PLACE PREFORMED CELLULAR POLYSTYRENE (P.C.P)”. • Corrected line work to show barrier turning at gutterline. • Added break line. NOTES: • Note 1: Revised “FOR SECTIONS J-J AND K-K, SEE SHEET 4.” to “FOR SECTIONS Q-Q AND R-R, SEE SHEET 9.”.
BD-624M	OLD 1 of 5 NEW 1 of 4	Revised number of sheets from 5 to 4. TITLE BLOCK: • Revised “SHEET 1 OF 5” to “SHEET 1 OF 4”. GENERAL NOTES: • Note 2: Revised “HOOKS ON BARS EXTENDING FROM BARRIER TRANSITION INTO THE BACKWALL MAY BE TURNED IN ANY

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-624M (cont.)	OLD 1 of 5 NEW 1 of 4 (cont.)	DIRECTION.” to “HOOKS ON BARS EXTENDING FROM SAFETY WING INTO THE STEM MAY BE TURNED IN ANY DIRECTION.”. ABUTMENT WITH FLARED WINGS: • Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”. TYPICAL PLAN (SKEWS < 75º): • Removed 10º flare and updated with new MASH barrier end transition (2 locations). • Revised “FOR BARRIER AND BRIDGE TERMINAL CONNECTION DETAILS, SEE BD-601M AND BC-739M.” to “F-SHAPE CONCRETE BARRIER SHOWN. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M.”. DETAIL A: • Removed 10º flare and updated with new MASH barrier end transition. DETAIL B: • Removed 10º flare and updated with new MASH barrier end transition. SECTION A-A: • Removed 10º flare and updated with new MASH barrier end transition (2 locations). SECTION B-B: • Removed 10º flare and updated with new MASH barrier end transition (2 locations). REFERENCE DRAWINGS: • Removed “BC-739M BRIDGE BARRIER TO GUIDE RAIL TRANSITION”. • Added “BD-610M PA BRIDGE BARRIER”. • Added “BD-617M PA TYPE 10M BRIDGE BARRIER”. • Added “BC-618M VERTICAL WALL CONCRETE BARRIER”. • Added “BC-622M REINFORCED CONCRETE ABUTMENTS WITH BACKWALL”. • Added “BC-734M ANCHOR SYSTEMS”. • Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”. Added “NOTE”.
	OLD 2 of 5 NEW 2 of 4	TITLE BLOCK: • Revised “FLARED WINGS LAYOUT AND DETAILS” to “SAFETY WING DETAILS”. • Revised “SHEET 2 OF 5” to “SHEET 2 OF 4”. SECTION C-C: • Revised section to remove 10º flare and update for new MASH barrier end transition.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-624M (cont.)	OLD 2 of 5 NEW 2 of 4 (cont.)	ALTERNATE SECTION C-C: • Revised section to remove 10º flare and update for new MASH barrier end transition. NOTES: • Note 5: Removed. • Note 5: Revised note “5” to “4”. • Note 6: Revised note “6” to “5”. SECTION D-D: • Removed barrier details. This makes the section generic for all barriers. • Added ①. • Added “(TOP OF PAVEMENT)” to GUTTERLINE. • Revised “CONSTR. JT” to “V-NOTCH & OPTIONAL CONSTR. JOINT (RAKED FINISH)”. • Added “CONSTR. JOINT & V-NOTCH”. • Added “BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB”. • Added “#6 @ 12” E.F.” bars between GUTTERLINE (TOP OF PAVEMENT) and BOTTOM OF PAVEMENT STRUCTURE OR 1” BELOW APPROACH SLAB. • Added "MIN. LAP" to 2'-2". • Added “F.F.” and “R.F.”. • Added 1’-8 ¼”. Added “SECTION E-E”. SECTION E-E: • Revised “SECTION E-E” to “SECTION F-F”. • Removed barrier details. This makes the section generic for all barriers. • Added ①. • Revised “CONSTR. JT” to “V-NOTCH & OPTIONAL CONSTR. JOINT (RAKED FINISH)”. • Added “CONSTR. JOINT & V-NOTCH”. • Added “BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB”. • Added “#6 @ 12” E.F.” bars between GUTTERLINE (TOP OF PAVEMENT) and BOTTOM OF PAVEMENT STRUCTURE OR 1” BELOW APPROACH SLAB. • Added "MIN. LAP" to 2'-2". • Added bend bar below BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB with 1'-2" lap. • Added “F.F.” and “R.F.”. Added “TABLE 1”. Added “LEGEND”. Removed “ALTERNATE BARRIER REINFORCEMENT SECTION”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-624M (cont.)	OLD 3 of 5	Removed sheet.
	OLD 4 of 5 NEW 3 OF 4	TITLE BLOCK: • Revised “SHEET 4 OF 5” to “SHEET 3 OF 4”. TYPICAL PLAN (SKEWS < 75º): • Removed 10º flare and updated with new MASH barrier end transition. • Revised “FOR 10º END FLARE DETAILS, SEE SHEETS 1, 2 AND 3.” to “F-SHAPE CONCRETE BARRIER SHOWN, FOR ADDITIONAL DETAILS, SEE BD-622M. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M.”. • Revised section marks “J-J” to “Q-Q”. • Revised section marks “K-K” to “R-R”. TYPCIAL ELEVATION: • Revised “V-NOTCH AT BOTTOM OF DECK” to “V-NOTCH AT BOTTOM OF DECK OR APPROACH SLAB”. • Removed “SPECIFY CONSTR. JT. IF EXP. JOINT BETWEEN WING AND ABUTMENT IS OMITTED”. • Revised section marks “H-H” to “P-P”. • Revised section marks “G-G” to “N-N”. SECTION K-K: • Revised “SECTION K-K” to “SECTION R-R”. • Added “45” F-SHAPE CONCRETE BARRIER SHOWN, 32” AND 42” F-SHAPE CONCRETE BARRIER SIMILAR.”. • Revised “CONSTR. JT” to “V-NOTCH AND OPTIONAL CONSTR. JT. (RAKED FINISH)”. • Added “OR APPROACH SLAB” to V-NOTCH @ BOTT. OF DECK. • Revised “#4 @ 6” ” to “#4 @ 12” (SEE NOTE 2)”. • Added “R.F.” and “F.F.”. SECTION J-J: • Revised “SECTION J-J” to “SECTION Q-Q”. • Revised barrier for new MASH barrier end transition (2 locations). • Revised “V-NOTCH AND OPTINAL CONSTR. JT. @ GUTTERLINE” to “V-NOTCH AND OPTIONAL CONSTR. JT.”. • Revised “V-NOTCH AND CONSTR. JT. @ GUTTERLINE” to “V-NOTCH AND CONSTR. JT.”. • Revised “V-NOTCH @ BOTTOM OF DECK” to “V-NOTCH @ BOTTOM OF DECK OR APPROACH SLAB”. • Added break line. ABUTMENT WITH U-WINGS: • Revised “SECTION G-G” to “SECTION N-N”. • Revised “SECTION H-H” to “SECTION P-P”. • Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-624M (cont.)	OLD 4 of 5 NEW 3 OF 4 (cont.)	NOTES: • Note 2: Revised to “WITHIN 10’ OF BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF A BRIDGE BARRIER, REDUCE THE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAIL SHOWN ON BD-622M, SHEETS 3-8.”.
	OLD 5 of 5 NEW 4 of 4	TITLE BLOCK: • Revised “SHEET 5 OF 5” to “SHEET 4 OF 4”. TYPICAL PLAN (SKEWS < 75º): • Removed 10º flare and updated with new MASH barrier end transition. • Revised “FOR 10º END FLARE DETAILS, SEE SHEETS 1, 2 AND 3.” to “F-SHAPE CONCRETE BARRIER SHOWN FOR ADDITIONAL DETAILS, SEE BD-622M. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M.”. • Revised section marks “J-J” to “Q-Q”. • Revised section marks “K-K” to “R-R”. TYPCIAL ELEVATION: • Revised “V-NOTCH AT BOTTOM OF DECK” to “V-NOTCH AT BOTTOM OF DECK OR APPROACH SLAB”. • Removed “SPECIFY CONSTR. JT. IF EXP. JOINT BETWEEN WING AND ABUTMENT IS OMITTED”. • Revised section marks “M-M” to “T-T”. • Revised section marks “L-L” to “S-S”. ABUTMENT WITH U-WINGS: • Revised “SECTION L-L” to “SECTION S-S”. • Revised “SECTION M-M” to “SECTION T-T”. • Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”. ABUTMENT PLAN – WITHOUT BACKWALL (SKEWS < 75º) U- WINGS FOR ADJACENT BEAMS: • Revised “STYROFOAM” to “PLACE PREFORMED CELLULAR POLYSTYRENE (P.C.P)”. • Added break line. NOTES: • Note 1: Revised “FOR SECTIONS J-J AND K-K, SEE SHEET 4.” to “FOR SECTION Q-Q AND R-R, SEE SHEET 3.”.
BD-627M	1 of 8	GENERAL NOTES: • Note 2: Revised “WORK QUALITY” to “PERFORM WORK”. INSTRUCTIONS TO DESIGNERS: • Note 4: Fixed locations of bullets • Note 5: Fixed locations of bullets.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-627M (cont.)	1 of 8 (cont.)	• Note 7: Fixed locations of bullet. • New Note: “9. THE 42” F-SHAPE CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNATED AS MASH TL-4. THE 32” F-SHAPE CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNATED AS MASH TL-3. THE ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNED AS MASH TL-2.”. • New Note: “10. THE 45” F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.” INDEX OF SHEETS: • Revised Sheet 7 title from “FLARED END TREATMENT” to “END TREATMENT”. REFERENCE DRAWINGS: • Deleted “BC-703M THRIE-BEAM TO VERTICAL WALL BRIDGE BARRIER TRANSITION CONNECTION”. • Deleted “BC-709M THRIE-BEAM TO PA TYPE 10M BRIDGE BARRIER TRANSITION CONNECTION”. • Deleted “BC-712M THRIE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION”. • Deleted “BC-739M BRIDGE BARRIER TO GUIDERAIL TRANSITION”. • Deleted “BD-615M PA HT BRIDGE BARRIER”. • Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”. • Added “BD-622M R.C. ABUTMENTS WITH BACKWALL”. • Added “BD-624M R.C. ABUTMENTS WITHOUT BACKWALL”.
	2 of 8	MOMENT SLAB (BURIED) WITH TYPICAL C.I.P. BARRIER: • Revised title to “MOMENT SLAB (BURIED) WITH C.I.P. 42” F-SHAPE CONCRETE BARRIER”. • Added “ * ”. • Deleted “(TYP.)” from “¾” X ¾” CHAMFER”. MOMENT SLAB (AT-GRADE) WITH TYPICAL C.I.P. BARRIER: • Revised title to “MOMENT SLAB (AT-GRADE) WITH C.I.P. 42” F-SHAPE CONCRETE BARRIER”. • Added “ * ”. • Deleted “(TYP.)” from “¾” X ¾” CHAMFER”.
	3 of 8	MOMENT SLAB (AT-GRADE) WITH TYPICAL PRECAST CONCRETE BARRIER: • Revised title to “MOMENT SLAB (AT-GRADE) WITH PRECAST 42” F-SHAPE CONCRETE BARRIER”. MOMENT SLAB (BURIED) WITH TYPICAL PRECAST CONCRETE BARRIER: • Revised title to “MOMENT SLAB (BURIED) WITH PRECAST 42” F-SHAPE CONCRETE BARRIER”. TYPICAL PRECAST CONCRETE BARRIER DETAILS: • Revised title to “PRECAST 42” F-SHAPE CONCRETE BARRIER DETAILS”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-627M (cont.)	3 of 8 (cont.)	NOTES: • Note 1: Revised “PER PUB.” to “CONFORMING TO PUBLICATION”. • Note 3: Revised “IN ACCORDANCE WITH” to “CONFORMING TO”.
	4 of 8	MOMENT SLAB WITH ALTERNATE SIDEWALK AND VERTICAL WALL BARRIER (C.I.P.): • Revised to “MOMENT SLAB WITH ALTERNATE SIDEWALK AND 42” VERTICAL WALL CONCRETE BARRIER (C.I.P.)”. MOMENT SLAB WITH ASPHALT OVERLAY ADJACENT TO TYPE 2 APPROACH SLAB WITH TYPICAL C.I.P. BARRIER: • Revised title to “MOMENT SLAB WITH ASPHALT OVERLAY ADJACENT TO TYPE 2 APPROACH SLAB WITH C.I.P. 42” F-SHAPE CONCRETE BARRIER”. • Added “ * ”. • Deleted “(TYP.)” from “¾” X ¾” CHAMFER”. • Revised “#4 @ 12” MAX.” to “#6 @ 12” MAX.” in barrier. • Revised “#5 @ 9½” MAX.” to “#5 @ 12” MAX.” in slab. ALTERNATE TRAFFIC BARRIER: • Revised title to “32” F-SHAPE CONCRETE BARRIER” • Replaced “TYPICAL” to “F-SHAPE CONCRETE”.
	5 of 8	MOMENT SLAB (BURIED) WITH TOE WALL AND TYPICAL C.I.P. BARRIER: • Revised title to “MOMENT SLAB (BURIED) WITH TOE WALL AND C.I.P. 42” F-SHAPE CONCRETE BARRIER”. • Added “ * ”. • Deleted “(TYP.)” from “¾” X ¾” CHAMFER”. MOMENT SLAB (AT-GRADE) WITH TOE WALL AND TYPICAL C.I.P. BARRIER: • Revised title to “MOMENT SLAB (AT-GRADE) WITH TOE WALL AND C.I.P. 42” F-SHAPE CONCRETE BARRIER”. • Added “ * ”. • Deleted “(TYP.)” from “¾” X ¾” CHAMFER”.
	6 of 8	JOINT NOTES: • Note 1: Revised “PER” to “AS SPECIFICED IN”.
	7 of 8	TITLE BLOCK: • Revised title to “END TRANSITION”. BARRIER TO GUIDE RAIL TRANSITION: • Deleted 10º flare from “PLAN” and “ELEVATION” views and showed new MASH barrier end transition. • Revised “BC-739M” to “RC-50M”. • Revised “TABLE” to “TABES (2 locations).

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-627M (cont.)	7 of 8 (cont.)	MOMENT SLAB ADJACENT TO BRIDGE: • Deleted 10º flare and showed new MASH barrier end transition. • Revised “BC-739M” to “RC-50M”. • Revised “TABLE” to “TABES (2 locations). SECTION B-B: • Revised “BC-739M” to “RC-50M”. NOTES: • Added new note: “2. REFER TO BD-622M OR BD-624M FOR BARRIER END TRANSITION DETAILS.”. Added: “MINIMUM MOMENT SLAB DIMENSIONS FOR NEW PROJECTS” table.
	8 of 8	SECTION D-D: • Revised “ALTERNATE” to “32” F-SHAPE CONCRETE”. DETAIL A: • Revised “PG 46-40” to “PG 64S-22”. • Revised “SECTION 470.2(a)” to “SECTION 471.2(a)”.
BD-628M	OLD 1 of 36 NEW 1 of 35	Total number of sheets revised from 36 to 35. TITLE BLOCK: • Revised “SHEET 1 OF 36” to “SHEET 1 of 35” GENERAL NOTES: • Note 2: Revised “WORKMANSHIP” to “PERFORM WORK”. MATERIAL NOTES: • Note 3: Added “OR GRADE 50” (2 locations). INDEX OF SHEETS: • Removed “36 TYPE 5 – DETAILS”. REFERENCE DRAWINGS: • Removed “BD-703M THRIE-BEAM TO VERTICAL WALL BRIDGE BARRIER TRANSITION CONNECTION.” • Removed “BC-708M THRIE-BEAM TO PA TYPE 10M BRIDGE BARRIER TRANSITION CONNECTION”. • Removed “BC-712M THRIE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION”. • Removed “BC-739M BRIDGE BARRIER TO GUIDE RAIL TRANSITION”. • Removed “BD-615M PA HT BRIDGE BARRIER”. • Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER” TO “VERTICAL WALL CONCRETE BRIDGE BARRIER”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 2 of 36 NEW 2 of 35	TITLE BLOCK: • Revised “SHEET 2 OF 36” to “SHEET 2 of 35” INSTRUCTIONS TO DESIGNERS: • Note 2: Added “FOR CONCRETE PAVEMENT THE MINIMUM APPROACH SLAB SKEW IS 60 DEGREES.”. • Note 14: Revised “TYPICAL” to “45” F-SHAPE”. • Added note – “20. ROADWAY INLETS ARE TO BE LOCATED AT A MINIMUM OF 10’-0” FROM THE END OF MOMENT SLABS OR SLEEPER SLABS, MEASURED PERPENDICULAR TO SLABS.”. APPROACH SLAB GUIDELINES NOTES: • Note 4: Revised note “4” to “5”. APPROACH SLAB SELECTION CRITERIA TABLE: • Revised minimum skew angle (degrees) for concrete roadway pavement types from “45” to “60”.
	OLD 3 of 36 NEW 3 of 35	TITLE BLOCK: • Revised “SHEET 3 OF 36” to “SHEET 3 of 35”
	OLD 4 of 36 NEW 4 of 35	TITLE BLOCK: • Revised “SHEET 4 OF 36” to “SHEET 4 of 35” PLAN 1 TYPE 1 AND 2: • Left barrier: Removed 10º flare and revised for MASH barrier end transition with curb. • Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”. • Right barrier: Removed 10º flare and revised for MASH barrier end transition without curb. • Revised “(LENGTH AS REQUIRED)” to “SEE NOTE 6 & 7” (2 locations). • Removed “10’-0” MIN.” dimension and “BEND LINE” callouts (2 locations). • Removed “8” CURB” and 8¾” dimension. • Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”. TYPE 2 APPROACH SLAB ADJACENT TO MOMENT SLAB: • Revised “SEAL WITH ASPHALT JOINT SEALANT (AC-20)” to “SEAL WITH ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)].” NOTES: • Note 6: Removed.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 4 of 36 NEW 4 of 35 (cont.)	• Note 7: Removed. • Added new note – “6. 45” F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.”. • Added new note – “7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16’-0” MINIMUM PER BD-627M.”. • Added new note – “8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.
	OLD 5 of 36 NEW 5 of 35	TITLE BLOCK: • Revised “SHEET 5 OF 36” to “SHEET 5 of 35” PLAN 2 TYPE 1 AND 2: • Left barrier: Removed 10º flare and revised for MASH barrier end transition with curb. Moved outside edge of approach slab and sleeper slab to end at rear face of curb. • Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”. • Revised curb callouts. • Right barrier: Removed 10º flare and revised for MASH barrier end transition without curb. Moved outside edge of approach slab and sleeper slab to end at front face of barrier. • Revised “SHEET 7” to “SHEET 5” (4 locations). • Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”. TYPE 2 – CONCRETE APPROACH SLAB WITH SUPERPAVE ASPHALT OVERLAY: • Revised 1” to ½”. • Revised 8” to 4”. • Revised detail for 4” curb. • Revised “SEAL WITH ASPHALT JOINT SEALANT (AC-20)” to “SEAL WITH ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)]”. TYPE 1, 3, OR 5 – CONCRETE APPROACH SLAB: • Revised 7” to 7½”. • Revised 1” to ½”. • Revised 8” to 4”. • Revised detail for 4” curb. • Revised “SEE NOTE 6” to “SEE NOTE 4”. JOINT SEALING DETAIL: • Revised “SEE NOTE 8” to “SEE NOTE 6”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 5 of 36 NEW 5 of 35 (cont.)	NOTES: • Note 4: Removed. • Note 5: Removed. • Note 6: Revised note “6” to “4”. • Note 7: Revised note “7” to “5”. • Note 8: Revised note “8” to “6”. • Added new note – “7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”. • Added new note – “8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”. Removed “DETAIL C”.
	OLD 6 of 36 NEW 6 of 35	TITLE BLOCK: • Revised “SHEET 6 OF 36” to “SHEET 6 of 35” PLAN 3 TYPE 1 AND 2: • Left barrier: Removed 10º flare and revised for MASH barrier end transition with curb. • Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”. • Right barrier: Removed 10º flare and revised for MASH barrier end transition without curb. • Added “AND NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations). • Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”. SECTION F-F: • Removed “BEND LINE” and revised for MASH barrier end transition. NOTES: • Note 4: Removed. • Added new note – “4. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”. • Added new note – “5. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.
	OLD 7 of 36 NEW 7 of 35	TITLE BLOCK: • Revised “SHEET 7 OF 36” to “SHEET 7 of 35” PLAN 4 TYPE 1 AND 2: • Left barrier: Removed 10º flare and revised for MASH barrier end transition with curb.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 7 of 36 NEW 7 of 35 (cont.)	• Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”. • Right barrier: Removed 10º flare and revised for MASH barrier end transition without curb. • Added “AND NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations). • Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”. SECTION G-G: • Removed “BEND LINE” and revised for MASH barrier end transition. MOMENT SLAB ADJACENT TO TYPE 2 APPROACH SLAB: • Revised “SEAL WITH ASPHALT JOINT SEALANT (AC-20)” to “SEAL WITH ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)]”. NOTES: • Note 6: Removed. • Note 7: Removed. • Added new note – “6. 45” F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.”. • Added new note – “7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16-0” MINIMUM PER BD-627M.”. • Added new note – “8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.
	OLD 8 of 36 NEW 8 of 35	TITLE BLOCK: • Revised “SHEET 8 OF 36” to “SHEET 8 of 35” SECTION E-E: • Revised “NOTE 7” to “NOTE 5” (8 locations).
	OLD 9 of 36 NEW 9 of 35	TITLE BLOCK: • Revised “SHEET 9 OF 36” to “SHEET 9 of 35”
	OLD 10 of 36 NEW 10 of 35	TITLE BLOCK: • Revised “SHEET 10 OF 36” to “SHEET 10 of 35”

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 11 of 36 NEW 11 of 35	TITLE BLOCK: • Revised “SHEET 11 OF 36” to “SHEET 11 of 35”
	OLD 12 of 36 NEW 12 of 35	TITLE BLOCK: • Revised “SHEET 12 OF 36” to “SHEET 12 of 35”
	OLD 13 of 36 NEW 13 of 35 OLD 13 of 36 NEW 13 of 35 (cont.)	TITLE BLOCK: • Revised “SHEET 13 OF 36” to “SHEET 13 of 35” TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 7: • Revised “1’-3” to 1’-6”. TYPE APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 7: • Revised “1’-3” to 1’-6”.
	OLD 14 of 36 NEW 14 of 35	TITLE BLOCK: • Revised “SHEET 14 OF 36” to “SHEET 14 of 35”
	OLD 15 of 36 NEW 15 of 35	TITLE BLOCK: • Revised “SHEET 15 OF 36” to “SHEET 15 of 35”
	OLD 16 of 36 NEW 16 of 35	TITLE BLOCK: • Revised “SHEET 16 OF 36” to “SHEET 16 of 35”
	OLD 17 of 36 NEW 17 of 35	TITLE BLOCK: • Revised “SHEET 17 OF 36” to “SHEET 17 of 35” TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 11: • Revised “1’-3” to 1’-6”. TYPE APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 11: • Revised “1’-3” to 1’-6”.
	OLD 18 of 36 NEW 18 of 35	TITLE BLOCK: • Revised “SHEET 18 OF 36” to “SHEET 18 of 35”

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 19 of 36 NEW 19 of 35	TITLE BLOCK: • Revised “SHEET 19 OF 36” to “SHEET 19 of 35” PLAN 1 TYPE 3: • Left barrier: Removed 10º flare and revised for MASH barrier end transition with curb. • Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”. • Right barrier: Removed 10º flare and revised for MASH barrier end transition without curb. • Added “& NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations). • Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”. SECTION K-K: • Removed “BEND LINE” and revised for MASH barrier end transition. NOTES: • Note 3: Removed. • Added new note – “3. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16’-0” MINIMUM PER BD-627M.”. • Added new note – “4. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M, AND RC-50M.”.
	OLD 20 of 36 NEW 20 of 35	TITLE BLOCK: • Revised “SHEET 20 OF 36” to “SHEET 20 of 35” PLAN 2 TYPE 3: • Left barrier: Removed 10º flare and revised for MASH barrier end transition with curb. • Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”. • Right barrier: Removed 10º flare and revised for MASH barrier end transition without curb. • Added “& NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations). • Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 20 of 36 NEW 20 of 35 (cont.)	SECTION L-L: • Removed “BEND LINE” and revised for MASH barrier end transition. NOTES: • Note 6: Removed. • Note 7: Removed. • Added new note – “6. 45” F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.”. • Added new note – “7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16’-0” MINIMUM PER BD-627M.”. • Added new note – “8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.
	OLD 21 of 36 NEW 21 of 35	TITLE BLOCK: • Revised “SHEET 21 OF 36” to “SHEET 21 of 35” PLAN 3 TYPE 3: • Left barrier: Removed 10º flare and revised for MASH barrier end transition with curb. Moved outside edge of approach slab and sleeper slab to end at rear face of curb. • Right barrier: Removed 10º flare and revised for MASH barrier end transition with curb. Moved outside edge of approach slab and sleeper slab to end at rear face of curb. • Added “& NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations). • Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”. • Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER” (2 locations). • Revised curb callouts. DETAIL R: • Revised 2 ½” to 3”. • Revised 6 ½” to 5” (3 locations). • Revised 2’-1” to 1’-9”. SECTION Z-Z: • Revised “8”x8” CURB” to “4” HEIGHT x 8” WIDE CURB”. • Revised detail for 4” curb. NOTES: • Note 5: Removed. • Note 6: Removed. • Added new note – “5. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 21 of 36 NEW 21 of 35 (cont.)	• Added new note – “6. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.
	OLD 22 of 36 NEW 22 of 35	TITLE BLOCK: • Revised “SHEET 22 OF 36” to “SHEET 22 of 35”
	OLD 23 of 36 NEW 23 of 35	TITLE BLOCK: • Revised “SHEET 23 OF 36” to “SHEET 23 of 35”
	OLD 24 of 36 NEW 24 of 35	TITLE BLOCK: • Revised “SHEET 24 OF 36” to “SHEET 24 of 35” TYPE 3 APPROACH SLAB – DETAIL 19: • Placed #6 bar inside hook.
	OLD 25 of 36 NEW 25 of 35	TITLE BLOCK: • Revised “SHEET 25 OF 36” to “SHEET 25 of 35”
	OLD 26 of 36 NEW 26 of 35	TITLE BLOCK: • Revised “SHEET 26 OF 36” to “SHEET 26 of 35” PLAN 1 TYPE 4: • Left barrier: Removed 10º flare and revised for MASH barrier end transition with curb. • Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”. • Right barrier: Removed 10º flare and revised for MASH barrier end transition without curb. • Added “& NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations). • Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”. SECTION P-P: • Removed “BEND LINE” and revised for MASH barrier end transition.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 26 of 36 NEW 26 of 35 (cont.)	NOTES: • Note 6: Removed. • Added new note – “6. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”. • Added new note – “7. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.
	OLD 27 of 36 NEW 27 of 35	TITLE BLOCK: • Revised “SHEET 27 OF 36” to “SHEET 27 of 35” PLAN 2 TYPE 4: • Left barrier: Removed 10º flare and revised for MASH barrier end transition with curb. Moved outside edge of approach slab and sleeper slab to end at rear face of curb. • Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”. • Revised curb callouts. • Right barrier: Removed 10º flare and revised for MASH barrier end transition without curb. Moved outside edge of approach slab and sleeper slab to end at front face of barrier. • Added “& NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations). • Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”. SECTION S-S: • Revised for MASH barrier end transition. NOTES: • Note 6: Removed. • Note 7: Removed. • Added new note – “6. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”. • Added new note – “7. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.
	OLD 28 of 36 NEW 28 of 35	TITLE BLOCK: • Revised “SHEET 27 OF 36” to “SHEET 27 of 35”. PLAN 3 TYPE 4: • Left barrier: Removed 10º flare and revised for MASH barrier end transition with curb. • Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”.
BD-628M (cont.)	OLD 28 of 36 NEW 28 of 35 (cont.)	• Right barrier: Removed 10º flare and revised for MASH barrier end transition without curb. SECTION T-T: • Removed “BEND LINE” and revised for MASH barrier end transition. TOOTH EXPANSION DAM ANCHORAGE DETAIL: • Added “SLIDING SURFACE ***”. • Added “*** 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING.”. NOTES: • Note 5: Removed. • Note 6: Removed. • Added new note – “5. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”. • Added new note – “6. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.
	OLD 29 of 36 NEW 29 of 35	TITLE BLOCK: • Revised “SHEET 29 OF 36” to “SHEET 29 of 35”
	OLD 30 of 36 NEW 30 of 35	TITLE BLOCK: • Revised “SHEET 30 OF 36” to “SHEET 30 of 35”
	OLD 31 of 36 NEW 31 of 35	TITLE BLOCK: • Revised “SHEET 31 OF 36” to “SHEET 31 of 35”
	OLD 32 of 36 NEW 32 of 35	TITLE BLOCK: • Revised “SHEET 32 OF 36” to “SHEET 32 of 35”
	OLD 33 of 36 NEW 33 of 35	TITLE BLOCK: • Revised “SHEET 33 OF 36” to “SHEET 33 of 35”
	OLD 34 of 36 NEW 34 of 35	TITLE BLOCK: • Revised “SHEET 34 OF 36” to “SHEET 34 of 35” SAFETY WING PLAN: • Removed 10º flare and revised for MASH barrier end transition.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 34 of 36 NEW 34 of 35 (cont.)	SECTION Q-Q: • Removed 10º flare and revised for MASH barrier end transition. • Removed callout of reinforcement in barrier. SECTION A-A: • Removed callout of reinforcement in barrier. JOINT INSTALLATION NOTES: • Note 9: Revised to “AFTER THE CONCRETE OF THE BLOCKOUT ACHIEVES THE MINIMUM COMPRESSIVE STRENGTH SPECIFIED IN PUBLICATION 408 SECTION 1001.3(q)1, REMOVE THE TEMPORARY SUPPORT ASSEMBLY AND GRIND OFF THE TACK WELDS UNTIL SMOOTH. NOTES: • Added new note: “2. REFER TO BD-622M AND BD-624M FOR REINFORCEMENT DETAILS.”.
	OLD 35 of 36 NEW 35 of 35	TITLE BLOCK: • Revised “SHEET 35 OF 36” to “SHEET 35 of 35” PLAN TYPE 5: • Left barrier: Removed 10º flare and revised for MASH barrier end transition with curb. • Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”. • Right barrier: Removed 10º flare and revised for MASH barrier end transition without curb. • Added “& NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations). • Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”. DETAIL A: • Removed 10º flare and revised for MASH barrier end transition. NOTES: • Note 5: Removed. • Note 6: Removed. • Note 7: Revised note “7” to “5”. • Added new note – “6. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”. • Added new note – “7. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M, BD-667M AND RC-50M.”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 36 of 36	Removed sheet.
BD-660M	1 of 2	NOTES: • Note 1: Revised to “PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.”. • Note 2: Revised to “DESIGN TOP LONGITUDINAL STEEL OVER THE PIERS, IN ACCORDANCE WITH LRFD SPECIFICATIONS AND DESIGN SECTION 5.12.3.3.”.
BD-661M	4 of 8	36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER: • Added “F-SHAPE” to detail title. • Revised note “TYPICAL BARRIER SHOWN. ALTERNATE BARRIER AND PLANK BEAM IS SIMILAR.” to “45” F-SHAPE CONCRETE BARRIER SHOWN, 32” AND 42” F-SHAPE CONCRETE BARRIER AND PLANK BEAM IS SIMILAR.”. • Added 3’-9” dimension. 36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING TYPICAL SIDEWALK: • Revised note “TYPICAL BARRIER SHOWN. ALTERNATE BARRIER IS SIMILAR.” to “45” F-SHAPE CONCRETE BARRIER SHOWN, 32” AND 42” F-SHAPE CONCRETE BARRIER AND PLANK BEAM IS SIMILAR.⑭. • Revised 3’-6” to 3’-9”. LEGEND: • Legend ⑨: Added “FOR END OF BARRIER TRANSITIONING TO GUIDE RAIL, FOLLOW DETAILS SHOWN ON BD-622M AND BD-624M.”. • Legend ⑬ revised 1’-2” to 1’-4”. • Added “⑭ IF THE 32” F-SHAPE CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF THE BARRIER AND RAILING MUST BE 3’-6” MINIMUM.”. REINFORCEMENT BAR NOTES: • Note 3: Revised “ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).”.
	5 of 8	36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK: • Added “WITH 42” VERTICAL WALL CONCRETE BARRIER” to detail title. • Revised ⑭ to ⑮. LEGEND: • Legend ⑨: Added “FOR END OF BARRIER TRANSITIONING TO GUIDE RAIL, FOLLOW DETAILS ON BD-622M AND BD-624M.”. • Revised ⑭ to ⑮.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-661M (cont.)	5 of 8 (cont.)	REINFORCEMENT BAR NOTES: • Note 3: Revised “ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).”.
BD-667M	1 of 9	GENERAL NOTES: • Note 3: Revised “WORKMANSHIP” to “PERFORM WORK”. REFERENCE DRAWINGS: • Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”. • Added “BD-622M R.C. ABUTMENTS WITH BACKWALL”. • Added “BD-624M R.C. ABUTMENTS WITHOUT BACKWALL”. • Removed “BC-739M BRIDGE BARRIER TO GUIDE RAIL TRANSITION”.
	5 of 9	ATTACHED RECTANGULAR WINGWALL ELEVATION: • Revised #6 @ 8” to #8 @ 6”. • Revised “L ≤ 8’-8” MAX.” to “L*”. ATTACHED TAPERED WINGWALL ELEVATION: • Revised “L ≤ 16’-7” MAX.” to “L ⑰ SEE TABLE 1 FOR MAX. LENGTH AND TABLE 2 FOR MIN. LENGTH”. DETACHED WINGWALL ELEVATION • Added “⑨”. SECTION J-J: • Revised for new MASH barrier end transition. • Revised “#6 @ 8” MAX.” to “#8 @ 6” MAX.”. • Revised “L” to “L*”. SECTION L-L: • Revised for new MASH barrier end transition. • Revised “L” to “L ⑰ SEE TABLE 1 FOR MAX. LENGTH AND TABLE 2 FOR MIN. LENGTH”. SECTION K-K: • Added “MIN.” to 2’-2”. • Revised “BD-601M” to “BD-622M AND BD-624M”. SECTION N-N: • Added “MIN.” to 2’-2”. • Revised “BD-601M” to “BD-622M AND BD-624M”. Removed bar detail. TABLE 1: • Revised lengths in “WINGWALL LENGTH BEYOND THE REAR FACE OF THE ABUTMENT (L)” column. • Revised reinforcement in “REINFORCEMENT” column.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-667M (cont.)	5 of 9 (cont.)	TABLE 2: • Revised 8’-8” to 9’-0”. • Added “AND THE MINIMUM BARRIER END TRANSITION LENGTH IN TABLE 3.” to note ***. LEGEND: • Added: “⑰ FOR MINIMUM BARRIER END TRANSITION LENGTH (L) REFER TO TABLE 3.”. Added “NOTE TO DESIGNER: THE BEAM DEPTH AND MAXIMUM WINGWALL LENGTHS ARE BASED ON STRUCTURAL CAPACITY OF THE WING WALL ATTACHMENT TO THE CAP. THEREFORE THE BARRIER END TRANSITION LENGTH INDICATED IN TABLE 3 MAY CONTROL THE MINIMUM BEAM DEPTH.”. Added “*THE WING LENGTH MUST BE LONG ENOUGH TO INCLUDE THE APPROPRIATE BARRIER END TRANSITION LENGTH FOR THE BRIDGE BARRIER TYPE ON THE STRUCTURE, SEE NOTE ON SHEET 6. SEE TABLE 3.”. Added “TABLE 3: RECTANGULAR WINGWALL”.
	6 of 9	PARTIAL SECTION THRU DETACHED WINGWALL EXPANSION JOINT: • Added “NOTE: IF THE ATTACHED RECTANGULAR WINGWALL CANNOT ACCOMMODATE THE REQUIRED TRANSITION LENGTH, USE THE ATTACHED TAPERED WINGWALL OR DETACHED WINGWALL.”.
	7 of 9	MINIMUM APPROACH SLAB LENGTH TABLE: • Revised Table title “MINIMUM APPROACH SLAB LENGTH ALONG CL”.
	9 of 9	CONNECTION DETAIL – ADDITIONAL BAY: • Added “▲ MAY BE EXCEEDED UP TO DECK PAN DEPTH PLUS 1”.”. NOTES: • Added Note 5: “FOR “TYPICAL CONNECTION DETAIL” SEE BC-754M.”.
BD-668M	1 of 3	NOTES: • Note 1: Revised “ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).”. • Note 2: Revised “MATERIAL AND WORK QUALITY” to “PROVIDE MATERIALS AND PERFORM WORK”. Deleted “SUPPLEMENTS THERETO, AND THE CONTRACT SPECIAL PROVISIONS”. • Note 6: Revise “TYPICAL” to “42” F-SHAPE”. • Note 13: Deleted.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-668M (cont.)	1 of 3 (cont.)	LEGEND: • Added "*** FOR SHEAR KEY DETAILS, SEE BC-775M.". • Added "① WITHIN 10' ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON BD-622M AND BD-624M.". TYPICAL PRECAST CHANNEL SECTIONS: • Added *** at shear key locations. • Added ① to barrier bar callout #4 @ 12" MAX. SPA. • Removed "SHEET 6". • Added 2'-11¼" dimension. • Revised note to "PRECAST CHANNEL BEAM SHOWN SUPPORTING 42" F-SHAPE CONCRETE BARRIER. OTHER F-SHAPE BARRIERS SIMILAR. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE 32', 42" AND 45" F-SHAPE CONCRETE BARRIERS NOT SHOWN, SEE BD-601M. SEE SHEET 3 FOR PA TYPE 10M BRIDGE BARRIER DETAILS AND VERTICAL WALL CONCRETE BARRIER DETAILS. REFERENCE DRAWING: • Revised "CONCRETE VERTICAL WALL BRIDGE BARRIER" to "VERTICAL WALL CONCRETE BARRIER". • Added "BD-622M R.C. ABUTMENTS WITH BACKWALL". • Added "BD-624M R.C. ABUTMENTS WITHOUT BACKWALL".
	2 of 3	NOTES: • Note 1: Deleted "STANDARD DRAWING". PARTIAL PLAN: • Added "SEAL JOINT BETWEEN THE BOTTOM OF THE BEAMS WITH BACKER ROD OR CCNS WITH DOUBLE SIDED ADHESIVE STRIP PRIOR TO FILLING SHEAR KEYS WITH NON-SHRINK EPOXY GROUT. (SEE BD-775M) to ½" joint. • Revised void detailing.
	3 of 3	TYPICAL PRECAST CHANNEL SECTION WITH CONCRETE VERTICAL WALL BRIDGE BARRIER: • Revised title to "TYPICAL PRECAST CHANNEL SECTION WITH 42" VERTICAL WALL CONCRETE BARRIER". • Revised note to "PRECAST CHANNEL BEAM SHOWN SUPPORTING VERTICAL WALL CONCRETE BARRIER. FOR GEOMETRC AND REINFORCEMENT DETAILS OF THE BARRIER NOT SHOWN, SEE BD-618M.". • Added note "(42" VERTICAL WALL CONCRETE BARRIER SHOWN, 32" VERTICAL WALL CONCRETE BARRIER SIMILAR)". • Added note "*** FOR SHEAR KEY DETAILS, SEE BC-775M)". • Added note "① WITHIN 10' ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON BD-622M AND BD-624M.".

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-668M (cont.)	3 of 3 (cont.)	• Revised 1 ½" CLR. to 2" CLR. • Added *** at shear key location. • Added ① to #4 @ 8" MAX. • Added 0" dimension. TYPICAL PRECAST CHANNEL SECTION WITH PA TYPE 10M BRIDGE BARRIER: • Revised "CURB" to "BARRIER WALL". • Revised 11½" to 1'-3½". • Revised rear face barrier to be vertical. Deleted ½". • Added a second set of anchor bolts and anchor plate. • Added 4" dimension between anchor bolts. • Revised "1'-1" CONCRETE CURB" to "1'-5" BARRIER WALL". • Added *** at shear key location. • Added note "* VARIES, SEE DESIGN CHART ON SHEET 2 FOR PRECAST CHANNEL BEAMS.". • Added note "*** FOR SHEAR KEY DETAILS, SEE BC-775M)". VERTICAL BARRIER BAR DETAIL: • Revised top of bar to be level. • Revised 2'-7" to 2'-5". • Revise 4" to 3". • Revised 1'-8½" to 1'-4". PA TYPE 10M BARRIER BAR DETAIL: • Revised top of bar to be level. • Revised 2'-0" to 2'-4". • Revised 11" to 1'-3". Deleted REFERENCE DRAWINGS
BD-679M	1 of 11	MOMENT SLAB: • Removed "MIN". REFERENCE DRAWING: • Revised "CONCRETE VERTICAL WALL BRIDGE BARRIER" to "VERTICAL WALL CONCRETE BARRIER".
	2 of 11	NOTES TO DESIGNER: • Note 11: Revised "PROVIDED" to "SPECIFIED". DESIGN PARAMETERS: • Note 1: Revised "NOTE 28" to "NOTE 25".
	4 of 11	TYPICAL C.I.P. MOMENT SLAB AND BARRIER SECTION: • Added ▲ to 3'-6" barrier height dimension. LEGEND: • Added: "▲ 45" F-SHAPE CONCRETE BARRIER NOT PERMITTED ON MOMENT SLAB.".

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-679M (cont.)	4 of 11 (cont.)	MOMENT SLAB NOTES: • Note 3: Added “BD-627M AND”.
	5 of 11	DETAIL D (WITHOUT CABLE CONNECTION): • Removed symbol from WELDED WIRE FABRIC (WWF).
	7 of 11	SECTION: • Removed 3’-7” dimension. • Revised NOTE to “45” F-SHAPE CONCRETE BARRIER SHOWN, 42” F-SHAPE CONCRETE BARRIER AND 42” VERTICAL WALL CONCRETE BARRIER SIMILAR.”. NOTES: • Added new note – “3. PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL THIS SHEET.”. Added “VERTICAL V-NOTCH DETAIL”.
	8 of 11	SECTION: • Removed 3’-7” dimension. • Revised NOTE to “45” F-SHAPE CONCRETE BARRIER SHOWN, 42” F-SHAPE CONCRETE BARRIER AND 42” VERTICAL WALL CONCRETE BARRIER SIMILAR. 45” F-SHAPE CONCRETE BARRIER NOT PERMITTED FOR SOUND BARRIERS ON MOMENT SLAB.”. NOTES: • Added new note – “3. PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS, SEE DETAIL SHEET 7.”.
	10 of 11	PLAN – STRUCTURE MOUNTED SOUND BARRIER TO GROUND MOUNTED SOUND BARRIER: • Revised detail to remove flare from end of barrier. • Revised “BEND POINT OR END OF WALL” to “END OF WALL OR BEGINNING OF BARRIER TRANSITION”. • Revised note to “(BARRIER/RETAINING WALL WITH BARRIER TRANSITION)”.

OS-299 (7-08)	TRANSMITTAL LETTER	**PUBLICATION:**
pennsylvania DEPARTMENT OF TRANSPORTATION		Publication 218M September 2016 Edition Change No. 2
		DATE: August 30, 2019

SUBJECT:

Revisions to
Standards for Bridge Design
September 2016 Edition

INFORMATION AND SPECIAL INSTRUCTIONS:

Incorporate the attached revisions into the September 2016 Edition of Publication 218M.

These standards may be used immediately and can be adopted as soon as practical on all new and existing designs without affecting letting schedules. All projects with T.S.&L. submissions after November 1, 2019 shall incorporate these new standards.

A description of the changes made to the 2016 Edition since Change 1 of August 4, 2017 are listed in the attached multi-sheet Table. On the standards, light green highlighting indicates Change 2 revisions to details and notes; light yellow highlighting indicates Change 1 revisions.

CANCEL AND DESTROY THE FOLLOWING:

Existing BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work.

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BY:

Melissa J. Batula, P.E.
Acting Director, Bureau of Project Delivery,
Highway Administration

Standard	Sheet	Description of Changes
General		Revised terminology for gender-neutrality throughout the standards (e.g. replaced WORKMANSHIP with WORK QUALITY).
BD-601M	1 of 11	NOTES, Note 4, Clear Distance: revised min. clear distance between reinforcement mats to be two lines that specify a 2" min. vertical clear distance between longitudinal bars in top and bottom mats and between transverse bars in top and bottom mats.
		NOTES, Note 4, Bar Spacing: consolidated maximum bar spacing for slabs and for barriers into one line.
		NOTES, Note 4, Bar Spacing: added TRANSVERSE REINFORCEMENT to MINIMUM SPACING.
		NOTES, Note 13: updated to 8th Edition AASHTO Article Number from 5.14.1.4 to 5.12.3.3 and DM-4 Section D5.14.1.1.4 to D5.12.3.3.
		NOTES, Note 16: in second line removed 32" from before ALTERNATE SIDEWALK. Added ALTERNATE BARRIER IS DESIGNED TO RESIST VEHICULAR COLLISION AT TEST LEVEL 3 to end of note.
		NOTES: deleted Note 23 and re-numbered subsequent notes; updated references to the re-numbered notes throughout the standard.
		NOTES: added Note 29 to require mechanical grinding of bridge decks without overlays on interstate, limited access and NHS routes; this requires an extra 1/4" of initial deck slab thickness and top cover; added references to this note in the typical slab panel details.
		NOTES: added Note 30 regarding eliminating the 1/2 " integral wearing surface from concrete deck slab when an epoxy, latex modified concrete (LMC) or polyester polymer concrete (PPC) overlay is used; added references to this note in the typical slab panel details.
		LEGEND, Item 3: updated referenced DM-4 article from D5.14.1.14 to D5.12.3.3.
		LEGEND, Item 5: updated lap splice lengths from 2'-7" to 2'-10" and from 3'-1" to 3'-10" for #5 and #6 bars in normal weight concrete, and from 4'-1" to 4'-6" for #6 bars in lightweight concrete.
	3 of 11	LEGEND, Item 7: updated lap splice lengths from 2'-7" to 2'-10" and from 3'-1" to 3'-10" for #5 and #6 bars in normal weight concrete, and from 4'-1" to 4'-6" for #6 bars in lightweight concrete.
	4 of 11	LEGEND, Item 5: updated lap splice lengths from 2'-7" to 2'-10" and from 3'-1" to 3'-10" for #5 and #6 bars in normal weight concrete, and from 4'-1" to 4'-6" for #6 bars in lightweight concrete.
	6 of 11	In three reinforcement bar details, revised length of horizontal leg (development length) from 1'-0" to 1'-6" for normal weight concrete and from 1'-3" to 1'-9" for light weight concrete.
	7 of 11	In four reinforcement bar details, revised length of horizontal leg (development length) from 1'-0" to 1'-6" for normal weight concrete and from 1'-3" to 1'-9" for light weight concrete.
	8 of 11	HAUNCH REINFORCEMENT DETAILS: removed LAP from 1'-0" rebar leg dimension (2 places).
		Deleted ALTERNATE CONTINUITY REINFORCEMENT DETAIL.
	10 of 11	TABLE 4: for S = 8'-6"; revised T from 8 1/2" to 8", S2 size to #5 and So to 4'-10", for S = 12'-9"; revised S1 to be #5 @5 1/2 and S3 to be #5 @6, and for S = 13'-9"; revised S1 to be #5 @5 1/2 and S3 to be #5 @6. *[e-Notification No. 68]*
BD-604M	1 of 4	NOTES: added Note 17 to state that barriers as shown are not MASH compliant and should not be used and re-numbered subsequent notes; updated references to the re-numbered notes.
		NOTES: added Note 18 stating that Sheet 4 shall be used for preliminary design only and re-numbered subsequent notes; updated references to the re-numbered notes.
		BARRIER NOTES, Note 24 (formerly 22): revised reference from BC-739M to RC-50M.
		REFERENCE DRAWINGS: Added BD-601M, BC-751M, BC-767M, BC-788M and RC-50M to list.
	2 of 4	DETAIL A: added SEE EXTRUSION NOTE call-out and Extrusion Note beneath Detail A. *[e-Notification No. 60]*
	3 of 4	BARRIER REINFORCEMENT: revised horizontal leg length from 1'-2" to 1'-10" for NORMAL WEIGHT CONCRETE and from 1'-5" to 2'-2" for LIGHTWEIGHT CONCRETE.
	4 of 4	TABLE 1: removed table entry for 3" Bearing Bar. *[e-Notification No. 60]*
		NOTES, DECK OVERLAYS, Note 3: revised terminology from BITUMINOUS OVERLAYS to ASPHALT PAVEMENT OVERLAYS.
BD-605M	1 of 6	DRAWING NOTES, Note 3: added CONTRACTOR MUST PERFORM FINAL DESIGN OF POST-TENSIONING SYSTEM. POST-TENSIONING CALCULATION MUST ACCOUNT FOR PROPOSED HARDWARE AND ARE TO to beginning of note.
BD-605M (cont.)	1 of 6 (cont.)	DRAWING NOTES, Note 4: added CONTRACTOR TO DESIGN LIFTING DEVICES AND CALCULATIONS MUST to the beginning of the note.
		DRAWING NOTES, Note 5: added BLAST CLEAN INSIDE FACE OF SHEAR BLOCKOUTS AND SHEAR KEYS TO CREATE to the beginning of the note.
		DRAWING NOTES: added Note 6: BLAST CLEAN TRANSVERSE AND LONGITUDINAL JOINTS OF PRECAST PANELS TO CREATE AN EXPOSED AGGREGATE FINISH.
		DRAWING NOTES: added Note 7: ASSESS THE STABILITY OF EXTERNAL PRECAST DECK PANELS DUE TO ASYMMETRICAL AND/OR ECCENTRIC LOADING. MAINTAIN STABILITY OF PRECAST DECK PANELS DURING LIFTING, TRANSPORTATION AND ERECTION OF THE PANELS UNTIL CLOSURE POURS AND POST-TENSIONING OPERATIONS ARE COMPLETE.
		SEQUENCE OF CONSTRUCTION Notes: added PRE-WET PRECAST INTERFACE OF JOINT WITH WATER TO CREATE A SATURATED SURFACE CONDITION. to second line of Note 6 and to first line of Note 12.
	2 of 6	SECTION A-A: added TINE FINISH OF PRECAST DECK PANELS call-out to top of deck.
	4 of 6	SHEAR CONNECTOR BLOCKOUT DETAIL: added call-out to sides of block-out to reference Drawing Note 5 on Sheet 1.
	5 of 6	SECTION B-B, SECTION D-D and LONGIT. CLOSURE POUR BETWEEN BEAMS/GIRDERS: added call-out to sides of joint/closure pour to reference Drawing Note 6 on Sheet 1.
	6 of 6	VERTICAL ADJUSTMENT DEVICE: modified FORMED POCKET object lines and revised call-out from 2 1/2" MIN. FORMED POCKET to SEE FORMED POCKET DETAIL.
		Added FORMED POCKET DETAIL.
BD-610M	1 of 17	VERTICAL REINFORCEMENT: revised horizontal leg length from 1'-0" to 1'-6" NORMAL WEIGHT CONCRETE / 1'-9" LIGHTWEIGHT CONCRETE.
		SECTION A-A: revised two anchor bars to an ANCHOR PLATE and revised size call-out to be 1/4" x 11 1/2" x 1'-3"
		NOTES: removed Note 9 and renumbered subsequent notes.
	3 of 17	SECTIONS C-C, D-D, G-G and Legend No. 2: revised rebar vertical lap splice from 2'-1" MIN. to 2'-2" MIN.
	6 of 17	SECTION F-F: revised anchor bars to be an anchor plate.
		SECTIONS E-E & F-F and Legend No. 3: revised rebar lap length from 2'-1" MIN. to 2'-2" MIN.
	10 of 17	SECTION K-K: revised anchor bars to be an anchor plate.
		SECTIONS J-J & K-K and Legend No. 2: revised rebar lap length from 2'-1" MIN. to 2'-2" MIN.
	11 of 17	PLAN & ELEVATION VIEWS (4 views): revised rebar splice length from 2'-1" MIN. to 2'-2" MIN.
		SECTIONS N-N & P-P: revised rebar splice length from 2'-1" MIN. to 2'-2" MIN.
	12 of 17	SIDEWALK DETAILS (3 details): revised anchor bars to be an anchor plate.
		VERTICAL REINFORCEMENT: revised horizontal leg length from 1'-0" to 1'-6" NORMAL WEIGHT CONCRETE / 1'-9" LIGHTWEIGHT CONCRETE.
	13 of 17	In two box beam details: revised anchor bars to be an anchor plate.
		ADJACENT BOX BEAMS SUPPORTING BARRIER detail: rebar vertical embedment in box beam revised from 1'-0" MIN. to 1'- 4" MIN. ✱✱.
		VERTICAL REINFORCEMENT (2 details): revised vertical rebar leg embedment length from 1'-0" to 1'-4" MIN. ✱✱, revised horizontal leg length from 1'-0" to 1'-4" (2 places), and added the following note: ✱✱ OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.
	14 of 17	ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK: revised anchor bars to be an anchor plate.
		VERTICAL REINFORCEMENT: revised horizontal leg length from 1'-0" to 1'-6" NORMAL WEIGHT CONCRETE / 1'-9" LIGHTWEIGHT CONCRETE.
	15 of 17	In two R.C. Culvert details: revised anchor bars to be an anchor plate.
		VERTICAL REINFORCEMENTS: revised horizontal leg length from 1'-0" to 1'-10" NORMAL WEIGHT CONCRETE / 2'-2" LIGHTWEIGHT CONCRETE.
	16 of 17	SECTIONS J-J & L-L: revised rebar splice length from 2'-1" MIN. to 2'-2" MIN.
		LONGITUDINAL REINF.: revised rebar leg lengths from 2'-1" to 2'-8" and 3'-10 1/4" to 4'-5 1/4".

Standard	Sheet	Description of Changes
BD-610M (cont.)	16 of 17 (cont.)	SECTIONS K-K & N-N: revised rebar splice length from 2′-1" to 2′-2" and moved leader line from gutter line to start of lap.
		VERTICAL CURB REINFORCEMENT: revised rebar leg lengths from 3′-8 3/4" to 3′-11 1/2" and 2′-2" to 2′-4".
	17 of 17	SECTION R-R: revived anchor bars to a single anchor plate for anchorage of post in barrier wall.
BD-611M	2 of 3	DIAPHRAGM AT ABUTMENT WITH BACKWALL: revised rebar lap splice from 1′-3" to 1′-11" due to adoption of 8th Edition AASHTO Spec.
BD-612M	1 of 3	WATER OR GAS LINE SUPPORT DETAIL: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	2 of 3	PIPELINE UTILITY - FULL DEPTH DIAPHRAGM: added GALVANIZED OR COMPLETELY ZINC-ELECTROPLATED to Threaded Insert call-out.
	3 of 3	END & PIER DIAPHRAGM details: added GALVANIZED OR COMPLETELY ZINC-ELECTROPLATED to Threaded Insert call-out.
BD-615M	2 of 3	VERTICAL REINFORCEMENT: revised horizontal rebar leg length from 1′-0" to 1′-6" for normal weight concrete and from 1′-3" to 1′-9" for light weight concrete.
BD-617M	1 of 16	SECTION A-A: removed erroneous 19 before 3/4" in threaded anchor studs call-out.
		VERTICAL REINFORCEMENT: revised horizontal leg length from 1′-0" to 1′-6" for normal weight concrete and from 1′-3" to 1′-9" for light weight concrete; moved horizontal leg's dimension line to start of straight segment.
	3 of 16	SECTIONS C-C, D-D & F-F: revised rebar splice length from 2′-1" MIN. to 2′-2" MIN.
	6 of 16	SECTIONS E-E and H-H: revised rebar splice length from 2′-1" MIN. to 2′-2" MIN.
	7 of 16	NOTES, Note 1: added IF SAFETY WINGS ARE NOT PRESENT, to beginning of line 1.
	10 of 16	SECTIONS N-N & P-P: added bar in top of barrier parapet *[e-Notification No. 64]*.
		PLAN VIEW, ELEVATION VIEW, SECTIONS N-N & P-P: revised rebar lap splice from 2′-1" to 2′-2".
	12 of 16	VERTICAL REINFORCEMENT (2 details): revised rebar leg embedment length from 12" MIN. to 1′-4" MIN. ✱✱, and revised horizontal leg length from 12" to 1′-4" (2 places), and added the following note: ✱✱ OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.
	13 of 16	VERTICAL REINFORCEMENT: moved horizontal leg's dimension line to start of straight segment.
		VERTICAL REINFORCEMENT: revised horizontal leg length from 1′-0" to 1′-6" for normal weight concrete and from 1′-3" to 1′-9" for light weight concrete.
	14 of 16	VERTICAL REINFORCEMENT - C.I.P. CULVERT: revised horizontal leg length from 1′-0" to 1′-6" for normal weight concrete and from 1′-3" to 1′-9" for light weight concrete; moved horizontal leg's dimension line to start of straight segment.
	15 of 16	SECTIONS K-K and N-N: revised rebar splice length from 2′-1" MIN. to 2′-2" MIN.
		Removed OF 35 from two references to BD-628M.
BD-618M	1 of 12	NOTES: removed Note 8.
		VERTICAL REINFORCEMENT: revised horizontal leg length from 1′-0" to 1′-6" for normal weight concrete and from 1′-3" to 1′-9" for light weight concrete.
	2 of 12	SECTIONS A-A & B-B: revised rebar splice length from 2′-1" MIN. to 2′-2" MIN.
	5 of 12	SECTION F-F: added 1′-8 1/4" dimension for thickness at top of wall stem.
		SECTION F-F: revised rebar splice length from 2′-1" MIN. to 2′-2" MIN.
		SECTION E-E: added Construction Joint lines in stem at 6' barrier termination and a horizontal joint 3' below barrier.
	6 of 12	TITLE BLOCK: removed WITHOUT BACKWALL from second line of title.
		TYPICAL PLAN: added following note below title: (FLARED SAFETY WING IS NOT REQUIRED. VERTICAL WALL BRIDGE BARRIER MUST TERMINATE ON BRIDGE DECK.)
	9 of 12	LEGEND, Item 2: revised lap splice lengths from 2'-7" to 3′-7" and from 3′-1" to 4′-4" for #5 and #6 bars in normal weight concrete, and from 3′-5" to 4′-9" and from 4′-1" to 5′-9" for #5 and #6 bars in light weight concrete.
		VERTICAL WALL BRIDGE BARRIER ON U-WING: revised rebar splice length from 2′-1" MIN. to 2′-2" MIN.

Standard	Sheet	Description of Changes
BD-618M (cont.)	11 of 12	AT TYPICAL BARRIER: decreased deck overhang limit from 8" to 4".
		VERTICAL REINFORCEMENT (2 details): revised vertical rebar leg embedment length from 12" MIN. to 1′-4" MIN. ✱✱, and revised horizontal leg length from 12" to 1′-4" (2 places), and added the following note: ✱✱ OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.
BD-619M	1 of 5	NOTE 2. REFERENCES: updated references.
		NOTE 3. DETAILING REQUIREMENTS: added CURVED in heading of table. Recommended fit conditions for Horizontal Curve I-Girder Bridges: changes (L/R)max from > 0.1 to ≥ 0.2.
		NOTE 3. DETAILING REQUIREMENTS, item 1 under tables: rewrote the discussion of the applicability of the SDLF condition.
		NOTE 4. USAGE AND ORIENTATION OF DIAPHRAGMS, item b): added SKEW before ANGLES in the last sentence for clarity (2 instances).
		NOTE 4. USEAGE AND ORIENTATION OF DIAPHRAGMS, item k): added BEND before RADII in last line for clarity.
	2 of 5	NOTE 6. SELECTION OF DIAPHRAGM MEMBERS, first paragraph: added AND SIZES to DIFFERENT TYPES OF MEMBERS USED for clarity.
		NOTE 6. SELECTION OF DIAPHRAGM MEMBERS, fifth bullet: added REFER TO PUB. 408 SECTION 1105.03(t) FOR MINIMUM BEND RADII.
		NOTE 9. DETERMINATION OF DESIGN LOADS, item a), sixth bullet: modified WS Load factor to 1.00 (3 instances).
		NOTE 9. DETERMINATION OF DESIGN LOADS, item a), sixth through tenth bullet: added LOAD COMBINATIONS for clarity (7 instances).
		NOTE 9. DETERMINATION OF DESIGN LOADS: added following bullet item: • IN THE ABOVE-LISTED LOAD COMBINATIONS, USE THE APPROPRIATE WIND VELOCITY FOR THE GIVEN LOAD COMBINATION.
	3 of 5	NOTE 10, item a), second bullet: revised fatigue category from E to E′.
		NOTE 10, item a), second bullet and item d), third bullet: added LOAD COMBINATION for clarity.
		NOTE 10, item d), first bullet: corrected spelling of CENTROID.
		NOTE 10, item d), fourth bullet: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325. (4 instances).
		NOTE 10, item d), fifth bullet: added USE CLASS C SLIP RESISTANCE FOR GALVANIZED BOLTS . . .
		Note 11c and 11d: revised WIND FORCE EFFECTS to GLOBAL (SYSTEM) DEAD, LIVE, AND WIND LOAD.
		NOTE 14, item d): updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	5 of 5	NOTE: added REFER TO AASHTO LRFD SECTION C6.7.4.2 FOR ADDITIONAL DISCUSSION REGARDING EFFICIENT FRAMING ARRANGEMENTS. to end of note.
		CONTIGUOUS CROSS-FRAME . . , and SEVERELY SKEWED SUPPORTS . . . : replaced 1.5 D with 4 b_f in the limits of O and added definition of b_f.
BD-620M	1 of 6	MINIMUM DESIGN WIND PRESSURE (PSF) FOR LATERAL BRACING DURING CONSTRUCTION: added CW and AND PRESSURE DISTRIBUTION TO GIRDERS to the title; added the wind pressure distribution to each girder in the schematic.
	3 of 6	NOTES, Note 3: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	5 of 6	NOTES, Note 3: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
BD-621M	1 of 3	PILE ANCHORAGE DETAILS: added note below detail title listing three conditions for which the shown anchorage is required. *[e-Notification No. 67]*
		NOTES, Note 9: corrected referenced sheet number for weep hole details.
		REFERENCE DRAWINGS: removed BD-625M R.C. ABUT. MISCELLANEOUS DETAILS from list.
	2 of 3	TYPICAL SECTION WITHOUT BACKWALL . . . – STEM HEIGHT LESS THAN 12′-0": Added SEE NOTE 13 call-out that was inadvertently deleted in initial 2016 edition.
BD-622M	1 of 5	ABUTMENT SECTION, Bearing Seat Slope: replaced 1V :10H with 1" / FT.
	2 of 5	SECTION D-D, SECTION E-E & ALT. BARRIER REINFORCEMENT SECTION: revised #4 rebar to #5 rebar lap length from 2′-1" to 2′-2" and moved leader line from the optional construction joint to the end of the lap.

Standard	Sheet	Description of Changes
BD-622M (cont.)	2 of 5 (cont.)	SECTION C-C and ALTERNATE SECTION C-C: added call-out for the class of cement concrete to be used in the flared safety wings above and below the optional horizontal construction joint.
	3 of 5	SECTION F-F (with or without curb block): revised #4 hairpin rebar to #5 rebar lap length from 2′-1" to 2′-2" and moved leader line from optional construction joint to the end of the lap.
		PLAN VIEW (2 places): revised #5 rebar lap length form 2′-6" to 2′-7".
	4 of 5	SECTION K-K: revised #4 rebar to #5 rebar lap length from 2′-1" to 2′-2" and moved leader line from the construction joint to the end of the lap.
BD-624M	1 of 5	GENERAL NOTES: deleted Note 1 and re-numbered subsequent notes.
	2 of 5	SECTION C-C and ALTERNATE SECTION C-C: added call-out for the class of cement concrete to be used in the flared safety wings above and below the optional horizontal construction joint.
		SECTIONS D-D & E-E and ALT. BARRIER REINF. SECTION: revised #4 hairpin rebar to #5 rebar lap length from 2′-1" to 2′-2" and moved leader line from the optional construction joint to the end of the lap.
	3 of 5	SECTION F-F (with and without curb block): revised #4 hairpin rebar to #5 rebar lap length from 2′-1" to 2′-2" and moved leader line from the construction joint to the end of the lap.
	4 of 5	SECTION K-K: revised #4 rebar to #5 rebar lap length from 2′-1" to 2′-2" and moved leader line from the construction joint to the end of the lap.
BD-626M	1 of 9	GENERAL ANCHOR WALL DESIGN METHODOLOGY, Note 7: added "WITH THE EXCEPTION OF SINGLE PILE DESIGN W/C.I.P. WALL AND COLUMN ALTERNATE," to first sentence, and added DEFLECTION TOWARDS THE BACKFILL FOR SINGLE PILE DESIGN W/C.I.P. WALL AND COLUMN DESIGNS SHALL BE PREVENTED IN ORDER TO AVOID OR REDUCE CRACKING ON EXPOSED FACE at end of note.
		NOTES TO DESIGNER: added Note 23: DESIGN CONCRETE AND REINFORCEMENT FOR A TEST LOAD OF 125% TO 150% OF UNFACTORED LOAD PER AASHTO ARTICLE 11.9.8.1 IN ADDITION TO THE STRENGTH CONDITION. FOR SINGLE PILE W/C.I.P. WALL AND COLUMN ALTERNATE, DESIGNER MUST…AND SPECIAL PROVISIONS.
	3 of 9	DOUBLE PILE DESIGN W/PRECAST LAGGING – WALL ELEVATION: corrected line-type for steel pile centerlines.
	5 of 9	SECTION G-G: modified soldier pile note ". . . Sheet 3 for CONFIGURATIONS and weld details)".
	7 of 9	SECTION J-J: Front face reinforcement mat modified. Added FF WALL callout.
		EMBEDDED ANCHORAGE DETAIL: rebar Details callout modified and added CIRCULAR BLOCKOUT callout.
	9 of 9	GUIDERAIL AT TOP OF WALL and BARRIER DETAIL 4: Replaced TYPE 1 with TYPE A in foundation drain's geotextile callout.
		Added DETAIL X – EXTRA WALL REINFORCEMENT AT TENDON ANCHORAGE
BD-627M	1 of 8	REFERENCE DRAWINGS: added RC-21M, RC-27M and BC-799M.
		CONTRACT DRAWING NOTES, Note 2: deleted fourth sentence with reference to BC-799M.
		INSTRUCTIONS TO DESIGNER: removed item 3 and renumbered subsequent items.
		INSTRUCTIONS TO DESIGNER: added item 9 regarding crash test level.
	2 of 8	MOMENT SLAB (BURIED): revised #6 rebar horizontal leg length from 2′-3" MIN. to 2′-4".
		Added note ■ AT DISCRETION OF THE DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4′-0" FOR REHABILITATION PROJECTS, SEE SHEET 7 which is referenced from the Barrier Moment Slab Width dimension in both Moment Slab details.
		MOMENT SLAB (AT-GRADE): removed MIN. from dimension of #4 rebar horizontal leg length.
	3 of 8	Revised terminology in detail title from REINFORCEMENT FOR BARRIER WITH <u>BITUMINOUS CONCRETE</u> SHOULDER to REINFORCEMENT FOR BARRIER WITH <u>ASPHALT-PAVED</u> SHOULDER.
		REINFORCEMENT FOR BARRIER WITH ~~BITUMINOUS CONCRETE~~ ASPHALT-PAVED SHOULDER: revised #6 rebar leg length from 2′-0" to 2′-4".
		Added note ■ AT DISCRETION OF THE DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4′-0" FOR REHABILITATION PROJECTS, SEE SHEET 7 which is referenced from the Barrier Moment Slab Width dimension in both Moment Slab details.

Standard	Sheet	Description of Changes
BD-627M (cont.)	4 of 8	Added note ■ AT DISCRETION OF THE DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4′-0" FOR REHABILITATION PROJECTS, SEE SHEET 7 which is referenced from the Barrier Moment Slab Width dimension in the MOMENT SLAB WITH ASPHALT OVERLAY detail.
		MOMENT SLAB WITH ASPHALT OVERLAY . . . : removed MIN. from dimension of #4 rebar horizontal leg length.
	5 of 8	MOMENT SLAB (BURIED): revised #6 rebar horizontal leg length from 2′-3" MIN. to 2′-4".
		MOMENT SLAB (BURIED): revised #6 vertical lap length from 2′-6" MIN. to 3′-1" MIN.
		MOMENT SLAB (AT-GRADE): removed MIN. from dimension of #4 rebar horizontal leg length.
		MOMENT SLAB (AT-GRADE): revised #6 vertical lap length from 2′-6" MIN. to 3′-1" MIN.
		Added note ■ AT DISCRETION OF THE DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4′-0" FOR REHABILITATION PROJECTS, SEE SHEET 7 which is referenced from the Barrier Moment Slab Width dimension in both Moment Slab details.
	6 of 8	PLAN – BARRIER MOMENT SLAB (Precast & C.I.P. Barrier): updated Tie Bar/Tie Bolt reference from RC-20M to RC-27M (4 instances).
		PLAN – BARRIER MOMENT SLAB (Precast & C.I.P. Barrier): revised Moment Slab Length dimension from (VARIES) 30′-0" MIN., 40′-0" MAX. to a fixed L = 30′-0" and revised the maximum number of pavements joints between moment slab joints from ONE to TWO.
	7 of 8	Added FOR REHABILITATION PROJECTS to sheet title in Title Block.
		BARRIER TO GUIDE RAIL TRANSITION, PLAN and MOMENT SLAB ADJACENT TO BRIDGE: added moment slab width dimension call-out: MOMENT SLAB WIDTH, W, SEE TABLE ON THIS SHEET FOR MINIMUM. TO MATCH PAVEMENT SHOULDER WIDTH.
		BARRIER TO GUIDE RAIL TRANSITION, PLAN and MOMENT SLAB ADJACENT TO BRIDGE: added moment slab length dimension call-out: MOMENT SLAB LENGTH, L, SEE TABLE ON THIS SHEET.
		Added table MINIMUM MOMENT SLAB DIMENSIONS FOR REHABILITATION PROJECTS.
BD-628M	1 of 36	INDEX OF SHEETS: added new Sheet 36 - TYPE 5 DETAILS.
	2 of 36	INSTRUCTIONS TO DESIGNER NOTES, Note 9, fourth bullet: revised terminology from BITUMINOUS PAPER ITEMS to ASPHALT-SATURATED PAPER ITEMS.
	3 of 36	SECTION A-A (Types 1 & 2): revised rebar lap splice length from 2′-9" to 3′-4".
	5 of 36	PLAN 2 – TYPE 1 AND TYPE 2: added OR CONTRACTION JOINT to joint call-outs and added references to Details B and D and Note 7.
		DETAIL B – CONSTRUCTION JOINT: revisions to match latest RC-23M include: combined two details with and without asphalt overlay into one detail that does not show the overlay, modified detail title, made top reinforcement discontinuous, dimensioned the joint key; etc.
		Revised NOTE A to NOTE B; revised note to match latest RC-23M.
		Added DETAIL D – CONTRACTION JOINT and NOTE D: detail and note match latest RC-23M.
		JOINT SEALING DETAIL: revisions to match latest RC-23M include: modified depth and width, added backer rod, referenced Note 8, etc.
		NOTES: added Note 7 regarding construction and contraction joint requirements and Note 8 with referenced specifications for joint material.
	8 of 36	SECTION E-E's four locations of Optional Keyed Construction Joints called-outs.: added AND NOTE 7 ON after SEE DETAIL B. Added OR CONTRACTION JOINT (SEE DETAIL D AND NOTE 7 ON SHEET 5).
		SECTION E-E (Types 1 & 2): #5 rebar splice length revised from 2′-9" to 3′-4".
		DETAIL D: replaced CLOSED CELL NEOPRENE SPONGE to PREFORMED CELLULAR POLYSTYRENE.
	19 of 36	SECTION J-J: rebar splice length revised from 2′-9" to 3′-1".
	20 of 36	DETAIL K: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	21 of 36	DETAIL R: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	24 of 36	TYPE 3 APPROACH SLAB: removed #6 bar from inside 180 hook of #6 from approach slab.
	26 of 36	SECTION O-O: rebar splice length revised from 2′-9" to 3′-4".

Standard	Sheet	Description of Changes
BD-628M (cont.)	29 of 36	Replaced bar marks with bar size (e.g. EA4 BARS replaced with #4) throughout and added a note that bars below the beam seat do not need to be epoxy-coated.
		PEDESTAL REINFORCEMENT ELEVATION: vertical rebar lap length at bottom of stem revised from 1′-3" to 2′-2"; vertical rebar lap length at keyed construction joint revised from 1′-9" to 2′-2".
	30 of 36	Replaced bar marks with bar size (e.g. ES6 BARS replaced with #6) throughout.
	31 of 36	DRAIN TROUGH REINFORCEMENT DETAIL: replaced bar marks with bar size (e.g. EA5 BARS replaced with #5).
	32 of 36	SECTION W-W: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	33 of 36	SECTION R-R: revised CLOSED CELL NEOPRENE SPONGE to PREFORMED CELLULAR POLYSTYRENE.
	34 of 36	SECION Q-Q and SECTION A-A: replaced bar marks with bar size (e.g. EC4 BARS replaced with #4) throughout and added a note that bars below the beam seat do not need to be epoxy-coated.
		SECTION A-A: vertical rebar lap splice length revised from 2′-1" to 2′-2".
	35 of 36	DETAIL A: added SECTION R-R arrows.
		NOTES: added Note 8 - FOR SECTIONS R-R & W-W, SEE SHEET 36.
		SECTION X-X: revised rebar splice length from 2′-9" to 3′-1".
		PLAN - TYPE 5: added reinforced slab extension at barrier flare with new SECTION W-W call-out.
		DETAIL P: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	36 of 36	Added a new sheet with new Sections W-W and R-R which are cut from the PLAN view on the previous sheet.
BD-629M	4 of 15	Revised splice length of circular ties from 1′-6" to 1′-10" in six details.
	7 of 15	SECTIONS A-A & C-C and OPTIONAL END TREATMENTS: revised rebar lap length from 18" to 1′-10" LAP.
	8 of 15	SECTIONS A-A & C-C and OPTIONAL END TREATMENTS: revised rebar lap length from 18" to 1′-10" LAP.
	10 of 15	SECTIONS A-A & C-C: revised splice length of circular ties from 1′-6" to 1′-10".
	12 of 15	SECTIONS A-A, B-B & C-C: revised splice length of circular ties from 1′-6" to 1′-10".
BD-631M	2 of 2	TYPICAL HEADWALL ELEVATION: revised lap length from 4′-1" to 4′-3".
BD-632M	1 of 15	NOTES, No. 11: corrected preformed drain limit from 2′ MINIMUM THICK to 2′ MINIMUM HIGH.
		NOTES: added Note 19 regarding additional excavation for bedding material (moved here from Sht. 4, Note 19) and added instruction for leveling bearing areas; renumbered subsequent notes.
		NOTES: added Note 21 regarding encasement of stone bedding materials.
		TYPICAL BOX SECTION: Added bedding material beneath box culvert
		SECTION ALONG C.L. CULVERT: deleted unused leader and dimension lines for culvert length; added note to call-out for and dimension of compacted or flowable backfill at inlet to clarify that this backfill is only along exterior face of end sections and wingwalls.
	3 of 15	SECTION B-B: revised vertical rebar lap splice length from 2′-1" to 2′-2" and moved leader line from the optional construction joint to the start of the lap; added call-out for optional construction joint.
	4 of 15	Updated references to notes on this sheet and Sheet 1 that were renumbered (5 instances).
		BOX DETAILS - WELDED WIRE FABRIC: chamfer size revised from 3/4"x3/4" to 3/4"x3/4" MIN. / 1"X1" MAX
		Added Note beneath DESIGN DATA box: REFER TO SHEET 14 FOR END SECTION SKEW ORIENTATION REQUIREMENTS.
		BOX DETAILS - WELDED WIRE FABRIC: added 2′-0" MIN. BEDDING IF ROCK IS ENCOUNTERED to bedding thickness dimension.
		NOTES, Note 15: revised terminology from BITUMINOUS OVERLAY to ASPHALT PAVEMENT OVERLAY.
		NOTES: moved Note 19 to Sheet 1 as Note 19; renumbered subsequent notes.
		NOTES: added Note 28 regarding acceptability of skewed segments for phased construction.
		NOTES: added Note 29 regarding encasement of stone bedding materials.

Standard	Sheet	Description of Changes
BD-632M (cont.)	4 of 15 (cont.)	DESIGN DATA, INSTRUCTIONS: replaced Minimum Wall and Slab Thickness bullet points with Table.
	5 of 15	PRECAST CULVERT WITH PRECAST END SECTION: revised terminology from BITUMINOUS BOND BREAKER to ASPHALT-SATURATED BOND BREAKER, removed 1′-0"...MIN. from BEDDING call-out, and updated number of referenced notes (2 instances).
		PRECAST WINGWALL CONNECTION DETAILS: switched location of SHIP LAP JOINT and KEYED JOINT details.
		PRECAST WINGWALL CONNECTION DETAILS - KEYED JOINT and SHIP LAP JOINT: replaced D (depth of key or ship lap) with 3" and added PUB 408 SECTION 1085.2(m) to Joint Sealing Material's call-out.
		PRECAST WINGWALL CONNECTION DETAILS - SHIP LAP JOINT: revised ship lap dimension from 1/2" TO 1" to 1/2" MIN. TO 1 1/2" MAX. and added 5" MIN. FOR T ≥ 15" to 3" MIN. FOR T < 15"
	6 of 15	PRECAST CULVERT WITH CAST-IN-PLACE WINGWALLS – PROFILE: Revised terminology from BITUMINOUS BOND BREAKER to ASPHALT-SATURATED BOND BREAKER, removed 1′-0"...MIN. from BEDDING call-out, and updated number of referenced note in THREADED INSERTS call-out.
		ALTERNATE CUTOFF WALL WITH GROUTED ROCK – DETAIL A (WITHOUT APRON): removed 1′-0"...MIN. from BEDDING call-out.
	7 of 15	Switched location of GENERAL NOTES and POST-TENSIONING NOTES.
		POST-TENSIONING NOTES: moved notes 7 and 8 to General Notes; inserted three new notes regarding full contact of joint sealing material, increasing number and adjusting location of strands, and reference for additional notes.
		POST-TENSION END SECTION (2 places): updated number of referenced note in WEEP HOLE call-out.
	9 of 15	Switched location of the TYPICAL HAUNCH SECTION DETAIL and the ALTERNATE HAUNCH SECTION DETAIL.
		CONFIGURATION FOR SLAB/WALL W/PT: revised Dimension 'F' from 1 1/2" to 1 1/2" MAX., 1" MIN.
	11 of 15	TYPICAL INTERIOR BAFFLE - PROFILE & APRON BAFFLE OPENING DETAIL: #5 rebar embedment lengths revised from 1′-3" MIN. to 1′-9" MIN.
	12 of 15	TYP. PRECAST SECTION (NORMAL) – SYMMETRICAL and UNSYMMETRICAL: removed WITH 3/8" NOMINAL MAX. SIZE AGGREGATE from end of ✳✳ note; removed 1′-0" MIN. and SEE NOTE 19 SHEET 4 from BEDDING call-out.
	14 of 15	New Sheet titled R.C. BOX CULVERT - PRECAST CONCRETE SEGMENT JOINT DETAILS including Design Instructions (with plan view schematics) and Design Example.
	15 of 15	New Sheet titled PRECAST BOX CULVERT WITH APRON - C.I.P. CONCRETE WEDGE TRANSITION
BD-633M	1 of 2	ARCH WEEPHOLE DETAIL: added TYPE A specification to the CLASS 4 GEOTEXTILE call-out.
BD-636M	--	Replaced PAIDD COMPUTER PROGRAM with PENNDOT ACCEPTED SOFTWARE throughout (17 total instances on 8 sheets)
		Updated the Pub. 280 title from “PENNSYLVANIA INSTALLATION DIRECT DESIGN MANUFACTURING SPECIFICATION” to “MANUFACTURING SPECIFICATION FOR REINFORCED CONCRETE PIPE” throughout (4 instances on 2 sheets)
		In title block on Sheets 3 thru 10, added PAIDD to beginning of the subtitle.
	1 of 10	NOTES, Note 13: revised reference for pipe spacing sketch from [SEE PAIDD SPECIFICATIONS FOR SKETCH] to [SEE SKETCH IN APPENDIX H OF DESIGN MANUAL, PART 4, STRUCTURES].
	2 of 10	TABLE A: removed references to PAIDD computer program.
	3 of 10	RESPONSIBILITIES FOR DESIGN, FABRICATION AND INSTALLATION OF CONCRETE PIPES: updated fourth subheading from MATERIALS AND TESTING DIVISION to STRUCTURAL MATERIALS SECTION.
		RESPONSIBILITIES FOR DESIGN, FABRICATION AND INSTALLATION OF CONCRETE PIPES, STRUCTURAL MATERIALS SECTION, Item No. 2: removed OR PAIDD.

Standard	Sheet	Description of Changes
BD-636M (cont.)	3 of 10 (cont.)	RESPONSIBILITIES FOR DESIGN, FABRICATION AND INSTALLATION OF CONCRETE PIPES, BUREAU OF PROJECT DELIVERY, Item No. 1: removed AND PAIDD.
		RESPONSIBILITIES FOR DESIGN, FABRICATION AND INSTALLATION OF CONCRETE PIPES, BUREAU OF PROJECT DELIVERY: Added two items as follows: 4. PAIDD SOFTWARE PACKAGE NO LONGER MAINTAINED BY PENNSYLVANIA PIPE ASSOCIATION. 5. REVIEW/ACCEPT PIPE ANALYSIS SOFTWARE PACKAGES FOR DEPARTMENT USE.
		DESIGN TABLES FOR HORIZONTAL ELLIPTICAL PIPE-STANDARD INSTALLATION- TYPE A / TYPE B: added Proof Test values to both tables.
		NOTES, Note 7, item (a): added new sentence to beginning - USE CORRESPONDING VALUES IN PROOF TEST LOAD TABLE TO TEST CONCRETE PIPE
BD-637M	6 sheets	Added new standard ACCELERATED BRIDGE CONSTRUCTION DETAILS FOR PRECAST RIGID FRAME.
BD-653M	1 of 2	FRAMING PLAN FOR SPREAD BOX BEAMS: revised diaphragm thicknesses as follows: from 10" to 1′-0" for interior and intermediate diaph., from 1′-0" to 1′-2" for end diaph. at piers and abutments with backwalls, and from 1′-3" to 1′-6" for end diaph. at abutments without backwalls.
		FRAMING PLAN FOR I-BEAMS: revised diaphragm thicknesses as follows: from 10" to 1′-0" for intermediate diaph. and from 1′-0" to 1′-2" for end diaph. at piers and abutments with backwalls.
BD-655M	1 of 2	Added ties to the concrete diaphragms beneath the P/S beam top flanges. (8 details)
		GENERAL NOTES: deleted Note 1 and re-numbered subsequent notes; updated references to re-numbered notes throughout standard.
		GENERAL NOTES, Note 7 (formerly 8): added INSERTS TO BE GALVANIZED OR COMPLETELY ZINC-ELECTROPLATED.
BD-656M	2 of 7	FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL: revised rebar lap length from 1′-0" MIN. to 1′-11" MIN.
	3 of 7	TYP. LONGIT. SECTS. FOR ADJ. BOX BEAMS (COMP.) – ABUTMENT WITHOUT BACKWALL: revised terminology from BITUMINOUS PAVEMENT to ASPHALT PAVEMENT.
	4 of 7	TYPICAL LONGITUDINAL SECTIONS (all 3 sections): revised terminology from BITUMINOUS PAVEMENT to ASPHALT PAVEMENT.
	7 of 7	ABUTMENT WITH BACKWALL: added #6 rebar inside of 180 degree hook in end of box beam.
BD-660M	1 of 2	NOTES: added Note 1 regarding providing material and workmanship in accordance with Pub. 408 and re-numbered subsequent notes.
		NOTES, Note 2 (formerly 1): updated referenced AASHTO/DM-4 article from 5.14.1.4 to 5.12.3.3.
BD-661M	1 of 8	GENERAL NOTES: deleted Note 1 and re-numbered subsequent notes.
		ADJACENT BOX BEAMS PLAN-TYPICAL BEAM and VIEW C-C END ELEVATION: added 1" Ø non-ferrous drain holes and call-outs.
	2 of 8	ADJACENT BOX BEAM with beam notch: moved dimension line to align with stirrup instead of beam notch.
	4 of 8	36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER: revised shape of #4 rebar anchoring the barrier to the box beam.
		36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER: revised the horizontal leg of rebar anchoring the barrier into the box beam from 1′-0" to 1′-4" and the embedment of the vertical leg into beam from 1′-0" MIN. to 1′-4" MIN; added an asterisk (*) to the embedment length call-out of the vertical leg; added the following note below the detail: * OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.
		36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER and 36" & 48" COMPOSITE ADJACENT BOX BEAMS TYPICAL SIDEWALK: added (MIN.) to dimension of the required height into the barrier of the rebar anchoring the barrier to the box beam.
		REINFORCEMENT DETAIL FOR BARRIERS WITH TYPICAL SIDEWALK: increased three rebar embedment lengths from 1′-0" MIN. to 1′-4" MIN.; added an asterisk (*) to the embedment length call-out of the vertical leg; added the following note below the detail: * OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.

Standard	Sheet	Description of Changes
BD-661M (cont.)	4 of 8 (cont.)	REINFORCEMENT DETAIL FOR BARRIER WITH TYPICAL SIDEWALK: for consistency, repositioned leader lines for embedment lengths to the point where the bar is bent horizontal instead of where it enters the beam (2 instances).
		LEGEND Item 12: updated DM-4 Section from DC5.14.1.4.8 to DC5.12.3.3.8.
	5 of 8	ALTERNATE SIDEWALK REINFORCEMENT DETAIL: horizontal leg length revised from 12" to 1′-6" NORMAL WEIGHT CONCRETE / 1′-9" LIGHT WEIGHT CONCRETE.
		LEGEND Item 12: updated DM-4 Section from DC5.14.1.4.8 to DC5.12.3.3.8.
	6 of 8	Added 1" Ø non-ferrous drain holes and call-outs to all plan and elevation views (6 instances).
		ALTERNATE END BLOCK REINFORCEMENT SPLICING DETAIL: revised rebar lap length from 1′-7" MIN. to 1′-9" MIN.
	7 of 8	TYPICAL STRAND PATTERN – PLANK BEAM: added asterisks (*) to number of strands in the second row; added the following note below the detail: * TRANSVERSE TENDON POCKET SIZE AND LOCATION COULD REDUCE AVAILABLE STRANDS IN SECOND ROW.
	8 of 8	ADJACENT BOX BEAM WITH TYPE 3 OR 4 APPROACH SLAB: added #6 rebar inside of 180 degree hook.
BD-662M	1 of 4	GENERAL NOTES, Note 1: revised to refer to PUBLICATION 408.
		GENERAL NOTES, Note 16: updated Article number from 5.10.10.1 to 5.9.4.4.1 to match 2017 AASHTO Specifications.
		AASHTO I-BEAM - ELEVATION: PRESTRESS ZONE + 2" replaced with SEE GENERAL NOTE 14. *[correction of e-Notification No. 66]*
		ADDITIONAL NOTCH REINF. END VIEW: LOWER LIMIT OF 601 BARS TO BE 2" ABOVE PRESTRESS ZONE replaced with SEE GENERAL NOTE 14. *[correction of e-Notification No. 66]*
		STANDARD PA I-BEAM - ELEVATION: replaced PRESTRESS ZONE + 2" with SEE GENERAL NOTE 14. *[correction of e-Notification No. 66]*
		END VIEW: replaced LOWER LIMIT OF 601 BARS TO BE 2" ABOVE PRESTRESS ZONE with SEE GENERAL NOTE 14. *[correction of e-Notification No. 66]*
		AASHTO I-BEAM TYPICAL SECTION & OPTIONAL 404 DETAIL: revised OPTIONAL LAP lengths from 1′-3" MIN. to 1′-4" MIN.
	2 of 4	PA BULB-TEE BEAM - ELEVATION: replaced PRESTRESS ZONE + 2" with SEE GENERAL NOTE 14 ON SHT. 1. *[correction of e-Notification No. 66]*
		ADDITIONAL NOTCH REINF. END VIEW: LOWER LIMIT OF 601 BARS TO BE 2" ABOVE PRESTRESS ZONE replaced with SEE GENERAL NOTE 14 ON SHEET 1. *[correction of e-Notification No. 66]*
	3 of 4	26" BOTTOM FLANGE: replaced N STRANDS with 12 STRANDS.
BD-664M	1 of 4	TYPICAL DIAPHRAGM details (2 details): added extra ties in diaphragms near beam flanges.
		NOTES: deleted Note 1 and re-numbered subsequent notes; updated references to re-numbered notes throughout the standard.
		SECTION A-A: revised diaphragm thickness from 3' MIN. to 2′-8" MIN.
	2 of 4	2" CLR. increased to 2 1/2" CLR. in three details at top of sheet.
		TYPICAL DIAPHRAGM DETAIL FASCIA BEAM and SECTION B-B: revised diaphragm thickness from 2′-6" MIN. to 2′-8" MIN.
		SECTION C-C: #5 rebar leg length revised from 2′-0" to 2′-1".
	3 of 4	PIER PLAN: revised diaphragm thickness from 2′-6" MIN. to 2′-8" MIN.
	4 of 4	OPTIONAL POSTITIVE MOMENT CONNECTION DETAIL AT PIER: revised clearance of hairpin rebars from 2" to 2 1/2" CLR. (TYP.)
		SECTION F-F: revised #5 rebar leg length from 2′-0" to 2′-1".
BD-666M	1 of 1	SECTION - FLEXURE STRENGTHENING OF BOX BEAM: replaced W with 10" MAX. at three places. Replaced X MIN. with 3" MIN.
		ELEVATION - SHEAR STRENGTHENING OF SPREAD BOX BEAM: replaced W with 10" MAX. and replaced X" MIN. with 3" MIN.

Standard	Sheet	Description of Changes
BD-667M	1 of 9	GENERAL NOTES, Note 8: revised rebar lap splice length for #4 bar from 2′-1" to 2′-2", for #5 bar from 2′-7" to 2′-9" and for #6 bar from 3′-1" to 3′-3".
		GENERAL NOTES: deleted Note 28 and re-numbered subsequent notes.
	3 of 9	SECTION A-A: added 12" MAX. (TYP.) dimension for rebars in bottom of cap beam; added 2" (TYP.) for distance of rebar from flange of pile.
		SECTIONS C-C and D-D: revised rebar lap splice length from 2′-1" MIN. to 2′-2" MIN. and removed OVERLAP from call-outs (4 instances).
		LEGEND, Item 7: revised rebar lap splice length from 2′-1" MIN. to 2′-2" MIN. and replaced OVERLAP with LAP LENGTH.
	5 of 9	ATTACHED RECTANGULAR WINGWALL ELEVATION and ATTACHED TAPERED WINGWALL ELEVATION: At maximum length dimension, added note to see Table 2 for minimum length.
		ATTACHED TAPERED WINGWALL ELEVATION and DETACHED WINGWALL ELEVATION: revised #5 rebar lap splice length from 2′-1" MIN. to 2′-9" MIN.
		SECTIONS K-K & N-N: revised rebar lap splice length from 2′-1" to 2′-2"; moved leader line from the gutter line to the start of the lap; and revised rebar leg lengths for increased lap length and cover to start of lap.
		SECTION M-M: #6 rebar embedment length revised from 1′-8" to 2′-1".
		Added TABLE 2 label to MINIMUM ATTACHED WINGWALL LENGTH (L) table under Table 1 and added WALL TYPE heading to first column.
	7 of 9	MINIMUM APPROACH SLAB LENGTH TABLE: replaced skew angle ranges in third and fourth column headings with specific skew angles and added a third note below table clarifying how to use table for skews between those given in table.
		LEGEND, Note 7: in first line revised 2′-1" OVERLAP to 2′-2" LAP LENGTH.
	8 of 9	PIPE PILE-TO-PILE CAP CONNECTION DETAIL, SECTION W-W: revised length of vertical leg of main reinforcement bars from 4′-0" to 4′-4".
	9 of 9	Added three new end diaphragm bracing details: END DIAPHRAGM BRACING (STAY-IN-PLACE), CONNECTION DETAIL - FIRST BAY ERECTED, and CONNECTION DETAIL - ADDITIONAL BAY.
		Added list of NOTES to accompany the new end diaphragm bracing details.
BD-668M	1 of 3	BAR DETAIL: horizontal leg length revised from 1′-0" to 1′-6" for NORMAL WEIGHT CONCRETE and 1′-9" for LIGHTWEIGHT CONCRETE.
	2 of 3	SECTION F-F: revised terminology from BITUMINOUS APPROACH to ASPHALT PAVEMENT APPROACH.
	3 of 3	VERTICAL BAR & PA TYPE 10M BARRIER BAR DETAILS: horizontal leg length revised from 1′-0" to 1′-6" for NORMAL WEIGHT CONCRETE and 1′-9" for LIGHTWEIGHT CONCRETE.
BD-676M	4 of 6	CONCRETE CAP DETAIL: added 3" height to bottom of the weep hole from top of the moment slab.
	5 of 6	PRECAST CONCRETE PANEL – ELEVATIONS (2 details): perimeter rebar bend length revised from 11" MIN. to 1′-3" MIN. for UNCOATED OR GALVANIZED and from 1′-4" MIN. to 1′-6" MIN. for EPOXY COATED.
	6 of 6	PRECAST CONCRETE PLANEL WITH OPTIONAL SLOPED BOTTOM – ELEVATIONS (2 details): perimeter rebar bend length revised from 11" MIN. to 1′-3" MIN. for UNCOATED OR GALVANIZED and from 1′-4" MIN. to 1′-6" MIN. for EPOXY COATED.
BD-677M	4 of 20	Welded Wire Fabric designation updated in six post cross sections: replaced WWF4x4-D4xD4 with 4x4-W4.0xW4.0
	11 of 20	ELEVATION: removed 6" MIN. spacing to ties at bottom of caisson, and added 3" spacing of ties from Optional Rough Construction Joint.
	16 of 20	ELEVATION: removed 6" MIN. spacing to ties at bottom of caisson, and added 3" spacing of ties from Optional Rough Construction Joint.
	17 of 20	ELEVATION: removed 6" MIN. spacing to ties at bottom of caisson, and added 3" spacing of ties from Optional Rough Construction Joint.
BD-678M	1 of 14	GENERAL NOTES, Note 3, Third Bullet: revised seismic acceleration coefficient “A” from 0.09 to 0.15.

Standard	Sheet	Description of Changes
BD-679M	2 of 11	DESIGN PARAMETERS, Note 1: revised number of BD-601M's Note from 28 to 26.
	4 of 11	MOMENT SLAB NOTES, Note 3: revised terminology from BITUMINOUS CONCRETE SHOULDER to ASPHALT-PAVED SHOULDER.
	5 of 11	PRECAST CONCRETE PANEL - Elevations: perimeter rebar bend length revised from 11" MIN. to 1′-3" MIN. for UNCOATED OR GALVANIZED and from 1′-4" MIN. to 1′-6" MIN. for EPOXY COATED.
BD-680M	5 of 8	STANDARD & SLOPED PANELS - Elevation Views: revised hooked leg length of #5 perimeter rebars from 1′-1" to 1′-7" for UNCOATED and from 1′-8" to 1′-11" for EXPOXY COATED.
	7 of 8	FOOTING REINFORCEMENT LAYOUT FOR STANDARD PANELS: #4 rebar splice length revised from 1′-9" to 1′-10".
BD-680M (cont.)	7 of 8 (cont.)	FOOTING STEP DETAILS FOR STANDARD PANELS: #4 rebar splice length revised from 1′-9" to 1′-10" (2 places) and top leg length revised from 1′-3" to 1′-5" (2 places).
	8 of 8	FOOTING PLANS AT END PANELS (3 options): SPLICE #4 BAR length revised from 1′-9" MIN. to 1′-10" MIN.
BD-697M	3 of 4	BEAM SEAT & INTEGRATED APPROACH DETAIL: revised terminology from BITUMINOUS PAVEMENT to ASPHALT PAVEMENT
		NOTES, Note 4: revised ROYSTON OR BITUMEN WATERPROOFING to WATERPROOFING MEMBRANE OR WATERPROOFING ASPHALT BINDERS.

OS-299 (7-08)

pennsylvania
DEPARTMENT OF TRANSPORTATION

TRANSMITTAL LETTER

PUBLICATION:

Publication 218M
April 2016 Edition
Change No. 1

DATE:

August 4, 2017

SUBJECT:

Revisions to
Standards for Bridge Design
April 2016 Edition

INFORMATION AND SPECIAL INSTRUCTIONS:

Incorporate the attached revisions into the April 2016 Edition of Publication 218M.

The revisions pertain primarily to:

*Manual for Assessing Safety Hardware (MASH) 2016 Edition

*Adding a new Standard Drawing for Type 31 Strong Post Guide Rail (RC-51M) (31" height to top of W-beam rail element)

*Deleting an existing Standard Drawing for Type 2 Strong Post Guide Rail (RC-52M) (27 3/4" height to top of W-Beam rail element).

These revised Standard Drawings should be adopted on all new and existing designs as soon as possible without affecting any letting schedules and in conjunction with the current Publication 408 Specifications. Regardless, revised standards must be used on projects let after December 31, 2017.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-609M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
		Revised Note 10 with updated weights of PA Structure Mounted Guide Rail bridge barriers for dead load calculations.
BD-610M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
BD-628M	Sheet 4	Revised Notes 6 and 7 to indicate Type 31-SC guide rail and posts.
	Sheet 5	Revised Notes 4 and 5 to indicate Type 31-SC guide rail and posts.
	Sheet 6	Revised Note 4 to indicate Type 31-SC posts.
	Sheet 7	Revised Notes 6 and 7 to indicate Type 31-SC guide rail and posts.
	Sheet 19	Revised Note 3 to indicate Type 31-SC posts.
	Sheet 20	Revised Notes 6 and 7 to indicate Type 31-SC guide rail and posts.
	Sheet 21	Revised Note 5 to indicate RC-51M.
BD-628M (cont.)	Sheet 21	Revised Note 6 to indicate Type 31-SC posts.
	Sheet 26	Revised Note 6 to indicate Type 31-SC posts.
	Sheet 27	Revised Notes 6 and 7 to indicate Type 31-SC guide rail and posts.
	Sheet 28	Revised Notes 5 and 6 to indicate Type 31-SC guide rail and posts.
	Sheet 35	Revised Notes 5 and 6 to indicate Type 31-SC guide rail and posts.
BD-631M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
	Sheet 2	Revised Typical Section (Metal Culverts) to indicate: *RC-51M (2 locations); *31-S, 31-SC, and 31-SCC guide rail with an increase in distances between the guide rail post and the collar; *Class A Cement Concrete Slab with an increase in dimensions to 5' x 5' x 8".
BD-632M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail). Revised Section Along Centerline Culvert to indicate: *RC-51M; *Class A Cement Concrete Slab with an increase in dimensions to 5' x 5' x 8".
	Sheet 2	Revised Section A-A to indicate RC-51M and Type 31 Strong Post Guide Rail.
	Sheet 4	Revised Box Details - Welded Wire Fabric detail to indicate chamfer sizes of 3/4" x 3/4".
	Sheets 5-6	Revised Profile, Precast Culvert with Precast End Section (Sheet 5) and Profile, Culvert with Cast-in-Place Wingwalls (Sheet 6) to indicate: *RC-51M; *31-S-, 31-SC, and 31-SCC guide rail with an increase in distances between the guide rail post and the collar.
	Sheet 7	SECTION E-E: Added 3/4" x 3/4" CHAMFER (TYP.) callout.
	Sheet 8	Revised Section F-F to indicate RC-51M and Type 31 Strong Post Guide Rail.
BD-641M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
BD-643M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
BD-644M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
BD-645M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-647M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
BD-649M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail). Deleted reference drawing RC-55M (Type 2 Weak Post Median Barrier).
BD-650M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail). Deleted reference drawing RC-55M (Type 2 Weak Post Median Barrier).

CANCEL AND DESTROY THE FOLLOWING:

The following revised BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work:

Index Sheet - Apr. 29, 2016
BD-609M - Apr. 29, 2016
BD-610M - Apr. 29, 2016
BD-628M - Apr. 29, 2016
BD-631M - Apr. 29, 2016
BD-632M - Apr. 29, 2016
BD-641M - Apr. 29, 2016
BD-643M - Apr. 29, 2016
BD-644M - Apr. 29, 2016
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BD-647M - Apr. 29, 2016
BD-649M - Apr. 29, 2016
BD-650M - Apr. 29, 2016

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APPROVED FOR ISSUANCE BY:

LESLIE S. RICHARDS
Secretary of Transportation

BY:

Brian G. Thompson, P.E.
Director, Bureau of Project Delivery,
Highway Administration

OS-299 (7-08) pennsylvania DEPARTMENT OF TRANSPORTATION	TRANSMITTAL LETTER	**PUBLICATION:** Publication 218M April 2016 Edition
		DATE: April 29, 2016

SUBJECT:

Standards for Bridge Design, BD-600M Series
April 2016 Edition

INFORMATION AND SPECIAL INSTRUCTIONS:

These standards may be used immediately and can be adopted as soon as practical on all new and existing designs without affecting letting schedules. All projects with T.S. & L. submissions after July 1, 2016 should incorporate these new standards.

The 2016 Edition incorporates Changes 1 through 3 issued for the 2010 Edition.

A description of the changes made to the 2010 Edition since Change 3 of 2014 and additional revisons of each standard are listed in the attached multi-sheet Table. Note highlighted details and/or notes on each standard are revisions made since Change 3 of Nov. 21, 2014.

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	APPROVED FOR ISSUANCE BY: Leslie S. Richards – Secretary of Transportation By: Brian G. Thompson Brian G. Thompson, P.E., Director of Bureau of Project Delivery, Highway Administration

STANDARD	SHEET	DESCRIPTION OF CHANGES
All	All	Removed all metric units.
BD-600M	1	Updated Number of Sheets for BD-601M and BD-617M, expanded two standards' titles and removed BD-642M.
BD-601M	1 of 11	TYPICAL SLAB PANEL 2: switched the longitudinal reinforcements over the transverse reinforcements in the top mat. NOTE No. 4: added STAGGER LONGITUDINAL REBARS SUCH THAT NO REBAR IN THE TOP MAT IS DIRECTLY ABOVE A REBAR IN THE BOTTOM MAT. Added Note 29.
	10 of 11	Added a new Sheet to include the new deck reinforcement tables. Indicated the new rebar tables are required for continuous span bridges and optional for simple span bridges.
BD-605M	1 of 6	GENERAL NOTES: added Note 4 to allow inclusion of scuppers in precast deck slabs per project-to-project base. Added Reference drawings.
	6 of 6	Revised the post-tensioning duct coupling detail.
BD-609M	1 of 1	Corrected the heads of bolts in Section A-A to be rounded for consistency.
BD-610M	17 shts.	Added a note to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M.
	16 of 17	Sections G-G, H-H, J-J and K-K were re-labeled to be J-J, K-K, N-N and L-L.
BD-612M	3 shts.	Added a note to applicable details to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M.
BD-615M	3 shts.	Added notes for preferred lighting pole locations and additional requirements if not. Fixed the discrepancies at many locations. Added a note to applicable details to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M.
	3 of 3	Note 4: Revised to require Anchor Angles to be galvanized.
BD-616M	1 of 2	Added General Note 13: FOR BOLT DIAMETER EQUAL OR GREATER THAN 1", THE HOLE DIAMETER SHALL BE 1/8" PLUS DIAMETER OF BOLT. ALSO, ADJUST EDGE DISTANCE, CENTER TO CENTER BOLT SPACINGS, CLEARANCES, ETC.
BD-617M	16 shts.	Add a note to applicable details to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M. Updated notes at many places for clarification.
BD-618M	1 of 12	Expanded limitation of usage for concrete vertical wall barrier to allow for new structures. Note 5: Eliminated the length restriction of vertical wall barrier for use on rehab. Clarified the beam seat types to avoid the confusion for slopped beam seat option. Added a note to applicable details to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M
	12 of 12	Note 4: Revised to require Anchor Angles to be galvanized. Added notes for preferred lighting pole locations and additional requirements if not. Fixed the inconsistencies at many locations.
BD-619M	2 of 5	Corrected the factor of WS in Strength III to comply with Table 3.4.1.1P-1 of DM-4.
	3 of 5	Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size.
BD-620M	1 of 6	Clarified the basic wind speed used in this standard has already included a 1.4 load factor.
BD-627M	4 of 8	MOMENT SLAB WITH ALTERNATE SIDEWALK: Revised slope from 2% to 1.5%.
BD-629M	3,7 & 8 of 15	ELEVATION: Remove mid-height splice requirement for column's vertical reinforcement in Seismic Zone 1.
BD-632M	5 of 13	Moved the cutoff wall for precast box culvert with precast end section from outside of the end

STANDARD	SHEET	DESCRIPTION OF CHANGES
		section to underneath of the end section.
	7 of 13	Added the requirement of galvanized strap in the vertical walls for connection of multiple end sections.
BD-633M	1 of 2	Updated Note 10 to indicate using LRFD for footing design.
BD-641M	1 of 8	Notes for DMS under DESIGN CRITERIA and NOTES TO DESIGNER were revised to be consistent with DM-4. Added a note under NOTES TO DESIGNER 1 to indicate the designer to ensure the availability of pipe size prior to PSE submittal if any pipe other than shown on the standard is selected. Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size.
	6-8 of 8	Eliminated some column pipe sizes due to the lack of availability on Sheets 6-8.
BD-642M	All	Eliminated this standard due to the lack of availability of the pipe sizes.
BD-643M	1 of 6	Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size. Added a note under NOTES TO DESIGNER to indicate the designer to ensure the availability of pipe size prior to PSE submittal if any pipe other than shown on the standard is selected. Notes for DMS under DESIGN CRITERIA and NOTES TO DESIGNER were revised to be consistent with DM-4.
	4 of 6	Corrected the term "ultimate" underneath the table of design criteria for consistency.
	5 & 6 of 6	Eliminated some column pipe sizes due to the lack of availability.
BD-644M	1 of 13	Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size. Notes for DMS under DESIGN CRITERIA and NOTES TO DESIGNER were revised to be consistent with DM-4.
	4 of 13	Added Note below Design Criteria table.
	8 of 13	Corrected the term "ultimate" underneath the table of design criteria for consistency.
	10-13 of 13	Eliminated some column pipe sizes due to the lack of availability.
BD-645M	1 of 7	Added a note under NOTES TO DESIGNER to indicate the designer to ensure the availability of pipe size prior to PSE submittal if any pipe other than shown on the standard is selected. Corrected the term "ultimate" underneath the table of design criteria for consistency on Sheet 4. Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size. Notes for DMS under DESIGN CRITERIA and NOTES TO DESIGNER are revised to be consistent with DM-4.
	4 of 7	Corrected the term "ultimate" underneath the table of design criteria for consistency.
	6 & 7 of 7	Eliminated some column pipe sizes due to the lack of availability.
BD-647M	1 of 5	Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size. Corrected the wind speed to 90MPH (3 second gust) to be consistent with value used to produce designs. Added a note under NOTES TO DESIGNER to indicate the designer to ensure the availability of

STANDARD	SHEET	DESCRIPTION OF CHANGES
		pipe size prior to PSE submittal if any pipe other than shown on the standard is selected.
BD-647M (continued)	2 & 3 of 5	Added Note below Design Criteria table.
	4 & 5 of 5	Eliminated some column pipe sizes due to the lack of availability
BD-649M	1 of 6	Notes for DMS under DESIGN CRITERIA and NOTES TO DESIGNER are revised to be consistent with DM-4. Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size.
	2 of 6	Added a note under NOTES TO DESIGNER on Sheet 1 to indicate the designer to ensure the availability of pipe size prior to PSE submittal if any pipe other than shown on the standard is selected.
	4 & 5 of 6	Eliminated some column pipe sizes due to the lack of availability.
BD-650M	4 of 4	Clarified the U-bar type in both panel connection details.
BD-651M	1 & 2 of 2	Revised the dowel bar to be stainless steel for corrosion protection.
BD-652M	2 of 3	Corrected the section properties for PA I-beams 26/54 and 24/63.
BD-656M	7 shts.	Added a note to all applicable abutment section to indicate longitudinal rebar on top on top rebar mat is similar but not shown. Increase the width full depth diaphragm at abutment without backwall for spread box beam to 1'-6". Added a note to indicate BRADD designed bridge still may use 1'-3" for this diaphragm. Increase the concrete cover to 2 ½" for all diaphragms.
BD-658M	1 of 1	Revised the required curtain wall for spread box beam in Section E-E to be optional when required for aesthetics, similar to the requirement for I-Beam in Section F-F
BD-660M	1 of 2	DECK PLACEMENT NOTE 4: added THE POINT OF CONTRAFLEXURE FOR PRESTRESSED CONCRETE CONTINUOUS BRIDGES SHALL BE CALCULATED AS THE SUM OF SIMPLE SPAN MOMENTS DUE TO DL1 AND CONTINUOUS MOMENTS FROM DL2. Drawing title revised to include FORMS, PRESTRESSED and AND STEEL. DECK PLACEMENT SEQUENCE SCHEMES FOR CONTINUOUS BRIDGES: added AND SEE NOTE 4 OF DECK PLACEMENT NOTES to Placement 4 dimension callout.
	2 of 2	Added a detail of deck placement for steel girder during phased/staged construction. LONGITUDINAL REINFORCEMENT STAGGER DETAIL IN NEGATIVE MOMENT REGION – added dimensions of staggered bar cutoffs to be development length and 2 x development length.
BD-661M	1 of 8	ADJACENT BOX BEAMS PLAN - TYPICAL BEAM: added 6" MIN. dimension between end of void and transverse tendon.
	2 of 8	Removed Legend 5 since it is not consistent with DM-4 and is not being used by PSLRFD computer program.
BD-662M	3 of 4	BEAM DAP DETAIL – SECTION B-B AT LOW END OF BEAM: Corrected the dimension A to be measured along CL-beam(currently was mistakenly specified to be measured normal to CL-bearings)
BD-665M	1 of 3	SECTION A-A: diaphragm cover increased to 2.5". Updated the material specifications referenced.
BD-667M	All	Added a note to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M.
	1 of 9	Added note underneath the typical elevation to require the top 15ft pile or entire pile length, whichever is smaller, needs to be galvanized for corrosion protection.
	9 of 9	Added note to indicate that the stability of the remaining existing structure for the proposed condition needs to be checked.
BD-676M	4 of 6	Revised the single face concrete barrier (roadway item) to moment slab with typical concrete barrier as they did not exist on the roadway standards.
BD-677M	2 of 20	DESIGN PARAMETERS, Note 4, last bullet point: replace CHIEF with DISTRICT in last line.
BD-677M (continued)	20 of 20	Clarified the usage (maximum spacing and minimum caisson length) for Types E and F post.
BD-678M	4,8,9,11,12 of 14	Corrected the bundle ties spacing to be "MAX" in many caisson elevation views.
BD-679M	4 of 11	Revised the exposed height of the single face concrete barrier to 2'-8" to be consistent with RC-58M
BD-697M	1 of 4	DESIGN METHODOLOGY's Note 1: added MAXIMUM in fifth, sixth and seventh bullet points prior to WATER. CONSTRUCTION METHODOLOGY's Note 5: added WHERE DIFFERENTIAL SETTLEMENT IS ANTICIPATED, OR ENCOUNTERED, PROVIDE A VERTICAL CONTROL JOINT IN THE WALL FACE TO REDUCE OR ELIMINATE CRACKING OF BLOCKS
	2 of 4	Added an optional end treatment of CMU block facing at wing ends.

COMMONWEALTH OF PENNSYLVANIA

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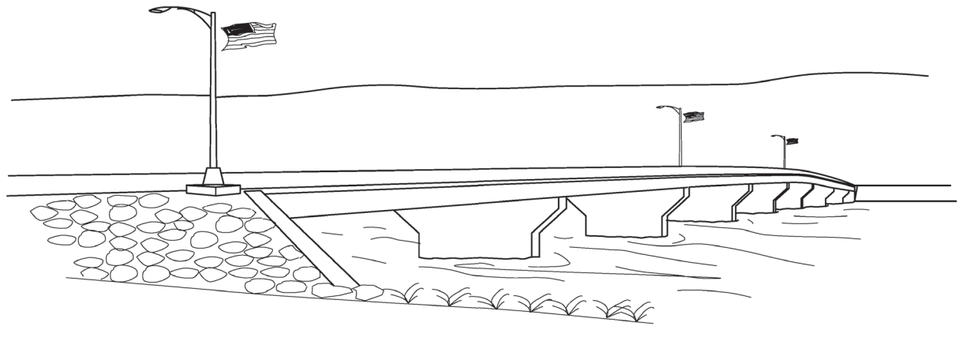
STANDARDS FOR BRIDGE DESIGN



BD–600M SERIES

APRIL 2016 EDITION

PUB. #218M

Click on the desired Standard to view.

Highlighting throughout the standards indicates revisions to the April 2016 Edition. The highlighting color indicates whether the most recent revision was part of Change #1, #2, #3, #4, #5 or #6. Refer to the legend on this index sheet or on the first sheet of each standard.

To obtain a clean printout without highlighting, select "Print" and in the dialogue box under "Comments and Forms" select "Document" from the pull-down menu.

INDEX OF STANDARDS FOR BRIDGE DESIGN with e-Notifications' red markups

SUBJECT	STD. DWG. NO.	TITLE	NO. OF SHTS.	DATE
SUPERSTRUCTURE	BD-600M	INDEX OF STANDARDS FOR BRIDGE DESIGN	1	FEB. 14, 2023
	BD-601M	CONCRETE DECK SLAB	12	FEB. 14, 2023
	BD-604M	GRID REINFORCED CONCRETE BRIDGE DECK	4	AUG. 30, 2019
	BD-605M	FULL DEPTH PRECAST CONCRETE DECK PANELS FOR PRESTRESSED CONCRETE PA BULB-TEE BEAM AND STEEL I-BEAM/I-GIRDER BRIDGES	6	AUG. 30, 2019
	BD-609M	PA 3-RAIL BRIDGE BARRIER	2	FEB. 14, 2023
	BD-610M	PA BRIDGE BARRIER	10	NOV. 23, 2022
	BD-611M	CONCRETE DIAPHRAGM DETAILS FOR STEEL I-BEAM STRUCTURES	3	AUG. 30, 2019
	BD-612M	UTILITY ATTACHMENT TO SUPERSTRUCTURE	3	AUG. 30, 2019
	BD-613M	HIGH LOAD MULTI-ROTATIONAL POT BEARINGS	7	NOV. 23, 2022
	~~BD-615M~~	~~PA HT BRIDGE BARRIER~~		DISCONTINUED
	BD-616M	FIELD SPLICE	2	NOV. 23, 2022
	BD-617M	PA TYPE 10M BRIDGE BARRIER	9	NOV. 23, 2022
	BD-618M	CONCRETE VERTICAL WALL BRIDGE BARRIER	9	FEB. 19, 2021
	BD-619M	CROSS FRAME AND SOLID PLATE DIAPHRAGMS FOR STEEL BEAM/ GIRDER BRIDGES DESIGNED WITH REFINED METHODS OF ANALYSIS	5	AUG. 30, 2019
	BD-620M	STEEL GIRDER BRIDGES LATERAL BRACING CRITERIA AND DETAILS	6	NOV. 23, 2022
ABUTMENTS AND PIERS	BD-621M	REINFORCED CONCRETE ABUTMENTS	3	AUG. 30, 2019
	BD-622M	R.C. ABUTMENTS WITH BACKWALL	10	NOV. 23, 2022
	BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL	4	NOV. 23, 2022
	BD-625M	WINGWALL LENGTH	1	APR. 29, 2016
	BD-626M	ANCHORED WALLS	9	AUG. 30, 2019
	BD-627M	MOMENT SLABS	8	NOV. 23, 2022
	BD-628M	BRIDGE APPROACH SLABS	35	NOV. 23, 2022
	BD-629M	REINFORCED CONCRETE PIERS	15	NOV. 23, 2022
CULVERTS AND PIPES	BD-631M	END WALL DETAILS	2	FEB. 14, 2023
	BD-632M	R.C. BOX CULVERT	16	FEB. 14, 2023
	BD-633M	R.C. ARCH CULVERT	2	AUG. 30, 2019
	BD-634M	GABION END WALLS	1	APR. 29, 2016
	BD-635M	DESIGN TABLES FOR METAL CULVERTS	4	APR. 29, 2016
	BD-636M	REINFORCED CONCRETE PIPES	10	AUG. 30, 2019
	BD-637M	ACCELERATED BRIDGE CONSTRUCTION DETAILS FOR PRECAST RIGID FRAME	6	FEB. 14, 2023
SIGN STRUCTURES	BD-641M	OVERHEAD SIGN STRUCTURES- CANTILEVER AND CENTER-MOUNT STRUCTURES - STRUT LENGTHS UP TO 40'	8	AUG. 4, 2017
	BD-643M	OVERHEAD SIGN STRUCTURES- 2 POST PLANAR TRUSS SPANS FROM 30' TO 100'	6	AUG. 4, 2017
	BD-644M	OVERHEAD SIGN STRUCTURES- 2 POST AND 4 POST TRI-CHORD TRUSS SPANS FROM 60' TO 240'	13	AUG. 4, 2017
	BD-645M	OVERHEAD SIGN STRUCTURES- 4 POST 4 CHORD TRUSS SPANS FROM 100' TO 200'	7	AUG. 4, 2017
	BD-647M	MONOPIPE SIGN STRUCTURES	5	AUG. 4, 2017
	BD-649M	DYNAMIC MESSAGE SIGNS - CENTER-MOUNT SIGN STRUCTURES	6	AUG. 4, 2017
	BD-650M	DYNAMIC MESSAGE SIGNS - TRUSS SIGN STRUCTURES	4	AUG. 4, 2017

SUBJECT	STD. DWG. NO.	TITLE	NO. OF SHTS.	DATE
PRESTRESSED CONCRETE STRUCTURES *	BD-651M	REQUIREMENTS FOR TENDONS, DOWELS SHEAR BLOCK, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS	2	NOV. 23, 2022
	BD-652M	PRESTRESSED BEAM SIZES AND SECTION PROPERTIES	3	APR. 29, 2016
	BD-653M	TYPICAL FRAMING PLANS AND DETAILS	2	NOV. 23, 2022
	BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS	2	AUG. 30, 2019
	BD-656M	TYPICAL LONGITUDINAL SECTIONS	7	AUG. 30, 2019
	BD-657M	I-BEAM AND BOX BEAM BRIDGES	1	APR. 29, 2016
	BD-658M	SHEAR BLOCK DETAILS AT PIER - PRESTRESSED CONCRETE I-BEAM, BULB-TEE AND BOX BEAM BRIDGES	1	APR. 29, 2016
	BD-660M	DECK SLAB, FORMS AND STEEL REINFORCEMENT PLACEMENT	2	NOV. 23, 2022
	BD-661M	BOX BEAM REINFORCEMENT DETAILS	8	NOV. 23, 2022
	BD-662M	I-BEAM AND PA BULB-TEE BEAM REINFORCEMENT DETAILS	4	AUG. 30, 2019
	BD-663M	CONCRETE DECK SLAB DESIGN & DETAILS FOR FLEX BEAM BRIDGES	6	JUNE 1, 2021
	BD-664M	CONTINUITY FOR LIVE LOAD DETAILS - I-BEAM AND PA BULB-TEE BEAM BRIDGES	4	AUG. 30, 2019
	BD-665M	CONTINUITY FOR LIVE LOAD DETAILS - BOX BEAM BRIDGES	3	APR. 29, 2016
	BD-666M	CFRP STRENGTHENING PRESTRESSED CONCRETE BEAMS	1	NOV. 23, 2022
	BD-667M	INTEGRAL ABUTMENT	10	NOV. 23, 2022
	BD-668M	PRECAST CHANNEL BEAM BRIDGES	3	NOV. 23, 2022
SOUND BARRIER WALLS	BD-676M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS	6	AUG. 30, 2019
	BD-677M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS	20	AUG. 30, 2019
	BD-678M	GROUND MOUNTED SOUND BARRIERS STEEL POSTS	14	AUG. 30, 2019
	BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS	11	FEB. 19, 2021
	BD-680M	OFFSET SOUND BARRIER WALLS	8	AUG. 30, 2019
	BD-697M	GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM	5	NOV. 23, 2022

USE THESE STANDARDS AS A GUIDE IN THE PREPARATION OF STRUCTURAL PLANS, IN CONJUNCTION WITH THE BC-700M SERIES STANDARD DRAWINGS.

DESIGN COMPUTATIONS ARE NOT REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS TAKEN VERBATIM FROM A STANDARD; E.G. A PRESTRESSED BEAM SECTION AS SHOWN ON A STANDARD MAY BE USED IF THE CORRESPONDING DIMENSION AND DESIGN DATA OF THE STRUCTURE BEING DESIGNED ARE IDENTICAL TO THOSE SHOWN ON THE STANDARD.

REASONABLE MODIFICATIONS OF THE DETAILS SHOWN ON THE STANDARDS MAY BE REQUIRED IF CONDITIONS WARRANT.

* BD-660M ALSO APPLIES TO STEEL BRIDGE DESIGN

APRIL 2016 EDITION

SEE CHANGE #1 FOR AUG. 4, 2017 STANDARD REVISIONS.
SEE CHANGE #2 FOR AUG. 30, 2019 STANDARD REVISIONS.
SEE CHANGE #3 FOR FEB. 19, 2021 STANDARD REVISIONS.
SEE CHANGE #4 FOR JUNE 1, 2021 STANDARD REVISIONS.
SEE CHANGE #5 FOR NOV. 23, 2022 STANDARD REVISIONS.
SEE CHANGE #6 FOR FEB. 14, 2023 STANDARD REVISIONS.

CHANGE 2

CHANGE 3

CHANGE 5

CHANGE 6

GENERAL NOTES:

1. DESIGN SPECIFICATIONS:
   - AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AND COMMENTARY
   - PENNDOT DESIGN MANUAL PART 4
2. MATERIAL STRENGTH:
   - REINFORCEMENT STEEL fy = 60 KSI
   - CONCRETE f'_c = 4 KSI (CLASS AAAP CONCRETE) FOR DECK SLABS AND TYPICAL SIDEWALKS AND
     f'_c = 3.5 KSI (CLASS AA CONCRETE) FOR BARRIERS AND RAISED SIDEWALK OR ALTERNATE SIDEWALK WITH 42" VERTICAL WALL CONCRETE BARRIER.
   - MODULAR RATIO (E_S/E_C) N = 8
3. DEAD LOAD:
   - NORMAL WEIGHT CONCRETE = 150 LB./FT^3
   - LIGHTWEIGHT CONCRETE = 115 LB./FT^3
   - PERMANENT METAL DECK FORMS = 15 LB./FT^2
   - FUTURE WEARING SURFACE = 30 LB./FT^2
4. DESIGN CONTROLS:
   - CONCRETE COVER:
     - DECK TOTAL TOP COVER = 2½"
     - DECK BOTTOM COVER = 1"
     - BARRIER = 2"
     - SIDEWALK TOP COVER = 2½"
     - ALTERNATE SIDEWALK DETAIL BARRIER = 2"
   - MIN. VERTICAL CLEAR DISTANCE BETWEEN LONGITUDINAL REINFORCEMENTS IN TOP MAT AND LONGITUDINAL REINFORCEMENTS IN THE BOTTOM MAT = 2"
   - MIN. VERTICAL CLEAR DISTANCE BETWEEN TRANSVERSE REINFORCEMENTS IN TOP MAT AND TRANSVERSE REINFORCEMENTS IN THE BOTTOM MAT = 2"
   - BAR SIZE:
     - MAXIMUM BAR SIZE: #6, EXCEPT FOR BARS DESIGNED TO MEET (18)
     - MINIMUM BAR SIZE: S1, S2, S5, AND S6 BARS: #5
       S4, S3, S3′, AND S7 BARS: #4
   - BAR SPACINGS:
     - MAXIMUM SPACING IN SLAB AND BARRIERS = 12"
     - MINIMUM TRANSVERSE REINFORCEMENT SPACING = 5½"
     - SPACING INCREMENTS = ½"
   - THE TOP ½" OF THE SLAB IS CONSIDERED TO BE AN INTEGRAL WEARING SURFACE.
   - STAGGER LONGITUDINAL REBARS SUCH THAT NO REBAR IN THE TOP MAT IS DIRECTLY ABOVE A REBAR IN THE BOTTOM MAT.
   - DECK THICKNESS: MINIMUM THICKNESS INCLUDING ½" INTEGRAL WEARING SURFACE = ((DISTANCE BETWEEN DESIGN SECTIONS FOR NEGATIVE MOMENT + 120") / 30 + ½") ≥ 8", THICKNESS INCREMENTS = ½"
   - Z FACTOR FOR CRACK CONTROL = 130 KIPS/IN.
5. USE ONLY FUSION BONDED EPOXY COATED REINFORCEMENT IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.
6. FOR ALL BARRIER REINFORCEMENT AND FOR HOOKED OR BENT BARS IN THE DECK SLAB, DO NOT USE RAIL STEEL (A 996). SEE DESIGN MANUAL PART 4, SECTION D5.4.3.1.
7. DESIGN TABLES ARE VALID FOR NORMAL WEIGHT CONCRETE DECKS. FOR LIGHTWEIGHT CONCRETE DECKS, INCREASE LENGTH L LISTED IN REINFORCEMENT TABLES SHEETS 10 AND 11 BY 13".
8. DETAIL ALL BARS ON THE CONTRACT DRAWINGS.
9. ALL DETAILS SHOWN ALSO APPLY TO P/S I-BEAMS, PA BULB-TEE AND P/S SPREAD BOX BEAMS EXCEPT AS NOTED.
10. FOR HAUNCH DETAILS, SEE SHEET 9.
11. FOR SKEW ANGLES 75° AND MORE, PLACE TRANSVERSE REINFORCEMENT IN DECK SLAB PARALLEL TO CENTERLINE OF BEARINGS.
12. SEE BC-767M AND BD-656M FOR ADDITIONAL REINFORCEMENT AT END OF DECK.
13. FOR TRANSITION OF LONGITUDINAL REINFORCEMENT FROM POSITIVE MOMENT AREA TO NEGATIVE MOMENT AREA, USE AASHTO ARTICLES 5.12.3.3 AND 6.10.1.7 AS MODIFIED BY DESIGN MANUAL PART 4, SECTIONS D5.12.3.3 AND D6.10.1.7.
14. DESIGN IS BASED ON DECKS SUPPORTED ON 3 OR MORE BEAMS.
15. THE STRENGTH DESIGN OF THE OVERHANG IS BASED ON THE ASSUMPTION THAT THE ENTIRE OVERHANG HAS A MINIMUM THICKNESS OF T + 1". THE BEAM HAUNCH MAY BE CONSIDERED AS EFFECTIVE IN CONTRIBUTING TO THIS THICKNESS FOR THE OVERHANG DESIGN ONLY.
16. THE 42" AND 45" F-SHAPE CONCRETE BARRIERS AND DECK SLABS, INCLUDING OVERHANGS, ARE DESIGNATED AS MASH TL-5. THE 42" F-SHAPE CONCRETE BARRIER IS DESIGNATED AS TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE HEIGHT OF THE BARRIER BELOW 42". THE ALTERNATE SIDEWALK WITH 42" VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-2. THE 50" SPLIT CONCRETE MEDIAN BARRIER AND 50" CONCRETE MEDIAN BARRIER ARE DESIGNATED AS MASH TL-4. THE 32" SPLIT CONCRETE MEDIAN BARRIER, 32" F-SHAPE CONCRETE BARRIER AND 32" CONCRETE MEDIAN BARRIER ARE DESIGNATED AS MASH TL-3.
17. DECK DESIGN TABLES ARE BASED ON THE EQUIVALENT STRIP METHOD AS PER AASHTO, ARTICLE 4.6.2.1.
18. FACTORED MOMENT = 1.25 (SLAB AND BARRIER MOMENT) + 1.5 (FWS MOMENT) + 1.75 (1+IM/100)(L.L. MOMENT)
19. DYNAMIC LOAD ALLOWANCE (IM) = 50%
20. SEE TABLES ON SHEETS 10 AND 11 FOR VALUES OF S, T, S1, S2, S3, S3′, S6, S7, So, AND L.
21. FOR DECK SLAB AND BARRIER DETAILS AND REINFORCEMENT FOR ADJACENT PRESTRESSED CONCRETE BOX BEAMS, SEE BD-660M AND BD-661M.
22. FOR BARRIER REINFORCEMENT DETAILS, SEE SHEETS 7 AND 8.
23. OVERHANG LENGTH MUST NOT EXCEED THE REQUIREMENTS OF DESIGN MANUAL PART 4, SECTION D9.7.1.5.1P.
24. THE SLAB REINFORCEMENT SHOWN ON SHEETS 10 AND 11 IS APPLICABLE FOR THE BARRIERS SHOWN ON SHEET 2, 3, 4 AND 5, PA TYPE 10M, PA BRIDGE BARRIER AND CONCRETE VERTICAL WALL BRIDGE BARRIERS AND BARRIERS WITH FENCES AND HANDRAILS. REDESIGN OF THE DECK IS REQUIRED WHEN OTHER ATTACHMENTS SUCH AS LIGHT POLES AND SIGN STRUCTURES ARE USED. SEE NOTE 25 FOR MODIFICATIONS REQUIRED WHEN SOUND BARRIERS ARE USED.
25. CONCRETE SOUND BARRIER SHOWN ON BC-779M AND BD-679M MAY BE MOUNTED ON THE TOP OF BARRIER AS DETAILED ON SHEET 2. STANDARD REINFORCEMENT MAY BE USED AS FOLLOWS:

    LIMITATIONS
    - HEIGHT OF SOUND BARRIER (ABOVE TOP OF BARRIER) ≤ 10′.
    - WEIGHT OF SOUND BARRIER PLUS THE WEIGHT OF BARRIER AND DECK SLAB MINUS 650 LB. MAY NOT BE IN EXCESS OF 600 LB. PER FOOT OF LENGTH.

    DECK DESIGN PROCEDURE
    - USING THE TABLES AND NOTES ON SHEETS 10 AND 11, ESTABLISH STANDARD DECK THICKNESS, REINFORCEMENT AND THE DESIGNATED MAXIMUM ALLOWANCE OVERHANG LENGTH BASED ON THE BEAM SPACING, S.
    - INCREASE THE DESIGNATED DECK THICKNESS BY 1/2", AND USE THIS THICKNESS ACROSS FULL WIDTH OF BRIDGE.
    - DECREASE THE DESIGNATED MAXIMUM ALLOWABLE OVERHANG LENGTH, So, BY 7".
    - INCREASE THE LENGTH OF S7 BARS BY 9".

    WHERE CONDITIONS EXCEED THE ABOVE LIMITATIONS, PERFORM SPECIAL DECK DESIGN.
26. FOR DEAD LOAD CALCULATIONS, THE WEIGHT OF BARRIERS/DIVISORS SHOWN ON BD-601M ARE AS FOLLOWS:
    - 45" F-SHAPE CONCRETE BARRIER 700 LB./FT,
    - 42" F-SHAPE CONCRETE BARRIER 650 LB./FT,
    - 32" F-SHAPE CONCRETE BARRIER 520 LB./FT,
    - 50" SPLIT CONCRETE MEDIAN BARRIER 750 LB./FT,
    - 32" SPLIT CONCRETE MEDIAN BARRIER 520 LB./FT,
    - 50" CONCRETE MEDIAN BARRIER 960 LB./FT,
    - 32" CONCRETE MEDIAN BARRIER 700 LB./FT,
    - CONCRETE MOUNTABLE DIVISOR TYPE A 260 LB./FT,
      TYPE B 280 LB./FT,
    - SPLIT CONCRETE MOUNTABLE DIVISOR TYPE A 130 LB./FT,
      TYPE B 140 LB./FT,
    - 42" VERTICAL WALL CONCRETE BARRIER ON ALTERNATE SIDEWALK (WITHOUT RAILING) 530 LB./FT.
27. TABLES 1-4 PROVIDED ON SHEET 10 CONSIDER THE TOP MAT TRANSVERSE BAR AS THE TOP BAR AND ARE ONLY APPLICABLE TO SIMPLE SPAN SUPERSTRUCTURE PROJECTS. TABLES 1-4 PROVIDED ON SHEET 11 CONSIDER THE TOP MAT LONGITUDINAL BAR AS THE TOP BAR AND SHALL BE USED FOR CONTINUOUS SPAN SUPERSTRUCTURE PROJECTS AND ARE OPTIONAL FOR USE IN SIMPLE SPAN SUPERSTRUCTURE PROJECTS.
28. MECHANICALLY GRIND BRIDGE DECKS WITHOUT OVERLAYS ON INTERSTATE, LIMITED ACCESS AND NHS ROUTES UNLESS EXEMPTED BY THE DISTRICT BRIDGE ENGINEER. INCLUDE MECHANICAL GRINDING SPECIFICATION IN CONTRACT. TO ACCOMMODATE MECHANICAL GRINDING, DECK SLAB SHALL BE PLACED WITH AN ADDITIONAL ¼" THICKNESS (T+ ¼") AND A TOP CLEAR COVER INCREASED BY ¼".
29. FOR BRIDGE DECKS WITH AN EPOXY, LATEX MODIFIED CONCRETE (LMC), OR POLYESTER POLYMER CONCRETE (PPC) OVERLAY, THE ½" INTEGRAL WEARING SURFACE MAY BE ELIMINATED WITH DISTRICT BRIDGE ENGINEER APPROVAL, THEREBY REDUCING THE CONCRETE DECK SLAB THICKNESS AND TOP CONCRETE COVER BY ½".

LEGEND:

(1) WITHIN 10′ ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS SHOWN ON BD-622M AND BD-624M.

(2) EXTEND ONE HALF OF THE S1, BOTTOM TRANSVERSE BARS, ACROSS THE FULL WIDTH OF THE OVERHANG. THE ALTERNATE BARS WHICH DO NOT EXTEND INTO THE OVERHANG SHALL EXTEND 6" MINIMUM BEYOND THE INTERIOR EDGE OF THE FLANGE OF THE FASCIA BEAM.

(3) BUNDLE THE BARS LISTED AS S7 IN THE REINFORCEMENT TABLES TO EACH S2 BAR.

(4) BEGIN S3 AND S3′ BARS AT LOCATION OF DESIGN SECTION FOR NEGATIVE MOMENT, SEE SHEET 9. S3 AND S3′ BARS DO NOT NEED TO BE PLACED OVER THE BEAM FOR SPREAD BOX BEAM BRIDGE.

(5) FOR EMBEDMENT INTO THE CONCRETE BARRIER, SEE SHEET 7.

(6) FOR DRIP NOTCH DETAILS, SEE BC-775M.

(7) UNDERSIDE OF DECK SLAB MAY BE CONSTRUCTED LEVEL.

(8) FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP. (SEE NOTE 24)

(9) FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHEET 2.

(10) IF THE BARRIER IS POSITIONED DIRECTLY ABOVE A GIRDER THE S7 BAR, IF REQUIRED, MUST EXTEND THE DISTANCE "L" BEYOND THE ADJACENT BEAMS ON EACH SIDE.

(11) DECK SLAB LAP SPLICE LENGTH:
- NORMAL WEIGHT CONCRETE: 3′-0" #5 BARS; 3′-7" #6 BARS
- LIGHT WEIGHT CONCRETE: 3′-6" #5 BARS; 4′-2" #6 BARS

(12) DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTER LINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 & S7 BARS. BEVEL DRAINS AS PER BC-751M.

(13) WHEN A TRAFFIC BARRIER IS MOUNTED ON THE DECK BETWEEN TWO GIRDERS, PROVIDE TOP AND BOTTOM REINFORCEMENT AREA IN THE DECK IN THE BAY WHERE THE BARRIER EXISTS, AT LEAST EQUAL TO THE OVERHANG TOP REINFORCEMENT AREA AS SHOWN ON SHEETS 10 AND 11. IF S7 BARS ARE REQUIRED THEY SHOULD MATCH THE SPACING OF THE S2 BARS ON THE TOP MAT AND S1 BARS ON THE BOTTOM MAT.

(14) TO BE USED WHEN MATCHING DETAIL IS SPECIFIED IN APPROACH ROADWAY.

(15) TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS.

(16) SPACE BARS S3, S3′, S4, S5, AND S6 SYMMETRICALLY ABOUT THE PANEL CENTERLINE.

(17) PROVIDE HAUNCH TO COMPENSATE FOR IRREGULARITIES IN CAMBER. SEE TABLE 1, SHEET 9 FOR MINIMUM HAUNCH REQUIREMENTS.

(18) FOR PRESTRESSED CONCRETE BRIDGES MADE CONTINUOUS, DESIGN S5 AND S6 BARS IN ACCORDANCE WITH DM-4 ARTICLE D5.12.3.3.

(19) USE BEAM HAUNCH DETAILS SHOWN WITH REMOVABLE DECK FORMS. FACE OF HAUNCH IS VERTICAL WHEN PERMANENT METAL DECK FORMS ARE USED IN PLACING THE DECK. BEAM HAUNCH DETAIL SHALL CONFORM TO BC-732M.

(20) SPLICES SHOULD BE OUTSIDE OF NEGATIVE MOMENT AREA IF POSSIBLE, IF NOT, CENTER BAR LENGTH ON CENTER OF NEGATIVE MOMENT AREA. STAGGER SPLICES AS PER BD-660M.

CONTRACT DRAWING NOTE:

1. THE FOLLOWING NOTE IS TO BE PLACED ON THE CONTRACT DRAWINGS WHEN THE 42" F-SHAPE CONCRETE BARRIER IS USED: THE 42" F-SHAPE CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE BARRIER HEIGHT BELOW 42".

REFERENCE DRAWINGS

RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-65M	CONCRETE MOUNTABLE CURBS
BD-609M	PA 3-RAIL BRIDGE BARRIER
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-656M	TYP. LONGITUDINAL SECTIONS I-BEAM AND BOX BEAM BRIDGES
BD-660M	DECK SLAB AND STEEL REINFORCEMENT PLACEMENT
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-662M	I-BEAM AND PA BULB-TEE BEAM REINFORCEMENT DETAILS
BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS
BC-701M	PROTECTIVE FENCE
BC-706M	PA 3-RAIL BRIDGE BARRIER
BC-711M	ALUMINUM PROTECTIVE BARRIER
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-719M	BRIDGE DECK TEMPORARY BARRIERS
BC-720M	ALUMINUM OR STEEL BRIDGE HAND RAILING
BC-722M	LIGHTING POLE ANCHORAGE
BC-732M	PERMANENT METAL DECK FORMS
BC-734M	ANCHOR SYSTEMS
BC-751M	BRIDGE DRAINAGE
BC-752M	CONCRETE DECK SLAB DETAILS
BC-762M	TOOTH EXPANSION DAM
BC-767M	NEOPRENE STRIP SEAL DAM
BC-775M	MISCELLANEOUS PRESTRESS DETAILS
BC-779M	STRUCTURE MOUNTED SOUND BARRIER WALLS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

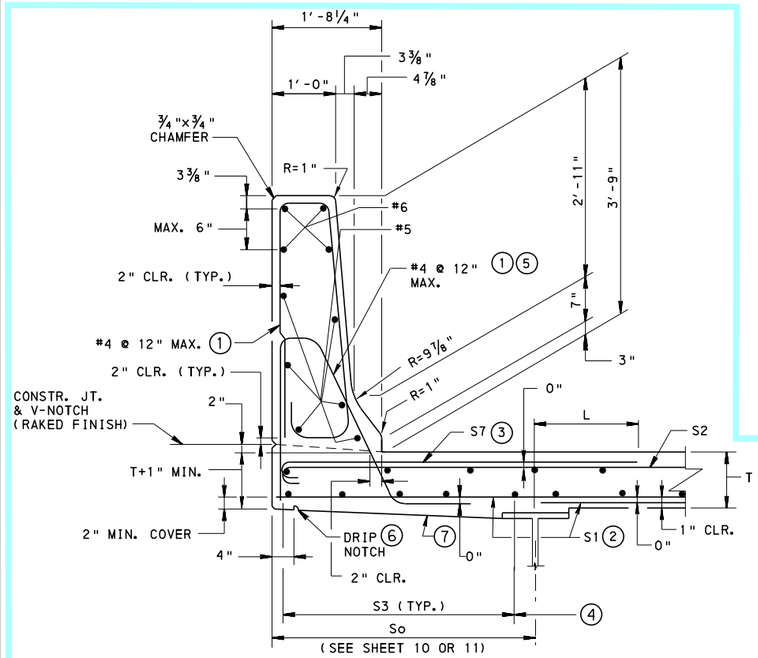
STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

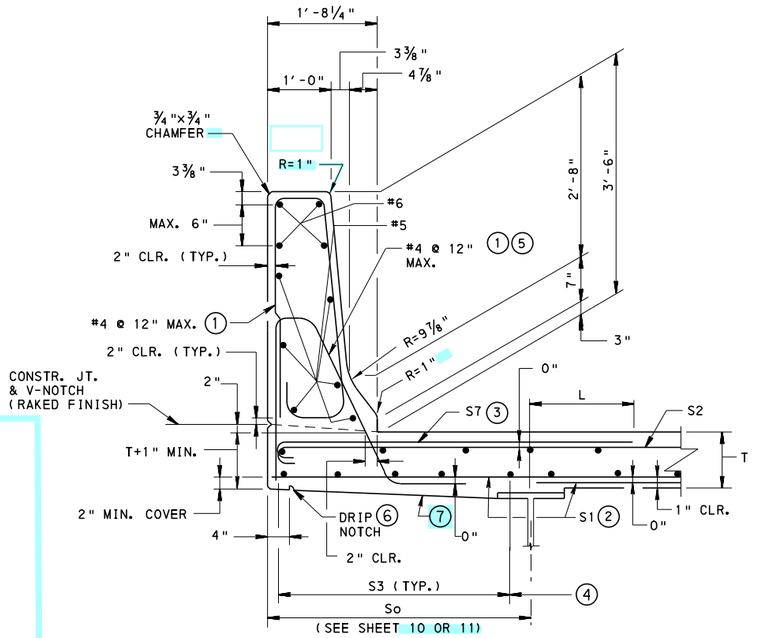
RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 12

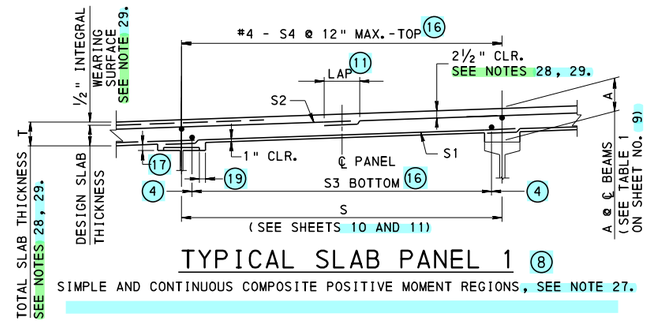
BD-601M



45" F-SHAPE CONCRETE BARRIER DETAIL ⑧ ⑨

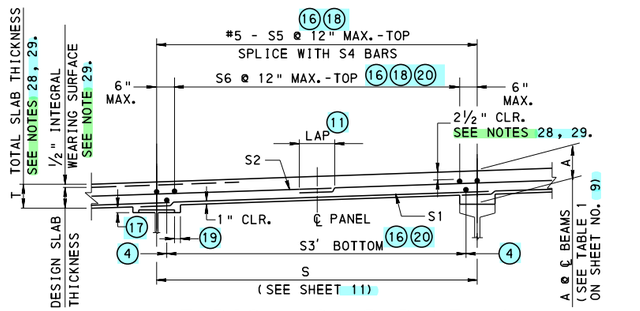


42" F-SHAPE CONCRETE BARRIER DETAIL ⑧ ⑨



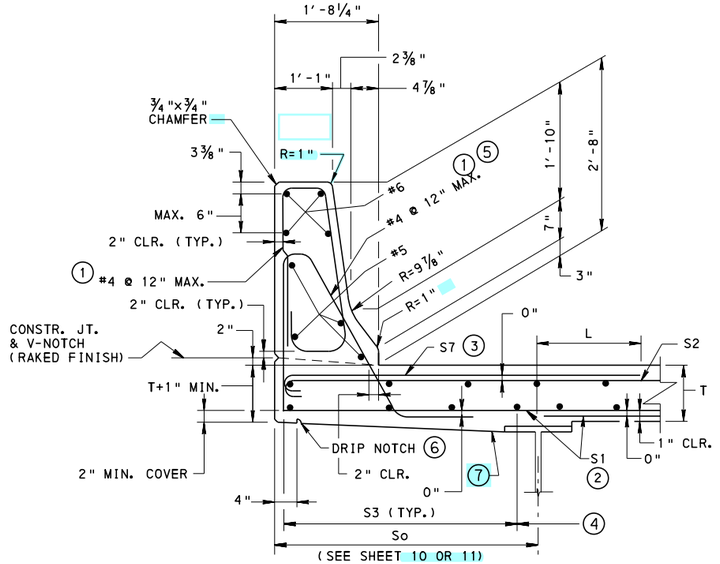
TYPICAL SLAB PANEL 1 ⑧

SIMPLE AND CONTINUOUS COMPOSITE POSITIVE MOMENT REGIONS, SEE NOTE 27.

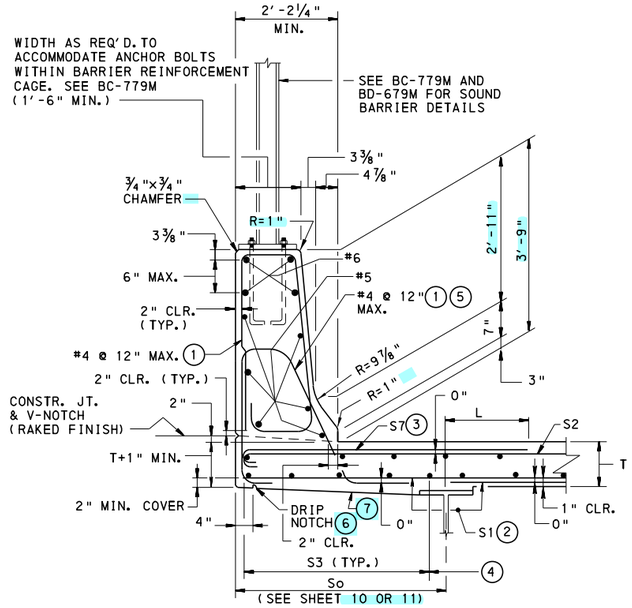


TYPICAL SLAB PANEL 2

CONTINUOUS COMPOSITE NEGATIVE MOMENT REGIONS



32" F-SHAPE CONCRETE BARRIER DETAIL ⑧ ⑨



45" F-SHAPE CONCRETE BARRIER WITH STRUCTURE MOUNTED SOUND BARRIER DETAIL ⑧ ⑨

(DETAILS SIMILAR FOR ALUMUNUM PROTECTIVE BARRIER. SEE THE APPROPRIATE BC-STANDARD FOR THE BARRIER TOP WIDTH.)

(42" F-SHAPE CONCRETE BARRIER SIMILAR)

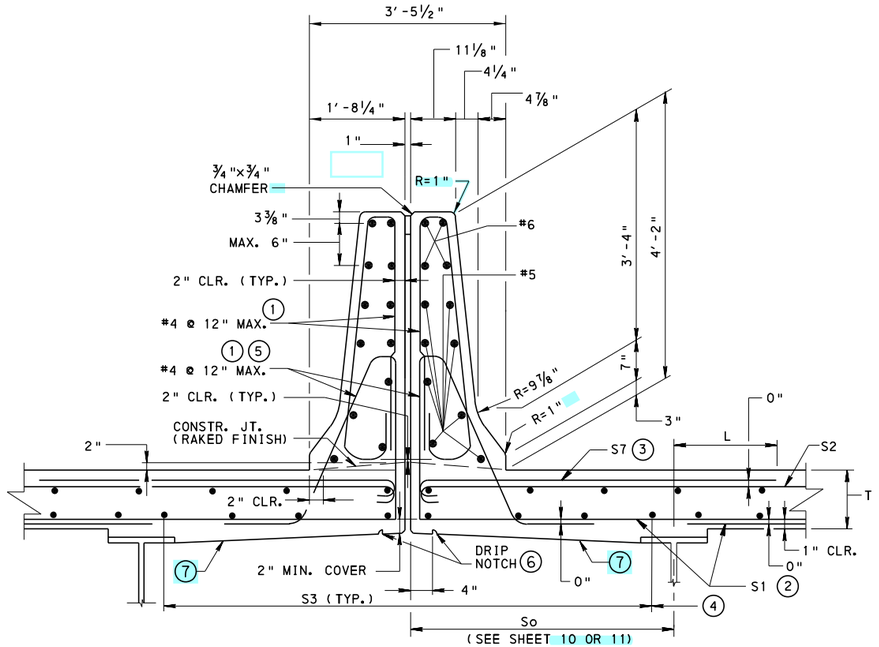
NOTES:

1. FOR ADDITIONAL NOTES AND LEGEND, SEE SHEET 1.
2. BARRIER LAP SPLICE LENGTH: NORMAL WEIGHT CONCRETE: 3′-7" #5 BARS, 4′-4" #6 BARS; LIGHT WEIGHT CONCRETE: 4′-2" #5 BARS, 5′-1" #6 BARS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

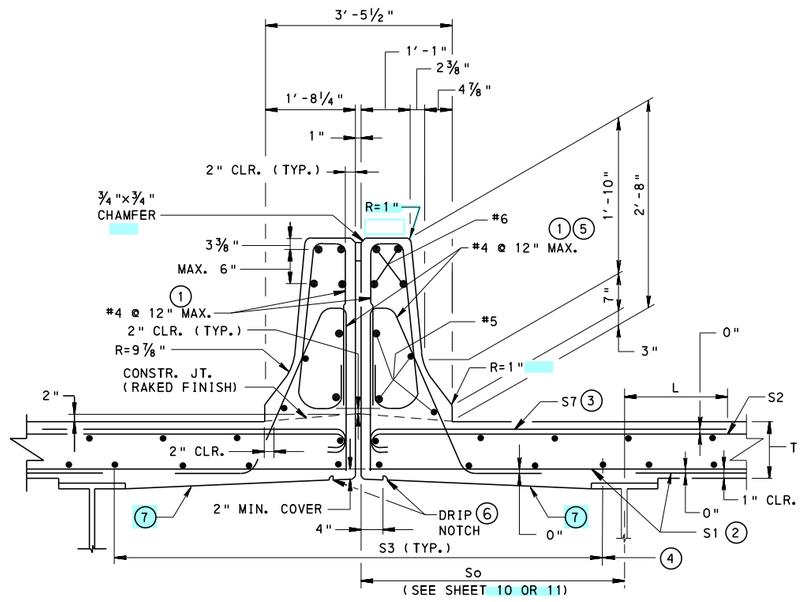
STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED FEB. 14, 2023	RECOMMENDED FEB. 14, 2023	SHEET 2 OF 12
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-601M



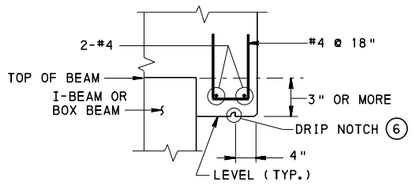
50" SPLIT CONCRETE MEDIAN BARRIER DETAIL (8)(9)(14)

(SEE BC-788M FOR OPEN JOINT DETAIL)



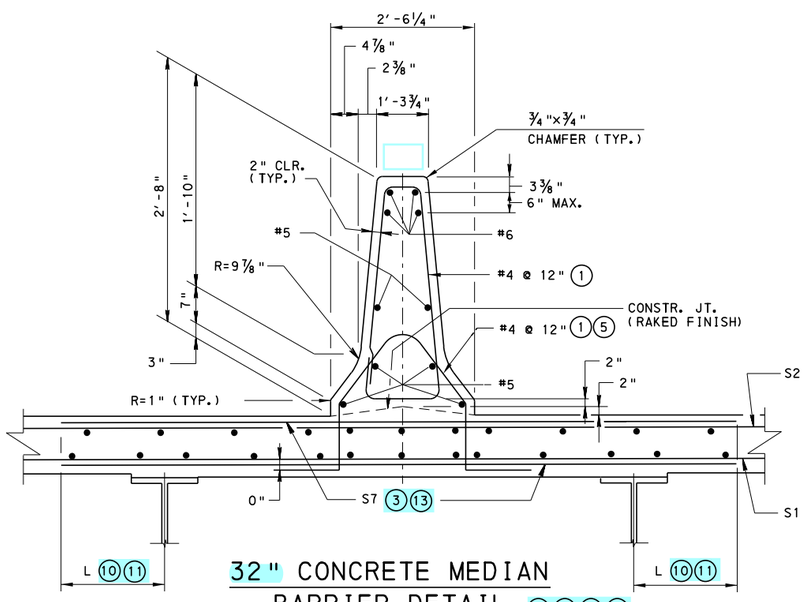
32" SPLIT CONCRETE MEDIAN BARRIER DETAIL (8)(9)(14)

(SEE BC-788M FOR OPEN JOINT DETAIL)

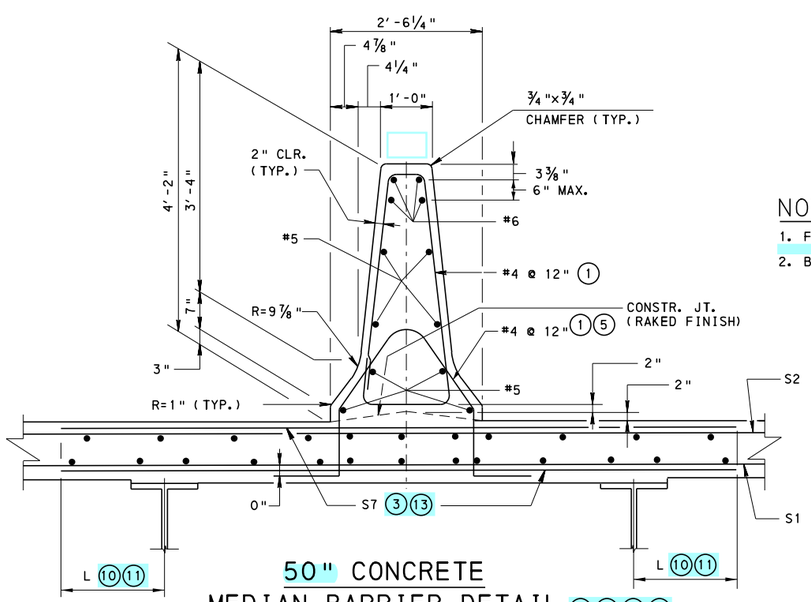


TYPICAL OVERHANG REINFORCEMENT

(TO BE USED WHEN THE OVERHANG IS 3" OR MORE IN DEPTH)



32" CONCRETE MEDIAN BARRIER DETAIL (8)(9)(14)(15)



50" CONCRETE MEDIAN BARRIER DETAIL (8)(9)(14)(15)

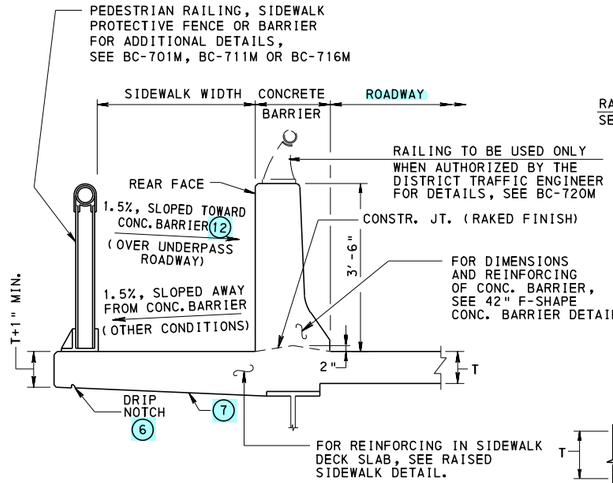
NOTES:

1. FOR ADDITIONAL NOTES AND LEGEND, SEE SHEET 1.
2. BARRIER LAP SPLICE LENGTH: NORMAL WEIGHT CONCRETE: 3′-7" #5 BARS, 4′-4" #6 BARS; LIGHT WEIGHT CONCRETE: 4′-2" #5 BARS, 5′-1" #6 BARS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

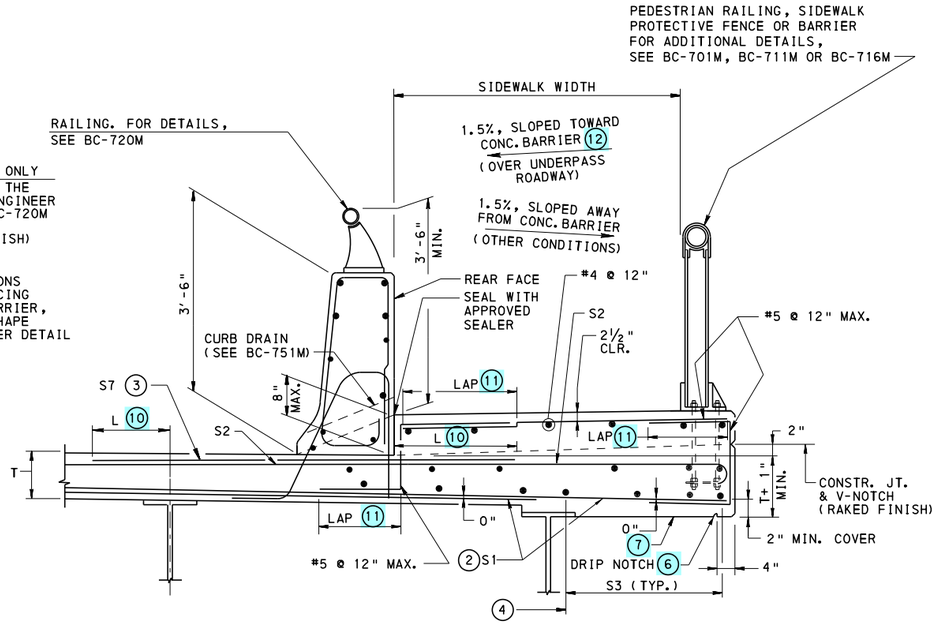
STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED FEB. 14, 2023	RECOMMENDED FEB. 14, 2023	SHEET 3 OF 12
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-601M



TYPICAL SIDEWALK DETAIL

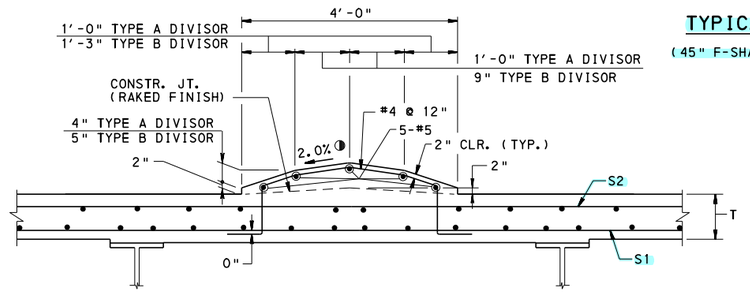
(45" F-SHAPE CONCRETE BARRIER SIMILAR)



RAISED SIDEWALK DETAIL (8)(9)

(SEE SHEET 2 FOR BARRIER REINFORCEMENT)

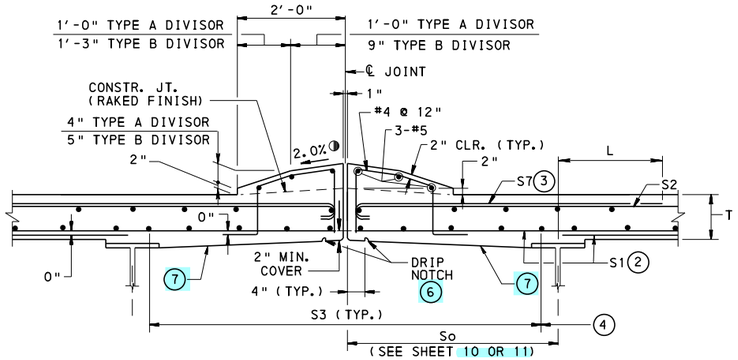
(42" F-SHAPE CONCRETE BARRIER SHOWN, 32" AND 45" F-SHAPE CONCRETE BARRIER SIMILAR)



◑ FOR TYPE A AND B DIVISORS, SET CROSS SLOPE AT 2.0%. WHERE WIDER THAN SHOWN DIVISORS ARE USED, PROVIDE WIDTH AND SET CROSS SLOPE BETWEEN 1.0% AND 2.0%.

CONCRETE MOUNTABLE DIVISOR DETAIL (8)(9)(14)(15)

(NOT FOR USE AS A TRAFFIC BARRIER, SEE RC-65M.)

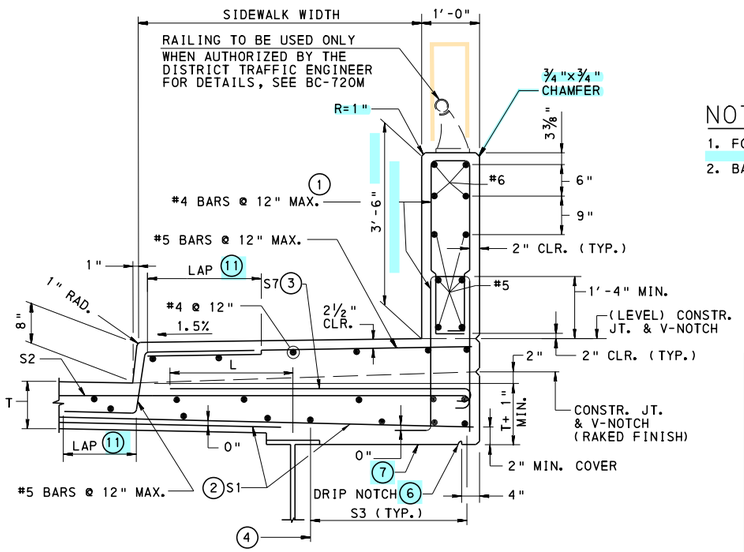


SPLIT CONCRETE MOUNTABLE DIVISOR DETAIL (8)(9)(14)(15)

(SEE BC-788M FOR OPEN JOINT DETAIL)
(NOT FOR USE AS A TRAFFIC BARRIER, SEE RC-65M.)

PROTECTED SIDEWALKS

REQUIRED FOR BRIDGES WITH A POSTED VEHICULAR SPEED GREATER THAN 45 MPH OR A STRUCTURE LENGTH LONGER THAN 200 FEET, UNLESS WAIVED BY THE DEPARTMENT (SEE DM-4 DC2.3.2.2.2).



ALTERNATE SIDEWALK WITH 42" VERTICAL WALL CONCRETE BARRIER DETAIL (8)(9)(14)

PERMITTED FOR BRIDGES WITH A POSTED VEHICULAR SPEED LESS THAN OR EQUAL TO 45 MPH AND A STRUCTURE LENGTH LESS THAN OR EQUAL TO 200 FEET, SEE DM-4 DC2.3.2.2.2.

NOTES:

1. FOR ADDITIONAL NOTES AND LEGEND, SEE SHEET 1.
2. BARRIER LAP SPLICE LENGTH: NORMAL WEIGHT CONCRETE: 3'-7" #5 BARS, 4'-4" #6 BARS; LIGHT WEIGHT CONCRETE: 4'-2" #5 BARS, 5'-1" #6 BARS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

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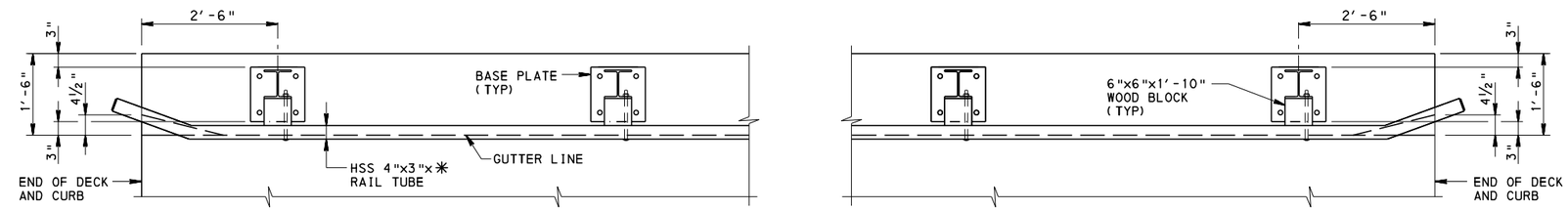
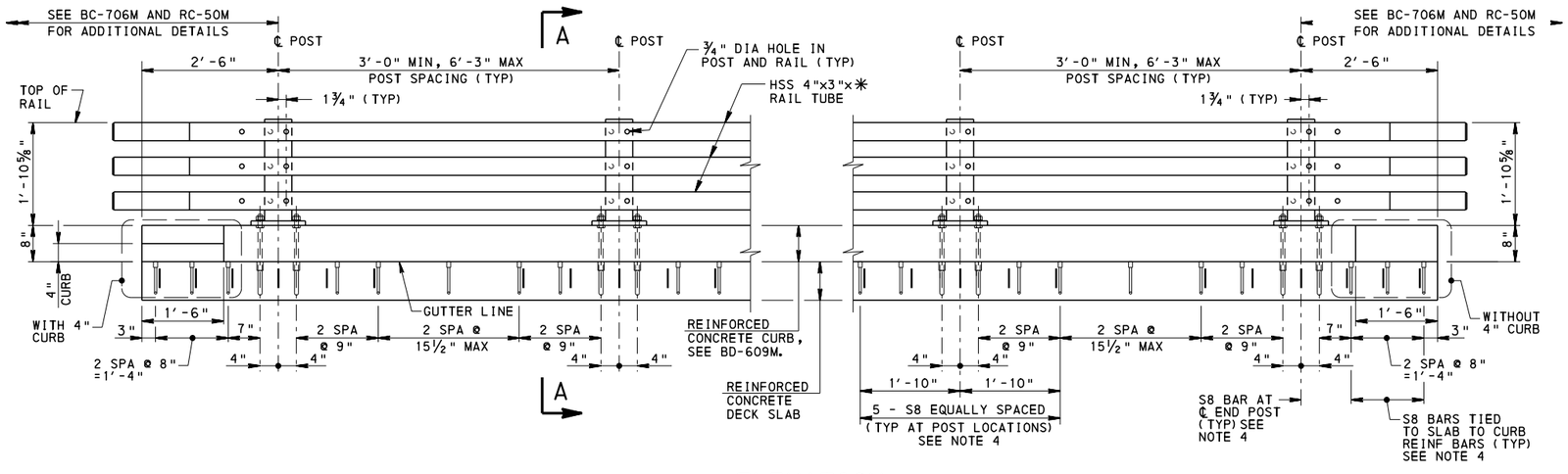
CHIEF ENGINEER, HIGHWAY ADMIN.



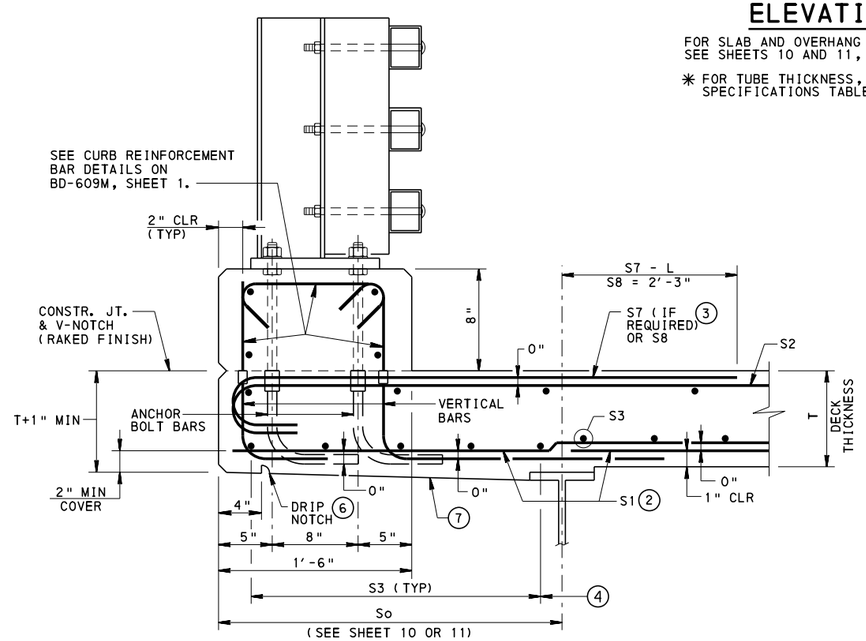
PLAN



ELEVATION

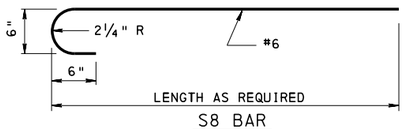
FOR SLAB AND OVERHANG REINFORCEMENT SEE SHEETS 10 AND 11, TABLES 1 THRU 4.

✳ FOR TUBE THICKNESS, SEE TUBE RAIL SPECIFICATIONS TABLE ON BC-706M.

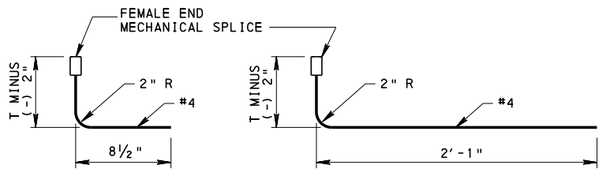


SECTION A-A ⑧⑨

NOTE:
PRIOR TO CONSTRUCTING CURB AND DECK, ANCHOR BOLTS SHALL BE INSTALLED WITH EITHER A TEMPLATE OR ACTUAL POST W/ BASEPLATE INSTALLED TO ENSURE PROPER ANCHOR BOLT ALIGNMENT & PLACEMENT.



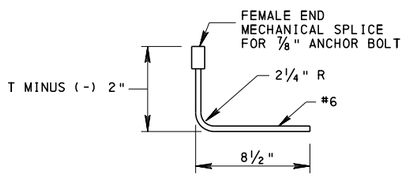
S8 BAR



VERTICAL REINFORCEMENT
ALL VERTICAL REINFORCEMENT #4

SLAB TO CURB REINFORCEMENT BAR DETAILS

MECHANICAL SPLICE AS LISTED IN BULLETIN 15



ANCHOR BOLT BAR DETAIL

MECHANICAL SPLICE AS LISTED IN BULLETIN 15

NOTES:

1. FOR ADDITIONAL NOTES AND LEGEND, SEE SHEET 1.
2. THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3.
3. FOR PA 3-RAIL BRIDGE BARRIER DETAILS, SEE BD-609M.
4. PROVIDE S8 BARS ONLY WHEN S7 BARS ARE NOT REQUIRED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD CONCRETE DECK SLAB PA 3-RAIL BRIDGE BARRIER FOR BEAM BRIDGES

RECOMMENDED FEB. 14, 2023
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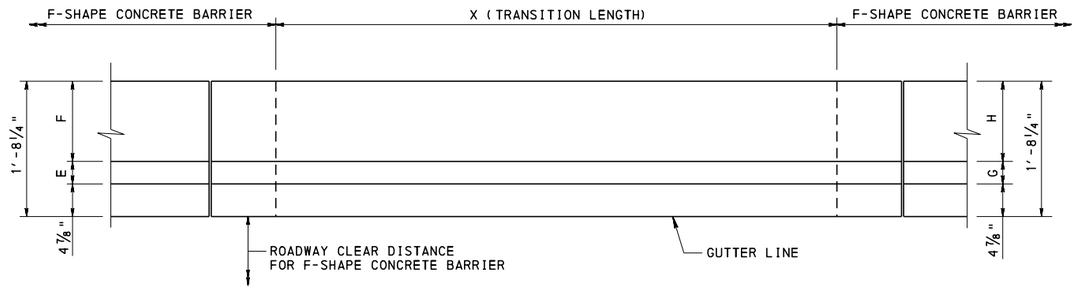
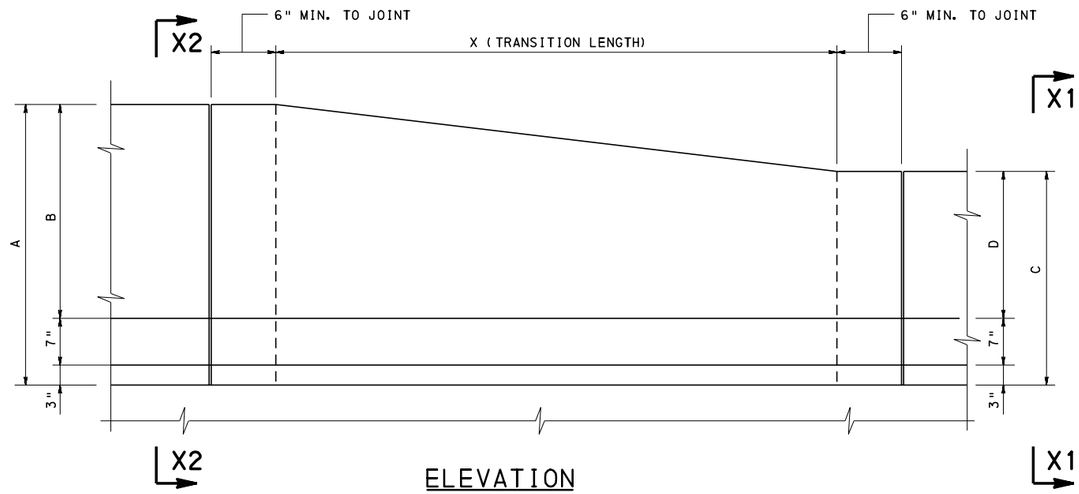
RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-601M



PLAN



ELEVATION

F-SHAPE TO F-SHAPE CONCRETE BARRIER TRANSITION

TRANSITION	A	B	C	D	E	F	G	H	X
45" F-SHAPE TO 32" F-SHAPE	3'-9"	2'-11"	2'-8"	1'-10"	3⅜"	1'-0"	2⅜"	1'-1"	6'-6" MIN.
42" F-SHAPE TO 32" F-SHAPE	3'-6"	2'-8"	2'-8"	1'-10"	3⅜"	1'-0"	2⅜"	1'-1"	5'-0" MIN.
45" F-SHAPE TO 42" F-SHAPE	3'-9"	2'-11"	3'-6"	2'-8"	3⅜"	1'-0"	3⅜"	1'-0"	2'-0" MIN.

NOTES:

1. FOR SECTIONS X1-X1 AND X2-X2, SEE SPECIFIC F-SHAPE CONCRETE BARRIER DETAIL, SHEET 2.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD
CONCRETE DECK SLAB

F-SHAPE CONCRETE
BARRIER TRANSITIONS

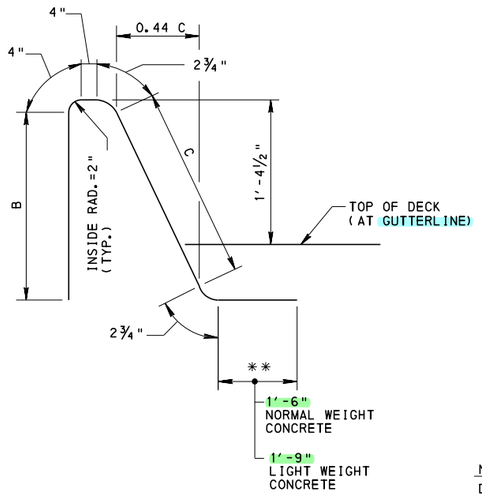
RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 12

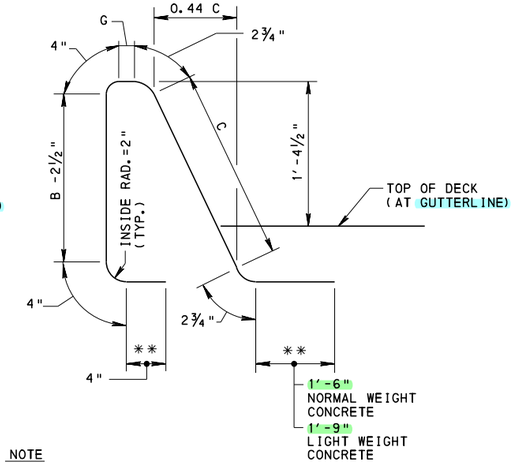
BD-601M

** WHEN THE DECK IS SLOPED AWAY FROM THE GUTTERLINE SLOPE LEG TO MATCH DECK CROSS-SLOPE. DESIGNER TO PROVIDE NECESSARY DIMENSIONS.



F-SHAPE BARRIERS AND SPLIT MEDIAN BARRIERS

(FOR DIMENSIONS "B" AND "C", SEE TABLE 1)

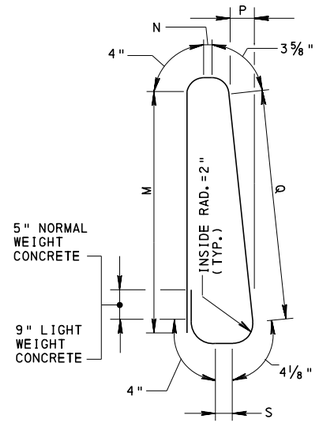


NOTE

DIMENSION G TO BE DETERMINED BY THE DESIGNER

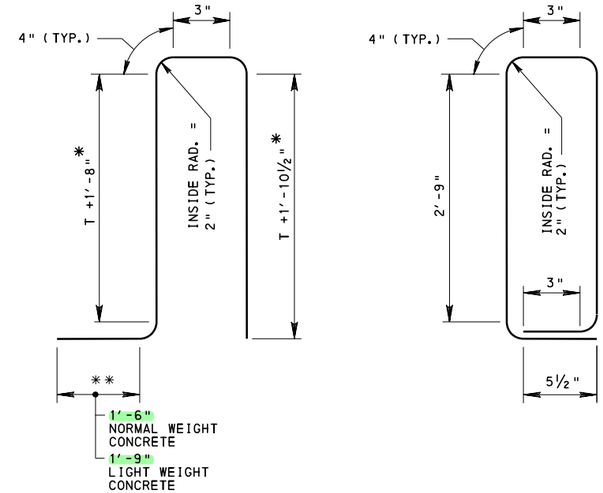
F-SHAPE BARRIERS WITH SOUND BARRIERS AND ALUMINUM PROTECTIVE BARRIER

(FOR DIMENSIONS "B" AND "C", SEE TABLE 1)



F-SHAPE BARRIERS AND SPLIT MEDIAN BARRIERS

(FOR DIMENSIONS M, N, P, Q AND S, SEE TABLE 2)
(DETERMINE DIMENSIONS N AND S FOR BARRIER WITH SOUND BARRIER)



ALTERNATE SIDEWALK WITH 42" VERTICAL WALL CONCRETE BARRIER

* DETAILED FOR SIDEWALK DEPTH OF 8"

TABLE 1

B AND C DIMENSIONS

T	F-SHAPE BARRIERS AND SPLIT MEDIAN BARRIERS	
	B	C
8.0"	1'-9"	1'-11"
8.5"	1'-9½"	1'-11½"
9.0"	1'-10"	2'-0"
9.5"	1'-10½"	2'-0½"
10.0"	1'-11"	2'-1¼"
10.5"	1'-11½"	2'-1¾"
11.0"	2'-0"	2'-2¼"
11.5"	2'-0½"	2'-2¾"

TABLE 2

M, N, P, Q AND S DIMENSIONS

	M	N	P	Q	S
45" F-SHAPE CONCRETE BARRIER	3'-0½"	3⅜"	3⅜"	2'-10¾"	6¾"
42" F-SHAPE CONCRETE BARRIER	2'-9½"	3⅜"	3⅜"	2'-7¾"	6¾"
32" F-SHAPE CONCRETE BARRIER AND 32" SPLIT MEDIAN BARRIER	1'-11½"	4½"	2¼"	1'-9¾"	6¾"
50" SPLIT CONCRETE MEDIAN BARRIER	3'-5½"	2½"	4⅛"	3'-3¾"	6¾"

REINFORCEMENT DETAILS

REINFORCEMENT BAR NOTES

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.

NOTES:

FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

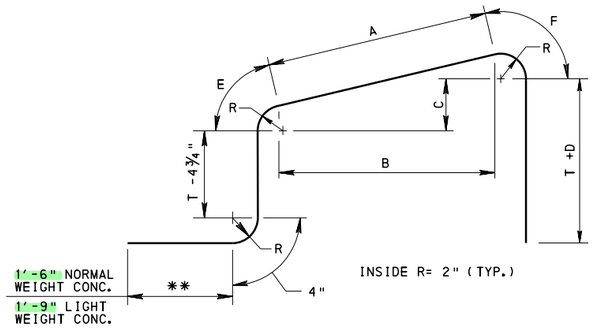
STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 7 OF 12

BD-601M

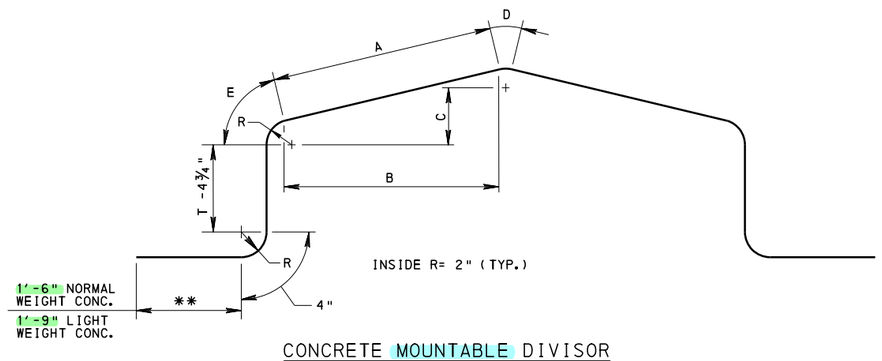


SPLIT CONCRETE MOUNTABLE DIVISOR

(FOR DIMENSIONS A, B, C, D, E AND F, SEE TABLE 3)

TABLE 3						
A, B, C, D, E AND F DIMENSIONS						
SPLIT DIVISORS	A	B	C	D	E	F
TYPE A	15¼"	15"	3"	⅝"	3½"	4¼"
TYPE B	15¾"	15¼"	4¼"	1½"	3¼"	4½"

(WHERE WIDER THAN SHOWN DIVISORS ARE USED, PROVIDE WIDTH AND A, B, C AND D DIMENSIONS)



CONCRETE MOUNTABLE DIVISOR

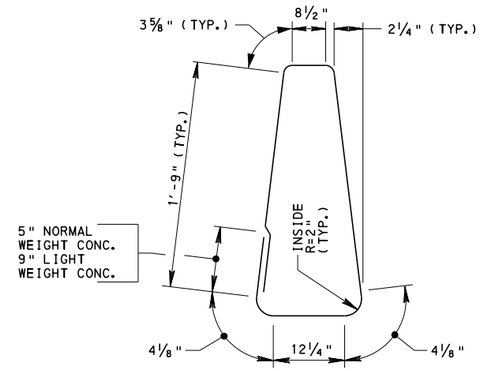
(FOR DIMENSIONS A, B, C, D, AND E, SEE TABLE 4)

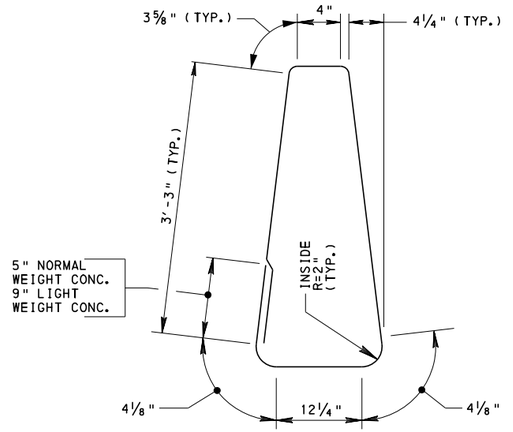
TABLE 4					
A, B, C, D, AND E DIMENSIONS					
DIVISORS	A	B	C	D	E
TYPE A	19¾"	19½"	4¼"	½"	3½"
TYPE B	20¼"	20"	5¼"	½"	3⅜"

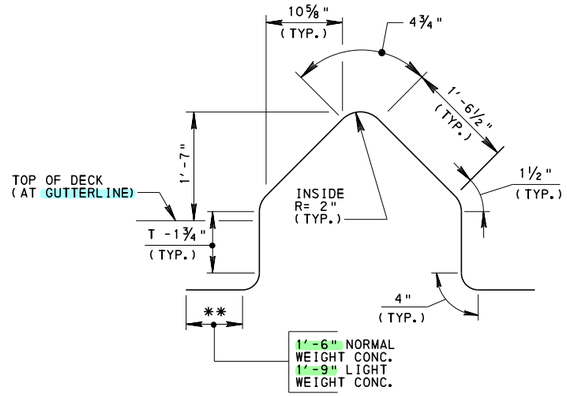
(WHERE WIDER THAN SHOWN DIVISIORS ARE USED, PROVIDE WIDTH AND A, B, AND C DIMENSIONS)

REINFORCEMENT DETAILS

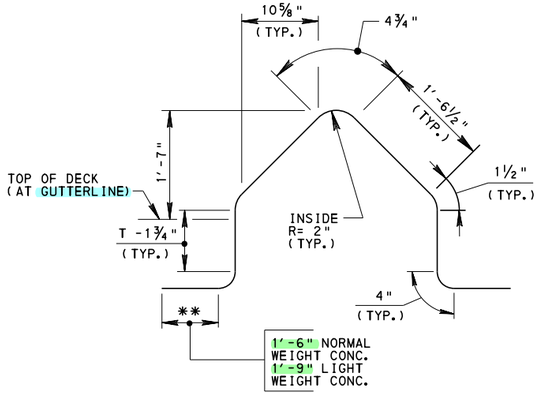
** WHEN THE DECK IS SLOPED AWAY FROM THE GUTTERLINE SLOPE LEG TO MATCH DECK CROSS-SLOPE. DESIGNER TO PROVIDE NECESSARY DIMENSIONS.







32" CONCRETE MEDIAN BARRIER



50" CONCRETE MEDIAN BARRIER

NOTES:

FOR NOTES, SEE SHEET 1.

REINFORCEMENT BAR NOTES

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

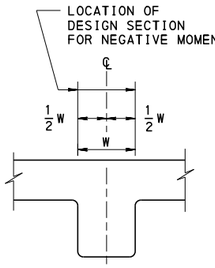
STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

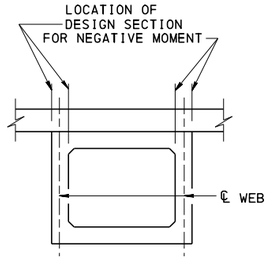
RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 8 OF 12

BD-601M

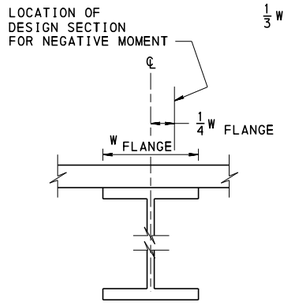


MONOLITHIC CONSTRUCTION

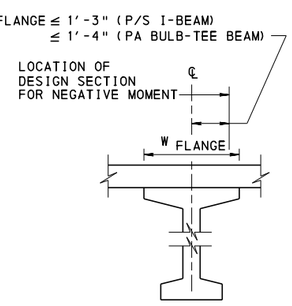


P/S CONCRETE BOX BEAMS*

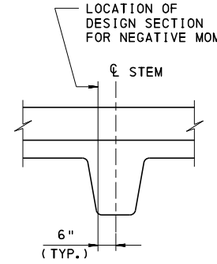
*TREAT EACH WEB OF A BOX BEAM AS A SEPARATE RECTANGULAR BEAM.



STEEL BEAMS



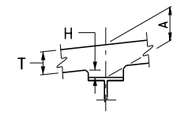
P/S CONCRETE I BEAMS & PA BULB-TEE BEAMS



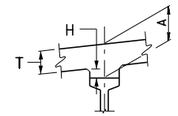
NEXT BEAMS

TABLE 1: MINIMUM HAUNCH THICKNESSES	
STEEL I-BEAMS AND PLATE GIRDERS	
PLAN CAMBER	H
UP TO 1½"	½"
OVER 1½" TO 3"	¾"
OVER 3"	1"
P/S CONC. I-BEAMS, PA BULB-TEE AND SPREAD BOX BEAMS	
PLAN CAMBER	H
ALL	½"

1. "T" IS THE DECK THICKNESS AS INDICATED ON SHEETS 2, 3 AND 4.
2. PROVIDE THE SPECIFIED MINIMUM HAUNCH THICKNESSES ALONG THE FULL LENGTH OF BEAMS, INCLUDING SPLICE PLATE REGIONS OF STEEL BEAM BRIDGES.
3. "A" IS THE DIMENSION FROM TOP OF DECK TO TOP OF BEAM AT THE CENTERLINE OF BEAM. INCLUDE THE FOLLOWING WHEN DETERMINING DIMENSION "A":
   - DECK THICKNESS, "T"
   - MINIMUM HAUNCH THICKNESS, "H"
   - EFFECT OF DECK CROSS SLOPE

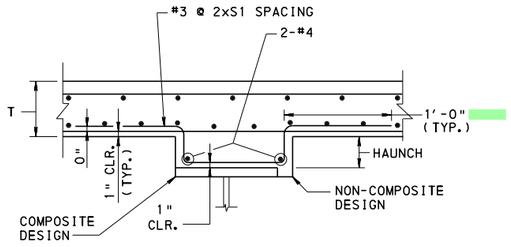


STEEL BEAM/GIRDER



P/S CONCRETE BEAM

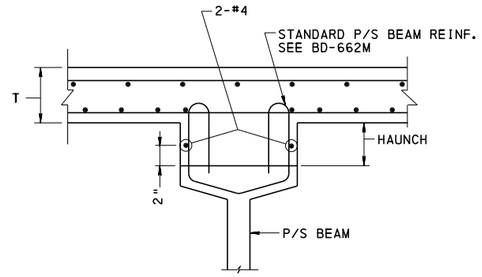
LOCATION OF DESIGN SECTION FOR NEGATIVE MOMENT IN DECK SLABS



STEEL BEAMS

PROVIDE WHEN HAUNCH THICKNESS IS 3" OR GREATER ANYWHERE ACROSS WIDTH OF HAUNCH

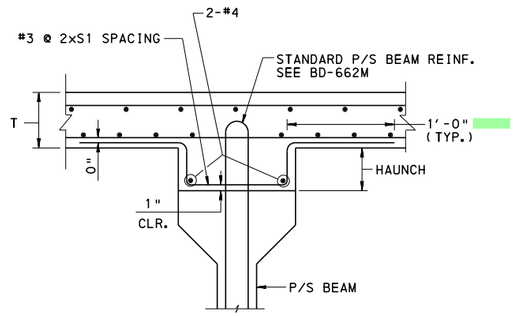
FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



AASHTO TYPE P/S CONC. I-BEAM
(P/S SPREAD BOX BEAM SIMILAR)

PROVIDE WHEN HAUNCH THICKNESS IS 5" OR GREATER ANYWHERE ACROSS WIDTH OF HAUNCH

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



P/S CONC. PA I-BEAM & PA BULB-TEE BEAMS

PROVIDE WHEN SIP FORMS ARE PRESENT AND HAUNCH THICKNESS IS 5" OR GREATER ANYWHERE ACROSS WIDTH OF HAUNCH OR WHEN SIP FORMS ARE NOT PRESENT AND THE HAUNCH THICKNESS IS 3" OR GREATER ANYWHERE ACROSS WIDTH OF HAUNCH.

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

HAUNCH REINFORCEMENT DETAILS

INSTRUCTIONS FOR DETAILING HAUNCH REINFORCEMENT ON CONSTRUCTION PLANS

1. DETAIL HAUNCH REINFORCEMENT ON THE REINFORCEMENT BAR SCHEDULE.
2. SHOW HAUNCH REINFORCEMENT DETAILS ON THE CONSTRUCTION PLANS.
3. SHOW THE LIMITS OF HAUNCH REINFORCEMENT ALONG THE LENGTH OF EACH BEAM/GIRDER ON THE SLAB PLAN OR ON ANOTHER APPROPRIATE DETAIL.
4. INCLUDE ONE OF THE FOLLOWING NOTES ON THE PLANS:

   WHEN HAUNCH REINFORCEMENT IS REQUIRED

   "THE HAUNCH REINFORCEMENT QUANTITY SHOWN ON THE REINFORCEMENT BAR SCHEDULE PROVIDES THE AMOUNT NECESSARY TO COVER THE LIMITS SHOWN ON SHEET **. PROVIDE ADDITIONAL HAUNCH REINFORCEMENT IN OTHER REGIONS ALONG THE LENGTH OF THE BEAM WHERE ACTUAL HAUNCHES EXCEED THE THICKNESSES SPECIFIED IN BC-752M."

   ** PROVIDE APPROPRIATE SHEET NUMBER(S).

   WHEN HAUNCH REINFORCEMENT IS NOT REQUIRED BASED ON COMPUTED BEAM CAMBERS

   "BEAM HAUNCH REINFORCEMENT WAS NOT DETERMINED TO BE REQUIRED FOR THE COMPUTED BEAM CAMBERS. HOWEVER, PROVIDE HAUNCH REINFORCEMENT IN ACCORDANCE WITH BC-752M WHERE IRREGULAR BEAM CAMBERS OR OTHER CONSTRUCTION CONDITIONS PROVIDE ACTUAL HAUNCHES THAT EXCEED THE THICKNESSES SPECIFIED IN BC-752M."

NOTES:

FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED FEB. 14, 2023	RECOMMENDED FEB. 14, 2023	SHEET 9 OF 12
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-601M

TABLE 1: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 0 IN.

USE FOR:
- **PRECAST PRESTRESSED SPREAD BOX BEAMS**
- **PLANK BEAMS**
- **STEEL I-BEAMS WITH TOP FLANGE WIDTH < 12"**

S	T(in.)	S1	S2	S3	S7+	So	L	NOTES
4'-3"	8	#5 @9-1/2	#5 @11-1/2	#4 @9	1 #6	2'-8"	3'-1"	
4'-7"	8	#5 @9-1/2	#5 @10	#4 @9	1 #5	2'-10"	3'-1"	
4'-11"	8	#5 @9	#5 @9	#4 @9	1 #5	3'-1"	2'-10"	
5'-2"	8	#5 @9	#5 @8	#4 @9	1 #4	3'-3"	2'-10"	
5'-6"	8	#5 @9	#5 @7-1/2	#4 @8-1/2	1 #4	3'-5"	2'-10"	
5'-10"	8	#5 @9	#5 @7	#4 @8-1/2	1 #4	3'-8"	2'-5"	
6'-2"	8	#5 @8-1/2	#5 @6-1/2	#4 @8	1 #4	3'-10"	2'-6"	
6'-6"	8	#5 @8	#5 @6	#4 @7-1/2	1 #4	4'-1"	2'-4"	
6'-10"	8	#5 @8	#5 @5-1/2	#4 @7-1/2	1 #4	4'-3"	2'-3"	
7'-2"	8	#5 @7-1/2	#5 @5-1/2	#5 @11	1 #4	4'-5"	2'-3"	
7'-6"	8	#5 @7	#5 @5-1/2	#5 @11	1 #4	4'-5"	2'-3"	
7'-10"	8	#5 @7	#6 @7	#5 @10	---	3'-9"	---	B,C
8'-2"	8	#5 @7	#6 @7	#5 @10	---	3'-9"	---	B,C
8'-6"	8	#5 @7	#6 @7	#5 @10	---	3'-9"	---	B,C
8'-10"	8	#5 @6-1/2	#6 @6-1/2	#5 @9-1/2	---	3'-10"	---	B,C
9'-2"	8-1/2	#5 @6-1/2	#6 @7	#5 @9-1/2	---	3'-11"	---	B,C
9'-6"	8-1/2	#5 @6-1/2	#6 @7	#5 @9-1/2	---	3'-11"	---	B,C
9'-10"	8-1/2	#5 @6	#6 @6-1/2	#5 @9	---	4'-0"	---	B,C
10'-2"	9	#5 @6-1/2	#6 @6-1/2	#5 @9-1/2	---	4'-3"	---	B,C
10'-5"	9	#5 @6	#6 @6	#5 @9	---	4'-5"	---	B,C
10'-9"	9	#5 @6	#6 @6	#5 @9	---	4'-5"	---	B,C
11'-1"	9-1/2	#5 @6	#6 @6	#5 @9	---	4'-7"	---	B,C
11'-5"	9-1/2	#5 @6	#6 @5-1/2	#5 @9	---	4'-10"	---	B,C
11'-9"	9-1/2	#5 @6	#6 @5-1/2	#5 @9-1/2	---	4'-10"	---	B,C
12'-1"	9-1/2	#5 @6	#6 @5-1/2	#5 @9-1/2	---	4'-10"	---	B,C
12'-5"	10	#5 @6	#6 @5-1/2	#5 @9-1/2	---	5'-2"	---	B,C
12'-9"	10	#5 @6	#6 @5-1/2	#5 @10	---	5'-2"	---	B,C
13'-1"	10-1/2	#5 @6	#6 @5-1/2	#5 @10	---	5'-5"	---	B,C
13'-5"	10-1/2	#5 @6	#6 @5-1/2	#5 @10	---	5'-5"	---	B,C
13'-9"	11	#5 @6	#6 @5-1/2	#5 @10-1/2	---	5'-8"	---	B,C
14'-1"	11-1/2	#5 @6-1/2	#6 @5-1/2	#5 @11	---	6'-0"	---	
14'-5"	11-1/2	#5 @6	#6 @5-1/2	#5 @10-1/2	---	6'-0"	---	
14'-9"	11-1/2	#5 @6-1/2	#6 @5-1/2	#5 @11	---	6'-0"	---	
15'-1"	11-1/2	#5 @6	#6 @5-1/2	#5 @11	---	6'-0"	---	

TABLE 2: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 3 IN.

USE FOR:
- **PRECAST PRESTRESSED I-BEAMS WITH TOP FLANGE WIDTH < 18"**
- **STEEL I-BEAMS WHEN: 12" ≤ TOP FLANGE WIDTH < 24"**

S	T(in.)	S1	S2	S3	S7+	So	L	NOTES
4'-3"	8	#5 @9-1/2	#5 @11-1/2	#4 @9	1 #6	2'-8"	3'-0"	
4'-7"	8	#5 @9-1/2	#5 @11	#4 @9	1 #6	2'-10"	3'-2"	
4'-11"	8	#5 @9	#5 @10	#4 @9	1 #5	3'-1"	2'-10"	
5'-2"	8	#5 @9	#5 @9	#4 @9	1 #5	3'-3"	2'-11"	
5'-6"	8	#5 @9	#5 @8-1/2	#4 @8-1/2	1 #4	3'-5"	3'-0"	
5'-10"	8	#5 @9	#5 @8	#4 @8-1/2	1 #4	3'-8"	2'-9"	
6'-2"	8	#5 @8-1/2	#5 @7-1/2	#4 @8	1 #4	3'-10"	2'-8"	
6'-6"	8	#5 @8	#5 @7	#4 @7-1/2	1 #4	4'-1"	2'-8"	
6'-10"	8	#5 @8	#5 @7	#4 @7-1/2	1 #4	4'-2"	2'-8"	A,C
7'-2"	8	#5 @7-1/2	#5 @6-1/2	#5 @11	1 #4	4'-4"	2'-6"	A,C
7'-6"	8	#5 @7	#5 @6	#5 @11	1 #4	4'-6"	2'-6"	A,C
7'-10"	8	#5 @7	#5 @5-1/2	#5 @10	1 #4	4'-8"	2'-6"	A,C
8'-2"	8	#5 @7	#5 @5-1/2	#5 @10	1 #4	4'-8"	2'-6"	A,C
8'-6"	8	#5 @7	#5 @5-1/2	#5 @10	1 #4	4'-8"	2'-6"	A,C
8'-10"	8	#5 @6-1/2	#5 @5-1/2	#5 @9-1/2	1 #4	4'-8"	2'-4"	A,C
9'-2"	8	#5 @6	#5 @5-1/2	#5 @9	1 #4	4'-8"	2'-4"	A,C
9'-6"	8-1/2	#5 @6-1/2	#5 @5-1/2	#5 @9-1/2	---	4'-0"	---	B,C
9'-10"	8-1/2	#5 @6	#5 @5-1/2	#5 @9	---	4'-0"	---	B,C
10'-2"	8-1/2	#5 @6	#6 @7	#5 @9	---	4'-2"	---	B,C
10'-5"	9	#5 @6	#6 @7	#5 @9	---	4'-4"	---	B,C
10'-9"	9	#5 @6	#6 @6-1/2	#5 @9	---	4'-6"	---	B,C
11'-1"	9	#5 @5-1/2	#6 @6	#5 @8-1/2	---	4'-8"	---	B,C
11'-5"	9-1/2	#5 @6	#6 @6-1/2	#5 @9	---	4'-8"	---	B,C
11'-9"	9-1/2	#5 @6	#6 @6	#5 @9	---	4'-11"	---	B,C
12'-1"	9-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9	---	5'-2"	---	B,C
12'-5"	9-1/2	#5 @6	#6 @5-1/2	#5 @9-1/2	---	5'-2"	---	B,C
12'-9"	9-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9	---	5'-2"	---	B,C
13'-1"	9-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9	---	5'-2"	---	B,C
13'-5"	10	#5 @5-1/2	#6 @5-1/2	#5 @9	---	5'-6"	---	B,C
13'-9"	10-1/2	#5 @6	#6 @5-1/2	#5 @10	---	5'-9"	---	B,C
14'-1"	10-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9-1/2	---	5'-9"	---	B,C
14'-5"	11	#5 @6	#6 @5-1/2	#5 @10-1/2	---	6'-0"	---	
14'-9"	11	#5 @5-1/2	#6 @5-1/2	#5 @9-1/2	---	6'-0"	---	
15'-1"	11-1/2	#5 @6	#6 @5-1/2	#5 @10-1/2	---	6'-0"	---	

TABLE 3: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 6 IN.

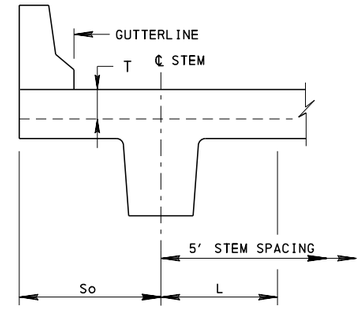
USE FOR:
- **PRECAST PRESTRESSED I-BEAMS WHEN: 18" < TOP FLANGE WIDTH < 36"**
- **STEEL I-BEAMS WHEN: 24" ≤ TOP FLANGE WIDTH < 48"**
- **NEXT BEAMS**

S	T(in.)	S1	S2	S3	S7+	So	L	NOTES
4'-3"	8	#5 @9-1/2	#5 @11-1/2	#4 @9	1 #6	2'-8"	3'-3"	
4'-7"	8	#5 @9-1/2	#5 @11-1/2	#4 @9	1 #6	2'-10"	3'-3"	
4'-11"	8	#5 @9	#5 @11-1/2	#4 @9	1 #6	3'-1"	3'-4"	
5'-2"	8	#5 @9	#5 @11	#4 @9	1 #6	3'-3"	3'-6"	
5'-6"	8	#5 @9	#5 @10	#4 @8-1/2	1 #5	3'-5"	3'-2"	
5'-10"	8	#5 @9	#5 @9	#4 @8-1/2	1 #5	3'-8"	3'-2"	
6'-2"	8	#5 @8-1/2	#5 @9	#4 @8	1 #5	3'-10"	3'-2"	
6'-6"	8	#5 @8	#5 @8-1/2	#4 @7-1/2	1 #4	4'-0"	3'-1"	
6'-10"	8	#5 @8	#5 @8	#4 @7-1/2	1 #4	4'-2"	3'-0"	
7'-2"	8	#5 @7-1/2	#5 @7-1/2	#5 @11	1 #4	4'-3"	3'-0"	A,C
7'-6"	8	#5 @7	#5 @7	#5 @11	1 #4	4'-5"	3'-0"	A,C
7'-10"	8	#5 @7	#5 @7	#5 @10	1 #4	4'-5"	3'-0"	A,C
8'-2"	8	#5 @7	#5 @7	#5 @10	1 #4	4'-5"	2'-11"	A,C
8'-6"	8	#5 @7	#5 @6-1/2	#5 @10	1 #4	4'-7"	2'-9"	A,C
8'-10"	8	#5 @6-1/2	#5 @6-1/2	#5 @9-1/2	1 #4	4'-7"	2'-11"	A,C
9'-2"	8	#5 @6	#5 @6	#5 @9	1 #4	4'-10"	2'-9"	A,C
9'-6"	8	#5 @6	#5 @5-1/2	#5 @9	1 #4	5'-0"	2'-9"	A,C
9'-10"	8	#5 @5-1/2	#5 @5-1/2	#5 @8-1/2	1 #4	5'-0"	2'-9"	A,C
10'-2"	8-1/2	#5 @6	#5 @5-1/2	#5 @9	---	4'-3"	---	B,C
10'-5"	8-1/2	#5 @5-1/2	#5 @5-1/2	#5 @8-1/2	---	4'-3"	---	B,C
10'-9"	8-1/2	#5 @5-1/2	#6 @7	#5 @8-1/2	---	4'-5"	---	B,C
11'-1"	9	#5 @5-1/2	#6 @7	#5 @8-1/2	---	4'-7"	---	B,C
11'-5"	9	#5 @5-1/2	#6 @6-1/2	#5 @8-1/2	---	4'-9"	---	B,C
11'-9"	9	#5 @5-1/2	#6 @6-1/2	#5 @8-1/2	---	4'-9"	---	B,C
12'-1"	9-1/2	#5 @5-1/2	#6 @6	#5 @8-1/2	---	5'-3"	---	B,C
12'-5"	9-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9	---	5'-6"	---	B,C
12'-9"	9-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8	---	5'-6"	---	B,C
13'-1"	9-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9	---	5'-6"	---	B,C
13'-5"	9-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8-1/2	---	5'-6"	---	B,C
13'-9"	9-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8-1/2	---	5'-6"	---	B,C
14'-1"	10	#5 @5-1/2	#6 @5-1/2	#5 @9	---	5'-10"	---	B,C
14'-5"	10	#5 @5-1/2	#6 @5-1/2	#5 @9	---	5'-10"	---	B,C
14'-9"	10-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9	---	6'-0"	---	
15'-1"	10-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9	---	6'-0"	---	

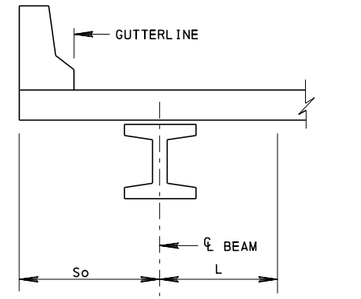
TABLE 4: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 12 IN.

USE FOR:
- **PRECAST PRESTRESSED PA BULB-TEE AND I-BEAMS WITH TOP FLANGE WIDTH ≥ 36"**
- **STEEL I-BEAMS OR STEEL CLOSED BOXES WITH TOP FLANGE WIDTH ≥ 48"**

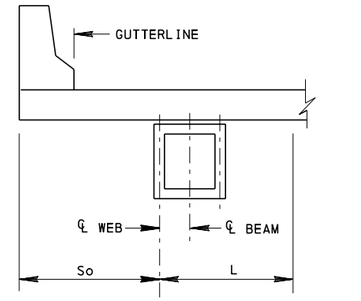
S	T(in.)	S1	S2	S3	S7+	So	L	NOTES
4'-3"	8	#5 @9-1/2	#5 @11-1/2	#4 @9	1#6	2'-8"	3'-9"	
4'-7"	8	#5 @9-1/2	#5 @11-1/2	#4 @9	1#6	2'-10"	3'-9"	
4'-11"	8	#5 @9	#5 @11-1/2	#4 @9	1#6	3'-1"	3'-9"	
5'-2"	8	#5 @9	#5 @11-1/2	#4 @9	1#6	3'-3"	3'-9"	
5'-6"	8	#5 @9	#5 @11-1/2	#4 @8-1/2	1#6	3'-5"	3'-9"	
5'-10"	8	#5 @9	#5 @11-1/2	#4 @8-1/2	1#6	3'-8"	3'-10"	
6'-2"	8	#5 @8-1/2	#5 @11-1/2	#4 @8	1#6	3'-10"	3'-11"	
6'-6"	8	#5 @8	#5 @11-1/2	#4 @7-1/2	1#6	4'-1"	4'-1"	
6'-10"	8	#5 @8	#5 @11	#4 @7-1/2	1#6	4'-3"	4'-0"	
7'-2"	8	#5 @7-1/2	#5 @11	#5 @11	1#6	4'-6"	4'-0"	
7'-6"	8	#5 @7	#5 @10	#5 @11	1#5	4'-8"	3'-10"	
7'-10"	8	#5 @7	#5 @9-1/2	#5 @10	1#5	4'-10"	3'-10"	
8'-2"	8	#5 @7	#5 @9	#5 @10	1#5	4'-11"	3'-10"	
8'-6"	8	#5 @7	#5 @9	#5 @10	1#5	4'-11"	3'-10"	
8'-10"	8	#5 @6-1/2	#5 @8-1/2	#5 @9-1/2	1#4	4'-8"	3'-9"	
9'-2"	8	#5 @6	#5 @8	#5 @9	1#4	4'-10"	3'-8"	
9'-6"	8	#5 @6	#5 @7-1/2	#5 @9	1#4	4'-11"	3'-5"	A,C
9'-10"	8	#5 @5-1/2	#5 @7	#5 @8-1/2	1#4	5'-1"	3'-5"	A,C
10'-2"	8	#5 @5-1/2	#5 @7	#5 @8-1/2	1#4	5'-1"	3'-4"	A,C
10'-5"	8	#5 @5-1/2	#5 @6-1/2	#5 @7-1/2	1#4	5'-4"	4'-0"	A,C
10'-9"	8	#5 @5-1/2	#5 @6	#5 @7-1/2	1#4	5'-6"	4'-0"	A,C
11'-1"	8-1/2	#5 @5-1/2	#5 @6	#5 @7-1/2	1#4	5'-10"	4'-0"	A,C
11'-5"	8-1/2	#5 @5-1/2	#5 @5-1/2	#5 @7-1/2	---	4'-10"	---	B,C
11'-9"	8-1/2	#5 @5-1/2	#5 @5-1/2	#5 @7-1/2	---	4'-10"	---	B,C
12'-1"	9	#5 @5-1/2	#5 @5-1/2	#5 @7-1/2	---	5'-0"	---	B,C
12'-5"	9	#5 @5-1/2	#6 @7	#5 @7-1/2	---	5'-3"	---	B,C
12'-9"	9	#6 @7	#6 @7	#5 @7	---	5'-3"	---	B,C
13'-1"	9-1/2	#5 @5-1/2	#6 @7	#5 @8	---	5'-5"	---	B,C
13'-5"	9-1/2	#5 @5-1/2	#6 @6-1/2	#5 @8	---	5'-8"	---	B,C
13'-9"	9-1/2	#6 @7	#6 @6	#5 @7	---	5'-10"	---	B,C
14'-1"	9-1/2	#5 @5-1/2	#6 @6	#5 @8-1/2	---	5'-10"	---	B,C
14'-5"	9-1/2	#6 @7	#6 @6	#5 @7-1/2	---	5'-10"	---	B,C
14'-9"	9-1/2	#6 @7	#6 @5-1/2	#5 @7-1/2	---	6'-0"	---	
15'-1"	10	#6 @7	#6 @6	#5 @7-1/2	---	6'-0"	---	



NEXT BEAM



STEEL I-BEAM, P/S I-BEAM AND PA BULB-TEE



BOX BEAM

DEFINITION OF So (OVERHANG LENGTH)

THESE DESIGN TABLES ARE APPLICABLE TO SIMPLE SPAN SUPERSTRUCTURE PROJECTS ONLY.

DESIGN NOTES:

1. BEAM SPACING, "S"
   - ALL EXCEPT SPREAD BOX BEAMS AND NEXT BEAMS:
     S = MAXIMUM BEAM SPACING, CENTERLINE TO CENTERLINE OF ADJACENT BEAMS
   - SPREAD BOX BEAMS:
     S = MAXIMUM BEAM SPACING - 2'-7" [36" WIDE BEAMS]
     S = MAXIMUM BEAM SPACING - 3'-7" [48" WIDE BEAMS]
   - NEXT BEAMS:
     S = 4'-3" FOR BEAM SPACING ≤10'-0" (BEAM WIDTH)
     S = BEAM SPACING - 6'-0" FOR BEAM SPACING >10'-0" (BEAM WIDTH)
   - WHERE S <4'-3", USE S = 4'-3"
2. "T" = TOTAL SLAB THICKNESS, INCLUDES ½" INTEGRAL WEARING SURFACE.
3. OVERHANG LENGTH, "So"
   - FOR DEFINITION OF "So", SEE DETAILS THIS SHEET.
   - THE So VALUES SHOWN IN THE TABLES INDICATE THE MAXIMUM ALLOWABLE OVERHANG LENGTHS UTILIZING THE SPECIFIED REINFORCEMENT.
   - FOR SPLIT MEDIAN BARRIERS, REDUCE THE So VALUES LISTED IN THE TABLES BY 1".
   - SEE NOTES 24, 25 AND 26 ON SHEET 1 FOR ADDITIONAL LIMITATIONS.
4. FOR LOCATION OF REINFORCEMENT BARS, SEE SHEETS 2, 3 AND 4. FOR LOCATION OF DIMENSION "L", SEE SHEETS 2, 3 AND 4.
5. THE TOP MAT REINFORCING PROVIDED IN THE TABLES ON THIS SHEET CORRELATE WITH THE TRANSVERSE BARS AS THE TOP BAR IN THE MAT.
6. FOR OTHER BEAMS NOT LISTED UNDER THE HEADING OF THE TABLES ABOVE, DETERMINE THE DISTANCE FROM THE DESIGN SECTION FOR NEGATIVE MOMENT TO THE CENTERLINE OF BEAM USING THE SKETCHES ON SHEET 8. USE THE REINFORCEMENT TABLE WHICH CAPTION SHOWS A DISTANCE FROM THE DESIGN SECTION FOR NEGATIVE MOMENT TO THE CENTERLINE OF BEAMS EQUAL TO OR SMALLER THAN THE CALCULATED DISTANCE.

NOTES:

(A) THE OVERHANG LENGTH, So, SHOWN MAY BE INCREASED BY UP TO 5 INCHES IF #5 S7 BARS REPLACE THE #4 S7 BARS SHOWN. THE LENGTH "L" SHALL BE TAKEN NO LESS THAN 4'-3".

(B) THE OVERHANG LENGTH, So, SHOWN MAY BE INCREASED BY UP TO 8 INCHES IF #4 S7 BARS ARE BUNDLED TO EACH S2 BAR SHOWN. THE OVERHANG LENGTH, So, SHOWN MAY BE INCREASED BY UP TO 13 INCHES IF #5 S7 BARS ARE BUNDLED TO EACH S2 BAR SHOWN. THE LENGTH "L" SHALL BE TAKEN NO LESS THAN 4'-3".

(C) WHEN THE LENGTH OF THE OVERHANG IS INCREASED IN ACCORDANCE WITH NOTE (A) OR (B) ABOVE, THE INCREASED OVERHANG LENGTH SHALL NOT EXCEED THE LIMITS STATED IN DESIGN MANUAL PART 4, SECTION D9.7.1.5.1P.

\+ FOR BRIDGES WITH TOTAL WIDTH NO MORE THAN 36', THE S7 BARS MAY BE ELIMINATED IF THE FOLLOWING CONDITIONS ARE SATISFIED:
- THE OVERHANG LENGTH, So, DOES NOT EXCEED THE SMALLER OF:
  - THE LIMIT DETERMINED IN NOTE "C" ABOVE
  - 3'-9" FOR OVERHANGS SUPPORTING BARRIERS OR 3'-8" FOR OVERHANGS SUPPORTING SPLIT MEDIAN BARRIERS
- S2 BARS SHOWN IN THE TABLES ARE REPLACED WITH:
  #6 @ 7" FOR 8" THICK DECKS
  #6 @ 7½" FOR 8½" THICK DECKS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-601M

TABLE 1: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 0 IN.

USE FOR:
- **PRECAST PRESTRESSED SPREAD BOX BEAMS**
- **PLANK BEAMS**
- **STEEL I-BEAMS WITH TOP FLANGE WIDTH < 12"**

S	T(in.)	S1	S2	S3	S3'	S6	S7	So	L	NOTES
4'-3"	8	#5 @9-1/2	#5 @8-1/2	#4 @9	#4 @6	#5	1 #6	2'-8"	3'-5"	
4'-7"	8	#5 @7	#5 @7-1/2	#4 @9	#4 @6	#5	1 #6	2'-10"	3'-1"	
4'-11"	8	#5 @9	#5 @7	#4 @8-1/2	#4 @6	#5	1 #5	3'-1"	3'-0"	
5'-2"	8	#5 @9	#5 @7	#4 @8-1/2	#4 @6	#5	1 #5	3'-3"	2'-11"	
5'-6"	8	#5 @9	#5 @6-1/2	#4 @8-1/2	#4 @6	#5	1 #5	3'-5"	2'-11"	
5'-10"	8	#5 @9	#5 @6-1/2	#4 @8-1/2	#4 @6	#5	1 #5	3'-8"	2'-11"	
6'-2"	8	#5 @8-1/2	#5 @6	#4 @8	#4 @6	#5	1 #5	3'-10"	2'-11"	
6'-6"	8	#5 @8	#5 @6	#4 @7-1/2	#4 @6	#5	1 #5	4'-1"	2'-11"	
6'-10"	8	#5 @8	#5 @5-1/2	#4 @7-1/2	#4 @6	#5	1 #5	4'-3"	2'-11"	
7'-2"	8-1/2	#5 @7-1/2	#6 @6-1/2	#5 @11	#5 @6	#5	1 #5	4'-5"	2'-11"	
7'-6"	8-1/2	#5 @7	#6 @6-1/2	#5 @10	#5 @6	#5	1 #5	4'-5"	2'-11"	
7'-10"	8-1/2	#5 @7	#6 @6	#5 @10	#5 @6	#5	1 #4	3'-9"	2'-5"	A,B,C
8'-2"	8-1/2	#5 @7	#6 @6	#5 @10	#5 @6	#5	1 #4	3'-9"	2'-5"	A,B,C
8'-6"	8-1/2	#5 @7	#6 @6	#5 @10	#5 @6	#5	1 #4	3'-9"	2'-5"	A,B,C
8'-10"	8-1/2	#5 @6-1/2	#6 @6	#5 @9-1/2	#5 @6	#5	1 #4	3'-10"	2'-5"	A,B,C
9'-2"	8-1/2	#5 @6-1/2	#6 @6	#5 @9-1/2	#5 @6	#6	1 #4	3'-11"	2'-5"	A,B,C
9'-6"	8-1/2	#5 @6-1/2	#6 @6	#5 @9-1/2	#5 @6	#6	1 #4	3'-11"	2'-5"	A,B,C
9'-10"	8-1/2	#5 @6	#6 @5-1/2	#5 @8-1/2	#5 @6	#6	---	4'-0"	---	
10'-2"	9	#5 @6-1/2	#6 @6	#5 @9-1/2	#5 @6	#6	1 #4	4'-3"	2'-5"	A,B,C
10'-5"	9	#5 @6	#6 @5-1/2	#5 @8-1/2	#5 @6	#6	1 #4	4'-5"	2'-5"	A,B,C
10'-9"	9	#5 @6	#6 @5-1/2	#5 @8-1/2	#5 @6	#6	1 #4	4'-5"	2'-5"	A,B,C
11'-1"	9-1/2	#5 @6	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	4'-7"	2'-5"	A,B,C
11'-5"	9-1/2	#5 @6	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	4'-10"	2'-5"	A,B,C
11'-9"	10	#5 @6	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	4'-10"	2'-5"	A,B,C
12'-1"	10	#5 @6	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	4'-10"	2'-5"	A,B,C
12'-5"	10-1/2	#5 @6	#6 @5-1/2	#5 @9-1/2	#5 @6	#6	1 #4	5'-2"	2'-5"	A,B,C
12'-9"	10-1/2	#5 @6	#6 @5-1/2	#5 @9-1/2	#5 @6	#6	1 #4	5'-2"	2'-5"	A,B,C
13'-1"	10-1/2	#5 @6	#6 @5-1/2	#5 @9-1/2	#5 @6	#6	1 #4	5'-5"	2'-5"	A,B,C
13'-5"	11	#5 @6	#6 @5-1/2	#5 @9-1/2	#5 @6	#6	1 #4	5'-5"	2'-5"	A,B,C
13'-9"	11	#5 @6	#6 @5-1/2	#5 @10	#5 @6	#6	1 #4	5'-8"	2'-5"	A,B,C
14'-1"	11-1/2	#5 @6-1/2	#6 @5-1/2	#5 @11	#5 @6	#6	1 #4	6'-0"	2'-5"	A,B,C
14'-5"	11-1/2	#5 @6	#6 @5-1/2	#5 @10	#5 @6	#6	1 #4	6'-0"	2'-5"	A,B,C
14'-9"	12	#5 @6-1/2	#6 @5-1/2	#5 @11	#5 @6	#6	1 #4	6'-0"	2'-5"	A,B,C
15'-1"	12	#5 @6	#6 @5-1/2	#5 @10-1/2	#5 @6	#6	1 #4	6'-0"	2'-5"	A,B,C

TABLE 2: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 3 IN.

USE FOR:
- **PRECAST PRESTRESSED I-BEAMS WITH TOP FLANGE WIDTH < 18"**
- **STEEL I-BEAMS WHEN: 12" ≤ TOP FLANGE WIDTH < 24"**

S	T(in.)	S1	S2	S3	S3'	S6	S7	So	L	NOTES
4'-3"	8	#5 @9-1/2	#5 @9-1/2	#4 @9	#4 @6	#5	1 #6	2'-8"	3'-8"	
4'-7"	8	#5 @9-1/2	#5 @9	#4 @9	#4 @6	#5	1 #6	2'-10"	3'-8"	
4'-11"	8	#5 @9	#5 @8	#4 @8-1/2	#4 @6	#5	1 #5	3'-1"	3'-2"	
5'-2"	8	#5 @9	#5 @8	#4 @8-1/2	#4 @6	#5	1 #5	3'-3"	3'-2"	
5'-6"	8	#5 @9	#5 @7-1/2	#4 @8-1/2	#4 @6	#5	1 #5	3'-5"	3'-2"	
5'-10"	8	#5 @9	#5 @7	#4 @8-1/2	#4 @6	#5	1 #5	3'-8"	3'-2"	
6'-2"	8	#5 @8-1/2	#5 @6-1/2	#4 @8	#4 @6	#5	1 #5	3'-10"	3'-2"	
6'-6"	8	#5 @8	#5 @6-1/2	#4 @7-1/2	#4 @6	#5	1 #5	4'-1"	3'-2"	
6'-10"	8	#5 @8	#5 @6	#4 @7-1/2	#4 @6	#5	1 #5	4'-2"	3'-2"	
7'-2"	8	#5 @7-1/2	#5 @5-1/2	#5 @11	#5 @6	#5	1 #5	4'-4"	3'-2"	
7'-6"	8	#5 @7	#5 @5-1/2	#5 @10	#5 @6	#5	1 #6	4'-6"	3'-8"	
7'-10"	8	#5 @7	#5 @5-1/2	#5 @10	#5 @6	#5	1 #6	4'-8"	3'-8"	
8'-2"	8-1/2	#5 @7	#5 @5-1/2	#5 @10	#5 @6	#5	1 #5	4'-8"	3'-2"	
8'-6"	8-1/2	#5 @7	#5 @5-1/2	#5 @10	#5 @6	#5	1 #5	4'-8"	3'-2"	
8'-10"	8-1/2	#5 @6-1/2	#5 @5-1/2	#5 @9-1/2	#5 @6	#5	1 #5	4'-8"	3'-2"	
9'-2"	8-1/2	#5 @6	#5 @5-1/2	#5 @8-1/2	#5 @6	#5	1 #5	4'-8"	3'-2"	
9'-6"	9	#5 @6-1/2	#5 @5-1/2	#5 @9-1/2	#5 @6	#6	1 #4	4'-0"	2'-8"	A,B,C
9'-10"	9	#5 @6	#6 @6-1/2	#5 @8-1/2	#5 @6	#6	1 #4	4'-0"	2'-8"	A,B
10'-2"	9	#5 @6	#6 @6-1/2	#5 @8-1/2	#5 @6	#6	1 #4	4'-2"	2'-8"	A,B
10'-5"	9	#5 @6	#6 @6	#5 @8-1/2	#5 @6	#6	1 #4	4'-4"	2'-8"	A,B,C
10'-9"	9	#5 @6	#6 @5-1/2	#5 @8-1/2	#5 @6	#6	1 #4	4'-6"	2'-8"	A,B,C
11'-1"	9	#5 @5-1/2	#6 @5-1/2	#5 @8	#5 @6	#6	1 #4	4'-8"	2'-8"	A,B,C
11'-5"	9-1/2	#5 @6	#6 @5	#5 @9	#5 @6	#6	1 #4	4'-8"	2'-8"	A,B,C
11'-9"	9-1/2	#5 @6	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	4'-11"	2'-8"	A,B,C
12'-1"	9-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8-1/2	#5 @6	#6	1 #4	5'-2"	2'-8"	A,B
12'-5"	10	#5 @6	#6 @5-1/2	#5 @9-1/2	#5 @6	#6	1 #4	5'-2"	2'-8"	A,B,C
12'-9"	10	#5 @5-1/2	#6 @5-1/2	#5 @8-1/2	#5 @6	#6	1 #4	5'-2"	2'-8"	A,B,C
13'-1"	10-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	5'-2"	2'-8"	A,B,C
13'-5"	10-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	5'-6"	2'-8"	A,B,C
13'-9"	10-1/2	#5 @6	#6 @5-1/2	#5 @10	#5 @6	#6	1 #4	5'-9"	2'-8"	A,B
14'-1"	11	#5 @5-1/2	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	5'-9"	2'-8"	A,B,C
14'-5"	11	#5 @6	#6 @5-1/2	#5 @10	#5 @6	#6	1 #4	6'-0"	2'-8"	A,B,C
14'-9"	11-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9-1/2	#5 @6	#6	1 #4	6'-0"	2'-8"	A,B,C
15'-1"	11-1/2	#5 @6	#6 @5-1/2	#5 @10-1/2	#5 @6	#6	1 #4	6'-0"	2'-8"	A,B,C

TABLE 3: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 6 IN.

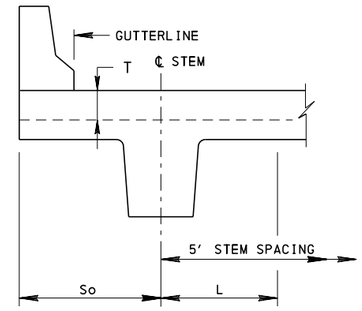
USE FOR:
- **PRECAST PRESTRESSED I-BEAMS WHEN: 18" < TOP FLANGE WIDTH < 36"**
- **STEEL I-BEAMS WHEN: 24" ≤ TOP FLANGE WIDTH < 48"**
- **NEXT BEAMS**

S	T(in.)	S1	S2	S3	S3'	S6	S7	So	L	NOTES
4'-3"	8	#5 @9-1/2	#5 @10-1/2	#4 @9	#4 @6	#5	1 #6	2'-8"	4'-2"	
4'-7"	8	#5 @9-1/2	#5 @10	#4 @9	#4 @6	#5	1 #6	2'-10"	4'-2"	
4'-11"	8	#5 @9	#5 @9-1/2	#4 @8-1/2	#4 @6	#5	1 #6	3'-1"	4'-2"	
5'-2"	8	#5 @9	#5 @8-1/2	#4 @8-1/2	#4 @6	#5	1 #6	3'-3"	4'-2"	
5'-6"	8	#5 @9	#5 @8	#4 @8-1/2	#4 @6	#5	1 #5	3'-5"	3'-8"	
5'-10"	8	#5 @9	#5 @8	#4 @8-1/2	#4 @6	#5	1 #5	3'-8"	3'-8"	
6'-2"	8	#5 @8-1/2	#5 @7-1/2	#4 @8	#4 @6	#5	1 #5	3'-10"	3'-8"	
6'-6"	8	#5 @8	#5 @7	#4 @7-1/2	#4 @6	#5	1 #5	4'-0"	3'-8"	
6'-10"	8	#5 @8	#5 @6-1/2	#4 @7-1/2	#4 @6	#5	1 #5	4'-2"	3'-8"	
7'-2"	8	#5 @7-1/2	#5 @6	#5 @11	#5 @6	#5	1 #5	4'-3"	3'-8"	
7'-6"	8	#5 @7	#5 @5-1/2	#5 @10	#5 @6	#5	1 #5	4'-5"	3'-8"	
7'-10"	8	#5 @7	#5 @5-1/2	#5 @10	#5 @6	#5	1 #5	4'-5"	3'-8"	
8'-2"	8	#5 @7	#5 @5-1/2	#5 @10	#5 @6	#5	1 #5	4'-5"	3'-8"	
8'-6"	8	#5 @7	#5 @6	#5 @10	#5 @6	#5	1 #6	4'-7"	4'-2"	
8'-10"	8	#5 @6-1/2	#5 @5-1/2	#5 @9-1/2	#5 @6	#5	1 #6	4'-7"	4'-2"	
9'-2"	8-1/2	#5 @6	#6 @6	#5 @8-1/2	#5 @6	#5	1 #6	4'-10"	4'-2"	
9'-6"	8-1/2	#5 @6	#6 @5-1/2	#5 @8-1/2	#5 @6	#5	1 #5	5'-0"	3'-8"	
9'-10"	8-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8	#5 @6	#5	1 #5	5'-0"	3'-8"	
10'-2"	8-1/2	#5 @6	#6 @5-1/2	#5 @8-1/2	#5 @6	#6	1 #4	4'-3"	3'-2"	A,B,C
10'-5"	8-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8	#5 @6	#6	1 #4	4'-3"	3'-2"	A,B,C
10'-9"	8-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8	#5 @6	#6	1 #4	4'-5"	3'-2"	A,B
11'-1"	9	#5 @5-1/2	#6 @6	#5 @8	#5 @6	#6	1 #4	4'-7"	3'-2"	A,B
11'-5"	9	#5 @5-1/2	#6 @6	#5 @8	#5 @6	#6	1 #4	4'-9"	3'-2"	A,B
11'-9"	9	#5 @5-1/2	#6 @5-1/2	#5 @8-1/2	#5 @6	#6	1 #4	4'-9"	3'-2"	A,B
12'-1"	9-1/2	#5 @5-1/2	#6 @6	#5 @8-1/2	#5 @6	#6	1 #4	5'-3"	3'-2"	A,B
12'-5"	9-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8-1/2	#5 @6	#6	1 #4	5'-6"	3'-2"	A,B
12'-9"	9-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8	#5 @6	#6	1 #4	5'-6"	3'-2"	A,B
13'-1"	10	#5 @5-1/2	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	5'-6"	3'-2"	A,B
13'-5"	10	#5 @5-1/2	#6 @5-1/2	#5 @8-1/2	#5 @6	#6	1 #4	5'-6"	3'-2"	A,B
13'-9"	10-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8-1/2	#5 @6	#6	1 #4	5'-6"	3'-2"	A,B,C
14'-1"	10-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	5'-10"	3'-2"	A,B
14'-5"	10-1/2	#5 @5-1/2	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	5'-10"	3'-2"	A,B
14'-9"	11	#5 @5-1/2	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	6'-0"	3'-2"	A,B,C
15'-1"	11	#5 @5-1/2	#6 @5-1/2	#5 @9	#5 @6	#6	1 #4	6'-0"	3'-2"	A,B,C

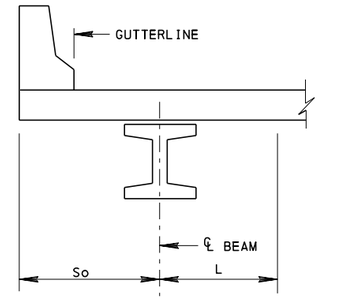
TABLE 4: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 12 IN.

USE FOR:
- **PRECAST PRESTRESSED PA BULB-TEE AND I-BEAMS WITH TOP FLANGE WIDTH ≥ 36"**
- **STEEL I-BEAMS OR STEEL CLOSED BOXES WITH TOP FLANGE WIDTH ≥ 48"**

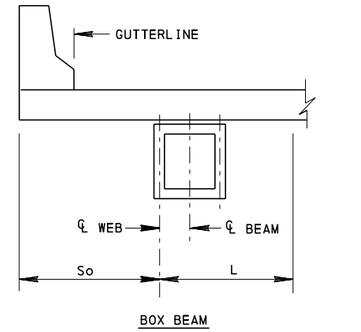
S	T(in.)	S1	S2	S3	S3'	S6	S7	So	L	NOTES
4'-3"	8	#5 @9-1/2	#5 @11	#4 @9	#4 @6	#5	1 #6	2'-8"	4'-2"	
4'-7"	8	#5 @9-1/2	#5 @11	#4 @9	#4 @6	#5	1 #6	2'-10"	4'-2"	
4'-11"	8	#5 @9	#5 @11	#4 @8-1/2	#4 @6	#5	1 #6	3'-1"	4'-2"	
5'-2"	8	#5 @9	#5 @11	#4 @8-1/2	#4 @6	#5	1 #6	3'-3"	4'-2"	
5'-6"	8	#5 @9	#5 @10-1/2	#4 @8-1/2	#4 @6	#5	1 #6	3'-5"	4'-2"	
5'-10"	8	#5 @9	#5 @10	#4 @8-1/2	#4 @6	#5	1 #6	3'-8"	4'-2"	
6'-2"	8	#5 @8-1/2	#5 @9-1/2	#4 @8	#4 @6	#5	1 #6	3'-10"	4'-2"	
6'-6"	8	#5 @8	#5 @8-1/2	#4 @7-1/2	#4 @6	#5	1 #6	4'-1"	4'-2"	
6'-10"	8	#5 @8	#5 @7-1/2	#4 @7-1/2	#4 @6	#5	1 #6	4'-3"	4'-2"	
7'-2"	8	#5 @7-1/2	#5 @6	#5 @11	#5 @6	#5	1 #6	4'-6"	4'-2"	
7'-6"	8	#5 @7	#5 @5-1/2	#5 @10	#5 @6	#5	1 #6	4'-8"	4'-2"	
7'-10"	8	#5 @7	#5 @5-1/2	#5 @10	#5 @6	#5	1 #6	4'-10"	4'-2"	
8'-2"	8	#5 @7	#5 @5-1/2	#5 @10	#5 @6	#5	1 #6	4'-11"	4'-2"	
8'-6"	8	#5 @7	#5 @5-1/2	#5 @10	#5 @6	#5	1 #6	4'-10"	4'-2"	
8'-10"	8	#5 @6-1/2	#5 @6-1/2	#5 @9-1/2	#5 @6	#5	1 #6	4'-11"	4'-2"	
9'-2"	8	#5 @6	#5 @5-1/2	#5 @8-1/2	#5 @6	#5	1 #6	4'-10"	4'-2"	
9'-6"	8-1/2	#5 @6	#6 @5-1/2	#5 @8-1/2	#5 @6	#5	1 #6	4'-11"	4'-2"	
9'-10"	8-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8	#5 @6	#5	1 #6	5'-1"	4'-2"	
10'-2"	8-1/2	#5 @5-1/2	#6 @5-1/2	#5 @8	#5 @6	#5	1 #6	5'-1"	4'-2"	
10'-5"	8-1/2	#5 @5-1/2	#6 @6	#5 @7-1/2	#5 @6	#5	1 #6	5'-4"	4'-2"	
10'-9"	8-1/2	#5 @5-1/2	#6 @6	#5 @7-1/2	#5 @6	#5	1 #6	5'-6"	4'-2"	
11'-1"	9	#5 @5-1/2	#6 @6	#5 @7-1/2	#5 @6	#6	1 #6	5'-10"	4'-2"	
11'-5"	9	#5 @5-1/2	#5 @5-1/2	#5 @7-1/2	#5 @6	#6	1 #6	4'-10"	4'-2"	
11'-9"	9-1/2	#5 @5-1/2	#5 @5-1/2	#5 @7-1/2	#5 @6	#6	1 #6	4'-10"	4'-2"	
12'-1"	10	#5 @5-1/2	#5 @5-1/2	#5 @7-1/2	#5 @6	#6	1 #6	5'-0"	3'-8"	
12'-5"	10	#5 @5-1/2	#6 @7	#5 @6	#5 @6	#6	1 #6	5'-3"	4'-2"	
12'-9"	10	#5 @5-1/2	#6 @7	#5 @6	#5 @6	#6	1 #6	5'-3"	4'-2"	
13'-1"	10	#5 @5-1/2	#6 @6-1/2	#5 @6	#5 @6	#6	1 #5	5'-5"	3'-8"	
13'-5"	10	#5 @5-1/2	#6 @6-1/2	#5 @6	#5 @6	#6	1 #5	5'-8"	3'-8"	
13'-9"	10	#5 @5-1/2	#6 @6	#5 @6	#5 @6	#6	1 #5	5'-10"	3'-8"	
14'-1"	10	#5 @5-1/2	#6 @6	#5 @6-1/2	#5 @6	#6	1 #5	5'-10"	3'-8"	
14'-5"	10-1/2	#6 @7	#6 @6	#5 @7-1/2	#5 @6	#6	1 #5	5'-10"	3'-8"	
14'-9"	11	#6 @7	#6 @6	#5 @7-1/2	#5 @6	#6	1 #5	6'-0"	3'-8"	C
15'-1"	11	#6 @7	#6 @6	#5 @7-1/2	#5 @6	#6	1 #5	6'-0"	3'-8"	C



NEXT BEAM



STEEL I-BEAM, P/S I-BEAM AND PA BULB-TEE



BOX BEAM

DEFINITION OF So (OVERHANG LENGTH)

THESE DESIGN TABLES ARE FOR USE IN CONTINUOUS SPAN SUPERSTRUCTURE PROJECTS AND MAY BE USED FOR SIMPLE SPAN SUPERSTRUCTURE PROJECTS.

DESIGN NOTES:

1. BEAM SPACING, "S"
   - ALL EXCEPT SPREAD BOX BEAMS AND NEXT BEAMS:
     S = MAXIMUM BEAM SPACING, CENTERLINE TO CENTERLINE OF ADJACENT BEAMS
   - SPREAD BOX BEAMS:
     S = MAXIMUM BEAM SPACING - 2'-7" [36" WIDE BEAMS]
     S = MAXIMUM BEAM SPACING - 3'-7" [48" WIDE BEAMS]
   - NEXT BEAMS:
     S = 4'-3" FOR BEAM SPACING ≤10'-0" (BEAM WIDTH)
     S = BEAM SPACING - 6'-0" FOR BEAM SPACING >10'-0" (BEAM WIDTH)
   - WHERE S <4'-3", USE S = 4'-3"

2. "T" = TOTAL SLAB THICKNESS, INCLUDES ½" INTEGRAL WEARING SURFACE.

3. OVERHANG LENGTH, "So"
   - FOR DEFINITION OF "So", SEE DETAILS THIS SHEET.
   - THE So VALUES SHOWN IN THE TABLES INDICATE THE MAXIMUM ALLOWABLE OVERHANG LENGTHS UTILIZING THE SPECIFIED REINFORCEMENT.
   - FOR SPLIT MEDIAN BARRIERS, REDUCE THE So VALUES LISTED IN THE TABLES BY 1".
   - SEE NOTES 24, 25 AND 26 ON SHEET 1 FOR ADDITIONAL LIMITATIONS.

4. FOR LOCATION OF REINFORCEMENT BARS IN THE BOTTOM MAT, SEE SHEETS 2, 3 AND 4. FOR LOCATION OF DIMENSION "L", SEE SHEETS 2, 3 AND 4.

5. THE TOP MAT REINFORCING PROVIDED IN THE TABLES ON THIS SHEET CORRELATE WITH THE LONGITUDINAL BARS AS THE TOP BAR IN THE MAT. THIS CONFIGURATION IS NOT GRAPHICALLY DEPICTED IN THIS STANDARD EXCEPT IT IS SHOWN IN THE DETAIL TITLED "TYPICAL SLAB PANEL 2" ON SHEET 2.

6. FOR OTHER BEAMS NOT LISTED UNDER THE HEADING OF THE TABLES ABOVE, DETERMINE THE DISTANCE FROM THE DESIGN SECTION FOR NEGATIVE MOMENT TO THE CENTERLINE OF BEAM USING THE SKETCHES ON SHEET 8. USE THE REINFORCEMENT TABLE WHICH CAPTION SHOWS A DISTANCE FROM THE DESIGN SECTION FOR NEGATIVE MOMENT TO THE CENTERLINE OF BEAMS EQUAL TO OR SMALLER THAN THE CALCULATED DISTANCE.

NOTES:

(A) THE OVERHANG LENGTH, So, SHOWN MAY BE INCREASED BY UP TO 5 INCHES IF #5 S7 BARS REPLACE THE #4 S7 BARS SHOWN. THE LENGTH "L" SHALL BE TAKEN NO LESS THAN 4'-3".

(B) WHEN THE LENGTH OF THE OVERHANG IS INCREASED IN ACCORDANCE WITH NOTE (A) ABOVE, THE INCREASED OVERHANG LENGTH SHALL NOT EXCEED THE LIMITS STATED IN DESIGN MANUAL PART 4, SECTION D9.7.1.5.1P.

(C) EVERY OTHER S7 BAR SHOWN MAY BE ELIMINATED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

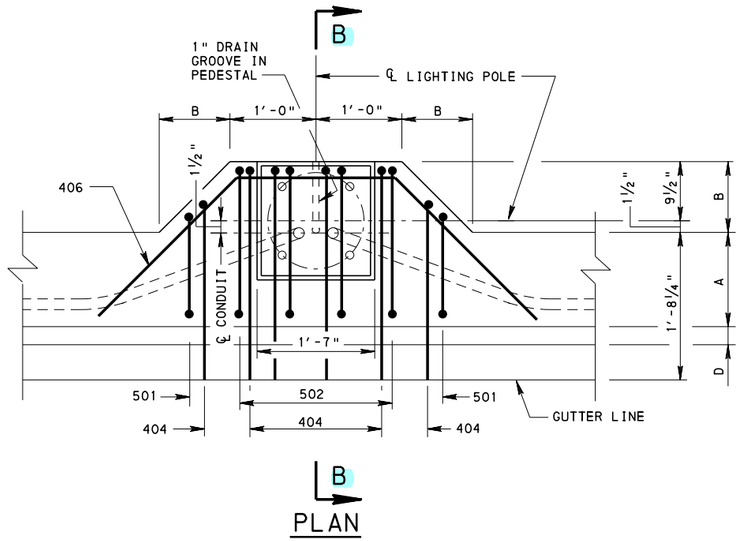
STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

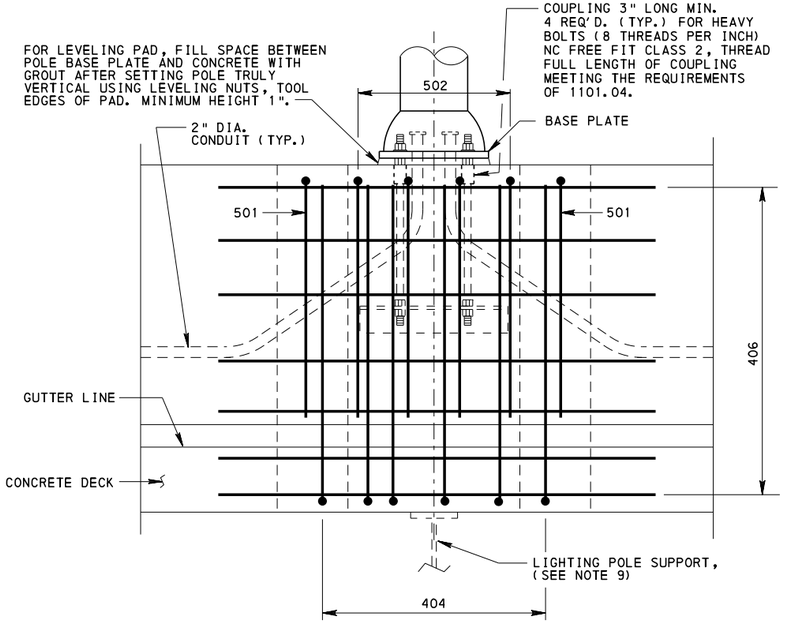
RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 11 OF 12

BD-601M



PLAN

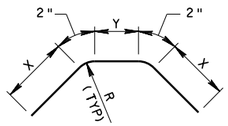


ELEVATION

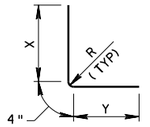
BARRIER TYPE	"A"	"B"	"C"	"D"
45" F-SHAPE CONCRETE BARRIER	1'-0"	11"	3'-9"	3⅜"
42" F-SHAPE CONCRETE BARRIER	1'-0"	11"	3'-6"	3⅜"
32" F-SHAPE CONCRETE BARRIER	1'-1"	11"	2'-8"	2⅜"

REINFORCEMENT TABLE

MARK	SIZE	LENGTH 45" F-SHAPE	LENGTH 42" F-SHAPE	LENGTH 32" F-SHAPE	NUMBER	TYPE	X 45" F-SHAPE	X 42" F-SHAPE	X 32" F-SHAPE	Y	Z
404	4	8'-5"	8'-2"	7'-4"	6	②	4'-1"	3'-10"	3'-0"	4'-0"	----
406	4	5'-11"	5'-11"	5'-11"	7	①	2'-0"	2'-0"	2'-0"	1'-7"	----
501	5	5'-6⅝"	5'-3⅝"	4'-7⅝"	2	③	2'-11"	2'-8"	2'-0"	4½"	1'-6"
502	5	5'-10⅝"	5'-10⅝"	5'-2⅝"	4	③	2'-11"	2'-8"	2'-0"	11½"	1'-6"



①



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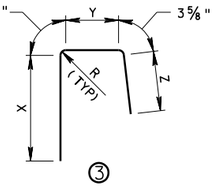
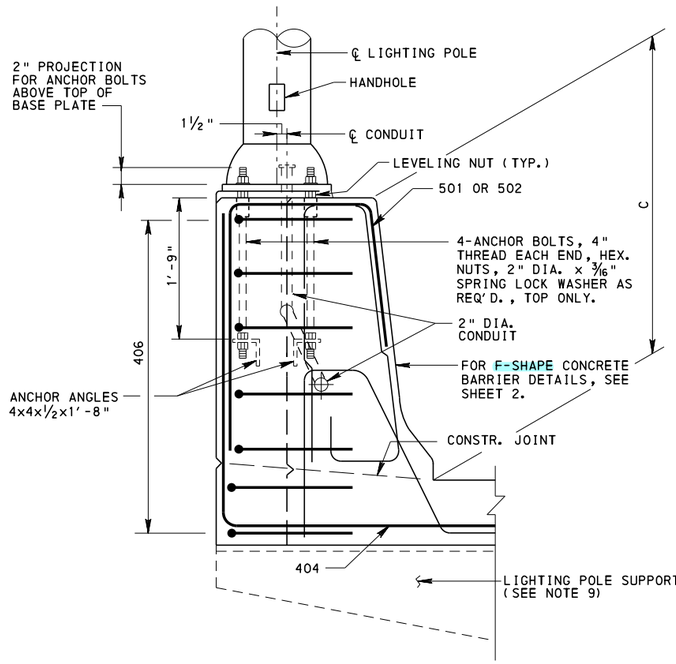


③

REINFORCEMENT DETAILS

REINFORCEMENT BAR NOTES

1. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
2. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).
3. RADIUS, R= 2", FOR #4 BARS AND R= 3", FOR #5 BARS, IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.



SECTION B-B

NOTES:

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
2. SET ANCHOR BOLTS ACCURATELY BY THE TEMPLATE FURNISHED BY THE MANUFACTURER, TO THE CORRECT ELEVATION AND ALIGNMENT AND SECURELY BRACE AGAINST DISPLACEMENT BEFORE THE SURROUNDING CONCRETE IS PLACED. ANCHOR BOLT DIAMETER AS REQUIRED BY LIGHTING POLE MANUFACTURER. (FOR FUTURE LIGHTING PROVISIONS, SEE CHART ON THIS SHEET.)
3. SEAL CONDUIT AND PROTECT THREADS FOR FUTURE LIGHTING INSTALLATIONS.
4. CONFORM ANCHOR MATERIALS TO 1101.4 PUB.408, ANCHOR ANGLES ARE PERMITTED TO BE GALVANIZED.
5. SET LIGHTING POLES TRULY VERTICAL WITH BASES LEVEL USING LEVELING NUTS.
6. PROVIDE 2" CLEAR ON ALL REINFORCEMENT UNLESS NOTED.
7. PROVIDE A MINIMUM OF 2½" CONCRETE COVER FOR CONDUIT.
8. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BARRIER NOT SHOWN, SEE SHEET 2.
9. PREFERRED LOCATION FOR LIGHTING POLES IS AT PIERS AND ABUTMENTS. REFER TO BD-655M FOR ABUTMENT DETAILS AND BD-658M FOR PIER DETAILS TO HELP DEVELOP LIGHT POLE SUPPORT DETAIL. LIGHTING POLE SUPPORT, IF NEEDED, TO BE DESIGNED BY THE ENGINEER TO DISTRIBUTE LOAD TO BOTH FASCIA AND FIRST INTERIOR BEAM.
10. FOR LIGHTING POLE LOCATIONS WITHIN A SPAN, THE LUMINIARE DEFLECTION MUST BE EVALUATED FOR DYNAMIC EFFECTS.

PROVISIONS FOR FUTURE LIGHTING		
MOUNTING HEIGHT	ANCHOR BOLT CIRCLE DIA.	ANCHOR BOLT DIAMETER
50'-0" MAX.	15"	1"

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD CONCRETE DECK SLAB LIGHTING POLE ANCHORAGE DETAILS FOR BEAM BRIDGES

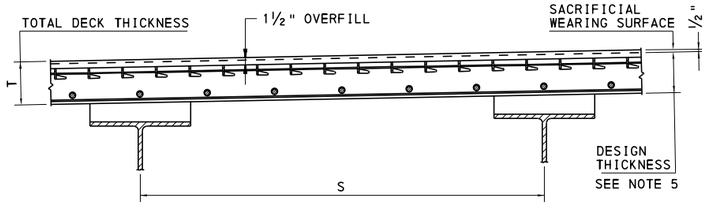
RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 12 OF 12

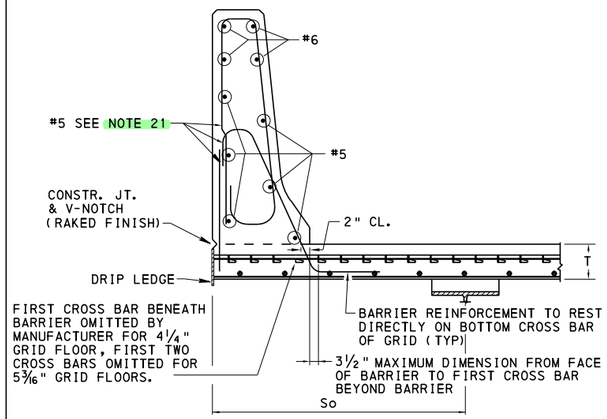
BD-601M

CHANGE 2

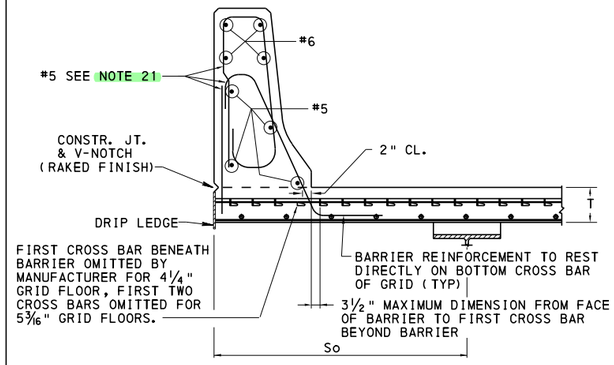


TYPICAL GRID REINFORCED CONCRETE DECK PANEL

DECK ATTACHMENT, PANEL SPLICE AND HAUNCH DETAILS SHOWN ON SHEET 2.
TYPICAL HAUNCH FOR GIRDERS SHOWN FOR ILLUSTRATION ONLY.

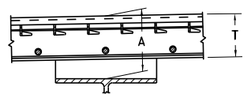


TYPICAL CONCRETE BARRIER DETAIL



ALTERNATE CONCRETE BARRIER DETAIL

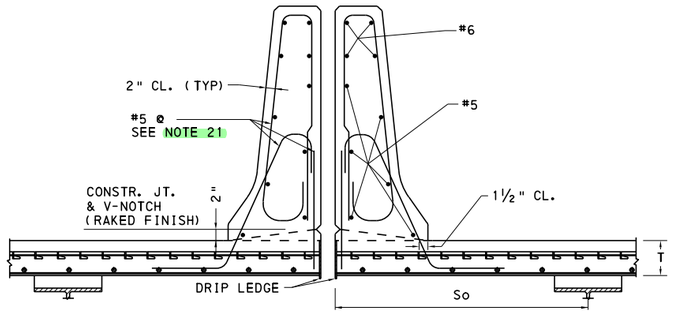
TO BE USED ONLY IF AUTHORIZED BY CHIEF BRIDGE ENGINEER



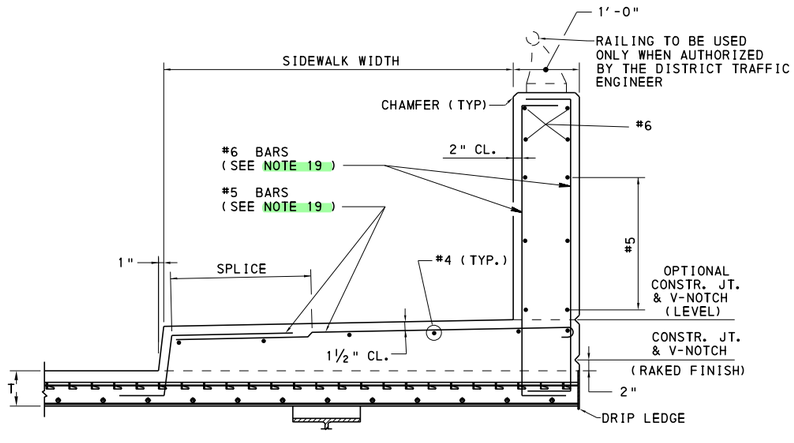
PLAN CAMBER (in)	A (in)
UP TO 1½"	T+½"
OVER 1½"TO 3"	T+¾"
OVER 3"	T+ 1"

- VARIATION IN FLANGE THICKNESS IS NOT INCLUDED IN "A". MODIFY "A" FOR A CONCAVE (SAG) VERTICAL CURVE.
- ADD EFFECT OF DECK CROSS SLOPE TO "A" TO PROVIDE MINIMUM HAUNCH WIDTH ACROSS FULL WIDTH OF BEAM FLANGE.
- ADD THICKNESS OF TOP SPLICE PLATES TO "A" FOR GIRDERS WITH SPLICES, AS APPLICABLE.

HAUNCH DETAIL



SPLIT MEDIAN BARRIER



ALTERNATE SIDEWALK DETAIL

BARRIER NOTES

19. 4 ¼" FULL DEPTH GRID REINFORCED CONCRETE BRIDGE DECK SHOWN, DETAILS ARE APPROPRIATE FOR 5⅜6" FULL DEPTH DECK DESIGNS AS WELL.
20. FILL HALF DEPTH GRIDS FULL DEPTH FOR A MINIMUM DISTANCE OF 3'-0" FROM THE OUTSIDE EDGE OF THE DECK.
21. WITHIN 14'-0" ON BOTH SIDES OF AN OPEN JOINT IN THE BARRIER, AND AT THE END OF THE BRIDGE, REDUCE MAXIMUM SPACING OF REINFORCEMENT TO HALF THE SHOWN SPACING.
22. CLEAN AND ROUGHEN TOP OF CONCRETE DECK WHICH LIES DIRECTLY BENEATH THE BARRIER PRIOR TO POURING THE BARRIER CONCRETE TO ENSURE ADEQUATE SHEAR TRANSFER.
23. ATTACHMENT DETAIL APPLICABLE FOR ALL OVERLAY TYPES.
24. FOR BARRIER SIDEWALK AND MEDIAN BARRIER DIMENSIONS SEE BD-601M. FOR BARRIER REINFORCEMENT DIMENSIONS NOT SHOWN, SEE BD-601M. FOR BRIDGE BARRIER TO GUIDE RAIL TRANSITION DETAILS, SEE RC-50M.

NOTES:

1. ALL REINFORCEMENT BARS SHOWN MEET THE REQUIREMENTS OF ASTM A615, A996, OR A706.
2. DESIGN SPECIFICATIONS:
   - AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AND COMMENTARY
   - DESIGN MANUAL PART 4, VOLUME 1, PART B DESIGN SPECIFICATIONS.
3. MATERIAL STRENGTH:
   - STEEL BARS AND SHAPES:
     AASHTO M270, GRADE 36, f = 36 ksi
     AASHTO M270, GRADE 50, f = 50 ksi
   - REINFORCEMENT STEEL:
     f_y = 60 ksi
   - CONCRETE:
     f'_c = 4,000 psi CLASS AAAP CONCRETE
     MODULAR RATIO (E_s/E_c) N = 8
4. DEAD LOAD:
   - DENSITY OF NORMAL WEIGHT CONCRETE 150 lbs/ft³
   - DENSITY OF LIGHTWEIGHT CONCRETE 115 lbs/ft³
   - DEAD LOAD OF VARIOUS GRID REINFORCED SYSTEMS, USING BOTH NORMAL AND LIGHTWEIGHT CONCRETE, AND INTEGRAL OVERFILL, ARE SHOWN IN THE TABLES ON SHEETS 4 OR 5.
5. PROVIDE 1½" CONCRETE COVER ON REINFORCEMENT BARS UNLESS OTHERWISE NOTED.
6. PROVIDE 1½" COVER OVER GRID. THE TOP ½" OF THE OVERFILL/OVERLAY IS CONSIDERED SACRIFICIAL.
7. SEE NOTES ON SHEET 4 FOR STEEL GRID COATING OPTIONS.
8. USE ONLY FUSION BONDED EPOXY COATED REINFORCEMENT. FOR BARRIER REINFORCEMENT, DO NOT USE RAIL STEEL (A996). SEE DESIGN MANUAL PART 4, SECTION D 5.4.3.1.
9. DESIGN TABLES ARE VALID FOR BOTH NORMAL WEIGHT AND LIGHTWEIGHT CONCRETE.
10. WHEN THE HAUNCH HEIGHT (MEASURED FROM TOP OF BEAM TO BOTTOM OF SLAB) EXCEEDS 3", PROVIDE HAUNCH REINFORCEMENT.
11. DESIGN IS BASED ON DECKS SUPPORTED ON 3 OR MORE BEAMS.
12. THE TYPICAL BARRIER, THE ALTERNATE SIDEWALK DETAIL AND DECK SLABS, INCLUDING OVERHANGS, ARE DESIGNED TO RESIST A VEHICULAR COLLISION FORCE AT TEST LEVEL 5. THE SPLIT MEDIAN BARRIERS AND THE ALTERNATE BARRIER ARE DESIGNED TO RESIST A VEHICULAR COLLISION AT TEST LEVEL 4. WHEN NO LONGITUDINAL DECK JOINT IS PROVIDED, CONTINUE ROADWAY MEDIAN BARRIER ACROSS THE STRUCTURE (SEE STANDARD DRAWING RC-57M FOR ATTACHMENT DETAILS).
13. DECK DESIGN TABLES ARE BASED ON THE ORTHOTROPIC PLATE FORMULA AS PER 1994 AASHTO LRFD, ARTICLE 4.6.2.1.8.
14. FACTORED MOMENT = 1.25(SLAB & PARAPET MOMENT) + 1.5(FWS MOMENT) + 1.75(1+IM/100)(LL MOMENT)
15. DYNAMIC LOAD ALLOWANCE (IM) = 50%
16. FOR STANDARD TYPICAL WATERPROOFING AND EXPANSION DETAILS SEE BC-788M.
17. THE BRIDGE BARRIERS ON THIS STANDARD HAVE NOT BEEN UPDATED FOR MASH COMPLIANCE. DO NOT USE THE BARRIERS SHOWN ON THIS STANDARD.
18. SHEET 4 SHALL BE USED FOR PRELIMINARY DESIGN ONLY.

BC-726M	STEEL GRID REINFORCED CAST IN PLACE CONCRETE BRIDGE DECK FOR BEAM BRIDGES DESIGN & DETAILS
BC-751M	BRIDGE DRAINAGE
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE & STEEL I-BEAM BRIDGES
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
BD-601M	CONCRETE DECK SLAB
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

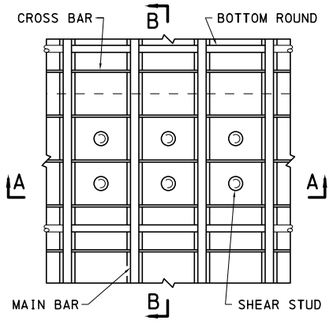
STANDARD GRID REINFORCED CONCRETE BRIDGE DECK DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

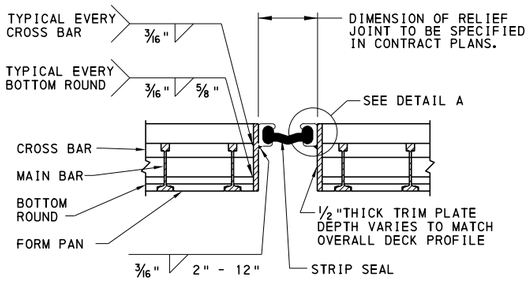
RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 4

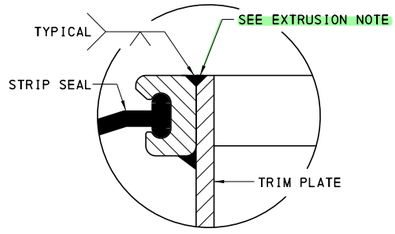
BD-604M



PLAN VIEW

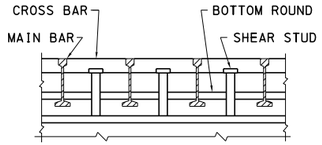


TYPICAL EXPANSION/RELIEF JOINT

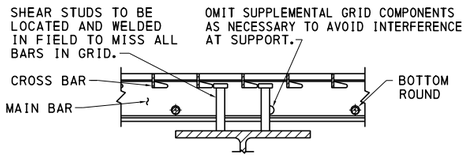


DETAIL A

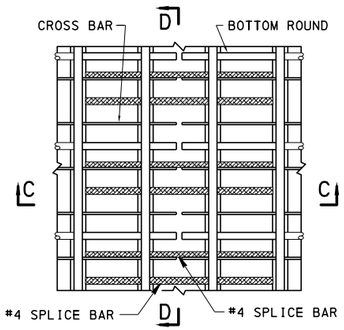
EXTRUSION NOTE:
ONE PIECE EXTRUSION IN LIEU OF TWO PIECE MEMBER (EXTRUSION AND PLATE COMBINATION) IS PERMITTED. WELD IN ACCORDANCE WITH AASHTO/AWS D1.5M SPECIFICATIONS.



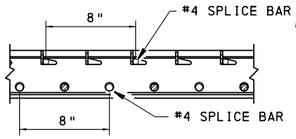
SECTION A-A
STEEL OR CONCRETE SUPPORT



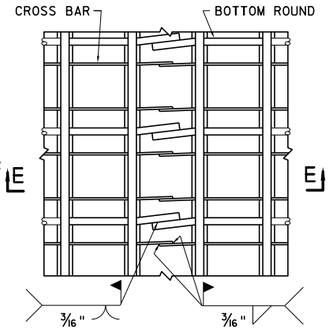
SECTION B-B
STEEL SUPPORT



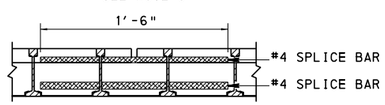
WELDLESS PLAN VIEW
SEE NOTE 8



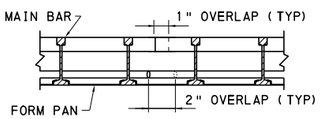
SECTION D-D



CROSS BAR OVERLAY PLAN

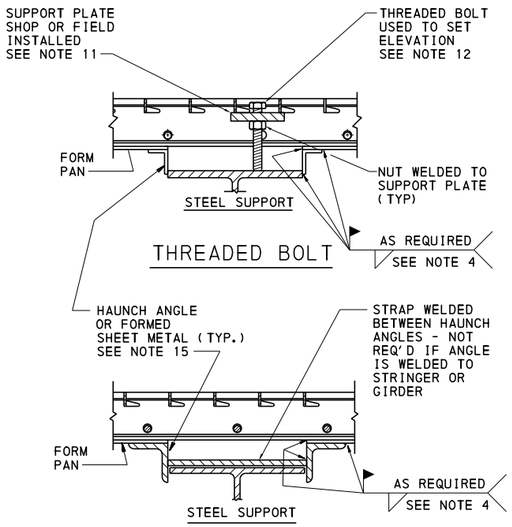


SECTION C-C



SECTION E-E

SPLICE BETWEEN PANELS

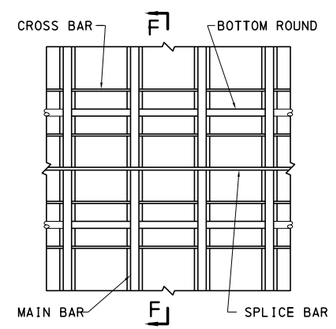


THREADED BOLT

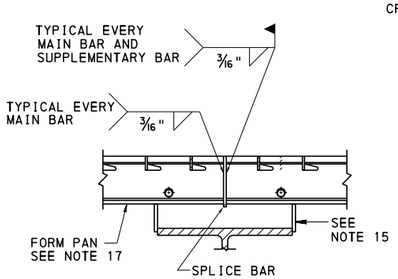
FORMED ANGLE - WELDED STRAP

ELEVATION OPTIONS

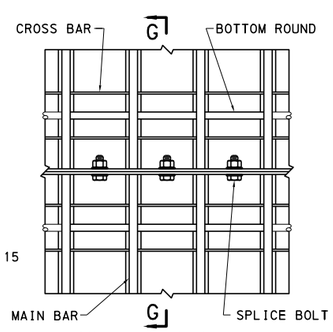
SEE NOTES 9 THRU 17



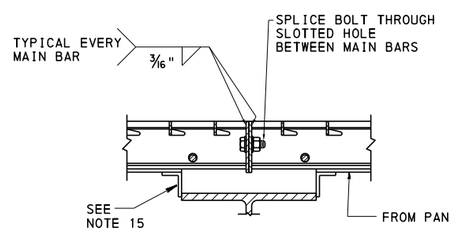
SPLICE BAR PLAN VIEW



SECTION F-F



BOLTED PLAN VIEW



SECTION G-G

MAIN BAR SPLICE AT PANEL ENDS

SEE NOTES 17 & 18

NOTES:

DECK ATTACHMENT:

1. ATTACH GRID REINFORCED CONCRETE BRIDGE DECKS TO BRIDGE FRAMING ELEMENTS (STRINGER, GIRDERS) WITH HEADED SHEAR STUDS. DESIGNED ACCORDING TO AASHTO LRFD ARTICLE 9.7.1.2.
2. DESIGNER IS TO PROVIDE DESIGN FOR SHEAR STUDS. MAKE SHEAR STUD SPACINGS CONSISTENT WITH GRID MAIN BAR SPACING.
3. USE FULL DEPTH FILL FOR ALL GRID DESIGNS, INCLUDING HALF DEPTH FLOORS, OVER FRAMING MEMBERS.
4. IF GRID REINFORCED DECKS ARE TO BE WELDED TO SUPPORTS, A MINIMUM 1/4" x 3" FILLET WELD SHALL BE USED AT EACH GRID I-BEAM (OR TEE) INTERSECTION WITH EACH BRIDGE STRINGER OR GIRDER.
5. A VARIETY OF CONSTRUCTION METHODS HAVE BEEN USED TO SET THE PROPER ELEVATION OF A GRID REINFORCED DECK. SOME OF THE MORE COMMON METHODS ARE DESCRIBED IN A BRIDGE GRID FLOORING MANUFACTURER'S ASSOCIATION (BGFMA) PUBLICATION TITLED "GRID REINFORCED CONCRETE DECK ATTACHMENT", WHICH IS HEREBY INCORPORATED INTO THESE STANDARDS. SEE "ELEVATION OPTIONS" NOTES ON THIS SHEET FOR METHODS OF ACHIEVING PROPER DECK ELEVATION AND HAUNCH FORMING.
6. ALTERNATE DECK ELEVATION/HAUNCH FORMING METHODS MAY BE SUBMITTED BY THE CONTRACTOR FOR ENGINEER'S APPROVAL.
7. GRID OR SUPPORT MECHANISM MAY BE TACK WELDED INTERMITTENTLY TO PREVENT MOVEMENT DURING CONCRETE POURING OPERATION.

WELDLESS SPLICE BETWEEN PANELS:

8. SPLICE REBAR MAY BE INSERTED EITHER THROUGH SLOT IN GRID I-BEAM THROUGH WHICH CROSS BARS ARE PLACED, OR THROUGH A SEPARATE PUNCHED SLOT.

ELEVATION OPTIONS:

9. SUITABILITY OF ELEVATION OPTION DEPENDS ON LIVE LOAD PLACED ON GRID PRIOR TO FILLING WITH CONCRETE.
10. REGARDLESS OF ELEVATION OPTION USED, USE HEADED SHEAR STUDS FOR DECK ATTACHMENT TO BEAMS.
11. SUPPORT PLATE TO BE SHOP OR FIELD INSTALLED UNDER CROSS BARS AS SHOWN IN THREADED BOLT ELEVATION DETAIL, OR UNDER MAIN GRID BARS WHERE APPLICABLE.
12. TACK WELDING THREADED STUD TO SUPPORT IS PERMITTED TO ENABLE LEVELING OF PANEL.
13. ANY CONSTRUCTION LOADS PLACED ON THE GRID BEFORE CONCRETE IS POURED, AS WELL AS THE WEIGHT OF THE WET CONCRETE, MUST BE ACCOUNTED FOR IN THE DESIGN AND SPACING OF THE SUPPORT ASSEMBLY.
14. THREADED BOLT TO BE UNCOATED A307M STEEL.
15. HAUNCH ANGLE MAY BE WELDED TO STRINGER/GIRDER WHERE PERMITTED BY ENGINEER.
16. HEADED SHEAR STUDS NOT SHOWN IN ELEVATION DETAILS FOR CLARITY.
17. OMIT CONCRETE FORM PAN OVER SUPPORT MEMBERS.
18. CHOICE OF SPLICE OPTION DEPENDS ON PRESENCE OF TRAFFIC DURING CONSTRUCTION AND WIDTH BETWEEN STAGES. FOR ATYPICAL CONDITIONS (SPLICE BETWEEN STRINGERS, FOR EXAMPLE) CONTACT MANUFACTURER.

MISC. NOTES:

19. REFER TO BC-767M FOR JOINT DETAILS AT SIDEWALKS, ETC.
20. REFER TO BC-751M FOR SCUPPER DETAILS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GRID REINFORCED CONCRETE BRIDGE DECK DESIGN & DETAILS FOR BEAM BRIDGES

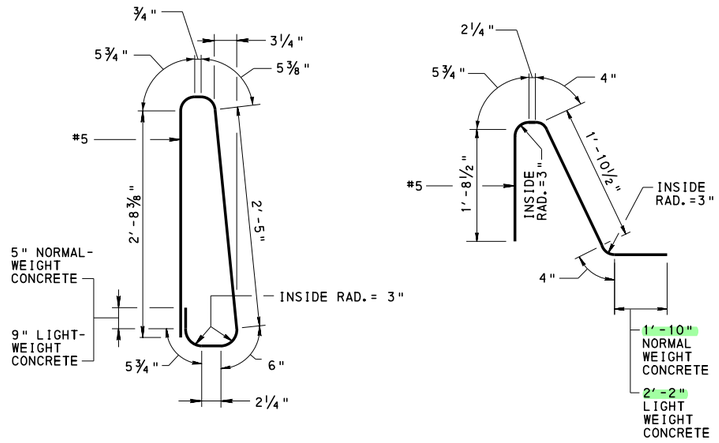
RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

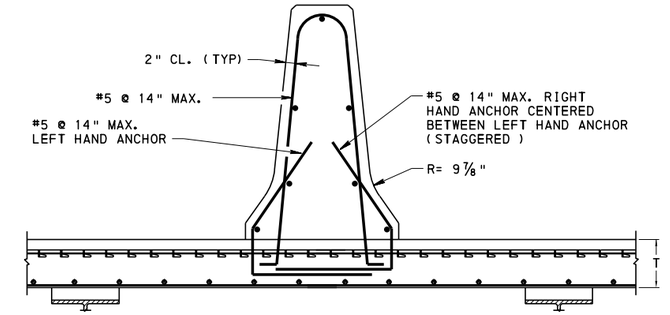
SHEET 2 OF 4

BD-604M

NOTE:
DIMENSIONS INDICATED FOR TYPICAL BARRIER HEIGHT OF 3'-6", ADJUST DIMENSIONS ACCORDINGLY IF ALTERNATE BARRIER IS APPROVED.

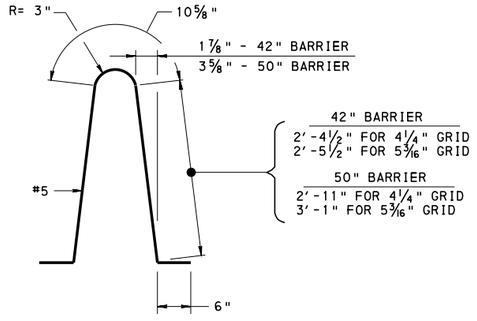


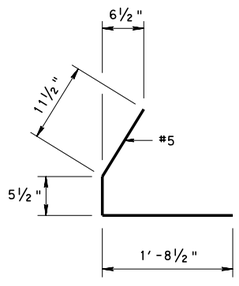
BARRIER REINFORCEMENT



MODIFIED CONCRETE MEDIAN BARRIER DETAIL

SOME GRID CROSS BARS MAY BE OMITTED TO FACILITATE REBAR PLACEMENT





MODIFIED MEDIAN BARRIER REINFORCEMENT

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GRID REINFORCED CONCRETE BRIDGE DECK DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 3 OF 4 BD-604M

MAXIMUM SPANS FOR INFINITE FATIGUE LIFE

TABLE 1: FULL DEPTH FLOORING DESIGNS

BEARING BAR (IN)	BEARING BAR SPACING (IN)	NUMBER OF SUPPLEMENTAL BARS (SEE NOTE 3)	SIZE OF SUPPLEMENTAL BARS (IN)	MAXIMUM SPAN (FT) (SEE NOTE 2)	TYPE OF CONCRETE FILL	OVERALL DECK WEIGHT (STEEL AND CONCRETE)		CANTILEVER REBAR SIZE AND SPACING (SEE NOTE 1)	MAXIMUM OVERHANG BASED ON THE CAPACITY OF DECK STRENGTHENED TO RESIST PL-3 CRASH LOAD (FT) (SEE NOTE 4)	MAXIMUM OVERHANG BASED ON 0.625 x INTERIOR SPAN (FT)
						NORMAL WEIGHT CONCRETE (LBS/FT²)	LIGHT WEIGHT CONCRETE (LBS/FT²)			
4¼	6	0	—	7.0	OVERFILL	83	70	#4 @ 6"	4.0	4.0
				7.0	FLUSH FILL	62	53			
4¼	8	0	—	4.0	OVERFILL	81	68	#5 @ 4"	3.5	2.5
				4.0	FLUSH FILL	60	51			
5⅜	6	0	—	5.0	OVERFILL	96	81	#4 @ 6"	4.5	3.0
				5.0	FLUSH FILL	75	64			
5⅜	8	0	—	3.5	OVERFILL	94	79	#4 @ 8"	4.0	2.0
				3.5	FLUSH FILL	73	62			
5⅜	6	1	1 x 5/16	8.5	OVERFILL	97	82	N/A	4.5	5.0
				8.0	FLUSH FILL	76	65			
5⅜	8	1	1 x 5/16	6.0	OVERFILL	96	80	#4 @ 8"	4.0	3.5
				6.0	FLUSH FILL	75	63			
5⅜	10	1	1 x 5/16	5.0	OVERFILL	94	78	#5 @ 10"	3.5	3.0
				5.0	FLUSH FILL	73	61			
5⅜	6	2	1 x 5/16	11.0	OVERFILL	100	85	N/A	5.0	6.5
				8.0	FLUSH FILL	76	68			
5⅜	8	2	1 x 5/16	8.5	OVERFILL	97	82	N/A	4.0	5.0
				6.0	FLUSH FILL	76	65			
5⅜	10	2	1 x 5/16	7.0	OVERFILL	95	80	#4 @ 10"	3.5	4.0
				5.0	FLUSH FILL	74	63			

TABLE 2: HALF DEPTH FLOORING DESIGNS

BEARING BAR (IN)	BEARING BAR SPACING (IN)	NUMBER OF SUPPLEMENTAL BARS (SEE NOTE 3)	SIZE OF SUPPLEMENTAL BARS (IN)	MAXIMUM SPAN (FT) (SEE NOTE 2)	TYPE OF CONCRETE FILL	OVERALL DECK WEIGHT (STEEL AND CONCRETE)		CANTILEVER REBAR SIZE AND SPACING (SEE NOTE 1)	MAXIMUM OVERHANG BASED ON THE CAPACITY OF DECK STRENGTHENED TO RESIST PL-3 CRASH LOAD (FT) (SEE NOTE 4)	MAXIMUM OVERHANG BASED ON 0.625 x INTERIOR SPAN (FT)
						NORMAL WEIGHT CONCRETE (LBS/FT²)	LIGHT WEIGHT CONCRETE (LBS/FT²)			
5⅜	6	1	1 x 5/16	7.5	OVERFILL	70	60	N/A	4.5	5.0
				7.5	FLUSH FILL	49	43			
5⅜	8	1	1 x 5/16	6.0	OVERFILL	67	57	#4 @ 8"	4.0	3.5
				6.0	FLUSH FILL	46	40			
5⅜	10	1	1 x 5/16	4.5	OVERFILL	66	56	#5 @ 10"	3.5	3.0
				4.5	FLUSH FILL	45	39			
5⅜	6	2	1 x 5/16	11.0	OVERFILL	72	63	N/A	5.0	6.5
				11.0	FLUSH FILL	51	46			
5⅜	8	2	1 x 5/16	8.0	OVERFILL	69	59	N/A	4.0	5.0
				8.0	FLUSH FILL	48	42			
5⅜	10	2	1 x 5/16	6.5	OVERFILL	67	57	#4 @ 10"	3.5	4.0
				6.5	FLUSH FILL	46	40			

NOTES ON TABLES:

1. COLUMN LABELED "CANTILEVER REBAR" INDICATES SIZE AND SPACING OF REBAR WHICH MUST BE INSERTED FLUSH WITH TOP OF GRID INTO GRID REINFORCED DECK OVERHANG.
2. SPAN LENGTHS INDICATED ARE BASED BOTH ON HISTORICAL DATA AND FIELD TESTED INSTALLATIONS. IT IS ACKNOWLEDGED THAT THERE ARE DISCREPANCIES WHEN SPAN LENGTH OF VARIOUS DECK DESIGNS ARE COMPARED.
3. ALL LISTED DESIGNS REQUIRE THE USE OF STEEL GRADE 50 EXCEPT DECK DESIGN 5⅜" I-BEAM @ 6" c/c WITH TWO (2) SUPPLEMENTARY BARS WHICH REQUIRES THE USE OF GRADE 36.
4. REFER TO LRFD AASHTO SECTION 13.2 FOR DEFINITION OF PL-3 LOADING.

NOTES:

GRID SURFACES COATING:

1. SURFACES OF GRID IN CONTACT WITH CONCRETE NEED NOT BE COATED IF GRID IS TO RECEIVE AN OVERLAY. IF THIS OPTION IS USED, APPLY AN APPROVED COATING SYSTEM TO THE UNDERSIDE AND EXPOSED SURFACES OF THE GRID. FOR EXAMPLE THE UNDERSIDE OF THE GRID COULD BE PAINTED WITH THE SAME SYSTEM USED TO COAT BRIDGE SUPERSTRUCTURE.
2. THE STEEL GRID MAY BE FABRICATED FROM UNCOATED WEATHERING STEEL, IN WHICH CASE THE CONCRETE FORM PANS TO BE MADE FROM PRE-GALVANIZED SHEETS MEETING ASTM A653, G-90.
3. FOR ADDITIONAL CORROSION PROTECTION, A COATING SYSTEM MAY BE APPLIED TO ALL GRID SURFACES (INCLUDING THOSE IN CONTACT WITH THE CONCRETE). FOR EXAMPLE, STEEL GRID PANELS MAY BE HOT DIP GALVANIZED, IN WHICH CASE NO ADDITIONAL COATING OF UNDERSIDE IS REQUIRED.

DECK OVERLAY:

1. UNLESS PROHIBITED DUE TO PROJECT DECK DEAD LOAD RESTRICTIONS, ALL GRID REINFORCED CONCRETE BRIDGE DECKS ARE TO RECEIVE AN OVERLAY WHEN INITIALLY INSTALLED. IF A PROJECT REQUIRES A FLUSH FILLED DECK, COAT ALL GRID SURFACES WITH AN APPROVED PAINT SYSTEM, OR HOT DIP GALVANIZE THEM.
2. INTEGRAL OVERLAYS (POURED MONOLITHICALLY WITH CONCRETE PLACED INTO GRID) IS A RECOMMENDED METHOD OF CONSTRUCTING AN OVERLAY. WEIGHTS SHOWN IN MAXIMUM SPAN TABLES FOR "OVERFILL" BASED ON 1¾" THICKNESS OF CONCRETE ABOVE TOP OF STEEL GRID BARS.
3. ASPHALT PAVEMENT OVERLAYS MAY BE APPLICABLE IN ACCORDANCE WITH PUB 408, SECTION 420, 680, 1080.3(e), AND AS DIRECTED BY THE ENGINEER.
4. EXERCISE GREAT CARE WHEN USING SEPARATELY POURED RIGID OVERLAYS OF SPECIAL MIX DESIGNS (MICRO-SILICA, LMC, FOR EXAMPLE) TO INSURE ADEQUATE CLEANING OF THE TOP OF THE FLUSH FILLED GRID SURFACE PRIOR TO PLACEMENT OF THE OVERLAY. THE SAME PRECAUTIONS APPLIES FOR ANY SPECIAL POLYMER OVERLAY.

STANDARD SHOP PRACTICES, FABRICATION AND ERECTION TOLERANCES:

REFER TO BRIDGE GRID FLOORING MANUFACTURER'S ASSOCIATION (BGFMA) PUBLICATION "STANDARD SHOP PRACTICES AND FABRICATION TOLERANCES FOR GRID REINFORCED CONCRETE DECKS", FOR ADDITIONAL GUIDANCE.

EFFECTIVE FLANGE WIDTH:

DESIGN GRIDS TO BEHAVE COMPOSITE WITH SUPPORTS; SHEAR STUD DESIGN IS TO BE IN ACCORDANCE WITH AASHTO SPECIFICATIONS. STANDARD AASHTO CRITERIA FOR DETERMINING EFFECTIVE WIDTH OF FLANGE APPLY, IN WHICH T = OVERALL DEPTH OF DECK, INCLUDING INTEGRAL OVERFILL OR PROPERLY BONDED RIGID OVERLAY (LESS ½" SACRIFICIAL WEARING COURSE). FOR EXAMPLE, FOR A HALF DEPTH 5⅜" GRID WITH A 1¾" OVERFILL, T = 6⅞" (5⅜" + 1¾" -1/2 ").

COMPOSITE GIRDER DESIGN:

FOR COMPUTATION OF COMPOSITE SECTION PROPERTY OF GIRDER IN POSITIVE MOMENT REGION, ALL GRID CROSS BARS PLUS ACTUAL CONCRETE THICKNESS ARE COUNTED. FOR EXAMPLE, FOR A HALF DEPTH 5⅜" GRID, (2½" OF CONCRETE WITHIN THE GRID AND A 1¾" INTEGRAL OVERFILL OR 4¼" TOTAL), DESIGN TO USE ALL CROSS BARS AND 3¾" (4¾" LESS ½" SACRIFICIAL) OF CONCRETE ACROSS THE EFFECTIVE WIDTH. PRESENCE OF CONCRETE IS NEGLECTED IN NEGATIVE MOMENT REGION, AND FABRICATION NOTCHES IN CROSS BARS ARE DEDUCTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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STANDARD
GRID REINFORCED CONCRETE BRIDGE DECK DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 4 OF 4 BD-604M

CHANGE 2

GENERAL NOTES

1. USE OF THIS STANDARD REQUIRES PERMISSION FROM THE DISTRICT BRIDGE ENGINEER. THE STANDARD IS INTENDED TO BE UTILIZED BY DESIGNERS OF ACCELERATED BRIDGE CONSTRUCTION PROJECTS AND BY CONTRACTORS FOR VALUE ENGINEERING OR DESIGN-BUILD PROJECTS.

2. THIS STANDARD APPLIES TO STRAIGHT BRIDGES WITH A SKEW BETWEEN 90 DEGREES AND 60 DEGREES INCLUSIVE, CONSTRUCTED WITH EITHER PRESTRESSED CONCRETE PA BULB-TEE BEAMS OR STEEL BEAMS/GIRDERS.

3. SPANS CROSSING ROADWAYS AND RAILROADS SHALL USE REMOVABLE HAUNCH FORMWORK. ALL OTHER SPANS SHALL USE STAY-IN-PLACE HAUNCH FORMWORK. SEE SHEET 4 FOR HAUNCH FORMWORK DETAILS.

4. IF SCUPPER IS DETERMINED TO BE REQUIRED ON THE DECK SLAB, DESIGNER MUST ENSURE THE DECK SLAB REINFORCEMENT ADEQUACY AT SCUPPER AND DECK GEOMETRY ADEQUACY AT LONGITUDINAL POST TENSIONING DUCT IF APPLICABLE.

DESIGN NOTES

1. MINIMUM STRUCTURAL THICKNESS OF PRECAST CONCRETE DECK PANELS SHALL BE 8". THICKER PANELS MAY BE REQUIRED TO ACCOMMODATE POST-TENSIONING ANCHORAGES AND ANCHORAGE REINFORCEMENT. PRECAST CONCRETE DECK PANEL THICKNESS SHALL INCLUDE A ¼" ALLOWANCE FOR GRINDING.

2. WEARING SURFACE SHALL BE EITHER EPOXY BASED SURFACE TREATMENT FOR BRIDGE DECKS, ⅜" MIN. THICKNESS OR LATEX MODIFIED CONCRETE WEARING SURFACE, 1¼" MIN. THICKNESS AS DIRECTED BY THE DISTRICT BRIDGE ENGINEER. WEARING SURFACE SHALL BE PLACED AFTER ALL CLOSURE POURS, JOINTS, HAUNCHES, AND SHEAR BLOCKOUTS HAVE BEEN GROUTED/CONCRETED, CURED, AND GROUND SMOOTH AS REQUIRED.

3. ULTRA HIGH PERFORMANCE CONCRETE STRENGTH VARIES WITH TIME, DESIGNER SHOULD CHECK WITH MANUFACTURER TO DETERMINE APPROPRIATE MATERIAL FOR PROJECT SCHEDULE.

4. THE DESIGN OF LONGITUDINAL POST-TENSIONING SHALL BE IN ACCORDANCE WITH AASHTO SECTION 9.7.5. FOR CONTINUOUS SPANS, THE DESIGNER SHALL PROVIDE ADDITIONAL PRESTRESS IN DECK TO OVERCOME THE SERVICE LOAD TENSILE STRESS DUE TO NEGATIVE COMPOSITE DEAD LOAD AND LIVE LOAD MOMENTS TO ACHIEVE AN EFFECTIVE MINIMUM PRESTRESS OF 0.250 KSI IN DECK UNDER ALL SERVICE LOADING CONDITIONS.

5. DESIGNER SHALL PROVIDE THE NUMBER, LOCATION, FORCE AND STRESSING SEQUENCE OF THE POST-TENSIONING TENDONS. GENERAL ZONE REINFORCING SHALL BE DESIGNED BY THE DESIGNER AND DEPICTED ON THE CONTRACT DRAWINGS. FINAL DESIGN OF POST-TENSIONING SYSTEM AND LOCAL ZONE REINFORCING SHALL BE PERFORMED BY THE CONTRACTOR. THE PLANS SHALL NOTE THE ASSUMPTIONS USED TO DEVELOP THE POST TENSIONING FORCE INCLUDING THE ASSUMPTIONS USED FOR LOSS CALCULATIONS.

6. THE NUMBER AND LOCATION OF LIFTING DEVICES SHALL BE DETERMINED BY THE DESIGNER AND SHOWN ON THE CONTRACT DRAWINGS. THE DESIGNER SHALL VERIFY THAT THE PANELS ARE STABLE AND STRUCTURALLY ADEQUATE WHEN LIFTED BY THE SELECTED LOCATIONS. DESIGN OF LIFTING DEVICES SHALL BE PERFORMED BY THE CONTRACTOR.

7. DESIGN OF BEAMS SHALL ACCOUNT FOR UNEQUAL DISTRIBUTION OF DEAD LOAD CAUSED BY NON-SYMMETRIC PANELS. NOTE DEAD LOAD OF PRECAST PANEL (INCLUDING BARRIER) IS APPLIED TO NONCOMPOSITE BEAM SECTION. ON THE CONTRACT DRAWINGS, PROVIDE THE FRACTION OF DECK PANEL WEIGHT ASSUMED TO BE CARRIED BY EACH OF THE BEAMS.

8. VERTICAL ADJUSTMENT DEVICES SHALL BE SIZED USING TWICE THE TRIBUTARY AREA TO ACCOUNT FOR THE POSSIBILITY THAT ALL DEVICES MAY NOT BE IN CONTACT WITH THE BEAMS DURING INITIAL PLACEMENT.

9. DESIGN OF THE DECK OVERHANG AND BRIDGE BARRIER REINFORCING SHALL ACCOUNT FOR THE OPEN JOINTS IN THE BRIDGE BARRIER.

10. DEAD LOAD OF EPOXY BASED SURFACE TREATMENT FOR BRIDGE DECKS, ⅜" MIN. THICKNESS SHALL BE TAKEN AS 7 LB/SF.

11. DEAD LOAD OF LATEX MODIFIED CONCRETE WEARING SURFACE, 1¼" MIN. THICKNESS SHALL BE TAKEN AS 16 LB/SF.

12. MATERIALS: REINFORCEMENT STEEL fy = 60 KSI
CONCRETE f'c = 5 KSI MIN. (DECK AND BARRIER)

13. CONCRETE COVER: DECK TOP COVER = 2½"
DECK BOTTOM COVER = 1"
BARRIER = 2"
TRANSVERSE JOINTS = 1½"
LONGITUDINAL JOINTS = 1½"

14. DESIGNER SHALL DESIGN THE PRECAST PANEL REINFORCEMENT. THE USE OF BD-601M DESIGN TABLES FOR PRECAST PANEL REINFORCEMENT DOES NOT CONSTITUTE A DESIGN. HOWEVER, THE PRECAST PANEL REINFORCEMENT SHALL NOT BE LESS THAN WHAT WOULD BE DETERMINED FROM THE BD-601M DESIGN TABLES.

DRAWING NOTES

1. PROVIDE MATERIALS AND WORK QUALITY IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.

2. SUBMIT SHOP DRAWINGS FOR PRECAST CONCRETE DECK PANELS AND ASSOCIATED COMPONENTS.

3. CONTRACTOR MUST PERFORM FINAL DESIGN OF POST-TENSIONING SYSTEM. POST-TENSIONING CALCULATIONS MUST ACCOUNT FOR PROPOSED HARDWARE AND ARE TO BE SUBMITTED AS PART OF SHOP DRAWING SUBMISSION.

4. CONTRACTOR TO DESIGN LIFTING DEVICES AND CALCULATIONS MUST BE SUBMITTED AS PART OF SHOP DRAWING SUBMISSION.

5. BLAST CLEAN INSIDE FACES OF SHEAR BLOCKOUTS AND SHEAR KEYS TO CREATE AN EXPOSED AGGREGATE FINISH.

6. BLAST CLEAN TRANSVERSE AND LONGITUDINAL JOINTS OF PRECAST PANELS TO CREATE AN EXPOSED AGGREGATE FINISH.

7. ASSESS THE STABILITY OF EXTERNAL PRECAST DECK PANELS DUE TO ASYMMETRICAL AND/OR ECCENTRIC LOADING. MAINTAIN STABILITY OF PRECAST DECK PANELS DURING LIFTING, TRANSPORTATION AND ERECTION OF THE PANELS UNTIL CLOSURE POURS AND POST-TENSIONING OPERATIONS ARE COMPLETE.

SEQUENCE OF CONSTRUCTION

1. ERECT BEAMS AND INSTALL DIAPHRAGMS.

2. IF STAY-IN-PLACE HAUNCH FORMWORK IS APPLICABLE, PLACE FORMWORK PER DETAILS ON SHEET 4. REMOVABLE FORMS ARE PLACED AFTER PANELS ARE SET (SEE STEP 9 BELOW).

3. PREPARE PANELS BY PRE-SETTING THE VERTICAL ADJUSTMENT DEVICES TO THE REQUIRED ANTICIPATED DEPTH.

4. SET PRECAST DECK PANELS STARTING AT EITHER ABUTMENT AND PROGRESS ALONG BEAM/GIRDER LINE TO OPPOSITE ABUTMENT.

5. ADJUST EACH PANEL TO PROPER ELEVATION USING VERTICAL ADJUSTMENT DEVICES. ADJUST TORQUE IN VERTICAL ADJUSTMENT DEVICE TO PROPERLY DISTRIBUTE DECK DEAD LOAD TO BEAMS (AS DETERMINED BY DESIGN).

6. PLACE FORMWORK FOR TRANSVERSE JOINTS. COUPLE POST-TENSIONING DUCTS (IF REQUIRED). PRE-WET PRECAST INTERFACE OF JOINT WITH WATER TO CREATE A SATURATED SURFACE CONDITION. FILL TRANSVERSE JOINTS WITH ULTRA HIGH PERFORMANCE CONCRETE IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION, IF APPLICABLE OR NON-SHRINK EPOXY GROUT PER SECTION 1080.2(c) OF PENNDOT PUB.408.

7. TRANSVERSE JOINT MATERIAL SHALL REACH A MINIMUM STRENGTH OF 4 KSI BEFORE PROCEEDING TO NEXT STEP.

8. INSTALL POST-TENSIONING STRANDS IN DUCTS AND TENSION TO SPECIFIED STRESS (IF REQUIRED). GROUT DUCTS WITHIN 3 CALENDAR DAYS AFTER TENSIONING. PUMP GROUT FROM LOW END OF BRIDGE AND FILL POST-TENSIONING DUCTS FULL LENGTH OF BRIDGE (IF REQUIRED). IF GROUTING IS NOT GOING TO BE PERFORMED DURING THE SAME DAY THE TENDONS ARE STRESSED, THEN WITHIN 4 HOURS AFTER STRESSING, PROTECT THE TENDONS AND GROUT DUCTS AGAINST CORROSION AND DEBRIS BY TEMPORARILY SEALING ALL OPENINGS AND VENTS, CLEANING RUST AND OTHER DEBRIS FROM ALL METAL SURFACES TO BE COVERED BY THE GROUT CAP; AND PLACING THE GROUT CAP, INCLUDING A SEAL, OVER THE ANCHOR PLATE UNTIL THE TENDON IS GROUTED. FAILURE TO GROUT THE DUCTS WITHIN 3 CALENDAR DAYS AFTER TENSIONING WILL REQUIRE THE CONTRACTOR TO DEMONSTRATE THE DUCTS ARE UNOBSTRUCTED TO ACHIEVE COMPLETE GROUTING. IF OBSTRUCTION(S) ARE PRESENT, CLEAN DUCTS TO REMOVE OBSTRUCTIONS AND RE-INSPECT PRIOR TO GROUTING.

9. IF REMOVABLE HAUNCH FORMWORK IS REQUIRED, PLACE HAUNCH FORMWORK PER DETAILS ON SHEET 4.

10. FILL SHEAR BLOCKOUTS AND HAUNCHES WITH ULTRA HIGH PERFORMANCE CONCRETE IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION, IF APPLICABLE OR WITH EPOXY NON-SHRINK GROUT PER SECTION 1080.2(c) OF PENNDOT PUB.408.

11. PLACE FORMWORK FOR LONGITUDINAL JOINT IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION.

12. PRE-WET PRECAST INTERFACE OF JOINT WITH WATER TO CREATE A SATURATED SURFACE CONDITION. FILL LONGITUDINAL CLOSURE POUR WITH ULTRA HIGH PERFORMANCE CONCRETE IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION.

13. GROUT POST-TENSIONING BLOCKOUTS (IF REQUIRED). GROUT SHALL BE PLACED IN BLOCKOUTS NO MORE THAN 14 DAYS AFTER TENDONS ARE STRESSED.

14. REMOVE ANY REMAINING FORMWORK THAT IS NOT STAY-IN-PLACE.

15. PREPARE DECK SURFACE AND PLACE WEARING SURFACE.

BD-601M	CONCRETE DECK SLAB
BC-751M	BRIDGE DRAINAGE

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

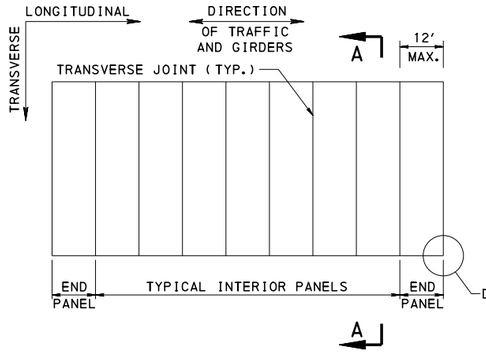
STANDARD
FULL DEPTH PRECAST CONCRETE DECK PANELS FOR PRESTRESSED CONCRETE PA BULB-TEE BEAM AND STEEL I-BEAM/I-GIRDER BRIDGES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

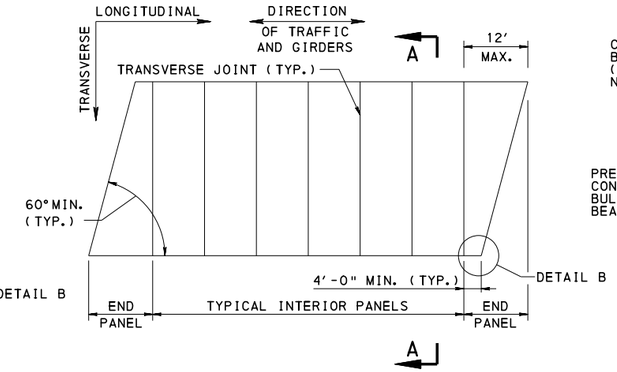
RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 6

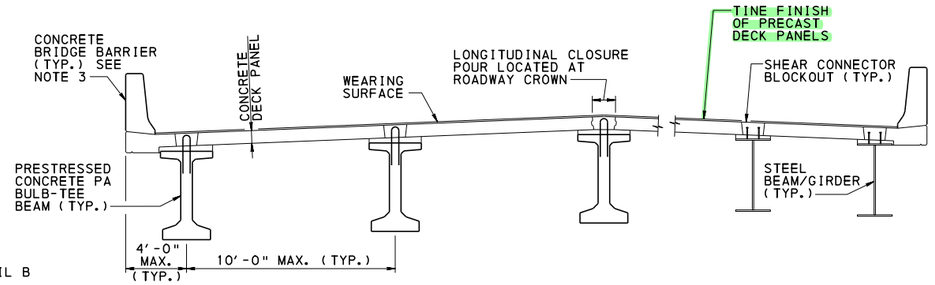
BD-605M



PANELS FOR 90° BRIDGES

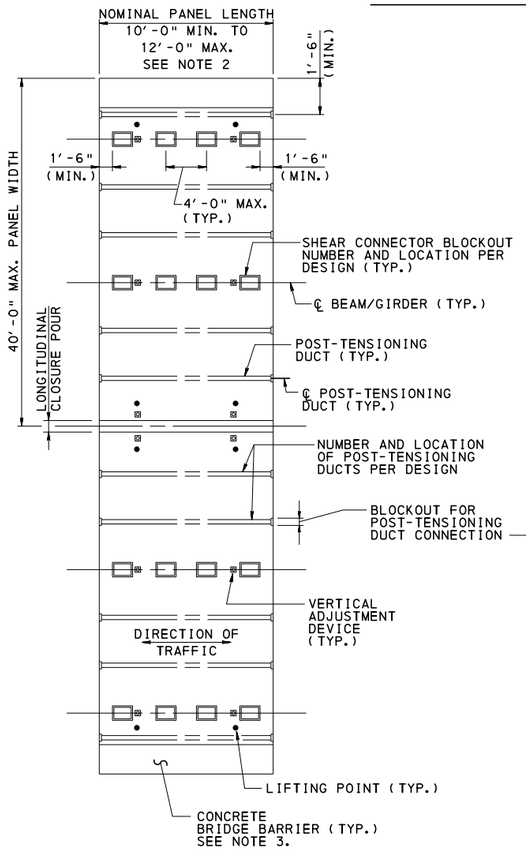


PANELS FOR SKEWED BRIDGES
BETWEEN 90° AND 60°

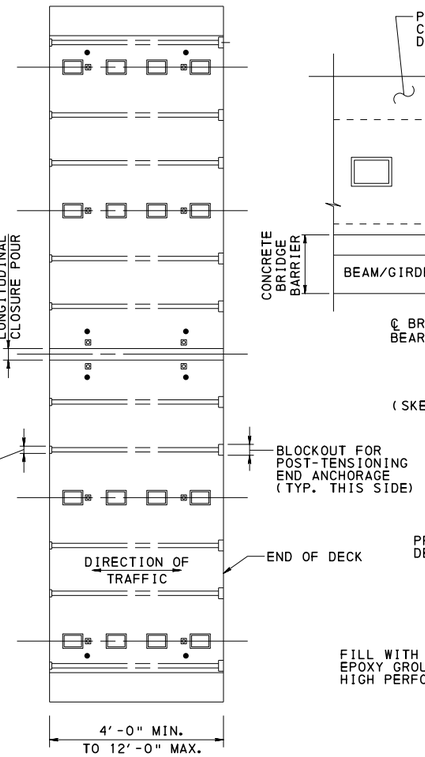


SECTION A-A
PRECAST CONCRETE DECK PANEL

TYPICAL DECK LAYOUT

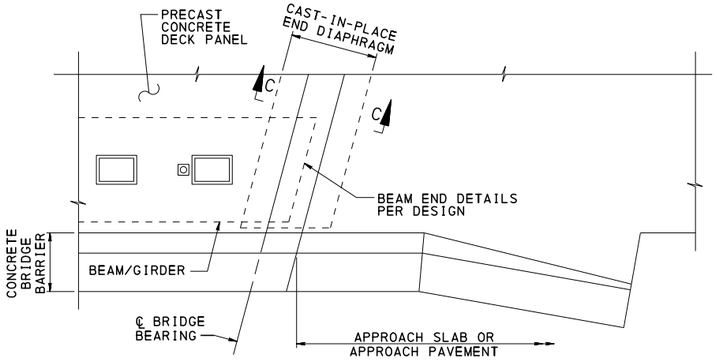


INTERIOR PANEL
(SEE NOTE 4)

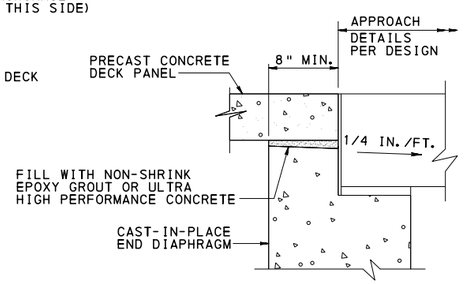


END PANEL
(SIMILAR TO INTERIOR PANEL EXCEPT AS NOTED)
(SEE NOTE 4)

TYPICAL PANEL LAYOUTS



DETAIL B
(SKEWED BRIDGE SHOWN; NON-SKEWED BRIDGE SIMILAR)



SECTION C-C
(PRECAST CONCRETE DECK PANEL EDGE SUPPORT AT ABUTMENT)
(BEAM/GIRDER NOT SHOWN FOR CLARITY)

NOTES:

1. FOR ADDITIONAL NOTES, SEE SHEET 1.
2. PANEL LENGTH TO BE DETERMINED BY DESIGNER. MINIMUM AND MAXIMUM VALUES ARE GUIDELINES FOR INTERIOR PANELS. DESIGNER SHALL VERIFY ABILITY TO SHIP PANELS.
3. BRIDGE BARRIERS SHALL BE CAST INTEGRAL WITH DECK PANEL PRIOR TO ERECTION. BRIDGE BARRIER MAY BE CAST-IN-PLACE AT THE OPTION OF THE CONTRACTOR.
4. PANELS SHOWN WITH LONGITUDINAL POST-TENSIONING. PANELS WITHOUT LONGITUDIANL POST-TENSIONING SIMILAR.
5. FOR DECK PANEL REINFORCEMENT DETAILS, SEE SHEET 3.
6. FOR HAUNCH DETAILS AND SHEAR CONNECTOR BLOCKOUT DETAILS, SEE SHEET 4.
7. FOR BRIDGE BARRIER DETAILS, TRANSVERSE JOINT DETAILS AND LONGITUDINAL CLOSURE POUR DETAILS, SEE SHEET 5.
8. FOR VERTICAL ADJUSTMENT DEVICE DETAILS AND POST-TENSIONING DETAILS, SEE SHEET 6.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
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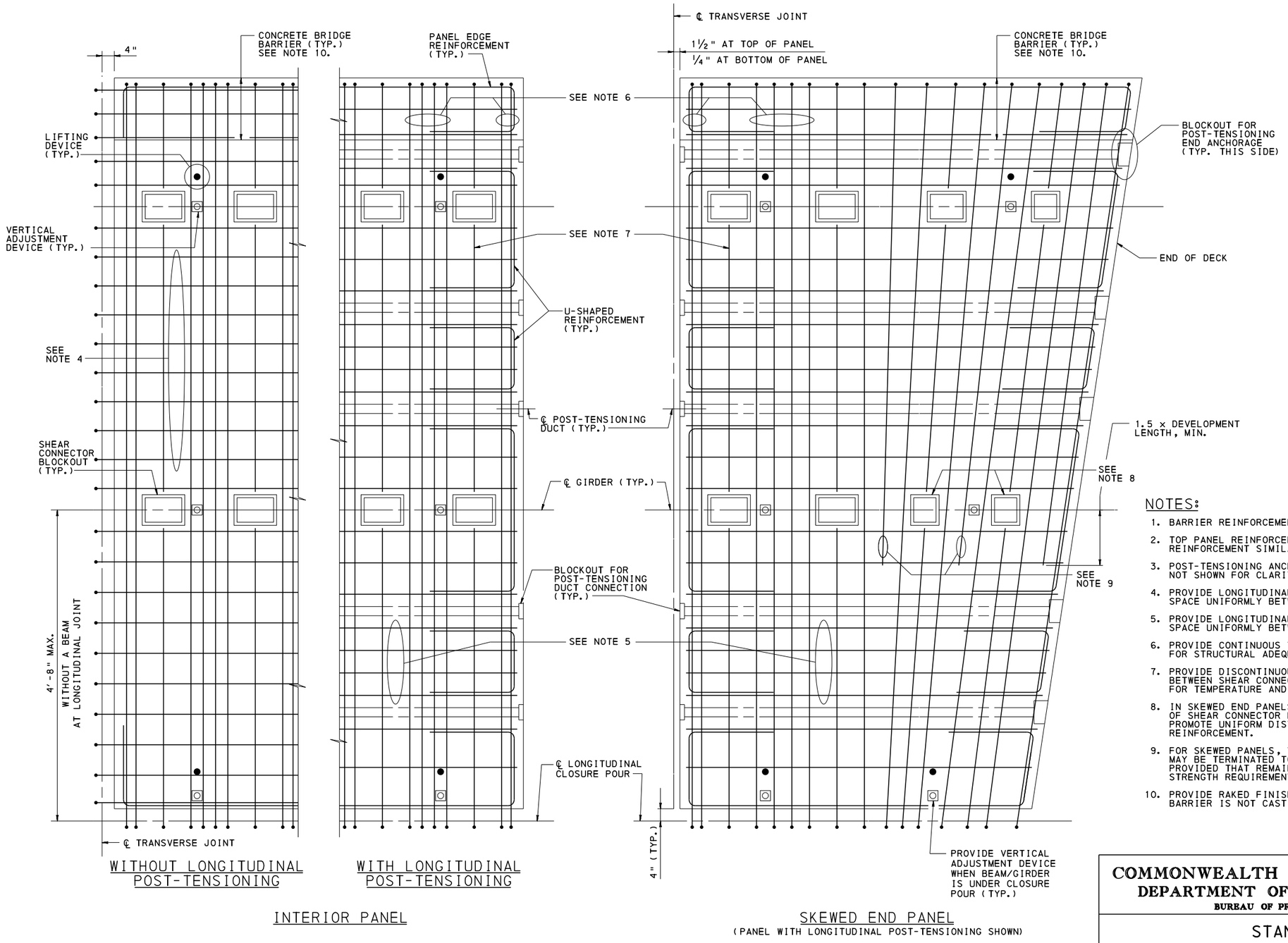
RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

BD-605M



WITHOUT LONGITUDINAL POST-TENSIONING

WITH LONGITUDINAL POST-TENSIONING

INTERIOR PANEL

SKEWED END PANEL
(PANEL WITH LONGITUDINAL POST-TENSIONING SHOWN)

TYPICAL PANEL REINFORCEMENT LAYOUTS

NOTES:

1. BARRIER REINFORCEMENT NOT SHOWN FOR CLARITY.
2. TOP PANEL REINFORCEMENT SHOWN. BOTTOM PANEL REINFORCEMENT SIMILAR.
3. POST-TENSIONING ANCHORAGE ZONE REINFORCEMENT NOT SHOWN FOR CLARITY.
4. PROVIDE LONGITUDINAL STEEL FOR DISTRIBUTION. SPACE UNIFORMLY BETWEEN BEAMS.
5. PROVIDE LONGITUDINAL STEEL FOR DISTRIBUTION. SPACE UNIFORMLY BETWEEN POST-TENSIONING DUCTS.
6. PROVIDE CONTINUOUS TRANSVERSE REINFORCEMENT FOR STRUCTURAL ADEQUACY.
7. PROVIDE DISCONTINUOUS TRANSVERSE REINFORCEMENT BETWEEN SHEAR CONNECTOR BLOCKOUTS AS REQUIRED FOR TEMPERATURE AND SHRINKAGE.
8. IN SKEWED END PANELS, ADJUST SIZE AND SPACING OF SHEAR CONNECTOR BLOCKOUTS AS REQUIRED TO PROMOTE UNIFORM DISTRIBUTION OF TRANSVERSE REINFORCEMENT.
9. FOR SKEWED PANELS, TRANSVERSE REINFORCEMENT MAY BE TERMINATED TO AVOID SPACING CONFLICTS PROVIDED THAT REMAINING REINFORCEMENT MEETS STRENGTH REQUIREMENTS.
10. PROVIDE RAKED FINISH CONSTRUCTION JOINT WHEN BARRIER IS NOT CAST INTEGRAL WITH DECK PANEL.

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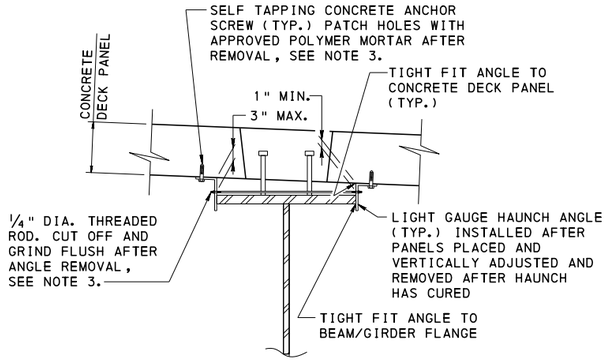
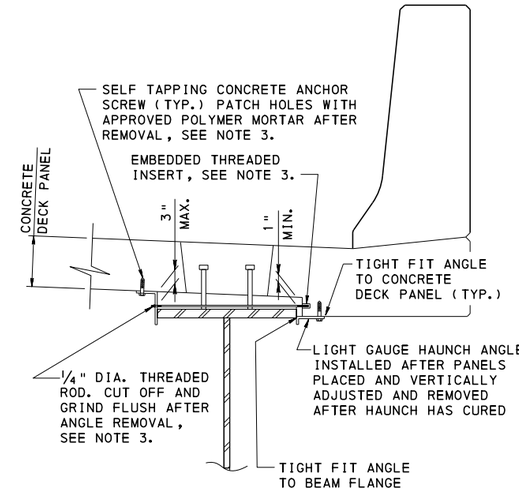
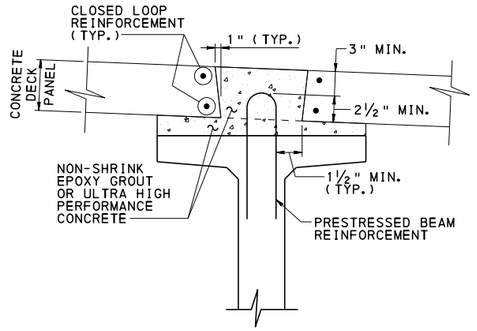
RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 3 OF 6 BD-605M



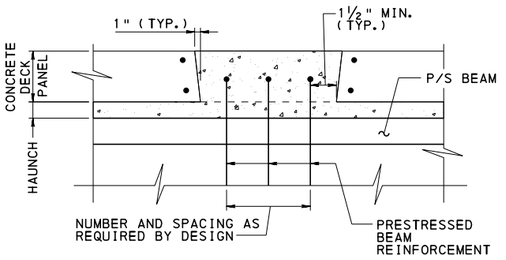
REMOVABLE HAUNCH FORMWORK DETAIL
INTERIOR STEEL BEAM/GIRDER



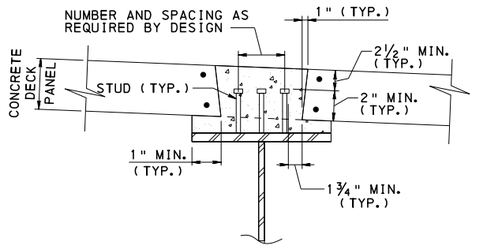
REMOVABLE HAUNCH FORMWORK DETAIL
STEEL FASCIA BEAM/GIRDER



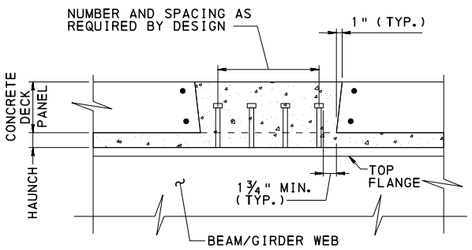
SECTION A-A
FOR PRESTRESSED BEAM



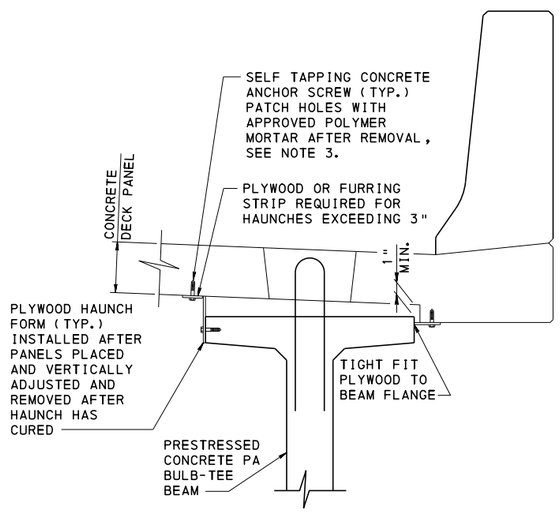
SECTION B-B
FOR PRESTRESSED BEAM



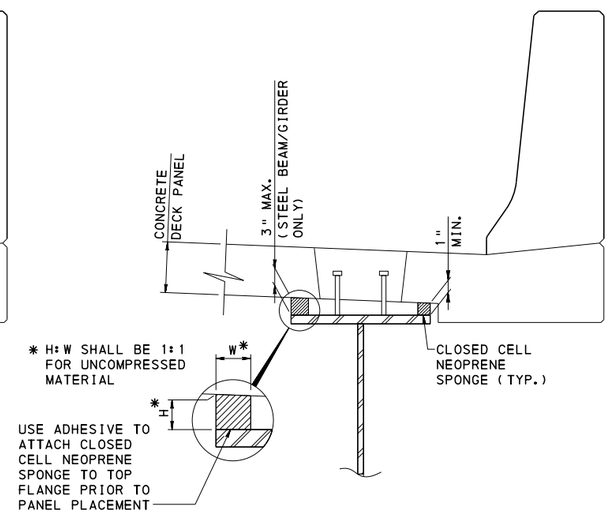
SECTION A-A
FOR STEEL BEAM/GIRDER
(SIMILAR TO PRESTRESSED BEAM EXCEPT AS NOTED)



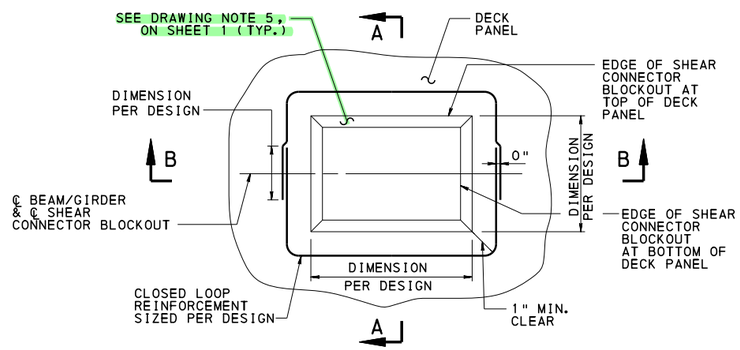
SECTION B-B
FOR STEEL BEAM/GIRDER



REMOVABLE HAUNCH FORMWORK DETAIL
PRESTRESSED BEAM



STAY-IN-PLACE HAUNCH FORMWORK DETAIL
(STEEL BEAM/GIRDER SHOWN, CONCRETE BEAM SIMILAR)



SHEAR CONNECTOR
BLOCKOUT DETAIL

NOTES:

1. HAUNCH FORMWORK MATERIAL, ATTACHMENT HARDWARE AND PATCHING MATERIAL ARE INCIDENTAL ITEMS TO THE PRECAST DECK.
2. PAINT ALL EXPOSED STEEL WITH APPROVED GALVANIZED SPRAY CONTAINING A MINIMUM OF 92% ZINC.
3. MAXIMUM SPACING OF FORM SUPPORT/ATTACHMENT DEVICES IS 4'-0".

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DEPARTMENT OF TRANSPORTATION
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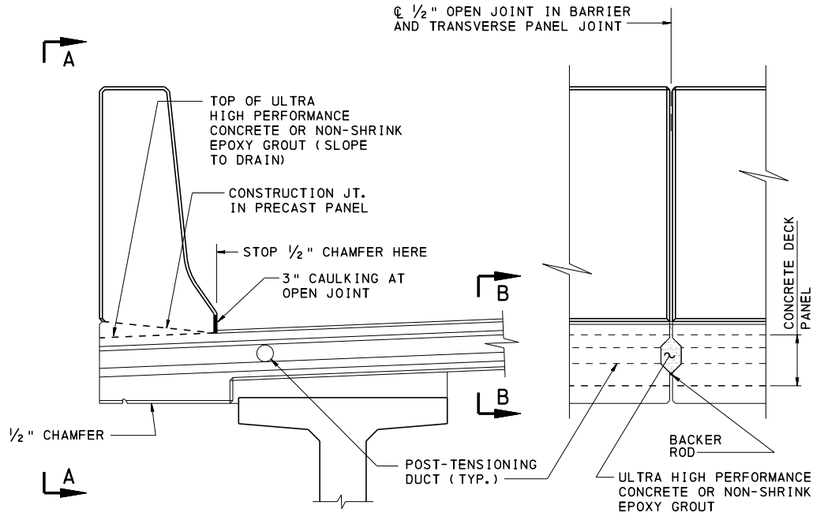
RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

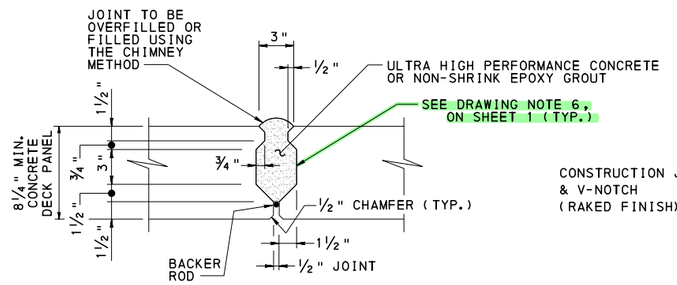
SHEET 4 OF 6

BD-605M

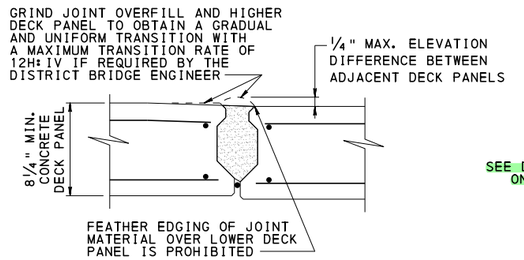


PARTIAL SECTION AT KEYED TRANSVERSE JOINT

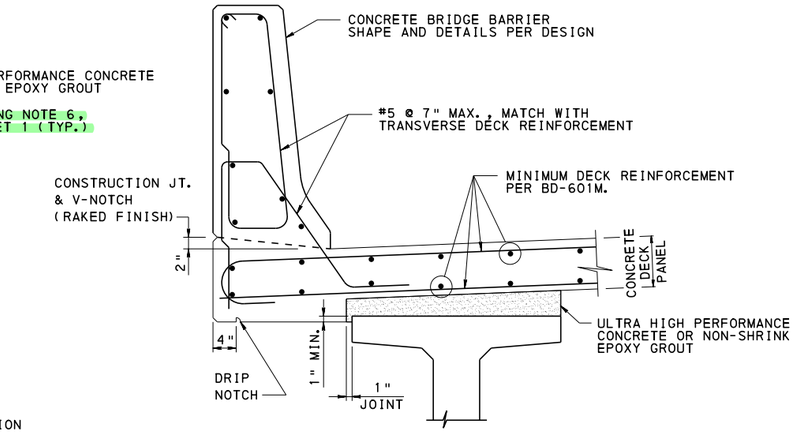
VIEW A-A



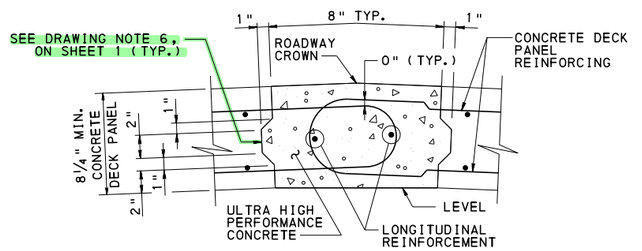
SECTION B-B
(SHOWING JOINT DIMENSIONS)
(DECK REINFORCEMENT NOT SHOWN FOR CLARITY)



SECTION B-B
(SHOWING JOINT ALIGNMENT)

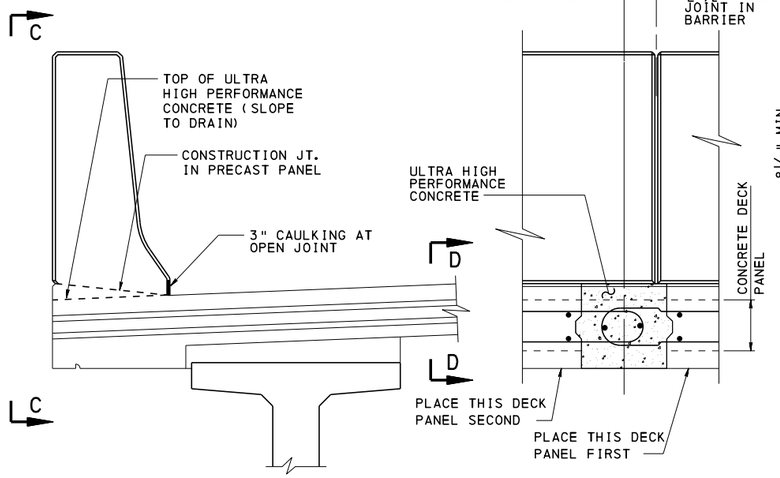


CONCRETE BRIDGE BARRIER DETAIL
TYPICAL BARRIER SHOWN, OTHERS PER DESIGN



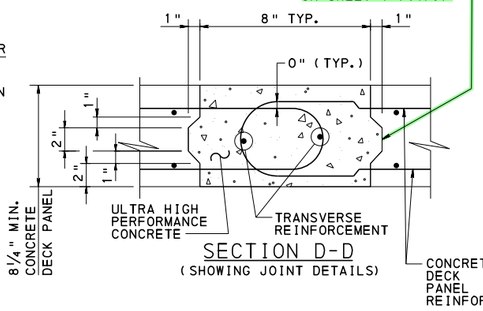
LONGITUDINAL CLOSURE POUR BETWEEN BEAMS/GIRDERS

KEYED TRANSVERSE JOINT DETAILS
(TO BE USED FOR DECKS WITH LONGITUDINAL POST-TENSIONING)

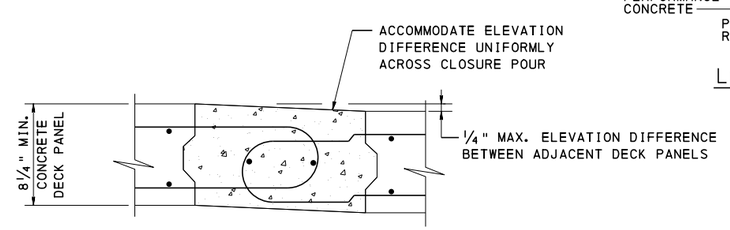


PARTIAL SECTION AT REINFORCED TRANSVERSE JOINT

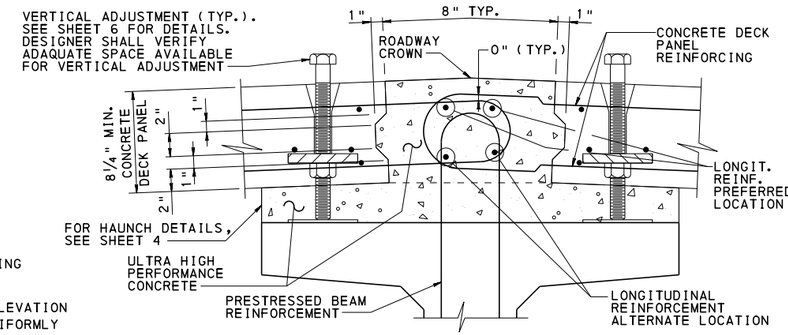
VIEW C-C



SECTION D-D
(SHOWING JOINT DETAILS)



SECTION D-D
(SHOWING JOINT ALIGNMENT)



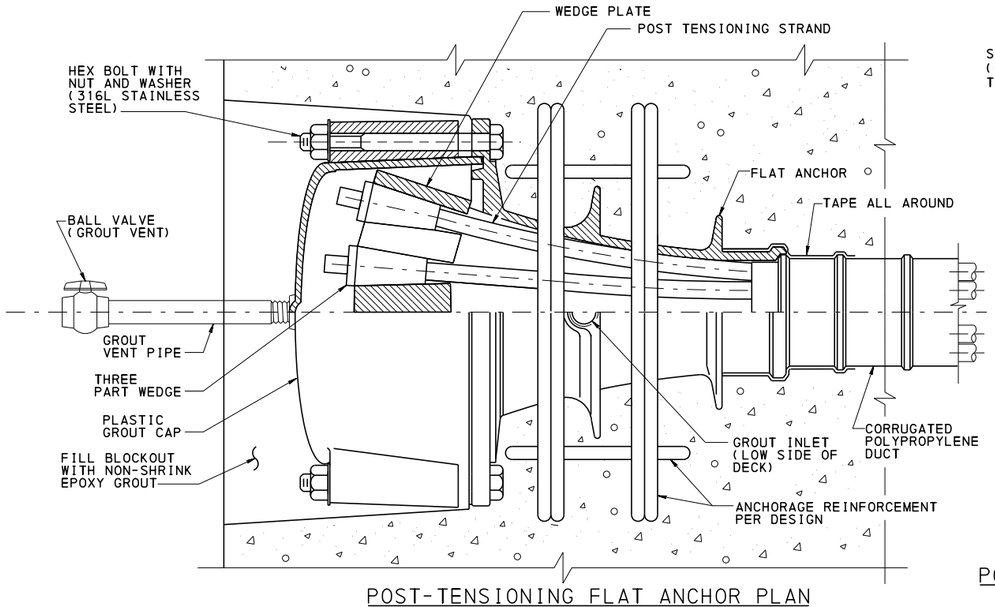
LONGITUDINAL CLOSURE POUR OVER BEAM
(CONCRETE BEAM SHOWN, STEEL BEAM/GIRDER SIMILAR)
(HAUNCH DETAILS NOT SHOWN FOR CLARITY)

REINFORCED TRANSVERSE JOINT DETAILS
(TO BE USED FOR DECKS WITHOUT LONGITUDINAL POST-TENSIONING)

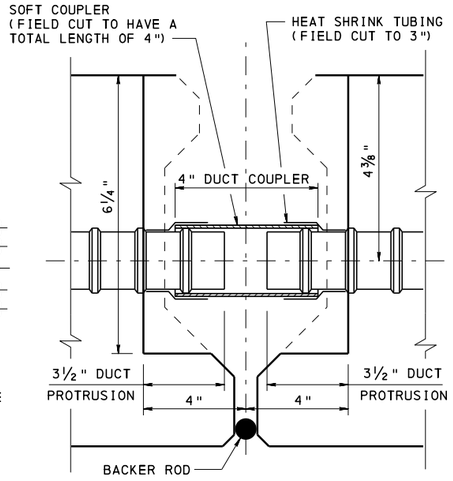
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
FULL DEPTH PRECAST CONCRETE DECK PANELS FOR PRESTRESSED CONCRETE PA BULB-TEE BEAM AND STEEL I-BEAM/I-GIRDER BRIDGES

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 5 OF 6 BD-605M

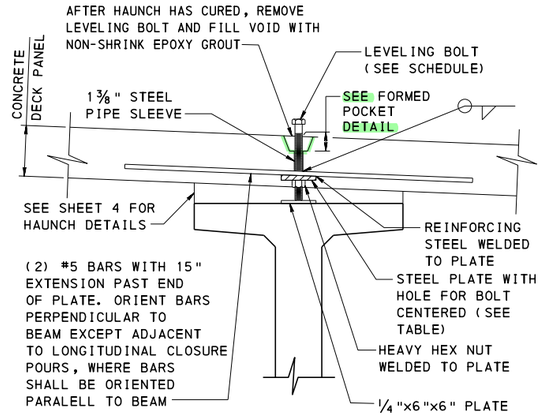


POST-TENSIONING FLAT ANCHOR PLAN



POST-TENSIONING DUCT COUPLING DETAIL AT TRANSVERSE JOINT

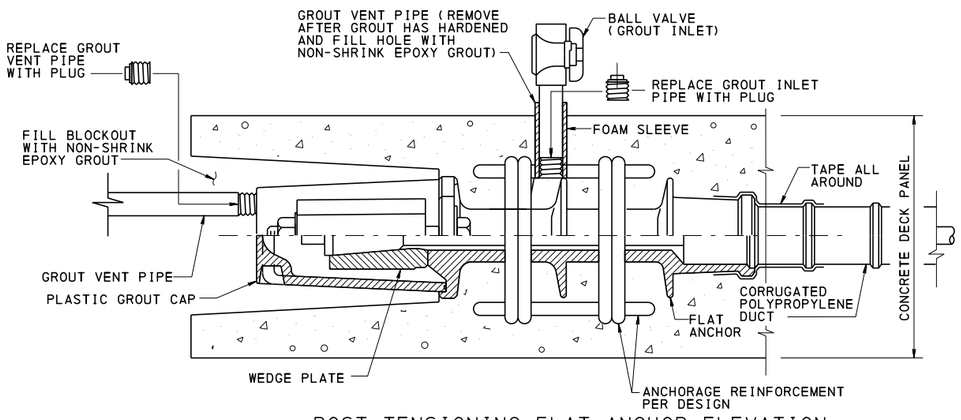
(SEE SECTION B-B ON SHEET 5)



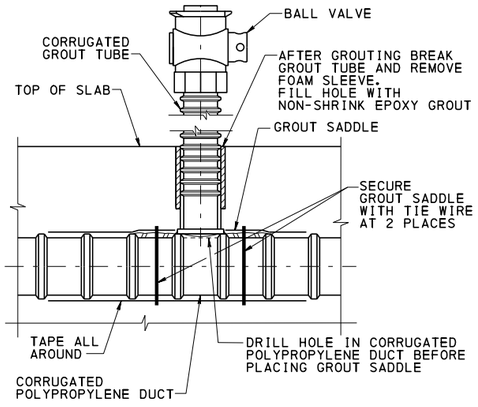
VERTICAL ADJUSTMENT DEVICE

(VERTICAL ADJUSTMENT ON STEEL BEAM/GIRDER SIMILAR)
(HAUNCH DETAILS NOT SHOWN FOR CLARITY)
(MIN. OF 2 LOCATIONS PER BEAM PER PANEL)

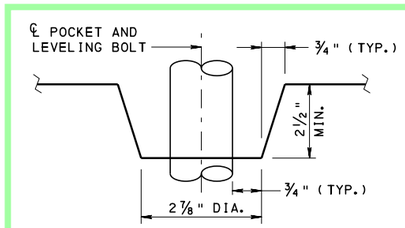
VERTICAL ADJUSTMENT SCHEDULE		
SERVICE LOAD	BOLT DIA.	STEEL PLATE WITH HOLE FOR BOLT CENTERED
10 K	1"	4"x4"x⅝"
20 K	1¼"	4"x4"x⅞"



POST-TENSIONING FLAT ANCHOR ELEVATION



POST-TENSIONING PORT DETAIL



FORMED POCKET DETAIL

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
FULL DEPTH PRECAST CONCRETE DECK PANELS FOR PRESTRESSED CONCRETE PA BULB-TEE BEAM AND STEEL I-BEAM/I-GIRDER BRIDGES

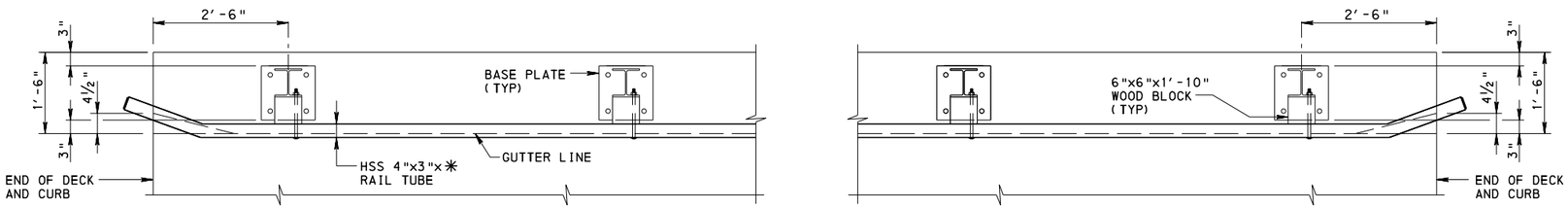
RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

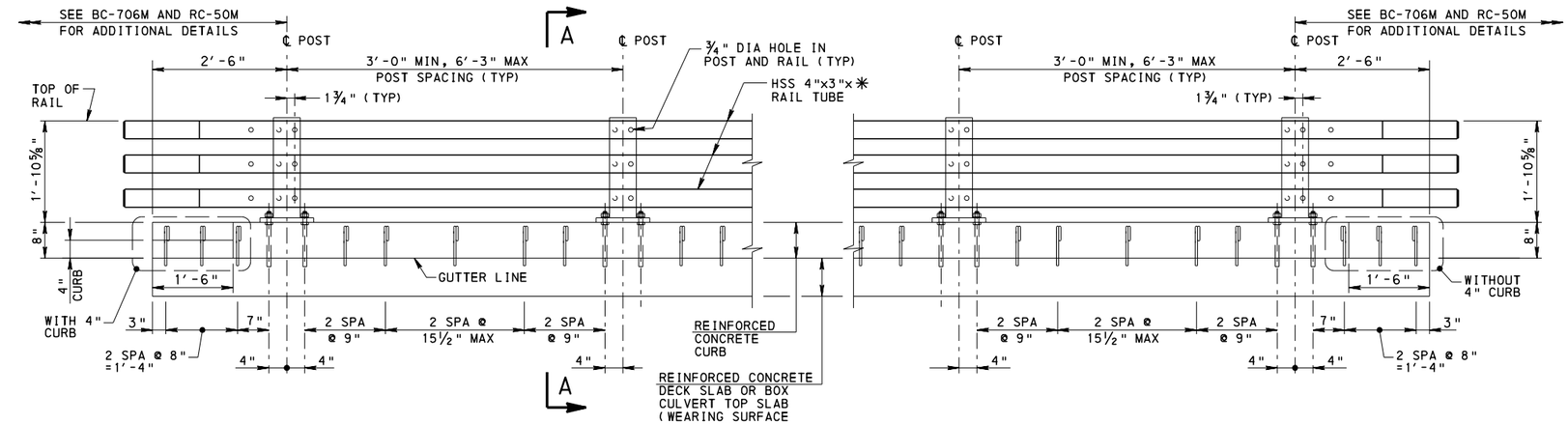
SHEET 6 OF 6

BD-605M

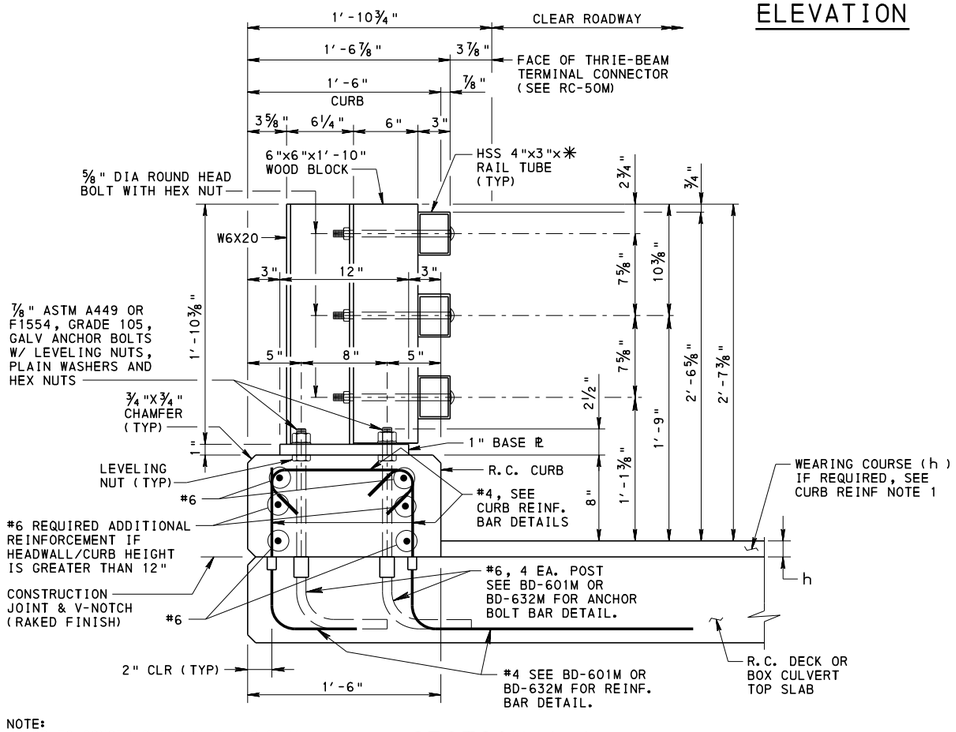
CHANGE 6



PLAN



ELEVATION

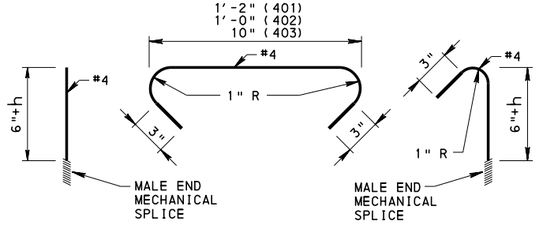


SECTION A-A

DECK REINFORCEMENT NOT SHOWN FOR CLARITY

NOTE:
PRIOR TO CONSTRUCTING CURB AND DECK, ANCHOR BOLTS SHALL BE INSTALLED WITH EITHER A TEMPLATE OR ACTUAL POST W/ BASEPLATE INSTALLED TO ENSURE PROPER ANCHOR BOLT ALIGNMENT & PLACEMENT.

✳ FOR TUBE THICKNESS, SEE TUBE RAIL SPECIFICATIONS TABLE ON BC-706M.



CURB REINF. NOTES:

1. 2½" MIN, 11" MAX COMBINATION FILL AND OVERLAY TOTAL WEARING COURSE THICKNESS (h)

CURB REINFORCEMENT BAR DETAILS

MECHANICAL SPLICES PRECAST INTO DECK OR TOP SLAB.
MECHANICAL SPLICES AS LISTED IN BULLETIN 15

NOTES:

1. THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3.
2. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
3. LOCATE RAIL SPLICES AT EXPANSION JOINTS AND AT OTHER LOCATIONS WHERE NECESSARY. PROVIDE RAILS AS LONG AS PRACTICAL, WITH A MINIMUM OF THREE POSTS BETWEEN SPLICES, UNLESS OTHERWISE REQUIRED FOR EXPANSION. SEE BC-706M FOR RAILING JOINT DETAILS.
4. PROVIDE RAIL TUBES CONTINUOUS OVER NOT LESS THAN TWO RAILING POSTS. NO WELDED BUTT SPLICES WILL BE ALLOWED IN THE RAIL TUBE SECTIONS.
5. LOCATE CENTERLINE OF POST 1′-0" MINIMUM FROM AN EXPANSION JOINT.
6. LOCATE A SCUPPER OR METAL DRAIN 2′-6" MINIMUM FROM CENTER LINE OF POST.
7. PROVIDE A MINIMUM OF TWO RAILING POSTS.
8. USE f′c = 3.5 KSI CLASS AA CEMENT CONCRETE IN THE CURB.
9. PLACE POST AND POST ANCHOR BOLTS NORMAL TO GRADE AND RAILS PARALLEL TO GRADE.
10. COAT ALL SURFACES OF THE BASE PLATE IN CONTACT WITH CONCRETE WITH CAULKING COMPOUND PRIOR TO ERECTION. AFTER ERECTION AND ALIGNMENT, SEAL OPENINGS BETWEEN METAL SURFACES AND THE CONCRETE WITH CAULKING COMPOUND MEETING THE REQUIREMENTS OF PUBLICATION 408, SECTION 705.7(b).
11. DO NOT USE DEFLECTION JOINTS IN THE CURB WITH PA 3-RAIL BRIDGE BARRIERS.
12. PROVIDE POST SPACINGS ON THE PLANS.
13. FOR LOCATION OF DRAIN HOLES IN RAIL TUBES, SEE BC-706M.
14. THE MAXIMUM JOINT MOVEMENT FOR THE PA 3-RAIL BRIDGE BARRIER IS 9".
15. CALCULATE THE DEAD LOAD (LB/FT) OF THE PA 3-RAIL BRIDGE BARRIER USING THE FOLLOWING FORMULA:

    WEIGHT = (110 LBS/AVERAGE POST SPACING) + 25 LBS (RAIL TUBE WEIGHT) + (CURB WEIGHT)

    - THE 110 LBS INCLUDES THE WEIGHT OF THE POST, WOOD BLOCK AND TUBE-TO-POST BOLTS.
    - THE RAIL TUBE WEIGHT IS BASED ON 3 RAILS WITH A 3/16" WALL THICKNESS (3x8.15 LBS/FT).

RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
BD-601M	CONCRETE DECK SLAB
BD-632M	R.C. BOX CULVERT
BC-706M	PA 3-RAIL BRIDGE BARRIER
BC-734M	ANCHOR SYSTEMS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD

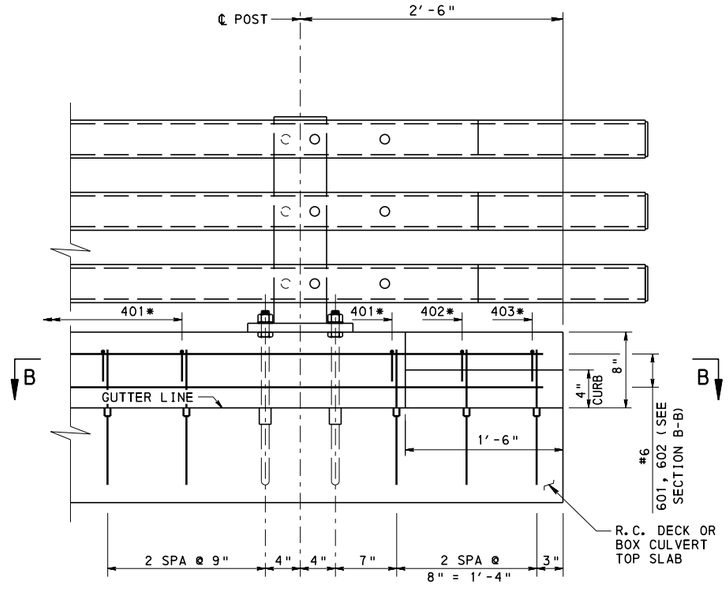
PA 3-RAIL BRIDGE BARRIER BARRIER DETAILS - 1

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 2

BD-609M



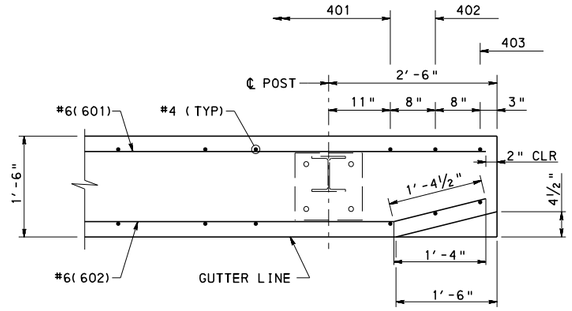
* SEE CURB REINFORCEMENT BAR DETAILS, SHEET 1.

ELEVATION

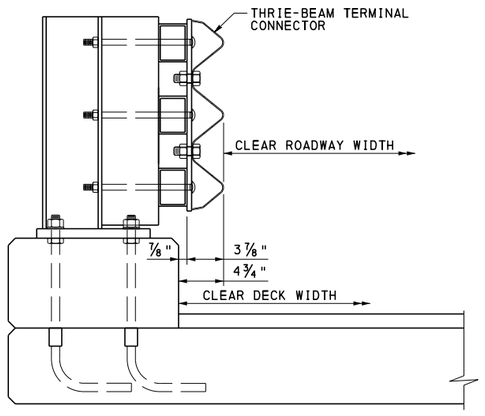
(WEARING COURSE NOT SHOWN)

PA 3-RAIL BRIDGE BARRIER END TRANSITION

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)
(GUIDE RAIL, CONNECTION PLATE AND BOLTS OMITTED FOR CLARITY)



SECTION B-B



CLEAR ROADWAY WIDTH DETAIL

CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 4¾" ON BOTH SIDES AT THE BARRIER FOR THRIE-BEAM TERMINAL CONNECTOR WIDTH.

NOTES:

1. FOR ADDITIONAL REINFORCEMENT DETAILS, SEE SHEET 1.
2. DIMENSIONS ALONG BARS ARE MEASURED ALONG THE OUTSIDE EDGE.
3. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD

PA 3-RAIL BRIDGE BARRIER
BARRIER DETAILS - 2

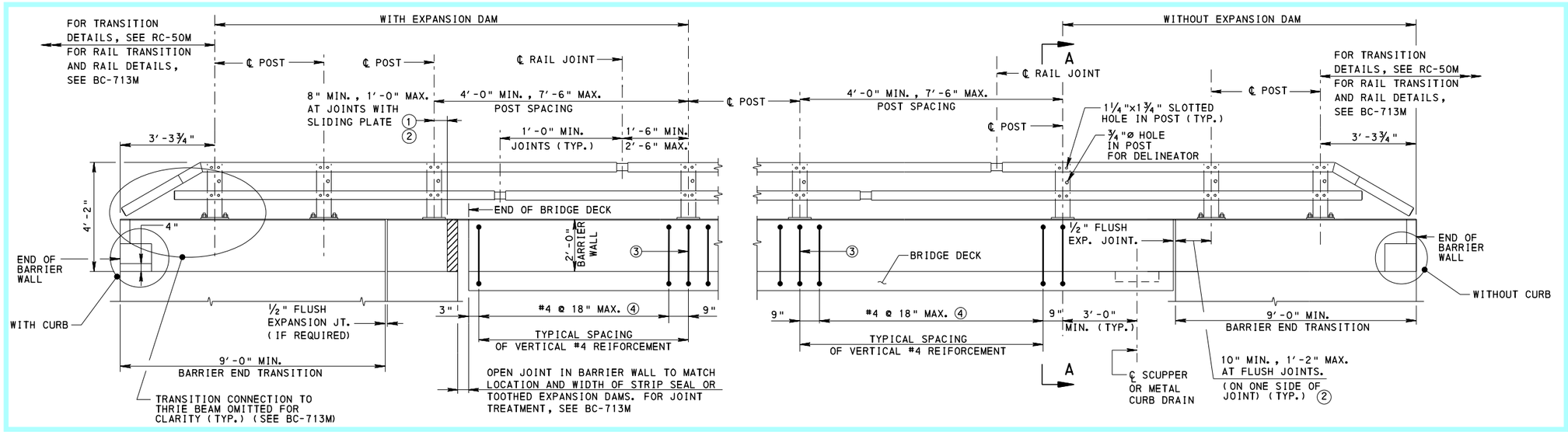
RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 2

BD-609M

CHANGE 1
CHANGE 2
CHANGE 3
CHANGE 5



TYPICAL PA BRIDGE BARRIER ELEVATION

LEGEND

① ℄ POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR ℄ POST TO EDGE OF FIXED END OF SLIDING PLATE

② NO POST REQUIRED ADJACENT TO FLUSH JOINTS AT WINGWALL. IF POSTS LOCATED AT EXPANSION JOINT

③ PLACE 1-#4 VERTICAL BAR AT ℄ POST.

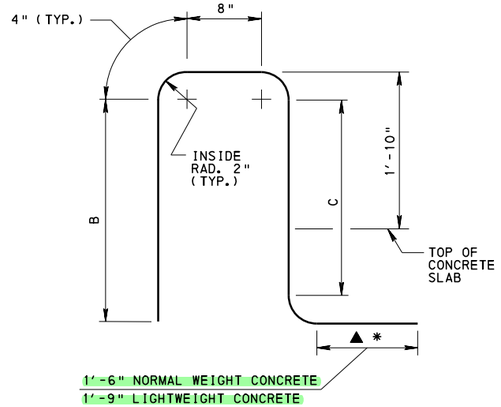
④ WITHIN 10'-0" ON BOTH SIDES OF AN OPEN JOINT IN THE BARRIER WALL, REDUCE SPACING OF REINFORCEMENT TO #4 @ 12" MAX. PLACE REINFORCEMENT 3" FROM ANY JOINT.

NOTES:

1. THE PA BRIDGE BARRIER IS DESIGNATED AS MASH TL-5.
2. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
3. LOCATE RAIL SPLICES AT EXPANSION JOINTS AND AT OTHER LOCATIONS WHERE NECESSARY. PROVIDE RAILS AS LONG AS PRACTICAL, WITH A MINIMUM OF THREE POSTS BETWEEN SPLICES, UNLESS OTHERWISE REQUIRED FOR EXPANSION.
4. THE MAXIMUM JOINT MOVEMENT FOR THE PA BRIDGE BARRIER IS 9".
5. FOR LOCATION OF DRAIN HOLES IN RAIL TUBES, SEE BC-713M.
6. PROVIDE RAIL JOINTS IN ALL RAILS IN THE BAY ABOVE AN EXPANSION DAM. SEE BC-713M, SHEET 1, FOR RAIL JOINT DETAILS.
7. FOR DEAD LOAD CALCULATIONS, THE MASS OF FOUR TYPES OF PA BRIDGE BARRIER ARE AS FOLLOWS:

TYPICAL	500 LB./FT.
SIDEWALK	510 LB./FT.
RAISED SIDEWALK	510 LB./FT.
ALT. SIDEWALK	510 LB./FT.
(ALL CASES ASSUME	5'-9" POST SPACING)

8. USE f'c = 3.5 KSI CLASS AA CONCRETE FOR BARRIER WALL.
9. DETAILS ARE NOT SHOWN FOR NON-COMPOSITE ADJACENT BOX BEAMS, PRECAST BRIDGE SLABS, PLANK BEAMS, AND PRECAST CHANNEL BEAMS BECAUSE THEY CANNOT BE DESIGNED FOR A MASH TL-5 BARRIER RATING.
10. PROVIDE POST SPACINGS ON THE CONTRACT PLANS.
11. FOR DETAILS OF THE PA BRIDGE BARRIER ON SUBSTRUCTURE UNITS, SEE THE APPROPRIATE SUBSTRUCTURE DETAILS AND REINFORCEMENT IN BD-622M AND BD-624M. FOR DETAILS AT THE END OF BARRIER, SEE SHEETS 3 AND 4.
12. FOR SECTION A-A, SEE SHEET 2.
13. PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL SHEET 2.



VERTICAL REINFORCEMENT

(FOR DIMENSIONS B & C, SEE TABLE 1)

▲ WHEN THE DECK IS SLOPED AWAY FROM THE GUTTERLINE SLOPE LEG TO MATCH DECK CROSS-SLOPE. DESIGNER TO PROVIDE NECESSARY DIMENSIONS.

* FOR ALUMINUM PROTECTIVE BARRIER, ADD A SIMILAR 90° HOOK TO THE REAR LEG OF THE REINFORCEMENT.

TABLE 1

B & C DIMENSIONS FOR PA BRIDGE BARRIER

T	B	C
8.0"	2'-2½"	1'-11"
8.5"	2'-3"	1'-11½"
9.0"	2'-3½"	2'-0"
9.5"	2'-4"	2'-0½"
10.0"	2'-4½"	2'-1"
10.5"	2'-5"	2'-1½"
11.0"	2'-5½"	2'-2"
11.5"	2'-6"	2'-2½"

VERTICAL REINFORCEMENT DIMENSION TABLE

NOTE: T DESIGNATES DECK SLAB THICKNESS

REINFORCEMENT BAR NOTES:

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).
4. FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

REFERENCE DRAWINGS	
BC-701M	PROTECTIVE FENCE
BC-711M	ALUMINUM PROTECTIVE BARRIER
BC-713M	PA BRIDGE BARRIER
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-721M	ELECTRICAL DETAILS
BC-722M	LIGHTING POLE ANCHORAGE
BC-734M	ANCHOR SYSTEMS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-751M	BRIDGE DRAINAGE
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
BD-601M	CONCRETE DECK SLAB
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-632M	R.C. BOX CULVERT
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BD-658M	SHEAR BLOCK DETAILS AT PIER - PRESTRESSED CONCRETE I-BEAM AND BOX BEAM BRIDGES
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS - BOX BEAM BRIDGES
BD-667M	INTEGRAL ABUTMENT
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-51M	TYPE 31 STRONG POST GUIDE RAIL

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

PA BRIDGE BARRIER

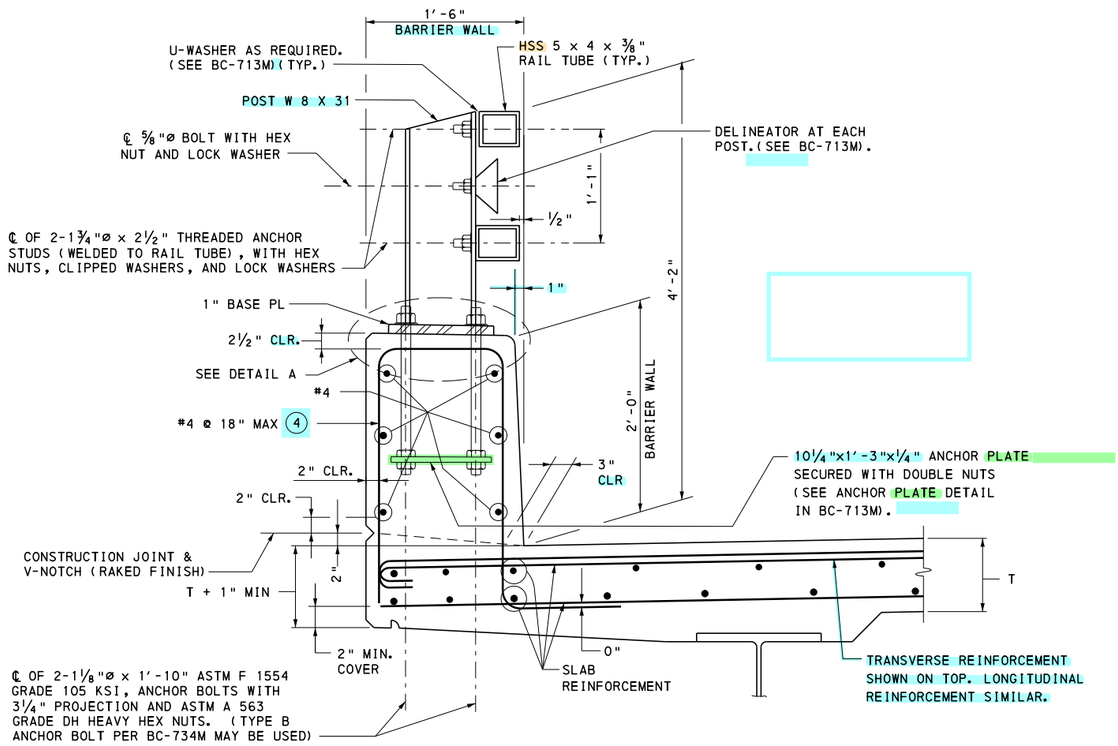
BARRIER DETAILS - 1

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

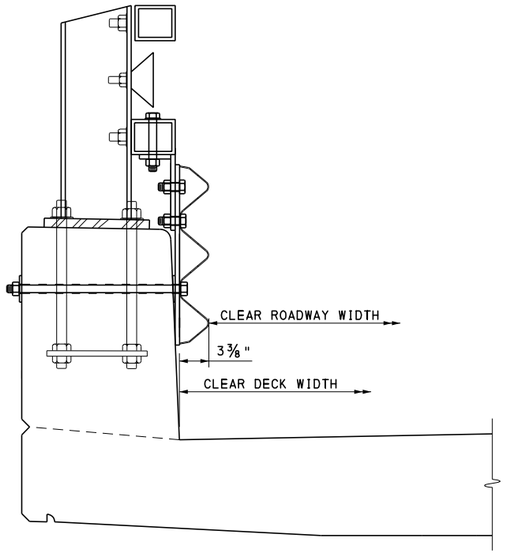
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 10

BD-610M



SECTION A-A

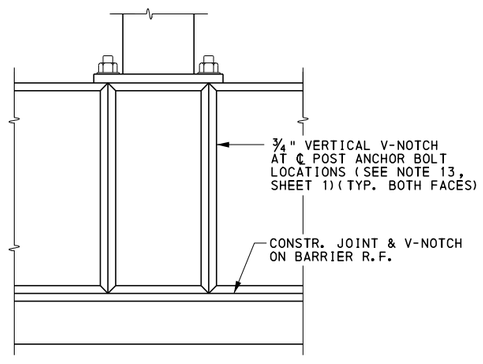


CLEAR ROADWAY WIDTH DETAIL

CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3 3/8" ON BOTH SIDES AT BARRIER FOR THRIE-BEAM TERMINAL CONNECTOR WIDTH.

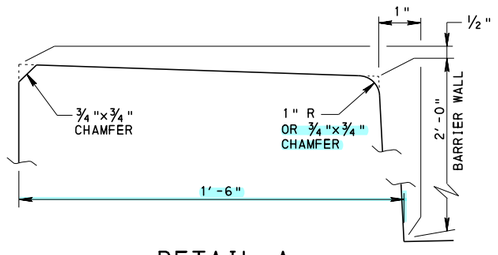
LEGEND:

(4) WITHIN 10'-0" ON BOTH SIDES OF AN OPEN JOINT IN THE BARRIER WALL, REDUCE SPACING OF REINFORCEMENT TO #4 @ 12" MAX. PLACE REINFORCEMENT 3" FROM ANY JOINT.



VERTICAL V-NOTCH DETAIL

(BARRIER REAR FACE SHOWN, FRONT FACE SIMILAR)



DETAIL A

(BASE PLATE AND ANCHOR BOLTS NOT SHOWN FOR CLARITY)

NOTES:

1. FOR LOCATION OF SECTION A-A, SEE SHEET 1.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

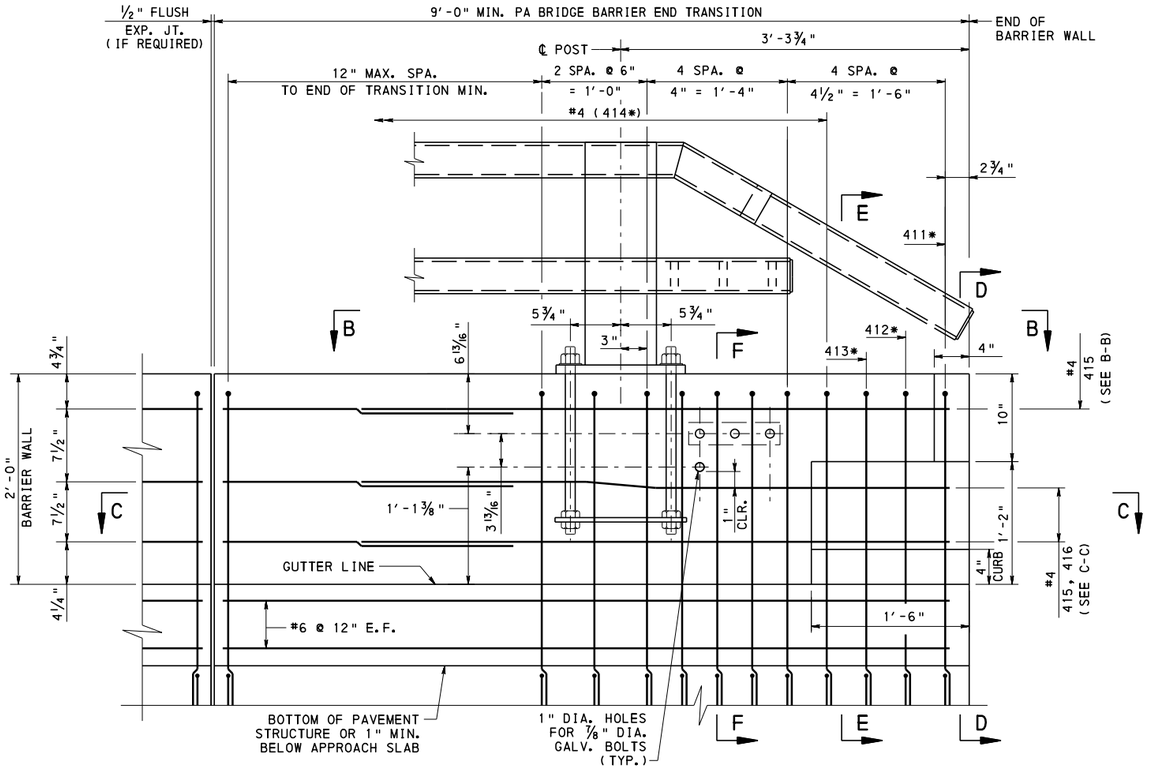
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

PA BRIDGE BARRIER

BARRIER DETAILS - 2

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 2 OF 10
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-610M

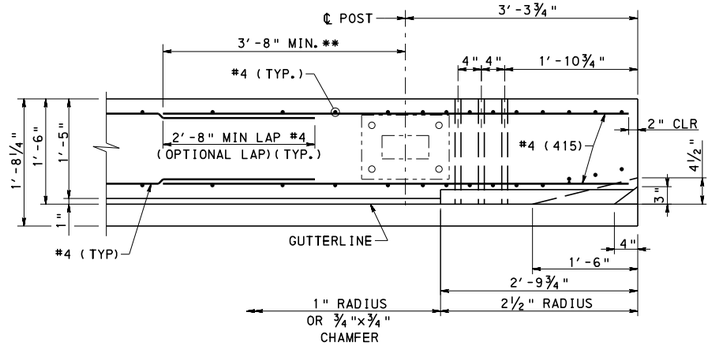


ELEVATION

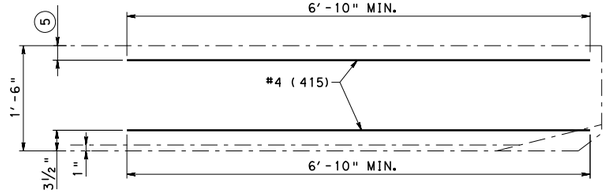
* SEE VERTICAL REINFORCEMENT DETAIL, SHEET 4.
** REINFORCEMENT DETAILING SHOWN REPRESENTS A CONDITION WHERE AN EXPANSION JOINT IS NOT PRESENT.

PA BRIDGE BARRIER END TRANSITION

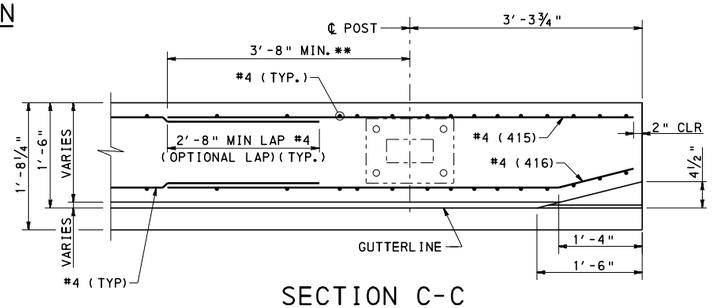
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)
(GUIDE RAIL, CONNECTION PLATE ASSEMBLY AND BOLTS OMITTED FOR CLARITY)



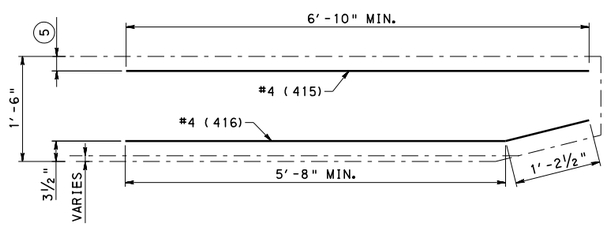
SECTION B-B



HORIZONTAL REINFORCEMENT
(SEE NOTE 2)



SECTION C-C



HORIZONTAL REINFORCEMENT
(SEE NOTE 2)

LEGEND:

(5) 2½" FOR SAFETY WINGS, 3⅛" FOR U-WINGS.

NOTES:

1. FOR SECTION D-D, E-E AND F-F, SEE SHEET 4.
2. DIMENSIONS ALONG BARS ARE MEASURED ALONG THE OUTSIDE EDGE.
3. FOR ADDITIONAL NOTES, SEE SHEET 1.

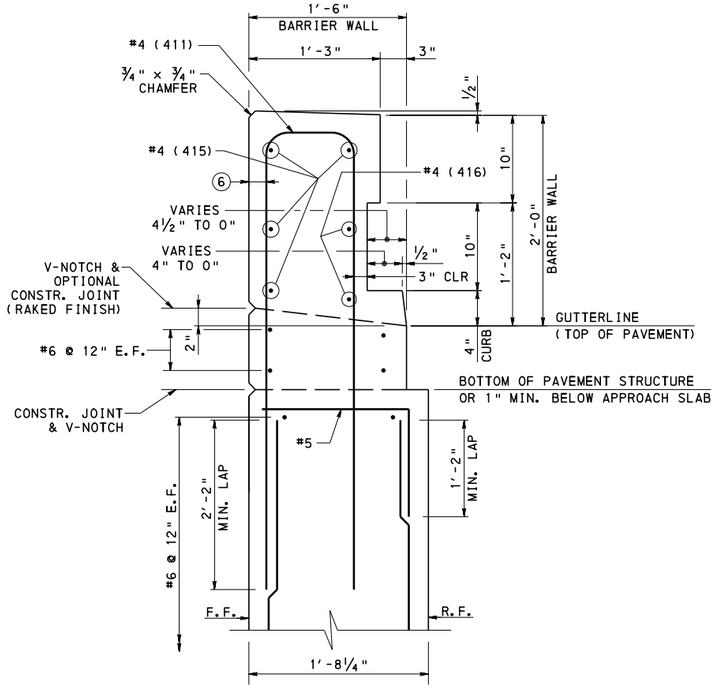
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

PA BRIDGE BARRIER

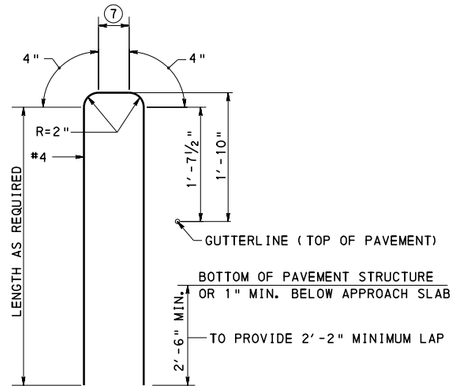
END OF BARRIER DETAILS - 1

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 3 OF 10
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-610M

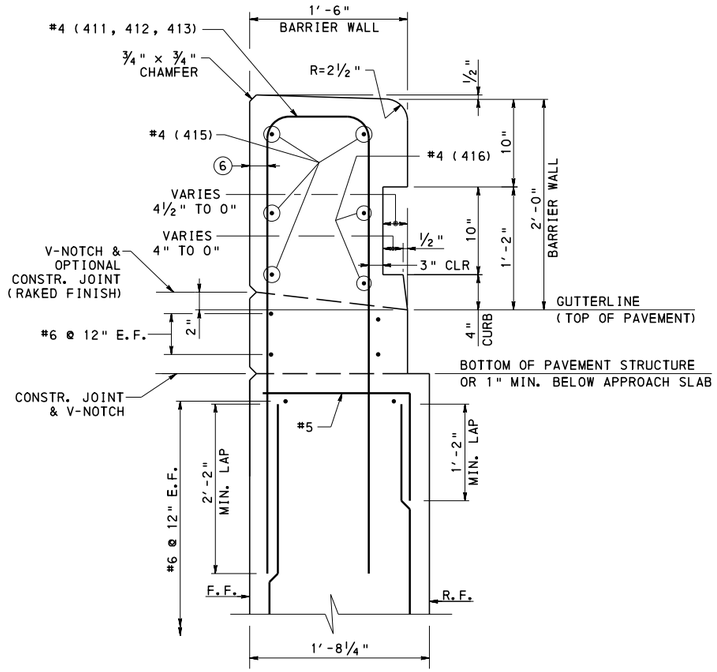


SECTION D-D (8)

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)

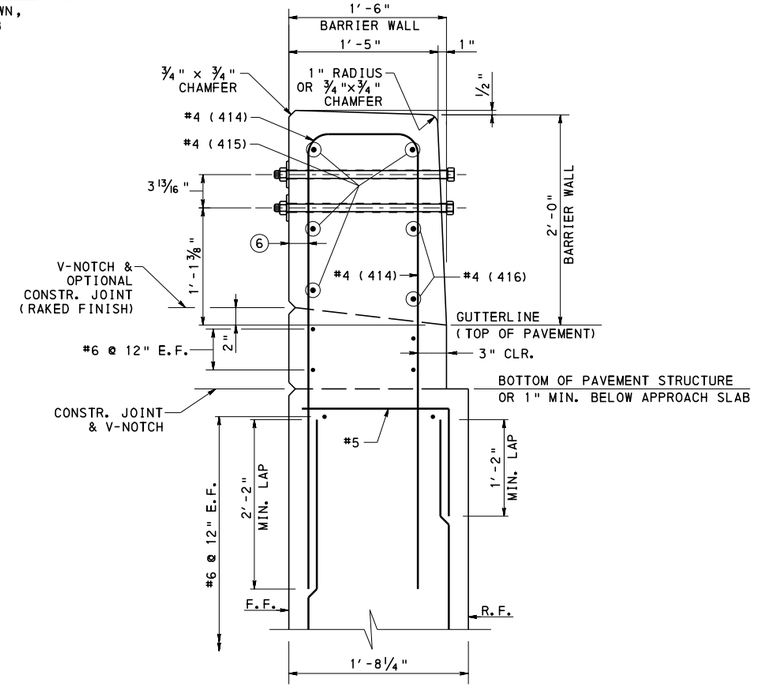


VERTICAL REINFORCEMENT



SECTION E-E (8)

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)



SECTION F-F (8)

LEGEND:

(6) 2" CLR. FOR SAFETY WINGS,
2⅝" CLR. FOR U-WINGS.

(7) FOR SAFETY WINGS:
4¼" (411)
5¼" (412)
6⅜" (413)
8" (414)

FOR U-WINGS:
3⅝" (411)
4⅝" (412)
5¾" (413)
7⅜" (414)

(8) REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WING. REINFORCEMENT IN U-WING BELOW 1′-6" WIDTH IS AS REQUIRED BY DESIGN.

NOTES:

1. FOR SECTION D-D, E-E AND F-F LOCATION, SEE SHEET 3.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

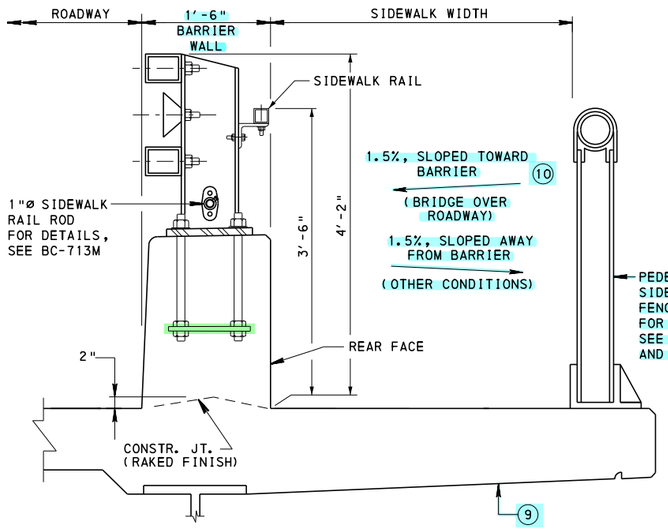
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

PA BRIDGE BARRIER

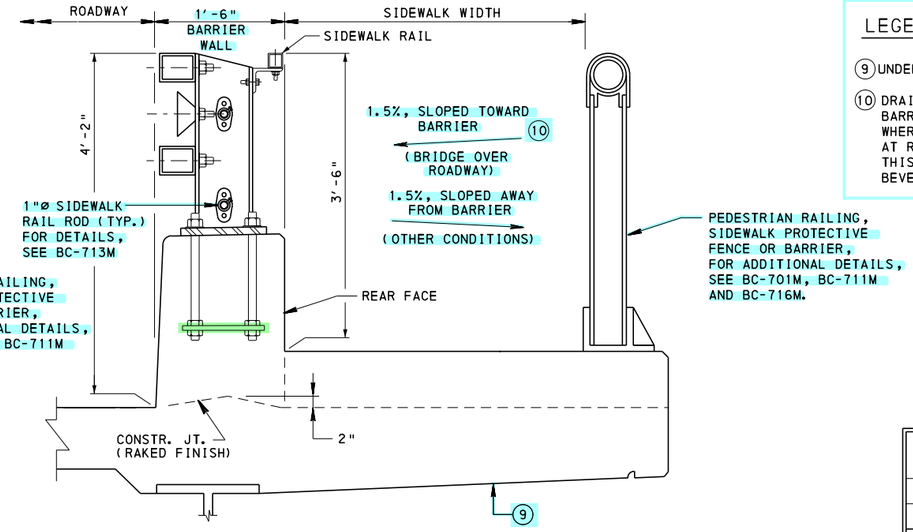
END OF BARRIER DETAILS - 2

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 4 OF 10
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-610M



TYPICAL SIDEWALK DETAIL

(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE DECK SLAB, SEE BD-601M)



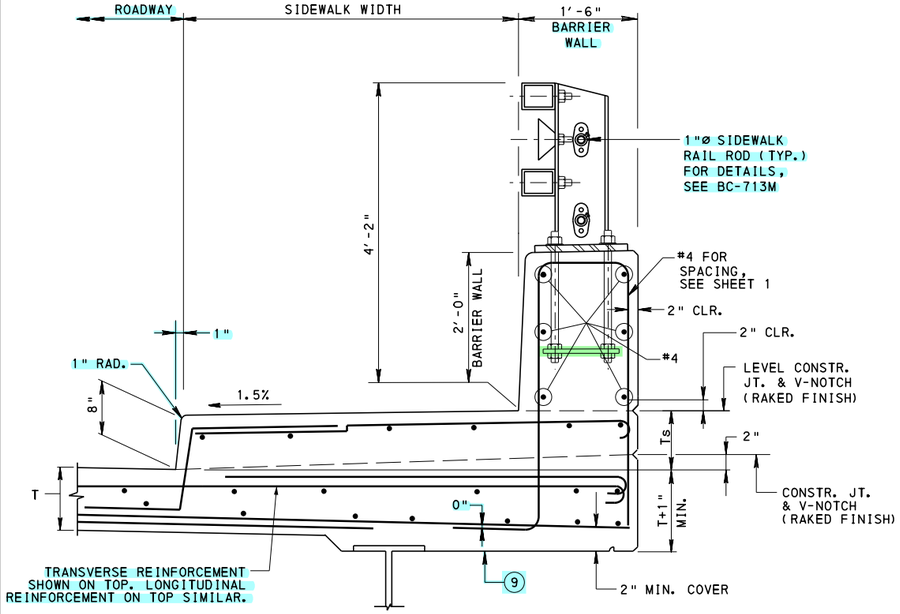
RAISED SIDEWALK DETAIL

(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE SIDEWALK AND DECK SLAB, SEE BD-601M)

LEGEND:

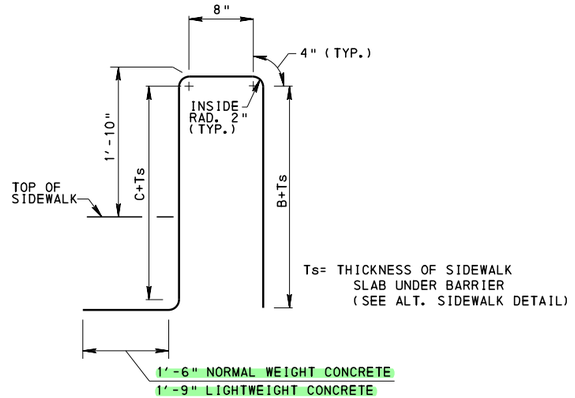
(9) UNDERSIDE OF DECK MAY BE CONSTRUCTED LEVEL.

(10) DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTERLINE ELEVATIONS. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.



ALTERNATE SIDEWALK DETAIL

(FOR REINFORCEMENT DETAILS OF THE SIDEWALK AND DECK SLAB, SEE BD-601M)



VERTICAL REINFORCEMENT

(FOR DIMENSIONS "B & C", SEE TABLE 1)

REINFORCEMENT BAR NOTES:

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

TABLE 1		
B & C DIMENSIONS FOR PA BRIDGE BARRIER		
T	B	C
8.0"	2'-2½"	1'-11"
8.5"	2'-3"	1'-11½"
9.0"	2'-3½"	2'-0"
9.5"	2'-4"	2'-0½"
10.0"	2'-4½"	2'-1"
10.5"	2'-5"	2'-1½"
11.0"	2'-5½"	2'-2"
11.5"	2'-6"	2'-2½"

VERTICAL REINFORCEMENT DIMENSION TABLE

NOTE: T DESIGNATES DECK SLAB THICKNESS

NOTES:

1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 2.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

PA BRIDGE BARRIER

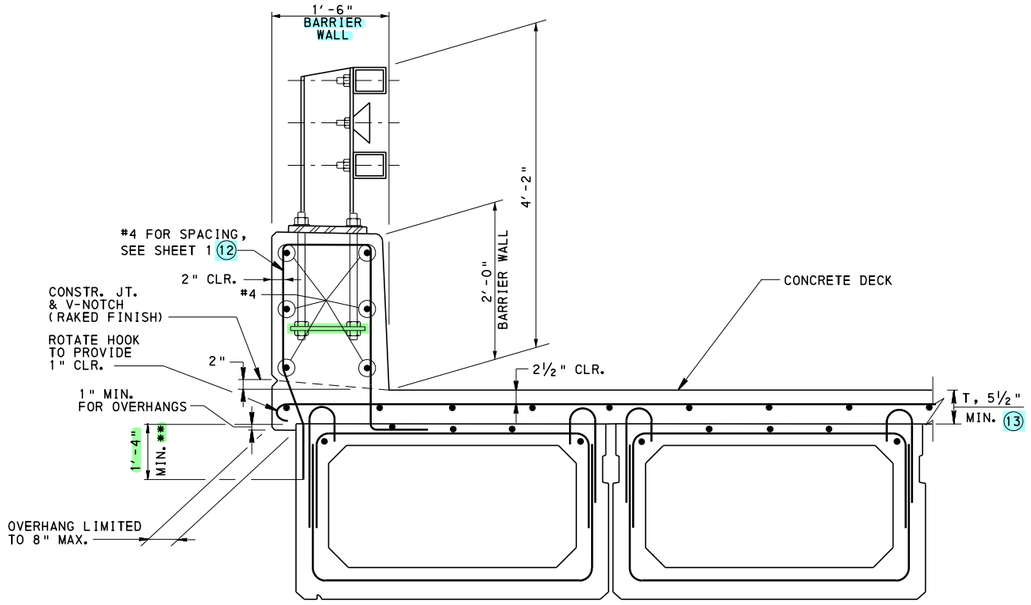
SIDEWALK DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

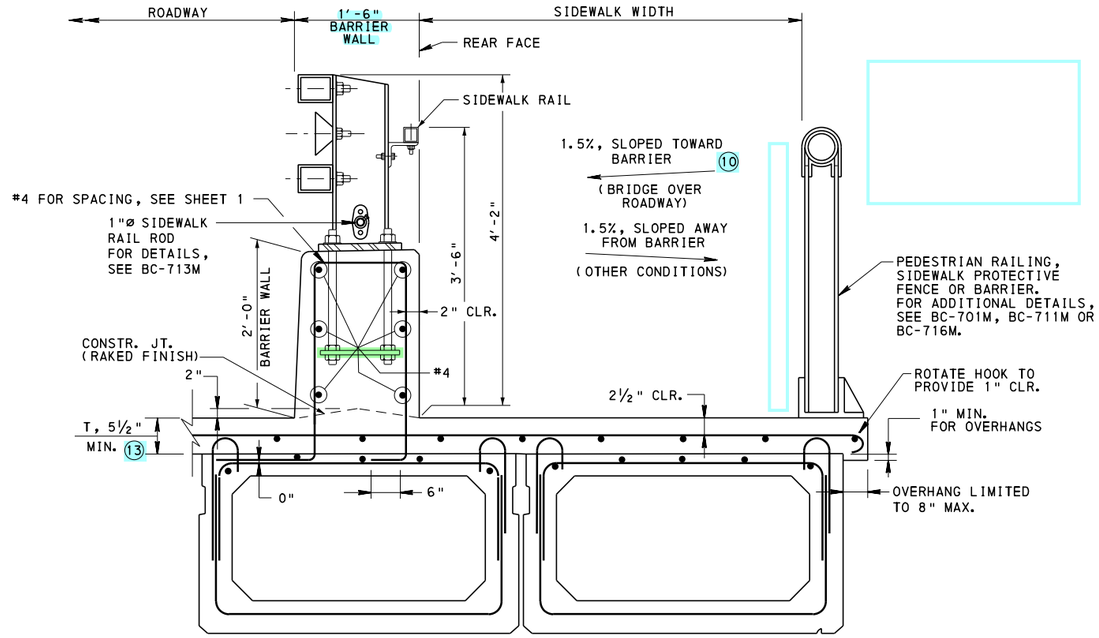
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 5 OF 10

BD-610M



36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER

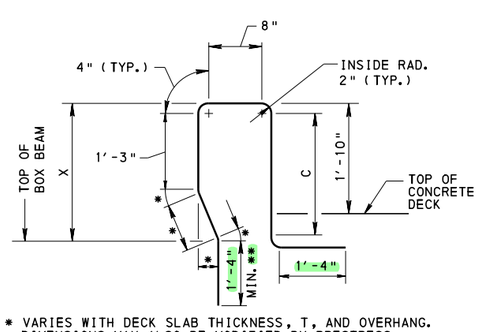


36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING TYPICAL SIDEWALK (11)

(RAISED SIDEWALK DETAIL SIMILAR)

TABLE 1		
X AND C DIMENSIONS FOR PA BRIDGE BARRIER		
T	AT COMP. ADJ. BOX BEAMS SUPPORTING BARRIER	
	X	C
5.5"	2'-3½"	2'-0½"
6.0"	2'-4 "	2'-1"
6.5"	2'-4½"	2'-1½"
7.0"	2'-5"	2'-2"
7.5"	2'-5½"	2'-2½"
8.0"	2'-6"	2'-3"

NOTE: T DESIGNATES DECK SLAB THICKNESS

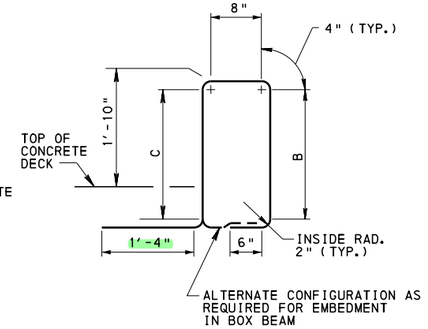


* VARIES WITH DECK SLAB THICKNESS, T, AND OVERHANG. DIMENSIONS MAY ALSO BE MODIFIED BY PRESTRESS FABRICATOR TO AVOID INTERFERENCE WITH BEAM FORM WORK.

** OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.

VERTICAL REINFORCEMENT

(FOR DIMENSIONS "X" AND "C", SEE TABLE 1)



VERTICAL REINFORCEMENT

(FOR DIMENSIONS "B" AND "C", SEE TABLE 2)

TABLE 2		
B AND C DIMENSIONS FOR PA BRIDGE BARRIER		
T	AT COMP. ADJ. BOX BEAMS SUPPORTING SIDEWALK OR RAISED SIDEWALK	
	B	C
5.5"	2'-0½"	2'-0½"
6.0"	2'-1"	2'-1"
6.5"	2'-1½"	2'-1½"
7.0"	2'-2"	2'-2"
7.5"	2'-2½"	2'-2½"
8.0"	2'-3"	2'-3"

NOTE: T DESIGNATES DECK SLAB THICKNESS

LEGEND

(10) DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTERLINE ELEVATIONS. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.

(11) USE ONLY WHEN ROADWAY AND SIDEWALK WIDTHS PERMIT THE HORIZONTAL LEGS OF THE BARRIER BAR TO BE EMBEDDED ENTIRELY WITHIN ONE BEAM. ROADWAY/SIDEWALK WIDTHS MAY NEED TO BE ADJUSTED TO ACCOMMODATE THIS CONDITION.

(12) BEND AS REQUIRED TO ACCOMMODATE OVERHANG. SEE BC-736M.

(13) INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD.

REINFORCEMENT BAR NOTES:

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).
4. FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

NOTES:

1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 2.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

PA BRIDGE BARRIER

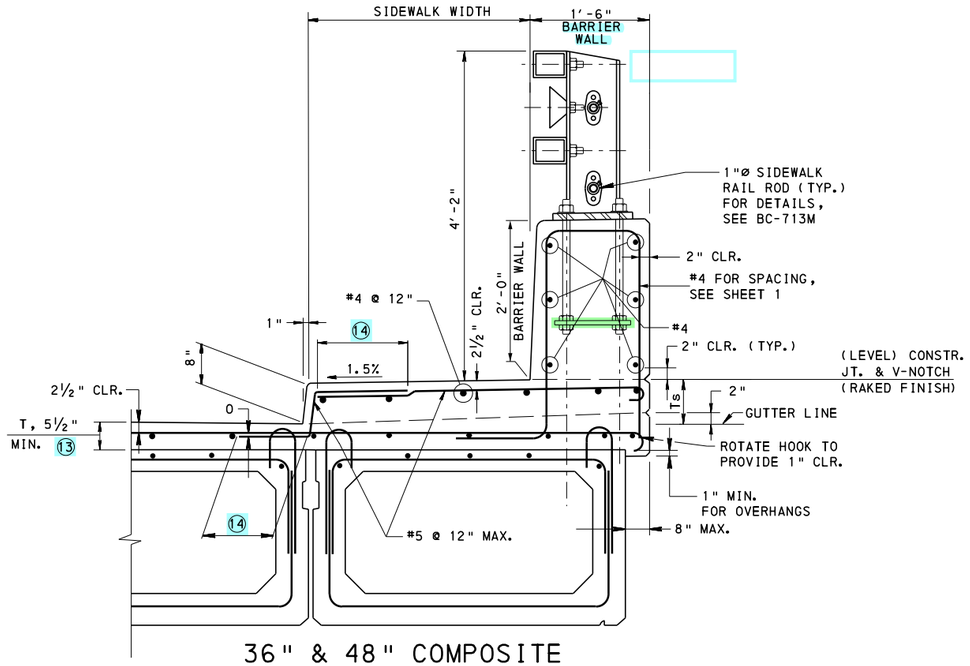
ADJACENT BOX BEAM DETAILS - 1

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

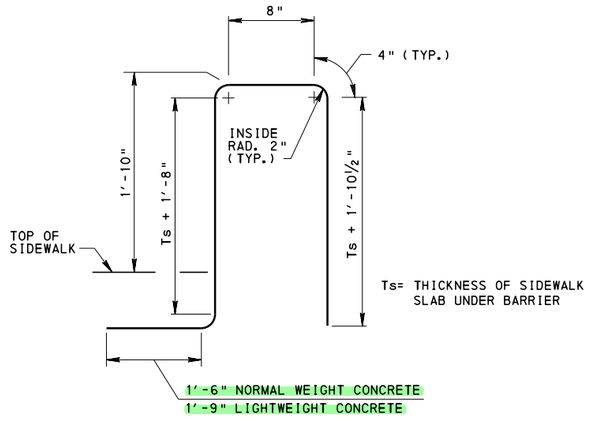
RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 10

BD-610M



36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK



VERTICAL REINFORCEMENT

LEGEND

13 INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD.

14 FOR DIMENSION, SEE BD-601M, SHEET 4.

NOTES:

1. FOR GEOMETRY AND REINFORCEMENT DETAILS OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 2.
2. DETAILS ARE NOT SHOWN FOR NON-COMPOSITE ADJACENT BOX BEAMS, PRECAST BRIDGE SLABS, PLANK BEAMS, AND PRECAST CHANNEL BEAMS BECAUSE THEY CANNOT BE DESIGNED FOR A TL-5 BARRIER RATING.
3. FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.
4. FOR ADDITIONAL NOTES, SEE SHEET 1.

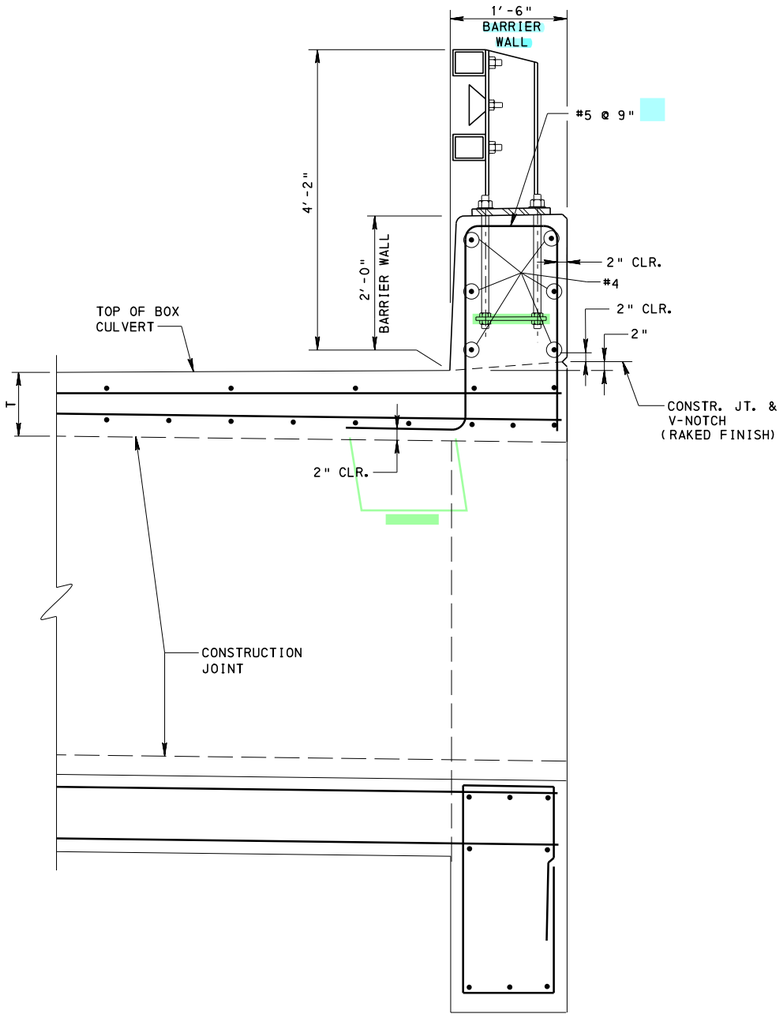
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

PA BRIDGE BARRIER

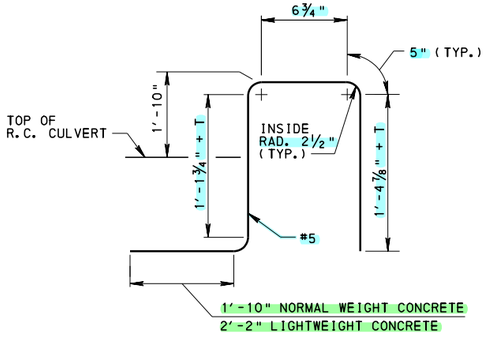
ADJACENT BOX BEAM DETAILS - 2

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 7 OF 10 BD-610M

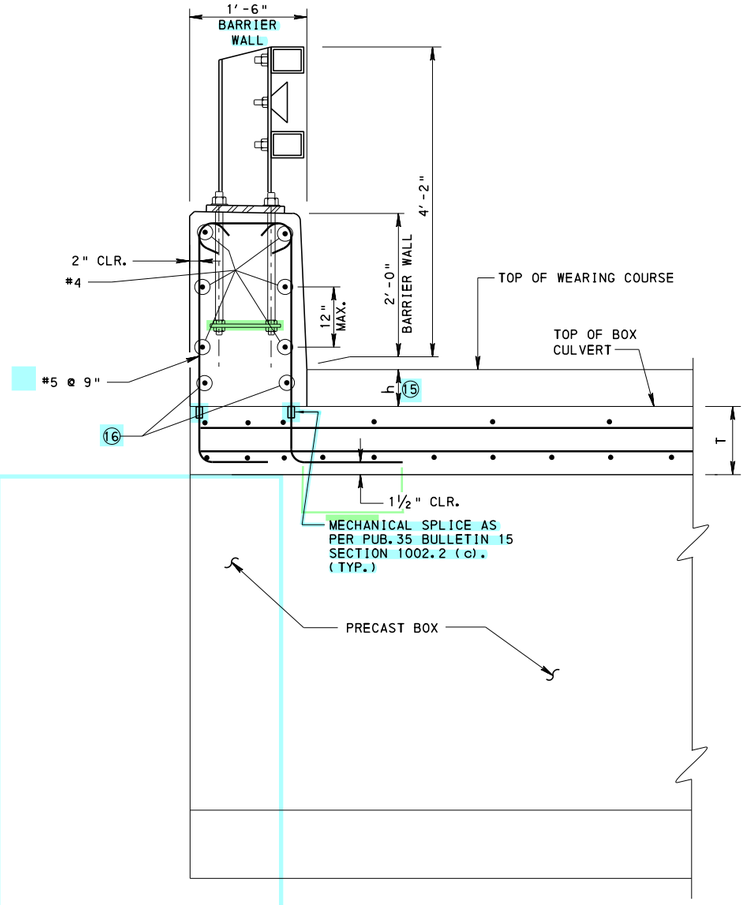


AT GRADE SECTION AT C.I.P. R.C. CULVERT

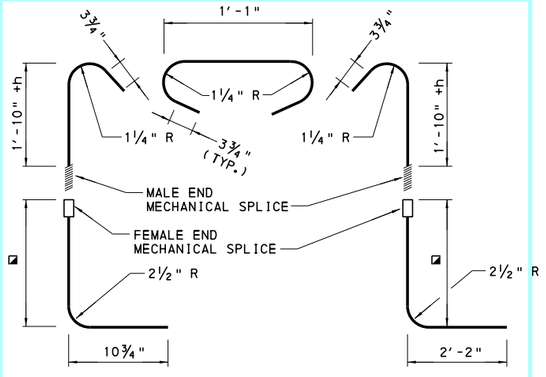
(TYPICAL HEADWALL SECTION)
NOTE: FOR R.C. CULVERT DETAILS, SEE BD-632M.



CAST-IN-PLACE CULVERT VERTICAL REINFORCEMENT



AT GRADE SECTION AT PRECAST R.C. CULVERT



PRECAST CULVERT VERTICAL REINFORCEMENT

ALL VERTICAL REINFORCEMENT #5

◪ FOR T<10": T-2"
FOR T≥10": 8" MIN.

REINFORCEMENT BAR NOTES:

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

LEGEND:

(15) 2½" MIN., 11" MAX. TOTAL THICKNESS (h); h IS THE DISTANCE MEASURED FROM TOP OF BOX CULVERT TO TOP OF WEARING COURSE.

(16) ADD SETS OF 2 - #4 BARS AS REQUIRED.

NOTES:

1. FOR PA BARRIER MOUNTED ON CULVERT, PROVIDE REINFORCEMENT AS SHOWN ON THIS SHEET #5 @ 9". FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 2.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

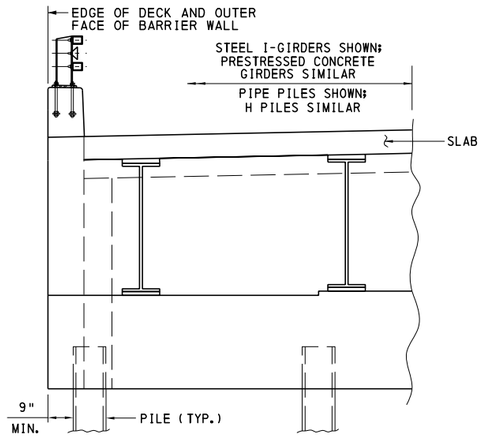
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

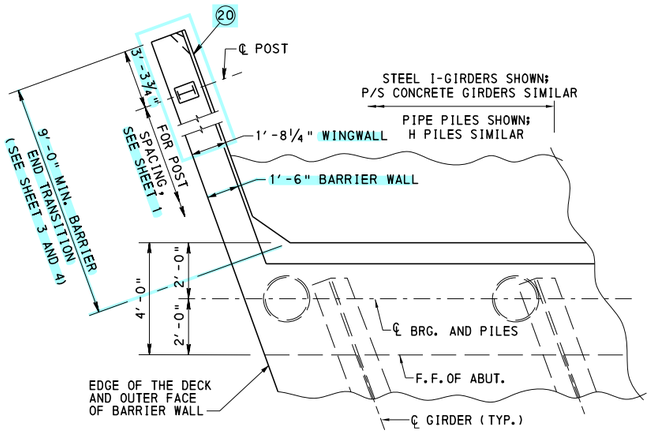
PA BRIDGE BARRIER

BOX CULVERT DETAILS

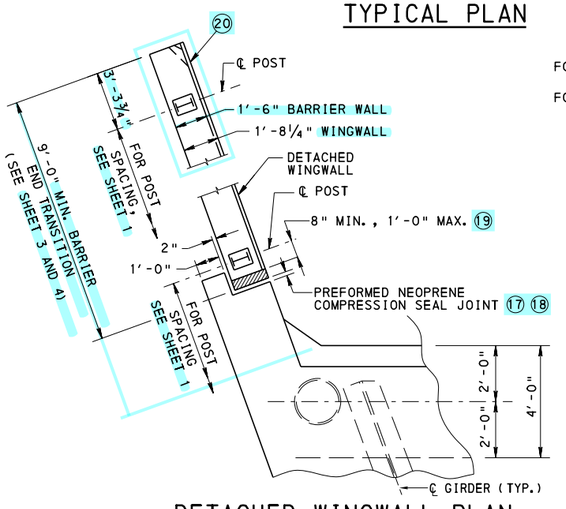
RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 8 OF 10
		BD-610M



TYPICAL ELEVATION

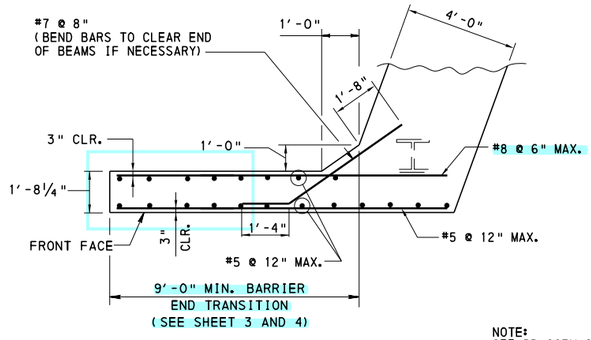


TYPICAL PLAN

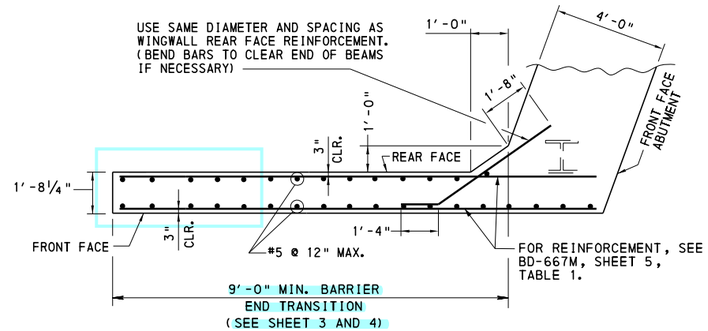


DETACHED WINGWALL PLAN

(FOR DIMENSIONS AND CALL OUTS NOT SHOWN, SEE TYPICAL PLAN)

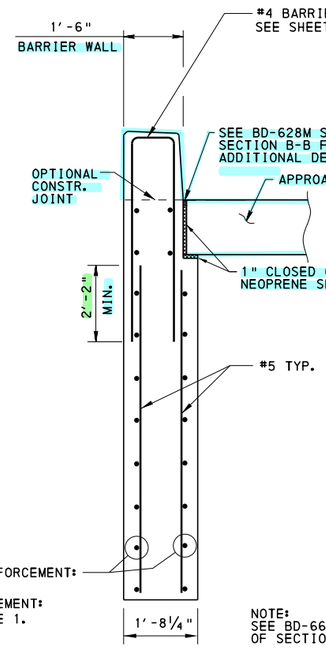


SECTION J-J



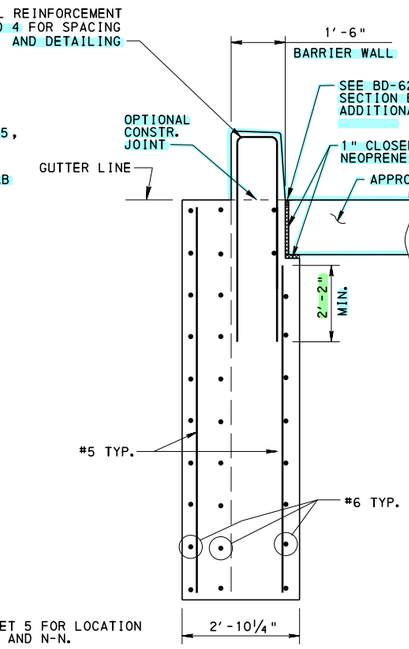
SECTION L-L

NOTE:
SEE BD-667M SHEET 5 FOR LOCATION OF SECTIONS J-J AND L-L.



SECTION K-K

(RECTANGULAR OR TAPERED WING)



SECTION N-N

(DETACHED WING)

LEGEND:

(17) FOR DETAILS OF THE PREFORMED NEOPRENE COMPRESSION SEAL JOINT, SEE BD-667M, SHEET 6.

(18) FOR DETAILS OF THE BENT PLATE ON CONCRETE BARRIER WALL, SEE BC-713M.

(19) ℄ POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR ℄ POST TO EDGE OF FIXED END OF SLIDING PLATE.

(20) SECTION SHOWN WITHOUT CURB, WITH CURB FOLLOW DETAILS ON SHEETS 3 AND 4.

NOTES:

1. SEE BD-667M FOR ALL OTHER INTEGRAL ABUTMENT DETAILS.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

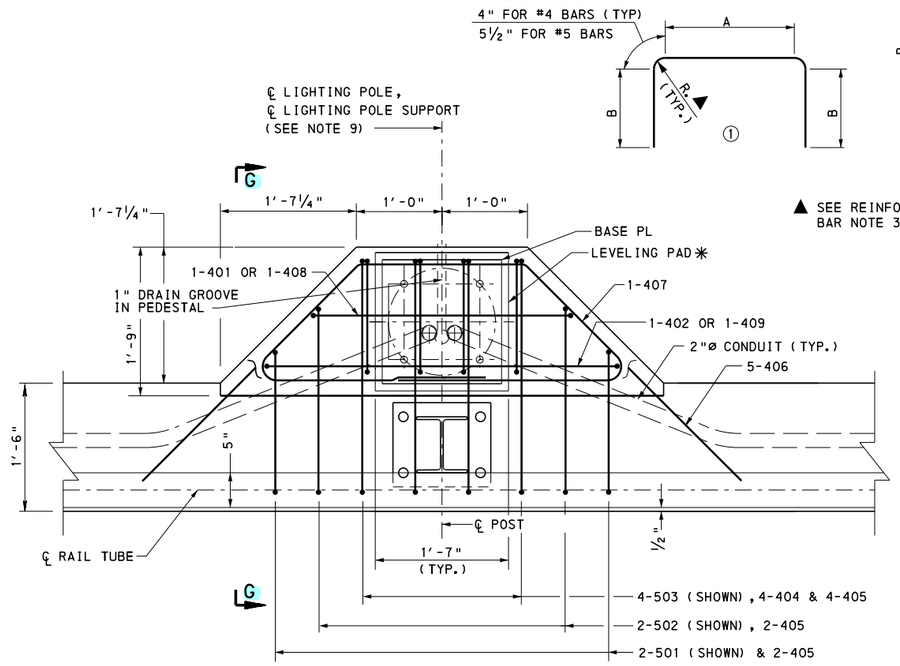
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

PA BRIDGE BARRIER

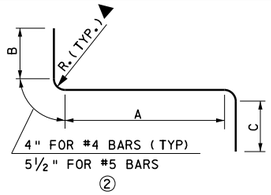
INTEGRAL ABUTMENT DETAILS

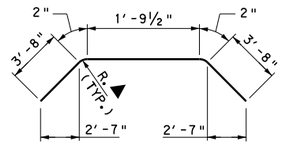
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 9 OF 10
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-610M



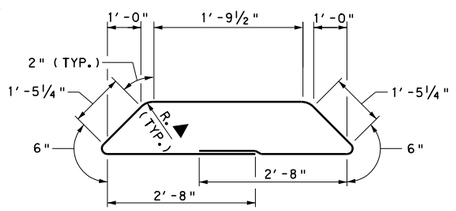
PLAN

(BARRIER REINFORCEMENT NOT SHOWN FOR CLARITY)





▲ SEE REINFORCEMENT BAR NOTE 3.



REINFORCEMENT DETAILS

REINFORCEMENT BAR NOTES:

1. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
2. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).
3. RADIUS, R= 2" FOR #4 BARS AND 3" FOR #5 BARS, IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.

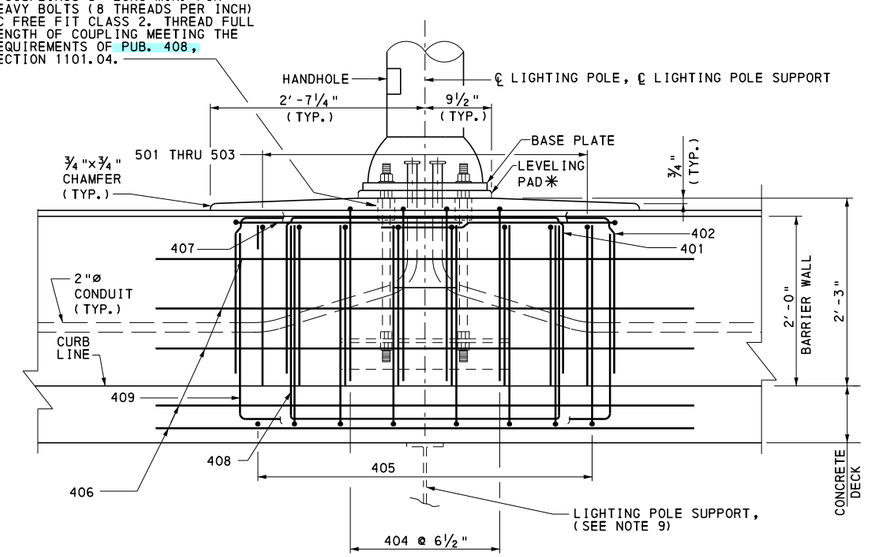
REINFORCEMENT TABLE

MARK	SIZE	LENGTH	NUMBER	TYPE	A	B	C
401	4	6'-8"	1	①	2'-9"	1'-7½"	-----
402	4	7'-7"	1	①	3'-8"	1'-7½"	-----
404	4	4'-9"	4	①	1'-0"	1'-6½"	-----
405	4	5'-3½"	8	②	2'-8½"	2'-3"	0"
406	4	9'-5½"	5	③	-----	-----	-----
407	4	11'-4"	1	④	-----	-----	-----
408	4	7'-11"	1	①	2'-9"	2'-3"	-----
409	4	8'-10"	1	①	3'-8"	2'-3"	-----
501	5	4'-3"	2	①	11"	1'-2½"	-----
502	5	4'-9½"	2	①	1'-5½"	1'-2½"	-----
503	5	5'-4"	4	①	2'-0"	1'-2½"	-----

NOTES:

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
2. SET ANCHOR BOLTS ACCURATELY BY THE TEMPLATE FURNISHED BY THE MANUFACTURER, TO THE CORRECT ELEVATION AND ALIGNMENT AND SECURELY BRACE AGAINST DISPLACEMENT BEFORE THE SURROUNDING CONCRETE IS PLACED. ANCHOR BOLT DIAMETER AS REQUIRED BY LIGHTING POLE MANUFACTURER. (FOR FUTURE LIGHTING PROVISIONS, SEE CHART ON THIS SHEET.)
3. SEAL CONDUIT AND PROTECT THREADS FOR FUTURE LIGHTING INSTALLATIONS.
4. CONFORM ANCHOR MATERIALS TO 1101.4 PUB. 408, ANCHOR ANGLES ARE PERMITTED TO BE GALVANIZED.
5. SET LIGHTING POLES TRULY VERTICAL WITH BASES LEVEL USING LEVELING NUTS.
6. PROVIDE 2" CLEAR ON ALL REINFORCEMENT UNLESS NOTED.
7. PROVIDE A MINIMUM OF 2½" CONCRETE COVER FOR CONDUIT.
8. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 1.
9. PREFERRED LOCATION FOR LIGHTING POLES IS AT PIERS AND ABUTMENTS. LIGHTING POLE SUPPORT, IF NEEDED, TO BE DESIGNED BY THE ENGINEER TO DISTRIBUTE LOAD TO BOTH FASCIA AND FIRST INTERIOR BEAM. FOR LIGHT POLE SUPPORTS, USE BD-657M FOR ABUTMENT DETAILS, AND BD-658M FOR PIER DETAILS.
10. FOR LIGHTING POLE LOCATIONS WITHIN A SPAN, THE LUMINAIRE DEFLECTION MUST BE EVALUATED FOR DYNAMIC EFFECTS.

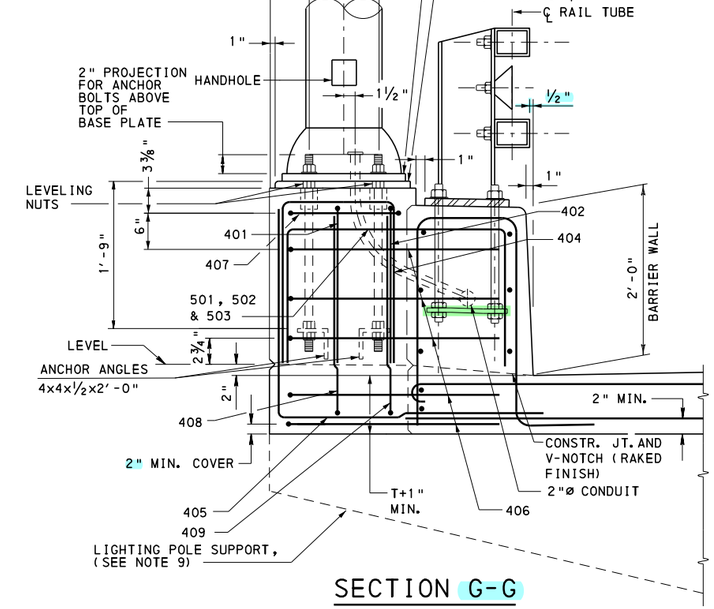
4-COUPLINGS 3" LONG MIN. FOR HEAVY BOLTS (8 THREADS PER INCH) NC FREE FIT CLASS 2. THREAD FULL LENGTH OF COUPLING MEETING THE REQUIREMENTS OF PUB. 408, SECTION 1101.04.



ELEVATION

(RAILING POST, TUBES, BARRIER AND DECK REINFORCEMENT NOT SHOWN FOR CLARITY)

✳ FILL SPACE BETWEEN POLE BASE PLATE AND CONCRETE WITH GROUT AFTER SETTING POLE TRULY VERTICAL USING LEVELING NUTS. TOOL EDGES OF PAD. MINIMUM HEIGHT OF LEVELING PAD IS 1".



SECTION G-G

PROVISIONS FOR FUTURE LIGHTING

MOUNTING HEIGHT	ANCHOR BOLT CIRCLE DIA.	ANCHOR BOLT DIAMETER
50'-0" MAX.	15"	1"

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

PA BRIDGE BARRIER

LIGHTING POLE ANCHORAGE DETAILS

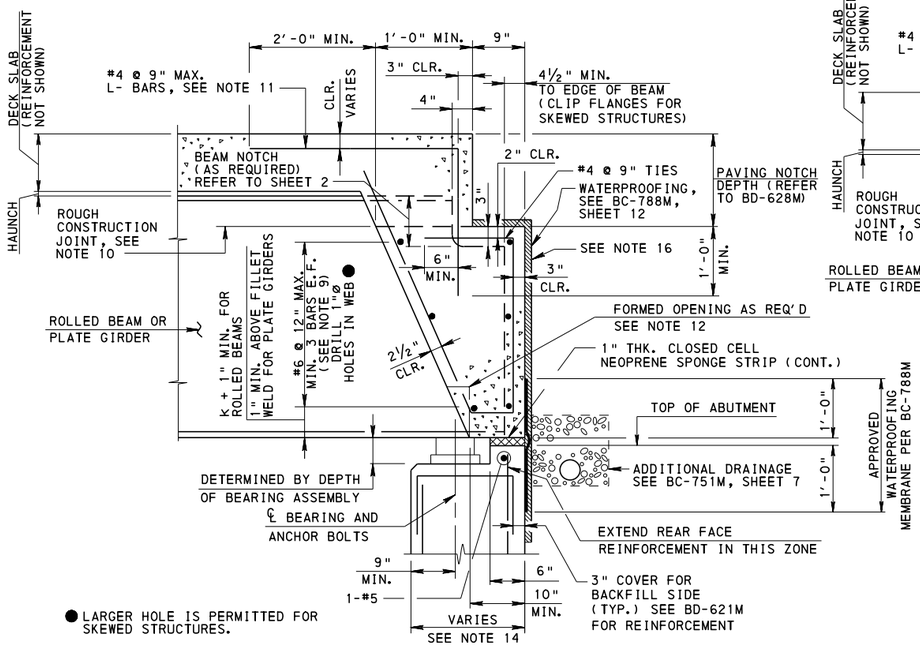
RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

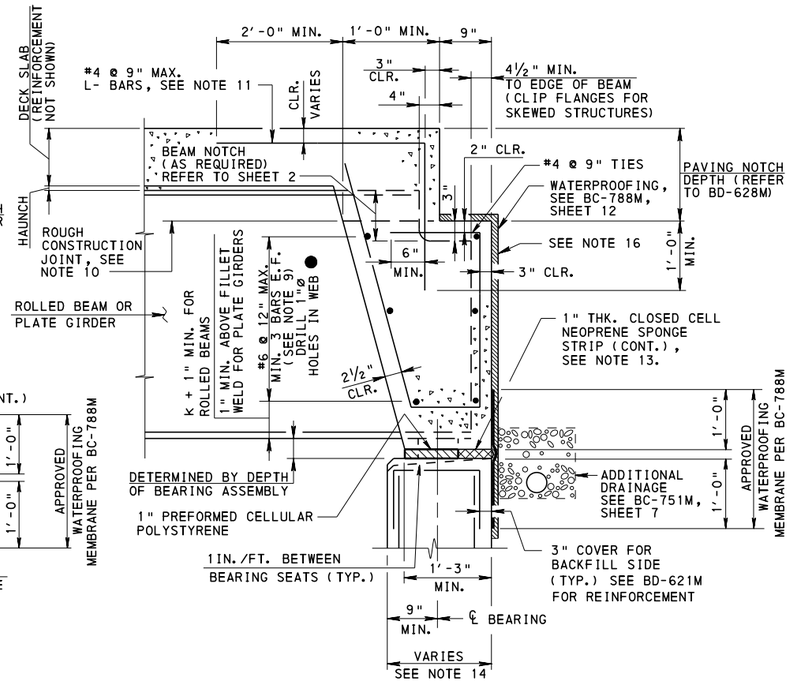
SHEET 10 OF 10

BD-610M

CHANGE 2



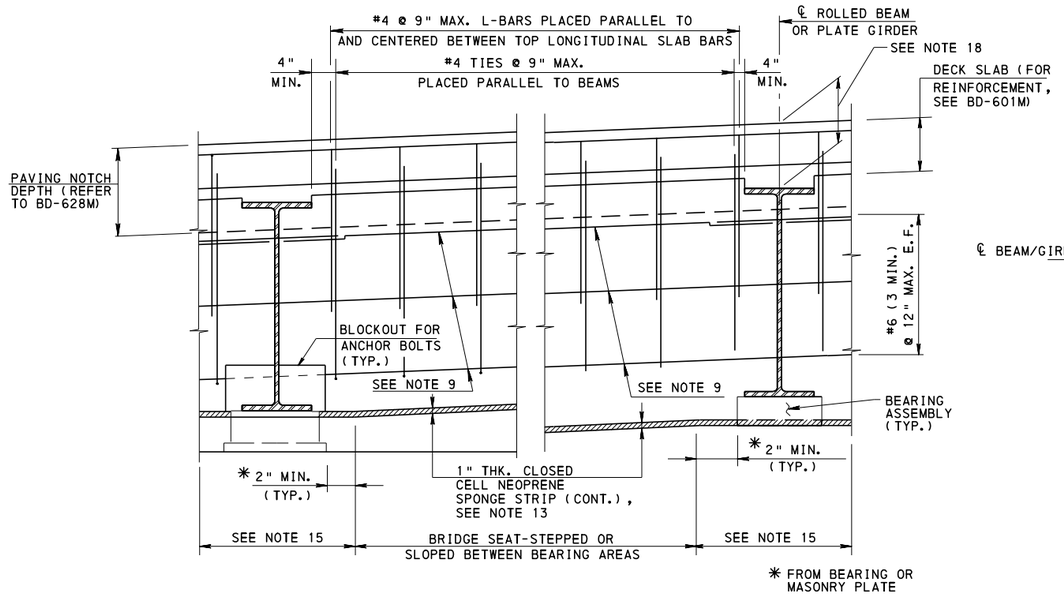
SECTION - POT BEARINGS



SECTION - ELASTOMERIC BEARINGS

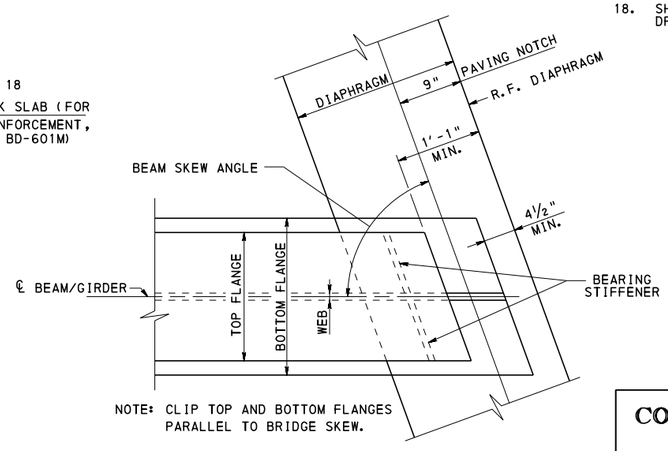
FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL WITH PAVING NOTCH

(FOR TYPE 1 AND 2 APPROACH SLABS)



POT BEARINGS — ELASTOMERIC BEARINGS

ELEVATION



PLAN - SKEWED STRUCTURES

NOTES:

1. PROVIDE MATERIAL AND WORK QUALITY IN ACCORDANCE WITH PUBLICATION 408.
2. PROVIDE 2" MININUM CONCRETE COVER ON REINFORCEMENT BARS EXCEPT WHERE NOTED.
3. ALL REINFORCEMENT BARS ARE EPOXY COATED.
4. USE OF THE CONCRETE DIAPHRAGM IS RESTRICTED TO GIRDER DEPTHS UP TO 6'-0" OR THE DECK MOVEMENT CAUSED BY THE TEMPERATURE CHANGE AND THE ROTATION DUE TO LIVE LOAD PLUS IMPACT NOT TO EXCEED ½", WHICHEVER CONTROLS.
5. "K" = FLANGE THICKNESS + FILLET, AS INDICATED IN AISC TABLES OF BEAM DIMENSIONS.
6. USE CLASS AAAP CEMENT CONCRETE UP TO BOTTOM OF PAVING NOTCH.
7. SLOPE TOP OF ABUTMENT TO DRAIN TO FRONT FACE BETWEEN BEARING AREAS ON SPANS GREATER THAN 50 FT.
8. PROVIDE A FULL DEPTH KEYED CONSTRUCTION JOINT WHEN STAGE CONSTRUCTION IS REQUIRED.

THE FOLLOWING NOTES ARE TO BE USED WHEN REFERENCED ON THE DRAWINGS:

9. PROVIDE LAP SPLICES FOR BARS THRU BEAM/GIRDER WEBS WHERE CONTINUOUS BARS ARE IMPRACTICAL. REAR FACE BARS ARE CONTINUOUS.
10. PLACE PORTION OF DIAPHRAGM TO THE CONSTRUCTION JOINT ELEVATION INDICATED. WAIT TWO HOURS MINIMUM BEFORE PLACING DECK CONCRETE.
11. PLACE TOP LEG OF #4 L- BARS PARALLEL TO AND ON THE SAME PLANE AS THE TOP LONGITUDINAL DECK SLAB REINFORCEMENT.
12. FORM AN OPENING AS REQUIRED TO CLEAR ANCHOR BOLT BY 1" ALL AROUND AT LIMITS OF THERMAL MOVEMENT. ADJUST REINFORCEMENT TO PROVIDE MINIMUM CONCRETE COVER.
13. CUT NEOPRENE SPONGE TO CLEAR BEARING ASSEMBLY.
14. WIDTH OF TOP OF ABUTMENT IS GOVERNED BY THE DIAPHRAGM WIDTH, REQUIRED BEARING AREA, AND APPLICABLE CLEARANCES.
15. FOR BEARING SEAT SLOPE, REFER TO DESIGN DRAWINGS.
16. PLACE 2" THICK PREFORMED CELLULAR POLYSTRENE (ASTM C578) OVER WATERPROOFING MEMBRANE ON REAR FACE OF CONCRETE DIAPHRAGM PER BC-788M.
17. PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615, ASTM A996, OR A706. DO NOT WELD REINFORCEMENT BARS. DO NOT USE RAIL STEEL A996 WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
18. SHOW THICKNESS AT CENTERLINE OF BEARINGS ON CONTRACT DRAWINGS:
    PLATE GIRDERS: PROVIDE DISTANCE FROM TOP OF DECK SLAB TO TOP OF WEB
    ROLLED SHAPES: PROVIDE DISTANCE FROM TOP OF DECK SLAB TO TOP OF FLANGE

REFERENCE DRAWINGS	
BD-601M	CONCRETE DECK SLAB
BD-621M	R.C. ABUT. TYP. SECT. AND DETAILS
BD-624M	R.C. ABUT. WITHOUT BACKWALL
BD-628M	BRIDGE APPROACH SLABS
BC-751M	BRIDGE DRAINAGE
BC-755M	BEARINGS
BC-788M	TYP. WATERPROOFING AND EXPANSION DETAILS
RC-23M	BRIDGE APPROACH SLABS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

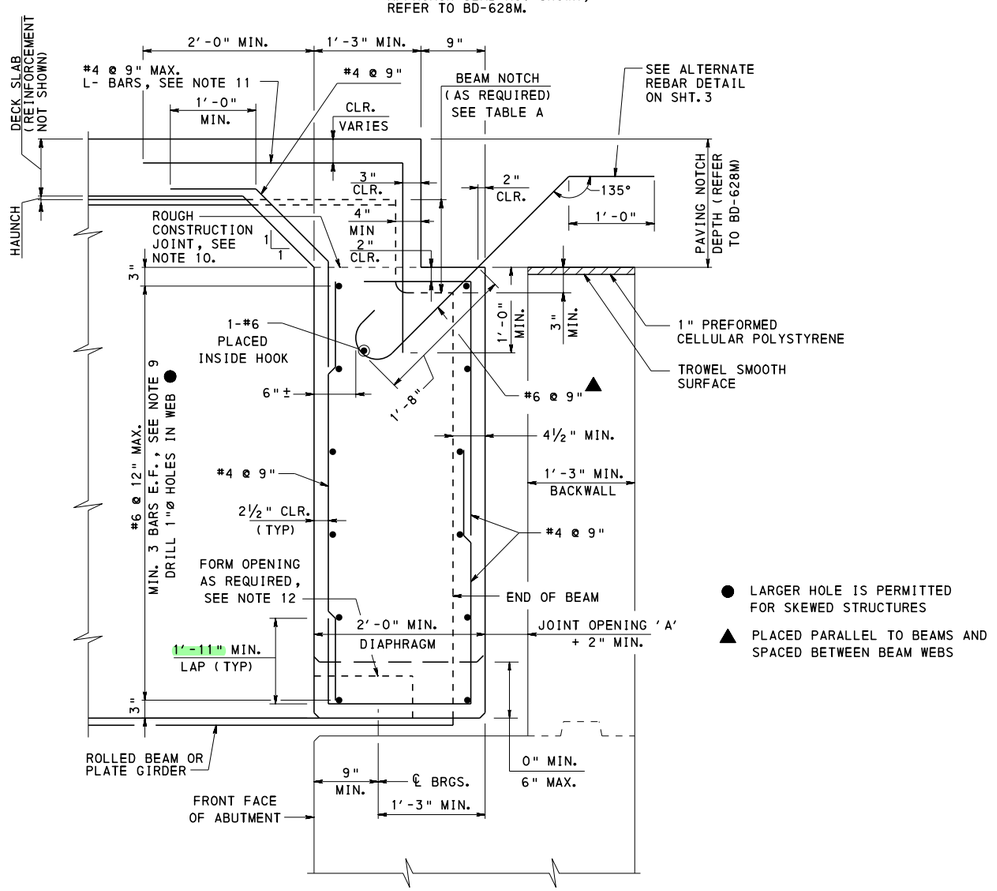
STANDARD
CONCRETE DIAPHRAGM DETAILS
FOR STEEL I-BEAM STRUCTURES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 3

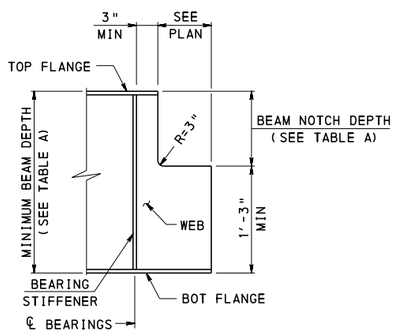
BD-611M



● LARGER HOLE IS PERMITTED FOR SKEWED STRUCTURES

▲ PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAM WEBS

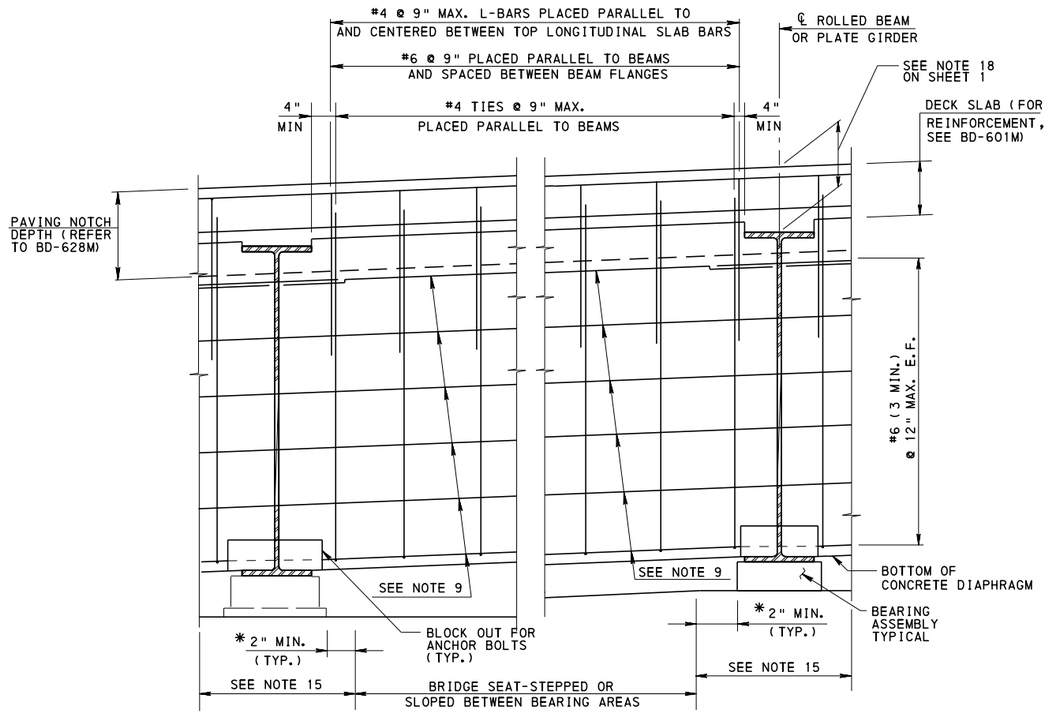
DIAPHRAGM AT ABUTMENT WITH BACKWALL FOR TYPE 3 APPROACH SLABS



BEAM NOTCH

TABLE A BEAM NOTCH DEPTHS FOR STEEL I-BEAMS			
APPROACH SLAB TYPE (SEE NOTE 1)	BEAM NOTCH DEPTH	MINIMUM BEAM DEPTH	REMARKS
1	10½"	2'-1½"	SEE NOTE 2
2	1'-3½"	2'-6½"	SEE NOTE 2
3	1'-0½"	3'-4"	SEE NOTES 3 AND 4
4	1'-0½"	3'-4"	SEE NOTES 3 AND 4
RC-23M	10½"	N/A	SEE NOTE 5

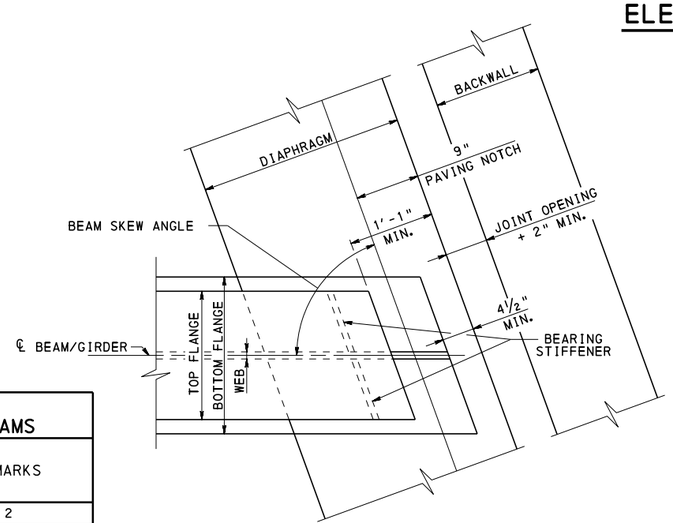
BEAM NOTCH NOTES
1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. SUPPORT APPROACH SLAB ON ABUTMENT FOR BEAM DEPTHS LESS THAN SHOWN.
3. BACKWALL PLACED UNDER APPROACH SLAB.
4. TYPE 3 APPROACH SLABS ARE NOT PERMITTED FOR BEAM DEPTHS LESS THAN 40". USE TYPE 1 OR 2 APPROACH SLAB WITH BACKWALL.
5. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.



* FROM BEARING OR MASONRY PLATE

POT BEARINGS — ELASTOMERIC BEARINGS

ELEVATION



NOTE: CLIP TOP AND BOTTOM FLANGES PARALLEL TO BRIDGE SKEW.

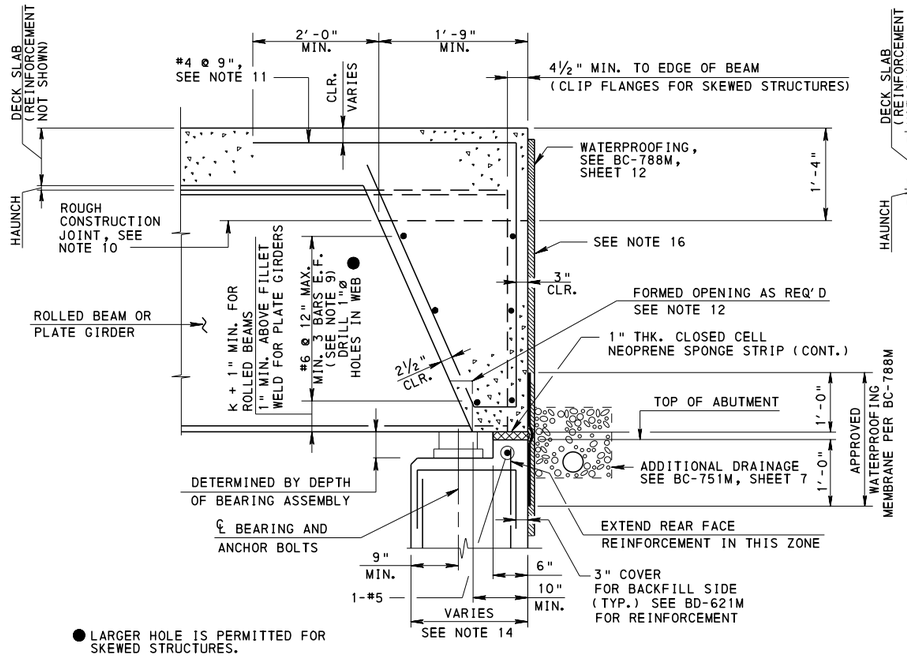
PLAN - SKEWED STRUCTURES

NOTES:
1. FOR NOTES, SEE SHEET 1.

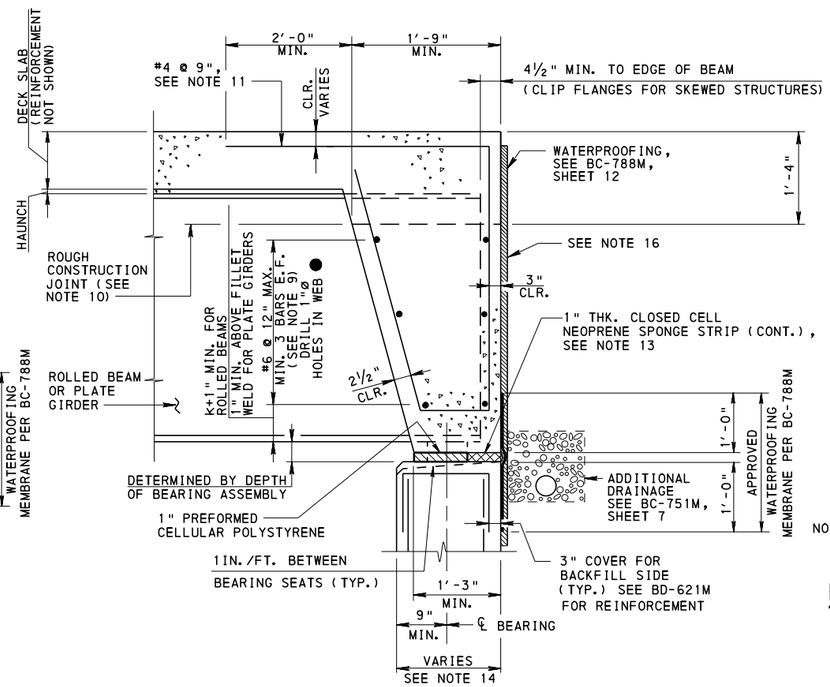
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CONCRETE DIAPHRAGM DETAILS FOR STEEL I-BEAM STRUCTURES

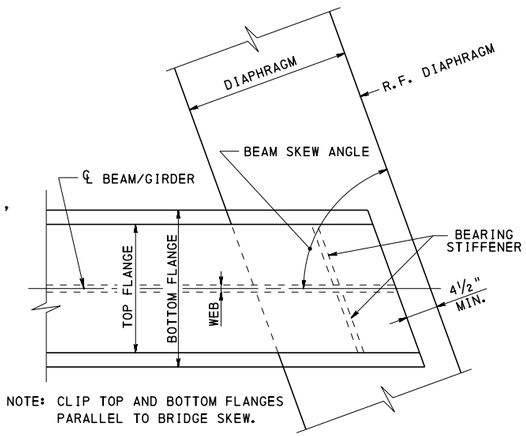
RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 2 OF 3
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-611M



SECTION - POT BEARINGS



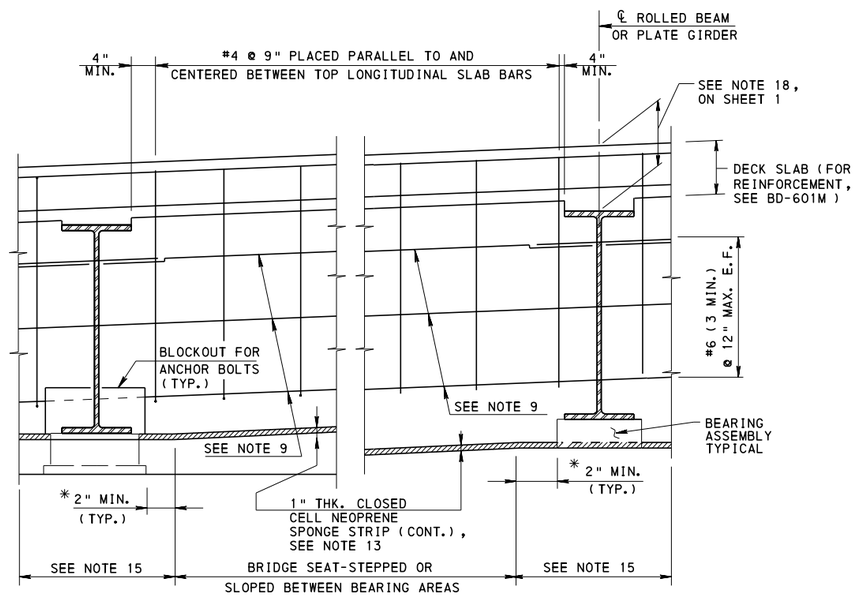
SECTION - ELASTOMERIC BEARINGS



NOTE: CLIP TOP AND BOTTOM FLANGES PARALLEL TO BRIDGE SKEW.

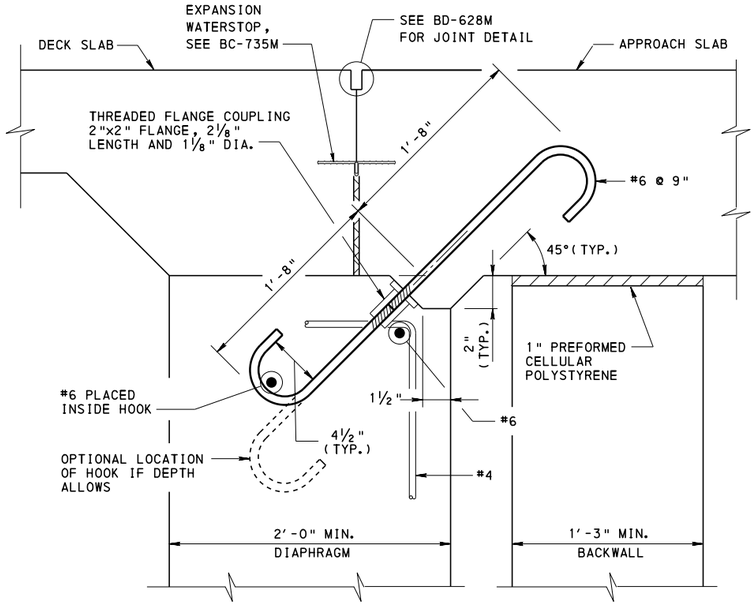
PLAN - SKEWED STRUCTURES

FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL AND PAVING NOTCH



POT BEARINGS ELASTOMERIC BEARINGS

ELEVATION



ALTERNATE REBAR DETAIL

END OF SPREAD BOX BEAM TO MATCH NOTCH SHOWN ABOVE FOR THIS ALTERNATE.

NOTES:

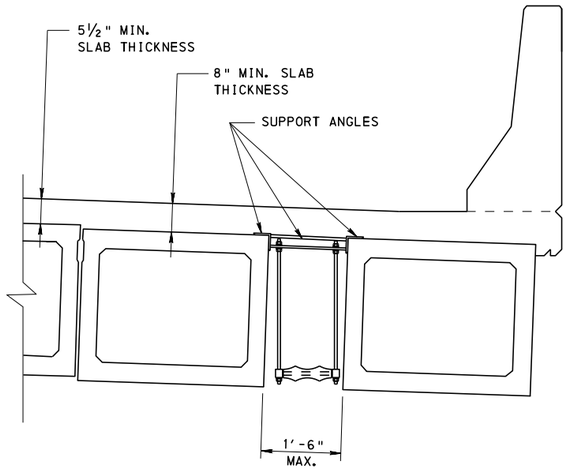
1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

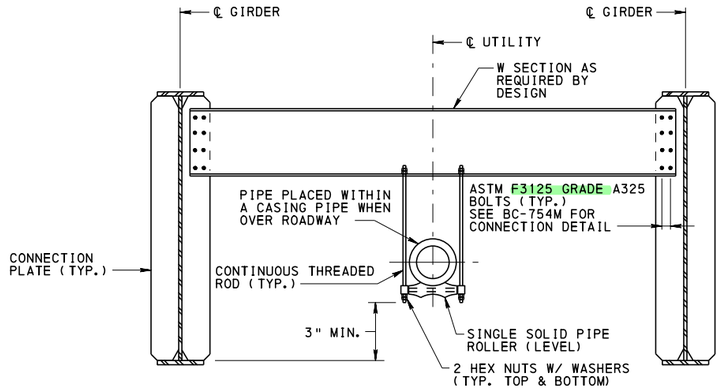
STANDARD
CONCRETE DIAPHRAGM DETAILS
FOR STEEL I-BEAM STRUCTURES

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 3 OF 3
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-611M

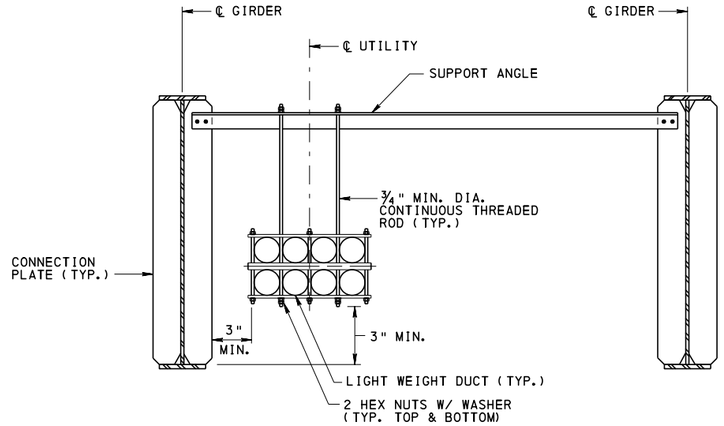
CHANGE 2



LOCATION OF UTILITIES
ON ADJACENT BOX BRIDGES



WATER OR GAS LINE SUPPORT DETAIL
N.T.S.



UTILITY SUPPORT DETAIL
N.T.S.

NOTES:

1. ALL COMPONENTS FOR SUPPORTS MUST BE DESIGNED DURING FINAL PLAN PREPARATION.
2. SHOP DRAWINGS OF SUPPORTS MUST BE PROVIDED AND APPROVED PRIOR TO CONSTRUCTION.
3. GALVANIZE ALL HANGERS, SUPPORTS AND ASSOCIATED HARDWARE. IN ADDITION, FOR STEEL BRIDGES PAINT ALL FABRICATED STEEL WITH ZINC RICH PRIMER AND APPLY FINISH COAT TO MATCH BEAM COLOR.
4. VERTICAL POSITION OF UTILITIES MUST BE SET TO PROVIDE AT LEAST 3" CLEARANCE TO BOTTOM OF BEAMS FROM UTILITY OR ITS CASING. IN ADDITION, MAINTAIN AT LEAST 1" CLEARANCE FROM UTILITY TO TOP OR BOTTOM HORIZONTAL REBARS IN END DIAPHRAGM.

SPECIAL RESTRICTIONS AND NOTES FOR: LOCATION OF PIPES CARRYING CHEMICALS OR HEAT RADIATING GASES OR FLUIDS & OF CONDUITS CARRYING ELECTRICAL POWER:

NOT ACCEPTABLE:

1. EMBEDMENT OF SUCH PIPES IN P/S ADJACENT BOX BEAMS.
2. EMBEDMENT OF SUCH PIPES IN CURBS & PARAPETS UNLESS SPECIAL PROVISIONS (TO BE APPROVED BY THE BRIDGE ENGINEER) ARE TO BE MADE TO PERMIT DISSIPATION OF THE DEVELOPING HEAT.

ACCEPTABLE:

1. BETWEEN BEAMS ON SPREAD BEAM BRIDGES (I OR BOX).
2. UNDER DIVISOR, IF IN EXISTENCE.
3. ON COMPOSITE ADJACENT BOXES WHEN SPREAD UP TO 1'-6". IN THIS CASE SLAB THICKNESS BETWEEN BEAMS DESIGNED PER BD-601M. ALSO SPECIAL PROVISIONS (TO BE APPROVED BY THE BRIDGE ENGINEER) ARE TO BE MADE TO PERMIT DISSIPATION OF THE DEVELOPING HEAT.

SPECIAL REQUIREMENTS FOR FLUID CARRYING PIPES:

1. STEEL CASING REQUIRED IN SPANS OVER ROADWAYS OR WALKWAYS.

DESIGN INSTRUCTIONS:

1. FURNISH COMPUTATIONS FOR ADJACENT BEAMS WHEN UTILITY LOAD IS LOCATED BETWEEN BEAMS AND IS MORE THAN 5 lb/ft.
2. FURNISH COMPUTATIONS IN ANY CASE FOR ADJACENT BEAMS WHEN UTILITY IS SUSPENDED FROM OVERHANGING SLAB OR DIVISOR (INCLUDE HORIZONTAL ACCIDENTAL IMPACT ON RAILING AND PARAPET).
3. STRUCTURES WITH CATHODIC PROTECTION REQUIRE SPECIAL DETAILS AND APPROVAL OF BRIDGE ENGINEER.

BD-601M	CONCRETE DECK SLAB
BC-754M	STEEL DIAPHRAGMS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

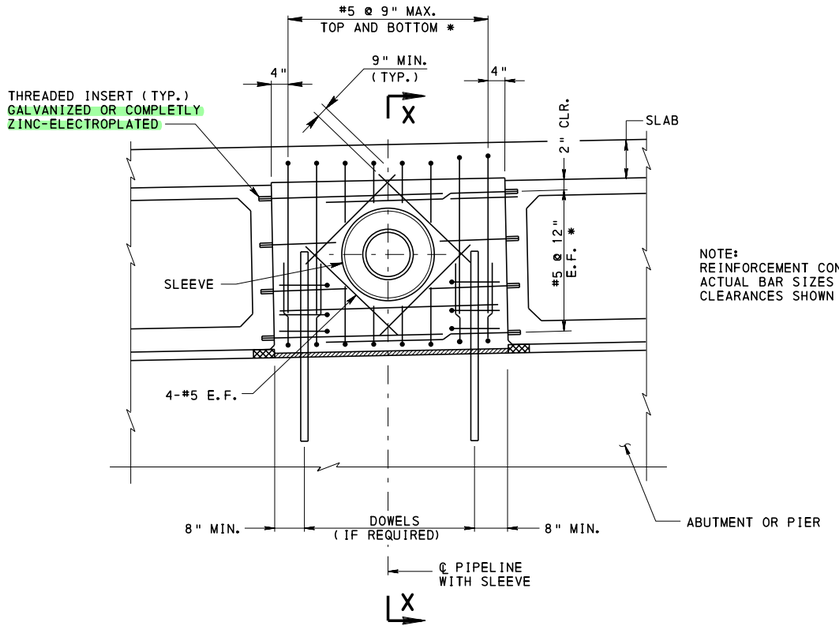
STANDARD
UTILITY ATTACHMENT
TO SUPERSTRUCTURE

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 3

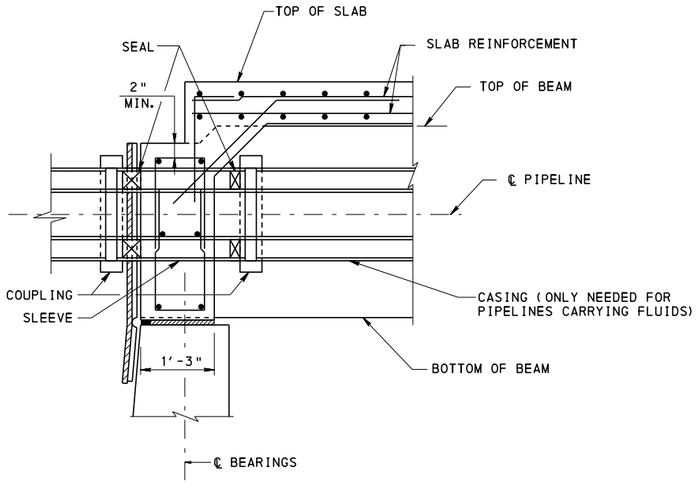
BD-612M



PIPELINE UTILITY - FULL DEPTH DIAPHRAGM

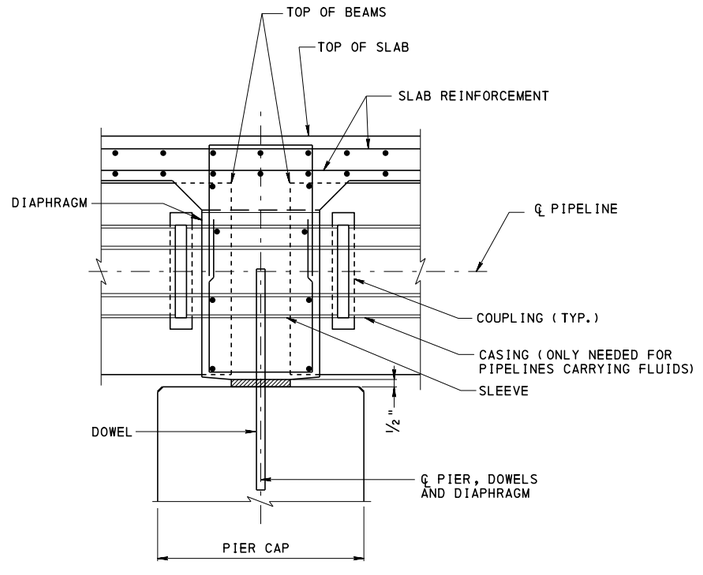
(SLAB REINFORCEMENT NOT SHOWN FOR CLARITY)

NOTE:
REINFORCEMENT CONFIGURATIONS SHOWN ARE MINIMUMS.
ACTUAL BAR SIZES AND SPACING MUST BE DESIGNED.
CLEARANCES SHOWN ARE MINIMUMS.



SECTION X-X (AT ABUTMENT)

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



SECTION X-X (AT PIER)

LEGEND:

E.F.	DENOTES EACH FACE
	PREFORMED CELLULAR POLYSTYRENE
*	SPLAY OR CUT AS NEEDED TO ACCOMMODATE UTILITY

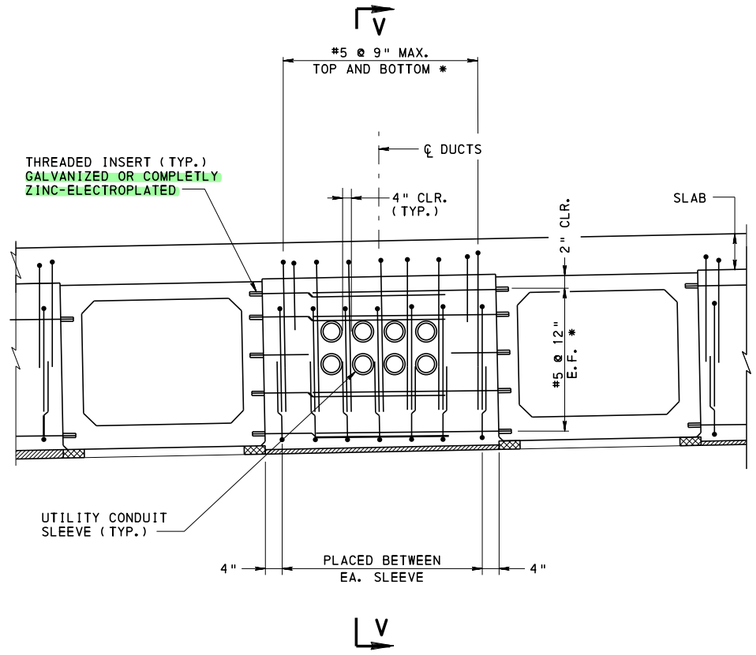
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD UTILITY ATTACHMENT TO SUPERSTRUCTURE

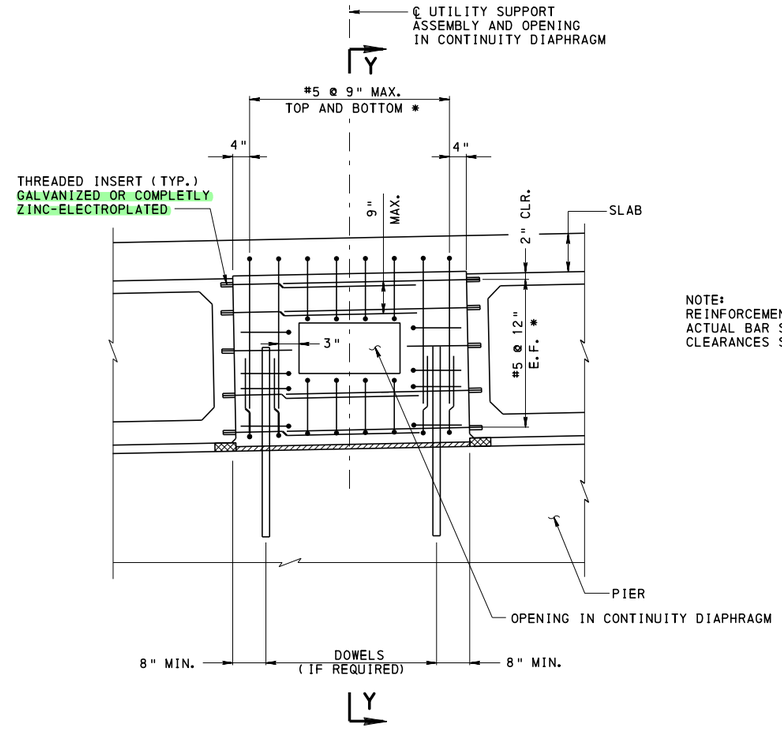
RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

BD-612M

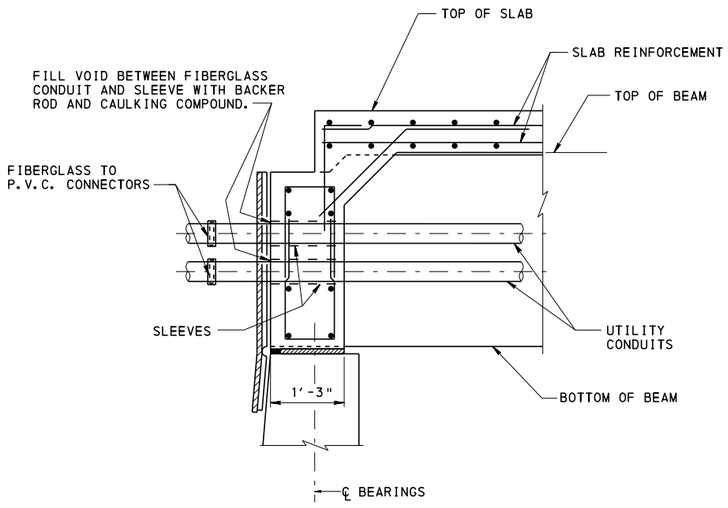


END DIAPHRAGM W/MULTIPLE SLEEVES
FOR UTILITY CONDUITS
(SLAB REINFORCEMENT NOT SHOWN FOR CLARITY)



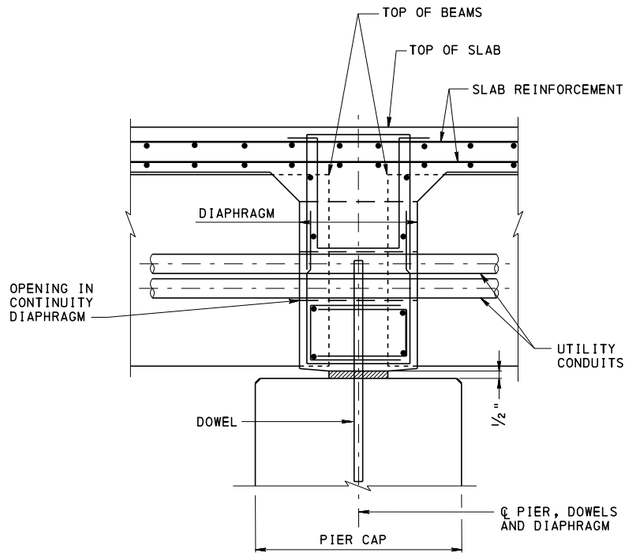
PIER DIAPHRAGM OPENING
FOR UTILITY CONDUITS
(SLAB REINFORCEMENT NOT SHOWN FOR CLARITY)

NOTE:
REINFORCEMENT CONFIGURATIONS SHOWN ARE MINIMUMS.
ACTUAL BAR SIZES AND SPACING MUST BE DESIGNED.
CLEARANCES SHOWN ARE MINIMUMS.



SECTION V-V

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



SECTION Y-Y

LEGEND:

E.F.	DENOTES EACH FACE
	PREFORMED CELLULAR POLYSTYRENE
*	SPLAY OR CUT AS NEEDED TO ACCOMMODATE UTILITY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD UTILITY ATTACHMENT TO SUPERSTRUCTURE

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 3 OF 3

BD-612M

CHANGE 5

DESIGN METHODOLOGY:

1. THE INFORMATION SHOWN IN THIS STANDARD IS PROVIDED FOR USE IN THE DEVELOPMENT OF THE CONTRACT DOCUMENTS. THE DESIGNER IS RESPONSIBLE FOR THE PRESENTATION OF ALL DESIGN INFORMATION. BEARING DESIGN DRAWINGS SHOULD INCLUDE, AS A MINIMUM, BEARING LOCATION PLAN, LOAD TABLE, TABLE OF DIMENSIONS FOR TYPE AND SIZE (LOAD) OF BEARING(S) SELECTED, REFERENCE TO BC-756M AND ANY OTHER DETAILS NECESSARY FOR THE COMPLETION OF SHOP DRAWINGS AND FABRICATION BY THE CONTRACTOR.

2. THE INFORMATION SHOWN IN THIS STANDARD AND BC-756M MAY BE USED FOR BEARING DESIGNS BY EITHER AASHTO STANDARD SPECIFICATIONS UTILIZING SERVICE LOADS OR AASHTO LRFD SPECIFICATIONS UTILIZING SERVICE AND EXTREME EVENT LIMIT STATE LOAD COMBINATIONS AS MODIFIED BY DM-4 AND HEREIN.

3. DIVIDE THE HORIZONTAL SEISMIC LOADS, DERIVED FROM EITHER SPECIFICATION, BY 1.5 PER AASHTO (1992) STANDARD SPECIFICATION, DIVISION 1-A, SECTION 7.1.

4. A TOTAL DESIGN ROTATION OF 0.03 RADIANS (INCLUDING 0.02 RADIANS OF CONSTRUCTION TOLERANCE) WAS USED FOR THIS STANDARD.

5. GUIDED AND NON-GUIDED BEARINGS ARE DESIGNED FOR A TOTAL LONGITUDINAL MOVEMENT OF 3" (PLUS 1" OF CONSTRUCTION TOLERANCE IN EACH DIRECTION). ADDITIONAL LONGITUDINAL MOVEMENT CAN BE ACCOMMODATED BY INCREASING THE LENGTH OF THE SOLE PLATE, STAINLESS STEEL, GUIDE BARS, AND GUIDE PLATE.

6. NON-GUIDED BEARINGS ARE DESIGNED FOR A TOTAL TRANSVERSE MOVEMENT OF 0.5" (PLUS 0.75" OF CONSTRUCTION TOLERANCE IN EACH DIRECTION). ADDITIONAL TRANSVERSE MOVEMENT CAN BE ACCOMMODATED BY INCREASING APPROPRIATE COMPONENT DIMENSIONS.

7. WELDED CONNECTIONS ARE DESIGNED USING ALLOWABLE STRESS DESIGN.

POT DESIGN:

1. THE THICKNESS OF THE POT WALL OF THE FIXED AND GUIDED BEARINGS WAS CALCULATED USING AASHTO (1998) LRFD EQUATION 14.7.4.7-1 AND SECTION C14.7.4.6.

2. THE THICKNESS OF THE POT WALL OF THE NON-GUIDED BEARINGS ARE DESIGNED FOR A NOMINAL HORIZONTAL LOAD EQUAL TO 10% OF THE DESIGN VERTICAL CAPACITY (P_r), AND USING AASHTO (1998) LRFD EQUATION 14.7.4.6-5 (P_r=10%P_r) AND SECTION C14.7.4.6.

3. THE THICKNESS OF THE POT BASE WAS CALCULATED USING AASHTO (1998) LRFD EQUATIONS 14.7.4.6-3 AND 14.7.4.6-4.

PISTON DESIGN:

1. THE HEIGHT OF THE PISTON RIM WAS CALCULATED USING AASHTO (1998) LRFD EQUATIONS 14.7.4.7-2 AND 14.7.4.7-3 ALONG WITH SECTION C14.7.4.7.

2. THE DIAMETER OF THE PISTON WAS CALCULATED USING AASHTO (1998) LRFD EQUATION 14.7.4.7-4 AND USING A MAXIMUM CLEARANCE OF 0.04" BETWEEN THE PISTON AND THE POT AND A DESIGN ROTATION OF 0.03 RADIANS.

MASONRY PLATE DESIGN:

1. THE MASONRY PLATE WAS DESIGNED ASSUMING IT WILL BE PLACED NORMAL TO THE BEAM/GIRDER CENTERLINE. OTHER ORIENTATIONS BETWEEN THE MASONRY PLATE AND THE BEAM/GIRDER CENTERLINE ARE PERMITTED. HOWEVER, THE ENGINEER IS REQUIRED TO CHECK ALL GEOMETRY TO ENSURE THAT ALL CLEARANCE REQUIREMENTS ARE SATISFIED.

2. THE MASONRY PLATE THICKNESS (A) HAS BEEN DESIGNED FOR BENDING IN THE FOLLOWING MANNER: THE PRESSURE DUE TO THE BEARING REACTION IS ASSUMED TO DISTRIBUTE EVENLY OVER THE ENTIRE MASONRY PLATE. THE MINIMUM PLATE THICKNESS IS THEN DESIGNED BY MODELING THE MASONRY PLATE AS A CANTILEVER BEAM WITH A CANTILEVER LENGTH EQUAL TO THE LONGEST PERPENDICULAR DISTANCE BETWEEN THE EDGE OF THE MASONRY PLATE AND EDGE OF THE POT PLATE.

SOLE PLATE DESIGN:

1. THE SOLE PLATE THICKNESS (H) HAS BEEN DESIGNED FOR BENDING IN THE FOLLOWING MANNER: CIRCULAR PTFE IS ASSUMED AS AN EQUIVALENT SQUARE AREA. THE PRESSURE IS THEN ASSUMED TO DISTRIBUTE FROM THE PTFE THROUGH THE PLATE AT A 1:1.5 SLOPE. THE MINIMUM PLATE THICKNESS IS THEN DESIGNED BY MODELING THE SOLE PLATE AS A CANTILEVER BEAM. THE CANTILEVER BEAM LENGTH ASSUMED IS THE MINIMUM OF THE FOLLOWING DIMENSIONS:
   - THE LARGEST DISTANCE FROM THE EDGE OF DISTRIBUTED PRESSURE AREA TO THE EDGE OF THE PTFE'S (OR PISTON'S) ASSUMED EQUIVALENT SQUARE AREA.
   - THE LARGEST DISTANCE FROM THE EDGE OF THE SOLE PLATE TO THE EDGE OF THE PTFE'S (OR PISTON'S) ASSUMED EQUIVALENT SQUARE AREA.

2. THE SOLE PLATE THICKNESS GIVEN IN COLUMN "H" IS THE MINIMUM THICKNESS. ANY ADDITIONAL THICKNESS, "I", REQUIRED TO ACCOMMODATE THE BEVEL MUST BE ADDED TO THE OVERALL BEARING HEIGHT GIVEN IN COLUMN "PP".

3. A MINIMUM SOLE PLATE THICKNESS OF 0.8125" WAS USED FOR THIS STANDARD.

INSTRUCTIONS FOR USING DESIGN TABLES:

1. CALCULATE THE MINIMUM AND MAXIMUM VERTICAL DESIGN LOAD REACTIONS PER BEARING AS FOLLOWS:

   LRFD SPECIFICATIONS
   - USE THE SERVICE I AND EXTREME EVENT I LIMIT STATES.
   - COMPUTE THE MINIMUM REACTION LOADS BY INCLUDING THE MINIMUM VALUE OF PERMANENT LOADS AND THE LOADS THAT PRODUCE UPLIFT.

   STANDARD SPECIFICATIONS
   - USE ALL SERVICE LOAD GROUPS.
   - REDUCE LOADS BY THE PERCENT INCREASE IN ALLOWABLE STRESS AS PERMITTED BY AASHTO.
   - THE PERCENT INCREASE IN ALLOWABLE STRESS, AS DEFINED BY AASHTO, SHOULD NOT BE USED FOR THE CALCULATION OF THE MINIMUM VERTICAL DESIGN LOAD.
   - COMPUTE THE MINIMUM REACTION LOADS BY INCLUDING THE MINIMUM VALUE OF PERMANENT LOADS AND THE LOADS THAT PRODUCE UPLIFT.

2. FOR FIXED AND GUIDED BEARING CALCULATE THE MAXIMUM HORIZONTAL DESIGN LOAD PER BEARING AS FOLLOWS:

   LRFD SPECIFICATIONS
   - USE THE SERVICE I AND EXTREME EVENT I LIMIT STATES.
   - DIVIDE THE EXTREME EVENT I LIMIT STATE LOADS BY 1.50.
   - FOR FIXED BEARINGS COMPUTE THE MAXIMUM HORIZONTAL DESIGN LOAD AS THE RESULTANT VECTOR SUM OF THE HORIZONTAL LOADS FOR EACH LIMIT STATE.
   - FOR GUIDED BEARINGS, COMPUTE THE MAXIMUM HORIZONTAL DESIGN LOAD AS THE RESULTANT SUM OF THE HORIZONTAL LOADS FOR EACH LIMIT STATE APPLIED NORMAL TO THE ORIENTATION OF THE GUIDE BAR.

   STANDARD SPECIFICATIONS
   - USE ALL SERVICE LOAD GROUPS.
   - REDUCE LOADS BY THE PERCENT INCREASE IN ALLOWABLE STRESS AS PERMITTED BY AASHTO.
   - DIVIDE THE GROUP VII LOADS BY 1.50.
   - FOR FIXED BEARINGS COMPUTE THE MAXIMUM HORIZONTAL DESIGN LOAD AS THE RESULTANT VECTOR SUM OF THE HORIZONTAL LOADS FOR EACH LOAD GROUP.
   - FOR GUIDED BEARINGS, COMPUTE THE MAXIMUM HORIZONTAL DESIGN LOAD AS THE RESULTANT SUM OF THE HORIZONTAL LOADS FOR EACH LOAD GROUP APPLIED NORMAL TO THE ORIENTATION OF THE GUIDE BAR.

   INSTRUCTIONS BELOW ARE APPLICABLE TO BOTH THE AASHTO LRFD SPECIFICATIONS AND STANDARD SPECIFICATIONS

3. DETERMINE THE CONTROLLING MINIMUM AND MAXIMUM VERTICAL DESIGN LOAD REACTIONS AND THE MAXIMUM HORIZONTAL DESIGN LOAD. THESE ARE THE DESIGN LOADS TO BE USED WITH THE DESIGN TABLES. IF THE MAXIMUM DESIGN LOAD IS GREATER THAN 1500 KIPS THESE DESIGN STANDARDS ARE NOT APPLICABLE.

4. CALCULATE THE MAXIMUM GIRDER END ROTATION ABOUT EACH AXIS DUE TO MAXIMUM LIVE LOAD PLUS IMPACT AS WELL AS ALL PERMANENT LOADS AND GEOMETRIC CONSTRAINTS SUCH AS ROADWAY GEOMETRY AND CAMBER. ALL OR MOST OF THE ROTATION DUE TO PERMANENT LOADS AND GEOMETRY MAY BE ACCOMMODATED BY BEVELING THE SOLE PLATE. INCLUDE THE ROTATIONS NOT ACCOMMODATED BY THE BEVELED SOLE PLATE IN THE DESIGN ROTATION. COMPUTE THE VECTOR RESULTANT SUM OF THE TRANSVERSE AND LONGITUDINAL ROTATIONS AND ADD 0.02 RADIANS FOR CONSTRUCTION TOLERANCE. IF THE TOTAL ROTATION INCLUDING THE CONSTRUCTION TOLERANCE EXCEEDS 0.03 RADIANS, THE DESIGN TABLES ARE NOT APPLICABLE. COMPUTE ROTATIONS USING THE SERVICE I LIMIT STATE FOR LRFD DESIGNS. COMPUTE ROTATIONS USING APPLICABLE SERVICE LOAD GROUPS FOR DESIGNS USING STANDARD SPECIFICATIONS.

5. FOR FIXED AND GUIDED BEARINGS, COMPUTE THE RATIO OF THE MAXIMUM HORIZONTAL DESIGN LOAD TO THE MAXIMUM VERTICAL DESIGN LOAD $(H/V)_{DES}$ ON THE BEARING. FOR $(H/V)_{DES}$ RATIOS LESS THAN OR EQUAL TO 0.10, USE THE 10% HORIZONTAL LOAD TABLES. FOR $(H/V)_{DES}$ RATIOS GREATER THAN 0.10 AND LESS THAN OR EQUAL TO 0.30, USE THE 30% HORIZONTAL LOAD TABLES.

   NOTE THAT IT IS ACCEPTABLE TO USE BEARINGS WITH VERTICAL LOAD CAPACITIES GREATER THAN THE MAXIMUM VERTICAL DESIGN LOAD TO PROVIDE A GREATER HORIZONTAL LOAD CAPACITY. THIS PROCEDURE MAY BE USED FOR THE SELECTION OF MORE ECONOMICAL BEARINGS OR TO ACHIEVE A SATISFACTORY DESIGN WHERE THE PRELIMINARY BEARING SELECTION DOES NOT SATISFY THE $(H/V)_{DES}$ RATIO CRITERIA OF 0.30.

6. CHOOSE THE APPROPRIATE DESIGN TABLE. TABLES ARE DIVIDED BASED ON BEARING TYPE AND H/V RATIOS.

7. SELECT A PRELIMINARY BEARING SIZE FROM THE DESIGN TABLES WITH A LOAD CAPACITY EQUAL TO OR EXCEEDING THE DESIGN LOAD IN BOTH THE HORIZONTAL AND VERTICAL DIRECTIONS.

8. COMPUTE THE RATIO OF THE MINIMUM VERTICAL DESIGN LOAD TO VERTICAL LOAD CAPACITY OF THE BEARING. IF THIS RATIO IS LESS THAN 0.20, THE DESIGN TABLES ARE NOT APPLICABLE.

9. FOR GUIDED AND NON-GUIDED BEARINGS, CALCULATE THE TOTAL LONGITUDINAL MOVEMENT (NOT INCLUDING THE 1" CONSTRUCTION TOLERANCE IN EACH DIRECTION). IF THE TOTAL LONGITUDINAL MOVEMENT IS GREATER THAN 3", INCREASE THE FOLLOWING DIMENSIONS AN AMOUNT EQUAL TO THE TOTAL LONGITUDINAL MOVEMENT MINUS 3"
   - SOLE PLATE: "J"
   - STAINLESS STEEL PLATES: "LL" AND "NN"
   - GUIDE BARS: "CC"

10. ONCE ALL DESIGN LOAD CRITERIA ARE SATISFIED, THE BEARING DIMENSIONS SHOWN IN THE DESIGN TABLES FOR THE INDIVIDUAL BEARING MAY BE USED.

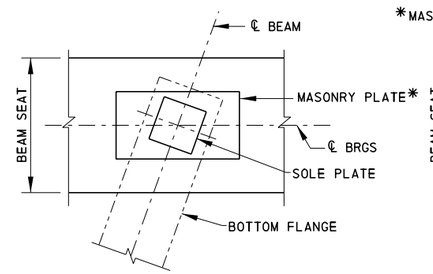
11. DESIGN THE CONNECTION OF THE SOLE PLATE TO THE GIRDER IN ACCORDANCE WITH THE SCHEMATICS OF BC-756M AND THE AASHTO BRIDGE DESIGN SPECIFICATIONS. ALL TABULATED SOLE PLATE DIMENSIONS ARE MINIMUMS.

INSTRUCTIONS FOR USING DESIGN TABLES CON'T:

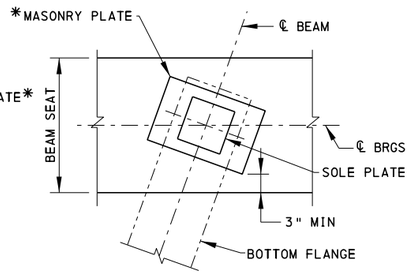
12. WHERE THE CENTERLINE OF THE MASONRY PLATE IS NOT PARALLEL TO THE CENTERLINE OF THE BEAM AND SOLE PLATE, COMPUTE CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND THE SOLE PLATE AND GUIDE BARS. IF REQUIRED, TO PROVIDE NECESSARY CLEARANCES, RESIZE THE FOLLOWING MASONRY PLATE DIMENSIONS:
   - MASONRY PLATE WIDTH: "B"
   - MASONRY PLATE LENGTH: "C"
   - MASONRY PLATE THICKNESS: "A"
   - ANCHOR BOLT LOCATION: " D"

13. CHECK OVERALL GEOMETRY AND VERIFY THAT ALL OTHER DESIGN REQUIREMENTS ARE SATISFIED. RECOMPUTE THE BEARING HEIGHT, "PP", WHEN BEVELED SOLE PLATES ARE USED AND/OR THE MASONRY PLATE THICKNESS IS INCREASED.

14. CHECK THAT ANCHOR BOLTS DO NOT INTERFERE WITH PIER OR ABUTMENT REINFORCEMENT, AND THAT THE BEARING ASSEMBLY MEETS ALL CLEARANCE REQUIREMENTS RELATIVE TO ITS PLACEMENT ON THE SUBSTRUCTURE AND CONNECTION TO THE SUPERSTRUCTURE.



SKEWED TO ℄ BEAM



NORMAL TO ℄ BEAM

SOLE AND MASONRY PLATE ORIENTATION OPTIONS

*- TO FACILITATE FUTURE REPLACEMENT, CONSIDER SIZING MASONRY PLATE AND LOCATING ANCHOR BOLTS SO THAT THE BOLTS ARE NOT BENEATH THE GIRDER FLANGE.

INDEX OF SHEETS

STANDARD ABBREVIATIONS:

HLMR - HIGH LOAD MULTI-ROTATIONAL
DIA. - DIAMETER
I.D. - INSIDE DIAMETER
Ø - DIAMETER
PTFE - POLYTETRAFLUOROETHYLENE
G.P. = GUIDE PLATE
G.B. = GUIDE BAR

BC-756M	HIGH LOAD MUTI ROTATIONAL POT BEARINGS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
HIGH LOAD MULTI-ROTATIONAL
POT BEARINGS
DESIGN METHODOLOGY

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 7

BD-613M

GUIDED POT BEARING DESIGN EXAMPLE
LRFD SPECIFICATIONS

AASHTO LRFD LIMIT STATES	DESIGN LOADS (KIPS)										
	VERTICAL								HORIZONTAL		
	DL		LL+I		WIND		TOTAL		TRANSVERSE	LONGITUDINAL	RESOLUTION
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX			
SERVICE I	200	220	-5	124	-7	20	188	364	44	0	44
EXTREME EVENT I	180	250	0	0	0	0	180	250	46	0	46/1.5=30.7

PARAMETERS:

DESIGN LOADS: SEE BEARING SCHEDULE
SKEW ANGLE: 70 DEGREES
SERVICE LOAD ROTATION: 0.007 RADIANS
TOTAL LONGITUDINAL MOVEMENT: 2.70" (2 X CONTRACTION OF 1.35")

DESIGN:

1. DETERMINE CONTROLLING DESIGN LOADS (SEE TABLE):

   VERTICAL LOADS:
   MAXIMUM: 364 KIPS
   MINIMUM: 180 KIPS

   HORIZONTAL LOAD: 44 KIPS

2. CHECK ROTATIONAL CAPACITY:

   SERVICE ROTATION = 0.007 RADIANS
   CONSTRUCTION ROTATION TOLERANCE = 0.02 RADIANS
   DESIGN ROTATION = 0.007 + 0.02 = 0.027 RADIANS < 0.03 OK
   TO USE DESIGN TABLES

3. SELECT APPROPRIATE LOAD TABLE:

   DESIGN HORIZONTAL LOAD/DESIGN VERTICAL LOAD = 44/364 = 12%
   TRY 30% LOAD TABLES

4. SELECT PRELIMINARY BEARING SIZE:

   REQUIRED VERTICAL LOAD CAPACITY = 364 KIPS
   REQUIRED HORIZONTAL LOAD CAPACITY = 44
   TRY 400 KIP BEARING > 364 OK
   HORIZONTAL LOAD CAPACITY 120 > 44 OK

   ALTERNATIVELY, A 450 KIP BEARING FROM THE 10% LOAD TABLE COULD BE SELECTED SINCE THE HORIZONTAL CAPACITY IS LISTED AS 45 KIPS WHICH IS > THAN THE 44 KIP DESIGN LOAD.

5. CHECK 20% VERTICAL LOAD CRITERION

   VERTICAL CAPACITY = 400 KIPS
   MINIMUM VERTICAL LOAD = 180 KIPS
   MINIMUM VERTICAL DESIGN LOAD / VERTICAL CAPACITY = 180/400 = 0.45 > 0.20 OK

6. CHECK ALTERNATIVE DESIGN(USING 10% DESIGN TABLE):

   VERTICAL CAPACITY = 450 KIPS
   MINIMUM VERTICAL DESIGN LOAD /VERTICAL CAPACITY = 180/450 = 0.33 > 0.20 OK

   ALTHOUGH BOTH BEARINGS SATISFY THE LOAD CHECKS, ONE MAY BE MORE APPROPRIATE FOR A PARTICULAR APPLICATION. SELECT MOST APPROPRIATE BEARING.

7. CHECK MOVEMENT CAPACITY:
   TOTAL MOVEMENT = 2 X ONE-WAY MOVEMENT = 2 X 1.35" = 2.70" < 3.0" OK

8. ONCE ALL DESIGN LOAD CRITERIA ARE SATISFIED, THE BEARING DIMENSIONS SHOWN IN THE DESIGN TABLES FOR THE INDIVIDUAL BEARING MAY BE USED.

9. DESIGN THE CONNECTION OF THE SOLE PLATE TO THE GIRDER IN ACCORDANCE WITH THE SCHEMATICS OF BC-756M AND THE AASHTO BRIDGE DESIGN SPECIFICATIONS. ALL TABULATED SOLE PLATE DIMENSIONS ARE MINIMUMS.

10. IF THE CENTERLINE OF THE MASONRY PLATE IS NOT PARALLEL TO THE CENTERLINE OF THE BEAM AND SOLE PLATE, CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND THE SOLE PLATE AND GUIDE BARS MUST BE CHECKED. IF REQUIRED TO PROVIDE NECESSARY CLEARANCES, RESIZE THE FOLLOWING MASONRY PLATE DIMENSIONS:

    MASONRY PLATE WIDTH: "B"
    MASONRY PLATE LENGTH: "C"
    MASONRY PLATE THICKNESS: "A"
    ANCHOR BOLT LOCATION: "D"

11. CHECK OVERALL GEOMETRY AND VERIFY THAT ALL OTHER DESIGN REQUIREMENTS ARE SATISFIED. RECOMPUTE THE BEARING HEIGHT, "PP", WHEN BEVELED SOLE PLATES ARE USED AND/OR THE MASONRY PLATE THICKNESS IS INCREASED.

12. CHECK THAT ANCHOR BOLTS DO NOT INTERFERE WITH PIER OR ABUTMENT REINFORCEMENT, AND THAT THE BEARING ASSEMBLY MEETS ALL CLEARANCE REQUIREMENTS RELATIVE TO ITS PLACEMENT ON THE SUBSTRUCTURE AND CONNECTION TO THE SUPERSTRUCTURE.

GUIDED POT BEARING DESIGN EXAMPLE
STANDARD SPECIFICATIONS - SERVICE LOAD DESIGN

AASHTO SERVICE LOAD GROUP	DESIGN LOADS (KIPS)										
	VERTICAL								HORIZONTAL		
	DL		LL+I		WIND		TOTAL		TRANSVERSE	LONGITUDINAL	RESOLUTION
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX			
1	200	220	-5	124	-	-	195	344	0	0	0
2	200	220	-	-	-7	20	193	240/1.25=192	38	0	38/1.25=30.4
3	200	220	-5	124	-2	6	193	350/1.25=280	22	0	22/1.25=17.6
4	200	220	-5	124	-	-	195	344/1.25=275.2	0	0	0
5	200	220	-	-	-7	20	193	240/1.4=171.4	38	0	38/1.4=27.1
6	200	220	-5	124	-2	6	193	350/1.4=250	22	0	22/1.4=15.7
7	200	220	-	-	-	-	200	220/1.5=146.7	46	0	46/1.5=30.7

PARAMETERS:

DESIGN LOADS: SEE BEARING SCHEDULE
SKEW ANGLE: 70 DEGREES
SERVICE LOAD ROTATION: 0.007 RADIANS
TOTAL LONGITUDINAL MOVEMENT: 2.70" (2 X CONTRACTION OF 1.35")

DESIGN:

1. DETERMINE CONTROLLING DESIGN LOADS(SEE TABLE):

   VERTICAL LOADS:
   MAXIMUM: 344 KIPS
   MINIMUM: 193 KIPS

   HORIZONTAL LOAD: 30.7 KIPS

2. CHECK ROTATIONAL CAPACITY:

   SERVICE ROTATION = 0.007 RADIANS
   CONSTRUCTION ROTATION TOLERANCE = 0.02 RADIANS
   DESIGN ROTATION = 0.007 + 0.02 = 0.027 RADIANS < 0.03 OK
   TO USE DESIGN TABLES

3. SELECT APPROPRIATE LOAD TABLE:

   DESIGN HORIZONTAL LOAD/DESIGN VERTICAL LOAD = 30.7/344 = 8.9%
   USE 10% LOAD TABLES

4. SELECT PRELIMINARY BEARING SIZE:

   REQUIRED VERTICAL LOAD CAPACITY = 344 KIPS
   REQUIRED HORIZONTAL LOAD CAPACITY = 30.7 KIPS
   TRY 350 KIP BEARING > 344 OK
   HORIZONTAL LOAD CAPACITY 35 > 30.7 OK

5. CHECK 20% VERTICAL LOAD CRITERION

   VERTICAL CAPACITY = 350 KIPS
   MINIMUM VERTICAL DESIGN LOAD / VERTICAL CAPACITY = 193/350 = 0.55 > 0.20 OK

6. CHECK MOVEMENT CAPACITY:
   TOTAL LONGITUDINAL MOVEMENT = 2 X ONE-WAY MOVEMENT = 2 X = 1.35" = 2.70" < 3.0" OK

7. ONCE ALL DESIGN LOAD CRITERIA ARE SATISFIED, THE BEARING DIMENSIONS SHOWN IN THE DESIGN TABLES FOR THE INDIVIDUAL BEARING MAY BE USED.

8. DESIGN THE CONNECTION OF THE SOLE PLATE TO THE GIRDER IN ACCORDANCE WITH THE SCHEMATICS OF BC-756M AND THE AASHTO BRIDGE DESIGN SPECIFICATIONS. ALL TABULATED SOLE PLATE DIMENSIONS ARE MINIMUMS.

9. IF THE CENTERLINE OF THE MASONRY PLATE IS NOT PARALLEL TO THE CENTERLINE OF THE BEAM AND SOLE PLATE, CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND THE SOLE PLATE AND GUIDE BARS MUST BE CHECKED. IF REQUIRED TO PROVIDE NECESSARY CLEARANCES, RESIZE THE FOLLOWING MASONRY PLATE DIMENSIONS:

    MASONRY PLATE WIDTH: "B"
    MASONRY PLATE LENGTH: "C"
    MASONRY PLATE THICKNESS: "A"
    ANCHOR BOLT LOCATION: "D"

10. CHECK OVERALL GEOMETRY AND VERIFY THAT ALL OTHER DESIGN REQUIREMENTS ARE SATISFIED. RECOMPUTE THE BEARING HEIGHT, "PP", WHEN BEVELED SOLE PLATES ARE USED AND/OR THE MASONRY PLATE THICKNESS IS INCREASED.

11. CHECK THAT ANCHOR BOLTS DO NOT INTERFERE WITH PIER OR ABUTMENT REINFORCEMENT, AND THAT THE BEARING ASSEMBLY MEETS ALL CLEARANCE REQUIREMENTS RELATIVE TO ITS PLACEMENT ON THE SUBSTRUCTURE AND CONNECTION TO THE SUPERSTRUCTURE.

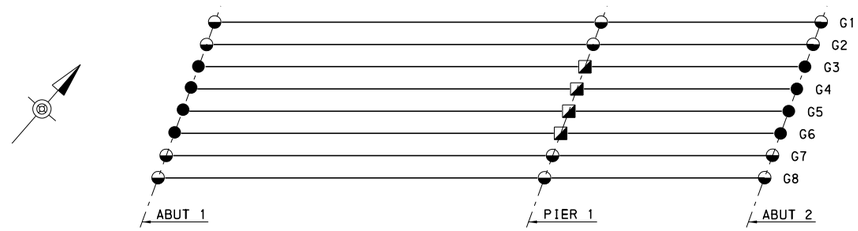
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
HIGH LOAD MULTI-ROTATIONAL
POT BEARINGS
ILLUSTRATIVE DESIGN EXAMPLE

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-613M



LEGEND:

- ◪ = FIXED POT BEARING
- ● = GUIDED EXPANSION POT BEARINGS
- ◒ = NON-GUIDED EXPANSION POT BEARINGS

SCHEMATIC POT BEARING LOCATION PLAN

FACTORED LOADS (kips)												BEARING SIZE REQUIRED		NUMBER OF BEARINGS REQUIRED
LOCATION	BEARING TYPE ✳	LIMIT STATE	VERTICAL						HORIZONTAL			MAXIMUM MOVEMENT (ONE-WAY) (INCHES)	VERTICAL LOAD (kips)	HORIZONTAL LOAD (kips)	
			DL		LL+I		TOTAL		TRANSVERSE	LONGITUDINAL	RESOLUTION				
			MIN	MAX	MIN	MAX	MIN	MAX							
ABUT 1	GUIDED EXP	SER I	124.0	177.7	-6.1	128.6	118.0	306.2	24.8	0	24.8	2.29"	350	105	4
		EXT I	155.0	227.8	0	0	155.0	227.8	77.4	0	77.4/1.5 = 51.60				
	NON-GUIDED EXP	SER I	124.1	211.5	-6.1	128.6	118.1	340.1	0	0	0	2.29"	350	35	4
		EXT I	155.2	270.1	0	0	155.2	270.1	0	0	0				
PIER	FIX	SER I	313.5	366.4	0	253.7	313.5	620.0	39.9	39.6	56.2	0"	750	225	4
		EXT I	391.8	471.2	0	0	391.8	471.2	161.5	278.3	326.8/1.5 = 217.9				
	NON-GUIDED EXP	SER I	317.7	446.6	0	253.7	317.7	700.2	0	0	0	0"	750	75	4
		EXT I	397.2	571.5	0	0	397.2	571.5	0	0	0				
ABUT 2	GUIDED EXP	SER I	100.9	131.9	-33.4	110.8	67.5	242.7	15.2	0	15.2	1.70"	300	30	4
		EXT I	63.7	117.4	0	0	63.7	117.4	39.5	0	39.5/1.5 = 26.3				
	NON-GUIDED EXP	SER I	100.0	138.2	-33.4	110.8	66.6	249.1	0	0	0	1.70"	250	25	4
		EXT I	62.5	137.8	0	0	62.5	137.8	0	0	0				

✳ SEE BC-756M FOR DETAILS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
HIGH LOAD MULTI-ROTATIONAL POT BEARINGS
EXAMPLE BEARING LOCATION PLAN AND LOAD TABLE

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

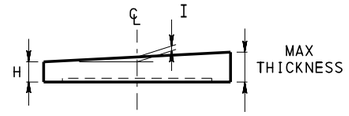
DESIGN TABLES FOR FIXED POT BEARINGS (10% HORIZONTAL LOAD)

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	ROTATION (RADS.)	MASONRY PLATE ▲						ANCHOR BOLT		SOLE PLATE ▲				POT						NEOPRENE DISC			PISTON				BEARING ✱ HEIGHT
			A	B	C	D	E	F	QTY.	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	PP
200	20	0.03	1½"	11⅞"	19⅜"	7⅞"	3 11/16"	-	4	1¼"	13/16"	PER DESIGN (BEVELED SOLE PLATE)	10⅜"	10⅜"	2 1/16"	10⅜"	1½"	9/16"	¼"	¾"	1"	8⅞"	⅜"	1⅛"	8.835	5/16"	¼"	5⅛"
250	25	0.03	1½"	13⅛"	20⅝"	8 1/16"	4⅝"	-	4	1¼"	13/16"		11⅝"	11⅝"	2 3/16"	11⅝"	1 9/16"	⅝"	¼"	⅞"	1"	9⅞"	⅜"	1⅛"	9.835	5/16"	¼"	5 3/16"
300	30	0.03	1½"	14"	21½"	8½"	4¾"	-	4	1¼"	13/16"		12½"	12½"	2 5/16"	12½"	1¾"	9/16"	¼"	⅞"	1⅛"	10¾"	⅜"	1¼"	10.710	⅜"	¼"	5⅜"
350	35	0.03	1½"	15¼"	22⅝"	9 1/16"	5⅜"	-	4	1¼"	13/16"		13⅝"	13⅝"	2 7/16"	13⅝"	1⅞"	9/16"	¼"	1"	1¼"	11⅝"	⅜"	1¼"	11.585	⅜"	¼"	5½"
400	40	0.03	1⅝"	15⅞"	23⅜"	9 7/16"	5 1/16"	-	4	1¼"	13/16"		14⅜"	14⅜"	2 9/16"	14⅜"	1 15/16"	⅝"	¼"	1"	1¼"	12⅜"	⅜"	1¼"	12.335	⅜"	¼"	5 1/16"
450	45	0.03	1⅝"	16⅞"	24⅜"	9 15/16"	6 3/16"	-	4	1¼"	13/16"		15⅜"	15⅜"	2¾"	15⅜"	2 1/16"	11/16"	¼"	1⅛"	1⅜"	13⅛"	⅜"	1⅜"	13.085	7/16"	¼"	6"
500	50	0.03	1⅝"	17½"	25"	10¼"	6½"	-	4	1¼"	13/16"		16"	16"	2 13/16"	16"	2⅛"	11/16"	¼"	1⅛"	1⅜"	13¾"	⅜"	1⅜"	13.710	7/16"	¼"	6"
550	55	0.03	1⅝"	18½"	26"	10¾"	7"	-	4	1¼"	13/16"		17"	17"	3 3/16"	17"	2¼"	15/16"	¼"	1¼"	1½"	14½"	⅜"	1½"	14.460	7/16"	¼"	6½"
600	60	0.03	1⅝"	19⅞"	26⅝"	11 1/16"	7 1/16"	-	4	1¼"	13/16"		17⅝"	17⅝"	3 3/16"	17⅝"	2 7/16"	¾"	¼"	1¼"	1⅝"	15⅛"	⅜"	1½"	15.085	½"	¼"	6 7/16"
650	65	0.03	1⅝"	21¼"	27¼"	11⅜"	8⅜"	-	4	1¼"	13/16"		18¼"	18¼"	3 3/16"	18¼"	2 7/16"	¾"	¼"	1¼"	1⅝"	15¾"	⅜"	1½"	15.710	½"	¼"	6 7/16"
700	70	0.03	1⅝"	22½"	28"	11¾"	9"	-	4	1¼"	13/16"		19"	19"	3 7/16"	19"	2½"	15/16"	¼"	1⅜"	1⅝"	16¼"	⅜"	1½"	16.210	½"	¼"	6⅝"
750	75	0.03	1⅝"	23¾"	28⅝"	12 1/16"	9⅝"	-	4	1¼"	13/16"		19⅜"	19⅝"	3 7/16"	19⅝"	2⅝"	13/16"	¼"	1⅜"	1¾"	16⅞"	⅜"	1⅝"	16.835	½"	¼"	6¾"
800	80	0.03	1⅝"	24⅞"	29⅜"	12 7/16"	10 3/16"	-	4	1¼"	13/16"		20⅜"	20⅜"	3 11/16"	20⅜"	2 11/16"	1"	¼"	1½"	1¾"	17⅜"	⅜"	1⅝"	17.335	9/16"	¼"	6 15/16"
850	85	0.03	1⅝"	26⅛"	29⅞"	12 11/16"	10 13/16"	-	4	1¼"	13/16"		20⅞"	20⅞"	3 11/16"	20⅞"	2 13/16"	⅞"	¼"	1½"	1⅞"	17⅞"	⅜"	1⅝"	17.835	9/16"	¼"	6 15/16"
900	90	0.03	1⅞"	26⅛"	31⅞"	13 5/16"	10 7/16"	-	4	1½"	13/16"		21⅜"	21⅜"	3 11/16"	21⅜"	2 13/16"	⅞"	¼"	1½"	1⅞"	18⅜"	⅜"	1⅝"	18.335	9/16"	¼"	7 3/16"
950	95	0.03	1⅞"	27"	32⅝"	13 11/16"	10⅞"	-	4	1½"	13/16"		22⅛"	22⅛"	3 15/16"	22⅛"	3"	15/16"	¼"	1⅝"	2"	18⅞"	½"	1¾"	18.835	9/16"	¼"	7½"
1000	100	0.03	1⅞"	28⅛"	33⅛"	13 15/16"	11 7/16"	-	4	1½"	13/16"		22⅝"	22⅝"	3 15/16"	22⅝"	3"	15/16"	¼"	1⅝"	2"	19⅜"	½"	1¾"	19.335	⅝"	¼"	7½"
1100	110	0.03	1⅞"	30¼"	34⅛"	14 7/16"	12½"	-	4	1½"	13/16"		23⅝"	23⅝"	4 3/16"	23⅝"	3⅜"	1"	¼"	1⅝"	2⅛"	20⅜"	½"	1¾"	20.335	⅝"	¼"	7 11/16"
1200	120	0.03	1⅞"	32⅛"	35¼"	15"	13 7/16"	-	4	1½"	13/16"		24¾"	24¾"	4 3/16"	24¾"	3 3/16"	1"	¼"	1¾"	2⅛"	21¼"	½"	1⅞"	21.210	11/16"	¼"	7 13/16"
1300	130	0.03	2"	33⅞"	37¾"	15⅞"	13 15/16"	-	4	1¾"	13/16"		25¾"	25¾"	4 7/16"	25¾"	3⅜"	1 1/16"	¼"	1⅞"	2¼"	22"	½"	1⅞"	21.960	11/16"	¼"	8⅛"
1400	140	0.03	2"	35⅝"	38⅝"	16 5/16"	14 13/16"	-	4	1¾"	13/16"		26⅝"	26⅝"	4 11/16"	26⅝"	3½"	1 3/16"	¼"	1⅞"	2⅜"	22⅞"	½"	2"	22.835	11/16"	¼"	8½"
1500	150	0.03	2"	37¼"	39⅝"	16 3/16"	15⅝"	-	4	1¾"	13/16"		27⅝"	27⅝"	4 11/16"	27⅝"	3 9/16"	1⅛"	¼"	2"	2⅜"	23⅝"	½"	2"	23.585	¾"	¼"	8 7/16"

DESIGN TABLES FOR FIXED POT BEARINGS (30% HORIZONTAL LOAD)

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	ROTATION (RADS.)	MASONRY PLATE ▲						ANCHOR BOLT		SOLE PLATE ▲				POT						NEOPRENE DISC			PISTON				BEARING ✱ HEIGHT
			A	B	C	D	E	F	QTY.	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	PP
200	60	0.03	1⅜"	12⅞"	20⅜"	7 15/16"	4 3/16"	-	4	1¼"	13/16"	PER DESIGN (BEVELED SOLE PLATE)	11⅜"	11⅜"	2¼"	11⅜"	1⅝"	⅝"	¼"	1¼"	1"	8⅞"	⅜"	1⅛"	8.835	5/16"	¼"	5 1/16"
250	75	0.03	1⅜"	14⅛"	21⅝"	8 9/16"	4 3/16"	-	4	1¼"	13/16"		12⅝"	12⅝"	2⅜"	12⅝"	1⅝"	9/16"	¼"	1⅜"	1"	9⅞"	⅜"	1¼"	9.835	⅜"	¼"	5⅛"
300	90	0.03	1⅝"	15¼"	24¼"	9½"	5"	-	4	1½"	13/16"		13¾"	13¾"	2 1/16"	13¾"	1 3/16"	⅝"	¼"	1½"	1⅛"	10¾"	⅜"	1⅜"	10.710	7/16"	¼"	5 11/16"
350	105	0.03	1⅝"	16⅜"	25⅜"	10 1/16"	5 9/16"	-	4	1½"	13/16"		14⅞"	14⅞"	2 9/16"	14⅞"	2"	9/16"	¼"	1⅝"	1¼"	11⅝"	⅜"	1⅜"	11.585	7/16"	¼"	5¾"
400	120	0.03	1⅝"	17⅜"	26⅜"	10 9/16"	6 1/16"	-	4	1½"	13/16"		15⅞"	15⅞"	2 11/16"	15⅞"	2 1/16"	5/8"	¼"	1¾"	1¼"	12⅜"	⅜"	1½"	12.335	½"	¼"	5 15/16"
450	135	0.03	1⅞"	18⅜"	28⅞"	11 7/16"	6 3/16"	-	4	1¾"	13/16"		16⅞"	16⅞"	2 15/16"	16⅞"	2¼"	11/16"	¼"	1⅞"	1⅜"	13⅛"	⅜"	1½"	13.085	½"	¼"	6⅜"
500	150	0.03	1⅞"	19¼"	29¾"	11⅞"	6⅝"	-	4	1¾"	13/16"		17¾"	17¾"	2 15/16"	17¾"	2¼"	11/16"	¼"	2"	1⅜"	13¾"	⅜"	1½"	13.710	9/16"	5/16"	6⅜"
550	165	0.03	1⅞"	20¼"	30½"	12¼"	7⅛"	-	4	1¾"	13/16"		18½"	18½"	3 3/16"	18½"	2 7/16"	¾"	¼"	2"	1½"	14½"	⅜"	1⅝"	14.460	9/16"	5/16"	6 11/16"
600	180	0.03	2⅛"	20⅞"	32⅞"	13 1/16"	7 1/16"	-	4	2"	13/16"		19⅜"	19⅜"	3 7/16"	19⅜"	2⅜"	⅞"	¼"	2⅛"	1⅝"	15⅛"	⅜"	1⅝"	15.085	⅝"	5/16"	7 3/16"
650	195	0.03	2⅛"	21¾"	33¾"	13½"	7½"	-	4	2"	13/16"		20¼"	20¼"	3 7/16"	20¼"	2⅝"	13/16"	¼"	2¼"	1⅝"	15¾"	⅜"	1¾"	15.710	⅝"	5/16"	7¼"
700	210	0.03	2⅛"	22½"	34¼"	13¾"	7⅞"	-	4	2"	13/16"		20¾"	20¾"	3 7/16"	20¾"	2⅝"	13/16"	¼"	2¼"	1⅝"	16¼"	⅜"	1¾"	16.210	11/16"	5/16"	7¼"
750	225	0.03	2⅛"	23⅝"	35⅛"	14 3/16"	8 7/16"	-	4	2"	13/16"		21⅝"	21⅝"	3 11/16"	21⅝"	2 13/16"	⅞"	¼"	2⅜"	1¾"	16⅞"	⅜"	1⅞"	16.835	11/16"	5/16"	7 9/16"
800	240	0.03	2"	24"	34⅜"	14 3/16"	9"	-	6	1¾"	13/16"		22⅜"	22⅜"	3 11/16"	22⅜"	2 13/16"	⅞"	¼"	2½"	1¾"	17⅜"	⅜"	1⅞"	17.335	11/16"	⅜"	7 7/16"
850	255	0.03	1 15/16"	24½"	34⅞"	14 7/16"	9¼"	-	6	1¾"	13/16"		22⅞"	22⅞"	3 15/16"	22⅞"	3"	15/16"	5/16"	2½"	1⅞"	17⅞"	⅜"	2"	17.835	11/16"	⅜"	7 11/16"
900	270	0.03	2 3/16"	25¼"	37⅛"	15 3/16"	9¼"	-	6	2"	13/16"		23⅝"	23⅝"	3 15/16"	23⅝"	3"	15/16"	5/16"	2⅝"	1⅞"	18⅜"	⅜"	2"	18.335	¾"	⅜"	7 15/16"
950	285	0.03	2 3/16"	25⅞"	37⅝"	15 7/16"	9 9/16"	-	6	2"	13/16"		24⅛"	24⅛"	4 3/16"	24⅛"	3 3/16"	1"	5/16"	2⅝"	2"	18⅞"	½"	2"	18.835	¾"	⅜"	8⅛"
1000	300	0.03	2 3/16"	26⅝"	38⅜"	15 13/16"	9 15/16"	-	6	2"	13/16"		24⅞"	24⅞"	4 3/16"	24⅞"	3 3/16"	1"	5/16"	2¾"	2"	19⅜"	½"	2⅛"	19.335	¾"	⅜"	8¼"
1100	330	0.03	2 3/16"	28⅝"	39⅝"	16 7/16"	10 15/16"	-	6	2"	13/16"		26⅛"	26⅛"	4 7/16"	26⅛"	3⅜"	1 1/16"	5/16"	2⅞"	2⅛"	20⅜"	½"	2⅛"	20.335	13/16"	7/16"	8 7/16"
1200	360	0.03	2 5/16"	29⅛"	40¾"	17"	11 3/16"	5"	8	2"	13/16"		27¼"	27¼"	4 7/16"	27¼"	3 7/16"	1"	5/16"	3"	2⅛"	21¼"	½"	2¼"	21.210	⅞"	7/16"	8 5/8"
1300	390	0.03	2¼"	30¼"	41¾"	17½"	11¾"	5 1/16"	8	2"	13/16"		28¼"	28¼"	4 5/8"	28¼"	3 9/16"	1 1/16"	⅜"	3⅛"	2¼"	22"	½"	2⅜"	21.960	⅞"	7/16"	8⅞"
1400	420	0.03	2¼"	31½"	42⅞"	18 1/16"	12⅜"	5¼"	8	2"	13/16"		29⅜"	29⅜"	4 15/16"	29⅜"	3¾"	1 3/16"	⅜"	3¼"	2⅜"	22⅞"	½"	2⅜"	22.835	15/16"	7/16"	9⅛"
1500	450	0.03	2¼"	33"	43⅞"	18 9/16"	13⅛"	5½"	8	2"	13/16"		30⅜"	30⅜"	4 15/16"	30⅜"	3 13/16"	1⅛"	⅜"	3⅜"	2⅜"	23⅝"	½"	2½"	23.585	15/16"	½"	9 3/16"

▲ - THE INDICATED SOLE PLATE DIMENSIONS "J" AND "K" MUST BE INCREASED TO ACCOMMODATE THE TAPPED SCREW CONNECTION FOR PRESTESSED CONCRETE BEAMS SHOWN ON BC-756M, SHEET 6 OF 6. DUE TO THE INCREASED SOLE PLATE DIMENSIONS, CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND THE SOLE PLATE MUST BE CHECKED. THE MASONRY PLATE AND ANCHOR BOLT LOCATIONS MAY NEED TO BE ADJUSTED IN ACCORDANCE WITH THE INSTRUCTIONS FOR USING DESIGN TABLES, NOTE 12 ON SHEET 1 OF 7.



BEVELED SOLE PLATE DETAIL

✱- BEARING HEIGHT INCLUDES ⅛" BEDDING MATERIAL. EFFECTS OF BEVELED SOLE PLATE ARE NOT INCLUDED. IF BEVELED SOLE PLATE IS USED CALCULATE INCREASED BEARING HEIGHT ACCORDINGLY.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
HIGH LOAD MULTI-ROTATIONAL POT BEARINGS - FIXED

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

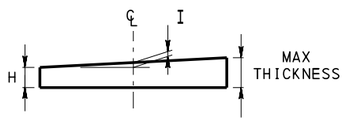
SHEET 4 OF 7

BD-613M

DESIGN TABLES FOR NON-GUIDED POT BEARINGS

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	ROTATION (RADS.)	MASONRY PLATE ▲					ANCHOR BOLT		SOLE PLATE ▲				POT						NEOPRENE DISC			PISTON			PTFE	STAINLESS STEEL		BEARING * HEIGHT
			A	B	C	D	E	QTY.	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	HH	LL	MM	PP
200	20	0.03	1½"	11⅞"	19⅞"	7 11/16"	3 11/16"	4	1¼"	13/16"	PER DESIGN (BEVELED SOLE PLATE)	13⅞"	10⅞"	2 1/16"	10⅜"	1½"	9/16"	¼"	¾"	1"	8⅞"	⅜"	15/16"	8.835	5/16"	8⅝"	13⅝"	10⅝"	5"
250	25	0.03	1½"	13⅛"	20⅞"	8 3/16"	4 5/16"	4	1¼"	13/16"		14⅞"	11⅞"	2 3/16"	11⅜"	1 9/16"	⅝"	¼"	¾"	1"	9⅞"	⅜"	15/16"	9.835	5/16"	9⅝"	14⅝"	11⅝"	5 3/16"
300	30	0.03	1⅝"	13¾"	21¾"	8⅝"	4⅝"	4	1¼"	13/16"		15¾"	12¾"	2 5/16"	12¼"	1¾"	9/16"	¼"	¾"	1⅛"	10¾"	⅜"	15/16"	10.710	3/8"	10½"	15½"	12½"	5⅜"
350	35	0.03	1⅝"	14⅝"	22⅝"	9 1/16"	5 1/16"	4	1¼"	13/16"		16⅝"	13⅝"	2⅜"	13⅛"	1⅞"	½"	¼"	¾"	1¼"	11⅝"	⅜"	1 1/16"	11.585	3/8"	11⅜"	16⅜"	13⅜"	5 9/16"
400	40	0.03	1⅝"	16"	23⅜"	9⅞"	5¾"	4	1¼"	13/16"		17⅜"	14⅜"	2⅝"	13⅞"	1 15/16"	11/16"	¼"	¾"	1¼"	12⅜"	⅜"	1 1/16"	12.335	3/8"	12⅛"	17⅛"	14⅛"	5¾"
450	45	0.03	1¾"	16⅛"	24⅛"	9 13/16"	5 13/16"	4	1¼"	13/16"		18⅛"	15⅛"	2 13/16"	14⅝"	2 1/16"	¾"	¼"	¾"	1⅜"	13⅛"	⅜"	1 1/16"	13.085	7/16"	12⅞"	17⅞"	14⅞"	6 1/16"
500	50	0.03	1¾"	17⅜"	24¾"	10⅛"	6 7/16"	4	1¼"	13/16"		18¾"	15¾"	2⅞"	15¼"	2 3/16"	11/16"	¼"	¾"	1⅜"	13¾"	⅜"	1 3/16"	13.710	7/16"	13½"	18½"	15½"	6⅛"
550	55	0.03	1¾"	18⅞"	25½"	10½"	7⅜"	4	1¼"	13/16"		19½"	16½"	3⅛"	16"	2¼"	⅞"	¼"	¾"	1½"	14½"	⅜"	1 3/16"	14.460	7/16"	14¼"	19¼"	16¼"	6 7/16"
600	60	0.03	1¾"	20¼"	26⅛"	10 13/16"	7⅞"	4	1¼"	13/16"		20⅛"	17⅛"	3 3/16"	16 5/16"	2 7/16"	¾"	¼"	¾"	1⅝"	15⅛"	⅜"	1 3/16"	15.085	½"	14⅞"	19⅞"	16⅞"	6 7/16"
650	65	0.03	1¾"	21⅝"	26¾"	11⅛"	8 3/16"	4	1¼"	13/16"		20¾"	17¾"	3 3/16"	17¼"	2 7/16"	11/16"	¼"	¾"	1⅝"	15¾"	⅜"	1 5/16"	15.710	½"	15½"	20½"	17½"	6½"
700	70	0.03	1¾"	23⅛"	27¼"	11⅜"	9 5/16"	4	1¼"	13/16"		21¼"	18¼"	3 7/16"	17¾"	2½"	5/16"	¼"	¾"	1⅝"	16¼"	⅜"	1 5/16"	16.210	½"	16"	21"	18"	6¾"
750	75	0.03	1¾"	24⅜"	27⅞"	11 11/16"	9 15/16"	4	1¼"	13/16"		21⅞"	18⅞"	3 7/16"	18⅜"	2⅝"	13/16"	¼"	¾"	1¾"	16⅞"	⅜"	1 5/16"	16.835	½"	16⅝"	21⅝"	18⅝"	6¾"
800	80	0.03	1¾"	25¾"	28⅜"	11 15/16"	10⅝"	4	1¼"	13/16"		22⅜"	19⅜"	3¾"	18⅞"	2 11/16"	1 1/16"	¼"	¾"	1¾"	17⅜"	⅜"	1 5/16"	17.335	9/16"	17⅛"	22⅛"	19⅛"	7"
850	85	0.03	1¾"	27"	28⅞"	12⅜"	11¼"	4	1¼"	13/16"		22⅞"	19⅞"	3 11/16"	19⅜"	2 13/16"	⅞"	¼"	¾"	1⅞"	17⅞"	⅜"	1 7/16"	17.835	9/16"	17⅝"	22⅝"	19⅝"	7 1/16"
900	90	0.03	1⅞"	27⅜"	30⅞"	12 13/16"	11 1/16"	4	1½"	13/16"		23⅜"	20⅜"	3 11/16"	19⅞"	2 13/16"	⅞"	¼"	¾"	1⅞"	18⅜"	⅜"	1 7/16"	18.335	9/16"	18⅛"	23⅛"	20⅛"	7 3/16"
950	95	0.03	1⅞"	28½"	31⅜"	13 1/16"	11⅝"	4	1½"	13/16"		23⅞"	20⅞"	3 15/16"	20⅜"	3"	15/16"	¼"	¾"	2"	18⅞"	½"	1 7/16"	18.835	9/16"	18⅝"	23⅝"	20⅝"	7⅜"
1000	100	0.03	1⅞"	29½"	31⅞"	13 5/16"	12⅛"	4	1½"	13/16"		24⅜"	21⅜"	3 15/16"	20⅞"	3"	15/16"	¼"	¾"	2"	19⅜"	½"	1 7/16"	19.335	⅝"	19⅛"	24⅛"	21⅛"	7⅜"
1100	110	0.03	1⅞"	31½"	32⅞"	13 13/16"	13⅛"	4	1½"	13/16"		25⅜"	22⅜"	4¼"	21⅞"	3 3/16"	1 1/16"	¼"	¾"	2⅛"	20⅜"	½"	1 9/16"	20.335	⅝"	20⅛"	25⅛"	22⅛"	7¾"
1200	120	0.03	1⅞"	33½"	33¾"	14¼"	14⅛"	4	1½"	13/16"		26¼"	23¼"	4⅛"	22¾"	3 3/16"	15/16"	¼"	¾"	2⅛"	21¼"	½"	1 9/16"	21.210	11/16"	21"	26"	23"	7⅝"
1300	130	0.03	2⅛"	34⅜"	36"	15"	14⅜"	4	1¾"	15/16"		27"	24"	4⅞"	23½"	3⅜"	1 1/16"	¼"	¾"	2¼"	22"	½"	1 11/16"	21.960	11/16"	21¾"	26¾"	23¾"	8¼"
1400	140	0.03	2⅛"	36¼"	36⅞"	15 7/16"	15⅛"	4	1¾"	13/16"		27⅞"	24⅞"	4⅝"	24⅜"	3½"	1⅛"	¼"	¾"	2⅜"	22⅞"	½"	1 11/16"	22.835	11/16"	22⅝"	27⅝"	24⅝"	8 7/16"
1500	150	0.03	2¼"	38"	38"	16"	16"	4	1¾"	15/16"		28⅝"	25⅝"	4 11/16"	25⅛"	3 3/16"	1⅛"	¼"	¾"	2⅜"	23⅝"	½"	1 11/16"	23.585	¾"	23⅜"	28⅜"	25⅜"	8 9/16"

▲ - THE INDICATED SOLE PLATE DIMENSIONS "J" AND "K" MUST BE INCREASED TO ACCOMMODATE THE TAPPED SCREW CONNECTION FOR PRESTESSED CONCRETE BEAMS SHOWN ON BC-756M, SHEET 6 OF 6. LOCATE TAPPED SCREWS OUTSIDE THE PERIMETER OF THE FILLET WELD TOE THAT CONNECTS THE 13 GAUGE STAINLESS STEEL TO THE SOLE PLATE. IF THE BOLT PATTERN FALLS OUTSIDE THE LIMITS OF THE EMBEDDED PLATE, HLMR POT BEARINGS SHALL NOT BE USED. DUE TO THE INCREASED SOLE PLATE DIMENSIONS, CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND THE SOLE PLATE MUST BE CHECKED. THE MASONRY PLATE AND ANCHOR BOLT LOCATIONS MAY NEED TO BE ADJUSTED IN ACCORDANCE WITH THE INSTRUCTIONS FOR USING DESIGN TABLES, NOTE 12 ON SHEET 1 OF 7.



BEVELED SOLE PLATE DETAIL

*- BEARING HEIGHT INCLUDES ⅛" BEDDING MATERIAL. EFFECTS OF BEVELED SOLE PLATE ARE NOT INCLUDED. IF BEVELED SOLE PLATE IS USED CALCULATE INCREASED BEARING HEIGHT ACCORDININGLY.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
HIGH LOAD MULTI-ROTATIONAL
POT BEARINGS - NON-GUIDED

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 5 OF 7

BD-613M

DESIGN TABLES FOR GUIDED POT BEARINGS (10% HORIZONTAL LOAD)

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	ROTATION (RADS.)	MASONRY PLATE ▲						ANCHOR BOLT		SOLE PLATE ▲				POT						NEOPRENE DISC			PISTON				GUIDE PLATE	
			A	B	C	D	E	F	QTY.	G	H		J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
200	20	0.03	1 1/8"	11 7/8"	23 3/8"	9 11/16"	3 11/16"	-	4	1 1/4"	13/16"	PER DESIGN (BEVELED SOLE PLATE)	15 1/4"	14 7/8"	2"	10 3/8"	1 1/2"	1/2"	1/4"	3/4"	1"	8 7/8"	3/8"	1 1/8"	8.835	5/16"	1/4"	1 1/16"	10 3/8"
250	25	0.03	2"	13 1/8"	25 3/8"	10 7/16"	4 5/16"	-	4	1 1/4"	13/16"		16 1/2"	16 3/8"	2 3/16"	11 5/8"	1 9/16"	5/8"	1/4"	1/8"	1"	9 7/8"	3/8"	1 1/4"	9.835	5/16"	1/4"	1 1/4"	11 5/8"
300	30	0.03	2"	14 3/4"	26 1/4"	10 7/8"	5 1/8"	-	4	1 1/4"	13/16"		17 3/8"	17 1/4"	2 5/16"	12 1/2"	1 3/4"	9/16"	1/4"	1/8"	1 1/8"	10 3/4"	3/8"	1 1/4"	10.710	3/8"	1/4"	1 1/4"	12 1/2"
350	35	0.03	2 1/8"	15 1/8"	27 5/8"	11 3/16"	5 5/16"	-	4	1 1/4"	13/16"		18 1/2"	18 5/8"	2 3/8"	13 5/8"	1 7/8"	1/2"	1/4"	1"	1 1/4"	11 5/8"	3/8"	1 3/8"	11.585	3/8"	1/4"	1 3/8"	13 5/8"
400	40	0.03	2 1/8"	16 3/4"	28 3/8"	11 15/16"	6 1/8"	-	4	1 1/4"	13/16"		19 1/4"	19 3/8"	2 9/16"	14 3/8"	1 15/16"	5/8"	1/4"	1"	1 1/4"	12 3/8"	3/8"	1 3/8"	12.335	3/8"	1/4"	1 3/8"	14 3/8"
450	45	0.03	2 1/4"	16 7/8"	29 5/8"	12 3/16"	6 3/16"	-	4	1 1/4"	13/16"		20 1/4"	20 5/8"	2 13/16"	15 3/8"	2 1/8"	11/16"	1/4"	1 1/8"	1 3/8"	13 1/8"	3/8"	1 1/2"	13.085	7/16"	1/4"	1 1/2"	15 3/8"
500	50	0.03	2 1/4"	18 1/8"	30 1/4"	12 7/8"	6 13/16"	-	4	1 1/4"	13/16"		20 7/8"	21 1/4"	2 13/16"	16"	2 1/8"	11/16"	1/4"	1 1/8"	1 3/8"	13 3/4"	3/8"	1 1/2"	13.710	7/16"	1/4"	1 1/2"	16"
550	55	0.03	2 3/8"	18 1/2"	31 1/4"	13 3/8"	7"	-	4	1 1/4"	13/16"		21 7/8"	22 1/4"	3 1/8"	17"	2 1/4"	7/8"	1/4"	1 1/4"	1 1/2"	14 1/2"	3/8"	1 1/2"	14.460	7/16"	1/4"	1 1/2"	17"
600	60	0.03	2 3/8"	19 1/8"	32 1/8"	13 13/16"	7 5/16"	-	4	1 1/4"	13/16"		22 1/2"	23 1/8"	3 3/16"	17 5/8"	2 7/16"	3/4"	1/4"	1 1/4"	1 5/8"	15 1/8"	3/8"	1 5/8"	15.085	1/2"	1/4"	1 5/8"	17 5/8"
650	65	0.03	2 1/2"	19 3/4"	32 3/4"	14 1/8"	7 5/8"	-	4	1 1/4"	13/16"		23 1/8"	23 3/4"	3 1/8"	18 1/4"	2 7/16"	11/16"	1/4"	1 1/4"	1 5/8"	15 3/4"	3/8"	1 5/8"	15.710	1/2"	1/4"	1 5/8"	18 1/4"
700	70	0.03	2 1/2"	20 1/2"	33 1/2"	14 1/2"	8"	-	4	1 1/4"	13/16"		23 7/8"	24 1/2"	3 7/16"	19"	2 7/16"	15/16"	1/4"	1 3/8"	1 5/8"	16 1/4"	3/8"	1 5/8"	16.210	1/2"	1/4"	1 5/8"	19"
750	75	0.03	2 1/2"	21 1/8"	34 3/8"	14 15/16"	8 5/16"	-	4	1 1/4"	13/16"		24 1/2"	25 3/8"	3 7/16"	19 5/8"	2 5/8"	1 3/16"	1/4"	1 3/8"	1 3/4"	16 1/8"	3/8"	1 5/8"	16.835	9/16"	1/4"	1 3/4"	19 5/8"
800	80	0.03	2 1/2"	21 7/8"	35 1/8"	15 5/16"	8 11/16"	-	4	1 1/4"	13/16"		25 1/2"	26 1/8"	3 3/4"	20 3/8"	2 11/16"	1 1/16"	1/4"	1 1/2"	1 3/4"	17 3/8"	3/8"	1 3/4"	17.335	9/16"	1/4"	1 3/4"	20 3/8"
850	85	0.03	2 1/2"	22 3/4"	35 5/8"	15 9/16"	9 1/8"	-	4	1 1/4"	13/16"		25 3/4"	26 5/8"	3 9/16"	20 7/8"	2 11/16"	7/8"	1/4"	1 1/2"	1 7/8"	17 7/8"	3/8"	1 3/4"	17.835	9/16"	1/4"	1 3/4"	20 7/8"
900	90	0.03	2 3/4"	22 7/8"	37 5/8"	16 3/16"	8 13/16"	-	4	1 1/2"	13/16"		26 1/4"	27 1/8"	3 11/16"	21 3/8"	2 13/16"	7/8"	1/4"	1 1/2"	1 7/8"	18 3/8"	3/8"	1 3/4"	18.335	9/16"	1/4"	1 3/4"	21 3/8"
950	95	0.03	2 3/4"	24 1/4"	38 5/8"	16 11/16"	9 1/2"	-	4	1 1/2"	13/16"		27"	28 1/8"	3 15/16"	22 1/8"	3"	15/16"	1/4"	1 5/8"	2"	18 1/8"	1/2"	1 3/4"	18.835	5/8"	1/4"	1 7/8"	22 1/8"
1000	100	0.03	2 3/4"	25 1/8"	39 1/8"	16 15/16"	9 15/16"	-	4	1 1/2"	13/16"		27 1/2"	28 5/8"	3 15/16"	22 5/8"	3"	15/16"	1/4"	1 5/8"	2"	19 3/8"	1/2"	1 7/8"	19.335	5/8"	1/4"	1 7/8"	22 5/8"
1100	110	0.03	2 3/4"	27"	40 1/8"	17 7/16"	10 7/8"	-	4	1 1/2"	13/16"		28 1/2"	29 5/8"	4 3/16"	23 5/8"	3 3/16"	1"	1/4"	1 5/8"	2 1/8"	20 3/8"	1/2"	1 7/8"	20.335	5/8"	1/4"	1 7/8"	23 5/8"
1200	120	0.03	3"	27 1/8"	41 5/8"	18 3/16"	10 15/16"	-	4	1 1/2"	13/16"		29 5/8"	31 1/8"	4 5/16"	24 3/4"	3 3/16"	1 1/8"	1/4"	1 3/4"	2 1/8"	21 1/4"	1/2"	1 7/8"	21.210	11/16"	1/4"	2"	24 3/4"
1300	130	0.03	3 1/4"	27 7/8"	44 1/8"	19 1/16"	10 15/16"	-	4	1 3/4"	13/16"		30 5/8"	32 1/8"	4 9/16"	25 3/4"	3 3/8"	1 3/16"	1/4"	1 7/8"	2 1/4"	22"	1/2"	2"	21.960	11/16"	1/4"	2"	25 3/4"
1400	140	0.03	3 1/4"	29 1/2"	45 1/4"	19 5/8"	11 3/4"	-	4	1 3/4"	13/16"		31 1/2"	33 1/4"	4 9/16"	26 5/8"	3 1/2"	1 1/16"	1/4"	1 7/8"	2 3/8"	22 7/8"	1/2"	2"	22.835	11/16"	1/4"	2 1/8"	26 5/8"
1500	150	0.03	3 1/4"	31 1/8"	46 1/4"	20 1/8"	12 9/16"	-	4	1 3/4"	13/16"		32 1/2"	34 1/4"	4 13/16"	27 5/8"	3 9/16"	1 1/4"	1/4"	2"	2 3/8"	23 5/8"	1/2"	2 1/8"	23.585	3/4"	1/4"	2 1/8"	27 5/8"

▲ - THE INDICATED SOLE PLATE DIMENSIONS "J" AND "K" MUST BE INCREASED TO ACCOMMODATE THE TAPPED SCREW CONNECTION FOR PRESTESSED CONCRETE BEAMS SHOWN ON BC-756M, SHEET 6 OF 6. LOCATE TAPPED SCREWS OUTSIDE THE PERIMETER OF THE FILLET WELD TOE THAT CONNECTS THE 13 GAUGE STAINLESS STEEL TO THE SOLE PLATE. IF THE BOLT PATTERN FALLS OUTSIDE THE LIMITS OF THE EMBEDDED PLATE, HLMR POT BEARINGS SHALL NOT BE USED. DUE TO THE INCREASED SOLE PLATE DIMENSIONS, CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND THE SOLE PLATE MUST BE CHECKED. THE MASONRY PLATE AND ANCHOR BOLT LOCATIONS MAY NEED TO BE ADJUSTED IN ACCORDANCE WITH THE INSTRUCTIONS FOR USING DESIGN TABLES, NOTE 12 ON SHEET 1 OF 7.

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	GUIDE BARS							PTFE				STAINLESS STEEL				BEARING * HEIGHT
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN	OO	PP
200	20	1 3/8"	1 3/8"	15 1/4"	5/16"	7/16"	5/16"	5.434	7 5/8"	3/16"	5/8"	10 1/8"	15 1/8"	8 5/8"	15 1/8"	7/8"	6 7/16"
250	25	1 1/2"	1 1/2"	16 1/2"	5/16"	7/16"	5/16"	6.059	8 1/2"	3/16"	3/4"	11 3/8"	16 3/8"	9 1/2"	16 3/8"	1"	7"
300	30	1 1/2"	1 1/2"	17 3/8"	5/16"	7/16"	5/16"	6.496	9 3/8"	3/16"	3/4"	12 1/4"	17 1/4"	10 3/8"	17 1/4"	1"	7 1/16"
350	35	1 5/8"	1 5/8"	18 1/2"	5/16"	7/16"	5/16"	7.059	10 1/8"	3/16"	7/8"	13 3/8"	18 3/8"	11 1/8"	18 3/8"	1 1/8"	7 1/2"
400	40	1 5/8"	1 5/8"	19 1/4"	5/16"	7/16"	5/16"	7.434	10 3/4"	3/16"	7/8"	14 1/8"	19 1/8"	11 3/4"	19 1/8"	1 1/8"	7 5/8"
450	45	1 3/4"	1 3/4"	20 1/4"	5/16"	7/16"	5/16"	7.934	11 3/8"	3/16"	1"	15 1/8"	20 1/8"	12 3/8"	20 1/8"	1 1/4"	8 3/16"
500	50	1 3/4"	1 3/4"	20 7/8"	5/16"	7/16"	5/16"	8.246	12"	3/16"	1"	15 3/4"	20 3/4"	13"	20 3/4"	1 1/4"	8 3/16"
550	55	1 3/4"	1 3/4"	21 7/8"	5/16"	7/16"	5/16"	8.746	12 5/8"	3/16"	1"	16 3/4"	21 3/4"	13 5/8"	21 3/4"	1 1/4"	8 5/8"
600	60	1 7/8"	1 7/8"	22 1/2"	5/16"	7/16"	5/16"	9.059	13 1/8"	3/16"	1 1/8"	17 3/8"	22 3/8"	14 1/8"	22 3/8"	1 3/8"	8 7/8"
650	65	1 7/8"	1 7/8"	23 1/8"	5/16"	7/16"	5/16"	9.371	13 3/4"	3/16"	1 1/8"	18"	23"	14 3/4"	23"	1 3/8"	8 15/16"
700	70	1 7/8"	1 7/8"	23 7/8"	5/16"	7/16"	5/16"	9.746	14 1/4"	3/16"	1 1/8"	18 3/4"	23 3/4"	15 1/4"	23 3/4"	1 3/8"	9 3/16"
750	75	2"	2"	24 1/2"	5/16"	7/16"	5/16"	10.059	14 3/4"	3/16"	1 1/4"	19 3/8"	24 3/8"	15 3/4"	24 3/8"	1 1/2"	9 5/16"
800	80	2"	2"	25 1/4"	5/16"	7/16"	5/16"	10.434	15 1/4"	3/16"	1 1/4"	20 1/8"	25 1/8"	16 1/4"	25 1/8"	1 1/2"	9 11/16"
850	85	2"	2"	25 3/4"	5/16"	7/16"	5/16"	10.684	15 5/8"	3/16"	1 1/4"	20 5/8"	25 5/8"	16 5/8"	25 5/8"	1 1/2"	9 5/8"
900	90	2"	2"	26 1/4"	5/16"	7/16"	5/16"	10.934	16 1/8"	3/16"	1 1/4"	21 1/8"	26 1/8"	17 1/8"	26 1/8"	1 1/2"	9 7/8"
950	95	2 1/8"	2 1/8"	27"	5/16"	7/16"	5/16"	11.309	16 1/2"	3/16"	1 3/8"	21 7/8"	26 7/8"	17 1/2"	26 7/8"	1 5/8"	10 3/16"
1000	100	2 1/8"	2 1/8"	27 1/2"	5/16"	7/16"	5/16"	11.559	17"	3/16"	1 3/8"	22 3/8"	27 3/8"	18"	27 3/8"	1 5/8"	10 5/16"
1100	110	2 1/8"	2 1/8"	28 1/2"	5/16"	7/16"	5/16"	12.059	17 3/4"	3/16"	1 3/8"	23 3/8"	28 3/8"	18 3/4"	28 3/8"	1 5/8"	10 1/2"
1200	120	2 1/4"	2 1/4"	29 5/8"	5/16"	7/16"	5/16"	12.652	18 5/8"	1/4"	1 1/2"	24 1/2"	29 1/2"	19 5/8"	29 1/2"	1 3/4"	11"
1300	130	2 1/4"	2 1/4"	30 5/8"	5/16"	7/16"	5/16"	13.152	19 3/8"	1/4"	1 1/2"	25 1/2"	30 1/2"	20 3/8"	30 1/2"	1 3/4"	11 3/16"
1400	140	2 3/8"	2 3/8"	31 1/2"	5/16"	7/16"	5/16"	13.590	20 1/8"	1/4"	1 5/8"	26 3/8"	31 3/8"	21 1/8"	31 3/8"	1 7/8"	11 11/16"
1500	150	2 3/8"	2 3/8"	32 1/2"	5/16"	7/16"	5/16"	14.090	20 3/4"	1/4"	1 5/8"	27 3/8"	32 3/8"	21 3/4"	32 3/8"	1 7/8"	12"

BEVELED SOLE PLATE DETAIL

*- BEARING HEIGHT INCLUDES 1/8" BEDDING MATERIAL. EFFECTS OF BEVELED SOLE PLATE ARE NOT INCLUDED. IF BEVELED SOLE PLATE IS USED CALCULATE INCREASED BEARING HEIGHT ACCORDININGLY.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
HIGH LOAD MULTI-ROTATIONAL
POT BEARINGS - GUIDED
10% HORIZONTAL LOAD

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 7

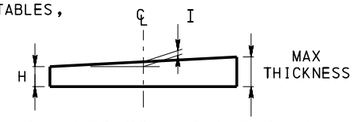
BD-613M

DESIGN TABLES FOR GUIDED POT BEARINGS (30% HORIZONTAL LOAD)

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	ROTATION (RADS.)	MASONRY PLATE ▲						ANCHOR BOLT		SOLE PLATE ▲				POT						NEOPRENE DISC			PISTON				GUIDE PLATE	
			A	B	C	D	E	F	QTY.	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
200	60	0.03	2"	12 7/8"	26 7/8"	11 3/16"	4 3/16"	-	4	1 1/4"	13/16"	PER DESIGN (BEVELED SOLE PLATE)	16 1/4"	17 7/8"	2 3/16"	11 3/8"	1 5/8"	9/16"	1/4"	1 1/4"	1"	8 7/8"	3/8"	1 1/4"	8.835	3/8"	1/4"	2 1/8"	11 3/8"
250	75	0.03	2 1/8"	14 1/8"	28 5/8"	12 1/16"	4 13/16"	-	4	1 1/4"	13/16"		17 1/2"	19 5/8"	2 3/16"	12 5/8"	1 11/16"	1/2"	1/4"	1 3/8"	1"	9 7/8"	3/8"	1 3/8"	9.835	7/16"	1/4"	2 3/8"	12 5/8"
300	90	0.03	2 3/8"	15 1/4"	31 1/2"	13 1/8"	5"	-	4	1 1/2"	13/16"		18 5/8"	21"	2 7/16"	13 3/4"	1 13/16"	5/8"	1/4"	1 1/2"	1 1/8"	10 3/4"	3/8"	1 3/8"	10.710	7/16"	1/4"	2 1/2"	13 3/4"
350	105	0.03	2 3/8"	16 3/4"	32 7/8"	13 13/16"	5 3/4"	-	4	1 1/2"	13/16"		19 3/4"	23 3/8"	2 9/16"	14 7/8"	2"	9/16"	1/4"	1 5/8"	1 1/4"	11 5/8"	3/8"	1 1/2"	11.585	1/2"	1/4"	2 5/8"	14 7/8"
400	120	0.03	2 1/2"	17 3/8"	34 1/4"	14 1/2"	6 1/16"	-	4	1 1/2"	13/16"		20 3/4"	23 3/4"	2 3/4"	15 7/8"	2 1/8"	5/8"	1/4"	1 3/4"	1 1/4"	12 3/8"	3/8"	1 1/2"	12.335	1/2"	1/4"	2 3/4"	15 7/8"
450	135	0.03	2 3/4"	18 3/8"	37"	15 1/2"	6 3/16"	-	4	1 3/4"	15/16"		21 3/4"	25"	2 7/8"	16 7/8"	2 3/16"	11/16"	1/4"	1 7/8"	1 3/8"	13 1/8"	3/8"	1 5/8"	13.085	9/16"	1/4"	2 7/8"	16 7/8"
500	150	0.03	2 3/4"	19 7/8"	38 1/4"	16 1/8"	6 15/16"	-	4	1 3/4"	15/16"		22 5/8"	26 1/4"	2 15/16"	17 3/4"	2 1/4"	11/16"	1/4"	2"	1 3/8"	13 3/4"	3/8"	1 5/8"	13.710	9/16"	5/16"	3"	17 3/4"
550	165	0.03	3"	20"	39 1/4"	16 5/8"	7"	-	4	1 3/4"	1 1/16"		23 3/8"	27 1/4"	3 3/16"	18 1/2"	2 7/16"	3/4"	1/4"	2"	1 1/2"	14 1/2"	3/8"	1 5/8"	14.460	5/8"	5/16"	3 1/8"	18 1/2"
600	180	0.03	3 1/4"	20 7/8"	41 7/8"	17 9/16"	7 1/16"	-	4	2"	1 1/16"		24 1/4"	28 3/8"	3 7/16"	19 3/8"	2 9/16"	7/8"	1/4"	2 1/8"	1 5/8"	15 1/8"	3/8"	1 7/8"	15.085	5/8"	5/16"	3 1/8"	19 3/8"
650	195	0.03	3 1/4"	21 3/4"	43 1/8"	18 3/16"	7 1/2"	-	4	2"	1 3/16"		25 1/8"	29 5/8"	3 7/16"	20 1/4"	2 5/8"	13/16"	1/4"	2 1/4"	1 5/8"	15 3/4"	3/8"	1 7/8"	15.710	5/8"	5/16"	3 3/8"	20 1/4"
700	210	0.03	3 1/4"	22 1/4"	43 7/8"	18 9/16"	7 3/4"	-	4	2"	1 3/16"		25 5/8"	30 3/8"	3 7/16"	20 3/4"	2 5/8"	13/16"	1/4"	2 1/4"	1 5/8"	16 1/4"	3/8"	2"	16.210	11/16"	5/16"	3 3/8"	20 3/4"
750	225	0.03	3 1/4"	23 5/8"	45"	19 1/8"	8 1/16"	-	4	2"	1 3/16"		26 1/2"	31 1/2"	3 11/16"	21 5/8"	2 13/16"	7/8"	1/4"	2 3/8"	1 3/4"	16 7/8"	3/8"	2"	16.835	11/16"	3/8"	3 5/8"	21 5/8"
800	240	0.03	3 1/4"	24"	44 5/8"	19 5/16"	9"	-	6	1 3/4"	1 5/16"		27 1/4"	32 5/8"	3 11/16"	22 3/8"	2 13/16"	7/8"	5/16"	2 1/2"	1 3/4"	17 3/8"	3/8"	2 1/8"	17.335	11/16"	3/8"	3 5/8"	22 3/8"
850	255	0.03	3 1/4"	24 1/2"	45 1/8"	19 3/16"	9 1/4"	-	6	1 3/4"	1 5/16"		27 3/4"	33 1/8"	3 15/16"	22 7/8"	3"	15/16"	5/16"	2 1/2"	1 7/8"	17 7/8"	3/8"	2 1/8"	17.835	3/4"	3/8"	3 5/8"	22 7/8"
900	270	0.03	3 1/2"	25 1/4"	47 5/8"	20 7/16"	9 1/4"	-	6	2"	1 5/16"		28 1/2"	34 1/8"	3 15/16"	23 5/8"	3"	15/16"	5/16"	2 5/8"	1 7/8"	18 3/8"	3/8"	2 1/8"	18.335	3/4"	3/8"	3 7/8"	23 5/8"
950	285	0.03	3 1/2"	26 1/2"	48 1/2"	20 7/8"	9 7/8"	-	6	2"	1 7/16"		29"	35"	4 1/16"	24 1/8"	3 3/16"	15/16"	5/16"	2 5/8"	2"	18 7/8"	1/2"	2 1/4"	18.835	13/16"	3/8"	3 7/8"	24 1/8"
1000	300	0.03	3 1/2"	28 1/8"	49 5/8"	21 7/16"	10 11/16"	-	6	2"	1 7/16"		29 3/4"	36 1/8"	4 1/16"	24 7/8"	3 3/16"	7/8"	5/16"	2 3/4"	2"	19 3/8"	1/2"	2 1/4"	19.335	13/16"	3/8"	4 1/8"	24 7/8"
1100	330	0.03	3 11/16"	28 1/8"	51 1/8"	22 3/16"	10 11/16"	-	6	2"	1 9/16"		31"	37 5/8"	4 5/16"	26 1/8"	3 3/8"	7/8"	5/16"	2 7/8"	2 1/8"	20 3/8"	1/2"	2 1/4"	20.335	13/16"	7/16"	4 1/8"	26 1/8"
1200	360	0.03	3 11/16"	29 1/2"	52 5/8"	22 15/16"	11 3/8"	3 11/16"	8	2"	1 9/16"		32 1/8"	39 1/8"	4 7/16"	27 1/4"	3 7/16"	1"	3/8"	3"	2 1/8"	21 1/4"	1/2"	2 1/4"	21.210	7/8"	7/16"	4 3/8"	27 1/4"
1300	390	0.03	3 15/16"	30 1/4"	54 1/8"	23 11/16"	11 3/4"	3 7/8"	8	2"	1 11/16"		33 1/8"	40 5/8"	4 7/8"	28 1/4"	3 5/8"	1 1/4"	3/8"	3 1/8"	2 1/4"	22"	1/2"	2 1/2"	21.960	15/16"	7/16"	4 9/16"	28 1/4"
1400	420	0.03	3 15/16"	31 1/2"	55 5/8"	24 7/16"	12 3/8"	4 1/16"	8	2"	1 11/16"		34 1/4"	42 1/8"	4 13/16"	29 3/8"	3 3/4"	1 1/16"	3/8"	3 1/4"	2 3/8"	22 7/8"	1/2"	2 1/2"	22.835	15/16"	1/2"	4 13/16"	29 3/8"
1500	450	0.03	3 15/16"	33 3/8"	56 7/8"	25 1/16"	13 5/16"	4 1/4"	8	2"	1 13/16"		35 1/4"	43 3/8"	5 1/4"	30 3/8"	3 13/16"	1 7/16"	3/8"	3 3/8"	2 3/8"	23 5/8"	1/2"	2 5/8"	23.585	1"	1/2"	4 13/16"	30 3/8"

▲ - THE INDICATED SOLE PLATE DIMENSIONS "J" AND "K" MUST BE INCREASED TO ACCOMMODATE THE TAPPED SCREW CONNECTION FOR PRESTESSED CONCRETE BEAMS SHOWN ON BC-756M, SHEET 6 OF 6. LOCATE TAPPED SCREWS OUTSIDE THE PERIMETER OF THE FILLET WELD TOE THAT CONNECTS THE 13 GAUGE STAINLESS STEEL TO THE SOLE PLATE. IF THE BOLT PATTERN FALLS OUTSIDE THE LIMITS OF THE EMBEDDED PLATE, HLMR POT BEARINGS SHALL NOT BE USED. DUE TO THE INCREASED SOLE PLATE DIMENSIONS, CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND THE SOLE PLATE MUST BE CHECKED. THE MASONRY PLATE AND ANCHOR BOLT LOCATIONS MAY NEED TO BE ADJUSTED IN ACCORDANCE WITH THE INSTRUCTIONS FOR USING DESIGN TABLES, NOTE 12 ON SHEET 1 OF 7.

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	GUIDE BARS							PTFE				STAINLESS STEEL				BEARING HEIGHT ✱
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN	OO	PP
200	60	2 3/8"	2 3/8"	16 1/4"	5/16"	1/2"	5/16"	5.934	7 5/8"	3/16"	1 5/8"	11 1/8"	16 1/8"	8 5/8"	16 1/8"	1 7/8"	7 13/16"
250	75	2 5/8"	2 5/8"	17 1/2"	5/16"	1/2"	5/16"	6.559	8 1/2"	3/16"	1 7/8"	12 3/8"	17 3/8"	9 1/2"	17 3/8"	2 1/8"	8 1/4"
300	90	2 3/4"	2 3/4"	18 5/8"	5/16"	1/2"	5/16"	7.121	9 3/8"	3/16"	2"	13 1/2"	18 1/2"	10 3/8"	18 1/2"	2 1/4"	8 7/8"
350	105	2 7/8"	2 7/8"	19 3/4"	5/16"	7/16"	5/16"	7.684	10 1/8"	3/16"	2 1/8"	14 5/8"	19 5/8"	11 1/8"	19 5/8"	2 3/8"	9 3/16"
400	120	3"	3"	20 3/4"	3/8"	1/2"	3/8"	8.184	10 3/4"	3/16"	2 1/4"	15 5/8"	20 5/8"	11 3/4"	20 5/8"	2 1/2"	9 1/2"
450	135	3 1/8"	3 1/8"	21 3/4"	3/8"	1/2"	3/8"	8.684	11 3/8"	3/16"	2 3/8"	16 5/8"	21 5/8"	12 3/8"	21 5/8"	2 5/8"	10 5/16"
500	150	3 1/4"	3 1/4"	22 5/8"	7/16"	9/16"	7/16"	9.121	12"	3/16"	2 1/2"	17 1/2"	22 1/2"	13"	22 1/2"	2 3/4"	10 3/8"
550	165	3 3/8"	3 3/8"	23 3/8"	7/16"	9/16"	7/16"	9.496	12 5/8"	3/16"	2 5/8"	18 1/4"	23 1/4"	13 5/8"	23 1/4"	2 7/8"	11 1/16"
600	180	3 1/2"	3 1/2"	24 1/4"	7/16"	9/16"	7/16"	9.934	13 1/8"	3/16"	2 3/4"	19 1/8"	24 1/8"	14 1/8"	24 1/8"	3"	11 3/16"
650	195	3 5/8"	3 5/8"	25 1/8"	1/2"	5/8"	1/2"	10.371	13 3/4"	3/16"	3 7/8"	20"	25"	14 3/4"	25"	3 1/8"	12 1/8"
700	210	3 3/4"	3 3/4"	25 5/8"	1/2"	5/8"	1/2"	10.621	14 1/4"	3/16"	3"	20 1/2"	25 1/2"	15 1/4"	25 1/2"	3 1/4"	12 1/4"
750	225	3 7/8"	3 7/8"	26 1/2"	1/2"	5/8"	1/2"	11.059	14 3/4"	3/16"	3 1/8"	21 3/8"	26 3/8"	15 3/4"	26 3/8"	3 3/8"	12 5/8"
800	240	4"	4"	27 1/4"	9/16"	11/16"	9/16"	11.434	15 1/4"	3/16"	3 1/4"	22 1/8"	27 1/8"	16 1/4"	27 1/8"	3 1/2"	12 7/8"
850	255	4"	4"	27 3/4"	9/16"	11/16"	9/16"	11.684	15 5/8"	3/16"	3 1/4"	22 5/8"	27 5/8"	16 5/8"	27 5/8"	3 1/2"	13 1/16"
900	270	4 1/8"	4 1/8"	28 1/2"	9/16"	11/16"	9/16"	12.059	16 1/8"	3/16"	3 3/8"	23 3/8"	28 3/8"	17 1/8"	28 3/8"	3 5/8"	13 3/16"
950	285	4 1/4"	4 1/4"	29"	5/8"	3/4"	5/8"	12.309	16 1/2"	3/16"	3 1/2"	23 7/8"	28 7/8"	17 1/2"	28 7/8"	3 3/4"	13 15/16"
1000	300	4 3/8"	4 3/8"	29 3/4"	5/8"	3/4"	5/8"	12.715	17"	1/4"	3 5/8"	24 5/8"	29 5/8"	18"	29 5/8"	3 7/8"	14 1/8"
1100	330	4 1/2"	4 1/2"	31"	5/8"	3/4"	5/8"	13.340	17 3/4"	1/4"	3 3/4"	25 7/8"	30 7/8"	18 3/4"	30 7/8"	4"	14 1/2"
1200	360	4 5/8"	4 5/8"	32 1/8"	11/16"	13/16"	11/16"	13.902	18 5/8"	1/4"	3 7/8"	27"	32"	19 5/8"	32"	4 1/8"	14 7/8"
1300	390	4 7/8"	4 7/8"	33 1/8"	11/16"	13/16"	11/16"	14.402	19 3/8"	1/4"	4 1/8"	28"	33"	20 3/8"	33"	4 3/8"	16 1/16"
1400	420	5"	5"	34 1/4"	3/4"	7/8"	3/4"	14.965	20 1/8"	1/4"	4 1/4"	29 1/8"	34 1/8"	21 1/8"	34 1/8"	4 1/2"	16 3/16"
1500	450	5 1/8"	5 1/8"	35 1/4"	3/4"	7/8"	3/4"	15.465	20 3/4"	1/4"	4 3/8"	30 1/8"	35 1/8"	21 3/4"	35 1/8"	4 5/8"	16 13/16"



BEVELED SOLE PLATE DETAIL

✱- BEARING HEIGHT INCLUDES 1/8" BEDDING MATERIAL. EFFECTS OF BEVELED SOLE PLATE ARE NOT INCLUDED. IF BEVELED SOLE PLATE IS USED CALCULATE INCREASED BEARING HEIGHT ACCORDININGLY.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
HIGH LOAD MULTI-ROTATIONAL
POT BEARINGS - GUIDED
30% HORIZONTAL LOAD

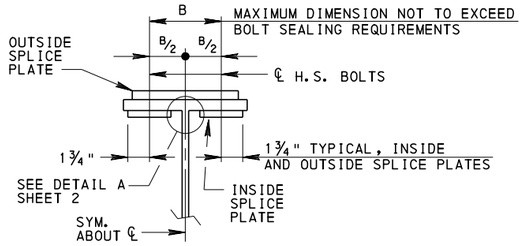
RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

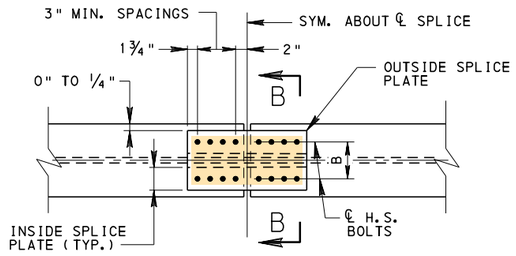
SHEET 7 OF 7

BD-613M

CHANGE 5

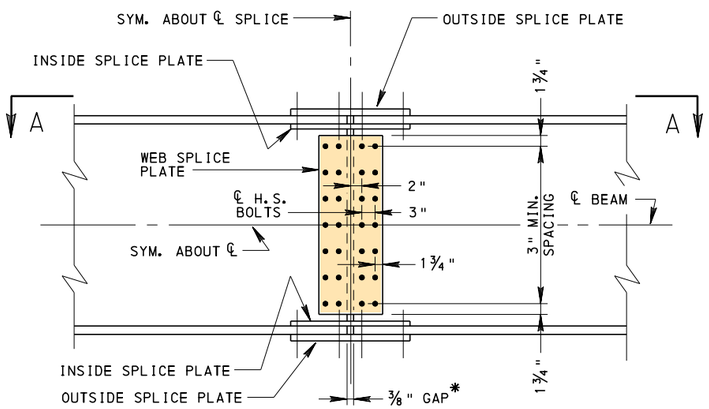


SECTION B-B



VIEW A-A

FLANGE SPLICE DETAIL - TYPE 1



WEB SPLICE DETAIL

* USE 3/8" GAP FOR DESIGN, DETAIL AS 1/4" GAP ON DRAWINGS.

GENERAL NOTES:

1. DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AS SUPPLEMENTED BY DESIGN MANUAL PART 4, STRUCTURES.
2. DETAILS SHOWN ARE FOR 7/8" DIAMETER HIGH STRENGTH BOLTS.
3. BOLT SPACINGS SHOWN ARE PREFERRED MINIMUMS.
4. EDGE DISTANCES SHOWN ARE MINIMUMS BASED ON SHEARED OR GAS CUT EDGES PLUS AN ADDITIONAL 1/4" CLEARANCE IN ACCORDANCE WITH STRUCTURAL COMMITTEE FOR ECONOMICAL FABRICATION DETAIL. THIS WILL PROVIDE A TOLERANCE FOR PUNCHING, DRILLING AND REAMING.
5. FOR THE MINIMUM EDGE DISTANCES, THE BEARING CAPACITY OF THE WEB PLATE, ESPECIALLY THIN WEB PLATES, MAY BE SIGNIFICANTLY LESS THAN THE BOLT SHEAR CAPACITY RESULTING IN THE PLATE BEARING CAPACITY CONTROLLING THE DESIGN. THE DESIGNER SHOULD ADJUST THE WEB EDGE DISTANCES, INCREASING THE PLATE BEARING CAPACITY, TO MINIMIZE THE NUMBER OF GAGE LINES OF WEB BOLTS. THE DESIGNER SHOULD INCREASE THE WEB EDGE DISTANCE TO OBTAIN A DESIGN WITH THE TYPICAL 2 OR 3 ROWS OF WEB SPLICE BOLTS.
6. DESIGNER TO VERIFY INSTALLATION CLEARANCES AS ILLUSTRATED IN AISC MANUAL OF STEEL CONSTRUCTION.
7. DESIGNER TO INDICATE WHETHER OR NOT THE BOLTS ARE DESIGNED FOR THREADS EXCLUDED FROM SHEAR PLANE.
8. DESIGN THE TENSION FLANGE, COMPRESSION FLANGE AND WEB SPLICES (PLATES AND BOLTS) IN ACCORDANCE WITH AASHTO LRFD ARTICLE 6.13.6.1 AND DM-4 ARTICLE 6.13.6.1.
9. CHECK GIRDER CAPACITY AT THE SPLICE FOR REDUCTION DUE TO BOLTS HOLES IN THE TENSION FLANGE USING THE EFFECTIVE AREA, A_e, AS DEFINED IN AASHTO LRFD ARTICLE 6.13.6.1.3b.

   THIS GIRDER CAPACITY CHECK IS CRITICAL FOR SINGLE SPAN STRUCTURES AND CONTINUOUS STRUCTURES WITH SPLICES IN HIGH MOMENT REGIONS.

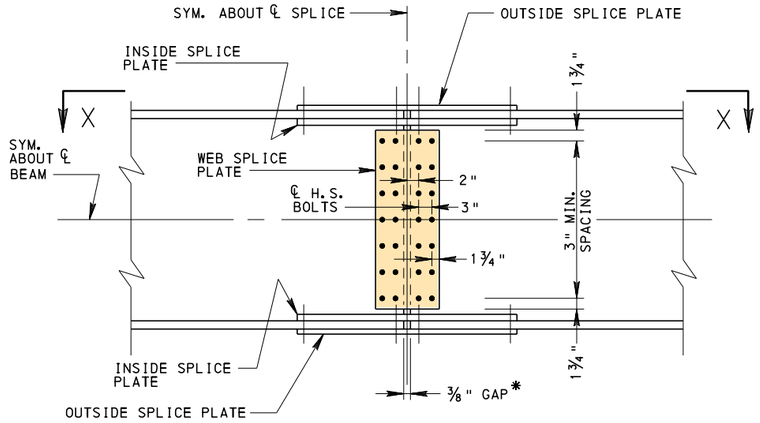
   IN CASES THAT A SIGNIFICANT REDUCTION IN FLANGE CAPACITY OCCURS DUE TO EFFECTIVE AREA, CONSIDER A STAGGERED BOLT PATTERN.
10. THE EFFECTIVE COMPRESSION FLANGE AREA SHALL BE TAKEN EQUAL TO THE GROSS AREA OF THE COMPRESSION FLANGE.
11. DESIGNER TO VERIFY THAT BOLT SPACINGS FOR FLANGE SPLICES AND WEB SPLICES DO NOT EXCEED BOLT SEALING REQUIREMENTS.
12. OFFSET DECK JOINTS A MINIMUM 3'-0" FROM STEEL FIELD GIRDER SPLICES.
13. FOR BOLT DIAMETER EQUAL OR GREATER THAN 1", THE HOLE DIAMETER SHALL BE 1/8" PLUS DIAMETER OF BOLT. ALSO, ADJUST EDGE DISTANCE, CENTER TO CENTER BOLT SPACINGS, CLEARANCES, ETC.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

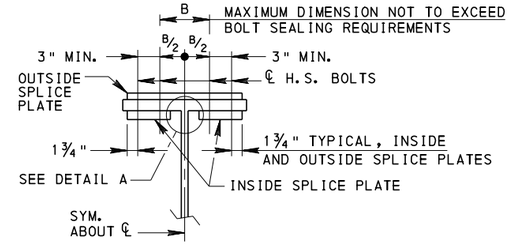
FIELD SPLICE

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 1 OF 2
		BD-616M

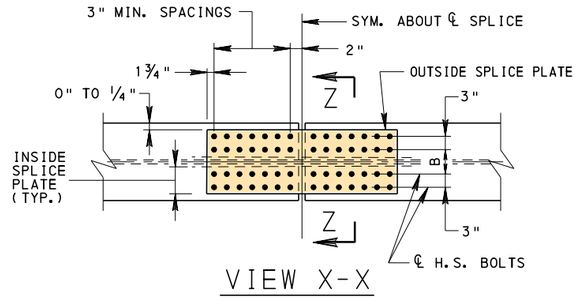


WEB SPLICE DETAIL

* USE ⅜" GAP FOR DESIGN, DETAIL AS ¼" GAP ON DRAWINGS.

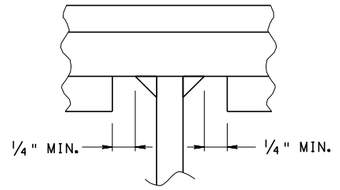


SECTION Z-Z



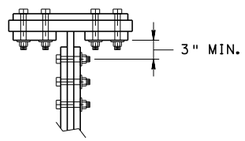
VIEW X-X

FLANGE SPLICE DETAIL - TYPE 2

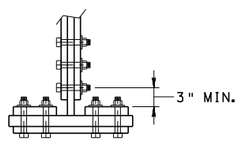


DETAIL A

NOTE:
SEE SHEET 1 FOR GENERAL NOTES.

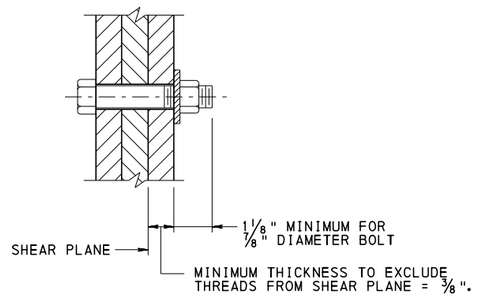


TOP FLANGE



BOTTOM FLANGE

⅞" DIAMETER BOLT ENTERING AND TIGHTENING CLEARANCES



BOLT SHEAR PLANE

MINIMUM PLATE THICKNESS IS ⅜".

NOTE:
BASED ON 1½" THREAD LENGTH FOR ⅞" DIAMETER BOLT

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

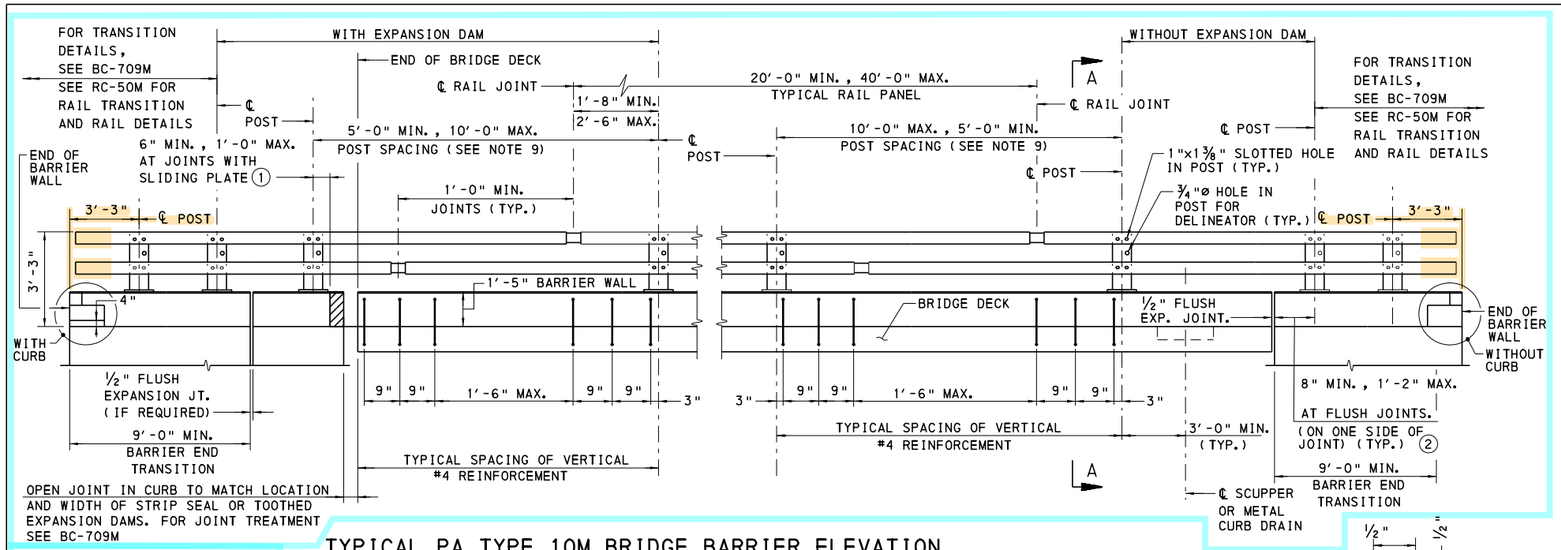
FIELD SPLICE

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 2 OF 2
		BD-616M

CHANGE 2

CHANGE 3

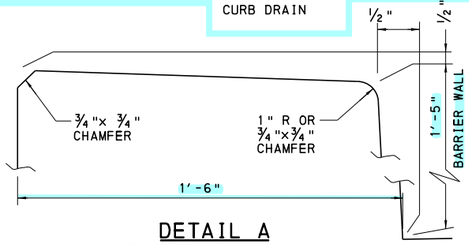
CHANGE 5



TYPICAL PA TYPE 10M BRIDGE BARRIER ELEVATION

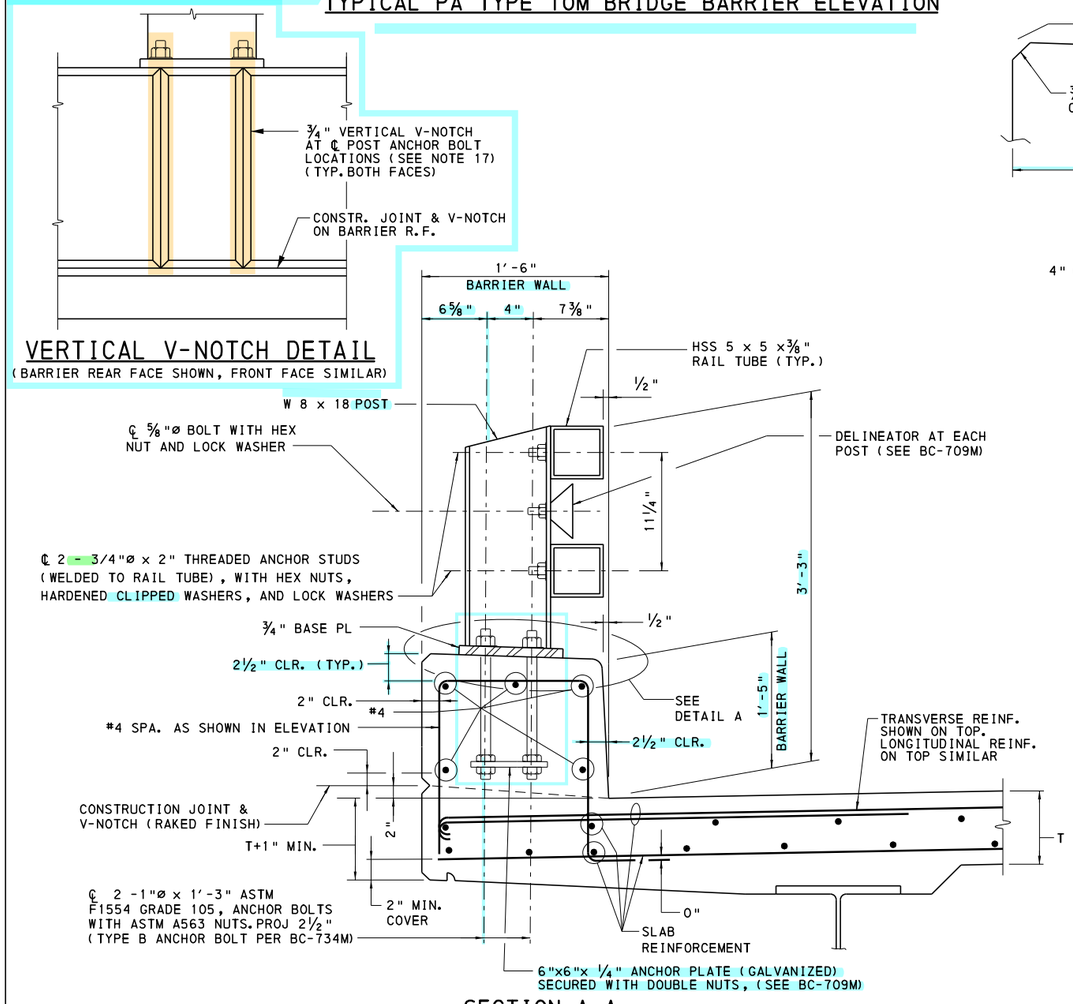
VERTICAL V-NOTCH DETAIL

(BARRIER REAR FACE SHOWN, FRONT FACE SIMILAR)

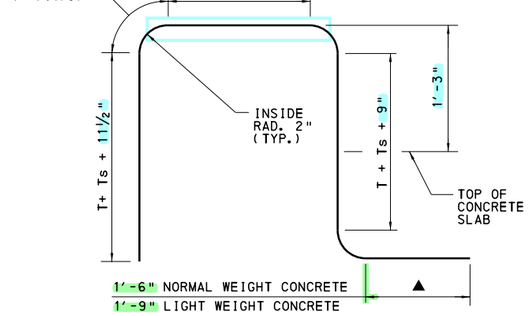


DETAIL A

(BASE PLATE AND ANCHOR BOLTS NOT SHOWN FOR CLARITY)



SECTION A-A



VERTICAL REINFORCEMENT

BD-601M	CONCRETE DECK SLAB
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-632M	R.C. BOX CULVERT
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BD-658M	SHEAR BLOCK DETAILS AT PIER - P/S CONCRETE I-BEAM AND BOX BEAM BRIDGES
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS BOX BEAMS
BD-667M	INTEGRAL ABUTMENT
BC-701M	PROTECTIVE FENCE
BC-709M	PA TYPE 10M BRIDGE BARRIER
BC-711M	ALUMINUM PROTECTIVE BARRIER
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-734M	ANCHOR SYSTEMS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE & STEEL I-BEAM BRIDGES
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-51M	TYPE 31 STRONG POST GUIDE RAIL

REFERENCE DRAWINGS

NOTES:

1. THE PA TYPE 10M BRIDGE BARRIER IS DESIGNATED AS MASH TL-4.
2. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
3. LOCATE RAIL SPLICES AT EXPANSION JOINTS AND AT OTHER LOCATIONS WHERE NECESSARY. PROVIDE RAILS AS LONG AS PRACTICAL, WITH A MINIMUM OF THREE POSTS BETWEEN SPLICES, UNLESS OTHERWISE REQUIRED FOR EXPANSION.
4. PROVIDE RAIL TUBES CONTINUOUS OVER NOT LESS THAN TWO RAILING POSTS. NO WELDED BUTT SPLICES WILL BE ALLOWED IN THE RAIL TUBE SECTIONS.
5. USE f'c = 3.5 KSI CLASS AA CONCRETE FOR BARRIER WALL.
6. TIGHTEN ALL BOLTS THAT HAVE LOCK WASHERS TO SNUG CONDITION ONLY.
7. PLACE POST AND POST ANCHOR BOLTS NORMAL TO GRADE AND RAILS PARALLEL TO GRADE.
8. COAT ALL SURFACES OF THE BASE PLATE IN CONTACT WITH CONCRETE WITH CAULKING COMPOUND PRIOR TO ERECTION. AFTER ERECTION AND ALIGNMENT, SEAL OPENINGS BETWEEN THE METAL SURFACES AND THE CONCRETE WITH CAULKING COMPOUND AS SPECIFIED IN PUBLICATION 408, SECTION 705.8(b).
9. ONE OR MORE 10'-0" MAX. POST SPACINGS MAY BE REDUCED TO 5'-0" MIN. IN ORDER TO MAINTAIN APPROPRIATE SPACING DIMENSIONS FROM THE END OF THE RAIL, EXPANSION JOINTS AND DRAINAGE SCUPPERS.
10. DO NOT USE DEFLECTION JOINTS WITH PA TYPE 10M BRIDGE BARRIERS.
11. PROVIDE POST SPACINGS ON THE PLANS.
12. THE MAXIMUM JOINT MOVEMENT FOR THE PA TYPE 10M BRIDGE BARRIER IS 9".
13. FOR LOCATION OF DRAIN HOLES IN RAIL TUBES, SEE BC-709M.
14. PROVIDE RAILING JOINTS IN ALL RAILS IN THE BAY ABOVE AN EXPANSION DAM. SEE BC-709M, SHEET 1, FOR RAILING JOINT DETAILS.
15. FOR DEAD LOAD CALCULATIONS, THE WEIGHT OF THREE TYPES OF PA TYPE 10M BRIDGE BARRIER ARE AS FOLLOWS:

TYPICAL 10M	375 LB./FT.
SIDEWALK 10M	385 LB./FT.
ALT. SIDEWALK 10M	385 LB./FT.

(ALL CASES ASSUME 7'-6" POST SPACING)

16. FOR DETAILS OF THE PA TYPE 10M BRIDGE BARRIER ON SUBSTRUCTURE UNITS, SEE THE APPROPRIATE SUBSTRUCTURE DETAILS AND REINFORCEMENT IN BD-622M AND BD-624M. FOR DETAILS AT THE END OF BARRIER, SEE SHEETS 2 & 3.
17. PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL THIS SHEET.

REINFORCEMENT BAR NOTES:

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. RADIUS, R=2", IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.
4. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

LEGEND:

(1) ℄ POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR ℄ POST TO EDGE OF FIXED END OF SLIDING PLATE.

(2) NO POST REQUIRED ADJACENT TO FLUSH JOINTS AT WINGWALL IF POSTS LOCATED AT EXPANSION JOINT.

Ts= THICKNESS OF SIDEWALK UNDER BARRIER

T = THICKNESS OF SLAB UNDER BARRIER

▲ WHEN THE DECK IS SLOPED AWAY FROM THE GUTTERLINE, SLOPE REINFORCEMENT LEG TO MATCH DECK CROSS-SLOPE. DESIGNER TO PROVIDE NECESSARY DIMENSIONS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

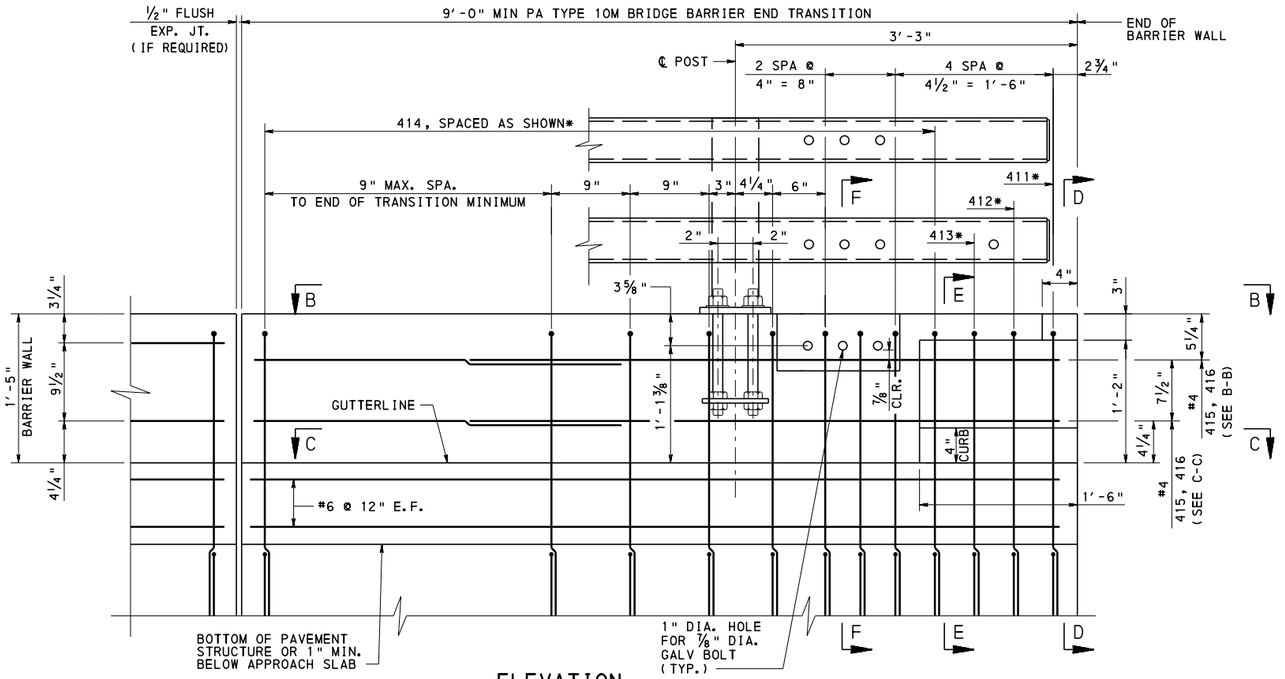
PA TYPE 10M BRIDGE BARRIER BARRIER DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 9

BD-617M

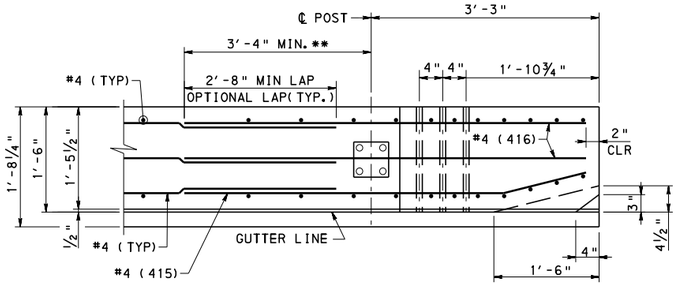


ELEVATION

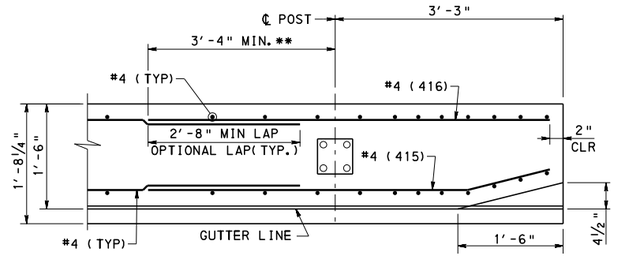
* SEE VERTICAL REINFORCEMENT DETAIL, SHEET 3.
** REINFORCEMENT DETAILING SHOWN REPRESENTS A CONDITION WHERE AN EXPANSION JOINT IS NOT PRESENT.

PA TYPE 10M BARRIER END TRANSITION

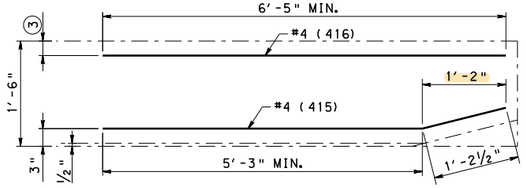
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)
(GUIDE RAIL, CONNECTION PLATE ASSEMBLY AND BOLTS OMITTED FOR CLARITY)



SECTION B-B

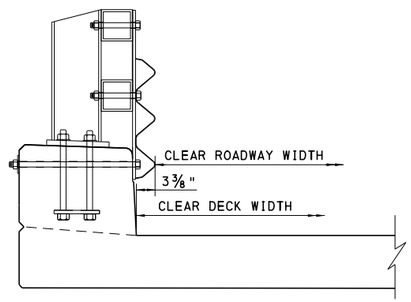


SECTION C-C



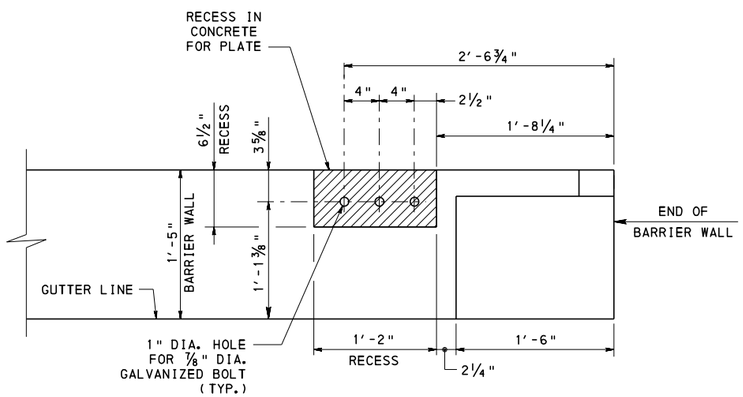
HORIZONTAL REINFORCEMENT

(SEE NOTE 2)



CLEAR ROADWAY WIDTH DETAIL

CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3⅜" ON BOTH SIDES AT THE BARRIER FOR THE THRIE-BEAM TERMINAL CONNECTOR WIDTH.



THRIE-BEAM GUIDE RAIL RECESS AND BOLT HOLE DETAIL

(WITHOUT CURB SHOWN, WITH CURB SIMILAR)

NOTES:

1. FOR SECTION D-D, E-E AND F-F SEE SHEET 3.
2. DIMENSION FROM FACE OF BARRIER TO BAR IS MEASURED TO OUTSIDE FACE OF REINFORCEMENT BAR.
3. FOR ADDITIONAL NOTES, SEE SHEET 1.

LEGEND:

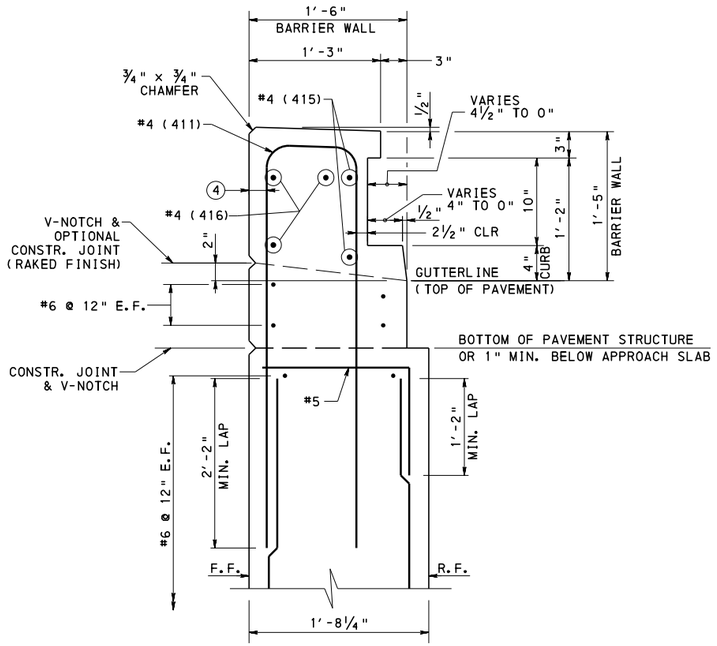
③ 2½" CLR. FOR SAFETY WING, 3⅛" CLR. FOR U-WING.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

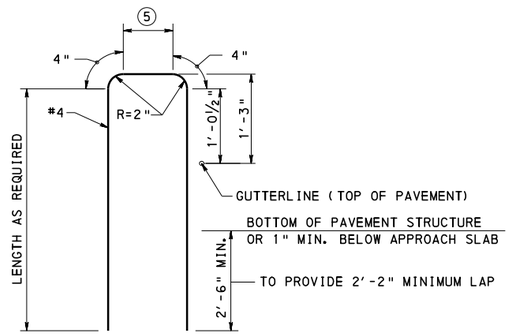
PA TYPE 10M BRIDGE BARRIER END OF BARRIER DETAILS - 1

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 2 OF 9
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-617M

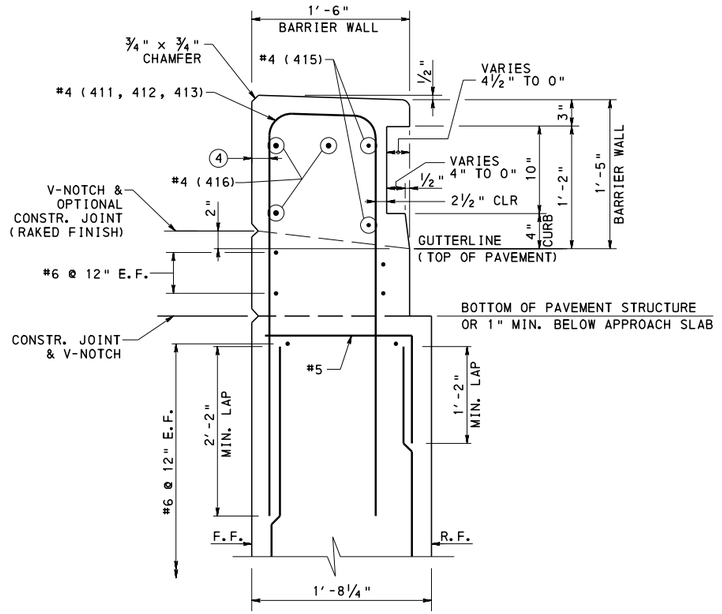


SECTION D-D (6)

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)

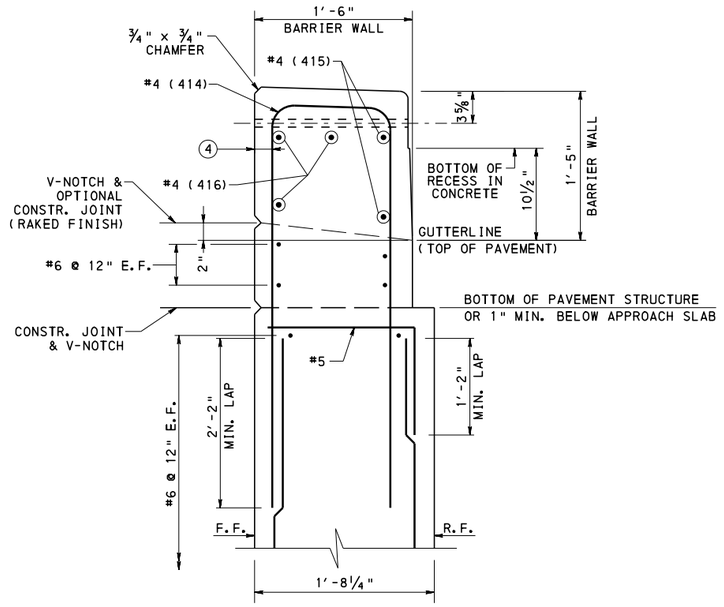


VERTICAL REINFORCEMENT



SECTION E-E (6)

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)



SECTION F-F (6)

LEGEND:

(4) 2" CLR. FOR SAFETY WINGS,
2⅝" CLR. FOR U-WINGS.

(5) FOR SAFETY WINGS:
4¾" (411)
5¾" (412)
6⅞" (413)
8½" (414)

FOR U-WINGS:
4⅛" (411)
5⅛" (412)
6½" (413)
7⅞" (414)

(6) REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WINGS. REINFORCEMENT IN U-WING BELOW 1′-6" WIDTH IS AS BY DESIGN.

NOTES:

1. FOR SECTION D-D, E-E AND F-F LOCATION, SEE SHEET 2.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

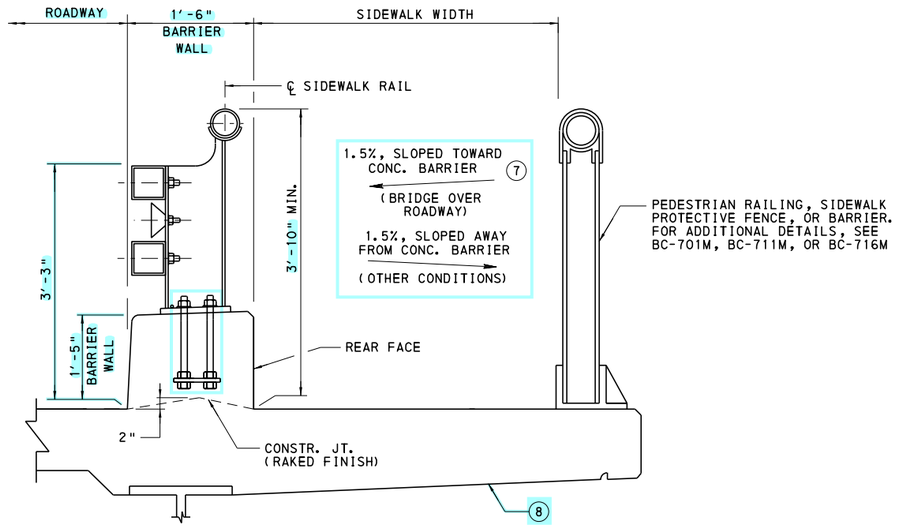
STANDARD

PA TYPE 10M BRIDGE BARRIER END OF BARRIER DETAILS - 2

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

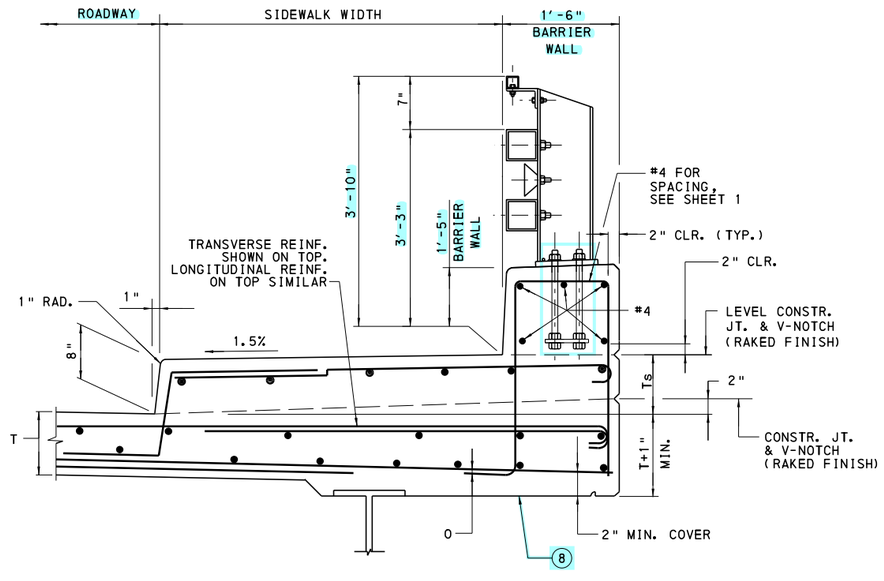
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-617M



TYPICAL SIDEWALK DETAIL

(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE DECK SLAB, SEE BD-601M)



ALTERNATE SIDEWALK DETAIL

(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE SIDEWALK AND DECK SLAB, SEE BD-601M)

LEGEND:

(7) DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN THE SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.

(8) UNDERSIDE OF DECK MAY BE CONSTRUCTED LEVEL.

NOTES:

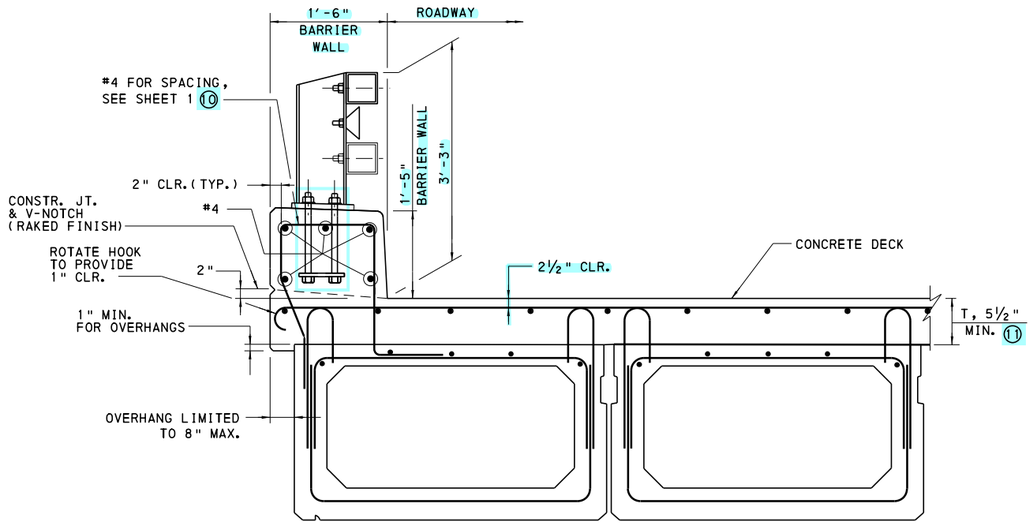
1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA TYPE 10M BARRIER NOT SHOWN, SEE SHEET 1.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

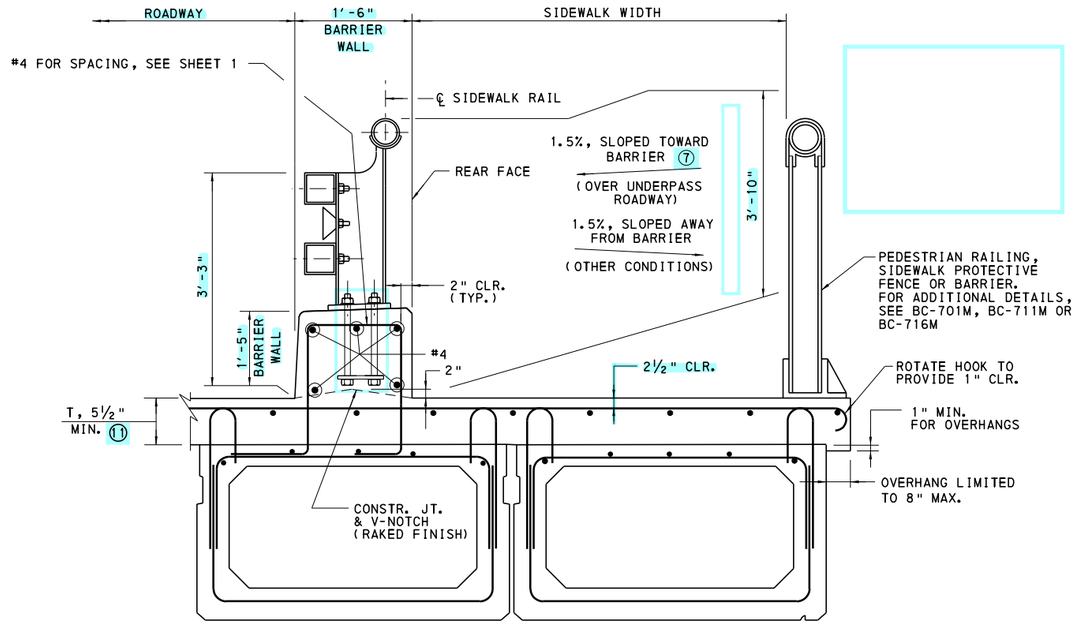
STANDARD

PA TYPE 10M BRIDGE BARRIER SIDEWALK DETAILS

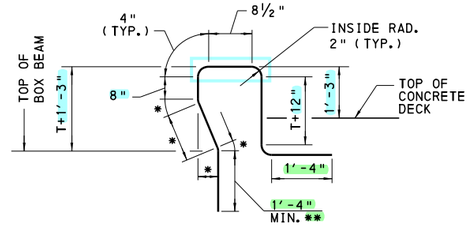
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 4 OF 9
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-617M



36" & 48" COMPOSITE
ADJACENT BOX BEAMS
SUPPORTING BARRIER



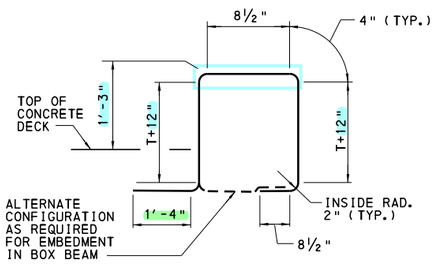
36" & 48" COMPOSITE
ADJACENT BOX BEAMS
SUPPORTING TYPICAL SIDEWALK (9)



* VARIES WITH DECK SLAB THICKNESS, T, AND OVERHANG. DIMENSIONS MAY ALSO BE MODIFIED BY PRESTRESS FABRICATOR TO AVOID INTERFERENCE WITH BEAM FORM WORK.

** OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.

VERTICAL REINFORCEMENT



VERTICAL REINFORCEMENT

NOTE: FOR REINFORCEMENT BAR NOTES SEE SHEET 1.

LEGEND:

(7) DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN THE SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.

(9) USE ONLY WHEN ROADWAY AND SIDEWALK WIDTHS PERMIT THE HORIZONTAL LEGS OF THE BARRIER BAR TO BE EMBEDDED ENTIRELY WITHIN ONE BEAM. ROADWAY/SIDEWALK WIDTHS MAY NEED TO BE ADJUSTED TO ACCOMMODATE THIS CONDITION.

(10) BEND AS REQUIRED TO ACCOMMODATE OVERHANG. SEE BC-736M.

(11) INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD.

NOTES:

1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA TYPE 10M BARRIER NOT SHOWN, SEE SHEET 1.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

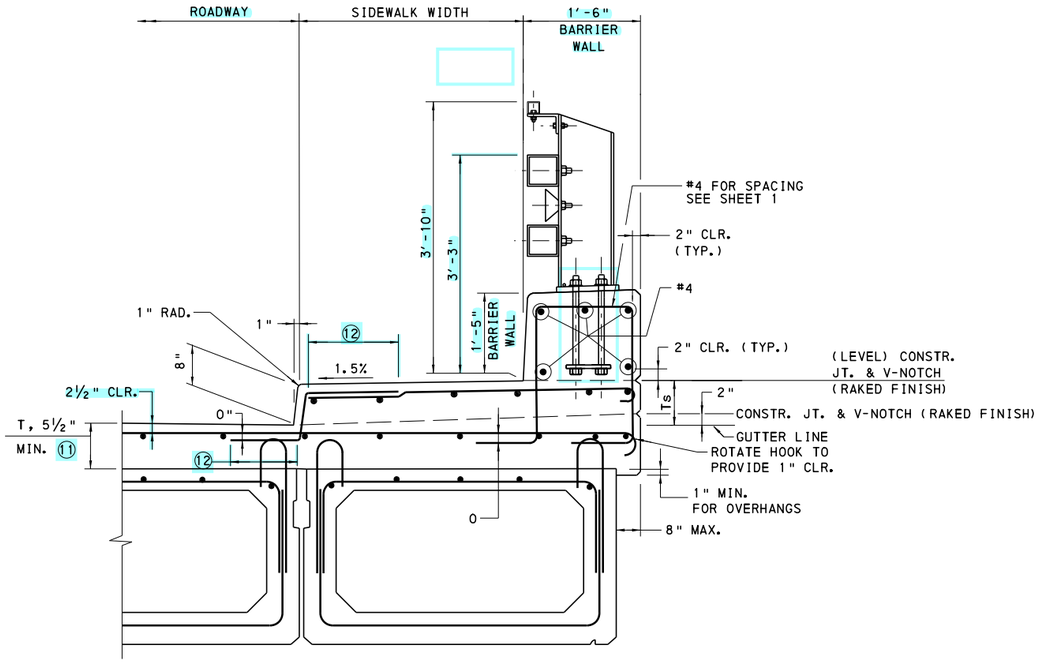
PA TYPE 10M BRIDGE BARRIER
ADJACENT BOX BEAM DETAILS - 1

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 5 OF 9

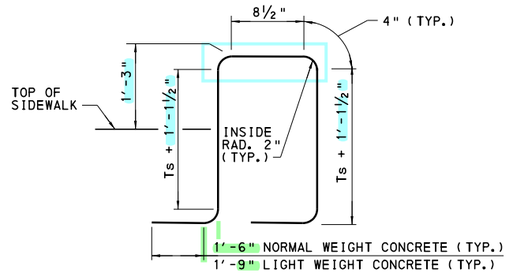
BD-617M



36" & 48" COMPOSITE ADJACENT BOX BEAMS

SUPPORTING ALTERNATE SIDEWALK

FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE SIDEWALK, SEE BD-601M.



VERTICAL REINFORCEMENT

FOR REINFORCEMENT BAR NOTES, SEE SHEET 1

NOTES:

1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA TYPE 10M BARRIER NOT SHOWN, SEE SHEET 1.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

LEGEND:

⑪ INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD.

⑫ FOR DIMENSIONS, SEE BD-601M, SHEET 4.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

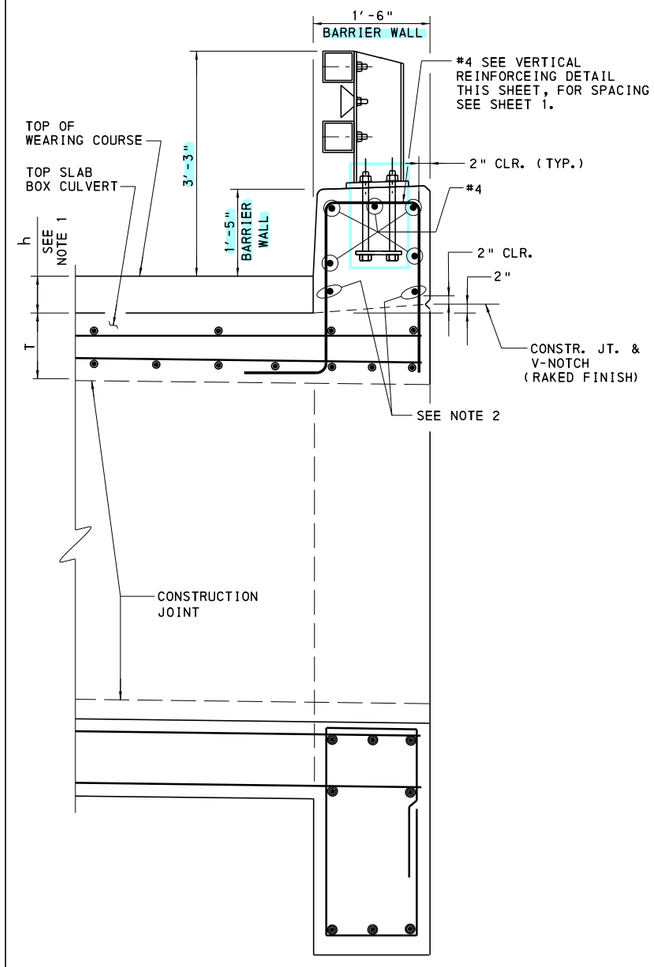
PA TYPE 10M BRIDGE BARRIER
ADJACENT BOX BEAM DETAILS - 2

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

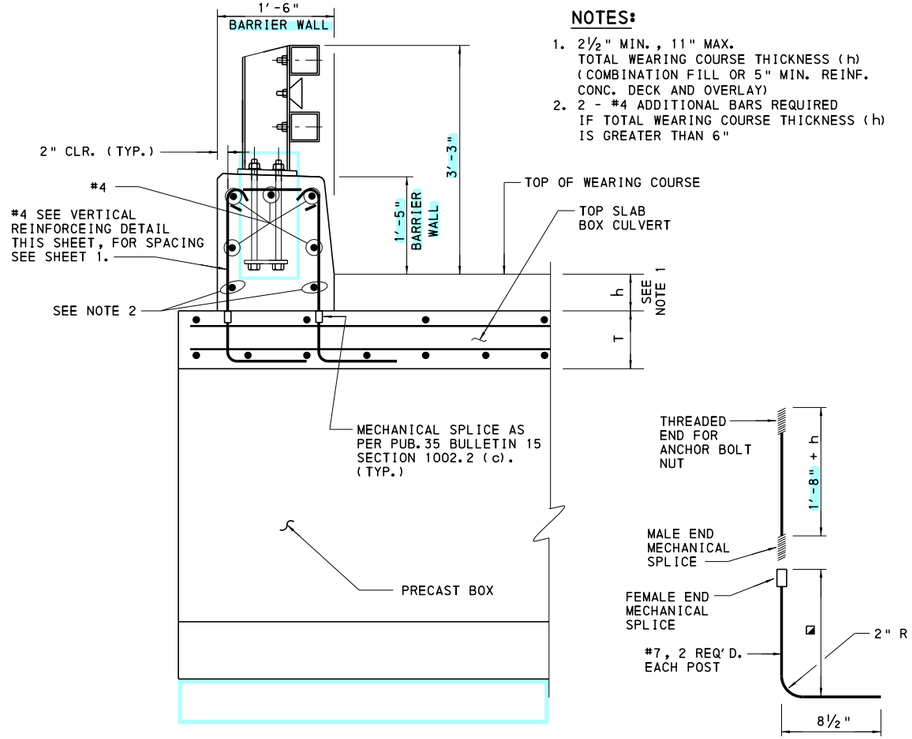
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 9

BD-617M



SECTION - C.I.P.



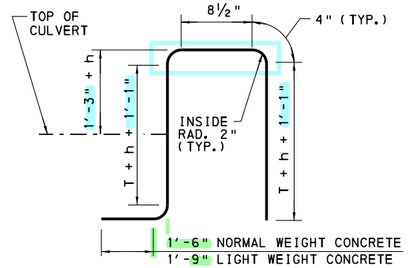
SECTION - PRECAST

NOTES:

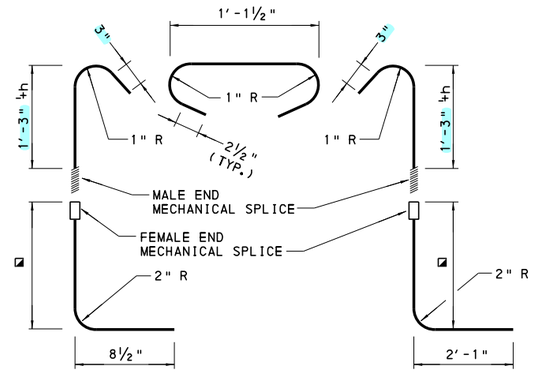
1. 2½" MIN., 11" MAX. TOTAL WEARING COURSE THICKNESS (h) (COMBINATION FILL OR 5" MIN. REINF. CONC. DECK AND OVERLAY)
2. 2 - #4 ADDITIONAL BARS REQUIRED IF TOTAL WEARING COURSE THICKNESS (h) IS GREATER THAN 6"

OPTIONAL
ANCHOR BOLT DETAIL

APPLIES TO PRECAST CULVERT ONLY



C.I.P. CULVERT



PRECAST CULVERT
VERTICAL REINFORCEMENT

ALL VERTICAL REINFORCEMENT #4

◪ FOR T<10": T-2"
FOR T≥10": 8" MIN.

R.C. CULVERT AT GRADE

NOTES:

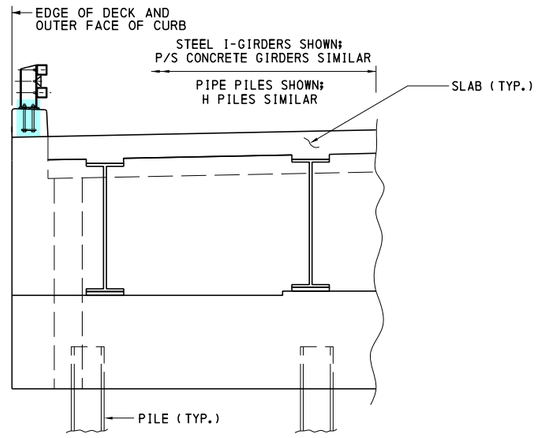
1. FOR R.C. CULVERT DETAILS, SEE BD-632M.
2. FOR POST AND REINFORCEMENT BAR SPACING, SEE SHEET 1.
3. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

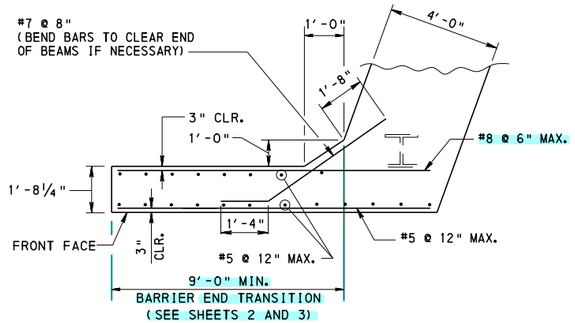
STANDARD

PA TYPE 10M BRIDGE BARRIER BOX CULVERT DETAILS

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 7 OF 9
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-617M

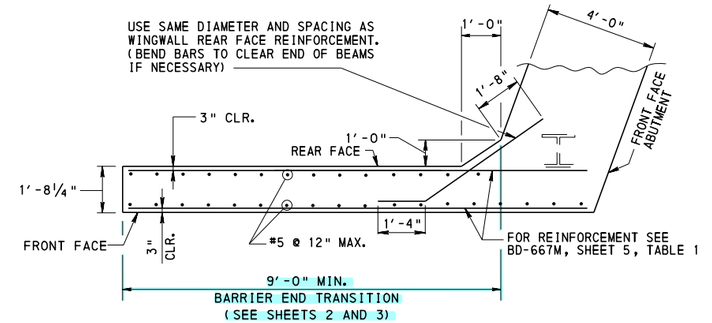


TYPICAL ELEVATION



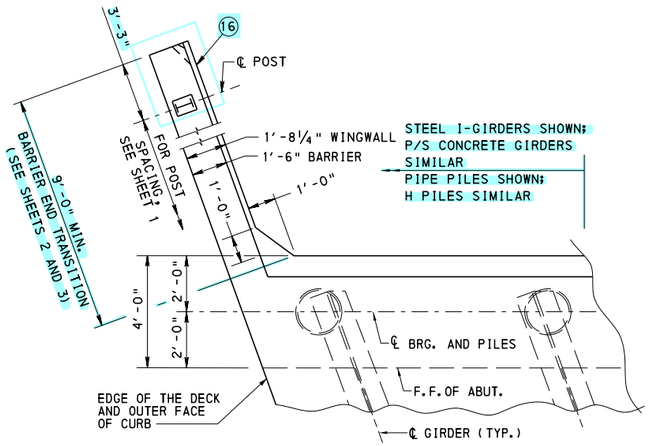
SECTION J-J

SEE BD-667M SHEET 5 FOR LOCATION OF SECTIONS J-J AND L-L.

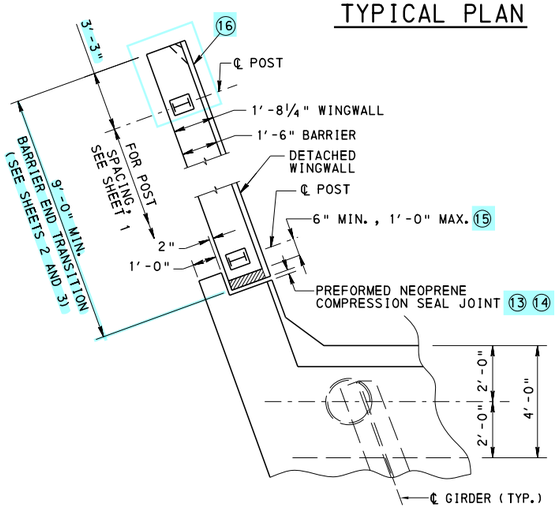


SECTION L-L

(FOR REINFORCEMENT NOT SHOWN
SEE BD-667M, SHEET 4)

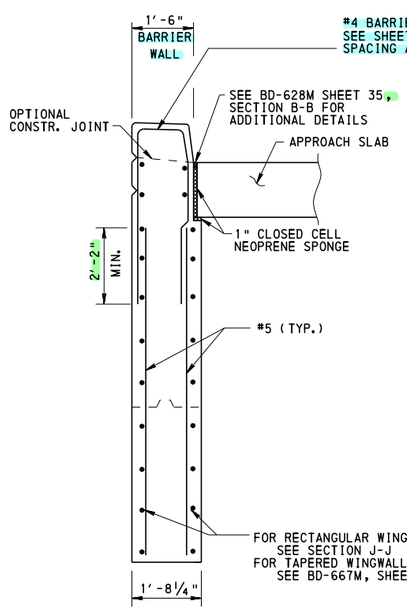


TYPICAL PLAN



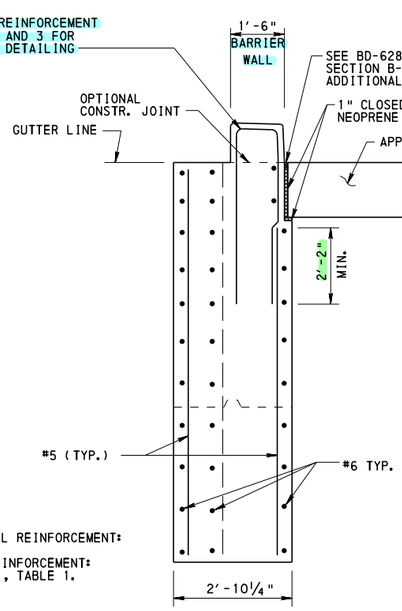
DETACHED WINGWALL PLAN

(FOR DIMENSIONS AND CALL OUTS
NOT SHOWN, SEE TYPICAL PLAN)



SECTION K-K

(RECTANGULAR OR TAPERED WING)



SECTION N-N

(DETACHED WING)

SEE BD-667M SHEET 5 FOR LOCATION OF SECTIONS K-K AND N-N.

LEGEND:

13 FOR DETAILS OF THE PREFORMED NEOPRENE COMPRESSION SEAL JOINT AND SLIDING PLATE, SEE BD-667M, SHEETS 5 AND 6.

14 FOR DETAILS OF THE BENT PLATE ON CONCRETE CURB, SEE BC-709M.

15 ℄ POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR ℄ POST TO EDGE OF FIXED END OF SLIDING PLATE.

16 SECTION SHOWN WITHOUT CURB, WITH CURB FOLLOW DETAILS ON SHEETS 2 AND 3.

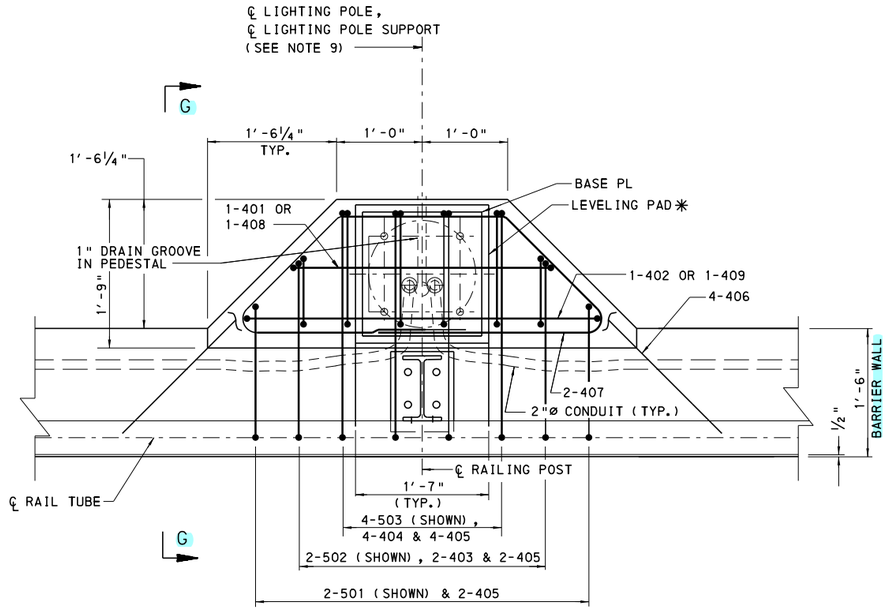
NOTES:

1. SEE BD-667M FOR ALL OTHER INTEGRAL ABUTMENT DETAILS.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
PA TYPE 10M BRIDGE BARRIER
INTEGRAL ABUTMENT DETAILS

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 8 OF 9
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-617M



PLAN

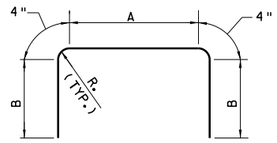
(BARRIER REINFORCEMENT NOT SHOWN FOR CLARITY)

NOTES:

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
2. SET ANCHOR BOLTS ACCURATELY BY THE TEMPLATE FURNISHED BY THE MANUFACTURER, TO THE CORRECT ELEVATION AND ALIGNMENT AND SECURELY BRACE AGAINST DISPLACEMENT BEFORE THE SURROUNDING CONCRETE IS PLACED. ANCHOR BOLT DIAMETER AS REQUIRED BY LIGHTING POLE MANUFACTURER. (FOR FUTURE LIGHTING PROVISIONS, SEE CHART ON THIS SHEET.)
3. SEAL CONDUIT AND PROTECT THREADS FOR FUTURE LIGHTING INSTALLATIONS.
4. CONFORM ANCHOR MATERIALS TO 1101.4 PUB. 408.
5. SET LIGHTING POLES TRULY VERTICAL WITH BASES LEVEL USING LEVELING NUTS.
6. PROVIDE 2" CLEAR ON ALL REINFORCEMENT UNLESS NOTED.
7. PROVIDE A MINIMUM OF 2 1/2 " CONCRETE COVER FOR CONDUIT.
8. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA TYPE 10M BRIDGE BARRIER NOT SHOWN, SEE SHEET 1.
9. PREFERRED LOCATION FOR LIGHTING POLES IS AT PIERS AND ABUTMENTS. REFER TO BD-655M FOR ABUTMENT DETAILS AND BD-658M FOR PIER DETAILS TO HELP DEVELOP LIGHT POLE SUPPORT DETAIL. LIGHTING POLE SUPPORT, IF NEEDED, TO BE DESIGNED BY THE ENGINEER TO DISTRIBUTE LOAD TO BOTH FASCIA AND FIRST INTERIOR BEAM.
10. FOR LIGHTING POLE LOCATIONS WITHIN A SPAN, THE LUMINAIRE DEFLECTION MUST BE EVAULATED FOR DYNAMIC EFFECTS.

PROVISIONS FOR FUTURE LIGHTING		
MOUNTING HEIGHT	ANCHOR BOLT CIRCLE DIA.	ANCHOR BOLT DIAMETER
50'-0" MAX.	15"	1"

REINFORCEMENT TABLE							
MARK	SIZE	LENGTH	NUMBER	TYPE	A	B	C
401	4	6'-6"	1	1	2'-7"	1'-7½"	-----
402	4	7'-5"	1	1	3'-6"	1'-7½"	-----
403	4	4'-5"	2	1	5"	1'-8"	-----
404	4	4'-11"	4	1	11"	1'-8"	-----
405	4	5'-2½"	8	2	2'-7½"	2'-3"	0"
406	4	9'-1½"	4	3	-----	-----	-----
407	4	10'-11"	2	4	-----	-----	-----
408	4	7'-9"	1	1	2'-7"	2'-3"	-----
409	4	8'-8"	1	1	3'-6"	2'-3"	-----
501	5	3'-6½"	2	2	1'-0"	9"	10½"
502	5	4'-0½"	2	2	1'-6"	9"	10½"
503	5	4'-6"	4	2	1'-11½"	9"	10½"



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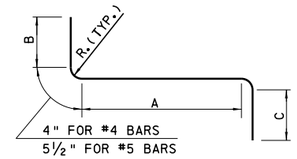
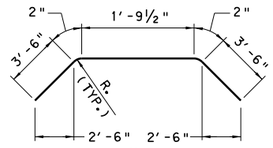


②



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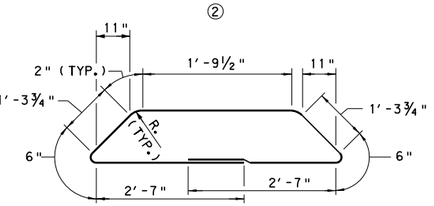
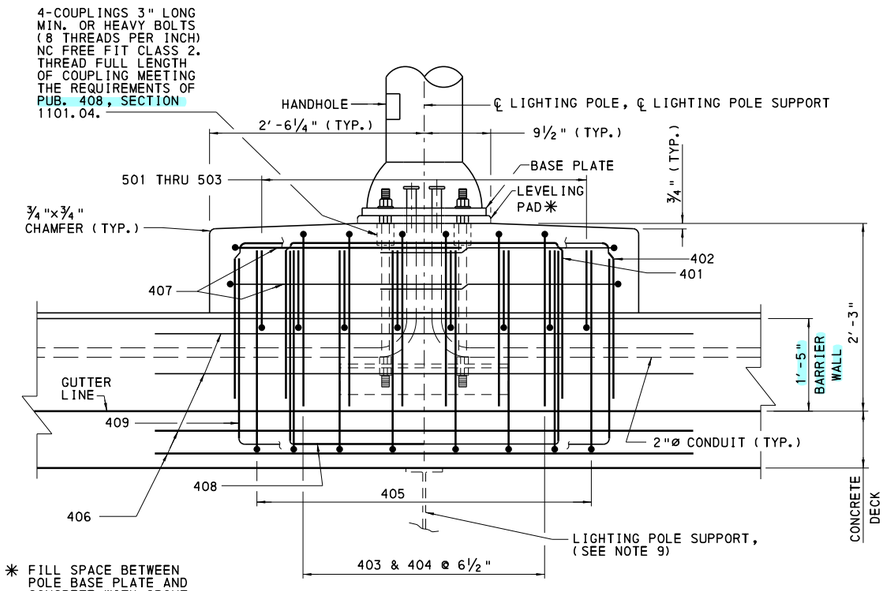


④

REINFORCEMENT DETAILS

REINFORCEMENT BAR NOTES

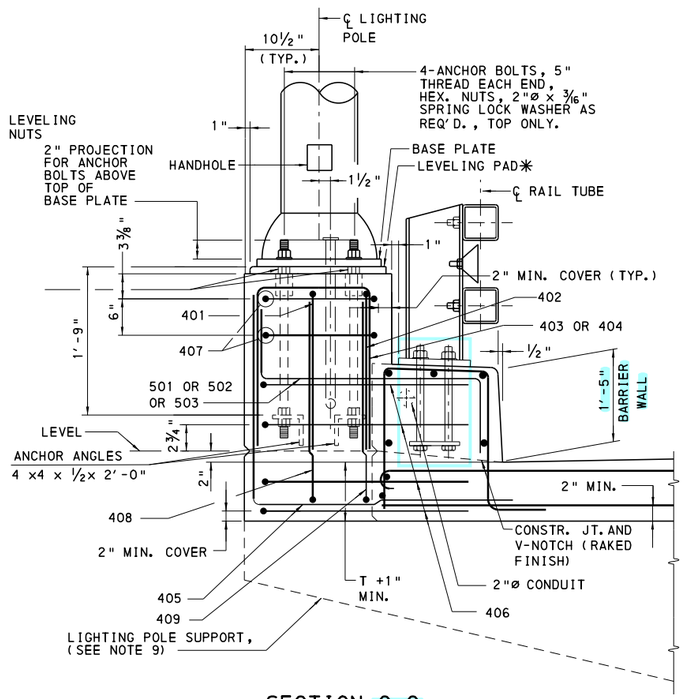
1. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
2. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).
3. RADIUS, R=2", FOR #4 BARS AND R=3" FOR #5 BARS, IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.



ELEVATION

(RAILING POST, TUBES, BARRIER AND DECK REINFORCEMENT NOT SHOWN FOR CLARITY)

✳ FILL SPACE BETWEEN POLE BASE PLATE AND CONCRETE WITH GROUT AFTER SETTING POLE TRULY VERTICAL USING LEVELING NUTS. TOOL EDGES OF PAD. MINIMUM HEIGHT OF LEVELING PAD IS 1".



SECTION G-G

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

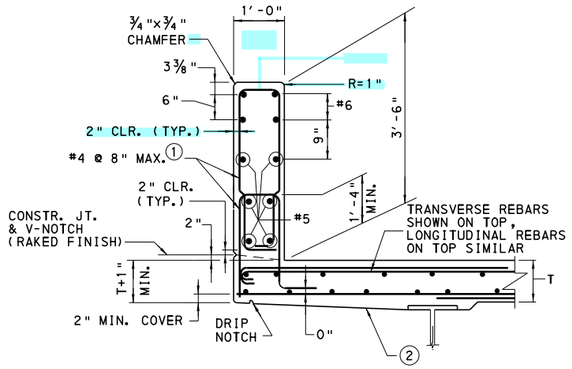
STANDARD

PA TYPE 10M BRIDGE BARRIER LIGHTING POLE ANCHORAGE DETAILS

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 9 OF 9
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-617M

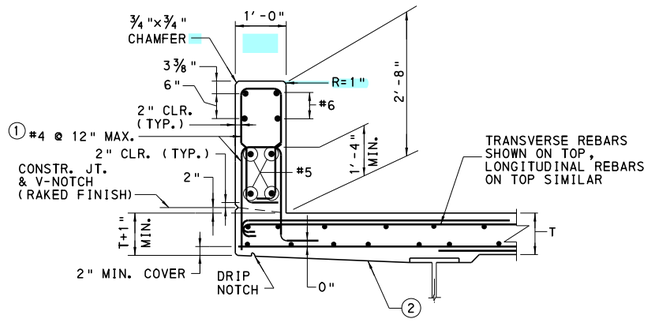
CHANGE 2

CHANGE 3



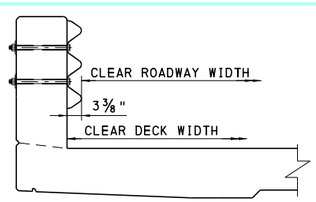
42" VERTICAL WALL CONCRETE BARRIER DETAIL

(FOR REINFORCEMENT IN DECK SLAB, SEE BD-601M)



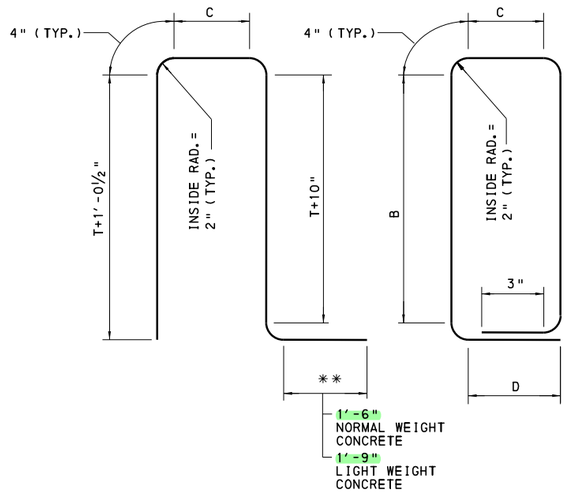
32" VERTICAL WALL CONCRETE BARRIER DETAIL

(FOR REINFORCEMENT IN DECK SLAB, SEE BD-601M)



CLEAR ROADWAY WIDTH DETAIL

CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3⅜" ON BOTH SIDES AT BARRIER FOR THRIE-BEAM TERMINAL CONNECTOR WIDTH



VERTICAL REINFORCEMENT

(SEE TABLE 1 FOR DIMENSIONS B, C, D)

** WHEN THE DECK IS SLOPED AWAY FROM THE GUTTERLINE, SLOPE LEG TO MATCH DECK CROSS-SLOPE. DESIGNER TO PROVIDE NECESSARY DIMENSIONS.

TABLE 1
VERTICAL REINFORCEMENT DIMENSIONS

	B	C	D
42" VERTICAL WALL CONCRETE BARRIER	2'-7"	3"	5½"
32" VERTICAL WALL CONCRETE BARRIER	1'-9"	3"	5½"

REINFORCEMENT BAR NOTES

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. RADIUS, R=2, IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.
4. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1 (c).

LEGEND:

① WITHIN 10 FT. ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS ON SHEETS 2-6.

② UNDERSIDE OF DECK SLAB MAY BE CONSTRUCTED LEVEL.

NOTES:

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
2. THE 42" VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-5. THE 42" VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE HEIGHT OF THE BARRIER BELOW 42".
3. THE 32" VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-3.
4. FOR DEAD LOAD CALCULATIONS, THE WEIGHT OF VERTICAL WALL CONCRETE BARRIERS ARE AS FOLLOWS:
   - 42" VERTICAL CONCRETE WALL — 530 LB./FT.
   - 32" VERTICAL CONCRETE WALL — 400 LB./FT.
   - SIDEWALK VERTICAL CONCRETE WALL — 530 LB./FT.
   - RAISED SIDEWALK VERTICAL CONCRETE WALL — 540 LB./FT.
5. FOR DETAILS OF THE 42" AND 32" VERTICAL WALL CONCRETE BARRIER ON SUBSTRUCTURE UNITS, SEE THE APPROPRIATE SUBSTRUCTURE DETAILS IN BD-622M AND BD-624M.

CONTRACT DRAWING NOTE:

1. THE FOLLOWING NOTE IS TO BE PLACED ON THE CONTRACT DRAWINGS WHEN THE 42" VERTICAL WALL CONCRETE BARRIER IS USED: THE 42" VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE BARRIER HEIGHT BELOW 42".

REFERENCE DRAWINGS	
BD-601M	CONCRETE DECK SLAB
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BD-658M	SHEAR BLOCK DETAILS AT PIER - P/S CONCRETE I-BEAM AND BOX BEAM BRIDGES
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS BOX BEAMS
BC-701M	PROTECTIVE FENCE
BC-711M	ALUMINUM PROTECTIVE BARRIER
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-720M	ALUMINUM OR STEEL BRIDGE HAND RAILING
BC-734M	ANCHOR SYSTEMS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE & STEEL I-BEAM BRIDGES
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS

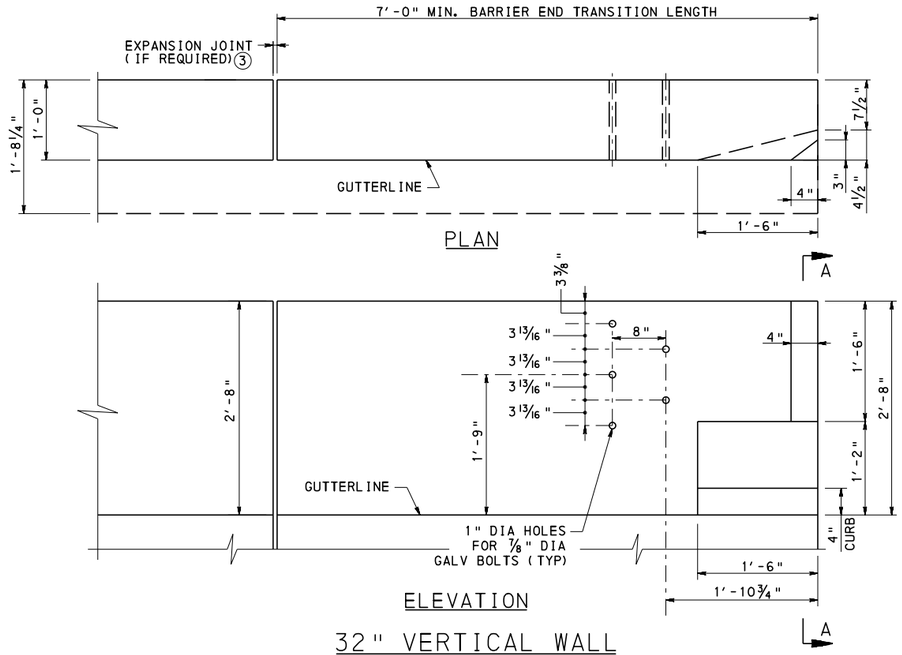
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

VERTICAL WALL CONCRETE BARRIER

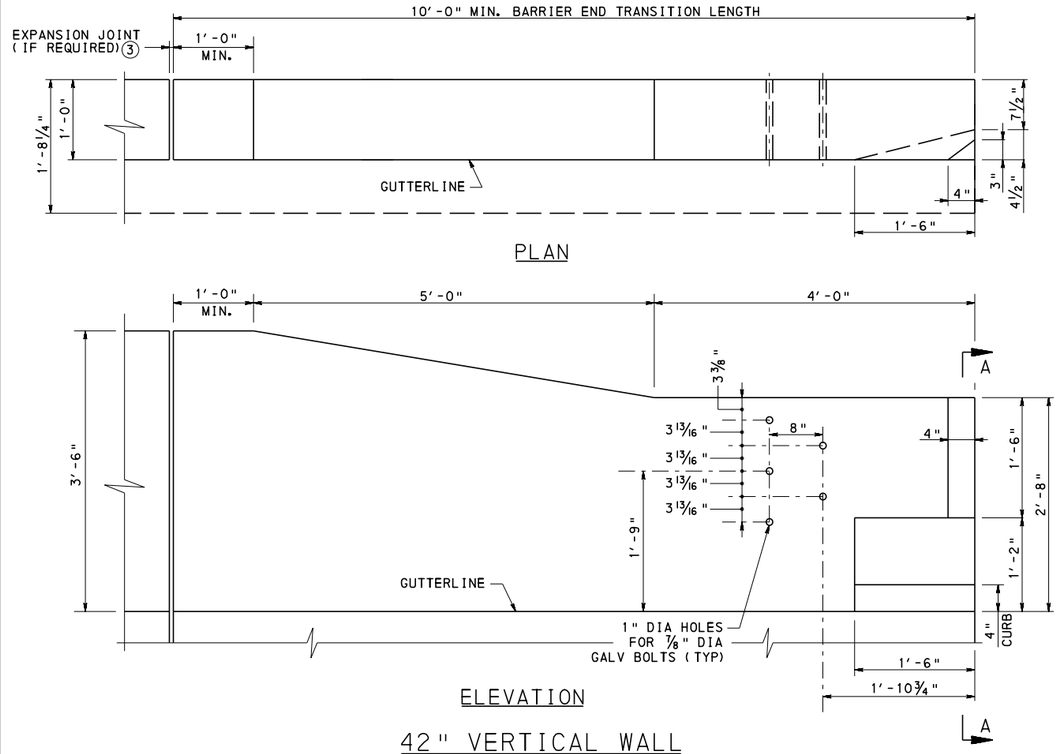
RECOMMENDED FEB. 19, 2021
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 19, 2021
Bruce E. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY



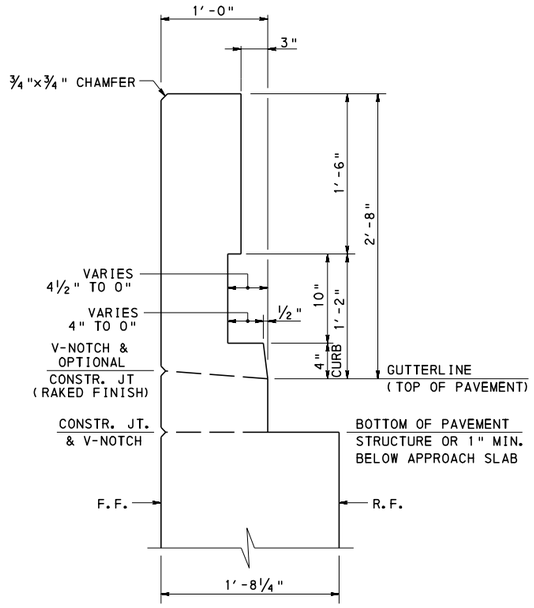
32" VERTICAL WALL
CONCRETE BARRIER END TRANSITION

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)



42" VERTICAL WALL
CONCRETE BARRIER END TRANSITION

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)



SECTION A-A

LEGEND:

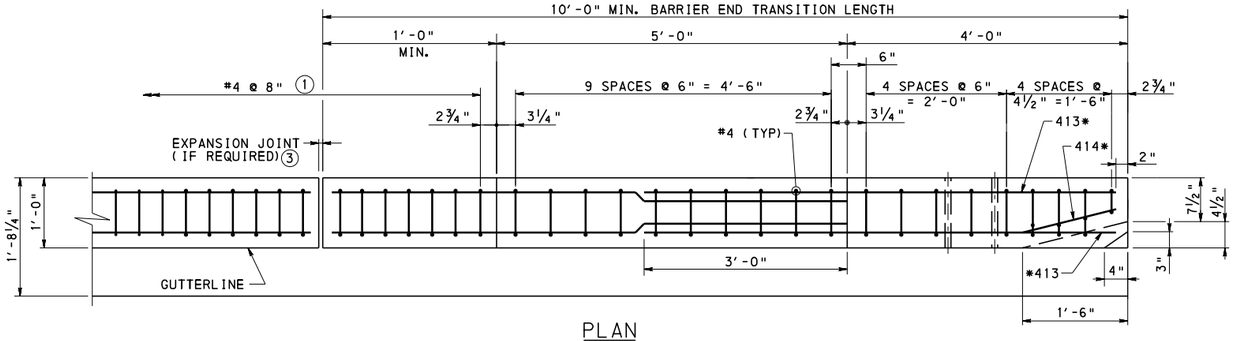
③ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

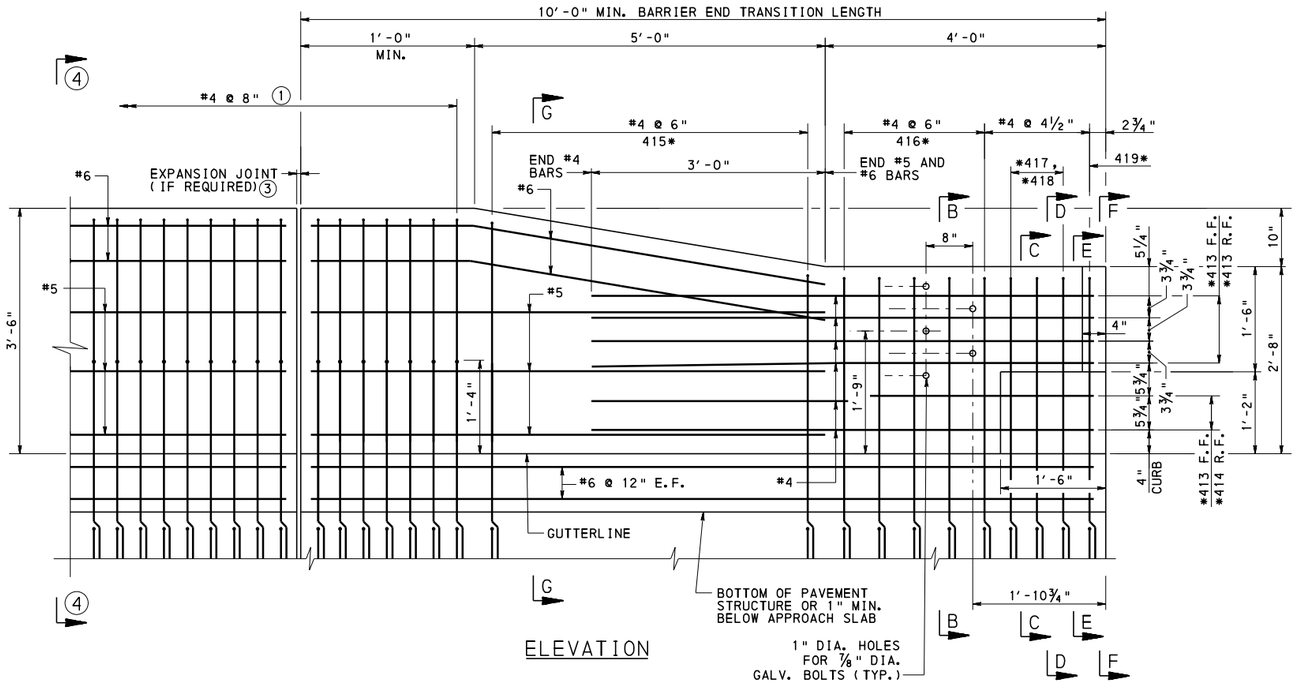
STANDARD

VERTICAL WALL
CONCRETE BARRIER
BARRIER END TRANSITION - 1

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 2 OF 9
Thomas A. Maciore CHIEF BRIDGE ENGINEER	Bruce E. Thyssen DIRECTOR, BUR. OF PROJECT DELIVERY	BD-618M



PLAN

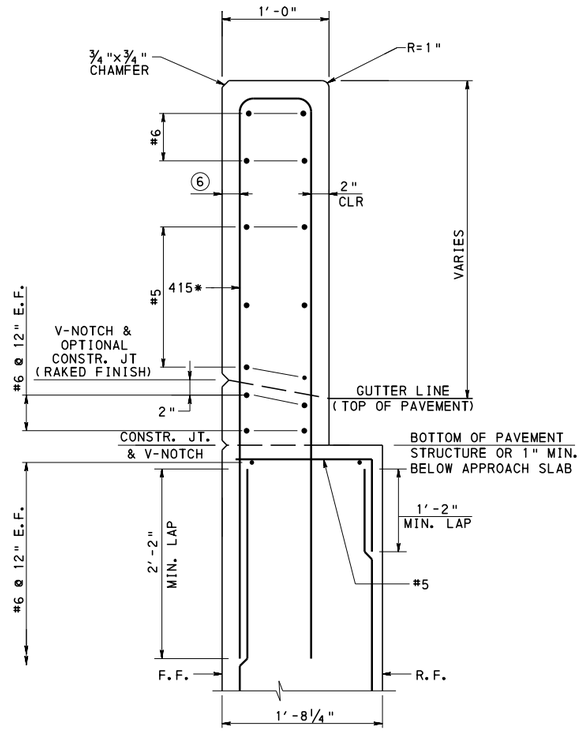


ELEVATION

42" VERTICAL WALL CONCRETE BARRIER END TRANSITION

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)

* SEE REINFORCEMENT DETAILS, SHEETS 5 & 6.



SECTION G-G ⑦

LEGEND:

① WITHIN 10 FT. ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS ON SHEETS 2-6.

③ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".

④ SEE 42" VERTICAL WALL CONCRETE BARRIER DETAIL, SHEET 1.

⑥ 2" CLR. FOR SAFETY WINGS, 2⅝" CLR. FOR U-WINGS.

⑦ REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WING. REINFORCEMENT IN U-WING BELOW 1'-0" WIDTH IS AS REQUIRED PER DESIGN.

NOTES:

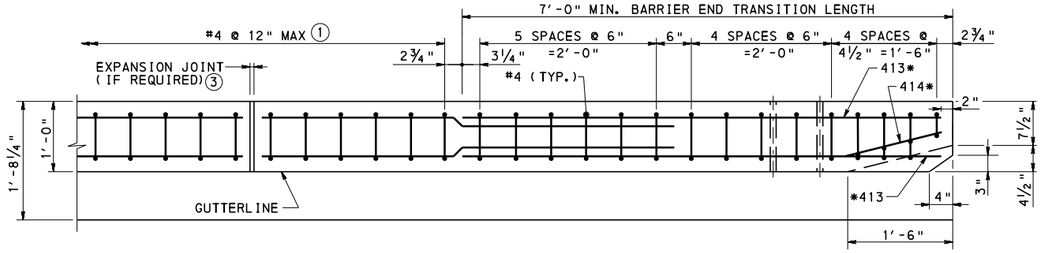
1. FOR ADDITIONAL BARRIER END TRANSITION DETAILS AND REINFORCEMENT, SEE BD-622M AND BD-624M.
2. FOR SECTION B-B, C-C, D-D, E-E AND F-F SEE SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

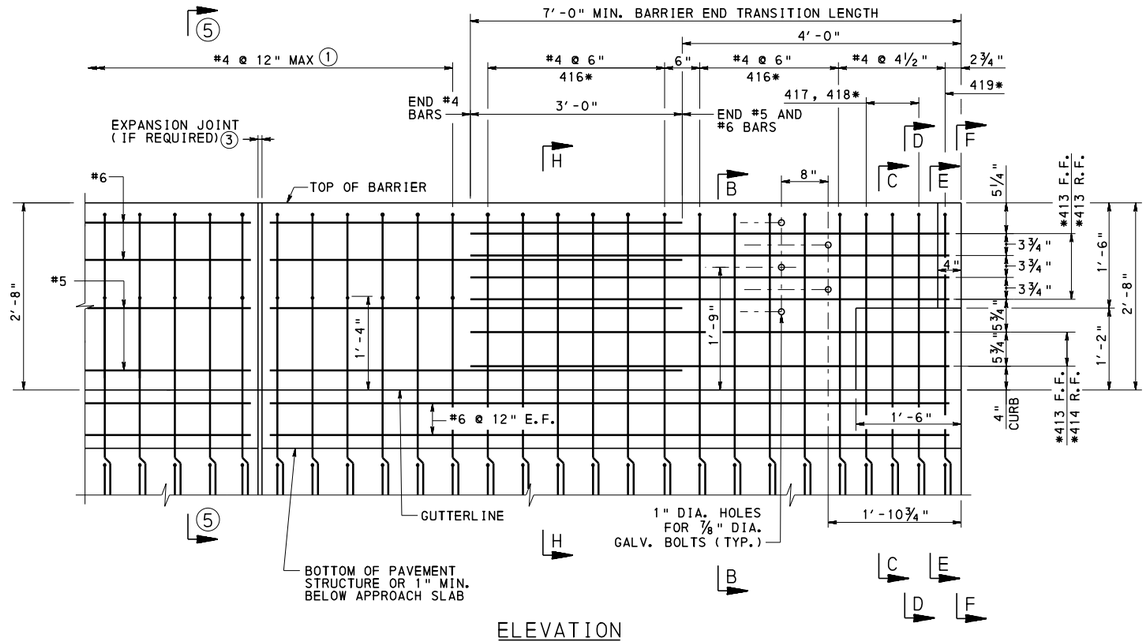
STANDARD

VERTICAL WALL
CONCRETE BARRIER
BARRIER END TRANSITION - 2

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 3 OF 9
Thomas P. Macioce	Bruce E. Thyagus	BD-618M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	



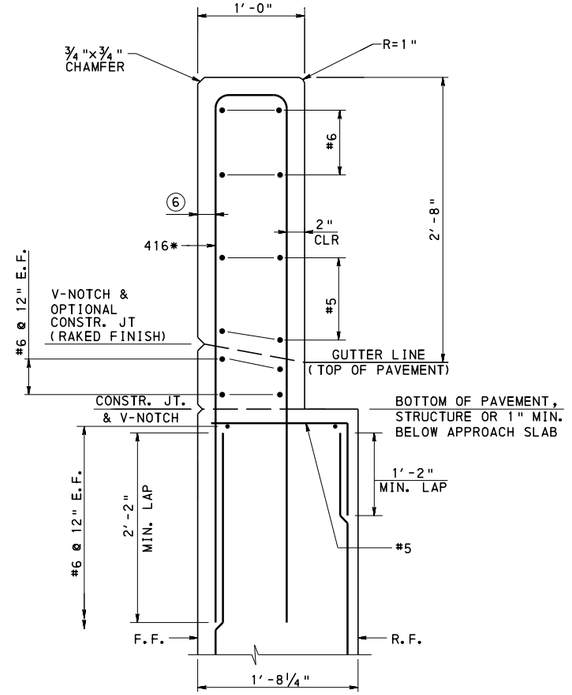
PLAN



ELEVATION

32" VERTICAL WALL CONCRETE BARRIER END TRANSITION

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)



SECTION H-H (7)

NOTE: #4 LONGITUDINAL BARS IN THE BARRIER ARE NOT SHOWN FOR CLARITY.

LEGEND:

(1) WITHIN 10 FT. ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS ON SHEETS 2-6.

(3) EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3′-7", MINIMUM LAP FOR #6 BAR IS 4′-4".

(5) SEE 32" VERTICAL WALL CONCRETE BARRIER DETAIL, SHEET 1.

(6) 2" CLR. FOR SAFETY WINGS, 2⅝" CLR. FOR U-WINGS.

(7) REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WING. REINFORCEMENT IN U-WING BELOW 1′-0" WIDTH IS AS REQUIRED PER DESIGN.

* SEE REINFORCEMENT DETAILS, SHEETS 5 & 6.

NOTES:

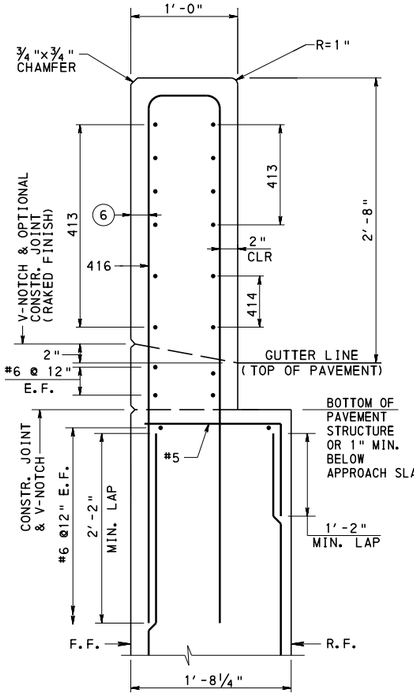
1. FOR ADDITIONAL BARRIER END TRANSITION DETAILS AND REINFORCEMENT, SEE BD-622M AND BD-624M.
2. FOR SECTION B-B, C-C, D-D, E-E AND F-F SEE SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

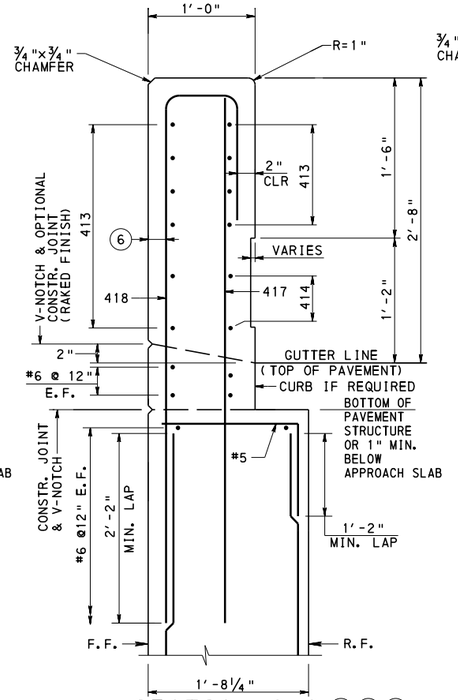
STANDARD

VERTICAL WALL
CONCRETE BARRIER
BARRIER END TRANSITION - 3

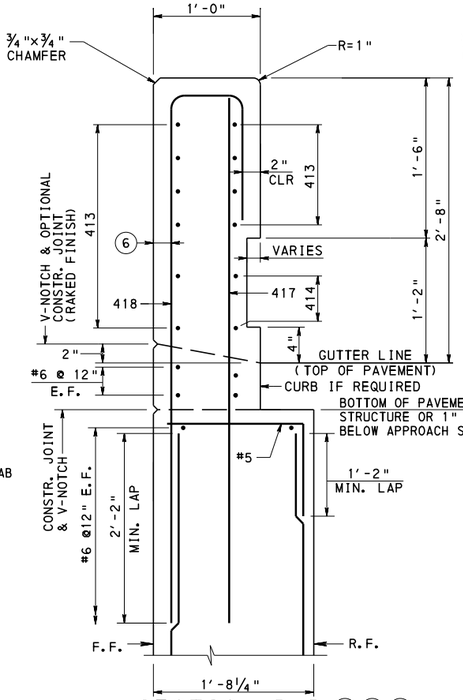
RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 4 OF 9
Thomas A. Maciore	Bruce E. Thompson	BD-618M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	



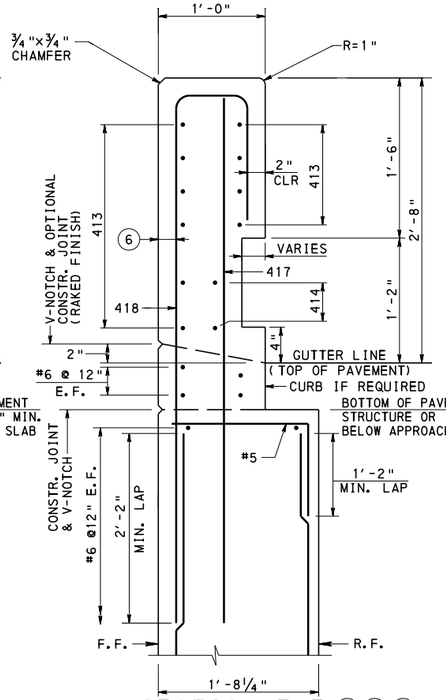
SECTION B-B ⑦ ⑧ ⑨



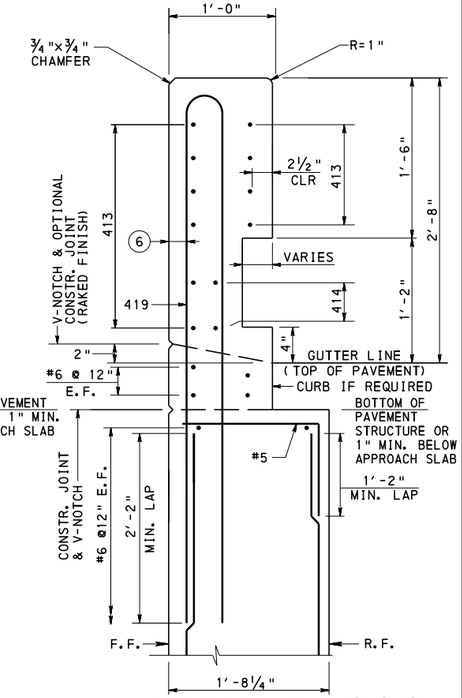
SECTION C-C ⑦ ⑧ ⑨



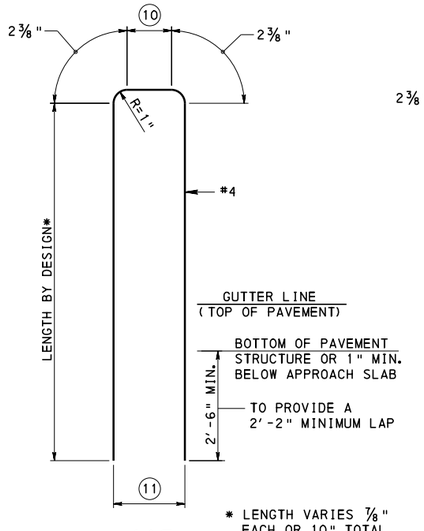
SECTION D-D ⑦ ⑧ ⑨



SECTION E-E ⑦ ⑧ ⑨

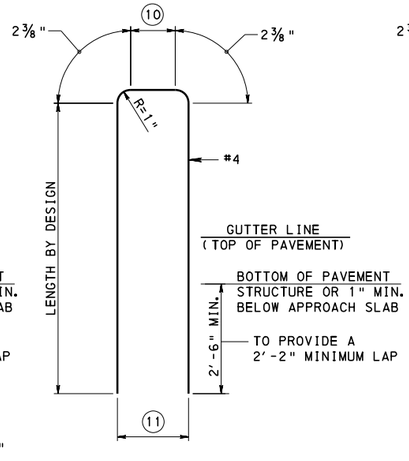


SECTION F-F ⑦ ⑧ ⑨



415

* LENGTH VARIES ⅞" EACH OR 10" TOTAL THRU TRANSITION.



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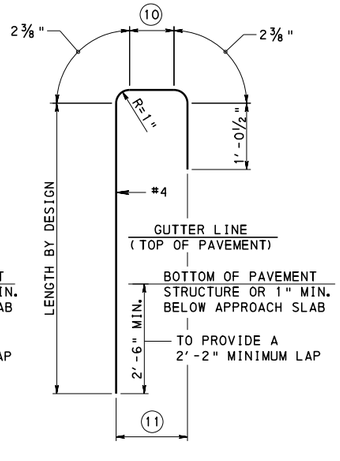

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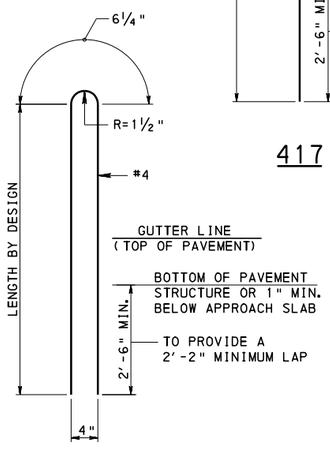

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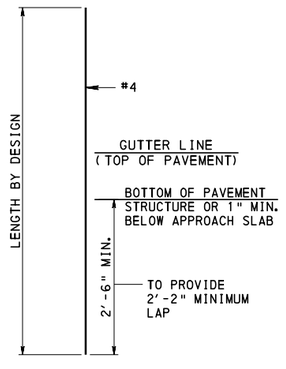


417

LEGEND:

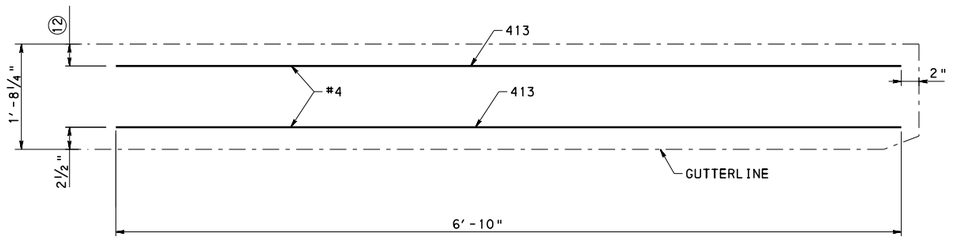
6. 2" CLR. FOR SAFETY WINGS. 2⅝" CLR. FOR U-WINGS.
7. REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WINGS. REINFORCEMENT IN U-WING BELOW 1′-0" WIDTH IS AS REQUIRED PER DESIGN.
8. TYPICAL SECTIONS SHOWN WITH CURB, WITHOUT CURB SIMILAR.
9. FOR DETAILS OF THE BARRIER SUPPORT WALLS, SEE BD-622M AND BD-624M, SHEET 2.
10. 5" FOR SAFETY WINGS. 4⅜" FOR U-WINGS.
11. 8" FOR SAFETY WINGS. 7⅜" FOR U-WINGS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

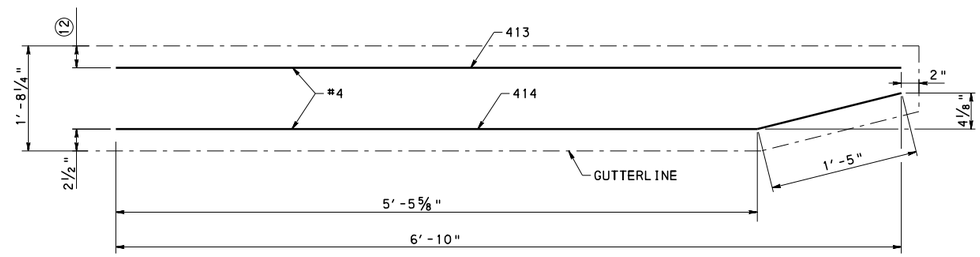
STANDARD

VERTICAL WALL CONCRETE BARRIER END TRANSITION REINFORCEMENT - 1

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 5 OF 9
Thomas A. Maciore	Bruce E. Thigpen	BD-618M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	



PLAN
413



PLAN
414

LEGEND:

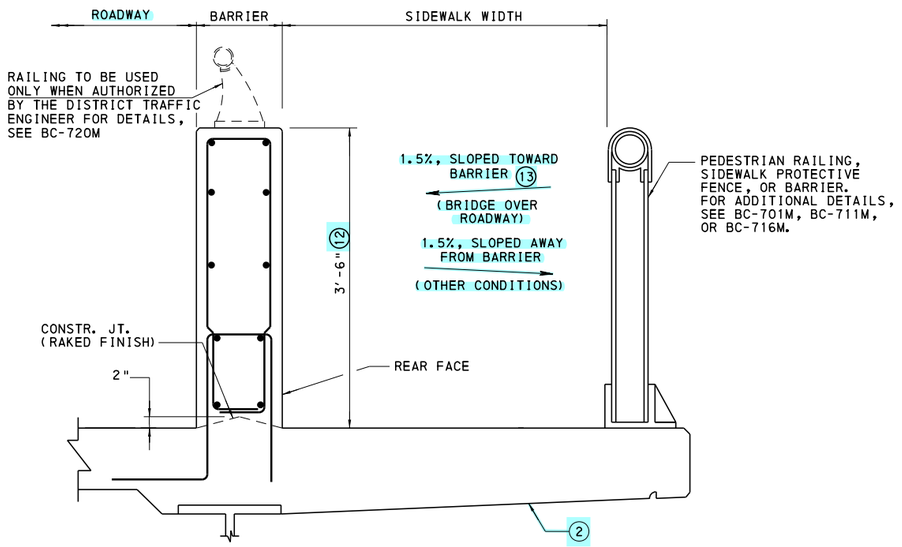
⑫ 2½" CLR. FOR SAFETY WINGS.
3⅛" CLR. FOR U-WINGS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

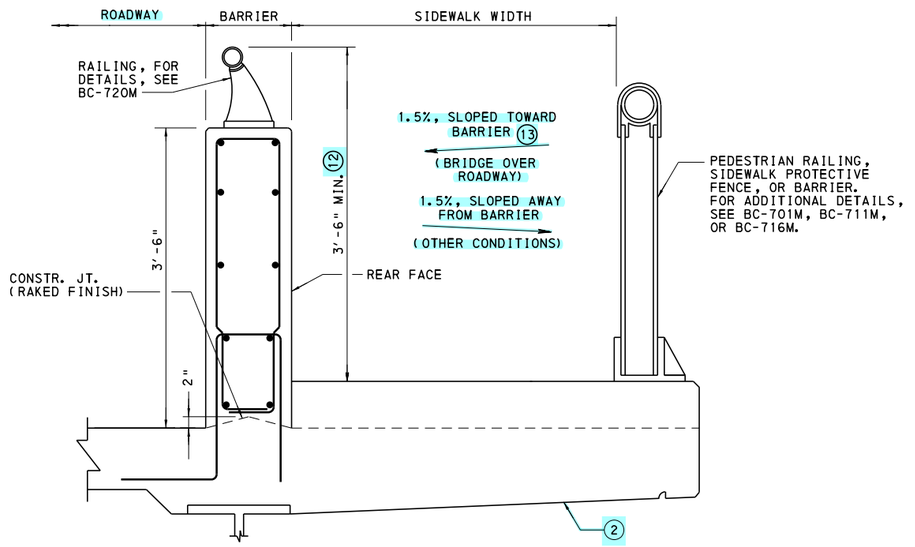
VERTICAL WALL CONCRETE BARRIER END TRANSITION REINFORCEMENT - 2

RECOMMENDED FEB. 19, 2021 Thomas P. Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED FEB. 19, 2021 Bruce B. Thomas DIRECTOR, BUR. OF PROJECT DELIVERY	SHEET 6 OF 9 BD-618M



TYPICAL SIDEWALK DETAIL

(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE DECK SLAB, SEE BD-601M.)



RAISED SIDEWALK DETAIL

(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE SIDEWALK AND DECK SLAB, SEE BD-601M.)

LEGEND:

(2) UNDERSIDE OF DECK MAY BE CONSTRUCTED LEVEL.

(12) 42" VERTICAL WALL CONCRETE BARRIER SHOWN. IF 32" VERTICAL WALL CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF THE BARRIER AND RAILING MUST BE 3'-6" MINIMUM ON SIDEWALK SIDE OF RAILING.

(13) DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIERS OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT THE REAR FACE OF THE BARRIER 1" ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAIN PER BC-751M.

NOTES:

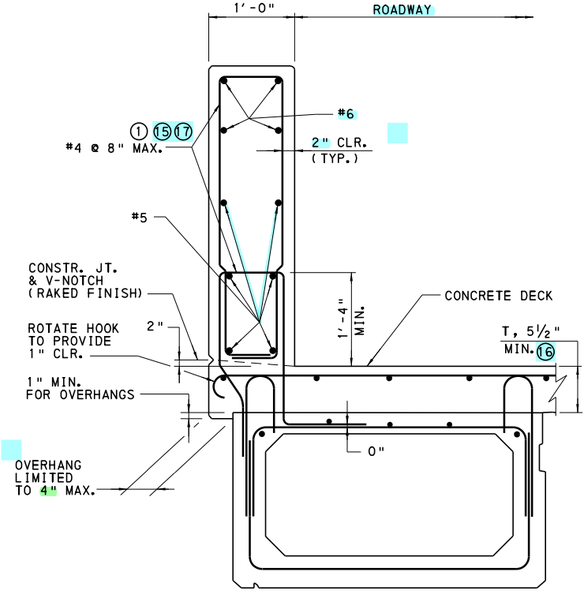
1. FOR VERTICAL WALL BARRIER DETAILS AT ALTERNATE SIDEWALK, SEE BD-601M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

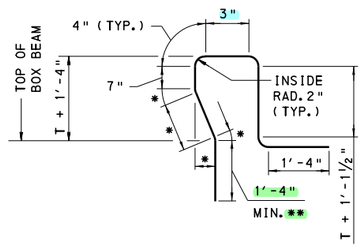
VERTICAL WALL CONCRETE BARRIER SIDEWALK DETAILS

RECOMMENDED FEB. 19, 2021 Thomas P. Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED FEB. 19, 2021 Bruce B. Thyagus DIRECTOR, BUR. OF PROJECT DELIVERY	SHEET 7 OF 9 BD-618M



36" & 48" COMPOSITE
ADJACENT BOX BEAMS
SUPPORTING BARRIER

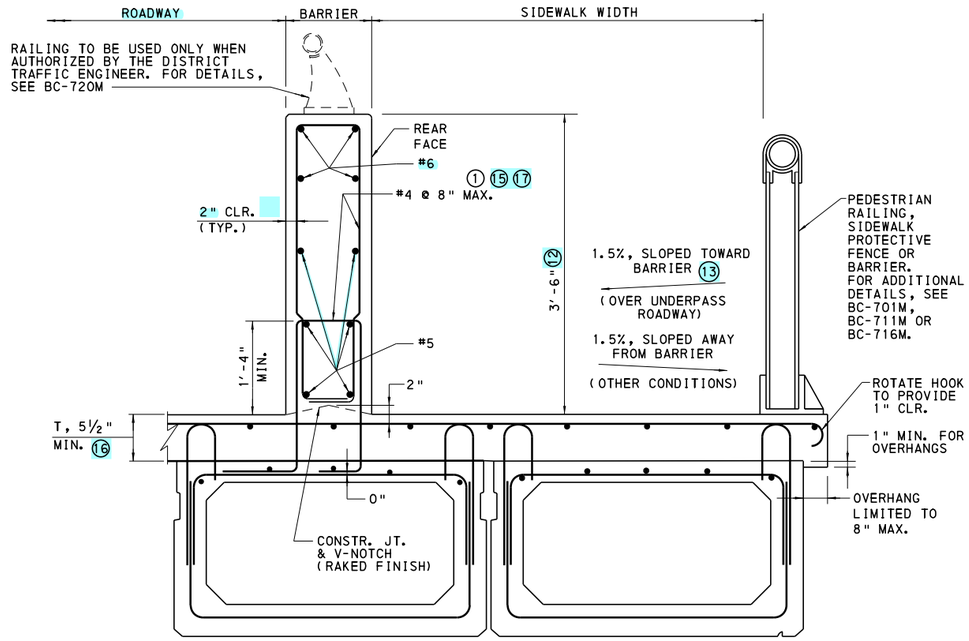
(42" VERTICAL WALL CONCRETE BARRIER SHOWN, 32" VERTICAL WALL CONCRETE BARRIER SIMILAR)



* VARIES WITH DECK SLAB THICKNESS, T, AND OVERHANG. DIMENSIONS MAY ALSO BE MODIFIED BY PRESTRESS FABRICATOR TO AVOID INTERFERENCE WITH BEAM FORM WORK.

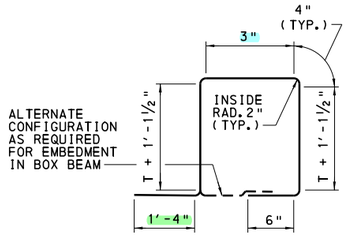
** OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM

VERTICAL REINFORCEMENT



⑭ 36" & 48" COMPOSITE
ADJACENT BOX BEAMS
SUPPORTING TYPICAL SIDEWALK

(RAISED SIDEWALK DETAIL SIMILAR)



VERTICAL REINFORCEMENT

LEGEND:

① WITHIN 10 FT. ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCING BARS TO HALF THE SPACING SHOWN. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS ON SHEETS 2-6.

⑫ 42" VERTICAL WALL CONCRETE BARRIER SHOWN. IF 32" VERTICAL WALL CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF BARRIER AND RAILING MUST BE 3'-6" MIN. ON SIDEWALK SIDE OF RAILING.

⑬ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIERS OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT THE REAR FACE OF THE BARRIER 1" ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAIN PER BC-751M.

⑭ USE ONLY WHEN ROADWAY AND SIDEWALK WIDTHS PERMIT THE HORIZONTAL LEGS OF THE BARRIER BAR TO BE EMBEDDED ENTIRELY WITHIN ONE BEAM. ROADWAY/SIDEWALK WIDTHS MAY NEED TO BE ADJUSTED TO ACCOMMODATE THIS CONDITION.

⑮ BEND AS REQUIRED TO ACCOMMODATE OVERHANG. SEE BC-736M.

⑯ INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD.

⑰ FOR 32" VERTICAL WALL CONCRETE BARRIER USE #4 @ 12".

NOTES:

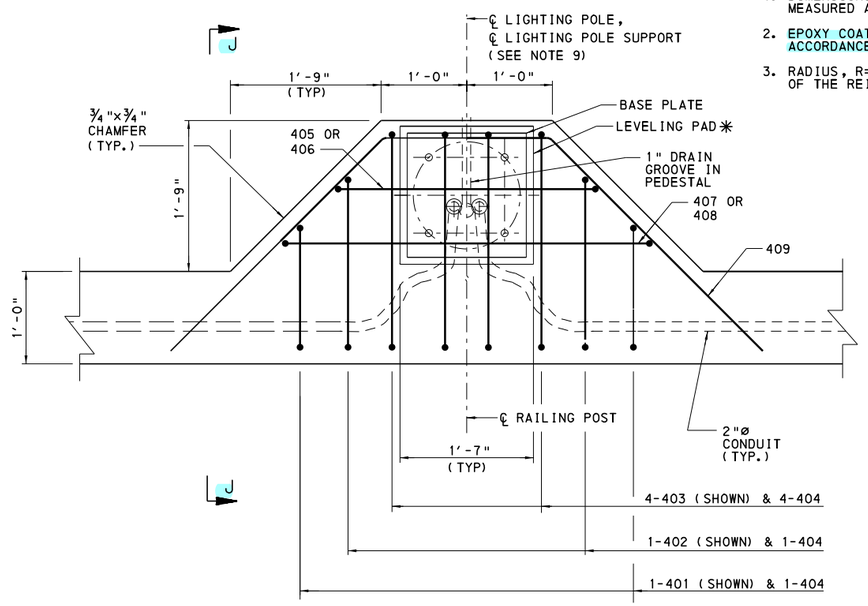
1. FOR VERTICAL WALL CONCRETE BARRIER DETAILS AT 36" AND 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK, SEE BD-661M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

VERTICAL WALL
CONCRETE BARRIER
ADJACENT BOX BEAM DETAILS

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 8 OF 9
Thomas P. Macioce CHIEF BRIDGE ENGINEER	Bruce D. Thorson DIRECTOR, BUR. OF PROJECT DELIVERY	BD-618M

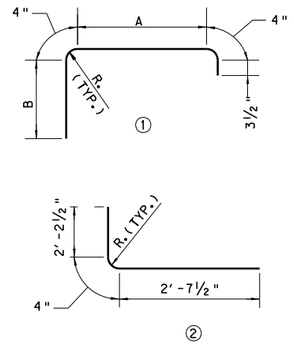


PLAN

(VERTICAL WALL BARRIER REINFORCEMENT NOT SHOWN FOR CLARITY)

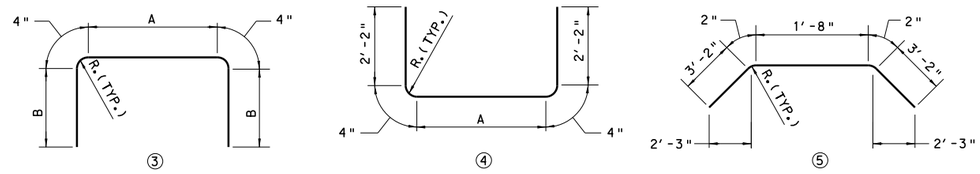
REINFORCEMENT BAR NOTES

1. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
2. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 7091(c).
3. RADIUS, R=2", IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.

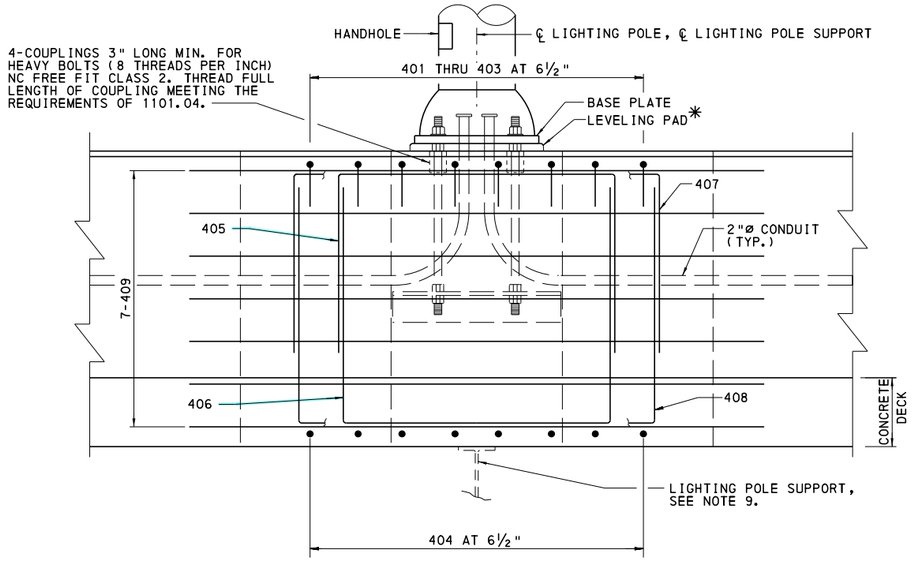


REINFORCEMENT BAR TABLE

MARK	SIZE	LENGTH A: 42" VERTICAL WALL CONCRETE BARRIER	LENGTH A: 32" VERTICAL WALL CONCRETE BARRIER	NUMBER	TYPE	A	B: 42" VERTICAL WALL CONCRETE BARRIER	B: 32" VERTICAL WALL CONCRETE BARRIER
401	4	4'-9½"	3'-11½"	2	1	10½"	2'-11½"	2'-1½"
402	4	5'-4"	4'-6"	2	1	1'-5"	2'-11½"	2'-1½"
403	4	5'-11"	5'-1"	4	1	2'-0"	2'-11½"	2'-1½"
404	4	5'-2"	5'-2"	8	2	---	---	---
405	4	9'-0"	7'-4"	1	3	2'-6"	2'-11"	2'-1"
406	4	7'-6"	7'-6"	1	4	2'-6"	---	---
407	4	10'-2"	8'-6"	1	3	3'-8"	2'-11"	2'-1"
408	4	8'-8"	8'-8"	1	4	3'-8"	---	---
409	4	8'-4"	8'-4"	7	5	---	---	---

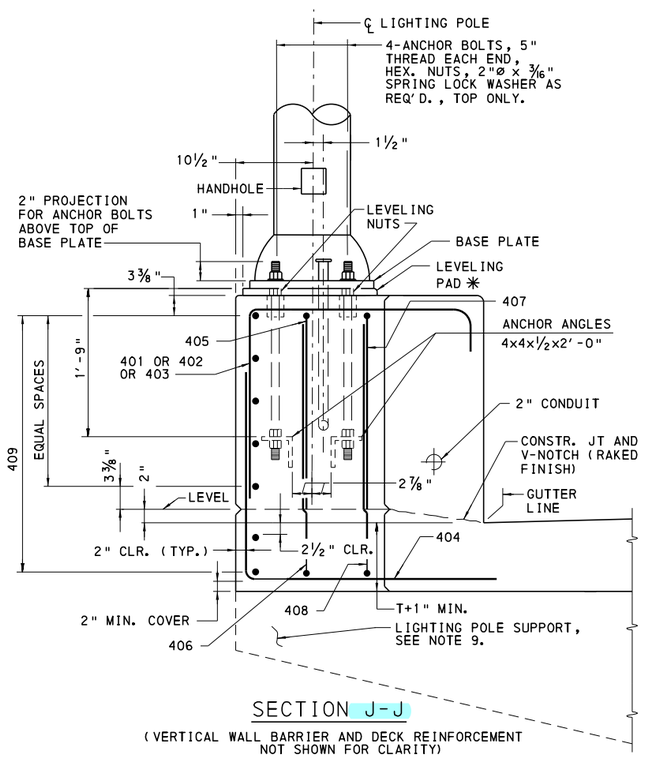


REINFORCEMENT DETAILS



ELEVATION

(VERTICAL WALL BARRIER AND DECK REINFORCEMENT NOT SHOWN FOR CLARITY)



SECTION J-J

(VERTICAL WALL BARRIER AND DECK REINFORCEMENT NOT SHOWN FOR CLARITY)

NOTES:

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
2. SET ANCHOR BOLTS ACCURATELY BY THE TEMPLATE FURNISHED BY THE MANUFACTURER, TO THE CORRECT ELEVATION AND ALIGNMENT AND SECURELY BRACE AGAINST DISPLACEMENT BEFORE THE SURROUNDING CONCRETE IS PLACED. ANCHOR BOLT DIAMETER AS REQUIRED BY LIGHTING POLE MANUFACTURER. (FOR FUTURE LIGHTING PROVISIONS, SEE CHART ON THIS SHEET.)
3. SEAL CONDUIT AND PROTECT THREADS FOR FUTURE LIGHTING INSTALLATIONS.
4. CONFORM ANCHOR MATERIALS TO 1101.4 PUB. 408. ANCHOR ANGLES ARE TO BE GALVANIZED.
5. SET LIGHTING POLES TRULY VERTICAL WITH BASES LEVEL USING LEVELING NUTS.
6. PROVIDE 2" CLEAR ON ALL REINFORCEMENT EXCEPT AS NOTED.
7. PROVIDE A MINIMUM OF 2½" CONCRETE COVER FOR CONDUIT.
8. CONTINUE NORMAL BARRIER REINFORCEMENT THROUGH THICKENED PORTION OF BARRIER.
9. PREFERRED LOCATION FOR LIGHTING POLES IS AT PIERS AND ABUTMENTS. REFER TO BD-655M FOR ABUTMENT DETAILS AND BD-658M FOR PIER DETAILS TO HELP DEVELOP LIGHT POLE SUPPORT DETAIL. LIGHTING POLE SUPPORT, IF NEEDED, TO BE DESIGNED BY THE ENGINEER TO DISTRIBUTE LOAD TO BOTH FASCIA AND FIRST INTERIOR BEAM.
10. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE VERTICAL WALL CONCRETE BARRIER NOT SHOWN, SEE SHEET 1.
11. FOR LIGHTING POLE LOCATIONS WITHIN A SPAN, THE LUMINAIRE DEFLECTION MUST BE EVAULATED FOR DYNAMIC EFFECTS.

PROVISIONS FOR FUTURE LIGHTING		
MOUNTING HEIGHT	ANCHOR BOLT CIRCLE DIA.	ANCHOR BOLT DIAMETER
50'-0" MAX.	15"	1"

* FILL SPACE BETWEEN POLE BASE PLATE AND CONCRETE WITH GROUT AFTER SETTING POLE TRULY VERTICAL USING LEVELING NUTS. TOOL EDGES OF PAD. MINIMUM HEIGHT OF LEVELING PAD IS 1".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
VERTICAL WALL CONCRETE BARRIER LIGHTING POLE ANCHORAGE DETAILS

RECOMMENDED FEB. 19, 2021
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 19, 2021
Bruce B. Thigpen
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 9 OF 9

BD-618M

CHANGE 2

NOTES FOR DESIGNING AND DETAILING DIAPHRAGMS

(THIS STANDARD IS ONLY APPLICABLE FOR BRIDGES DESIGNED WITH A REFINED METHOD OF ANALYSIS)

1. DESIGN SPECIFICATIONS

   a) AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (AASHTO LRFD).

   b) PENNDOT DESIGN MANUAL, PART 4 (PENNDOT DM4).

   c) PENNDOT SPECIFICATIONS, PUBLICATION 408 (PUB 408).

2. REFERENCES

   a) AISC SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, ANSI/AISC 360-10, JULY 7, 2016 (AISC SPEC).

   b) FEDERAL HIGHWAY ADMINISTRATION, STEEL BRIDGE DESIGN HANDBOOK, VOLUME 13, BRACING SYSTEM DESIGN, PUBLICATION NO. FHWA-HIF-16-002-VOL 13, DECEMBER 2015 (FHWA SBDH).

   c) NATIONAL STEEL BRIDGE ALLIANCE, SKEWED AND CURVED STEEL I-GIRDER BRIDGE FIT, AUGUST 2016.

3. DETAILING REQUIREMENTS

   a) GIRDERS SHALL BE DESIGNED AND DETAILED SUCH THAT THE GIRDER WEBS ARE VERTICAL (PLUMB) AS SPECIFIED IN THE TABLES BELOW.

   DEFINITIONS:

   NLF = NO LOAD FIT. GIRDER WEBS VERTICAL (PLUMB) UNDER NO LOAD CONDITIONS (I.E., WHEN TEMPORARY SHORING IS PROVIDED TO ACHIEVE OR APPROXIMATE ZERO VERTICAL DEFLECTIONS)

   SDLF = STEEL DEAD LOAD FIT. GIRDER WEBS VERTICAL (PLUMB) WHEN STEEL DEAD LOADS ARE APPLIED (WEIGHT OF STRUCTURAL STEEL) BUT PRIOR TO DECK PLACEMENT. IF TEMPORARY SHORING WAS USED, SDLF IMPLIES GIRDER WEBS VERTICAL (PLUMB) WITH ALL TEMPORARY SHORING REMOVED.

   TDLF = TOTAL DEAD LOAD FIT. GIRDER WEBS VERTICAL (PLUMB) AFTER ALL DEAD LOADS ARE APPLIED (INCLUDING WEIGHT OF STEEL, WEIGHT OF DECK SLAB AND WEIGHT OF SUPERIMPOSED DEAD LOADS, BUT NOT INCLUDING FUTURE WEARING SURFACE).

   L = ACTUAL SPAN LENGTH, BEARING TO BEARING ALONG THE CENTERLINE OF THE GIRDER.

   R_S = RADIUS OF CURVATURE AT BRIDGE CENTERLINE.

   I = SKEW INDEX, SEE NOTE 7 OF THIS STANDARD FOR DEFINITION.

RECOMMENDED FIT CONDITIONS FOR STRAIGHT I-GIRDER BRIDGES
(INCLUDING CURVED BRIDGES WITH L/R IN ALL SPANS LESS THAN 0.03 +/-)[1]

NON-SKEWED BRIDGES AND SKEWED BRIDGES WITH SKEW ≥ 70 DEGREES +/-			
	RECOMMENDED	ACCEPTABLE	AVOID
ANY SPAN LENGTH	ANY		NONE

SKEWED BRIDGES WITH SKEW < 70 DEGREES +/- AND $I_S \leq 0.30$ +/-			
	RECOMMENDED	ACCEPTABLE	AVOID
ANY SPAN LENGTH	TDLF OR SDLF		NLF

SKEWED BRIDGES WITH SKEW < 70 DEGREES +/- AND $I_S > 0.30$ +/-			
	RECOMMENDED	ACCEPTABLE	AVOID
SPAN LENGTHS ≤ 200 FEET	SDLF	TDLF	NLF
SPAN LENGTHS > 200 FEET	SDLF		TDLF & NLF

RECOMMENDED FIT CONDITIONS FOR HORIZONTALLY CURVED I-GIRDER BRIDGES
[$(L/R)_{MAX} \geq 0.03$ +/-][1]

BRIDGES WITH RADIAL OR SKEWED SUPPORTS			
	RECOMMENDED	ACCEPTABLE	AVOID
LARGE SPAN LENGTHS > 250 FEET +/- AND $(L/R)_{MAX} \geq 0.2$	NLF[2]	SDLF	TDLF
ALL OTHER CASES	SDLF	NLF	TDLF

1 FOR THE VARIOUS RECOMMENDED FIT CONDITIONS PRESENTED IN THE TABLES ABOVE, THE SPAN LENGTH, SKEW, AND CURVATURE LIMITS SHOULD BE CONSIDERED APPROXIMATE GUIDELINES AND SHOULD BE EVALUATED IN THE FULL CONTEXT OF THE GEOMETRIC AND STRUCTURAL COMPLEXITY OF THE GIVEN BRIDGE. THE RECOMMENDATION OF SDLF FOR CASES IDENTIFIED IN THE TABLE ABOVE FOR HORIZONTALLY CURVED BRIDGES IS BASED ON MANY YEARS OF PRACTICE AND RECENT RESEARCH RESULTS. IN PRACTICE, THE USE OF SDLF HAS BEEN ALMOST UNIVERSAL FOR CURVED I-BRIDGES WITH $(L/R)_{MAX} < 0.2$. THE RECOMMENDATION TRANSITIONS TO NLF ABOVE THE LIMIT BASED ON A STUDY OF THESE TYPES OF BRIDGES WHICH SHOWS LOCKED-IN LACK-OF-FIT FORCES CAN BECOME SIGNIFICANT IN BRIDGES WITH LONGER SPANS AND SMALLER RADII. NLF MATCHES THE NORMAL ANALYSIS METHODS USED IN THE DESIGN AND WILL PROVIDE A BETTER MATCH BETWEEN PREDICTED FORCES AND DISPLACEMENTS THAN SDLF WHEN THE STEEL DEAD LOAD DISPLACEMENTS BECOME LARGE.

2 THE RECOMMENDATION TO USE NLF DETAILING DOES NOT NECESSARILY IMPLY THE NEED TO USE TEMPORARY SHORING, NOR DOES THE USE OF SDLF OR TDLF DETAILING IMPLY THAT TEMPORARY SHORING CANNOT BE USED. AS DISCUSSED IN THE DESIGN AND ANALYSIS SECTION OF DM-4 SECTION 6, APPENDIX E6, THE CHOICE OF DETAILING METHOD AFFECTS THE NATURE AND MAGNITUDE OF THE BRIDGE'S INTERNAL DEAD LOAD FORCES AND OF THE "FIT-UP" FORCES WHICH THE ERECTOR MAY NEED TO APPLY TO ASSEMBLE THE STRUCTURAL STEEL. THE NATURE AND MAGNITUDE OF THESE FORCES ARE ALSO INFLUENCED BY THE USE OF TEMPORARY SHORING. BRIDGES ERECTED WITHOUT TEMPORARY SHORING CAN BE DETAILED FOR NLF AND SUCCESSFULLY ERECTED IF THE FIT-UP FORCES ARE MANAGEABLE. LIKEWISE, BRIDGES WHICH ARE TO BE ERECTED USING SOME FORM OF TEMPORARY SHORING CAN BE DETAILED FOR SDLF OR TDLF AND SUCCESSFULLY ERECTED IF THE FIT-UP FORCES ARE MANAGEABLE.

   b) WHERE THE MAXIMUM OUT-OF-PLANE GIRDER ROTATIONS DUE TO ALL DEAD LOADS, EXCLUDING FUTURE WEARING SURFACE EXCEEDS 0.005 RADIANS, PROVIDE A TABLE IN THE CONSTRUCTION DRAWINGS SHOWING THE TOTAL DEAD LOAD OUT-OF-PLANE GIRDER ROTATIONS AT THE GIRDER TENTH POINTS AND AT EACH DIAPHRAGM CONNECTION LOCATION. PROVIDE ROTATION VALUES FOR EACH GIRDER.

4. USAGE AND ORIENTATION OF DIAPHRAGMS

   a) FOR STRAIGHT BRIDGES, PLACE INTERMEDIATE DIAPHRAGMS PARALLEL TO THE SKEW AND IN CONTIGUOUS LINES FOR SKEW ANGLES OF 70° TO 90°. FOR SKEWS LESS THAN 70°, PLACE DIAPHRAGMS NORMAL TO THE GIRDER, EITHER IN CONTIGUOUS LINES OR IN A STAGGERED ARRANGEMENT. THE USE OF A STAGGERED ARRANGEMENT TYPICALLY RESULTS IN LOWER DIAPHRAGM FORCES, BUT MAY INCREASE GIRDER FLANGE LATERAL BENDING MOMENTS. IN SEVERELY SKEWED, VERY WIDE BRIDGES (BRIDGES WITH A HIGH SKEW INDEX, I_S), OMITTING SELECT DIAPHRAGMS (WITHOUT COMPROMISING THE BRACING OF GIRDERS) TYPICALLY RESULTS IN A MORE ECONOMICAL DESIGN.

   b) FOR STRAIGHT BRIDGES, PIER DIAPHRAGMS (DIAPHRAGMS AT INTERMEDIATE BEARINGS) MAY BE OMITTED IF PROVISIONS ARE MADE TO TRANSMIT HORIZONTAL SUPERSTRUCTURE FORCES INTO THE BEARINGS, AND AN ACCEPTABLE METHOD FOR JACKING THE GIRDERS FOR FUTURE BEARING REPLACEMENT IS INCORPORATED INTO THE DESIGN. IF PIER DIAPHRAGMS ARE USED, ORIENT CROSS FRAMES PARALLEL TO THE SKEW FOR SKEW ANGLES OF 70° TO 90°, OR NORMAL TO THE GIRDER FOR SKEW ANGLES LESS THAN 70°.

   c) FOR CURVED GIRDER BRIDGES WITH RADIAL SUPPORTS, PLACE INTERMEDIATE AND PIER DIAPHRAGMS RADIAL TO THE GIRDERS AND IN CONTIGUOUS LINES.

   d) FOR CURVED GIRDER BRIDGES WITH SKEWED SUPPORTS, GENERALLY PLACE INTERMEDIATE DIAPHRAGMS RADIAL TO THE GIRDERS AND IN CONTIGUOUS LINES.

   e) WHEN DIAPHRAGMS ARE PLACED RADIAL TO THE GIRDER IN CURVED AND/OR SKEWED BRIDGES, IT MAY BE ADVANTAGEOUS IN THE IMMEDIATE VICINITY OF THE SKEWED SUPPORTS TO OMIT DIAPHRAGMS THAT WOULD OTHERWISE FRAME DIRECTLY INTO THE SUPPORT; RESUME PLACEMENT OF CONTIGUOUS RADIAL DIAPHRAGMS IN THE NEXT ADJACENT BAY. GENERALLY PLACE PIER DIAPHRAGMS PARALLEL TO THE SKEW FOR SKEW ANGLES OF 70° TO 90°, OR NORMAL TO THE GIRDER FOR SKEWS LESS THAN 70°.

   f) FOR CASES OF UNUSUALLY COMPLEX FRAMING AND/OR SEVERE GEOMETRY, SUBMIT A PROPOSED FRAMING PLAN TO THE BUREAU OF PROJECT DELIVERY, BRIDGE DESIGN AND TECHNOLOGY DIVISION FOR REVIEW PRIOR TO BEGINNING FINAL DESIGN.

   g) END DIAPHRAGMS ARE REQUIRED AT THE ENDS OF GIRDERS TO SUPPORT THE EDGE OF DECK AND THE EXPANSION JOINTS.

   h) END DIAPHRAGMS SHOULD BE DESIGNED TO ACCOMODATE JACKING OF THE GIRDERS FOR BEARING REPLACEMENT UNLESS OTHER ACCEPTABLE PROVISIONS FOR JACKING ARE INCORPORATED INTO THE DESIGN.

   i) PLACE END DIAPHRAGMS APPROXIMATELY PARALLEL TO THE CENTERLINE OF BEARINGS. POSITION END DIAPHRAGM CONNECTION COMPONENTS SO AS TO CREATE MINIMUM OFFSET FROM THE CENTERLINE OF BEARINGS. DIAPHRAGM CONNECTION PLATE MAY BE PLACED BEHIND THE BEARING STIFFENER TO MINIMIZE THE OFFSET.

   j) COORDINATE BEARING STIFFENER AND CONNECTION PLATE LOCATIONS WITH DETAILS OF BEARING TO GIRDER CONNECTIONS.

   k) FOR SKEWED CONNECTIONS, THE DESIGNER SHOULD VERIFY THE PRACTICALITY OF BENT CONNECTION PLATE GEOMETRY. REFER TO SECTION 1105.03(f) OF PENNDOT PUB 408 FOR MINIMUM BEND RADII.

   l) THE DIAPHRAGM CONNECTION PLATE DETAILS SHOWN ARE VALID FOR SKEW ANGLES 25° TO 90°. PROVIDE SPECIAL DETAILS FOR SKEW ANGLES LESS THAN 25°.

   m) PROVIDE CONNECTION PLATES ON THE OUTSIDE FACE OF FASCIA GIRDERS AT INTERMEDIATE DIAPHRAGM LOCATIONS FOR TWO AND THREE GIRDER SYSTEMS.

5. SELECTION OF DIAPHRAGM TYPE

   DIAPHRAGM TYPES SHOULD BE SELECTED BASED ON THE FOLLOWING GUIDELINES. SPECIAL CONDITIONS (VARIABLE SKEW, VARIABLE GIRDER SPACING, ETC.) MAY WARRANT A DEPARTURE FROM THESE GUIDELINES.

   INTERMEDIATE DIAPHRAGMS

   - TYPE X: TYPE X DIAPHRAGMS SHOULD BE USED IN CASES WHERE THE RATIO OF GIRDER SPACING (S) TO GIRDER DEPTH "D" IS 1.0 OR LESS ($S/D \leq 1.0$).
   - TYPE K: TYPE K DIAPHRAGMS SHOULD BE USED IN CASES WHERE THE RATIO OF GIRDER SPACING "S" TO GIRDER DEPTH "D" IS 1.5 OR GREATER ($S/D \geq 1.5$).
   - IN CASES WHERE THE RATIO OF GIRDER SPACING "S" TO GIRDER DEPTH "D" IS BETWEEN 1.0 AND 1.5, EITHER TYPE X OR TYPE K DIAPHRAGMS MAY BE USED. SECONDARY CONSIDERATIONS INCLUDE:
     i. ACHIEVING A GENERAL EFFICIENT ANGLE BETWEEN DIAPHRAGM DIAGONAL AND HORIZONTAL (CHORD) MEMBERS AS CLOSE TO 45° AS POSSIBLE.
     ii. MINIMIZING SHOP HANDLING OF DIAPHRAGMS BY USING TYPE K DIAPHRAGMS WHICH DO NOT NEED TO BE REMOVED FROM THEIR FABRICATION JIG AND INVERTED TO WELD THE SECOND DIAGONAL.
   - SOLID PLATE: SOLID PLATE DIAPHRAGMS SHOULD BE USED WHEN REQUIRED TO ADDRESS HIGH DIAPHRAGM FORCE EFFECTS AND/OR IN CASES WHERE GIRDERS ARE TIGHTLY SPACED AND LARGE DIAGONAL AND HORIZONTAL (CHORD) MEMBERS WOULD OTHERWISE BE REQUIRED FOR A TYPE X DIAPHRAGM.

✳ NOTES FOR DESIGNING AND DETAILING DIAPHRAGMS, CONTINUED ON SHEET 2 ✳

REFERENCE DRAWINGS	
BC-753M	STEEL GIRDER DETAILS
BC-754M	STEEL DIAPHRAGMS FOR STEEL BEAM/GIRDER STRUCTURES (STRAIGHT GIRDERS ONLY)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
CROSS FRAME AND SOLID PLATE DIAPHRAGMS FOR STEEL BEAM/GIRDER BRIDGES DESIGNED WITH REFINED METHODS OF ANALYSIS

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 5

BD-619M

NOTES FOR DESIGNING AND DETAILING DIAPHRAGMS (CONTINUED FROM SHEET 1)

5. SELECTION OF DIAPHRAGM TYPE (CONTINUED FROM SHEET 1)

END DIAPHRAGMS

- TYPE K: TYPE K DIAPHRAGMS ARE TYPICALLY THE MOST ECONOMICAL DESIGN AND SHOULD BE USED IN CASES WHERE GIRDER JACKING FOR BEARING REMOVAL IS PROVIDED AT A LOCATION OTHER THAN THE END DIAPHRAGM.

- TYPE K INVERTED: TYPE K INVERTED DIAPHRAGMS SHOULD BE USED IN CASES WHERE JACKING FOR BEARING REMOVAL OCCURS AT THE END DIAPHRAGM AND JACKING LOADS DO NOT REQUIRE A SOLID PLATE DIAPHRAGM. THE USE OF TYPE K INVERTED DIAPHRAGMS FACILITATES PASSAGE OF LARGER UTILITIES THROUGH THE DIAPHRAGM.

- SOLID PLATE: SOLID PLATE DIAPHRAGMS SHOULD BE USED IN CASES WHERE NECESSARY TO ADDRESS HIGH DIAPHRAGM FORCE EFFECTS FROM A REFINED ANALYSIS AND/OR IN CASES WHERE JACKING FORCES FOR BEARING REMOVAL EXCEED THE LIMITATIONS OF A TYPE K INVERTED DIAPHRAGM.

6. SELECTION OF DIAPHRAGM MEMBERS

SELECT THE MOST ECONOMICAL DIAPHRAGM MEMBERS WHICH MEET DESIGN STRENGTH AND DETAILING REQUIREMENTS. IT IS GENERALLY DESIRABLE TO REASONABLY MINIMIZE THE NUMBER OF DIFFERENT TYPES AND SIZES OF MEMBERS USED IN A GIVEN DESIGN, BUT IT IS ACCEPTABLE TO USE DIFFERENT MEMBER SIZES IN CASES WHERE A LIMITED NUMBER OF DIAPHRAGMS HAVE SIGNIFICANTLY HIGHER DESIGN LOADS THAN OTHER DIAPHRAGMS IN THE SAME BRIDGE.

THE MOST COMMON TYPES OF DIAPHRAGM MEMBERS FOR TYPE X, TYPE K AND TYPE K INVERTED DIAPHRAGMS ARE LISTED BELOW.

- ANGLE SECTIONS: THE MOST ECONOMICAL DIAPHRAGM MEMBERS ARE TYPICALLY SINGLE ANGLE SECTIONS (AISC "L" SHAPES). EQUAL LEG ANGLES SHOULD BE USED. UNEQUAL LEG ANGLES SHOULD NOT BE USED. DOUBLE ANGLES ARE GENERALLY MORE EXPENSIVE TO FABRICATE THAN WT SECTIONS SINCE MORE HANDLING, SPECIAL COATINGS AND SOME REVERSE-SIDE WELDING ARE TYPICALLY REQUIRED.

- WT SECTIONS: WHEN DESIGN FORCE EFFECTS EXCEED THE CAPACITY OF ANGLE SECTIONS, WT SECTIONS (AISC "WT" SHAPES) MAY BE USED. WT SECTIONS ARE FABRICATED BY CUTTING W SECTIONS (AISC WIDE FLANGE, OR "W" SHAPES) IN HALF LONGITUDINALLY, WHICH ADDS SIGNIFICANT FABRICATION AND STRAIGHTENING COSTS.

- W SECTIONS: IN SPECIAL CASES WIDE FLANGE W SECTIONS (AISC WIDE FLANGE, OR "W", SHAPES) MAY BE USED, ESPECIALLY FOR END DIAPHRAGMS. JUSTIFICATION FOR THE USE OF W SECTIONS INCLUDES THE POTENTIAL FOR HIGH ORTHOGONAL FORCES (SUCH AS JACKING FORCES) CAUSING BENDING OF THE MEMBER, OR UNUSUALLY HIGH AXIAL FORCE EFFECTS. THE FLANGES OF W SECTIONS MAY REQUIRE COPING TO ALLOW FOR CONNECTION TO GUSSET PLATES.

THE MOST COMMON TYPES OF DIAPHRAGM MEMBERS FOR SOLID PLATE DIAPHRAGMS ARE LISTED BELOW.

- CHANNEL SECTIONS: CHANNEL SECTIONS (AISC "C" AND "MC" SHAPES) MAY BE USED FOR SOLID PLATE DIAPHRAGMS IN CASES OF SHALLOW GIRDER DEPTH. CHANNEL SECTIONS ARE TYPICALLY REASONABLY ECONOMICAL IF A COMMONLY ROLLED AND WIDELY AVAILABLE SIZE IS USED.

- BENT PLATES: COLD BENT PLATES MAY BE USED FOR SOLID PLATE DIAPHRAGMS IN CASES OF SHALLOW GIRDER DEPTH. BENT PLATES MAY BE MORE ECONOMICAL THAN CHANNEL SECTIONS IN CASES WHERE A COMMONLY ROLLED AND WIDELY AVAILABLE CHANNEL SECTION IS NOT AVAILABLE IN THE REQUIRED SIZE. REFER TO PUB 408 SECTION 1105.03(f) FOR MINIMUM BEND RADII.

- W SECTIONS: W SECTIONS (AISC WIDE FLANGE, OR "W", SHAPES) MAY BE USED FOR SOLID PLATE DIAPHRAGMS IN CASES WHERE A CHANNEL SECTION OF THE REQUIRED SIZE IS NOT AVAILABLE (SUCH AS CASES OF DEEPER GIRDERS). THE FLANGES OF W SECTIONS MAY REQUIRE COPING TO ALLOW FOR CONNECTION TO STIFFENERS IF GUSSET PLATES ARE NOT USED. THE USE OF EXCESSIVELY HEAVY W SECTIONS IS DISCOURAGED DUE TO POOR ECONOMY IN DIAPHRAGM APPLICATIONS AND HIGH COST/LIMITED AVAILABILITY.

- WELDED PLATE GIRDERS: WELDED PLATE GIRDERS MAY BE USED FOR SOLID PLATE DIAPHRAGMS IN CASES WHERE AN ECONOMICAL W SECTION IS NOT AVAILABLE. THE FLANGES OF PLATE GIRDERS MAY REQUIRE COPING TO ALLOW FOR CONNECTION TO STIFFENERS IF GUSSET PLATES ARE NOT USED. IF WELDED PLATE GIRDERS WILL BE SUBJECT TO JACKING LOADS FOR BEARING REPLACEMENT, THE NEED FOR JACKING STIFFENERS SHOULD BE INVESTIGATED.

7. CHARACTERIZATION OF STRAIGHT BRIDGES BY SKEW INDEX

STRAIGHT GIRDER BRIDGES SHOULD BE CATEGORIZED BY SKEW INDEX. THE SKEW INDEX, "I_S" IS CALCULATED AS FOLLOWS:

$$I_S = W_G / \{ L_S \tan(\emptyset_P) \}$$

WHERE:

W_G = BRIDGE WIDTH PERPENDICULAR TO THE CENTERLINE, FASCIA GIRDER TO FASCIA GIRDER (FT)

$\emptyset_P$ = THE SMALLER ANGLE BETWEEN THE HIGHWAY CENTERLINE (OR A TANGENT THERETO) AND A LINE PARALLEL TO THE CENTERLINE OF THE SUPPORT (90 DEGREES = NONSKEWED).

L_S = SPAN LENGTH (FT)

IN CASES OF MULTIPLE SPAN UNITS, THE LARGEST SKEW INDEX OF ALL THE SPANS SHALL BE USED TO CHARACTERIZE THE UNIT.

CURVED GIRDER BRIDGES CANNOT BE CHARACTERIZED BY SKEW INDEX AT THIS TIME.

8. LEVEL OF REFINED ANALYSIS

a) REFINED ANALYSIS: REFINED ANALYSIS TYPICALLY CONSISTS OF 3D ANALYSIS, OR MAY CONSIST OF AN ENHANCED 2D ANALYSIS IF THE 2D ANALYSIS INCLUDES BOTH OF THE FOLLOWING FEATURES:

I. CONSIDERATION OF WARPING STIFFNESS WHEN MODELING THE TORSIONAL STIFFNESS OF I-SHAPED GIRDERS.

II. A COMPLETE REPRESENTATION OF THE STIFFNESS OF DIAPHRAGMS BY MEANS OF A SHEAR-DEFORMABLE BEAM ELEMENT (TIMOSHENKO BEAM) AND IN ACCORDANCE WITH THE REFINED ANALYSIS REQUIREMENTS OF DM-4 SECTION 4.6.3

REFINED ANALYSIS IS GENERALLY REQUIRED FOR STRAIGHT GIRDER BRIDGES WITH SKEW INDEX GREATER THAN 0.30 ($I_S > 0.30$) AND SKEW ANGLE < 70 DEGREES.

REFINED ANALYSIS IS REQUIRED FOR ALL CURVED GIRDER BRIDGES.

REFINED ANALYSIS IS REQUIRED FOR KINKED GIRDER BRIDGES MEETING THE DEFINITION OF CURVED GIRDERS AS OUTLINED IN DM-4 SECTION 4.6.1.2.1.

9. DETERMINATION OF DESIGN LOADS

a) LIMIT STATES AND LOAD FACTORS:

- ALL APPLICABLE LIMIT STATES, AS IDENTIFIED IN SECTION 3 OF THE AASHTO LRFD, SHALL BE INVESTIGATED AS PART OF THE DIAPHRAGM DESIGN. LOAD FACTORS FOR THE LOAD COMBINATIONS FOR EACH LIMIT STATE SHALL BE AS PRESENTED IN SECTION 3 OF THE AASHTO LRFD, WITH THE FOLLOWING ADDITIONS:

- BOTH THE STRENGTH AND STIFFNESS REQUIREMENTS FOR STABILITY BRACING (AS SPECIFIED IN THE AISC SPEC APPENDIX 6.3 AND/OR THE FHWA SBDH, VOL. 13) MUST BE SATISFIED.

- THE STIFFNESS REQUIREMENT (AS PRESENTED IN THE FHWA SBDH, VOL. 13) IS:

$$\beta_T = (2.4 L M_f^2) / (\emptyset n E I_{eff} C_{bb}^2)$$

- THE STRENGTH REQUIREMENT (AS PRESENTED IN THE FHWA SBDH, VOL. 13) IS:

$$M_{br} = (0.005 L_b L M_f^2) / (n E I_{eff} C_{bb}^2 h_o)$$

- SEE PENNDOT DM-4, APPENDIX E6P, SECTION E6.5P FOR BASIC DEFINITION OF ALL VARIABLES. SEE BELOW FOR ADDITIONAL DEFINITION OF THE ULTIMATE MOMENT (M_f).

- THE ULTIMATE MOMENT (M_f) USED TO CALCULATE STABILITY BRACING STRENGTH AND STIFFNESS REQUIREMENTS (IN ACCORDANCE WITH THE PROVISIONS OF THE AISC SPEC APPENDIX 6.3 AND/OR THE FHWA SBDH VOL. 13) SHOULD BE BASED ON THE FOLLOWING LOAD COMBINATIONS FOR THE GIVEN LIMIT STATE UNDER INVESTIGATION:

  - STRENGTH I, FINAL CONDITION, COMPOSITE, NEGATIVE MOMENT REGIONS: 1.25 DC + 1.5 DW + 1.75 LL
  - STRENGTH I, CONSTRUCTION CONDITION, NONCOMPOSITE, POSITIVE OR NEGATIVE MOMENT REGIONS: 1.25 DC + 1.25 DW + 1.5 CONSTRUCTION LOADS (INCLUDING DYNAMIC EFFECTS IF APPLICABLE)
  - STRENGTH III, FINAL CONDITION, COMPOSITE, NEGATIVE MOMENT REGIONS: 1.25 DC + 1.5 DW + 0 LL + 1.00 WS
  - STRENGTH III, CONSTRUCTION CONDITION, NONCOMPOSITE, POSITIVE OR NEGATIVE MOMENT REGIONS: 1.25 DC + 1.25 DW + 1.00 WS +1.25 CONSTRUCTION LOADS (DC IS DEAD LOAD OF STEEL ONLY)
  - STRENGTH V, FINAL CONDITION, COMPOSITE, NEGATIVE MOMENT REGIONS: 1.25 DC + 1.5 DW + 1.35 LL + 1.00 WS + 1.0 WL
  - SPECIAL STEEL CONSTRUCTION LOAD COMBINATION: 1.4 DC + 1.4 CONSTRUCTION LOADS (INCLUDING DYNAMIC EFFECTS IF APPLICABLE)

- IN THE ABOVE-LISTED LOAD COMBINATIONS, THE STRENGTH I, CONSTRUCTION CONDITION LOAD COMBINATION SHOULD INCLUDE NO WIND LOADING, BUT FULL CONSTRUCTION LOADS ASSOCIATED WITH DECK PLACEMENT, INCLUDING CONSIDERATION OF CONSTRUCTION LIVE LOADS AND DYNAMIC EFFECTS AS APPLICABLE.

- IN THE ABOVE-LISTED LOAD COMBINATIONS, THE STRENGTH III, CONSTRUCTION CONDITION LOAD COMBINATION SHOULD INCLUDE WIND LOADING AND REDUCED CONSTRUCTION LOADS (SUCH AS WEIGHT OF STATIC CONSTRUCTION EQUIPMENT AND STORED MATERIALS WITH NO CONSTRUCTION LIVE LOAD). THE STRENGTH III, CONSTRUCTION CONDITION, NEED NOT BE CHECKED FOR DECK PLACEMENT CONDITIONS (THE STRENGTH I LIMIT STATE COVERS THIS CONDITION).

- IN THE ABOVE-LISTED LOAD COMBIATIONS, FOR CONSTRUCTION CONDITION LOAD COMBINATIONS, DW SHOULD ONLY INCLUDE ANY APPLICABLE UTILITY LOADS, BUT NOT FUTURE WEARING SURFACE LOADING.

- IN THE ABOVE-LISTED LOAD COMBINATIONS, USE THE APPROPRIATE WIND VELOCITY FOR THE GIVEN LOAD COMBINATION. REFER TO AASHTO LRFD SECTION 3.8.

- ONCE THE STABILITY BRACING FORCES HAVE BEEN CALCULATED USING THESE APPROPRIATELY FACTORED ULTIMATE MOMENT (M_f) VALUES, THEY SHOULD BE MULTIPLIED BY A 1.0 LOAD FACTOR FOR COMBINATION WITH OTHER FORCE EFFECTS IN THE APPROPRIATE LOAD COMBINATIONS WHEN EVALUATING BRACING STRENGTH AND STIFFNESS REQUIREMENTS.

b) GRAVITY LOAD (DEAD LOAD AND LIVE LOAD) EFFECTS:

FOR BRIDGES WITH SKEW INDEX LESS THAN 0.30 ($I_S < 0.30$) WHERE SIMPLIFIED ANALYSIS METHODS ARE USED, THE EFFECTS OF GRAVITY LOADS MAY BE NEGLECTED WHEN DETERMINING DIAPHRAGM DESIGN LOADS.

FOR BRIDGES WITH SKEW INDEX GREATER THAN 0.30 ($I_S > 0.30$) WHERE REFINED ANALYSIS METHODS ARE USED, DIAPHRAGM GRAVITY LOAD EFFECTS SHOULD BE DETERMINED FROM THE REFINED ANALYSIS.

c) WIND LOAD EFFECTS:

WIND LOAD EFFECTS SHOULD BE INCLUDED IN THE CALCULATION OF DIAPHRAGM DESIGN FORCES. APPROPRIATE WIND PRESSURES AND ASSOCIATED FACTORS SHOULD BE CALCULATED FOLLOWING THE GUIDANCE IN SECTION 3 OF THE AASHTO LRFD. WIND PRESSURE APPLIED TO THE FASCIA GIRDER CAN BE APPORTIONED AS FOLLOWS:

- WIND PRESSURE ON TOP 50% OF THE DEPTH OF THE FASCIA GIRDER CAN BE APPORTIONED TO THE TOP FLANGE AND CAN BE ASSUMED TO BE TRANSFERRED DIRECTLY INTO THE DECK.

- WIND PRESSURE ON THE BOTTOM 50% OF THE DEPTH OF FASCIA GIRDER CAN BE APPORTIONED TO THE BOTTOM FLANGE. THE BOTTOM FLANGE CAN BE ASSUMED TO TRANSFER THE RESULTING WIND LOAD TO INDIVIDUAL INTERMEDIATE DIAPRAGMS BY MEANS OF FLANGE LATERAL BENDING. THE LOAD IN EACH INTERMEDIATE DIAPHRAGM CAN BE DETERMINED BY MEANS OF A TRIBUTARY SPAN ASSUMPTION. THE DIAPHRAGMS SHOULD BE DESIGNED TO TRANSFER THIS LOAD INTO THE DECK.

- THE RESULTING WIND LOAD IN THE DECK CAN BE ASSUMED TO BE TRANSFERRED BY AND THROUGH THE DECK TO THE PIER AND END DIAPHRAGMS, THE PIER AND END DIAPHRAGMS SHOULD BE DESIGNED TO TRANSFER THE RESULTING WIND LOAD FROM THE DECK TO THE BEARINGS.

✳ NOTES FOR DESIGNING AND DETAILING DIAPHRAGMS, CONTINUED ON SHEET 3 ✳

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CROSS FRAME AND SOLID PLATE DIAPHRAGMS FOR STEEL BEAM/GIRDER BRIDGES DESIGNED WITH REFINED METHODS OF ANALYSIS

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 2 OF 5
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-619M

NOTES FOR DESIGNING AND DETAILING DIAPHRAGMS (CONTINUED FROM SHEET 2)

9. DETERMINATION OF DESIGN LOADS (CONTINUED FROM SHEET 2)

d) FATIGUE LOADING EFFECTS:

A DETAILED ANALYSIS OF FATIGUE LOADING IS NOT REQUIRED FOR THE DESIGN OF DIAPHRAGMS IN BRIDGES WITH A SKEW INDEX LESS THAN 0.30 ($I_S < 0.30$) WHERE A REFINED ANALYSIS IS NOT PERFORMED. INSTEAD THE LENGTH OF LONGITUDINAL FILLET WELDS CONNECTING DIAPHRAGM CHORD AND DIAGONAL MEMBERS TO GUSSET PLATES SHALL NOT BE LESS THAN 4". THE MINIMUM WELD SIZE REQUIREMENTS OF THE AASHTO LRFD SHALL BE MET.

FOR CURVED GIRDER BRIDGES OR BRIDGES WITH A SKEW INDEX GREATER THAN 0.30 ($I_S > 0.30$) A REFINED ANALYSIS IS REQUIRED AND SHALL INCLUDE DETERMINATION OF FATIGUE STRESS RANGES IN THE DIAPHRAGM MEMBERS. FOLLOW THE GUIDANCE PROVIDED IN THE COMMENTARY OF THE AASHTO LRFD (C6.6.1.2.1), REGARDING THE DETERMINATION OF FATIGUE STRESS RANGES WHEN COMPUTED USING A REFINED ANALYSIS.

e) STABILITY BRACING FORCES:

STABILITY BRACING STRENGTH AND STIFFNESS REQUIREMENTS SHOULD BE SATISFIED, IN ACCORDANCE WITH THE AISC SPEC (APPENDIX 6.3) AND THE FHWA SBDH (VOL 13). STABILITY BRACING FORCES SHOULD BE COMBINED WITH OTHER LOADS AS SPECIFIED ABOVE IN THIS STANDARD.

STABILITY BRACING FORCES SHOULD BE CALCULATED FOR DIAPHRAGMS BRACING TOP FLANGES IN POSITIVE MOMENT REGIONS. THE MAXIMUM POSITIVE MOMENT AND ASSOCIATED DIAPHRAGM SPACING (IN THE VICINITY OF THE MAXIMUM POSITIVE MOMENT LOCATION) SHOULD BE USED TO CALCULATE STABILITY BRACING FORCES. ONLY NON-COMPOSITE DEAD LOAD EFFECTS SHOULD BE CONSIDERED IN CALCULATING STABILITY BRACING FORCES FOR DIAPHRAGMS IN THE POSITIVE MOMENT REGION; ONCE THE DECK IS CURED, THE TOP FLANGE IN COMPRESSION IS CONTINUOUSLY BRACED BY THE DECK.

STABILITY BRACING FORCES SHOULD BE CALCULATED FOR DIAPHRAGMS BRACING BOTTOM FLANGES IN NEGATIVE MOMENT REGIONS (IN MULTIPLE SPAN CONTINUOUS BRIDGES). THE ULTIMATE NEGATIVE MOMENT AT THE LOCATION OF THE FIRST DIAPHRAGM AWAY FROM THE PIER SHOULD BE USED TO CALCULATE STABILITY BRACING FORCES.

IF DIAPHRAGM SPACING IS DIFFERENT IN THE POSITIVE AND NEGATIVE MOMENT REGIONS, THE DIAPHRAGM SPACING IN EACH REGION SHOULD BE USED FOR CALCULATION OF STABILITY BRACING FORCES IN THAT PARTICULAR REGION.

10. DETAILED DESIGN PROCEDURES FOR TYPE X AND TYPE K INTERMEDIATE DIAPHRAGMS

a) DESIGN OF TOP CHORD, BOTTOM CHORD, AND DIAGONALS IN TYPE X AND TYPE K DIAPHRAGMS.

- STRENGTH DESIGN: STRENGTH DESIGN SHALL BE PERFORMED IN ACCORDANCE WITH THE APPROPRIATE AASHTO LRFD PROVISIONS (SECTION 6). FOR ANGLE SECTIONS (AISC "L" SHAPES) THE EFFECTIVE SLENDERNESS RATIO METHOD IN THE AASHTO LRFD (SECTION 6.9.4.4) SHALL BE USED. FOR OTHER SECTIONS SUCH AS WT, W, AND CHANNEL SECTIONS (AISC "WT", "WIDE FLANGE", "C", AND "MC" SHAPES), THE DESIGN SHALL CONSIDER BOTH AXIAL LOAD AND FLEXURE DUE TO THE ECCENTRICITY OF CONNECTIONS (BEAM-COLUMN INTERACTION) , AND SHALL CONSIDER SECOND-ORDER MOMENT AMPLIFICATION IN THE CASE OF COMPRESSION LOADING IN ACCORDANCE WITH THE AASHTO LRFD (SECTION 6.9.2.2).
- FATIGUE DESIGN: EVALUATE FATIGUE OF THE BASE METAL IN THE CONNECTION OF DIAPHRAGM MEMBERS TO GUSSET PLATES USING LONGITUDINAL WELDS AS A CATEGORY E' DETAIL, AS SPECIFIED IN THE AASHTO LRFD (TABLE 6.6.1.2.3.-1). FOR INTERSTATE AND NATIONAL HIGHWAY SYSTEM (NHS) BRIDGES, DESIGN DIAPHRAGMS FOR THE FATIGUE I LOAD COMBINATION AS DEFINED IN THE AASHTO LRFD. FOR OTHER BRIDGES, DESIGN DIAPHRAGMS FOR THE FATIGUE II LOAD COMBINATION AS DEFINED IN THE AASHTO LRFD; DESIGNED FOR A 100-YEAR SERVICE LIFE.
- THE EFFECTIVE LENGTH OF TOP CHORD, BOTTOM CHORD AND DIAGONAL MEMBERS SHALL BE DETERMINED IN ACCORDANCE WITH THE APPLICABLE PROVISIONS OF THE AASHTO LRFD. FOR DIAGONAL MEMBERS IN TYPE X DIAPHRAGMS WHICH ARE CONNECTED AT THEIR POINTS OF INTERSECTION, SEE SECTION 2.7 OF THE FHWA SBDH, VOL. 13, FOR PROVISIONS REGARDING THE USE OF 0.5L IN EFFECTIVE LENGTH CALCULATIONS.

b) DESIGN OF GUSSET PLATES

GUSSET PLATES SHALL BE DESIGNED IN ACCORDANCE WITH THE APPROPRIATE PROVISIONS OF THE AASHTO LRFD (SECTION 6.14.2.8) , ADDRESSING TENSION, COMPRESSION AND SHEAR AS APPLICABLE.

c) DESIGN OF WELDED CONNECTION OF DIAPHRAGM MEMBERS TO GUSSET PLATES

THE WELDED CONNECTION OF DIAPHRAGM MEMBERS (TOP CHORD, BOTTOM CHORD, DIAGONALS) TO THE GUSSET PLATES SHOULD BE DESIGNED IN ACCORDANCE WITH THE PROVISIONS OF THE AASHTO LRFD (SECTION 6).

d) DESIGN OF BOLTED CONNECTION OF GUSSET PLATES TO CONNECTION PLATES AND/OR BEARING STIFFENERS

- THE BOLTED CONNECTIONS OF GUSSET PLATES TO CONNECTION PLATES AND/OR BEARING STIFFENERS SHOULD BE DESIGNED IN ACCORDANCE WITH THE PROVISIONS OF THE AASHTO LRFD (SECTION 6). IN-PLANE ECCENTRICITY OF LOADING APPLIED TO THE BOLT GROUP (RESULTANT OF LOAD NOT ACTING THROUGH THE CENTROID OF THE BOLT GROUP) SHALL BE CONSIDERED.
- ALL APPLICABLE COMBINATIONS OF TENSION AND COMPRESSION LOADS IN INDIVIDUAL MEMBERS SHOULD BE CONSIDERED; EITHER INVESTIGATE ALL TRUE CONCURRENT COMBINATIONS OF LOADS, OR DESIGN FOR CONSERVATIVE ENVELOPING COMBINATIONS OF THE MAXIMUM COMPRESSION AND TENSION FORCES IN EACH MEMBER CONNECTED TO THE GUSSET PLATE.
- INVESTIGATE SHEAR IN THE BOLTS AND BEARING IN THE CONNECTED MATERIALS (BOTH THE GUSSET PLATE AND THE CONNECTION PLATE OR BEARING STIFFENER) UNDER ALL APPLICABLE STRENGTH LOAD COMBINATIONS. INVESTIGATE SLIP OF BOLTED CONNECTIONS UNDER THE SERVICE II LOAD COMBINATION.
- USE 7/8" DIAMETER ASTM F3125 GRADE A325 BOLTS WHENEVER POSSIBLE. 1" DIAMETER ASTM F3125 GRADE A325 BOLTS MAY BE USED IN SITUATIONS WHERE THE USE OF 7/8" DIAMETER BOLTS WOULD RESULT IN AN EXCESSIVE NUMBER OF BOLTS IN THE CONNECTION. THE USE OF ASTM F3125 GRADE A325 BOLTS LARGER THAN 1" DIAMETER, OR THE USE OF ANY SIZE ASTM F3125 GRADE 490 BOLTS, REQUIRES APPROVAL FROM THE CHIEF BRIDGE ENGINEER.
- DESIGN BOLTED CONNECTIONS ASSUMING A CLASS B CONSTANT SURFACE SLIP RESISTANCE. USE CLASS C SLIP RESISTANCE FOR GALVANIZED BOLTS. (SEE NOTE 14(e) OF THIS STANDARD).
- BOLT SPACINGS, END DISTANCES, AND EDGE DISTANCES SHOULD MEET AASHTO LRFD REQUIREMENTS.
- USE STANDARD SIZE HOLES. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" IN DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" IN DIAMETER AND LARGER, THE WIDTH OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
- THE USE OF OVERSIZE HOLES OR SLOTTED HOLES REQUIRES APPROVAL FROM THE CHIEF BRIDGE ENGINEER.
- CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE CHECKED.

e) DESIGN OF CONNECTION PLATES

THE WELDS CONNECTING THE CONNECTION PLATE (OR BEARING STIFFENER) TO THE GIRDER WEB AND FLANGES SHOULD BE DESIGNED WITH ADEQUATE STRENGTH TO TRANSMIT THE DIAPHRAGM FORCES INTO THE GIRDERS. INVESTIGATE THE STRENGTH OF THE WELDED CONNECTIONS IN ACCORDANCE WITH THE PROVISIONS OF THE AASHTO LRFD (SECTION 6).

11. DETAILED DESIGN PROCEDURES FOR TYPE K AND TYPE K INVERTED PIER AND END DIAPHRAGMS

a) IN GENERAL, DESIGN TYPE K AND TYPE K INVERTED END DIAPHRAGMS FOLLOWING THE GUIDANCE PRESENTED IN NOTE 10 OF THIS STANDARD FOR DESIGN OF TYPE X AND TYPE K INTERMEDIATE DIAPHRAGMS, EXCEPT AS SPECIFICALLY MODIFIED BELOW.

b) IN SITUATIONS WHERE TYPE K INVERTED END DIAPHRAGMS ARE USED AND THE TOP CHORD ACTS TO STRENGTHEN AND STIFFEN THE EDGE OF THE DECK AT EXPANSION JOINTS, THE DIAPHRAGM TOP CHORD IS TYPICALLY A CHANNEL OR W SECTION (AISC "C", "MC", OR WIDE FLANGE SHAPE). THE DIAPHRAGM TOP CHORD IN THIS SITUATION IS TYPICALLY MADE TO ACT IN A COMPOSITE FASHION WITH THE DECK VIA THE USE OF SHEAR CONNECTORS.

c) THE DIAPHRAGM TOP CHORD SHOULD BE DESIGNED TO CARRY A PORTION OF THE DEAD LOAD OF THE WET CONCRETE DECK AS WELL AS WHEEL LOADS APPLIED TO THE DECK, IN ADDITION TO ANY GLOBAL (SYSTEM) DEAD, LIVE, AND WIND LOAD EFFECTS. THE DIAPHRAGM TOP CHORD MAY BE TREATED AS EITHER A TWO SPAN CONTINUOUS BEAM (SIMPLY SUPPORTED AT ITS ENDS, CONTINUOUS OVER THE POINT OF CONNECTION TO THE DIAGONALS), OR AS TWO SIMPLE SPANS (SIMPLY SUPPORTED AT ITS ENDS AND AT THE POINT OF CONNECTION TO THE DIAGONALS).

d) THE DIAGONALS SHOULD BE DESIGNED TO CARRY DEAD LOAD AND LIVE LOAD REACTIONS FROM THE DIAPHRAGM TOP CHORD'S ACTION AS A BEAM STIFFENING AND STRENGTHENING THE EDGE OF THE DECK AT EXPANSION JOINTS, IN ADDITION TO ANY GLOBAL (SYSTEM) DEAD, LIVE, AND WIND LOAD EFFECTS.

e) THE CONNECTION PLATES FOR PIER AND END DIAPHRAGMS TYPICALLY ALSO FUNCTION AS BEARING STIFFENERS AND SHOULD BE DESIGNED FOR BOTH DIAPHRAGM LOADS AND BEARING REACTIONS, FOLLOWING THE APPROPRIATE PROVISIONS OF THE AASHTO LRFD (SECTIONS 6.9.2.1, 6.10.11.2 AND 6.13.3.2).

12. DETAILED DESIGN PROCEDURES FOR SOLID PLATE INTERMEDIATE OR PIER AND END DIAPHRAGMS

a) TYPICALLY, SOLID PLATE INTERMEDIATE DIAPHRAGMS ARE DESIGNED FOR THEIR APPROPRIATE STRENGTH LIMIT STATE DESIGN LOAD EFFECTS IN A MANNER SIMILAR TO THE DESIGN OF OTHER STEEL GIRDERS OR BEAMS, IN ACCORDANCE WITH THE AASHTO LRFD (SECTION 6).

b) IF SOLID PLATE PIER OR END DIAPHRAGMS WILL BE SUBJECTED TO JACKING LOADS FOR BEARING REPLACEMENT, BEARING STIFFENERS SHOULD BE DESIGNED AND PROVIDED, UNLESS IT CAN BE CLEARLY SHOWN BY CALCULATION THAT THE UNSTIFFENED WEB HAS SUFFICIENT AXIAL (BUCKLING), WEB LOCAL YIELDING, AND WEB CRIPPLING CAPACITY, FOLLOWING THE APPROPRIATE PROVISIONS OF THE AASHTO LRFD (SECTION 6).

c) SOLID PLATE INTERMEDIATE OR PIER AND END DIAPHRAGMS ARE TYPICALLY CONNECTED TO STIFFENERS VIA BOLTED CONNECTIONS. THESE BOLTED CONNECTIONS SHOULD BE DESIGNED IN ACCORDANCE WITH THE PROVISIONS OF THE AASHTO LRFD (SECTION 6). ECCENTRICITY OF LOADING APPLIED TO THE BOLT GROUP SHALL BE CONSIDERED. INVESTIGATE SHEAR IN THE BOLTS AND BEARING IN THE CONNECTED MATERIALS (BOTH THE SOLID PLATE DIAPHRAGM'S WEB AND THE CONNECTION PLATE OR BEARING STIFFENER) UNDER ALL APPLICABLE STRENGTH LIMIT STATES. INVESTIGATE SLIP OF BOLTED CONNECTIONS UNDER THE SERVICE II LIMIT STATE.

d) IN SITUATIONS WHERE THE SPAN TO DEPTH RATIO OF SOLID PLATE DIAPHRAGMS IS LESS THAN OR EQUAL TO 4.0, SHEAR DEFORMATIONS MUST BE CONSIDERED WHEN EVALUATING THE STRENGTH ADEQUACY OF THE DIAPHRAGM.

13. BEARING DESIGN

a) DESIGN BEARINGS TO ACCOMMODATE APPLICABLE VERTICAL LOAD DEMANDS, HORIZONTAL LOAD DEMANDS, HORIZONTAL MOVEMENT DEMANDS, AND ROTATIONAL DEMANDS, AS APPROPRIATE. CONSIDER THE CONCURRENT COMBINATIONS OF THESE DEMANDS AT EACH STAGE OF CONSTRUCTION (INCLUDING PRIOR TO DECK PLACEMENT) AND UNDER FINAL CONDITIONS.

b) WHEN EVALUATING THE ROTATIONAL DEMAND ON BEARINGS FOR CURVED OR SKEWED STEEL GIRDER BRIDGES, CONSIDER BOTH THE MAJOR AXIS BENDING ROTATION OF THE GIRDER (ROTATION ABOUT THE TRANSVERSE AXIS OF THE GIRDER) AND GIRDER LAYOVER (ROTATION ABOUT THE LONGITUDINAL AXIS OF THE GIRDER).

c) WHEN EVALUATING GIRDER LAYOVER ROTATIONAL DEMANDS ON BEARINGS AT SKEWED SUPPORTS (FOR EITHER CURVED OR STRAIGHT GIRDER BRIDGES), CONSIDER THE EFFECTS OF THE CHOSEN DETAILING METHOD (NLF, SDLF, TDLF) ON THE VALUES OF THE GIRDER LAYOVER ROTATIONAL DEMANDS. THE CHOSEN DETAILING METHOD AFFECTS THE MAGNITUDE AND DIRECTION OF GIRDER LAYOVER AT VARIOUS STAGES OF CONSTRUCTION (I.E., DURING GIRDER ERECTION, WITH ALL STEEL ERECTED PRIOR TO DECK PLACEMENT, AFTER DECK PLACEMENT, ETC.).

d) IF BEARINGS CANNOT BE ECONOMICALLY DESIGNED TO ACCOMMODATE ALL ROTATIONAL DEMANDS UNDER ALL LOADING CONDITIONS (DURING ALL STAGES OF CONSTRUCTION AND UNDER FINAL CONDITIONS), CONSIDER THE USE OF SOLE PLATES BEVELED BOTH TRANSVERSELY AND LONGITUDINALLY, OR REQUIRING THE BLOCKING OF GIRDERS DURING CONSTRUCTION (I.E., THE SUPPORT OF GIRDERS ON TEMPORARY BLOCKING). BASE BEARING DESIGN DECISIONS ON THE GOAL OF ACHIEVING A BALANCE OF ECONOMY, CONSTRUCTABILITY, AND LONG TERM SERVICEABILITY CRITERIA.

14. NOTES TO BE SHOWN ON THE CONSTRUCTION DRAWINGS

a) PROVIDE MATERIALS AND WORK QUALITY IN ACCORDANCE WITH PUBLICATION 408 AND AASHTO/AWS D1.5 SPECIFICATIONS.

b) DEVELOP SHOP DRAWINGS AND ERECTION PROCEDURES THAT DETAIL ALL WEBS VERTICAL UNDER (SPECIFY THE APPROPRIATE LOADING CONDITION, AS INDICATED IN NOTE 3.a OF THIS STANDARD, I.E., NO LOAD FIT (NLF), STEEL DEAD LOAD FIT (SDLF) OR TOTAL DEAD LOAD FIT (TDLF)) CONDITION.

c) USE STANDARD SIZE HOLES FOR ALL BOLTS.

d) USE (INDICATE 7/8" OR AS SPECIFIED IN THE DESIGN AND PLANS) DIAMETER ASTM F3125 GRADE A325 BOLTS HAVING AN UNTHREADED SHANK OF SUFFICIENT LENGTH TO NOT ALLOW ANY THREADS TO EXIST IN THE PLANE BETWEEN THE TWO CONNECTED PARTS (SHEAR PLANE).

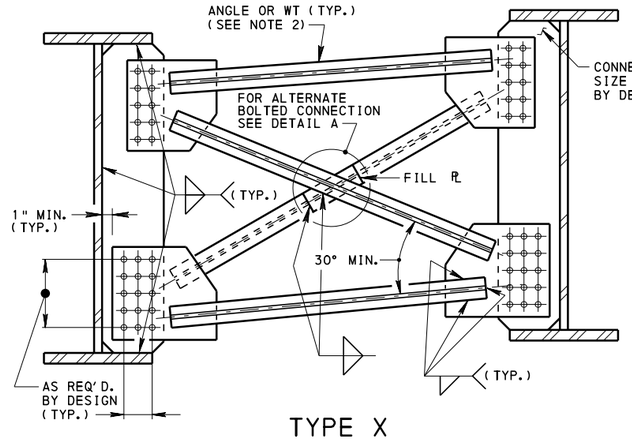
e) FURNISH PAINT THAT HAS BEEN QUALIFIED AS CLASS B IN ACCORDANCE WITH SECTION 6.13.2.8 OF AASHTO LRFD SPECIFICATION. (INCLUDE THIS NOTE FOR PAINTED BRIDGES AND WEATHERING STEEL BRIDGES)

f) BLAST CLEAN THE FAYING SURFACES OF SPLICES AND CONNECTIONS OF ALL STRUCTURAL ELEMENTS IN ACCORDANCE WITH PUBLICATION 408 SECTION 1060.3(b)3. REBLAST UNPAINTED ELEMENTS THAT REMAIN UNASSEMBLED FOR A PERIOD OF 12 MONTHS OR MORE FOLLOWING THE INTITIAL CLEANING. (INCLUDE THIS NOTE FOR WEATHERING STEEL BRIDGES ONLY)

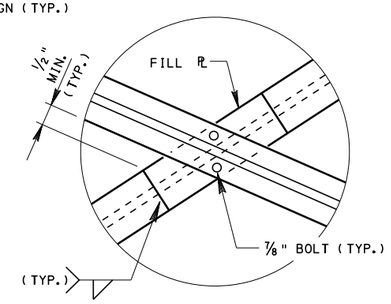
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CROSS FRAME AND SOLID PLATE DIAPHRAGMS FOR STEEL BEAM/GIRDER BRIDGES DESIGNED WITH REFINED METHODS OF ANALYSIS

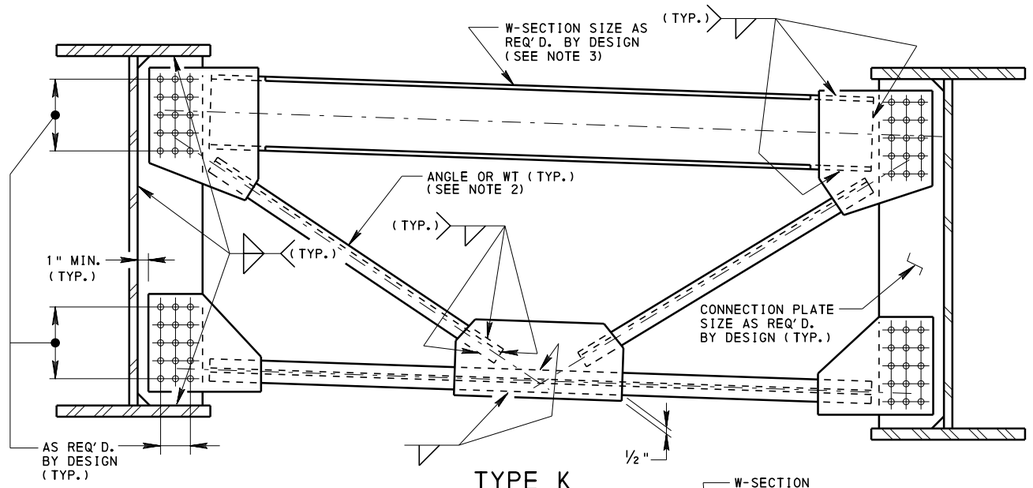
RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 3 OF 5 BD-619M



TYPE X



DETAIL A

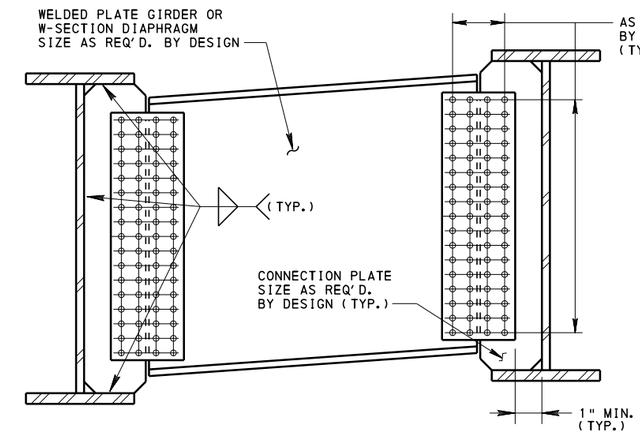


TYPE K

TYPE K

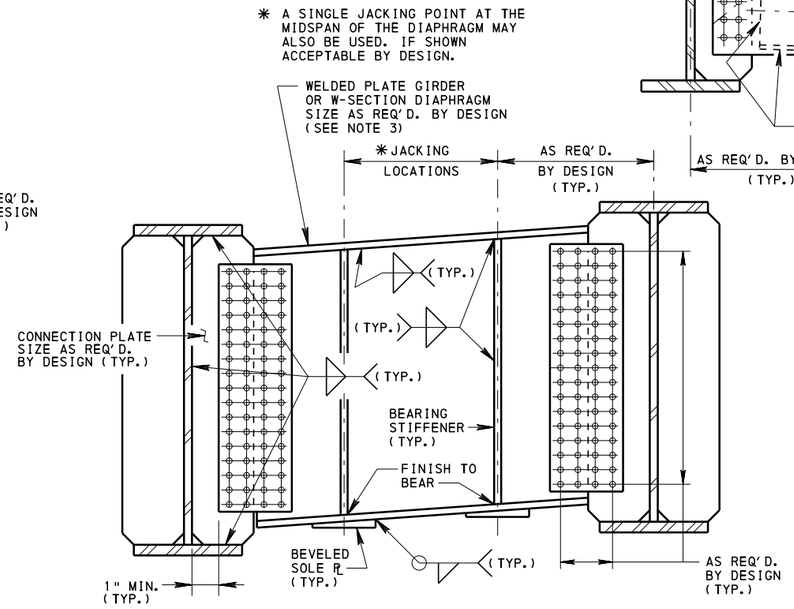
NOTES:

1. REFER TO NOTES ON SHEETS 1, 2 AND 3 FOR DESIGN REQUIREMENTS.
2. MEMBER TYPE AND SIZE AS REQUIRED BY DESIGN. MEMBERS SHOULD TYPICALLY CONSIST OF SINGLE ANGLES OR WT SECTIONS. BACK TO BACK DOUBLE ANGLES ARE PERMITTED FOR UNPAINTED WEATHERING STEEL BRIDGES ONLY.
3. FOR END DIAPHRAGMS, SUPPORT EDGE OF DECK WITH TOP CHORD, AND PROVIDE A SINGLE ROW OF ¾"Ø STUDS AT A NOMINAL 1'-0" SPACING.



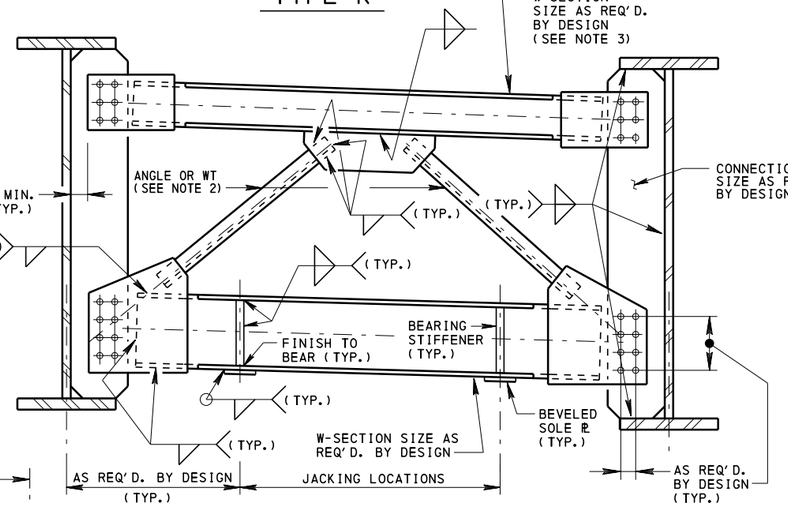
SOLID PLATE

INTERMEDIATE DIAPHRAGMS



SOLID PLATE

END DIAPHRAGMS

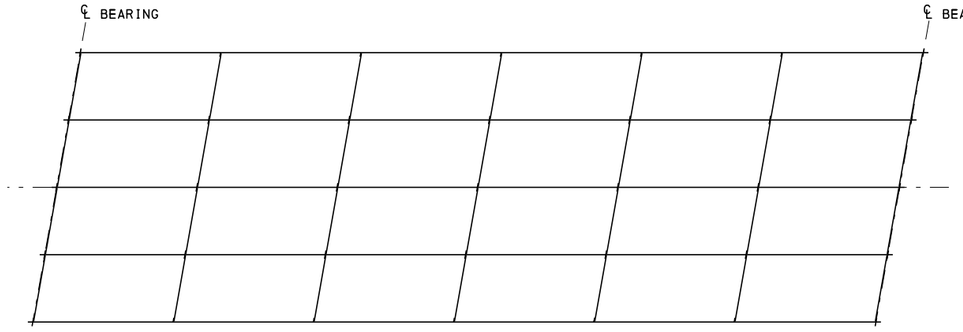


TYPE K INVERTED

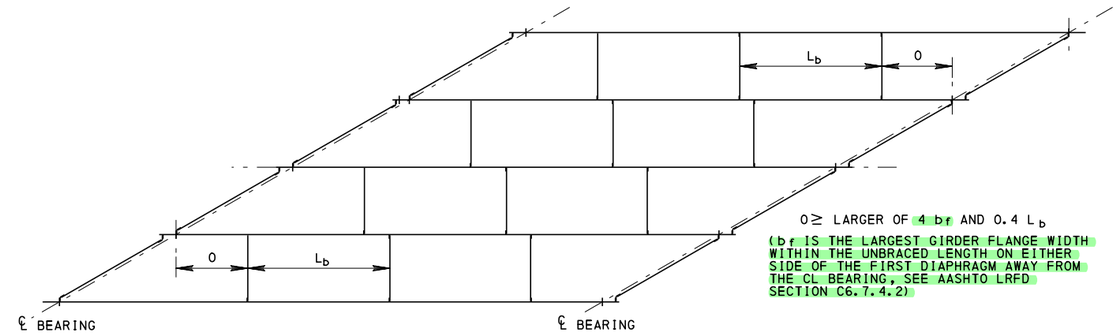
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CROSS FRAME AND SOLID PLATE DIAPHRAGMS FOR STEEL BEAM/GIRDER BRIDGES DESIGNED WITH REFINED METHODS OF ANALYSIS

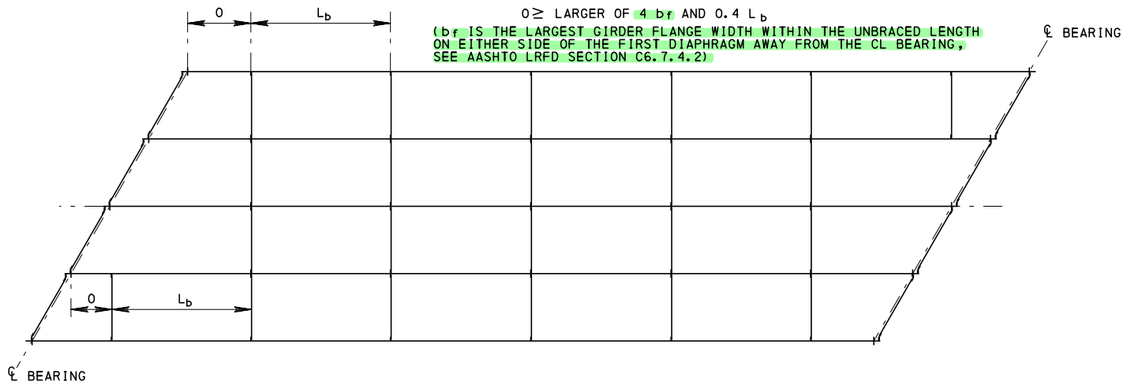
RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 4 OF 5
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-619M



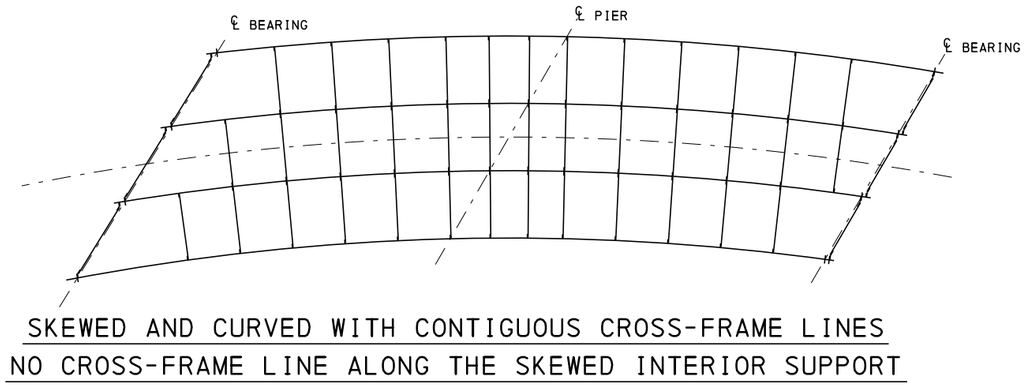
SKEWED SUPPORTS WITH CONTIGUOUS CROSS-FRAME LINES PARALLEL TO THE SKEW (SKEW ≥ 70°)



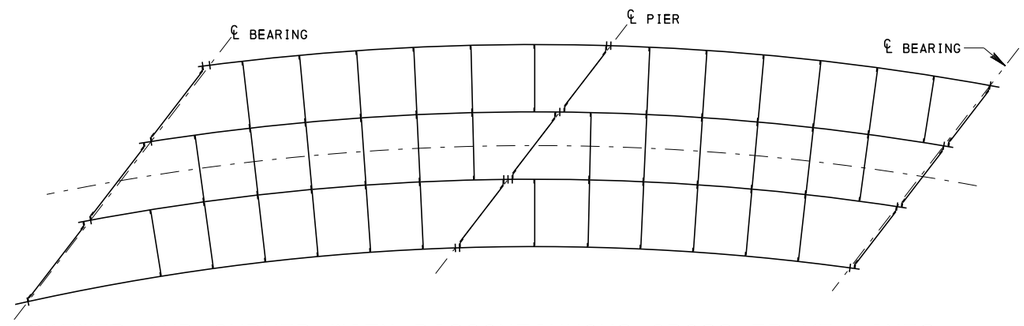
SEVERELY SKEWED SUPPORTS WITH STAGGERED CROSS-FRAME LINES



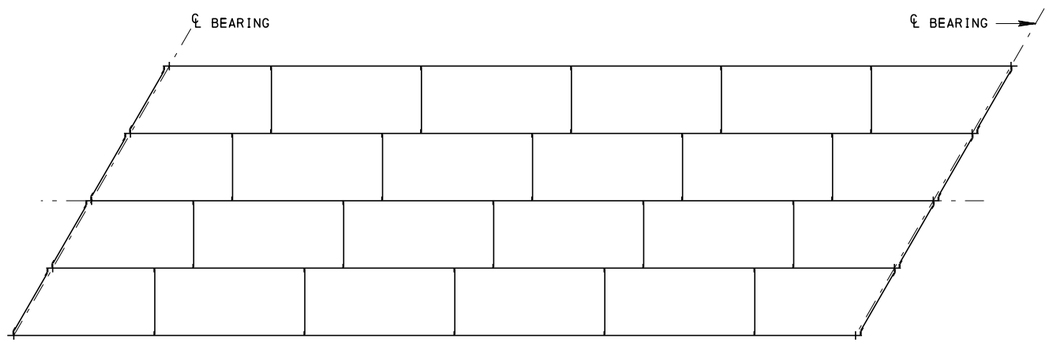
CONTIGUOUS CROSS-FRAME LINES (WITHIN THE SPAN) NORMAL TO THE GIRDER TANGENTS (SKEW < 70°)



SKEWED AND CURVED WITH CONTIGUOUS CROSS-FRAME LINES NO CROSS-FRAME LINE ALONG THE SKEWED INTERIOR SUPPORT



SKEWED AND CURVED WITH DISCONTINUOUS CROSS-FRAME LINES CROSS-FRAME LINE ALONG THE SKEWED INTERIOR SUPPORT



DISCONTINUOUS (STAGGERED) CROSS-FRAME LINES ALONG THE ENTIRE SPAN NORMAL TO THE GIRDER TANGENTS (SKEW < 70°)

SKEWED INTERIOR SUPPORT LINES:

- FOR SKEWS < 70°, CROSS-FRAMES ALONG THE SKEWED SUPPORT LINE ARE NOT GENERALLY RECOMMENDED.
- DETAILING AT INTERSECTIONS WITH CROSS-FRAMES NORMAL TO GIRDER IS COMPLEX.
- NOT NEEDED IF CROSS-FRAMES NORMAL TO GIRDER ARE AT BEARINGS THAT RESIST LATERAL FORCES AND FLANGE ARE ADEQUATELY BRACED.

WHERE DISCONTINUOUS CROSS-FRAMES ARE UTILIZED NEAR INTERIOR SUPPORTS, ENSURE THAT:

- A CROSS-FRAME IS MATCHED WITH EACH BEARING THAT RESISTS LATERAL FORCE
- WHERE A BEARING DOES NOT RESIST LATERAL FORCE, GIRDER BOTTOM FLANGE IS ADEQUATELY BRACED.

NOTE:

THESE FRAMING PLANS ARE CONCEPTUAL ONLY AND ARE PROVIDED ONLY TO ILLUSTRATE POTENTIAL FRAMING ARRANGEMENTS FOR VARIOUS CURVED AND/OR SKEWED BRIDGE GEOMETRIES. DESIGNERS SHALL ESTABLISH A STRUCTURE SPECIFIC FRAMING PLAN, CONSIDERING ECONOMY OF FABRICATION AND CONSTRUCTION AS WELL AS CONTROL OF FORCE EFFECTS. REFER TO AASHTO LRFD SECTION C6.7.4.2 FOR ADDITIONAL DISCUSSION REGARDING EFFICIENT FRAMING ARRANGEMENTS.

CONCEPTUAL FRAMING PLANS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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STANDARD CROSS FRAME AND SOLID PLATE DIAPHRAGMS FOR STEEL BEAM/GIRDER BRIDGES DESIGNED WITH REFINED METHODS OF ANALYSIS

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 5 OF 5 BD-619M

CHANGE 2

CHANGE 5

LATERAL STABILITY BRACING
DESIGN CRITERIA FOR GIRDER BRIDGES
PRIOR TO DECK COMPLETION:

THE CRITERION IN THIS STANDARD APPLIES ONLY TO COMPLETELY ERECTED STEEL SUPERSTRUCTURE, WITHOUT THE DECK. THE STABILITY OF PARTIAL AND COMPLETED GIRDERS IN THE VARIOUS STAGES OF ERECTION PRIOR TO INSTALLATION OF ALL GIRDERS AND DIAPHRAGMS IS THE RESPONSIBILITY OF THE CONTRACTOR AS SPECIFIED IN PUBLICATION 408 SECTION 1050.3(c). (APPLIES TO TANGENT, SKEWED AND CURVED BRIDGES. APPLIES TO SINGLE AND MULTI-SPAN BRIDGES.)

1. PROVIDE LATERAL BRACING FOR BRIDGES WITH SPANS IN EXCESS OF 300 FT. TO AID IN CONSTRUCTION OF THE BRIDGE. DESIGN BRACING FOR THE SPECIFIED WIND LOADS.

2. EVALUATE THE NEED FOR LATERAL BRACING FOR SPANS IN EXCESS OF 200 FT. BASED ON LATERAL DEFLECTION.

3. GIRDERS SHALL BE DESIGNED SO THAT NO LATERAL BRACING IS NECESSARY FOR GIRDER SPANS LESS THAN 200 FEET, RATIO OF GIRDER SPACING OVER GIRDER DEPTH LESS THAN OR EQUAL TO 2 AND A BRIDGE CROSS SECTION WITH 4 OR MORE GIRDERS. THE ENGINEER WILL EVALUATE THE DEAD LOAD PLUS WIND CONDITION WITH AN UNBRACED TOP FLANGE, AND IF NECESSARY, MODIFY THE GIRDER DESIGN.

4. EVALUATE LATERAL DEFLECTION OF STEEL SUPERSTRUCTURE FOR A PERMISSIBLE DEFLECTION OF L/150. PROVIDE BRACING IF DEFLECTION LIMIT IS EXCEEDED. AN ACCEPTABLE ANALYSIS METHOD IS A HAND CALCULATION FOR A SINGLE FASCIA GIRDER (NON COMPOSITE) OR A GRID ANALYSIS FOR THE ENTIRE STEEL SUPERSTRUCTURE FRAMING. THE DIAPHRAGM ACTION OF THE STAY-IN-PLACE FORMS SHALL BE NEGLECTED. FINALLY, IF A GRID ANALYSIS IS USED, THE DIAPHRAGM/GIRDER CONNECTION SHALL BE MODELED AS A PIN IN THE PLANE OF THE GRID. IT IS CONSERVATIVE TO ASSUME PINNED DIAPHRAGM TO GIRDER CONNECTIONS. A MORE RIGOROUS ANALYSIS MODELING PARTIAL FIXITY AT THE CONNECTIONS CONSISTENT WITH THE CONNECTION DETAILING IS ACCEPTABLE.

5. EVALUATE GIRDER STRESSES FOR COMBINED STEEL SUPERSTRUCTURE DEAD LOADS AND WIND LOADS USING THE FOLLOWING LOAD COMBINATIONS:
   STRENGTH I - 1.25x(DC) + 1.5x(CDL) + 1.5x(CLL)
   STRENGTH III - 1.25x(DC) + 1.25x(CDL) + 1.0(CW)
   STRENGTH IV - 1.4x(DC) + 1.4x(CDL) + 1.4x(CLL)
   SERVICE - 1.0x(DC) + 1.0x(CDL) + 1.0x(CLL) + 1.0x(CW)
   UPLIFT (MIN.) - 0.9x(DC) + 0.9x(CDL) + 1.0x(CW)
   UPLIFT (MAX.) - 1.35x(DC) + 1.35x(CDL) + 1.0x(CW)
   NOTE:
   DC = PERMANENT DEAD LOAD
   CDL= CONSTRUCTION DEAD LOAD
   CLL= CONSTRUCTION LIVE LOAD
   CW = WIND LOAD

6. USE THE MINIMUM DESIGN WIND LOAD SPECIFIED IN THE TABLE ON THIS SHEET, EXCEPT FOR BRIDGES OVER TRAFFIC, INCREASE THESE PRESSURES BY 5 PSF.

7. WIND LOAD PER FOOT OF BRIDGE IS (GIRDER DEPTH + DECK THICKNESS AT FASCIA GIRDER) X DESIGN WIND PRESSURE. DESIGN WINDWARD GIRDER FOR THE FULL MINIMUM DESIGN WIND LOAD. DESIGN ALL OTHER GIRDERS, EXCEPT THE FIRST INTERIOR GIRDER ADJACENT TO THE WINDWARD GIRDER, FOR HALF THE MINIMUM DESIGN WIND LOAD.

8. USE OVERSIZED OR SLOTTED HOLES TO DESIGN THE GUSSET PLATES.

9. DESIGN BOLTED CONNECTION OF THE BRACING TO GIRDER TO PREVENT SLIP FROM WIND FORCES WITH THE PERMISSIBLE INCREASE IN ALLOWABLE SLIP FORCE. DESIGN CONNECTIONS FOR ACTUAL FORCES. PROVIDE OVERSIZED OR SLOTTED HOLES AND DESIGN THE CONNECTION FOR WIND FORCES ONLY.

10. USE PERMANENT BRACING ARRANGEMENT; CABLE BRACING IS NOT CONSIDERED PERMANENT. PROVIDE SAME CORROSION PROTECTION USED IN THE AS-DESIGNED STRUCTURAL STEEL.

11. GIRDER SECTION CHECKS FOR THE PERMANENT CONDITION ARE BEYOND THE SCOPE OF THESE CRITERIA. THE CRITERIA FOR THESE CHECKS ARE SPECIFIED IN AASHTO AND DESIGN MANUAL PART 4 WITH METHODOLOGY SHOWN IN THE AISC STEEL BRIDGE DESIGN HANDBOOKS.

REFERENCES:

THE REFERENCE FOR EACH CRITERION ON THIS SHEET IS AS FOLLOWS:

R1. EXPERIENCE INDICATES THAT SPANS IN EXCESS OF 300 FT. GENERALLY HAVE WIND ISSUES DURING CONSTRUCTION.

R2. EXPERIENCE INDICATES THAT WIND MAY AFFECT THE STEEL SUPERSTRUCTURE IN A MANNER THAT WOULD REQUIRE WIND BRACING FOR SPANS FROM 200 TO 300 FT.

R3. EXPERIENCE OF THE APC BRIDGE COMMITTEE, STEEL SUPERSTUCTURE STABILITY SUBCOMMITTEE INDICATES THAT SPANS LESS THAN 200 FT. HAVE NOT HAD WIND ISSUES DURING CONSTRUCTION.

R4. L/150 IN 300 FT. IS 2 FT. THIS WAS FELT TO BE ACCEPTABLE TO BOTH DESIGN PERSONNEL AND CONTRACTORS.

R5. AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

R6. ENGINEERING FOR STRUCTURAL SAFETY IN CONSTRUCTION OF BRIDGE SUPERSTRUCTURES (REFERENCE MANUAL, OCTOBER 2013, NHI COURSE NUMBER 130102).

R7. PROFESSIONAL EXPERIENCE

R8. CONTRACTOR PREFERENCE

R9. PROFESSIONAL EXPERIENCE

R10. CONTRACTOR PREFERENCE

R11. DESIGN SPECIFICATION FOR THE PERMANENT CONDITION

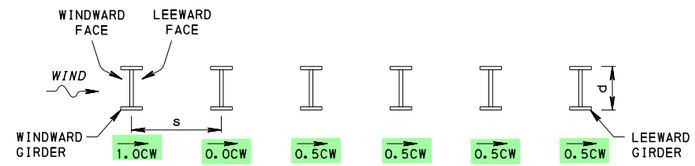
STAGED CONSTRUCTION CONSIDERATIONS

WHEN PHASED/STAGED CONSTRUCTION IS SPECIFIED, THE FOLLOWING ITEMS SHALL BE ADDRESSED:

1. THE LATERAL STABILITY BRACING DESIGN CRITERIA SHALL BE APPLIED FOR EACH STAGE OF CONSTRUCTION. THE WIND BRACING ARRANGEMENT REQUIRED FOR THE FINAL CONDITION MAY NOT PROVIDE THE REQUIRED STABILITY OF EACH STAGE.

2. THE DESIGNER SHALL INVESTIGATE AND ADDRESS THE VERTICAL AND LATERIAL MOVEMENTS DURING PHASED/STAGED CONSTRUCTION. THE DETAILING AND CONSTRUCTIBILITY OF BRACING SPANNING BETWEEN GIRDERS OF DIFFERENT STAGES MUST BE ENSURED AND MAY REQUIRE DETAILS TO ACCOMODATE THE MOVEMENTS. ANTICIPATED MOVEMENTS SHALL BE NOTED ON THE PLANS SO THAT THE CONTRACTOR CAN ACCOUNT FOR THEM IN ANY DESIGN AND DETAILING.

MINIMUM DESIGN WIND PRESSURE CW (PSF)
AND PRESSURE DISTRIBUTION TO GIRDERS
FOR LATERAL BRACING DURING CONSTRUCTION



CONSTRUCTION DURATION	0-6 WEEKS		6 WEEKS-1 YEAR		1-2 YEARS	
SUPERSTRUCTURE HEIGHT ABOVE GROUND LEVEL (FT.)	$s/d \leq 2$	$2 < s/d \leq 4$	$s/d \leq 2$	$2 < s/d \leq 4$	$s/d \leq 2$	$2 < s/d \leq 4$
0-15	19	21	26	28	29	32
20	20	22	27	30	31	34
25	21	23	28	31	32	35
30	22	24	30	32	34	37
40	24	26	31	34	36	39
50	25	27	33	36	38	41
60	26	28	34	37	39	42
70	27	29	35	39	40	44
80	28	30	37	40	42	45
90	28	31	38	41	43	47
100	29	31	38	42	43	47

NOTES:

1. LINEAR INTERPOLATION FOR INTERMEDIATE VALUES OF HEIGHT IS ACCEPTABLE.

2. BASIC WIND SPEED IS 115 MPH WITH A 1.4 LOAD FACTOR BUILT INTO IT AND IS BASED ON AN APPROXIMATE 7% PROBABILITY OF EXCEEDANCE IN 50 YEARS.

3. EXPOSURE CONDITION IS CATEGORY C APPLICABLE TO OPEN GRASSLAND AND SCATTERED OBSTRUCTION GENERALLY LESS THAN 30 FEET HIGH.

4. FOR BRIDGES NOT EXPOSED TO CATEGORY C, THESE WIND PRESSURES NEED TO BE ADJUSTED ACCORDINGLY. USE REFERENCE IN NOTE R6 AS A GUIDELINE.

BC-732M	PERMANENT METAL DECK FORMS
BC-753M	STEEL GIRDER DETAILS
BC-754M	STEEL DIAPHRAGMS FOR STEEL BEAM/GIRDER STRUCTURES (STRAIGHT GIRDERS ONLY)

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA
AND DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 6

BD-620M

ADDITIONAL LATERAL STABILITY CRITERIA FOR SKEWED STEEL BRIDGES

(APPLIES TO STRAIGHT AND CURVED BRIDGES)

1. THE DESIGN ENGINEER SHALL CHECK SKEWED BRIDGES FOR THE FOLLOWING LOADING CONDITIONS:

   A) WIND LOADING ON THE STEEL SUPERSTRUCTURE PRIOR TO DECK PLACEMENT - THE PROCEDURE SHOULD FOLLOW THAT USED FOR THE STRAIGHT, UNSKEWED BRIDGE. THE LOADED AREA SHALL BE THE VERTICAL PLANE AREA OF THE FASCIA GIRDER.

   B) PARTIAL WIDTH LOADING UNDER STAGED CONSTRUCTION FOR FUTURE DECK REPLACEMENT AS DIRECTED BY THE DEPARTMENT.

   C) VERTICAL AND LATERAL DEFLECTIONS SHALL BE EVALUATED FOR STEEL SELF-WEIGHT AND THE DECK DEAD LOAD.

2. BEARINGS SHALL BE DESIGNED TO ACCOMMODATE GIRDER ROTATION DURING THE DECK POUR BOTH IN AND OUT OF THE GIRDER PLANE. GIRDERS AND THEIR BEARING STIFFENERS SHOULD BE VERTICAL AT THE BEARINGS UNDER FULL DEAD LOAD. UPLIFT SHALL BE CHECKED AT EACH BEARING FOR WORST LOADING CONDITION IN EACH CONSTRUCTION PHASE.

3. INCLUDE LATERAL WIND BRACING IN THE DESIGN OF GIRDERS THAT DO NOT MEET THE CRITERIA AS SHOWN ON SHEET 1. DESIGN LATERAL BRACING TO CARRY WIND LOADS ONLY AND DETAIL THE BRACING SO THAT IT WILL NOT PARTICIPATE IN CARRYING PRIMARY STRUCTURE FORCES.

4. THE ENGINEER SHALL IDENTIFY THE NEED FOR AND LOCATION OF FALSEWORK AND PROVIDE INFORMATION AS PER DM4 D2.5.3 1P; HOWEVER, THE DESIGN AND FOUNDATION OF THE FALSEWORK IS THE RESPONSIBILITY OF THE CONTRACTOR.

5. USE TOP OR BOTTOM FLANGE BRACING FOR STRAIGHT GIRDERS. FOR GIRDERS WITH NARROW TOP FLANGE WIDTH, IT IS RECOMMENDED TO USE BOTTOM FLANGE LATERAL BRACING.

ADDITIONAL LATERAL STABILITY CRITERIA FOR STRAIGHT STEEL GIRDER BRIDGES

1. USE TOP OR BOTTOM FLANGE BRACING FOR STRAIGHT GIRDERS. FOR GIRDERS WITH NARROW TOP FLANGE WIDTH, IT IS RECOMMENDED TO USE BOTTOM FLANGE LATERAL BRACING.

2. THE ENGINEER SHALL IDENTIFY THE NEED FOR AND LOCATION OF FALSEWORK AND PROVIDE INFORMATION AS PER DM4 D2.5.3 1P; HOWEVER, THE DESIGN AND FOUNDATION OF THE FALSEWORK IS THE RESPONSIBILITY OF THE CONTRACTOR.

3. BEARINGS SHALL BE DESIGNED TO ACCOMMODATE GIRDER IN PLANE ROTATIONS DURING THE DECK POUR. GIRDERS AND THEIR BEARING STIFFENERS SHOULD BE VERTICAL AT THE BEARINGS UNDER FULL DEAD LOAD. UPLIFT SHALL BE CHECKED AT EACH BEARING FOR WORST LOADING CONDITION IN EACH CONSTRUCTION PHASE.

4. INCLUDE LATERAL WIND BRACING IN THE DESIGN OF GIRDERS THAT DO NOT MEET THE CRITERIA AS SHOWN ON SHEET 1. DESIGN LATERAL BRACING TO CARRY WIND LOADS ONLY AND DETAIL THE BRACING SO THAT IT WILL NOT PARTICIPATE IN CARRYING PRIMARY STRUCTURE FORCES.

ADDITIONAL LATERAL STABILITY CRITERIA FOR CURVED STEEL GIRDER BRIDGES

1. THE DESIGN ENGINEER SHALL CHECK CURVED STEEL GIRDER BRIDGES FOR THE FOLLOWING LOADING CONDITIONS:

   A) WIND LOADING ON THE STEEL SUPERSTRUCTURE PRIOR TO DECK PLACEMENT - THE PROCEDURE SHALL FOLLOW THAT USED FOR THE STRAIGHT, UNSKEWED BRIDGE. THE LOADED AREA IS THE SURFACE AREA OF THE LONGEST GIRDER. ALLOWABLE HORIZONTAL DEFLECTIONS SHALL BE BASED ON CRITERIA FOR STRAIGHT UNSKEWED GIRDERS AND BRIDGES PRIOR TO DECK PLACEMENT.

   B) PARTIAL WIDTH LOADING UNDER STAGED CONSTRUCTION FOR FUTURE DECK REPLACEMENT AS DIRECTED BY THE DEPARTMENT.

   C) VERTICAL AND LATERAL DEFLECTIONS SHALL ALSO BE EVALUATED FOR STEEL SELF-WEIGHT AND THE DECK DEAD LOAD.

2. BEARINGS SHALL BE DESIGNED TO ACCOMMODATE GIRDER ROTATION DURING THE DECK POUR BOTH IN AND OUT OF THE GIRDER PLANE. GIRDERS AND THEIR BEARING STIFFENERS SHALL BE VERTICAL AT THE BEARINGS UNDER FULL DEAD LOAD. UPLIFT SHALL BE EVALUATED AT EACH BEARING FOR WORST LOADING CONDITION IN EACH CONSTRUCTION PHASE.

3. INCLUDE LATERAL WIND BRACING IN THE DESIGN OF GIRDERS THAT DO NOT MEET THE CRITERIA AS SHOWN ON SHEET 1. DESIGN LATERAL BRACING TO CARRY WIND LOADS ONLY AND DETAIL THE BRACING SO THAT IT WILL NOT PARTICIPATE IN CARRYING PRIMARY STRUCTURE FORCES.

4. THE ENGINEER SHALL IDENTIFY THE NEED FOR AND LOCATION OF FALSEWORK AND PROVIDE INFORMATION AS PER DM4 D2.5.3 1P; HOWEVER, THE DESIGN AND FOUNDATION OF THE FALSEWORK IS THE RESPONSIBILITY OF THE CONTRACTOR.

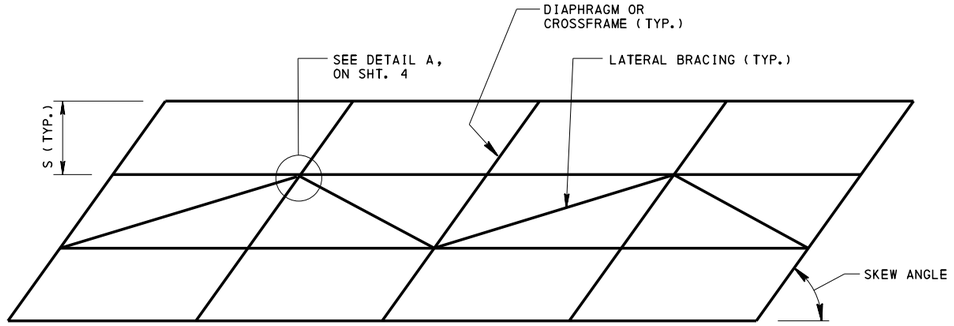
5. DESIGN LATERAL BRACING FOR WIND LOADS. DESIGN AND DETAIL THE LATERAL BRACING SO THAT TORSIONAL FORCES FROM DEAD LOADS AND LIVE LOADS ON THE GIRDER ARE NOT RESISTED BY THE LATERAL BRACING.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA
AND DETAILS

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 2 OF 6
		BD-620M

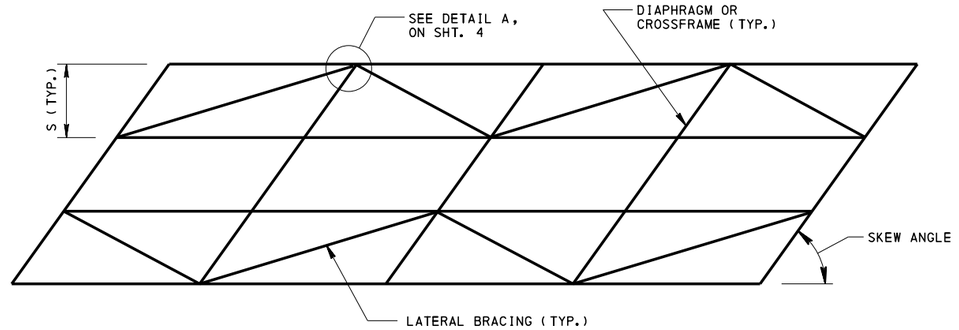


PLAN

LATERAL BRACING (PREFERRED)

FOR ODD NUMBER OF GIRDERS, OFFSET BRACING ONE BAY.

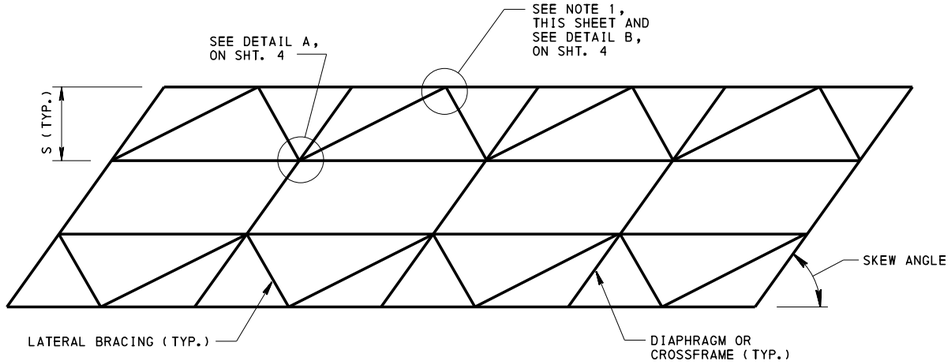
TYPICAL SKEWED STRUCTURE WHEN DESIGN IS NOT CONTROLLED BY WIND LOADING OF FLANGE.



PLAN

ALTERNATE LATERAL BRACING - TYPE 1

TYPICAL SKEWED STRUCTURE



PLAN

ALTERNATE LATERAL BRACING - TYPE 2

TYPICAL SKEWED STRUCTURE

NOTES:

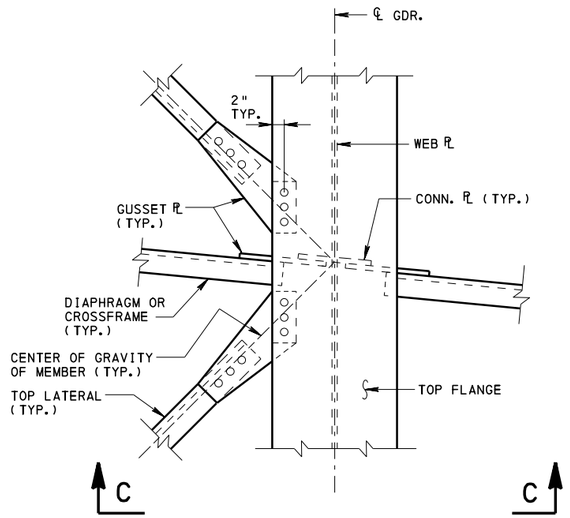
1. USE INTERMEDIATE BRACING POINT (DETAIL B, SHT. 4) AS NEEDED IF DESIGN IS CONTROLLED BY LATERAL FLANGE BENDING AT FASCIA GIRDERS AND LATERAL STABILITY.
2. USE ANGLE OR STRUCTURAL TEE BRACING MEMBERS WHENEVER POSSIBLE.
3. LATERAL BRACING FIELD CONNECTIONS SHALL BE MADE FOR 7/8"ø ASTM F3125 GRADE A325 H.S. BOLTS USING OVERSIZED HOLES IN THE GUSSET PLATES, MINIMUM 2 BOLTS PER CONNECTION.
4. FOR EVEN NUMBER OF GIRDERS, CENTER GIRDER BAY OR SYMMETRICAL LAYOUT IS ACCEPTABLE. FOR ODD NUMBER OF GIRDERS, EITHER SINGLE BAY BRACING ADJACENT TO CENTER GIRDER OR SYMMETRICAL, BOTH BAYS ADJACENT TO CENTER GIRDER, LAYOUT IS ACCEPTABLE.
5. PARTIAL LENGTH LATERAL BRACING IS PERMITTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA AND DETAILS
(STRAIGHT GIRDERS)

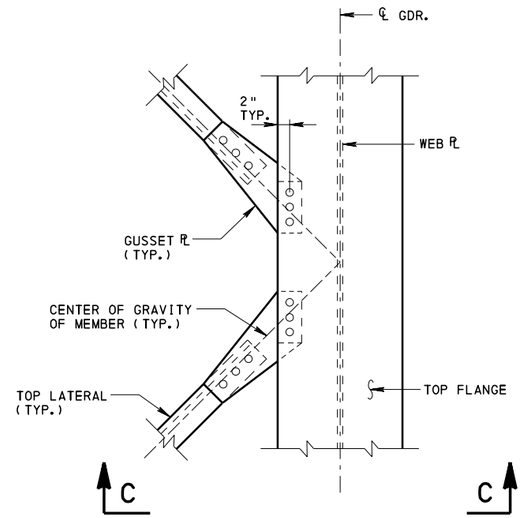
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 3 OF 6
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-620M



PLAN

DETAIL A

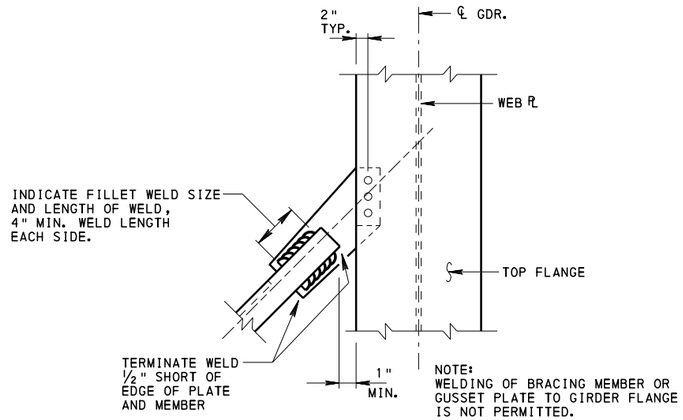
TYPICAL AT CROSSFRAME



PLAN

DETAIL B

INTERMEDIATE BRACING POINT
(SEE NOTE 1, ON SHT. 3)



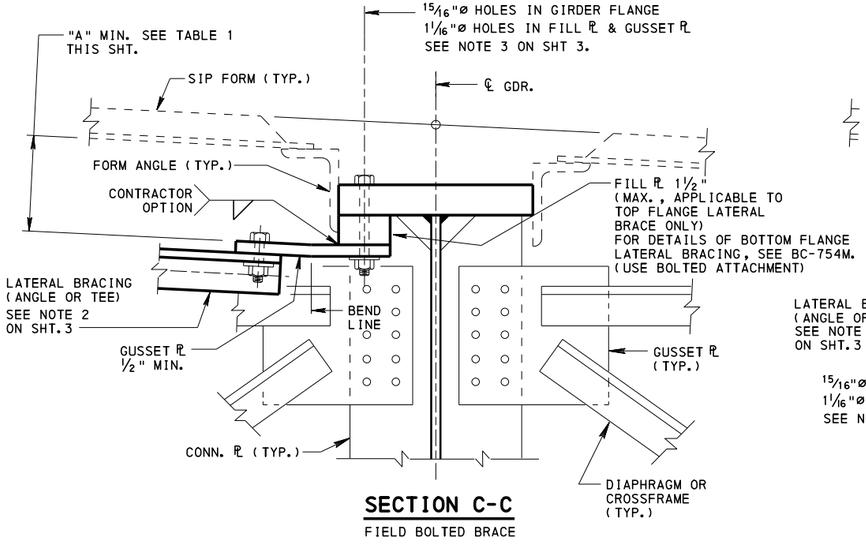
PLAN

VIEW D

SHOP WELDED OPTION
(FOR BRACING MEMBER TO GUSSET)

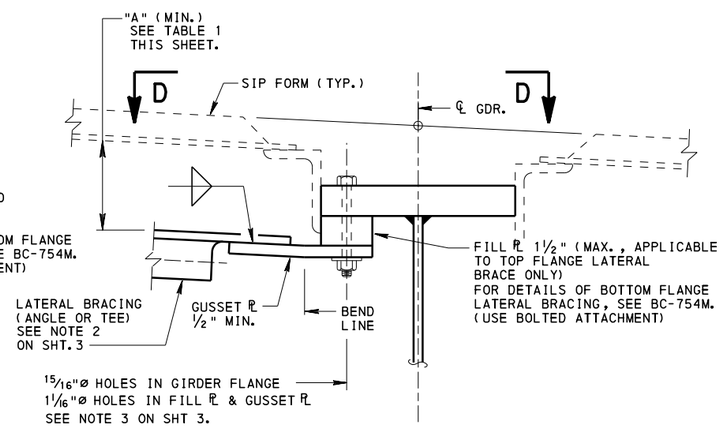
TOP FLANGE LATERAL BRACING CONNECTIONS

NOTE: PREFERRED ARRANGEMENT IS TO ATTACH LATERAL BRACING TO THE BOTTOM FLANGE AS SHOWN ON BC-754M. THE TOP FLANGE ATTACHMENT DETAILS ARE SHOWN FOR THE INFREQUENT SITUATIONS THAT NECESSITATE ATTACHMEMENT TO THE TOP FLANGE.



SECTION C-C

FIELD BOLTED BRACE



ALTERNATE SECTION C-C

SHOP WELDED, FIELD BOLTED BRACE

TABLE 1

CLEAR DISTANCE BETWEEN GIRDER FLANGES	DIM. "A"
9'-0"	4 1/2"
8'-0" TO 9'-0"	3"
6'-0" TO 8'-0"	2 1/2"
UNDER 6'-0"	2"

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

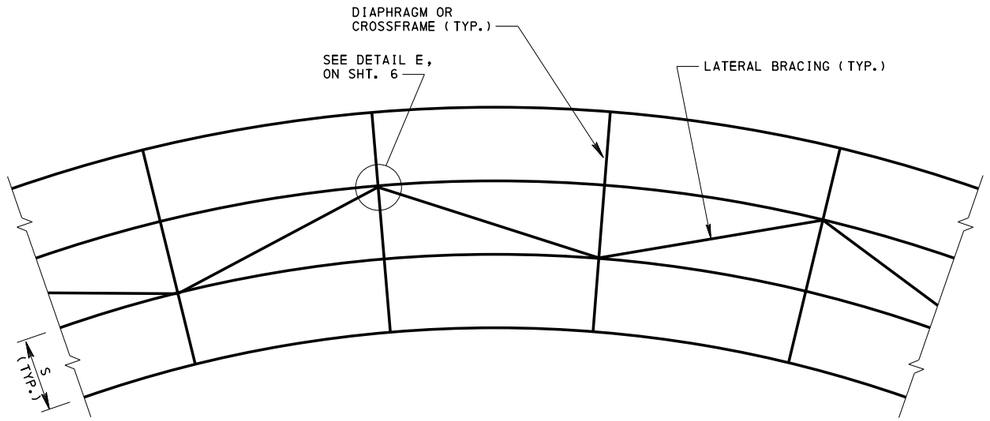
STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA AND DETAILS
(STRAIGHT GIRDERS)

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 4 OF 6

BD-620M

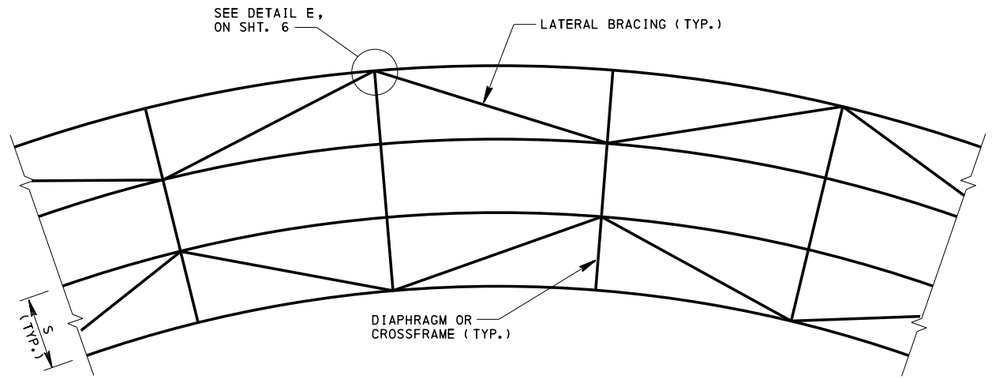


PLAN

LATERAL BRACING
(PREFERRED)

TYPICAL CURVED STRUCTURE

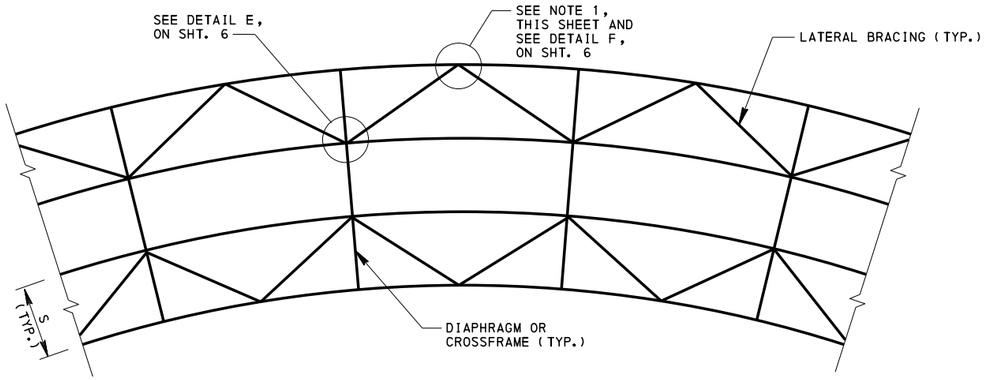
FOR ODD NUMBER OF GIRDERS, OFFSET BRACING ONE BAY.



PLAN

ALTERNATE LATERAL BRACING - TYPE 1

TYPICAL CURVED STRUCTURE



PLAN

ALTERNATE LATERAL BRACING - TYPE 2

NOTES:

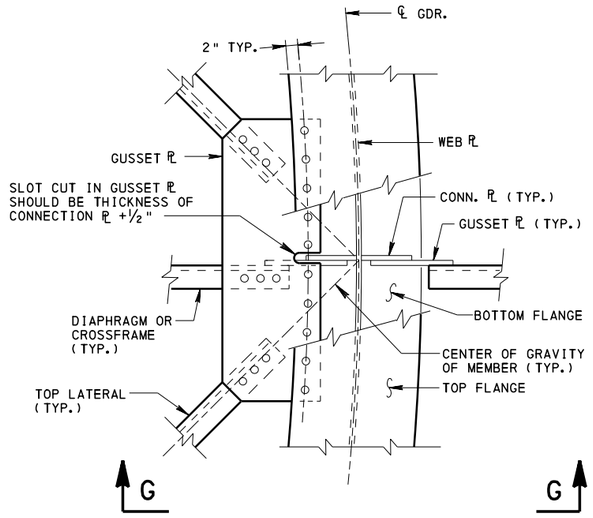
1. USE INTERMEDIATE BRACING POINT (DETAIL F, SHT. 6) AS NEEDED IF DESIGN IS CONTROLLED BY LATERAL FLANGE BENDING AT FASCIA GIRDERS AND LATERAL STABILITY.
2. USE ANGLE OR STRUCTURAL TEE BRACING MEMBERS WHENEVER POSSIBLE.
3. LATERAL BRACING FIELD CONNECTIONS SHALL BE MADE FOR $\frac{7}{8}$"ø ASTM F3125 GRADE A325 H.S. BOLTS USING OVERSIZED HOLES IN THE GUSSET PLATES. MINIMUM 2 BOLTS PER CONNECTION.
4. FOR EVEN NUMBER OF GIRDERS, CENTER GIRDER BAY OR SYMMETRICAL LAYOUT IS ACCEPTABLE. FOR ODD NUMBER OF GIRDERS, EITHER SINGLE BAY BRACING ADJACENT TO CENTER GIRDER OR SYMMETRICAL, BOTH BAYS ADJACENT TO CENTER GIRDER, LAYOUT IS ACCEPTABLE.
5. PARTIAL LENGTH LATERAL BRACING IS PERMITTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA AND DETAILS
(CURVED BRIDGES)

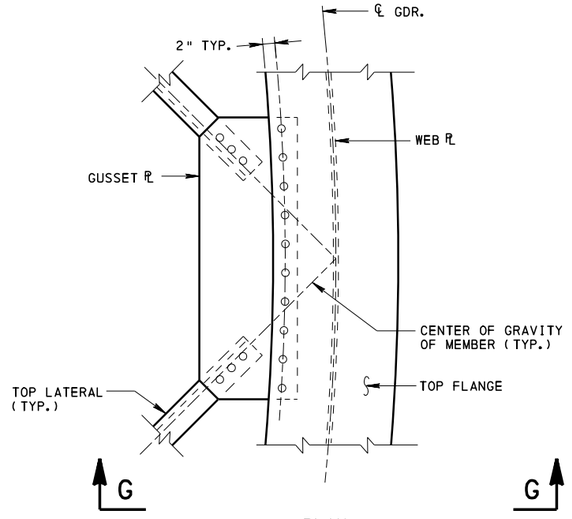
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 5 OF 6
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-620M



PLAN

DETAIL E

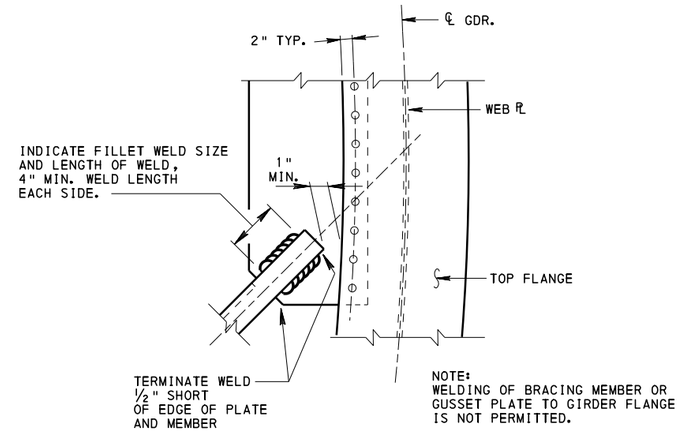
TYPICAL AT CROSSFRAME



PLAN

DETAIL F

INTERMEDIATE BRACING POINT
(SEE NOTE 1, ON SHT.5)



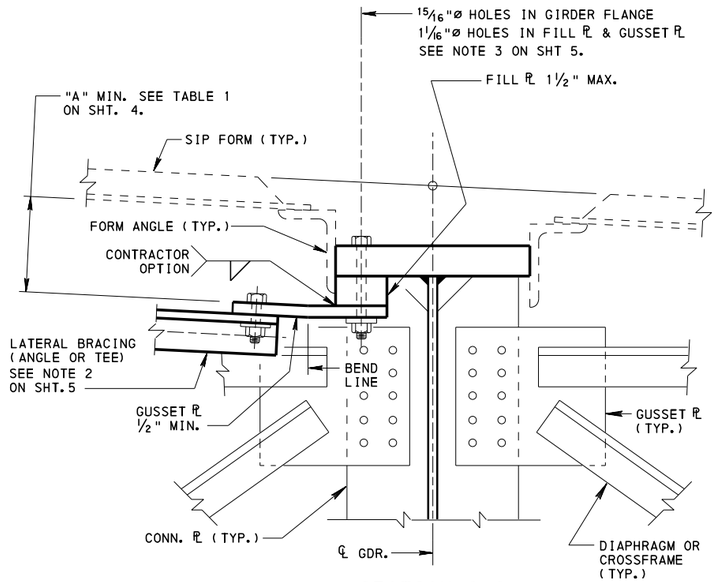
PLAN

VIEW H

SHOP WELDED OPTION
(FOR BRACING MEMBER TO GUSSET)

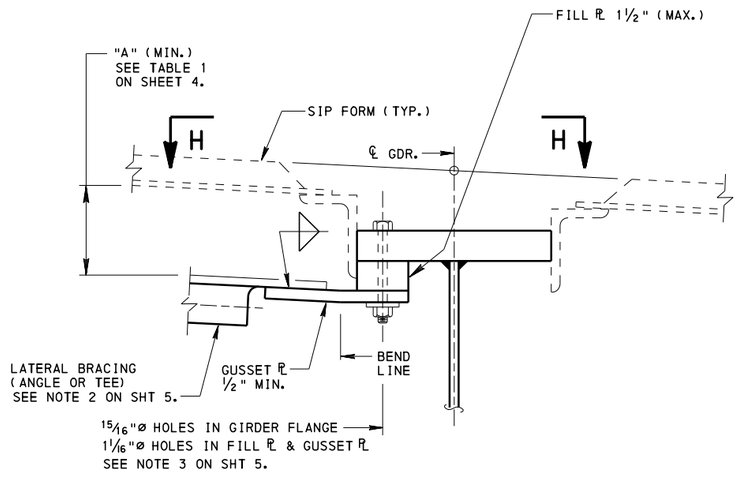
TOP FLANGE LATERAL BRACING CONNECTIONS

NOTE: BOTTOM FLANGE LATERAL BRACING IS NOT PERMITTED WITHOUT PRIOR APPROVAL OF CHIEF BRIDGE ENGINEER SINCE THE BRACING WILL CHANGE THE BEHAVIOR OF THE GIRDERS TO BEHAVE AS A PSEUDO-BOX GIRDER.



SECTION G-G

FIELD BOLTED BRACE



ALTERNATE SECTION G-G

SHOP WELDED, FIELD BOLTED BRACE

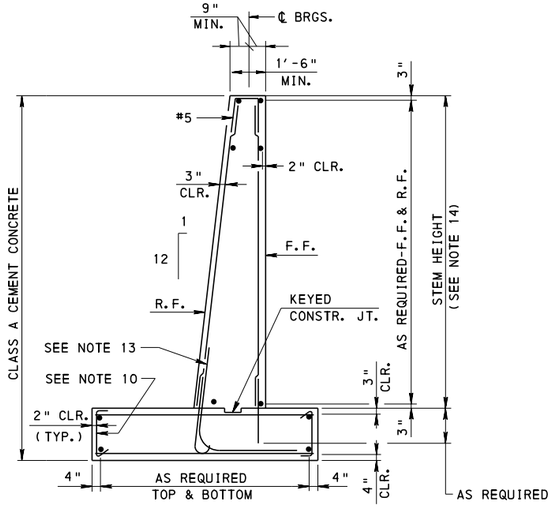
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA AND DETAILS
(CURVED GIRDERS)

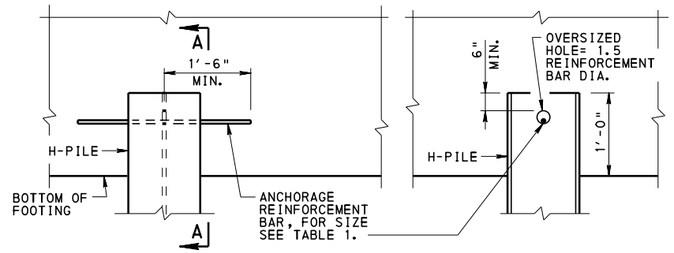
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 6 OF 6
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-620M

CHANGE 2



TYPICAL SECTION WITHOUT BACKWALL

(WITH OR WITHOUT BATTER)



H-PILE ANCHORAGE

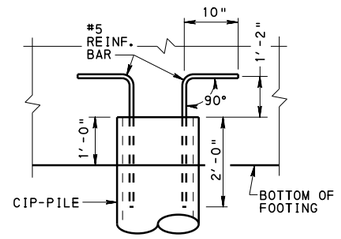
SECTION A-A

DETAIL A

TABLE 1

SIZE OF THREADED BAR BASED ON PILE SIZE

PILE SIZE	BAR SIZE
HP 8 x 36	#5
HP 10 x 42	#5
HP 10 x 57	#6
HP 12 x 53	#6
HP 12 x 63	#6
HP 12 x 74	#6
HP 12 x 84	#7
HP 14 x 73	#6
HP 14 x 89	#7
HP 14 x 102	#7
HP 14 x 117	#8



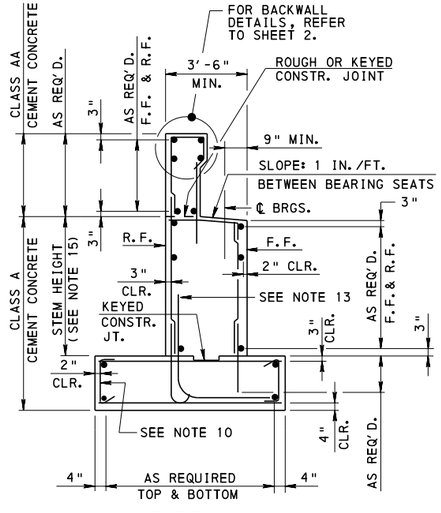
CIP-PILE ANCHORAGE

DETAIL B

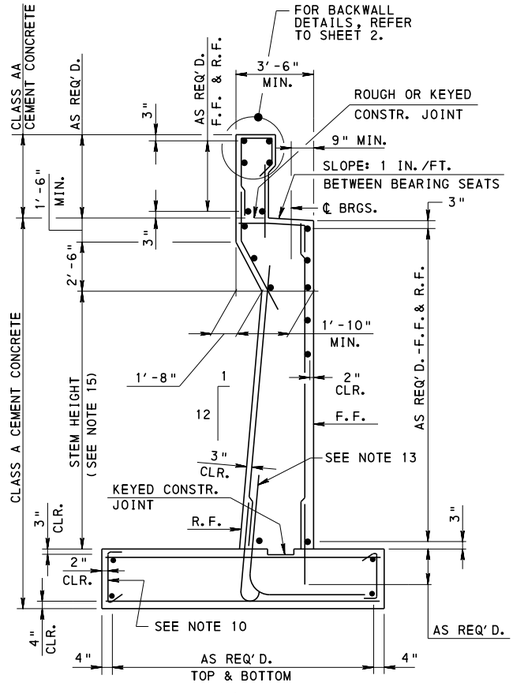
PILE ANCHORAGE DETAILS

REQUIRED IF ANY OF THE FOLLOWING CONDITIONS EXIST:

1. SITE CLASS E & F.
2. RESPONSE ACCERLERATION COEFFICIENT GREATER THAN OR EQUAL TO 0.1.
3. PILE IS SUBJECT TO UPLIFT FORCES AT STRENGTH OR EXTREME LIMIT STATES.

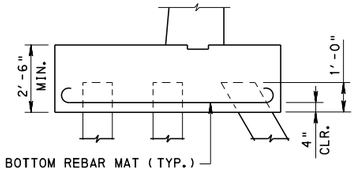


TYPE I



TYPE II

TYPICAL SECTION WITH BACKWALL



PILE FOOTING

NOTE:
FOR PILE ANCHORAGE SEE DETAIL A AND B

NOTES:

1. PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615, ASTM A996, OR A706. DO NOT WELD REINFORCEMENT BARS. DO NOT USE RAIL STEEL A996 WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
2. MATERIALS AND WORK QUALITY ARE TO BE IN ACCORDANCE WITH SPECIFICATIONS PUB. 408.
3. ABUTMENT DIMENSIONS TO BE DETERMINED BY THE DESIGN.
4. FOR DETERMINING BACKWALL USE, SEE DESIGN MANUAL, PART 4, STRUCTURES.
5. PROVIDE 2" CONCRETE COVER ON REINFORCEMENT BARS, UNLESS OTHERWISE NOTED.
6. USE CLASS AA CEMENT CONCRETE IN BACKWALLS. USE CLASS A CEMENT CONCRETE IN OTHER PARTS OF ABUTMENT.
7. ALL BACKWALL REINFORCEMENT IS TO BE EPOXY COATED.
8. FOR ADDITIONAL EPOXY COATED REINFORCEMENT BARS, SEE DESIGN MANUAL, PART 4, STRUCTURES, SECTION D5.4.3.6P AND AS NOTED.
9. FOR WEEP HOLE DETAILS, SEE SHEET 3 AND BC-751M.
10. TIE TOP AND BOTTOM MATS OF REINFORCING STEEL WITH #4 TIE BARS AT A MAXIMUM SPACING OF 4'-0" IN BOTH DIRECTIONS. PROVIDE TIE BARS WITH 90° HOOK AT ONE END AND 135° HOOK AT THE OTHER END. ALTERNATE 90° AND 135° HOOKS AT TOP IN ALTERNATE TIES.
11. EPOXY COAT J-BARS AND L-BARS PROTRUDING FROM THE FOOTINGS INTO THE STEMS.
12. KEY FOR CONSTRUCTION JOINT MAY BE FORMED INTO THE STEM OR INTO THE FOOTING.
13. OPTIONAL DETAIL TO REINFORCE TOE AND STEM IN LIEU OF J-BAR.
14. BATTER NOT REQUIRED IF STEM HEIGHT IS LESS THAN 12'-0".
15. PROVIDE TYPE I ABUTMENT WHEN STEM HEIGHT IS LESS THAN 12'-0" OTHERWISE PROVIDE TYPE II ABUTMENT.

INSTRUCTIONS

- F.F. = FRONT FACE, R.F. = REAR FACE.
- INDICATE REINFORCEMENT BAR LAP SPLICE LENGTH AND EMBEDMENT LENGTH OF DOWELS ON THE PLANS.

DESIGN DATA

- DENSITY OF BACKFILL MATERIAL = 120 LB/FT^3
- DENSITY OF CONCRETE = 150 LB/FT^3
- EQUIVALENT FLUID EARTH PRESSURE = 35 PSF/FT OF DEPTH.
- LIVELOAD SURCHARGE = REFER TO DESIGN MANUAL, PART 4, D3.11.
- FOR BACKWALL DESIGN CRITERIA, REFER TO DESIGN MANUAL, PART 4, STRUCTURES, D11.6.
- NEGLECT THE EFFECT OF PASSIVE PRESSURE DUE TO SOIL IN FRONT OF WALL.
- 1'-0" MINIMUM TOE.
- 2'-0" FOOTING THICKNESS FOR SPREAD FOOTINGS, 2'-6" MINIMUM FOOTING THICKNESS FOR FOOTINGS ON PILES.

BD-628M	BRIDGE APPROACH SLABS
BC-735M	WALL CONSTR. AND EXPANSION JOINT DETAILS
BC-751M	BRIDGE DRAINAGE
BC-762M	TOOTH EXP. DAM FOR PRESTRESSED CONC. & STEEL BEAM BRIDGES
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONC. & STEEL I-BEAM BRIDGES
BC-788M	TYP. WATERPROOFING AND EXPANSION DETAILS
RC-23M	BRIDGE APPROACH SLABS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

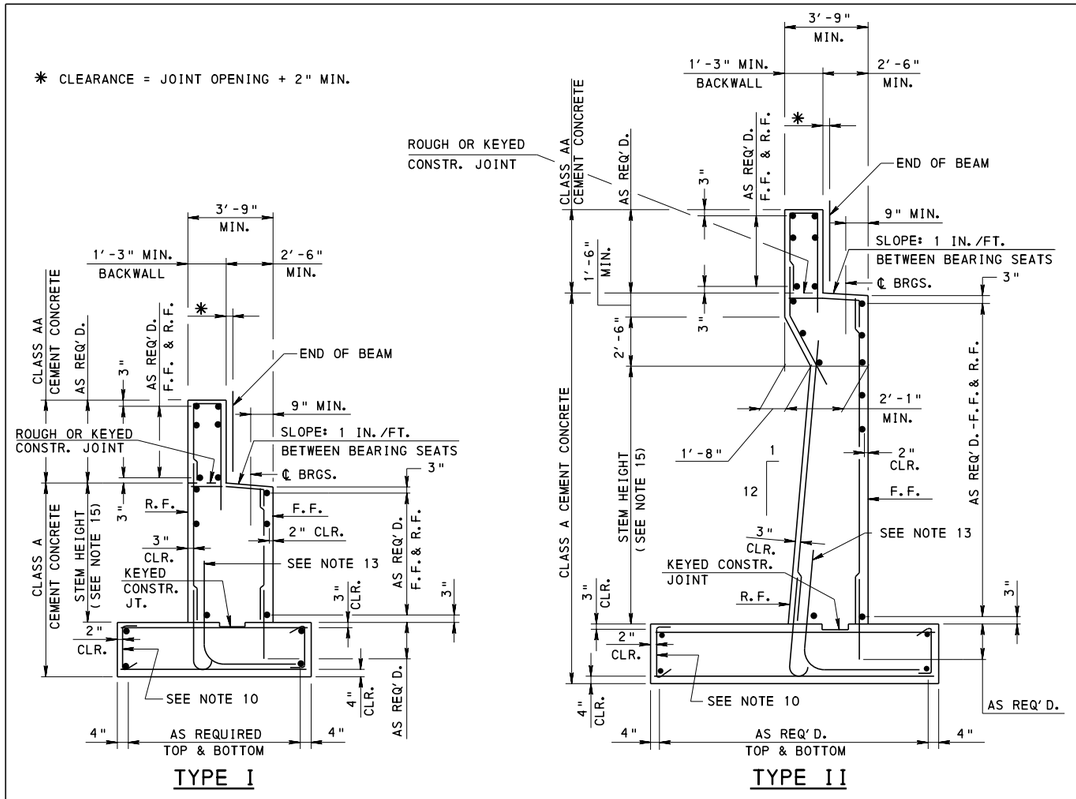
STANDARD
REINFORCED CONCRETE ABUTMENTS
TYPICAL SECTIONS AND DETAILS

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

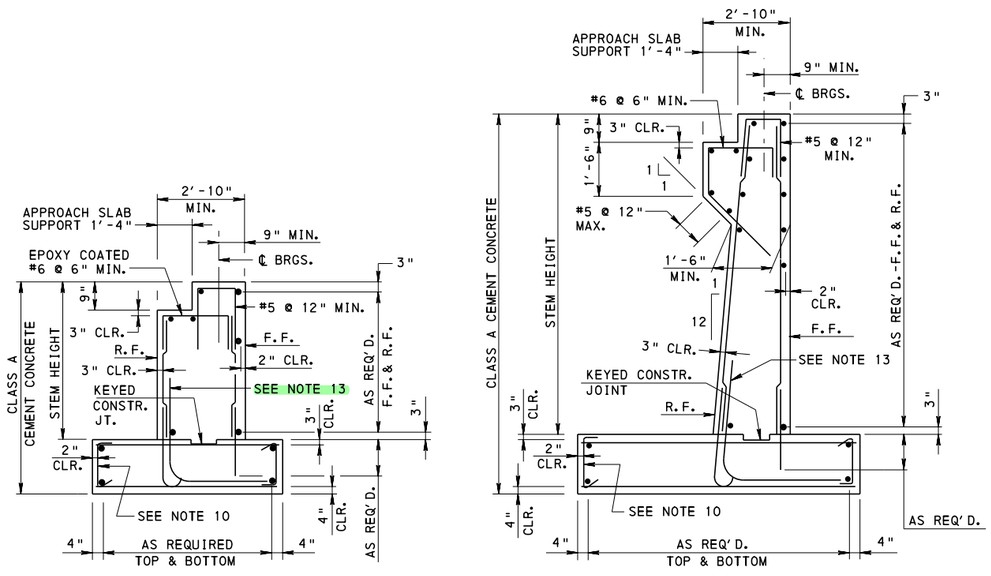
RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 3

BD-621M



TYPICAL SECTION WITH BACKWALL FOR TYPE 3 AND 4 APPROACH SLABS



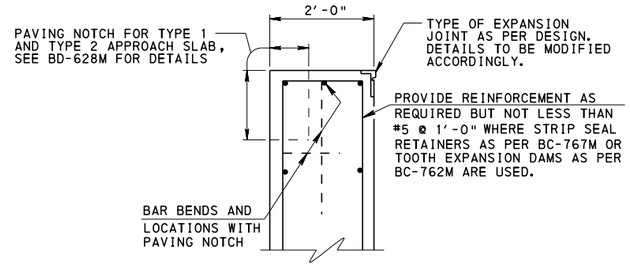
TYPICAL SECTION WITHOUT BACKWALL FOR TYPE 1 AND TYPE 2 APPROACH SLAB CORBEL

(SEE TABLE A)

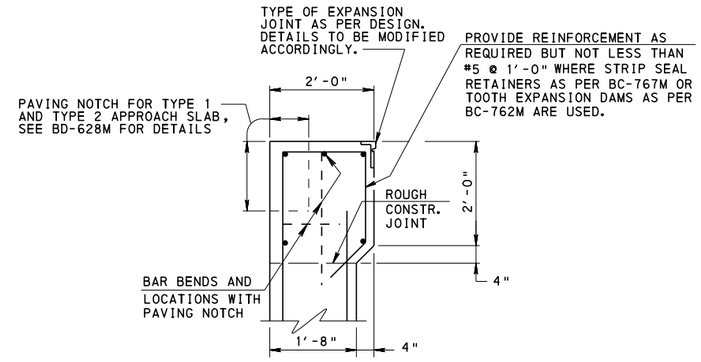
TABLE A BEAM DEPTHS FOR APPROACH SLAB CORBEL		
BEAM TYPE	APPROACH SLAB TYPE (SEE NOTE 1)	MAXIMUM BEAM DEPTH
PRESTRESSED CONCRETE ADJACENT BOX BEAMS	1	24"
	2	27"
PRESTRESSED CONCRETE SPREAD BOX BEAMS	1	21"
	2	27"
PRESTRESSED CONCRETE AASHTO TYPE I-BEAMS	N/A	N/A
PRESTRESSED CONCRETE PA BULB-TEE BEAMS	N/A	N/A
PRESTRESSED CONCRETE PA I-BEAMS	N/A	N/A
STEEL BEAMS	1	2'-1½"
	2	2'-6½"

TABLE A NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. DO NOT USE A CORBEL WHEN THE BEAM DEPTHS ARE GREATER THAN INDICATED.



OPTION 1



OPTION 2

BACKWALL DETAILS

(WITHOUT BACKWALL SUPPORTED APPROACH SLAB OR WITH TYPE 1 AND TYPE 2 APPROACH SLAB)

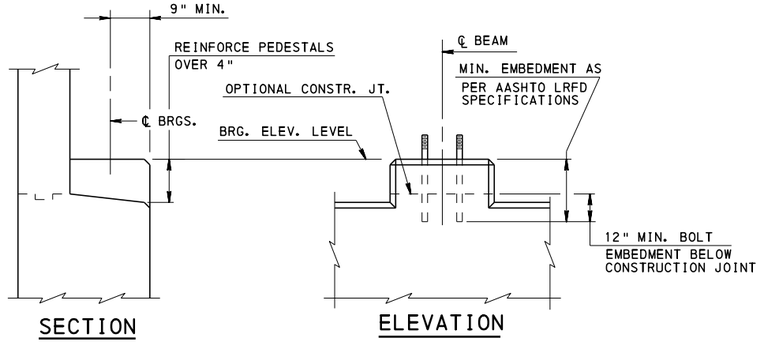
NOTES:

1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

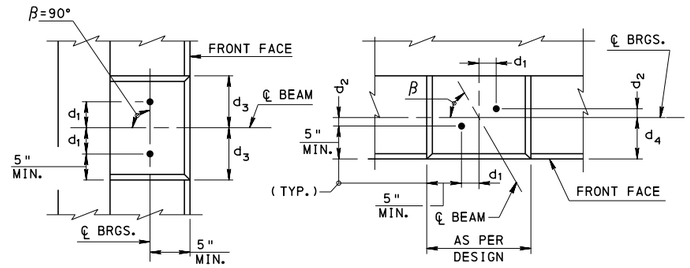
STANDARD
REINFORCED CONCRETE ABUTMENTS
TYPICAL SECTIONS AND DETAILS

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 2 OF 3
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-621M



ABUTMENT WITH BACKWALL

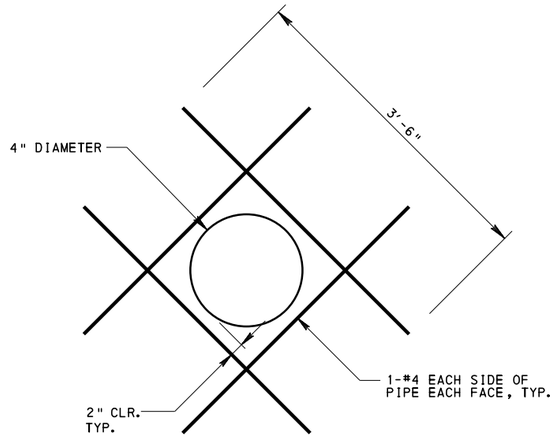
NOTE: BACKWALL NOT SHOWN



ANCHOR BOLT PLAN

INSTRUCTIONS

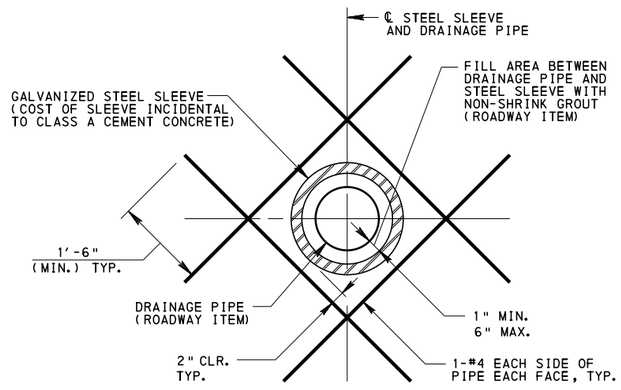
- SHOW SKEW ANGLE β AND THE DIMENSIONS d_1, d_2, d_3, d_4 REQUIRED FOR LOCATION OF THE ANCHOR BOLTS ON THE PLANS.
- BEARING AREA AND SETTING OF ANCHOR BOLTS TO CONFORM TO SECTION 1001.3(K)9 AND 1001.3(f) OF PUB. 408.
- IF THE BOLT EMBEDMENT CANNOT BE FULLY DEVELOPED IN NEW CONCRETE CAP, THEN THE BOLT EMBEDMENT DEVELOPMENT MUST BE DONE IN THE EXISTING CONCRETE SECTION.



WEEP HOLE REINFORCEMENT DETAIL

NOTES:

1. REINFORCE WEEP HOLES WITH #4 ON EACH FACE PLACED IN A DIAGONAL FASHION AS SHOWN.
2. LOCATION OF STRUCTURE FOUNDATION DRAINS AND WEEP HOLES MUST BE SHOWN ON THE CONTRACT PLANS.

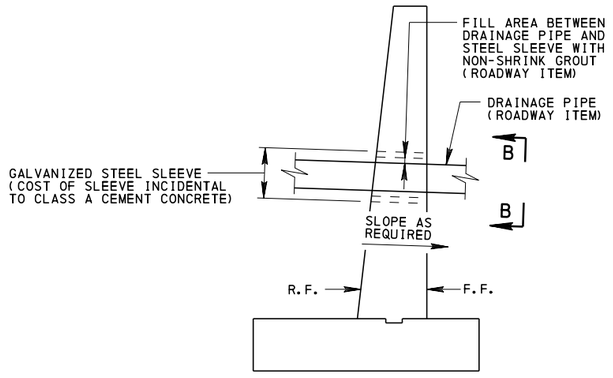


SECTION B-B

DRAINAGE THROUGH WALL STEM

NOTES:

1. INDICATE SIZE AND LOCATION OF THE GALVANIZED STEEL SLEEVE AND DRAINAGE PIPE ON THE CONTRACT PLANS.
2. INDICATE STEEL SLEEVE INVERT ELEVATION AND SLOPE ON THE CONTRACT PLANS.
3. DETERMINE SIZE OF STEEL SLEEVE BASED ON THE OUTSIDE DIMENSION OF THE DRAINAGE PIPE.



SLEEVE DETAIL

NOTES:

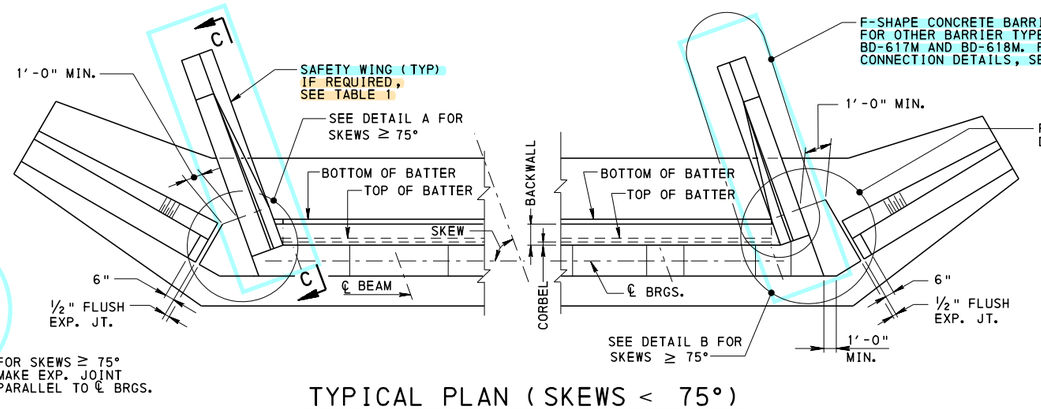
1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

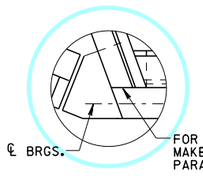
STANDARD
REINFORCED CONCRETE ABUTMENTS
ANCHOR BOLT AND DRAINAGE DETAILS

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 3 OF 3 BD-621M

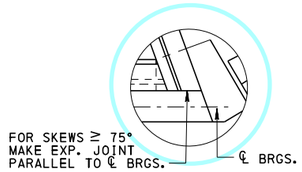
CHANGE 2
CHANGE 3
CHANGE 5



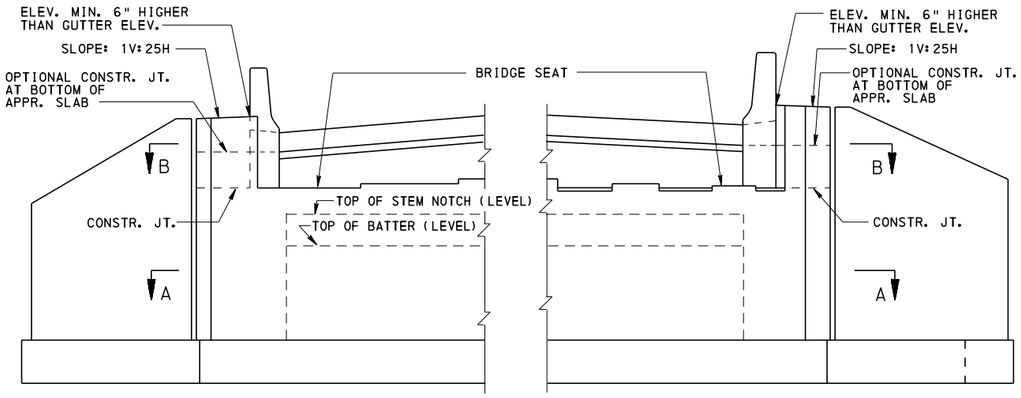
TYPICAL PLAN (SKEWS < 75°)



DETAIL A

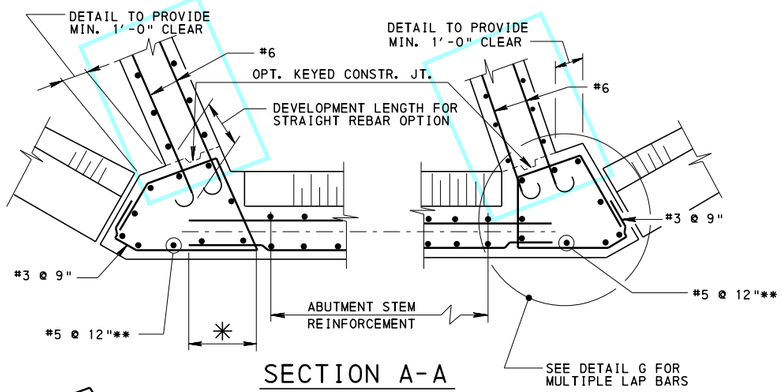


DETAIL B

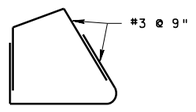


TYPICAL ELEVATION

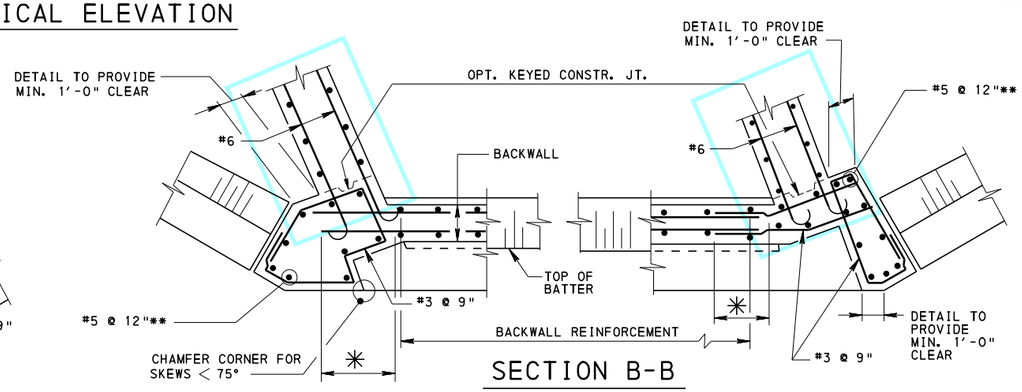
NOTE:
NO LAPS FOR LONGITUDINAL BARS IN SAFETY WING BELOW GUTTERLINE



SECTION A-A



DETAIL G



SECTION B-B

✳ EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP.)

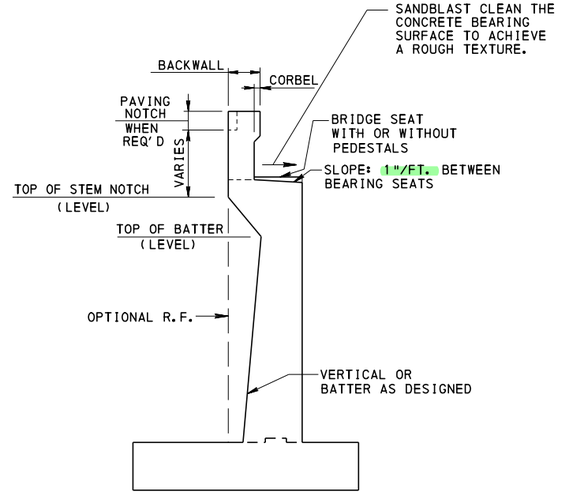
** IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT, #6 REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

ABUTMENTS WITH FLARED WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS. SEE DETAIL G.

GENERAL NOTES:

1. FOR SECTION C-C, SEE SHEET 2.
2. HOOKS ON BARS EXTENDING FROM SAFETY WING INTO THE BACKWALL OR STEM MAY BE TURNED IN ANY DIRECTION.
3. SAFETY WINGS ARE NOT NEEDED WHEN USING APPROACH SLAB TYPES 1 - 4 (SEE BD-628M).



ABUTMENT SECTION

TABLE 1	
APPROACH SLAB TYPE	SAFETY WING REQUIRED?
TYPE 1-4 (BD-628M)	NO(1)
RC-23M (BRADD)	YES(2)
NONE	YES(2)

(1) BARRIERS INTEGRAL WITH APPROACH SLAB
(2) BARRIERS SUPPORTED BY SAFETY WINGS

REFERENCE DRAWINGS

BD-601M	CONCRETE DECK SLAB
BD-610M	PA BRIDGE BARRIER
BD-617M	PA TYPE 10M BRIDGE BARRIER
BD-618M	VERTICAL WALL CONCRETE BARRIER
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-657M	ABUTMENT DETAILS
BC-734M	ANCHOR SYSTEMS
BC-751M	BRIDGE DRAINAGE
BC-762M	TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE & STEEL BEAM BRIDGES
BC-767M	NEOPRENE STRIP SEAL DAM
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

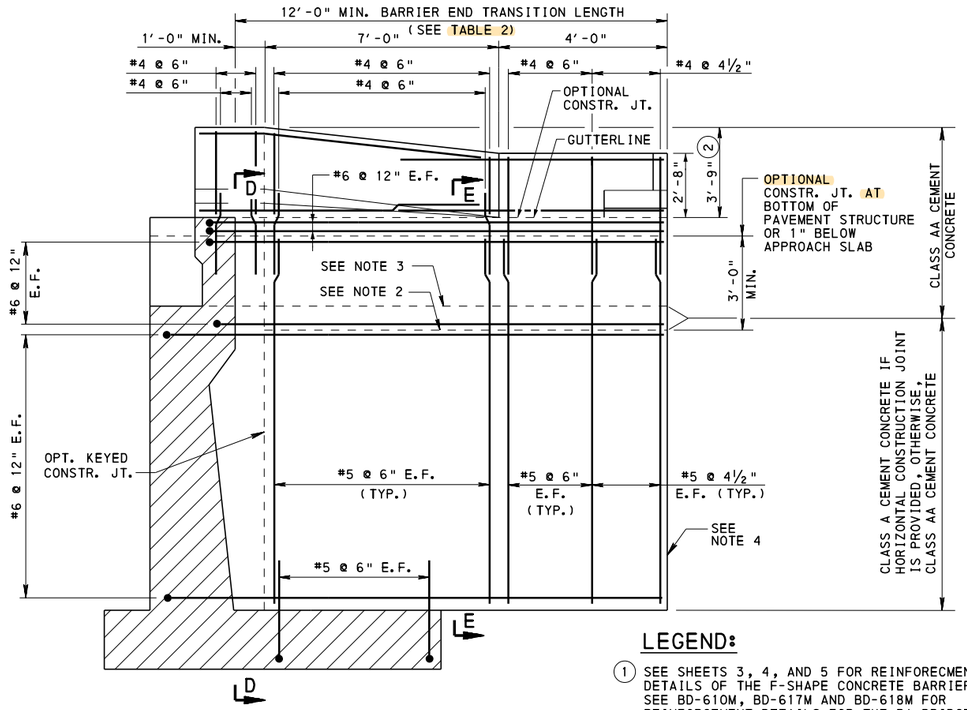
STANDARD
R. C. ABUTMENTS WITH BACKWALL FLARED WINGS LAYOUT AND DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 10

BD-622M

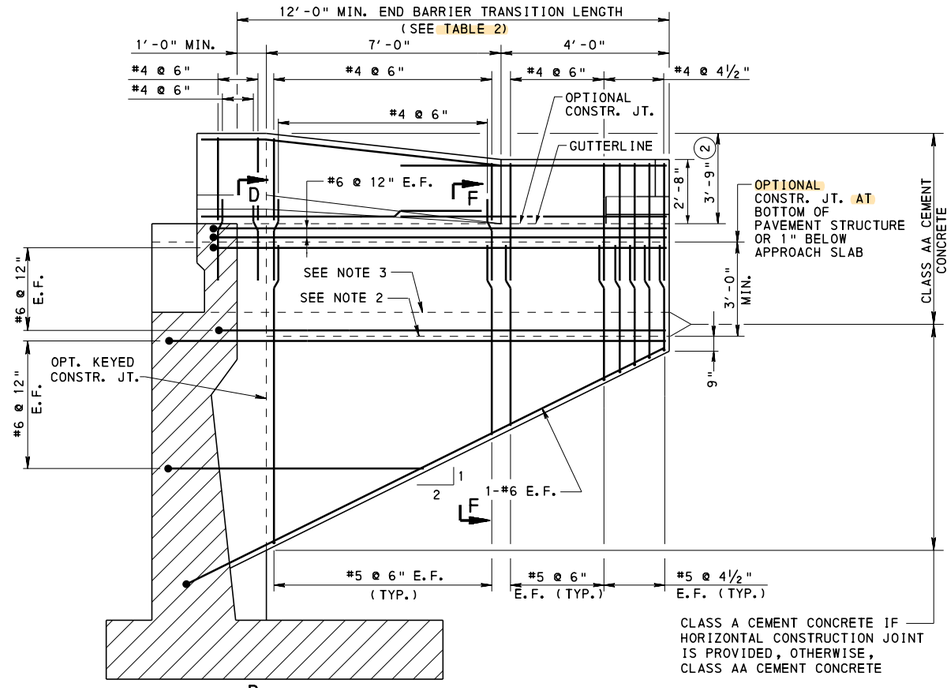


SECTION C-C (1)

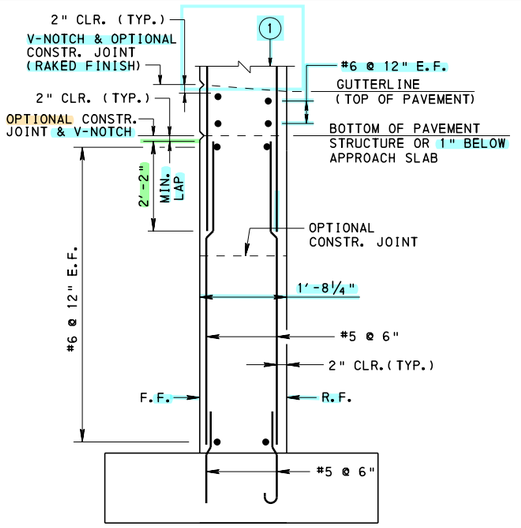
LEGEND:

(1) SEE SHEETS 3, 4, AND 5 FOR REINFORECMENT DETAILS OF THE F-SHAPE CONCRETE BARRIER. SEE BD-610M, BD-617M AND BD-618M FOR REINFORCEMENT DETAILS FOR THE PA BRIDGE BARRIER, PA TYPE 10M BRIDGE BARRIER AND VERTICAL WALL CONCRETE BARRIER.

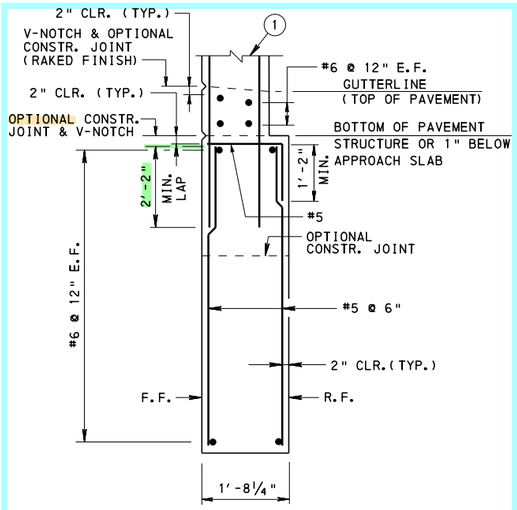
(2) 45" F-SHAPE CONCRETE BARRIER SHOWN. 32" AND 42" F-SHAPE CONCRETE BARRIER SIMILAR



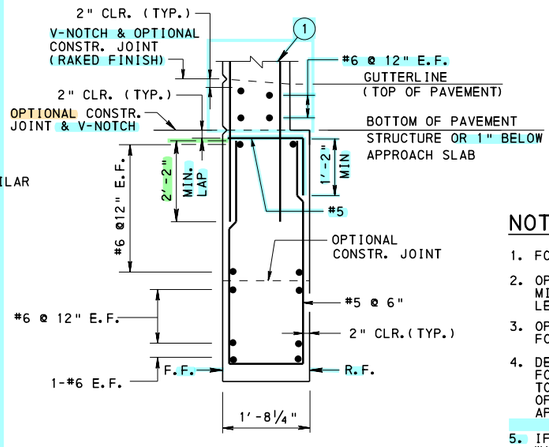
ALTERNATE SECTION C-C (1)



SECTION D-D



SECTION E-E



SECTION F-F

TABLE 2	
BARRIER TYPE	MINIMUM BARRIER END TRANSITION LENGTH
32", 42", 45" F-SHAPE CONCRETE BARRIER	12'-0"
32" VERTICAL WALL CONCRETE BARRIER	7'-0"
42" VERTICAL WALL CONCRETE BARRIER	10'-0"
PA BRIDGE BARRIER	9'-0"
PA TYPE 10M BRIDGE BARRIER	9'-0"

NOTES:

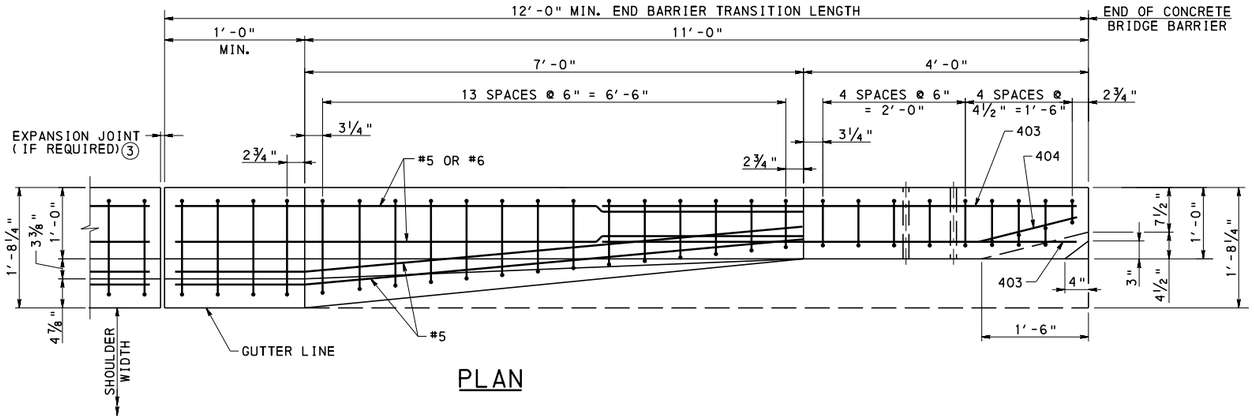
1. FOR TYPICAL PLAN AND ELEVATION, SEE SHEET 1.
2. OPTIONAL CONSTRUCTION JOINT LOCATED 3'-0" MINIMUM FROM BOTTOM OF DECK FOR BEAM DEPTHS LESS THAN 2'-1".
3. OPTIONAL CONSTRUCTION JOINT LOCATED AT BEAM SEAT FOR BEAM DEPTHS GREATER THAN OR EQUAL TO 2'-1".
4. DENOTES PREFERRED CONFIGURATION OF BARRIER WALL ON FOOTING FOR ABUTMENT STEM HEIGHTS MEASURED FROM TOP OF FOOTING TO TOP OF BEAM SEAT LESS THAN 30'-0". ALTERNATE CONFIGURATIONS OF BARRIER WALLS ON FOOTINGS CAN BE USED ONLY WITH THE APPROVAL OF THE DISTRICT BRIDGE ENGINEER.
5. IF FILL HEIGHTS ON BOTH SIDES OF THE SAFETY WING WALL CAN NOT BE MAINTAINED WITHIN 5'-0" OF EACH OTHER, THEN ALL REINFORCEMENT BARS MUST BE DESIGNED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

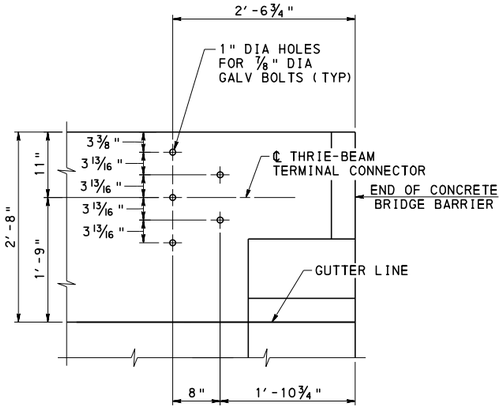
STANDARD
R. C. ABUTMENTS WITH BACKWALL
SAFETY WING DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

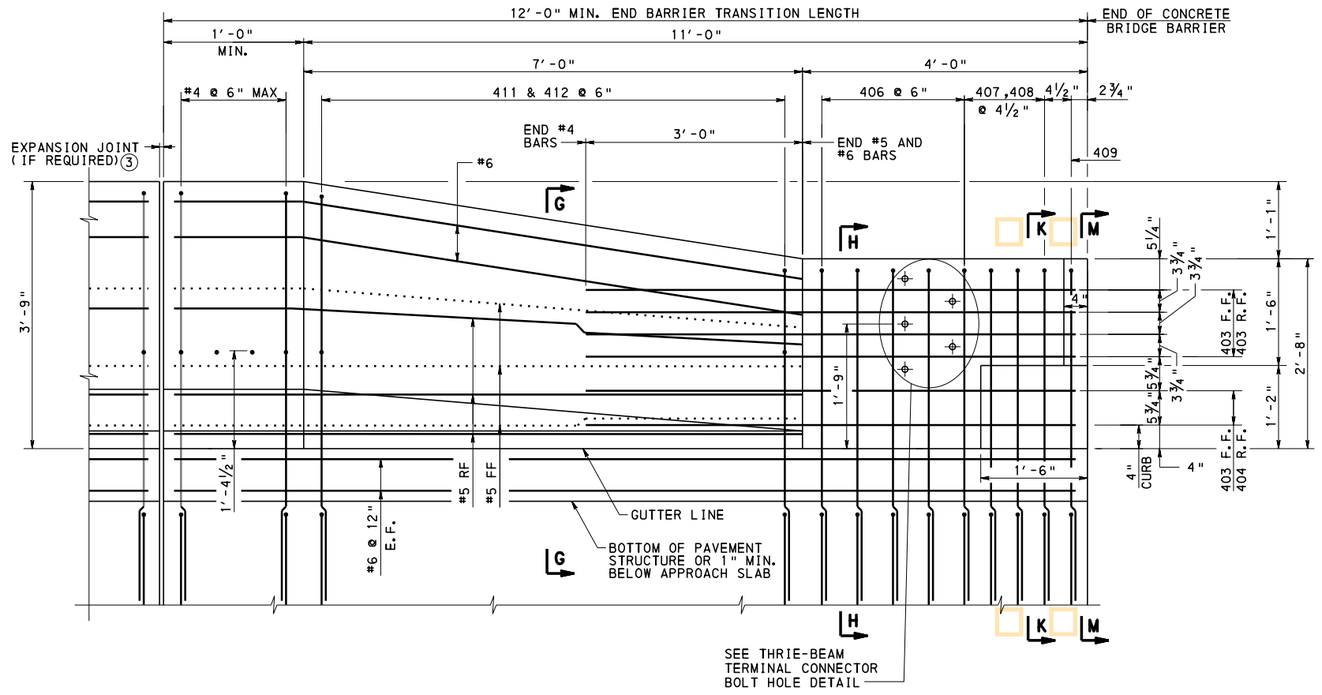
RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.



PLAN



THRIE-BEAM TERMINAL CONNECTOR BOLT HOLE DETAIL



ELEVATION

45" F-SHAPE CONCRETE BRIDGE BARRIER END TRANSITION REINFORCEMENT DETAIL

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)

LEGEND:

③ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3′-7", MINIMUM LAP FOR #6 BAR IS 4′-4".

NOTES:

1. FOR SECTIONS G-G, H-H, J-J, K-K, L-L AND M-M, SEE SHEET 6.
2. FOR 406, 407, 408, 409, 411 AND 412 BAR DETAILS, SEE SHEET 7.
3. FOR 403 AND 404 BAR DETAILS, SEE SHEET 8.

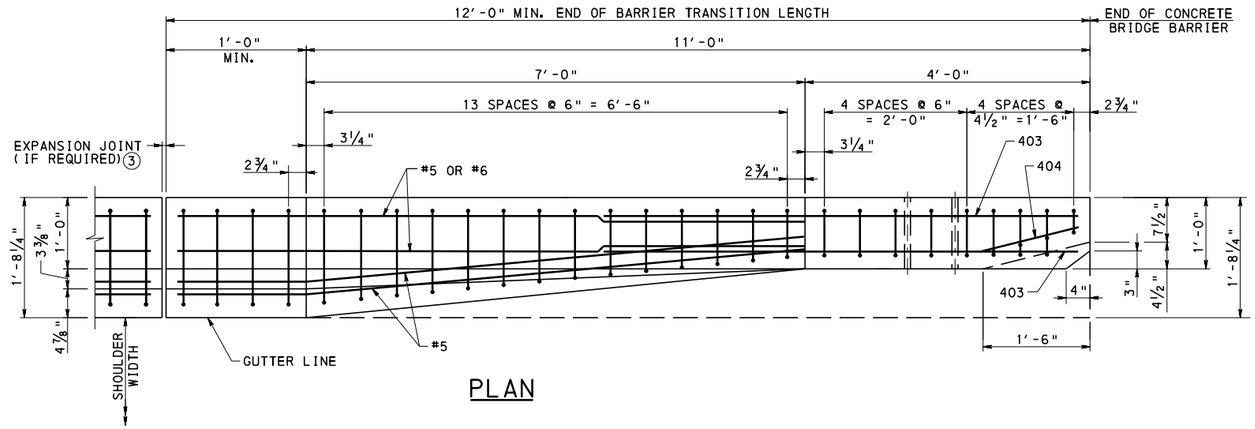
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

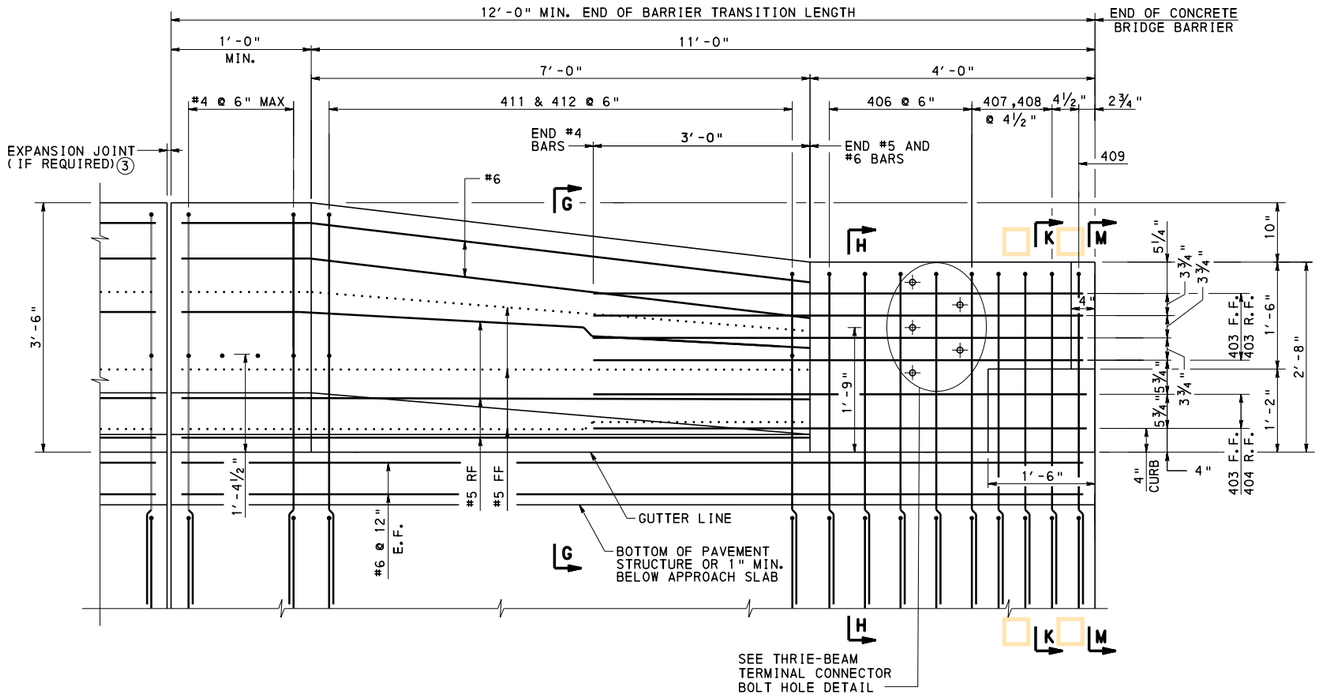
R. C. ABUTMENTS WITH BACKWALL

BRIDGE BARRIER TRANSITION REINFORCEMENT - 1

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 3 OF 10
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-622M



PLAN



ELEVATION

42" F-SHAPE CONCRETE BRIDGE BARRIER TRANSITION REINFORCEMENT DETAIL

(WITH CURB SHOWN, WITHOUT CURB SIMILAR

LEGEND:

③ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3′-7", MINIMUM LAP FOR #6 BAR IS 4′-4".

NOTES:

1. FOR SECTIONS G-G, H-H, J-J, K-K, L-L AND M-M, SEE SHEET 6.
2. FOR THRIE-BEAM TERMINAL CONNECTOR BOLT HOLE DETAIL, SEE SHEET 3.
3. FOR 406, 407, 408, 409, 411 AND 412 BAR DETAILS, SEE SHEET 7.
4. FOR 403 AND 404 BAR DETAILS, SEE SHEET 8.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

R. C. ABUTMENTS WITH BACKWALL

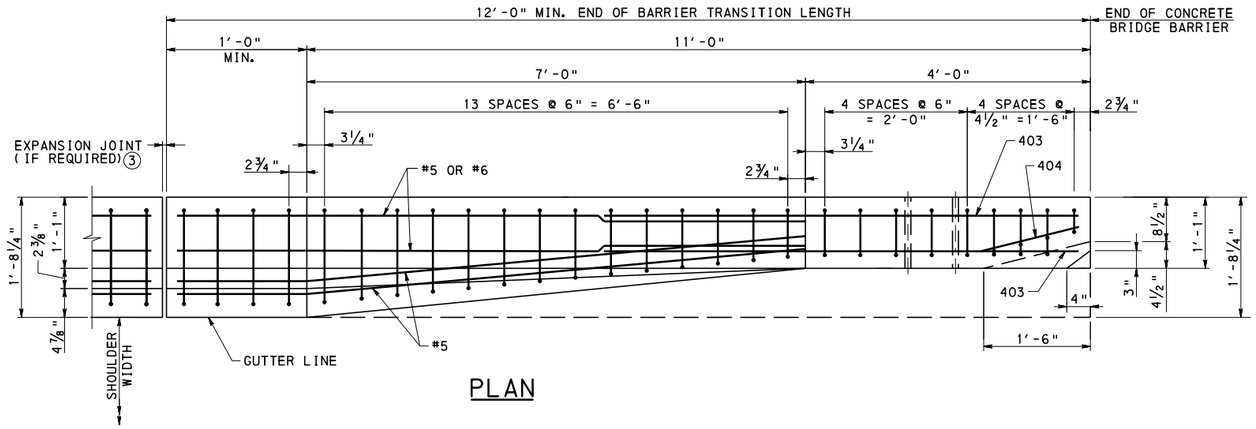
BRIDGE BARRIER TRANSITION REINFORCEMENT - 2

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

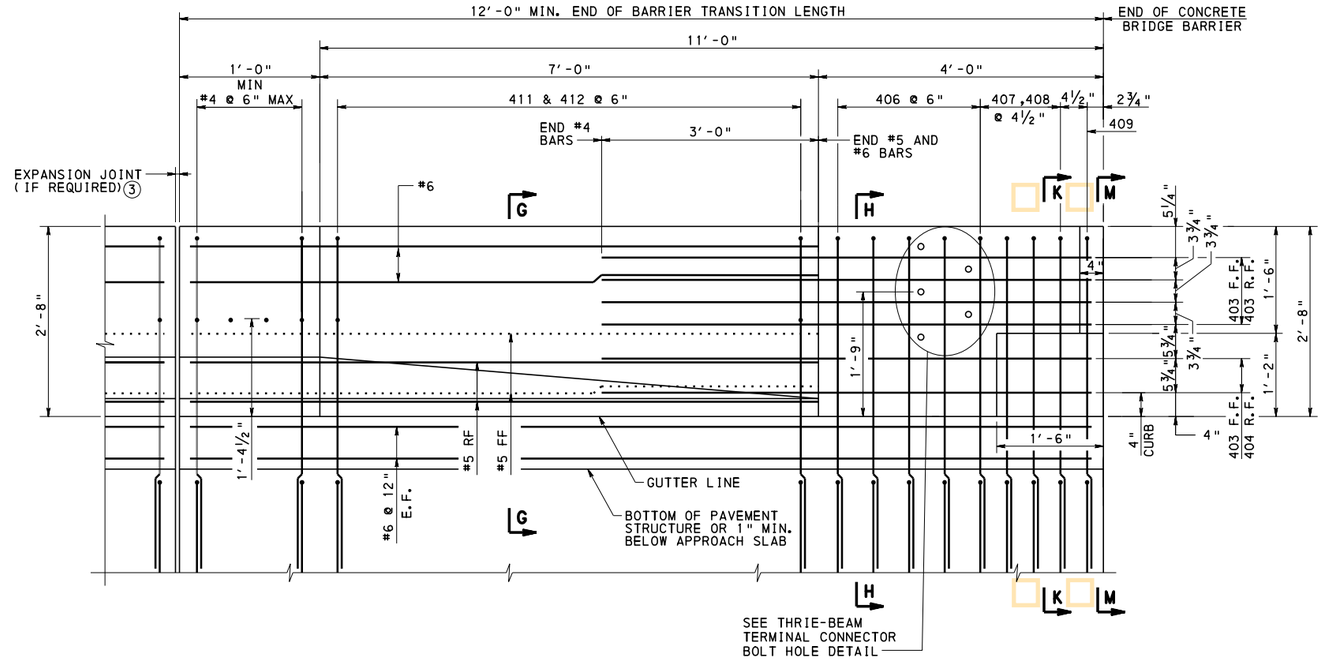
RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 4 OF 10

BD-622M



PLAN



ELEVATION

32" F-SHAPE CONCRETE BRIDGE BARRIER TRANSITION REINFORCEMENT DETAIL

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)

LEGEND:

③ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3′-7", MINIMUM LAP FOR #6 BAR IS 4′-4".

NOTES:

1. FOR SECTIONS G-G, H-H, J-J, K-K, L-L AND M-M, SEE SHEET 6.
2. FOR THRIE-BEAM TERMINAL CONNECTOR BOLT HOLE DETAIL, SEE SHEET 3.
3. FOR 406, 407, 408, 409, 411 AND 412 BAR DETAILS, SEE SHEET 7.
4. FOR 403 AND 404 BAR DETAILS, SEE SHEET 8.

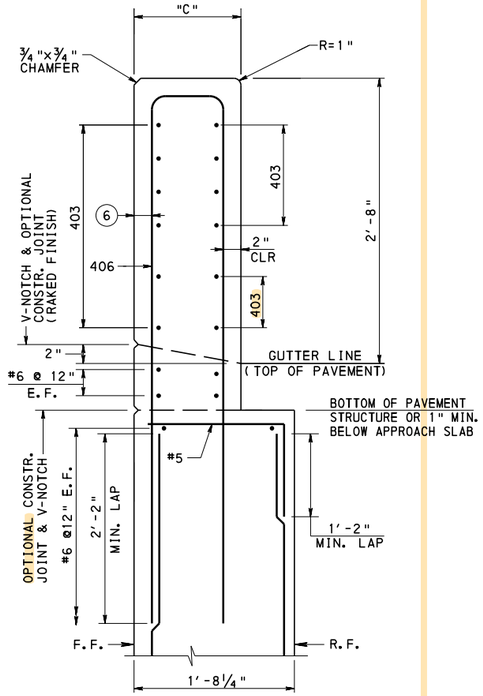
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

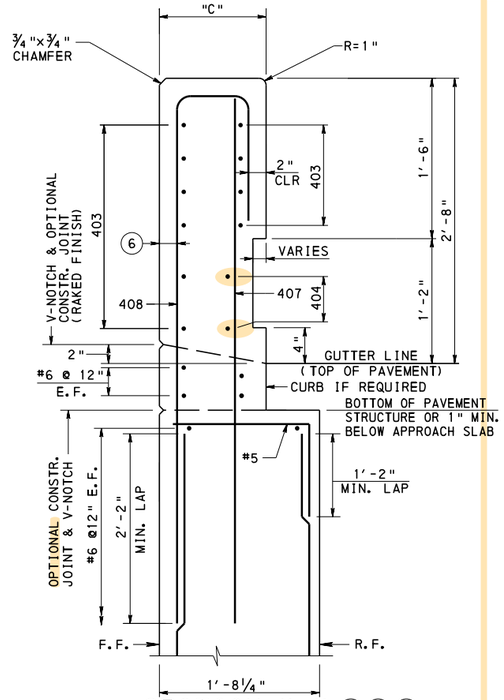
R. C. ABUTMENTS WITH BACKWALL

BRIDGE BARRIER TRANSITION REINFORCEMENT - 3

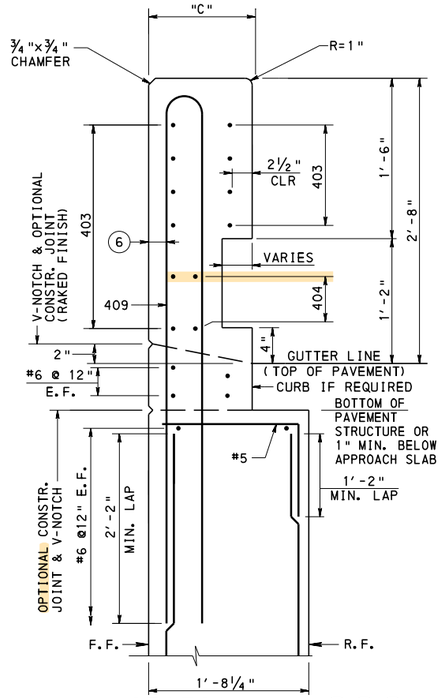
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 5 OF 10
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-622M



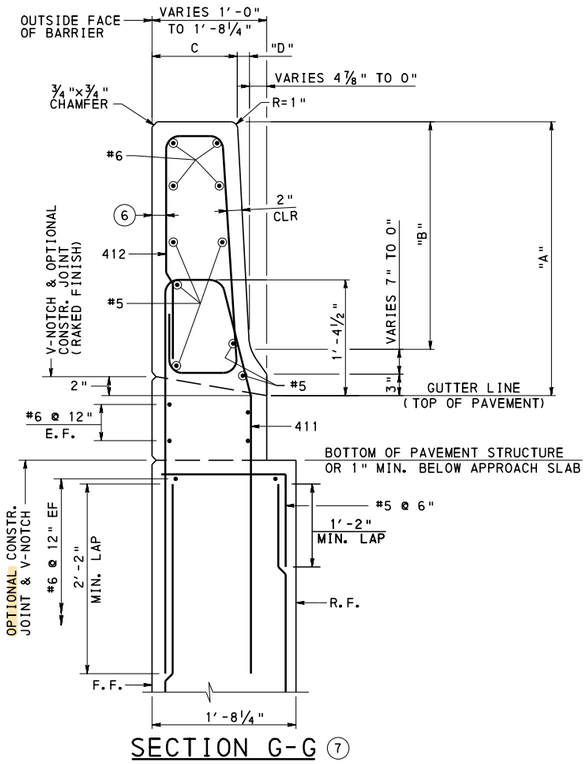
SECTION H-H (5) (7)



SECTION K-K (4) (5) (7)



SECTION M-M (4) (5) (7)



SECTION G-G (7)

TABLE 3				
BARRIER TYPE	"A"	"B"	"C"	"D"
32" F-SHAPE CONCRETE BARRIER	2'-8"	1'-10"	1'-1"	VARIES 2⅜" TO 0"
42" F-SHAPE CONCRETE BARRIER	VARIES 3'-6" TO 2'-8"	VARIES 2'-8" TO 1'-10"	1'-0"	VARIES 3⅜" TO 0"
45" F-SHAPE CONCRETE BARRIER	VARIES 3'-9" TO 2'-8"	VARIES 2'-11" TO 1'-10"	1'-0"	VARIES 3⅜" TO 0"

NOTES:

1. FOR 406, 407, 408, 409, 411 AND 412 BAR DETAILS, SEE SHEET 7.
2. FOR 403 AND 404 BAR DETAILS, SEE SHEET 8.

LEGEND:

(4) TYPICAL SECTIONS SHOWN WITH CURB, WITHOUT CURB SIMILAR.

(5) FOR DETAILS OF THE BARRIER SUPPORT WALLS, SEE SHEET 2.

(6) 2" CLR. FOR SAFETY WINGS.
2⅝" CLR. FOR U-WINGS.

(7) REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WING. REINFORCEMENT IN U-WING BELOW END TRANSITION IS AS REQUIRED BY DESIGN.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

R. C. ABUTMENTS WITH BACKWALL

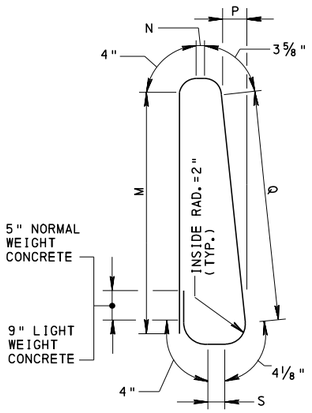
BRIDGE BARRIER TRANSITION REINFORCEMENT - 4

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 10

BD-622M



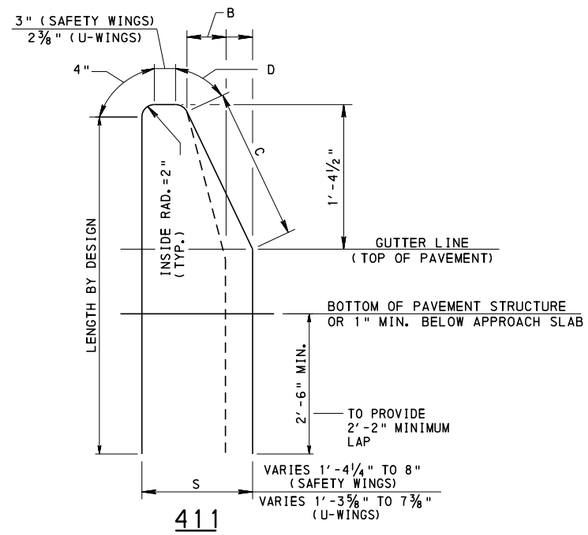
412

(FOR DIMENSIONS M, N, P, Q AND S, SEE TABLE 4)

TABLE 4

M, N, P, Q AND S DIMENSIONS

	M	N	P	Q	S
45" F-SHAPE CONCRETE BARRIER	VARIES 3'-0½" TO 1'-11½"	3⅜" (SAFETY WINGS) 2¾" (U-WINGS)	VARIES 3⅜" TO 0"	VARIES 2'-10¾" TO 1'-9¾"	VARIES 6¾" TO 3⅜" (SAFETY WINGS) VARIES 6⅛" TO 2¾" (U-WINGS)
42" F-SHAPE CONCRETE BARRIER	VARIES 2'-9½" TO 1'-11½"	3⅜" (SAFETY WINGS) 2¾" (U-WINGS)	VARIES 3⅜" TO 0"	VARIES 2'-7¾" TO 1'-9¾"	VARIES 6¾" TO 3⅜" (SAFETY WINGS) VARIES 6⅛" TO 2¾" (U-WINGS)
32" F-SHAPE CONCRETE BARRIER	1'-11½"	4½" (SAFETY WINGS) 3⅞" (U-WINGS)	VARIES 2¼" TO 0"	1'-9¾"	VARIES 6¾" TO 4½" (SAFETY WINGS) VARIES 6⅛" TO 3⅞" (U-WINGS)



411

(FOR DIMENSIONS "B", "C" AND "D", SEE TABLE 5)

TABLE 5

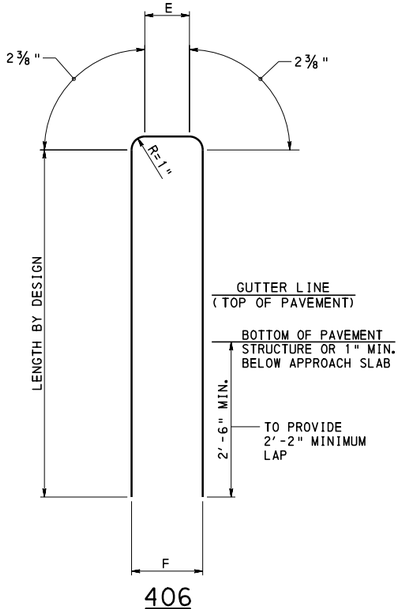
B, C, AND D DIMENSIONS

	B	C	D
45" F-SHAPE CONCRETE BARRIER	VARIES ¼" TO 8⅝"	1'-4⅜"	VARIES 2½" TO 4"
42" F-SHAPE CONCRETE BARRIER	VARIES ¼" TO 8⅝"	1'-4⅜"	VARIES 2½" TO 4"
32" F-SHAPE CONCRETE BARRIER	VARIES 1¼" TO 8⅝"	1'-4⅜"	VARIES 2½" TO 4"

TABLE 6

E, F, G AND H DIMENSIONS

		E	F	G	H
SAFETY WINGS	42 & 45" F-SHAPE CONCRETE BARRIER	5"	8"	6¼"	4"
	32" F-SHAPE CONCRETE BARRIER	6"	9"	7¾"	5"
U-WINGS	42 & 45" F-SHAPE CONCRETE BARRIER	4⅜"	7⅜"	5⅝"	3⅜"
	32" F-SHAPE CONCRETE BARRIER	5⅜"	8⅜"	7⅛"	4⅜"



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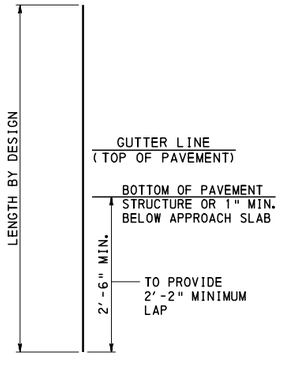

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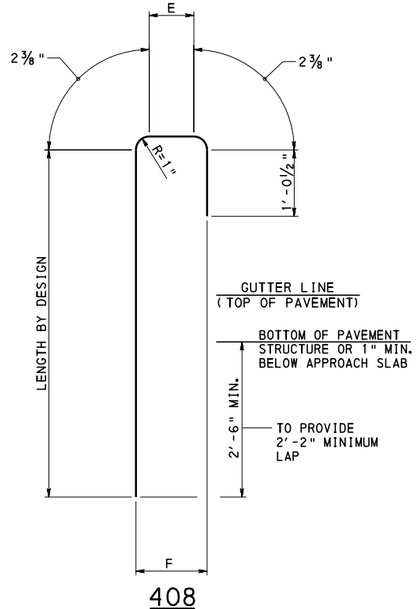

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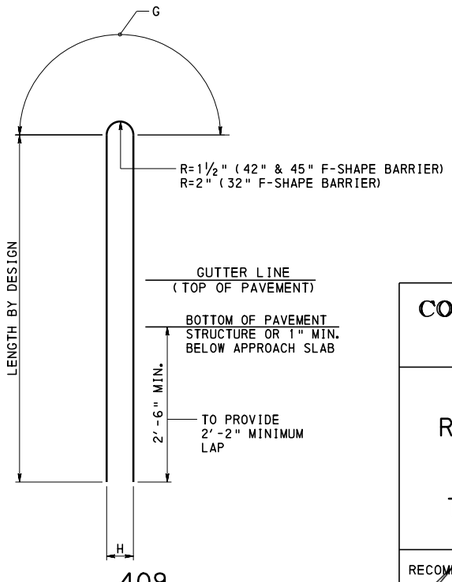


409

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
R. C. ABUTMENTS WITH BACKWALL

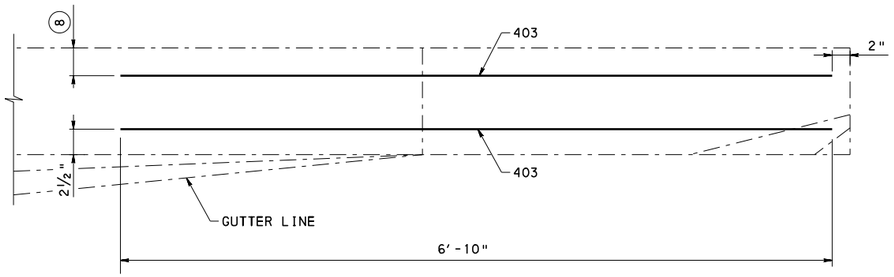
BRIDGE BARRIER TRANSITION REINFORCEMENT - 5

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

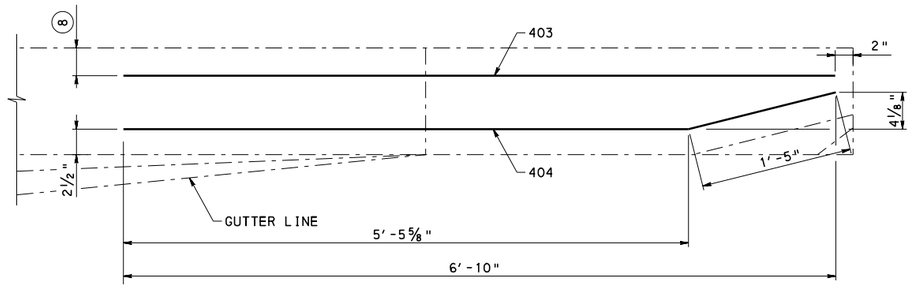
SHEET 7 OF 10

BD-622M



PLAN

403



PLAN

404

LEGEND:

(6) 2½" CLR. FOR SAFETY WINGS.
3⅛" CLR. FOR U-WINGS.

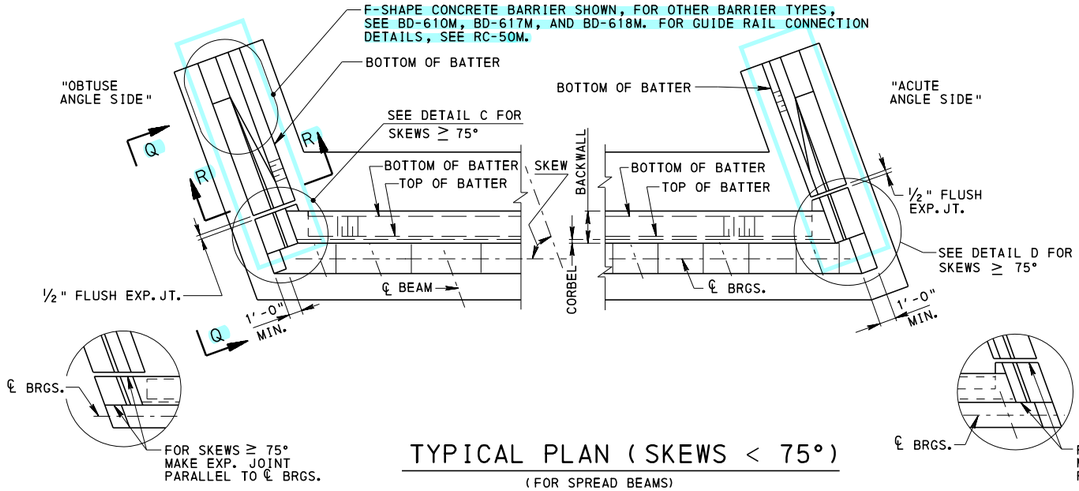
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

R. C. ABUTMENTS WITH BACKWALL

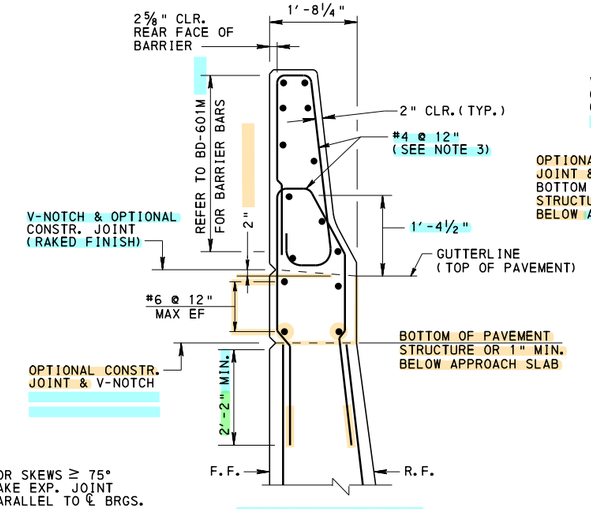
BRIDGE BARRIER
TRANSITION REINFORCEMENT - 6

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 8 OF 10
		BD-622M



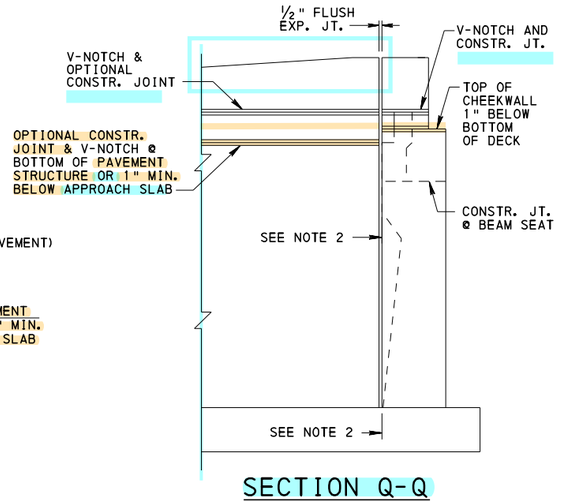
TYPICAL PLAN (SKEWS < 75°)

(FOR SPREAD BEAMS)



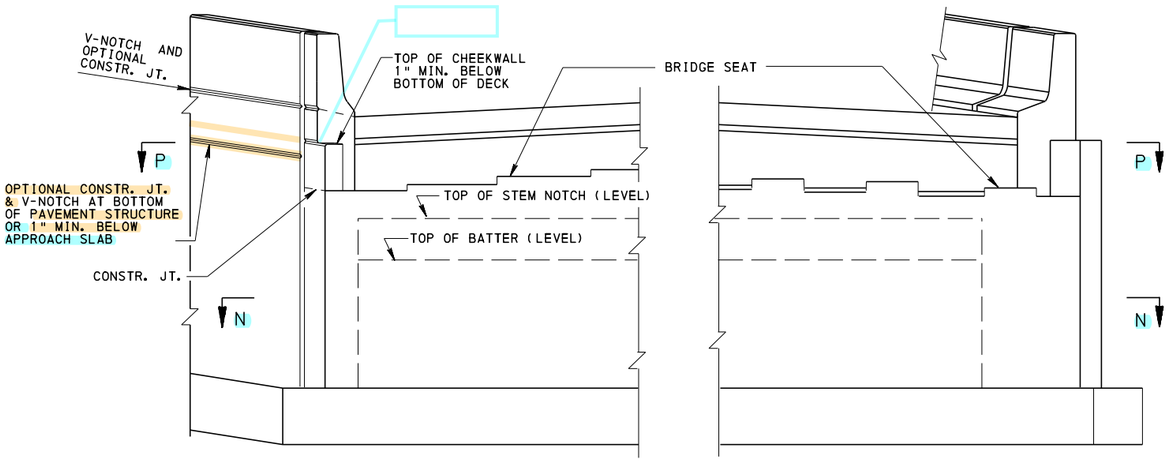
SECTION R-R

(WITH OR WITHOUT BATTER)
45" F-SHAPE CONCRETE BARRIER SHOWN.
32" AND 42" F-SHAPE CONCRETE BARRIER SIMILAR.



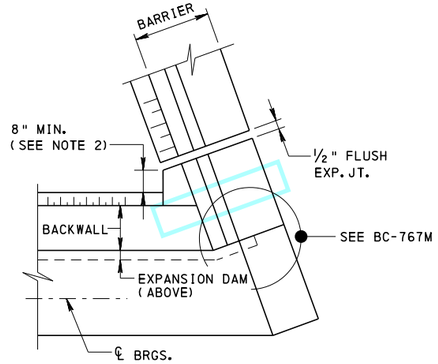
SECTION Q-Q

DETAIL C



TYPICAL ELEVATION

DETAIL D



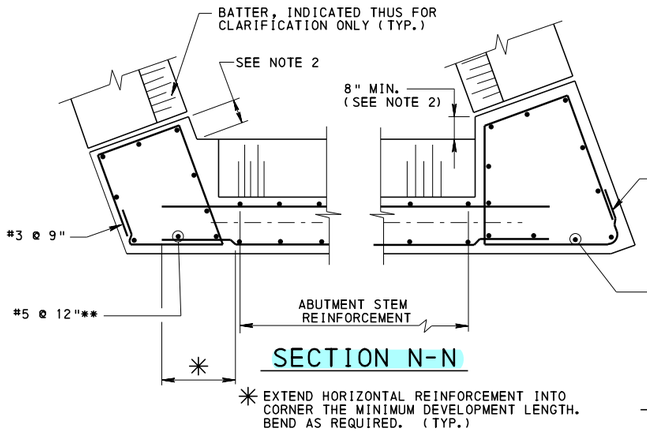
TYPICAL CORNER DETAIL FOR EXPANSION DAM (SKEWS < 75°)

NOTE: ACUTE SIDE WITH 45" F-SHAPE CONCRETE BARRIER IS SHOWN FOR NEOPRENE STRIP SEAL DAM. 32" AND 42" F-SHAPE CONCRETE BARRIER AND TOOTH EXPANSION DAM ARE SIMILAR.

NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER AS REQUIRED BY DESIGN.

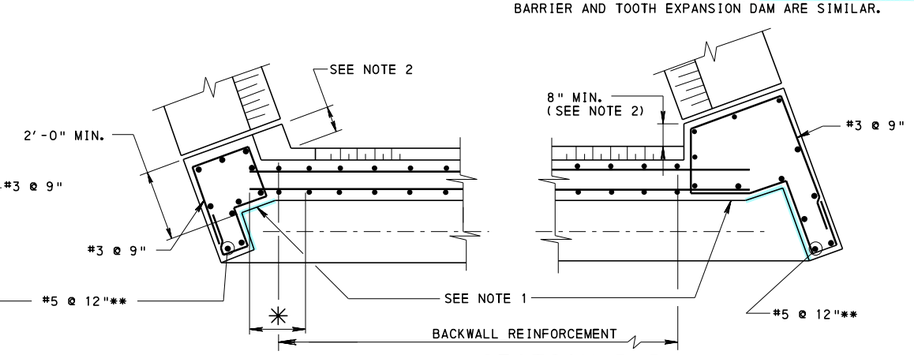
NOTES:

1. LAYOUT OF CORNER DETAILS ARE SHOWN TO ACCOMMODATE TURNING OF NEOPRENE STRIP SEAL DAM AT 90° TO BARRIER. SEE TYPICAL CORNER DETAIL FOR EXPANSION DAM THIS SHEET. DETAIL IS SIMILAR FOR TOOTH EXPANSION DAM.
2. EXTEND ABUTMENT CORNER 8" MINIMUM BEYOND BACK OF BACKWALL AND BOTTOM OF BATTER AT ACUTE ANGLE OF U-WING. EXTEND ABUTMENT CORNER 0 (ZERO) MINIMUM BEYOND BACK OF BACKWALL AND BOTTOM OF BATTER AT OBTUSE ANGLE OF U-WING AND PROVIDE A MINIMUM 2'-0" CORNER DIMENSION AS SHOWN.
3. WITHIN 10'-0" ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS SHOWN ON SHEETS 3-8.



SECTION N-N

✳ EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP.)



SECTION P-P

ABUTMENT WITH U-WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS. SEE DETAIL C, SHEET 1.

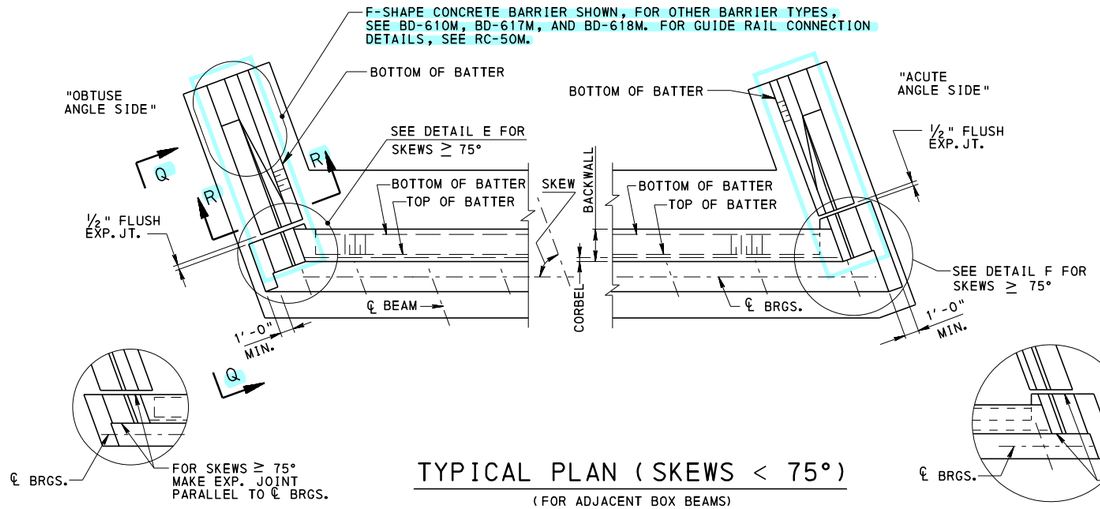
** IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT, #6 REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

R. C. ABUTMENTS WITH BACKWALL U-WINGS LAYOUT AND DETAILS FOR SPREAD BEAMS

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 9 OF 10
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-622M

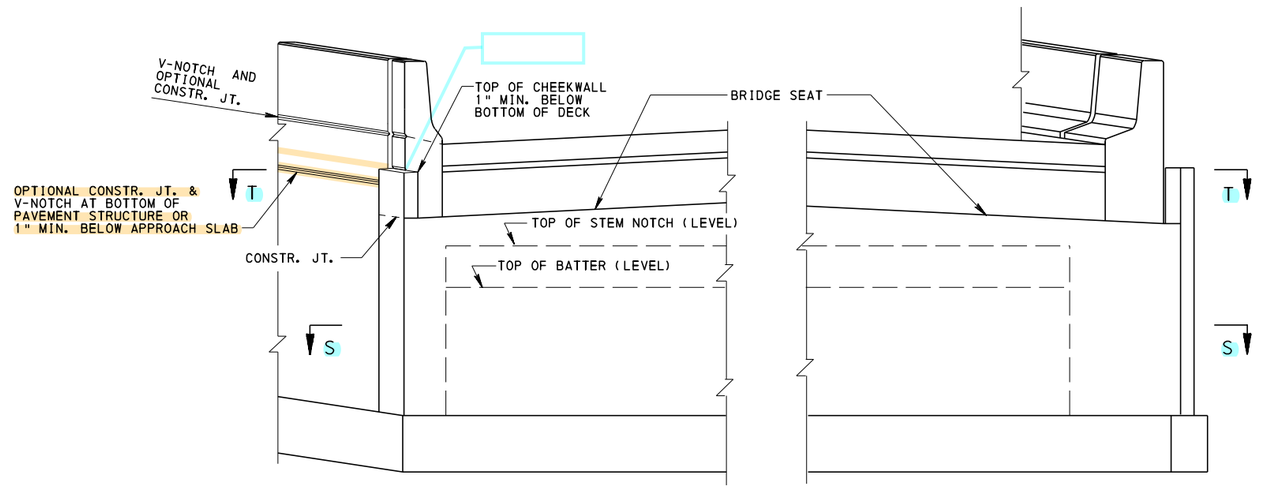


TYPICAL PLAN (SKEWS < 75°)

(FOR ADJACENT BOX BEAMS)

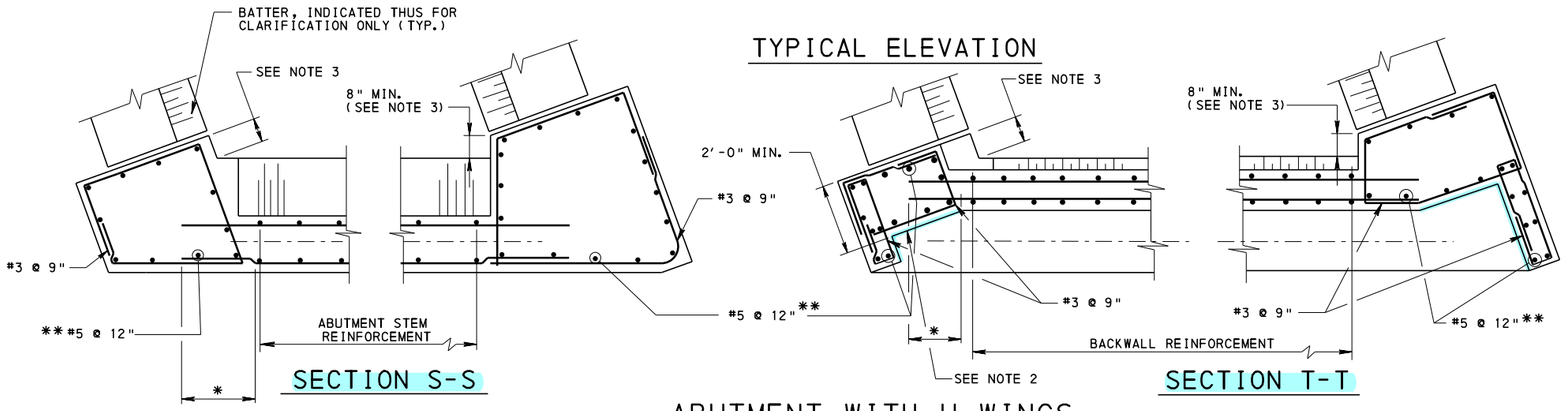
DETAIL E

DETAIL F



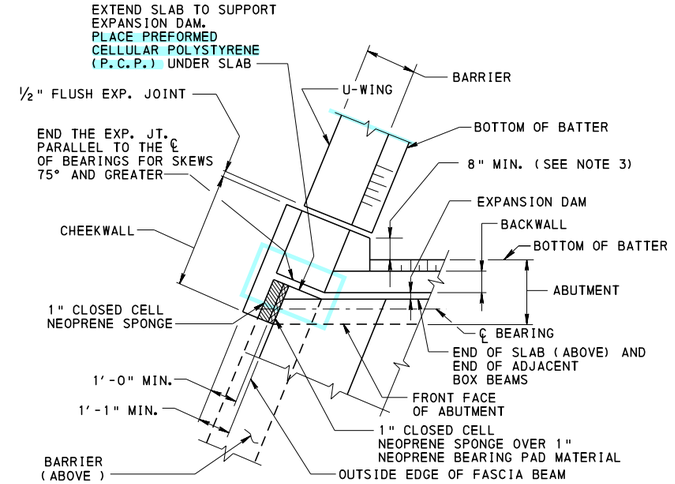
ABUTMENT WITH U-WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS. SEE DETAIL G, SHEET 1.



* EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP.)

** IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT, #6 REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.



ABUTMENT PLAN - WITH BACKWALL (SKEWS < 75°)

U-WINGS FOR ADJACENT BEAMS

(DETAIL SHOWN WITH OVERHANG)

NOTES:

1. FOR SECTIONS Q-Q AND R-R, SEE SHEET 9.
2. LAYOUT OF CORNER DETAILS ARE SHOWN TO ACCOMMODATE TURNING OF NEOPRENE STRIP SEAL DAM AT 90° TO BARRIER. SEE TYPICAL CORNER DETAIL FOR EXPANSION DAM SHEET 4 FOR SKEWS < 75°. DETAIL IS SIMILAR FOR TOOTH EXPANSION DAM.
3. EXTEND ABUTMENT CORNER 8" MINIMUM BEYOND BACK OF BACKWALL AND BOTTOM OF BATTER AT ACUTE ANGLE OF U-WING. EXTEND ABUTMENT CORNER 0 (ZERO) MINIMUM BEYOND BACK OF BACKWALL AND BOTTOM OF BATTER AT OBTUSE ANGLE OF U-WING AND PROVIDE A MINIMUM 2'-0" CORNER DIMENSION AS SHOWN.

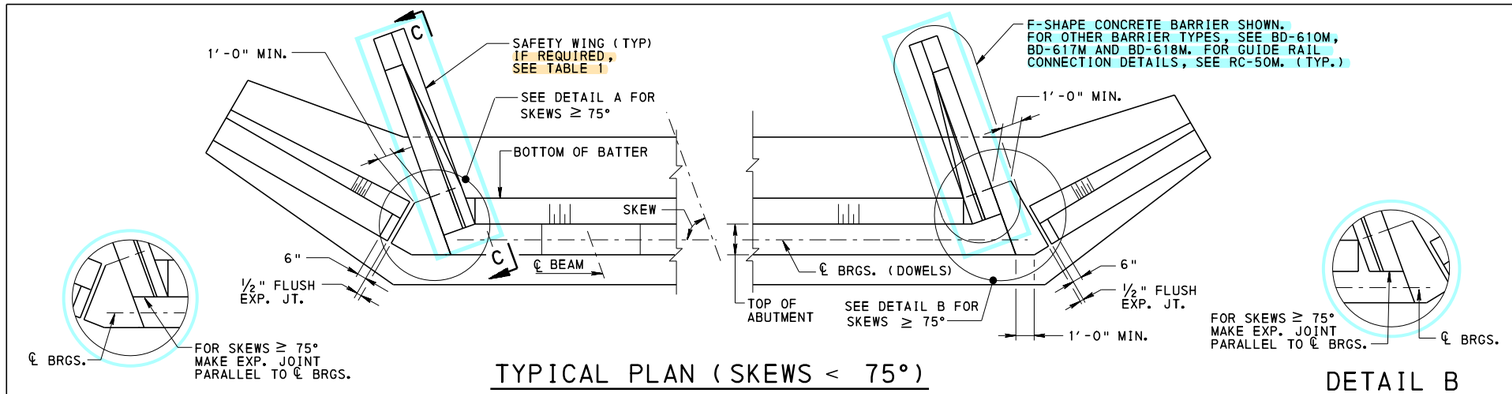
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

R. C. ABUTMENTS WITH BACKWALL U-WINGS LAYOUT AND DETAILS FOR ADJACENT BOX BEAMS

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 10 OF 10
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-622M

CHANGE 2
CHANGE 3
CHANGE 5



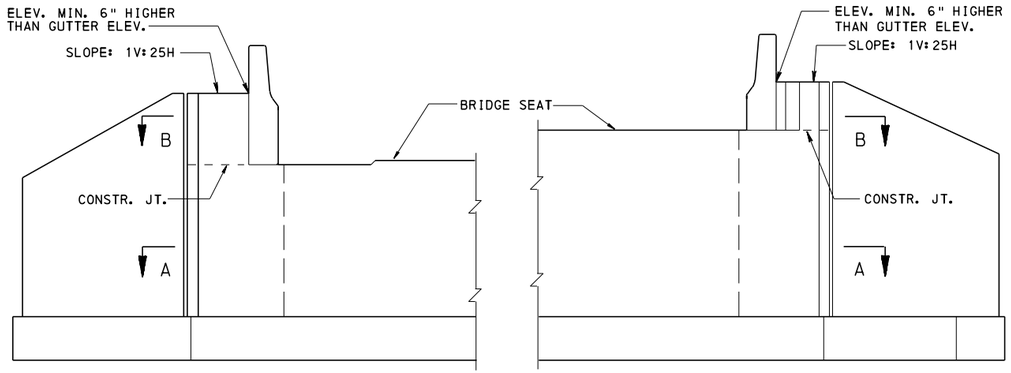
TYPICAL PLAN (SKEWS < 75°)

DETAIL A

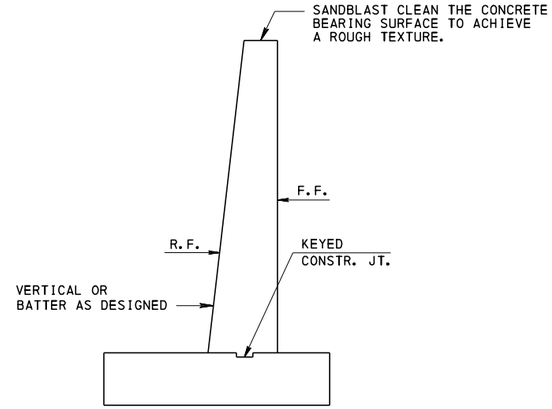
DETAIL B

GENERAL NOTES:

1. FOR SECTION C-C, SEE SHEET 2.
2. HOOKS ON BARS EXTENDING FROM SAFETY WING INTO THE STEM MAY BE TURNED IN ANY DIRECTION.
3. SAFETY WINGS ARE NOT NEEDED WHEN USING APPROACH SLAB TYPES 1 - 4 (SEE BD-628M).



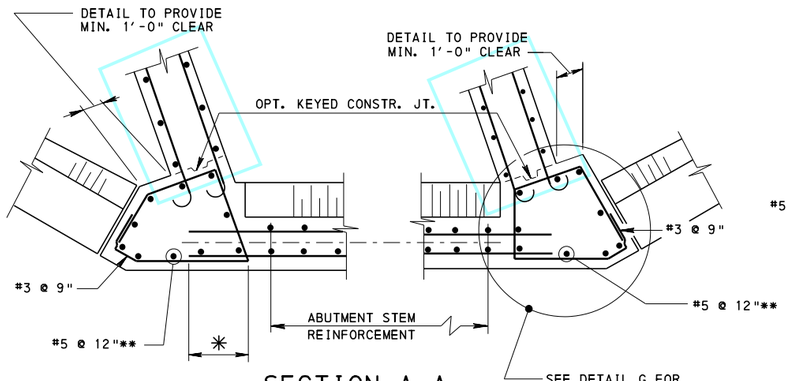
TYPICAL ELEVATION



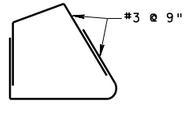
ABUTMENT SECTION

NOTE:

1. NO LAPS ARE PERMITTED FOR LONGITUDINAL BARS IN SAFETY WING BELOW GUTTERLINE.



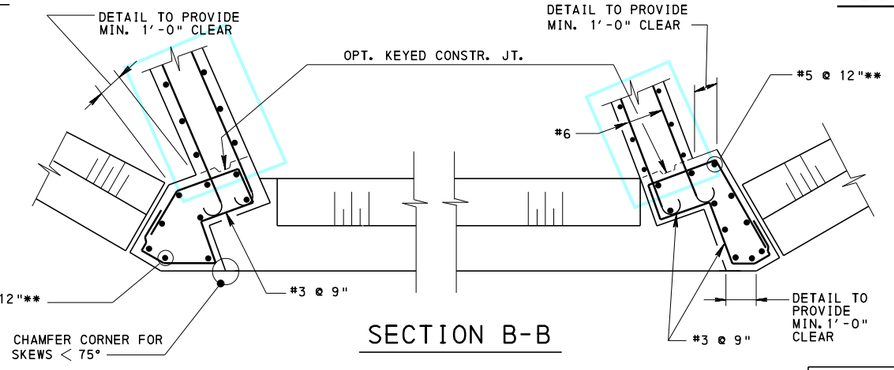
SECTION A-A



DETAIL G

ABUTMENTS WITH FLARED WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS. SEE DETAIL G.



SECTION B-B

TABLE 1	
APPROACH SLAB TYPE	SAFETY WING REQUIRED?
TYPE 1-4 (BD-628M)	NO(1)
RC-23M (BRADD)	YES(2)
NONE	YES(2)

(1) BARRIERS INTEGRAL WITH APPROACH SLAB
(2) BARRIERS SUPPORTED BY SAFETY WINGS

✳ EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP.)

** IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT, #6 REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

BD-601M	CONCRETE DECK SLAB
BD-610M	PA BRIDGE BARRIER
BD-617M	PA TYPE 10M BRIDGE BARRIER
BD-618M	VERTICAL WALL CONCRETE BARRIER
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	REINFORCED CONCRETE ABUTMENTS WITH BACKWALL
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-657M	ABUTMENT DETAILS
BC-734M	ANCHOR SYSTEMS
BC-751M	BRIDGE DRAINAGE
BC-762M	TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE & STEEL BEAM BRIDGES
BC-767M	NEOPRENE STRIP SEAL DAM
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

R. C. ABUTMENTS WITHOUT BACKWALL

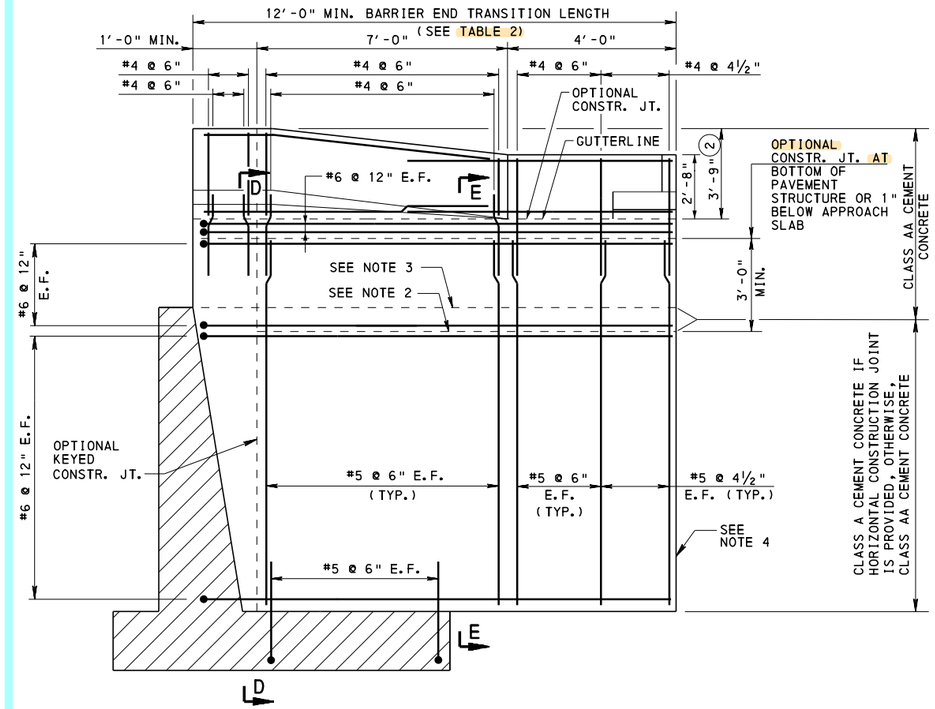
FLARED WINGS LAYOUT AND DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

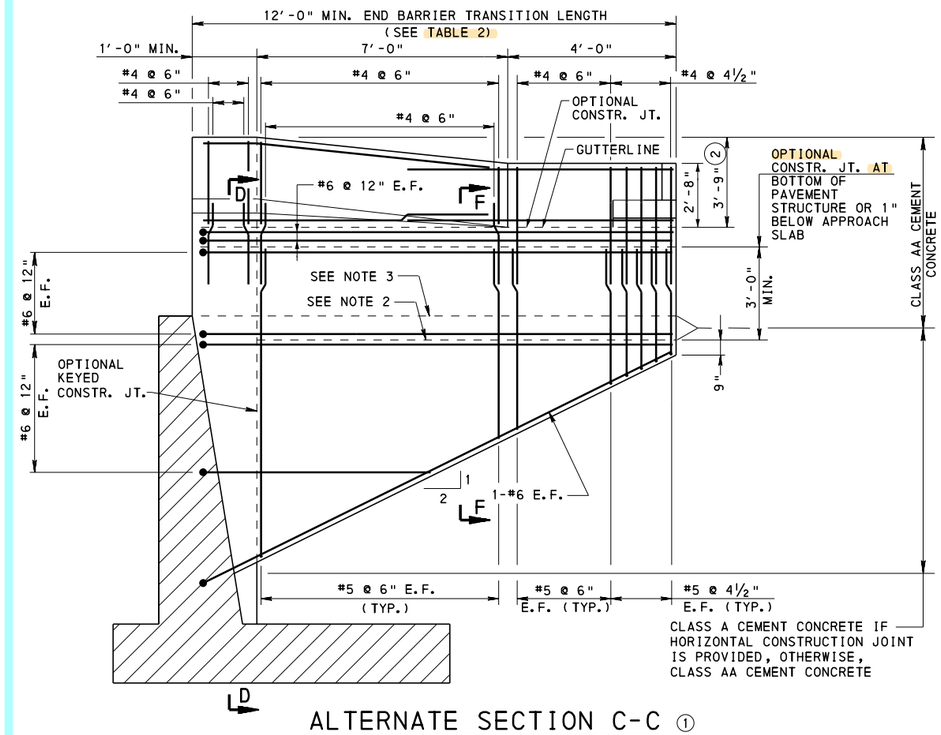
RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 4

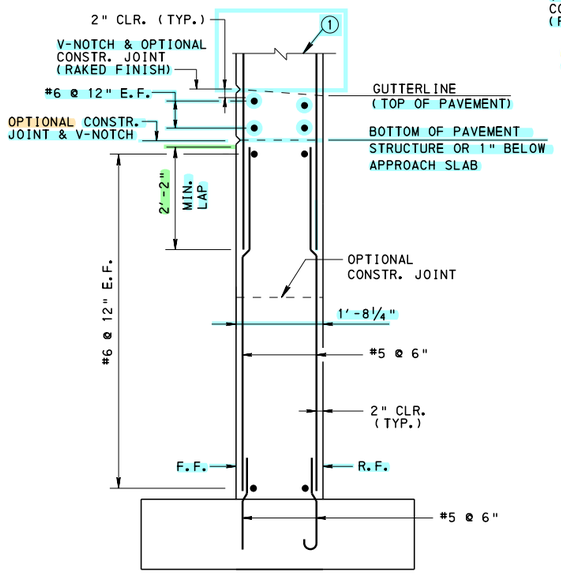
BD-624M



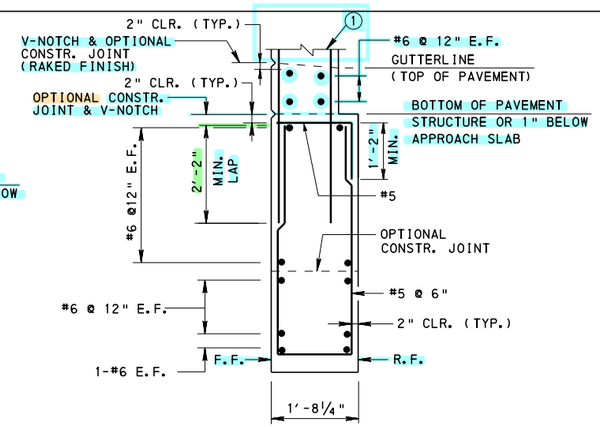
SECTION C-C ①



ALTERNATE SECTION C-C ①



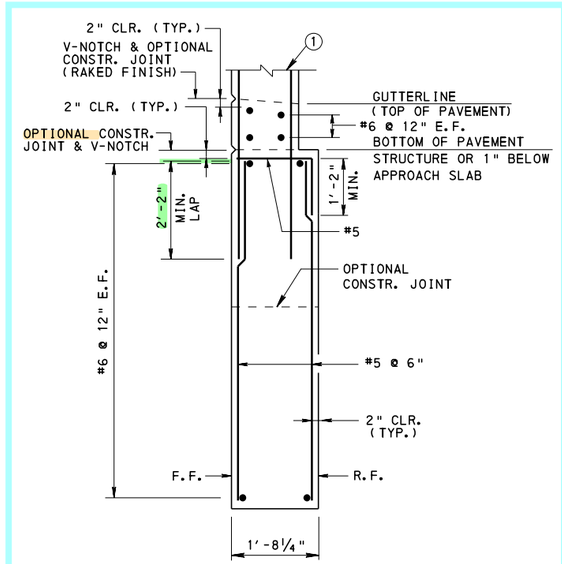
SECTION D-D



SECTION F-F

NOTES:

1. FOR TYPICAL PLAN AND ELEVATION, SEE SHEET 1.
2. OPTIONAL CONSTRUCTION JOINT LOCATED 3′-0" MINIMUM FROM BOTTOM OF DECK FOR BEAM DEPTHS LESS THAN 2′-1".
3. OPTIONAL CONSTRUCTION JOINT LOCATED AT BEAM SEAT FOR BEAM DEPTHS GREATER THAN OR EQUAL TO 2′-1".
4. DENOTES PREFERRED CONFIGURATION OF BARRIER WALL ON FOOTING FOR ABUTMENT STEM HEIGHTS MEASURED FROM TOP OF FOOTING TO TOP OF BEAM SEAT LESS THAN 30′-0". ALTERNATE CONFIGURATIONS OF BARRIER WALLS ON FOOTINGS CAN BE USED ONLY WITH THE APPROVAL OF THE DISTRICT BRIDGE ENGINEER.
5. IF FILL HEIGHTS ON BOTH SIDES OF THE SAFETY WING WALL CAN NOT BE MAINTAINED WITHIN 5′-0", OF EACH OTHER, THEN ALL REINFORCEMENT BARS MUST BE DESIGNED.



SECTION E-E

LEGEND:

① SEE BD-622M, SHEETS 3-7 FOR DETAILS OF THE F-SHAPE BARRIER END SECTIONS ABOVE THE GUTTERLINE. SEE BD-610M, BD-617M AND BD-618M FOR REINFORCEMENT DETAILS FOR THE PA BRIDGE BARRIER, TYPE 10M BRIDGE BARRIER AND VERTICAL WALL CONCRETE BARRIER.

② 45° F-SHAPE CONCRETE BARRIER SHOWN. 32" & 42" F-SHAPE CONCRETE BARRIER SIMILAR.

TABLE 2

BARRIER TYPE	MINIMUM BARRIER END TRANSITION LENGTH
32", 42", 45° F-SHAPE CONCRETE BARRIER	12′-0"
32" VERTICAL WALL CONCRETE BARRIER	7′-0"
42" VERTICAL WALL CONCRETE BARRIER	10′-0"
PA BRIDGE BARRIER	9′-0"
PA TYPE 10M BRIDGE BARRIER	9′-0"

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

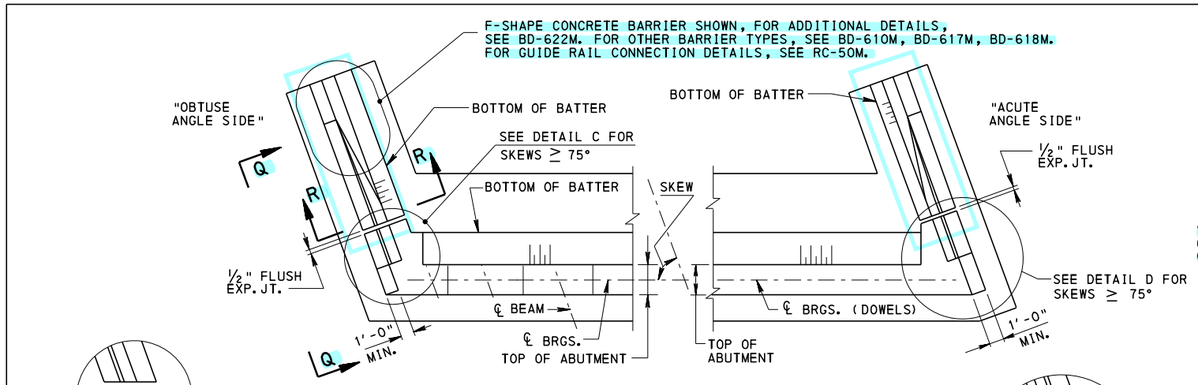
R. C. ABUTMENTS WITHOUT BACKWALL

SAFETY WING DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

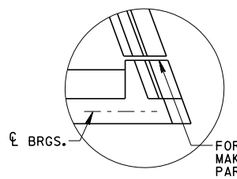
BD-624M



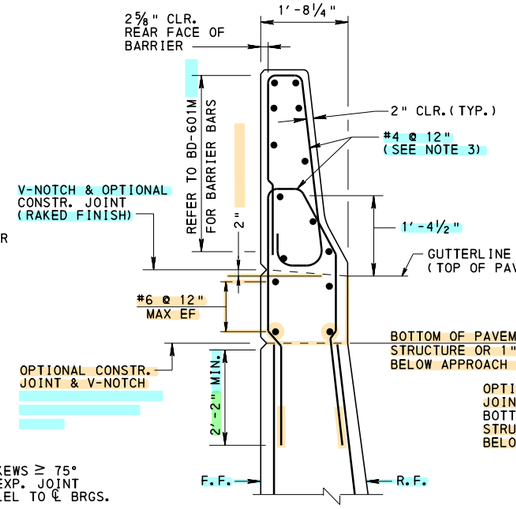
DETAIL C

TYPICAL PLAN (SKEWS < 75°)

(FOR SPREAD BEAMS)



DETAIL D

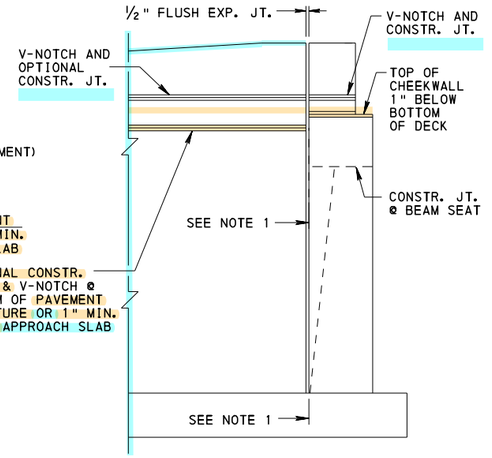


SECTION R-R

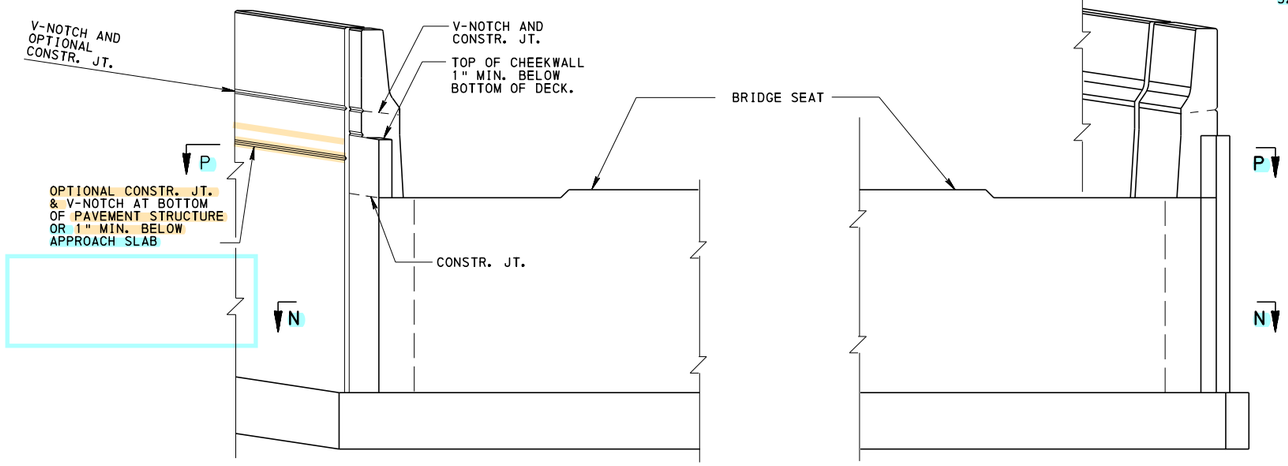
(WITH OR WITHOUT BATTER)

45" F-SHAPE CONCRETE BARRIER SHOWN, 32" AND 42" F-SHAPE CONCRETE BARRIER SIMILAR.

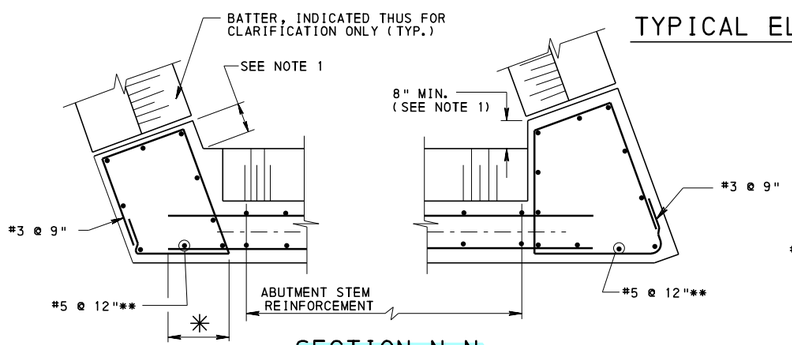
NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER AS REQUIRED BY DESIGN.



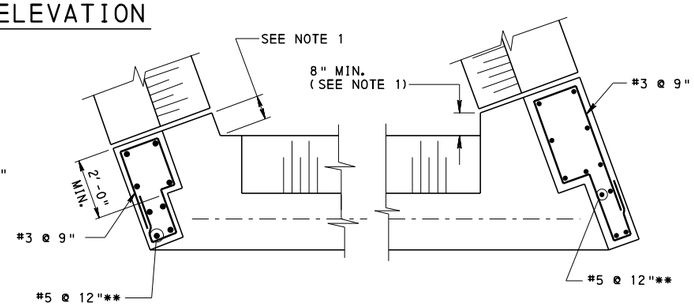
SECTION Q-Q



TYPICAL ELEVATION



SECTION N-N



SECTION P-P

✳ EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP.)

ABUTMENT WITH U-WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS. SEE DETAIL G, SHEET 1.

** IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT, #6 REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

NOTES:

1. EXTEND ABUTMENT CORNER 8" MINIMUM BEYOND BOTTOM OF BATTER AT ACUTE ANGLE OF U-WING. EXTEND ABUTMENT CORNER 0 (ZERO) MINIMUM BEYOND BOTTOM OF BATTER AT OBTUSE ANGLE OF U-WING AND PROVIDE A MINIMUM 2'-0" CORNER DIMENSION AS SHOWN.

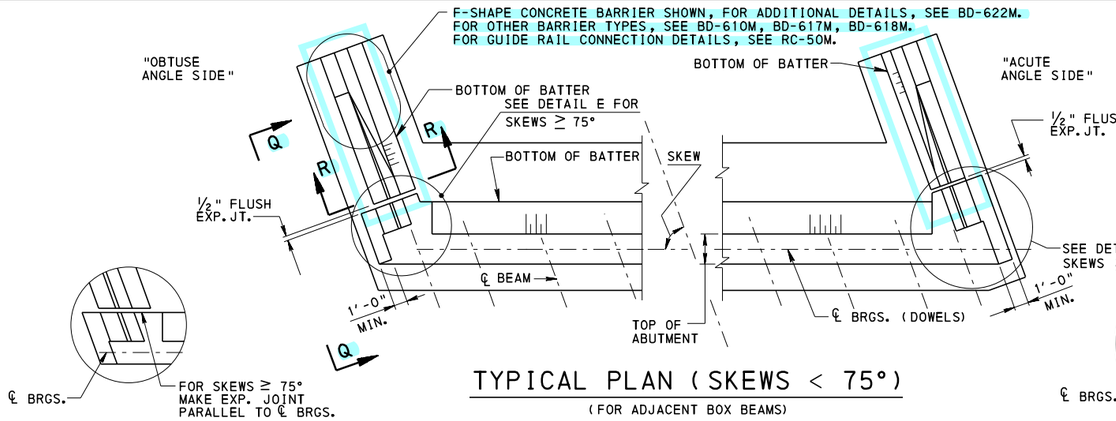
2. WITHIN 10' OF BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF A BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS SHOWN IN BD-622M, SHEETS 3-8.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

R. C. ABUTMENTS WITHOUT BACKWALL U-WINGS LAYOUT AND DETAILS

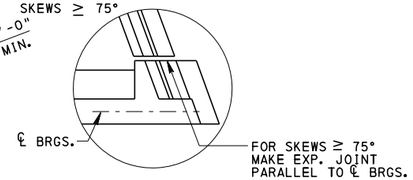
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 3 OF 4
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-624M



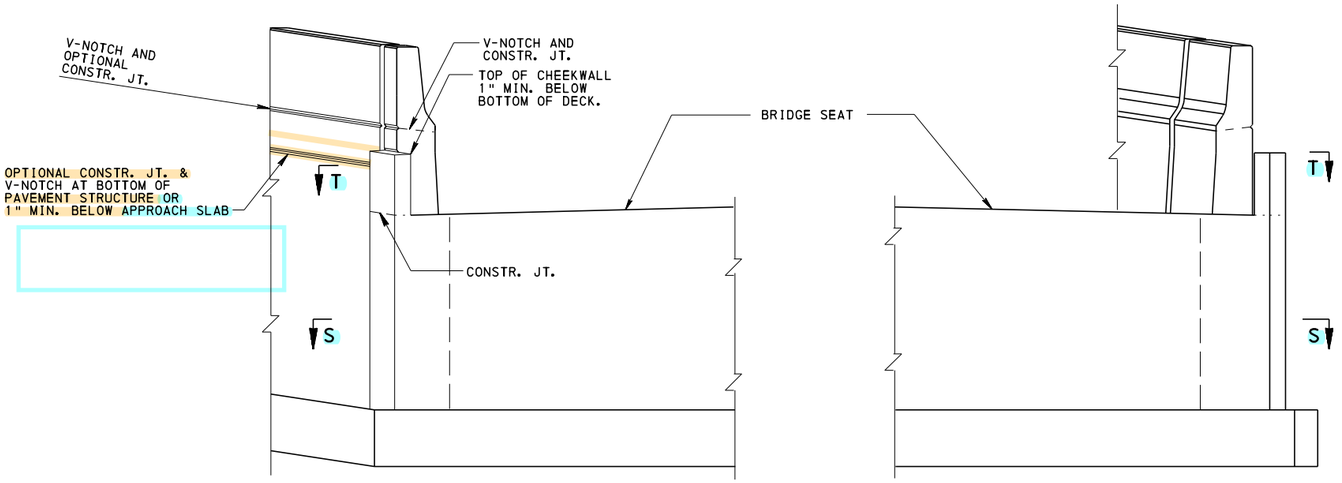
TYPICAL PLAN (SKEWS < 75°)

(FOR ADJACENT BOX BEAMS)

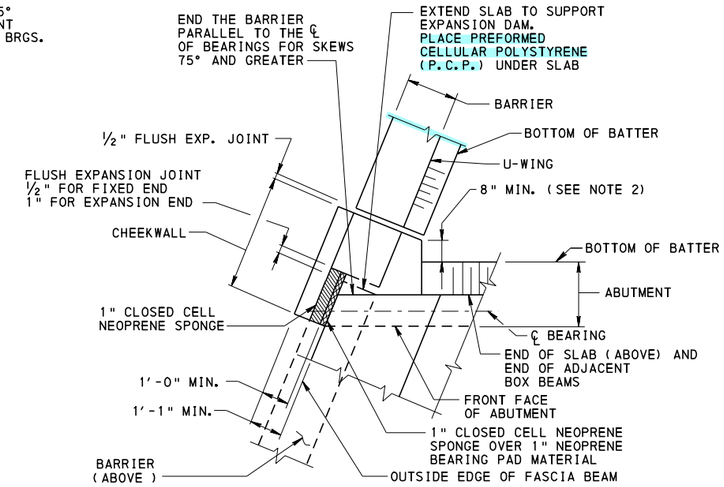
DETAIL E



DETAIL F



TYPICAL ELEVATION



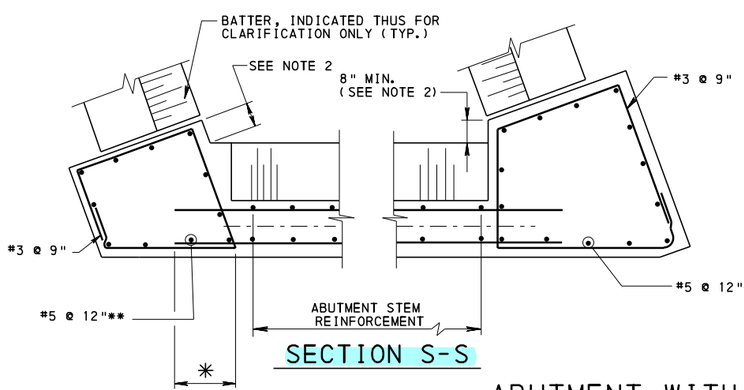
ABUTMENT PLAN - WITHOUT BACKWALL (SKEWS < 75°)

U-WINGS FOR ADJACENT BEAMS

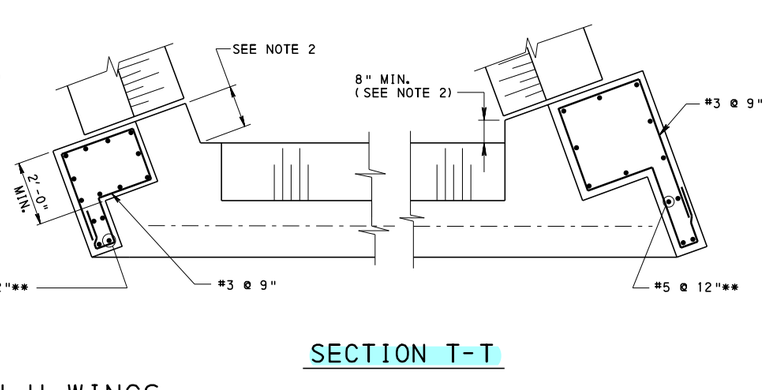
(DETAIL SHOWN WITH OVERHANG)

NOTES:

1. FOR SECTION Q-Q AND R-R, SEE SHEET 3.
2. EXTEND ABUTMENT CORNER 8" MINIMUM BEYOND BOTTOM OF BATTER AT ACUTE ANGLE OF U-WING. EXTEND ABUTMENT CORNER 0 (ZERO) MINIMUM BEYOND BOTTOM OF BATTER AT OBTUSE ANGLE OF U-WING AND PROVIDE A MINIMUM 2'-0" CORNER DIMENSION AS SHOWN.



SECTION S-S



SECTION T-T

ABUTMENT WITH U-WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS. SEE DETAIL G, SHEET 1.

✳ EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP.)

** IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT, #6 REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

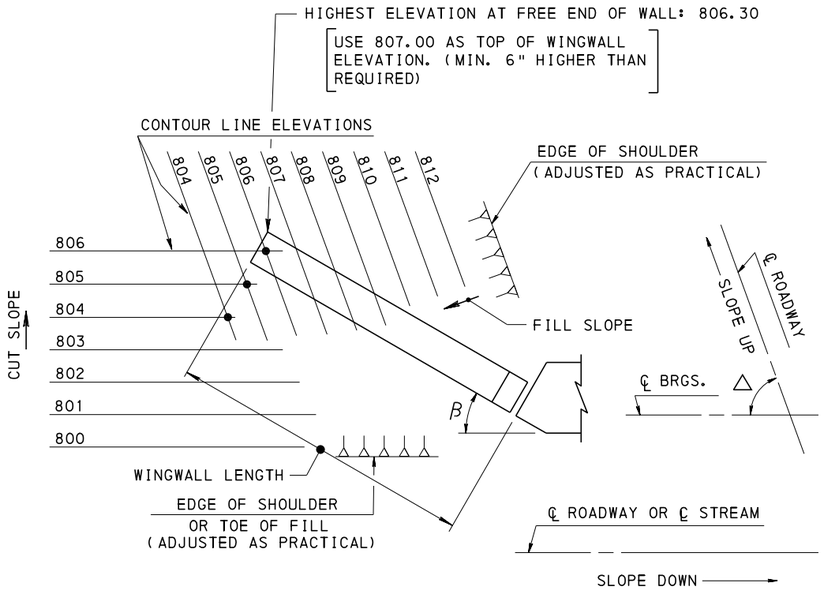
STANDARD

R. C. ABUTMENTS WITHOUT BACKWALL

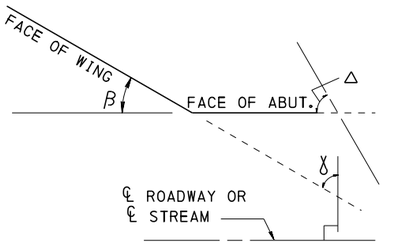
U-WINGS LAYOUT AND DETAILS FOR ADJACENT BOX BEAMS

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 4 OF 4
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-624M

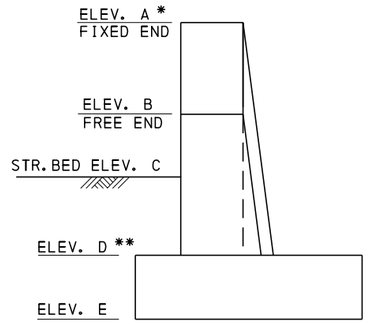
IN GENERAL, PROVIDE WINGWALLS OF SUFFICIENT LENGTH TO RETAIN THE ROADWAY EMBANKMENT TO THE REQUIRED EXTENT AND TO FURNISH PROTECTION AGAINST EROSION. COMPUTE WINGWALL LENGTHS USING THE ACTUAL CONDITION AT THE SITE. THE FOLLOWING METHOD IS PROPOSED TO COMPUTE THE REQUIRED LENGTHS.



LENGTH OF WINGWALL
SCHEME A



PLAN



TYPICAL SECTION

GIVEN:

BRIDGE SKEW (△) = ____° ____ ′; ANGLE BETWEEN FRONT FACE OF WING & FRONT FACE OF ABUTMENT (β) = ____° ____ ′;

ANGLE BETWEEN PERPENDICULAR TO ROADWAY CENTERLINE & FRONT FACE OF WING (γ) = ____° ____ ′

FIND WING LENGTH:

$$\text{ELEV. A}^{*} - \text{ELEV. C} = \frac{\text{WING LENGTH} \times \text{SINE}(\beta)}{\text{CUT SLOPE}} + \frac{\text{WING LENGTH} \times \text{COS}(\gamma)}{\text{FILL SLOPE}}$$

(-) = W.L.( ) + W.L.( )

W.L.( ) = _____

W.L. = _____ CALL _____ ←

(FOR 'U' WINGS ADD 3' TO THE COMPUTED LENGTH.)

FIND ELEV. B :

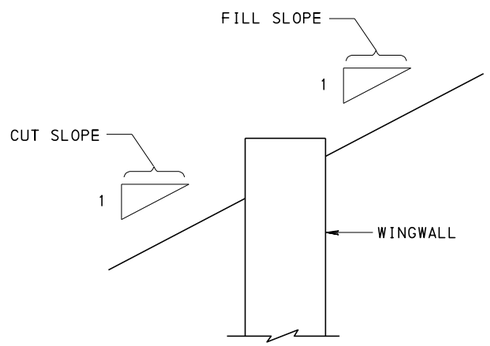
$$\text{ELEV. B} = \text{ELEV. A} - \frac{\text{WING LENGTH} \times \text{COS}(\gamma)}{\text{FILL SLOPE}} = \_\_\_\_ - \_\_\_\_ \times \_\_\_\_$$

HENCE ELEV. B = _____

* SUBTRACT 6" TO COMPUTE WING LENGTH ONLY.

** [ELEV. C - ELEV. D] = 12" + STREAMBED SLOPE x COS (β) OR MORE ON OUTLET END ONLY.

LENGTH OF WINGWALL
SCHEME B



SLOPE DEFINITIONS

RC-12M	BACKFILL AT STRUCTURES
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

WINGWALL LENGTH

RECOMMENDED APR. 29, 2016
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 1

BD-625M

CHANGE 2

GENERAL NOTES

(FOR CONTRACT DRAWINGS)

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH SPECIFICATIONS PUBLICATION 408, AASHTO/AWS D1.5 BRIDGE WELDING CODE AND THE SPECIAL PROVISIONS.
2. DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AS SUPPLEMENTED BY DESIGN MANUAL PART 4, STRUCTURES.
3. USE CLASS A CEMENT CONCRETE FOR CONCRETE EMBEDMENT, CAST-IN-PLACE CONCRETE, LAGGING, WALLS, AND CORBELS.
4. FOR PRECAST CONCRETE LAGGING FOLLOW SECTION 714 OF PUB 408 AND USE 4000 PSI CONCRETE. CHAMFER EXPOSED CONCRETE EDGES ¾" × ¾" WHERE NOTED.
5. PROVIDE GRADE 60 REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A 615, A 996, OR A 706. DO NOT WELD GRADE 60 REINFORCING BARS UNLESS SPECIFIED. GRADE 40 REINFORCING STEEL BARS MAY BE SUBSTITUTED WITH A PROPORTIONAL INCREASE IN CROSS-SECTIONAL AREA IF APPROVED BY THE CHIEF BRIDGE ENGINEER. DO NOT USE RAIL STEEL ASTM A 996 WHERE BENDING OR WELDING OF THE REINFORCEMENT BARS IS INDICATED.
6. PROVIDE STRUCTURAL STEEL CONFORMING TO AASHTO M270 (ASTM A709) GRADE 36 OR 50. PIPE CONFORMING TO API GRADE N-80 OR ASTM A53 MAY BE USED AS PERMANENT CASING.
7. PROVIDE WELDED STUD SHEAR CONNECTORS MANUFACTURED FROM STEEL CONFORMING TO ASTM A108.
8. IF REQUIRED, PROVIDE PERMANENT CASING CONFORMING TO ASTM A 53 AT THE ANCHOR HEAD. API GRADE N-80 CASING WITH FLUSH JOINT THREADED CONNECTION TO ASTM A 53 PIPE MAY BE USED FOR THE REMAINDER OF THE CASING . [USE FOR LATENT ANCHOR SYSTEMS WHERE STRUCTURAL WELDS ARE REQUIRED.]
9. PROVIDE PERMANENT CASING IN THE BACKFILL WHEN CONSTRUCTING A WALL FROM THE BOTTOM UP. SPLICING OF PILES IS DISCOURAGED. IF CONDITIONS DICTATE, PROVIDE SPLICE A MINIMUM OF 5′ BELOW FINISHED GROUND LINE IN FRONT OF THE WALL. USE SPLICE DETAIL IN ACCORDANCE WITH BC-757M.
10. CONTROL PILE DRIVING BY THE WAVE EQUATION ANALYSIS. DRIVE TEST PILES TO ABSOLUTE REFUSAL. THE ENGINEER SHALL VERIFY FROM THE TEST PILE DRIVING RESULTS THE CAPABILITY OF THE PILE HAMMER SELECTED BY THE CONTRACTOR. DRIVE BEARING PILES TO ABSOLUTE REFUSAL INTO THE STRATUM DEFINED BY A TIP ELEVATION WHICH IS PREDETERMINED BY THE ENGINEER FROM TEST PILES. THE STRUCTURE CONTROL ENGINEER SHALL DETERMINE THE ACCEPTABILITY OF THE BEARING PILES WHICH ATTAIN ABSOLUTE REFUSAL ABOVE THE PREDETERMINED TIP ELEVATIONS.
11. PROVIDE PILE TIP REINFORCEMENT FOR DRIVEN PILES.
12. FOR CAST-IN-PLACE WALLS DRIVE OR PLACE PILES TO WITHIN 2" IN 10′ OF VERTICAL. DRIVE OR PLACE EACH PILE TO WITHIN 3" OF THE INDICATED LOCATION AT FINISHED GROUND LINE IN FRONT OF THE WALL.
13. FOR PRECAST LAGGING DRIVE OR PLACE PILES TO WITHIN 1" IN 10′ OF VERTICAL, BUT DO NOT ALLOW AN OUT-OF-PLANE OFFSET OF MORE THAN 1" IN 10" WITH RESPECT TO ADJACENT PILES. DRIVE OR PLACE EACH PILE WITHIN 2" HORIZONTALLY OF THE INDICATED LOCATION AT FINISHED GROUND LINE. PROVIDE MINIMUM BEARING DISTANCE FOR PRECAST LAGGING AT EDGE OF PILE FLANGE AS INDICATED IN PRECAST CONCRETE LAGGING DETAILS. IF NECESSARY, FABRICATE PRECAST LAGGING AFTER DRIVING OR PLACING PILES TO ENSURE PROPER FIT AND BEARING DISTANCE.
14. PROVIDE ANCHOR TENDONS CONSISTING OF 7-WIRE UNCOATED STRANDS CONFORMING TO AASHTO M 203 (ASTM A 416) WITH LOW-RELAXATION WIRE CONFORMING TO ASTM A 421, GRADE 270. [FOR ANCHORS CONSISTING OF STRANDS]
15. PROVIDE ANCHOR TENDONS CONSISTING OF STEEL BARS CONFORMING TO AASHTO-M275, TYPE II.
16. FOR GROUTING ANCHORS USE NEAT CEMENT OR SAND CEMENT GROUT WITH TYPE I, II, OR III PORTLAND CEMENT CONFORMING TO AASHTO M85. [INDICATE TYPE II FOR CORROSIVE ENVIRONMENTS.] BULLETIN 15 APPROVED NONSHRINK OR EXPANSIVE ADDITIVES MAYBE USED.
17. PROVIDE NO. 57 COARSE AGGREGATE FOR STRUCTURAL BACKFILL. PLACE BACKFILL IN ACCORDANCE WITH SECTION 1001.3(q)2b OF PUB. 408.
18. FOR AS-DESIGNED PERMANENT ANCHOR WALL - THE CONTRACTOR IS RESPONSIBLE FOR THE FINAL DESIGN AND DETAILED DESIGN OF THE FOLLOWING:
    - ANCHOR STRAND DESIGN
    - TRUMPET DESIGN
    - UNBONDED STRESSING LENGTH
    - BOND LENGTH DESIGN
    - STEEL CASING EMBEDMENT LENGTH [LATENT ANCHORS ONLY]
    - ANCHOR HEADS
    - CENTRALIZERS
    - ANCHOR CORROSION PROTECTION SYSTEM
    - GROUTING PROCEDURE
    - TIMBER LAGGING DESIGN
    - JACKING ASSEMBLY - HYDRAULIC JACK AND PUMP, STRESSING ANCHORAGE, PRESSURE GAGES/LOAD CELLS, DIALS TO MEASURE MOVEMENT AND JACK CHAIR
19. FOR CONTRACTOR DESIGNED PERMANENT ANCHOR WALL - THE CONTRACTOR IS RESPONSIBLE FOR THE FULL DESIGN, DETAILING, FABRICATION AND CONSTRUCTION OF THE PERMANENTLY ANCHORED WALL IN ACCORDANCE WITH THE SPECIAL PROVISION PERMANENT ANCHORED WALL.
20. PROVIDE PERFORMANCE, PROOF, AND CREEP TESTING OF ANCHORS AND INDICATE TESTING REQUIREMENTS AND RESULTS IN ACCORDANCE WITH THE SPECIAL PROVISIONS. FOR ANCHORS THAT FAIL TEST REQUIREMENTS, REPLACE ANCHORS OR MODIFY THE STRUCTURE TO MEET ALL DESIGN CODES AND REQUIREMENTS IN ACCORDANCE WITH THE SPECIAL PROVISION.
21. SUBMIT FINAL DESIGN CALCULATIONS AND DESIGN DETAILS IN ACCORDANCE WITH THE SPECIAL PROVISIONS.
22. CHAMFER EXPOSED CONCRETE EDGES 1" X 1" EXCEPT AS NOTED.
23. GALVANIZE MATERIAL IN ACCORDANCE WITH SECTION 1105.02(s)1 OF PUB. 408. REPAIR GALVANIZED SURFACES DAMAGED DURING CONSTRUCTION IN ACCORDANCE WITH SECTION 1105.02(s)2 OF PUB. 408.
24. REPAIR EPOXY COATED SURFACES DAMAGED DURING CONSTRUCTION IN ACCORDANCE WITH SECTION 1092.3(e) OF PUB. 408.
25. ENSURE INTIMATE CONTACT BETWEEN EXCAVATION FACE AND THE BACK FACE OF TIMBER LAGGING PRIOR TO STRESSING ANCHOR. [FOR TOP DOWN INSTALLATION]
26. GRIND AND FINISH ANCHOR OPENINGS IN DOUBLE PILES TO A SMOOTH CONDITION.
27. APPLY SHEAR STUDS TO WEBS OF DRIVEN PILES AFTER DRIVING PILES TO REFUSAL. WELD SHEAR STUDS IN ACCORDANCE WITH AASHTO/AWS D1.5 SECTIONS 7.5.5 AND 7.6.
28. WELDING SPECIFICATIONS: ANSI/AASHTO/AWS/D1.5 BRIDGE WELDING CODE AND IN ACCORDANCE WITH SECTION 1105.03(m) OF PUB. 408 AND THE SPECIAL PROVISIONS. USE QUALIFIED WELDERS IN ACCORDANCE WITH AWS D1.5 SECTION 5 PART B. FOLLOW D1.1 FOR TUBULAR (API OR ASTM A53) MATERIAL.
29. FIELD WELDING OF STEEL: USE THE SHIELDED METAL ARC PROCESS AND LOW HYDROGEN ELECTRODES WHICH ARE COMPATIBLE WITH THE BASE METAL AS SPECIFIED, AND IN ACCORDANCE WITH AN APPROVED WELD PROCEDURE SPECIFICATION.
30. DO NOT WELD WHEN SURFACES TO BE WELDED ARE MOIST OR EXPOSED TO RAIN, SNOW OR WIND, OR WHEN WELDERS ARE EXPOSED TO INCLEMENT CONDITIONS THAT WILL ADVERSELY AFFECT THE QUALITY OF THE WORK.
31. DO NOT WELD OR BURN WHEN THE TEMPERATURE IS BELOW 0-DEGREES F. PREHEAT AND MAINTAIN THE TEMPERATURE OF THE METAL TO AT LEAST 70-DEGREES F WHEN THE TEMPERATURE OF THE METAL IS BETWEEN 0-DEGREES AND 30-DEGREES F DURING WELDING OR BURNING. EXTEND THE AREA TO BE HEATED 3 INCHES BEYOND THE WELD IN ALL DIRECTIONS.
32. REMOVE ANY MOISTURE PRESENT AT POINT OF WELD BY APPLICATION OF HEAT. PROVIDE WINDBREAKS FOR PROTECTION FROM DIRECT WIND.
33. THOROUGHLY CLEAN ALL PORTIONS OF NEW SURFACES TO RECEIVE WELDS OF ALL FOREIGN MATTER, INCLUDING PAINT FILM, FOR A DISTANCE OF 2" FROM EACH SIDE OF THE OUTSIDE LINES OF WELD PRIOR TO PLACING THE WELD.
34. TEST INDICATED WELDS USING NON-DESTRUCTIVE METHODS IN ACCORDANCE WITH AASHTO AWS D1.5 2002 BRIDGE WELDING CODE, SECTION 6.7.
35. LAGGING MAY BE PLACED INSIDE THE REAR FLANGE, IF BLOCKED, OR INSIDE THE FRONT FLANGE.

NOTES TO DESIGNER

1. APPLICABILITY OF THIS STANDARD DRAWING:
    - THIS STANDARD APPLIES TO PERMANENT ANCHORED WALLS WITH DISCRETE VERTICAL ELEMENTS.
    - THIS STANDARD APPLIES TO ANCHORS BONDED IN ROCK. ANCHORS BONDED IN SOIL ARE PERMITTED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.
    - THIS STANDARD APPLIES TO DISCRETE VERTICAL ELEMENTS WITH FOUNDATIONS ON OR INTO ROCK. DESCRETE VERTICAL ELEMENTS TERMINATING IN SOIL ARE PERMITTED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.
2. SOLDIER PILES MAY BE DESIGNED USING H-PILES, WIDE FLANGE BEAMS OR CONCRETE DRILLED SHAFTS. ANCHORED WALLS MAY BE DESIGNED USING STEEL SHEET PILES.
3. PROVIDE REINFORCEMENT BAR DEVELOPMENT LENGTHS AND SPLICE LENGTHS IN ACCORDANCE WITH AASHTO LFRD BRIDGE DESIGN SPECIFICATIONS, AS SUPPLEMENTED BY DESIGN MANUAL PART 4.
4. PROVIDE NOT LESS THAN TWO LAYERS OF CORROSIVE PROTECTION FOR THE TENDONS BY ENCAPSULATION IN A GROUT-FILLED CORRUGATED PLASTIC OR DEFORMED STEEL SHEATH.
5. APPLY PROTECTIVE COATINGS FOR REINFORCED CONCRETE SURFACES IN ACCORDANCE WITH DESIGN MANUAL PART 4 WHERE WALL IS EXPOSED TO SALT SPRAY. SEE SECTION 1019 OF PUBLICATION 408.
6. PROVIDE EPOXY COATED REINFORCING BARS IN ACCORDANCE WITH DESIGN MANUAL 4 CONSIDERING POTENTIALLY CORROSIVE ENVIRONMENTS.
7. PROVIDE CONCRETE CAP OVER ANCHOR PLACED BELOW FINAL GRADE.
8. STEEL PILES MAY BE GRADE 50 STEEL; HOWEVER, BASE POINT BEARING CAPACITY ON NOT MORE THAN 36 ksi. DESIGNER MAY USE 50 KSI WHEN EVALUATING COMBINED BENDING AND AXIAL LOADS FOR GRADE 50 PILES.
9. SPECIFY PROTECTIVE COATINGS FOR STEEL COMPONENTS IN ACCORDANCE WITH DESIGN MANUAL PART 4 CONSIDERING POTENTIALLY CORROSIVE ENVIRONMENTS. THE FOLLOWING PROVIDES GENERAL GUIDANCE:
    - STEEL ANCHORAGE FULLY ENCASED IN CONCRETE - NO ADDITIONAL PROTECTION REQ'D.
    - STEEL EMBEDDED IN ROCK SOCKET / SHAFT SECTION AND ENCASED IN CONCRETE, INCLUDING LEAN CONCRETE FILL - ZINC PRIMER, GALVANIZING, OR EPOXY COATING
    - EXPOSED STEEL OR STEEL ENCASED IN LEAN CONCRETE - THREE-COAT PAINT SYSTEM, GALVANIZING, OR EPOXY COATING
    - DRIVEN PILES - DEDUCT 1/16" SACRIFICIAL STEEL AROUND FULL PERIMETER
    - PILES IN CONTACT WITH BACKFILL - THREE-COAT PAINT SYSTEM, GALVANIZING, OR EPOXY COATING
    - WHERE PROTECTIVE COATING IS REQUIRED, GALVANIZING IS PREFERRED.

    PROVIDE THREE-COAT PAINT SYSTEM IN ACCORDANCE WITH SECTION 1060 OF PUB.408. PROVIDE GALVANIZING IN ACCORDANCE WITH SECTION 1105.02(s) OF PUB.408. PROVIDE EPOXY COATING IN ACCORDANCE WITH SECTION 1092 OF PUB.408.
10. DO NOT USE STEEL BARS FOR ANCHORS WITH BOTTOM UP INSTALLATION DUE TO POTENTIAL DAMAGE FROM SETTLEMENT, UNLESS APPROVED BY THE CHIEF BRIDGE ENGINEER.
11. INDICATE ON THE DESIGN DRAWINGS "ANCHOR DESIGN LOAD". USE SER-I LIMIT STATE TO DETERMINE THE ANCHOR DESIGN LOAD. THE PERFORMANCE TEST LOAD IS DEFINED AS A MULTIPLIER (1.33) TIMES THE ANCHOR DESIGN LOAD. ANCHOR DESIGN LOAD WILL NOT EXCEED 0.6 GUARANTEED ULTIMATE TENSILE STRENGTH (GUTS) AND ANCHOR PROOF TEST LOAD WILL NOT EXCEED 0.8 GUTS.
12. LOCK-OFF LOAD SHALL NOT BE LESS THAN 50% OF THE ULTIMATE TENSILE STRENGTH OF THE STRANDS. IF ADDITIONAL STRANDS ARE REQUIRED FOR REDUNDANCY, A MINIMUM OF 40% OF THE ULTIMATE TENSILE STRENGTH OF THE STRANDS MAY BE USED. IN ANY CASE, THE STRANDS AND ANCHOR ASSEMBLY (INCLUDING WEDGES) ARE CLEANED OF ANY CONTAMINANTS IMMEDIATELY BEFORE LOCK-OFF, AND THE STRANDS AND WEDGES ARE CLEANED, GREASED, AND CAPPED WITHIN 48 HOURS AFTER LOCK-OFF.
13. FOR BOTTOM UP INSTALLATION, BACKFILL UP TO A MINIMUM HEIGHT OF 4′ ABOVE THE ANCHOR LOCATION, OR AS REQUIRED TO DEVELOP SUFFICIENT PASSIVE PRESSURE PRIOR, TO ANCHOR INSTALLATION AND STRESSING.
14. REQUIRE ADDITIONAL CLEAR CONCRETE COVER TO REINFORCEMENT BARS TO ACCOUNT FOR IMPRESSIONS OF AESTHETIC SURFACE TREATMENT.
15. AFTER PLACEMENT OF CEMENT CONCRETE IN CONCRETE EMBEDMENT, PLACE LEAN CEMENT CONCRETE OR FLOWABLE FILL IN REMAINDER OF DRILLED HOLE UP TO TOP OF GROUND. REMOVE LEAN CEMENT CONCRETE OR FLOWABLE FILL DURING EXCAVATION TO PLACE TIMBER LAGGING. [FOR TOP DOWN INSTALLATION] FLOWABLE FILL PER PUB 408 SECTION 220.2, TYPE A OR B.
16. DESIGN FOR THE PRESENCE OF WATER BEHIND THE WALL AS REQUIRED BY SITE CONDITIONS AND DRAINAGE. DRAINS ARE TO OUTLET AT MAXIMUM INTERVALS OF 100′.
17. IF CAST-IN-PLACE CAP BEAM IS USED, CONSTRUCT THE CAP BEAM AFTER LOCK OFF OF ANCHORS.
18. IF PRECAST LAGGING IS USED, LOCK OFF ANCHORS PRIOR TO INSTALLATION.
19. UNLESS SPECIFICALLY REQUIRED TO ADDRESS DRAINAGE NEEDS FOR SPECIFIC SITE CONDITIONS AVOID PLACEMENT OF INLETS, UTILITY HOLES, AND DRAINAGE FACILITIES IN THE BACKFILL OF THE ANCHORED WALL TO AVOID DAMAGE TO ANCHORS DUE TO INSTALLATION OR MAINTENANCE ACTIVITIES.
20. EVALUATE ACCESSIBILITY OF DRILLING RIG TO PILE LOCATIONS. ENSURE THAT A RELATIVELY LEVEL AREA CAN BE ACCOMMODATED ADJACENT TO THE PILE LOCATIONS FOR DRILLING OPERATIONS.
21. USE REDUCED SECTION PROPERTIES AT OPENINGS FOR ANCHOR PENETRATIONS IN THE PILE SECTIONS AT ANCHOR LOCATIONS.
22. SIZE TIMBER LAGGING IN ACCORDANCE WITH CONSTRUCTION HANDBOOK FOR BRIDGE TEMPORARY WORKS BY AASHTO.
23. DESIGN CONCRETE AND REINFORCEMENT FOR A TEST LOAD OF 125% TO 150% OF UNFACTORED LOAD PER AASHTO ARTICLE 11.9.8.1 IN ADDITION TO THE STRENGTH CONDITION. FOR SINGLE PILE W/C.I.P. WALL AND COLUMN ALTERNATIVE, DESIGNER MUST EVALUATE BOTH A MINIMUM AND MAXIMUM STRUCTURAL BACKFILL DENSITY TO LIMIT WALL DEFLECTION TOWARDS BACKFILL DUE TO ANCHOR STRESSING OPERATIONS. INCLUDE STRUCTURAL BACKFILL DENSITY RANGE ON CONTRACT DRAWINGS AND SPECIAL PROVISIONS.

GENERAL ANCHOR WALL DESIGN METHODOLOGY

1. ESTABLISH PROJECT REQUIREMENTS INCLUDING ALL GEOMETRY, EXTERNAL LOADING CONDITIONS (TEMPORARY AND/OR PERMANENT, ETC.), CONSTRUCTION CONSTRAINTS AND PERFORMANCE CRITERIA IN ACCORDANCE WITH THE SPECIAL PROVISIONS.
2. EVALUATE SITE SUBSURFACE CONDITIONS AND RELEVANT PROPERTIES OF IN SITU SOIL AND ROCK.
3. ESTABLISH ANCHOR INCLINATION ANGLES. INCLINE ANCHORS TO MINIMIZE ANCHOR LENGTH, TO AVOID UTILITIES AND OTHER UNDERGROUND OBSTRUCTIONS, TO STAY WITHIN RIGHT-OF-WAY, AND TO OPTIMIZE ANCHOR FORCE.
4. DETERMINE EARTH PRESSURE DISTRIBUTIONS, INCLUDING SURCHARGES, FOR WALL WITH APPROPRIATE LOAD FACTORS AND LIMIT STATES AS PER DESIGN MANUAL PART 4 AND THIS STANDARD. RESISTING PASSIVE PRESSURE BEGINS AT BOTTOM OF WALL.
5. EVALUATE GLOBAL STABILITY FOR ANCHORED SYSTEM USING LIMIT EQUILIBRIUM ANALYSES. REVISE ANCHOR GEOMETRY IF NECESSARY.
6. FOR ANALYSIS AND DESIGN OF WALL ELEMENTS, EMBEDMENT DEPTHS AND ANCHOR FORCES, USE EITHER AASHTO METHOD OR TWO DIMENSIONAL BEAM FINITE ELEMENT COMPUTER MODEL.
7. DESIGN WALL ELEMENTS FOR THE RESULTING FORCES (MOMENT, SHEAR AND AXIAL) AND DEFLECTION. WITH THE EXCEPTION OF SINGLE PILE DESIGN W/C.I.P. WALL AND COLUMN ALTERNATIVE, LIMIT DEFLECTION TO A MAXIMUM OF 1" UNLESS THE SENSITIVITY OF ADJACENT STRUCTURES OR FACILITIES REQUIRES A LESSER LIMIT. WALL DEFLECTION IN EXCESS OF 1" IS PERMITTED WITH APPROVAL OF THE CHEIF BRIDGE ENGINEER. INCLUDE MONITORING PROGRAM TO VERIFY THAT DEFLECTION OF ADJACENT STRUCTURES DOES NOT EXCEED 1" LIMIT. DEFLECTION TOWARDS THE BACKFILL FOR SINGLE PILE DESIGN W/C.I.P. WALL AND COLUMN DESIGNS SHALL BE PREVENTED IN ORDER TO AVOID OR REDUCE CRACKING ON EXPOSED FACE.
8. DETERMINE REQUIRED PILE EMBEDMENT OR CONCRETE EMBEDMENT DEPTH FOR SHAFT AND ROCK SOCKET.
9. ESTIMATE NUMBER OF STRANDS OR BAR DIAMETER REQUIRED TO RESIST ANCHOR FORCES. ESTIMATE ANCHOR BOND LENGTH AND PULLOUT CAPACITY. FINAL DETERMINATION OF THE SIZE AND NUMBER OF STRANDS OR BAR DIAMETER, ANCHOR BOND DIAMETER, GROUTING METHOD, GROUTING PRESSURE AND ANCHOR BOND LENGTH IS THE RESPONSIBILITY OF THE ANCHOR SPECIALTY CONTRACTOR.
10. CHECK AXIAL LOAD RESISTANCE OF THE CONCRETE EMBEDMENT OR DRIVEN PILE.
11. CHECK TEMPORARY CONDITIONS (CONSTRUCTION STAGING) FOR THE STR-I LIMIT STATE.
12. CHECK DEFLECTION FOR THE WORST CASE SER-I LIMIT STATES.
13. CHECK WALL COMPONENTS SUCH AS BEARING PLATE ASSEMBLY, CORBEL, AND WALER.
14. CHECK WALL REDUNDANCY AS PER WALL REDUNDANCY PROCEDURE ON SHEET 2.
15. CHECK THAT SUFFICIENT PASSIVE PRESSURE CAN BE DEVELOPED BEHIND THE WALL AT THE UPPERMOST ANCHOR TO RESIST THE ANCHOR TEST LOAD.

BD-627M	MOMENT SLABS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-751M	BRIDGE DRAINAGE
BC-757M	STEEL PILE TIP REINFORCEMENT & SPLICES
RC-12M	BACKFILL AT STRUCTURES
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD ANCHORED WALLS NOTES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

BD-626M

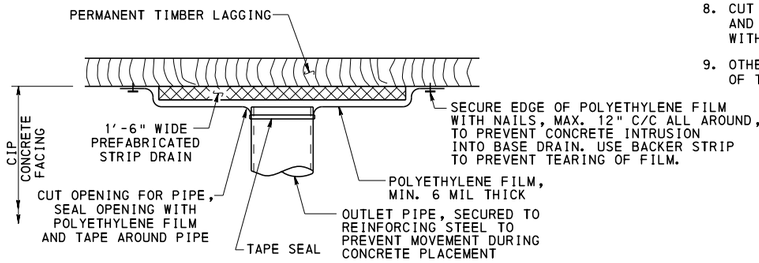
WALL REDUNDANCY

1. ANCHOR LOADS: USE EXT III LIMIT STATE TO DETERMINE ANCHOR REDUNDANCY LOADS ASSUMING ONE ANCHOR FAILS. USE ANCHOR RESISTANCE EQUAL TO ANCHOR PROOF TEST LOAD, 0.8 GUTS.
2. WALL ELEMENTS AND FOUNDATION FOR REDUNDANCY: DESIGN WALL ELEMENTS AND FOUNDATION FOR EXT-III.
3. DEFLECTION CHECKS ARE NOT REQUIRED FOR REDUNDANCY.
4. DESIGN ANCHOR WALL TO PROTECT FROM CATASTROPHIC FAILURE DUE TO THE FAILURE OF ANY ONE ANCHOR AS FOLLOWS:

   a.) WALL WITH CAST-IN-PLACE FACING: DESIGN THE FACING TO DISTRIBUTE LOAD TO ADJACENT SOLDIER PILES AND ANCHORS IN THE EVENT ANY ONE ANCHOR FAILS.

   b.) WALL WITH PRECAST LAGGING: DESIGN A POSITIVE MEANS OF REDUNDANCY IN THE EVENT ANY ONE ANCHOR FAILS USING ONE OR MORE, BUT NOT LIMITED TO, THE FOLLOWING METHODS:

   - PROVIDE CONTINUOUS REINFORCED CAST-IN-PLACE CONCRETE CAP BEAM
   - PROVIDE HORIZONTAL STEEL TIE RODS BETWEEN PILES
   - PROVIDE ADDITIONAL ANCHORS
   - DESIGN ADJACENT ANCHORS TO RESIST ADDITIONAL LOAD REDISTRIBUTED FROM THE FAILED ANCHOR



ALTERNATE FITTING FOR CONNECTION OF PIPE TO STRIP DRAIN

WITH C.I.P. WALL SHOWN, WITH PRECAST LAGGING SIMILAR

TYPICAL LATENT ANCHOR CONSTRUCTION PROCEDURE

LATENT ANCHORS: THE USE OF LATENT ANCHORS MAY BE CONSIDERED FOR STRENGTHENING OR LIMITING DISPLACEMENT OF EXISTING WALLS, WITH OR WITHOUT A NEW CONCRETE BLANKET WALL. THE CASING IS DESIGNED AS A STRUCTURAL MEMBER, TRANSFERING THE ANCHOR LOAD TO THE CASING EMBEDMENT (BOND) LENGTH. THE ANCHOR IS NOT ENGAGED BY THE WALL UNTIL THERE IS A TENDENCY FOR WALL MOVEMENT.

1. DRILL THROUGH WALL, FILL AND INTO THE ROCK TO THE REQUIRED STEEL CASING EMBEDMENT LENGTH. HOLE MUST BE OF SUFFICIENT DIAMETER TO ACCEPT ALL COMPONENTS AND PROVIDE SPECIFIED COVER.
2. FILL HOLE WITH SUFFICIENT GROUT AND PLUNGE CASING TO THE FULL DEPTH OF EMBEDMENT LENGTH TO ENSURE FULL GROUTING OF ANNULAR SPACE BETWEEN CASING AND ROCK.
3. AFTER SUFFICIENT CURE OF THE GROUT, WITH A MINIMUM COMPRESSIVE STRENGTH OF 1000 PSI AND A MINIMUM OF 16 HOURS, DRILL ANCHOR BOND LENGTH, INSTALL ANCHOR, AND PRESSURE GROUT THE BOND LENGTH.
4. INSTALL HOT DIPPED GALVANIZED BEARING PLATE, FIELD WELD THE PLATE TO THE STEEL CASING, AND FIELD GALVANIZE. CLEAN AND FIELD GALVANIZE THE EXPOSED END OF CASING.
5. PRIOR TO TESTING THE ANCHORS, WEDGE THE STEEL CASING IN THE HOLE THROUGH THE WALL TO FIRMLY SECURE IT. AFTER ANCHOR BOND GROUT HAS CURED, PERFORM LOAD TESTS AND PROOF TESTS ON THE ANCHORS AND LOCK OFF LOAD TO THE DESIGN LOAD IN ACCORDANCE WITH THE SPECIAL PROVISIONS. JACK AGAINST BEARING PLATE. DO NOT APPLY JACKING LOADS TO THE WALL.
6. GROUT THE STEEL CASING UNTIL GROUT EMERGES FROM END OF CASING. GROUT ANNULAR SPACE BETWEEN CASING AND THE WALL.
7. CONSTRUCT ANCHOR CORBELS. ENSURE FULL CONSOLIDATION OF CONCRETE BEHIND BEARING PLATE.
8. CUT EXCESS TENDON LENGTH. INSTALL GREASE FILLED GALVANIZED CAP, AND CAULK JOINT BETWEEN BEARING PLATE AND CONCRETE ON ALL SIDES WITH APPROVED ELASTOMERIC CAULKING COMPOUND.
9. OTHER METHODS OF CONSTRUCTION MAY BE CONSIDERED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.

LIMIT STATES AND LOADING

1. USE THE FOLLOWING LOAD FACTORS:

	LOAD FACTORS FOR ANCHOR WALL DESIGNS					
	LOAD TYPES					
LIMIT STATE	DC	DD	DW	EH	LS	LL
STR-I **	1.25	1.25	1.50	1.35	1.75	1.75
EXT-III *	1.25	1.25	1.50	1.05	1.15	1.15
SER-I	1.00	1.00	1.00	1.00	1.00	1.00

* - FOR REDUNDANCY ANALYSIS

** - USE A LOAD FACTOR FOR EH = 1.5 FOR DIFFICULT GEOLOGY, SUCH AS AREAS PRONE TO LANDSLIDES

DC - SELF WEIGHT OF WALL COMPONENTS AND VERTICAL COMPONENT OF ANCHOR LOAD

DD - DOWNDRAG ACTING UPON DRILLED CAISSON OR PILE PER DESIGN MANUAL PART 4.

DW - WEIGHT OF ATTACHED UTILITIES AND WEIGHT OF WALL-SUPPORTED MOMENT SLAB

EH - HORIZONTAL EARTH PRESSURE PER DESIGN MANUAL PART 4.

LS - LIVE LOAD SURCHARGE PER DESIGN MANUAL PART 4.

LL - LIVE LOAD TRANSMITTED DIRECTLY TO STRUCTURE FROM WALL-SUPPORTED MOMENT SLAB (DOES NOT INCLUDE IMPACT)

NOTE 1: EH LOADS MAY HAVE VERTICAL AND HORIZONTAL COMPONENTS ACTING SIMULTANEOUSLY.

2. LIMIT STATE DESCRIPTIONS:

STR-I BASIC LOAD COMBINATION FOR DESIGN OF ANCHOR WALL ELEMENTS AND FOUNDATION ELEMENTS.

EXT-III REDUNDANCY LOAD COMBINATION FOR DESIGN OF ANCHOR WALL ELEMENTS AND FOUNDATION (USE THIS LIMIT STATE WITH OR WITHOUT GLOBAL STABILITY LOAD CONSISTENT WITH THE GOVERNING STRENGTH LIMIT STATE)

SER-I BASIC LOAD COMBINATION FOR DEFLECTION CHECK AND ANCHOR DESIGN

WALL ELEMENTS CONSIST OF SOLDIER PILE, CONCRETE EMBEDMENT, LAGGING, WALER, WALL FACING, CORBEL, AND BEARING PLATE ASSEMBLY.

FOUNDATION ELEMENTS CONSIST OF SIDE RESISTANCE AND BEARING STRESS OF CONCRETE EMBEDMENT AND PILES.

ANCHOR DESIGN CONSISTS OF STRAND SELECTION AND BOND ZONE.

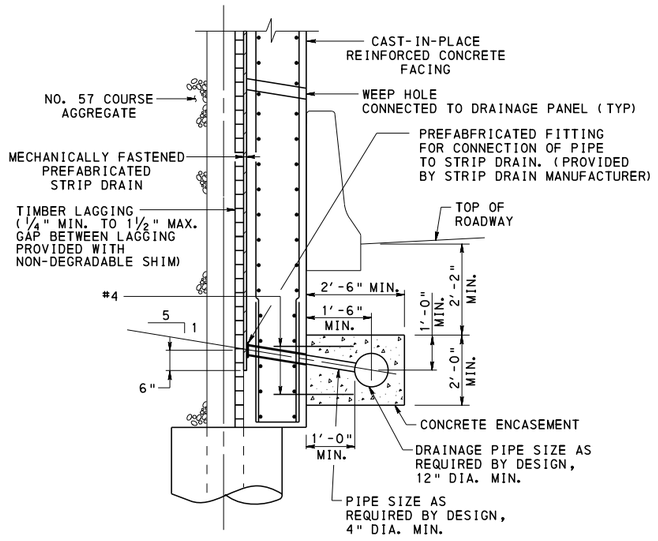
DEFLECTION CHECK IS FOR HORIZONTAL WALL DISPLACEMENTS.

3. ANCHOR RESISTANCE:

ANCHOR LOAD RESISTANCE	
SER-I	0.6 GUTS
STR-I	0.75 GUTS
EXT-III	0.8 GUTS

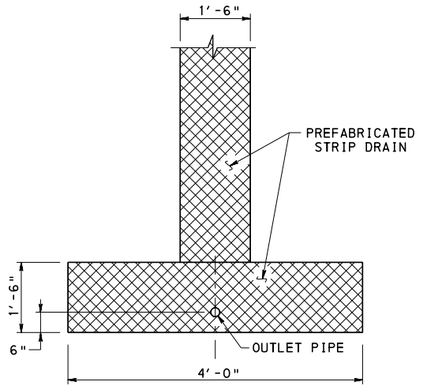
GUTS - GUARANTEED ULTIMATE TENSILE STRENGTH

RESISTANCE FACTORS: USE RESISTANCE FACTORS FOR WALL ELEMENTS AND FOUNDATION ELEMENTS IN ACCORDANCE WITH AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AS SUPPLEMENTED BY DESIGN MANUAL 4.



SECTION AT DRAINAGE PANEL

WITH C.I.P. WALL SHOWN, WITH PRECAST LAGGING SIMILAR



ELEVATION AT DRAINAGE PANEL

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

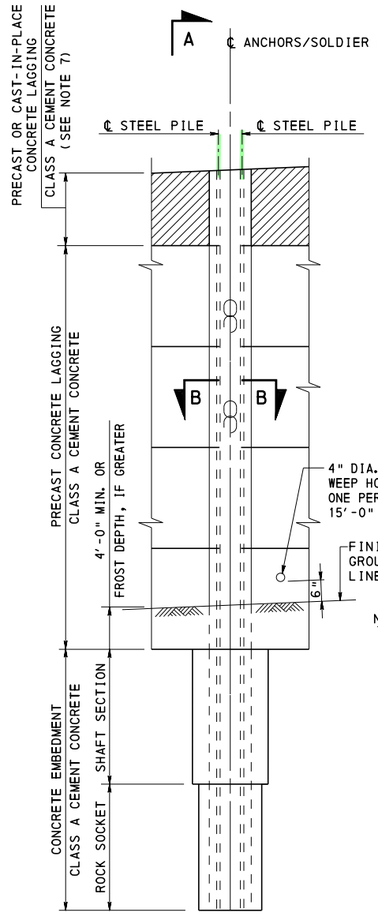
STANDARD
ANCHORED WALLS
NOTES AND DRAINAGE DETAILS

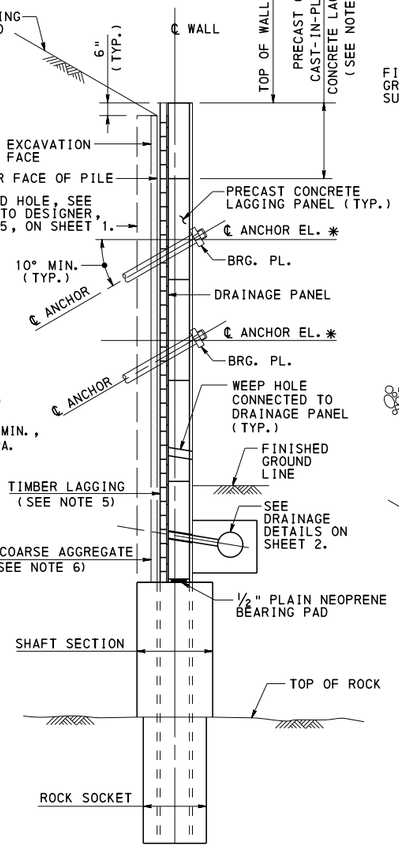
RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

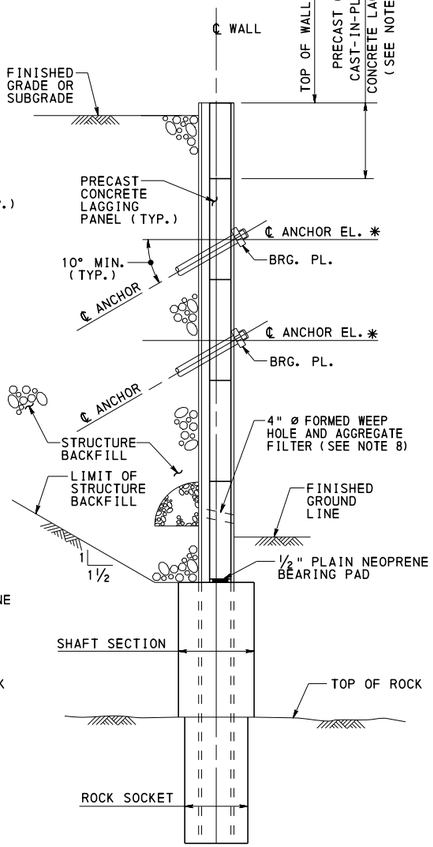
SHEET 2 OF 9

BD-626M

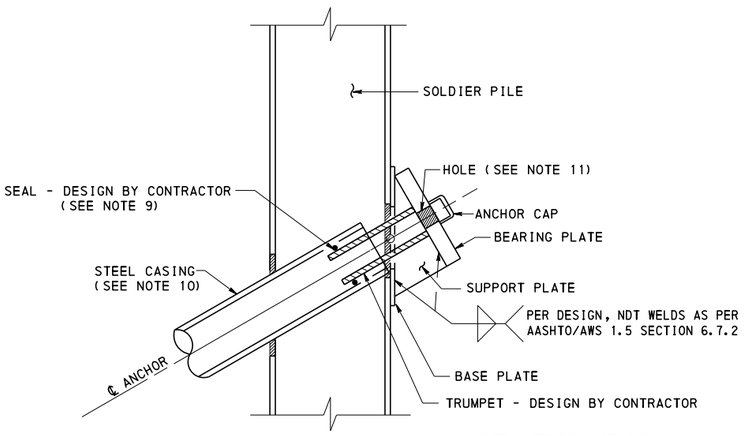




SECTION A-A
TOP DOWN INSTALLATION

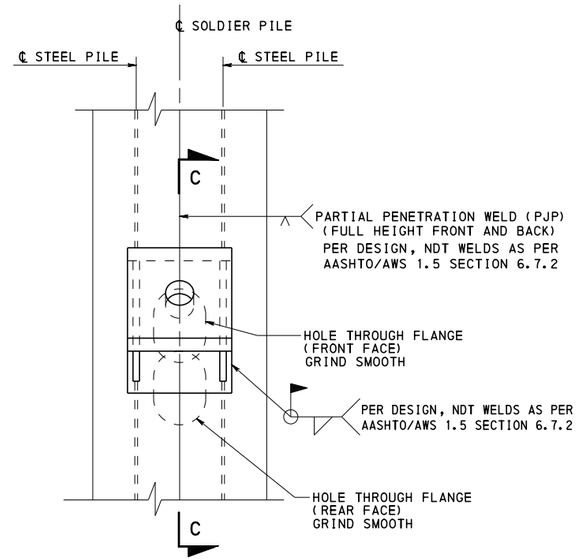


SECTION A-A
BOTTOM UP INSTALLATION



NOTE: TENDON NOT SHOWN FOR CLARITY

SECTION C-C



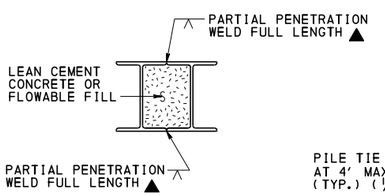
ELEVATION

ANCHORAGE DETAIL

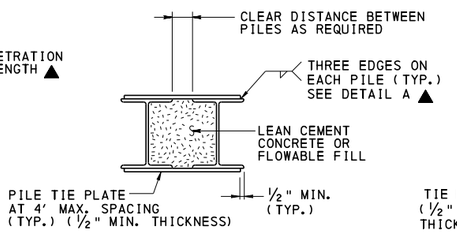
(CONTINUOUSLY WELD PILES SHOWN, TIE PLATED PILES SIMILAR)

DOUBLE PILE DESIGN W/PRECAST LAGGING

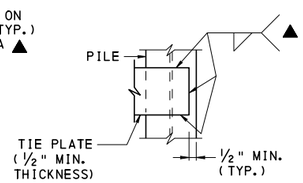
TOP DOWN & BOTTOM UP INSTALLATION



◑ SECTION B-B
CONTINUOUSLY WELDED PILES



◑ SECTION B-B
TIE PLATED PILES
(PREFERRED ALTERNATE)



DETAIL A

▲ - WELD PER DESIGN, NDT WELDS AS PER AASHTO/AWS 1.5 SECTION 6.7.2

◑ - WALL AND LAGGING NOT SHOWN FOR CLARITY (SEE TYPICAL SECTION AT PRECAST LAGGING ON SHEET 4.

LEGEND:

*	VALUE TO BE PROVIDED ON DESIGN DRAWINGS
EF	EACH FACE
FF	FRONT FACE
RF	REAR FACE
CIP	CAST IN PLACE

NOTES:

1. FOR PRECAST CONCRETE LAGGING DETAILS SEE SHEET 4.
2. FOR CONCRETE EMBEDMENT DETAILS SEE SHEET 9.
3. FOR ADJACENT ROADWAY AND DRAINAGE DETAILS SEE SHEET 9.
4. FOR ANCHOR DETAILS SEE SHEET 8.
5. PROVIDE ADEQUATE SHORING (TIMBER LAGGING) BEHIND SOLDIER PILES TO RETAIN EXCAVATION FACE AS EXCAVATION PROCEEDS.
6. PROVIDE NO. 57 COARSE AGGREGATE TO FILL ANY GAPS BETWEEN TIMBER LAGGING AND EXCAVATION FACE.
7. USE CAST-IN-PLACE LAGGING WHERE TOP OF WALL IS SLOPED. PRECAST LAGGING MAY BE USED FOR STEPPED TOP OF WALL.
8. FOR WEEP HOLE AND AGGREGATE FILTER DETAILS AND ALTERNATE DRAINAGE DETAILS SEE BC-751M.
9. PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND STEEL CASING FOR ANCHOR DESIGNS WITH PERMANENT STEEL CASINGS. PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND PLASTIC SHEATH FOR ANCHOR DESIGNS WITHOUT PERMANENT STEEL CASINGS.
10. DETAILS WITH PERMANENT STEEL CASING ARE SHOWN. DETAILS ARE SIMILAR WHERE PERMANENT CASING IS NOT REQUIRED AND SHEATHING EXTENDS INTO TRUMPET.
11. HOLE DIAMETER WILL BE DEPENDENT ON THE SELECTED ANCHORHEAD (WEDGE PLATE).

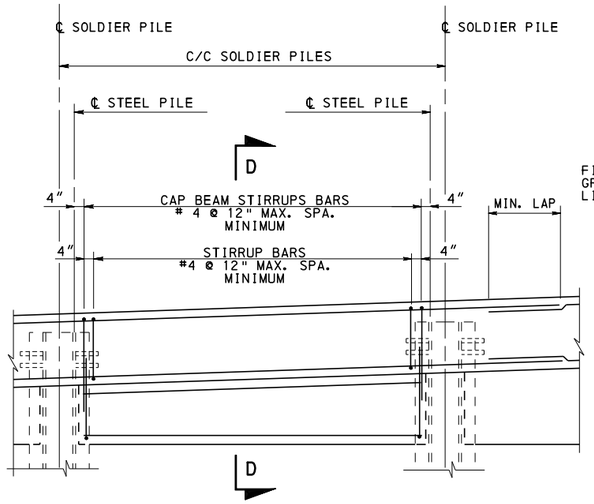
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

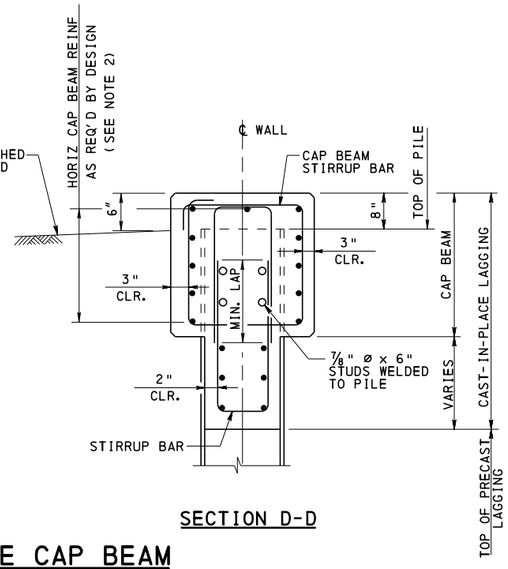
ANCHORED WALLS

DOUBLE PILE DESIGN W/PRECAST LAGGING

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 3 OF 9
		BD-626M



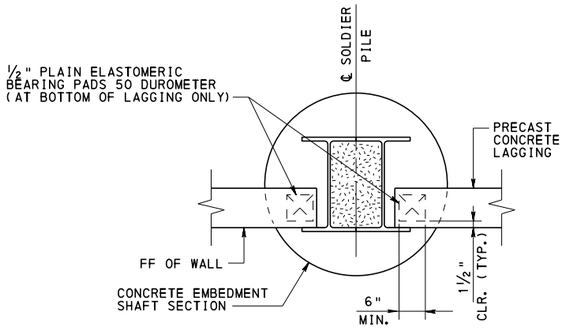
ELEVATION



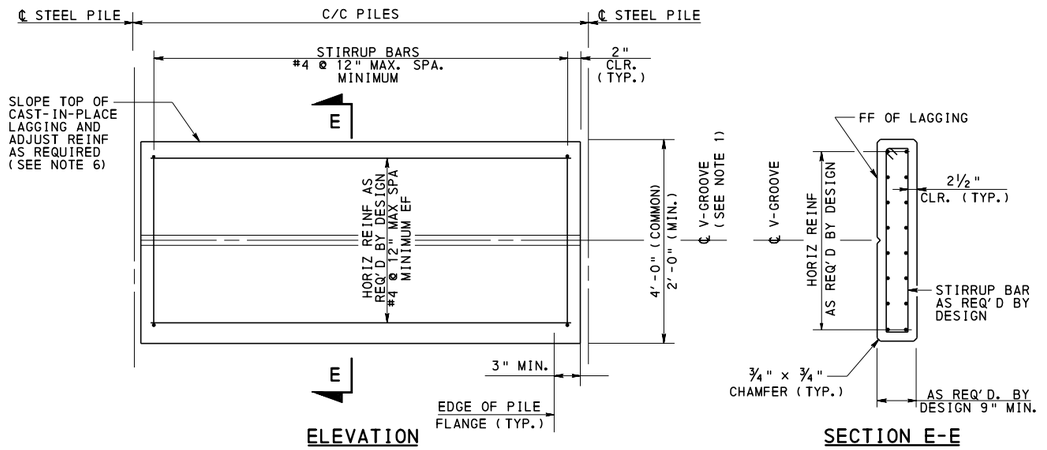
SECTION D-D

CAST-IN-PLACE CAP BEAM

FOR USE OF CAP BEAM FOR REDUNDANCY
(SEE NOTE 2)



BEARING PAD DETAIL

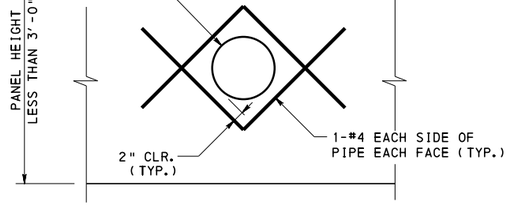


ELEVATION

SECTION E-E

PRECAST AND CAST-IN-PLACE CONCRETE LAGGING

(SEE NOTES 3 AND 6)



WEEP HOLE REINFORCEMENT DETAIL

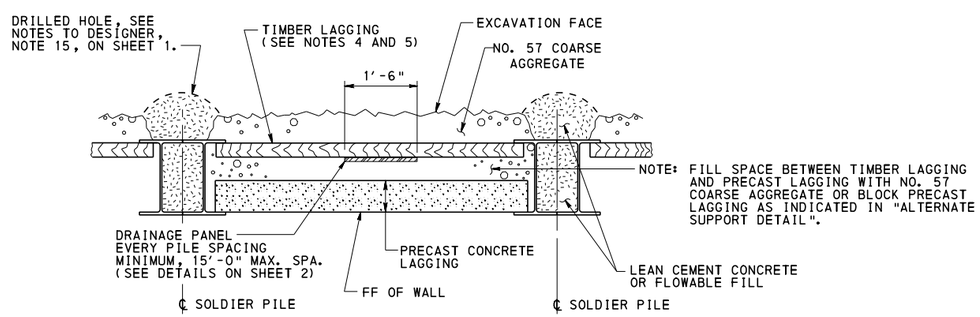
- REINFORCE WEEP HOLES WITH #4 ON EACH FACE PLACED IN A FASHION AS SHOWN.
- LOCATION OF STRUCTURE FOUNDATION DRAINS AND WEEP HOLES MUST BE SHOWN ON THE CONTRACT PLANS.

NOTES:

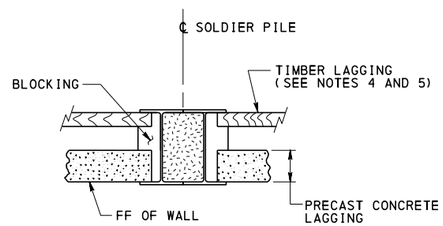
1. PROVIDE A V-GROOVE MID-DEPTH IF DESIRED FOR APPEARANCE.
2. IF CAP BEAM IS USED FOR REDUNDANCY, DESIGN FOR REDUNDANCY FORCES; OTHERWISE DESIGN FOR APPLICABLE EARTH PRESSURES.
3. IF PRECAST CONCRETE LAGGING IS NOT FULLY DETAILED ON THE DESIGN DRAWINGS (NO REINFORCEMENT BAR SCHEDULE), THAN THE CONTRACTOR IS REQUIRED TO SUBMIT SHOP DRAWINGS FOR ACCEPTANCE PRIOR TO FABRICATION.
4. PROVIDE TIMBER FOR TIMBER LAGGING IN ACCORDANCE WITH SECTION 1031.2(a) OF PUB. 408.
5. ALL TIMBER LAGGING IS TO REMAIN IN PLACE FOR THE FINAL CONSTRUCTION.
6. USE CAST-IN-PLACE LAGGING WHERE TOP OF WALL IS SLOPED. PRECAST LAGGING MAY BE USED FOR STEPPED TOP OF WALL.

LEGEND:

EF EACH FACE
FF FRONT FACE
RF REAR FACE



TYPICAL SECTION AT PRECAST LAGGING



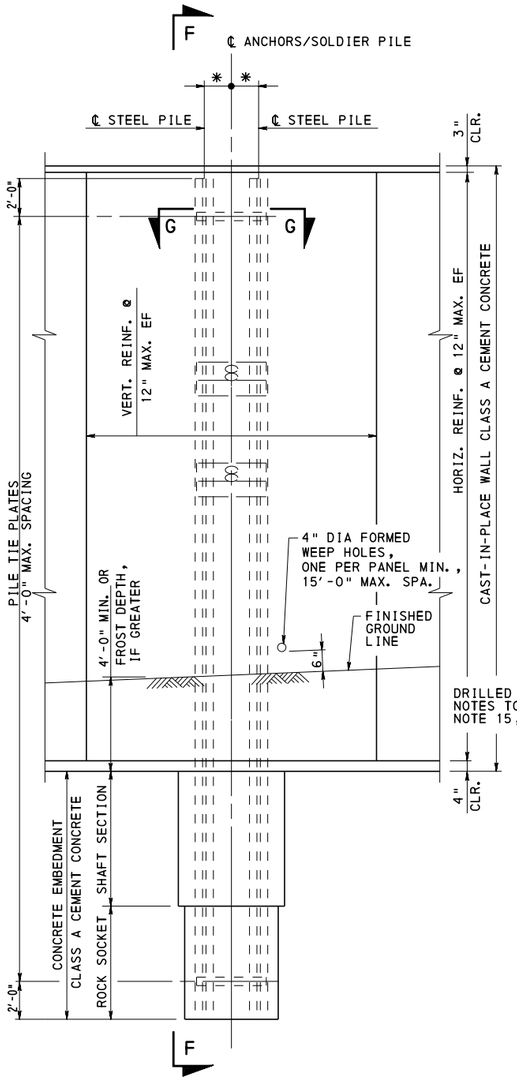
ALTERNATE SUPPORT DETAIL

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

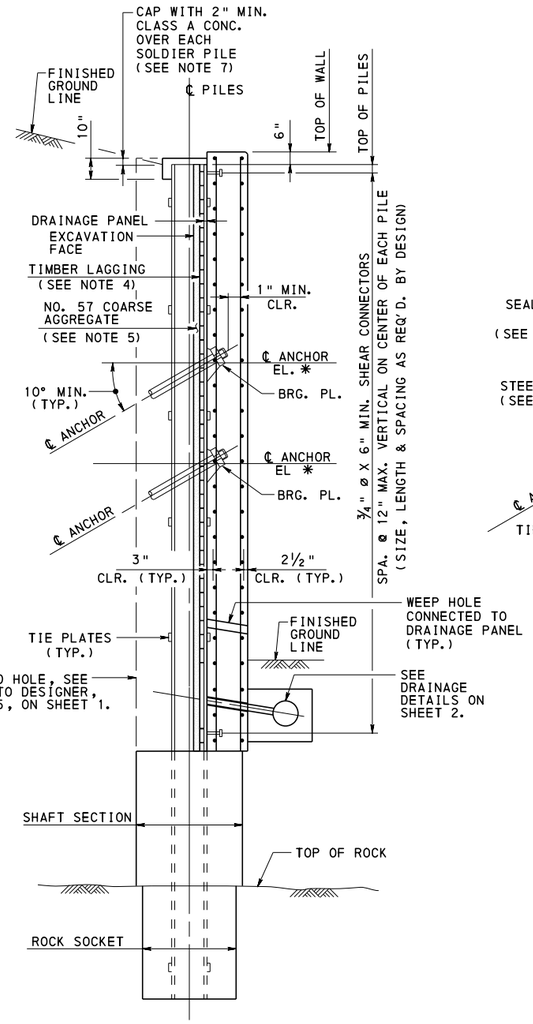
STANDARD

ANCHORED WALLS
DOUBLE PILE DESIGN WITH
PRECAST LAGGING

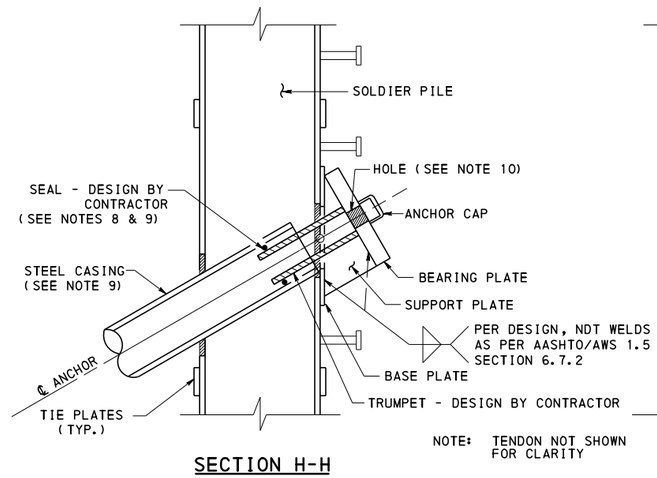
RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 4 OF 9
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-626M



WALL ELEVATION

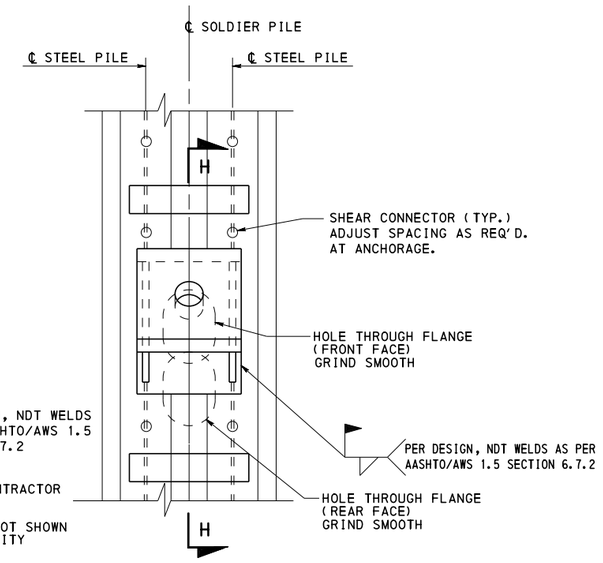


SECTION F-F



SECTION H-H

NOTE: TENDON NOT SHOWN FOR CLARITY



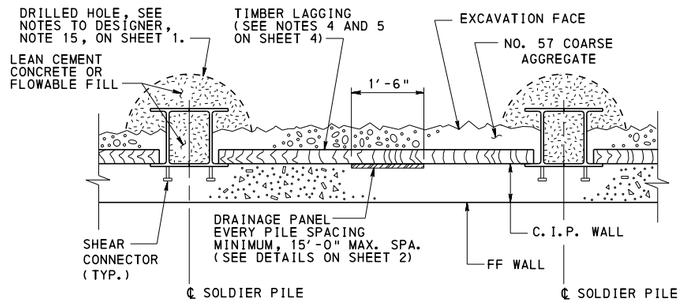
ELEVATION

ANCHORAGE DETAIL

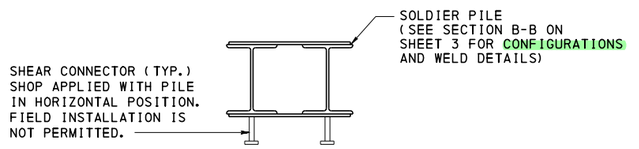
(TIE PLATED PILES SHOWN, CONTINUOUSLY WELD PILES SIMILAR)

DOUBLE PILE DESIGN W/CIP WALL

TOP DOWN INSTALLATION



TYPICAL SECTION AT C.I.P. WALL



SECTION G-G

WALL AND LAGGING NOT SHOWN FOR CLARITY
(SEE TYPICAL SECTION AT C.I.P. WALL ON THIS SHEET)

NOTES:

1. FOR CONCRETE EMBEDMENT DETAILS SEE SHEET 9.
2. FOR ADJACENT ROADWAY AND DRAINAGE DETAILS SEE SHEET 9.
3. FOR ANCHOR DETAILS SEE SHEET 8.
4. PROVIDE ADEQUATE SHORING (TIMBER LAGGING) BEHIND SOLDIER PILE FLANGES TO RETAIN EXCAVATION FACE AS EXCAVATION PROCEEDS.
5. PROVIDE NO. 57 COARSE AGGREGATE TO FILL ANY GAPS BETWEEN TIMBER LAGGING AND EXCAVATION FACE.
6. FOR DOUBLE PILE DESIGN WITH C.I.P. WALL, EITHER PILE CONFIGURATION SHOWN IN SECTION C-C ON SHEET 3 MAY BE USED.
7. CONCRETE CAP OVER PILE MAY BE DETAILED FOR MONOLITHIC PLACEMENT INTEGRAL WITH THE WALL FACING.
8. PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND STEEL CASING FOR ANCHOR DESIGNS WITH PERMANENT STEEL CASINGS. PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND PLASTIC SHEATH FOR ANCHOR DESIGNS WITHOUT PERMANENT STEEL CASINGS.
9. DETAILS WITH PERMANENT STEEL CASING ARE SHOWN. DETAILS ARE SIMILAR WHERE PERMANENT CASING IS NOT REQUIRED AND SHEATHING EXTENDS INTO TRUMPET.
10. HOLE DIAMETER WILL BE DEPENDENT ON THE SELECTED ANCHORHEAD (WEDGE PLATE).
11. FOR WEEP HOLE REINFORCEMENT DETAIL SEE SHEET 6.

LEGEND:

*	VALUE TO BE PROVIDED ON DESIGN DRAWINGS
EF	EACH FACE
FF	FRONT FACE
RF	REAR FACE
CIP	CAST IN PLACE

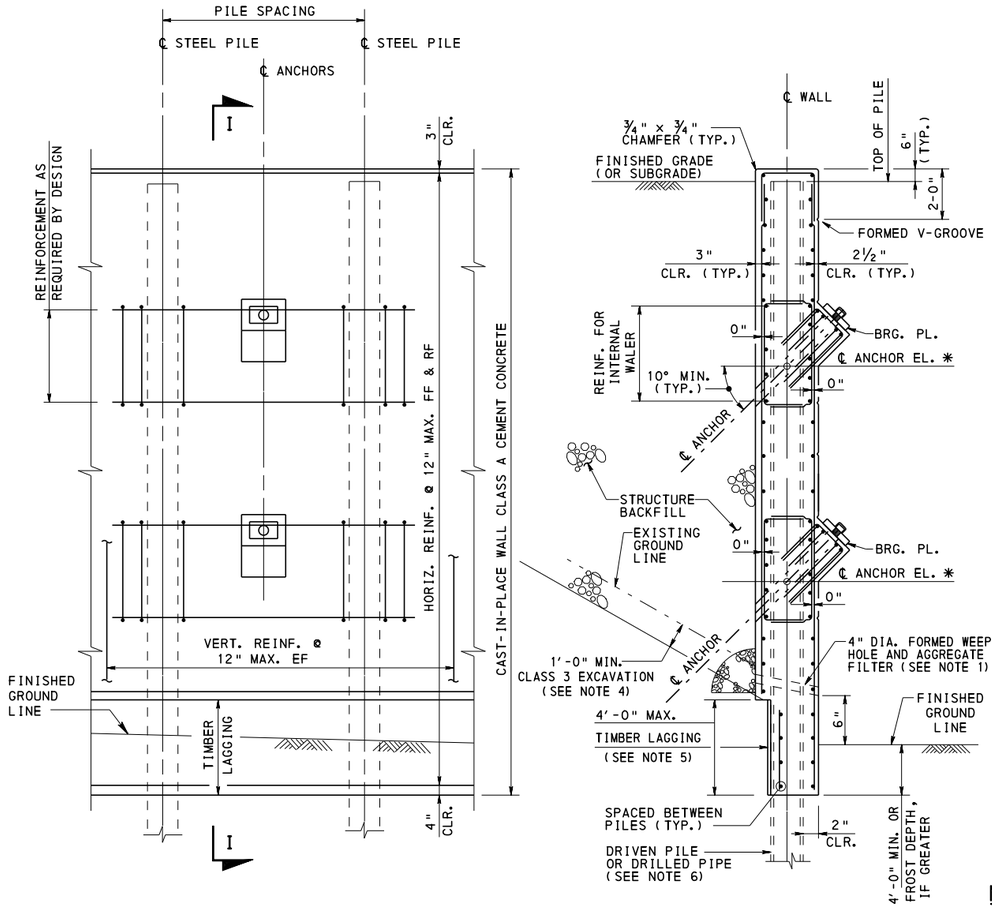
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

ANCHORED WALLS

DOUBLE PILE DESIGN W/CIP WALL

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 5 OF 9 BD-626M



WALL ELEVATION

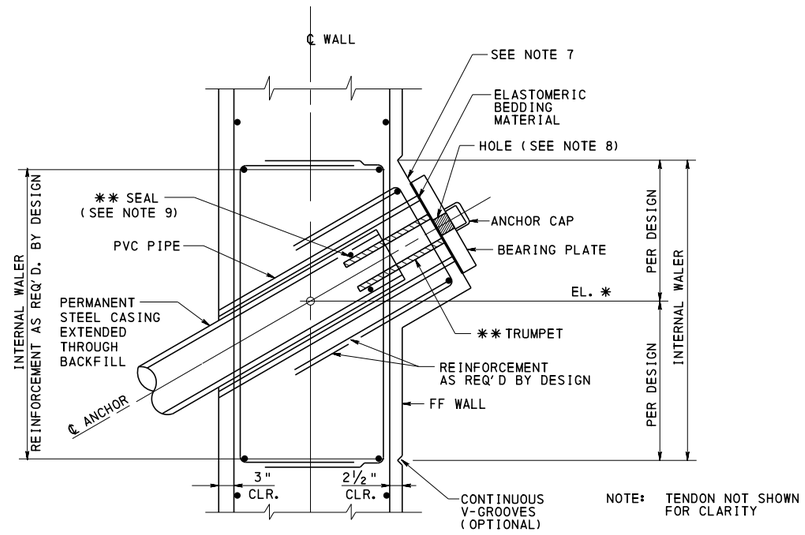
SECTION I-I

SINGLE PILE DESIGN W/ CIP WALL

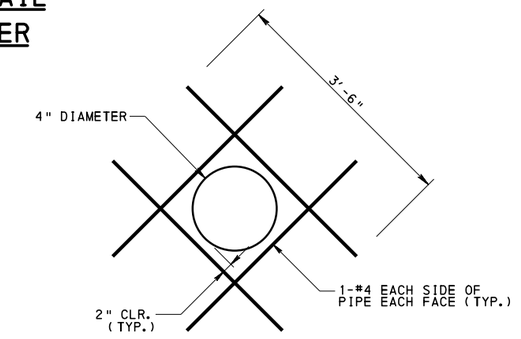
BOTTOM UP INSTALLATION

LEGEND:

*	VALUE TO BE PROVIDED ON DESIGN DRAWINGS
**	CONTRACTOR DESIGN (TO BE NOTED FOR AS-DESIGNED WALLS ONLY)
EF	EACH FACE
FF	FRONT FACE
RF	REAR FACE
CIP	CAST IN PLACE



ANCHORAGE DETAIL
INTERNAL WALER



WEEP HOLE REINFORCEMENT DETAIL

NOTES:

1. REINFORCE WEEP HOLES WITH #4 ON EACH FACE PLACED IN A DIAGONAL FASHION AS SHOWN.
2. LOCATION OF STRUCTURE FOUNDATION DRAINS AND WEEP HOLES MUST BE SHOWN ON THE CONTRACT PLANS.

NOTES:

1. FOR WEEP HOLE AND AGGREGATE FILTER DETAILS AND ALTERNATE DRAINAGE DETAILS SEE BC-751M
2. FOR ADJACENT ROADWAY AND DRAINAGE DETAILS SEE SHEET 9.
3. FOR ANCHOR DETAILS SEE SHEET 8.
4. PLACE CLASS 4, TYPE A GEOTEXTILE BLANKET BETWEEN STRUCTURE BACKFILL AND EXCAVATION AND SUBGRADE IN ACCORDANCE WITH RC-12M.
5. PROVIDE ADEQUATE SHORING (TIMBER LAGGING) BEHIND SOLDIER PILES TO RETAIN EXCAVATION FACE AS EXCAVATION PROCEEDS (IF REQUIRED).
6. CONCRETE EMBEDMENT MAY BE USED INSTEAD OF DRIVEN PILES BASED ON SITE CONDITIONS AND ECONOMY.
7. PROVIDE SURFACE PERPENDICULAR TO CENTERLINE ANCHOR WITHIN 0.3° TOLERANCE. GRIND CONCRETE SURFACE TO REMOVE PROJECTING IRREGULARITIES EXCEEDING 1/32". ENSURE THAT THERE ARE NO ACCUMULATIONS OF ZINC AROUND EDGE OF GALVANIZED BEARING PLATE.
8. HOLE DIAMETER WILL BE DEPENDENT ON THE SELECTED ANCHORHEAD (WEDGE PLATE).
9. PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND STEEL CASING FOR ANCHOR DESIGNS WITH PERMANENT STEEL CASINGS.

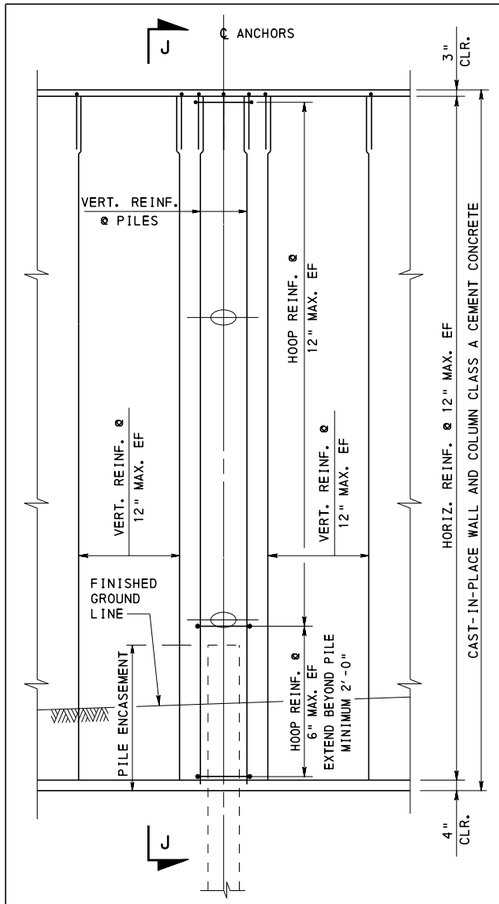
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

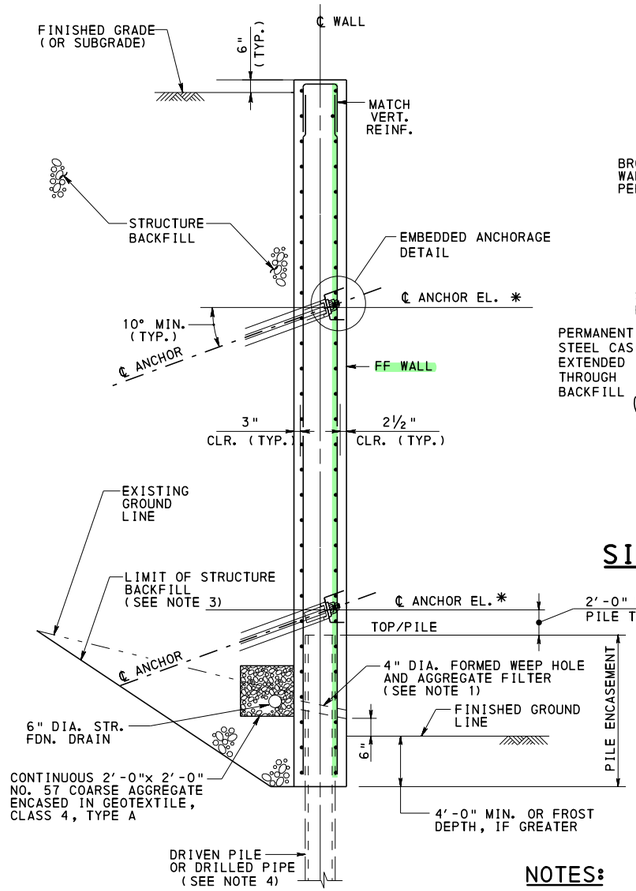
ANCHORED WALLS

SINGLE PILE DESIGN W/CIP WALL

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 6 OF 9
		BD-626M



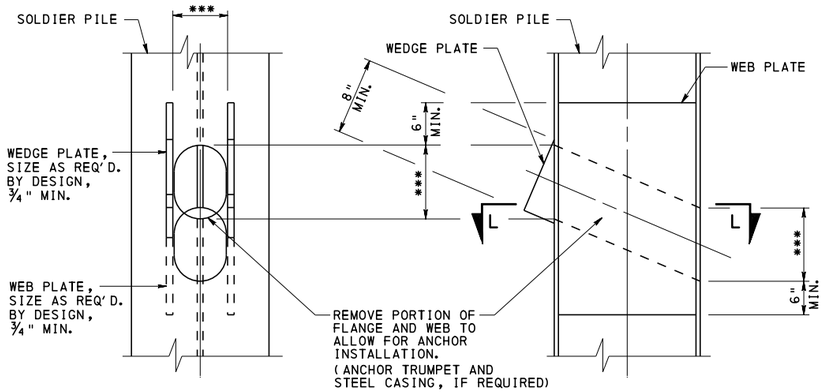
WALL ELEVATION



SECTION J-J

SINGLE PILE DESIGN W/ CIP WALL & COLUMN

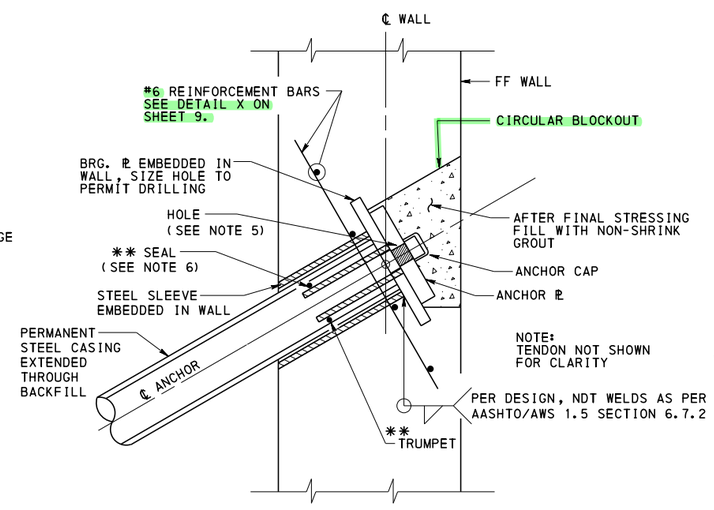
BOTTOM UP INSTALLATION



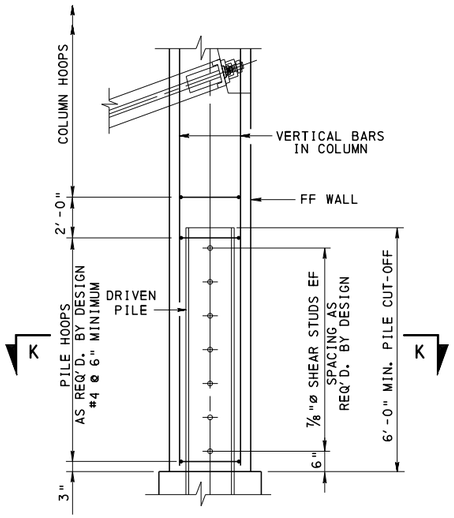
FRONT VIEW SIDE VIEW

THRU-PILE CONNECTION

*** - SPACING AS REQUIRED BY ANCHOR TRUMPET AND STEEL CASING, IF REQUIRED



EMBEDDED ANCHORAGE DETAIL
SINGLE PILE W/CIP WALL AND COLUMN



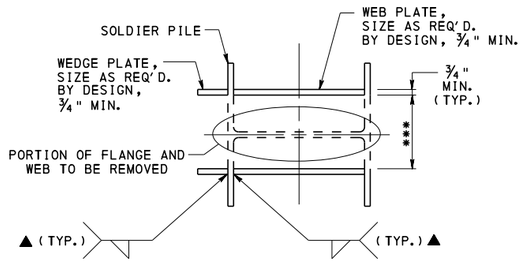
PILE ENCASEMENT DETAIL

LEGEND:

*	VALUE TO BE PROVIDED ON DESIGN DRAWINGS
**	CONTRACTOR DESIGN (TO BE NOTED FOR AS-DESIGNED WALLS ONLY)
EF	EACH FACE
FF	FRONT FACE
RF	REAR FACE
CIP	CAST IN PLACE

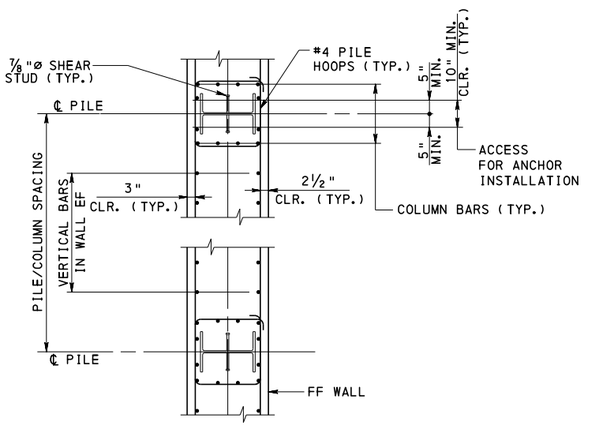
NOTES:

1. FOR WEEP HOLE AND AGGREGATE FILTER DETAILS AND ALTERNATE DRAINAGE DETAILS SEE BC-751M
2. FOR ADJACENT ROADWAY AND DRAINAGE DETAILS SEE SHEET 9.
3. PLACE CLASS 4, TYPE A GEOTEXTILE BLANKET BETWEEN STRUCTURE BACKFILL AND EXCAVATION AND SUBGRADE IN ACCORDANCE WITH RC-12M.
4. PILES WITH CONCRETE EMBEDMENTS MAY BE USED INSTEAD OF DRIVEN PILES BASED ON SITE CONDITIONS AND ECONOMY.
5. HOLE DIAMETER WILL BE DEPENDENT ON THE SELECTED ANCHORHEAD (WEDGE PLATE).
6. PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND STEEL CASING FOR ANCHOR DESIGNS WITH PERMANENT STEEL CASINGS.
7. FOR WEEP HOLE REINFORCEMENT DETAIL SEE SHEET 6.
8. FOR ANCHOR DETAILS SEE SHEET 8.



SECTION L-L

▲ - WELD PER DESIGN, NDT WELDS AS PER AASHTO/AWS 1.5 SECTION 6.7.2



SECTION K-K

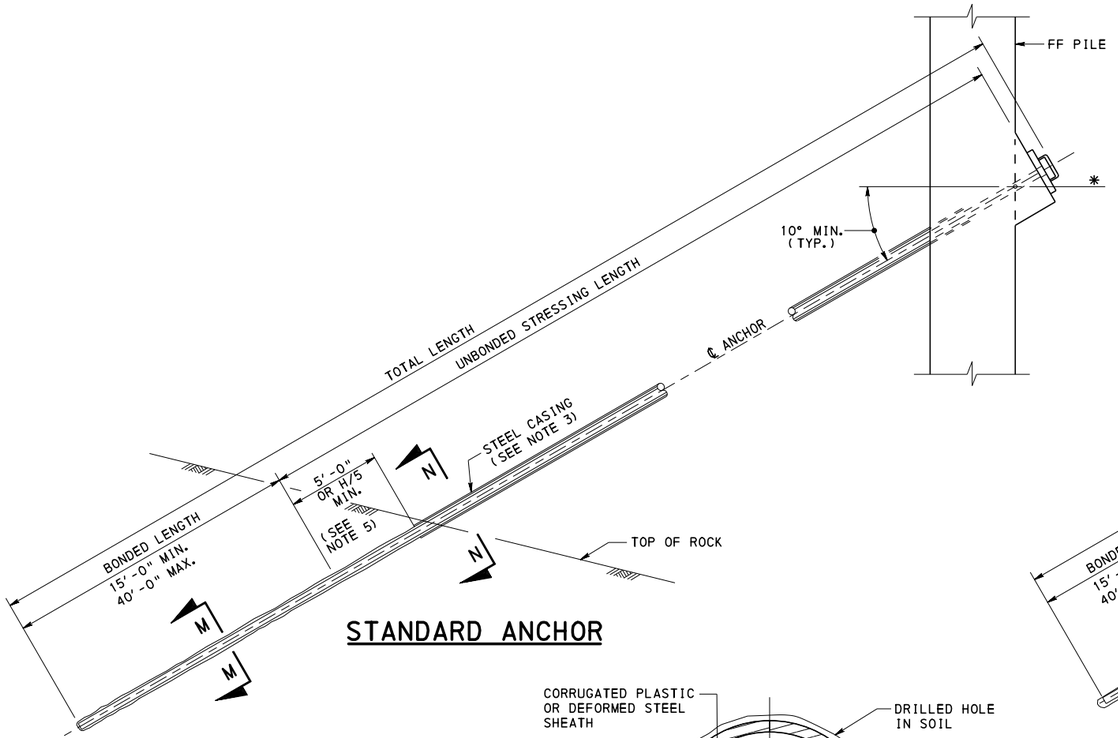
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

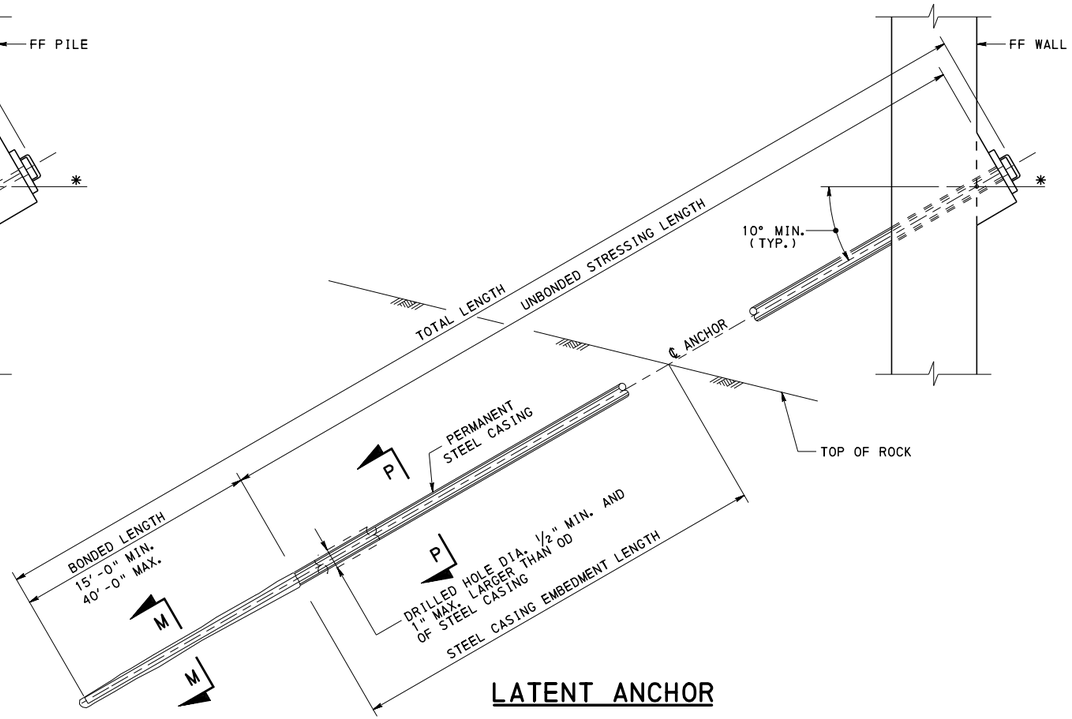
ANCHORED WALLS

SINGLE PILE DESIGN W/CIP WALL & COLUMN THRU-PILE CONNECTION DETAIL

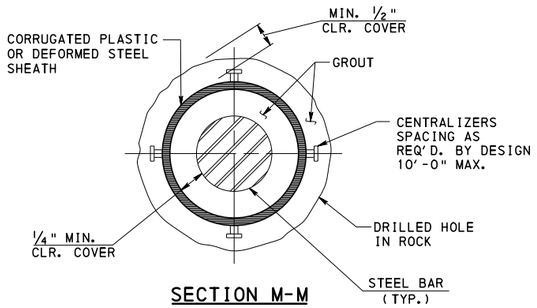
RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 7 OF 9 BD-626M



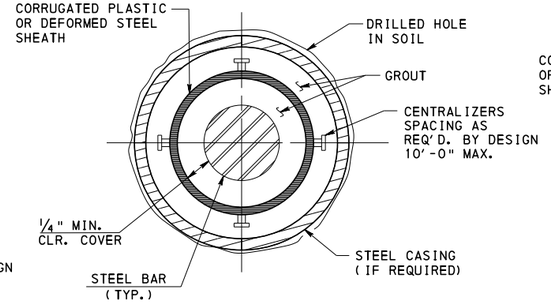
STANDARD ANCHOR



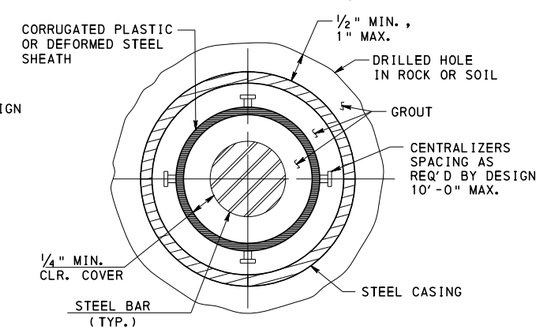
LATENT ANCHOR



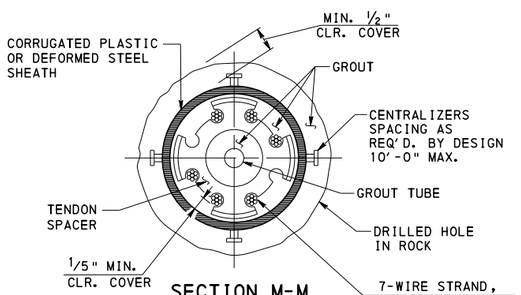
SECTION M-M
BAR TENDON
BONDED LENGTH



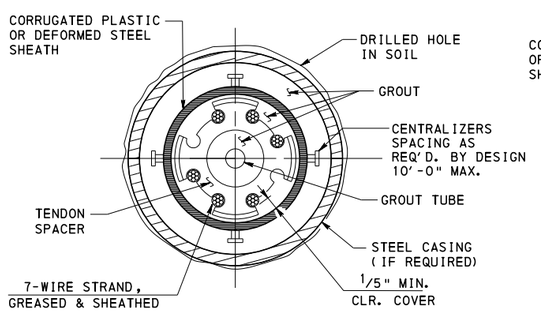
SECTION N-N
BAR TENDON
UNBONDED STRESSING LENGTH
WITH PERMANENT STEEL CASING



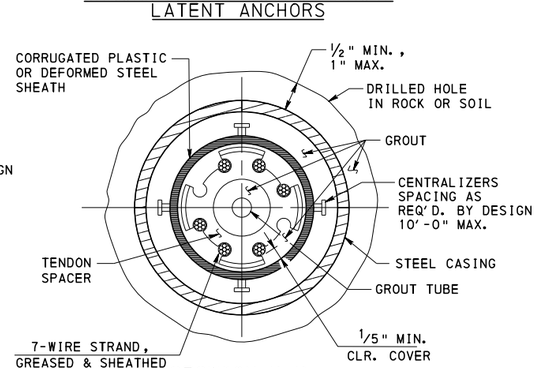
SECTION P-P
BAR TENDON
UNBONDED STRESSING LENGTH
LATENT ANCHORS



SECTION M-M
STRAND TENDON
BONDED LENGTH



SECTION N-N
STRAND TENDON
UNBONDED STRESSING LENGTH
WITH PERMANENT STEEL CASING



SECTION P-P
STRAND TENDON
UNBONDED STRESSING LENGTH
LATENT ANCHORS

NOTES:

1. FOR ANCHORAGE DETAILS, SEE SHEETS 3,5,6,7, AND 9.
2. FOR USE OF LATENT ANCHORS SEE SHEET 2.
3. USE PERMANENT CASING FOR DRILLED ANCHOR HOLES WHERE REQUIRED IN SOILS OR BACKFILL SUBJECT TO CAVING. (STANDARD ANCHOR ONLY)
4. LOCATE UPPER CENTRALIZER A MAXIMUM OF 5' FROM THE TOP OF THE TENDON BOND LENGTH. LOCATE LOWER CENTRALIZER 1' FROM THE BOTTOM OF THE TENDON BOND LENGTH.
5. H = DESIGN HEIGHT OF THE WALL.

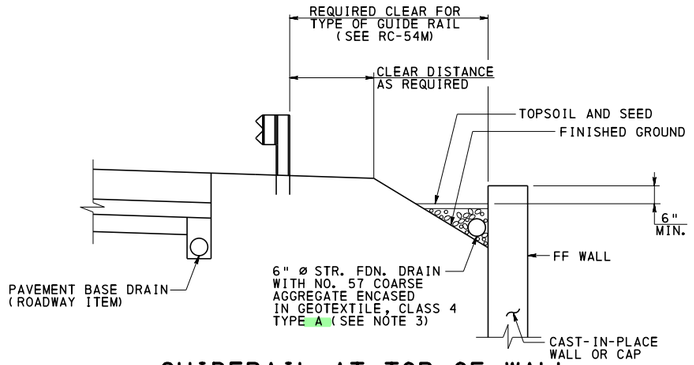
LEGEND:

*	VALUE TO BE PROVIDED ON DESIGN DRAWINGS
EF	EACH FACE
FF	FRONT FACE
RF	REAR FACE
CIP	CAST IN PLACE

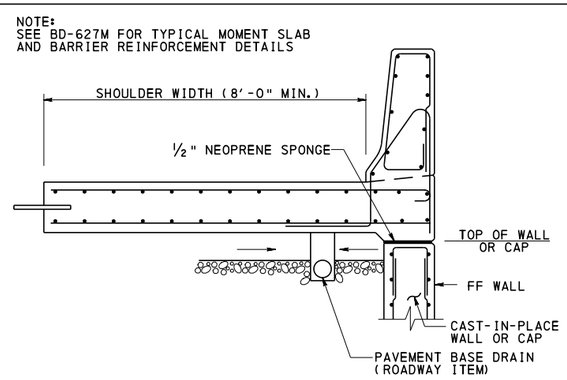
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
ANCHORED WALLS
ANCHOR DETAILS

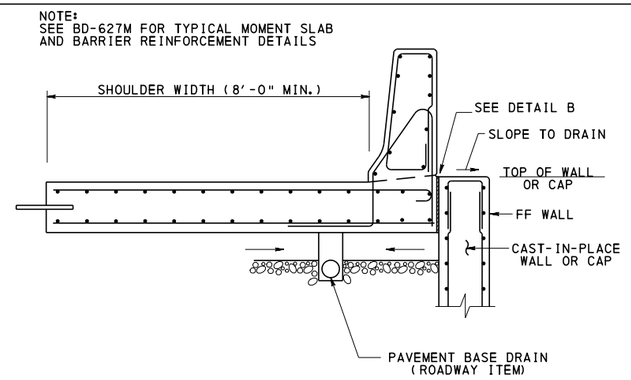
RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 8 OF 9 BD-626M



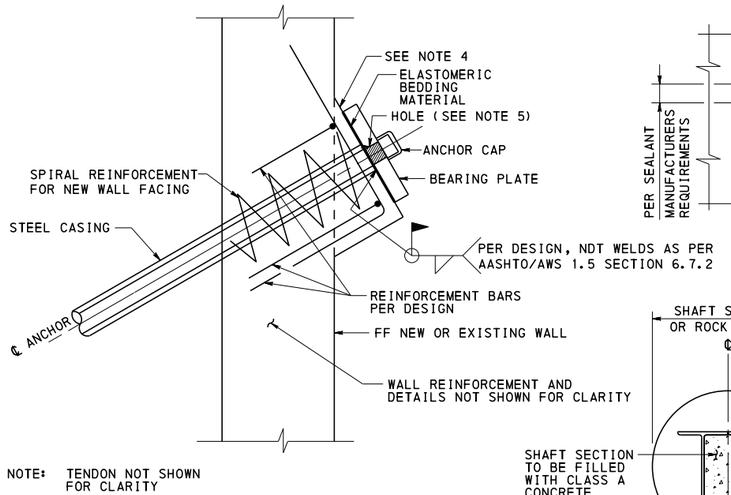
GUIDERAIL AT TOP OF WALL



BARRIER DETAIL 1

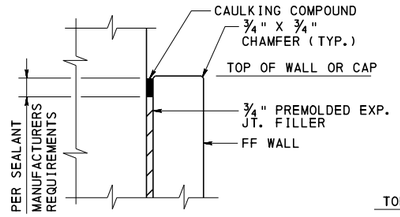


BARRIER DETAIL 2

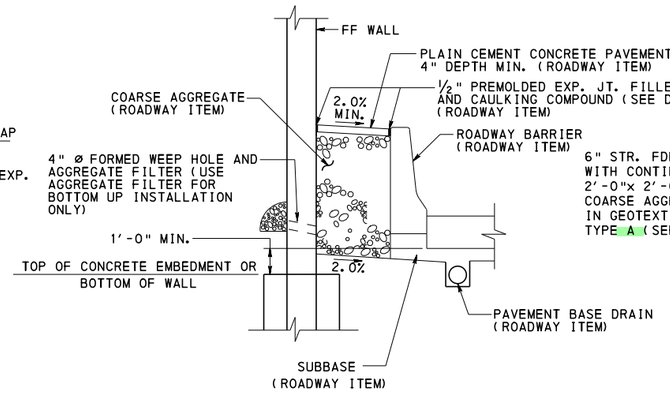


NOTE: TENDON NOT SHOWN FOR CLARITY

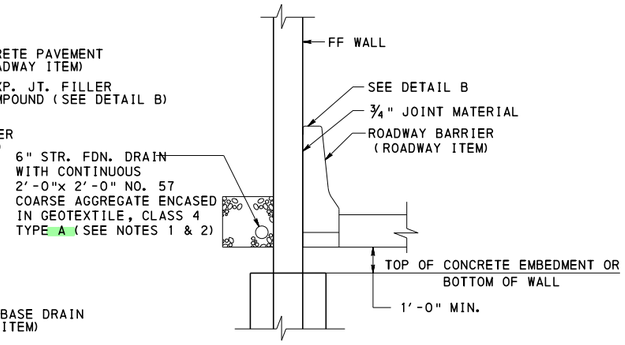
ANCHORAGE DETAIL LATENT ANCHOR



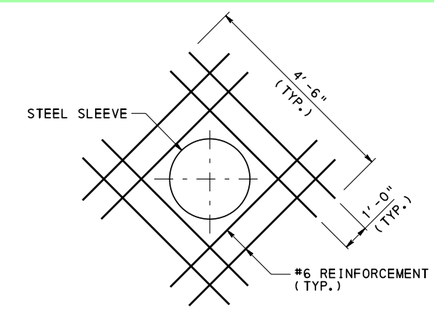
DETAIL B



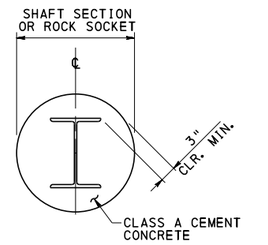
BARRIER DETAIL 3



BARRIER DETAIL 4



DETAIL X - EXTRA WALL REINFORCEMENT AT TENDON ANCHORAGE

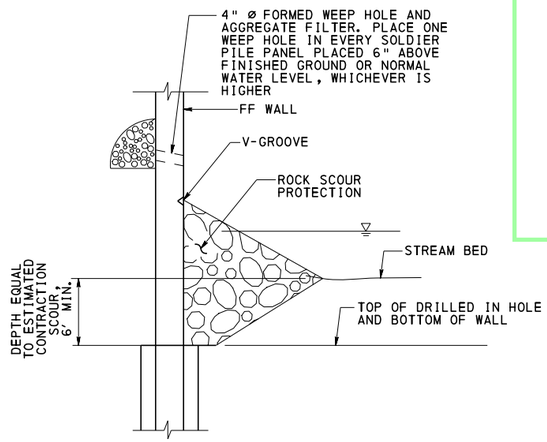


CONCRETE EMBEDMENT SECTION - DOUBLE BEAM

CONCRETE EMBEDMENT SECTION - SINGLE BEAM

NOTES:

1. AS AN ALTERNATE TO A FOUNDATION DRAIN, WEEP HOLES MAY BE PROVIDED 6" ABOVE TOP OF BARRIER PROVIDED THAT APPEARANCE IS ACCEPTABLE AND SUFFICIENT ROADWAY DRAINAGE IS PROVIDED UNLESS PROJECT SPECIFIC PLANS OR SITE CONDITIONS REQUIRE THE NEED FOR BOTH A FOUNDATION DRAIN AND WEEP HOLES.
2. USE FOUNDATION DRAIN FOR BOTTOM UP INSTALLATION ONLY.
3. USE FOUNDATION DRAIN WHERE ROADWAY PAVEMENT DRAINS ONTO SLOPE ABOVE WALL OR WHERE SLOPE ABOVE WALL PRODUCES SIGNIFICANT RUNOFF. PROVIDE IMPERVIOUS BARRIER LAYER ABOVE STRUCTURE BACKFILL.
4. PROVIDE SURFACE PERPENDICULAR TO CENTERLINE ANCHOR WITHIN 0.3° TOLERANCE. GRIND CONCRETE SURFACE TO REMOVE PROJECTING IRREGULARITIES EXCEEDING 1/32". GRIND GALVANIZED SURFACE OF BEARING PLATE SMOOTH TO REMOVE ACCUMULATIONS OF ZINC AROUND EDGES.
5. HOLE DIAMETER WILL BE DEPENDENT ON THE SELECTED ANCHORHEAD (WEDGE PLATE).



TYPICAL SECTION AT STREAM

LEGEND:

FF FRONT FACE

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

ANCHORED WALLS

MISCELLANEOUS DETAILS

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 9 OF 9
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-626M

CHANGE 2

CHANGE 3

CHANGE 5

NOTE: e-Notification revisions on Sheets 2 - 5

GENERAL NOTES:

1. DESIGN SPECIFICATIONS:
   - BARRIER AND MOMENT SLAB DESIGNED IN ACCORDANCE WITH THE AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1992 (INCLUDING THE 1993 AND 1994 INTERIM SPECIFICATIONS), AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES, AUGUST 1993 EDITION (INCLUDING LATEST REVISIONS).

2. CONSTRUCTION SPECIFICATIONS AND PERFORM WORK:
   - PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AND THE CONTRACT SPECIAL PROVISIONS.

3. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.

4. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.

5. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.

6. IF NEEDED DETAILS ARE NOT FOUND IN THIS STANDARD, A SPECIAL SUBMISSION REQUESTING APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.

MATERIAL NOTES:

1. CAST-IN-PLACE CONCRETE:
   - PROVIDE CLASS AA CEMENT CONCRETE IN THE MOMENT SLAB, BARRIERS, AND TOE WALLS.

2. PRECAST CONCRETE BARRIERS:
   - CLASS AA CEMENT CONCRETE, MODIFIED - FURNISH PRECAST BARRIERS IN ACCORDANCE WITH THE REQUIREMENTS OF PUBLICATION 408, SECTION 714, EXCEPT PROVIDE CONCRETE HAVING A 28-DAY COMPRESSIVE STRENGTH OF 4000 PSI WHEN TESTED IN ACCORDANCE WITH PTM NO. 604.

3. REINFORCEMENT STEEL:
   - PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615, ASTM A996, OR A706. DO NOT WELD REINFORCEMENT BARS. DO NOT USE RAIL STEEL A996 IN BARRIERS OR WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
   - EPOXY COAT ALL REINFORCEMENT BARS.
   - PROVIDE MINIMUM LAP AND EMBEDMENT LENGTH FOR REINFORCING BARS IN ACCORDANCE WITH BC-736M.

INSTRUCTIONS TO DESIGNERS:

1. THE INFORMATION SHOWN IN THIS STANDARD IS PROVIDED FOR USE IN THE DEVELOPMENT OF THE CONTRACT DRAWINGS. THE DESIGNER IS RESPONSIBLE FOR THE PRESENTATION OF ALL REQUIRED DETAILS AND NOTES.

2. DESIGN COMPUTATIONS ARE NOT REQUIRED FOR THE MOMENT SLAB AND BARRIER CONFIGURATIONS SHOWN ON THIS STANDARD. WHERE CONDITIONS AND/OR DETAILS DIFFER FROM THE STANDARD, COMPLETE DESIGN COMPUTATIONS MUST BE SUBMITTED TO THE DEPARTMENT. SUCH SPECIAL DESIGNS MUST PROVIDE ULTIMATE STRENGTH EQUAL TO THE DESIGN PROVIDED IN THIS STANDARD.

3. DESIGNER TO DETAIL ONLY CAST-IN-PLACE BARRIERS ON THE CONTRACT PLANS. PRECAST BARRIER OPTION IS ONLY PERMITTED AS A CONTRACTOR ALTERNATE.

4. CONTRACT DRAWINGS:
   - PREPARE CONTRACT DRAWINGS IN ACCORDANCE WITH THE DESIGN MANUAL, PART 4, THIS STANDARD AND OTHER PENNDOT STANDARDS.
   - PROVIDE COMPLETE DETAILS AND NOTES AS REQUIRED.
   - PROVIDE STAKE OUT PLAN.
   - PROVIDE COMPLETE REINFORCEMENT BAR DETAILS AND BAR SCHEDULE.
   - PROVIDE TOP OF SLAB (OR ROADWAY) ELEVATIONS AT ALL TRANSVERSE JOINT LOCATIONS.
   - PROVIDE ELEVATIONS AT GUTTER LINES AND EDGE OF MOMENT SLAB.

5. PAY ITEMS:
   - PROVIDE SEPARATE PAY ITEMS AND INDICATE THE APPROXIMATE QUANTITY FOR CONCRETE, REINFORCEMENT, PROTECTIVE COATINGS, AND ANY OTHER ITEM THAT MAY BE REQUIRED FOR THE CONSTRUCTION OF THE MOMENT SLAB AND BARRIER.
   - EXCAVATION, SUBBASE, AND SUBGRADE DRAINS ARE ROADWAY PAY ITEMS.

6. PROVIDE PAVEMENT BASE DRAINS IN ACCORDANCE WITH RC-30M.

7. PROTECTIVE COATINGS:
   - APPLY A PROTECTIVE COATING FOR REINFORCED CONCRETE SURFACES (PENETRATING SEALERS, BRIDGE SUPERSTRUCTURE) IN ACCORDANCE WITH PUBLICATION 408, SECTION 1019 TO THE TOP SURFACE OF THE MOMENT SLAB AND TO THE INSIDE FACE AND TOP SURFACES OF THE BARRIERS. DO NOT PLACE PENETRATING SEALERS ON TOP OF ANY SURFACE THAT RECEIVES ASPHALT OVERLAY.

8. SUBBASE THICKNESS BENEATH THE MOMENT SLAB AND BARRIER MUST MATCH THE ROADWAY SUBBASE THICKNESS.

9. THE 42" F-SHAPE CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNATED AS MASH TL4. THE 32" F-SHAPE CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNATED AS MASH TL-3. THE ALTERNATE SIDEWALK WITH 42" VERTICAL WALL CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNATED AS MASH TL-2.

10. THE 45" F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.

CONTRACT DRAWING NOTES:

THE FOLLOWING NOTES ARE TO BE PLACED ON THE CONTRACT DRAWINGS WHEN REQUIRED:

1. A HIGHER CLASS CONCRETE MAY BE SUBSTITUTED FOR A LOWER CLASS CONCRETE AT NO ADDITIONAL COST TO THE DEPARTMENT.

2. CONTRACTOR IS PERMITTED TO PROVIDE A PRECAST BARRIER IN PLACE OF THE CAST-IN-PLACE BARRIER. CONTRACTOR MUST SUBMIT SHOP DRAWINGS FOR REVIEW AND ACCEPTANCE IN ACCORDANCE WITH PUBLICATION 408. THE SHOP DRAWINGS MUST COMPLETELY DETAIL THE ENTIRE MOMENT SLAB AND BARRIER ALONG THE REQUIRED LENGTH.
   - CONTRACTOR IS RESPONSIBLE FOR LIFTING, HANDLING AND TRANSPORTATION STRESSES.
   - CONTRACTOR IS RESPONSIBLE FOR TEMPORARY BRACING DESIGN CALCULATIONS AND DETAILS.
   - LIFTING INSERTS:
     - PROVIDE GALVANIZED LIFTING INSERTS.
     - PROVIDE LIFTING INSERTS WITH A MINIMUM CAPACITY OF AT LEAST TWO TIMES THE CALCULATED LOAD ON THE INSERT.
     - PROVIDE A MINIMUM OF TWO LIFTING INSERTS PER BARRIER SECTION.

3. PROVIDE ANY OTHER NOTES AS REQUIRED.

INDEX OF SHEETS

REFERENCE DRAWINGS

RC-20M	CONCRETE PAVEMENT JOINTS
RC-21M	REINFORCED CONCRETE PAVEMENT
RC-24M	PAVEMENT RELIEF JOINT
RC-27M	PLAIN CONCRETE PAVEMENT
RC-30M	SUBSURFACE DRAINS
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
BC-709M	PA TYPE 10M BRIDGE BARRIER
BC-713M	PA BRIDGE BARRIER
BC-735M	WALL CONSTRUCTION AND EXPANSION JOINT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-752M	CONCRETE DECK SLAB DETAILS
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE AND STEEL BEAM BRIDGES
BC-799M	MECHANICALLY STABILIZED EARTH RETAINING WALLS
BD-601M	CONCRETE DECK SLAB
BD-610M	PA BRIDGE BARRIER
BD-617M	PA TYPE 10M BRIDGE BARRIER
BD-618M	PA VERTICAL WALL BRIDGE BARRIER
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-628M	BRIDGE APPROACH SLABS
BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

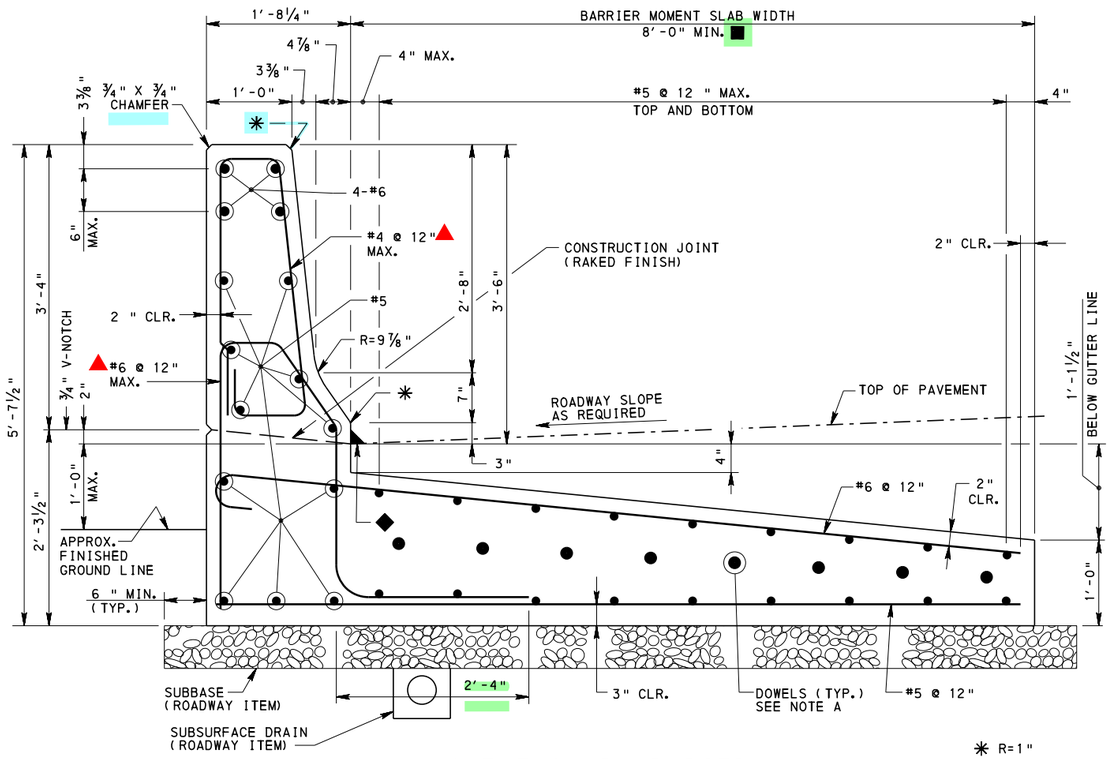
STANDARD MOMENT SLABS GENERAL NOTES

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

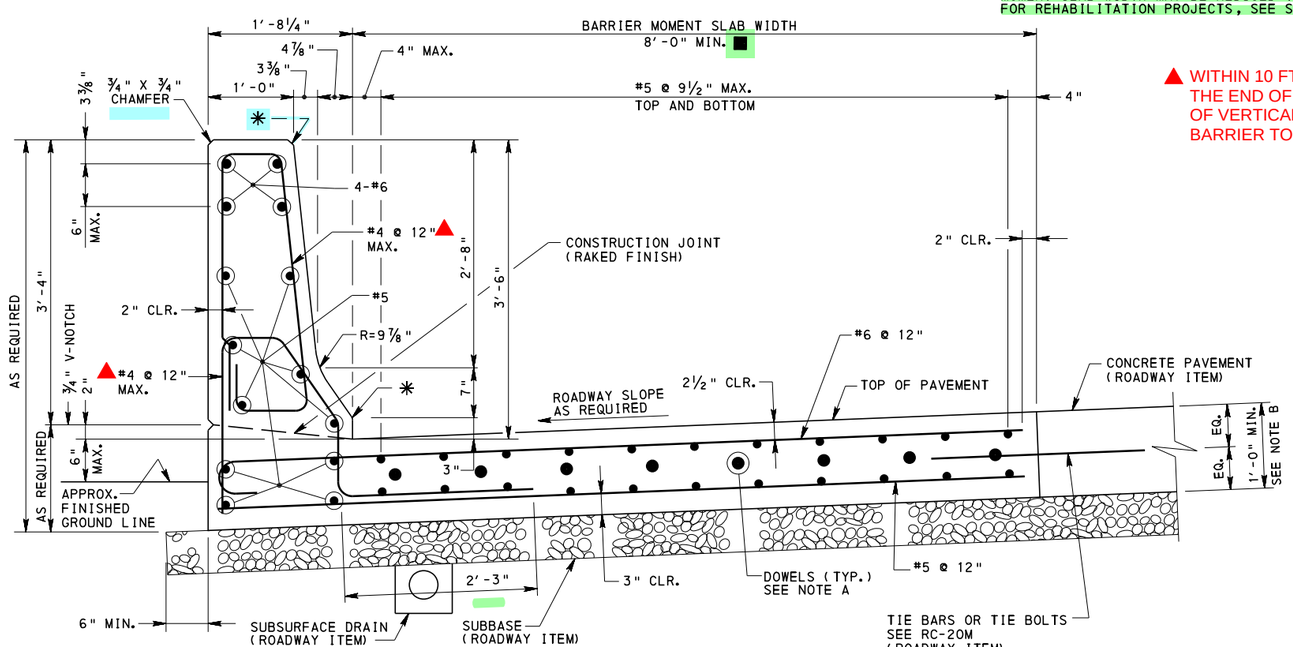
BD-627M

e-Notification No. 82,
dated Jan. 20, 2023



MOMENT SLAB (BURIED)
WITH C.I.P. 42" F-SHAPE CONCRETE BARRIER

(SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB)



MOMENT SLAB (AT-GRADE)
WITH C.I.P. 42" F-SHAPE CONCRETE BARRIER

(SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB)

✳ R=1"

◆ ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)]

■ AT DISCRETION OF DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4′-0". FOR REHABILITATION PROJECTS, SEE SHEET 7

▲ WITHIN 10 FT. OF AN EXPANSION JOINT AND AT THE END OF THE BARRIER, REDUCE SPACING OF VERTICAL REINFORCMENT BARS IN THE BARRIER TO HALF THE SHOWN SPACING.

NOTE A:
PROVIDE DOWELS AT EXPANSION JOINTS.
USE TYPE D OR E JOINT PER RC-20M.
USE SAME JOINT AS PROVIDED IN PAVEMENT.

NOTE B:
MOMENT SLAB DEPTH TO MATCH DEPTH OF CONCRETE PAVEMENT IN ROADWAY.

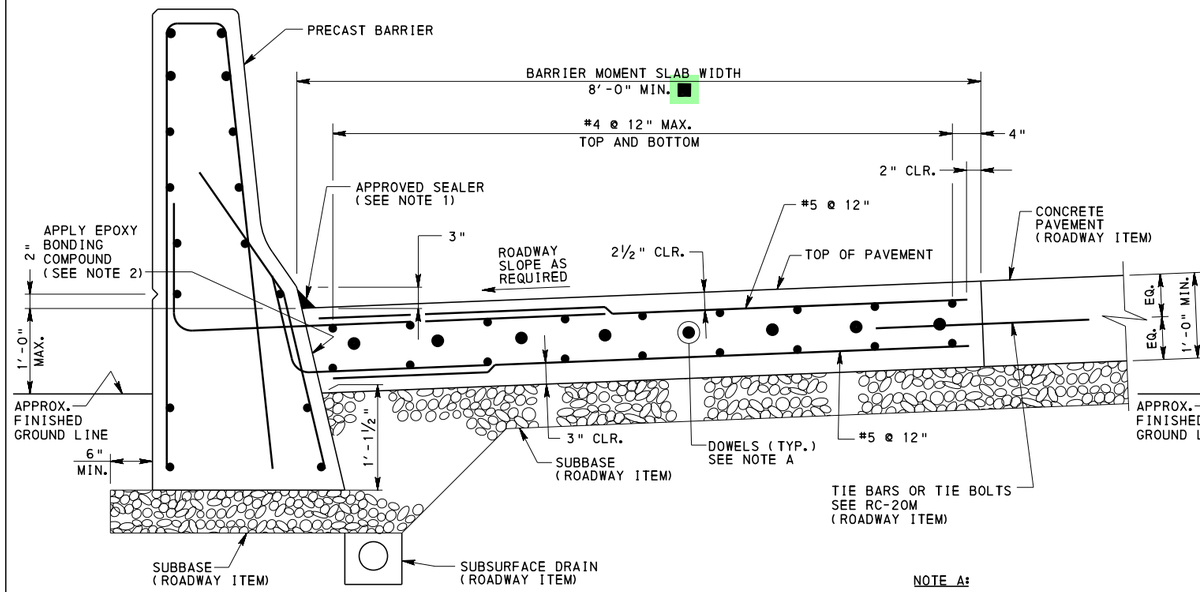
NOTES
1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
MOMENT SLABS
TYPICAL C.I.P. BARRIER DETAILS

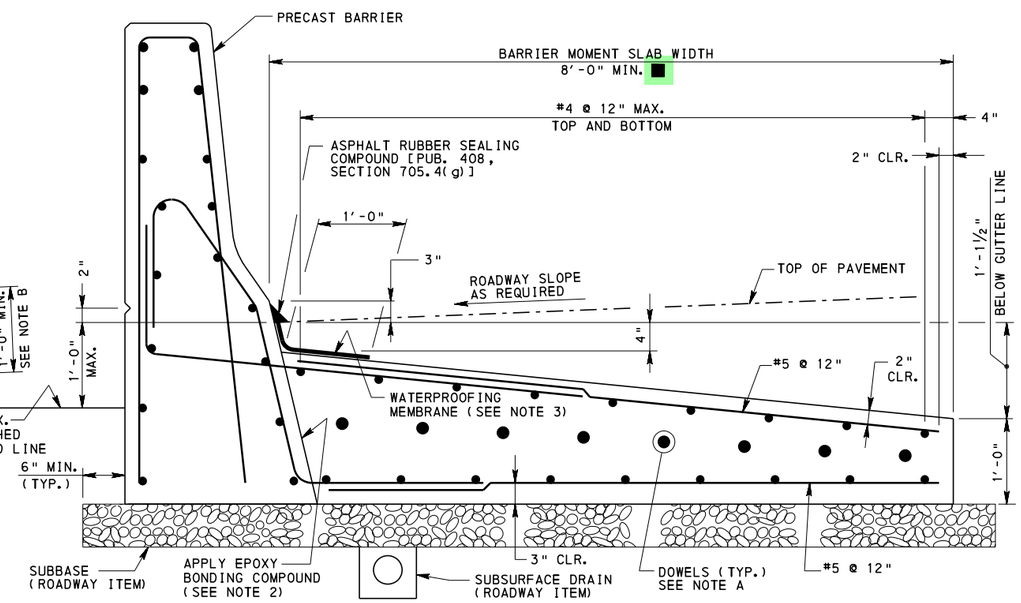
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 2 OF 8
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-627M

e-Notification No. 82, dated Jan. 20, 2023



MOMENT SLAB (AT-GRADE) WITH PRECAST 42" F-SHAPE CONCRETE BARRIER

(SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB)



MOMENT SLAB (BURIED) WITH PRECAST 42" F-SHAPE CONCRETE BARRIER

(SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB)

NOTE A:

PROVIDE DOWELS AT EXPANSION JOINTS.
USE TYPE D OR E JOINT PER RC-20M.
USE SAME JOINT AS PROVIDED IN PAVEMENT.

NOTE B:

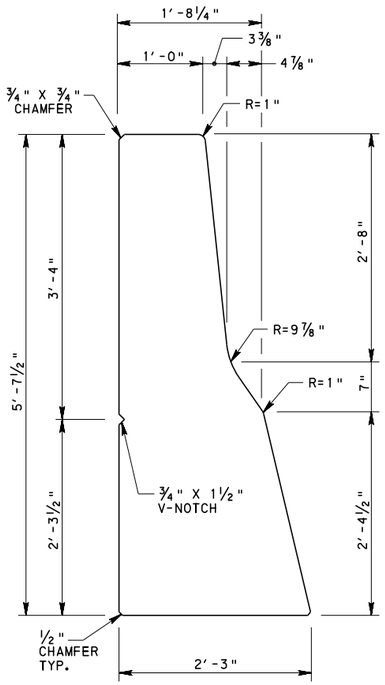
MOMENT SLAB DEPTH TO MATCH DEPTH OF CONCRETE PAVEMENT IN ROADWAY.

■ AT DISCRETION OF DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4'-0". FOR REHABILITATION PROJECTS, SEE SHEET 7

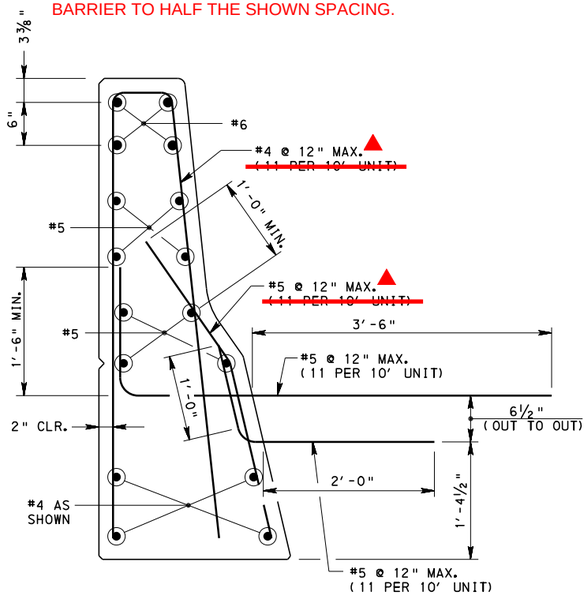
▲ WITHIN 10 FT. OF AN EXPANSION JOINT AND AT THE END OF THE BARRIER, REDUCE SPACING OF VERTICAL REINFORCMENT BARS IN THE BARRIER TO HALF THE SHOWN SPACING.

NOTES:

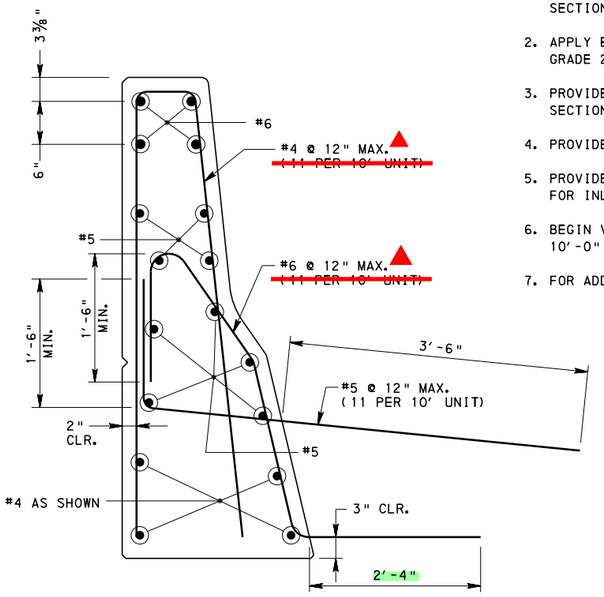
1. USE SILICONE JOINT SEALING MATERIAL CONFORMING TO PUBLICATION 408, SECTION 705.4 (a).
2. APPLY EPOXY BONDING COMPOUND CONFORMING TO ASTM C881 TYPE 11, GRADE 2 BETWEEN PRECAST BARRIER AND C.I.P. MOMENT SLAB.
3. PROVIDE WATERPROOFING MEMBRANE CONFORMING TO PUBLICATION 408, SECTION 680.
4. PROVIDE A MINIMUM PRECAST BARRIER LENGTH OF 10'-0".
5. PROVIDE SPECIAL DESIGN AND DETAILING OF THE MOMENT SLAB AND BARRIER FOR INLET INSTALLATIONS, SEE SHEET 8.
6. BEGIN VERTICAL REINFORCEMENT AT 3" FROM EITHER END OF 10'-0" PANEL.
7. FOR ADDITIONAL NOTES, SEE SHEET 1.



DIMENSIONS



REINFORCEMENT FOR BARRIER WITH CEMENT CONCRETE SHOULDER



REINFORCEMENT FOR BARRIER WITH ASPHALT-PAVED SHOULDER

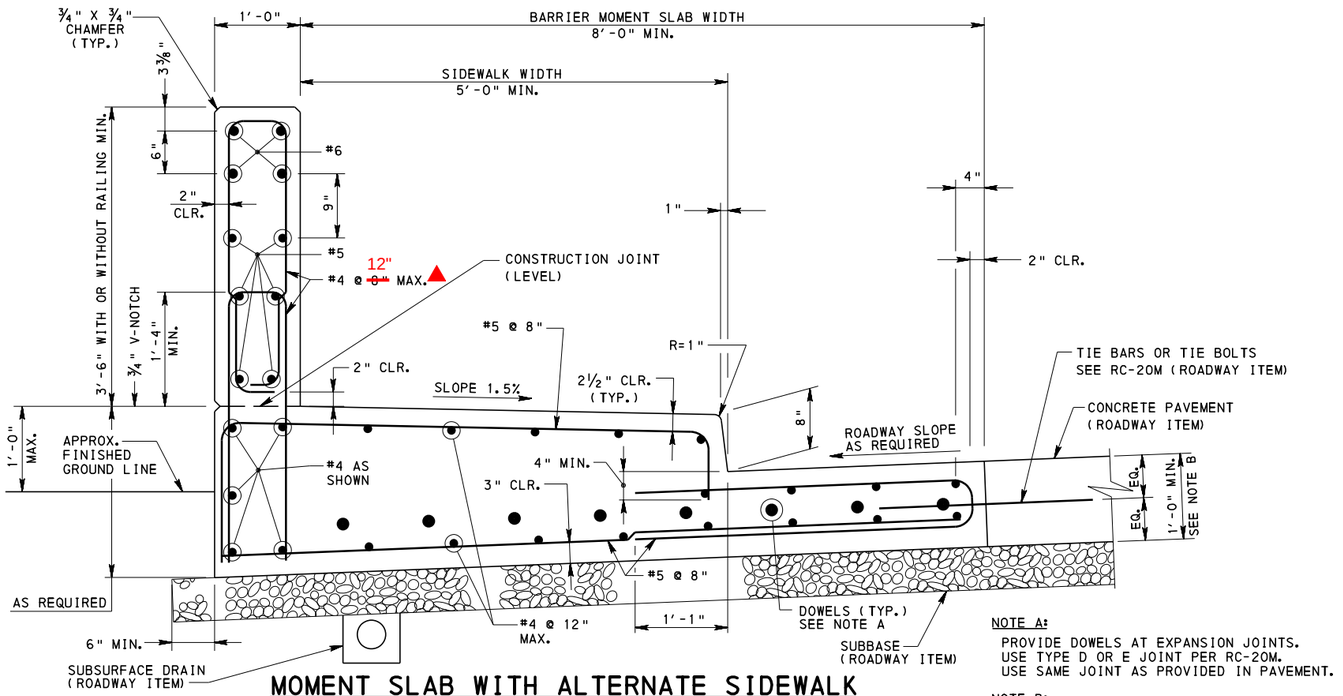
PRECAST 42" F-SHAPE CONCRETE BARRIER DETAILS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
MOMENT SLABS
TYPICAL PRECAST BARRIER DETAILS

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 3 OF 8
		BD-627M

e-Notification No. 82,
dated Jan. 20, 2023



MOMENT SLAB WITH ALTERNATE SIDEWALK AND 42" VERTICAL WALL CONCRETE BARRIER (C.I.P.)

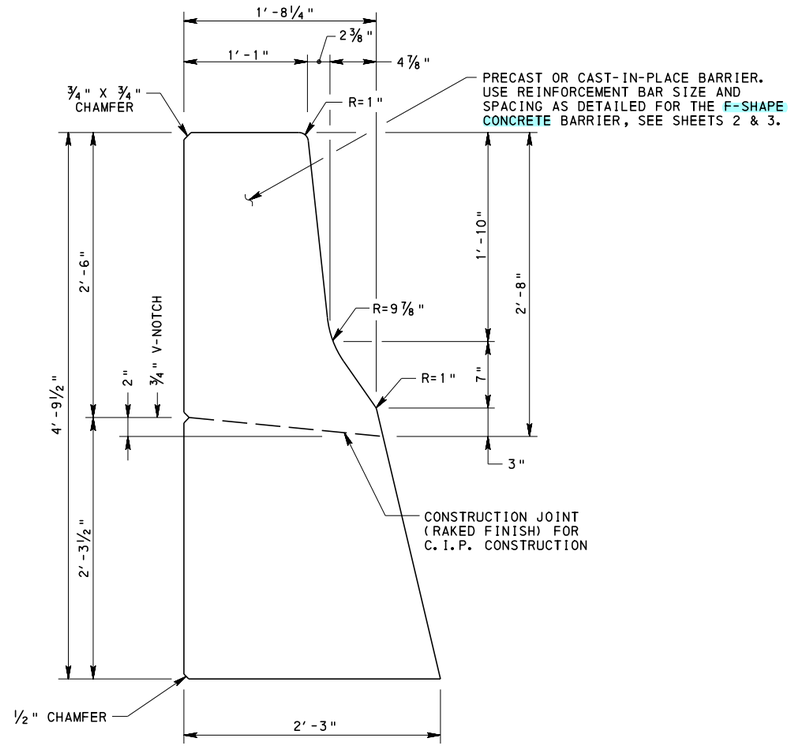
PERMITTED WITH A POSTED VEHICULAR SPEED LESS THAN OR EQUAL TO 45 MPH.

NOTE A:

PROVIDE DOWELS AT EXPANSION JOINTS.
USE TYPE D OR E JOINT PER RC-20M.
USE SAME JOINT AS PROVIDED IN PAVEMENT.

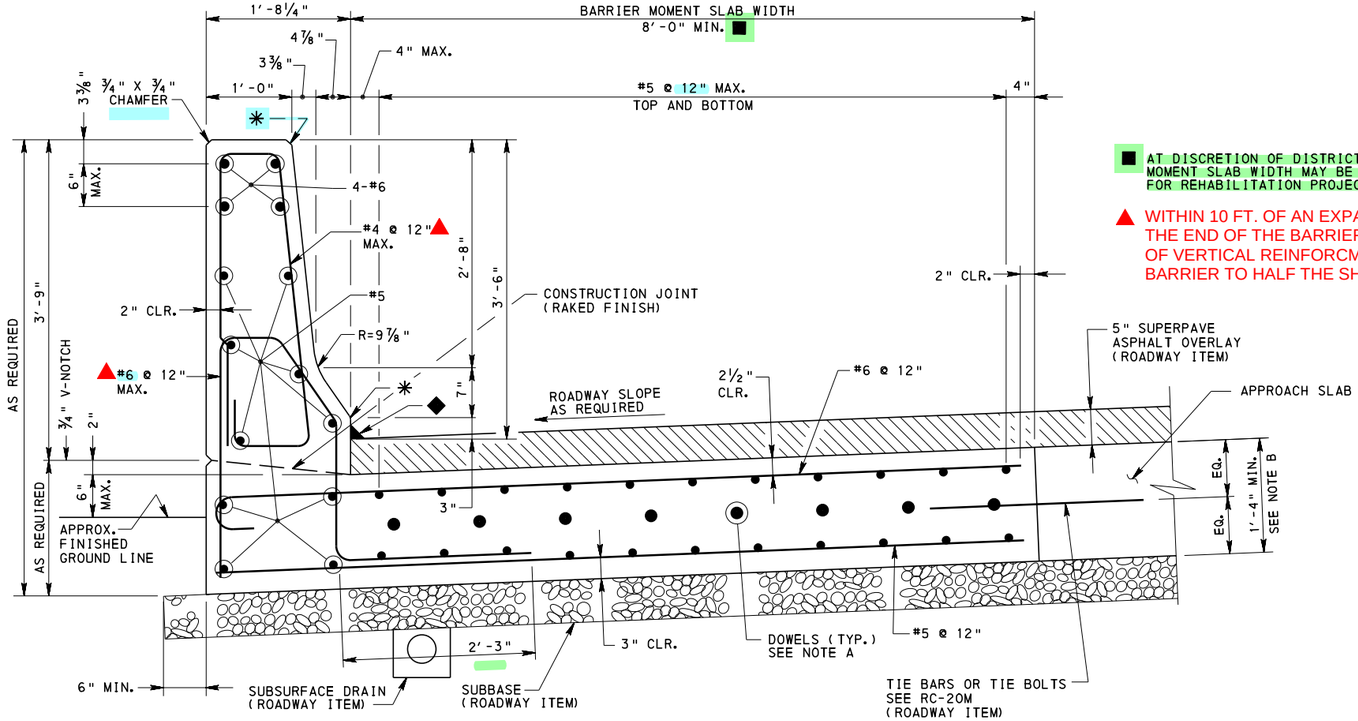
NOTE B:

MOMENT SLAB DEPTH TO MATCH DEPTH OF CONCRETE PAVEMENT IN ROADWAY.



32" F-SHAPE CONCRETE BARRIER

TO BE USED ONLY IF AUTHORIZED BY CHIEF BRIDGE ENGINEER



MOMENT SLAB WITH ASPHALT OVERLAY ADJACENT TO TYPE 2 APPROACH SLAB WITH C.I.P. 42" F-SHAPE CONCRETE BARRIER

(SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB)

■ AT DISCRETION OF DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4'-0". FOR REHABILITATION PROJECTS, SEE SHEET 7

▲ WITHIN 10 FT. OF AN EXPANSION JOINT AND AT THE END OF THE BARRIER, REDUCE SPACING OF VERTICAL REINFORCMENT BARS IN THE BARRIER TO HALF THE SHOWN SPACING.

✳ R=1"

◆ ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)]

NOTES

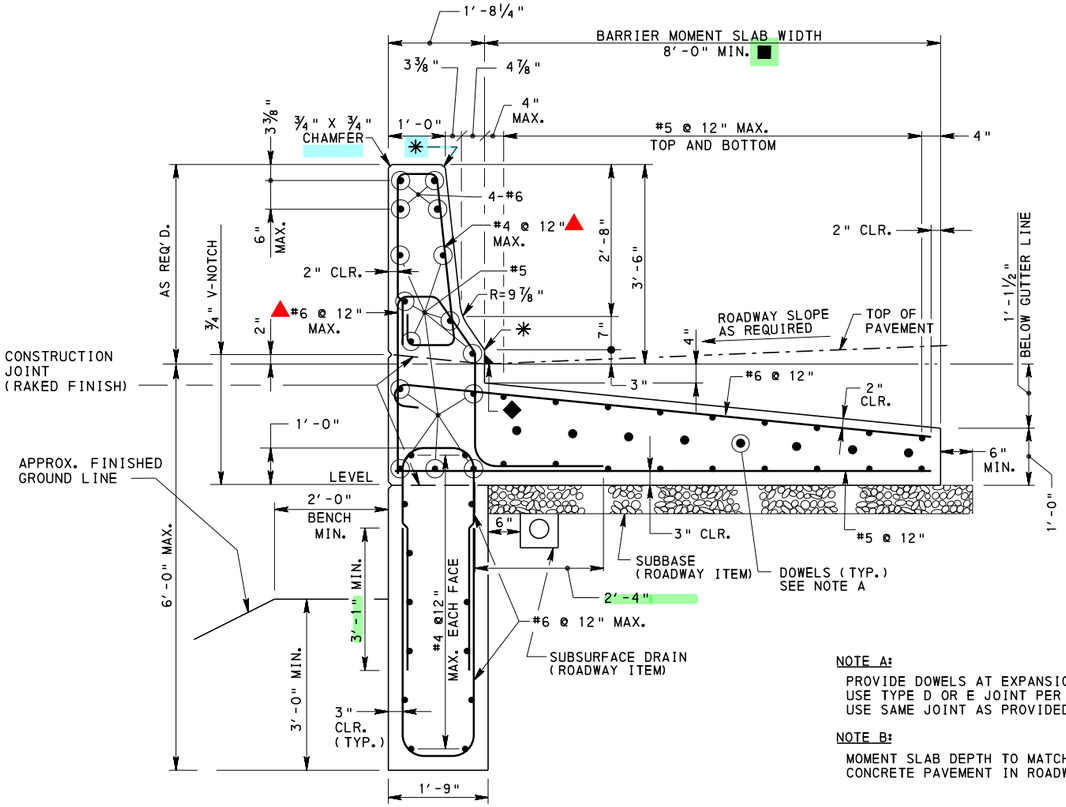
1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD MOMENT SLABS MISCELLANEOUS DETAILS

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 4 OF 8
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-627M

e-Notification No. 82,
dated Jan. 20, 2023

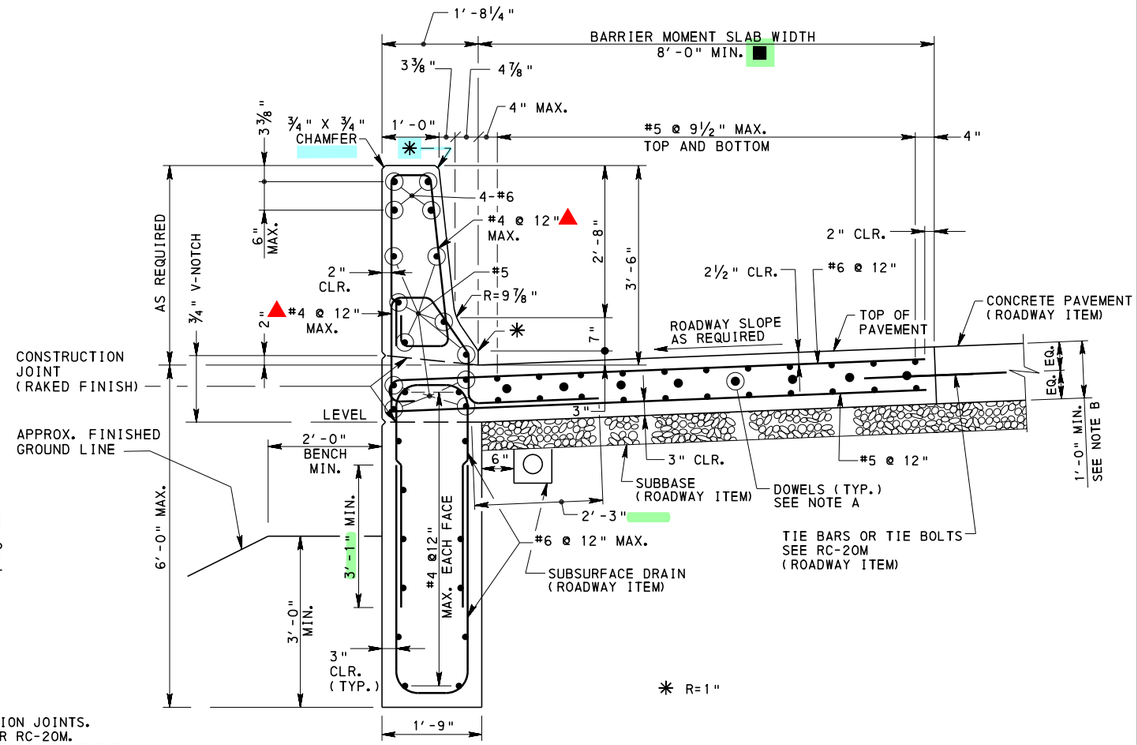


NOTE A:
PROVIDE DOWELS AT EXPANSION JOINTS.
USE TYPE D OR E JOINT PER RC-20M.
USE SAME JOINT AS PROVIDED IN PAVEMENT.

NOTE B:
MOMENT SLAB DEPTH TO MATCH DEPTH OF CONCRETE PAVEMENT IN ROADWAY.

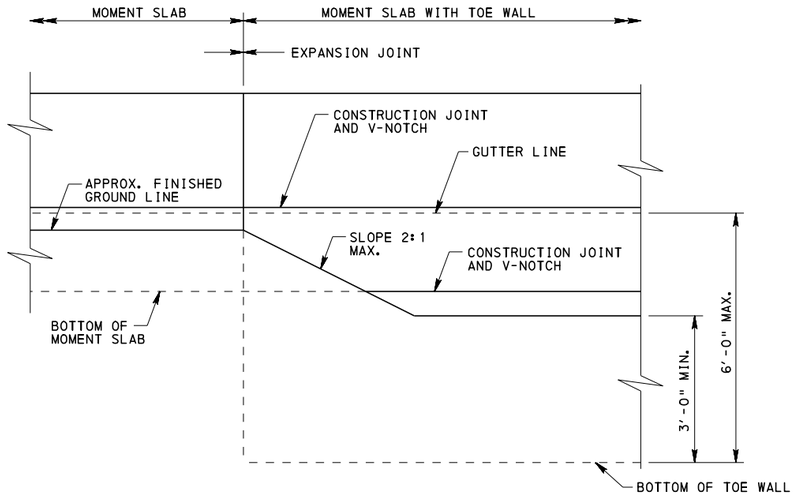
MOMENT SLAB (AT-GRADE) WITH TOE WALL AND C.I.P. 42" F-SHAPE CONCRETE BARRIER

(SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB)



MOMENT SLAB (BURIED) WITH TOE WALL AND C.I.P. 42" F-SHAPE CONCRETE BARRIER

(SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB)



TOE WALL ELEVATION TRANSITION

✳ R=1"

◆ ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)]

■ AT DISCRETION OF DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4'-0". FOR REHABILITATION PROJECTS, SEE SHEET 7

▲ WITHIN 10 FT. OF AN EXPANSION JOINT AND AT THE END OF THE BARRIER, REDUCE SPACING OF VERTICAL REINFORCMENT BARS IN THE BARRIER TO HALF THE SHOWN SPACING.

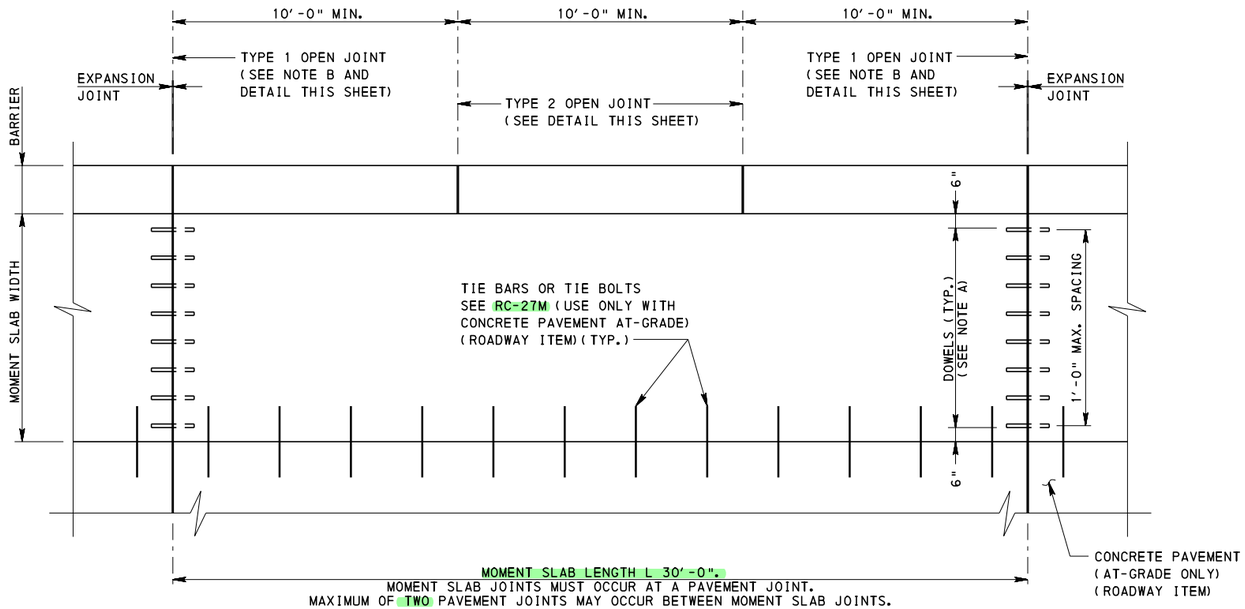
NOTES

1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
MOMENT SLABS
TOE-WALL DETAILS

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 5 OF 8
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-627M

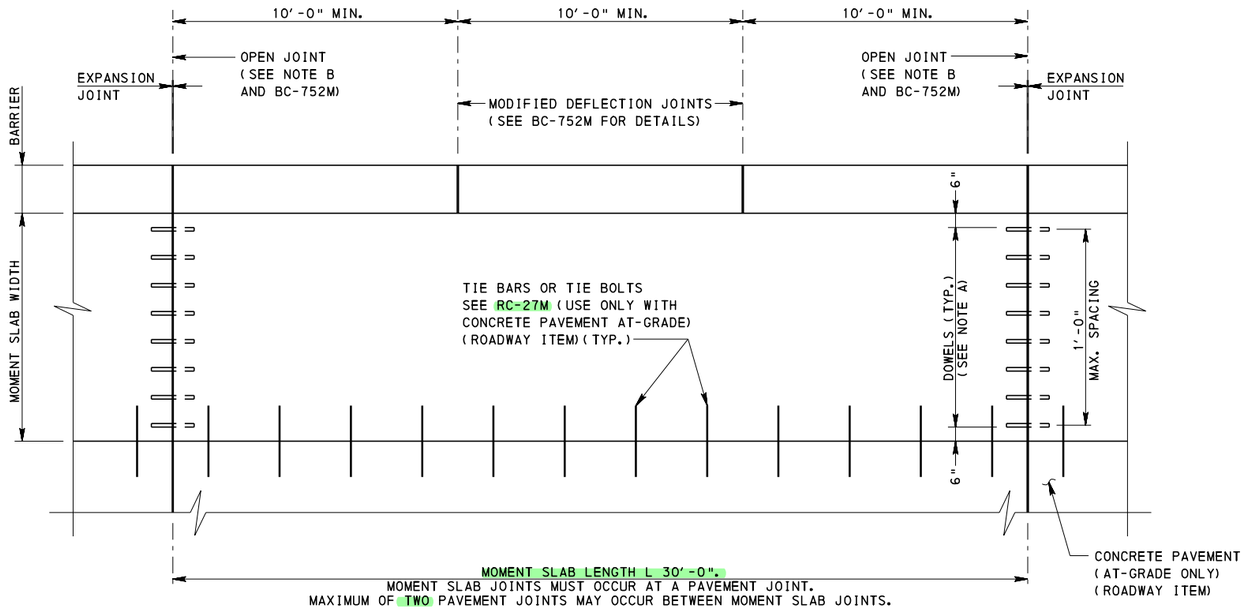


NOTE A: USE TYPE D OR E JOINT PER RC-27M. USE SAME JOINT AS PROVIDED IN PAVEMENT.

NOTE B: PROVIDE TYPE 1 OPEN JOINTS AT SAME LOCATIONS AS THOSE PROVIDED FOR THE MOMENT SLAB.

PLAN - BARRIER MOMENT SLAB

(PRECAST BARRIER)

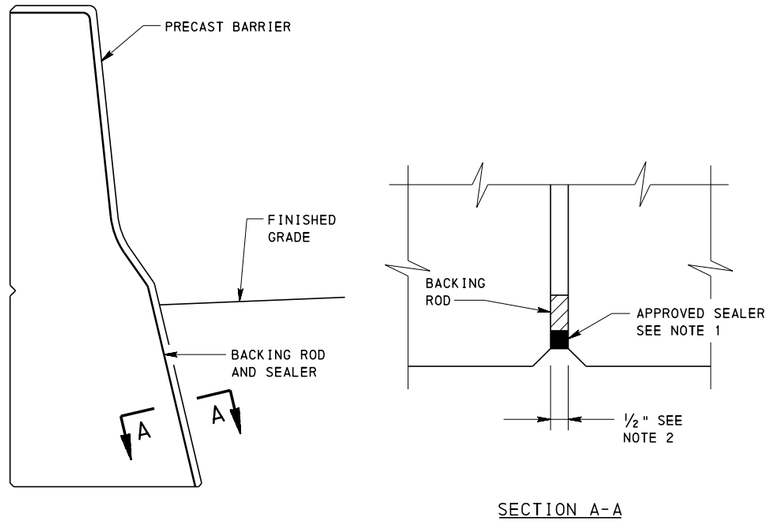


NOTE A: USE TYPE D OR E JOINT PER RC-27M. USE SAME JOINT AS PROVIDED IN PAVEMENT.

NOTE B: PROVIDE OPEN JOINTS IN BARRIER AT SAME LOCATIONS AS THOSE PROVIDED FOR THE MOMENT SLAB.

PLAN - BARRIER MOMENT SLAB

(C.I.P. BARRIER)



SECTION A-A

TYPE 1 AND TYPE 2 OPEN JOINT IN PRECAST BARRIER

JOINT NOTES:

1. ALL OPEN JOINTS IN THE BARRIER MUST BE FILLED WITH BACKING ROD AND SEALED WITH SILICONE JOINT SEALING MATERIAL AS SPECIFIED IN PUBLICATION 408, SECTION 705.4(a).
2. EXPOSED JOINTS AT BARRIER MAY VARY FROM 1/2" TO 1" WIDTH FOR TYPE 1 OPEN JOINT AND 1/4" TO 3/4" WIDTH FOR TYPE 2 OPEN JOINT, TO ALLOW FOR HORIZONTAL AND/OR VERTICAL CURVATURE IN WALL.

MOMENT SLAB AND BARRIER NOTE:

LOCATE EXPANSION JOINTS IN MOMENT SLAB AND BARRIER TO MATCH THE PAVEMENT JOINTS. DO NOT LOCATE EXPANSION JOINTS WITHIN 6'-0" OF THE CENTERLINE OF LIGHT POLE OR WITHIN 2'-0" OF THE CENTERLINE OF A JUNCTION BOX.

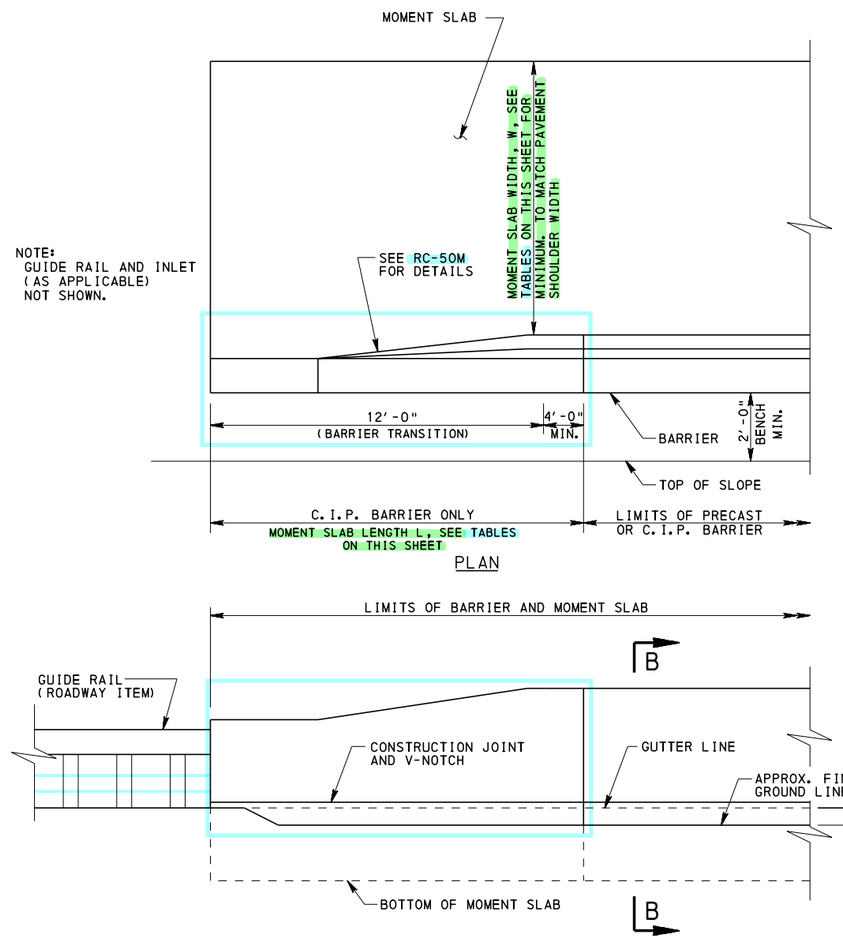
NOTES

1. FOR NOTES, SEE SHEET 1.

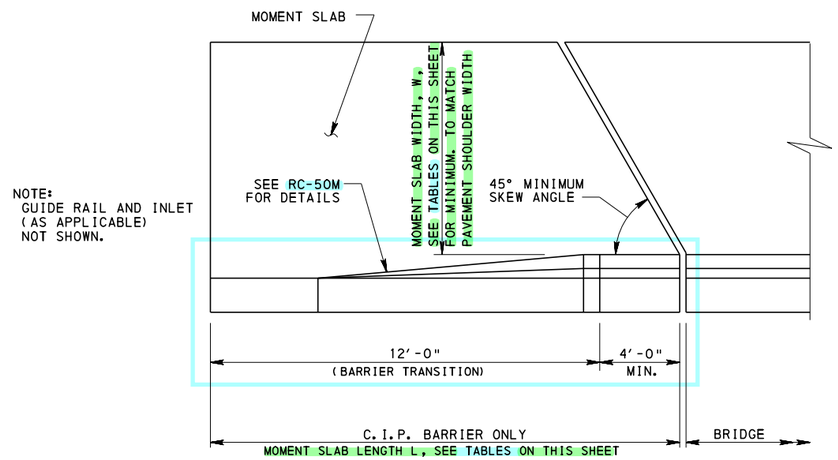
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD MOMENT SLABS PLANS

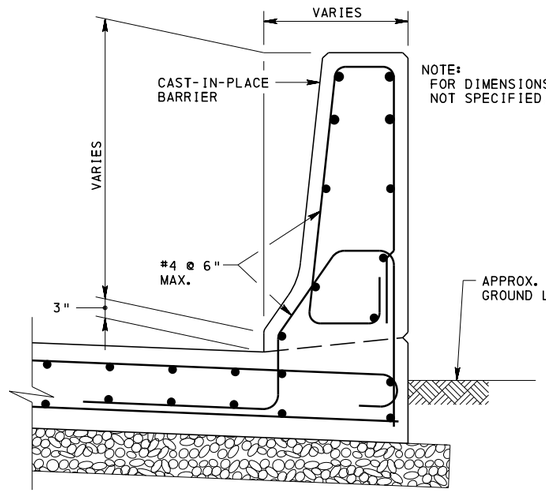
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 6 OF 8
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-627M



BARRIER TO GUIDE RAIL TRANSITION

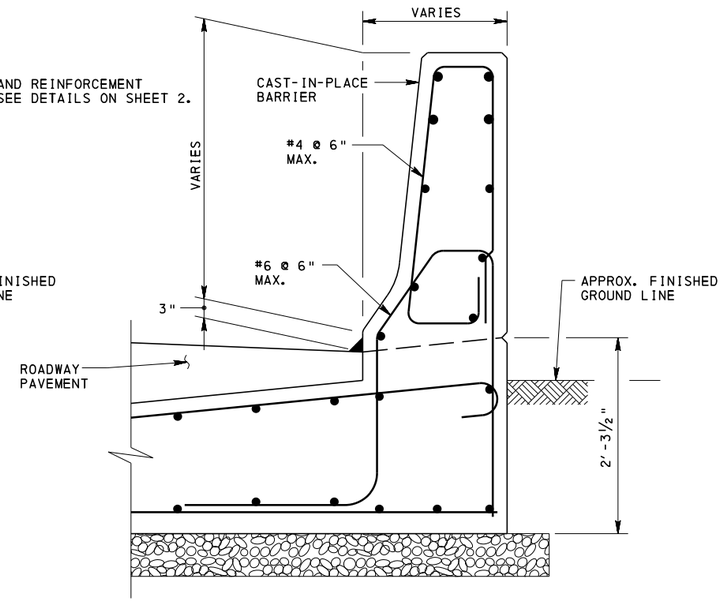


MOMENT SLAB ADJACENT TO BRIDGE



BARRIER WITH MOMENT SLAB (AT-GRADE)
(C.I.P.)

NOTE:
FOR DIMENSIONS AND REINFORCEMENT NOT SPECIFIED, SEE DETAILS ON SHEET 2.



BARRIER WITH MOMENT SLAB (BURIED)
(C.I.P.)

SECTION B-B

(REFER TO RC-50M FOR ADDITIONAL INFORMATION)

MINIMUM MOMENT SLAB DIMENSIONS FOR REHABILITATION PROJECTS		
OPTION	L	W
A	20'-0"	4'-0"
B	16'-0"	5'-0"

NOTE:
1. THE USE OF THIS TABLE IS FOR REHABILITATION ONLY AND AT THE DISCRETION OF THE DISTRICT BRIDGE ENGINEER.
2. THE DESIGNED CRASH TEST LEVEL IN THIS TABLE IS TL-3.

MINIMUM MOMENT SLAB DIMENSIONS FOR NEW PROJECTS
L=16'-0"
W=8'-0"

NOTES

1. FOR NOTES, SEE SHEET 1.
2. REFER TO BD-622M OR BD-624M FOR END OF BARRIER TRANSITION DETAILS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD MOMENT SLABS

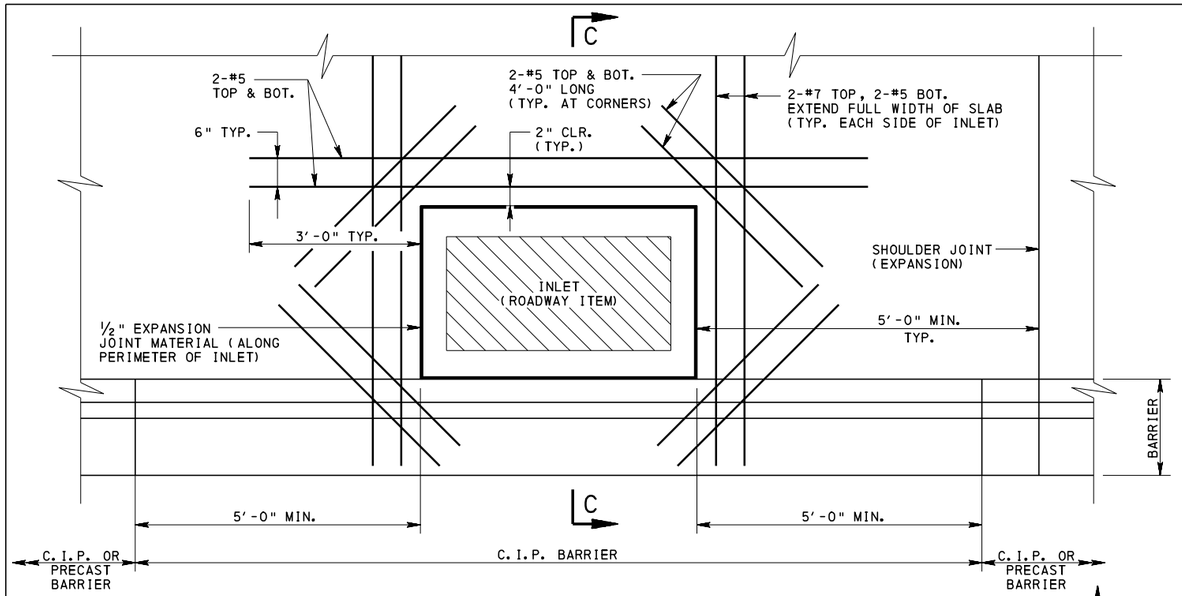
END TRANSITION

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

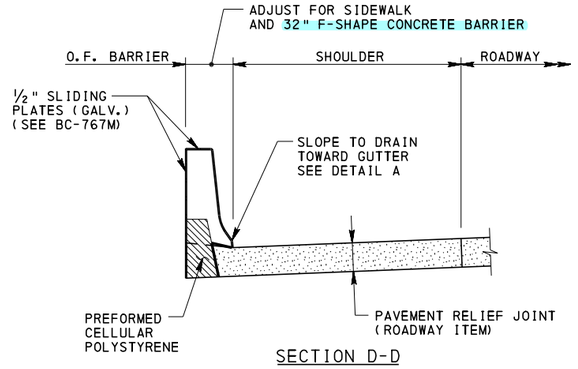
SHEET 7 OF 8

BD-627M

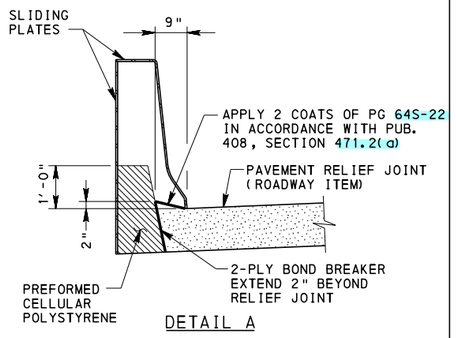


PLAN - SHOULDER DETAILS AT INLET

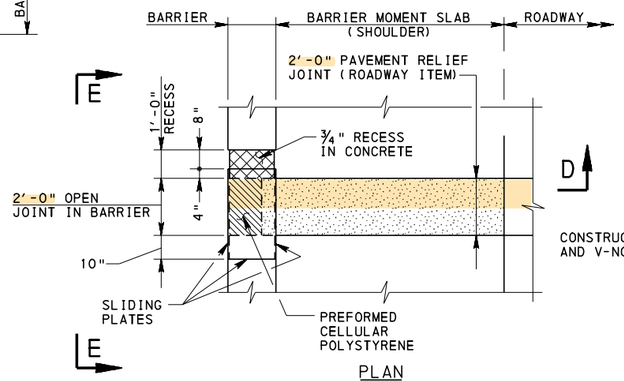
(ADDITIONAL REINFORCEMENT AT INLETS)



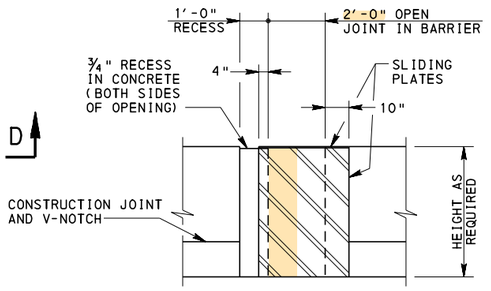
SECTION D-D



DETAIL A

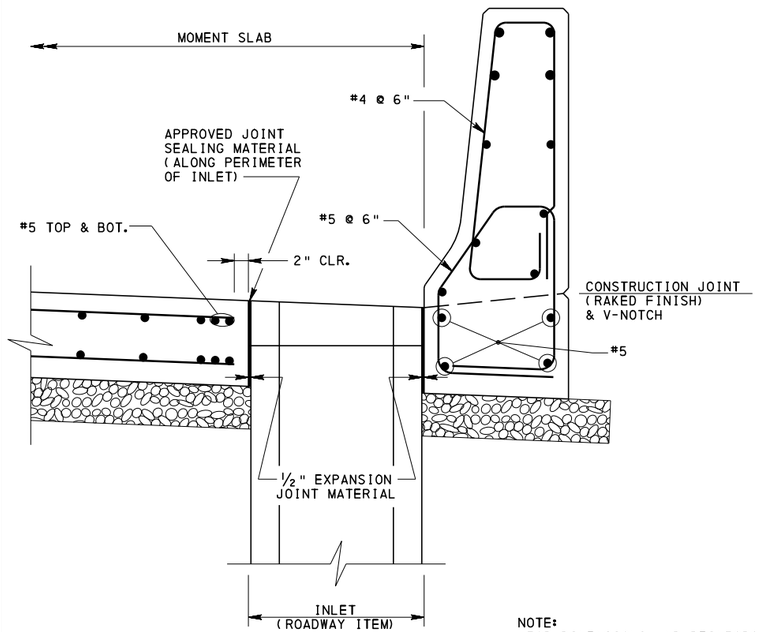


PLAN



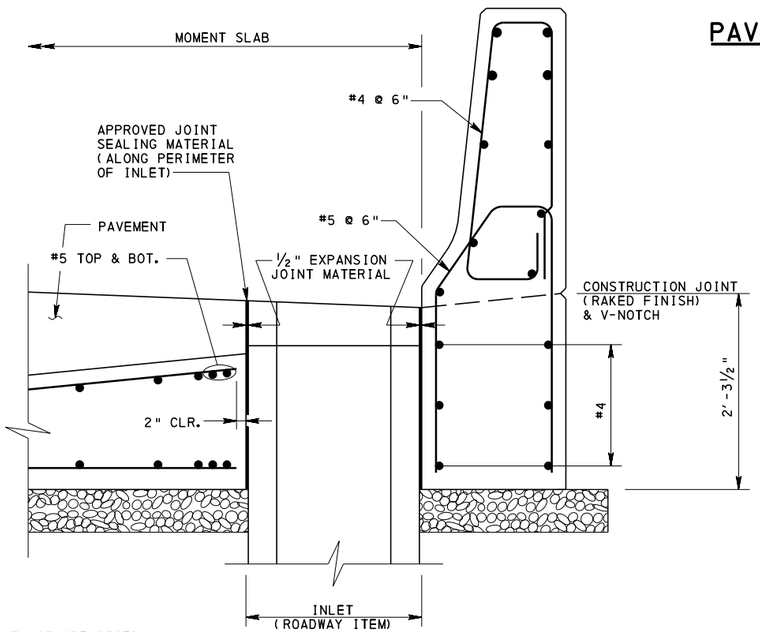
SECTION E-E

PAVEMENT RELIEF JOINT DETAILS



MOMENT SLAB (AT-GRADE)
(C.I.P.)

NOTE:
FOR DIMENSIONS AND REINFORCEMENT NOT SPECIFIED, SEE DETAILS ON SHEET 2.



MOMENT SLAB (BURIED)
(C.I.P.)

SECTION C-C

NOTES

1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

MOMENT SLABS
PAVEMENT RELIEF JOINT AND INLET INSTALLATION

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 8 OF 8
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-627M

CHANGE 2

CHANGE 3

CHANGE 5

GENERAL NOTES:

1. DESIGN SPECIFICATIONS:
   - AASHTO, LRFD BRIDGE DESIGN SPECIFICATIONS AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
   - DESIGN IS IN ACCORDANCE WITH THE LOAD AND RESISTANCE FACTOR DESIGN METHOD (LRFD).

2. CONSTRUCTION SPECIFICATIONS AND PERFORM WORK:
   - PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5M/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AWS/D1.1/D1.1M FOR WELDING NOT COVERED IN AASHTO/AWD/D1.5M/D1.5.)

3. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.

4. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.

5. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.

6. IF NEEDED DETAILS ARE NOT FOUND IN THIS STANDARD A SPECIAL SUBMISSION REQUESTING APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.

MATERIAL NOTES:

1. PROVIDE THE FOLLOWING CONCRETE CLASS:
   - PROVIDE CLASS A CEMENT CONCRETE IN SUPPORT PEDESTALS BELOW THE BRIDGE SEAT CONSTRUCTION JOINT FOR TYPE 4 APPROACH SLAB.
   - PROVIDE CLASS AA CEMENT CONCRETE IN APPROACH SLAB TYPES 1, 2 AND 4, SLEEPER SLABS, BARRIERS, SUPPORT PEDESTALS ABOVE THE BRIDGE SEAT CONSTRUCTION JOINT AND DRAIN TROUGH.
   - PROVIDE CLASS AAAP CEMENT CONCRETE IN APPROACH SLAB TYPES 3 AND 5.
   - A HIGHER CLASS OF CONCRETE MAY BE SUBSTITUTED FOR A LOWER CLASS OF CONCRETE AT NO ADDITIONAL COST TO THE DEPARTMENT.

2. REINFORCEMENT STEEL:
   - PROVIDE GRADE 60 DEFORMED REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A615, ASTM A996, OR A706. DO NOT WELD REINFORCEMENT BARS UNLESS SPECIFIED. DO NOT USE RAIL STEEL A996 IN BARRIERS OR WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
   - EPOXY COAT ALL REINFORCEMENT BARS.
   - PROVIDE MINIMUM LAP AND EMBEDMENT LENGTH FOR REINFORCING BARS IN ACCORDANCE WITH BC-736M.

3. FABRICATED STRUCTURAL STEEL:
   - PROVIDE STRUCTURAL STEEL CONFORMING TO AASHTO M270 GRADE 36 (OR GRADE 50) [ASTM A709, GRADE 36 OR GRADE 50] UNLESS NOTED OTHERWISE.

4. NEOPRENE COMPRESSION SEALS:
   - PROVIDE MATERIALS AND DETAILS IN ACCORDANCE WITH BC-766M.

5. NEOPRENE STRIP SEAL DAMS:
   - PROVIDE MATERIALS AND DETAILS IN ACCORDANCE WITH BC-767M.

6. TOOTH EXPANSION DAMS:
   - PROVIDE MATERIALS AND DETAILS IN ACCORDANCE WITH BC-762M.

APPROACH SLAB TYPES

TYPE	DESCRIPTION
1	CONCRETE APPROACH SLAB
2	CONCRETE APPROACH SLAB WITH SUPERPAVE ASPHALT OVERLAY
3	ABUTMENT WITH BACKWALL WITH ATTACHED CONCRETE APPROACH SLAB AND NEOPRENE STRIP SEAL DAM
4	ABUTMENT WITH BACKWALL WITH ATTACHED INTEGRAL CONCRETE DRAIN TROUGH AND TOOTH EXPANSION DAM
5	CONCRETE APPROACH SLAB WITH INTEGRAL ABUTMENT

NOTE: ASPHALT OVERLAY IS NOT PERMITTED ON APPROACH SLAB TYPES 1, 3, 4 AND 5.

INDEX OF SHEETS

REFERENCE DRAWINGS

RC-12M	BACKFILL AT STRUCTURES
RC-20M	CONCRETE PAVEMENT JOINTS
RC-24M	PAVEMENT RELIEF JOINT
RC-30M	SUBSURFACE DRAINS
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
BC-709M	PA TYPE 10M BRIDGE BARRIER
BC-713M	PA BRIDGE BARRIER
BC-735M	WALL CONSTRUCTION AND EXPANSION JOINT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-752M	CONCRETE DECK SLAB DETAILS
BC-762M	TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE AND STEEL BEAM BRIDGES
BC-766M	PREFORMED NEOPRENE COMPRESSION SEAL JOINT FOR APPROACH SLABS
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE AND STEEL I-BEAM BRIDGES
BC-775M	MISCELLANEOUS PRESTRESS DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
BC-799M	MECHANICALLY STABILIZED EARTH RETAINING WALLS
BD-601M	CONCRETE DECK SLAB
BD-610M	PA BRIDGE BARRIER
BD-611M	CONCRETE DIAPHRAGM DETAILS FOR STEEL I-BEAM STRUCTURES
BD-617M	PA TYPE 10M BRIDGE BARRIER
BD-618M	VERTICAL WALL CONCRETE BRIDGE BARRIER
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-627M	MOMENT SLABS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-662M	I-BEAM AND PA BULB-TEE BEAM REINFORCEMENT DETAILS
BD-667M	INTEGRAL ABUTMENTS
BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BRIDGE APPROACH SLABS
GENERAL NOTES - 1

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-628M

INSTRUCTIONS TO DESIGNER NOTES

1. THE INFORMATION SHOWN IN THIS STANDARD IS PROVIDED FOR USE IN THE DEVELOPMENT OF THE CONTRACT DRAWINGS. THE DESIGNER IS RESPONSIBLE FOR THE PRESENTATION OF ALL REQUIRED DETAILS AND NOTES.

2. APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW ANGLE. BRIDGE SKEW ANGLE MUST BE GREATER THAN OR EQUAL TO 45 DEGREES. IF THE BRIDGE SKEW ANGLE IS LESS THAN 45 DEGREES THE DESIGNER MUST DISCUSS ALTERNATE DETAILS WITH THE BRIDGE DESIGN AND TECHNOLOGY DIVISION. FOR CONCRETE PAVEMENT THE MINIMUM APPROACH SLAB SKEW IS 60 DEGREES.

3. DESIGNER TO DETERMINE AND SPECIFY THE APPROPRIATE TYPE OF APPROACH SLAB REQUIRED ON THE TS&L DRAWINGS FOR APPROVAL BY PENNDOT.

4. REFER TO APPROACH SLAB SELECTION CRITERIA TABLE FOR ADDITIONAL INFORMATION.

5. DIFFERENT APPROACH SLAB TYPES ARE PERMITTED ON THE SAME BRIDGE.

6. APPROACH SLABS ARE PERMITTED TO BE USED ON CURVED HORIZONTAL ALIGNMENTS. DESIGNER TO DETERMINE IF THESE DETAILS ARE APPROPRIATE FOR EACH INDIVIDUAL SITUATION.

7. CONTRACT DRAWINGS:
   - PROVIDE COMPLETE DETAILS AND NOTES AS REQUIRED.
   - PROVIDE COMPLETE REINFORCEMENT BAR DETAILS AND BAR SCHEDULE.
   - PROVIDE FINISHED TOP OF CONCRETE ELEVATIONS AT THE BEGIN AND END OF SLABS AND AT 10 FOOT INTERVALS. PROVIDE ELEVATIONS AT THE BASELINE, GUTTER LINES, AND AT BREAKS IN SLOPES.

8. APPROACH SLAB PER RC-23M:
   - APPROACH SLAB DETAILS SHOWN ON RC-23M ARE ONLY PERMITTED WHEN THE BRIDGE IS DESIGNED USING BRADD, UNLESS OTHERWISE DIRECTED.
   - APPROACH SLAB DETAILS ARE NOT REQUIRED ON THE CONTRACT DRAWINGS WHEN THE BRIDGE IS DESIGNED USING BRADD, UNLESS OTHERWISE DIRECTED.
   - IF THE APPROACH SLAB IS CONSTRUCTED IN ACCORDANCE WITH RC-23M, THE APPROACH SLAB IS A ROADWAY ITEM, UNLESS OTHERWISE DIRECTED.

9. BRIDGE PAY ITEMS:
   - BRIDGE APPROACH SLABS ARE TO BE INCLUDED AS PART OF THE LUMP SUM STRUCTURE AND SEPARATED INTO INDIVIDUAL ITEMS, UNLESS OTHERWISE DIRECTED.
   - PROVIDE SEPARATE COLUMNS IN THE QUANTITY BLOCK FOR EACH APPROACH SLAB. (APPROACH SLAB AT ABUTMENT 1 / APPROACH SLAB AT ABUTMENT 2)
   - PROVIDE SEPARATE ITEMS AND INDICATE THE APPROXIMATE QUANTITY FOR CONCRETE, REINFORCEMENT, NEOPRENE STRIP SEAL DAMS, TOOTH EXPANSION DAMS, COMPRESSION SEALS, PROTECTIVE COATINGS AND ANY OTHER ITEM THAT MAY BE REQUIRED FOR THE CONSTRUCTION OF THE APPROACH SLAB.
   - WATERSTOPS, POLYETHYLENE SHEETING, CLOSED CELL NEOPRENE SPONGE, EPOXY BONDING COMPOUND, SAWING AND SEALING JOINTS, BACKER ROD, AND ASPHALT-SATURATED PAPER ITEMS ARE INCIDENTAL TO THE APPROACH SLAB CONCRETE.
   - END COVER PLATES, BOLTS, WASHERS AND THREADED INSERTS FOR TYPE 3 AND 5 APPROACH SLABS ARE INCIDENTAL TO THE NEOPRENE STRIP SEAL DAM.
   - STAINLESS STEEL PLATES, RUBBERIZED TROUGH MATERIAL, GALVANIZED STEEL BARS, STAINLESS STEEL SCREWS, NON SHRINK GROUT, STUDS AND ANCHOR BOLTS REQUIRED FOR THE DRAIN TROUGH FOR TYPE 4 APPROACH SLAB ARE INCIDENTAL TO THE TOOTH EXPANSION DAM PAY ITEM.
   - TYPE 5 APPROACH SLABS:
     PROVIDE STRUCTURAL BACKFILL IN ACCORDANCE WITH RC-12M. SUBBASE MATERIAL NOT REQUIRED.

10. ROADWAY PAY ITEMS:
    - SUPERPAVE ASPHALT OVERLAY, ROADWAY PAVEMENT, PAVEMENT RELIEF JOINT, DUCTILE IRON PIPE, INLETS, EXCAVATION, SUBBASE MATERIAL AND SUBGRADE DRAINS ARE ROADWAY PAY ITEMS.
    - SUBBASE THICKNESS BENEATH THE APPROACH SLABS AND SLEEPER SLABS MUST MATCH THE ROADWAY SUBBASE THICKNESS.

11. SUPERPAVE ASPHALT OVERLAY:
    - THE TYPE OF SUPERPAVE ASPHALT MIXTURE DESIGNS PLACED ON TOP OF THE APPROACH SLAB MUST MATCH THE TYPE OF SUPERPAVE ASPHALT MIXTURE DESIGNS USED ON THE ADJACENT ROADWAY.
    - DESIGNER TO SPECIFY THE REQUIRED SUPERPAVE ASPHALT MIXTURE DESIGNS, FOR THE WEARING AND BASE COURSES, ON THE CONTRACT PLANS. THE DEPTH OF THE COURSES MUST EQUAL 5".
    - ASPHALT OVERLAY IS ONLY PERMITTED ON TYPE 2 APPROACH SLAB.

12. PAVEMENT SUBGRADE DRAIN:
    - PROVIDE SUBGRADE DRAIN, REFER TO RC-30M, ON THE LOW SIDE OF THE SLEEPER SLAB.

13. PROTECTIVE COATINGS:
    - APPLY A PROTECTIVE COATING FOR REINFORCED CONCRETE SURFACES (PENETRATING SEALER, BRIDGE SUPERSTRUCTURE) IN ACCORDANCE WITH PUBLICATION 408, SECTION 1019 TO THE TOP SURFACE OF APPROACH SLAB, EXPOSED SURFACES OF THE SLEEPER SLAB AND TO THE FACE AND TOP SURFACES OF THE BARRIERS. DO NOT PLACE PENETRATING SEALERS ON TOP OF ANY SURFACE THAT RECEIVES ASPHALT OVERLAY.

14. GENERAL INFORMATION:
    - PROVIDE PAVING NOTCH OUT-TO-OUT.
    - THE DETAILS PRESENTED IN THIS STANDARD SHOW A 45" F-SHAPE CONCRETE BARRIER. DESIGNER IS RESPONSIBLE TO PROVIDE THE APPROPRIATE DETAILS FOR THE TYPE OF BARRIER REQUIRED.
    - THE DIAPHRAGM REINFORCEMENT CONNECTING THE TYPE 3 APPROACH SLAB TO THE BRIDGE STRUCTURE WAS DEVELOPED BASED ON A HORIZONTAL LOAD EQUAL TO A FRICTION FACTOR OF 0.60 X DEADLOAD OF APPROACH SLAB
    - DESIGN OF ABUTMENTS AND BEARINGS WITH STRUCTURE SUPPORTED APPROACH SLAB: DESIGNER TO INCLUDE THE FOLLOWING ADDITIONAL VERTICAL LOADS INCURRED FROM THE APPROACH SLAB WHEN DESIGNING THE ABUTMENTS AND BEARINGS.
      - VERTICAL REACTION = 1/2 DEADLOAD OF APPROACH SLAB + PHL-93 LANE LOAD REACTION FROM APPROACH SLAB.
      - PHL-93 LANE LOAD REACTION IS OBTAINED BY TREATING THE BRIDGE APPROACH SLAB AS A SIMPLE BEAM WHICH SPANS FROM STRUCTURE TO SLEEPER SLAB. DESIGNER MUST DETERMINE MAXIMUM REACTION BASED ON LENGTH OF THE APPROACH SLAB.
    - DESIGN OF BACKWALL WITH BACKWALL SUPPORTED APPROACH SLAB: DESIGNER TO INCLUDE 1/2 DEADLOAD OF THE APPROACH SLAB, MAXIMUM PHL-93 LIVE LOAD REACTION (AXLES PLUS LANE LOAD) AND BRAKING FORCE WHEN DESIGNING THE BACKWALL.
    - DESIGN OF ABUTMENTS: DESIGNER TO INCLUDE 3'-0" LIVE LOAD SURCHARGE IN THE DESIGN OF THE ABUTMENT TO ACCOUNT FOR FUTURE CONDITION WITHOUT APPROACH SLABS (i.e. OMIT APPROACH SLAB DEADLOAD AND LIVE LOAD).

15. PLACE ROADWAY INLETS OUTSIDE THE LIMITS OF THE APPROACH SLAB OR SLEEPER SLABS.

16. OPENINGS IN BARRIERS AT BRIDGE / APPROACH SLAB INTERFACE ARE TO BE 1/2" OPEN JOINTS IN ACCORDANCE WITH BC-752M, PLACED PARALLEL TO THE CENTERLINE OF BEARINGS.

17. OPENINGS IN BARRIERS AT EXPANSION DEVICE (ROADWAY END OF APPROACH SLAB):
    - BRIDGE SKEWS GREATER THAN OR EQUAL TO 75 DEGREES: PROVIDE OPENINGS PARALLEL TO CENTERLINE OF BEARINGS.
    - BRIDGE SKEWS LESS THAN 75 DEGREES: PROVIDE OPENINGS PERPENDICULAR TO THE ROADWAY.

18. PRESTRESSED CONCRETE BEAMS:
    - BEAM NOTCHES: DEPTH OF BEAM NOTCH IS MODIFIED TO ACCOMMODATE THE DEPTH OF THE APPROACH SLABS IN ACCORDANCE WITH THE DETAILS SHOWN. SHOW BEAM NOTCH DIMENSIONS ON THE CONTRACT DRAWINGS.
    - STRAND PATTERN: STRAIGHT OR DEBONDED STRAND PATTERN IS PREFERRED OVER A DRAPED STRAND PATTERN TO INSURE PATTERN DOES NOT CONFLICT WITH THE INCREASED BEAM NOTCH DEPTH. DESIGNER TO INSURE THAT THE STRAND PATTERN DOES NOT CONFLICT WITH THE BEAM NOTCH.

19. STEEL BEAMS:
    - BEAM NOTCHES: PROVIDE BEAM NOTCH IN ACCORDANCE WITH THE DETAILS SHOWN. SHOW BEAM NOTCH DIMENSIONS ON THE CONTRACT DRAWINGS.

20. ROADWAY INLETS ARE TO BE LOCATED AT A MINIMUM OF 10'-0" FROM THE END OF MOMENT SLABS OR SLEEPER SLABS, MEASURED PERPENDICULAR TO SLABS.

21. GEOSYNTHETIC STABILIZED BRIDGE APPROACH:
    - THE DESIGNER MAY CHOOSE TO SPECIFY A RESILIENT SUBGRADE FOR A BRIDGE APPROACH PAVEMENT, APPROACH SLAB AND SLEEPER SLAB SUBGRADE AS SHOWN ON RC-15M AND AS SPECIFIED IN PUBLICATION 408, SECTION 224. A RESILIENT SUBGRADE IS JUSTIFIED FOR THE FOLLOWING CASES:
      - SITES HAVING RISK OF SEVERE EMBANKMENT EROSION DUE TO FLOOD OVERTOPPING OF APPROACH EMBANKMENT.
      - SITE HAVING RISK OF SETTLEMENT OF STRUCTURE BACKFILL WHERE ADDITIONAL RESISTANCE TO POSSIBLE SETTLEMENT OF THE APPROACH PAVEMENT IS WARRANTED.

APPROACH SLAB GUIDELINE NOTES

THE FOLLOWING GUIDELINES ARE PROVIDED IN ORDER TO HELP THE DESIGNER DETERMINE THE APPROPRIATE TYPE OF APPROACH SLAB TO BE SPECIFIED ON THE CONTRACT DRAWINGS. DESIGNER TO DISCUSS OPTIONS WITH PENNDOT PRIOR TO TS&L SUBMISSION.

1. BRADD BRIDGES:
   REFER TO RC-23M, APPROACH SLAB DETAILS ARE NOT REQUIRED ON THE CONTRACT DRAWINGS, UNLESS OTHERWISE DIRECTED.

2. TYPE 1 APPROACH SLAB:
   - PROVIDE TYPE 1 APPROACH SLAB WHEN CONCRETE OR FLEXIBLE PAVEMENT IS SPECIFIED. THE BARRIERS MUST BE CONNECTED TO THE APPROACH SLAB DIRECTLY OR USE MOMENT SLABS CONNECTED TO THE APPROACH SLAB.

3. TYPE 2 APPROACH SLAB:
   - PROVIDE TYPE 2 APPROACH SLAB WHEN FLEXIBLE PAVEMENT IS SPECIFIED. THE BARRIERS MUST BE CONNECTED TO THE APPROACH SLAB, DIRECTLY OR USE MOMENT SLABS CONNECTED TO THE APPROACH SLAB.

4. TYPE 3 APPROACH SLAB:
   - TYPE 3 APPROACH SLABS CONNECT THE BRIDGE SUPERSTRUCTURE AND BARRIERS WITH THE APPROACH SLAB.
   - PROVIDE TYPE 3 APPROACH SLAB WHEN AN EXPANSION DEVICE IS REQUIRED AND THE DEPARTMENT DIRECTS THE DESIGNER TO RELOCATE THE EXPANSION DEVICE FROM ON THE BRIDGE TO THE END OF THE APPROACH SLAB.
   - DESIGNER TO DETERMINE THE REQUIRED JOINT OPENING AT TIME OF CONSTRUCTION AND THE MOVEMENT REQUIREMENTS OF THE EXPANSION JOINT AT THE END OF THE APPROACH SLAB IN ACCORDANCE WITH THE REQUIREMENTS OF DESIGN MANUAL, PART 4.

5. TYPE 4 APPROACH SLAB:
   - PROVIDE TYPE 4 APPROACH SLAB WHEN AN EXPANSION DEVICE IS REQUIRED AND THE ANTICIPATED JOINT MOVEMENT IS OVER 4". EXTEND THE DECK SLAB CONTINUOUS OVER THE BACKWALL TO THE EXPANSION DEVICE SUPPORTED BY AN INTEGRAL DRAIN TROUGH.
   - DESIGNER TO DETERMINE THE REQUIRED JOINT OPENING AT TIME OF CONSTRUCTION AND THE MOVEMENT REQUIREMENTS OF THE EXPANSION JOINT AT THE END OF THE APPROACH SLAB IN ACCORDANCE WITH THE REQUIREMENTS OF DESIGN MANUAL, PART 4.

6. TYPE 5 APPROACH SLAB:
   - PROVIDE TYPE 5 APPROACH SLAB WHEN INTEGRAL ABUTMENTS ARE SPECIFIED.
   - DESIGNER TO DETERMINE THE REQUIRED JOINT OPENING AT TIME OF CONSTRUCTION AND THE MOVEMENT REQUIREMENTS OF THE EXPANSION JOINT AT THE END OF THE APPROACH SLAB IN ACCORDANCE WITH THE REQUIREMENTS OF DESIGN MANUAL, PART 4, APPENDIX G, SECTION 1.6.

7. TYPE 3 AND 5 APPROACH SLABS ARE NOT PERMITTED IF MECHANICALLY STABILIZED EARTH (MSE) ABUTMENTS AND/OR RETAINING WALLS ARE SPECIFIED. MSE RETAINING WALLS ARE PERMITTED BEYOND THE END OF THE SLEEPER SLAB.

8. REFER TO THE DETAILS FOR BEAM DEPTH LIMITATIONS.

APPROACH SLAB SELECTION CRITERIA TABLE

APPROACH SLAB TYPE	ROADWAY PAVEMENT TYPE	MINIMUM SKEW ANGLE (DEGREES)	ABUTMENT WITH BACKWALL?	APPROACH SLAB CONNECTED TO SUPERSTRUCTURE?	SUPERPAVE ASPHALT OVERLAY ON APPROACH SLAB?	EXPANSION JOINT AT END OF APPROACH SLAB
1	CONCRETE	60	N/A	NO	NO	N/A
	FLEXIBLE	45				
2	FLEXIBLE	45	N/A	NO	YES	N/A
3	CONCRETE	60	YES	YES	NO	NEOPRENE STRIP SEAL
	FLEXIBLE	45				
4	CONCRETE	60	YES	YES	NO	TOOTH EXPANSION DAM
	FLEXIBLE	45				
5 (SEE NOTE 1)	CONCRETE	60	N/A	YES	NO	NEOPRENE STRIP SEAL (IF REQUIRED)
	FLEXIBLE	45				

NOTES:

1. SKEW LIMITATIONS PER DESIGN MANUAL, PART 4, APPENDIX G, SECTION 1.2.2 MUST ALSO BE MET IN ORDER TO USE INTEGRAL ABUTMENTS.
2. IF BRIDGE SKEW ANGLE IS LESS THAN 45 DEGREES THE DESIGNER MUST DISCUSS ALTERNATE DETAILS WITH THE BRIDGE OFFICE.

CONTRACT DRAWINGS NOTES

THE FOLLOWING NOTES ARE TO BE PLACED ON THE CONTRACT DRAWINGS:

1. CONSTRUCT BRIDGE APPROACH SLAB AFTER THE BRIDGE DECK SLAB IS CONSTRUCTED.
2. PLACE CONCRETE IN ONE CONTINUOUS OPERATION, UNLESS OTHERWISE INDICATED OR DIRECTED.
3. TRANSVERSE CONSTRUCTION JOINTS ARE NOT PERMITTED IN THE CONCRETE APPROACH SLAB OR SLEEPER SLAB, UNLESS OTHERWISE INDICATED.
4. PROVIDE ANY OTHER NOTES AS REQUIRED.

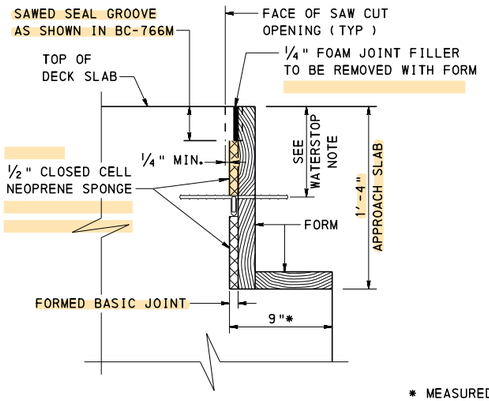
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

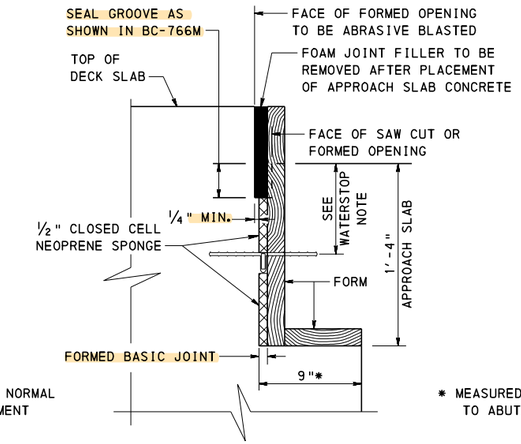
BRIDGE APPROACH SLABS
GENERAL NOTES - 2

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

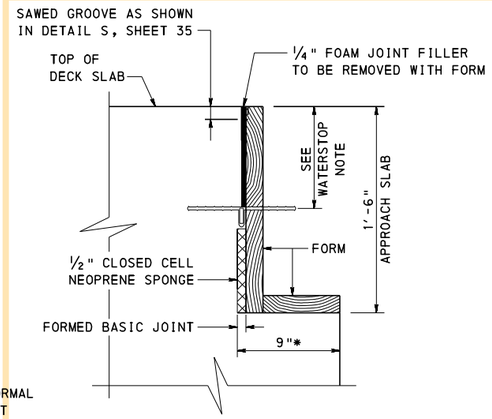


TYPE 1
APPROACH SLABS



* MEASURED NORMAL TO ABUTMENT

TYPE 2
APPROACH SLABS



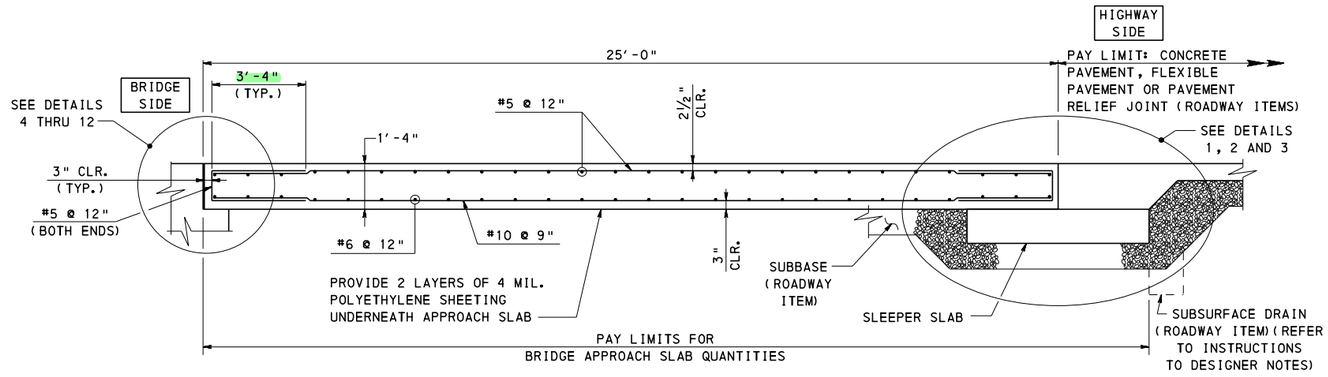
* MEASURED NORMAL TO ABUTMENT

TYPE 3
APPROACH SLABS

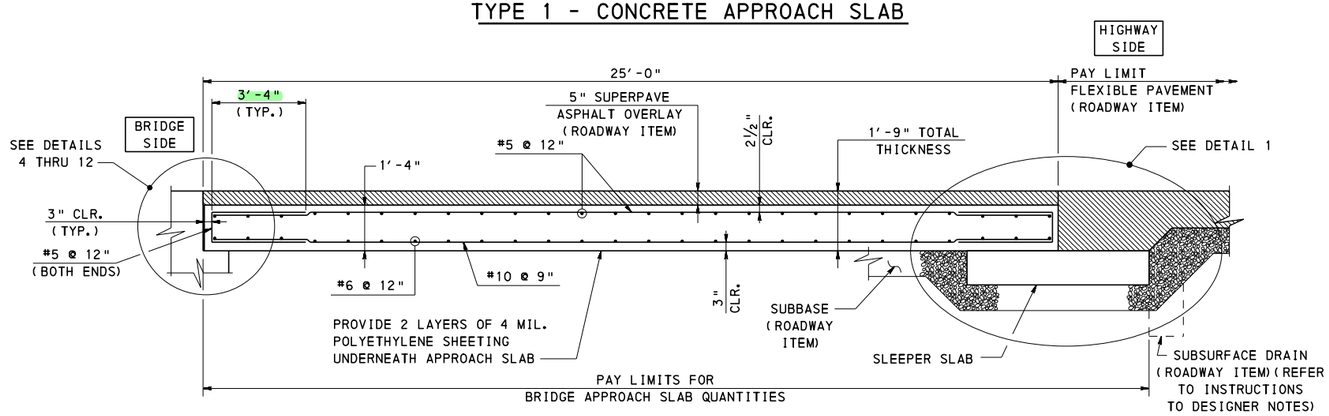
WATERSTOP NOTE:
AN EXPANSION WATERSTOP (TYPE E1 OR E2), IN ACCORDANCE WITH BC-735M, MUST BE INSTALLED AT MID-DEPTH OF APPROACH SLAB, OR ABOVE THE BEAM NOTCH FOR ADJACENT AND SPREAD BOX BEAMS. PLACE WATERSTOP TO PROVIDE POSITIVE DRAINAGE TO THE OUTSIDE OF THE STRUCTURE.

PAVING NOTCH FORMING DETAILS

NOTE: FOR BACKWALL SUPPORTED TYPE 1 AND TYPE 2 APPROACH SLABS (DETAILS 4 AND 5) AND TYPE 4 APPROACH SLABS, OMIT THE WATERSTOP AND CLOSED CELL NEOPRENE SPONGE ABOVE THE WATERSTOP.



TYPE 1 - CONCRETE APPROACH SLAB



TYPE 2 - CONCRETE APPROACH SLAB
WITH SUPERPAVE ASPHALT OVERLAY

SECTION A-A

DESCRIPTION OF PLANS FOR TYPE 1 AND TYPE 2 APPROACH SLABS

PLAN	DESCRIPTION	SHEET NO.
1	APPROACH SLAB SET TO ROADWAY WIDTH WITH FLARED WINGS AND MOMENT SLABS (IN SHOULDER)	4
2	FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS WITH FLARED WINGS OR SHORT U-WINGS	5
3	FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS WITH LONG U-WINGS	6
4	FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS WITH FLARED WINGS OR SHORT U-WINGS WITH MOMENT SLABS	7

DESCRIPTION OF DETAILS FOR TYPE 1 AND TYPE 2 APPROACH SLABS

DETAIL	DESCRIPTION	SHEET NO.
1	APPROACH SLAB ADJACENT TO FLEXIBLE PAVEMENT	9
2	APPROACH SLAB ADJACENT TO CONCRETE PAVEMENT	9
3	APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT	9
4	APPROACH SLAB SUPPORTED ON ABUTMENT BACKWALL WITH NEOPRENE STRIP SEAL DAM	10
5	APPROACH SLAB SUPPORTED ON ABUTMENT BACKWALL WITH TOOTH EXPANSION DAM	11
6	APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE ADJACENT BOX BEAMS	12
7	APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS	13
8	APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS	14
9	APPROACH SLAB SUPPORTED ON STEEL I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS	15
10	APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE ADJACENT BOX BEAMS	16
11	APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS	17
12	APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO STEEL I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS	18

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

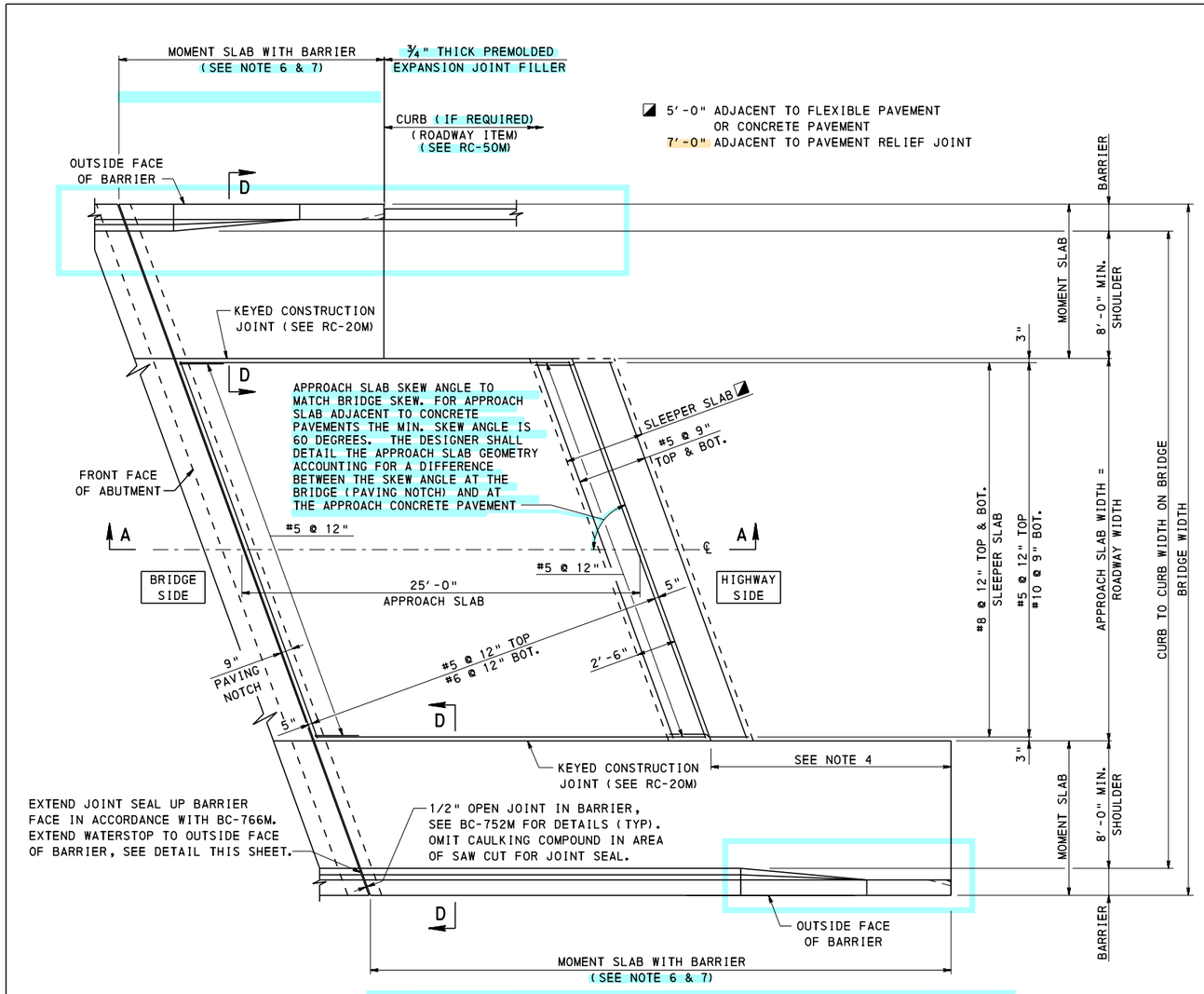
STANDARD

BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2
SECTIONS AND DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

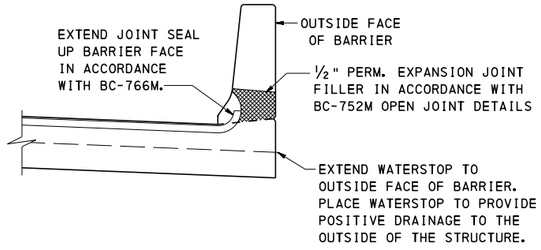
RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-628M

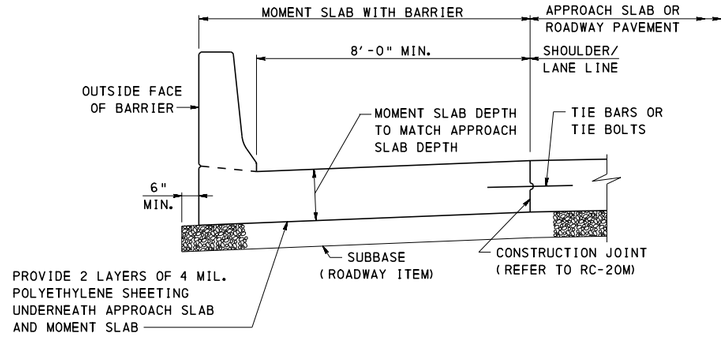


PLAN 1
TYPE 1 AND TYPE 2

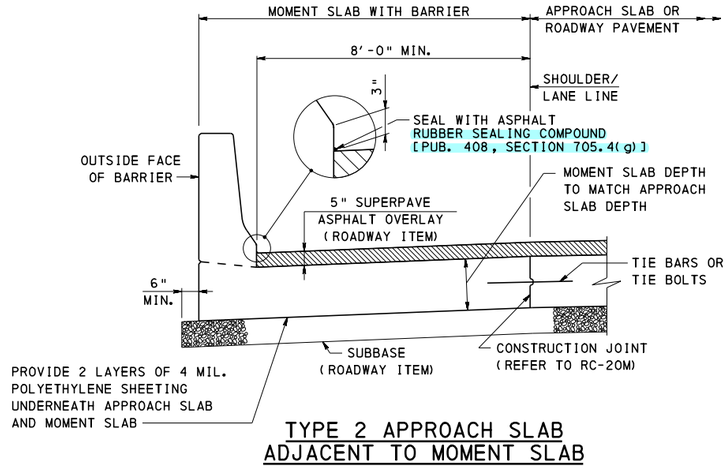
APPROACH SLAB SET TO ROADWAY WIDTH WITH FLARED WINGS AND MOMENT SLABS (IN SHOULDER)



JOINT SEAL AND WATERSTOP TERMINATION DETAIL



TYPE 1 APPROACH SLAB ADJACENT TO MOMENT SLAB



TYPE 2 APPROACH SLAB ADJACENT TO MOMENT SLAB

SECTION D-D

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION A-A, SEE SHEET 3.
3. FOR ADDITIONAL MOMENT SLAB DETAILS REFER TO BD-627M.
4. ELIMINATE THE TIE BARS OR TIE BOLTS ALONG LENGTH INDICATED.
5. PROVIDE PAVING NOTCH OUT TO OUT.
6. 45" F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.
7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16'-0" MINIMUM PER BD-627M.
8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

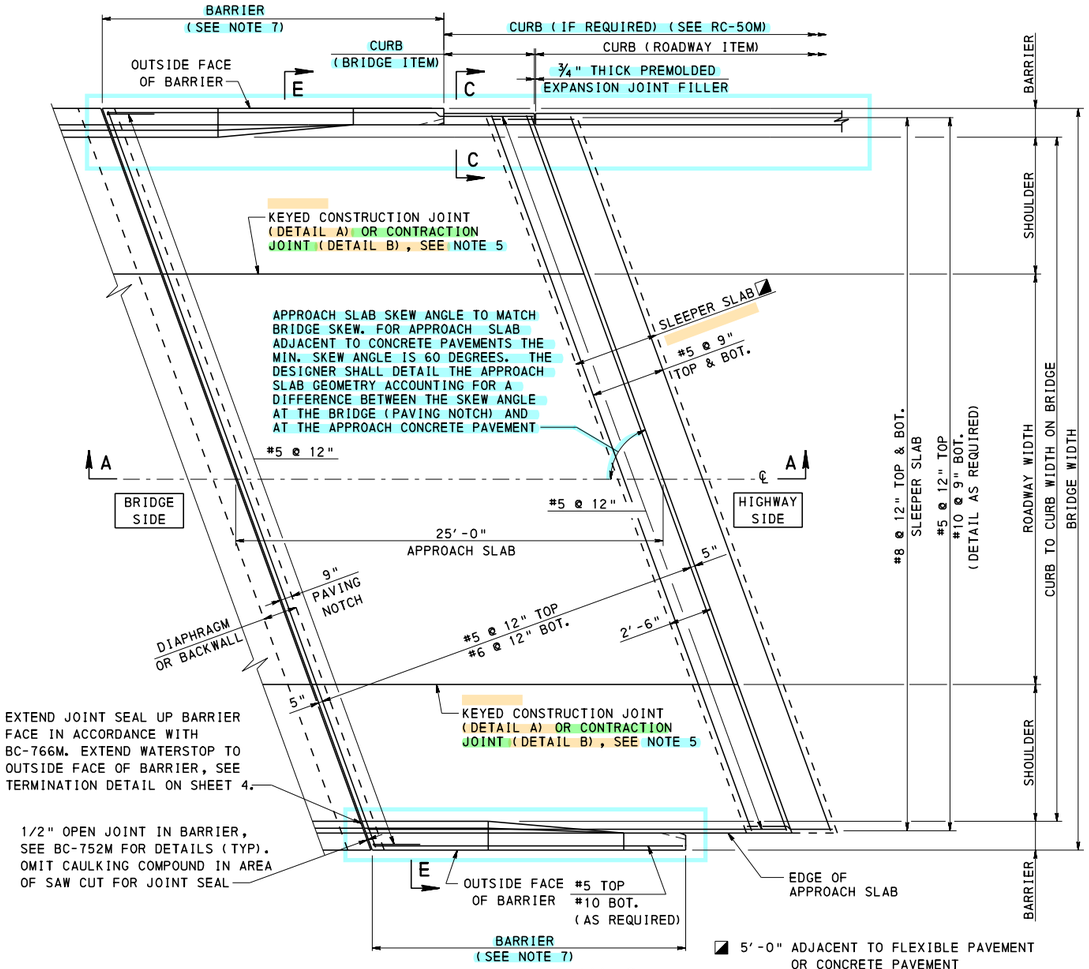
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - PLAN 1

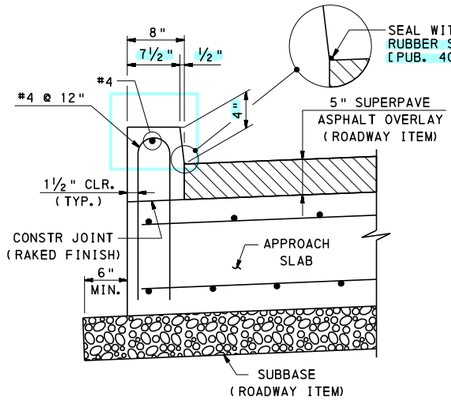
RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

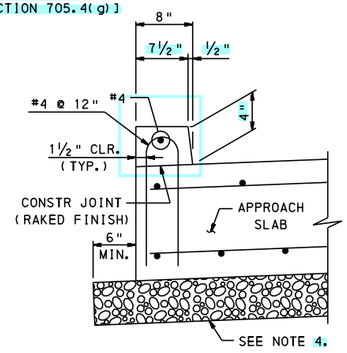


PLAN 2
TYPE 1 AND TYPE 2

FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS WITH FLARED WINGS OR SHORT U-WINGS



TYPE 2 - CONCRETE APPROACH SLAB WITH SUPERPAVE ASPHALT OVERLAY



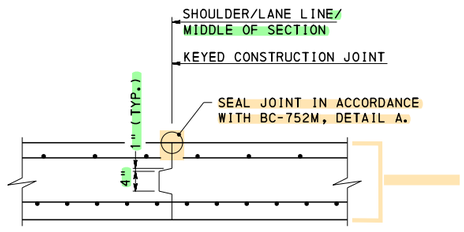
TYPE 1, 3, OR 5 - CONCRETE APPROACH SLAB

SECTION C-C

NOTES

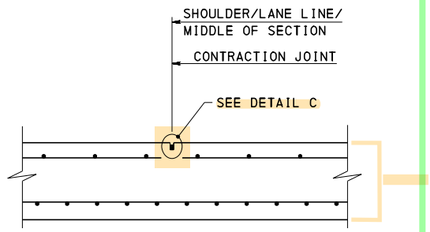
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION A-A, SEE SHEET 3.
3. FOR SECTION E-E, SEE SHEET 8.
4. TYPE 1 AND TYPE 3 APPROACH SLAB: SUBBASE (ROADWAY ITEM)
   TYPE 5 APPROACH SLAB: STRUCTURAL BACKFILL, REFER TO RC-12M.
5. CONSTRUCTION/CONTRACTION JOINT REQUIREMENTS:
   (CONTRACTION JOINT APPLIES WHERE ENTIRE APPROACH SLAB WIDTH IS CONSTRUCTED AT ONE TIME).
   - NOT REQUIRED IF APPROACH SLAB WIDTH IS ≤ 30 FT.
   - MINIMUM ONE JOINT IF APPROACH SLAB WIDTH IS > 30 FT. AND ≤ 60 FT.
   - MINIMUM TWO JOINTS IF APPROACH SLAB WIDTH IS > 60 FT.
   - MAXIMUM JOINT SPACING IS LIMITED TO 24 FT. IF SKEW ANGLE IS < 60 DEGREES

   PREFERRED INSTALLED LOCATION OF THE CONSTRUCTION AND CONTRACTION JOINTS:
   - BREAK LINE OF LANES AND/OR LANE SHOULDER.
   - NEAR MIDDLE OF THE SECTION. AVOID WHEEL PATHS.
6. FOR JOINT MATERIAL, REFER TO PUB.408, SECTION 705.4(a) OR (b).
7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.



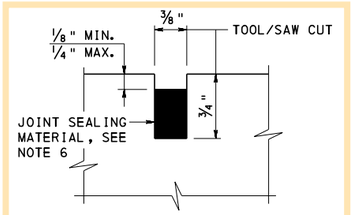
DETAIL A
CONSTRUCTION JOINT

NOTE: TOP REINFORCEMENT NOT CONTINUOUS THRU JOINT.
BOTTOM REINFORCEMENT CONTINUOUS THRU JOINT.
MECHANICAL SPLICES ARE PERMITTED AS AN OPTION FOR BOTTOM REINFORCEMENT.



DETAIL B
CONTRACTION JOINT

NOTE: TOP REINFORCEMENT NOT CONTINUOUS THRU JOINT.
BOTTOM REINFORCEMENT CONTINUOUS THRU JOINT.



DETAIL C

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

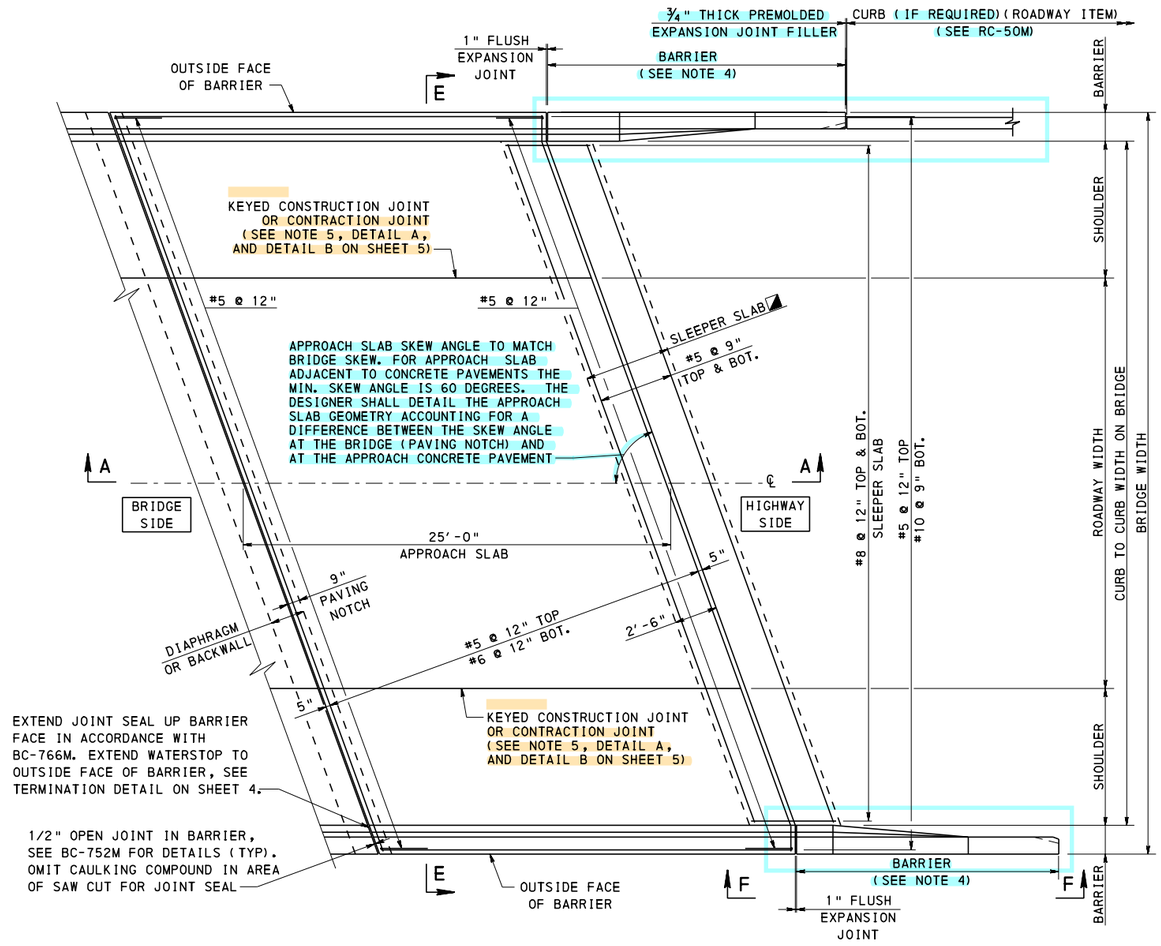
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - PLAN 2

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

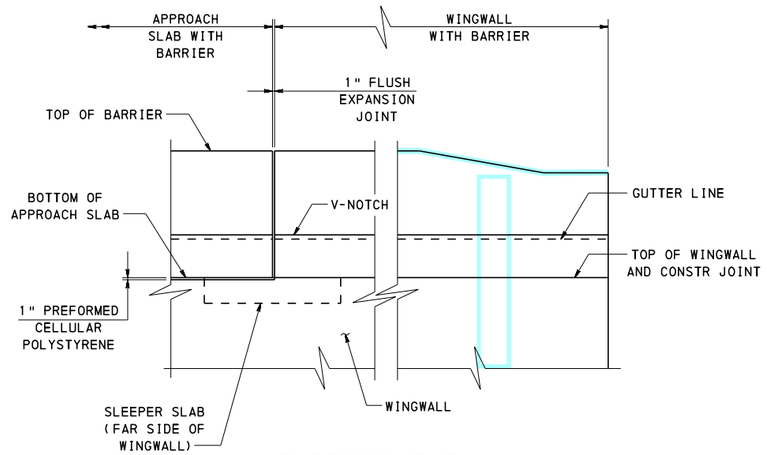
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 5 OF 35

BD-628M



5'-0" ADJACENT TO FLEXIBLE PAVEMENT OR CONCRETE PAVEMENT
7'-0" ADJACENT TO PAVEMENT RELIEF JOINT



SECTION F-F

PLAN 3
TYPE 1 AND TYPE 2
FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS WITH LONG U-WINGS

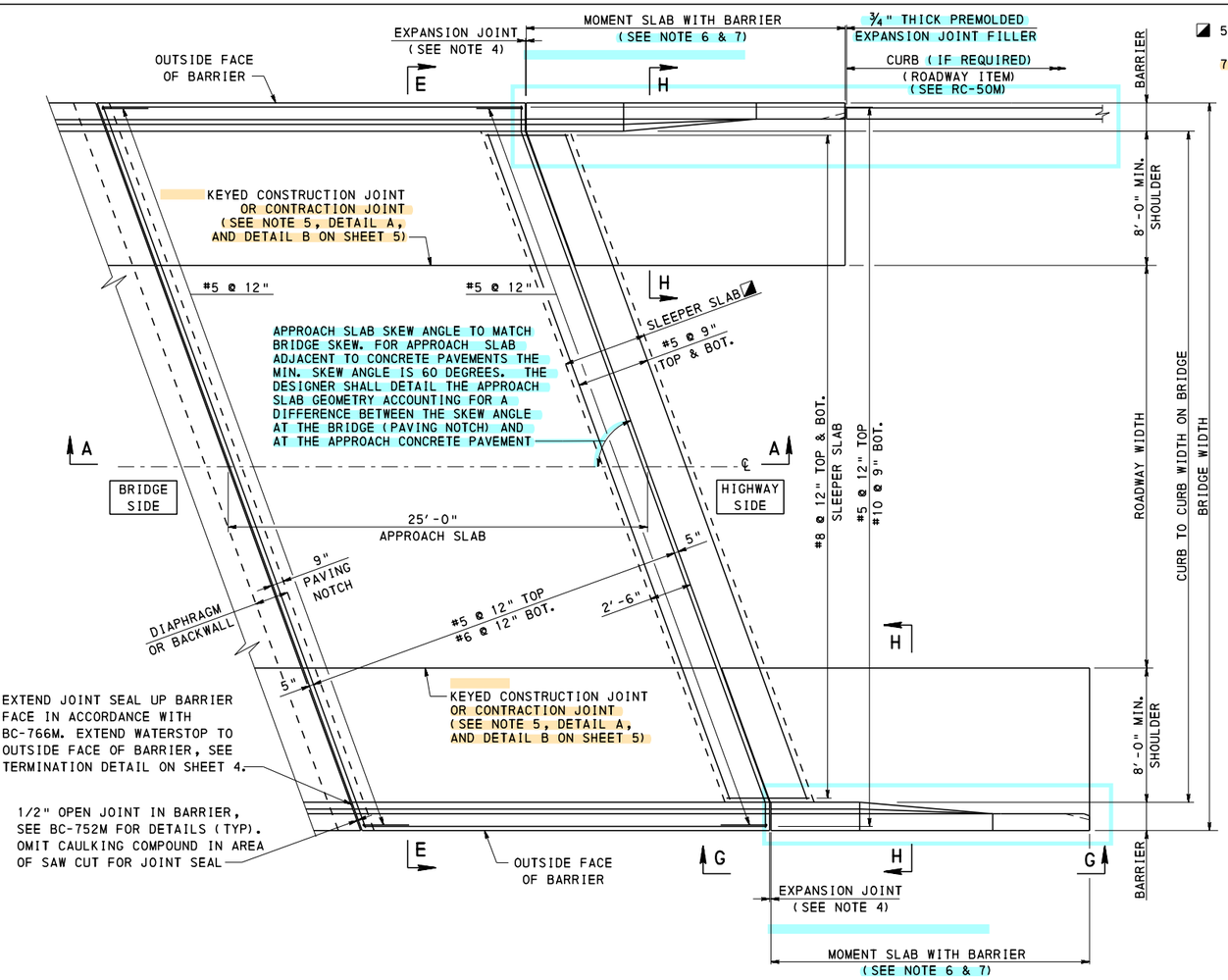
NOTES
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION A-A, SEE SHEET 3.
3. FOR SECTION E-E, SEE SHEET 8.
4. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
5. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

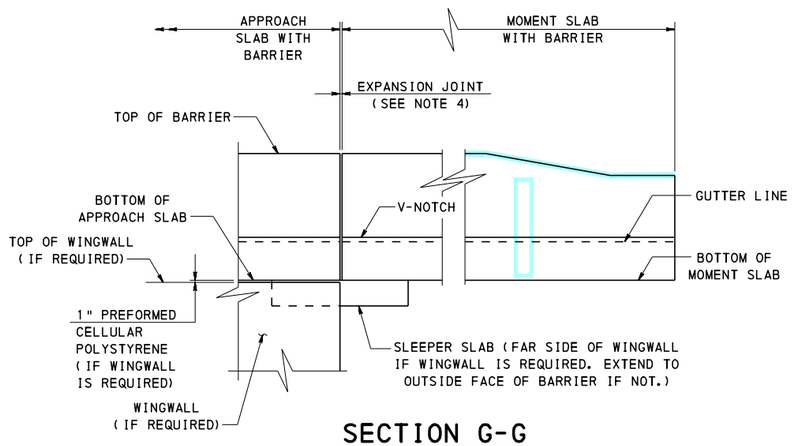
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - PLAN 3

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 6 OF 35 BD-628M



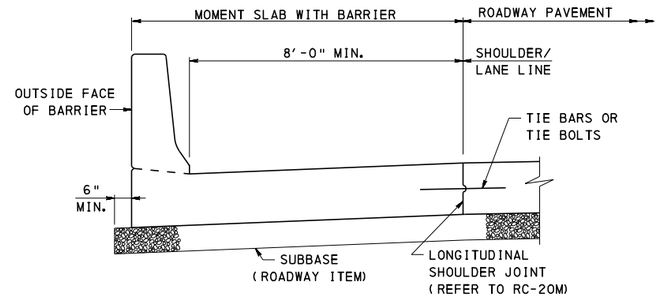
PLAN 4
TYPE 1 AND TYPE 2

FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS
WITH FLARED WINGS OR SHORT U-WINGS WITH MOMENT SLABS

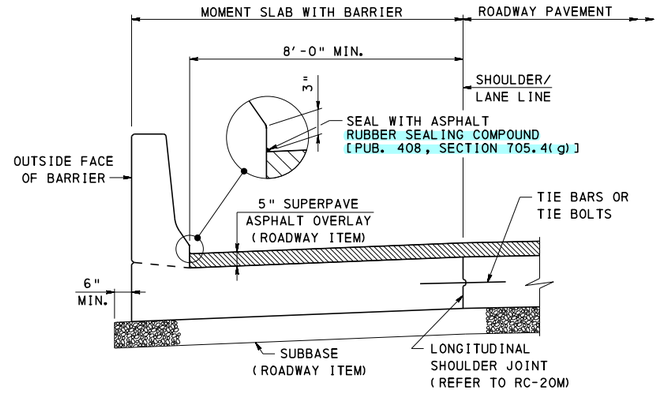


SECTION G-G

5'-0" ADJACENT TO FLEXIBLE PAVEMENT
OR CONCRETE PAVEMENT
7'-0" ADJACENT TO PAVEMENT RELIEF JOINT



MOMENT SLAB ADJACENT TO TYPE 1 APPROACH SLAB



MOMENT SLAB ADJACENT TO TYPE 2 APPROACH SLAB

SECTION H-H

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION A-A, SEE SHEET 3.
3. FOR SECTION E-E, SEE SHEET 8.
4. PROVIDE THE FOLLOWING JOINT OPENINGS:
   - APPROACH SLAB ADJACENT TO CONCRETE OR FLEXIBLE PAVEMENT:
     1" FLUSH EXPANSION JOINT
   - APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT:
     2'-0" AND PROVIDE SLIDING PLATE IN ACCORDANCE WITH THE DETAILS SHOWN ON BD-627M.
5. FOR ADDITIONAL MOMENT SLAB DETAILS REFER TO BD-627M.
6. 45" F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.
7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16'-0" MINIMUM PER BD-627M.
8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

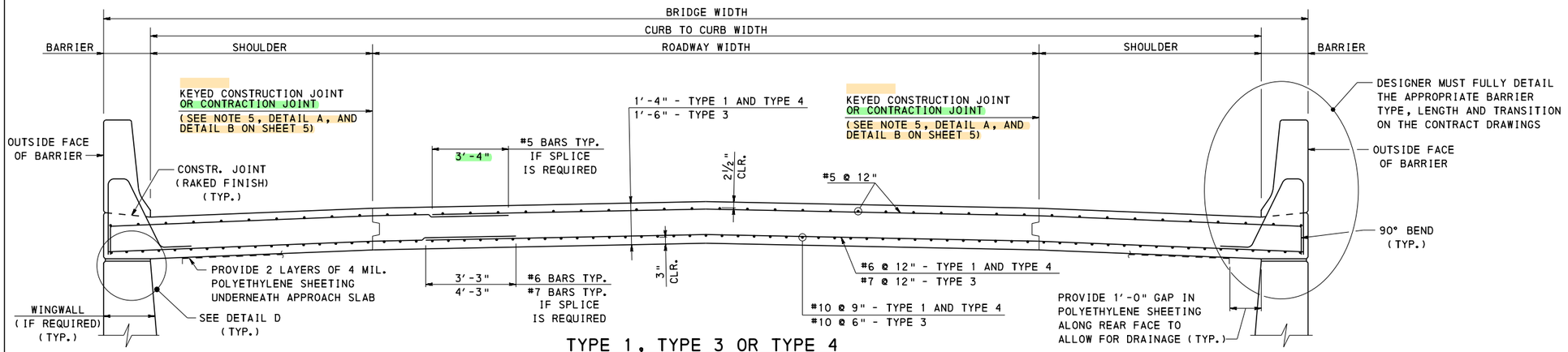
STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - PLAN 4

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

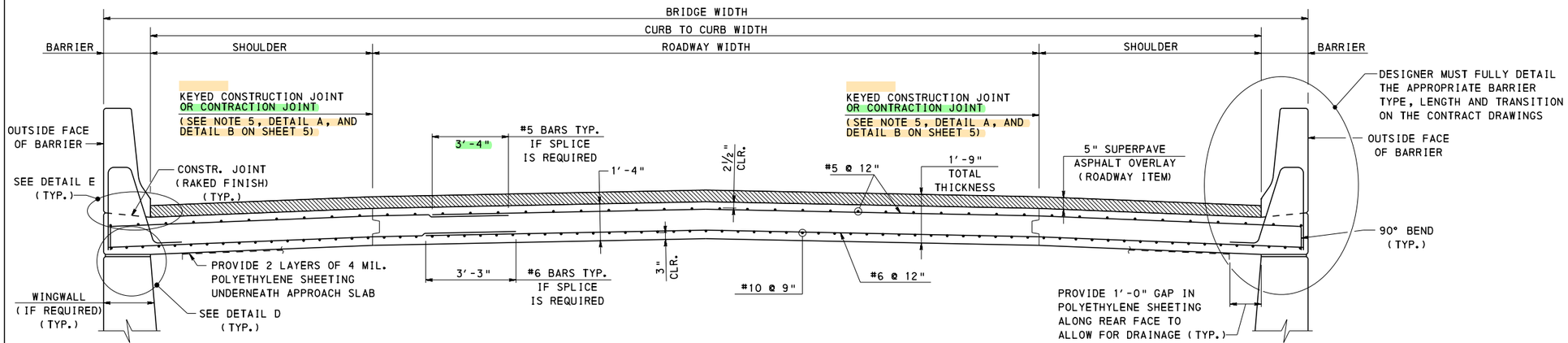
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 7 OF 35

BD-628M

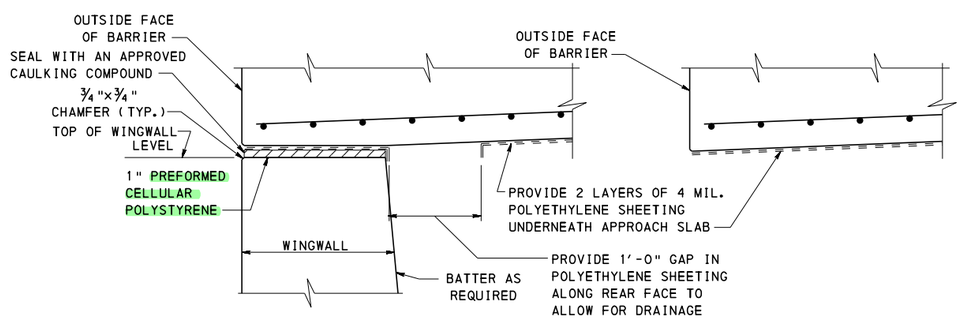


TYPE 1, TYPE 3 OR TYPE 4
CONCRETE APPROACH SLAB WITH ATTACHED BARRIERS



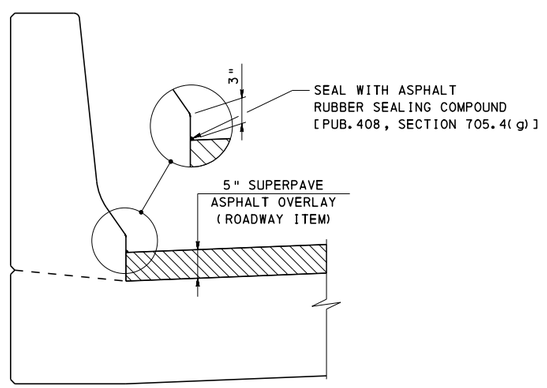
TYPE 2 - CONCRETE APPROACH SLAB WITH ATTACHED BARRIERS AND SUPERPAVE ASPHALT OVERLAY

SECTION E-E



DETAIL D
WITH WINGWALL

DETAIL D
WITHOUT WINGWALL



DETAIL E

NOTES
1. FOR NOTES, SEE SHEETS 1 AND 2.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

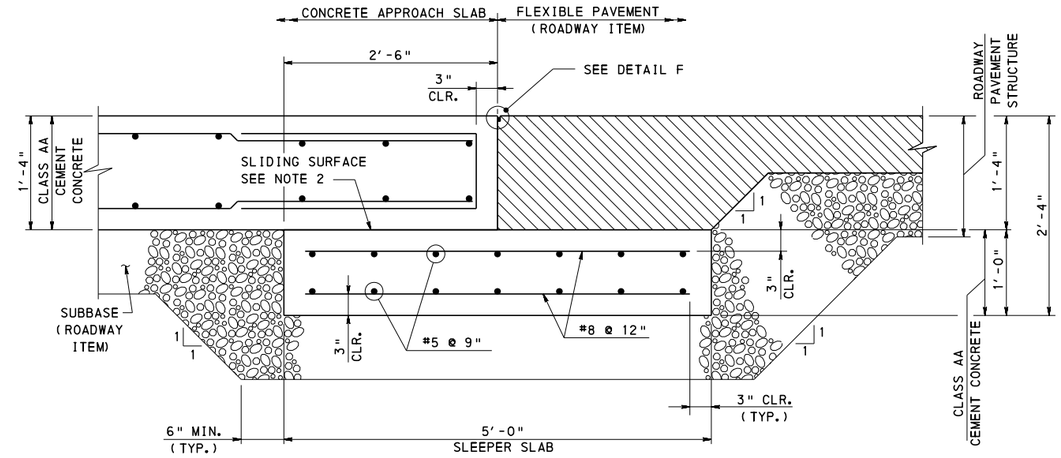
BRIDGE APPROACH SLABS
TYPE 1 THRU TYPE 4 - TRANSVERSE SECTION
WITH ATTACHED BARRIERS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

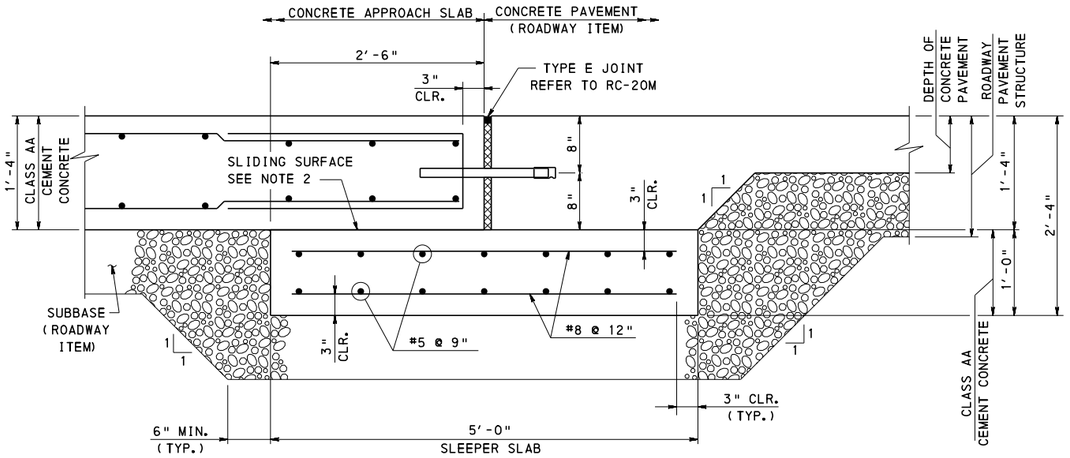
SHEET 8 OF 35

BD-628M



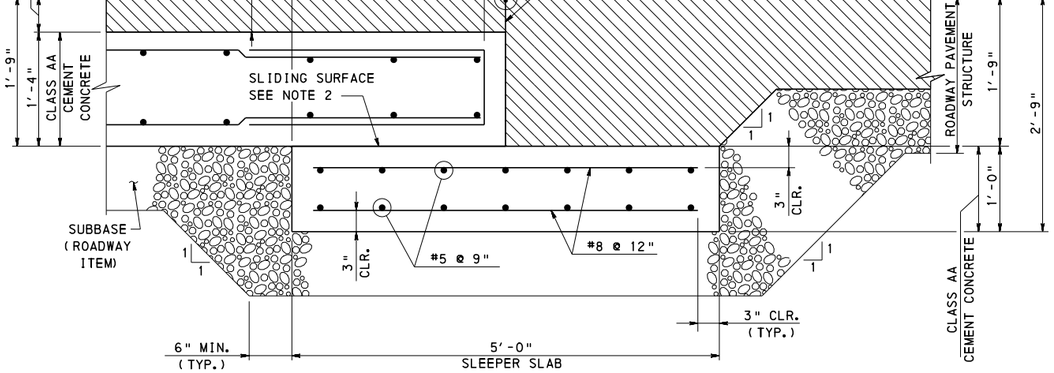
TYPE 1 AND TYPE 4 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 1

END OF APPROACH SLAB ADJACENT TO FLEXIBLE PAVEMENT



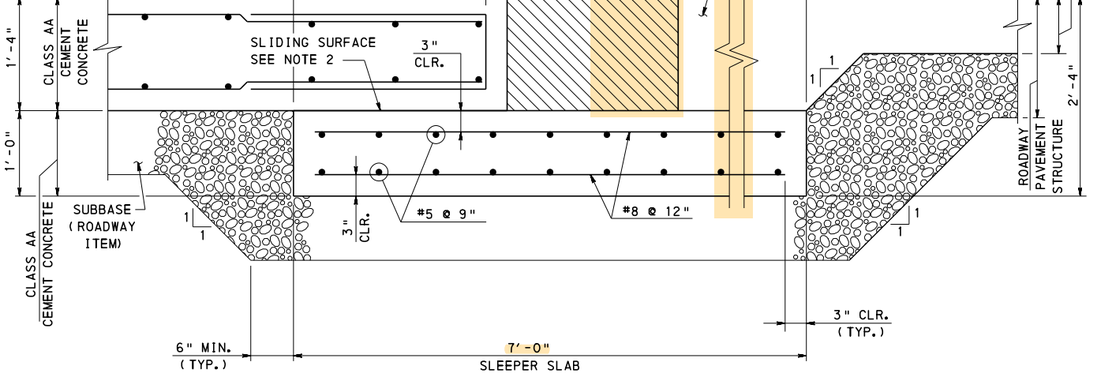
TYPE 1 AND TYPE 4 APPROACH SLAB - DETAIL 2

(SEE NOTE 3)
END OF APPROACH SLAB ADJACENT TO CONCRETE PAVEMENT



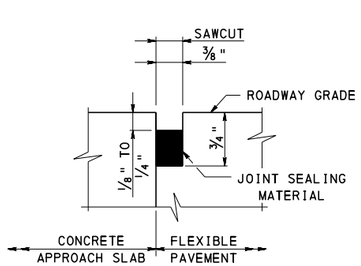
TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 1

END OF APPROACH SLAB ADJACENT TO FLEXIBLE PAVEMENT

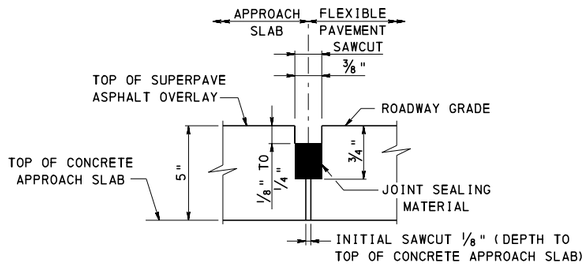


TYPE 1 AND TYPE 4 APPROACH SLAB - DETAIL 3

END OF APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT



DETAIL F



DETAIL G

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. TROWEL SMOOTH AND PLACE 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING AS BOND BREAKER.
3. USE DETAIL 2 ONLY WHEN LIMITED MOVEMENT IS ANTICIPATED IN THE ROADWAY OTHERWISE USE DETAIL 3. REFER TO RC-24M FOR ADDITIONAL INFORMATION.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

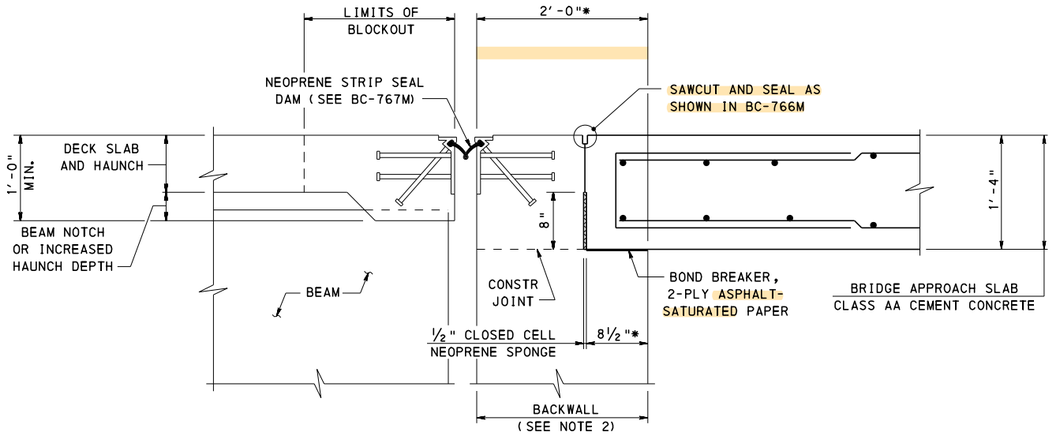
STANDARD

BRIDGE APPROACH SLABS TYPE 1, 2 AND 4 - DETAILS 1, 2 AND 3 (ADJACENT TO ROADWAY)

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

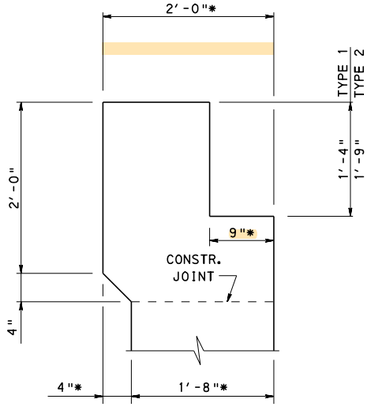
BD-628M



* MEASURED NORMAL TO ABUTMENT

TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 4

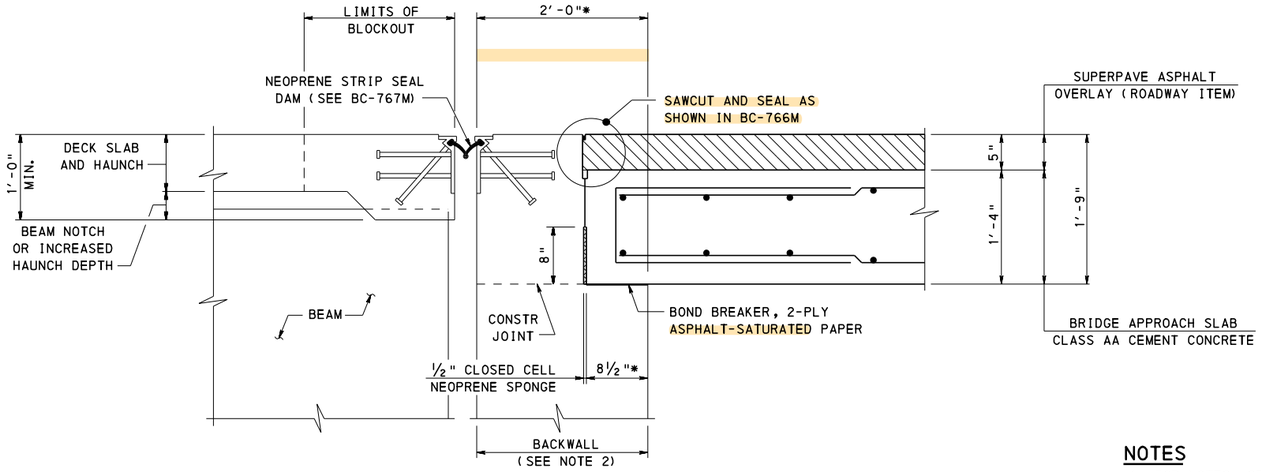
APPROACH SLAB SUPPORTED ON ABUTMENT
BACKWALL WITH NEOPRENE STRIP SEAL DAM



* MEASURED NORMAL TO ABUTMENT

OPTIONAL BACKWALL

(SEE NOTE 2)



* MEASURED NORMAL TO ABUTMENT

TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 4

APPROACH SLAB SUPPORTED ON ABUTMENT
BACKWALL WITH NEOPRENE STRIP SEAL DAM

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. DESIGNER TO DETERMINE BACKWALL SHAPE, REFER TO BD-621M, SHEET 2.
3. FOR PAVING NOTCH FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

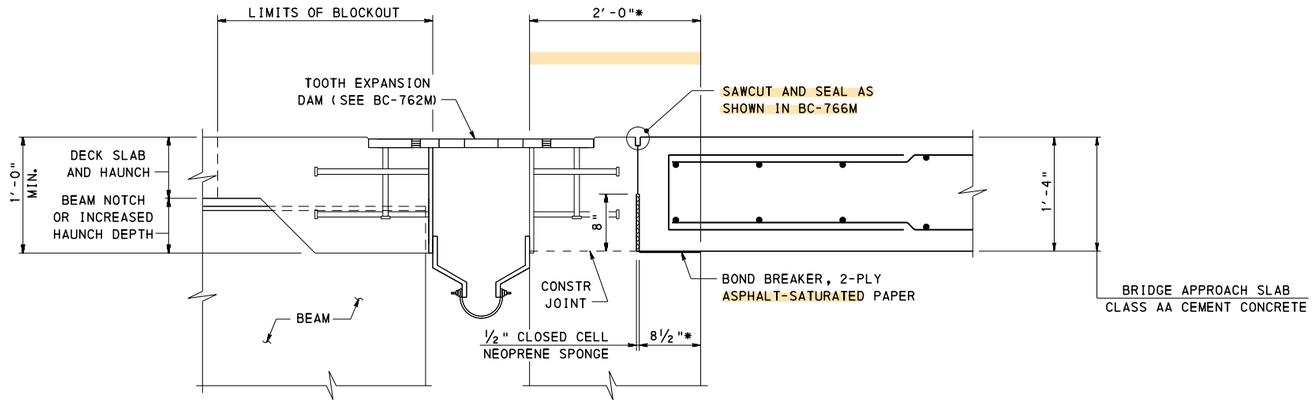
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 4
(NEOPRENE STRIP SEAL DAM WITH BACKWALL)

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

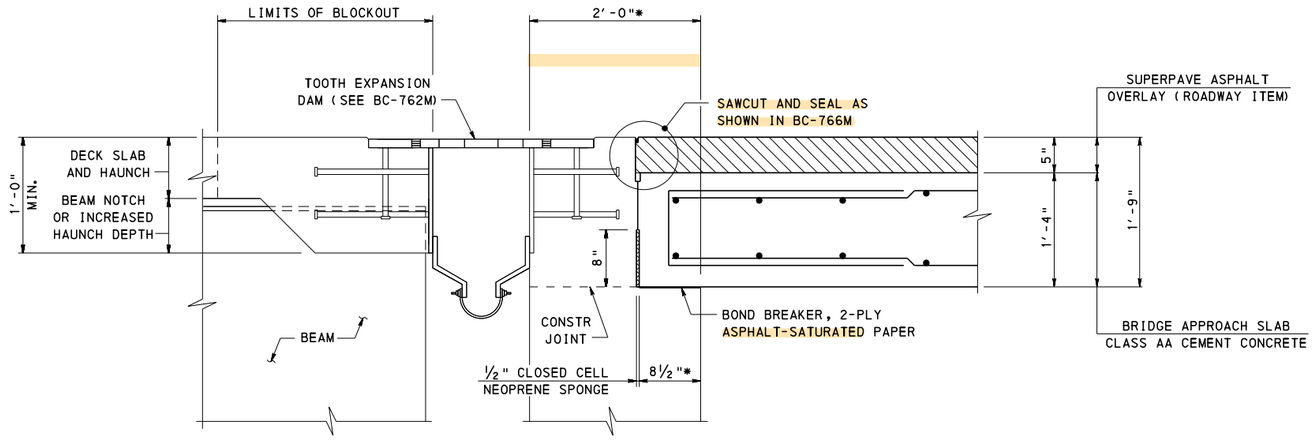
BD-628M



* MEASURED NORMAL TO ABUTMENT

TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 5

APPROACH SLAB SUPPORTED ON ABUTMENT
BACKWALL WITH TOOTH EXPANSION DAM



* MEASURED NORMAL TO ABUTMENT

TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 5

APPROACH SLAB SUPPORTED ON ABUTMENT
BACKWALL WITH TOOTH EXPANSION DAM

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR PAVING NOTCH FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

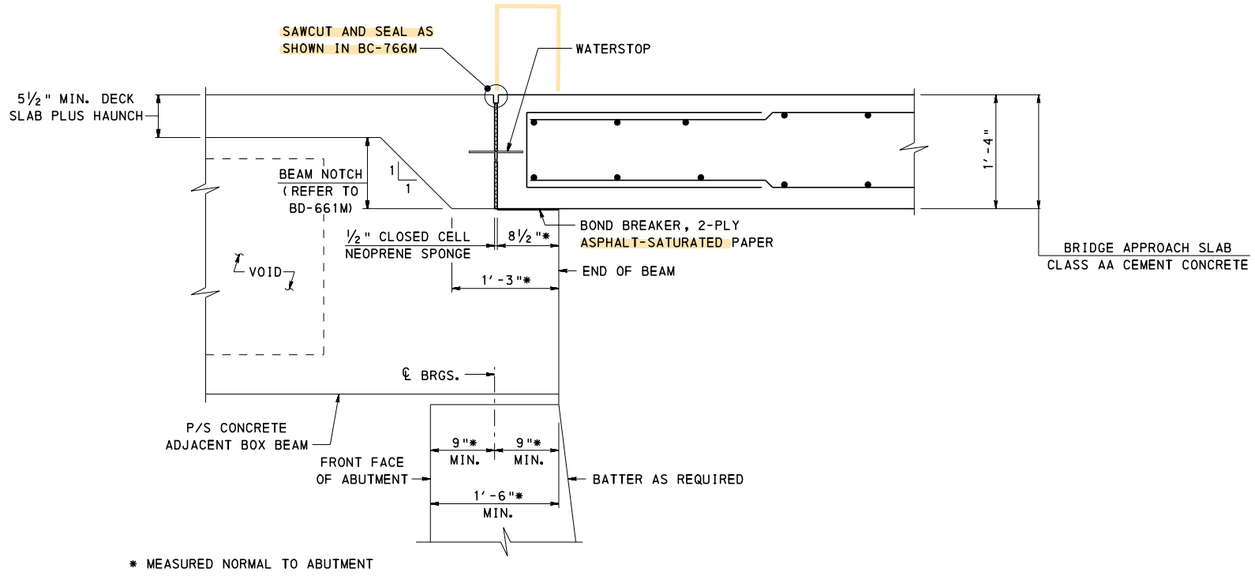
BRIDGE APPROACH SLABS

TYPE 1 AND TYPE 2 - DETAIL 5 (TOOTH EXPANSION DAM WITH BACKWALL)

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

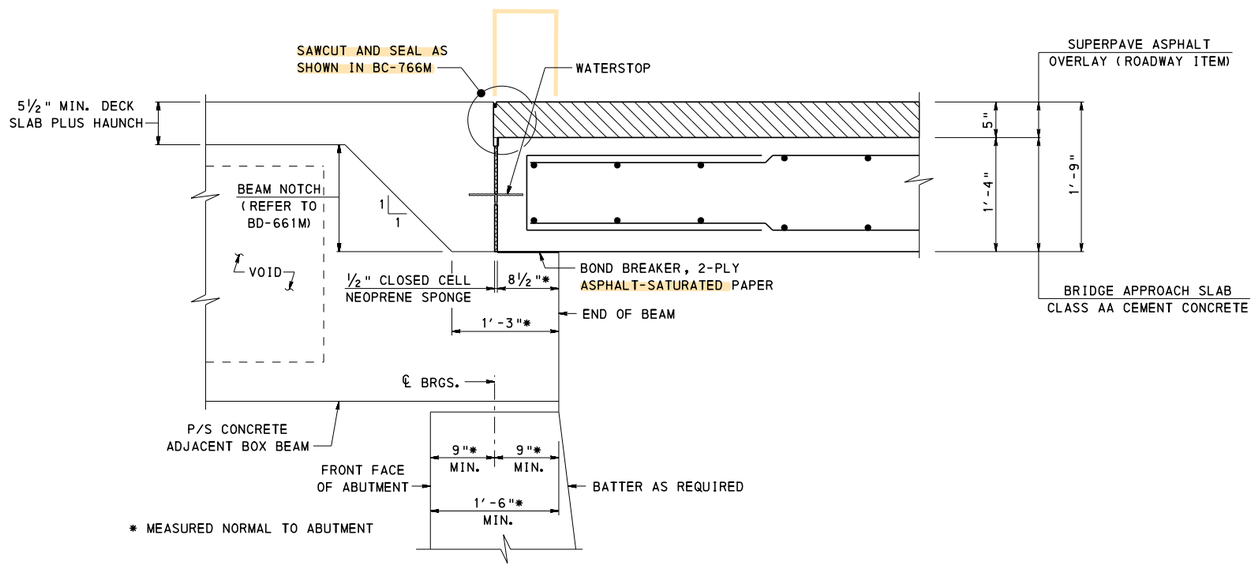
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-628M



TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 6

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE
ADJACENT BOX BEAMS FOR BEAM DEPTHS 27" AND GREATER



TYPE 2 APPROACH SLAB (WITH OVERLAY)- DETAIL 6

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE
ADJACENT BOX BEAMS FOR BEAM DEPTHS 30" AND GREATER

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED REFER TO DETAIL 10.
4. FOR PAVING NOTCH FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

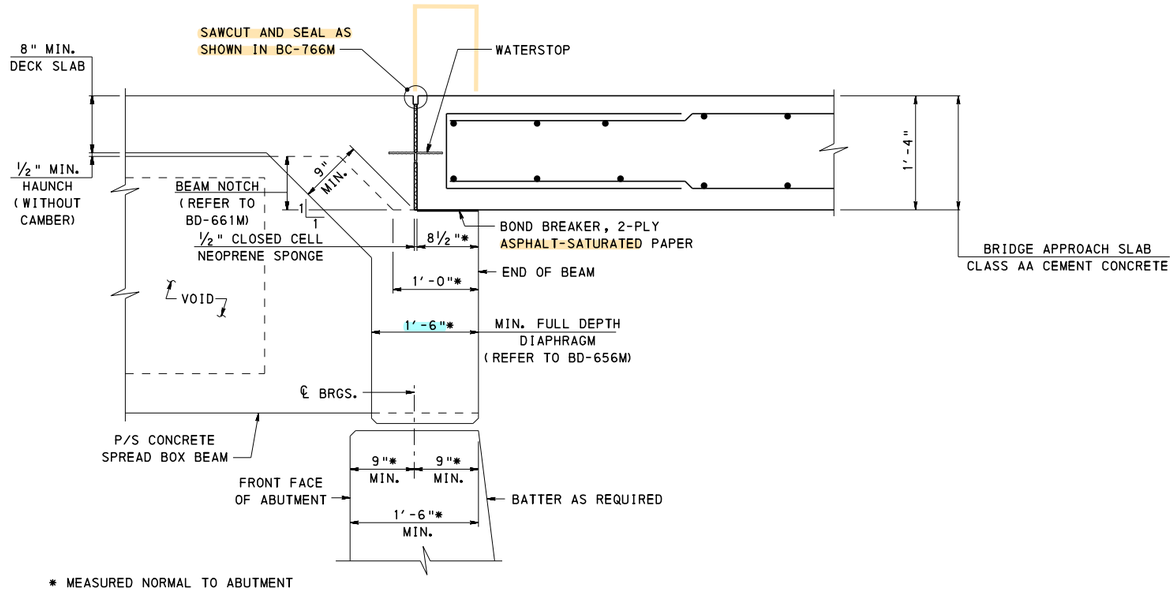
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 6
(P/S CONCRETE ADJACENT BOX BEAMS WITHOUT BACKWALL)

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

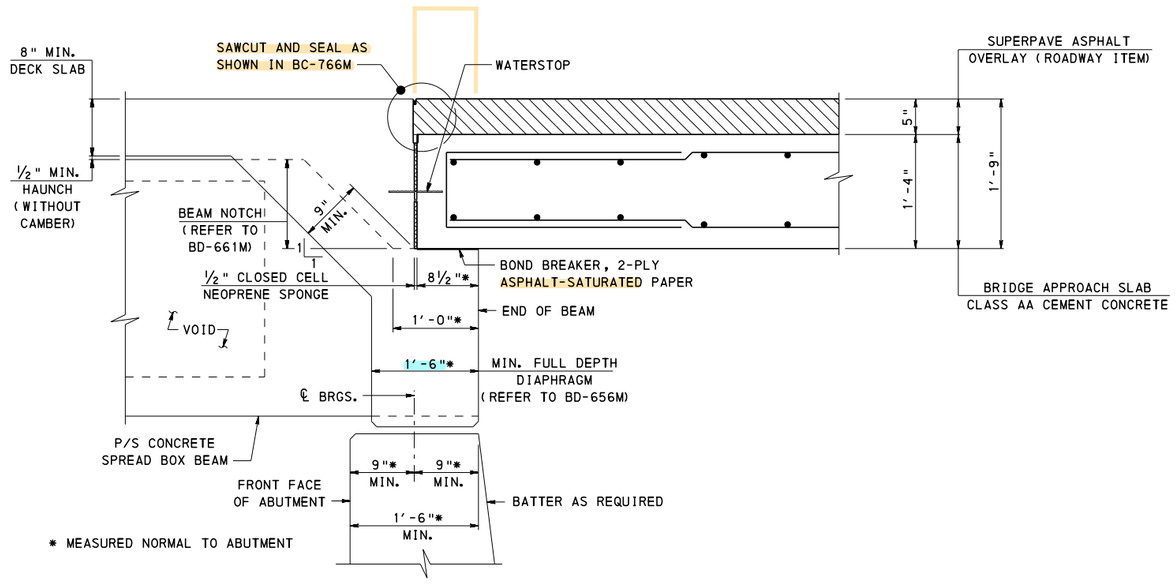
SHEET 12 OF 35

BD-628M



TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 7

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS FOR BEAM DEPTHS 24" AND GREATER



TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 7

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS FOR BEAM DEPTHS 30" AND GREATER

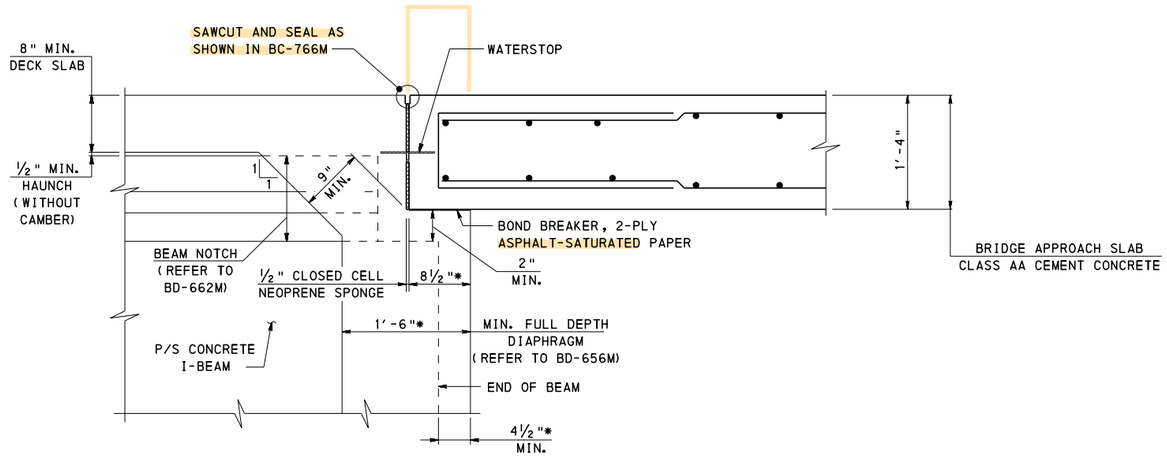
NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED REFER TO DETAIL 11.
4. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 7
(P/S CONCRETE SPREAD BOX BEAMS WITHOUT BACKWALL)

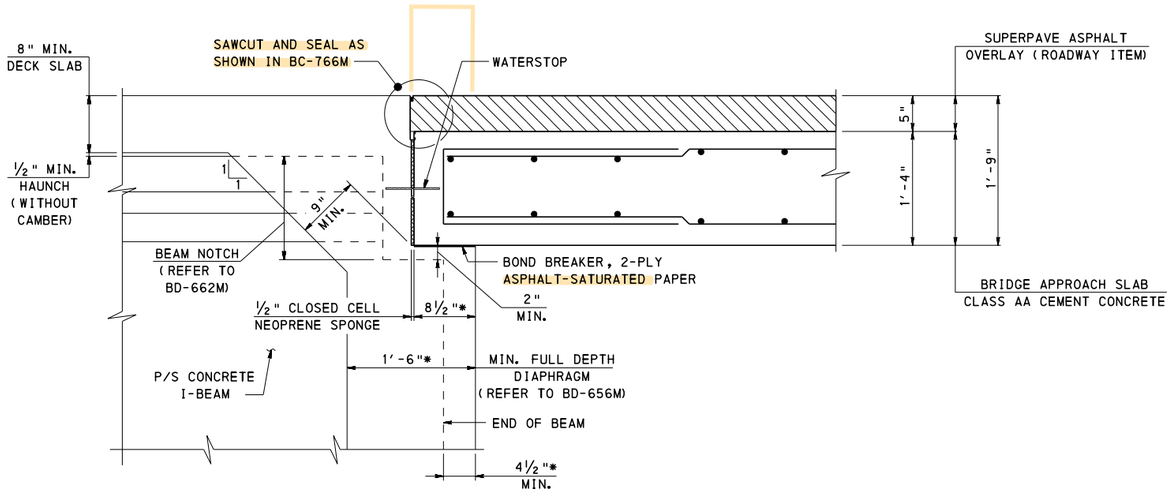
RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 13 OF 35
		BD-628M



* MEASURED NORMAL TO ABUTMENT

TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 8

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE
I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS



* MEASURED NORMAL TO ABUTMENT

TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 8

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE
I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

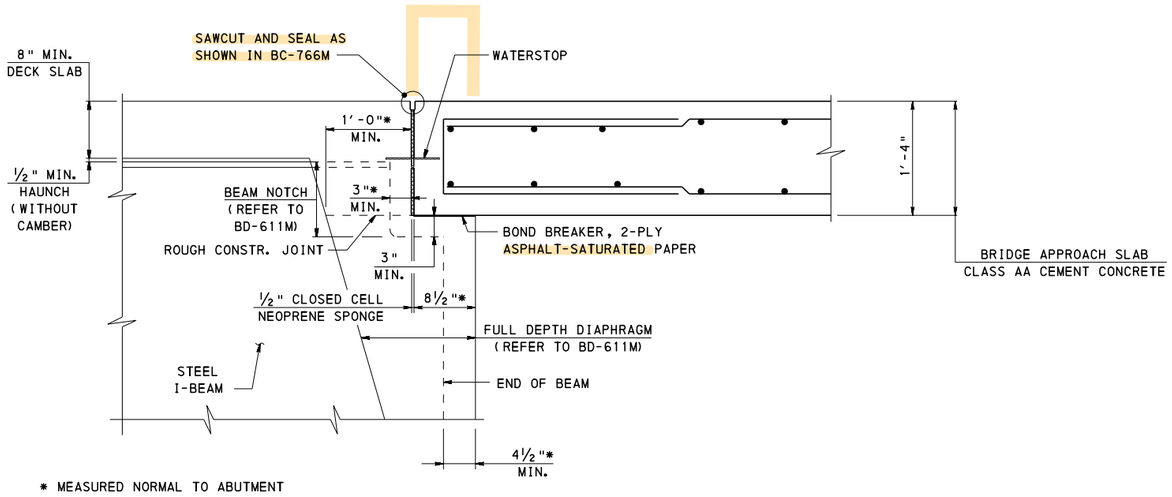
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 8
(P/S CONCRETE I-BEAMS WITHOUT BACKWALL)

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

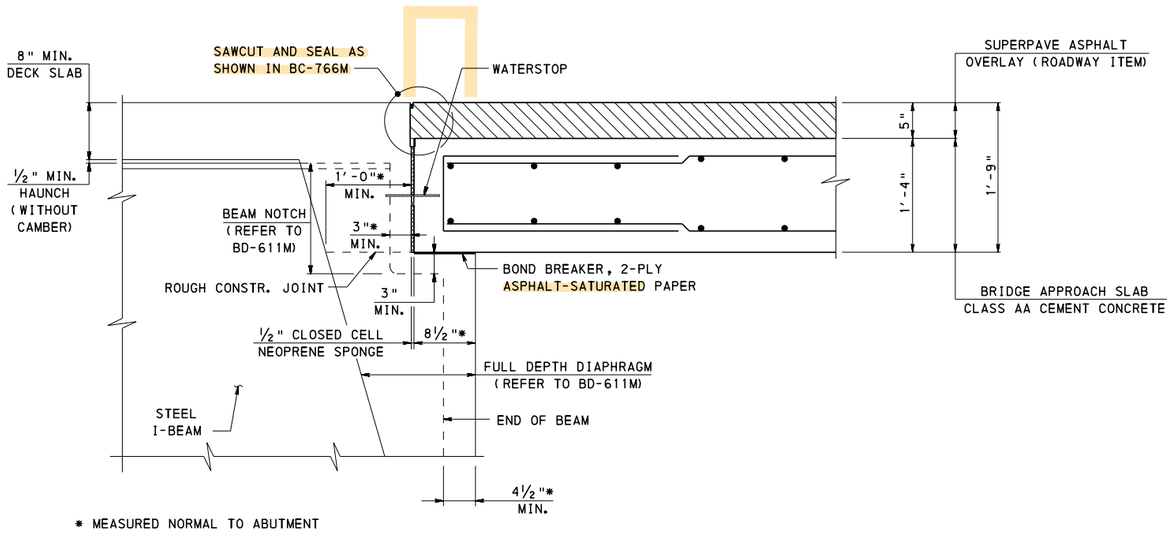
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-628M



TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 9

APPROACH SLAB SUPPORTED ON STEEL
I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS
FOR BEAM DEPTHS 2'-1 1/2" AND GREATER



TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 9

APPROACH SLAB SUPPORTED ON STEEL
I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS
FOR BEAM DEPTHS 2'-6 1/2" AND GREATER

NOTES

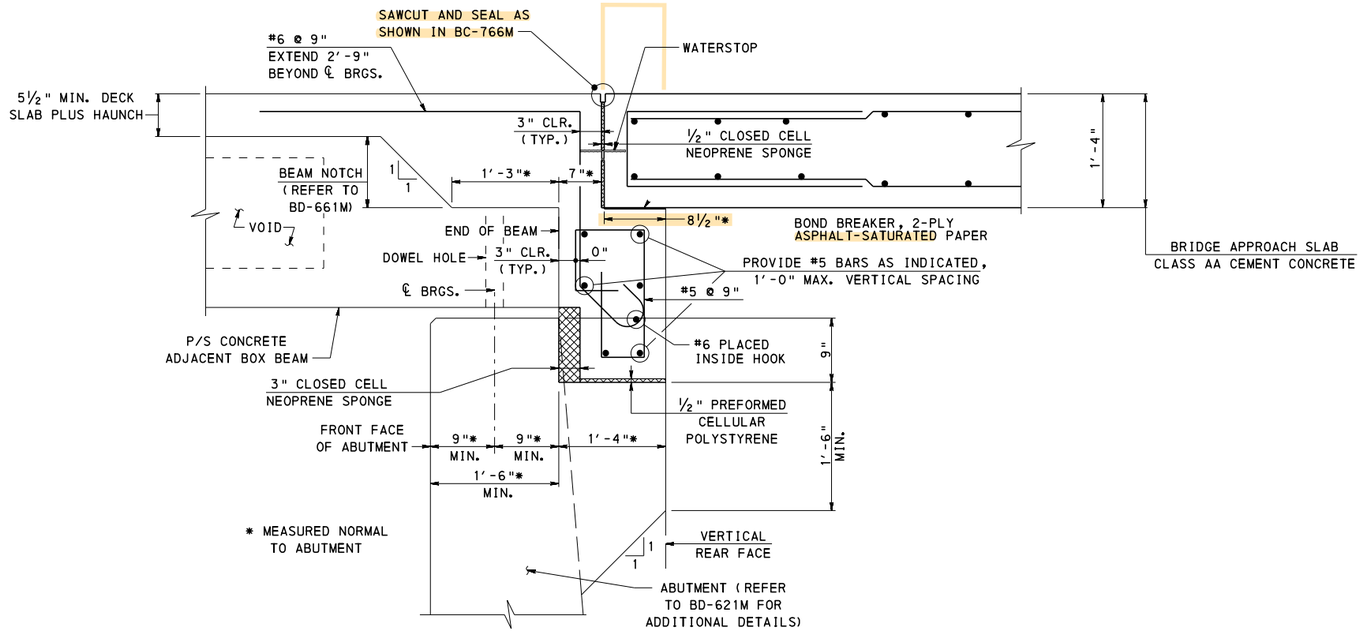
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED, REFER TO DETAIL 12.
3. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

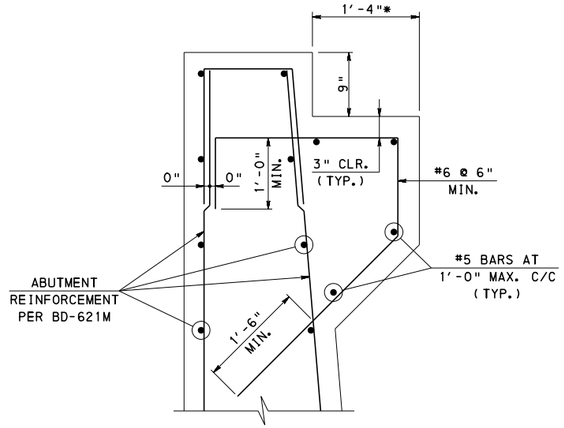
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 9
(STEEL BEAMS WITHOUT BACKWALL)

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 15 OF 35
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-628M



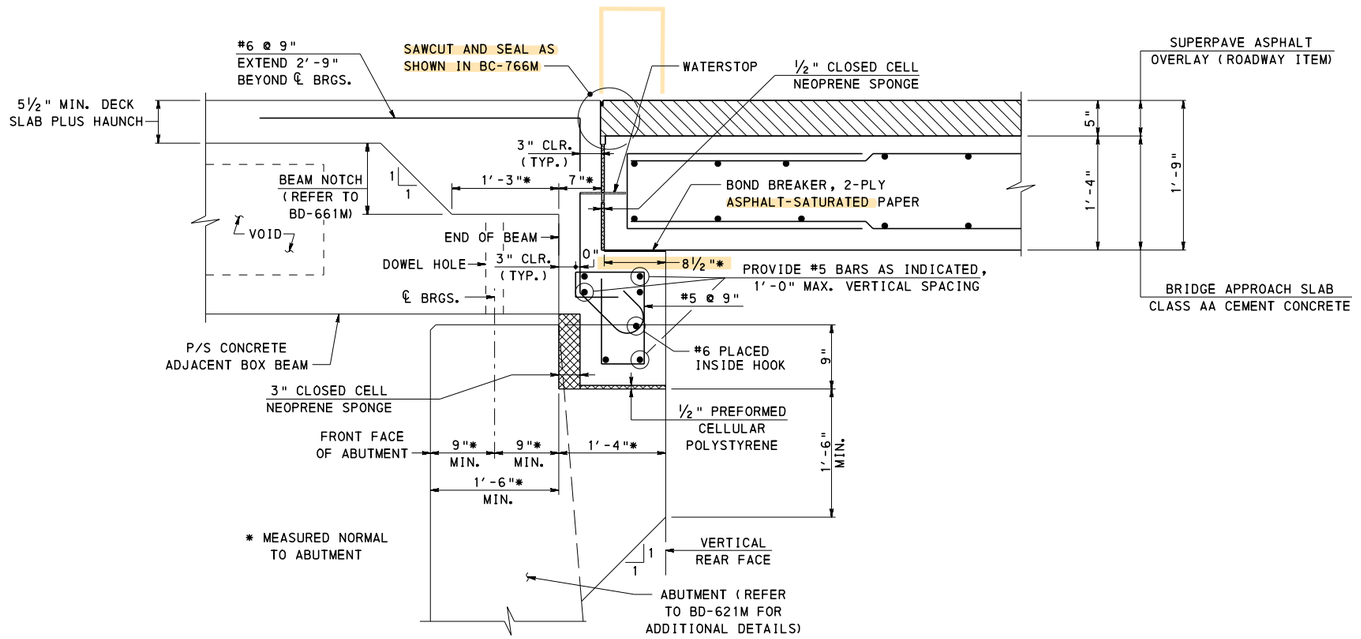
TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 10

APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE ADJACENT BOX BEAMS FOR BEAM DEPTHS LESS THAN 27"



ABUTMENT CORBEL REINFORCEMENT DETAIL

(BATTERED REAR FACE)



TYPE 2 APPROACH SLAB (WITH OVERLAY)- DETAIL 10

APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE ADJACENT BOX BEAMS FOR BEAM DEPTHS LESS THAN 30"

NOTES

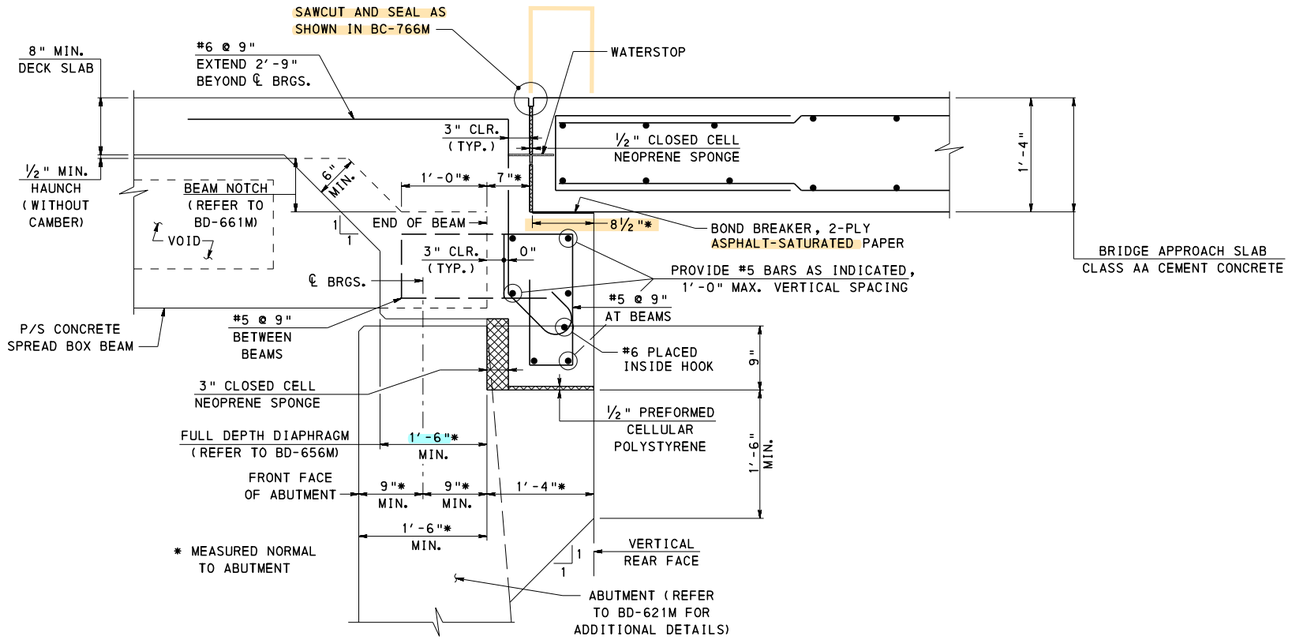
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

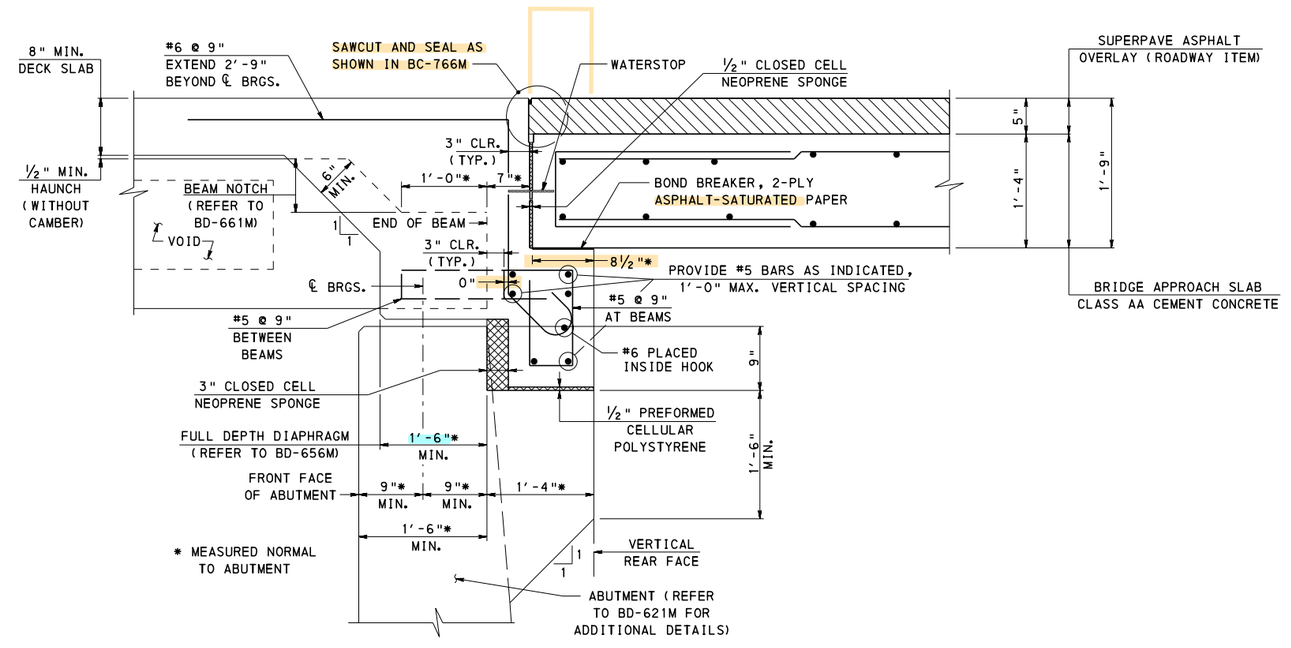
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 10
(P/S CONCRETE ADJACENT BOX BEAMS WITH ABUTMENT CORBEL)

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 16 OF 35
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-628M



TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 11

APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE
SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS
FOR BEAM DEPTHS LESS THAN 24"



TYPE 2 APPROACH SLAB (WITH OVERLAY)- DETAIL 11

APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE
SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS
FOR BEAM DEPTHS LESS THAN 30"

NOTES

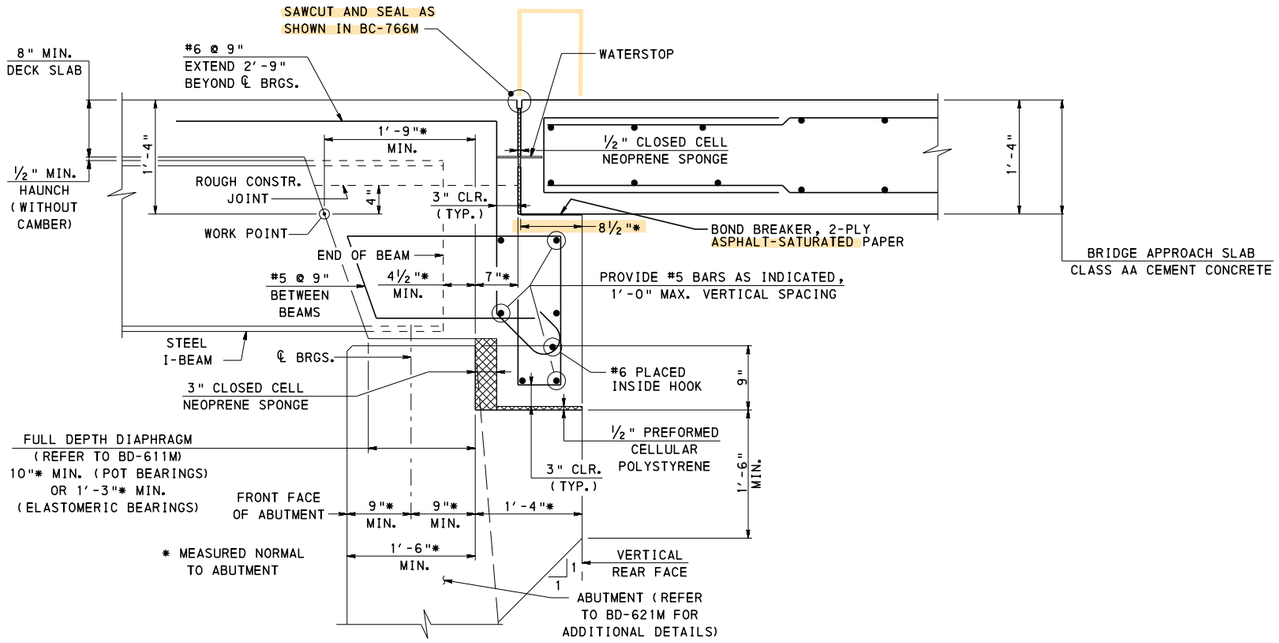
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.
3. FOR ABUTMENT CORBEL REINFORCEMENT DETAIL, SEE SHEET 16.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

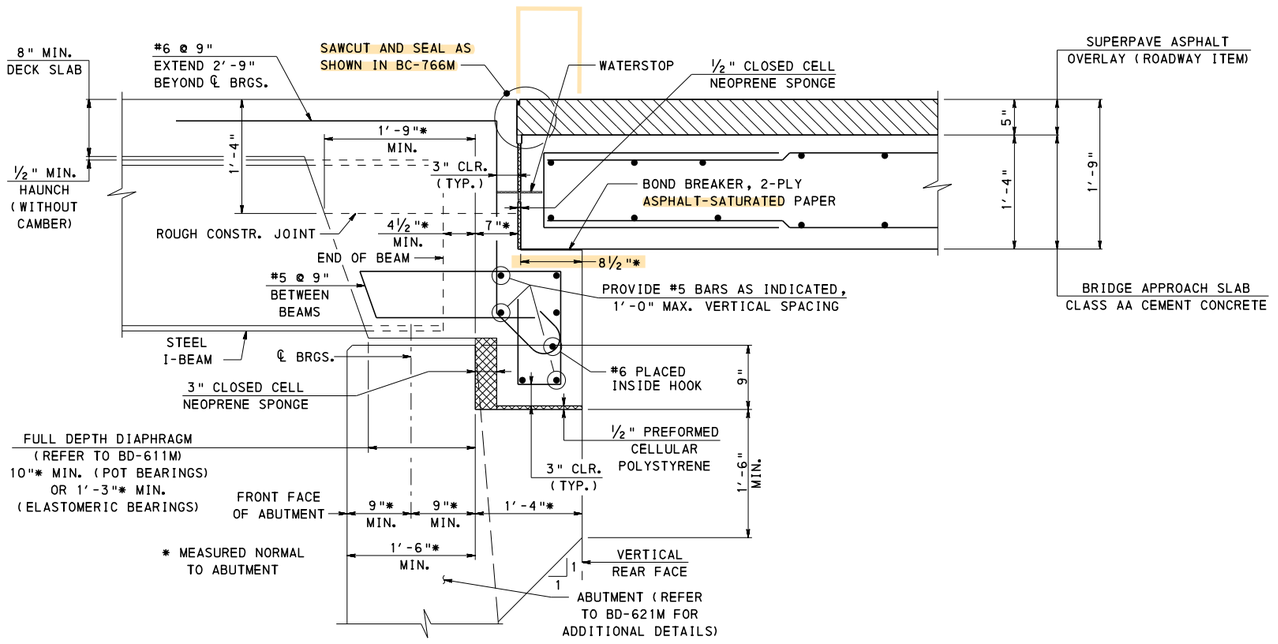
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 11
(P/S CONCRETE SPREAD BOX BEAMS
WITH ABUTMENT CORBEL)

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 17 OF 35
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-628M



TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 12

APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO STEEL I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS FOR BEAM DEPTHS LESS THAN 2'-1½"



TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 12

APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO STEEL I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS FOR BEAM DEPTHS LESS THAN 2'-6½"

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.
3. FOR ABUTMENT CORBEL REINFORCEMENT DETAIL, SEE SHEET 16.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

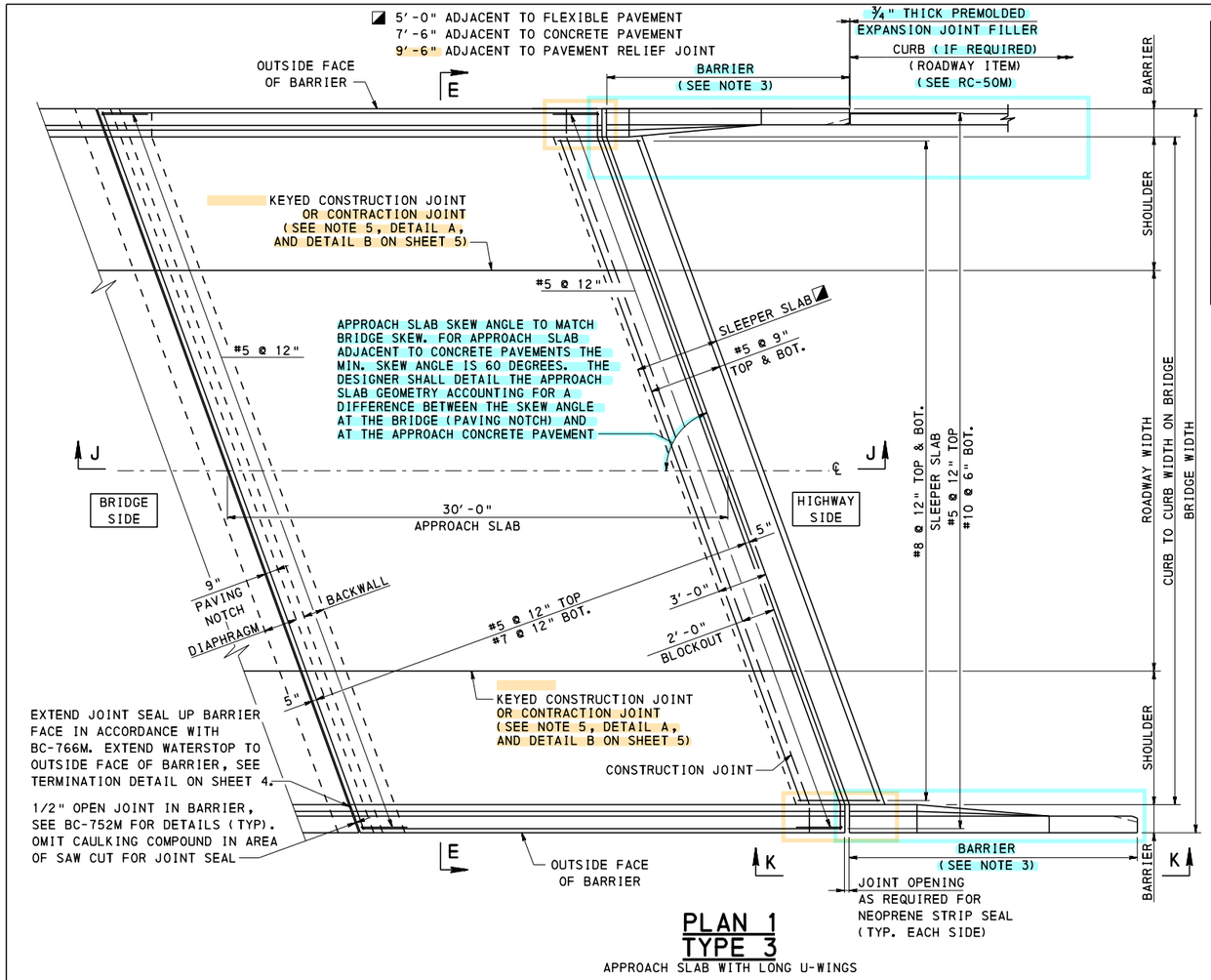
BRIDGE APPROACH SLABS

TYPE 1 AND TYPE 2 - DETAIL 12 (STEEL BEAMS WITH ABUTMENT CORBEL)

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-628M



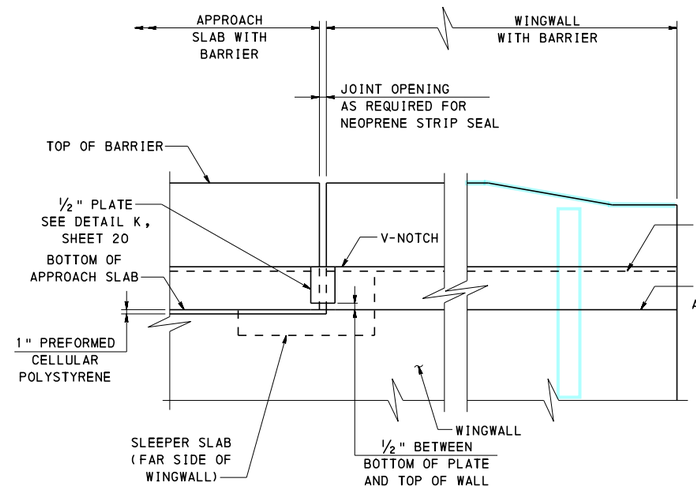
PLAN 1
TYPE 3
APPROACH SLAB WITH LONG U-WINGS

DESCRIPTION OF PLANS FOR TYPE 3 APPROACH SLABS

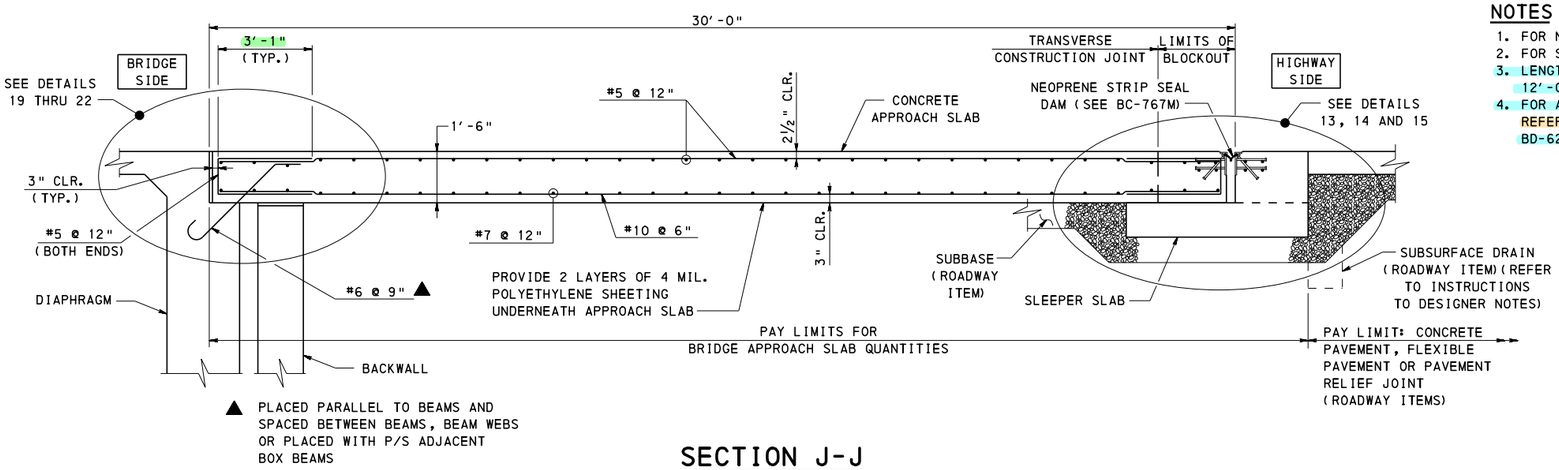
PLAN	DESCRIPTION	SHEET NO.
1	APPROACH SLAB WITH LONG U-WINGS	19
2	APPROACH SLAB WITH FLARED WINGS OR SHORT U-WINGS WITH MOMENT SLABS	20
3	APPROACH SLAB WITH FLARED WINGS OR SHORT U-WINGS	21

DESCRIPTION OF DETAILS FOR TYPE 3 APPROACH SLAB

DETAIL	DESCRIPTION	SHEET NO.
13	END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO FLEXIBLE PAVEMENT	22
14	END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO CONCRETE PAVEMENT	22
15	END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO PAVEMENT RELIEF JOINT	22
19	APPROACH SLAB CONNECTED TO PRESTRESSED CONCRETE ADJACENT BOX BEAMS WITH BACKWALL	24
20	APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE (PRESTRESSED CONCRETE SPREAD BOX BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL	24
21	APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE (PRESTRESSED CONCRETE I-BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL	25
22	APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE (STEEL I-BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL	25



SECTION K-K



▲ PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAMS, BEAM WEBS OR PLACED WITH P/S ADJACENT BOX BEAMS

SECTION J-J

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION E-E, SEE SHEET 8.
3. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12′-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
4. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

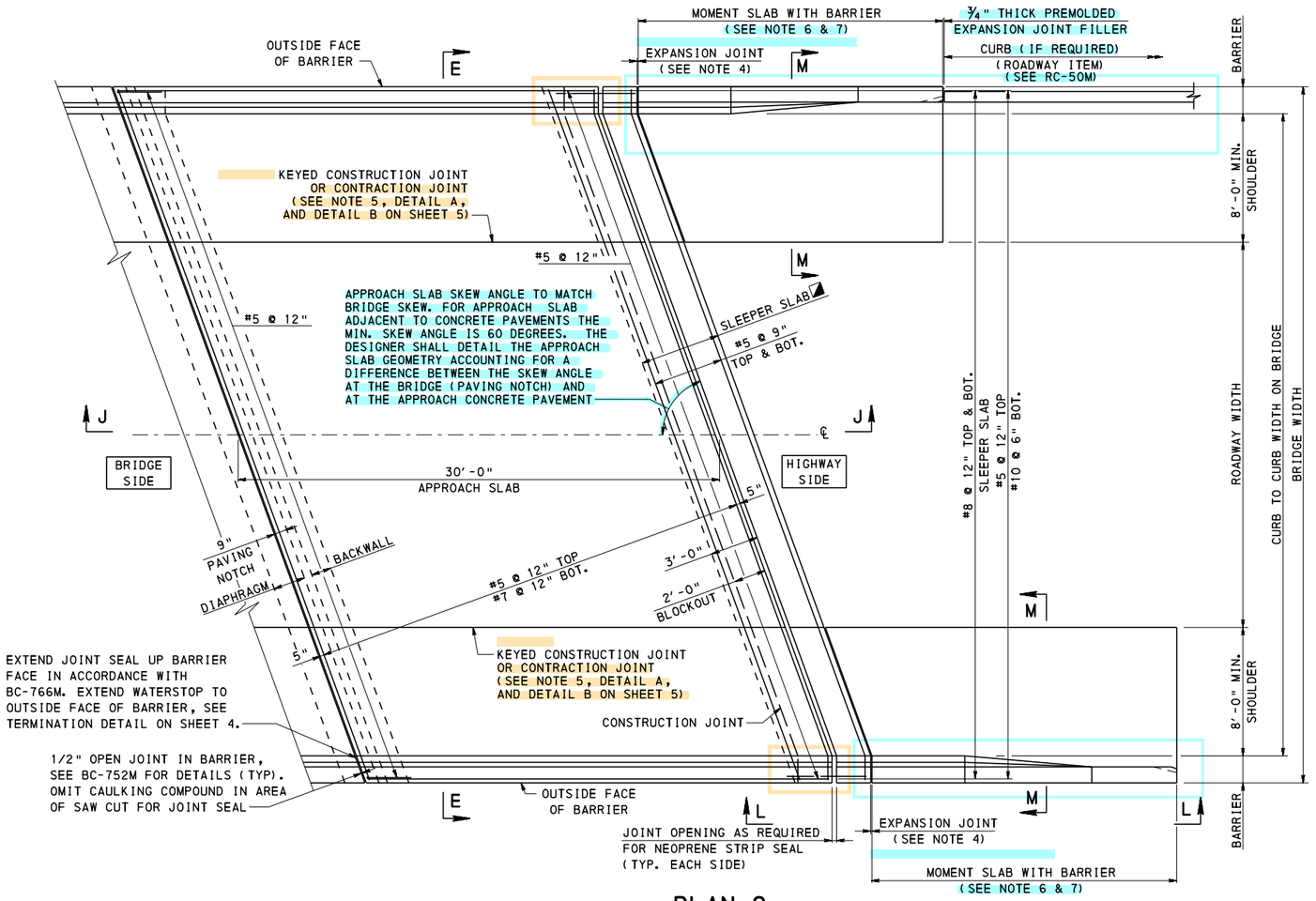
STANDARD
BRIDGE APPROACH SLABS
TYPE 3 - PLAN 1 AND SECTION

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 19 OF 35

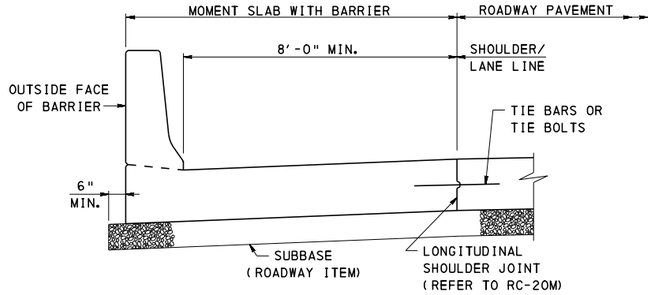
BD-628M



PLAN 2
TYPE 3

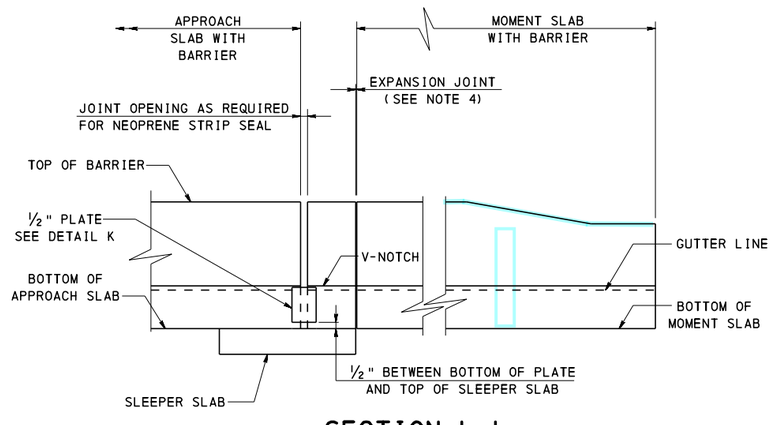
APPROACH SLAB WITH FLARED WINGS OR SHORT U-WINGS WITH MOMENT SLABS

◪ 5'-0" ADJACENT TO FLEXIBLE PAVEMENT
7'-6" ADJACENT TO CONCRETE PAVEMENT
9'-6" ADJACENT TO PAVEMENT RELIEF JOINT

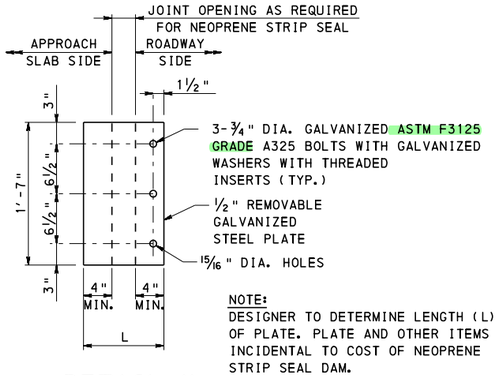


MOMENT SLAB ADJACENT TO TYPE 3 OR TYPE 4 APPROACH SLAB

SECTION M-M



SECTION L-L



NOTE:
DESIGNER TO DETERMINE LENGTH (L) OF PLATE. PLATE AND OTHER ITEMS INCIDENTAL TO COST OF NEOPRENE STRIP SEAL DAM.

DETAIL K
END COVER PLATE

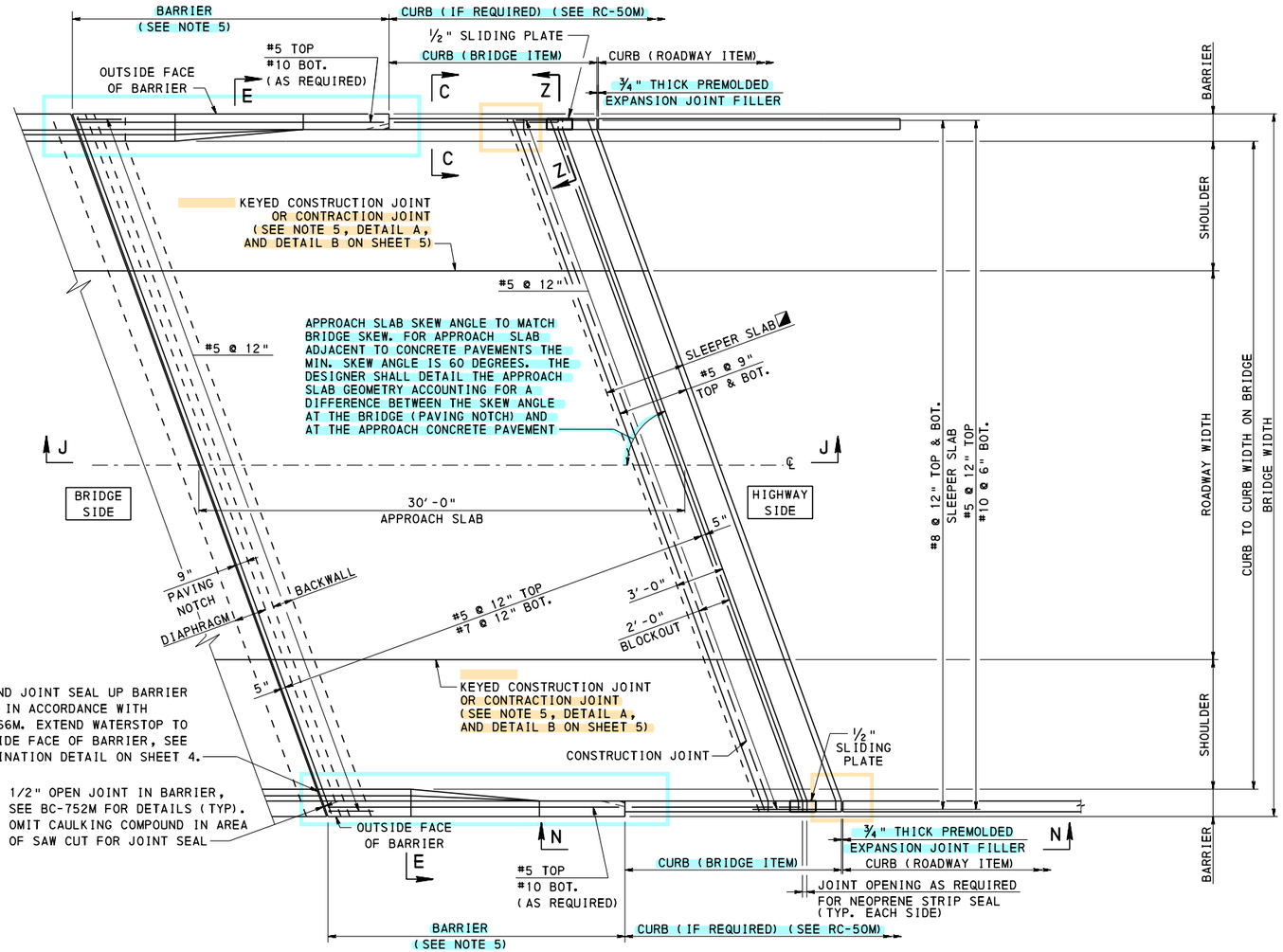
NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION E-E, SEE SHEET 8.
3. FOR SECTION J-J, SEE SHEET 19.
4. PROVIDE THE FOLLOWING JOINT OPENINGS:
   - APPROACH SLAB ADJACENT TO CONCRETE OR FLEXIBLE PAVEMENT: 1" FLUSH EXPANSION JOINT
   - APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT: 2'-0" AND PROVIDE SLIDING PLATE IN ACCORDANCE WITH THE DETAILS SHOWN ON BD-627M.
5. FOR ADDITIONAL MOMENT SLAB DETAILS REFER TO BD-627M.
6. 45" F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.
7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16'-0" MINIMUM PER BD-627M.
8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

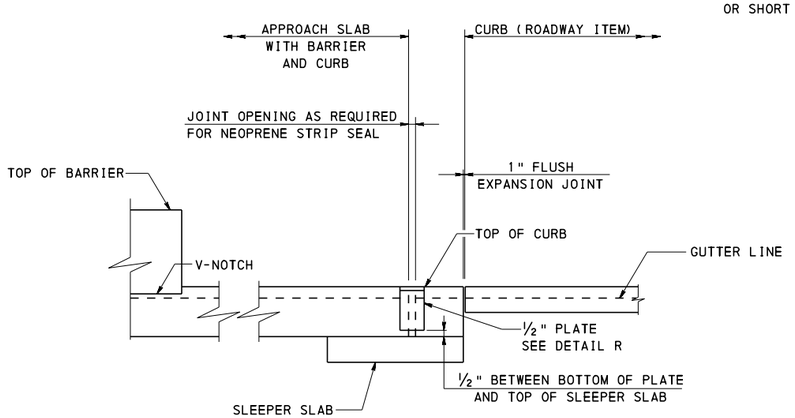
STANDARD
BRIDGE APPROACH SLABS
TYPE 3 - PLAN 2

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 20 OF 35
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-628M

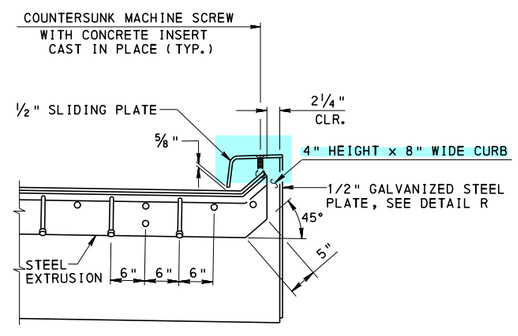


◪ 5'-0" ADJACENT TO FLEXIBLE PAVEMENT
7'-6" ADJACENT TO CONCRETE PAVEMENT
9'-6" ADJACENT TO PAVEMENT RELIEF JOINT

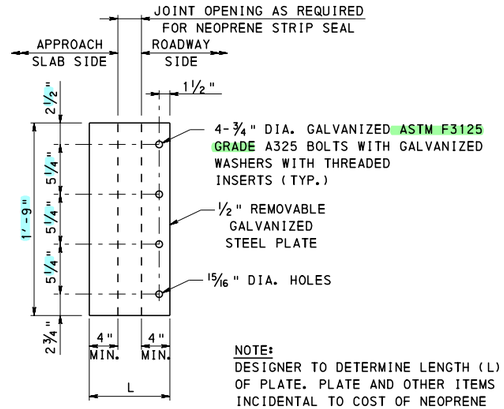
PLAN 3
TYPE 3
APPROACH SLAB WITH FLARED WINGS
OR SHORT U-WINGS



SECTION N-N



SECTION Z-Z



DETAIL R
END COVER PLATE

NOTE:
DESIGNER TO DETERMINE LENGTH (L)
OF PLATE. PLATE AND OTHER ITEMS
INCIDENTAL TO COST OF NEOPRENE
STRIP SEAL DAM.

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION C-C, SEE SHEET 5.
3. FOR SECTION E-E, SEE SHEET 8.
4. FOR SECTION J-J, SEE SHEET 19.
5. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
6. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

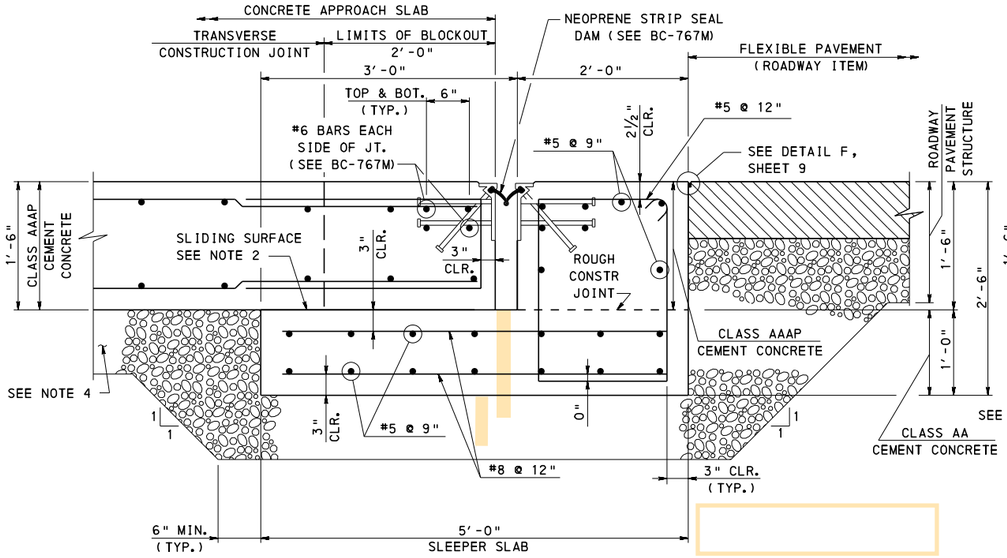
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BRIDGE APPROACH SLABS
TYPE 3 - PLAN 3

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

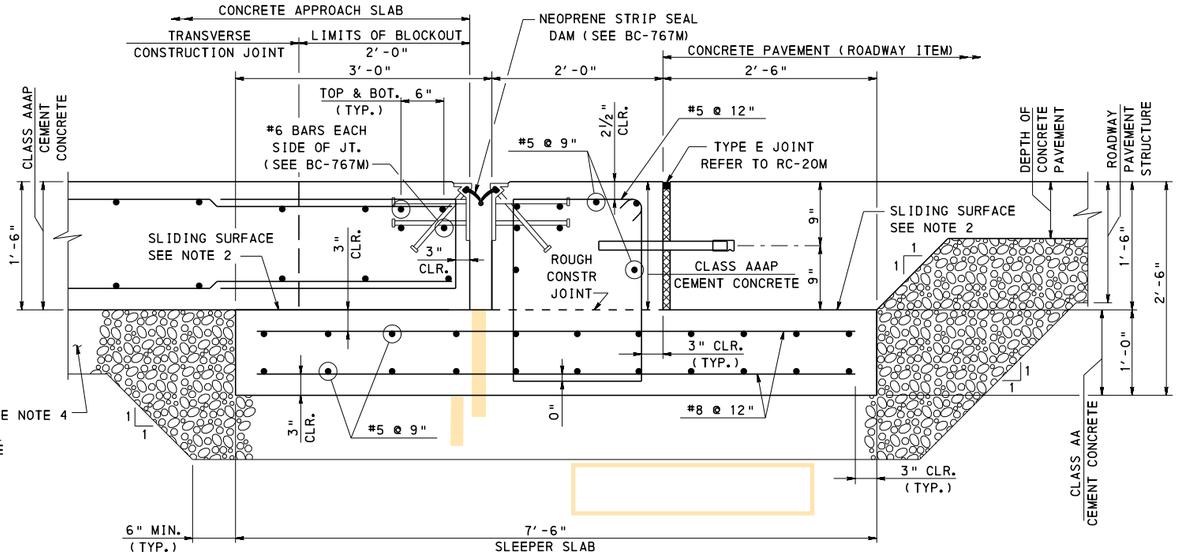
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-628M



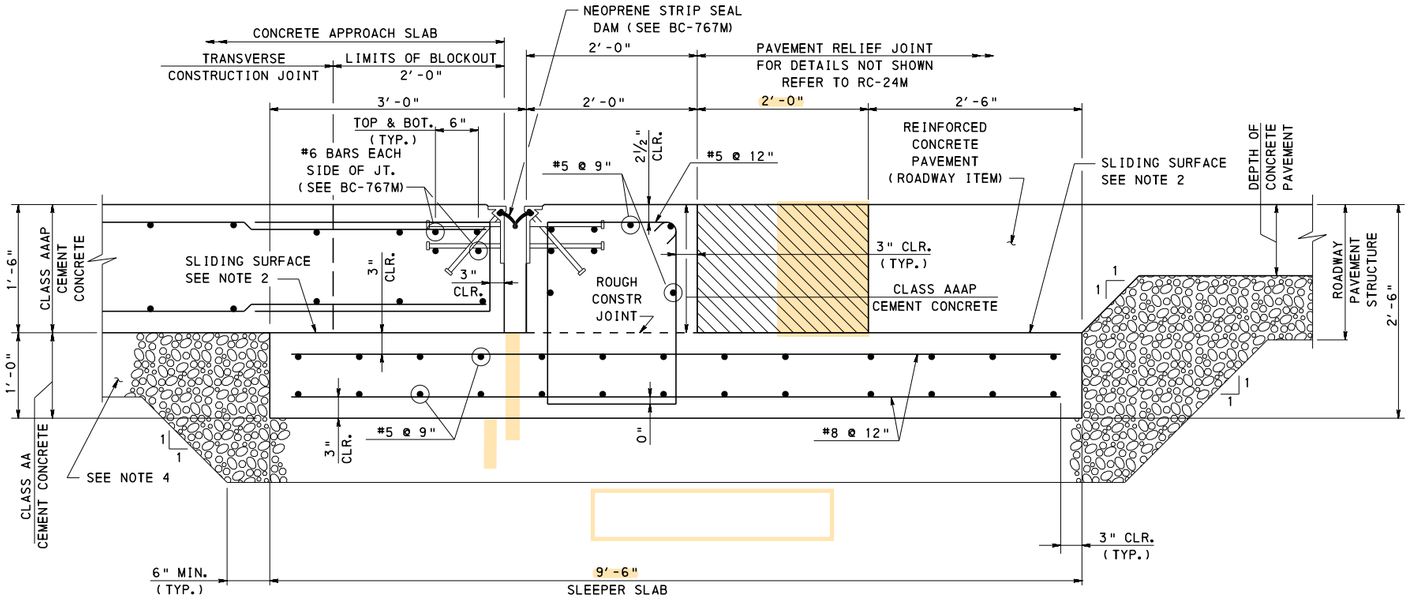
TYPE 3 AND TYPE 5 APPROACH SLAB - DETAIL 13

END OF APPROACH SLAB WITH NEOPRENE
STRIP SEAL DAM ADJACENT TO FLEXIBLE PAVEMENT



TYPE 3 AND TYPE 5 APPROACH SLAB - DETAIL 14

END OF APPROACH SLAB WITH NEOPRENE
STRIP SEAL DAM ADJACENT TO CONCRETE PAVEMENT
(SEE NOTE 3)



TYPE 3 AND TYPE 5 APPROACH SLAB - DETAIL 15

END OF APPROACH SLAB WITH NEOPRENE
STRIP SEAL DAM ADJACENT TO PAVEMENT RELIEF JOINT

NOTES

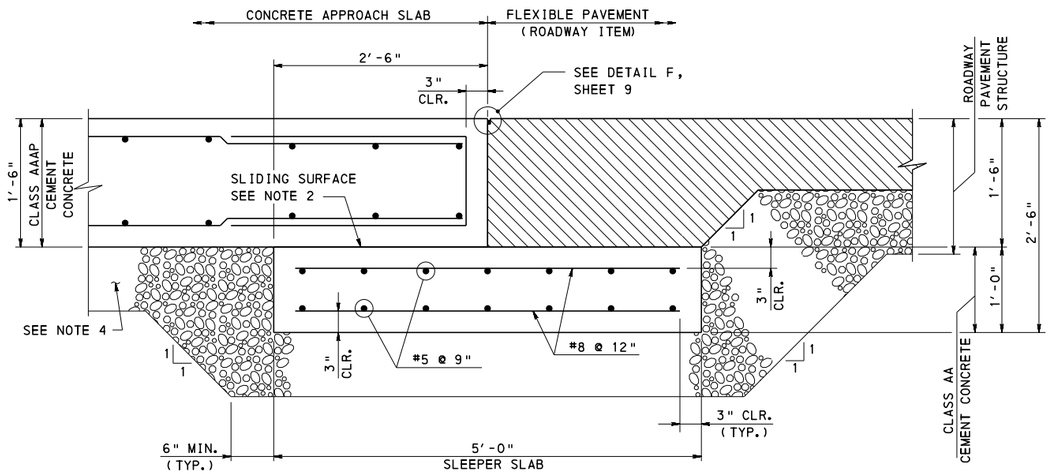
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. TROWEL SMOOTH AND PLACE 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING AS BOND BREAKER.
3. USE DETAIL 14 ONLY WHEN LIMITED MOVEMENT IS ANTICIPATED IN THE ROADWAY OTHERWISE USE DETAIL 15. REFER TO RC-24M FOR ADDITIONAL INFORMATION.
4. TYPE 3 APPROACH SLAB; SUBBASE (ROADWAY ITEM)
   TYPE 5 APPROACH SLAB; STRUCTURAL BACKFILL, REFER TO RC-12M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

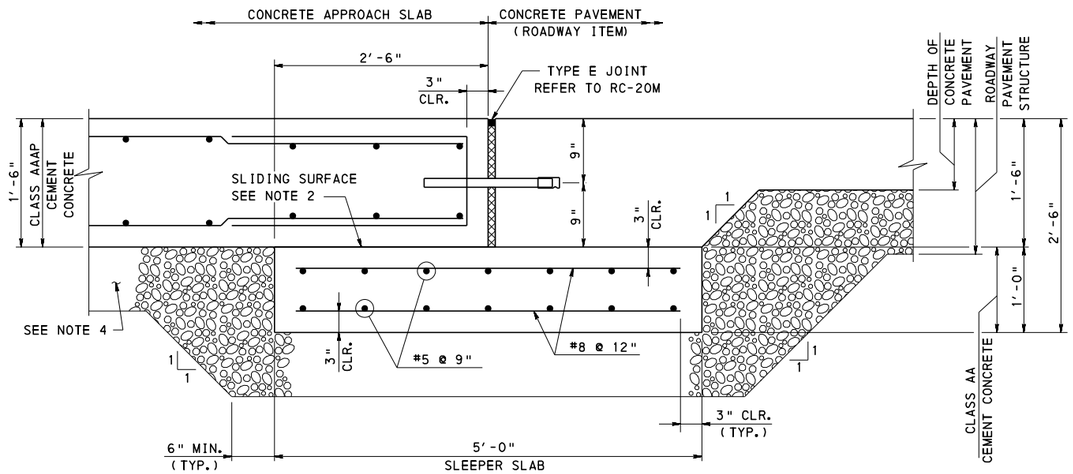
BRIDGE APPROACH SLABS
TYPE 3 & TYPE 5 - DETAILS 13, 14 AND 15
(ADJACENT TO ROADWAY)

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 22 OF 35
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-628M



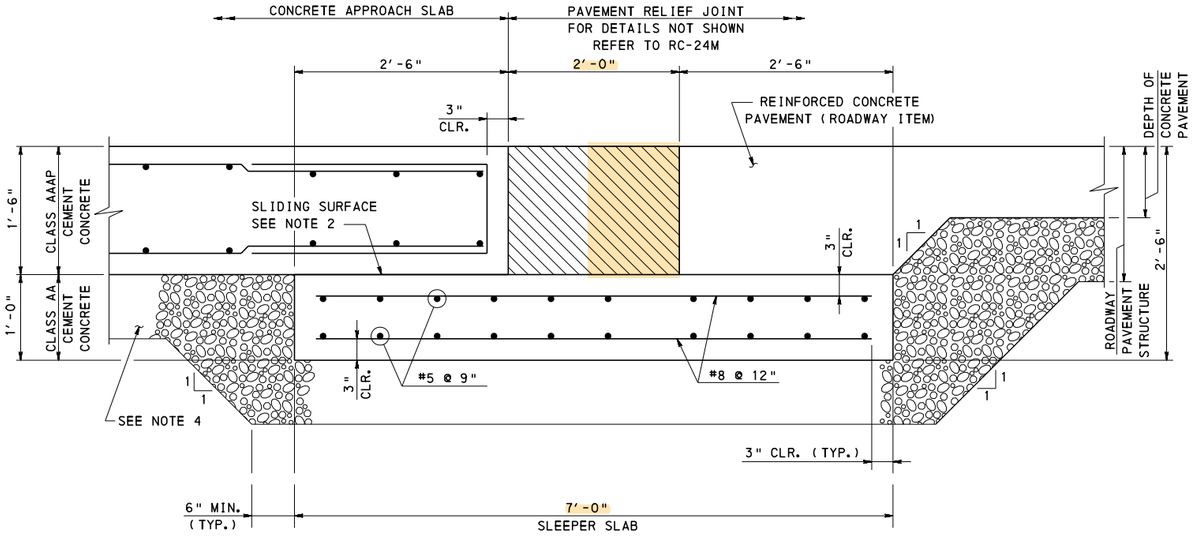
TYPE 5 APPROACH SLAB - DETAIL 16

END OF APPROACH SLAB
ADJACENT TO FLEXIBLE PAVEMENT



TYPE 5 APPROACH SLAB - DETAIL 17

END OF APPROACH SLAB
ADJACENT TO CONCRETE PAVEMENT
(SEE NOTE 3)



TYPE 5 APPROACH SLAB - DETAIL 18

END OF APPROACH SLAB
ADJACENT TO PAVEMENT RELIEF JOINT

NOTES

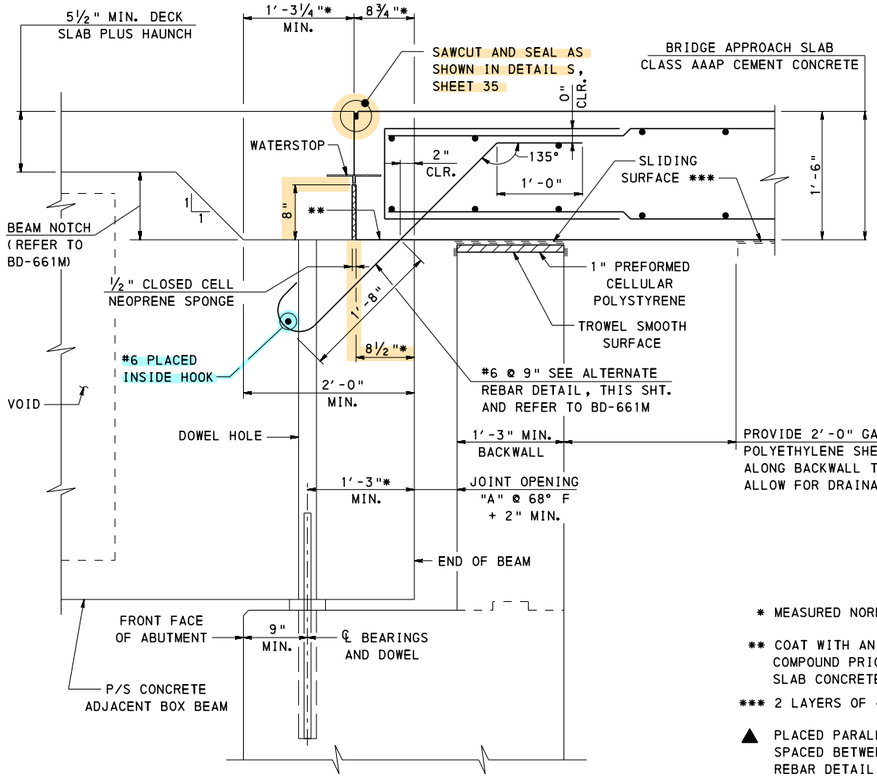
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. TROWEL SMOOTH AND PLACE 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING AS BOND BREAKER.
3. USE DETAIL 17 ONLY WHEN LIMITED MOVEMENT IS ANTICIPATED IN THE ROADWAY OTHERWISE USE DETAIL 18. REFER TO RC-24M FOR ADDITIONAL INFORMATION.
4. STRUCTURAL BACKFILL, REFER TO RC-12M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

BRIDGE APPROACH SLABS
TYPE 5 - DETAILS 16, 17 AND 18
(ADJACENT TO ROADWAY)

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 23 OF 35
		BD-628M

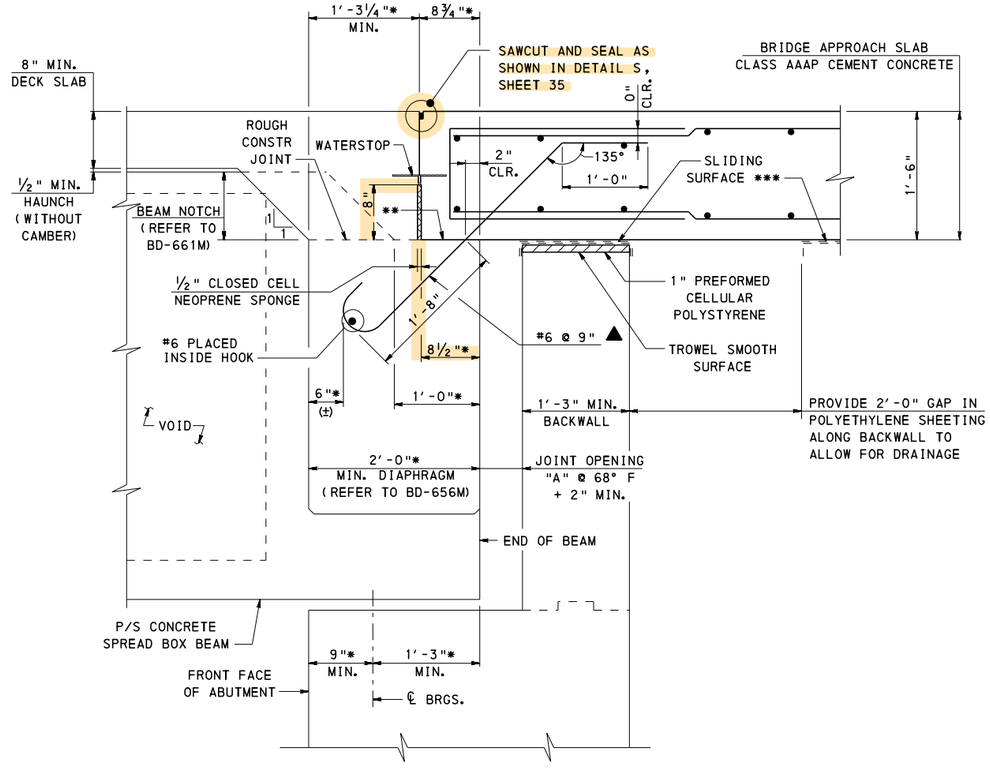


* MEASURED NORMAL TO ABUTMENT

** COAT WITH AN APPROVED EPOXY BONDING COMPOUND PRIOR TO PLACING APPROACH SLAB CONCRETE

*** 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING

▲ PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAMS, SEE ALTERNATE REBAR DETAIL, THIS SHEET.

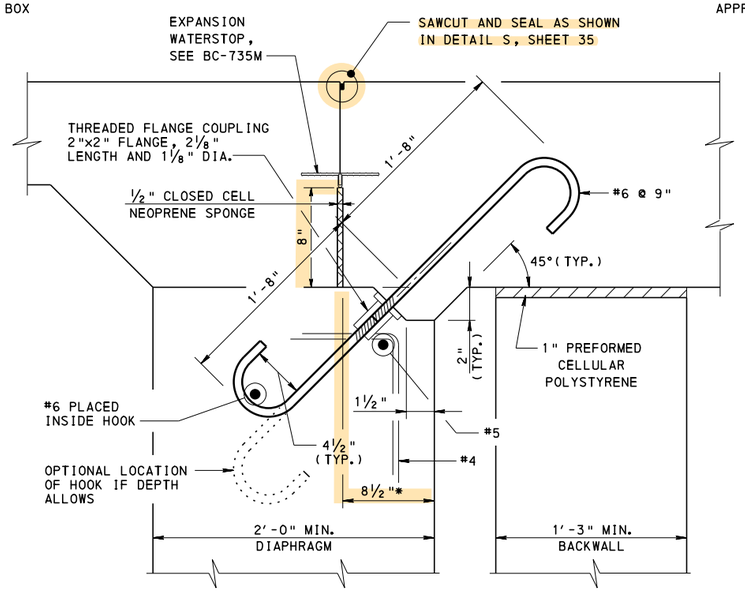


TYPE 3 APPROACH SLAB - DETAIL 19

APPROACH SLAB CONNECTED TO PRESTRESSED CONCRETE ADJACENT BOX BEAMS WITH BACKWALL, FOR BEAM DEPTHS 33" AND GREATER

TYPE 3 APPROACH SLAB - DETAIL 20

APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE (PRESTRESSED CONCRETE SPREAD BOX BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL, FOR BEAM DEPTHS 39" AND GREATER



ALTERNATE REBAR DETAIL

END OF BOX BEAM TO MATCH NOTCH SHOWN ABOVE FOR THIS ALTERNATE.

NOTES

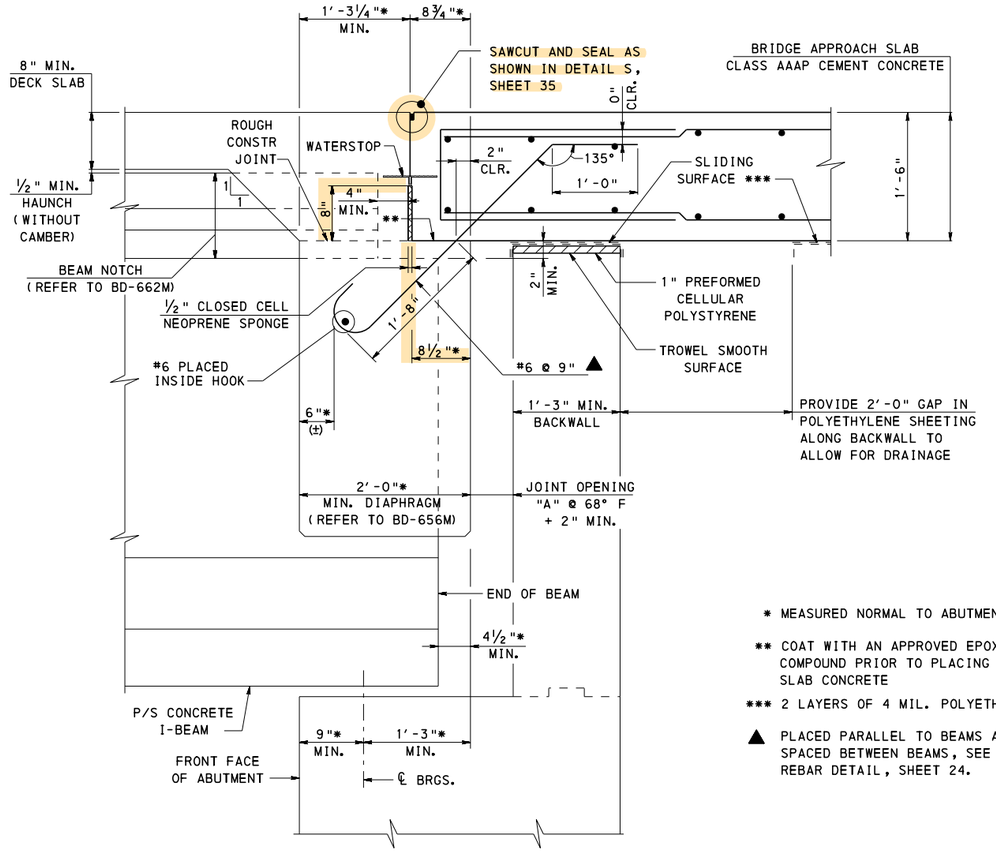
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
4. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.
5. SEE BC-767M FOR JOINT OPENING "A".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

BRIDGE APPROACH SLABS
TYPE 3 - DETAILS 19 AND 20
(P/S CONCRETE BOX BEAMS WITH BACKWALL)

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 24 OF 35
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-628M



* MEASURED NORMAL TO ABUTMENT

** COAT WITH AN APPROVED EPOXY BONDING COMPOUND PRIOR TO PLACING APPROACH SLAB CONCRETE

*** 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING

▲ PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAMS, SEE ALTERNATE REBAR DETAIL, SHEET 24.

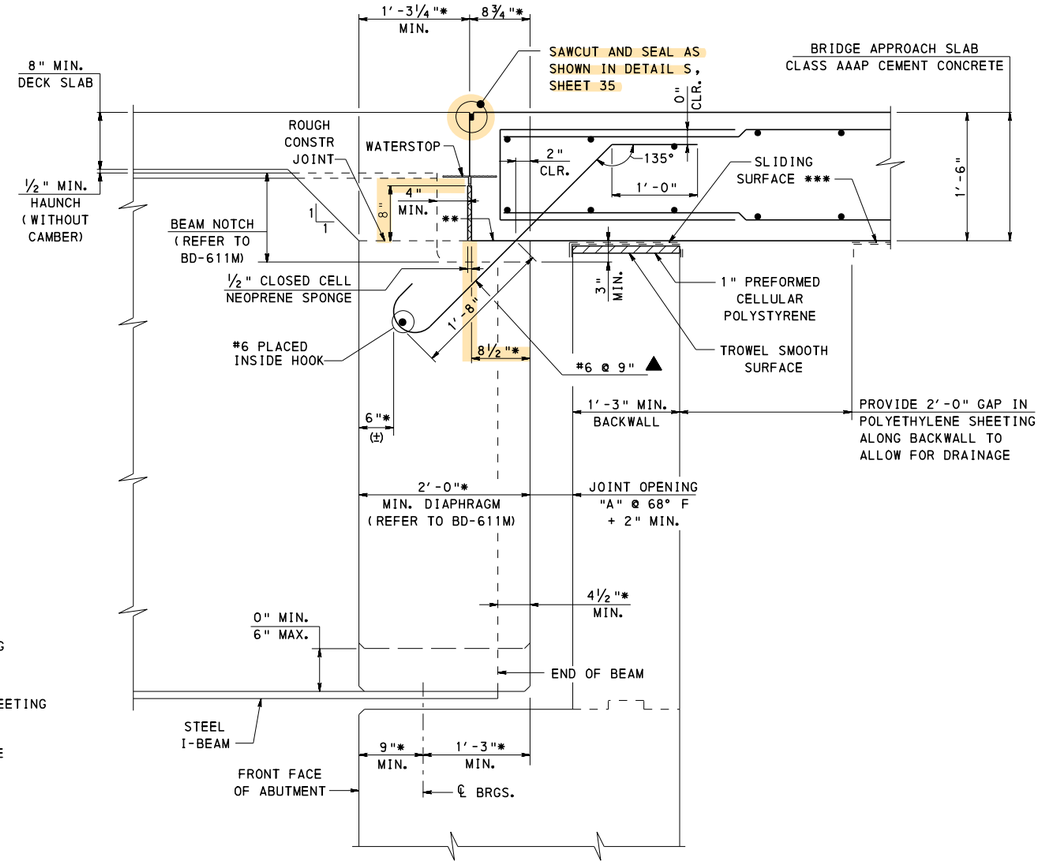
TYPE 3 APPROACH SLAB - DETAIL 21

APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE
(PRESTRESSED CONCRETE I-BEAMS AND CONCRETE END DIAPHRAGMS)
WITH BACKWALL - SEE TABLE A FOR MINIMUM BEAM DEPTHS

TABLE A

BEAM TYPE	MINIMUM BEAM DEPTHS
AASHTO TYPE I-BEAMS	63"
PA BULB-TEE BEAMS	47.25"
PA I-BEAMS	①

① THE FOLLOWING BEAMS ARE PERMITTED:
26/54, 24/60, 26/60
24/63, AND 26/63



TYPE 3 APPROACH SLAB - DETAIL 22

APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE
(STEEL I-BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL
FOR BEAM DEPTHS 40" AND GREATER

NOTES

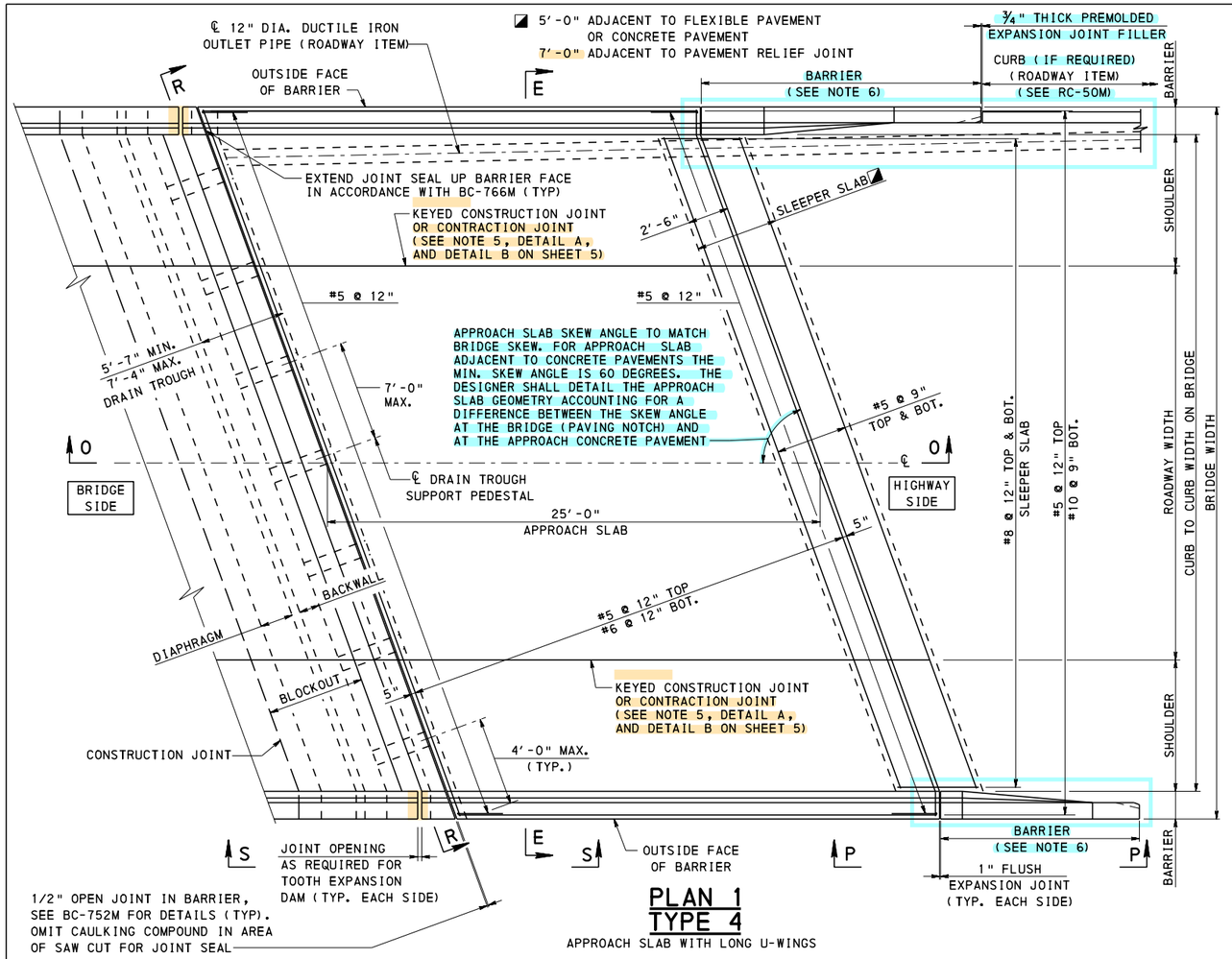
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL OR EXCEEDS THE DEPTHS INDICATED IN TABLE A. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
4. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.
5. SEE BC-767M FOR JOINT OPENING "A".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BRIDGE APPROACH SLABS
TYPE 3 - DETAILS 21 AND 22
(I-BEAMS WITH BACKWALL)

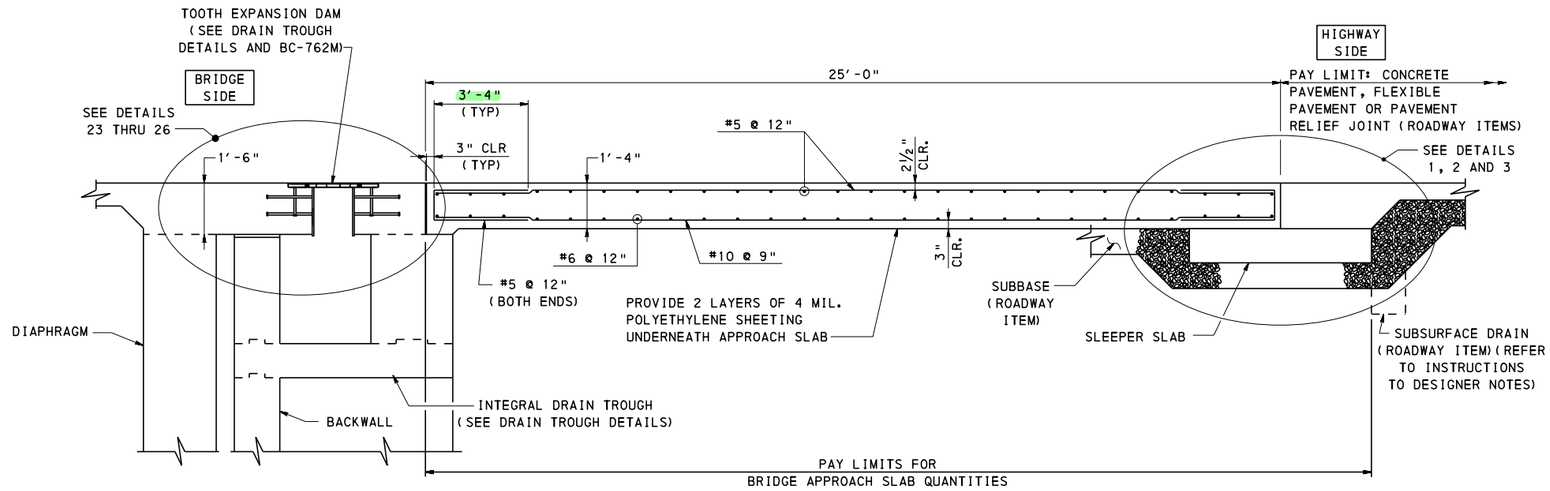
RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

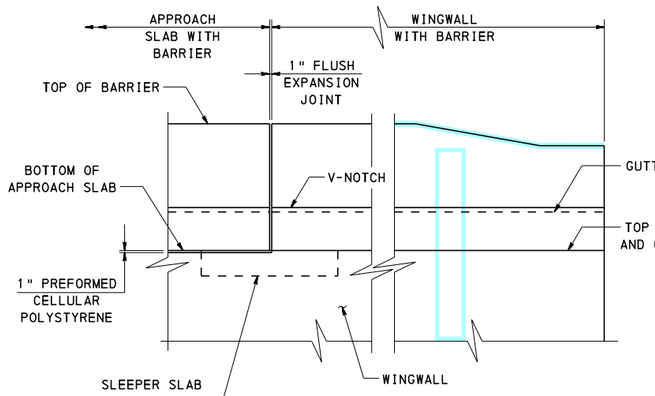


PLAN 1 TYPE 4

APPROACH SLAB WITH LONG U-WINGS



SECTION O-O



SECTION P-P

DESCRIPTION OF PLANS FOR TYPE 4 APPROACH SLABS

PLAN	DESCRIPTION	SHEET NO.
1	INTEGRAL DRAIN TROUGH WITH APPROACH SLAB AND LONG U-WINGS	26
2	INTEGRAL DRAIN TROUGH WITH APPROACH SLAB AND FLARED WINGS OR SHORT U-WINGS	27
3	INTEGRAL DRAIN TROUGH WITHOUT APPROACH SLAB AND FLARED WINGS OR SHORT U-WINGS	28

DESCRIPTION OF DETAILS FOR TYPE 4 APPROACH SLAB

DETAIL	DESCRIPTION	SHEET NO.
1	APPROACH SLAB ADJACENT TO FLEXIBLE PAVEMENT	9
2	APPROACH SLAB ADJACENT TO CONCRETE PAVEMENT	9
3	APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT	9
23	PRESTRESSED CONCRETE ADJACENT BOX BEAMS WITH BACKWALL AND INTEGRAL DRAIN TROUGH FOR TOOTH DAM AND NO APPROACH SLAB	29
24	PRESTRESSED CONCRETE SPREAD BOX BEAMS AND CONCRETE END DIAPHRAGMS WITH BACKWALL AND INTEGRAL DRAIN TROUGH FOR TOOTH DAM AND APPROACH SLAB SUPPORT	30
25	PRESTRESSED CONCRETE I-BEAMS AND CONCRETE END DIAPHRAGMS WITH BACKWALL AND INTEGRAL DRAIN TROUGH FOR TOOTH DAM AND NO APPROACH SLAB	31
26	STEEL I-BEAMS AND CONCRETE END DIAPHRAGMS WITH BACKWALL AND INTEGRAL DRAIN TROUGH FOR TOOTH DAM AND APPROACH SLAB SUPPORT	32

NOTES:

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION E-E, SEE SHEET 8.
3. FOR SECTION S-S, SEE SHEET 27.
4. FOR SECTION R-R, SEE SHEET 33.
5. FOR DRAIN TROUGH DETAILS, SEE SHEETS 28 - 34.
6. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
7. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

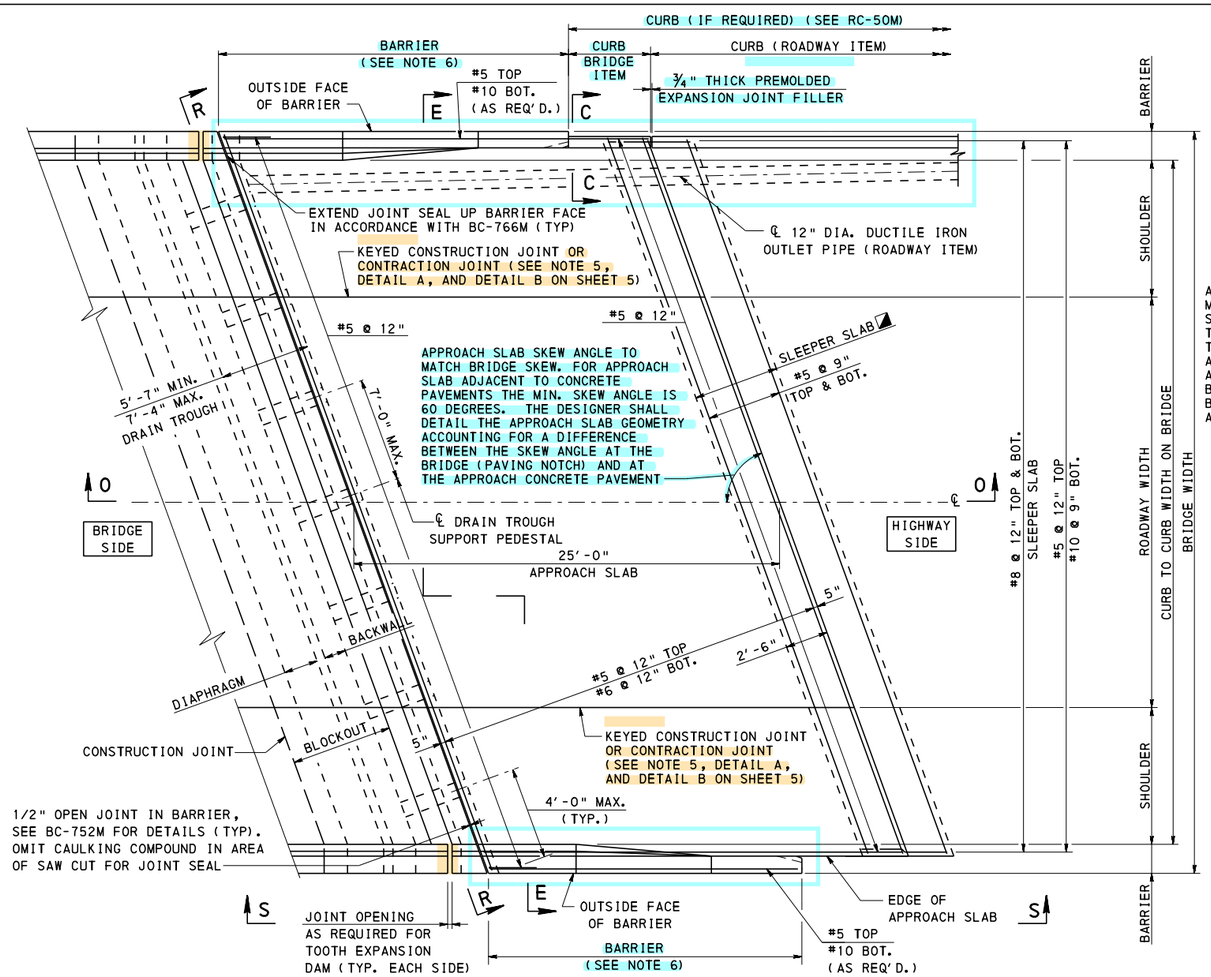
BRIDGE APPROACH SLABS TYPE 4 - PLAN 1 AND SECTION

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 26 OF 35

BD-628M

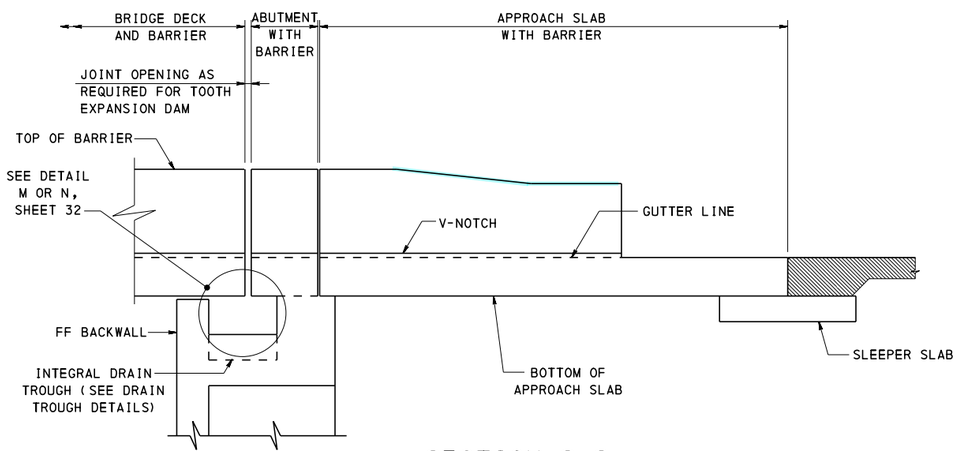


◪ 5'-0" ADJACENT TO FLEXIBLE PAVEMENT
OR CONCRETE PAVEMENT
7'-0" ADJACENT TO PAVEMENT RELIEF JOINT

APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MIN. SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT

PLAN 2
TYPE 4

APPROACH SLAB WITH FLARED WINGS
OR SHORT U-WINGS



SECTION S-S

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION E-E, SEE SHEET 8.
3. FOR SECTION O-O, SEE SHEET 26.
4. FOR SECTION R-R, SEE SHEET 33.
5. FOR DRAIN TROUGH DETAILS, SEE SHEETS 28 - 34.
6. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
7. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

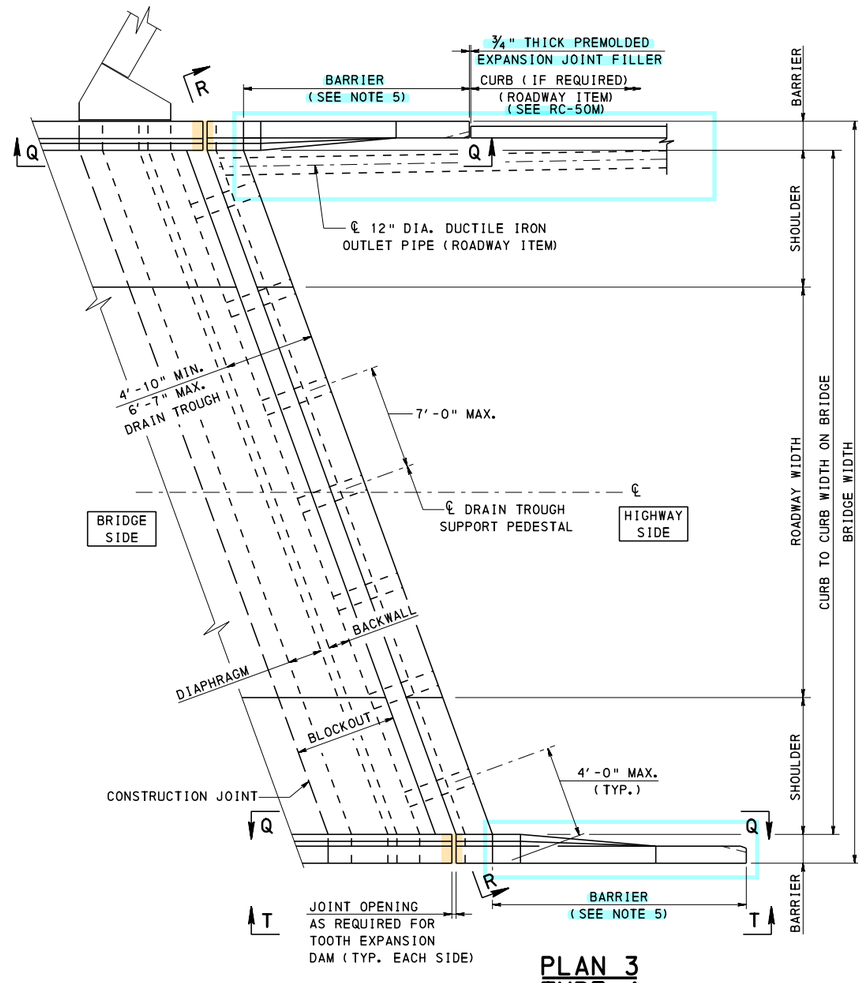
BRIDGE APPROACH SLABS
TYPE 4 - PLAN 2

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

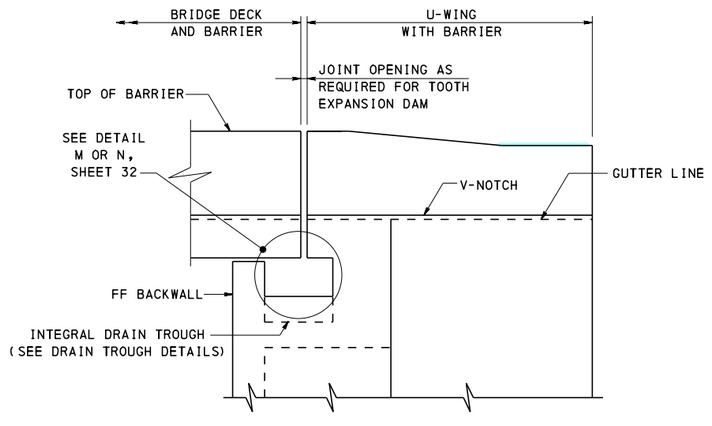
SHEET 27 OF 35

BD-628M

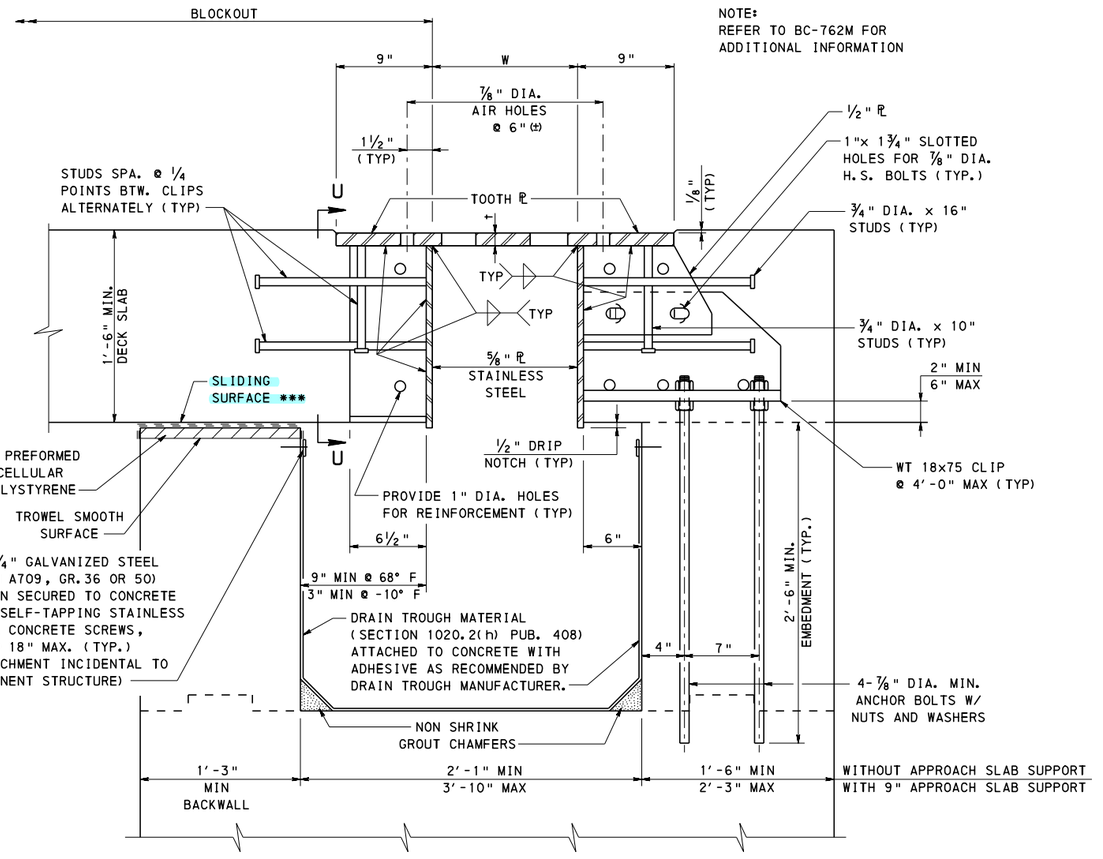


PLAN 3 TYPE 4

NO APPROACH SLAB WITH FLARED WINGS OR SHORT U-WINGS

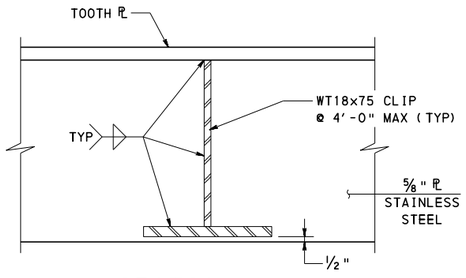


SECTION T-T



TOOTH EXPANSION DAM ANCHORAGE DETAIL

*** 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING.



SECTION U-U

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTIONS R-R, SEE SHEET 33.
3. FOR SECTIONS Q-Q, SEE SHEET 34.
4. FOR DRAIN TROUGH DETAILS, SEE SHEETS 28 - 34.
5. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
6. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

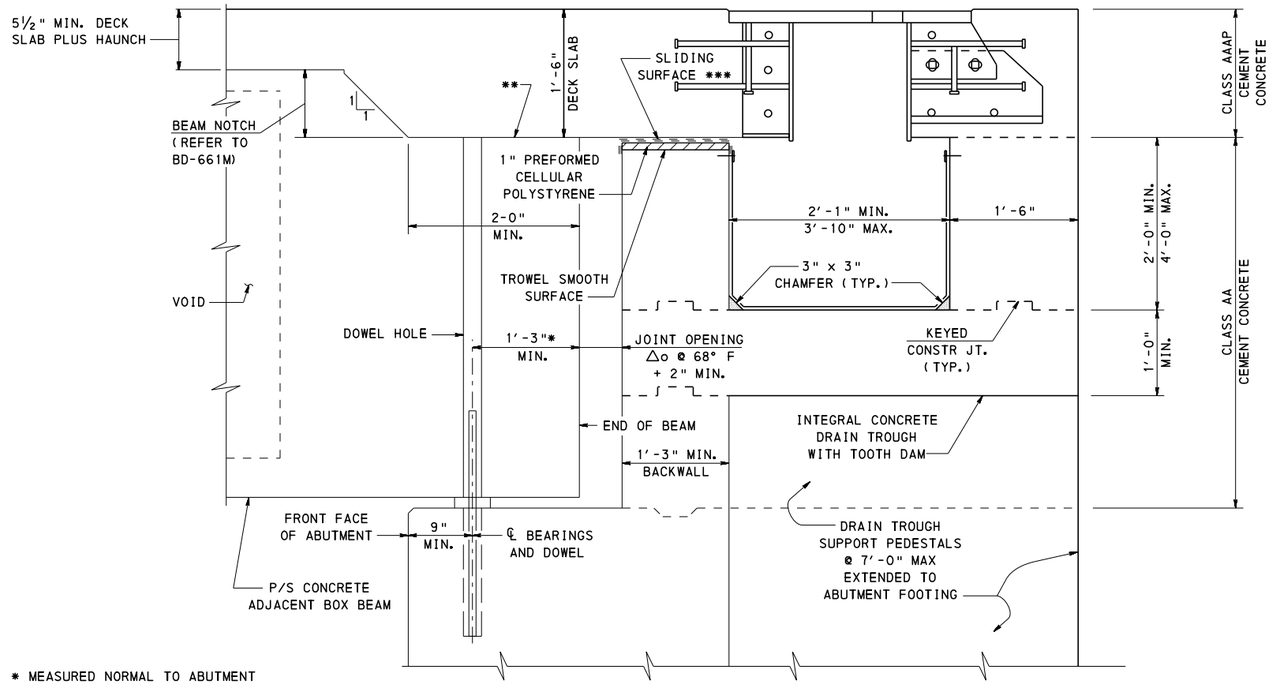
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD BRIDGE APPROACH SLABS TYPE 4 - PLAN 3

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

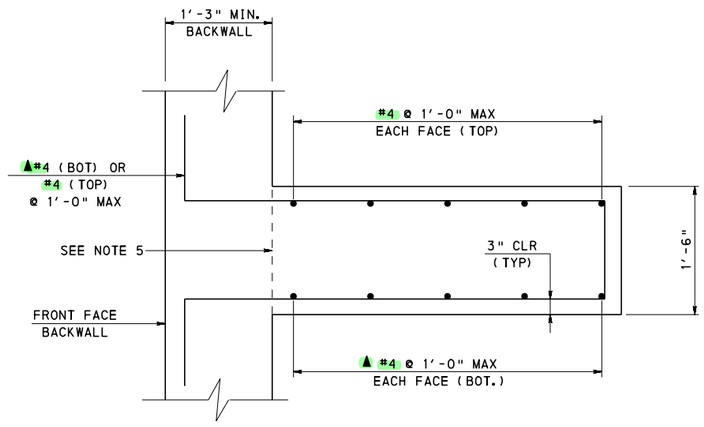
BD-628M



* MEASURED NORMAL TO ABUTMENT
** COAT WITH AN APPROVED EPOXY BONDING COMPOUND PRIOR TO PLACING DECK SLAB CONCRETE
*** 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING

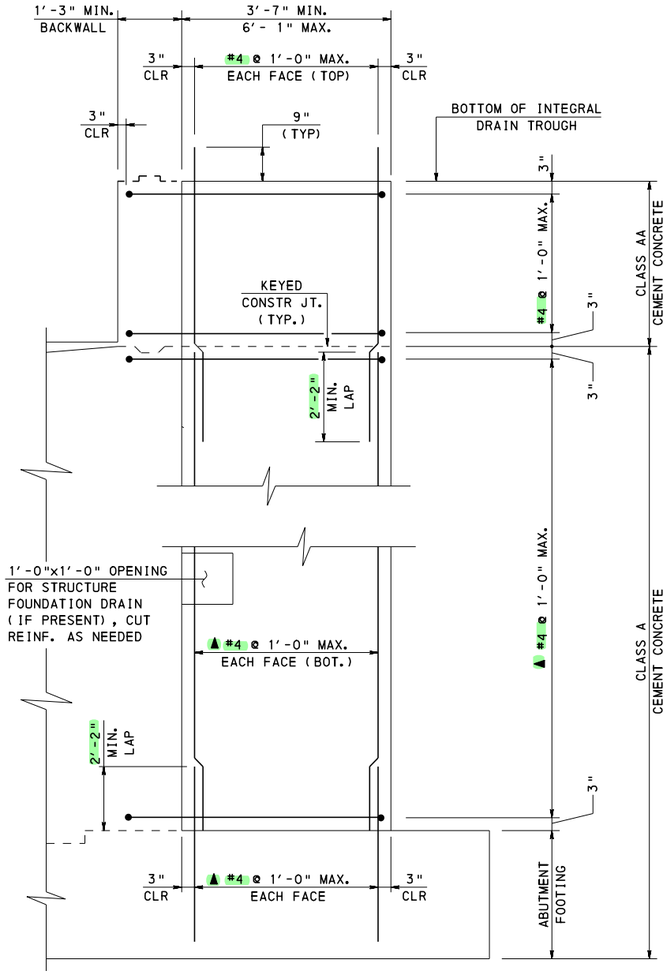
TYPE 4 APPROACH SLAB - DETAIL 23

PRESTRESSED CONCRETE ADJACENT BOX BEAMS WITH BACKWALL
FOR BEAM DEPTHS 33" AND GREATER
(SHOWN WITH FLEXIBLE PAVEMENT ADJACENT TO TOOTH DAM)



PEDESTAL REINFORCEMENT SECTION

▲ REINFORCEMENT BARS BELOW BEAM SEAT DO NOT NEED TO BE EPOXY-COATED



PEDESTAL REINFORCEMENT ELEVATION

▲ REINFORCEMENT BARS BELOW BEAM SEAT DO NOT NEED TO BE EPOXY-COATED

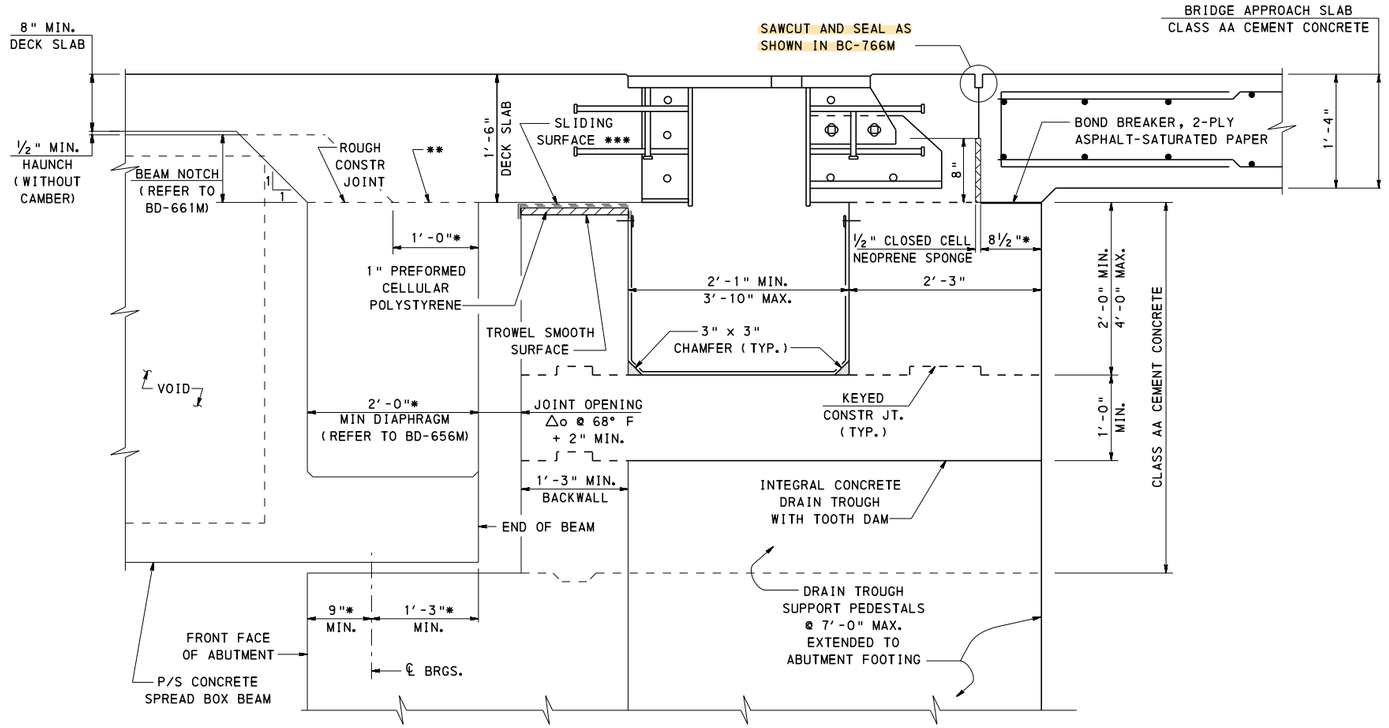
NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
4. SEE BC-762M FOR JOINT OPENING △o.
5. CONTRACTOR HAS THE OPTION OF FORMING AND POURING THE SUPPORT PEDESTALS INTEGRAL WITH THE ABUTMENT STEM OR PROVIDING A CONSTRUCTION JOINT WITH PROJECTING REINFORCEMENT.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BRIDGE APPROACH SLABS
TYPE 4 - DETAIL 23
(P/S CONCRETE BOX BEAMS WITH BACKWALL)

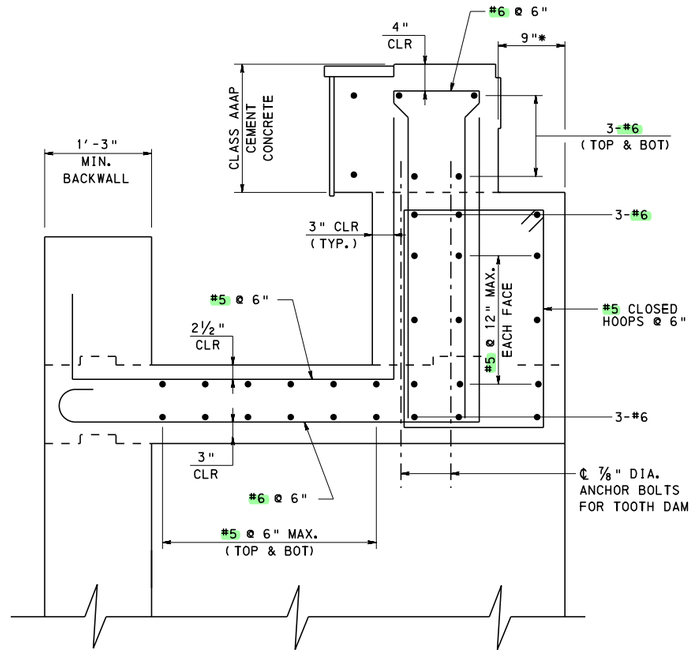
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 29 OF 35
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-628M



* MEASURED NORMAL TO ABUTMENT
** COAT WITH AN APPROVED EPOXY BONDING COMPOUND PRIOR TO PLACING DECK SLAB CONCRETE
*** 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING

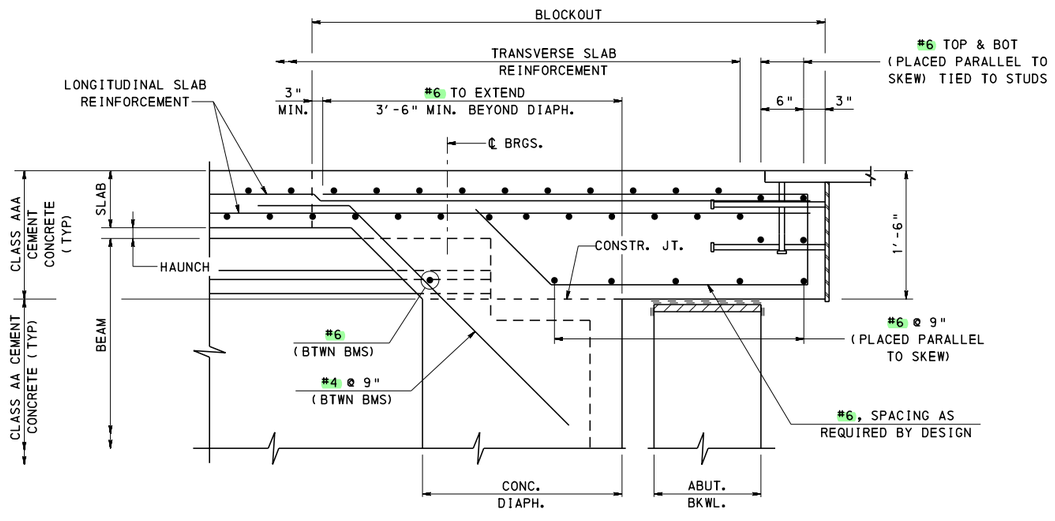
TYPE 4 APPROACH SLAB - DETAIL 24

PRESTRESSED CONCRETE SPREAD BOX BEAMS AND CONCRETE END DIAPHRAGMS WITH BACKWALL FOR BEAM DEPTHS 39" AND GREATER
(SHOWN WITH APPROACH SLAB ADJACENT TO TOOTH DAM)



DRAIN TROUGH REINFORCEMENT DETAIL

(SHOWN WITH APPROACH SLAB SUPPORT / PAVING NOTCH)



DECK SLAB REINFORCEMENT DETAIL

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

NOTES

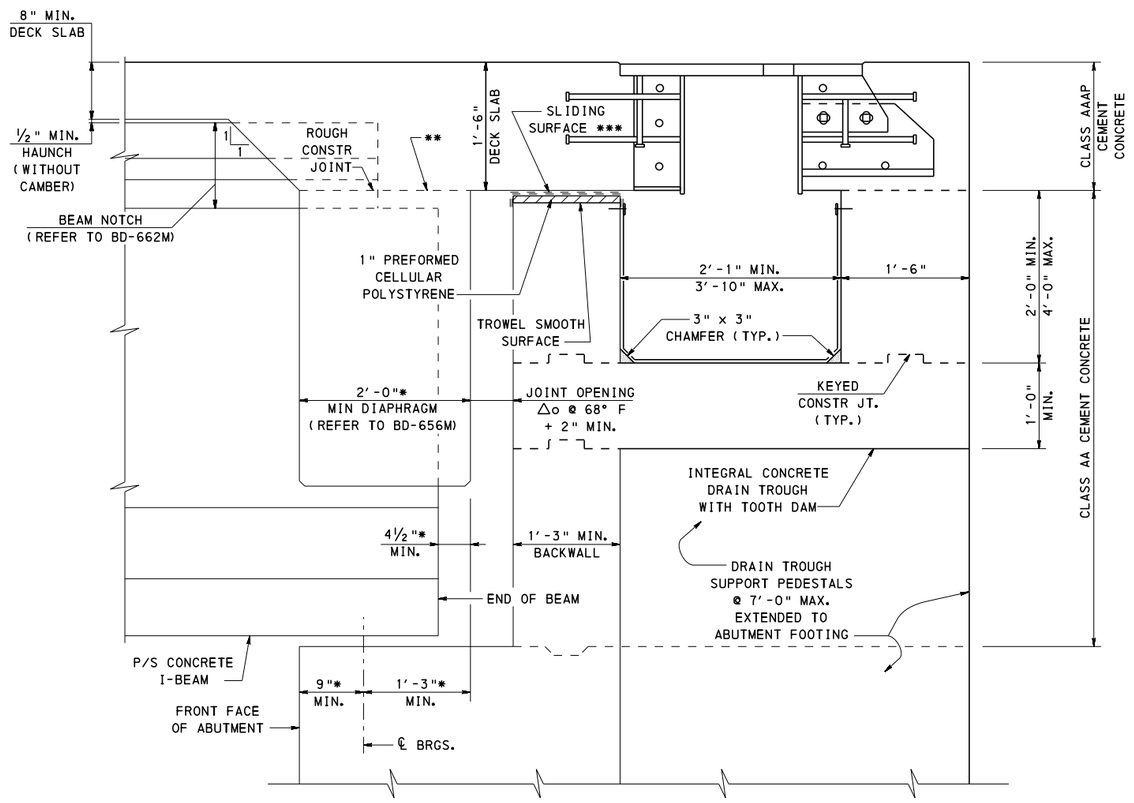
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
4. SEE BC-762M FOR JOINT OPENING △ o.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

BRIDGE APPROACH SLABS
TYPE 4 - DETAIL 24
(P/S CONCRETE BOX BEAMS WITH BACKWALL)

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 30 OF 35
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-628M



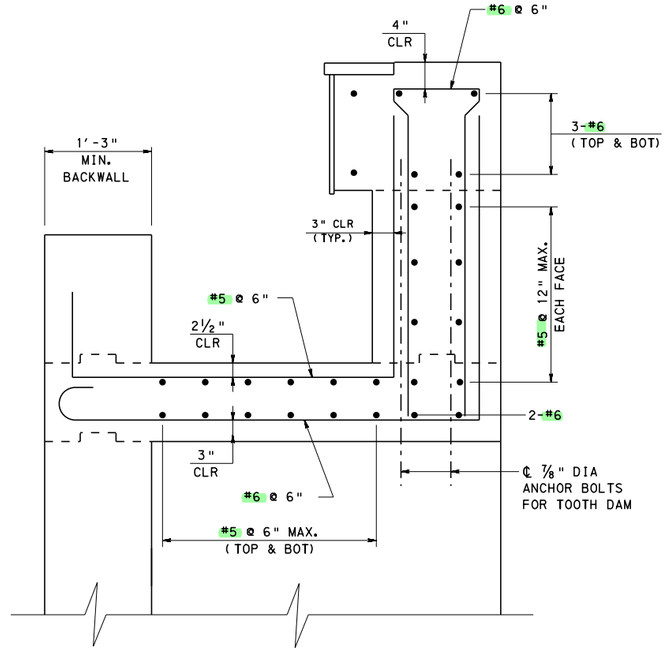
TYPE 4 APPROACH SLAB - DETAIL 25

PRESTRESSED CONCRETE I-BEAMS AND CONCRETE END DIAPHRAGMS
WITH BACKWALL - SEE TABLE A FOR MINIMUM BEAM DEPTHS
(SHOWN WITH FLEXIBLE PAVEMENT ADJACENT TO TOOTH DAM)

TABLE A	
BEAM TYPE	MINIMUM BEAM DEPTHS
AASHTO TYPE I-BEAMS	63"
PA BULB-TEE BEAMS	47.25"
PA I-BEAMS	①

① THE FOLLOWING BEAMS ARE PERMITTED:
26/54, 24/60, 26/60,
24/63, AND 26/63

* MEASURED NORMAL TO ABUTMENT
** COAT WITH AN APPROVED EPOXY
BONDING COMPOUND PRIOR TO
PLACING DECK SLAB CONCRETE
*** 2 LAYERS OF 4 MIL.
POLYETHYLENE SHEETING



DRAIN TROUGH REINFORCEMENT DETAIL

(SHOWN WITHOUT APPROACH SLAB SUPPORT / PAVING NOTCH)

NOTES

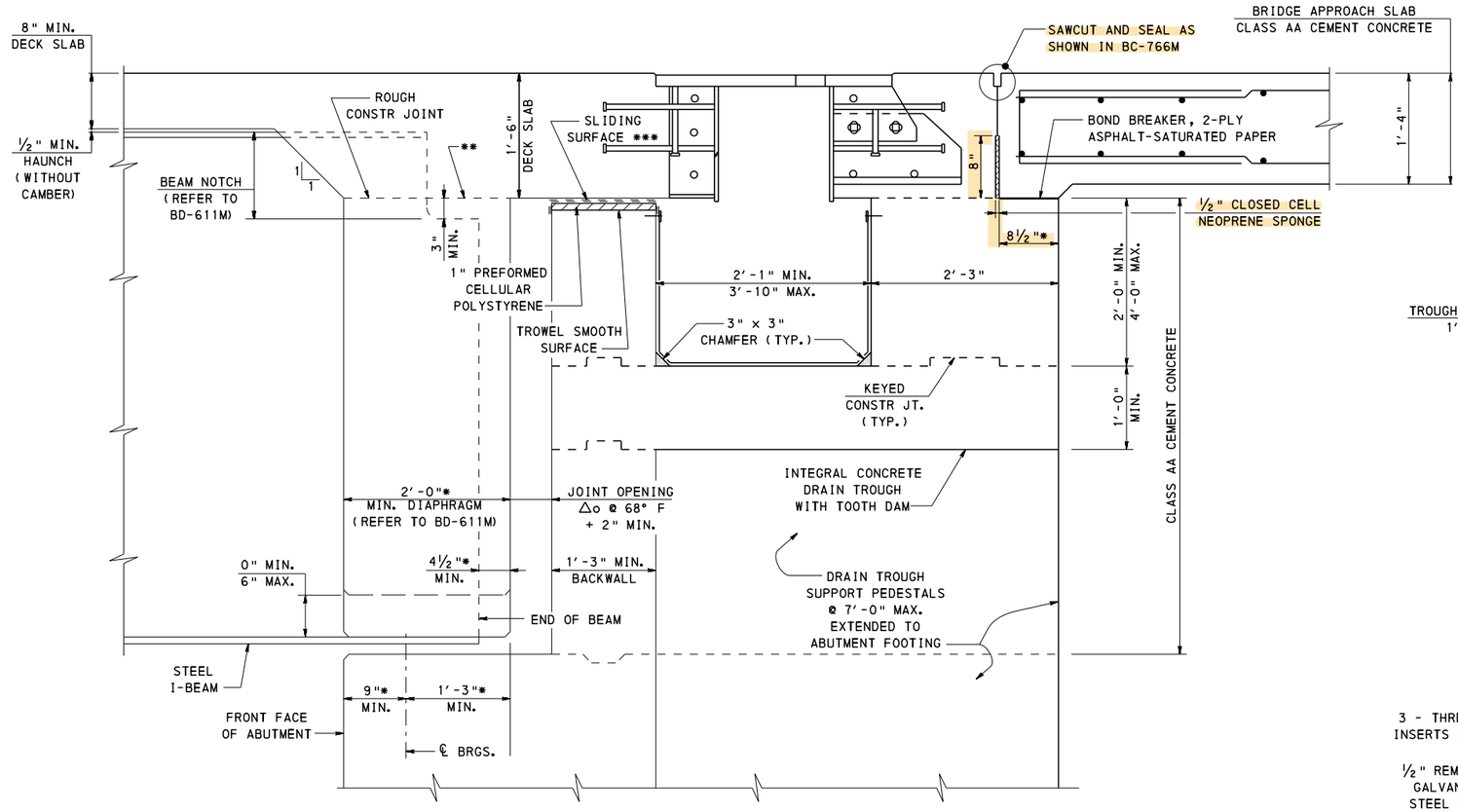
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
4. SEE BC-762M FOR JOINT OPENING △o.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

BRIDGE APPROACH SLABS
TYPE 4 - DETAIL 25
(P/S CONCRETE I-BEAMS WITH BACKWALL)

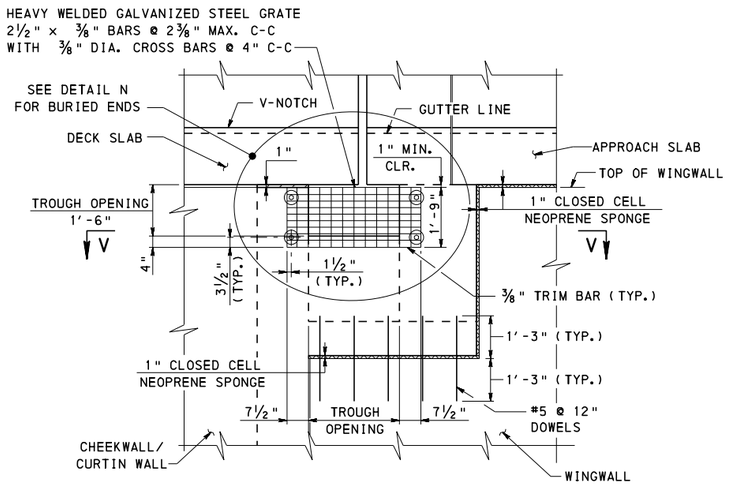
RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 31 OF 35
		BD-628M



TYPE 4 APPROACH SLAB - DETAIL 26

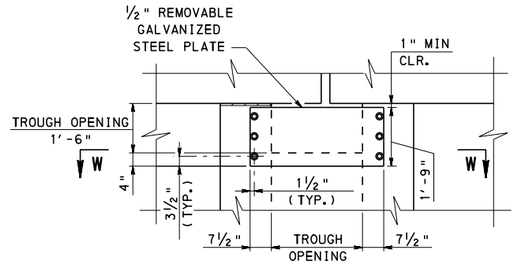
STEEL I-BEAMS AND CONCRETE END DIAPHRAGMS WITH BACKWALL FOR BEAM DEPTHS 40" AND GREATER (SHOWN WITH APPROACH SLAB ADJACENT TO TOOTH DAM)

* MEASURED NORMAL TO ABUTMENT
** COAT WITH AN APPROVED EPOXY BONDING COMPOUND PRIOR TO PLACING DECK SLAB CONCRETE
*** 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING



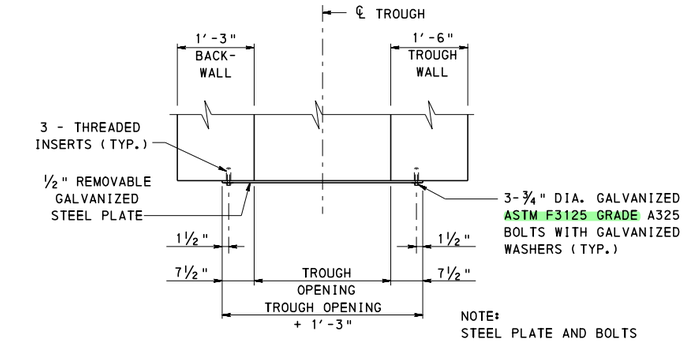
DETAIL M - DRAIN TROUGH END VIEW

(EXPOSED ENDS)



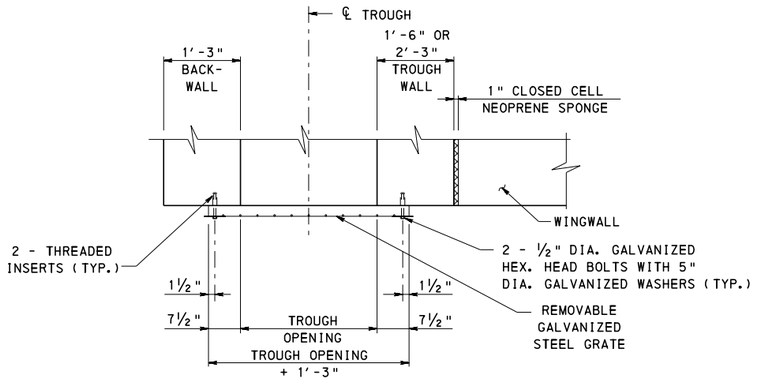
DETAIL N - DRAIN TROUGH END VIEW

(BURIED ENDS)



SECTION W-W

NOTE:
STEEL PLATE AND BOLTS INCIDENTAL TO COST OF TOOTH EXPANSION DAM.



SECTION V-V

NOTE:
STEEL GRATE AND BOLTS INCIDENTAL TO COST OF TOOTH EXPANSION DAM.

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
3. SEE BC-762M FOR JOINT OPENING △ o.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

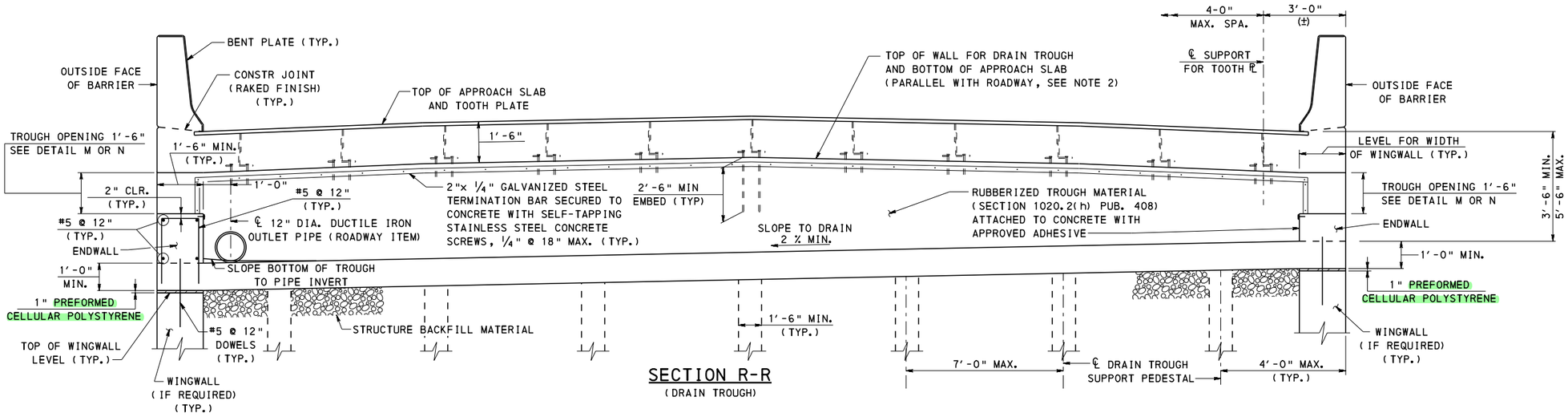
BRIDGE APPROACH SLABS
TYPE 4 - DETAIL 26
(STEEL BEAMS WITH BACKWALL)

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

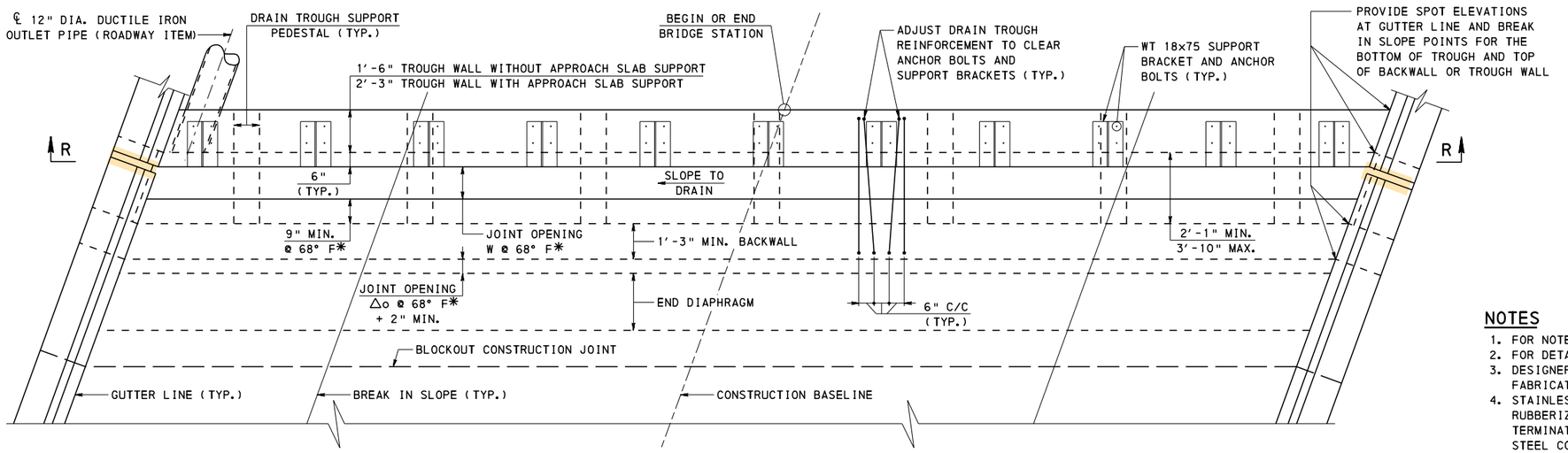
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 32 OF 35

BD-628M



SECTION R-R
(DRAIN TROUGH)



* TO BE ADJUSTED FOR INSTALLATION TEMPERATURE FOR SPECIFIED MOVEMENT CLASSIFICATION.

TOOTH DAM SUPPORT PLAN

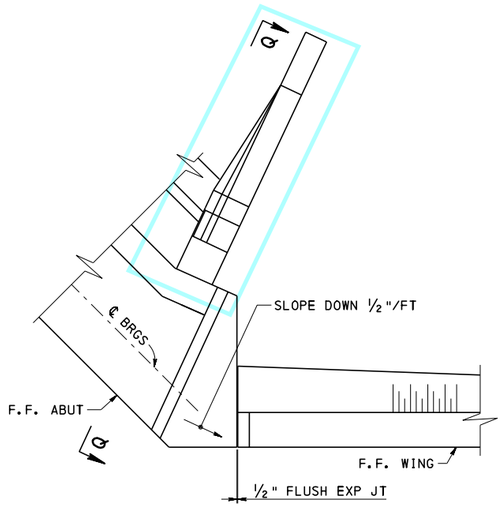
NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR DETAILS M AND N, SEE SHEET 32.
3. DESIGNER MAY ADJUST AS REQUIRED TO SIMPLIFY FABRICATION AND CONSTRUCTION.
4. STAINLESS STEEL PLATE, STUDS, ANCHOR BOLTS, RUBBERIZED TROUGH MATERIAL, GALVANIZED STEEL TERMINATION BARS, SELF-TAPPING STAINLESS STEEL CONCRETE SCREWS, NON SHRINK GROUT AND ANY OTHER ITEMS SHOWN ARE INCIDENTAL TO THE COST OF THE TOOTH EXPANSION DAM.

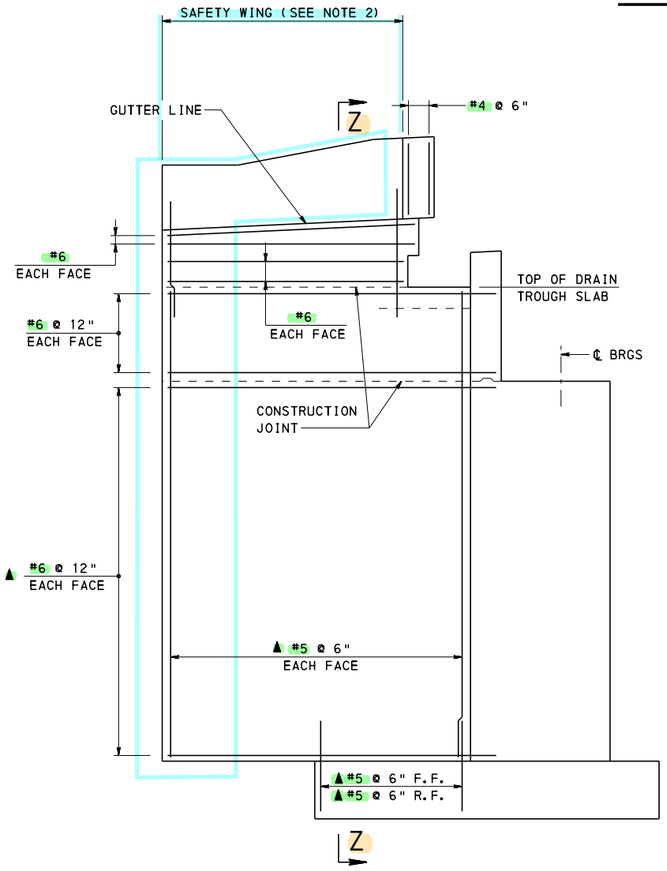
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BRIDGE APPROACH SLABS
TYPE 4 - DRAIN TROUGH DETAILS 1

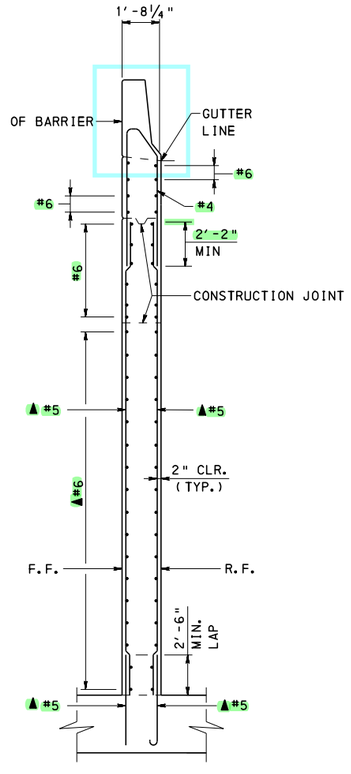
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 33 OF 35
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-628M



SAFETY WING PLAN

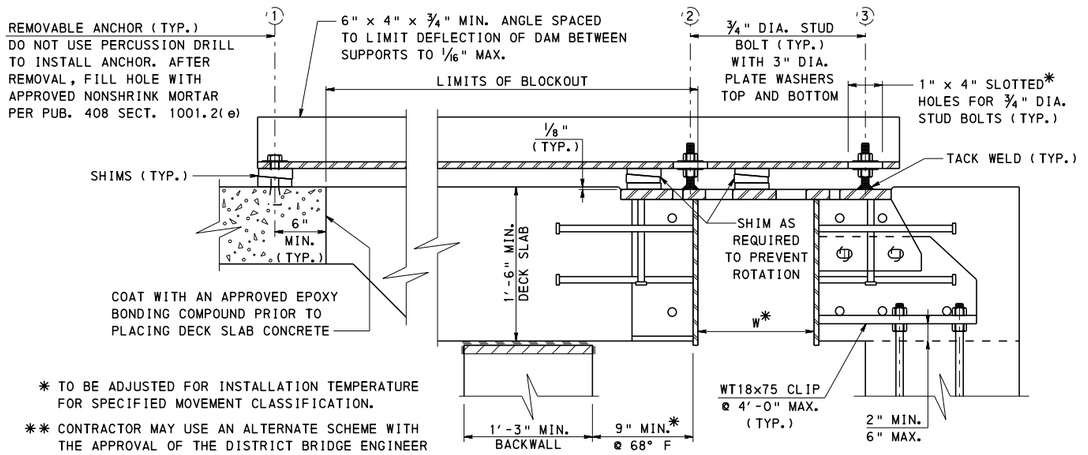


SECTION Q-Q



SECTION Z-Z

▲ REINFORCEMENT BARS BELOW BEAM SEAT DO NOT NEED TO BE EPOXY-COATED



* TO BE ADJUSTED FOR INSTALLATION TEMPERATURE FOR SPECIFIED MOVEMENT CLASSIFICATION.

** CONTRACTOR MAY USE AN ALTERNATE SCHEME WITH THE APPROVAL OF THE DISTRICT BRIDGE ENGINEER OR DISTRICT STRUCTURE CONTROL ENGINEER

CONCEPTUAL INSTALLATION SCHEME**

JOINT INSTALLATION NOTES:

1. CAST ANCHOR BOLTS INTO INTEGRAL CONCRETE DRAIN TROUGH.
2. INSTALL AND ADJUST FIXED PORTION OF TOOTH DAM ON TROUGH WALL TO THE PROPER LINE AND GRADE.
3. THE SURFACE OF THE BLOCKOUT MUST BE COMPLETELY CLEAN WHEN THE JOINT IS INSTALLED.
4. SUPPORT MOVEABLE PORTION OF TOOTH DAM IN THE BLOCKOUT FROM THE DECK SLAB AND FIXED PORTION OF THE TOOTH DAM (SEE CONCEPTUAL INSTALLATION SCHEME).
5. ADJUST MOVEABLE PORTION OF TOOTH DAM TO THE PROPER LINE AND GRADE WITH THE JOINT OPENING (W) SET WITH RESPECT TO THE INSTALLATION TEMPERTURE SHOWN ON THE PLANS.
6. DURING ASSEMBLY INSTALLATION TIGHTEN ANCHOR (1) AND BOTH NUTS ON STUD BOLTS (2) AND (3) MAKING SURE THE JOINT OPENING (W) REFLECTS THE INSTALLATION TEMPERATURE.
7. IMMEDIATELY AFTER BLOCKOUT IS CAST, LOOSEN TOP NUT ON STUD BOLT (3) TO PERMIT TEMPERATURE MOVEMENT IN THE ASSEMBLY. ALTERNATE THE PATTERN BETWEEN NEAR SIDE AND FAR SIDE OF JOINT ON SUCCESSIVE ASSEMBLIES, I.E. LOOSEN TOP NUT ON STUD BOLT (2) IMMEDIATELY AFTER BLOCKOUT IS CAST TO PERMIT MOVEMENT.
8. PROVIDE LOW FRICTION INTERFACE BETWEEN BOTTOM NUT AND WASHER ON STUD BOLTS AND ANGLE.
9. AFTER THE CONCRETE OF THE BLOCKOUT ACHIEVES THE MINIMUM COMPRESSIVE STRENGTH SPECIFIED IN PUBLICATION 408, SECTION 1001.3(q)1, REMOVE THE TEMPORARY SUPPORT ASSEMBLY AND GRIND OFF THE TACK WELDS UNTIL SMOOTH.
10. APPLY TOUCH-UP PAINT.

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. REFER TO BD-622M OR BD-624M FOR REINFORCEMENT REQUIREMENTS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BRIDGE APPROACH SLABS
TYPE 4 - DRAIN TROUGH DETAILS 2

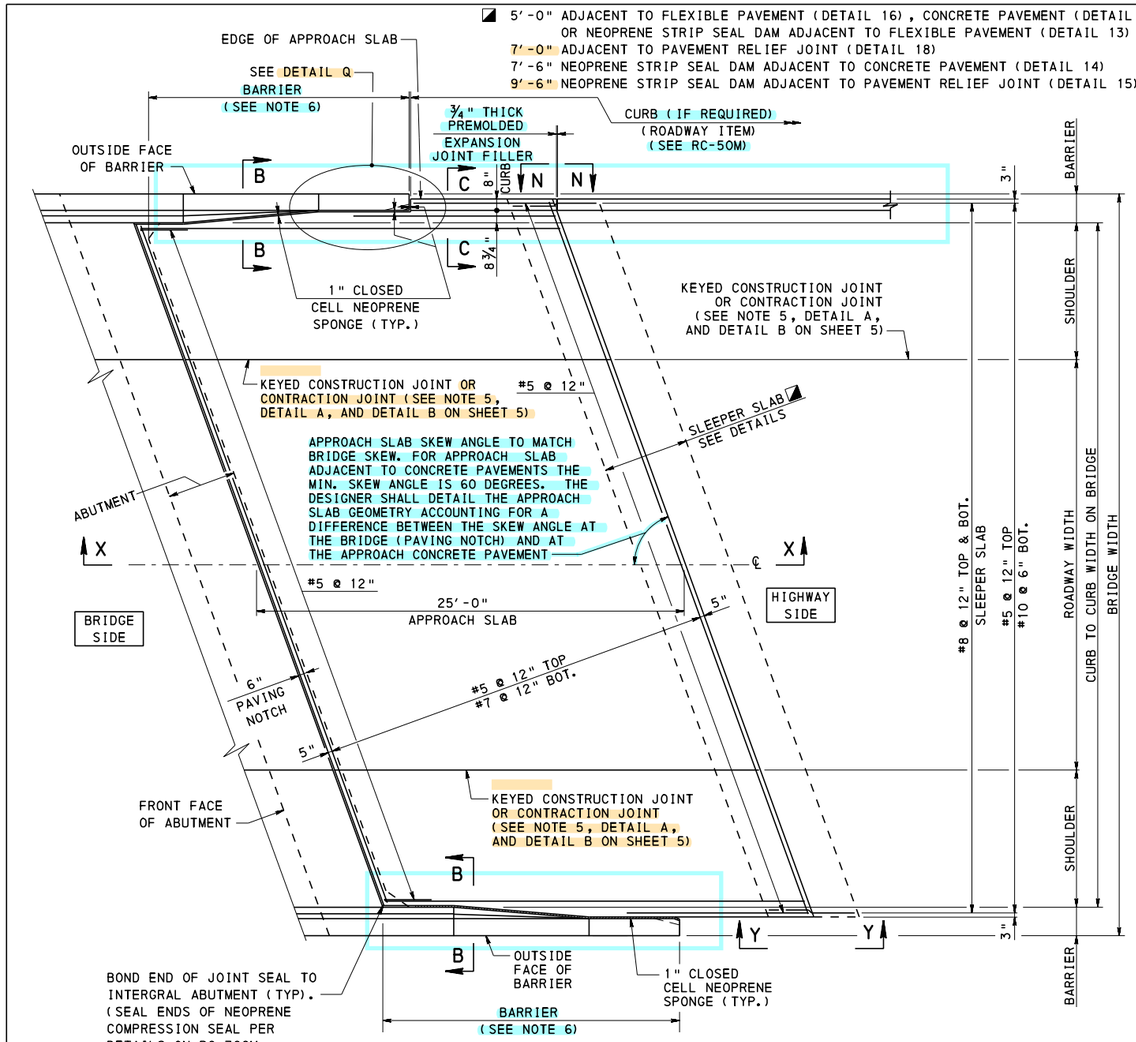
RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

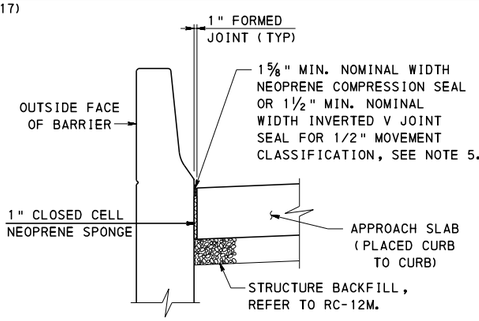
SHEET 34 OF 35

BD-628M

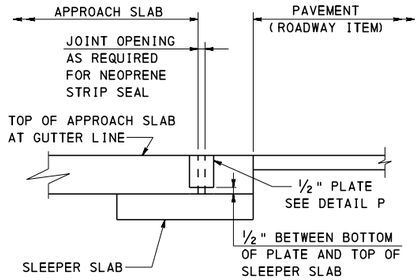
◪ 5′-0" ADJACENT TO FLEXIBLE PAVEMENT (DETAIL 16), CONCRETE PAVEMENT (DETAIL 17) OR NEOPRENE STRIP SEAL DAM ADJACENT TO FLEXIBLE PAVEMENT (DETAIL 13)
7′-0" ADJACENT TO PAVEMENT RELIEF JOINT (DETAIL 18)
7′-6" NEOPRENE STRIP SEAL DAM ADJACENT TO CONCRETE PAVEMENT (DETAIL 14)
9′-6" NEOPRENE STRIP SEAL DAM ADJACENT TO PAVEMENT RELIEF JOINT (DETAIL 15)



PLAN
TYPE 5
APPROACH SLAB WITH INTEGRAL ABUTMENT WITH U-WINGS



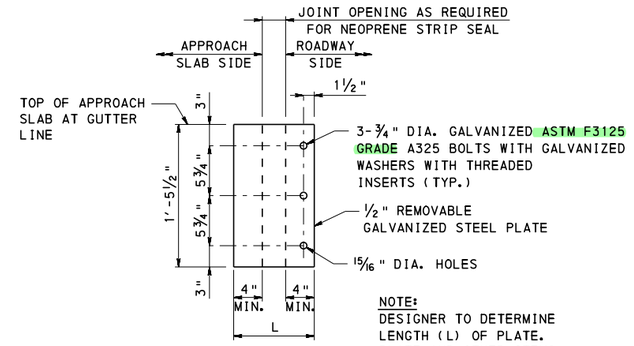
SECTION B-B



SECTION Y-Y
(FOR NEOPRENE STRIP SEAL)

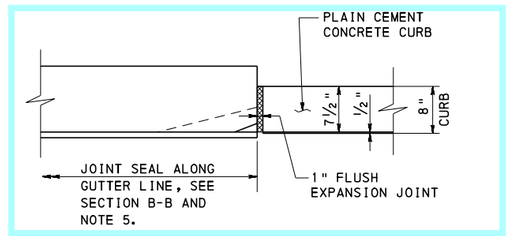
DESCRIPTION OF DETAILS FOR TYPE 5 APPROACH SLAB

DETAIL	DESCRIPTION	SHEET NO.
13	END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO FLEXIBLE PAVEMENT	22
14	END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO CONCRETE PAVEMENT	22
15	END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO PAVEMENT RELIEF JOINT	22
16	END OF APPROACH SLAB ADJACENT TO FLEXIBLE PAVEMENT	23
17	END OF APPROACH SLAB ADJACENT TO CONCRETE PAVEMENT	23
18	END OF APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT	23



DETAIL P
END COVER PLATE

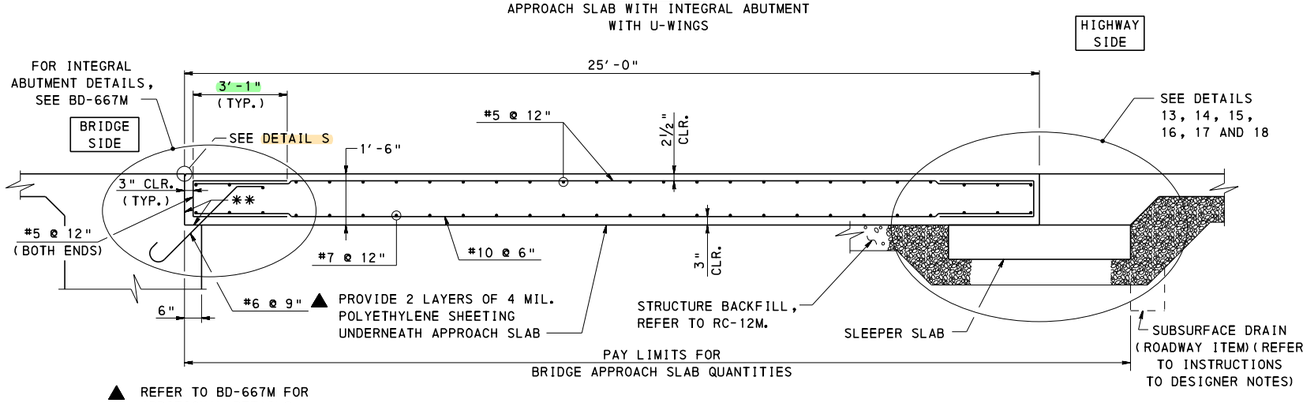
NOTE:
DESIGNER TO DETERMINE LENGTH (L) OF PLATE. PLATE AND OTHER ITEMS INCIDENTAL TO COST OF NEOPRENE STRIP SEAL DAM.



DETAIL Q

NOTES

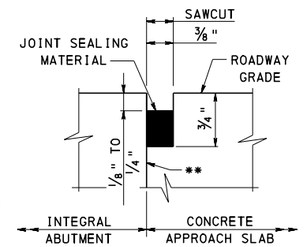
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION C-C, SEE SHEET 5.
3. FOR SECTION N-N, SEE SHEET 21.
4. PROVIDE PAVING NOTCH FROM CURB TO CURB.
5. USE ONLY APPROVED SEALS, AS LISTED IN BULLETIN 15. INSTALL JOINT SEALS TO A UNIFORM DEPTH WITH THE TOP OF THE SEAL FROM 1/4" TO 1/2" BELOW THE LEVEL OF THE PAVEMENT SURFACE. MAKE THE TOP EDGES OF THE CONTACT SURFACES ON BOTH SIDES OF THE SEAL AT THE SAME ELEVATION.
6. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12′-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
7. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M, BD-667M AND RC-50M.



▲ REFER TO BD-667M FOR ADDITIONAL DETAILS

** COAT WITH BOND BREAKER PRIOR TO PLACING APPROACH SLAB CONCRETE

SECTION X-X



DETAIL S

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BRIDGE APPROACH SLABS
TYPE 5 - PLAN AND SECTION

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 35 OF 35

BD-628M

CHANGE 2

CHANGE 5

GENERAL NOTES

1. MATERIALS AND WORK QUALITY ARE TO BE IN ACCORDANCE WITH PUBLICATION 408.
2. PIER DIMENSIONS ARE DETERMINED BY DESIGN.
3. PROVIDE THE FOLLOWING MINIMUM CONCRETE COVER FOR REINFORCEMENT:
   - 4" - CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH
   - 3" - CONCRETE EXPOSED TO EARTH
   - 2" - CONCRETE EXPOSED TO WEATHER
   - 1½" - TO CROSS TIES IN COLUMNS
   - 3" - SIDE COVER TO STIRRUPS IN PIER CAPS TO PROVIDE CONSTRUCTION TOLERANCE AND LONG TERM SERVICEABILITY
4. USE CLASS A CEMENT CONCRETE IN PIERS, FOOTINGS AND DRILLED SHAFTS.
5. USE CLASS C CEMENT CONCRETE BELOW BOTTOM OF FOOTINGS, IF SPECIFIED.
6. EPOXY COAT MAIN REINFORCEMENT BARS (J-BARS) PROTRUDING FROM PIER FOOTINGS INTO COLUMNS OR STEM AND CAP STEEL BELOW OPEN JOINTS.
7. FOR ADDITIONAL EPOXY COATED REINFORCEMENT BAR REQUIREMENTS, SEE DESIGN MANUAL, PART 4, CONCRETE STRUCTURES, SECTION D.5.4.3.6P.
8. KEY FOR CONSTRUCTION JOINT MAY BE FORMED INTO THE COLUMN OR INTO THE FOOTING.
9. SEE BC-736M FOR STANDARD SPLICE AND DEVELOPMENT LENGTHS.
10. PROVIDE ¾" V-NOTCH IN COLUMNS OF PIERS AT FINISH GROUND LINE FOR PIERS NEAR WATER.
11. FOR FOOTINGS FOUNDED ON BEDROCK A MINIMUM OF 1 FT. SOIL COVER IS PREFERRED BUT NOT REQUIRED. SOIL COVER MAY BE ANY DEPTH TO AVOID UNNECESSARY EXCAVATION.
12. FOR CHECKING CRACK CONTROL, THE SIDE CLEARANCE SHALL BE 2". A 3" COVER IS INDICATED TO PROVIDE CONSTRUCTION TOLERANCE AND LONG TERM SERVICEABILITY.
13. APPLY AN EPOXY RESIN COATING TO ENTIRE PIER COLUMN/WALL THAT ARE WITHIN SPLASH ZONE (14 FT. OF ROADWAY EDGE), TO PROTECT AGAINST SALT SPRAY.

DESIGN DATA

- UNIT WEIGHT OF BACKFILL MATERIAL = 120 lb/ft.^{3}
- UNIT WEIGHT OF CONCRETE = 150 lb/ft.^{3}
- EQUIVALENT FLUID EARTH PRESSURE = 35 psf/ft OF DEPTH
- FOR FOOTINGS USE A MINIMUM DEPTH INCREMENT OF 3"
- MINIMUM FOOTING THICKNESS: 2'-0" FOR SPREAD FOOTINGS
  2'-6" FOR FOOTINGS ON PILES
- SOLID PIERS SHALL HAVE A MINIMUM THICKNESS OF 2'-0" AND MAY BE WIDENED AT THE TOP TO ACCOMMODATE THE BRIDGE SEAT WHEN REQUIRED.
- FOR ROUND, SQUARE AND RECTANGULAR COLUMNS USE A 3'-0" MIN. COLUMN DIA./WIDTH. USE INCREMENTS OF 6" MINIMUM TO INCREASE COLUMN WIDTHS/DIA.
- SHRINKAGE KEYS MUST NOT BE USED IN PIER CAPS TO ELIMINATE PARTIAL OR TOTAL SHRINKAGE STRESSES.
- FOR COLUMNS OR PIER BENTS LOCATED IN THE SLOPED PORTION OF AN EMBANKMENT, INCREASE THE EARTH PRESSURE AGAINST THE BACK OF THE FOOTING AND COLUMN 100% TO INCLUDE THE EFFECT OF THE ADJACENT EMBANKMENT.
- PIERS LOCATED IN THE EMBANKMENT MUST BE INVESTIGATED FOR STABILITY NOT CONSIDERING SUPERSTRUCTURE LOADS.
- FOR STEEL BRIDGES WITH MULTIPLE FIXED PIERS AND CONTINUOUS DECK DESIGN, PROVIDE A TEMPERATURE/DISPLACEMENT TABLE FOR PLACEMENT AT OTHER THAN 70°F.

CONSTRUCTABILITY CONSIDERATIONS

- TO ALLOW PLACEMENT OF THE PIER CAP REINFORCEMENT CAGE:
  - PROVIDE SPLICES IN COLUMN TIES WHICH EXTEND INTO THE PIER CAP.
  - DO NOT EXTEND SPIRALS INTO THE PIER CAP. PROVIDE SPLICED TIES.
- FOR VERTICAL COLUMN REINFORCEMENT STABILITY, EXTEND VERTICAL COLUMN STEEL (J-BARS) TO BOTTOM MAT OF FOOTING REINFORCEMENT STEEL.
- COLUMN
  - FOR STEPPED COLUMN, PROVIDE 6" MINIMUM / 2'-0" MAXIMUM WIDTH VARIANCE. CONSIDER USING COLUMN SEGMENT LENGTHS WITH 1'-0" INCREMENTS FOR ALL BUT TOP COLUMN SEGMENT. SEE ELEVATION ON SHEET 9, FOR GRAPHICAL REPRESENTATION.
  - FOR ROUND COLUMNS, RECOMMENDED MAXIMUM COLUMN DIA. IS 8'-0".

INDEX OF DRAWINGS

REFERENCE DRAWINGS	
BC-735M	WALL CONSTR. & EXP. JOINT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-751M	BRIDGE DRAINAGE
BC-755M	BEARINGS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
BD-613M	HIGH LOAD MULTI-ROTATIONAL POT BEARINGS
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-651M	REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCK, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS
BD-653M	TYPICAL FRAMING PLANS AND DETAILS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-658M	SHEAR BLOCK DETAILS AT PIER - P/S CONCRETE I-BEAM AND BOX BEAM BRIDGES
BD-664M	CONTINUITY FOR LIVE LOAD DETAILS - I-BEAM BRIDGES
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS - BOX BEAM BRIDGES

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
REINFORCED CONCRETE PIERS

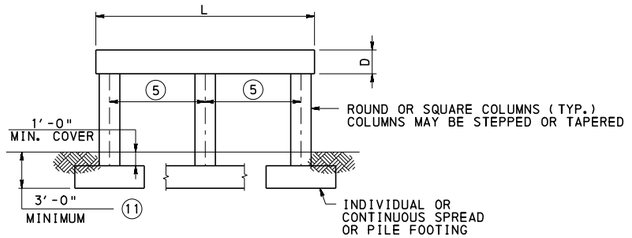
GENERAL NOTES AND DESIGN CRITERIA

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

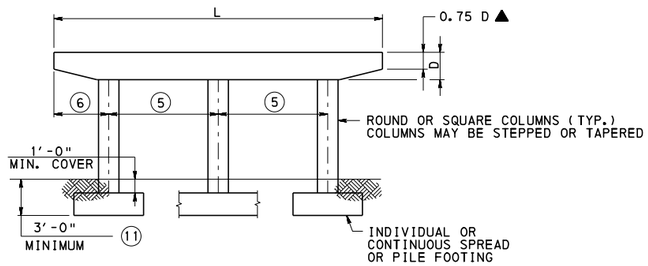
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 15

BD-629M



TYPE A



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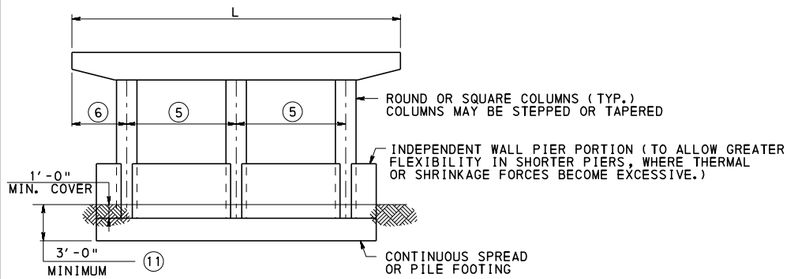

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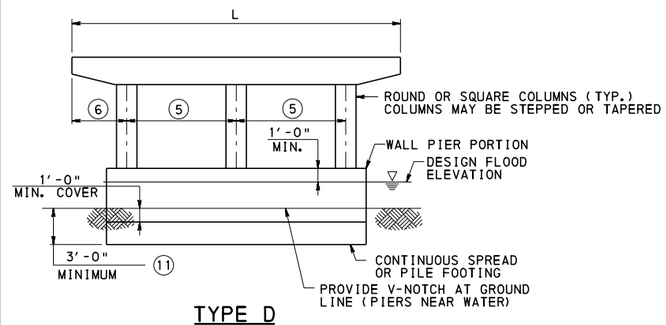
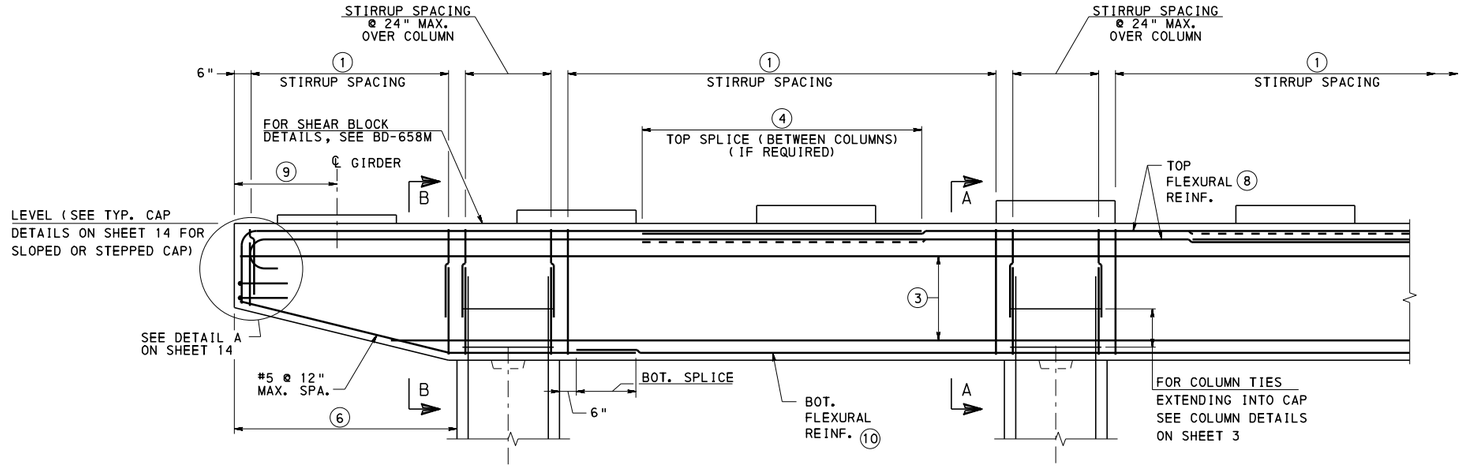


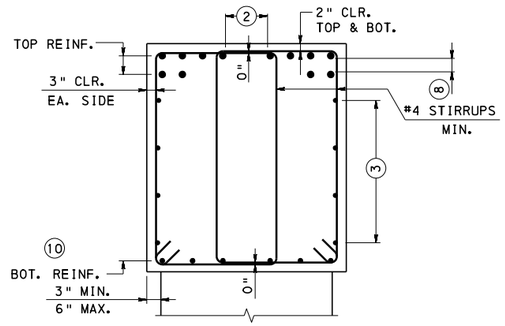
TYPE D

RECOMMENDED MULTI-COLUMN BENT CONFIGURATIONS			
PIER TYPE	GRADE SEPARATION	RIVER	RAILROAD WITHIN 25 FT. OF CL TRACK
A	X		
B	X		
C	X		X
D	X	X	X

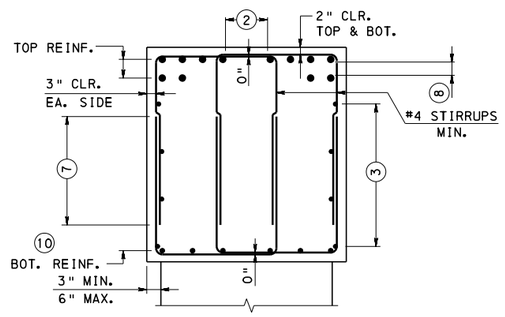


CAP ELEVATION

▲ - DENOTES RECOMMENDED VALUE



SECTION A-A
(DOUBLE STIRRUPS WITH TWO LAYERS OF TOP REINFORCEMENT)



SECTION B-B
(DOUBLE U-SHAPED STIRRUPS WITH TWO LAYERS OF TOP REINFORCEMENT)

NOTES:

1. STIRRUPS TO BE SPACED AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT, EXCEPT LOCALIZED REGIONS (HIGH SHEAR STRESS ZONES) WHERE A SMALLER SPACING WILL NOT INTERFERE WITH VIBRATION OR CONCRETE PLACEMENT. MAX. SPACING IS 12".
2. PROVIDE AT LEAST ONE SPACE AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT. FOR CAPS GREATER THAN 5′-0" WIDE PROVIDE TWO 9" CLEAR SPACES. PROVIDE 6" MIN. AT ALL OTHER SPACES. REINF. SPACING WILL NEED TO BE ADJUSTED TO CLEAR DOWELS OR ANCHOR BOLTS INCLUDING SLEEVES.
3. PROVIDE #5 @ 12" MIN. OR IF EFFECTIVE DEPTH "de" EXCEEDS 3′-0", PROVIDE LONGITUDINAL SKIN REINFORCEMENT PER AASHTO 5.7.3.4.
4. ALTERNATE SPLICE LOCATIONS OF ADJACENT BARS.
5. TYPICAL RANGE OF COLUMN SPACING, S IS 12′ TO 20′.▲
6. WHEN POSSIBLE, ENDS OF PIER CAPS SHALL EXTEND S/3 TO S/2 TO BALANCE POSITIVE AND NEGATIVE MOMENTS IN THE CAP.
7. FOR CONSTRUCTABILITY, PROVIDE STIRRUP SPLICE OVER COLUMNS AND CANTILEVER PORTIONS OF CAP.
8. MULTI-LAYERS
   - PLACE REINFORCING BARS DIRECTLY BELOW REINFORCING BARS IN UPPER LAYER(S)
   - CLEAR SPACING MUST BE 1½" MINIMUM
9. DIMENSION BASED ON THE FOLLOWING PARAMETERS: BEAM SIZE, BEARING SIZE, ANCHOR BOLT LOCATION/EDGE DISTANCES AND SKEW.
10. COORDINATE BOTTOM FLEXURAL CAP REINFORCEMENT WITH VERTICAL COLUMN REINFORCEMENT TO AVOID INTERFERENCE.
11. BOTTOM OF FOOTING ELEVATION DETERMINED BY SOIL CONDITIONS, FROST, SCOUR, PAVEMENT DEPTH, ROADWAY DRAINAGE OR ANY OTHER REQUIREMENTS AS DETERMINED BY THE ENGINEER.

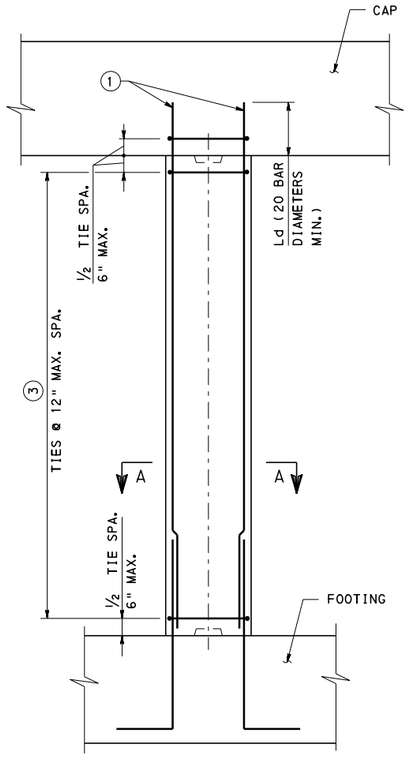
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD REINFORCED CONCRETE PIERS MULTI-COLUMN BENT DETAILS

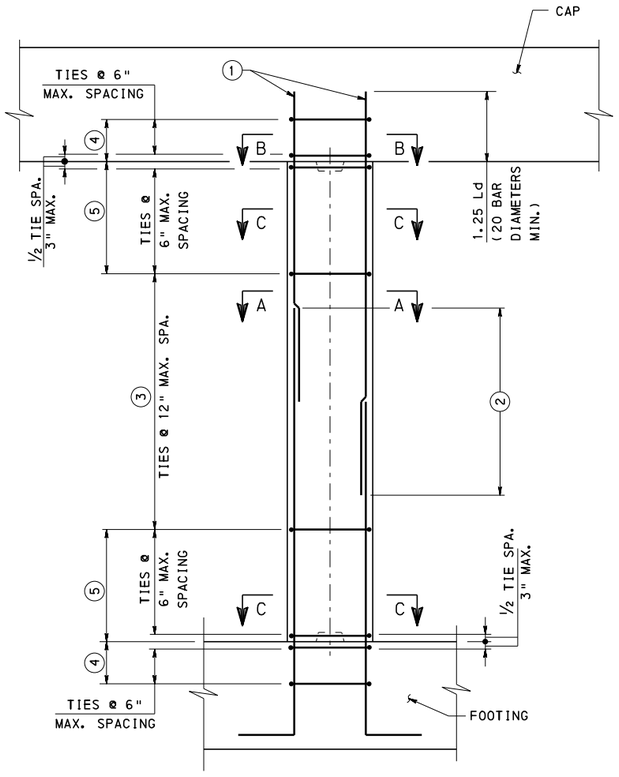
RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-629M

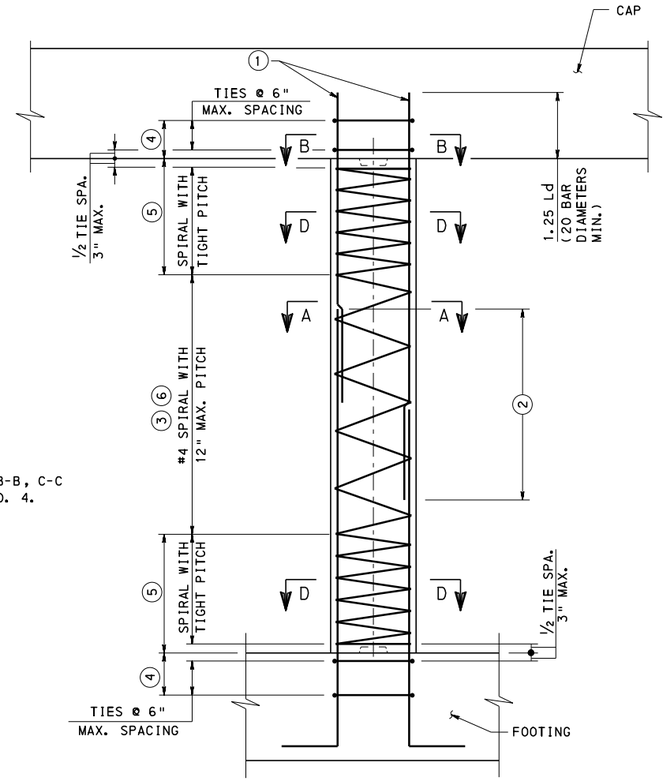


ROUND, SQUARE OR RECTANGULAR COLUMN
(RESPONSE ACCELERATION COEFFICIENT, S_{D1}, LESS THAN 0.10)



ROUND, SQUARE OR RECTANGULAR COLUMN
(SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, S_{D1}, GREATER THAN OR EQUAL TO 0.10)

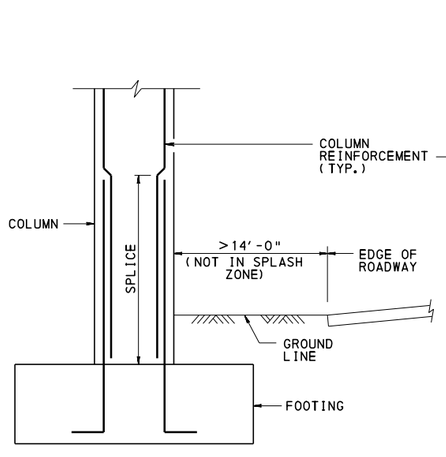
NOTE:
FOR SECTIONS A-A, B-B, C-C & D-D, SEE SHEET NO. 4.



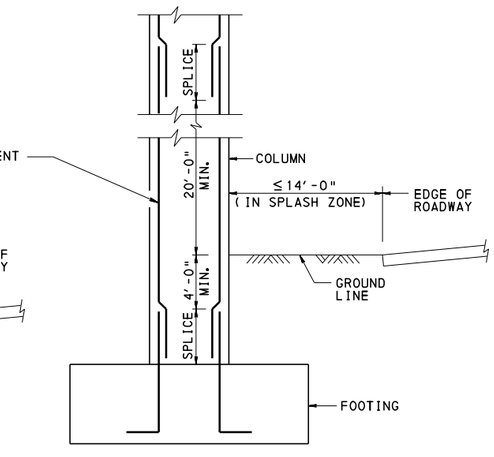
ROUND COLUMN (ALTERNATE)
(SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, S_{D1}, GREATER THAN OR EQUAL TO 0.10)

NOTES:

1. COORDINATE VERTICAL COLUMN REINFORCEMENT WITH BOTTOM FLEXURAL CAP REINFORCEMENT TO AVOID INTERFERENCE.
2. SPLICE CRITERIA: (SEE PERMITTED SPLICE LOCATION DETAILS)
   - THE SPLICE LENGTH MUST NOT BE LESS THAN CLASS B SPLICE PER BC-736M.
   - STAGGER CLASS B SPLICES SUCH THAT NO MORE THAN 50% OF THE REINFORCING BARS ARE SPLICED AT ONE LOCATION.
   - USE A 6" MAXIMUM TIE SPACING ALONG THE LENGTH OF THE SPLICE.
   - IF THE ABOVE SPLICE CRITERIA CANNOT BE MET, FULL-MECHANICAL CONNECTION SPLICES CAN BE USED PROVIDED NOT MORE THAN ALTERNATE REINFORCING BARS IN EACH LAYER ARE SPLICED AT A SECTION, AND THE DISTANCE BETWEEN SPLICES OF ADJACENT REINFORCING BARS IS GREATER THAN 24" MEASURED ALONG THE LONGITUDINAL AXIS OF THE COLUMN.
3. FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING OR PITCH OF SPIRAL MUST NOT EXCEED 6".
4. COLUMN CONNECTION GREATER OF: ½ MAX. COL. DIMENSION OR 15"
5. PLASTIC HINGE ZONE GREATER OF: MAX. COLUMN DIMENSION, 1/6 CLR. HEIGHT OF COLUMN OR 18"
6. SPIRAL REINFORCEMENT #4 @ 12" MAXIMUM PITCH, BUT NOT LESS THAN THE SIZE AND SPACING SHOWN ON THE DRAWINGS, MAY BE SUBSTITUTED AT NO ADDITIONAL COST TO THE DEPARTMENT.



PERMITTED SPLICE LOCATION IN NON-SPLASH ZONE



PERMITTED SPLICE LOCATION IN SPLASH ZONE

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

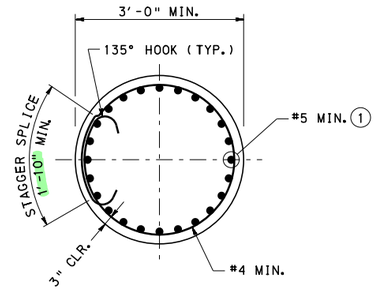
STANDARD REINFORCED CONCRETE PIERS MULTI-COLUMN BENT COLUMN DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

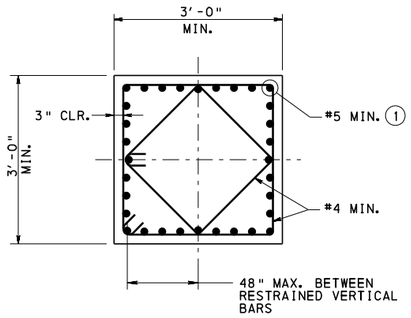
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 3 OF 15

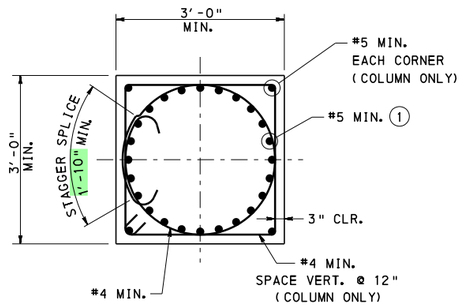
BD-629M



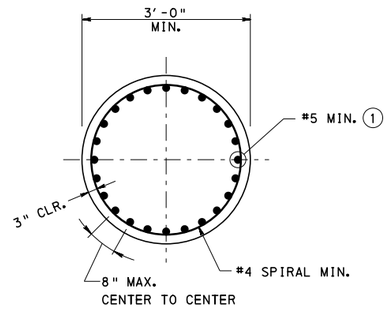
ROUND COLUMN



SQUARE COLUMN

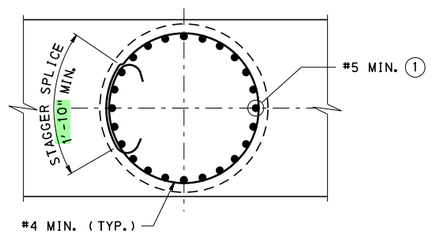


SQUARE COLUMN
(DESIGNED AS ROUND)

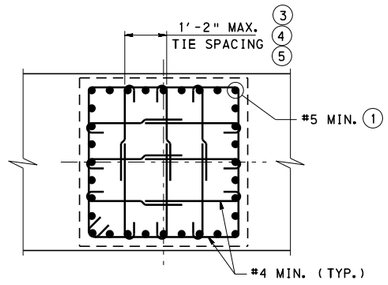


SECTION D-D (2)
(PLASTIC HINGE ZONE)

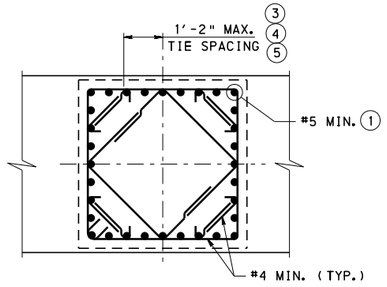
SECTION A-A (2)



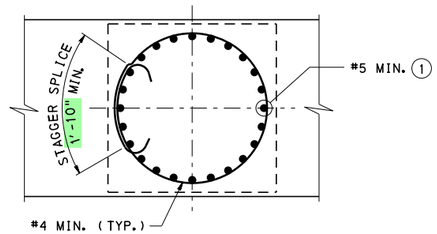
ROUND COLUMN



SQUARE COLUMN



SQUARE COLUMN
(ALTERNATE TIE ARRANGEMENT)

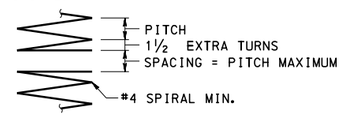


SQUARE COLUMN
(DESIGNED AS ROUND)

SPIRAL LENGTH = $\sqrt{(\pi D)^2+P^2}\,(H/P)+(3)(\pi D)$
(DOES NOT INCLUDE ADDITIONAL LENGTH FOR HOOKED ENDS)
D = DIAMETER
H = HEIGHT OF SPIRAL PIECE
P = PITCH (DISTANCE BETWEEN TURNS)
3 = 1½ TURNS TOP & BOTTOM

SPIRAL SPLICES:

- THE TOTAL SPIRAL LENGTH CAN BE DIVIDED INTO SEPARATE PIECES. EACH PIECE MUST BE PROVIDED WITH 1½ EXTRA TURNS AND A 135 DEGREE HOOK AT EACH END. EACH HOOK MUST ENGAGE A VERTICAL REINFORCING BAR. THE MAXIMUM DISTANCE BETWEEN THE SPIRAL PIECES IS LIMITED TO THE PITCH OF THE SPIRAL.

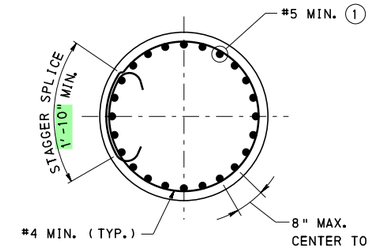


- OR APPROVED MECHANICAL CONNECTORS.

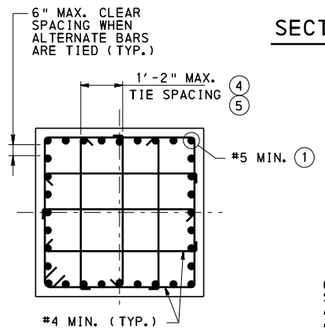
SPIRAL ANCHORAGE:

- 1½ EXTRA TURNS

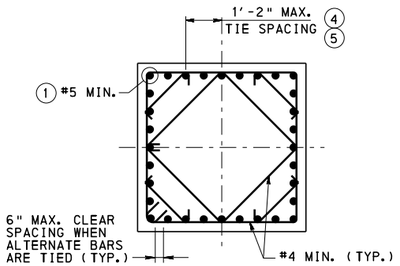
SECTION B-B (2)



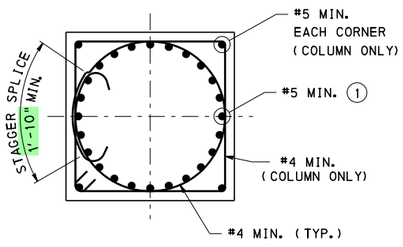
ROUND COLUMN



SQUARE COLUMN



SQUARE COLUMN
(ALTERNATE TIE ARRANGEMENT)



SQUARE COLUMN
(DESIGNED AS ROUND)

SECTION C-C (2)
(PLASTIC HINGE ZONE)

NOTES:

(1) COORDINATE VERTICAL COLUMN REINFORCEMENT WITH BOTTOM FLEXURAL CAP REINFORCEMENT TO AVOID INTERFERENCE.

(2) FOR LOCATION OF SECTIONS A-A, B-B, C-C & D-D, SEE COLUMN DETAILS SHEET NO. 3.

(3) CONTRACTOR MAY SUBSTITUTE SPLICED TIES AT NO ADDITIONAL COST TO THE DEPARTMENT.

(4) ALL HOOKS ON TIES MUST ENGAGE VERTICAL COLUMN REINFORCING STEEL. ALTERNATE 90° & 135° HOOKS ON CROSS TIES BOTH VERTICALLY AND HORIZONTALLY.

(5) WHERE NON-CONTINUOUS TIES ARE USED, THEY SHALL BE LAP SPLICED WITH A CLASS A SPLICE AND HAVE A 180 DEGREE HOOK WITH AN EXTENSION OF SIX BAR DIAMETERS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

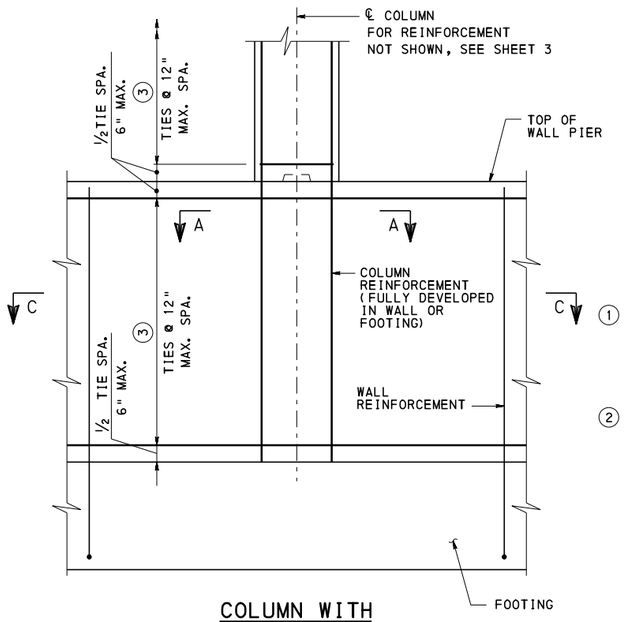
STANDARD REINFORCED CONCRETE PIERS MULTI-COLUMN BENT COLUMN SECTIONS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

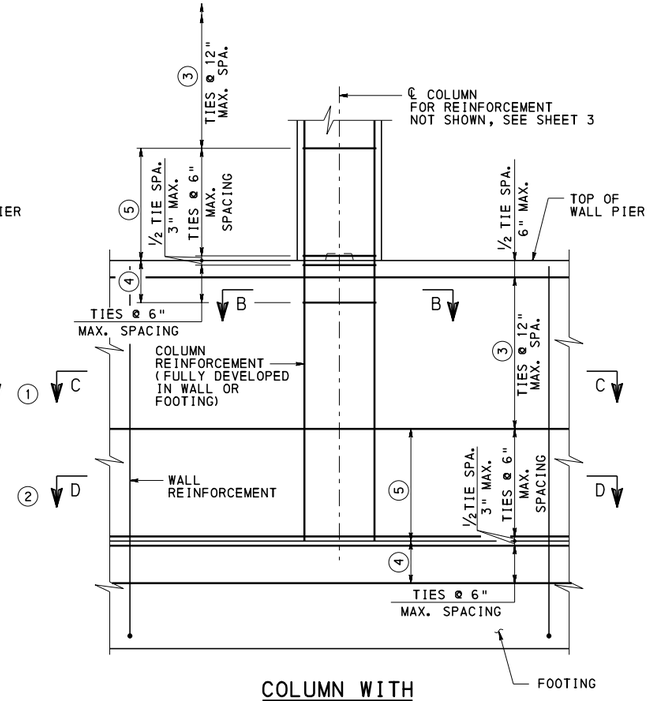
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 4 OF 15

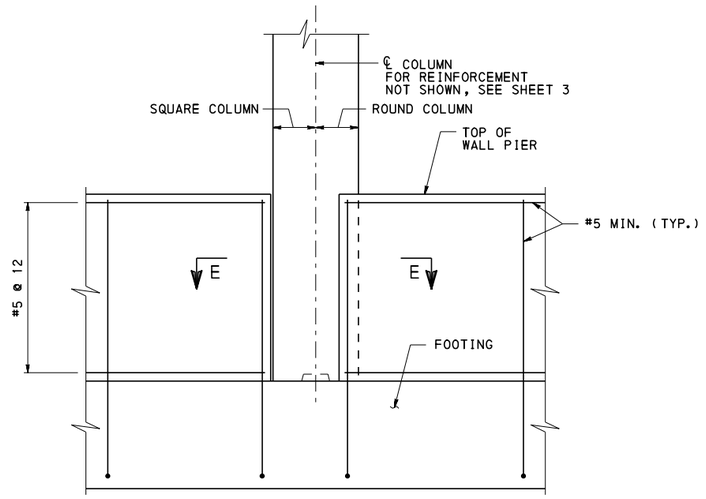
BD-629M



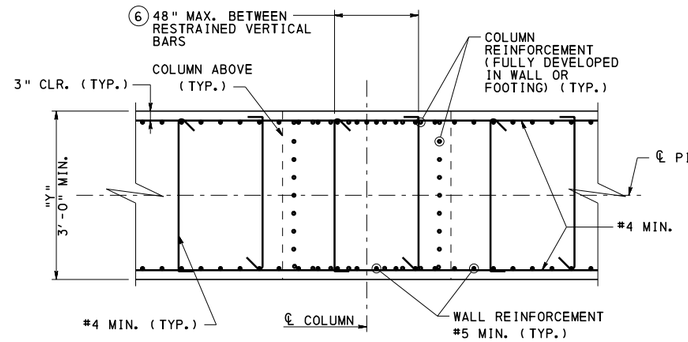
COLUMN WITH INTEGRAL WALL PIER (RESPONSE ACCELERATION COEFFICIENT, S_{D1}, LESS THAN 0.10)



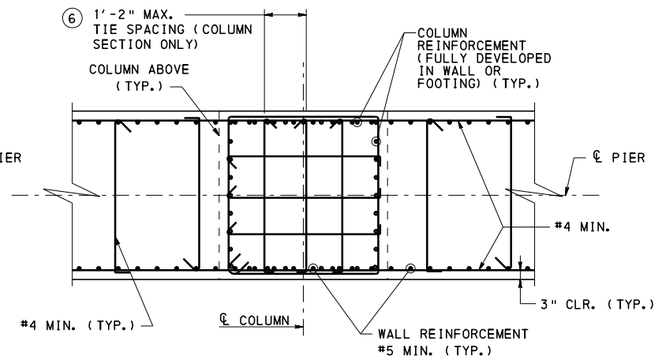
COLUMN WITH INTEGRAL WALL PIER (SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, S_{D1}, GREATER THAN OR EQUAL TO 0.10)



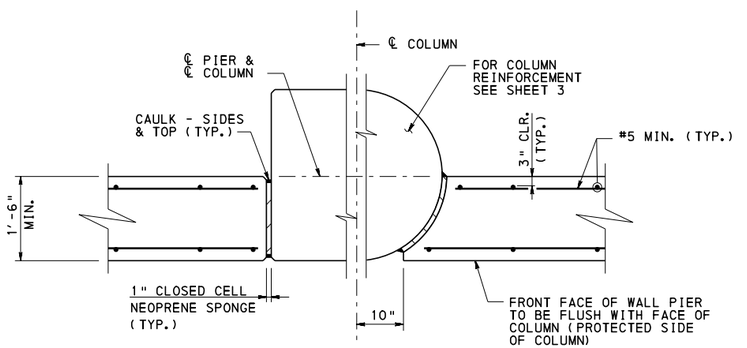
COLUMN WITH INDEPENDANT WALL PIER (SEISMIC DETAILING REQUIRED FOR COLUMN SECTION ONLY)



SECTION A-A



SECTION B-B



SQUARE COLUMN ROUND COLUMN

SECTION E-E

NOTES:

1. SECTION C-C IS SIMILAR TO SECTION A-A ON SOLID SHAFT DETAILS, SHEET 8.
2. SECTION D-D IS SIMILAR TO SECTION C-C ON SOLID SHAFT DETAILS, SHEET 8.
3. FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
4. COLUMN CONNECTION GREATER OF: ½ MAX. COL. DIMENSION (½ MAX. "Y" DIMENSION FOR WALL SECTION) OR 15"
5. PLASTIC HINGE ZONE GREATER OF: MAX. COLUMN DIMENSION (MAX. "Y" DIMENSION FOR WALL SECTION) , 1/6 CLR. HEIGHT OF COLUMN OR 18"
6. ALL HOOKS ON TIES MUST ENGAGE VERTICAL COLUMN REINFORCING STEEL. ALTERNATE 90° & 135° HOOKS ON CROSS TIES BOTH HORIZONTALLY AND VERTICALLY.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

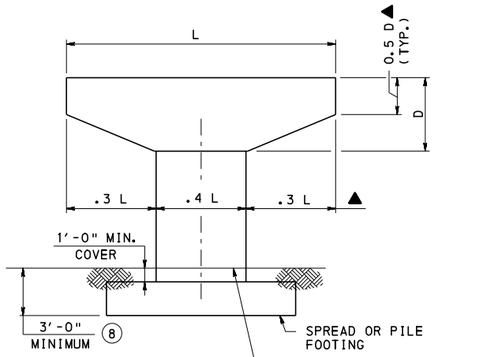
STANDARD REINFORCED CONCRETE PIERS MULTI-COLUMN BENT WALL PIER DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

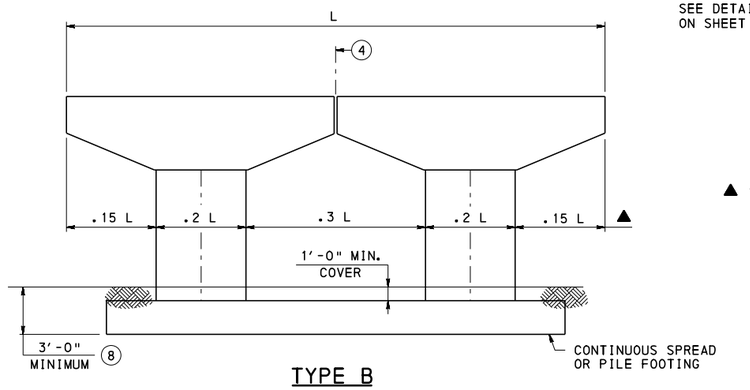
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 5 OF 15

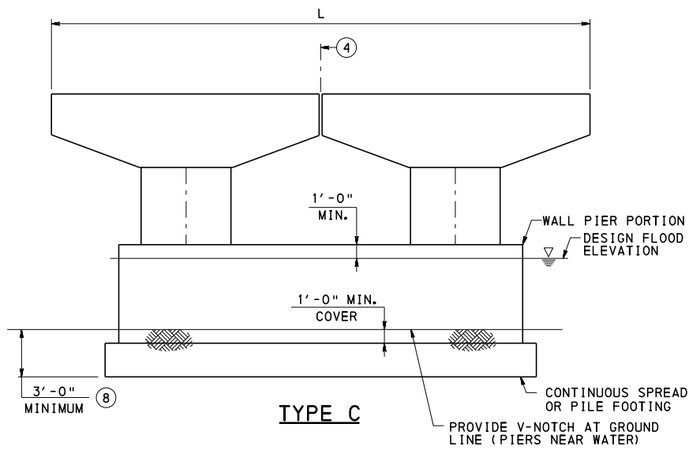
BD-629M



TYPE A



TYPE B



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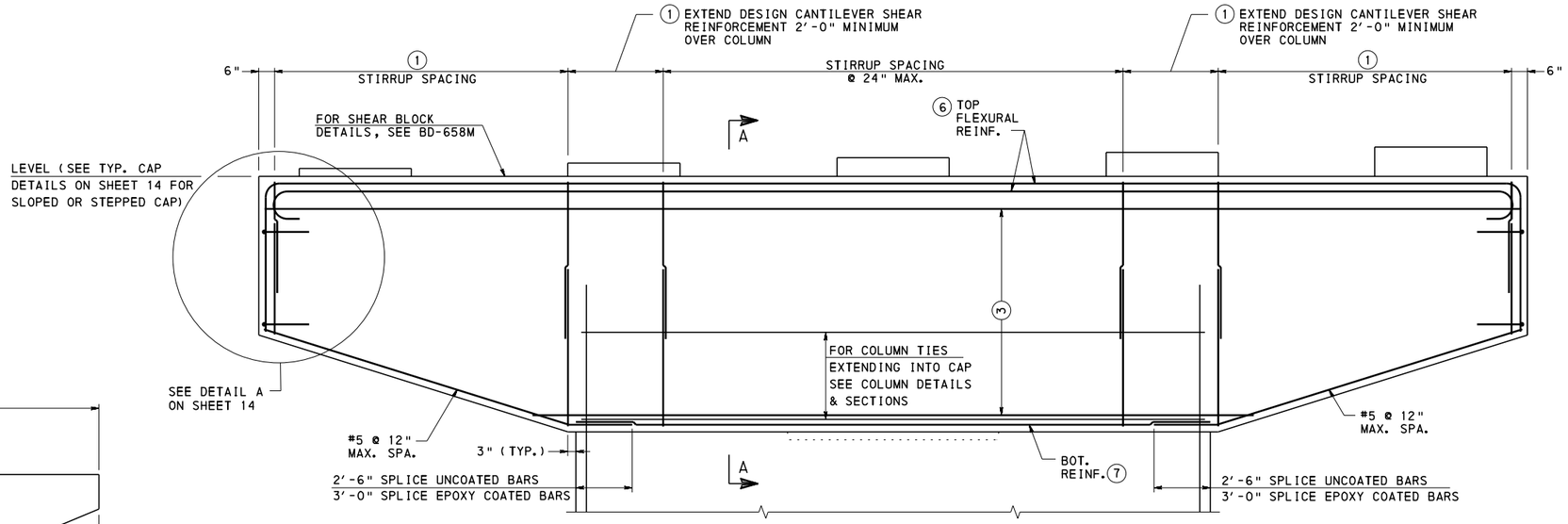
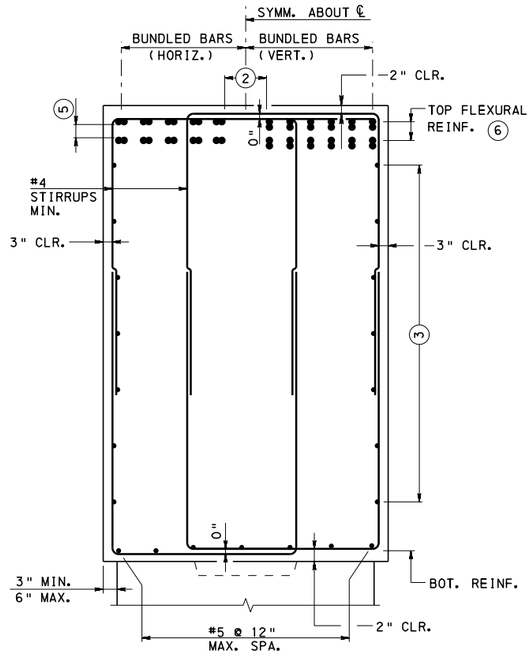


▲ - DENOTES RECOMMENDED VALUE

CAP ELEVATION



SECTION A-A

NOTES:

1. STIRRUPS TO BE SPACED AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT, EXCEPT LOCALIZED REGIONS (HIGH SHEAR STRESS ZONES) WHERE A SMALLER SPACING WILL NOT INTERFERE WITH VIBRATION OR CONCRETE PLACEMENT. MAX. SPACING IS 12".
2. PROVIDE AT LEAST ONE SPACE AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT. FOR CAPS GREATER THAN 5'-0" WIDE PROVIDE TWO 9" CLEAR SPACES. PROVIDE 6" MIN. AT ALL OTHER SPACES. REINFORCEMENT SPACING WILL NEED TO BE ADJUSTED TO CLEAR DOWELS OR ANCHOR BOLTS INCLUDING SLEEVES.
3. PROVIDE #5 @ 12" MIN. OR IF EFFECTIVE DEPTH "de" EXCEEDS 3'-0", PROVIDE LONGITUDINAL SKIN REINFORCEMENT PER AASHTO 5.7.3.4..
4. FLUSH EXP. JT. - FOR DECKS WITH LONGITUDINAL EXPANSION JOINT.
5. MULTI-LAYERS
   - PLACE REINFORCING BARS DIRECTLY BELOW REINFORCING BARS IN UPPER LAYER(S)
   - CLEAR SPACING MUST BE 1½" MINIMUM
6. EXTEND ALL TOP FLEXURAL REINFORCEMENT THE ENTIRE LENGTH OF CAP.
7. COORDINATE BOTTOM CAP REINFORCEMENT WITH VERTICAL COLUMN REINFORCEMENT TO AVOID INTERFERENCE.
8. BOTTOM OF FOOTING ELEVATION DETERMINED BY SOIL CONDITIONS, FROST, SCOUR, PAVEMENT DEPTH, ROADWAY DRAINAGE OR ANY OTHER REQUIREMENTS AS DETERMINED BY THE ENGINEER.

RECOMMENDED HAMMERHEAD PIER CONFIGURATIONS

PIER TYPE	GRADE SEPARATION	RIVER	RAILROAD WITHIN 25 FT. OF CL TRACK
A	X	X	X
B	X		
C	X	X	X

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

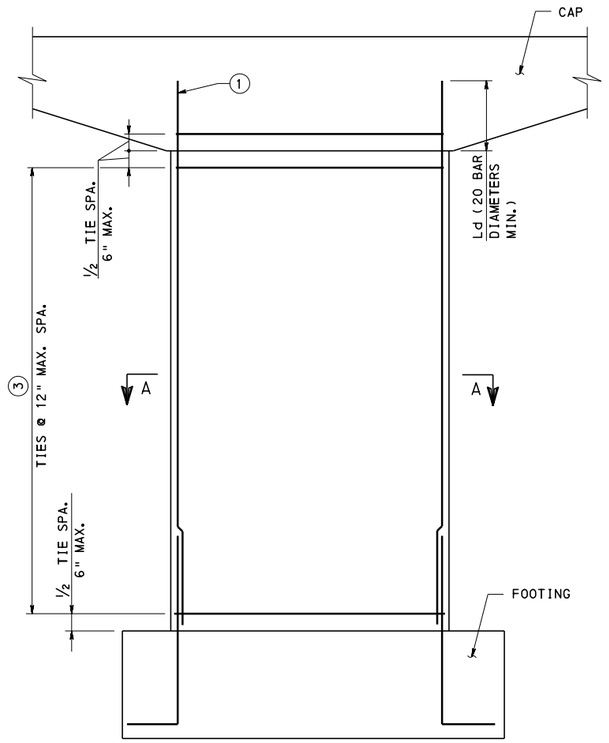
STANDARD REINFORCED CONCRETE PIERS HAMMERHEAD DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

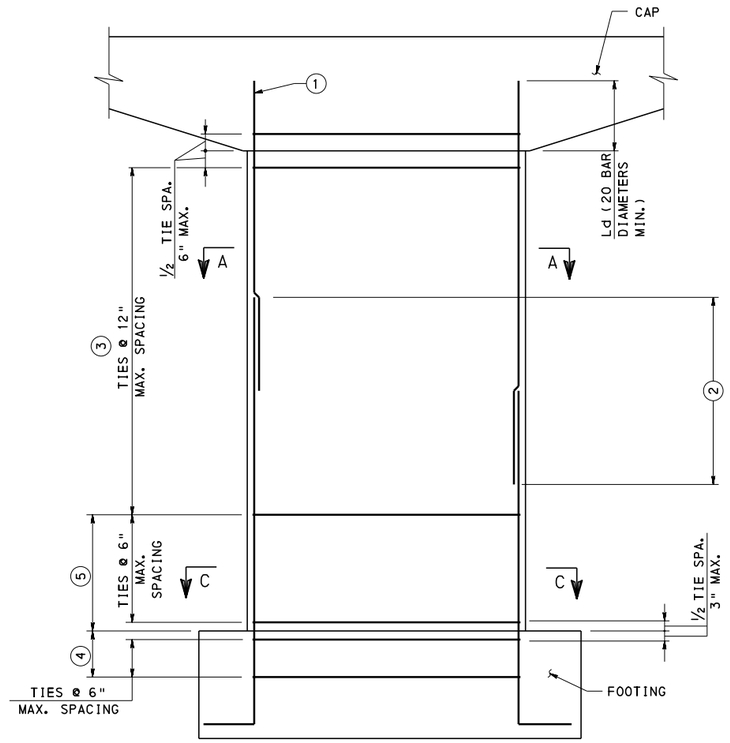
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 15

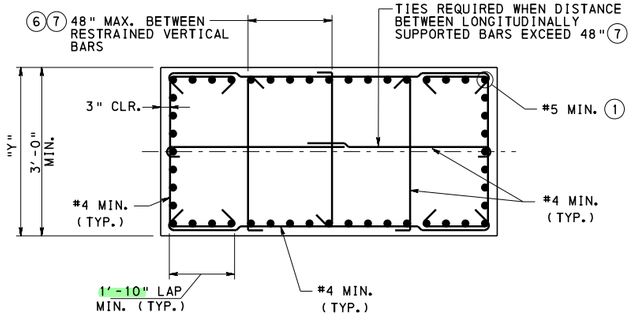
BD-629M



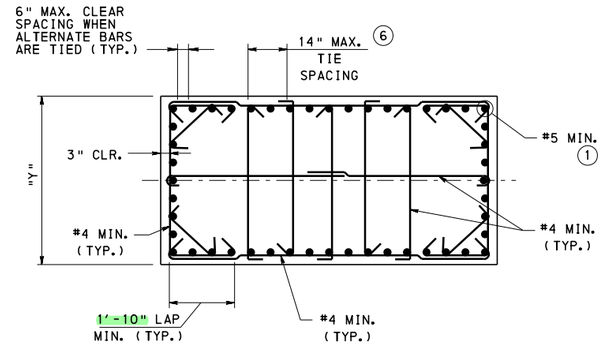
ELEVATION



ELEVATION

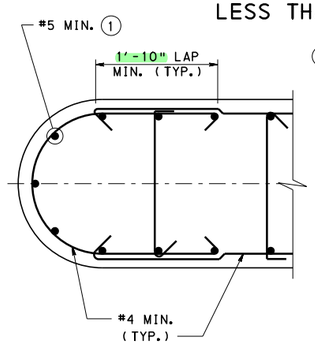


SECTION A-A

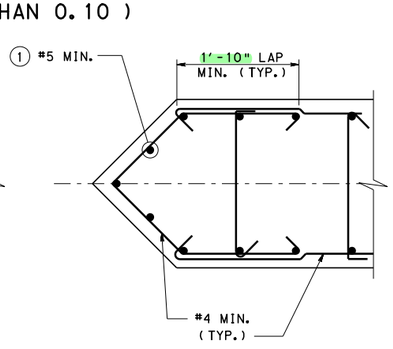


SECTION C-C
(PLASTIC HINGE ZONE)

ELEVATION
(RESPONSE ACCELERATION COEFFICIENT, S_{D1}, LESS THAN 0.10)



ROADWAY, STREAMS OR RIVERS



STREAMS OR RIVERS

OPTIONAL END TREATMENTS

ELEVATION
(SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, S_{D1}, GREATER THAN OR EQUAL TO 0.10)

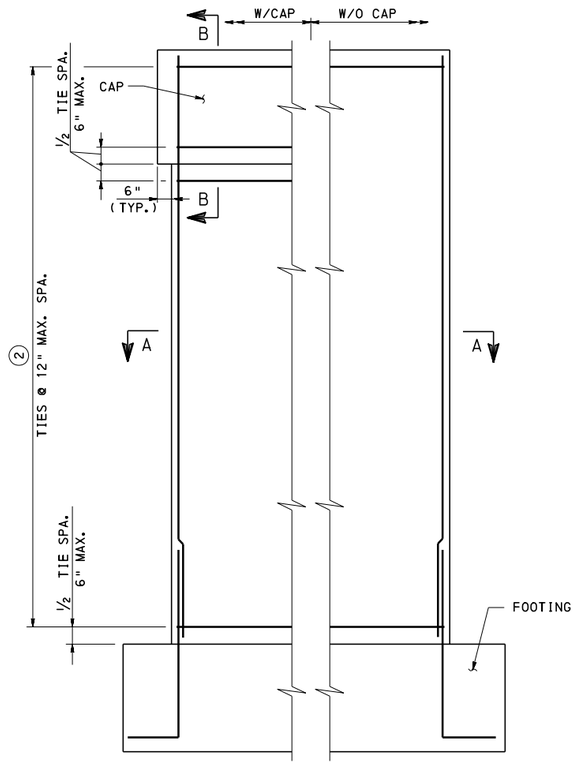
NOTES:

1. COORDINATE VERTICAL COLUMN REINFORCEMENT WITH BOTTOM CAP REINFORCEMENT TO AVOID INTERFERENCE.
2. FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
3. FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
4. COLUMN CONNECTION GREATER OF: ½ MAX. "Y" DIMENSION OR 15"
5. PLASTIC HINGE ZONE GREATER OF: MAX. "Y" DIMENSION, 1/6 CLR. HEIGHT OF COLUMN OR 18"
6. ALL HOOKS ON TIES MUST ENGAGE VERTICAL COLUMN REINFORCING STEEL. ALTERNATE 90° & 135° HOOKS ON CROSS TIES BOTH VERTICALLY AND HORIZONTALLY.
7. WHERE NON-CONTINUOUS TIES ARE USED, THEY SHALL BE LAP SPLICED WITH A CLASS A SPLICE AND HAVE A 180 DEGREE HOOK WITH AN EXTENSION OF SIX BAR DIAMETERS.

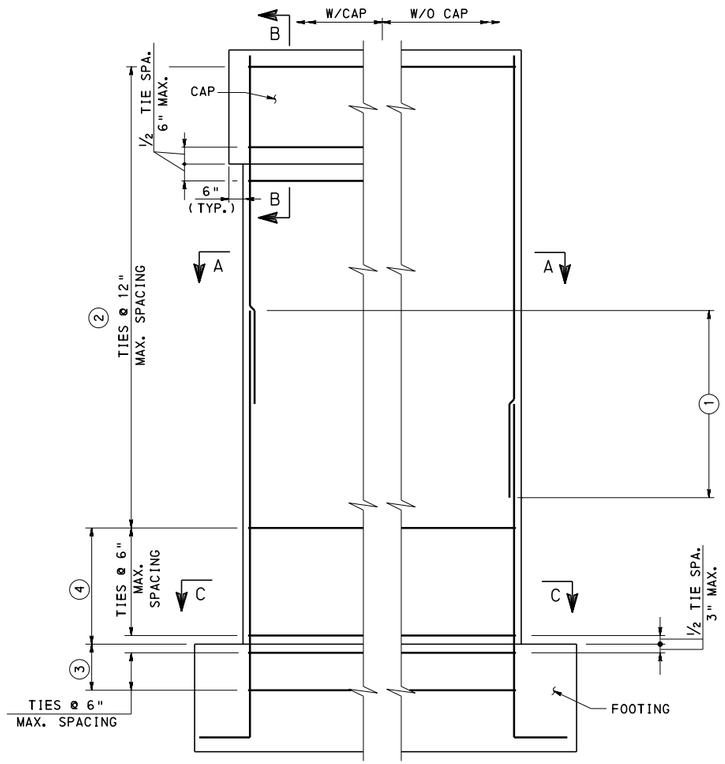
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD REINFORCED CONCRETE PIERS HAMMERHEAD COLUMN DETAILS AND SECTIONS

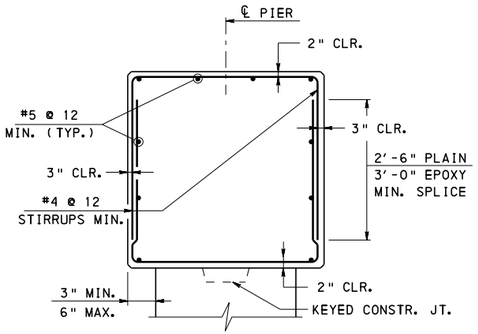
RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 Gavin E. Gray CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 7 OF 15 BD-629M



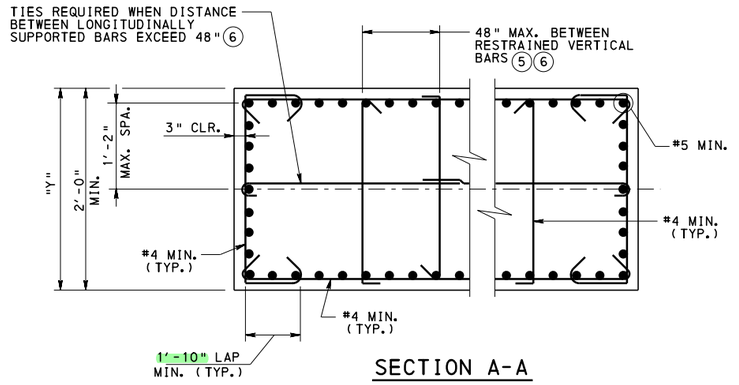
ELEVATION
(RESPONSE ACCELERATION COEFFICIENT, S_{D1}, LESS THAN 0.10)



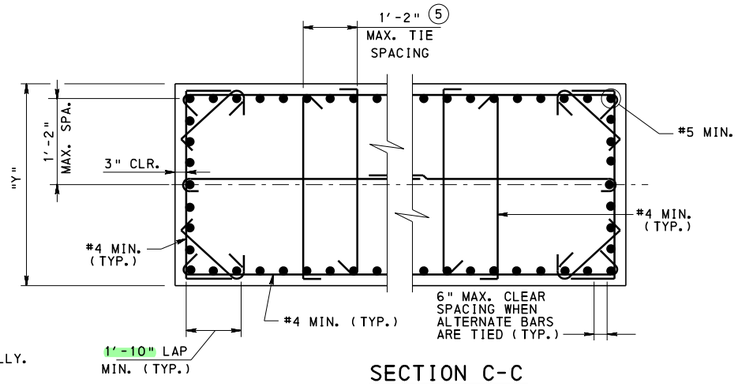
ELEVATION
(SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, S_{D1}, GREATER THAN OR EQUAL TO 0.10)



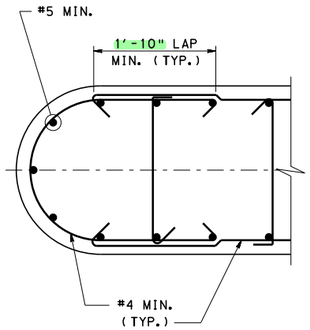
SECTION B-B



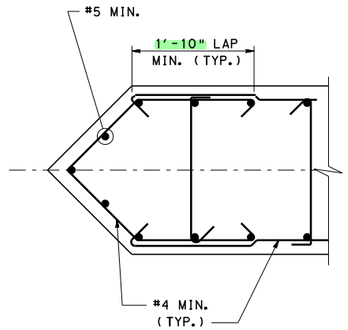
SECTION A-A



SECTION C-C
(PLASTIC HINGE ZONE)



ROADWAY, STREAMS OR RIVERS



STREAMS OR RIVERS

NOTES:

1. FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
2. FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
3. COLUMN CONNECTION GREATER OF: ½ MAX. "Y" DIMENSION OR 15"
4. PLASTIC HINGE ZONE GREATER OF: MAX. "Y" DIMENSION, 1/6 CLR. HEIGHT OF COLUMN OR 18"
5. ALL HOOKS ON TIES MUST ENGAGE VERTICAL COLUMN REINFORCING STEEL. ALTERNATE 90° & 135° HOOKS ON CROSS TIES BOTH VERTICALLY AND HORIZONTALLY.
6. WHERE NON-CONTINUOUS TIES ARE USED, THEY SHALL BE LAP SPLICED WITH A CLASS A SPLICE AND HAVE A 180 DEGREE HOOK WITH AN EXTENSION OF SIX BAR DIAMETERS.

OPTIONAL END TREATMENTS

RECOMMENDED SOLID SHAFT CONFIGURATION		
GRADE SEPARATION	RIVER	RAILROAD WITHIN 25 FT. OF CL TRACK
X	X	X

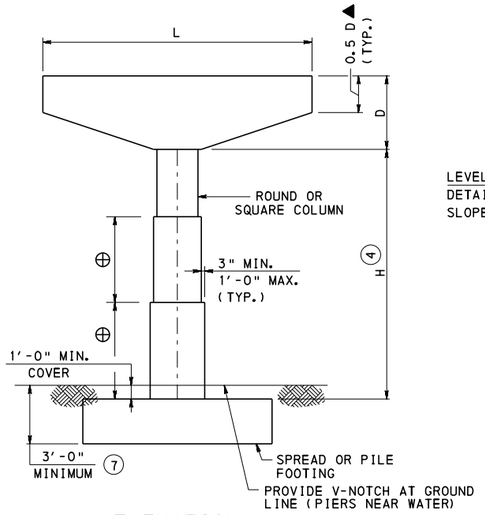
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD REINFORCED CONCRETE PIERS SOLID SHAFT (WALL) DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

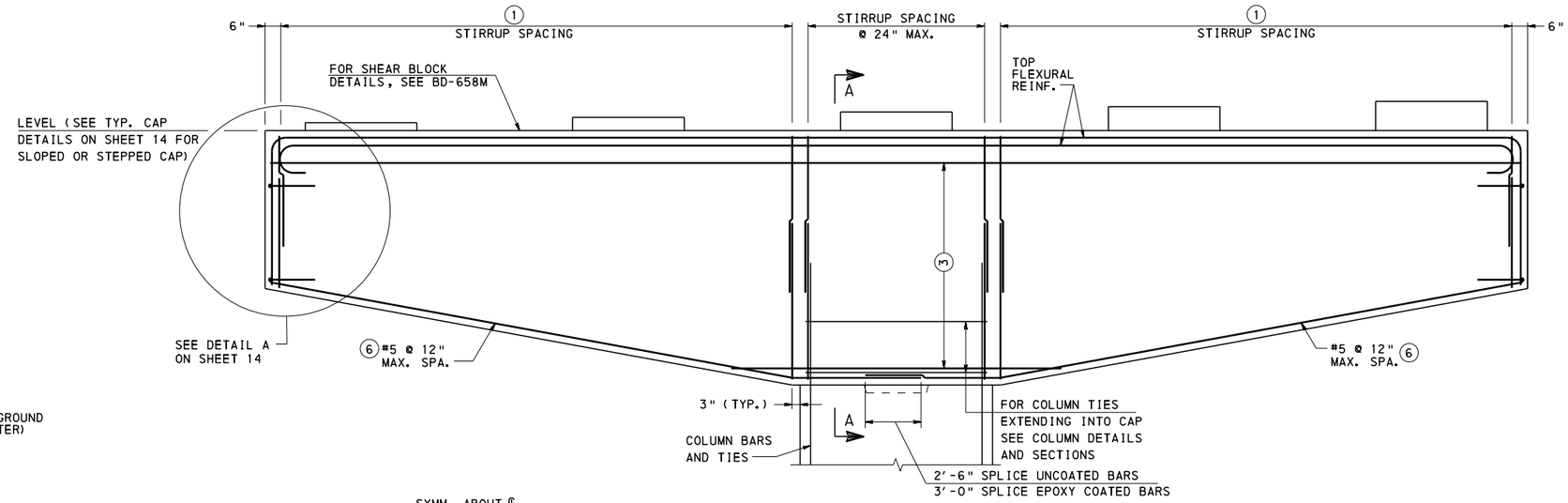
BD-629M



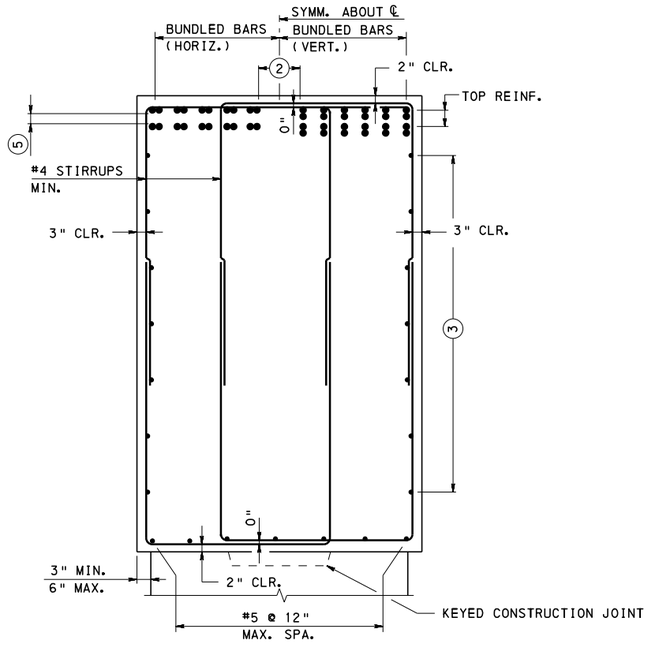
ELEVATION

⊕ CONSIDER USING 1'-0" INCREMENTS.

RECOMMENDED SINGLE COLUMN CONFIGURATION		
GRADE SEPARATION	RIVER	RAILROAD WITHIN 25 FT. OF CL TRACK
X	X	X



CAP ELEVATION



SECTION A-A

▲ - DENOTES RECOMMENDED VALUE

NOTES:

1. STIRRUPS TO BE SPACED AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT, EXCEPT LOCALIZED REGIONS (HIGH SHEAR STRESS ZONES) WHERE A SMALLER SPACING WILL NOT INTERFERE WITH VIBRATION OR CONCRETE PLACEMENT. MAX. SPACING IS 12".
2. PROVIDE AT LEAST ONE SPACE AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT. FOR CAPS GREATER THAN 5'-0" WIDE PROVIDE TWO 9" CLEAR SPACES. PROVIDE 6" MIN. AT ALL OTHER SPACES. REINF. SPACING WILL NEED TO BE ADJUSTED TO CLEAR DOWELS OR ANCHOR BOLTS INCLUDING SLEEVES.
3. PROVIDE #5 @ 12" MIN. OR IF EFFECTIVE DEPTH "de" EXCEEDS 3'-0" PROVIDE LONGITUDINAL SKIN REINFORCEMENT PER AASHTO 5.7.3.4..
- ▲ 4. GUIDELINES FOR COLUMN STEPS:
  - H < 20 FT. : NO STEP
  - H > 20 FT. AND H < 40 FT. : 1 STEP
  - H > 40 FT. : 2 OR MORE STEPS

  STEP CONSIDERATIONS:
  - MATERIAL SAVING VS. CONSTRUCTION COST
  - REDUCE COLUMN STIFFNESS TO MINIMIZE THERMAL AND/OR SEISMIC FORCES
  - LOCATION DETERMINED BY ANALYSIS
5. MULTI-LAYERS
   - PLACE REINFORCING BARS DIRECTLY BELOW REINFORCING BARS IN UPPER LAYER(S)
   - CLEAR SPACING MUST BE 1½" MINIMUM.
6. COORDINATE BOTTOM FLEXURAL CAP REINFORCEMENT WITH VERTICAL COLUMN REINFORCEMENT TO AVOID INTERFERENCE.
7. BOTTOM OF FOOTING ELEVATION DETERMINED BY SOIL CONDITIONS, FROST, SCOUR, ROADWAY PAVEMENT DEPTH, ROADWAY DRAINAGE OR ANY OTHER REQUIREMENTS AS DETERMINED BY THE ENGINEER.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

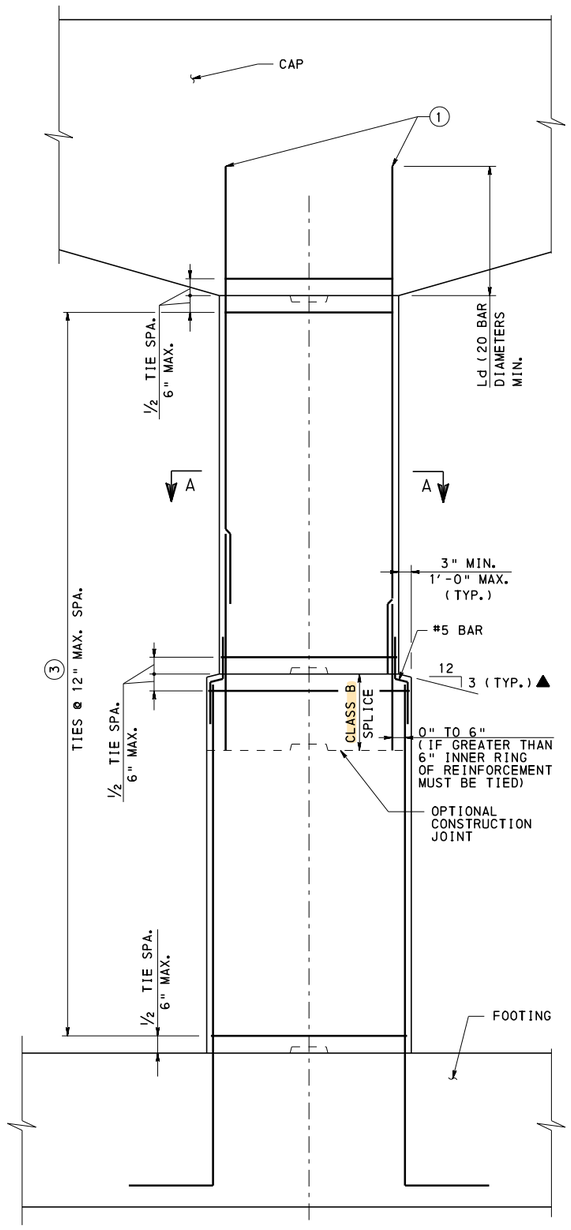
STANDARD REINFORCED CONCRETE PIERS SINGLE COLUMN DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

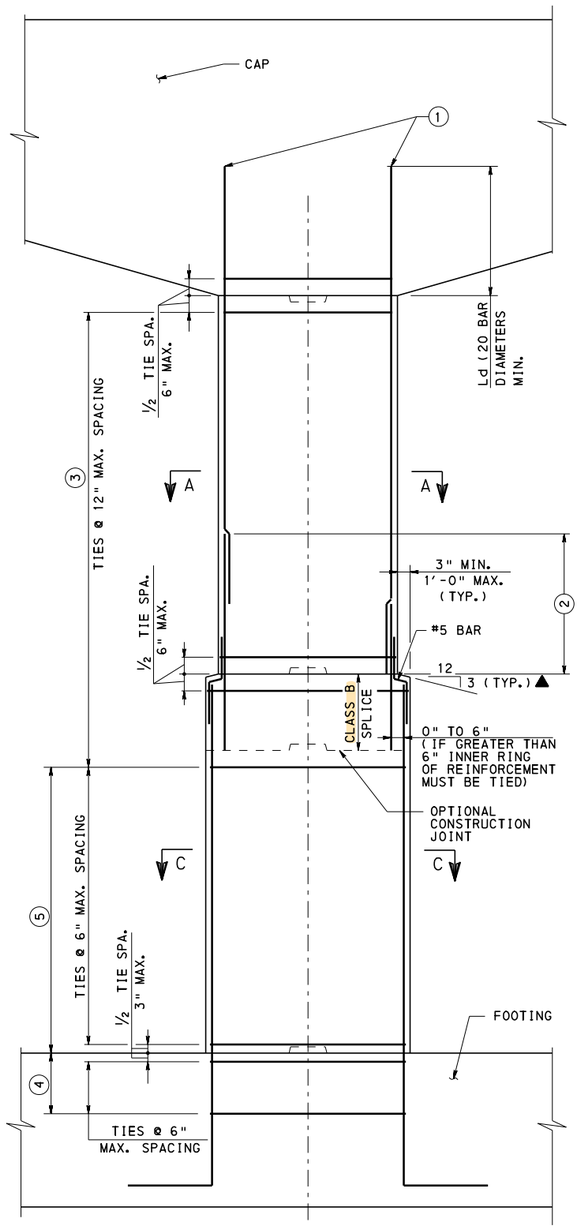
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 9 OF 15

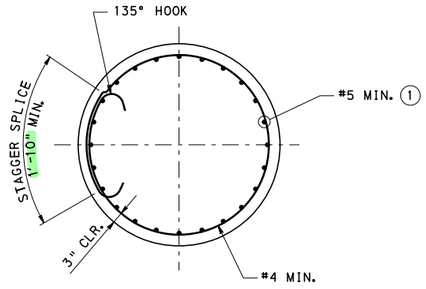
BD-629M



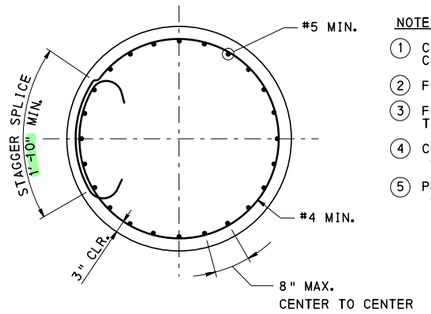
COLUMN
(RESPONSE ACCELERATION COEFFICIENT, S_{D1}, LESS THAN 0.10)



COLUMN
(SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, S_{D1}, GREATER THAN OR EQUAL TO 0.10)



SECTION A-A



SECTION C-C
(PLASTIC HINGE ZONE)

▲ - DENOTES RECOMMENDED VALUE

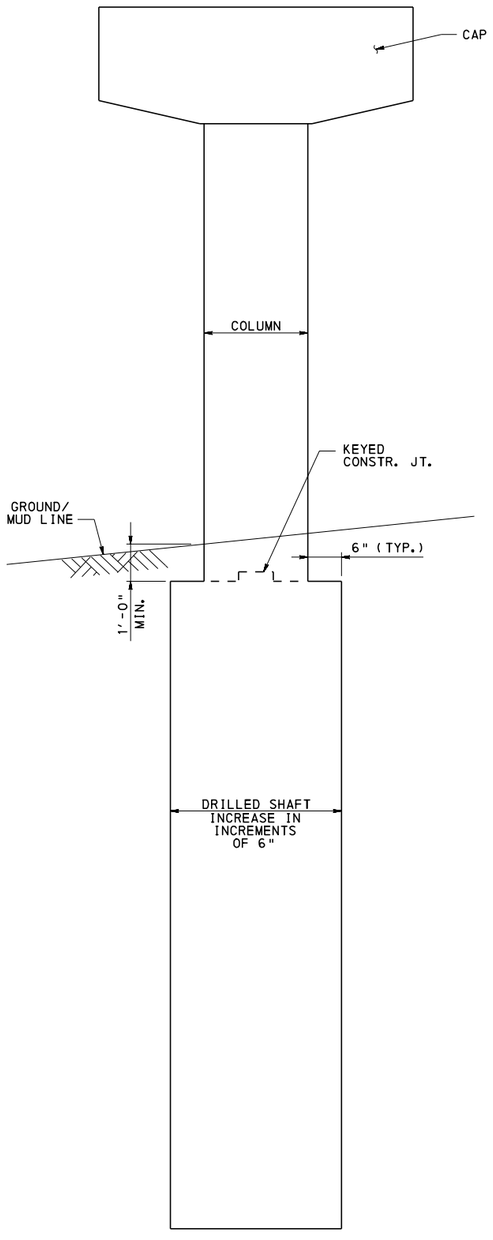
NOTES:

1. COORDINATE VERTICAL COLUMN REINFORCEMENT WITH BOTTOM CAP REINFORCEMENT TO AVOID INTERFERENCE.
2. FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
3. FOR BUNDLED #10 REINFORCING BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
4. COLUMN CONNECTION GREATER OF: ½ MAX. COL. DIMENSION OR 15"
5. PLASTIC HINGE ZONE GREATER OF: MAX. COL. DIMENSION, 1/6 CLR. HEIGHT OF COLUMN OR 18"

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

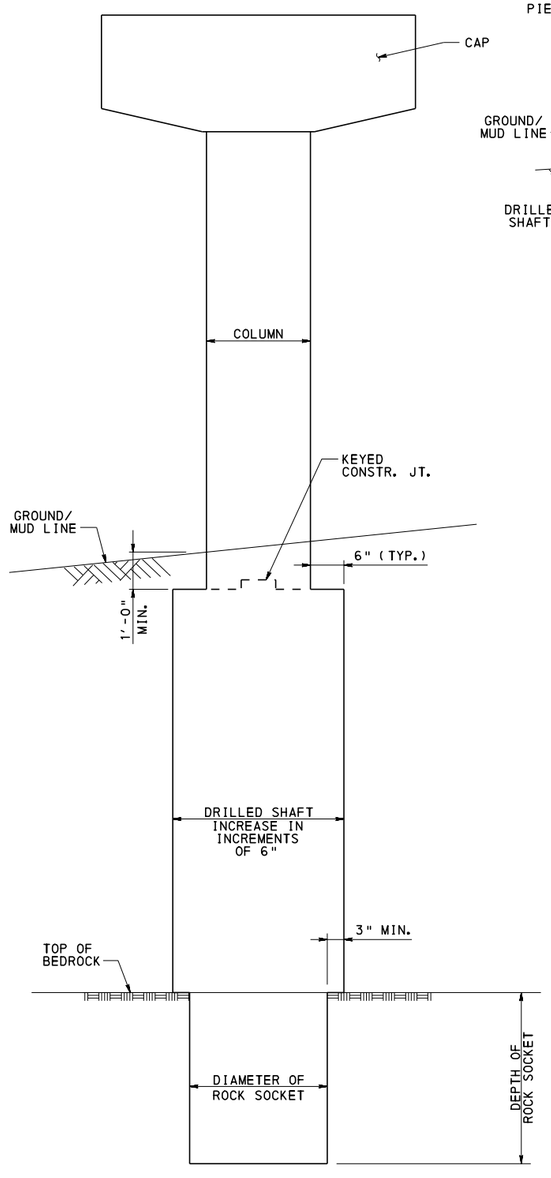
STANDARD REINFORCED CONCRETE PIERS SINGLE COLUMN COLUMN DETAILS AND SECTIONS

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 10 OF 15
		BD-629M

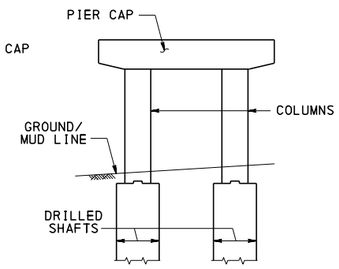


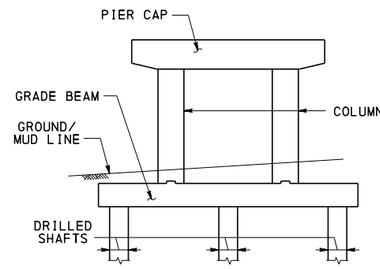
DRILLED SHAFT

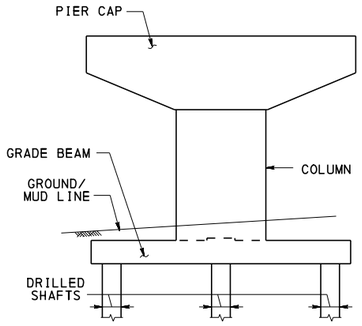
(1)



DRILLED SHAFT
(WITH ROCK SOCKET)

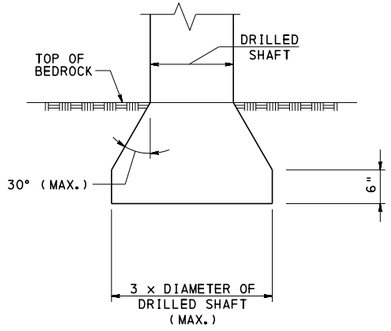






MULTI-DRILLED SHAFT CONFIGURATIONS

(DETAILS NOT SHOWN)



BELLED TIP

(2)

NOTES:

(1) DRILLED SHAFTS NOT FORMED OR SOCKETED INTO ROCK ARE GENERALLY NOT PERMITTED BY THE DEPT., AND IF USED, MUST BE APPROVED BY THE ACTING CHIEF BRIDGE ENGINEER.

(2) USE OF BELLED TIP REQUIRES THE PRIOR APPROVAL OF THE CHIEF BRIDGE ENGINEER.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

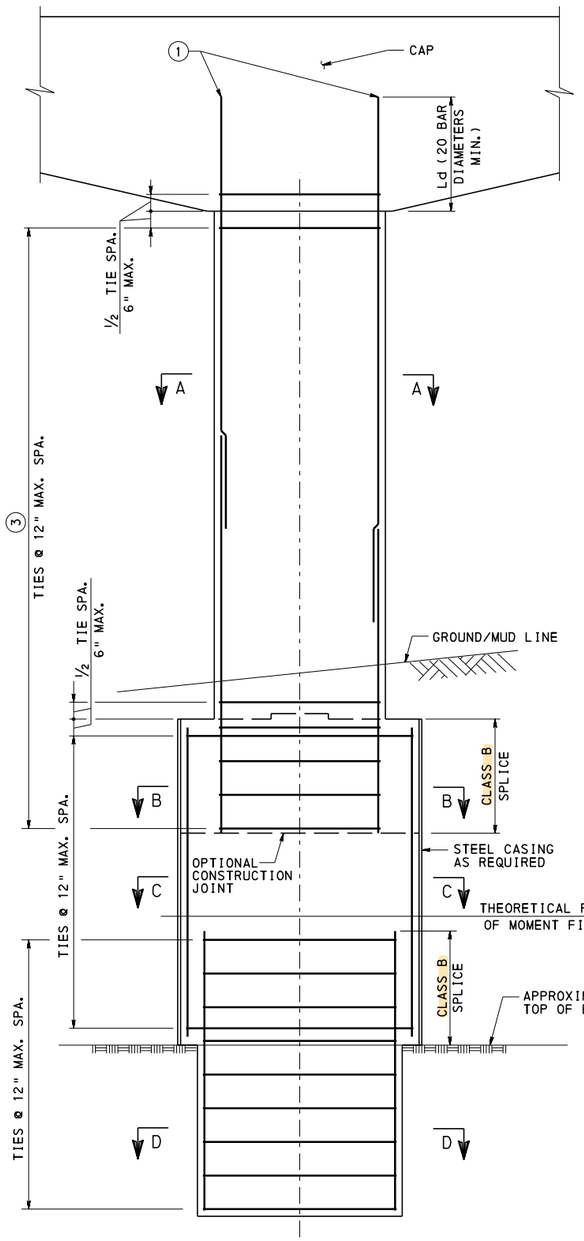
STANDARD REINFORCED CONCRETE PIERS SINGLE DRILLED SHAFT DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

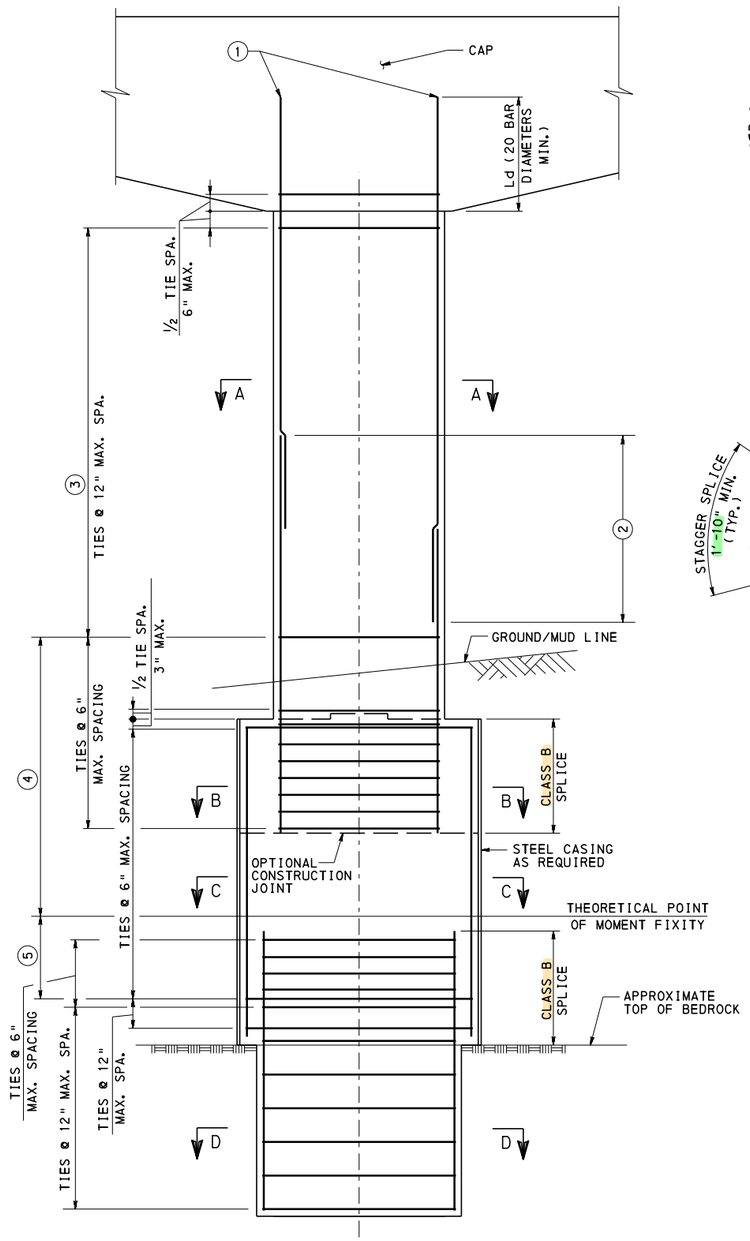
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 11 OF 15

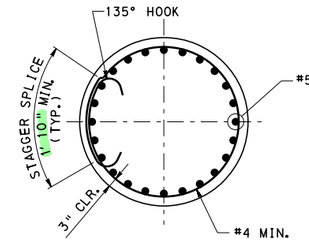
BD-629M



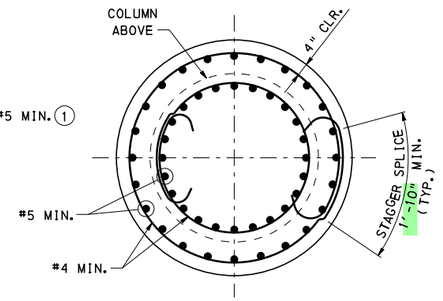
DRILLED SHAFT
(RESPONSE ACCELERATION COEFFICIENT, S_{D1}, LESS THAN 0.10)



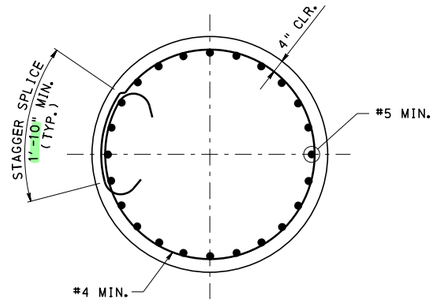
DRILLED SHAFT
(SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, S_{D1}, GREATER THAN OR EQUAL TO 0.10)



SECTION A-A



SECTION B-B



SECTION C-C
(SECTION D-D SIMILAR)

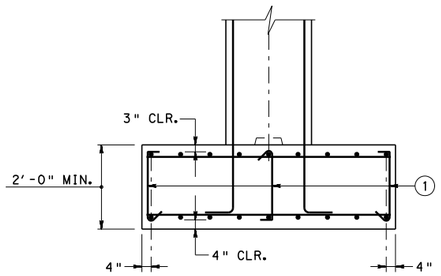
NOTES:

1. COORDINATE VERTICAL COLUMN REINFORCEMENT WITH BOTTOM CAP REINFORCEMENT.
2. FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
3. FOR BUNDLED #10 REINFORCING BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
4. PLASTIC HINGE ZONE
   GROUND/MUD LINE ELEVATION - THEORETICAL POINT OF MOMENT FIXITY ELEVATION + THE GREATER OF MAXIMUM COLUMN DIMENSION OR 1'-6".
5. PLASTIC HINGE ZONE
   3 X MAXIMUM COLUMN DIMENSION

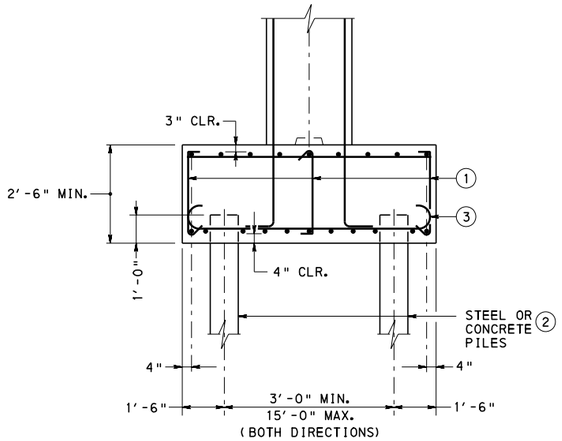
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD REINFORCED CONCRETE PIERS SINGLE DRILLED SHAFT SHAFT/COLUMN DETAILS AND SECTIONS

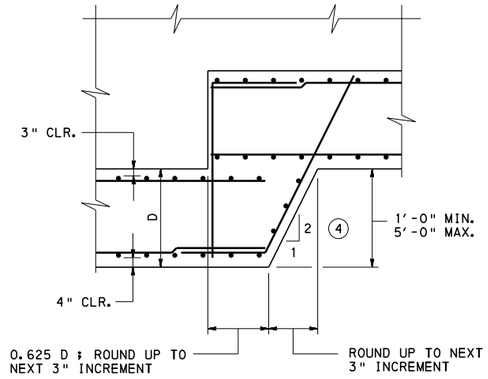
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 12 OF 15
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-629M



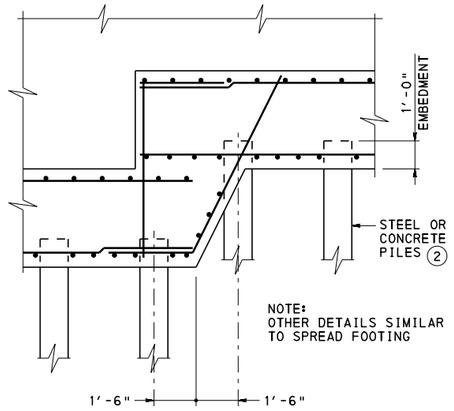
SINGLE COLUMN
SPREAD FOOTING



SINGLE COLUMN
PILE FOOTING

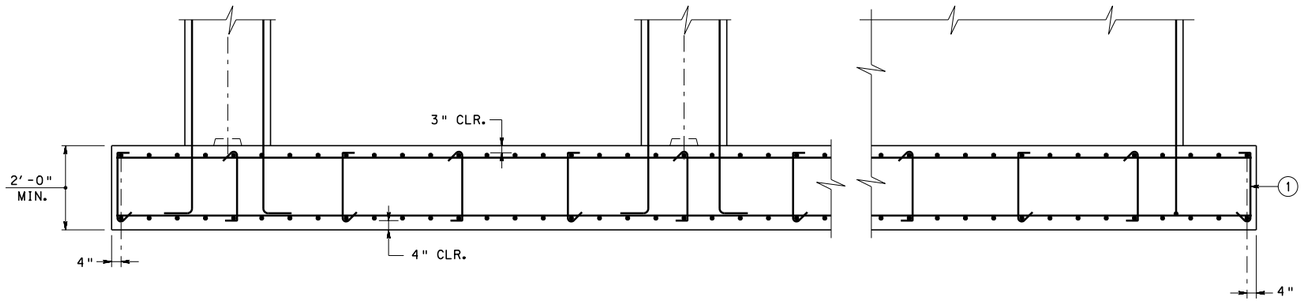


SPREAD FOOTING



PILE FOOTING

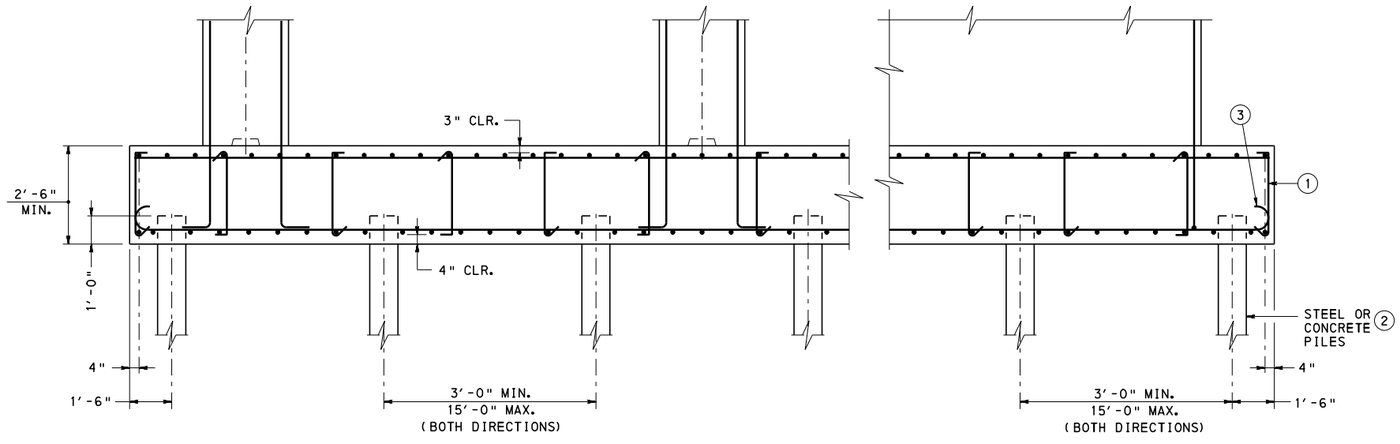
STEP DETAILS



MULTI-COLUMN BENT

HAMMERHEAD & WALL

CONTINUOUS SPREAD FOOTING



MULTI-COLUMN BENT

HAMMERHEAD & WALL

CONTINUOUS PILE FOOTING

NOTES:

1. TIE TOP AND BOTTOM MATS OF REINFORCING STEEL WITH #4 TIE BARS AT A MAXIMUM SPACING OF 4'-0" IN BOTH DIRECTIONS. PROVIDE TIE BARS WITH 90° HOOK AT ONE END AND 135° HOOK AT THE OTHER END. ALTERNATE 90° AND 135° HOOK AT TOP IN ALTERNATING TIES.
2. FOR PILE ANCHORAGE DETAILS, SEE BD-621M.
3. FOR REINFORCEMENT HOOK REQUIREMENTS ON PILE SUPPORTED FOOTINGS, SEE DM-4, SECTION 5.11.1.2.1.
4. SLOPE OF FOOTING STEP SHOWN IS FOR FOOTINGS ON ROCK OR PILES. USE 1:1 SLOPE FOR FOOTINGS ON SOIL.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

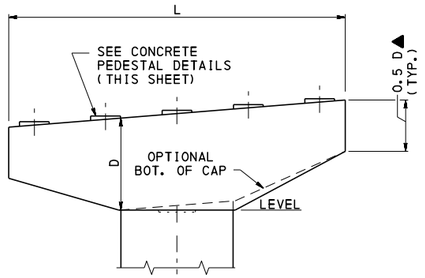
STANDARD REINFORCED CONCRETE PIERS TYPICAL FOOTING DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 13 OF 15

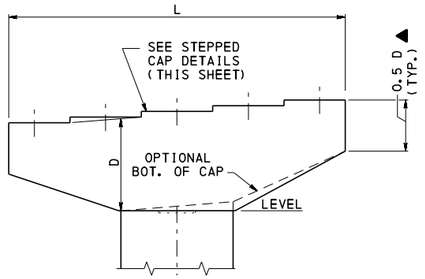
BD-629M



ELEVATION

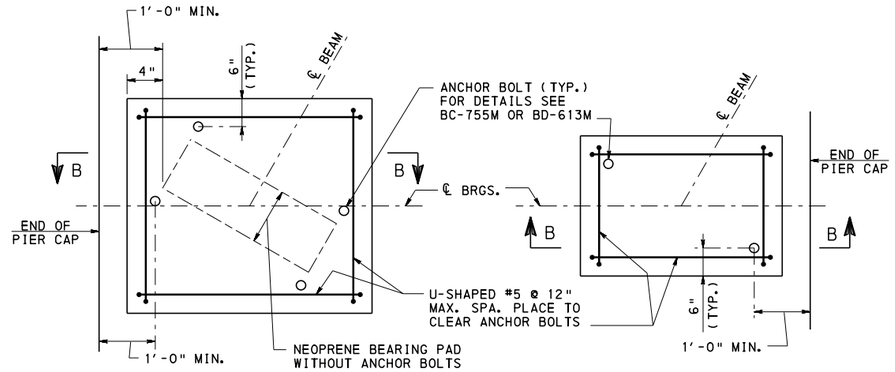
SLOPED CAP WITH PEDESTALS

▲ - DENOTES RECOMMENDED VALUE



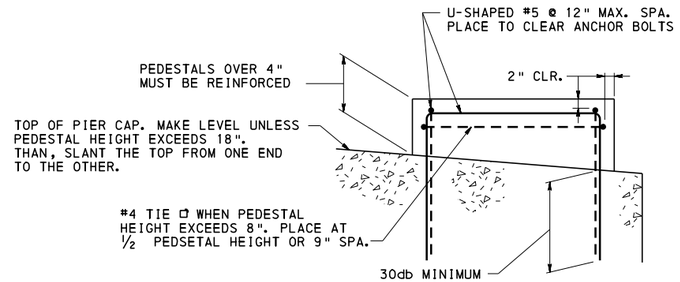
ELEVATION

STEPPED CAP



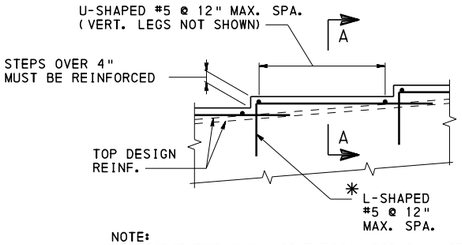
PLAN - 4 ANCHOR BOLTS OR NEOPRENE PAD

PLAN - 2 ANCHOR BOLTS



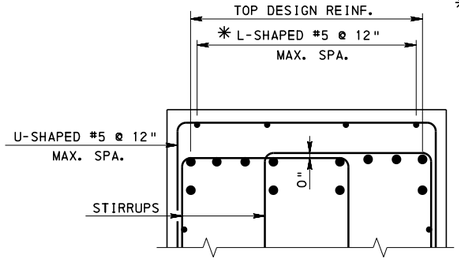
SECTION B-B

CONCRETE PEDESTAL DETAILS



NOTE:
REINFORCEMENT SHOWN IS TYPICAL FOR EACH STEP. SPACE TO CLEAR DOWELS OR ANCHOR BOLTS.

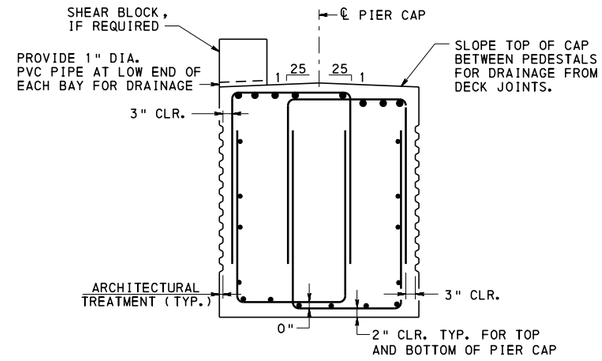
ELEVATION



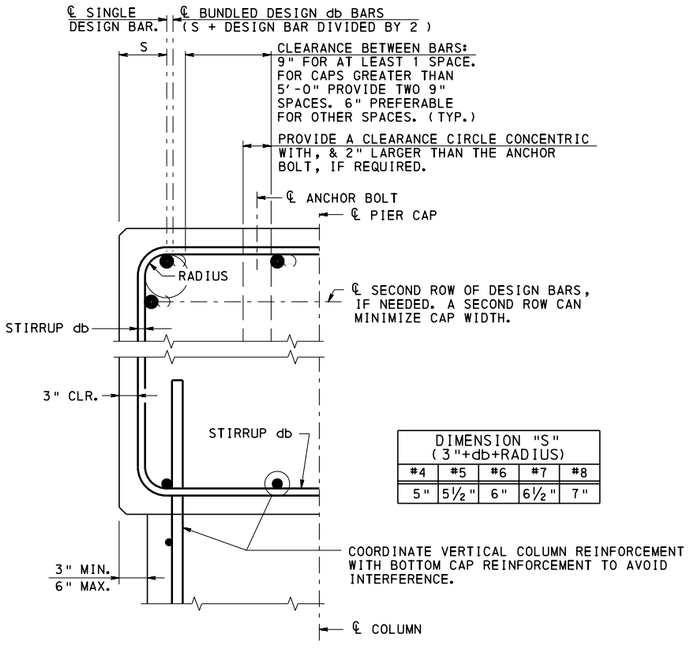
✳ REINFORCING BARS MAY BE CONSIDERED FOR SERVICEABILITY REQUIREMENTS.

SECTION A-A

STEPPED CAP DETAILS

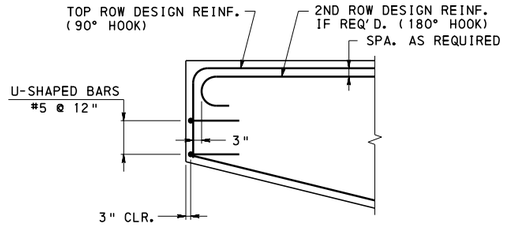


ARCHITECTURAL TREATMENT AND TOP OF CAP AT DECK JOINT

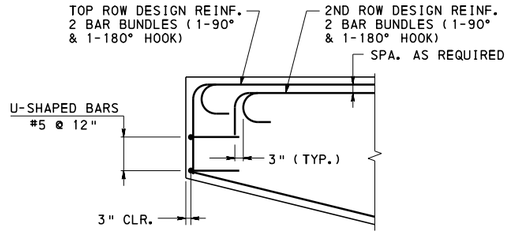


DIMENSION "S" (3"+db+RADIUS)				
#4	#5	#6	#7	#8
5"	5½"	6"	6½"	7"

PIER CAP SECTION



ELEVATION - SINGLE AND HORIZONTALLY BUNDLED BARS



ELEVATION - VERTICALLY BUNDLED BARS

DETAIL A

NOTE: STIRRUPS AND SIDE REINF. NOT SHOWN.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

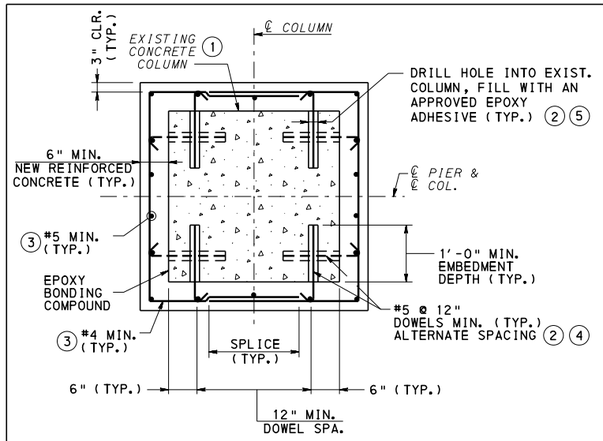
STANDARD REINFORCED CONCRETE PIERS TYPICAL CAP DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

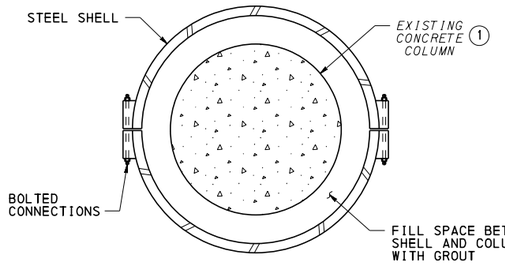
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 14 OF 15

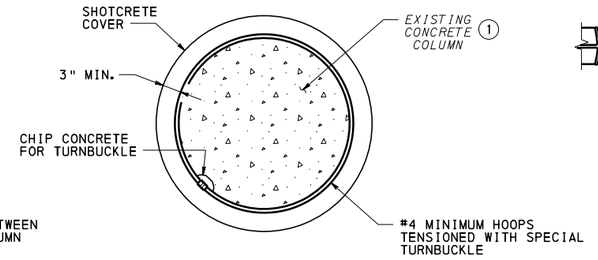
BD-629M



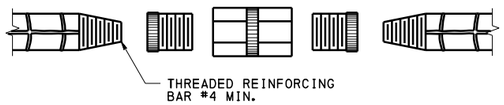
CROSS SECTION



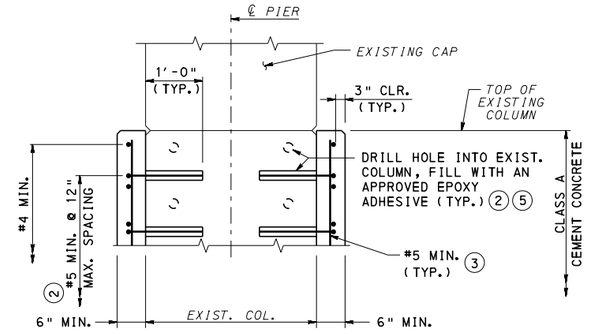
CROSS SECTION



CROSS SECTION

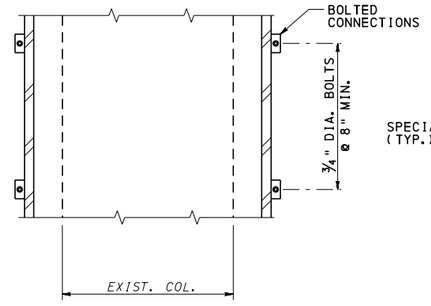


TURNBUCKLE DETAIL



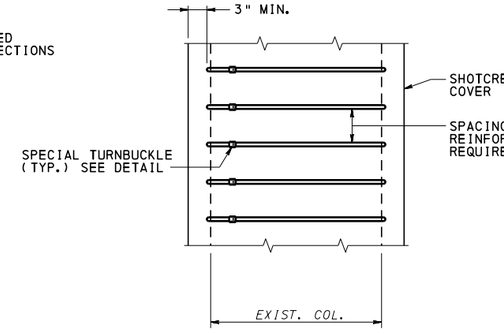
ELEVATION

TYPE 1



ELEVATION

TYPE 2



ELEVATION

TYPE 3

COLUMN REHABILITATION DETAILS

REHABILITATION NOTES:

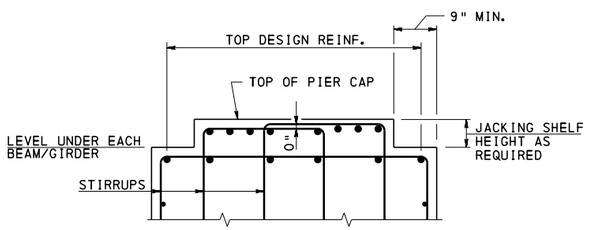
(1) WHERE NEW CONCRETE CONTACTS EXISTING CONCRETE, SANDBLAST AND THOROUGHLY CLEAN EXISTING CONCRETE SURFACE TO PARTIALLY EXPOSE AGGREGATE ¼" MIN. AND APPLY EPOXY BONDING COMPOUND.

(2) THE CONTRACTOR IS RESPONSIBLE FOR LOCATING THE EXISTING BARS PRIOR TO DRILLING DOWEL HOLES. ADJUST SPACING AS REQUIRED.

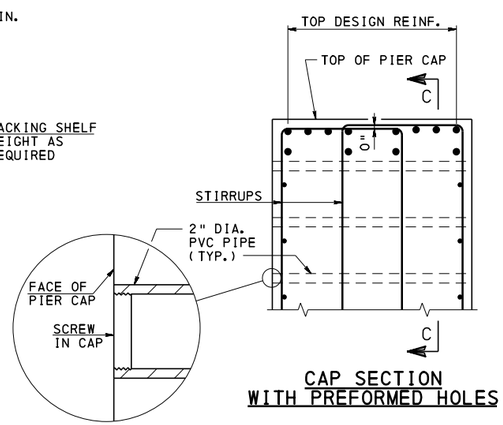
(3) CONTRACTOR IS RESPONSIBLE FOR FINAL REINFORCEMENT BAR LENGTHS.

(4) DOWEL BAR TO ENGAGE NEW VERTICAL COLUMN REINFORCEMENT.

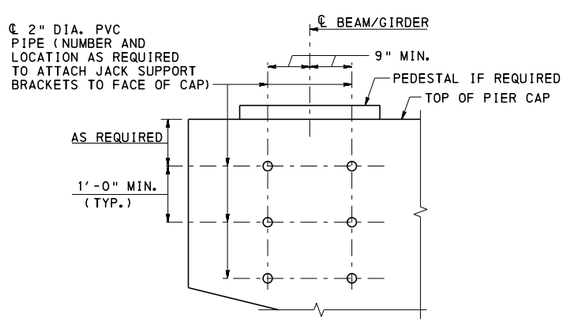
(5) DRILL HOLES OF PROPER DIAMETER AND DEPTH IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.



CAP SECTION
WITH JACKING SHELF



CAP SECTION
WITH PREFORMED HOLES



SECTION C-C

FUTURE SUPERSTRUCTURE JACKING DETAILS

JACKING NOTES:

(1) JACKING LOAD TO CONSIST OF SUPERSTRUCTURE DEAD LOAD ONLY

(2) SPACE 2" PVC PIPE TO CLEAR ANCHOR BOLTS AND PIER CAP REINFORCEMENT.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD REINFORCED CONCRETE PIERS REHABILITATION AND JACKING DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

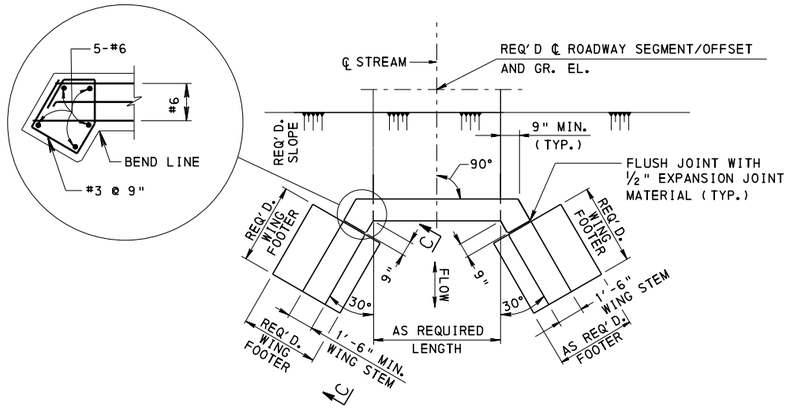
SHEET 15 OF 15

BD-629M

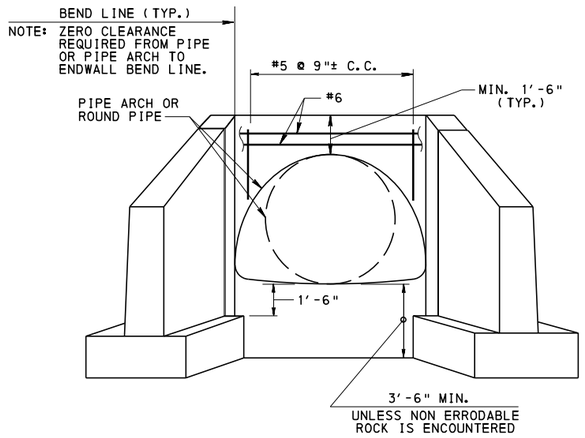
CHANGE 1

CHANGE 2

CHANGE 6

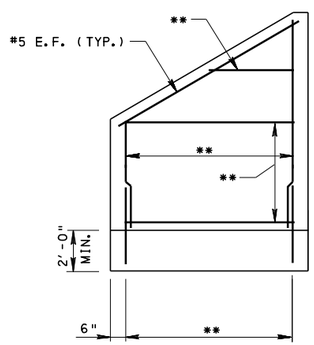


ENDWALL PLAN



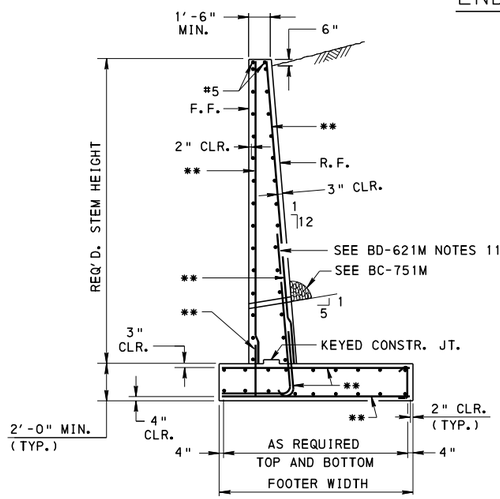
ENDWALL ELEVATION

NOTE: FOR OPTIONAL APRON DETAIL SEE BD-632M SHEET 1.



SECTION C-C

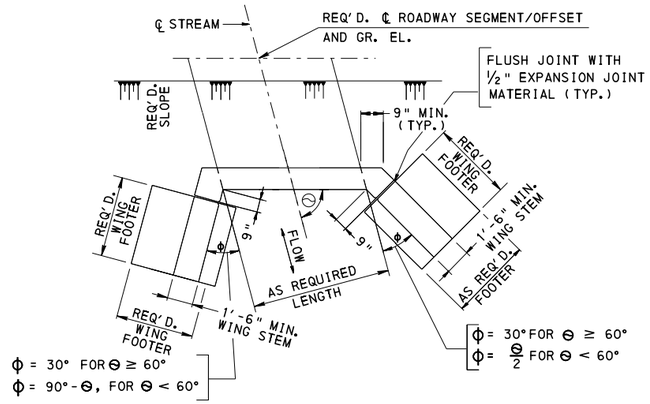
** SEE NOTE 12



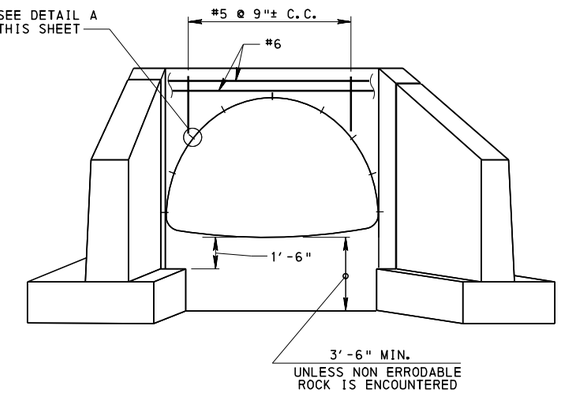
TYPICAL WING SECTION

** SEE NOTE 12

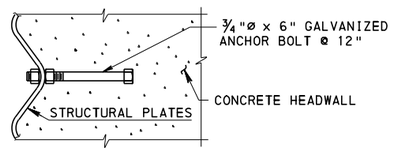
BATTER NOT REQUIRED IF STEM HEIGHT IS LESS THAN 12'-0"



ENDWALL PLAN-SKEWED CULVERT AND PLATE PIPE ARCH



ENDWALL ELEVATION-SKEWED CULVERT AND PLATE PIPE ARCH



DETAIL A

METAL STRUCTURAL PLATE ANCHORAGE

NOTES:

1. ALL REINFORCEMENT AND GALVANIZED ANCHOR BOLT STEEL BAR DETAILS MEET THE REQUIREMENTS OF ASTM A 615, A 996 OR A 706.
2. DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATION AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
3. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATIONS AS OUTLINED IN THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
4. PROVIDE MINIMUM LAP AND EMBEDMENT LENGTH OF REINFORCEMENT AND ANCHORS IN ACCORDANCE WITH AASHTO LRFD SPECIFICATIONS: SEE BC-736M.
5. INDICATE ALLOWABLE AND MAXIMUM DESIGN FOUNDATION PRESSURE FOR HEADWALL AND WINGWALL, AND COEFFICIENT OF FRICTION FOR WINGWALLS.
6. PLACE HEADWALL AND WINGWALL FOOTINGS BELOW THE SCOUR DEPTH OR FROST DEPTH WHICHEVER IS GREATER.
7. PROVIDE ROCK PROTECTION AT INLET AND OUTLET ENDS AND BEYOND THE ENDS OF THE WINGS. THIS CRITERIA ALSO APPLIES WHEN A 6" REINFORCED CONCRETE APRON IS USED.
8. IF THE LENGTH OF THE WINGWALL IS LESS THAN OR EQUAL TO 10', THE HEADWALL AND THE WINGWALL (NOT THE FOOTING) MAY BE PLACED IN ONE CONTINUOUS OPERATION. IN SUCH CASES THE HORIZONTAL STEEL OF BOTH WALLS MUST BE MADE CONTINUOUS BY ADEQUATE LAPS OR BENDS.
9. FOR WEEP HOLE REINFORCEMENT DETAIL SEE BD-621M.
10. FOR PA 3-RAIL BRIDGE BARRIER ATTACHMENT & CORRESPONDING HEADWALL REINFORCEMENT DETAILS FOR FILLS 2'-0" OR LESS, SEE BD-632M.
11. ALL END WALL AND EMBANKMENT SLOPE DIMENSIONS AND DATA TO BE SUPPLIED ON THE CONSTRUCTION PLAN BY THE DESIGNER.
12. PROVIDE WINGWALL REINFORCEMENT EACH FACE AS PER SPECIFIC DESIGN WITH MINIMUM #5 @ 18" EACH FACE.
13. USE CLASS A CEMENT CONCRETE IN WING WALL, FOOTING, AND HEADWALLS.
14. USE EPOXY COATED REINFORCEMENT FOR APPLICABLE SOIL AND WATER PH CONDITIONS.

DESIGN DATA FOR ENDWALL

- f'c = 3000 P.S.I. FOR CONCRETE (USE CLASS A CEMENT CONCRETE)
- fy = 60,000 P.S.I. FOR REINFORCEMENT BARS
- DENSITY OF BACKFILL MATERIAL = 120 LB/FT^3
- DENSITY OF CONCRETE = 150 LB/FT^3
- EQUIVALENT FLUID EARTH PRESSURE = 35 LB/FT^2/FT OF DEPTH.
- LIVE LOAD SURCHARGE : REFER TO DESIGN MANUAL PART 4.

LEGEND

CLR. : DENOTES CLEAR
Θ : DENOTES SKEW ANGLE
E.F. : DENOTES EACH FACE
F.F. : DENOTES FRONT FACE
R.F. : DENOTES REAR FACE
GR. EL. : DENOTES GRADE ELEVATION
REQ'D. : DENOTES REQUIRED AS DESIGNED DETAILS DIMENSIONED ON CONSTRUCTION PLAN

REFERENCE DRAWINGS	
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-625M	WINGWALL LENGTH
BD-632M	R.C. BOX CULVERT
BC-735M	WALL CONSTRUCTION AND EXPANSION JOINT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-751M	BRIDGE DRAINAGE

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

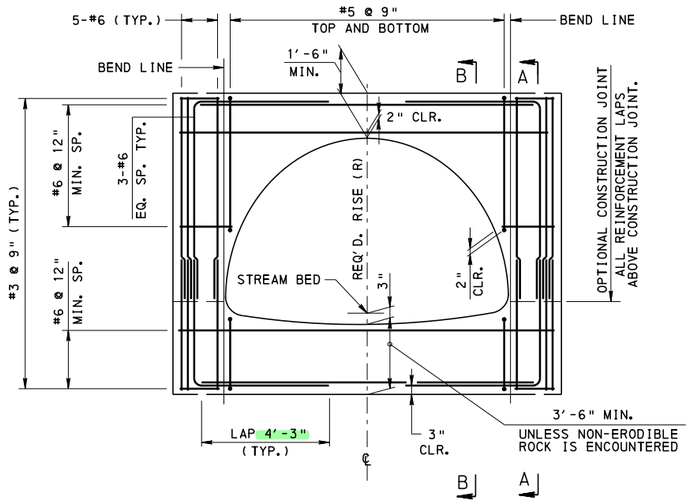
STANDARD END WALL DETAILS FOR CULVERTS

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

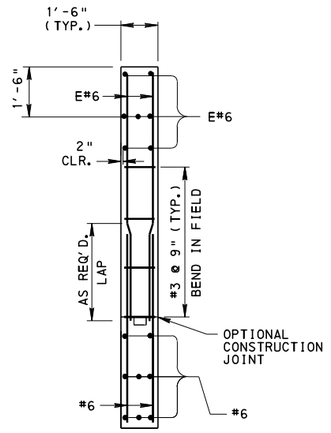
RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 2

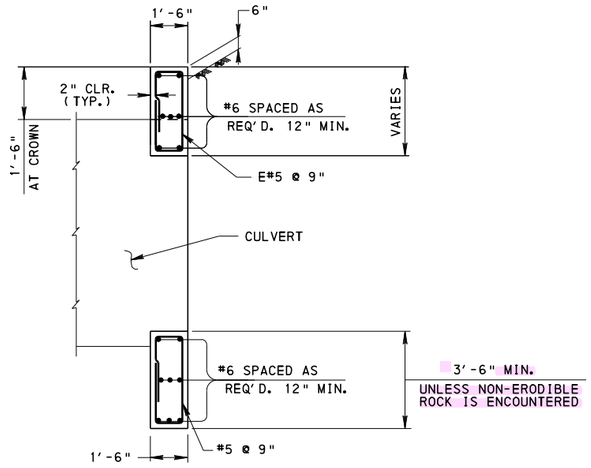
BD-631M



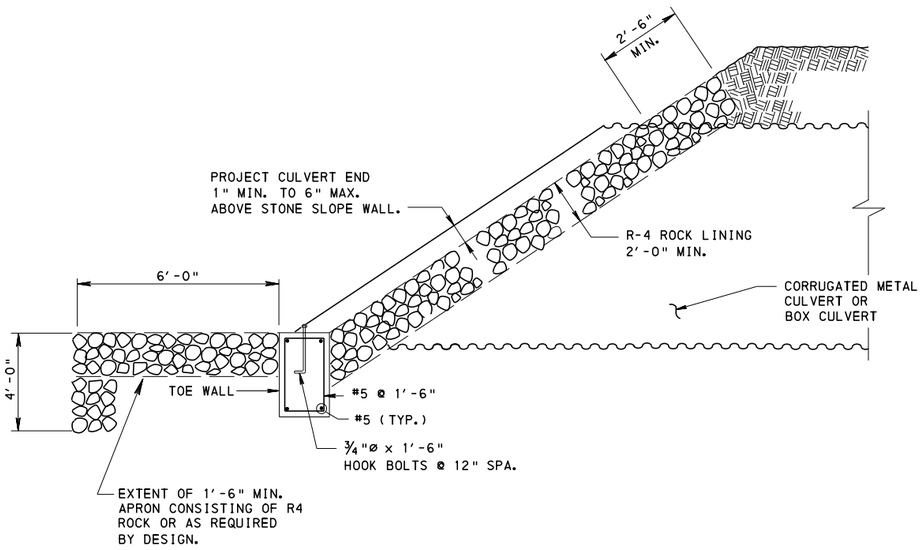
TYPICAL HEADWALL ELEVATION



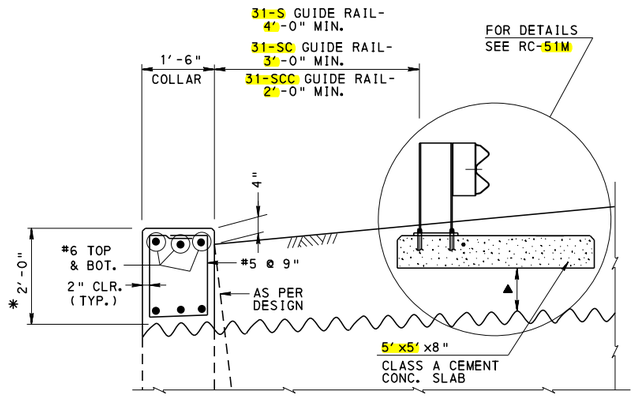
SECTION A-A
ADJACENT TO CULVERT



SECTION B-B
THRU CULVERT



ROCK LINING END WALL
SLOPED END CONDITION



TYPICAL SECTION
(METAL CULVERTS)

▲ REFER TO DETAIL IN RC-51M FOR "STEEL POSTS OVER UNDERGROUND STRUCTURES" WHEN THIS DIMENSION EXCEEDS 2'-0".

* WHEN THIS DIMENSION EXCEEDS 2'-0" CONCRETE HEADWALL REINFORCEMENT WILL REQUIRE A SEPARATE DESIGN.

LEGEND

CLR. :	DENOTES CLEAR
EQ. SP. :	DENOTES EQUAL SPACING
REQ'D. :	DENOTES REQUIRED AS DESIGNED DETAILS DIMENSIONED ON CONSTRUCTION PLAN

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD
END WALL DETAILS
FOR METAL CULVERTS

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 2

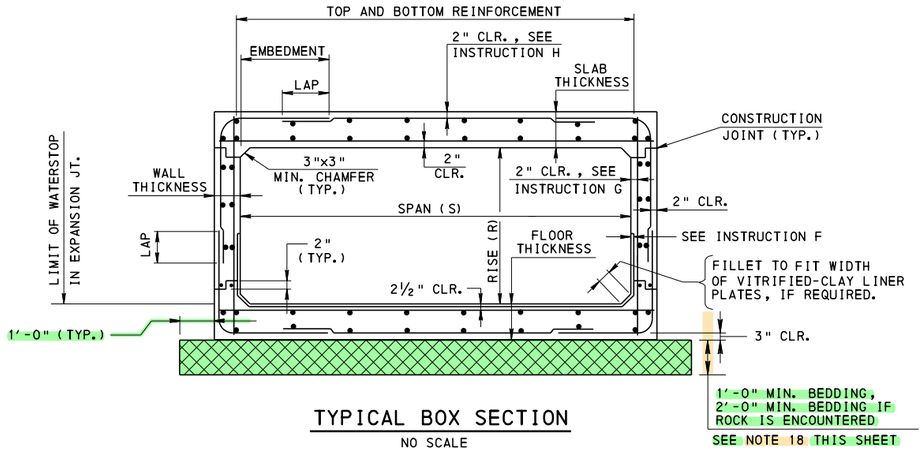
BD-631M

CHANGE 1

CHANGE 2

CHANGE 5

CHANGE 6



TYPICAL BOX SECTION

NO SCALE

DESIGN DATA FOR CAST-IN-PLACE BOX CULVERT

1. f'c = 3000 P.S.I. FOR CLASS A CEMENT CONCRETE
2. f'c = 4000 P.S.I. FOR TOP SLAB AT GRADE (CLASS AAAP CEMENT CONCRETE)
3. fy = 60,000 P.S.I. FOR REINFORCEMENT BARS
4. fy = 70,000 P.S.I. FOR PLAIN WELDED WIRE FABRIC
5. fy = 75,000 P.S.I. FOR DEFORMED WELDED WIRE FABRIC

INSTRUCTIONS

A. MINIMUM SLAB THICKNESS = 10"

B. MINIMUM WALL THICKNESS = 10" FOR RISE < 5'-0"

C. MINIMUM WALL THICKNESS = 1'-0" FOR RISE > 5'-0"

D. ADD 1½" (½" AT THE TOP AND 1" AT BOTTOM) TO THE EFFECTIVE DESIGN THICKNESS OF BOTTOM SLAB OF BOX CULVERTS, FOR THE TOTAL (PROVIDED) THICKNESS.

E. FOR BOX CULVERTS AT GRADE, ADD ½"INTEGRAL WEARING SURFACE TO THE TOP DECK SLAB THICKNESS.

F. IF SPECIFIED, VITRIFIED-CLAY LINER PLATES WITH TYPE B POINTING (INCLUDE COST IN THE PRICE OF CONCRETE TO WHICH ATTACHED.)

G. 3" CLEAR IF LINER PLATES ARE USED

H. 2½" CLEAR IF AT GRADE

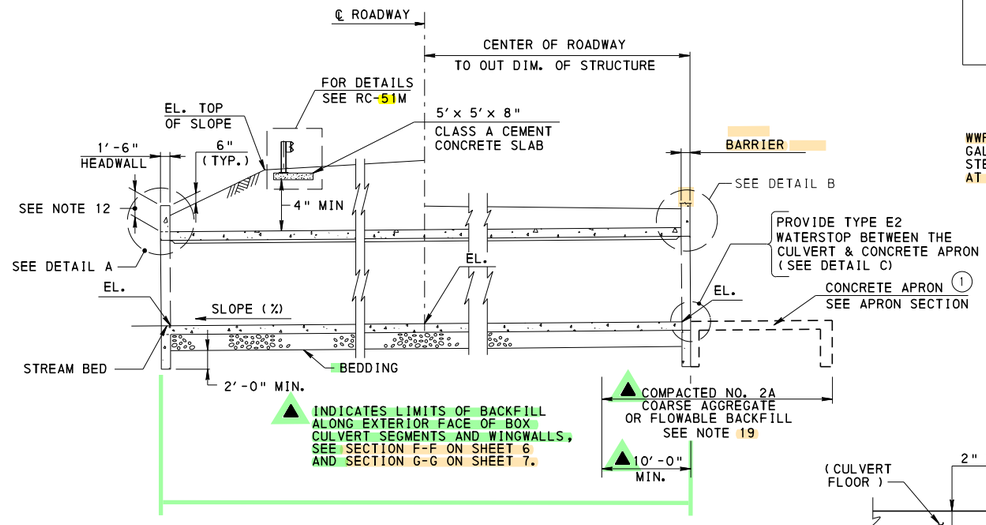
I. PLACE MAIN CIRCUMFERENTIAL REINFORCEMENT NORMAL TO THE CENTERLINE OF THE CULVERT.

J. PROVIDE EXPANSION JOINTS AT APPROXIMATELY 90' INTERVALS AND CONSTRUCTION JOINTS AT APPROXIMATELY 30' INTERVALS. PROVIDE EXPANSION JOINTS IN BOTTOM SLAB.

K. FOR ADDITIONAL WELDED WIRE FABRIC INFORMATION, SEE SHEET 5.

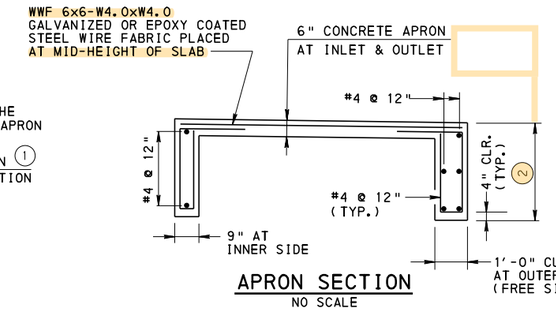
NOTES

1. PROVIDE GRADE 60 DEFORMED REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A615, A996 OR A706. DO NOT WELD REINFORCEMENT STEEL. DO NOT USE RAIL STEEL (A996) WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
2. DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
3. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
4. DEAD LOADS: INCLUDES SURFACE AREA DENSITY OF 30 P.S.F. FOR FUTURE WEARING SURFACE FOR BOXES AT GRADE.
5. USE EPOXY COATED REINFORCEMENT BARS IN THE FOLLOWING CONDITIONS:
   - TOP SLAB AND HEADWALL WITHIN 2'-0" OF GRADE.
   - ALL CURBS AND BARRIERS.
   - THROUGHOUT THE CULVERT WHEN VITRIFIED CLAY LINER PLATES ARE USED.
   - IN ALL APRON SLABS.
6. PROVIDE 2" CONCRETE COVER ON REINFORCEMENT BARS EXCEPT AS NOTED.
7. FOR HYDRAULIC DESIGN REFER TO DESIGN MANUAL, PART 2.
8. FOR LOW FLOW FISH PASSAGE DESIGN COMMENTARY REFER TO DESIGN MANUAL, PART 2.
9. INDICATE FACTORED BEARING RESISTANCE AND MAXIMUM DESIGN FOUNDATION PRESSURE ON THE PLANS.
10. PLACE HEADWALLS, APRON WALLS AND WINGWALL FOOTINGS BELOW FROST DEPTH OR 3'-6" WHICH EVER IS GREATER.
11. USE 4" ø FORMED WEEP HOLES AT 15'-0" MAXIMUM CENTERS PLACED AT A MINIMUM 1'-9" ABOVE BOTTOM OF SLAB OR 6" ABOVE NORMAL FLOW LINE, FOR DETAILS SEE BC-751M. FOR WEEP HOLES LOCATED IN THE COMPACTED NO. 2A COARSE AGGREGATE AREAS OR FLOWABLE BACKFILL AREAS, PROVIDE PREFORMED DRAIN CONFORMING TO PUBLICATION 408 SECTION 623.2(a), WHICH IS 2'-0" MINIMUM HIGH x 4'-0" WIDE CENTERED HORIZONTALLY ON WEEP HOLE, SEE PREFORMED DRAIN DETAIL ON SHEET 6.
12. CONCRETE HEADWALL REINFORCEMENT WILL REQUIRE A SEPARATE DESIGN IF HEIGHT IS GREATER THAN 2'-0".
13. USE THIS STANDARD DRAWING IN CONJUNCTION WITH THE APPLICABLE ROADWAY CONSTRUCTION STANDARDS FOR GUIDE RAIL.
14. REFER TO DESIGN DRAWINGS FOR SPACING OF POSTS.
15. THOROUGHLY COAT ALL SURFACES OF THE BASE PLATES IN CONTACT WITH CONCRETE WITH CAULKING COMPOUNDS PRIOR TO ERECTION. AFTER ERECTION AND ALIGNMENT, SEAL OPENINGS BETWEEN THE METAL SURFACES AND THE CONCRETE WITH CAULKING COMPOUND MEETING THE REQUIREMENTS OF PUBLICATION 408, SECTION 705.
16. FOR JOINT DETAILS SEE BC-735M. WHEN EXPANSION JOINTS ARE USED, WATERSTOPS ARE REQUIRED IN THE TOP AND BOTTOM SLABS AND THE WALLS.
17. FOR BARRIER TRANSITION DETAILS, SEE SHEET 4.
18. INDICATES ADDITIONAL EXCAVATION FOR BEDDING MATERIAL BELOW THE BOTTOM OF R.C. BOX CULVERT WITH LIMITS AS SHOWN. BACKFILL WITH 2A OR #8 COARSE AGGREGATE. LEVEL BEARING AREA FOR PRECAST BOX SEGMENT WITH MINIMUM THICKNESS OF FINE AGGREGATE.
19. PROVIDE COMPACTED NO. 2A COARSE AGGREGATE BACKFILL OR TYPE B FLOWABLE BACKFILL AT INLET END OF CULVERTS FOR A MINIMUM LENGTH OF 10'-0" PLUS WINGWALLS. HEIGHT OF COMPACTED NO. 2A COARSE AGGREGATE OR FLOWABLE BACKFILL IS A MINIMUM OF 2'-0" ABOVE NORMAL STREAM. ELEVATION EXTENDING TO THE BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING WHICHEVER IS DEEPER, 3'-6" MINIMUM.
20. CLASS A TYPE 4 GEOTEXTILE IS PERMITTED TO BE PLACED BETWEEN THE BEDDING MATERIAL AND EXCAVATION OR TO ENCASE THE BEDDING MATERIAL.
21. THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3.



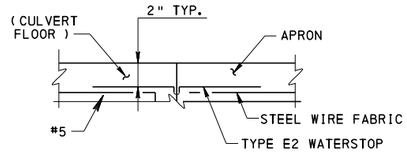
SECTION ALONG ℄ CULVERT

NO SCALE



APRON SECTION

NO SCALE



DETAIL C

NO SCALE

ABBREVIATIONS

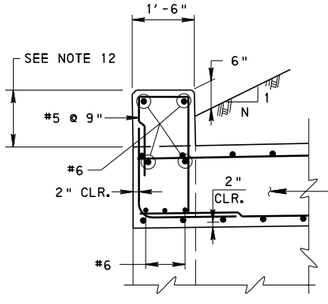
E.F. :	DENOTES EACH FACE
F.F. :	DENOTES FRONT FACE
R.F. :	DENOTES REAR FACE
EL. :	DENOTES ELEVATION
C.I.P. :	DENOTES CAST-IN-PLACE
B.B. :	DENOTES BACK BATTER

LEGEND

(1) USE APRON AT INLET AND OUTLET IF WARRANTED. SEE APRON SECTION THIS SHEET. FOR ALTERNATE DESIGN BY CONTRACTOR, PROVIDE THE APRONS ON THE PLANS.

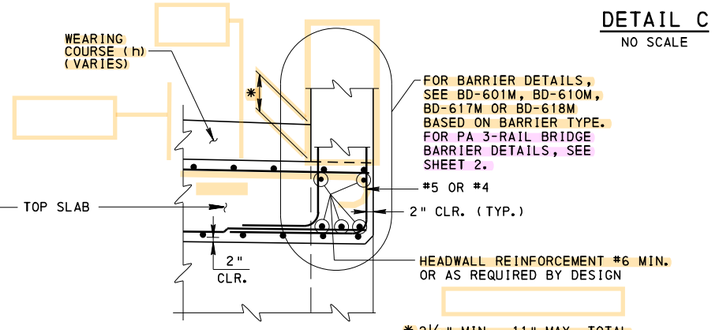
(2) EXTEND CUTOFF WALL TO BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING, WHICHEVER IS DEEPER, 3'-6" MIN. FROM TOP OF CULVERT BOTTOM SLAB. SEE NOTE 10.

(3) AN ALTERNATE CUTOFF WALL WITH GROUTED ROCK IS PERMITTED, SEE DETAILS ON SHEET 7



DETAIL A

IMPROVEMENT CONDITION
NO SCALE



DETAIL B

NO SCALE

* 2½" MIN., 11" MAX. TOTAL WEARING COURSE THICKNESS (h) (COMBINATION FILL, REINF. CONC. DECK, AND OVERLAY)

REFERENCE DRAWINGS

RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
BD-601M	CONCRETE DECK SLAB
BD-609M	PA 3-RAIL BRIDGE BARRIER
BD-610M	PA BRIDGE BARRIER
BD-617M	PA TYPE 10M BRIDGE BARRIER
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-625M	WINGWALL LENGTH
BD-631M	END WALL DETAILS
BC-706M	PA 3-RAIL BRIDGE BARRIER
BC-734M	ANCHOR SYSTEMS
BC-735M	WALL CONSTRUCTION AND EXPANSION JOINT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-751M	BRIDGE DRAINAGE
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
BC-798M	MECHANICAL CONNECTION DETAILS

COMMONWEALTH OF PENNSYLVANIA
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BUREAU OF BRIDGE

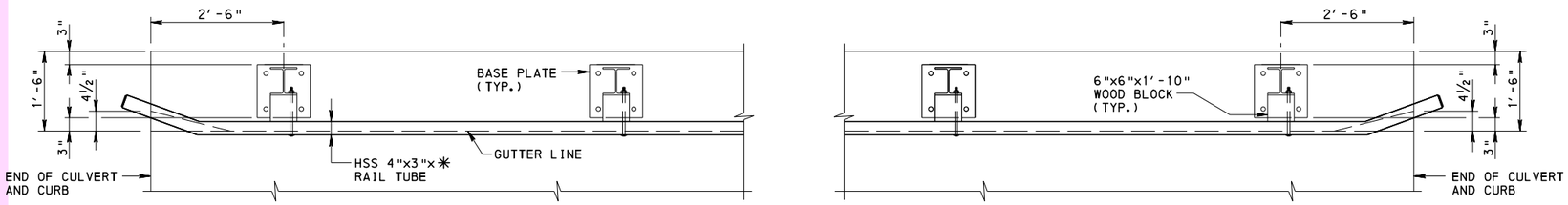
STANDARD R.C. BOX CULVERT CAST-IN-PLACE

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

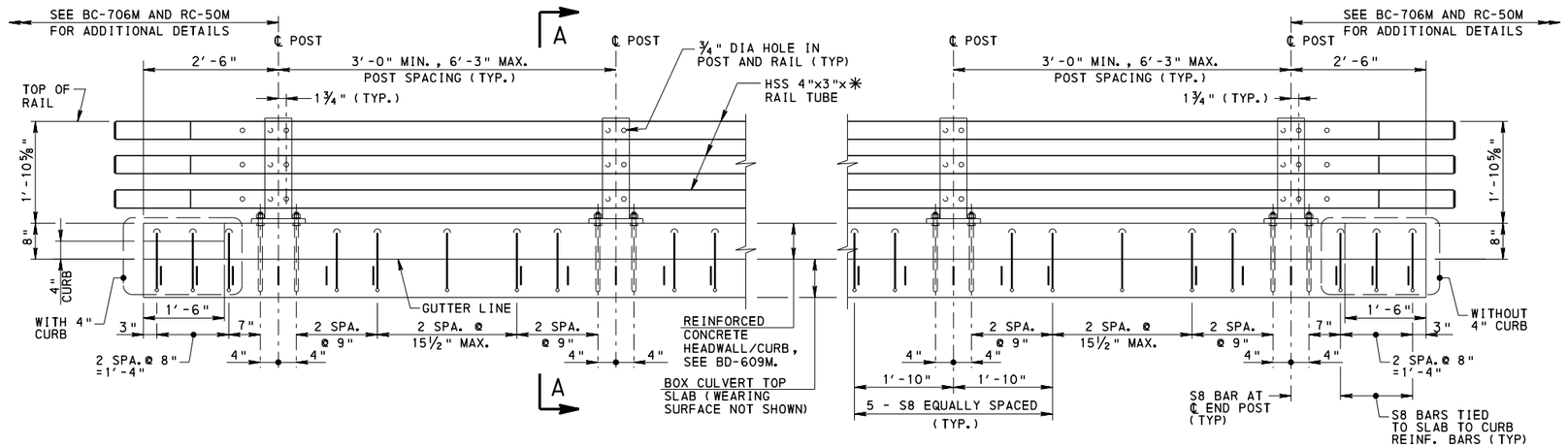
RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 16

BD-632M



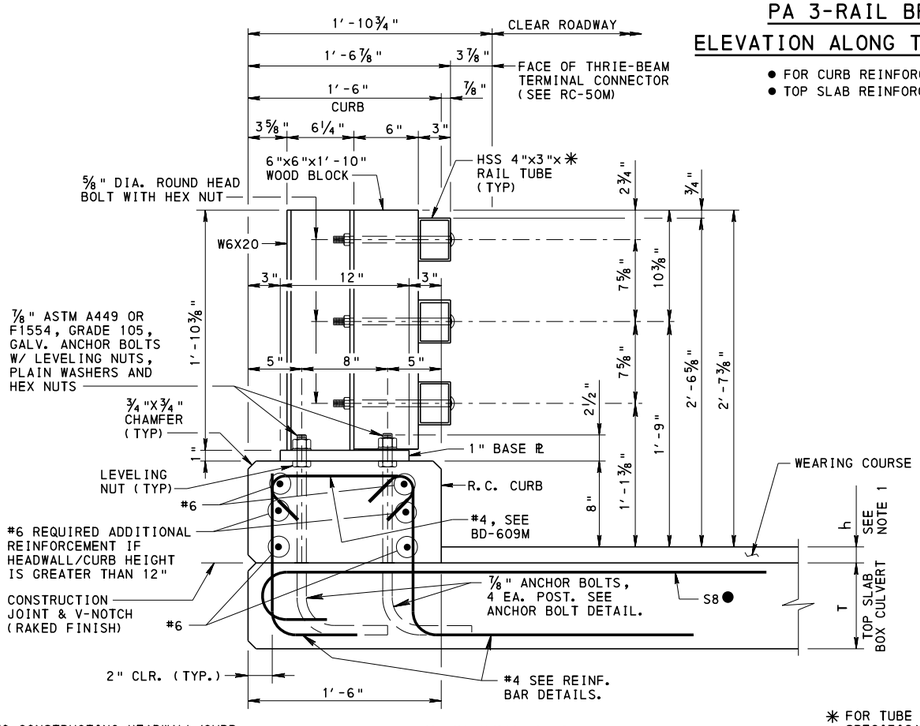
PLAN



PA 3-RAIL BRIDGE BARRIER

ELEVATION ALONG TOP SLAB OF CULVERT

- FOR CURB REINFORCEMENT SEE BD-609M.
- TOP SLAB REINFORCEMENT AS DESIGNED.

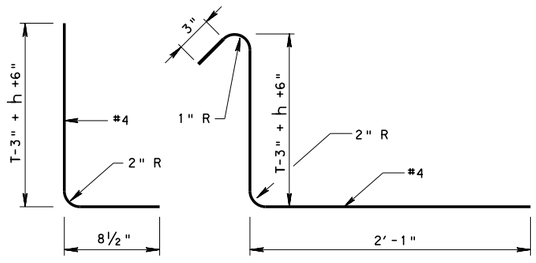


NOTE:
PRIOR TO CONSTRUCTING HEADWALL/CURB AND TOP SLAB, ANCHOR BOLTS SHALL BE INSTALLED WITH EITHER A TEMPLATE OR ACTUAL POST W/ BASEPLATE INSTALLED TO ENSURE PROPER ANCHOR BOLT ALIGNMENT & PLACEMENT.

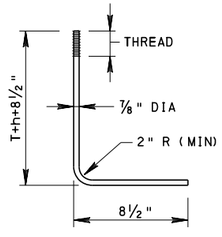
SECTION A-A

● S8 REINFORCEMENT REQUIRED AT POST LOCATIONS AND ENDS ONLY. SEE SHEET 9 FOR SLAB REINFORCEMENT BAR DETAILS.

✳ FOR TUBE THICKNESS, SEE TUBE RAIL SPECIFICATIONS TABLE ON BC-706M.



SLAB TO CURB REINFORCEMENT BAR DETAILS



ANCHOR BOLT DETAIL

NOTES:

1. 2½" MIN., 11" MAX. TOTAL WEARING COURSE THICKNESS (h) (COMBINATION FILL AND OVERLAY)

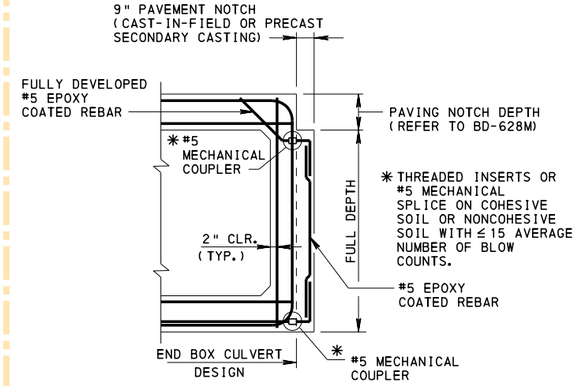
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD

R.C. BOX CULVERT

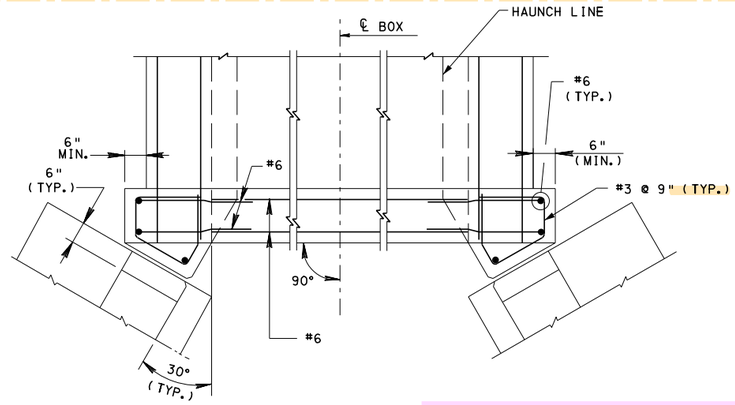
CAST-IN-PLACE

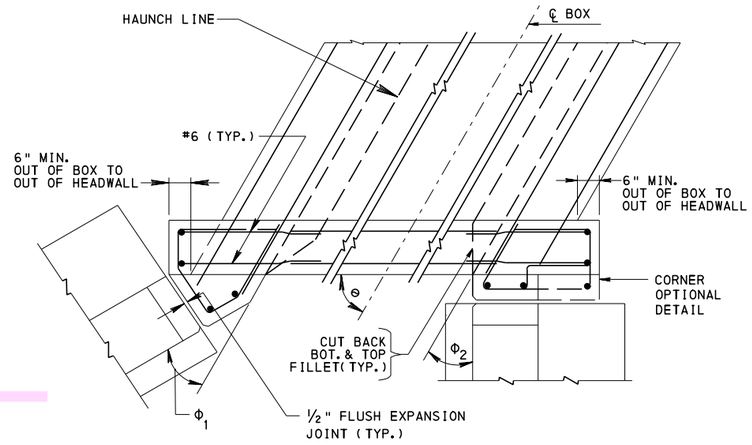
RECOMMENDED FEB. 14, 2023	RECOMMENDED FEB. 14, 2023	SHEET 2 OF 16
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-632M



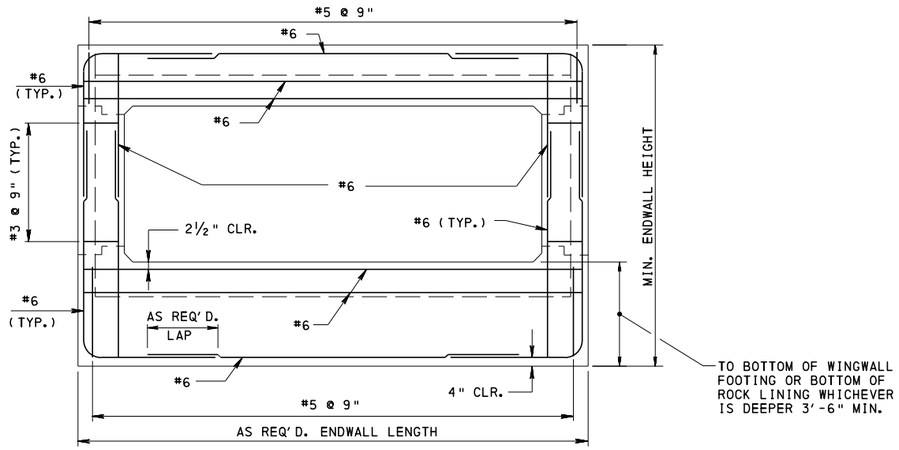
PAVEMENT NOTCH DETAIL

AT GRADE WHEN APPROACH SLAB IS REQUIRED



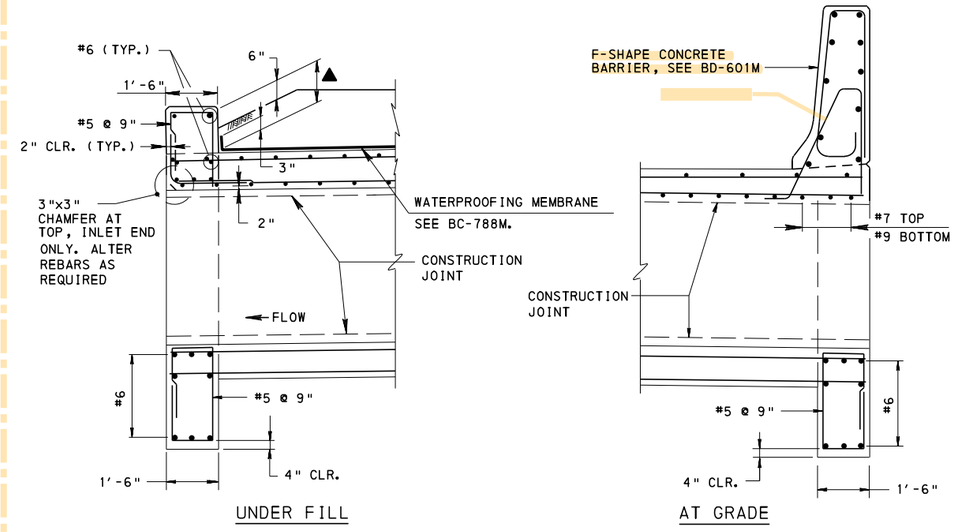


TYPICAL CULVERT HEADWALL DETAILS



TYPICAL HEADWALL ELEVATION

MINIMUM REINFORCEMENT SHOWN
NO SCALE



TYPICAL HEADWALL SECTIONS

LEGEND:

- Θ = SKEW ANGLE
- ϕ_1 = 30° FOR Θ ≥ 60°
- ϕ_1 = $\frac{\Theta}{2}$ FOR Θ < 60°
- ϕ_2 = 30° FOR Θ ≥ 60°
- ϕ_2 = 90°-Θ FOR Θ < 60°
- ▲ SEE NOTE 12, SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

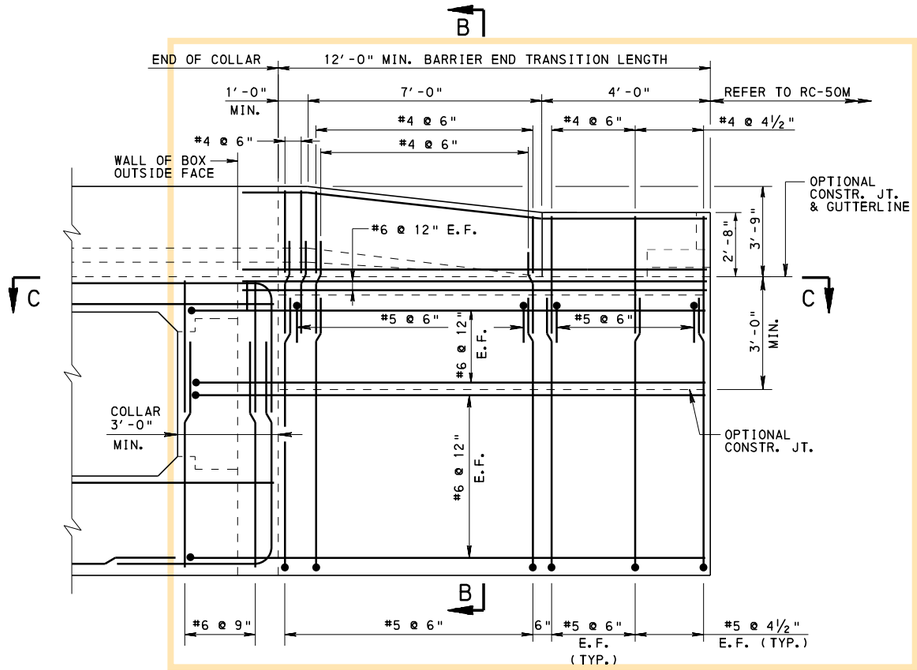
STANDARD
R.C. BOX CULVERT
CAST-IN-PLACE
HEADWALL DETAILS

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 3 OF 16

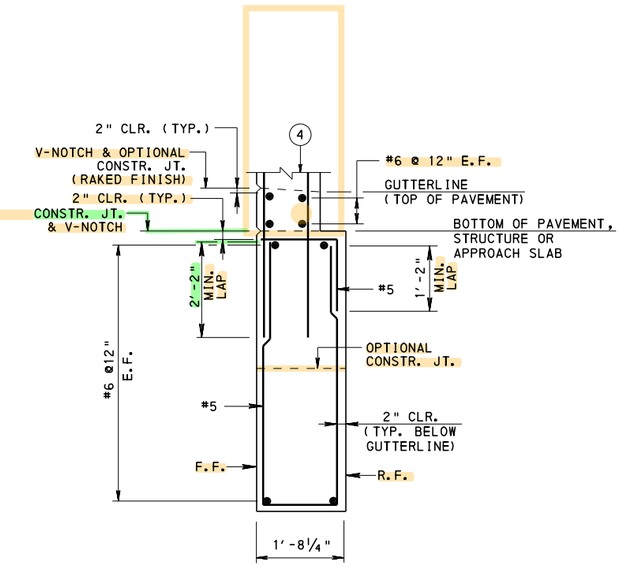
BD-632M



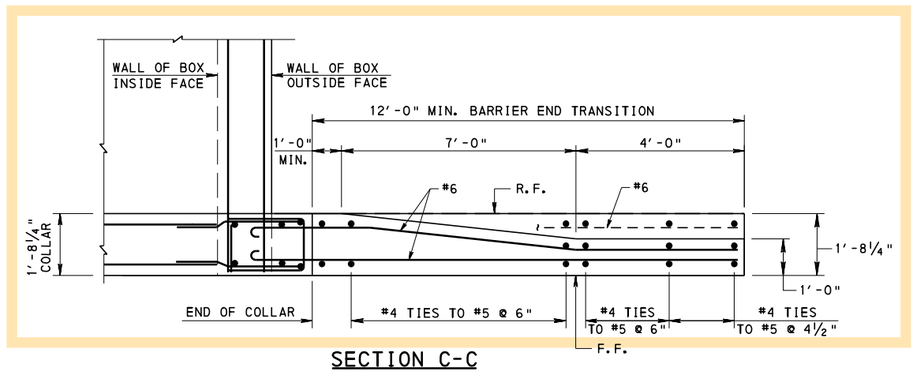
BARRIER TRANSITION SUPPORT WALL (4)(5)

45" F-SHAPE CONCRETE BARRIER SHOWN, 32" AND 42" F-SHAPE CONCRETE BARRIER SIMILAR.

NOTE: HOOKS ON BARS EXTENDING FROM BARRIER TRANSITION INTO THE COLLAR MAY BE TURNED IN ANY DIRECTION.



SECTION B-B



SECTION C-C

LEGEND

(4) FOR REINFORCEMENT DETAILS SEE BD-610M FOR PA BRIDGE BARRIER, BD-617M FOR PA TYPE 10M BRIDGE BARRIER, BD-618M FOR VERTICAL WALL CONCRETE BARRIER AND BD-622M AND BD-624M FOR F-SHAPE CONCRETE BARRIER.

(5) THE BARRIER AND BARRIER TRANSITION MAY BE SUPPORTED BY A BURIED MOMENT SLAB (SEE BD-627M) IN LIEU OF THE BARRIER TRANSITION SUPPORT WALL.

COMMONWEALTH OF PENNSYLVANIA
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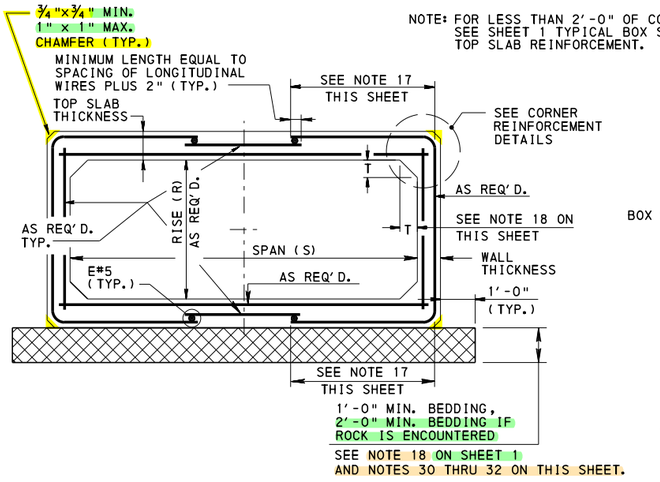
BUREAU OF BRIDGE

STANDARD
R.C. BOX CULVERT
CAST-IN-PLACE

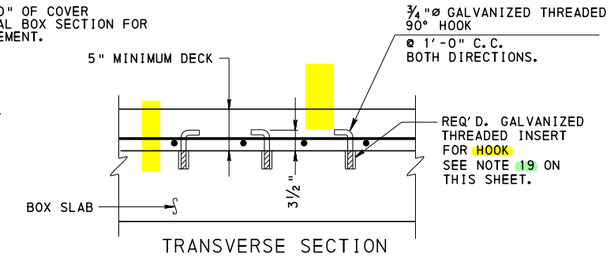
RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

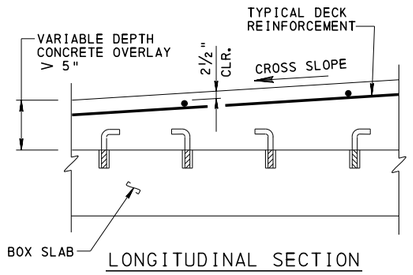
BD-632M



NOTE: FOR LESS THAN 2'-0" OF COVER SEE SHEET 1 TYPICAL BOX SECTION FOR TOP SLAB REINFORCEMENT.



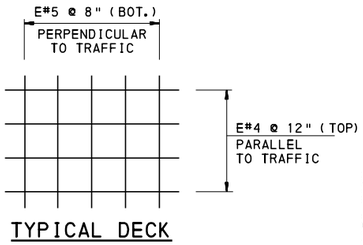
TRANSVERSE SECTION



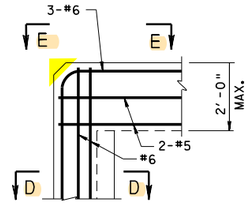
LONGITUDINAL SECTION

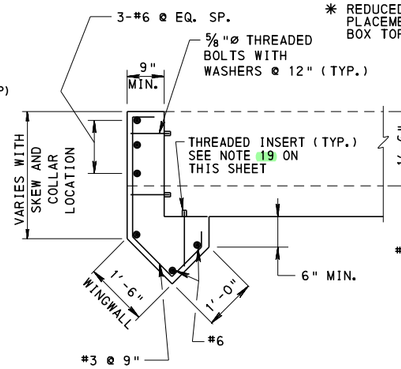
BOX DETAILS - WELDED WIRE FABRIC

(FOR 2'-0" OR MORE OF COVER)
SEE BC-798M FOR POST TENSION STRAND DETAILS



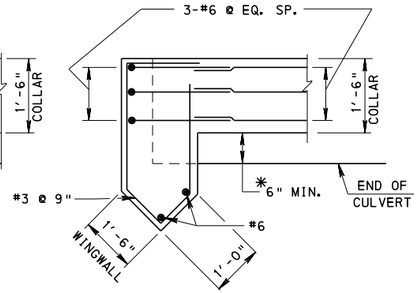
TYPICAL DECK REINFORCEMENT





SECTION D-D

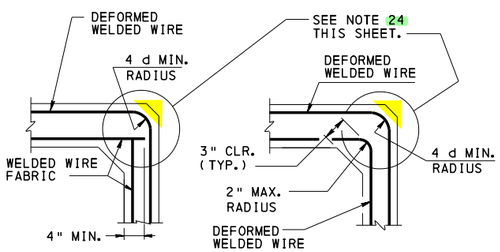
* REDUCED EDGE DISTANCE PERMITTED IF ADEQUATE CONCRETE PLACEMENT CAN STILL BE OBTAINED WITH PRESENCE OF BOTH BOX TOP SLAB AND COLLAR/CURB REINFORCEMENT.



SECTION E-E

DECK CONNECTION DETAILS

COLLAR CORNER DETAILS



DETAIL OPTION

CORNER REINFORCEMENT DETAILS

WELDED WIRE FABRIC

NOTES:

- FOR LESS THAN 2'-0" OF COVER SEE SHEET 1 TYPICAL BOX SECTION FOR TOP SLAB REINFORCEMENT.
- FOR POST TENSIONING DETAILS, SEE BC-798M.

DESIGN DATA:

- f'c = 5000 P.S.I. MINIMUM FOR CONCRETE
- f'c = 3000 P.S.I. MINIMUM FOR FISH BAFFLES/WEIRS
- f'c = 2000 P.S.I. MINIMUM FOR MUD SLABS
- fy = 60,000 P.S.I. FOR STEEL REINFORCING BARS
- fy = 70,000 P.S.I. FOR PLAIN WELDED WIRE FABRIC (IN FLAT SHEET)
- fy = 75,000 P.S.I. FOR DEFORMED WELDED WIRE FABRIC

INSTRUCTIONS:

SPAN S	POST TENSIONING DUCT LOCATION	MINIMUM SLAB OR WALL THICKNESS
8'-12'	HAUNCH	S/12
>12'	HAUNCH OR WALL	13"

- MINIMUM COVER FOR WELDED WIRE FABRIC :
  1. PROVIDE 1½", EXCEPT 2" FOR THE TOP WIRES OF THE TOP SLAB WHERE BOX FILL HEIGHT IS LESS THAN 2'-0".
  2. USE ½" MORE COVER FOR THE TOP WIRES OF THE BOTTOM SLAB.
- MINIMUM COVER FOR CONVENTIONAL REINFORCEMENT BARS:
  PROVIDE 2" FOR THE TOP BARS OF TOP AND BOTTOM SLABS, AND 1½" FOR ALL OTHER BARS, EXCEPT USE 2½" FOR TOP BARS WHEN SLAB IS AT GRADE.
- FOR WELDED WIRE FABRIC, SPACE CIRCUMFERENTIAL WIRES CENTER TO CENTER NOT LESS THAN 2" OR MORE THAN 4", AND SPACE LONGITUDINAL WIRES CENTER TO CENTER NOT MORE THAN 8".

REFER TO SHEET 15 FOR END SECTION SKEW ORIENTATION REQUIREMENTS.

NOTES

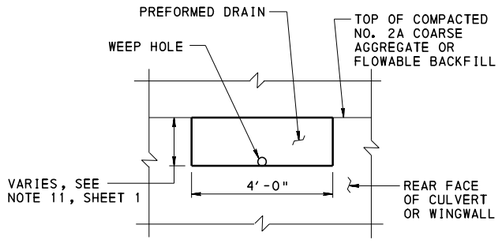
1. PROVIDE GRADE 60 DEFORMED REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A615, A996 OR A706. DO NOT WELD REINFORCEMENT STEEL. DO NOT USE RAIL STEEL (A996) WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
2. WELDED WIRE FABRIC WILL MEET THE REQUIREMENTS OF ASTM A1064 GRADE 70, AND DEFORMED WELDED WIRE FABRIC WILL MEET THE REQUIREMENTS OF ASTM A1064 GRADE 75.
3. USE EPOXY COATED REINFORCEMENT AND EPOXY OR GALVANIZED WELDED WIRE FABRIC IN THE FOLLOWING CONDITIONS:
   - IN THE CAST IN PLACE DECK AND HEADWALLS IF A DECK IS USED.
   - IN THE TOP SLAB AND HEADWALL WITHIN 2'-0" OF GRADE IF A CAST IN PLACE DECK IS NOT USED.
   - ALL CURBS AND BARRIERS.
   - THROUGHOUT THE CULVERT WHEN VITRIFIED CLAY LINER PLATES ARE USED.
   - IN ALL CAST-IN-PLACE APRON SLABS (SEE SHEET 1)

   IF EPOXY COATED WELDED WIRE FABRIC IS USED IT MUST MEET THE REQUIREMENTS OF ASTM A884, TYPE I, CLASS A.
4. DESIGN SPECIFICATIONS: AASHTO LRFD "BRIDGE DESIGN SPECIFICATION" AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
5. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
6. DEAD LOADS: INCLUDE A WEIGHT OF 30 P.S.F. FOR FUTURE WEARING SURFACE FOR BOXES AT GRADE.
7. PROVIDE MINIMUM LAP AND EMBEDMENT LENGTH OF REINFORCEMENT IN ACCORDANCE WITH LRFD SPECIFICATIONS: SEE BC-736M.
8. PROVIDE 2" CONCRETE COVER ON REINFORCEMENT BARS EXCEPT AS NOTED IN INSTRUCTIONS BELOW.
9. FOR HYDRAULIC DESIGN REFER TO DESIGN MANUAL, PART 2.
10. FOR LOW FLOW FISH PASSAGE DESIGN REFER TO DESIGN MANUAL, PART 2, AND SEE SHEETS 11, 12 AND 14.
11. INDICATE ALLOWABLE AND MAXIMUM DESIGN FOUNDATION PRESSURE ON PLANS.
12. PLACE HEADWALL AND WINGWALL FOOTINGS BELOW FROST DEPTH OR 3'-6" MINIMUM, WHICH EVER IS GREATER.
13. PROVIDE WATERPROOFING MEMBRANE FOR THE ENTIRE TOP WIDTH AND LENGTH OF THE BOX AND 2'-0" WIDTH ± ALONG THE SIDE JOINTS IN ACCORDANCE WITH PUBLICATION 408, SECTION 680.2(a) OR 680.2(b). FOR ADDITIONAL DETAILS REFER TO BC-788M.
14. USE 4"ø FORMED WEEPHOLES AT EVERY OTHER SEGMENT PLACED AT A MINIMUM 1'-9" ABOVE THE BOTTOM SLAB OR 6" ABOVE NORMAL FLOW LINE. FOR WEEPHOLE PLACEMENT, THE WEEPHOLE LOCATION MAY BE ADJUSTED BY A MAXIMUM OF 2" IN ANY DIRECTION, OR RELOCATE REINFORCEMENT BY A MAXIMUM OF ½". DO NOT CUT REINFORCEMENT BARS. NO ADDITIONAL WEEPHOLE REINFORCEMENT WILL BE REQUIRED. IF WIRE MESH IS USED, MAY CUT THE MESH TO FIT WEEPHOLE CONDUIT BUT REPLACE EQUIVALENT STEEL WITH ADDITIONAL WIRE MESH PLACED ON EACH SIDE OF WIRE MESH MAT.
15. PRECAST BOX CULVERTS AT GRADE (i.e. ≤ 2'-0" OF FILL) REQUIRE AN ADDITIONAL 5" MINIMUM REINFORCED CONCRETE DECK. THIS 5" DECK WILL BE MAINTAINED FOR ENTIRE BOX CULVERT. REFER TO TYPICAL DECK REINFORCEMENT (THIS SHT.) FOR DETAILS. FOR ADT ≤ 750 AND A.D.T.T. ≤ 25, AN ASPHALT PAVEMENT OVERLAY MAY BE UTILIZED IN LIEU OF A CONCRETE DECK.
16. DESIGN PRECAST REINFORCED CONCRETE BOXES TO HAVE OPENINGS IN 6" INCREMENTS WITH MINIMUM RISE OF 3'-0".
17. REQUIRED DIMENSION FOR BAR LENGTH IS THE TOTAL OF THE THEORETICAL CUT-OFF LENGTH PLUS THE REQUIRED ANCHORAGE.
18. HAUNCH SIZE SHOWN (T) IS BASED ON AASHTO M273. HAUNCH MAY BE MODIFIED IF THE BOX IS CUSTOM DESIGNED TO SATISFY DESIGN, TRANSPORTATION AND CONSTRUCTION REQUIREMENTS, BUT NOT LESS THAN 6" x 6".
19. THREADED INSERTS TO BE INCORPORATED IN PRECAST BOX AND DETAILED BY THE FABRICATOR.
20. CONCRETE HEADWALL REINFORCEMENT WILL REQUIRE A SEPARATE DESIGN IF HEIGHT IS GREATER THAN 2'-0".
21. IF APPROACH ROADWAY UTILIZES CURB, ADJUST DIMENSION TO MATCH CURB HEIGHT.
22. USE EPOXY BONDING COMPOUND WHERE EVER CAST-IN-PLACE CEMENT CONCRETE COMES IN CONTACT WITH PRECAST CEMENT CONCRETE. THE EPOXY BONDING COMPOUND IS TYPE 2, GRADE 2, AS DESCRIBED IN ASTM-C881-90.
23. THE USE OF PRECAST END SECTION IS NOT PRECLUDED BUT WILL BE REVIEWED ON AN INDIVIDUAL BASIS BY THE DISTRICT BRIDGE ENGINEER. HAUNCH SIZE MUST MATCH THAT OF BOX CULVERT SEGMENTS.
24. POST-TENSIONING DUCTS MAY BE PLACED AT EITHER CORNER OR HAUNCH TO SATISFY DESIGN AND CONSTRUCTION REQUIREMENTS. PROVIDE A 3" CONCRETE CLEARENCE. HAUNCH DUCT MUST BE SECURED TO INSIDE FACE REINFORCEMENT, SEE SHEETS 8 AND 10.
25. FOR DECK CONNECTION DETAIL FOR VARIABLE DEPTH CONCRETE DECKS, THE DECK REINFORCEMENT WILL BE INDEPENDENT OF ANCHOR BOLT AND MUST MAINTAIN CLEARANCE AND FOLLOW CROSS SLOPE.
26. SEE NOTE 19 ON SHEET 1 FOR BACKFILL REQUIREMENTS AT INLET END OF CULVERT AND NOTE 11 ON SHEET 1 FOR TREATMENT OF WEEP HOLES IN BACKFILL AREAS AT INLET END OF CULVERT.
27. SPECIFY 4'-0" MINIMUM SEGMENT LENGTH ON THE CONTRACT DRAWINGS.
28. FOR SKEWED SEGMENTS, A SQUARED (NORMAL) CONNECTION IS AN ACCEPTABLE OPTION DURING PHASE CONSTRUCTION.
29. CLASS A, TYPE 4 GEOTEXTILE IS PERMITTED TO BE PLACED BETWEEN THE BEDDING MATERIAL AND EXCAVATION OR TO ENCASEE THE BEDDING MATERIAL.
30. A 4" MINIMUM THICKNESS MUD SLAB MAY BE USED FOR PRECAST CULVERT INSTALLATION. BACKFILL BELOW MUD SLAB TO LIMITS OF EXCAVATION SHOWN IN DETAIL ON THIS SHEET. EXCAVATION AND BACKFILL LIMITS ARE MEASURED FROM TOP OF MUD SLAB.
31. USE CLASS C CEMENT CONCRETE FOR MUD SLABS.
32. TROWEL FINISH THE TOP OF MUD SLAB TO PROVIDE A SMOOTH SURFACE.

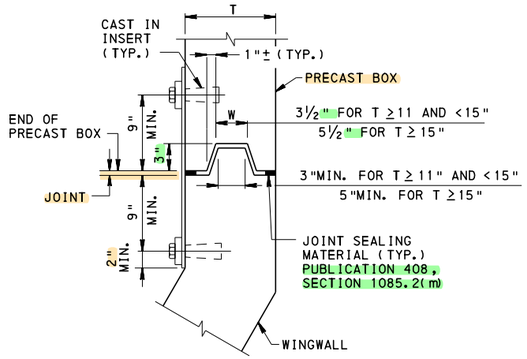
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD
R.C. BOX CULVERT
PRECAST

RECOMMENDED FEB. 14, 2023	RECOMMENDED FEB. 14, 2023	SHEET 5 OF 16
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-632M



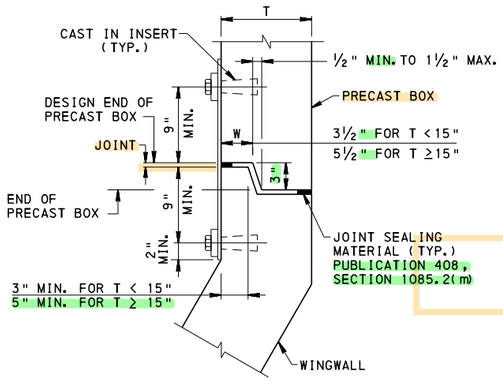
PREFORMED DRAIN DETAIL



PARTIAL PLAN

KEYED JOINT

DISCONTINUOUS IF POST TENSIONING IS REQUIRED



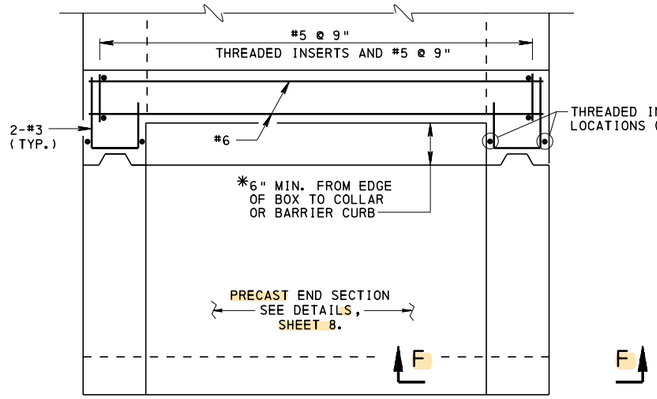
PARTIAL PLAN

SHIP LAP JOINT

DISCONTINUOUS IF POST TENSIONING IS REQUIRED

PRECAST WINGWALL CONNECTION DETAILS

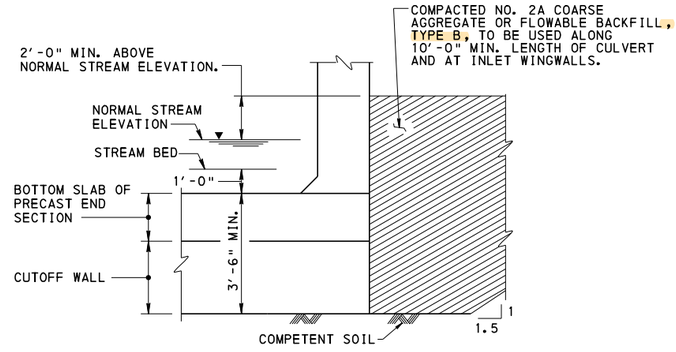
NOTES:
1. NO BOLT THROUGH CONNECTIONS CAN BE USED.
2. EITHER SHIP LAP OR KEYWAY JOINTS CAN BE USED. NO FLUSH BUTT JOINTS.
3. ONE (1) ROW OF JOINT SEALING FLEXIBLE FOAM MATERIAL EACH FACE.
4. FOR T <11", USE SHIP LAP DETAIL.



PLAN

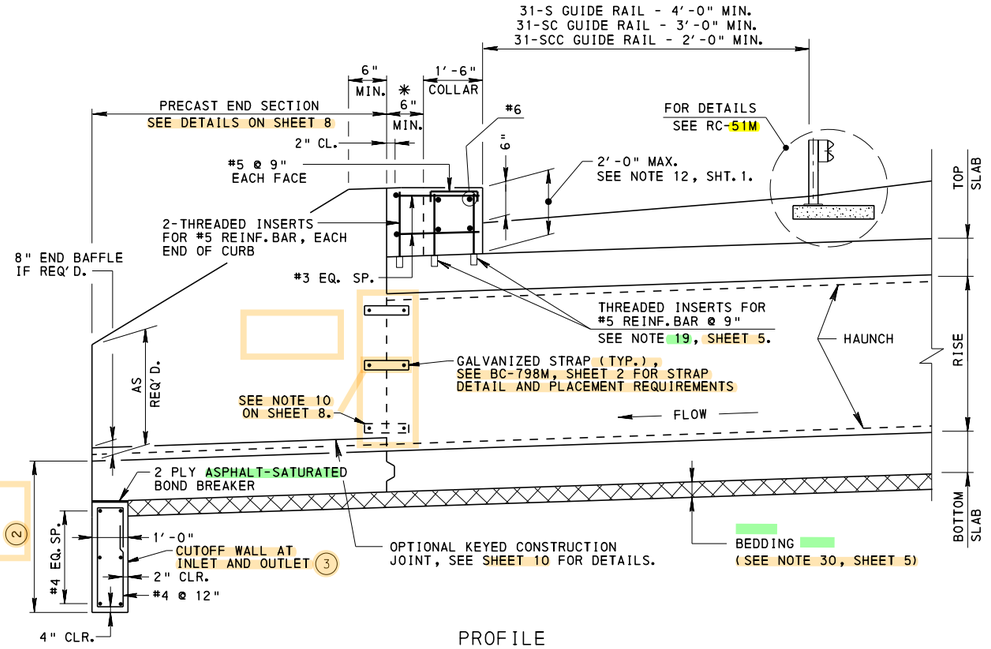
PRECAST END SECTION

* REDUCED EDGE DISTANCE PERMITTED IF ADEQUATE CONCRETE PLACEMENT CAN STILL BE OBTAINED WITH PRESENCE OF BOTH BOX TOP SLAB AND COLLAR/CURB REINFORCEMENT.



SECTION F-F

NOTE:
DESIGNER TO MODIFY AMOUNT OF COMPACTED NO. 2A COARSE AGGREGATE OR FLOWABLE BACKFILL TO PROVIDE ADEQUATE PROTECTION AGAINST PIPING OF STREAM FLOW THROUGH FILL AT INLET END OF CULVERT.



PROFILE

PRECAST CULVERT WITH PRECAST END SECTION

NOTES:
- SEE NOTE 23. SHEET 5.
- FOR SCOUR PROTECTION SEE "PRECAST CULVERT WITH CAST-IN-PLACE WINGWALLS" DETAIL, ON SHEET 7.
- IF SLAB THICKNESSES ARE LESS THAN 13", SEE NOTE 10 ON SHEET 8.
- POST TENSION BOTTOM SLAB OF END SECTION PRIOR TO INSTALLATION OF CUTOFF WALL.

LEGEND

(2) EXTEND CUTOFF WALL TO BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING, WHICHEVER IS DEEPER, 3'-6" MIN. FROM TOP OF BOTTOM SLAB. SEE NOTE 12, SHEET 5.

(3) AN ALTERNATE CUTOFF WALL WITH GROUTED ROCK IS PERMITTED, SEE DETAILS ON SHEET 7

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

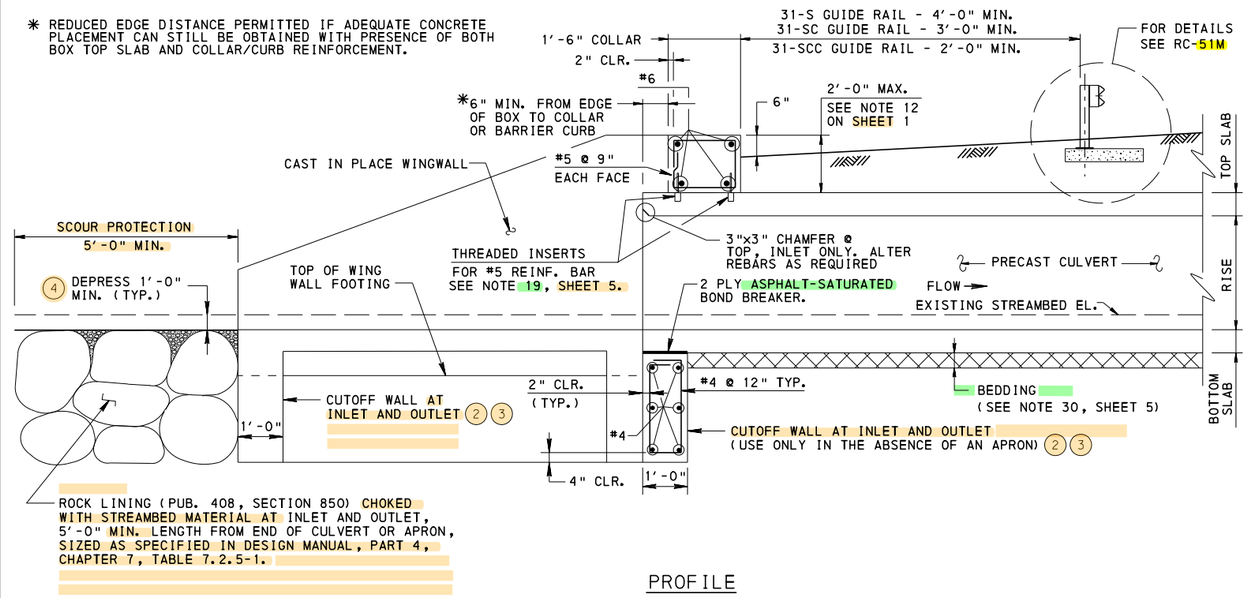
STANDARD
R.C. BOX CULVERT
PRECAST

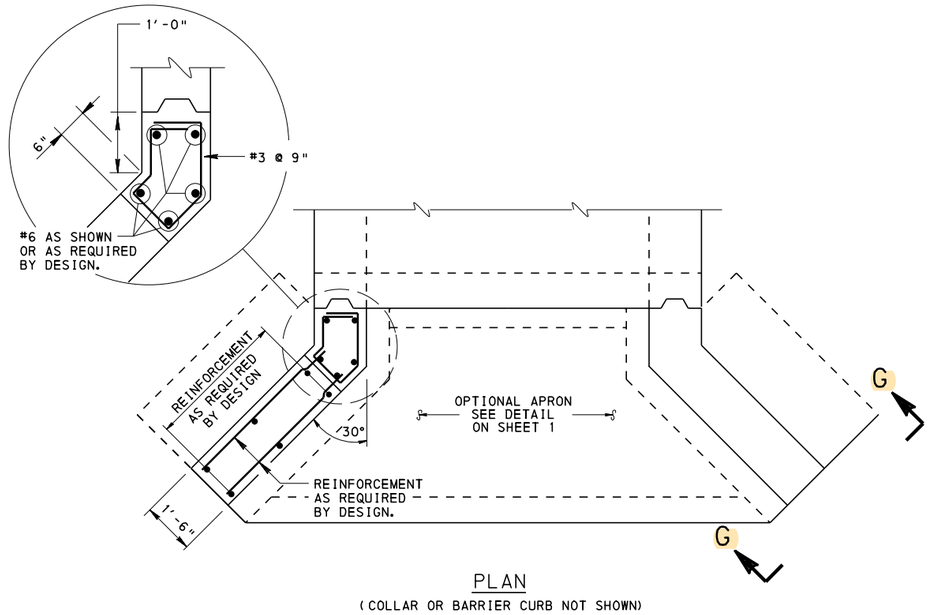
RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 16

BD-632M





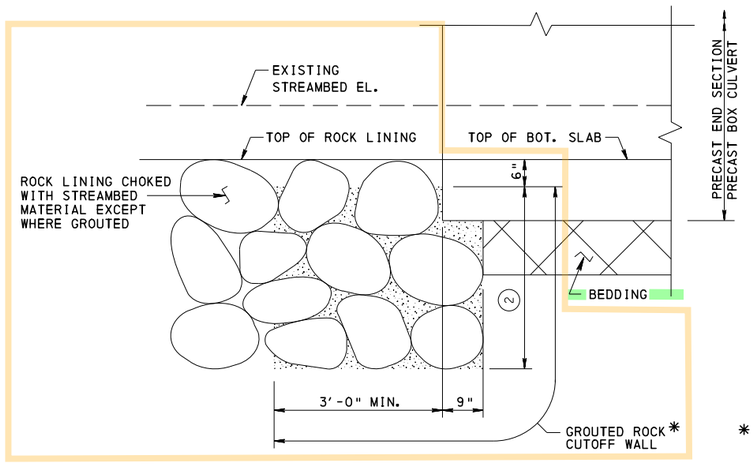
PRECAST CULVERT WITH CAST-IN-PLACE WINGWALLS

LEGEND

(2) EXTEND CUTOFF WALL TO BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING, WHICHEVER IS DEEPER, 3'-6" MIN. FROM TOP OF CULVERT BOTTOM SLAB. SEE NOTE 12, SHEET 5.

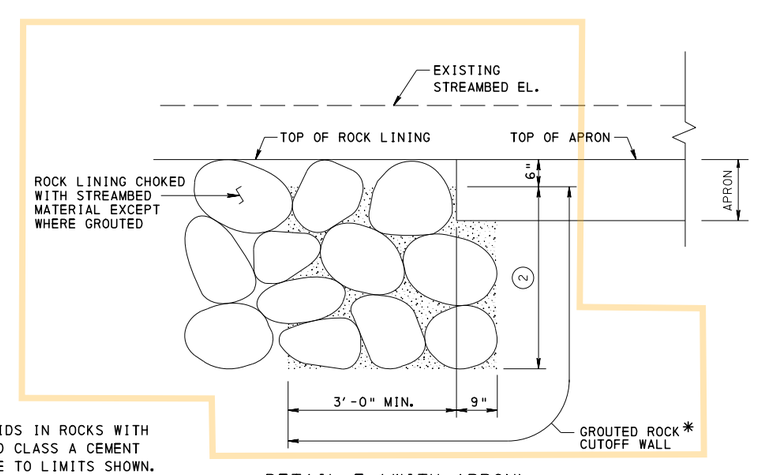
(3) AN ALTERNATE CUTOFF WALL WITH GROUTED ROCK IS PERMITTED, SEE DETAILS D AND E THIS SHEET.

(4) PLACE 1'-0" OF STREAMBED MATERIAL ON TOP OF THE ROCK LINING.



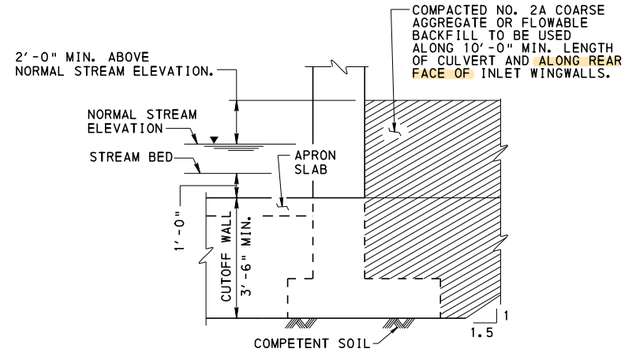
DETAIL D (WITHOUT APRON)
(STREAMBED MATERIAL NOT SHOWN)

* FILL VOIDS IN ROCKS WITH VIBRATED CLASS A CEMENT CONCRETE TO LIMITS SHOWN.



DETAIL E (WITH APRON)
(STREAMBED MATERIAL NOT SHOWN)

ALTERNATIVE CUTOFF WALL WITH GROUTED ROCK



SECTION G-G

NOTE:
DESIGNER TO MODIFY AMOUNT OF COMPACTED NO. 2A COARSE AGGREGATE OR FLOWABLE BACKFILL TO PROVIDE ADEQUATE PROTECTION AGAINST PIPING OF STREAM FLOW THROUGH FILL AT INLET END OF CULVERT.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

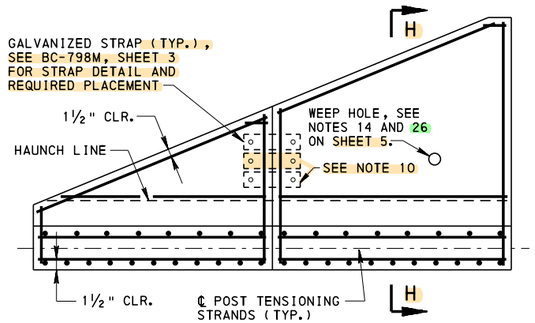
STANDARD
R.C. BOX CULVERT
PRECAST

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

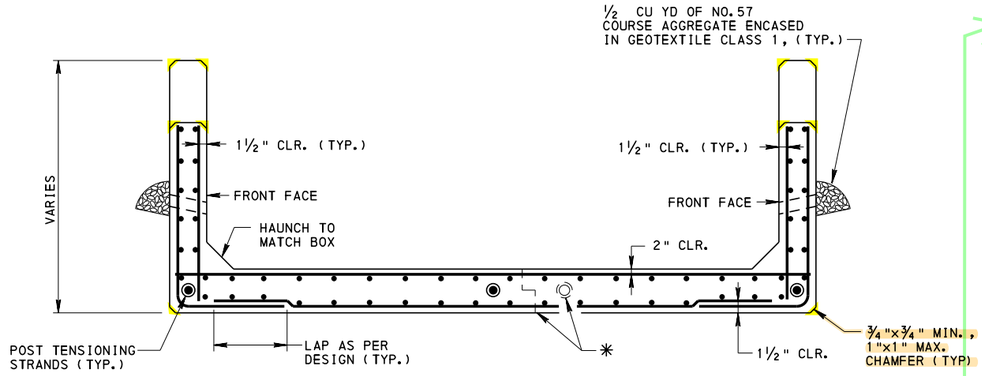
RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 7 OF 16

BD-632M

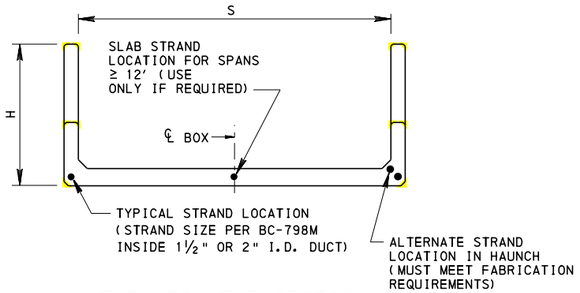


POST-TENSION END SECTION
SPAN >12 FEET

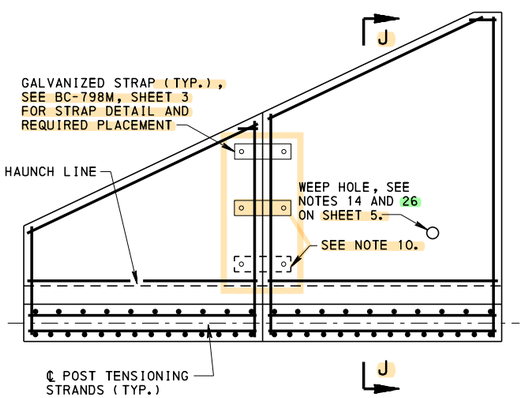


SECTION H-H

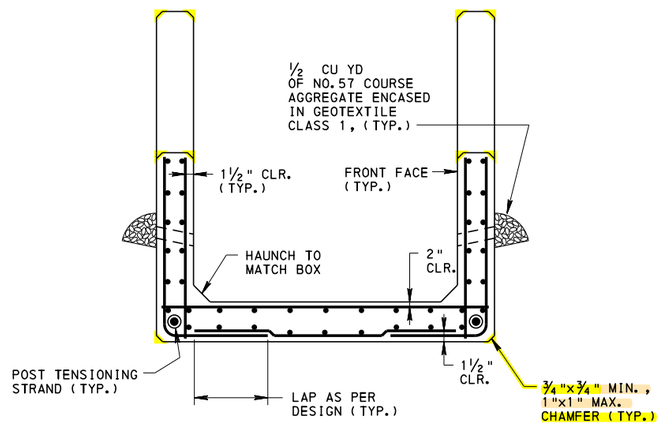
✳ SPECIFY JOINT AND ADDITIONAL END SECTION POST TENSION STRAND IF WIDTH IS RESTRICTED DUE TO SHIPPING RESTRAINTS.



TYP. BOX END SECTION
SHOWING STRAND LOCATIONS



POST-TENSION END SECTION
SPAN ≤ 12 FEET



SECTION J-J

GENERAL NOTES:

1. EPOXY COAT REINFORCEMENT AS PER R.C. BOX CULVERT DESIGN.
2. REBAR SHOWN IS FOR ORIENTATION ONLY, REBAR SIZE AND SPACING AS PER DESIGN.
3. WALL REINFORCEMENT CAN BE ADJUSTED TO ACCOMMODATE WEEPHOLE. DO NOT CUT REINFORCEMENT.
4. CAST-IN-PLACE CONCRETE IS PERMITTED IN ANY PORTION OF THE PRECAST END SECTIONS, ONLY IF HEIGHT OR WIDTH OF END SECTIONS ARE RESTRICTED DUE TO SHIPPING RESTRAINTS.

POST-TENSIONING NOTES:

1. EXTEND BOTTOM ROW OF POST-TENSIONING STRANDS THROUGH THE BOTTOM SLAB OF PRECAST CONCRETE INLET AND OUTLET END SECTIONS.
2. BOX SEGMENTS AND END SECTIONS ARE POST-TENSIONED IN STAGES. THE CONTRACTOR IS REQUIRED TO SUBMIT A PLAN FOR POST-TENSIONING SEQUENCE TO THE DEPARTMENT FOR APPROVAL PRIOR TO SETTING ANY SEGMENTS.
3. POST-TENSION BOX SEGMENTS FIRST, THEN PROVIDE:
   - MECHANICAL SPLICERS ON BOTTOM STRANDS TO CONNECT WITH THE INLET\OUTLET END SECTIONS AND POST-TENSION BOTTOM STRANDS THROUGH THE END SECTIONS.
   - STRAPS ON SIDES OF END SECTION AS SHOWN ON BC-798M. IF SLAB THICKNESSES ARE LESS THAN 13", SEE NOTE 10.
4. PROVIDE FULL CONTACT OF THE JOINT SEALING MATERIAL AROUND THE ENTIRE JOINT BETWEEN THE END SECTIONS AND THE BOX SECTIONS.
5. AFTER POST-TENSIONING IS APPROVED, CUT STRANDS TO PROVIDE A MINIMUM OF 2½" CLEAR FROM OUTSIDE FACE OF CONCRETE AND COAT RECESS WITH EPOXY BONDING COMPOUND AND FILL WITH NON-SHRINK GROUT.
6. THE NUMBER OF POST-TENSIONING STRANDS MAY BE INCREASED AND THEIR LOCATIONS MAY BE ADJUSTED BY THE FABRICATOR.
7. PRECAST CONCRETE SEGMENT LENGTH TO BE DETERMINED BY THE FABRICATOR.
8. STAGING, SPACING AND POST-TENSION FORCE TO BE SHOWN ON FABRICATOR'S SHOP DRAWINGS.
9. SEE BC-798M, SHEET 1 FOR ADDITIONAL POST-TENSIONING NOTES.
10. WHEN SLAB THICKNESSES ARE LESS THAN 13", A MINIMUM OF THREE (3) GALVANIZED STRAPS MAY BE INSTALLED ON EACH FACE AS AN ALTERNATIVE TO POST-TENSIONING. IF WINGS ARE FLARED ON SLAB THICKNESSES LESS THAN 13", THIS ALTERNATIVE SHOULD BE USED. SEE BC-798M, SHEET 2 FOR STRAP DETAILS AND PLACEMENT REQUIREMENTS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD
R.C. BOX CULVERT
PRECAST
POST-TENSIONED END SECTIONS

RECOMMENDED FEB. 14, 2023
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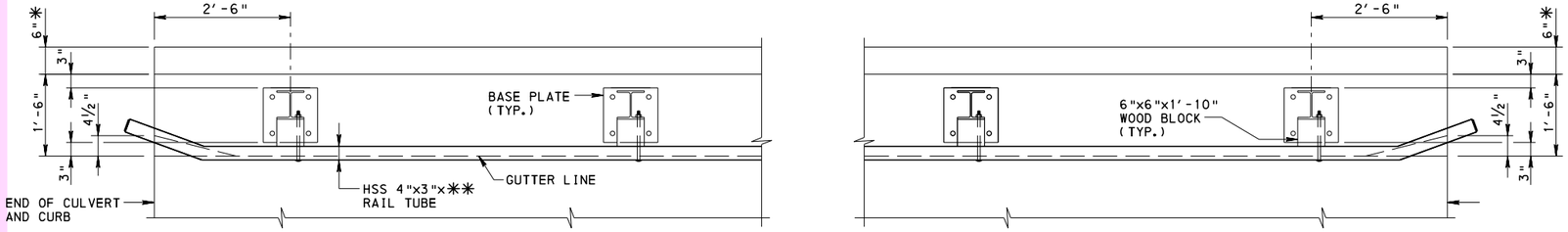
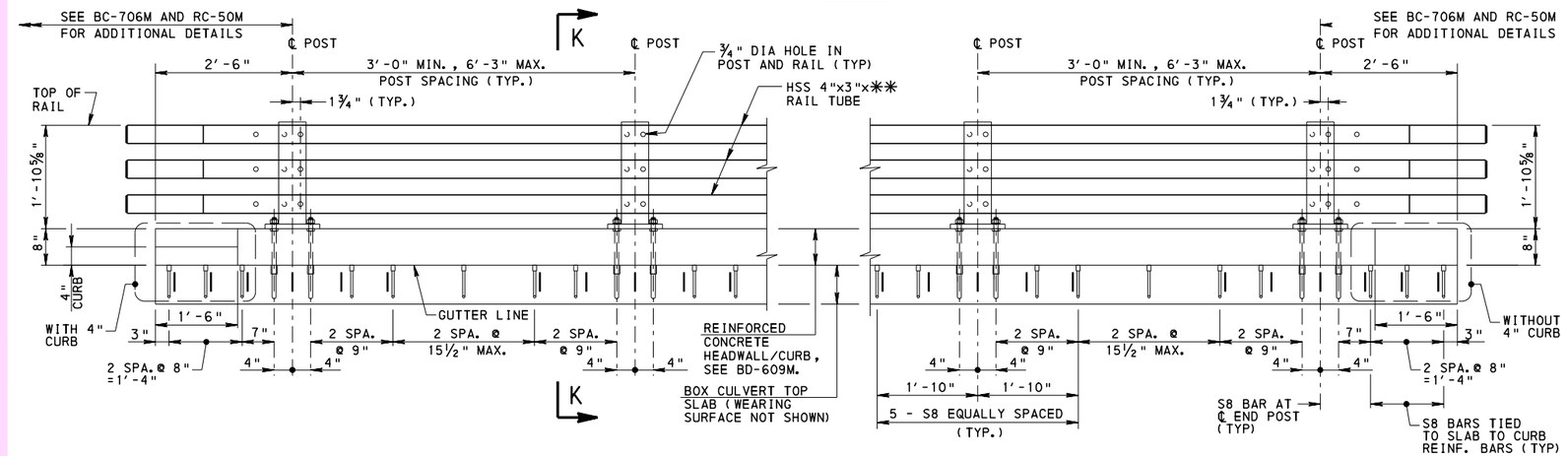
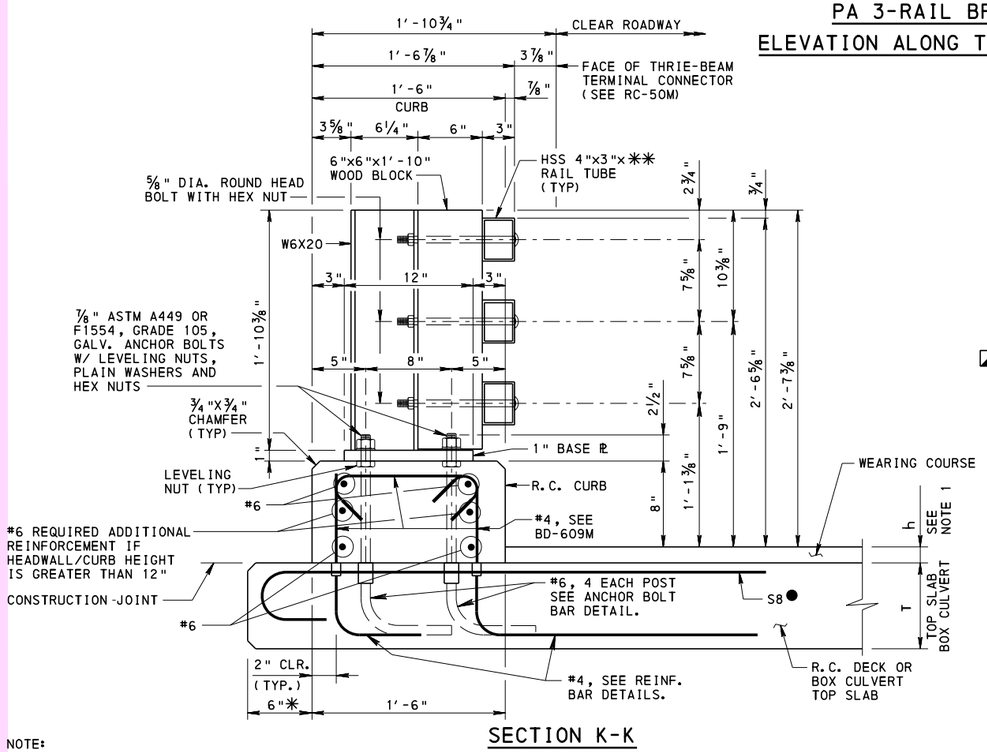
BD-632M



PLAN



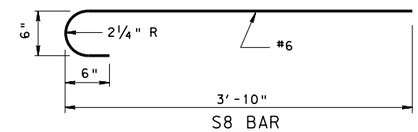
PA 3-RAIL BRIDGE BARRIER
ELEVATION ALONG TOP SLAB OF CULVERT



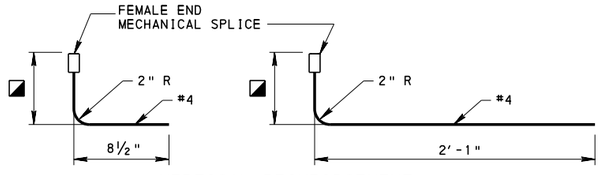
SECTION K-K

NOTE:
PRIOR TO CONSTRUCTING HEADWALL/CURB, INSTALL ANCHOR BOLTS IN THE MECHANICAL SPLICES. ENSURE PROPER PLACEMENT AND ALIGNMENT.

● S8 REINFORCEMENT REQUIRED AT POST LOCATIONS AND ENDS ONLY. SEE SLAB REINFORCEMENT BAR DETAILS THIS SHEET.

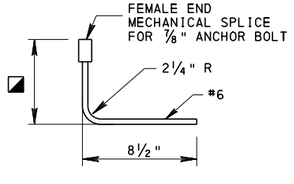


S8 BAR



VERTICAL REINFORCEMENT
ALL VERTICAL REINFORCEMENT #4

SLAB TO CURB
REINFORCEMENT BAR DETAILS
MECHANICAL SPLICE AS LISTED IN BULLETIN 15



ANCHOR BOLT BAR DETAIL
MECHANICAL SPLICE AS LISTED IN BULLETIN 15

LEGEND:

◪ FOR T< 10": T-2"
FOR T≥ 10": 8" MIN.
(T=TOP SLAB THICKNESS OF BOX CULVERT)

* REDUCED EDGE DISTANCE PERMITTED IF ADEQUATE CONCRETE PLACEMENT CAN STILL BE OBTAINED WITH PRESENCE OF BOTH BOX TOP SLAB AND CURB REINFORCEMENT.

** FOR TUBE THICKNESS SEE TUBE RAIL SPECIFICATIONS TABLE ON BC-706M.

NOTE:

1. 2½" MIN., 11" MAX. TOTAL WEARING COURSE THICKNESS (h) (COMBINATION OF FILL OR 5" MIN. REINF. CONC. DECK AND OVERLAY)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

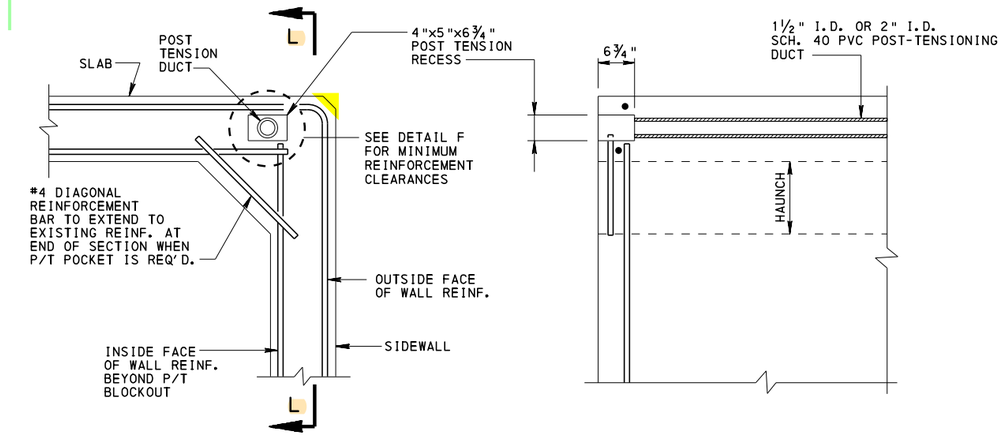
STANDARD
R.C. BOX CULVERT
PRECAST

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 9 OF 16

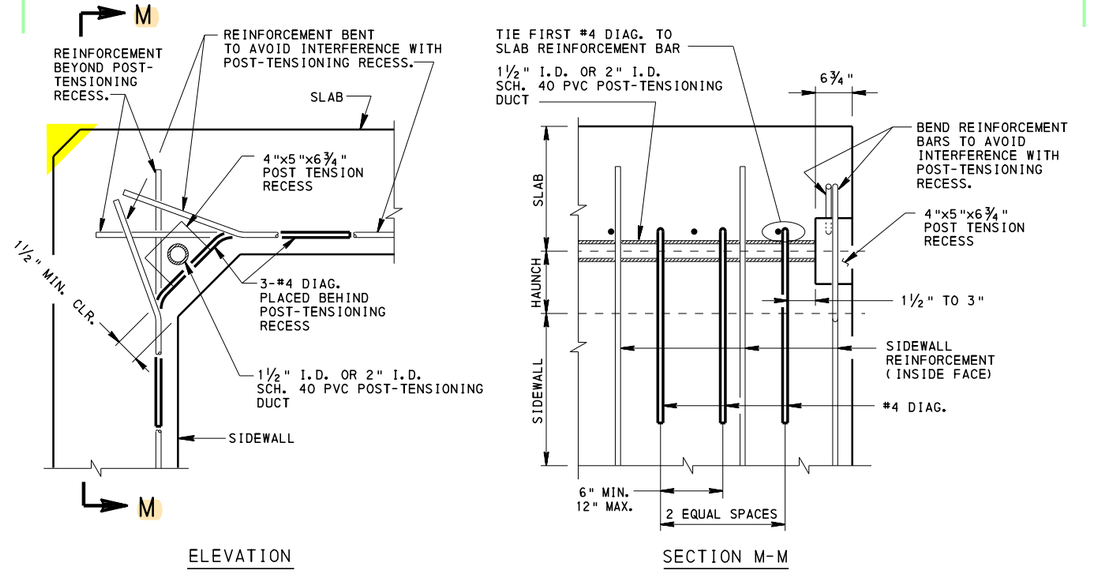
BD-632M



ELEVATION

SECTION L-L

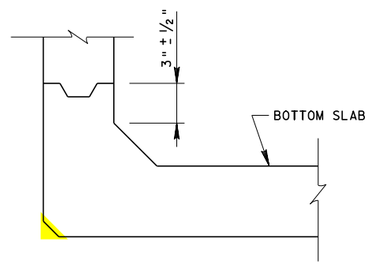
TYPICAL HAUNCH SECTION DETAIL



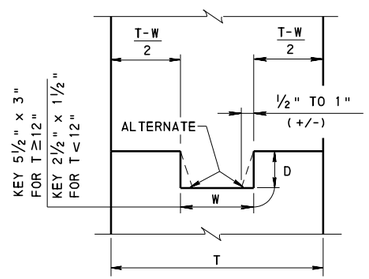
ELEVATION

SECTION M-M

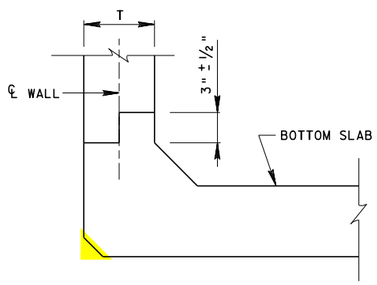
ALTERNATE HAUNCH SECTION DETAIL



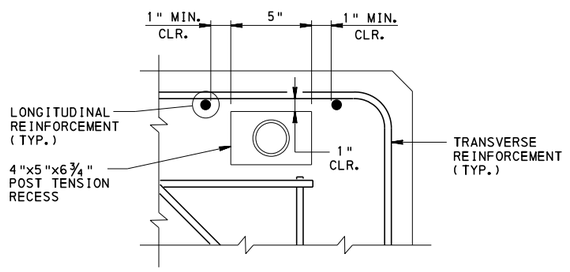
KEYED CONSTRUCTION JOINT



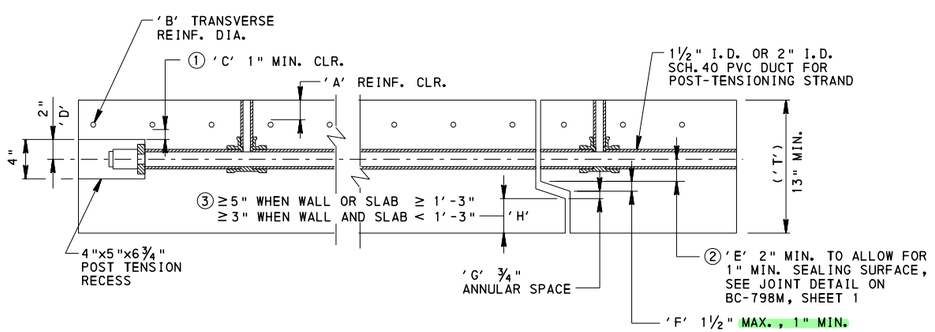
CONSTRUCTION JOINT DETAIL



ALTERNATE SHIP-LAP CONSTRUCTION JOINT



DETAIL F



CONFIGURATION FOR SLAB/WALL WITH POST-TENSIONING

MIN. SLAB/WALL THICKNESS ('T') DETERMINED TO ENSURE THE MIN. REQUIREMENTS ①②&③ ARE MET.

MIN. SLAB/WALL THICKNESS:
T = A + B + C + D + E + F + G + H

NOTE: PLACE POST-TENSIONING DUCTS ONLY IN CORNER HAUNCHES WHEN WALL THICKNESSES ARE <13".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

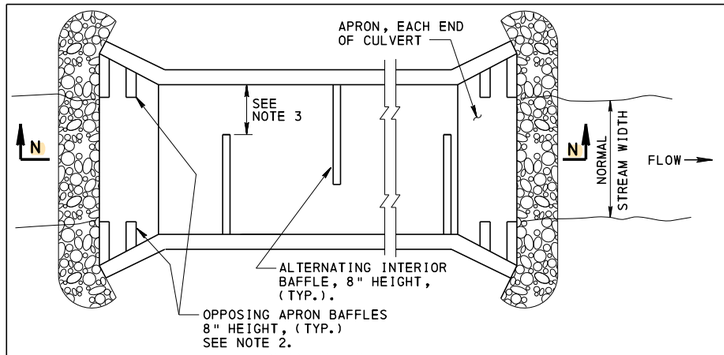
STANDARD
R.C. BOX CULVERT
MISCELLANEOUS DETAILS
PRECAST

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

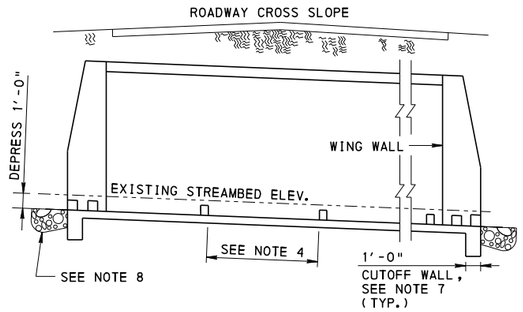
RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 10 OF 16

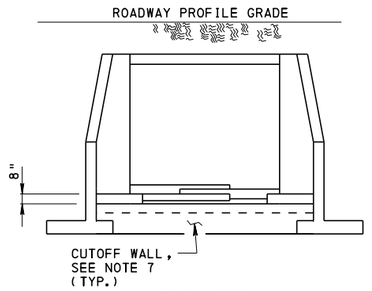
BD-632M



PLAN VIEW

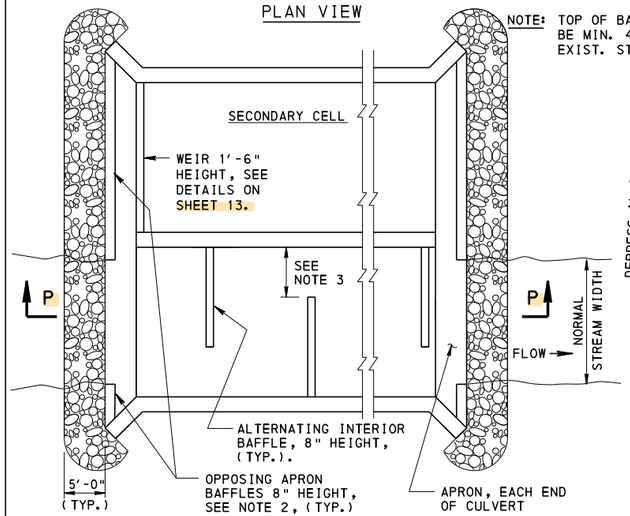


SECTION N-N

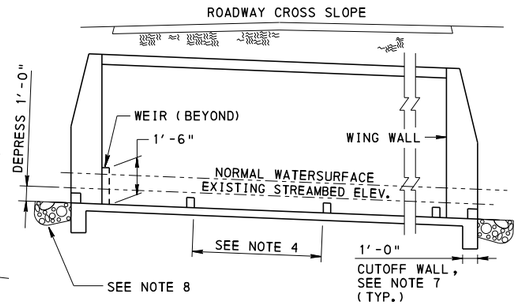


ELEVATION

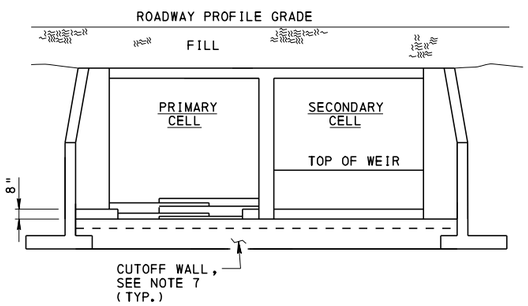
BOX CULVERTS



PLAN VIEW

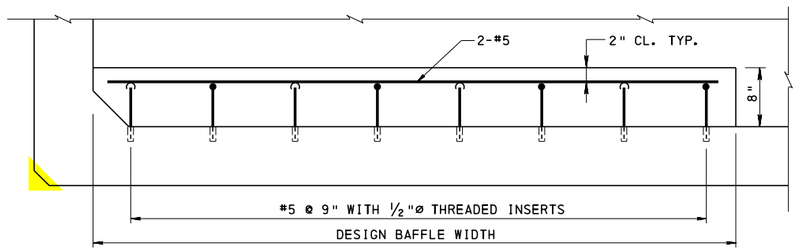


SECTION P-P

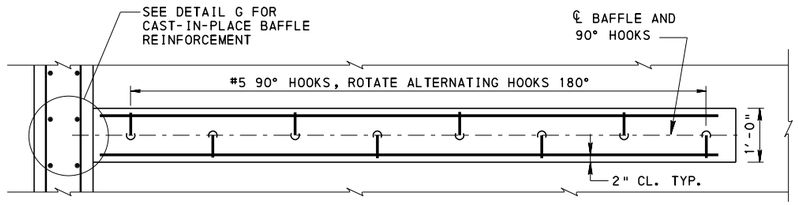


ELEVATION

TWIN CELL BOX CULVERTS



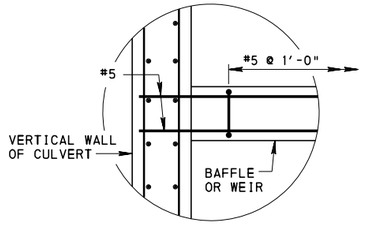
PROFILE



PLAN

TYPICAL BAFFLE

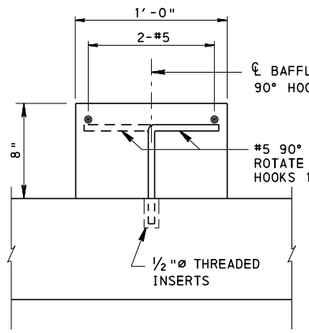
PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT SIMILAR EXCEPT AS NOTED ON THIS STANDARD.



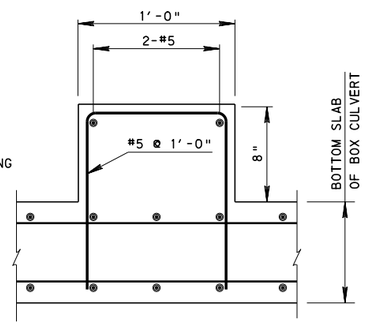
PLAN

DETAIL G

CAST-IN-PLACE BAFFLE/WEIR REINFORCEMENT



PRECAST BOX CULVERT
TYPICAL BAFFLE DETAIL



CAST-IN-PLACE BOX CULVERT
ALTERNATE BAFFLE DETAIL

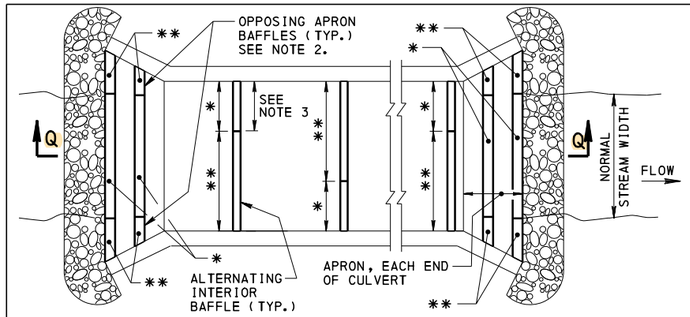
DESIGN NOTES:

1. THE BAFFLE SPACING AND OPENINGS SHOULD BE BASED ON THE NORMAL CHANNEL WIDTH UPSTREAM AND DOWNSTREAM OF THE STRUCTURE (I.E. EDGE OF WATER TO EDGE OF WATER DURING NORMAL FLOW). AT LEAST THREE (3) MEASUREMENTS SHOULD BE TAKEN UPSTREAM AND DOWNSTREAM OF THE STRUCTURE WHERE THE STREAM EXHIBITS NORMAL, STABLE CONDITIONS. AN AVERAGE OF THOSE SIX (6) MEASUREMENTS SHOULD THEN BE USED FOR THE BAFFLE CONFIGURATIONS.
   - MEASUREMENTS SHOULD NOT BE TAKEN WHERE THE CHANNEL HAS BEEN AFFECTED BY THE STRUCTURE OR SHOW SIGNS OF EROSION. BAFFLE CONFIGUATIONS SHOULD BE BASED ON NORMAL STREAM WIDTH (NOT TOP OF BANK TO TOP OF BANK OR WIDTH OF THE CULVERT).
2. THE OPENING IN THE APRON BAFFLES SHOULD BE EQUAL TO AVERAGE NORMAL WIDTH OF THE STREAM. THE APRON BAFFLES SHOULD CONNECT TO THE WINGWALLS AT EACH SIDE OF THE CULVERT. PLACE THE FIRST SET OF BAFFLES AT THE END OF THE APRON. IF THE APRON IS GREATER THAN 8'-0" LONG, A SECOND SET OF OPPOSING BAFFLES ARE REQUIRED TO BE SET AT 1/2 THE DISTANCE FROM THE END BAFFLE TO THE FACE OF THE BOX. FOR LONGER APRONS, BAFFLES NOT TO EXCEED 8'-0" SPACING.
3. THE OPENING IN THE INTERIOR BAFFLES SHOULD BE EQUAL TO 1/3 THE AVERAGE NORMAL WIDTH OF THE STREAM.
4. BAFFLES SHOULD BE SPACED AT THE AVERAGE NORMAL STREAM WIDTH OR 8', WHICHEVER IS GREATER. THE FIRST INTERIOR BAFFLE AT THE OUTLET SHOULD BE LOCATED AS CLOSE TO THE DOWNSTREAM END OF CULVERT AS POSSIBLE AND SPACED ACCORDINGLY FROM THAT POINT TO THE INLET.
5. IF BAFFLE SPACING NEEDS ADJUSTED DUE TO BOX SEGMENTS, THE SPACING SHOULD BE SHORTER NOT LONGER THAN CALCULATED SPACING.
6. THERE MAY BE UNUSUAL CIRCUMSTANCES IN WHICH THE STANDARD LAYOUT FOR BAFFLES WILL NOT ADEQUATELY ACCOMMODATE FISH PASSAGE. IN THESE CASES, THE PENNSYLVANIA FISH AND BOAT COMMISSION MUST PROVIDE SPECIFIC DESIGN GUIDANCE DURING PRELIMINARY DESIGN.
7. CUTOFF WALL IS TO ENSURE STREAMFLOW DOES NOT PASS BENEATH THE CULVERT. BOTTOM OF CUTOFF WALL IS TO EQUAL WING WALL FOOTINGS OR ROCK LINING WHICHEVER IS DEEPER 3'-6" MIN.
8. ROCK LINING AT THE INLET AND OUTLET SHOULD BE DEPRESSED THE ENTIRE LENGTH AND CHOKED WITH NATURAL STREAMBED MATERIAL. THE ROCK SHOULD BE FLUSH WITH THE CULVERT BOTTOM, NOT THE TOP OF THE BAFFLES. STREAMBED MATERIAL SALVAGED FROM EXCAVATION FOR THE BOX CULVERT SHOULD BE PLACED ON TOP OF THE ROCK LINING AND APRON TO THE MAXIMUM HEIGHT OF THE TOP OF THE BAFFLE TO THE LIMIT OF THE ROCK LINING TO FACILITATE THE DEVELOPEMENT OF A NATURAL STREAM BOTTOM IF FEASIBLE.
9. THE SLOPE OF THE NEW STRUCTURE SHOULD MATCH THE NATURAL STREAM SLOPE.
10. ADDITIONAL TWIN CELL DETAILS ARE SHOWN ON SHEET 12.
11. BAFFLES MAY BE SKEWED RELATIVE TO THE DIRECTION OF FLOW IN ORDER TO BE PARALLEL TO THE SECTION ENDS.
12. AN ALTERNATE DOUBLE WEIR BAFFLE DESIGN AS PROVIDED BY THE PENNSYLVANIA FISH AND BOAT COMMISSION IS PREFERRED AND MAY BE REQUIRED FOR SLOPES GREATER THAN 2% OR FOR BOXES THAT ARE SIGNIFICANTLY WIDER THAN THE NORMAL CHANNEL.

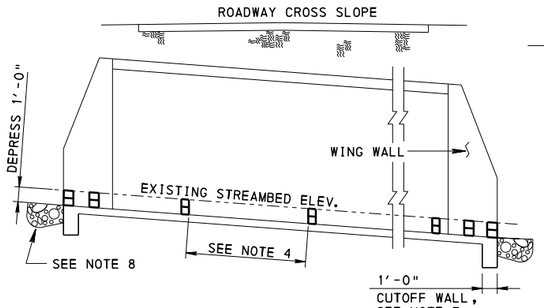
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD
R.C. BOX CULVERT
MISCELLANEOUS DETAILS
STREAM GRADES ≤ 2%

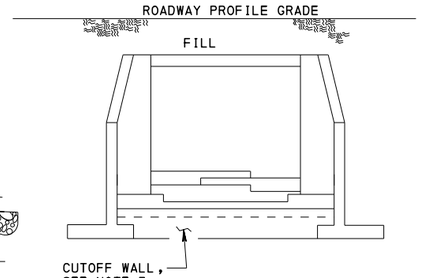
RECOMMENDED FEB. 14, 2023	RECOMMENDED FEB. 14, 2023	SHEET 11 OF 16
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-632M



PLAN VIEW

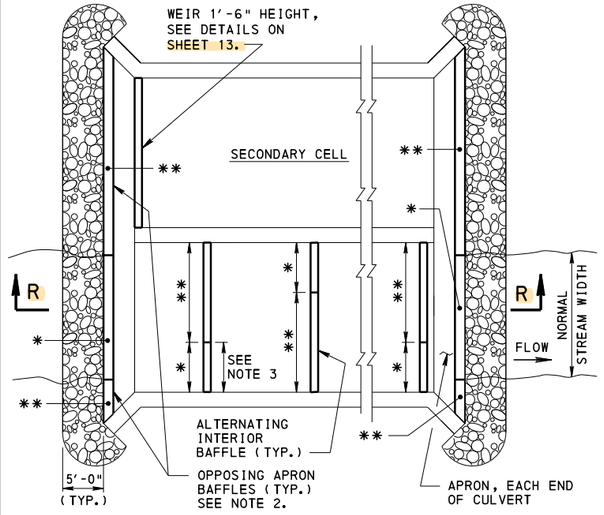


SECTION Q-Q

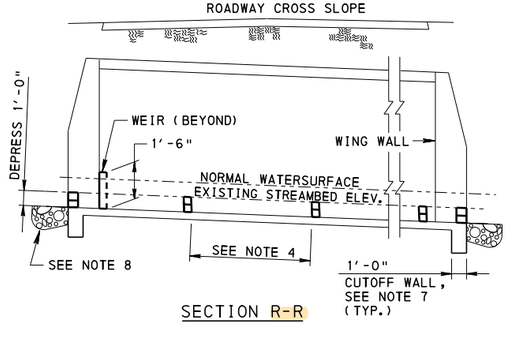


ELEVATION

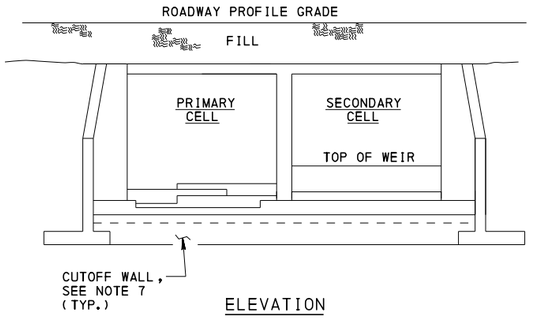
BOX CULVERTS



PLAN VIEW

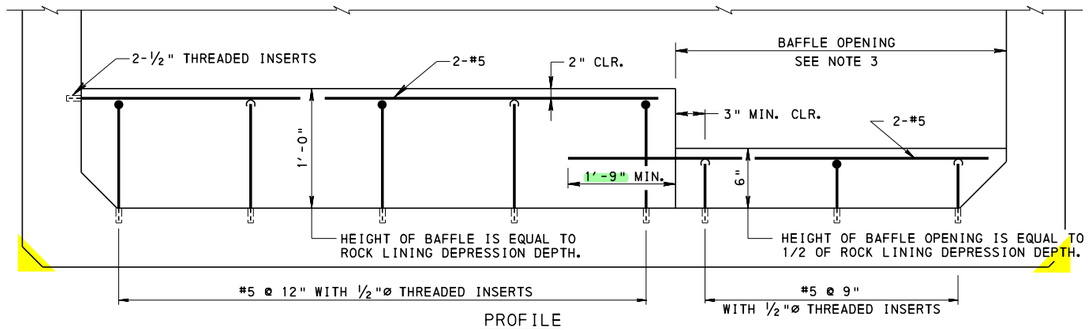


SECTION R-R

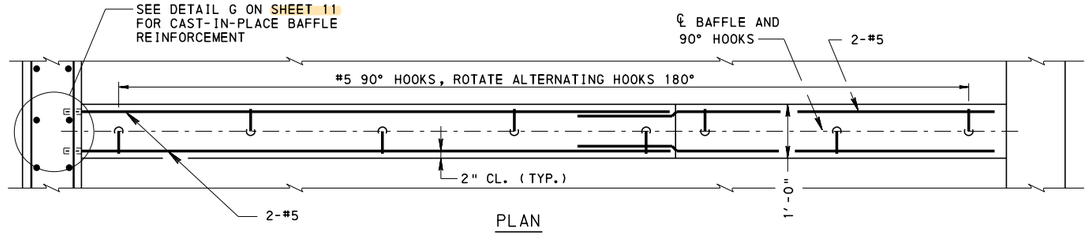


ELEVATION

TWIN CELL BOX CULVERTS



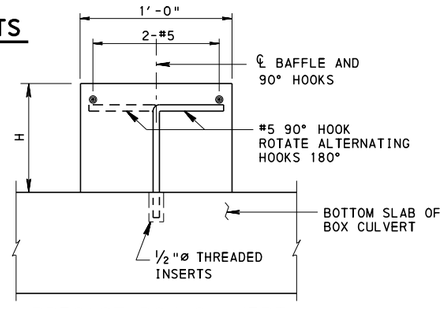
PROFILE



PLAN

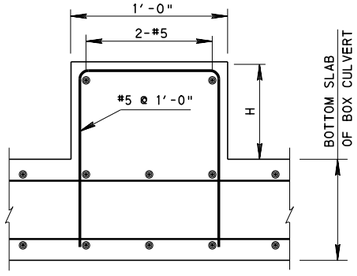
TYPICAL INTERIOR BAFFLE

PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT SIMILAR EXCEPT AS NOTED ON THIS STANDARD.



PRECAST BOX CULVERT TYPICAL BAFFLE DETAIL

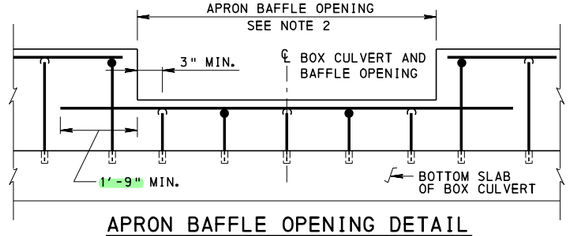
H = 1'-0" BAFFLE HEIGHT
6" BAFFLE HEIGHT AT OPENING



CAST-IN-PLACE BOX CULVERT ALTERNATE BAFFLE DETAIL

DESIGN NOTES:

1. THE BAFFLE SPACING AND OPENINGS SHOULD BE BASED ON THE NORMAL CHANNEL WIDTH UPSTREAM AND DOWNSTREAM OF THE STRUCTURE (I.E. EDGE OF WATER TO EDGE OF WATER DURING NORMAL FLOW). AT LEAST THREE (3) MEASUREMENTS SHOULD BE TAKEN UPSTREAM AND DOWNSTREAM OF THE STRUCTURE WHERE THE STREAM EXHIBITS NORMAL, STABLE CONDITIONS. AN AVERAGE OF THOSE SIX (6) MEASUREMENTS SHOULD THEN BE USED FOR THE BAFFLE CONFIGURATIONS.
   - MEASUREMENTS SHOULD NOT BE TAKEN WHERE THE CHANNEL HAS BEEN AFFECTED BY THE STRUCTURE OR SHOW SIGNS OF EROSION. BAFFLE CONFIGUATIONS SHOULD BE BASED ON NORMAL STREAM WIDTH (NOT TOP OF BANK TO TOP OF BANK OR WIDTH OF THE CULVERT).
2. THE OPENING IN THE APRON BAFFLES SHOULD BE EQUAL TO AVERAGE NORMAL WIDTH OF THE STREAM. THE APRON BAFFLES SHOULD CONNECT TO THE WINGWALLS AT EACH SIDE OF THE CULVERT. PLACE THE FIRST SET OF BAFFLES AT THE END OF THE APRON. IF THE APRON IS GREATER THAN 8'-0" LONG, A SECOND SET OF OPPOSING BAFFLES ARE REQUIRED TO BE SET AT ½ THE DISTANCE FROM THE END BAFFLE TO THE FACE OF THE BOX. FOR LONGER APRONS, BAFFLES NOT TO EXCEED 8'-0" SPACING.
3. THE OPENING IN THE INTERIOR BAFFLES SHOULD BE EQUAL TO 1/3 THE AVERAGE NORMAL WIDTH OF THE STREAM.
4. BAFFLES SHOULD BE SPACED AT THE AVERAGE NORMAL STREAM WIDTH OR 8', WHICHEVER IS GREATER. THE FIRST INTERIOR BAFFLE AT THE OUTLET SHOULD BE LOCATED AS CLOSE TO THE DOWNSTREAM END OF CULVERT AS POSSIBLE AND SPACED ACCORDINGLY FROM THAT POINT TO THE INLET.
5. IF BAFFLE SPACING NEEDS ADJUSTED DUE TO BOX SEGMENTS, THE SPACING SHOULD BE SHORTER NOT LONGER THAN CALCULATED SPACING.
6. THERE MAY BE UNUSUAL CIRCUMSTANCES IN WHICH THE STANDARD LAYOUT FOR BAFFLES WILL NOT ADEQUATELY ACCOMMODATE FISH PASSAGE. IN THESE CASES, THE PENNSYLVANIA FISH AND BOAT COMMISSION MUST PROVIDE SPECIFIC DESIGN GUIDANCE DURING PRELIMINARY DESIGN.
7. CUTOFF WALL IS TO ENSURE STREAMFLOW DOES NOT PASS BENEATH THE CULVERT. BOTTOM OF CUTOFF WALL IS TO EQUAL WING WALL FOOTINGS OR ROCK LINING WHICHEVER IS DEEPER 3'-6" MIN.
8. ROCK LINING AT THE INLET AND OUTLET SHOULD BE DEPRESSED THE ENTIRE LENGTH AND CHOKED WITH NATURAL STREAMBED MATERIAL. THE ROCK SHOULD BE FLUSH WITH THE CULVERT BOTTOM, NOT THE TOP OF THE BAFFLES. STREAMBED MATERIAL SALVAGED FROM EXCAVATION FOR THE BOX CULVERT SHOULD BE PLACED ON TOP OF THE ROCK LINING AND APRON TO THE MAXIMUM HEIGHT OF THE TOP OF THE BAFFLE TO THE LIMIT OF THE ROCK LINING TO FACILITATE THE DEVELOPEMENT OF A NATURAL STREAM BOTTOM IF FEASIBLE.
9. THE SLOPE OF THE NEW STRUCTURE SHOULD MATCH THE NATURAL STREAM SLOPE.
10. ADDITIONAL TWIN CELL DETAILS ARE SHOWN ON SHEET 12.
11. BAFFLES MAY BE SKEWED RELATIVE TO THE DIRECTION OF FLOW IN ORDER TO BE PARALLEL TO THE SECTION ENDS.
12. SEE NOTE 12 ON SHEET 11 FOR ALTERNATE BAFFLE DESIGN.



APRON BAFFLE OPENING DETAIL

APRON BAFFLE TYPICAL TO INTERIOR BAFFLE EXCEPT WHERE NOTED OTHERWISE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

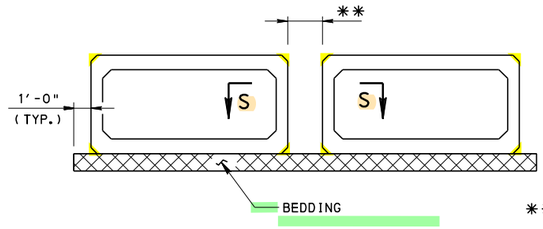
STANDARD
R.C. BOX CULVERT
MISCELLANEOUS DETAILS
STREAM GRADES > 2%

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

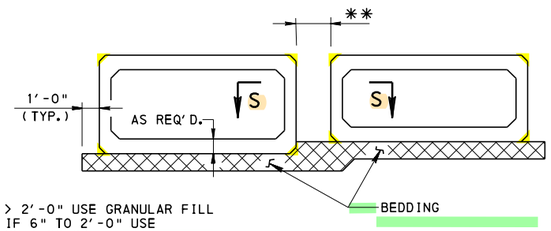
SHEET 12 OF 16

BD-632M



TYP. PRECAST SECTION (NORMAL)

SYMMETRICAL

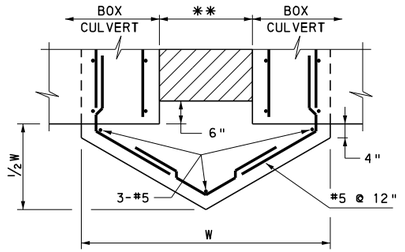


** IF > 2'-0" USE GRANULAR FILL
OR IF 6" TO 2'-0" USE
CLASS A CONCRETE.

NOTE:
DO NOT PLACE R.C. BOX CULVERTS
< 6" APART.

TYP. PRECAST SECTION (NORMAL)

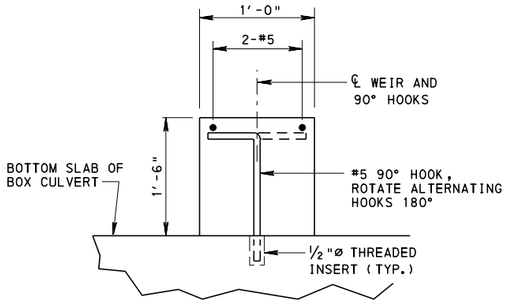
UNSYMMETRICAL - OPTION TO WEIR



NOTE: THREADED INSERTS MAY
BE USED AS AN ALTERNATE TO
BAR LAPS FOR #5 REINFORCEMENT.

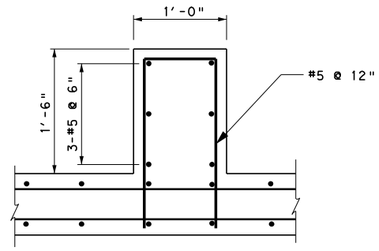
SECTION S-S

CONCRETE PLUG



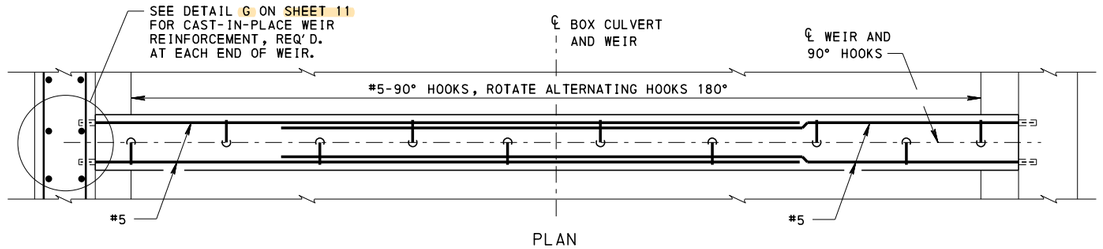
PRECAST BOX CULVERT
TYPICAL WEIR DETAIL

ALL STREAM GRADES

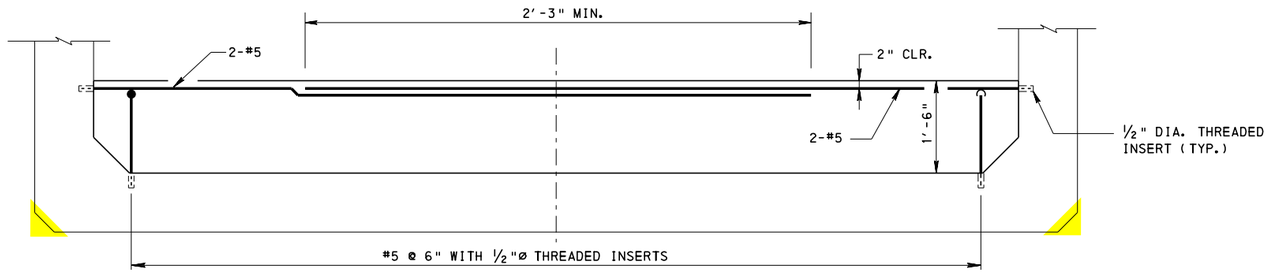


CAST-IN-PLACE BOX CULVERT
ALTERNATE WEIR DETAIL

ALL STREAM GRADES



PLAN



PROFILE

WEIR DETAIL

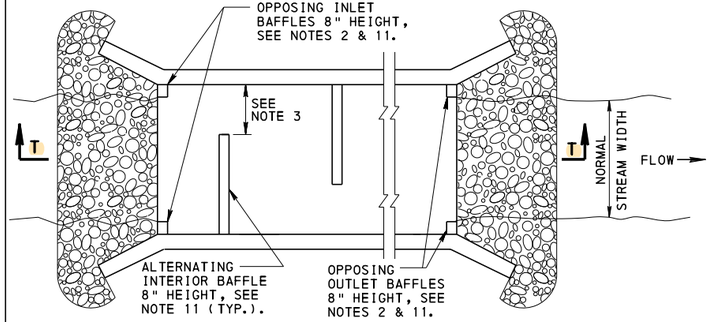
PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT
SIMILAR EXCEPT AS NOTED ON THIS STANDARD.

DESIGN NOTE:
THERE MAY BE UNUSUAL CIRCUMSTANCES IN WHICH THE STANDARD LAYOUT FOR BAFFLES WILL NOT ADEQUATELY ACCOMMODATE FISH PASSAGE. IN THESE CASES, THE PENNSYLVANIA FISH AND BOAT COMMISSION MUST PROVIDE SPECIFIC DESIGN GUIDANCE DURING PRELIMINARY DESIGN.

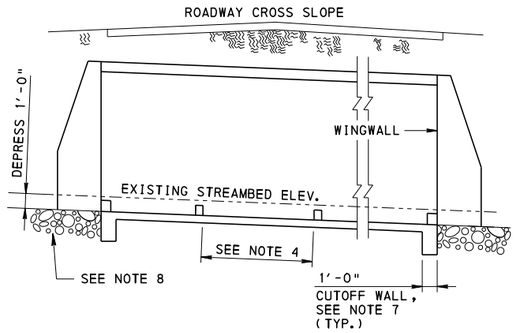
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD
R.C. BOX CULVERT
MISCELLANEOUS TWIN CELL DETAILS

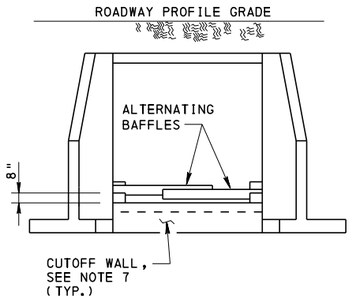
RECOMMENDED FEB. 14, 2023 CHIEF BRIDGE ENGINEER	RECOMMENDED FEB. 14, 2023 Gavin E. Gray CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 13 OF 16 BD-632M



PLAN VIEW



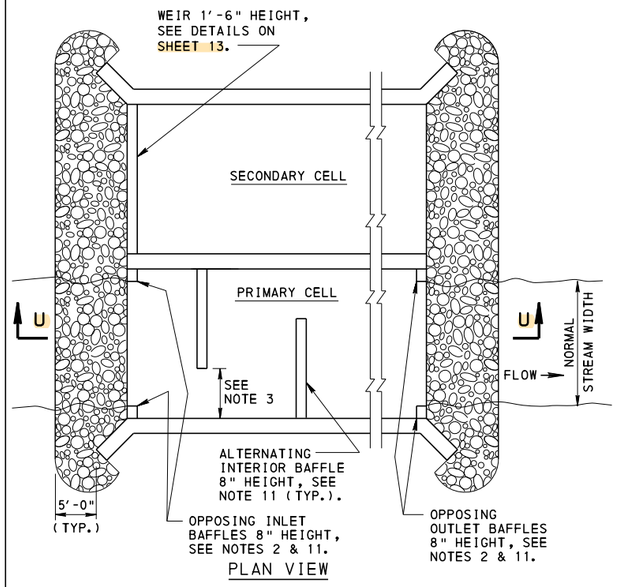
SECTION T-T



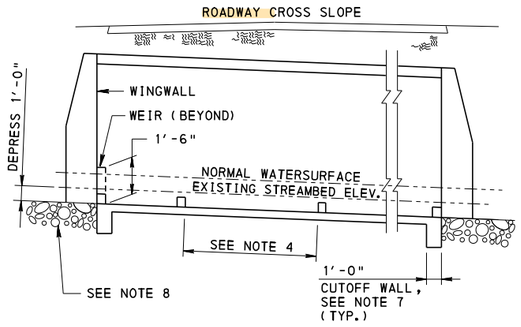
ELEVATION

NOTE: TOP OF BAFFLE SHALL BE MIN. 4" BELOW EXIST. STREAMBED ELEV.

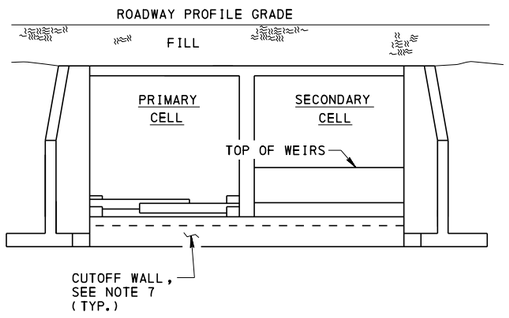
BOX CULVERTS



PLAN VIEW

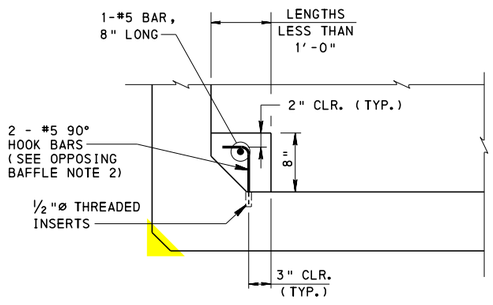


SECTION U-U



ELEVATION

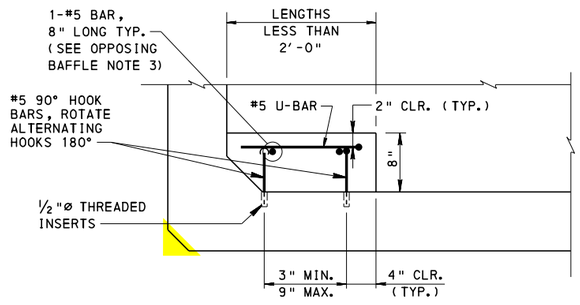
TWIN CELL BOX CULVERTS



OPPOSING BAFFLES LESS THAN 1'-0"

OPPOSING BAFFLE NOTES:

1. PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT SIMILAR EXCEPT AS NOTED ON SHEET 11.
2. FOR OPPOSING BAFFLES LESS THAN 1'-0", CAST ADJACENT INSERTS 7" ON CENTER FOR THE 2 - #5 90° HOOK BARS.
3. FOR OPPOSING BAFFLES LESS THAN 2'-0", REPLACE 2-#5 BARS WITH A #5 U-BAR SUPPORTED BY 8" LONG #5 BARS TIED TO ALTERNATING #5 90° HOOK BARS.



OPPOSING BAFFLES LESS THAN 2'-0"

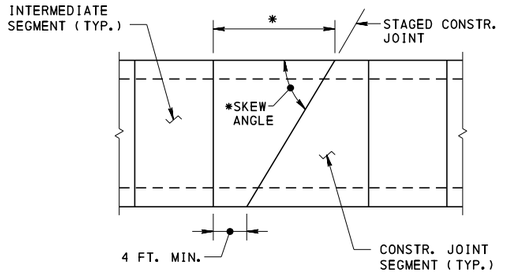
DESIGN NOTES:

1. THE BAFFLE SPACING AND OPENINGS SHOULD BE BASED ON THE NORMAL CHANNEL WIDTH UPSTREAM AND DOWNSTREAM OF THE STRUCTURE (I.E. EDGE OF WATER TO EDGE OF WATER DURING NORMAL FLOW). AT LEAST THREE (3) MEASUREMENTS SHOULD BE TAKEN UPSTREAM AND DOWNSTREAM OF THE STRUCTURE WHERE THE STREAM EXHIBITS NORMAL, STABLE CONDITIONS. AN AVERAGE OF THOSE SIX (6) MEASUREMENTS SHOULD THEN BE USED FOR THE BAFFLE CONFIGURATIONS.
   - MEASUREMENTS SHOULD NOT BE TAKEN WHERE THE CHANNEL HAS BEEN AFFECTED BY THE STRUCTURE OR SHOW SIGNS OF EROSION. BAFFLE CONFIGUATIONS SHOULD BE BASED ON NORMAL STREAM WIDTH (NOT TOP OF BANK TO TOP OF BANK OR WIDTH OF THE CULVERT).
2. OPPOSING BAFFLES SHOULD BE PLACED AT THE INLET AND THE OUTLET ENDS OF THE CULVERT. THE BAFFLE OPENING SHOULD BE A DISTANCE EQUAL TO THE AVERAGE NORMAL WIDTH OF THE STREAM.
3. THE OPENING IN THE INTERIOR BAFFLES SHOULD BE A DISTANCE EQUAL TO 1/3 THE AVERAGE NORMAL WIDTH OF THE STREAM.
4. INTERIOR BAFFLES SHOULD BE SPACED AT A DISTANCE EQUAL TO THE AVERAGE NORMAL STREAM WIDTH OR 8', WHICHEVER IS GREATER AND BE SPACED EVENLY BETWEEN THE INLET AND OUTLET BAFFLES.
5. IF BAFFLE SPACING NEEDS ADJUSTED DUE TO BOX SEGMENTS, THE SPACING SHOULD BE SHORTER NOT LONGER THAN CALCULATED SPACING.
6. THERE MAY BE UNUSUAL CIRCUMSTANCES IN WHICH THE STANDARD LAYOUT FOR BAFFLES WILL NOT ADEQUATELY ACCOMMODATE FISH PASSAGE. IN THESE CASES, THE PENNSYLVANIA FISH AND BOAT COMMISSION MUST PROVIDE SPECIFIC DESIGN GUIDANCE DURING PRELIMINARY DESIGN.
7. CUTOFF WALL IS TO ENSURE STREAMFLOW DOES NOT PASS BENEATH THE CULVERT. BOTTOM OF CUTOFF WALL IS TO EQUAL WING WALL FOOTINGS OR ROCK LINING WHICHEVER IS DEEPER 3'-6" MIN.
8. ROCK LINING AT THE INLET AND OUTLET SHOULD BE DEPRESSED THE ENTIRE LENGTH AND CHOKED WITH NATURAL STREAMBED MATERIAL. THE ROCK SHOULD BE FLUSH WITH THE CULVERT BOTTOM, NOT THE TOP OF THE BAFFLES. STREAMBED MATERIAL SALVAGED FROM EXCAVATION FOR THE BOX CULVERT SHOULD BE PLACED ON TOP OF THE ROCK LINING TO THE MAXIMUM HEIGHT OF THE TOP OF THE BAFFLE TO THE LIMIT OF THE ROCK LINING TO FACILITATE THE DEVELOPEMENT OF A NATURAL STREAM BOTTOM IF FEASIBLE.
9. THE SLOPE OF THE NEW STRUCTURE SHOULD MATCH THE NATURAL STREAM SLOPE.
10. ADDITIONAL TWIN CELL DETAILS ARE SHOWN ON SHEET 13.
11. FOR TYPICAL BAFFLE PLAN, PROFILE AND REINFORCEMENT DETAILS, SEE SHEET 11.
12. AN ALTERNATE DOUBLE WEIR BAFFLE DESIGN AS PROVIDED BY THE PENNSYLVANIA FISH AND BOAT COMMISSION IS PREFERRED AND MAY BE REQUIRED FOR SLOPES GREATER THAN 2% OR FOR BOXES THAT ARE SIGNIFICANTLY WIDER THAN THE NORMAL CHANNEL.

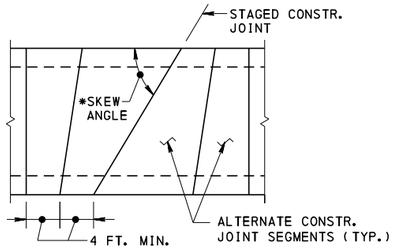
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD
R.C. BOX CULVERT WITHOUT APRONS
MISCELLANEOUS DETAILS
STREAM GRADES ≤ 2%

RECOMMENDED FEB. 14, 2023	RECOMMENDED FEB. 14, 2023	SHEET 14 OF 16
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-632M

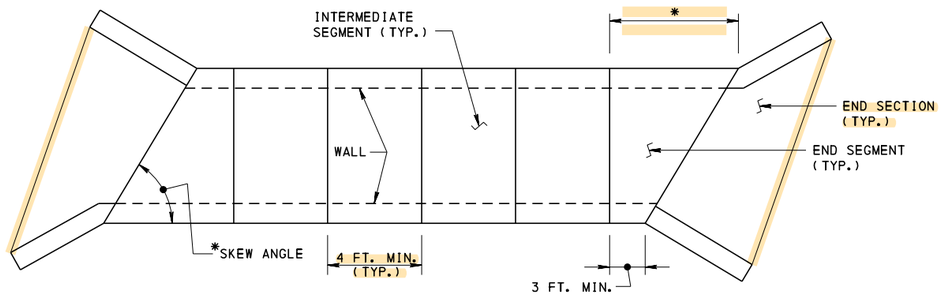


STAGED CONSTRUCTION JOINT DETAIL

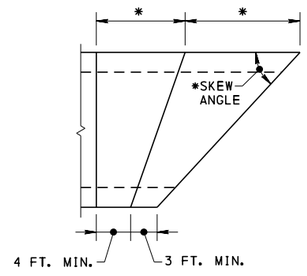


ALTERNATE STAGED CONSTRUCTION JOINT DETAIL

NOTE: DUAL CONSTRUCT JT. SEGMENTS SHOWN EACH SIDE OF JOINT; MORE THAN TWO CONSTR JT. SEGMENTS SIMILAR.



PLAN VIEW



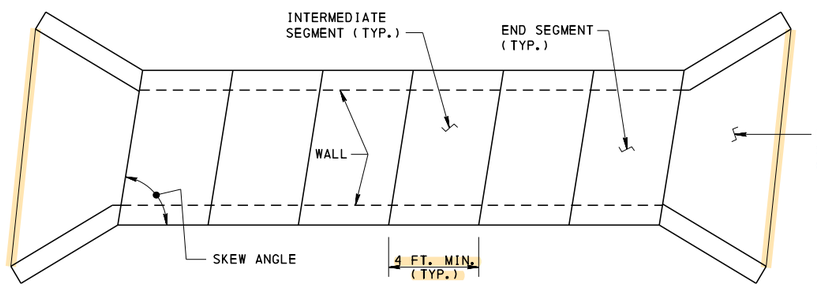
ALTERNATE END SEGMENTS DETAIL

NOTE: DUAL END SEGMENTS SHOWN; MORE THAN TWO END SEGMENTS SIMILAR.

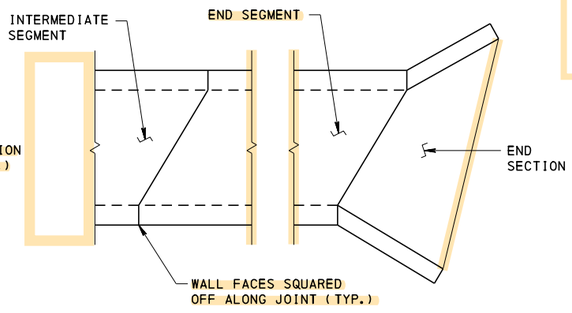
NOTE: AT THE SHOP DRAWING STAGE, THE FABRICATOR MAY SUBMIT ANY OPTION ON THIS STANDARD. IF THE OPTION SUBMITTED MEETS THE DESIGN, THE OPTION SHOULD BE ACCEPTED.

STANDARD SQUARED SEGMENT JOINTS

* SEE NOTE 2 AND FABRICATION LIMITATIONS THIS SHEET



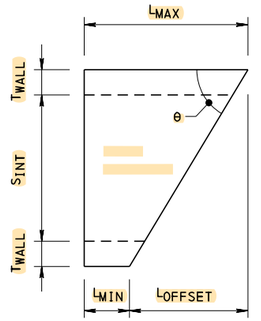
PLAN VIEW - SKEW ANGLE ≥ 75 DEG.



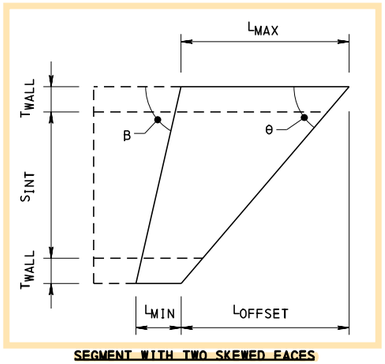
PARTIAL PLAN VIEW - SKEW ANGLE < 75 DEG.

ALTERNATE SKEWED SEGMENT JOINTS

FABRICATION LIMITATIONS



SEGMENT WITH ONE SKEWED FACE



SEGMENT WITH TWO SKEWED FACES

S_{INT} = INTERIOR CLEAR SPAN

T_{WALL} = WALL THICKNESS

W = OUT-TO-OUT WIDTH OF CULVERT = S_{INT} +2(T_{WALL})

L_{MAX} = MAXIMUM EXTERIOR LENGTH OF SEGMENT = H_{MOLD} - 4IN.

L_{MIN} = MINIMUM ALLOWED EXTERIOR LENGTH OF SEGMENT, SEE DETAILS ON THIS SHEET

L_{OFFSET} = OFFSET BETWEEN LONG AND SHORT SIDES

= L_{MAX} - L_{MIN} FOR SEGMENT WITH ONE SQUARE FACE

= L_{MAX} + (W/TAN β)- L_{MIN} FOR SEGMENT WITH TWO SKEWED FACES

H_{MOLD} = HEIGHT OF STEEL FORMING SYSTEM (TYPICALLY 8 FT. OR 10 FT.)

θ_{MIN} = MINIMUM SKEW ANGLE = 90 DEG. - ATAN (L_{OFFSET}/W)

β = SECONDARY SKEW ANGLE (IF BOTH FACES ARE SKEWED)

EXAMPLE CALCULATION - MINIMUM SKEW ANGLE

CALCULATE THE MINIMUM SKEW ANGLE THAT CAN BE FABRICATED WITH AN 8 FT. MOLD FOR AN END SEGMENT WITH SQUARED JOINT, S_{INT} = 10 FT., AND T_{WALL} = 12IN.

W = S_{INT} + 2(T_{WALL}) = 10FT. + 2(1FT.) = 12FT.

L_{MAX} = H_{MOLD} - 4IN. = 8FT. - 4IN. = 7.67FT.

L_{MIN} = 3FT. (END SEGMENT)

L_{OFFSET} = L_{MAX} - L_{MIN} = 7.667 FT. - 3FT. = 4.667FT

θ_{MIN} = 90 DEG. - ATAN (L_{OFFSET}/W) = 90 DEG. - ATAN(4.667 FT./12FT.) = 68.75 DEG.

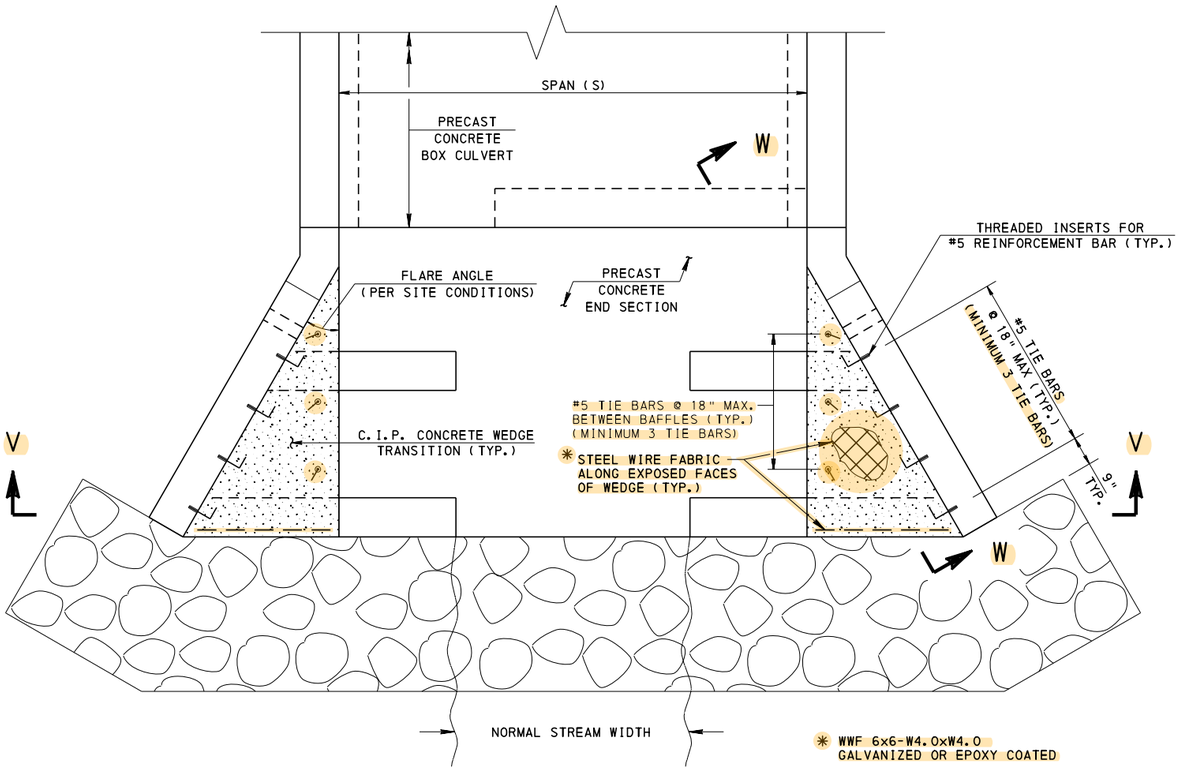
DESIGN NOTES

1. SQUARED SEGMENT JOINTS ARE PREFERRED DUE TO POST-TENSIONING EFFECTS. AT A MINIMUM, WALL FACES MUST BE SQUARED AT SEGMENT JOINTS FOR CULVERT SKEWS ANGLES LESS THAT 75 DEGREES.
2. THE MINIMUM SKEW ANGLE OF A CULVERT IS THE GREATER OF 35 DEGREES AND THE FABRICATION LIMIT AS ILLUSTRATED IN THE FABRICATION LIMITATIONS ON THIS SHEET.
3. THE MINIMUM SEGMENT LENGTH IS 4 FT. EXCEPT AS NOTED.
4. WHEN USING THE STANDARD SQUARED JOINTS, TWO OR MORE SEGMENTS ARE PERMITTED TO BE USED TO TRANSITION FROM THE SQUARED JOINTS TO THE SKEWED ENDS AND CONSTRUCTION JOINTS.

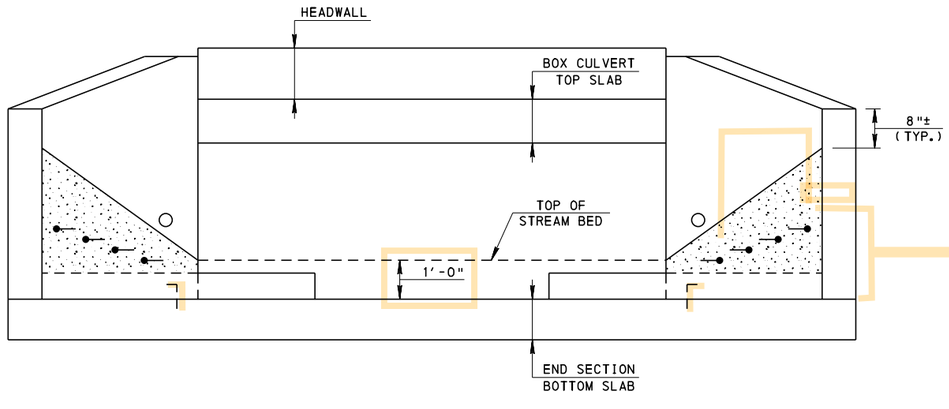
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD R.C. BOX CULVERT PRECAST CONCRETE SEGMENT JOINT DETAILS

RECOMMENDED FEB. 14, 2023	RECOMMENDED FEB. 14, 2023	SHEET 15 OF 16
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-632M



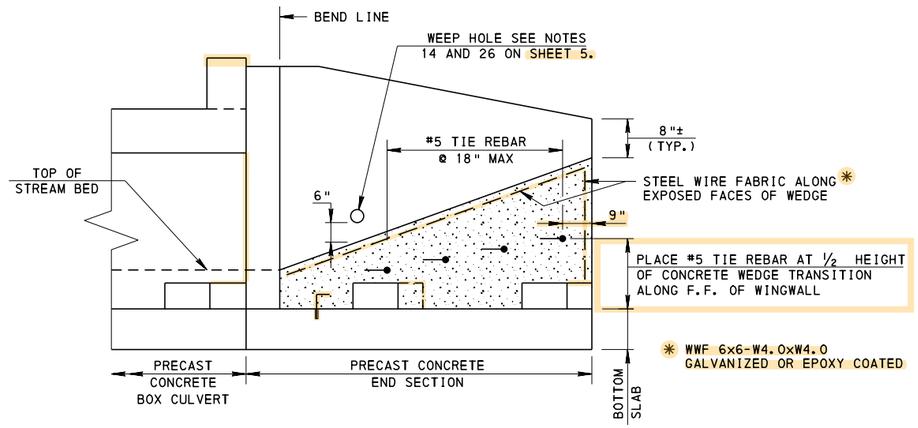
TYPICAL PLAN
NO SCALE



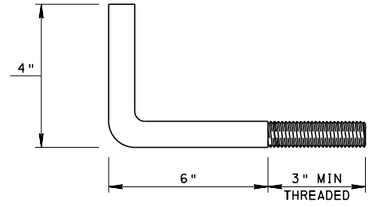
SECTION V-V
NO SCALE
(STEEL WIRE FABRIC ALONG EXPOSED FACES OF WEDGES NOT SHOWN)

DESIGN NOTES:

1. THE LAYOUT OF THE CONCRETE SLOPE TRANSITIONS SHOULD BE BASED ON THE REQUIRED GRADING AROUND THE WING WALLS.
2. CONSTRUCT CONCRETE SLOPE TRANSITIONS USING CLASS A CEMENT CONCRETE.
3. USE THIS DETAIL IN COORDINATION WITH THE DEPARTMENT OF ENVIRONMENTAL PROTECTION AND THE PENNSYLVANIA FISH AND BOAT COMMISSION DURING PRE-APP MEETING.



SECTION W-W
NO SCALE



#5 TIE BAR DETAIL
NO SCALE

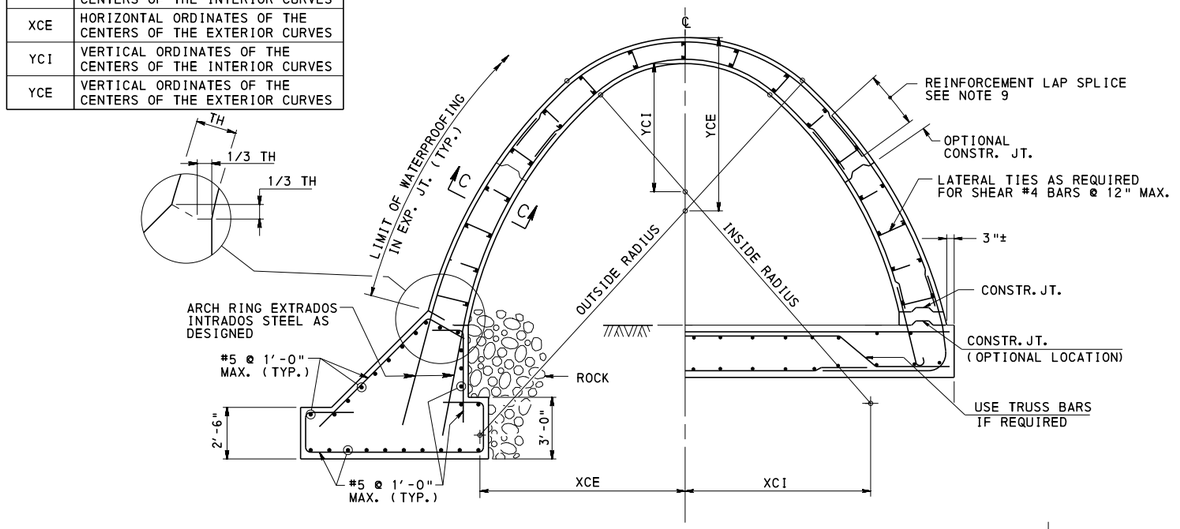
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD PRECAST BOX CULVERT WITH APRONS C.I.P CONCRETE WEDGE TRANSITION

RECOMMENDED FEB. 14, 2023 CHIEF BRIDGE ENGINEER	RECOMMENDED FEB. 14, 2023 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 16 OF 16
		BD-632M

CHANGE 2

MARK	DESCRIPTION
XCI	HORIZONTAL ORDINATES OF THE CENTERS OF THE INTERIOR CURVES
XCE	HORIZONTAL ORDINATES OF THE CENTERS OF THE EXTERIOR CURVES
YCI	VERTICAL ORDINATES OF THE CENTERS OF THE INTERIOR CURVES
YCE	VERTICAL ORDINATES OF THE CENTERS OF THE EXTERIOR CURVES



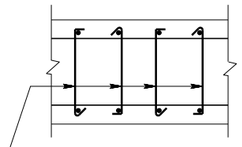
FIXED ARCH

TIED ARCH

(LOW FLOW TREATMENT NOT SHOWN)

TYPICAL ARCH SECTION

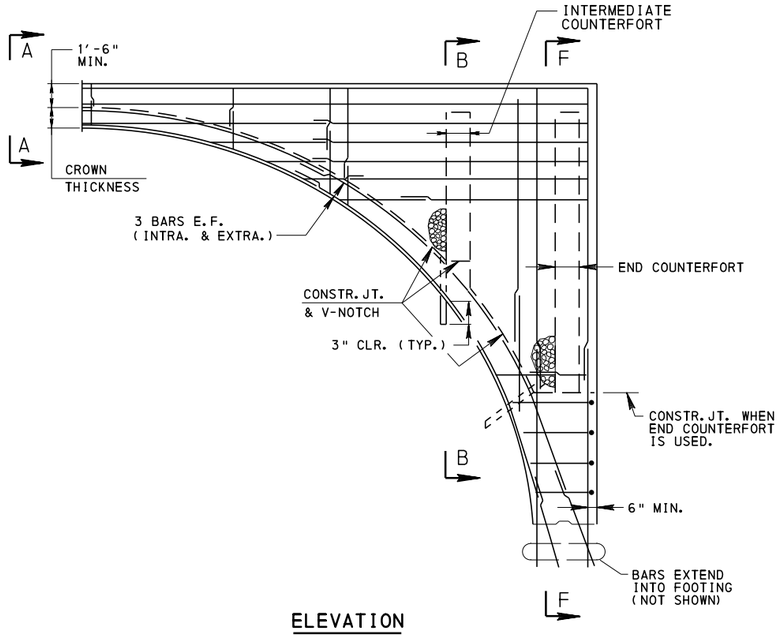
(WEEPHOLES NOT SHOWN, SEE ARCH WEEPHOLE DETAIL)



#4 BAR TIES, ALTERNATE INTERSECTIONS OF LONGITUDINAL & TRANSVERSE BARS AND STAGGER (TYP.)

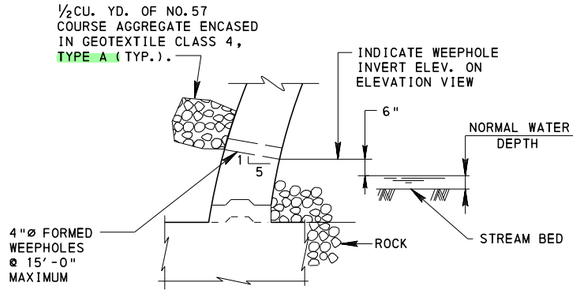
SECTION C-C

(TIE DETAIL)



ELEVATION

ARCH RING AND SPANDREL WALL DETAIL



ARCH WEEPHOLE DETAIL

GENERAL NOTES

1. DESIGN SPECIFICATIONS: AASHTO LRFD "BRIDGE DESIGN SPECIFICATIONS" AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
2. PROVIDE MATERIALS AND WORK QUALITY IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATIONS AS OUTLINED IN THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
3. PROVIDE 2" CONCRETE COVER ON REINFORCEMENT BARS EXCEPT AS NOTED.
4. FOR LOW FLOW FISH PASSAGE DESIGN, REFER TO BD-632M.
5. INDICATE FACTORED FOUNDATION RESISTANCE AND MAXIMUM DESIGN FOUNDATION PRESSURE.
6. PLACE HEADWALL AND WINGWALL FOOTINGS BELOW SCOUR DEPTH OR FROST DEPTH WHICHEVER IS GREATER.
7. SEE SHEET 2 FOR SECTION DETAILS.
8. MINIMUM FILL OVER CONCRETE ARCHES IS 12" OR SPAN LENGTH/8, WHICH EVER IS GREATER.
9. STAGGER ALL LAPS WITH A MINIMUM OF 1'-0" MEASURED ALONG THE CIRCUMFERENCE OF THE ARCH.
10. FOOTING DESIGN TO CONFORM TO AASHTO LRFD "BRIDGE DESIGN SPECIFICATIONS" AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
11. COUNTERFORT DESIGN REQUIRED FOR SPANDREL WALL OVER 8'-0".

INSTRUCTIONS

1. SPANS ≤ 15'-0" DESIGN WITH SEMI-CIRCULAR OR SEGMENTAL INTRADOS. SPANS > 15'-0" DESIGN WITH MULTI-CENTERED INTRADOS.
2. MINIMUM THICKNESS OF ARCH RING - 10" FOR SPANS ≤ 20'-0". 1'-0" FOR SPANS > 20'-0".
3. MINIMUM THICKNESS OF SKEWBACK ≥ 1.5 TIMES THE CROWN THICKNESS.
4. PLACE MAIN CIRCUMFERENTIAL REINFORCEMENT NORMAL TO THE CENTERLINE OF THE CULVERT.

DESIGN DATA

1. CONCRETE f'c = 3000 P.S.I. (CLASS A CEMENT CONCRETE)
2. REINFORCEMENT BARS fy = 60,000 P.S.I.

BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-631M	END WALL DETAILS
BD-632M	R.C. BOX CULVERT
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

R.C. ARCH CULVERT

DETAILS

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 2

BD-633M

NOTE:

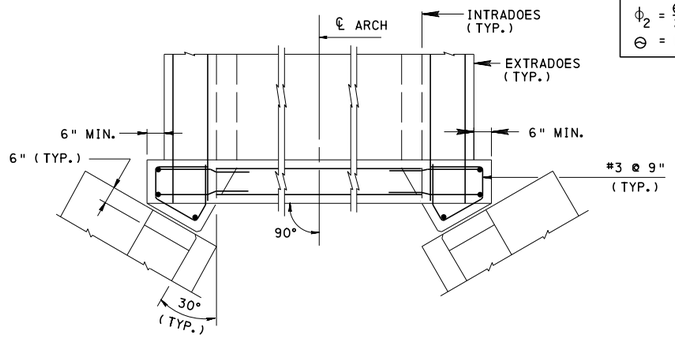
ϕ_1 = 30° FOR $\Theta \geq 60°$

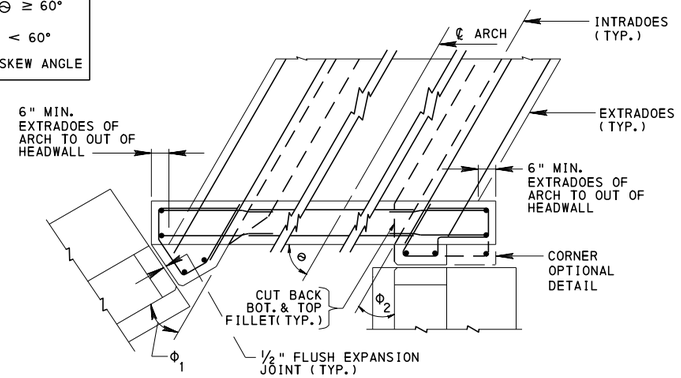
ϕ_1 = 90° Θ FOR $\Theta < 60°$

ϕ_2 = 30° FOR $\Theta \geq 60°$

$\phi_2 = \frac{\Theta}{2}$ FOR $\Theta < 60°$

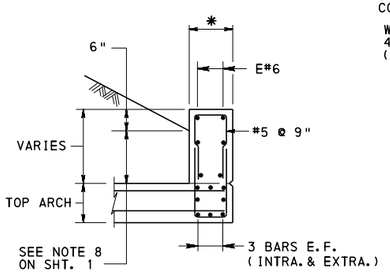
Θ = DENOTES SKEW ANGLE





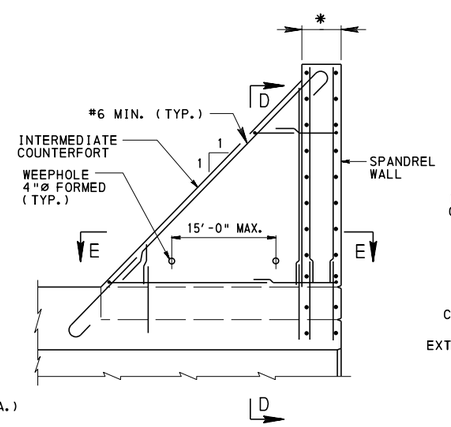
TYPICAL CULVERT HEADWALL DETAILS - FIXED AND TIED ARCH

(APRON NOT SHOWN)
PROVIDE CONCRETE APRON AT INLET AND OUTLET.



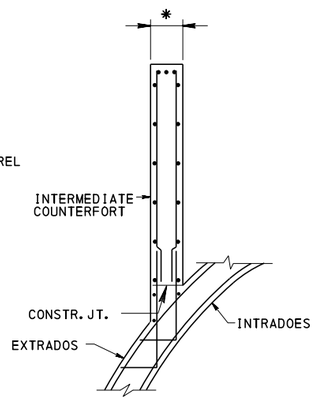
SECTION A-A

AT TOP OF ARCH RING

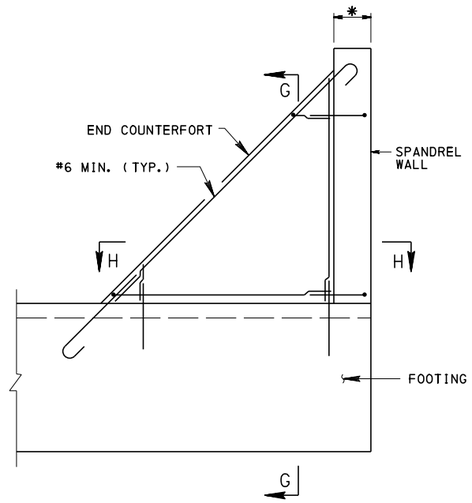


SECTION B-B

INTERMEDIATE COUNTERFORT

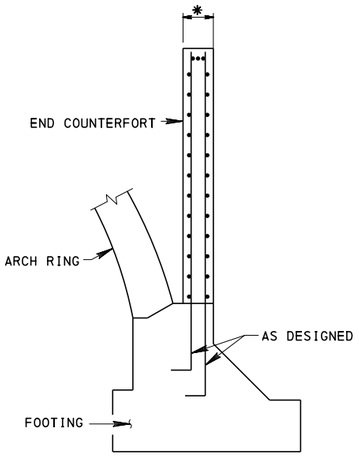


SECTION D-D

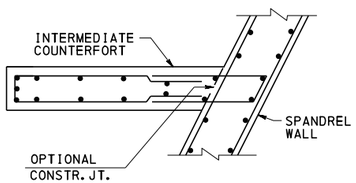


SECTION F-F

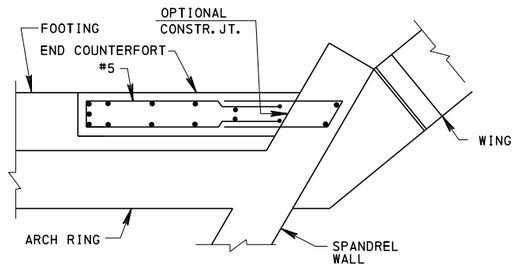
COUNTERFORT



SECTION G-G



SECTION E-E



SECTION H-H

TYPICAL SPANDREL WALL DETAILS

(SHOWING REINFORCEMENT BARS LAYOUT.)
* 1'-6" MINIMUM OR AS REQ'D.

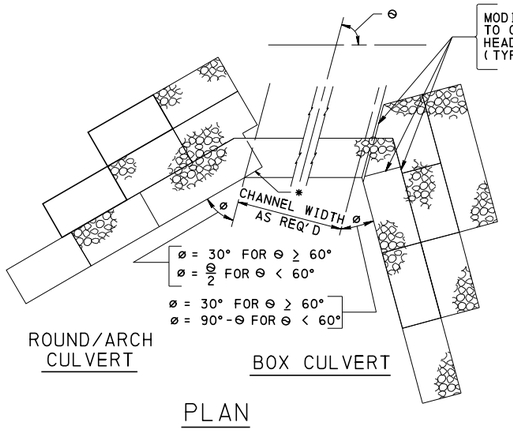
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

R. C. ARCH CULVERT

DETAILS

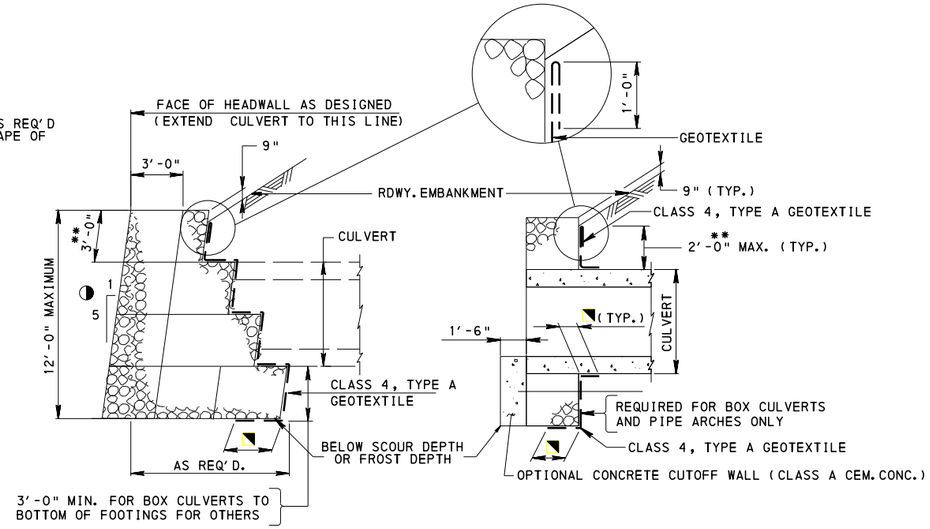
RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 2 OF 2
		BD-633M



ROUND/ARCH CULVERT

BOX CULVERT

PLAN



ADJACENT TO CULVERT

THRU CULVERT

TYPICAL SECTIONS

GENERAL NOTES

1. DESIGN SPECIFICATIONS: AASHTO LRFD "BRIDGE DESIGN SPECIFICATION" AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
2. PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATIONS AS OUTLINED IN THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
3. SUBMIT DESIGN COMPUTATIONS & DETAIL DRAWINGS SHOWING PROPOSED GABION LAYOUT IF GABION ENDWALLS ARE PERMITTED FOR USE IN LIEU OF THE REINFORCED CONCRETE ENDWALL SHOWN ON THE CONSTRUCTION DRAWINGS. GABION DRAWINGS MUST BE IN ACCORDANCE WITH THE CONCEPTUAL SKETCHES SHOWN ON THIS SHEET AND MUST BE APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION.
4. WHERE STABILITY ANALYSIS INDICATES THAT SLIDING IS A PROBLEM, PLACE A 1'-0" THICK BASE OF NO. 1 COARSE AGGREGATE UNDER THE GABION WALL.
5. USE GABION END WALLS FOR METAL CULVERTS AND PRECAST CONCRETE CULVERTS.
6. USE OF GABION WALLS IS PERMITTED UP TO 8'-0" MAXIMUM HEIGHT (OUT-TO-OUT) IN RURAL AREAS ONLY.
7. FOR ROCK PROTECTION DETAILS, SEE BD-631M.
8. FOR GABION SIZES, SEE BC-782M.

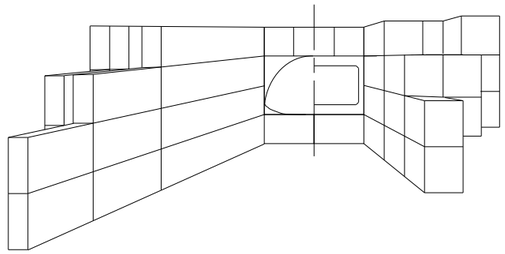
LEGEND:

* FOR ROUND/ARCH APPLICATION, PLACE INTERMEDIATE LAYERS OF GABIONS TO CONFORM TO OUTSIDE FACE OF THE CULVERT CONFIGURATION.

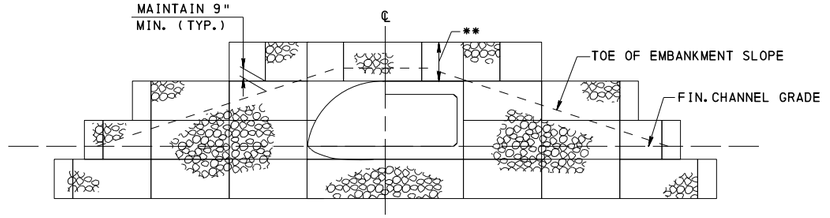
** CHECK THE GABION STABILITY (OVERTURNING AND SLIDING) FOR THE GABION OVER THE CULVERTS FOR ALL APPLICABLE FORCES DUE TO L.L. SURCHARGE AND FILL SLOPE BEING RETAINED BY IT.

◥ 1'-8" MIN. LENGTH OF GEOTEXTILE

◑ A STEPPED FRONT FACE IS AN ACCEPTABLE ALTERNATE TO THE SMOOTH INCLINED FRONT FACE SHOWN. WITH EACH 3'-0" VERTICLE LIFT TO BE PLACED WITH A 7" HORIZONTAL SETBACK.



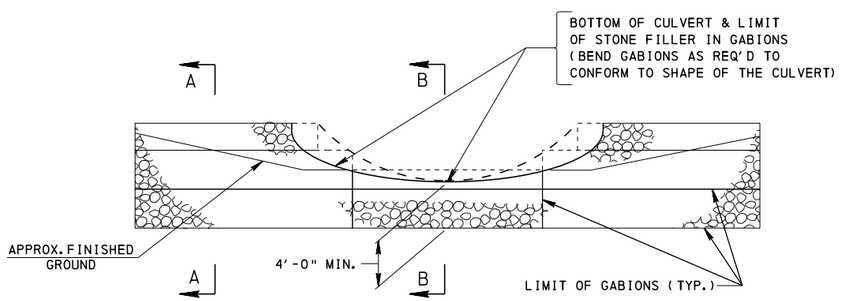
PERSPECTIVE ELEVATION



ROUND/ARCH CULVERT

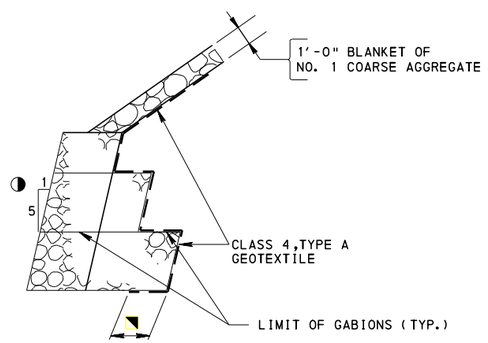
BOX CULVERT

DEVELOPED ELEVATION

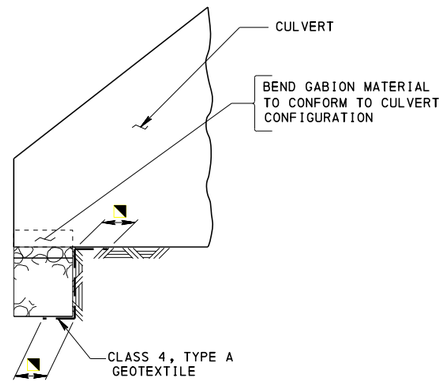


ELEVATION-ALTERNATE TO TOEWALL CONSTR.

(MINIMUM GABION FACE DIMENSIONS TO MATCH TOEWALL FACE DIMENSIONS)



SECTION A-A



SECTION B-B

BD-631M	END WALL DETAIL FOR METAL CULVERTS
BC-782M	GABION SLOPE WALL DETAILS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

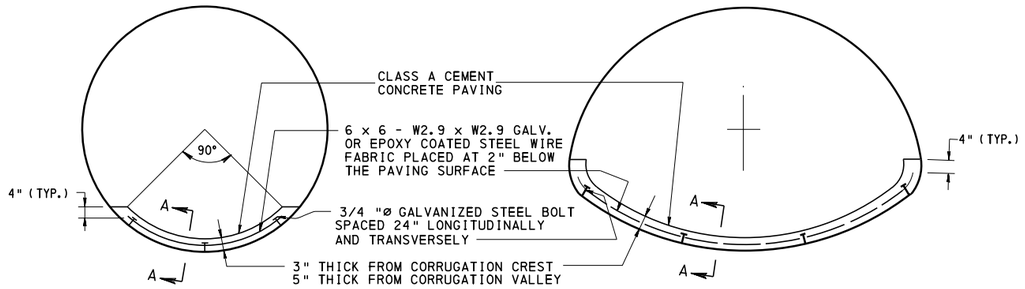
STANDARD GABION END WALLS DETAILS

RECOMMENDED APR. 29, 2016
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016
DIRECTOR, BUR. OF PROJECT DELIVERY

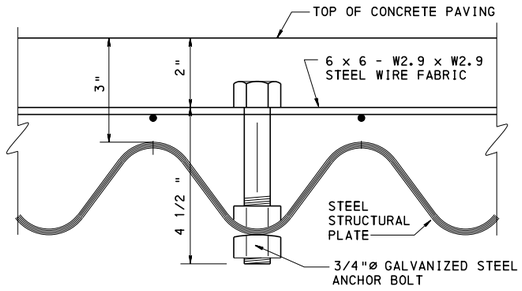
SHEET 1 OF 1

BD-634M



CIRCULAR PIPE

PIPE-ARCH



SECTION A-A

CONCRETE PAVED INVERT DETAILS

PLATE THICKNESS

PLATE THICKNESS		PLATE GAGE NO. *
GALVANIZED	UNCOATED	
0.280	0.2758	1
0.249	0.2451	3
0.218	0.2145	5
0.188	0.1838	7
0.170	0.1644	8
0.140	0.1345	10
0.111	0.1046	12

* APPLIES TO ENGLISH UNITS ONLY

NOTES:

1. PAVE INVERTS OF THE STEEL PIPES AND PIPE ARCHES WITH CLASS A CEMENT CONCRETE WITH MAXIMUM COARSE AGGREGATE SIZE OF 3/4". COVER 25% OF THE PERIPHERY OF PIPES AND APPROXIMATELY 40% OF THE PERIPHERY OF PIPE ARCHES, INCLUDING THE CORNER PLATES, TO A CONCRETE THICKNESS OF 3" ABOVE THE CREST OF CORRUGATIONS.

2. PLACE CONCRETE PAVING AFTER COMPLETION OF FILL OVER THE PIPES AND PIPE ARCHES.

3. BEFORE THE PLACEMENT OF CONCRETE, THOROUGHLY CLEAN AND DRY THE STEEL CULVERT SURFACE TO BE PAVED AND REMOVE ALL FOREIGN MATERIAL AND CORROSIVE LOOSE SCALE.

4. REINFORCE CONCRETE PAVING WITH GALVANIZED OR EPOXY COATED STEEL WIRE FABRIC AND PLACE IT 2" BELOW THE CONCRETE FACE WITH 4" CLEARANCE FROM THE EDGES OF CONCRETE PAVING. FASTEN STEEL WIRE FABRIC TO 3/4"ø GALVANIZED BOLTS WHICH ARE BOLTED TO THE STEEL CULVERT INVERT AND SPACED 24" ON CENTER LONGITUDINALLY AND TRANSVERSELY.

5. USE STEEL WIRE FABRIC OF #6 GAGE WIRE AT 6" CENTERS LONGITUDINALLY AND TRANSVERSELY. MINIMUM LAP LENGTH IS 8". FOLD STEEL WIRE FABRIC UNDER UPSTREAM AND DOWNSTREAM LIPS OF THE CULVERT AT LEAST 12".

6. FINISH CONCRETE PAVING TO A SMOOTH SURFACE. AFTER INITIAL SET, COVER CONCRETE SURFACE WITH A HEAVY SPRAY OR MOP COAT OF EMULSIFIED ASPHALT CLASS E-1. CURE CONCRETE FOR A MINIMUM OF 48 HOURS BEFORE WATER IS PERMITTED TO FLOW ON THE PAVED INVERT.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

DESIGN DETAILS FOR METAL CULVERTS

RECOMMENDED APR. 29, 2016 Thomas P Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED APR. 29, 2016 Brian D Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHEET 1 OF 4 BD-635M

STEEL STRUCTURAL PLATE PIPE THICKNESS REQUIREMENTS WITH MINIMUM☆ PREDICTED METAL LOSS CONDITION

(BACKFILL UNIT WEIGHT = 140 LBS. PER CU. FT.)

TOP PLATE THICKNESS 0.111 IN.

DIAMETER FT. (IN.)	MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.) 50-YEARS DESIGN LIFE WITHOUT PAVED INVERT	50-YEARS DESIGN LIFE WITH PAVED INVERT	100-YEARS DESIGN LIFE WITHOUT PAVED INVERT	100-YEARS DESIGN LIFE WITH PAVED INVERT
5 (60)	42	0.168	0.111	0.249	0.188
6 (72)	35	↓	↓	↓	↓
7 (84)	30	↓	↓	↓	↓
8 (96)	26	↓	↓	↓	↓
9 (108)	23	↓	↓	↓	↓
10 (120)	21	↓	↓	↓	↓
11 (132)	19	↓	↓	↓	↓
12 (144)	17	↓	↓	↓	↓
13 (156)	16	↓	↓	↓	↓
14 (168)	15	↓	↓	↓	↓
15 (180)	14	↓	↓	↓	↓
16 (192)	—	—	—	—	—
17 (204)	—	—	—	—	—
18 (216)	—	—	—	—	—
19 (228)	—	—	—	—	—
20 (240)	—	—	—	—	—

TOP PLATE THICKNESS 0.140 IN.

DIAMETER FT. (IN.)	MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.) 50-YEARS DESIGN LIFE WITHOUT PAVED INVERT	50-YEARS DESIGN LIFE WITH PAVED INVERT	100-YEARS DESIGN LIFE WITHOUT PAVED INVERT	100-YEARS DESIGN LIFE WITH PAVED INVERT
5 (60)	60	0.170	0.140	0.280	0.218
6 (72)	50	↓	↓	↓	↓
7 (84)	43	↓	↓	↓	↓
8 (96)	38	↓	↓	↓	↓
9 (108)	33	↓	↓	↓	↓
10 (120)	30	↓	↓	↓	↓
11 (132)	27	↓	↓	↓	↓
12 (144)	25	↓	↓	↓	↓
13 (156)	23	↓	↓	↓	↓
14 (168)	21	↓	↓	↓	↓
15 (180)	20	↓	↓	↓	↓
16 (192)	19	↓	↓	↓	↓
17 (204)	17	↓	↓	↓	↓
18 (216)	—	—	—	—	—
19 (228)	—	—	—	—	—
20 (240)	—	—	—	—	—

TOP PLATE THICKNESS 0.170 IN.

DIAMETER FT. (IN.)	MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.) 50-YEARS DESIGN LIFE WITHOUT PAVED INVERT	50-YEARS DESIGN LIFE WITH PAVED INVERT	100-YEARS DESIGN LIFE WITHOUT PAVED INVERT	100-YEARS DESIGN LIFE WITH PAVED INVERT
5 (60)	79	0.188	0.170	0.280	0.218
6 (72)	66	↓	↓	↓	↓
7 (84)	56	↓	↓	↓	↓
8 (96)	49	↓	↓	↓	↓
9 (108)	44	↓	↓	↓	↓
10 (120)	39	↓	↓	↓	↓
11 (132)	36	↓	↓	↓	↓
12 (144)	33	↓	↓	↓	↓
13 (156)	30	↓	↓	↓	↓
14 (168)	28	↓	↓	↓	↓
15 (180)	26	↓	↓	↓	↓
16 (192)	24	↓	↓	↓	↓
17 (204)	23	↓	↓	↓	↓
18 (216)	22	↓	↓	↓	↓
19 (228)	20	↓	↓	↓	↓
20 (240)	—	—	—	—	—

TOP PLATE THICKNESS 0.188 IN.

DIAMETER FT. (IN.)	MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.) 50-YEARS DESIGN LIFE WITHOUT PAVED INVERT	50-YEARS DESIGN LIFE WITH PAVED INVERT	100-YEARS DESIGN LIFE WITHOUT PAVED INVERT	100-YEARS DESIGN LIFE WITH PAVED INVERT
5 (60)	88	0.188	0.188	0.280	0.218
6 (72)	73	↓	↓	↓	↓
7 (84)	63	↓	↓	↓	↓
8 (96)	55	↓	↓	↓	↓
9 (108)	49	↓	↓	↓	↓
10 (120)	44	↓	↓	↓	↓
11 (132)	40	↓	↓	↓	↓
12 (144)	36	↓	↓	↓	↓
13 (156)	34	↓	↓	↓	↓
14 (168)	31	↓	↓	↓	↓
15 (180)	29	↓	↓	↓	↓
16 (192)	27	↓	↓	↓	↓
17 (204)	26	↓	↓	↓	↓
18 (216)	24	↓	↓	↓	↓
19 (228)	23	↓	↓	↓	↓
20 (240)	22	↓	↓	↓	↓

TOP PLATE THICKNESS 0.218 IN.

DIAMETER FT. (IN.)	MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.) 50-YEARS DESIGN LIFE WITHOUT PAVED INVERT	50-YEARS DESIGN LIFE WITH PAVED INVERT	100-YEARS DESIGN LIFE WITHOUT PAVED INVERT	100-YEARS DESIGN LIFE WITH PAVED INVERT
5 (60)	103	0.218	0.218	—	0.249
6 (72)	86	↓	↓	↓	↓
7 (84)	74	↓	↓	↓	↓
8 (96)	64	↓	↓	↓	↓
9 (108)	57	↓	↓	↓	↓
10 (120)	51	↓	↓	↓	↓
11 (132)	47	↓	↓	↓	↓
12 (144)	43	↓	↓	↓	↓
13 (156)	39	↓	↓	↓	↓
14 (168)	37	↓	↓	↓	↓
15 (180)	34	↓	↓	↓	↓
16 (192)	32	↓	↓	↓	↓
17 (204)	30	↓	↓	↓	↓
18 (216)	28	↓	↓	↓	↓
19 (228)	27	↓	↓	↓	↓
20 (240)	25	↓	↓	↓	↓

TOP PLATE THICKNESS 0.249 IN.

DIAMETER FT. (IN.)	MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.) 50-YEARS DESIGN LIFE WITHOUT PAVED INVERT	50-YEARS DESIGN LIFE WITH PAVED INVERT	100-YEARS DESIGN LIFE WITHOUT PAVED INVERT	100-YEARS DESIGN LIFE WITH PAVED INVERT
5 (60)	118	0.249	0.249	—	0.249
6 (72)	98	↓	↓	↓	↓
7 (84)	84	↓	↓	↓	↓
8 (96)	73	↓	↓	↓	↓
9 (108)	65	↓	↓	↓	↓
10 (120)	59	↓	↓	↓	↓
11 (132)	53	↓	↓	↓	↓
12 (144)	49	↓	↓	↓	↓
13 (156)	45	↓	↓	↓	↓
14 (168)	42	↓	↓	↓	↓
15 (180)	39	↓	↓	↓	↓
16 (192)	36	↓	↓	↓	↓
17 (204)	34	↓	↓	↓	↓
18 (216)	32	↓	↓	↓	↓
19 (228)	31	↓	↓	↓	↓
20 (240)	29	↓	↓	↓	↓

TOP PLATE THICKNESS 0.280 IN.

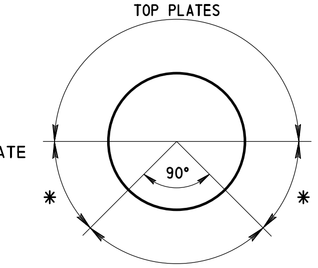
DIAMETER FT. (IN.)	MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.) 50-YEARS DESIGN LIFE WITHOUT PAVED INVERT	50-YEARS DESIGN LIFE WITH PAVED INVERT	100-YEARS DESIGN LIFE WITHOUT PAVED INVERT	100-YEARS DESIGN LIFE WITH PAVED INVERT
5 (60)	133	0.280	0.280	—	0.280
6 (72)	111	↓	↓	↓	↓
7 (84)	95	↓	↓	↓	↓
8 (96)	83	↓	↓	↓	↓
9 (108)	74	↓	↓	↓	↓
10 (120)	66	↓	↓	↓	↓
11 (132)	60	↓	↓	↓	↓
12 (144)	55	↓	↓	↓	↓
13 (156)	51	↓	↓	↓	↓
14 (168)	47	↓	↓	↓	↓
15 (180)	44	↓	↓	↓	↓
16 (192)	41	↓	↓	↓	↓
17 (204)	39	↓	↓	↓	↓
18 (216)	37	↓	↓	↓	↓
19 (228)	35	↓	↓	↓	↓
20 (240)	33	↓	↓	↓	↓

☆ REFER TO DM4, FIGURE 12.6.9.5P-2 FOR CORROSIVE ENVIRONMENTS.

NOTES:

1. THE "MAX. FILL HEIGHT" IS COMPUTED IN ACCORDANCE WITH THE LOAD FACTOR DESIGN PROCEDURES AS PER 1992 AASHTO SPECIFICATIONS.
2. THE "INVERT PLATE THICKNESS" IS COMPUTED IN ACCORDANCE WITH THE SERVICE LOAD DESIGN PROCEDURES AS PER AASHTO SPECIFICATIONS, BUT WITH A MINIMUM SAFETY FACTOR OF 1.3 AT THE END OF A DESIGN LIFE BASED ON THE METAL LOSS OF 2 MILS PER YEAR.
3. THE CONCRETE PAVED INVERT IS ASSUMED TO HAVE AN EQUIVALENT SERVICE LIFE OF 35 YEARS.
4. INVERT PLATES ARE THE PLATES AT THE LOWER 90° OF THE PIPE CIRCUMFERENCE. THE PLATES LOCATED BETWEEN THE INVERT PLATES AND THE HORIZONTAL DIAMETER LINE OF THE PIPE MAY BE ONE GAGE LIGHTER THAN THE INVERT PLATES, BUT NO LIGHTER THAN THE UPPER TOP PLATES. (SEE SKETCH)
5. ALL STEEL PLATES ARE 6"x 2" CORRUGATION AND MUST MEET THE REQUIREMENTS OF AASHTO M167 AND MUST BE GALVANIZED.
6. MINIMUM FILL HEIGHT FOR DESIGN LOAD IS SPAN/8 BUT NOT LESS THAN 12" AND IS MEASURED FROM TOP OF RIGID PAVEMENT OR BOTTOM OF FLEXIBLE PAVEMENT. FOR MINIMUM FILL AND COVER REQUIREMENTS (AND DIAGRAMS DEFINITION OF COVER) SEE RC-30. FOR PIPE UNDER PAVEMENT STRUCTURE PLACE PIPE AT THE GREATER DEPTH OF FILL AND COVER. WHEN FILL HEIGHT IS LESS THAN 3 FT, A SPECIAL DESIGN CONSIDERING THE MOST CRITICAL LOAD WILL BE NEEDED. A SPECIAL APPROVAL FROM THE CHIEF BRIDGE ENGINEER WILL BE REQUIRED IF THE PIPE-ARCH IS TO BE DESIGNED FOR SUCH PERMANENT CONDITION.
7. THESE DESIGN VALUES ARE BASED UPON ASSUMPTION THAT THE EXCAVATION, BACKFILL AND CONSTRUCTION METHODS IN RC STANDARDS AND PUBLICATION 408 ARE USED.
8. PIPES ARE DESIGNED FOR THE FILL HEIGHT INDICATED IN THIS TABLE. IF LIVE LOAD NEEDS TO BE PERMITTED DURING CONSTRUCTION FOR FILL HEIGHT LESS THAN 8 FT. OR THE SPAN LENGTH, WHICHEVER IS GREATER, THE DESIGN OF THE TOP PLATE MUST BE CHECKED FOR WORST LIVE LOAD PLUS DEAD LOAD CONDITION.
9. FOR CONVERSION OF GAGE TO THICKNESS TABLE SEE SHEET 1.
10. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.

TOP PLATES



INVERT PLATES

* ONE GAGE LIGHTER THAN INVERT PLATES BUT NO LIGHTER THAN TOP PLATES.

GENERAL NOTE:

FOR SHEETS 2 THROUGH 4, ALL DIMENSIONS ARE IN U.S. CUSTOMARY UNITS (FEET AND INCHES).

BD-631M	ENDWALL DETAILS FOR METAL CULVERTS
BD-634M	GABION ENDWALL DETAILS
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
DESIGN TABLES
FOR METAL CULVERTS

RECOMMENDED APR. 29, 2016 — Thomas P Macioce — CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016 — Brian D Thompson — DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 2 OF 4

BD-635M

STEEL STRUCTURAL PLATE PIPE-ARCH THICKNESS REQUIREMENTS WITH MINIMUM☆ PREDICTED METAL LOSS CONDITION (18" CORNER RADIUS)

(BACKFILL UNIT WEIGHT = 140 LBS. PER CU. FT.)

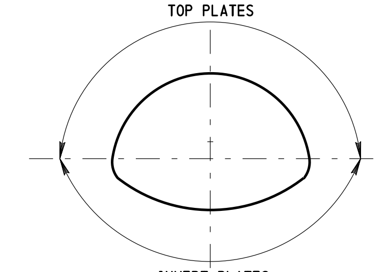
SIZE		MINIMUM REQUIRED TOP PLATE THICKNESS (IN.)	CORNER BEARING PRESSURE														
			2TSF					3TSF					4TSF				
			MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)			
				50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE	
SPAN (FT.-IN.)	RISE (FT.-IN.)			WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT
6-1	4-7	0.111	14	0.140	0.111	0.249	0.170	21	0.140	0.111	0.249	0.170	28	0.170	0.111	0.249	0.188
6-4	4-9		13					20					27				
6-9	4-11		12					19					25				
7-0	5-1		12					18					24				
7-3	5-3		11					17					23				
7-8	5-5		11					16					22				
7-11	5-7		10					16					21				
8-2	5-9		10					15					20				
8-7	5-11		9					14					19				
8-10	6-1		9					14					19				
9-4	6-3		7					13					18				
9-6	6-5		7					13					18				
9-9	6-7		7					13					17				
10-3	6-9		6					12					16				
10-8	6-11		6					12					16				
10-11	7-1		6					11					15				
11-5	7-3		5					10					15				

SIZE		MINIMUM REQUIRED TOP PLATE THICKNESS (IN.)	CORNER BEARING PRESSURE														
			2TSF					3TSF					4TSF				
			MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)			
				50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE	
SPAN (FT.-IN.)	RISE (FT.-IN.)			WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT
11-7	7-5	0.111	5	0.140	0.111	0.249	0.170	10	0.140	0.111	0.249	0.170	14	0.170	0.111	0.249	0.188
11-10	7-7		4					10					14				
12-4	7-9		—	—	—	—	—	9					13				
12-6	7-11		—	—	—	—	—	9					13				
12-8	8-1		—	—	—	—	—	9					13				
12-10	8-4		—	—	—	—	—	9					13				
13-5	8-5		—	—	—	—	—	8					12				
13-11	8-7		—	—	—	—	—	8					11				
14-1	8-9		—	—	—	—	—	7					11				
14-3	8-11		—	—	—	—	—	7					11				
14-10	9-1		—	—	—	—	—	7					10				
15-4	9-3		—	—	—	—	—	6					10				
15-6	9-5		—	—	—	—	—	6					10				
15-8	9-7		—	—	—	—	—	6					10				
15-10	9-10		—	—	—	—	—	6					9				
16-5	9-11		—	—	—	—	—	6					9				
16-7	10-1		—	—	—	—	—	5					9				

☆ REFER TO DM4, FIGURE 12.6.9.5P-2 FOR CORROSIVE ENVIRONMENTS.

NOTES:

1. THE "MAX. FILL HEIGHT" IS COMPUTED IN ACCORDANCE WITH THE LOAD FACTOR DESIGN PROCEDURES AS PER 1992 AASHTO SPECIFICATIONS.
2. THE "INVERT PLATE THICKNESS" IS COMPUTED IN ACCORDANCE WITH THE SERVICE LOAD DESIGN PROCEDURES AS PER AASHTO SPECIFICATIONS, BUT WITH A MINIMUM SAFETY FACTOR OF 1.3 AT THE END OF A DESIGN LIFE BASED ON THE METAL LOSS OF 2 MILS PER YEAR.
3. THE CONCRETE PAVED INVERT IS ASSUMED TO HAVE AN EQUIVALENT SERVICE LIFE OF 35 YEARS.
4. INVERT PLATES INCLUDE THE CORNER PLATES OF THE PIPE-ARCHES.
5. ALL STEEL PLATES ARE 6"x 2" CORRUGATION AND MUST MEET THE REQUIREMENTS OF AASHTO M167 AND MUST BE GALVANIZED.
6. MINIMUM FILL HEIGHT FOR DESIGN LOAD IS SPAN/8 BUT NOT LESS THAN 12" AND IS MEASURED FROM TOP OF RIGID PAVEMENT OR BOTTOM OF FLEXIBLE PAVEMENT. FOR MINIMUM FILL AND COVER REQUIREMENTS (AND DIAGRAMS DEFINITION OF COVER) SEE RC-30. FOR PIPE UNDER PAVEMENT STRUCTURE PLACE PIPE AT THE GREATER DEPTH OF FILL AND COVER. WHEN FILL HEIGHT IS LESS THAN 3 FT, A SPECIAL DESIGN CONSIDERING THE MOST CRITICAL LOAD WILL BE NEEDED. A SPECIAL APPROVAL FROM THE CHIEF BRIDGE ENGINEER WILL BE REQUIRED IF THE PIPE-ARCH IS TO BE DESIGNED FOR SUCH PERMANENT CONDITION.
7. THESE DESIGN VALUES ARE BASED UPON ASSUMPTION THAT THE EXCAVATION, BACKFILL AND CONSTRUCTION METHODS IN RC STANDARDS AND PUBLICATION 408 ARE USED.
8. PIPE-ARCHES ARE DESIGNED FOR THE FILL HEIGHT INDICATED IN THIS TABLE. IF LIVE LOAD NEEDS TO BE PERMITTED DURING CONSTRUCTION FOR FILL HEIGHT LESS THAN 8 FT. OR THE SPAN LENGTH, WHICHEVER IS GREATER, THE DESIGN OF THE TOP PLATE MUST BE CHECKED FOR WORST LIVE LOAD PLUS DEAD LOAD CONDITION.
9. FOR CONVERSION OF GAGE TO THICKNESS TABLE SEE SHEET 1.
10. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

DESIGN TABLES FOR METAL CULVERTS

RECOMMENDED APR. 29, 2016 Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016 Brian G Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 3 OF 4

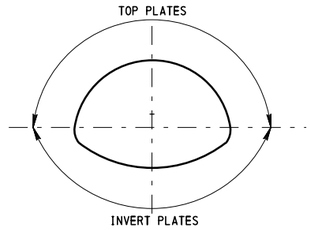
BD-635M

STEEL STRUCTURAL PLATE PIPE-ARCH THICKNESS REQUIREMENTS WITH MINIMUM☆ PREDICTED METAL LOSS CONDITION (31" CORNER RADIUS)

(BACKFILL UNIT WEIGHT = 140 LBS. PER CU. FT.)

SIZE		MINIMUM REQUIRED TOP PLATE THICKNESS (IN.)	CORNER BEARING PRESSURE													
			2TSF					3TSF					4TSF			
			MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)			
				50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE	
SPAN (FT.-IN.)	RISE (FT.-IN.)			WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT
13-3	9-4	0.111	10	0.140	0.111	0.249	0.170	16	0.170	0.111	0.280	0.188	22	0.170	0.111	0.280	0.218
13-6	9-6		10					16					21				
14-0	9-8		9					15					21				
14-2	9-10		9					15					20				
14-5	10-0		9					15					20				
14-11	10-2		8					14					19				
15-4	10-4		8					13					19				
15-7	10-6		8					13					18				
15-10	10-8		8					13					18				
16-3	10-10		7					13					18				
16-6	11-0		7					12					17				
17-0	11-2		7					12					17				
17-2	11-4		7					12					16				
17-5	11-6		7					12					16				
17-11	11-8		6					11					16				
18-1	11-10		6					11					15				
18-7	12-0		6					11					15				
18-9	12-2	↓	6		↓			11		↓			15		↓		
19-3	12-4	0.140	5		0.140			10		0.140			14		0.140		
19-6	12-6		5					10					14				
19-8	12-8		5					10					14				
19-11	12-10		5					10					14				
20-5	13-0		4					9					13				
20-7	13-2	↓	4	↓	↓	↓	↓	9	↓	↓	↓	↓	13	↓	↓	↓	↓

☆ REFER TO DM4, FIGURE 12.6.9.5P-2 FOR CORROSIVE ENVIRONMENTS.



NOTES:

1. THE "MAX. FILL HEIGHT" IS COMPUTED IN ACCORDANCE WITH THE LOAD FACTOR DESIGN PROCEDURES AS PER 1992 AASHTO SPECIFICATIONS.
2. THE "INVERT PLATE THICKNESS" IS COMPUTED IN ACCORDANCE WITH THE SERVICE LOAD DESIGN PROCEDURES AS PER AASHTO SPECIFICATIONS, BUT WITH A MINIMUM SAFETY FACTOR OF 1.3 AT THE END OF A DESIGN LIFE BASED ON THE METAL LOSS OF 2 MILS PER YEAR.
3. THE CONCRETE PAVED INVERT IS ASSUMED TO HAVE AN EQUIVALENT SERVICE LIFE OF 35 YEARS.
4. INVERT PLATES INCLUDE THE CORNER PLATES OF THE PIPE-ARCHES.
5. ALL STEEL PLATES ARE 6"x 2" CORRUGATION AND MUST MEET THE REQUIREMENTS OF AASHTO M167 AND MUST BE GALVANIZED.
6. MINIMUM FILL HEIGHT FOR DESIGN LOAD IS SPAN/8 BUT NOT LESS THAN 12" AND IS MEASURED FROM TOP OF RIGID PAVEMENT OR BOTTOM OF FLEXIBLE PAVEMENT. FOR MINIMUM FILL AND COVER REQUIREMENTS (AND DIAGRAMS DEFINITION OF COVER) SEE RC-30. FOR PIPE UNDER PAVEMENT STRUCTURE PLACE PIPE AT THE GREATER DEPTH OF FILL AND COVER. WHEN FILL HEIGHT IS LESS THAN 3 FT, A SPECIAL DESIGN CONSIDERING THE MOST CRITICAL LOAD WILL BE NEEDED. A SPECIAL APPROVAL FROM THE CHIEF BRIDGE ENGINEER WILL BE REQUIRED IF THE PIPE-ARCH IS TO BE DESIGNED FOR SUCH PERMANENT CONDITION.
7. THESE DESIGN VALUES ARE BASED UPON ASSUMPTION THAT THE EXCAVATION, BACKFILL AND CONSTRUCTION METHODS IN RC STANDARDS AND PUBLICATION 408 ARE USED.
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9. FOR CONVERSION OF GAGE TO THICKNESS TABLE SEE SHEET 1.
10. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

DESIGN TABLES FOR METAL CULVERTS

RECOMMENDED APR. 29, 2016	RECOMMENDED APR. 29, 2016	SHEET 4 OF 4
Thomas P. Macioce	Brian D. Thompson	BD-635M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	

CHANGE 2

INSTRUCTIONS:

* FOR USAGE OF TYPE A OR TYPE B PIPE, REFER TO D.M.2, TABLE 10.3.5
* FOR DIAMETERS GREATER THAN 48", USE TYPE A DESIGN FILL HEIGHT TABLES.
* LOCAL AUTHORITIES MAY USE TYPE B OR TYPE A DESIGN FILL HEIGHT TABLES.
* SPECIFY SHORING/TRENCH BOX INSTALLATION IF REQUIRED BY SITE CONDITIONS.
* USE PENNDOT ACCEPTED SOFTWARE TO PERFORM PIPE DESIGNS FOR REQUIRED FILL HEIGHTS AND CONCRETE STRENGTHS NOT SHOWN IN THE DESIGN TABLES ON SHEET 4 AND SHEETS 6 THRU 10, INDICATED BY DOUBLE ASTERISKS (**).
* REFER TO SHEET 3 FOR ADDITIONAL INSTRUCTIONS FOR USAGE OF THIS STANDARD.

DEFINITIONS:

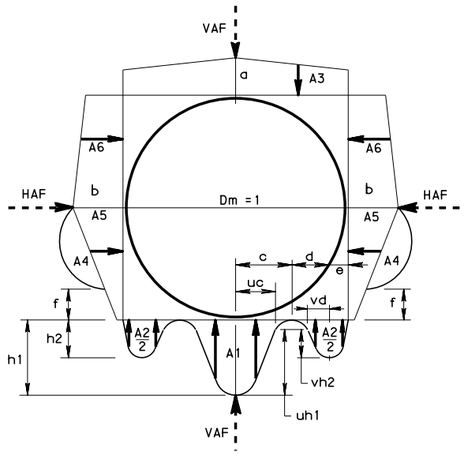
DIA	=	INSIDE DIAMETER OF THE CONCRETE PIPE.
TYPE A STANDARD INSTALLATION	=	HEAVY-DUTY CONCRETE PIPE EMBANKMENT INSTALLATION DESIGN (APPROXIMATELY 100-YEAR LIFE).
TYPE A SHORING/ TRENCH BOX INSTALLATION	=	HEAVY-DUTY CONCRETE PIPE TRENCH BOX OR SHORING INSTALLATION DESIGN (APPROXIMATELY 100-YEAR LIFE).
TYPE B STANDARD INSTALLATION	=	STANDARD DUTY CONCRETE PIPE EMBANKMENT INSTALLATION DESIGN (APPROXIMATELY 50-YEAR LIFE).
TYPE B SHORING/ TRENCH BOX INSTALLATION	=	STANDARD DUTY CONCRETE PIPE TRENCH BOX OR SHORING INSTALLATION DESIGN (APPROXIMATELY 50-YEAR LIFE).
PROOF TEST LOAD	=	THREE EDGE BEARING TEST TO A LOAD EXTRAPOLATED FROM 0.007" DESIGN REQUIREMENT TO PRODUCE A 0.01" CRACK.
PROOF LOAD	=	THE LOAD CARRIED BY A PIPE SUBJECTED TO A THREE EDGE BEARING TEST, EXPRESSED IN POUNDS PER LINEAR FOOT OF INSIDE DIAMETER. THE PROOF LOAD REFLECTS THE FIELD SERVICE LOAD CONDITION FOR BOTH LIVE AND DEAD LOADS.
PAIDD	=	PENNSYLVANIA INSTALLATION DIRECT DESIGN.
H	=	DESIGN FILL HEIGHT, FT.
fy	=	SPECIFIED YIELD STRENGTH OF REINFORCEMENT ksi
f'c	=	SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE ksi
HAF	=	HORIZONTAL ARCHING FACTOR
VAF	=	VERTICAL ARCHING FACTOR
Dm	=	1 FOR UNITY
A1 - A6	=	COEFFICIENTS WHICH REPRESENT THE INTEGRATION OF NON-DIMENSIONAL VERTICAL AND HORIZONTAL COMPONENTS OF SOIL PRESSURE UNDER THE INDICATED PORTIONS OF THE COMPONENT PRESSURE DIAGRAMS (AREA UNDER COMPONENT PRESSURE DIAGRAMS).
a, b, c, d, e, f, u, v	=	NON-DIMENSIONAL COEFFICIENTS DEFINING HORIZONTAL AND VERTICAL DIMENSIONS OF COMPONENT PRESSURE REGIONS.
d	=	0.5-c-e
h_1	=	$\frac{(1.5a1)}{c(1+u)}$
h_2	=	(1.5A2)/[(d) (1+v)+(2e)]
SPAN RATIO	=	SPAN ELLIPTICAL/EQUIVALENT ROUND = 1.28
RISE RATIO	=	RISE ELLIPTICAL/EQUIVALENT ROUND = 0.63
VAF	=	VAF ROUND
HAF	=	(RISE RATIO/SPAN RATIO) (HAF ROUND PIPE)
	=	0.49 (HAF ROUND PIPE)

PROCEDURE FOR EARTH LOAD MODELING:

CONSULT THE "CONCRETE PIPE TECHNOLOGY HANDBOOK", 1993 (PUBLISHED BY THE AMERICAN CONCRETE PIPE ASSOCIATION), CHAPTER 8, OR APPENDIX H OF THE DESIGN MANUAL PART 4, STRUCTURES, FOR A PROCEDURE FOR EARTH LOAD MODELING.

NOTES:

1. FABRICATE CONCRETE PIPE AS PER PUBLICATION 280 ENTITLED "MANUFACTURING SPECIFICATION FOR REINFORCED CONCRETE PIPE".
2. SEE RC-30M AND PUBLICATION 408, SECTIONS 601 AND 604 FOR INSTALLATION OF CONCRETE PIPES.
3. DESIGN CONCRETE PIPE IN ACCORDANCE WITH PENNSYLVANIA INSTALLATION DIRECT DESIGN (PAIDD), AND APPENDIX H OF DESIGN MANUAL, PART 4, STRUCTURES.
4. TEST CONCRETE PIPES IN ACCORDANCE WITH PUBLICATION 408 AND PROOF TEST LOAD TABLES [PRESENTED IN THIS STANDARD AND IN PUBLICATION 280]. PROOF TEST LOADS INCLUDE A 1.43 FACTOR OF SAFETY FOR FIELD CRACKING. TESTING TO ULTIMATE IS NOT REQUIRED.
5. REFERENCE RC-30M FOR MINIMUM FILL HEIGHT AND COVER REQUIREMENTS FOR CONCRETE PIPES.
6. THE DESIGN VALUES SHOWN IN THIS STANDARD ARE BASED UPON THE ASSUMPTION THAT THE EXCAVATION, BACKFILL AND CONSTRUCTION METHODS IN THE RC STANDARDS AND PUBLICATION 408 ARE USED.
7. ELLIPTICAL REINFORCEMENT IS NOT PERMITTED, EXCEPT FOR QUADRANT REINFORCEMENT AND FOR REINFORCEMENT OF ELLIPTICAL PIPE.
8. SMOOTH WELDED WIRE FABRIC IS USED IN THE DESIGN OF THE STEEL AREAS FOR CONCRETE PIPE. USE OF DEFORMED WIRE FABRIC OR DEFORMED WIRE IS PERMITTED.
9. USE DESIGN TABLES GIVEN IN THIS STANDARD TO DETERMINE STEEL AREA. USE PENNDOT ACCEPTED SOFTWARE FOR DESIGNS NOT COVERED BY THESE TABLES.
10. STEEL AREAS ARE SHOWN AS, $IN.^2$/FT.
11. PROVIDE ADDITIONAL CONCRETE COVER FOR ACIDIC ($pH \leq 4$) OR ABRASIVE ENVIRONMENTS.
12. ENSURE THAT CONSTRUCTION CONDITIONS (SHALLOW FILLS AND CONSTRUCTION TRAFFIC, IF APPLICABLE) ARE CONSIDERED AT THE TIME THE PIPE IS SPECIFIED.
13. A 2 FT. SPACING IS REQUIRED (A 3 FT. SPACING IS PREFERRED) FOR MULTIPLE PIPES [SEE SKETCH IN APPENDIX H OF DESIGN MANUAL, PART 4, STRUCTURES].
14. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.



SOIL PRESSURE DISTRIBUTION MODEL

RC-30M	SUBSURFACE DRAINS - PIPE PLACEMENT EXCAVATION - BEDDING - BACKFILL	
REFERENCE DRAWINGS		

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
REINFORCED CONCRETE PIPES
DESIGN CRITERIA

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 10

BD-636M

TABLE A

DESIGN DATA				
ITEMS	STANDARD INSTALLATION		TRENCH BOX/SHORING INSTALLATION	
INSTALLATION TYPE	TYPE A	TYPE B	TYPE A	TYPE B
HAUNCH COMPACTION	95% MIN.	95% MIN.	60% MIN.	60% MIN.
SOIL WEIGHT	140 lbs./ft.^{3}	140 lbs./ft.^{3}	140 lbs./ft.^{3}	140 lbs./ft.^{3}
LIVE LOAD	HS 25	HS 25	HS 25	HS 25
fy	65,000 psi	65,000 psi	65,000 psi	65,000 psi
f'c	MIN. 4,000 psi	MIN. 4,000 psi	MIN. 4,000 psi	MIN. 4,000 psi
CONCRETE COVER	1" OVER STEEL	1" OVER STEEL	1" OVER STEEL	1" OVER STEEL
LOAD FACTORS:	TYPE A	TYPE B	TYPE A	TYPE B
DEAD LOAD & EARTH LOAD FACTOR (SHEAR & MOMENT)	1.30	1.30	1.30	1.30
DEAD LOAD FACTOR (THRUST): REINFORCEMENT DESIGN CONCRETE COMPRESSION	1.00 1.30	1.00 1.30	1.00 1.30	1.00 1.30
LIVE LOAD FACTOR (SHEAR & MOMENT)	2.17	2.17	2.17	2.17
LIVE LOAD FACTOR (THRUST)	1.00	1.00	1.00	1.00
INTERNAL PRESSURE LOAD FACTORS (THRUST)	1.50	1.50	1.50	1.50
IMPACT (TO MAX. 8' HEIGHT)	40 [1.0-0.125H] ≥ 10%	40 [1.0-0.125H] ≥ 10%	40 [1.0-0.125H] ≥ 10%	40 [1.0-0.125H] ≥ 10%
STRENGTH REDUCTION (Φ FACTORS):	TYPE A	TYPE B	TYPE A	TYPE B
FLEXURE	0.90	0.95	0.90	0.95
RADIAL TENSION	0.85	0.90	0.85	0.90
DIAGONAL TENSION	0.85	0.90	0.85	0.90
CRACK CONTROL FACTOR	0.7	0.7	0.7	0.7
ORIENTATION ANGLE	±10°	±10°	±10°	±10°
MATERIAL & PROCESS FACTOR:	TYPE A	TYPE B	TYPE A	TYPE B
RADIAL TENSION	1.0	1.0	1.0	1.0
DIAGONAL TENSION	1.0	1.0	1.0	1.0
EMBANKMENT ARCHING FACTORS: VAF (VERTICAL) HAF (HORIZONTAL)	1.35 0.45	1.35 0.45	SEE TABLE 'C'	SEE TABLE 'C'

TABLE B

ARCHING COEFFICIENTS															
INSTALLATION TYPE	VAF	HAF	A1	A2	A3	A4	A5	A6	a	b	c	e	f	u	v
EMBANKMENT	1.35	0.45	0.62	0.73	1.35	0.19	0.08	0.18	1.40	0.40	0.18	0.08	0.05	0.80	0.80
TRENCH BOX OR SHORING	*	*	1.45	0.00	1.45	0.00	0.11	0.19	1.45	0.30	0.25	0.00	--	0.90	--

* SEE TABLE 'C'

TABLE C

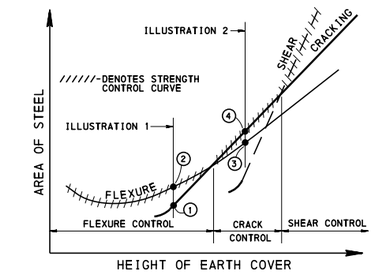
FACTORS FOR TRENCH BOX OR SHORING INSTALLATION ☆				
REQUIRED FILL HEIGHT FT.	12" THROUGH 36" DIAMETER		42" THROUGH 120" DIAMETER	
	VAF	HAF	VAF	HAF
1.5	1.20	0.29	1.20	0.29
2.0	1.15	0.29	1.20	0.29
3.0	1.00	0.25	1.20	0.25
7.0	0.70	0.18	0.90	0.18
10.0	0.70	0.16	0.90	0.16
15- 25	0.70	0.12	0.80	0.12

☆ BEDDING FACTOR USED TO DETERMINE PROOF TEST LOAD 1.60 FOR EARTH LOADS. LIVE LOAD BEDDING FACTOR AS PER ACPA "DESIGN DATA 40" DECEMBER, 1992.

TABLE D

FACTORS FOR TRENCH BOX OR SHORING INSTALLATION FOR ELLIPTICAL PIPE										
REQUIRED FILL HEIGHT FT.	EQUIVALENT ROUND		HORIZONTAL ELLIPTICAL				VERTICAL ELLIPTICAL			
			VAF		HAF		VAF		HAF	
	VAF	HAF	12"to 36"	42"to 120"	12"to 36"	42"to 120"	12"to 36"	42"to 120"	12"to 36"	42"to 120"
1.5	1.20	0.29	1.20	1.20	0.18	0.18	1.20	1.20	0.46	0.46
2.0	1.10	0.22	1.15	1.20	0.18	0.18	1.15	1.20	0.46	0.46
3.0	1.10	0.22	1.00	1.20	0.16	0.16	1.00	1.20	0.40	0.40
7.0	0.90	0.16	0.70	0.90	0.10	0.10	0.70	0.90	0.29	0.29
10.0	0.80	0.12	0.70	0.90	0.10	0.10	0.70	0.90	0.25	0.25
15- 25			0.70	0.90	0.08	0.08	0.70	0.90	0.19	0.19

FLEXURE-SHEAR-CRACK CONTROL RELATIONSHIP



EXAMPLE: TYPE B 48" STANDARD INSTALLATION

	2≤H<3	3≤H<7
WALL THICKNESS =	5¾"	5¾"
AREA OF STEEL: INNER CAGE =	0.15 SQ. IN.	0.14 SQ. IN.
OUTER CAGE =	0.09 SQ. IN.	0.07 SQ. IN.
PROOF TEST LOAD =	587 LBS.	823 LBS.

AS SEEN HERE, THE ACTUAL STRENGTH OF THE 3' TO 2' PIPE IS GREATER THAN THE 7' TO 3' PIPE AS REFLECTED BY THE STEEL AREA. THE PROOF LOAD TEST BEING A SERVICE LOAD CONDITION REFLECTS THE ANTICIPATED FIELD LOAD. THE ULTIMATE STRENGTH DESIGN METHOD USED TO DETERMINE STEEL AREAS HAS GREATER DESIGN SAFETY FACTOR FOR LIVE LOADS THAN FOR DEAD LOADS. FOR THIS REASON, THE PROOF LOAD, FOR LOW FILL HEIGHTS, IS NOT A LINEAR RELATIONSHIP WITH THE STEEL AREA.

ILLUSTRATION 1:

1. CRACK CONTROL 2. FLEXURE CONTROL

IN THIS ILLUSTRATION OF THE FLEXURE-SHEAR-CRACK CONTROL RELATIONSHIP, THE PROOF TEST LOAD FOR THIS CASE IS NOT A GOVERNING FACTOR SINCE FLEXURE CONTROLS THE DESIGN.

ILLUSTRATION 2:

3. FLEXURE CONTROL 4. CRACK CONTROL

IN THIS ILLUSTRATION OF THE FLEXURE-SHEAR-CRACK CONTROL RELATIONSHIP, THE PROOF TEST LOAD FOR THIS CASE IS A GOVERNING FACTOR SINCE FLEXURE IS NOT CONTROLLING THE DESIGN.

NOTE: PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN (CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES, RELY UPON THE MAXIMUM/MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD REINFORCED CONCRETE PIPES

DESIGN CRITERIA

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 2 OF 10 BD-636M

REINFORCED CONCRETE PIPE DESIGN EXAMPLES:

① DESIGN OF A 48" DIAMETER CONCRETE PIPE UNDER 3'-0" OF FILL.

TYPE A (HEAVY-DUTY) SOLUTION:

* DESIGNER DETERMINES THAT A 48" DIAMETER PIPE IS REQUIRED AND THAT THE MAXIMUM FILL HEIGHT IS 3'-0". END TREATMENT AND A STANDARD TYPE A INSTALLATION AS PER RC-30M ARE SPECIFIED.
* ITEM #0601-7072 IS SPECIFIED. FILL RANGE 10' TO 2'.
* FABRICATOR REFERENCES PUBLICATION 280 "MANUFACTURING SPECIFICATION FOR REINFORCED CONCRETE PIPE" FOR A 48" DIAMETER TYPE A STANDARD INSTALLATION PIPE. A 5" WALL THICKNESS AND f'c = 4000 PSI ARE SELECTED FOR 48" DIAMETER. THE AREA OF STEEL REQUIRED FOR A 3' ≤H<7' MAXIMUM FILL HEIGHT IS 0.19 IN.² FOR THE INSIDE CAGE AND 0.12 IN.² FOR THE OUTER CAGE.
* THE PIPE IS TESTED TO A PROOF TEST LOAD OF 867 LBS./LF AND MARKED PA 48A/S10-2.

TYPE B (STANDARD DUTY) SOLUTION:

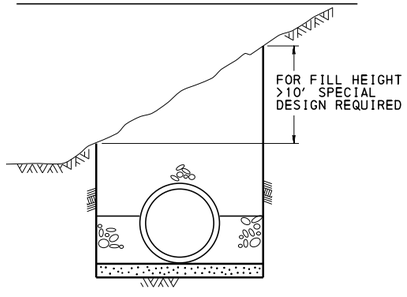
* DESIGNER DETERMINES THAT A 48" DIAMETER CONCRETE PIPE IS REQUIRED AND THAT THE MAXIMUM FILL HEIGHT IS 3'-0", END TREATMENT AND A STANDARD TYPE B INSTALLATION AS PER RC-30M ARE SPECIFIED.
* ITEM #0601-7370 IS SPECIFIED. FILL RANGE 10' TO 3'.
* FABRICATOR REFERENCES PUBLICATION 280 "MANUFACTURING SPECIFICATION FOR REINFORCED CONCRETE PIPE" FOR A 48" DIAMETER TYPE B STANDARD INSTALLATION PIPE. A 5¾" WALL THICKNESS AND f'c = 5000 PSI ARE SELECTED FOR 48" DIAMETER. THE AREA OF STEEL REQUIRED FOR A 3' ≤H<7' MAXIMUM FILL HEIGHT IS 0.14 IN.² FOR THE INSIDE CAGE AND 0.07 IN.² FOR THE OUTER CAGE.
* THE PIPE IS TESTED TO A PROOF TEST LOAD OF 823 LBS./LF AND MARKED PA 48B/S10-3.

② DESIGN OF A 36" DIAMETER CONCRETE PIPE UNDER 9' OF FILL IN A TRENCH BOX INSTALLATION.

SOLUTION:

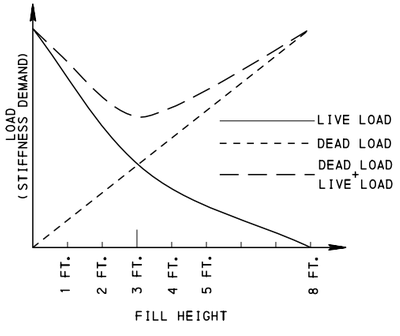
* DESIGNER DETERMINES THAT A 36" DIAMETER PIPE IS REQUIRED AND MAXIMUM FILL HEIGHT IS 9'-0". END TREATMENT AND A TYPE A TRENCH BOX INSTALLATION AS PER RC-30M ARE SPECIFIED.
* ITEM #0601-7537 IS SPECIFIED. FILL RANGE 10' TO 7'.
* FABRICATOR REFERENCES PUBLICATION 280 "MANUFACTURING SPECIFICATION FOR REINFORCED CONCRETE PIPE" FOR A 36" DIAMETER TYPE A SHORING/TRENCH BOX INSTALLATION PIPE. A DOUBLE CAGE, 4" WALL THICKNESS AND f'c = 4000 PSI ARE SELECTED FOR A 36" DIAMETER. THE AREA OF STEEL REQUIRED FOR A 7' ≤H<10' MAXIMUM FILL HEIGHT IS 0.16IN.² FOR THE INSIDE CAGE AND 0.07 IN.² FOR THE OUTER CAGE.
* THE PIPE IS TESTED TO A PROOF TEST LOAD OF 1174 LBS./LF AND MARKED PA 36A/SH10-7.

SIDE SLOPE CONDITION



SYMMETRICAL REINFORCEMENT IS REQUIRED FOR INSTALLATIONS WHERE SIDE SLOPE CONDITIONS EXIST. A SPECIAL DESIGN IS REQUIRED WHEN THE FILL HEIGHT VARIES MORE THAN 10' OVER THE TRENCH WIDTH.

CONCRETE PIPE LOADING CURVE



FOR SUBSTITUTION OF PIPES UNDER 3'-0" OF FILL OR LESS USE A LOWER HEIGHT OF FILL. FOR SUBSTITUTION OF PIPES OVER 3'-0" OF FILL OR GREATER, USE A HIGHER HEIGHT OF FILL.

RESPONSIBILITIES FOR DESIGN, FABRICATION AND INSTALLATION OF CONCRETE PIPES

DESIGNER:

1. DETERMINES DIAMETER OF PIPE REQUIRED BY HYDRAULICS.
2. DETERMINES MAXIMUM HEIGHT OF FILL.
   - FOR LONG PIPE RUNS, THE LENGTH MAY BE DIVIDED INTO SEGMENTS (DEPENDING UPON INLET LOCATIONS) WHICH MAY HAVE DIFFERENT MAXIMUM FILL HEIGHTS.
   - CONSIDERS THE EFFECT OF FUTURE WIDENING AND LOADS FOR THE PIPE DESIGN.
3. ENSURES THAT THE SIDE SLOPE IS STABLE AND THAT THE PIPE IS NOT EXPECTED TO PROVIDE SLOPE STABILITY.
4. SPECIFY CONCRETE PIPES AS INDICATED IN PUB. 280, SECTION 17.1.2. FOR PIPES WITH I.D.≥8' PREPARE S-DRAWINGS WHICH INCLUDE 2 CORE BORINGS AND A HEADWALL DESIGN ON THE DRAWING.
5. SPECIFIES END TREATMENTS AS PER RC-30M.
6. SPECIFIES INCREASED WALL THICKNESS, IF WARRANTED FOR ACIDIC OR ABRASIVE CONDITIONS.
7. SPECIFIES TRENCH BOX/SHORING INSTALLATION IF REQUIRED.
8. SPECIFIES PROPER ITEM NUMBER.

CONTRACTOR:

1. SELECTS THE TYPE OF PIPE INSTALLATION, i.e., EMBANKMENT OR TRENCH BOX/SHORING.
2. SUBMITS SPECIAL DESIGNS TO THE MATERIALS & TESTING DIVISION OF PENNDOT.
3. INSTALLS THE PIPE AS PER RC-30M.

FABRICATOR:

1. USES PRE-APPROVED DESIGNS [PAIDD/BD-636M, TABLES ON SHEETS 4 THRU 10 UNLESS A SPECIAL DESIGN IS REQUIRED].
2. ENSURES THAT THE PROPER STRUCTURE DESIGN FOR THE PIPE IS SELECTED, TESTED AND DELIVERED.
3. PROVIDES DESIGN AND DETAILS FOR SPECIAL DESIGN PIPES.
4. CONDUCTS PROOF LOAD TESTS ACCORDING TO PUB.280 TO PROOF TEST LOAD VALUES SPECIFIED IN PUB.280 OR BD-636M.

PENNDOT STRUCTURAL MATERIALS SECTION:

1. WITNESSES PROOF LOAD TESTS, CONDUCTS Q/A AT FABRICATION SHOP, AND APPROVES/REJECTS PIPES AT THE PLANT PRIOR TO LOADING THE PIPES FOR TRANSPORTATION TO THE JOB SITE.
2. APPROVES DESIGNS WHICH MEET THIS STANDARD.
3. PROVIDES SPECIAL DESIGNS TO THE BRIDGE QUALITY ASSURANCE DIVISION FOR APPROVAL.
4. MONITORS CONCRETE STRENGTHS AND OTHER MATERIAL PROPERTIES. ENSURES THAT ONLY APPROVED [SPECIFIED IN PA MATERIALS SPECIFICATION PUB 280] SHEAR REINFORCEMENT IS USED.
5. APPROVES SHOP DETAILS, ETC.
6. COORDINATES EFFORTS TO RESOLVE PIPE FAILURE/PROBLEMS.

DISTRICT CONSTRUCTION UNIT:

1. INSPECTS PIPE PRIOR TO INSTALLATION.
2. MONITORS INSTALLATION, ENSURING ALL STEPS IN RC-30M AND PUB. 408 ARE FOLLOWED.
3. INSPECTS PIPE AFTER THE SPECIFIED FILL IS PLACED.
4. ACCEPTS PIPES IN ACCORDANCE WITH PUB. 408.

BUREAU OF PROJECT DELIVERY:

1. MAINTAINS AND UPDATES THIS STANDARD, RC-30M, SPECIAL PROVISIONS, PUB. 408.
2. REVIEWS AND APPROVES SPECIAL DESIGNS SUBMITTED BY THE MATERIALS AND TESTING DIVISION.
3. ASSISTS THE BUREAU OF CONSTRUCTION AND DISTRICTS IN RESOLUTION OF STRUCTURAL PROBLEMS.
4. PAIDD SOFTWARE PACKAGE NO LONGER MAINTAINED BY PENNSYLVANIA PIPE ASSOCIATION.
5. REVIEW/ACCEPT PIPE ANALYSIS SOFTWARE PACKAGES FOR DEPARTMENT USE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD REINFORCED CONCRETE PIPES

PAIDD DESIGN EXAMPLES/RESPONSIBILITIES

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 3 OF 10 BD-636M

TYPE A STANDARD INSTALLATION - STEEL AREAS ($in.^2/ft.$)

Dia.	Wall Thick.	f'c (psi)	Required Fill/Cover Height H≤1.5'	1.5'≤H<2'	2'≤H<3'	3'≤H<7'	7'≤H≤10'	15'	20'	25'	30'	40'	50'	H > 50'
12"	2"	4000	0.09	←	←	0.08					→	0.14	**	**
		5000	*	*	*	*	*	*	*	*	*	*	0.18	**
12"	2¾"	4000	0.08	←	←	0.08					→	0.09	0.11	**
15"	2¼"	4000	0.12	←	←	0.08				→	0.10	0.12	0.22	**
15"	3"	4000	0.08	←	←	0.08				→	0.08	0.09	0.12	0.19	**
18"	2½"	4000	0.14	0.09	←	0.08			→	0.11	0.13	0.16	**	**	**
		5000	*	*	*	*	*	*	*	*	*	*	0.23	**	**
18"	3¼"	4000	0.14	0.08	←	0.07			→	0.08	0.10	0.12	0.18	**	**
21"	2¾"	4000	0.22	0.12	←	0.08	→	0.10	0.13	0.17	0.22	**	**	**
		6000	*	*	*	*	*	*	*	*	*	0.26	**	**
21"	3½"	4000	**	0.10	←	0.07	←	0.08	0.10	0.13	0.16	0.27	**	**
	3½"	5000	0.22	*	*	*	*	*	*	*	*	*	**	**
24"	3"	4000	**	0.15	←	0.10	→	0.12	0.16	0.20	0.28	**	**	**
24"	3¾"	4000	**	0.13	←	0.08	→	0.10	0.13	0.16	0.19	0.34	**	**
	3¾"	5000	0.22	*	*	*	*	*	*	*	*	*	**	**
27"	3¼"	4000	**	0.17	0.12	0.10	0.10	0.14	0.19	0.24	**	**	**	**
		5000	**	*	*	*	*	*	*	*	0.28	**	**	**
		6000	0.27	*	*	*	*	*	*	*	*	**	**	**
27"	4"	4000	**	0.15	0.10	0.09	0.09	0.12	0.15	0.19	0.23	**	**	**
		6000	0.27	*	*	*	*	*	*	*	*	**	**	**
30"	3½"	4000	**	0.20	0.14	0.12	0.12	0.17	0.22	0.29	**	**	**	**
30"	4¼"	4000	**	0.17	0.12	0.10	0.10	0.14	0.18	0.23	0.29	**	**	**
33"	3¾"	4000	**	0.22	0.17	0.17	0.17	0.22	0.25	**	**	**	**	**
		5000	**	*	*	*	*	*	*	0.31	0.42	**	**	**
33"	4½"	4000	**	0.19	0.15	0.12	0.12	0.16	0.21	0.26	0.35	**	**	**
36"	4"	4000	**	0.24	0.19	0.14	0.16	0.22	0.29	**	**	**	**	**
		5000	**	*	*	*	*	*	*	0.35	**	**	**	**
		6000	**	*	*	*	*	*	*	**	0.45	**	**	**
36"	4¾"	4000	**	0.20	0.17	0.13	0.14	0.19	0.24	0.30	**	**	**	**
		5000	**	*	*	*	*	*	*	*	0.35	**	**	**

TYPE A STANDARD INSTALLATION - STEEL AREAS ($in.^2/ft.$)

Dia.	Wall Thick.	f'c (psi)	Required Fill/Cover Height H≤1.5'	1.5'≤H<2'	2'≤H<3'	3'≤H<7'	7'≤H≤10'	15'	20'	25'	30'	40'	H > 40'
36"	4"	4000	0.19	0.18	0.14	0.11	0.12	0.16	0.21	0.28	0.39	**	**
			0.13	0.12	0.09	0.07	0.07	0.08	0.11	0.14	0.17	**	**
		6000	*	*	*	*	*	*	*	*	*	0.52	**
			*	*	*	*	*	*	*	*	*	0.22	**
36"	4¾"	4000	0.16	0.15	0.12	0.10	0.10	0.13	0.17	0.21	0.25	0.50	**
			0.10	0.09	0.07	0.07	0.07	0.07	0.08	0.10	0.12	0.17	**
42"	4½"	4000	0.20	0.19	0.17	0.17	0.17	0.20	0.25	0.36	0.49	**	**
			0.13	0.12	0.10	0.07	0.07	0.10	0.13	0.17	0.21	**	**
42"	5¼"	4000	0.16	0.16	0.14	0.14	0.14	0.16	0.21	0.25	0.37	**	**
			0.10	0.10	0.08	0.07	0.07	0.08	0.10	0.12	0.15	**	**
		5000	*	*	*	*	*	*	*	*	*	0.53	**
			*	*	*	*	*	*	*	*	*	0.20	**
48"	5"	4000	0.18	0.20	←	0.19	→	0.23	0.31	0.45	0.62	**	**
			0.11	0.13	←	0.12	→	0.12	0.16	0.20	0.24	**	**
48"	5¾"	4000	0.18	0.17	←	0.16	→	0.20	0.25	0.32	0.52	**	**
			0.11	0.10	←	0.10	→	0.07	0.12	0.15	0.18	**	**
		5000	*	*	*	*	*	*	*	*	*	0.71	**
			*	*	*	*	*	*	*	*	*	0.24	**
54"	5½"	4000	0.21	0.21	←	0.20	→	0.26	0.38	0.55	**	**	**
			0.14	0.13	←	0.12	→	0.14	0.18	0.23	**	**	**
		5000	*	*	*	*	*	*	*	*	0.64	**	**
			*	*	*	*	*	*	*	*	0.26	**	**
54"	6¼"	4000	0.19	0.18	←	0.18	→	0.23	0.29	0.45	0.68	**	**
			0.12	0.11	←	0.10	→	0.11	0.14	0.18	0.22	**	**

TYPE A STANDARD INSTALLATION - STEEL AREAS ($in.^2/ft.$)

Dia.	Wall Thick.	f'c (psi)	Required Fill/Cover Height H≤1.5'	1.5'≤H<2'	2'≤H<3'	3'≤H<7'	7'≤H≤10'	15'	20'	25'	30'	H > 30'
60"	6"	4000	0.22	0.22	0.22	0.22	0.22	0.30	0.45	0.69	**	**
			0.14	0.13	0.13	0.12	0.12	0.16	0.21	0.26	**	**
60"	6¾"	4000	0.20	0.20	0.19	0.19	0.20	0.26	0.33	0.59	**	**
			0.12	0.11	0.11	0.10	0.10	0.13	0.17	0.21	**	**
66"	6½"	4000	0.24	←	0.23	→	0.25	0.35	0.53	**	**	**
			0.14	←	0.14	→	0.14	0.18	0.23	**	**	**
		5000	*	*	*	*	*	*	*	0.66	**	**
			*	*	*	*	*	*	*	0.28	**	**
66"	7¼"	4000	0.21	←	0.21	→	0.23	0.30	0.43	0.71	**	**
			0.12	←	0.12	→	0.11	0.15	0.19	0.24	**	**
72"	7"	4000	0.25	0.25	0.24	0.26	0.29	0.40	0.65	**	**	**
			0.15	0.15	0.14	0.14	0.15	0.20	0.26	**	**	**
		5000	*	*	*	*	*	*	*	0.76	**	**
			*	*	*	*	*	*	*	0.31	**	**
72"	7¾"	4000	0.23	0.23	0.22	0.24	0.26	0.34	0.53	0.86	**	**
			0.13	0.13	0.12	0.12	0.13	0.17	0.22	0.27	**	**
		6000	*	*	*	*	*	*	*	*	0.72	**
			*	*	*	*	*	*	*	*	0.30	**
78"	7½"	4000	0.26	0.26	0.26	0.29	0.32	0.47	0.78	**	**	**
			0.15	0.15	0.15	0.15	0.17	0.22	0.28	**	**	**
		6000	*	*	*	*	*	*	*	0.80	**	**
			*	*	*	*	*	*	*	0.33	**	**
78"	8¼"	4000	0.24	0.24	0.24	0.27	0.29	0.38	0.66	**	**	**
			0.14	0.13	0.13	0.13	0.14	0.19	0.24	**	**	**
		5000	*	*	*	*	*	*	*	0.76	**	**
			*	*	*	*	*	*	*	0.29	**	**
		6000	*	*	*	*	*	*	*	*	0.86	**
			*	*	*	*	*	*	*	*	0.34	**

TYPE A STANDARD INSTALLATION - STEEL AREAS ($in.^2/ft.$)

Dia.	Wall Thick.	f'c (psi)	Required Fill/Cover Height H≤1.5'	1.5'≤H<2'	2'≤H<3'	3'≤H<7'	7'≤H≤10'	15'	20'	25'	H > 25'
84"	8"	4000	0.28	0.28	0.29	0.32	0.35	0.54	0.91	**	**
			0.16	0.16	0.16	0.16	0.18	0.24	0.31	**	**
		6000	*	*	*	*	*	*	*	0.90	**
			*	*	*	*	*	*	*	0.36	**
84"	8¾"	4000	0.26	0.26	0.27	0.30	0.33	0.43	0.79	**	**
			0.14	0.14	0.14	0.15	0.16	0.21	0.27	**	**
		5000	*	*	*	*	*	*	*	0.90	**
			*	*	*	*	*	*	*	0.32	**
90"	8½"	4000	0.30	0.30	0.32	0.36	0.39	0.64	**	**	**
			0.17	0.17	0.17	0.19	0.20	0.27	**	**	**
		5000	*	*	*	*	*	*	0.80	**	**
			*	*	*	*	*	*	0.33	**	**
		6000	*	*	*	*	*	*	*	1.00	**
			*	*	*	*	*	*	*	0.39	**
90"	9¼"	4000	0.28	0.28	0.30	0.33	0.36	0.52	0.94	**	**
			0.15	0.15	0.15	0.17	0.18	0.23	0.30	**	**
		6000	*	*	*	*	*	*	*	0.82	**
			*	*	*	*	*	*	*	0.34	**
96"	9"	4000	0.32	0.32	0.35	0.39	0.43	0.74	**	**	**
			0.18	0.17	0.18	0.20	0.22	0.29	**	**	**
		5000	*	*	*	*	*	*	0.91	**	**
			*	*	*	*	*	*	0.36	**	**
96"	9¾"	4000	0.30	0.30	0.33	0.37	0.40	0.62	**	**	**
			0.16	0.16	0.17	0.18	0.20	0.26	**	**	**
		5000	*	*	*	*	*	*	0.79	**	**
			*	*	*	*	*	*	0.32	**	**
		6000	*	*	*	*	*	*	*	0.95	**
			*	*	*	*	*	*	*	0.37	**
102"	9½"	4000	0.34	0.35	0.38	0.43	0.50	0.86	**	**	**
			0.18	0.18	0.20	0.22	0.24	0.31	**	**	**
		5000	*	*	*	*	*	*	1.04	**	**
			*	*	*	*	*	*	0.38	**	**
102"	10¼"	4000	0.32	0.33	0.36	0.40	0.44	0.75	**	**	**
			0.17	0.17	0.18	0.20	0.22	0.28	**	**	**
		5000	*	*	*	*	*	*	0.92	**	**
			*	*	*	*	*	*	0.34	**	**
		6000	*	*	*	*	*	*	0.75	**	**
			*	*	*	*	*	*	0.34	**	**

TYPE A STANDARD INSTALLATION - STEEL AREAS ($in.^2/ft.$)

Dia.	Wall Thick.	f'c (psi)	Required Fill/Cover Height H≤1.5'	1.5'≤H<2'	2'≤H<3'	3'≤H<7'	7'≤H≤10'	15'	20'	H > 20'
108"	10"	4000	0.36	0.37	0.41	0.46	0.57	1.00	**	**
			0.20	0.19	0.21	0.24	0.26	0.34	**	**
		6000	*	*	*	*	*	*	1.01	**
			*	*	*	*	*	*	0.41	**
108"	10¾"	4000	0.35	0.35	0.39	0.44	0.48	0.89	**	**
			0.18	0.18	0.20	0.22	0.24	0.31	**	**
		5000	*	*	*	*	*	*	1.06	**
			*	*	*	*	*	*	0.37	**
114"	10½"	4000	0.39	0.40	0.44	0.52	0.64	**	**	**
			0.20	0.21	0.23	0.26	0.28	**	**	**
		5000	*	*	*	*	*	0.86	**	**
			*	*	*	*	*	0.36	**	**
		6000	*	*	*	*	*	*	1.10	**
			*	*	*	*	*	*	0.44	**
114"	11¼"	4000	0.37	0.38	0.42	0.48	0.53	1.03	**	**
			0.19	0.19	0.21	0.24	0.26	0.33	**	**
		6000	*	*	*	*	*	*	0.94	**
			*	*	*	*	*	*	0.39	**
120"	11"	4000	0.41	0.43	0.47	0.59	0.71	**	**	**
			0.21	0.22	0.24	0.28	0.30	**	**	**
		5000	*	*	*	*	*	0.97	**	**
			*	*	*	*	*	0.38	**	**
120"	11¾"	4000	0.40	0.40	0.45	0.52	0.61	1.18	**	**
			0.20	0.20	0.23	0.26	0.28	0.36	**	**

NOTES:

1) * INDICATES SAME STEEL AREA AS SHOWN FOR THE LESSER CONCRETE STRENGTH.
2) ** INDICATES A SPECIAL DESIGN IS REQUIRED. USE PENNDOT ACCEPTED SOFTWARE.
3) ELLIPTICAL REINFORCING IS NOT ALLOWED, EXCEPT FOR QUADRANT REINFORCEMENT AND FOR REINFORCEMENT OF ELLIPTICAL PIPE.
4) FOR DOUBLE CIRCULAR STEEL REINFORCED PIPE, TWO AREAS ARE SHOWN. THE GREATER AREA IS FOR THE INNER CAGE STEEL AND LESSER AREA IS FOR OUTER CAGE STEEL.
5) SUBSTITUTION OF PIPES UNDER FILLS OF 3'-0" OR LESS IS PERMITTED ONLY WITH DESIGNER APPROVAL.
6) USE PENNDOT ACCEPTED SOFTWARE ONLY FOR PIPE DESIGNS NOT PROVIDED BY BD-636M.
7) STEEL AREAS SPECIFIED IN THE FILL HEIGHT / STEEL AREA TABLES ARE TO BE ACHIEVED USING ONE LAYER OF REINFORCEMENT FOR EACH CAGE. TWO LAYERS MAY BE SUBSTITUTED FOR ONE LAYER PROVIDED THE SUM OF THE STEEL AREAS OF THE 2 LAYERS IS EQUAL TO THE AREA OF STEEL FOR THE SINGLE LAYER CAGE. WHEN SUBSTITUTING, SPACING OF REINFORCEMENT IS TO REMAIN THE SAME. DESIGNING FOR 2 LAYERS OF REINFORCEMENT AND PROVIDING ONE LAYER OF REINFORCEMENT OF EQUIVALENT AREA IS NOT PERMITTED.

DESIGN TABLES FOR CIRCULAR PIPES - TYPE A STANDARD INSTALLATION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD REINFORCED CONCRETE PIPES

PAIDD DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 4 OF 10

BD-636M

TYPE A STANDARD INSTALLATION
REQUIRED FILL/COVER HEIGHT (FT.) - PROOF TEST LOAD (lbs./LF/FT.OF DIAMETER)

DIA. (in.)	1.0≤H≤1.5'	1.5'≤ H< 2'	2'≤H<3'	3'≤H<7'	7'≤ H≤10'	10'<H≤15'	15'<H≤20'	20'<H≤25'	25'<H≤30'	30'<H≤40'	40'<H≤50'	50'<H≤60'	60'<H≤70'	70'<H≤80'	80'<H≤90'	90'<H≤100'
12	1720	1237	972	752	911	1271	1667	2066	2470	3282	4097	4913	5730	6548	7366	8183
15	1547	1132	901	713	887	1244	1625	2015	2408	3200	3994	4790	5587	6384	7181	7979
18	1412	1049	845	698	871	1222	1597	1980	2367	3145	3926	4709	5492	6275	7059	7842
21	1303	980	798	686	858	1207	1577	1955	2337	3106	3877	4650	5423	6197	6971	7745
24	1215	928	766	703	886	1250	1635	2028	2425	3223	4023	4825	5628	6431	7234	8037
27	1386	1056	732	695	878	1240	1623	2013	2406	3199	3994	4790	5586	6383	7180	7978
30	1303	1003	701	688	872	1232	1613	2001	2392	3179	3970	4761	5553	6345	7137	7930
33	1230	955	674	683	866	1226	1604	1991	2380	3164	3950	4738	5526	6314	7102	7891
36	1094	915	654	691	881	1249	1636	2030	2428	3227	4030	4833	5637	6441	7246	8050
42	972	939	657	682	873	1240	1625	2017	2412	3206	4003	4802	5600	6399	7199	7998
48	793	871	618	675	867	1233	1617	2007	2400	3191	3984	4778	5573	6368	7163	7959
54	705	863	633	669	861	1228	1610	1999	2391	3178	3968	4760	5552	6344	7136	7928

DIA. (in.)	1.0≤H≤1.5'	1.5'≤ H< 2'	2'≤H<3'	3'≤H<7'	7'≤ H≤10'	10'<H≤15'	15'<H≤20'	20'<H≤25'	25'<H≤30'	30'<H≤40'	40'<H≤50'	50'<H≤60'	60'<H≤70'	70'<H≤80'	80'<H≤90'	90'<H≤100'
60	601	810	601	663	857	1222	1605	1992	2383	3168	3956	4745	5534	6324	7114	7904
66	555	814	657	658	850	1219	1600	1987	2377	3160	3946	4733	5520	6308	7096	7884
72	490	774	631	667	870	1245	1636	2032	2431	3232	4036	4841	5646	6452	7258	8064
78	435	736	606	663	867	1243	1632	2028	2426	3226	4029	4832	5636	6441	7245	8049
84	391	699	582	660	860	1240	1630	2025	2422	3221	4023	4825	5628	6431	7234	8037
90	355	633	590	656	861	1238	1627	2022	2419	3217	4017	4818	5620	6422	7224	8026
96	324	578	556	653	859	1236	1625	2019	2416	3213	4013	4813	5614	6415	7216	8017
102	339	606	516	650	857	1234	1623	2017	2413	3210	4008	4808	5608	6408	7208	8009
108	313	559	482	647	855	1232	1621	2015	2411	3207	4005	4803	5603	6402	7202	8001
114	291	518	475	645	853	1231	1619	2013	2409	3204	4001	4799	5598	6397	7196	7995
120	272	483	448	642	851	1229	1618	2011	2407	3202	3998	4796	5594	6392	7190	7989

NOTE: THESE PROOF LOADS INCLUDE A FACTOR OF SAFETY OF 1.43 FOR FIELD CRACK CONTROL.

LEGEND

▨ = FOR INFORMATION ONLY. PROOF LOAD TEST MUST BE PERFORMED TO THE MAXIMUM PROOF TEST LOAD FOR THE RANGE OF ITEM NUMBER.

PROOF TEST LOAD TABLE FOR CIRCULAR PIPES - TYPE A STANDARD INSTALLATION

NOTE : PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN (CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES RELY UPON THE MAXIMUM VS. MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES. SEE FIGURE "FLEXURE - SHEAR - CRACK CONTROL" AND EXAMPLE ON SHEET 2.

NOTE:
THESE PROOF LOADS INCLUDE A FACTOR OF SAFETY OF 1.43 FOR FIELD CRACK CONTROL.
USE PENNDOT ACCEPTED SOFTWARE TO DETERMINE PROOF LOAD VALUES FOR FILL HEIGHTS GREATER THAN 100'-0".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD REINFORCED CONCRETE PIPES

PAIDD DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 5 OF 10

BD-636M

TYPE B STANDARD INSTALLATION - STEEL AREAS (in.^{2}/ft.)

Dia.	Wall Thick.	f'c (psi)	Required Fill/Cover Height H≤1.5'	1.5'≤H≤2'	2'≤H≤3'	3'≤H≤7'	7'≤H≤10'	15'	20'	25'	30'	40'	50'	H >50'
12"	2"	4000	0.09	←		0.08					→	0.12	**	**
		5000	*	*	*	*	*	*	*	*	*	*	0.16	**
12"	2¾"	4000	0.08	←		0.08					→	0.08	*	**
15"	2¼"	4000	0.11	←		0.08				0.09	0.11	0.19	**	**
		6000	*	*	*	*	*	*	*	*	*	*	0.19	**
15"	3"	4000	0.08	←		0.07				0.07	0.09	0.12	0.16	**
18"	2½"	4000	0.13	←		0.08			0.10	0.12	0.15	**	**	**
		5000	*	*	*	*	*	*	*	*	*	0.21	**	**
18"	3¼"	4000	0.12	←		0.07			0.08	0.10	0.11	0.16	**	**
21"	2¾"	4000	0.17	0.11	←	0.07	→	0.09	0.12	0.16	0.19	**	**	**
21"	3½"	4000	0.16	0.07	←	0.07	→	0.08	0.10	0.12	0.15	0.23	**	**
24"	3"	4000	0.22	0.14	←	0.10	→	0.11	0.15	0.19	0.24	**	**	**
24"	3¾"	4000	0.22	0.12	←	0.08	→	0.09	0.12	0.15	0.18	0.30	**	**
27"	3¼"	4000	**	0.16	0.11	0.10	0.10	0.13	0.18	0.22	0.30	**	**	**
		5000	0.26	*	*	*	*	*	*	*	*	**	**	**
27"	4"	4000	**	0.14	0.10	0.08	0.08	0.11	0.14	0.18	0.22	**	**	**
		5000	0.25	*	*	*	*	*	*	*	*	**	**	**
30"	3½"	4000	**	0.18	←	0.13	→	0.16	0.21	0.26	**	**	**	**
		5000	**	*	*	*	*	*	*	*	0.31	**	**	**
		6000	0.29	*	*	*	*	*	*	*	*	**	**	**
30"	4¼"	4000	**	0.16	←	0.12	→	0.13	0.17	0.21	0.25	**	**	**
		6000	0.27	*	*	*	*	*	*	*	*	**	**	**
33"	3¾"	4000	**	0.21	←	0.16	→	0.18	0.24	0.31	**	**	**	**
		5000	**	*	*	*	*	*	*	*	0.39	**	**	**
33"	4½"	4000	**	0.18	←	0.14	→	0.15	0.20	0.24	0.30	**	**	**
36"	4"	4000	**	0.22	0.18	0.13	0.15	0.21	0.27	0.38	**	**	**	**
		5000	**	*	*	*	*	*	*	*	*	0.47	**	**
36"	4¾"	4000	**	0.19	0.16	0.12	0.13	0.18	0.23	0.28	**	**	**	**
		5000	**	*	*	*	*	*	*	*	0.32	**	**	**
		6000	**	*	*	*	*	*	*	*	*	0.46	**	**
36"	4"	4000	0.18	0.17	0.09	0.11	0.11	0.15	0.20	0.26	0.36	**	**	**
			0.12	0.11	0.07	0.07	0.07	0.08	0.10	0.13	0.16	**	**	**
		5000	*	*	*	*	*	*	*	*	*	0.53	**	**
			*	*	*	*	*	*	*	*	*	0.21	**	**
36"	4¾"	4000	0.15	0.14	0.11	0.09	0.09	0.13	0.16	0.20	0.23	0.43	**	**
			0.09	0.09	0.07	0.07	0.07	0.07	0.07	0.09	0.11	0.15	**	**
42"	4½"	4000	0.19	0.18	0.16	0.14	0.14	0.18	0.24	0.34	0.46	**	**	**
			0.12	0.12	0.09	0.08	0.08	0.10	0.13	0.16	0.19	**	**	**
		6000	*	*	*	*	*	*	*	*	*	0.62	**	**
			*	*	*	*	*	*	*	*	*	0.25	**	**
42"	5¼"	4000	0.16	0.15	0.13	0.12	0.12	0.15	0.20	0.24	0.30	0.61	**	**
			0.10	0.09	0.08	0.07	0.07	0.07	0.09	0.12	0.14	0.20	**	**
48"	5"	4000	0.19	0.19	0.18	0.16	0.16	0.21	0.29	0.42	0.56	**	**	**
			0.12	0.12	0.11	0.09	0.09	0.11	0.15	0.19	0.23	**	**	**
		6000	*	*	*	*	*	*	*	*	*	0.74	**	**
			*	*	*	*	*	*	*	*	*	0.29	**	**
48"	5¾"	4000	0.17	0.16	0.15	0.14	0.14	0.18	0.23	0.28	0.44	**	**	**
			0.10	0.10	0.09	0.07	0.07	0.09	0.11	0.14	0.17	**	**	**
		5000	*	*	*	*	*	*	*	*	*	0.62	**	**
			*	*	*	*	*	*	*	*	*	0.23	**	**

TYPE B STANDARD INSTALLATION
REQUIRED FILL/COVER HEIGHT FT./ PROOF TEST LOAD (lbs./LF/FT. OF DIAMETER)

DIA. (in.)	1.0≤H≤1.5'	1.5'≤ H≤2'	2'≤H≤3'	3'≤H≤7'	7'≤H≤10'	10'≤H≤15'	15'≤H≤20'	20'≤H≤25'	25'≤H≤30'	30'≤H≤40'	40'≤H≤50'	50'≤H≤60'	60'≤H≤70'	70'≤H≤80'	80'≤H≤90'	90'≤H≤100'
12	1634	1175	923	714	866	1213	1584	1963	2346	3118	3892	4668	5444	6220	6997	7774
15	1470	1075	856	677	843	1182	1544	1914	2287	3040	3795	4451	5308	6065	6822	7580
18	1342	996	802	663	827	1161	1517	1881	2248	2988	3730	4473	5217	5961	6706	7450
21	1238	931	758	652	816	1147	1498	1857	2220	2950	3683	4418	5152	5887	6622	7358
24	1154	881	728	668	841	1187	1553	1927	2303	3061	3822	4584	5347	6109	6872	7635
27	1317	1004	695	660	834	1178	1541	1912	2286	3039	3794	4550	5307	6064	6821	7579
30	1237	952	666	654	828	1171	1532	1901	2272	3020	3771	4523	5275	6028	6781	7534
33	1168	907	640	648	823	1164	1524	1891	2261	3006	3753	4501	5249	5998	6747	7496
36	1039	870	621	656	837	1186	1554	1929	2306	3066	3828	4591	5355	6119	6883	7648
42	924	892	624	648	829	1178	1543	1916	2291	3046	3803	4562	5320	6079	6839	7598
48	754	827	587	641	823	1171	1536	1906	2280	3031	3785	4539	5294	6050	6805	7561

NOTE: THESE PROOF LOADS INCLUDE A FACTOR OF SAFETY OF 1.43 FOR FIELD CRACK CONTROL.

NOTE : PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN (CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES RELY UPON THE MAXIMUM VS. MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES. SEE FIGURE "FLEXURE - SHEAR - CRACK CONTROL" AND EXAMPLE ON SHEET 2.

LEGEND

▨ = FOR INFORMATION ONLY. PROOF LOAD TEST MUST BE PERFORMED TO THE MAXIMUM PROOF TEST LOAD FOR THE RANGE OF ITEM NUMBER.

NOTES:

1) * INDICATES SAME STEEL AREA AS SHOWN FOR THE LESSER CONCRETE STRENGTH.
2) ** INDICATES A SPECIAL DESIGN IS REQUIRED. USE PENNDOT ACCEPTED SOFTWARE.
3) ELLIPTICAL REINFORCING IS NOT ALLOWED, EXCEPT FOR QUADRANT REINFORCEMENT AND FOR REINFORCEMENT OF ELLIPTICAL PIPE.
4) FOR DOUBLE CIRCULAR STEEL REINFORCED PIPE, TWO AREAS ARE SHOWN. THE GREATER AREA IS FOR THE INNER CAGE STEEL AND LESSER AREA IS FOR OUTER CAGE STEEL.
5) FOR PIPE SIZES GREATER THAN 48" DIAMETER, USE TYPE A STANDARD INSTALLATION DESIGN TABLES.
6) H = DESIGN FILL HEIGHT, FT.
7) SUBSTITUTION OF PIPES UNDER FILLS OF 3'-0" OR LESS IS PERMITTED ONLY WITH DESIGNER APPROVAL.
8) USE PENNDOT ACCEPTED SOFTWARE ONLY FOR PIPE DESIGNS NOT PROVIDED BY BD-636M.
9) STEEL AREAS SPECIFIED IN THE FILL HEIGHT / STEEL AREA TABLES ARE TO BE ACHIEVED USING ONE LAYER OF REINFORCEMENT FOR EACH CAGE. TWO LAYERS MAY BE SUBSTITUTED FOR ONE LAYER PROVIDED THE SUM OF THE STEEL AREAS OF THE 2 LAYERS IS EQUAL TO THE AREA OF STEEL FOR THE SINGLE LAYER CAGE. WHEN SUBSTITUTING, SPACING OF REINFORCEMENT IS TO REMAIN THE SAME. DESIGNING FOR 2 LAYERS OF REINFORCEMENT AND PROVIDING ONE LAYER OF REINFORCEMENT OF EQUIVALENT AREA IS NOT PERMITTED.

DESIGN TABLES AND PROOF TEST LOAD TABLE FOR CIRCULAR PIPES - TYPE B STANDARD INSTALLATION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
REINFORCED CONCRETE PIPES
PAIDD DESIGN TABLES

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SHEET 6 OF 10

BD-636M

TYPE A SHORING/TRENCH BOX - STEEL AREAS (in.²/ft.)								
			Required Fill/Cover Height					
Dia.	Wall Thick.	f'c (psi)	H≤1.5'	1.5'≤H≤2'	2'≤H≤3'	3'≤H≤7'	7'≤H≤10'	15'
12"	2"	4000	IS REQUIRED	IS REQUIRED	←	←	0.08	→
12"	2¾"	4000			←	←	0.08	→
15"	2¼"	4000			0.09	←	0.08	→
15"	3"	4000			0.09	←	0.08	→
18"	2½"	4000			0.12	0.09	0.08	0.10
18"	3¼"	4000			0.11	0.08	0.07	0.09
21"	2¾"	4000			0.14	0.11	0.10	0.13
21"	3½"	4000			0.14	0.10	0.08	0.11
24"	3"	4000			0.18	0.14	0.12	0.14
24"	3¾"	4000			0.17	0.12	0.09	0.10
27"	3¼"	4000			0.20	0.16	0.14	0.16
27"	4"	4000			0.17	0.14	0.12	0.16
30"	3½"	4000	**	0.33	0.24	0.19	0.16	0.20
30"	4¼"	4000	**	0.26	0.20	0.16	0.20	0.20
33"	3¾"	4000	**	0.36	0.27	0.21	0.18	0.23
33"	4½"	4000	**	0.30	0.23	0.18	0.16	0.21
36"	4"	4000	**	0.36	0.31	0.22	0.21	0.31
36"	4¾"	4000	**	0.31	0.26	0.20	0.18	0.26
36"	4"	4000	**	0.29	0.22	0.18	0.16	0.19
			**	0.16	0.12	0.09	0.07	0.09
36"	4¾"	4000	**	0.23	0.18	0.15	0.13	0.18
			**	0.12	0.09	0.07	0.07	0.07
42"	4½"	4000	**	0.30	0.26	0.23	0.23	0.35
			**	0.16	0.13	0.12	0.12	0.14
42"	5¼"	4000	**	0.24	0.22	0.20	0.20	0.25
			**	0.13	0.11	0.10	0.10	0.11

TYPE A SHORING/TRENCH BOX - STEEL AREAS (in.²/ft.)								
			Required Fill/Cover Height					
Dia.	Wall Thick.	f'c (psi)	H≤1.5'	1.5'≤H≤2'	2'≤H≤3'	3'≤H≤7'	7'≤H≤10'	15'
48"	5"	4000	**	0.30	0.30	0.26	0.27	0.44
			**	0.16	0.16	0.13	0.13	0.16
48"	5¾"	4000	**	0.26	0.26	0.23	0.23	0.30
			**	0.14	0.14	0.11	0.11	0.14
54"	5½"	4000	**	0.32	0.31	0.30	0.34	0.53
			**	0.17	0.16	0.15	0.15	0.18
54"	6¼"	4000	**	0.27	0.27	0.26	0.27	0.38
			**	0.14	0.13	0.13	0.12	0.15
60"	6"	4000	**	0.33	0.33	0.33	0.42	0.62
			**	0.18	0.17	0.17	0.17	0.20
60"	6¾"	4000	**	0.29	0.29	0.30	0.31	0.48
			**	0.15	0.14	0.15	0.14	0.18
66"	6½"	4000	**	0.35	0.35	0.38	0.50	0.74
			**	0.18	0.18	0.18	0.19	0.23
66"	7¼"	4000	**	0.31	0.31	0.33	0.37	0.60
			**	0.16	0.15	0.16	0.16	0.20
72"	7"	4000	**	0.37	0.39	0.43	0.58	**
			**	0.19	0.19	0.18	0.21	**
		5000	**	*	*	*	*	0.76
			**	*	*	*	*	0.26
72"	7¾"	4000	**	0.34	0.35	0.36	0.45	0.75
			**	0.17	0.16	0.17	0.19	0.23
78"	7½"	4000	**	0.39	0.39	0.51	0.67	**
			**	0.20	0.20	0.20	0.23	**
		5000	**	*	*	*	*	0.86
			**	*	*	*	*	0.28
78"	8¼"	4000	**	0.36	0.39	0.39	0.53	0.91
			**	0.18	0.18	0.18	0.21	0.25

TYPE A SHORING/TRENCH BOX - STEEL AREAS (in.²/ft.)								
			Required Fill/Cover Height					
Dia.	Wall Thick.	f'c (psi)	H≤1.5'	1.5'≤H≤2'	2'≤H≤3'	3'≤H≤7'	7'≤H≤10'	15'
84"	8"	4000	**	0.42	0.42	0.59	0.78	**
			**	0.21	0.21	0.22	0.26	**
		6000	**	*	*	*	*	0.90
			**	*	*	*	*	0.31
84"	8¾"	4000	**	0.39	0.39	0.47	0.64	**
			**	0.19	0.19	0.20	0.23	**
		5000	**	*	*	*	*	0.82
			**	*	*	*	*	0.28
90"	8½"	4000	**	0.45	0.45	0.68	0.92	**
			**	0.22	0.22	0.25	0.28	**
		6000	**	*	*	*	*	1.01
			**	*	*	*	*	0.33
90"	9¼"	4000	**	0.41	0.41	0.55	0.93	**
			**	0.20	0.20	0.23	0.28	**
		5000	**	*	*	*	*	0.94
			**	*	*	*	*	0.30
96"	9"	4000	**	0.50	0.48	0.76	**	**
			**	0.23	0.23	0.27	**	**
		5000	**	*	*	*	0.88	**
			**	*	*	*	0.30	**
96"	9¾"	4000	**	0.44	0.44	0.64	0.93	**
			**	0.21	0.21	0.25	0.28	**
		6000	**	*	*	*	*	0.95
			**	*	*	*	*	0.33
102"	9½"	4000	**	0.56	0.52	0.85	**	**
			**	0.25	0.25	0.30	**	**
		5000	**	*	*	*	0.97	**
			**	*	*	*	0.33	**
102"	10¼"	4000	**	0.47	0.48	0.73	**	**
			**	0.23	0.23	0.27	**	**
		5000	**	*	*	*	0.83	**
			**	*	*	*	0.30	**

TYPE A SHORING/TRENCH BOX - STEEL AREAS (in.²/ft.)								
			Required Fill/Cover Height					
Dia.	Wall Thick.	f'c (psi)	H ≤1.5'	1.5'≤H≤2'	2' ≤ H≤3'	3' ≤ H≤7'	7' ≤ H≤10'	
108"	10"	4000	**	0.62	0.58	***	**	
			**	0.26	0.26	*	**	
		6000	**	*	*	*	1.00	
			**	*	*	*	0.35	
108"	10¾"	4000	**	0.51	0.51	0.86	**	
			**	0.24	0.24	0.30	**	
		5000	**	*	*	*	0.93	
			**	*	*	*	0.33	
114"	10½"	4000	**	0.68	0.65	***	**	
			**	0.28	0.28	*	**	
		6000	**	*	*	*	1.11	
			**	*	*	*	0.38	
114"	11¼"	4000	**	0.58	0.55	0.73	**	
			**	0.26	0.26	0.29	**	
		5000	**	*	*	*	1.06	
			**	*	*	*	0.35	
120"	11"	4000	**	0.75	**	***	**	
			**	0.29	**	*	**	
		5000	**	*	0.72	*	**	
			**	*	0.30	*	**	
		6000	**	*	*	*	1.22	
			**	*	*	*	0.40	
120"	11¾"	4000	**	0.64	0.62	0.82	**	
			**	0.28	0.28	0.31	**	
		6000	**	*	*	*	1.07	
			**	*	*	*	0.38	

TYPE A SHORING/TRENCH BOX INSTALLATION REQUIRED FILL/COVER HEIGHT (FT.)/ PROOF TEST LOAD(lbs/LF/FT. OF DIAMETER)							
DIA. (in.)	1.5'≤H≤2'	2'≤H≤3'	3'≤H≤7'	7'≤H≤10'	10'≤H≤15'	15'≤H≤20'	20'≤H≤25'
12	1762	1496	1196	1295	1818	2376	2945
15	1621	1393	1135	1260	1772	2318	2872
18	1509	1313	1087	1237	1741	2276	2822
21	1418	1247	1048	1220	1719	2247	2787
24	1341	1192	1015	1207	1702	2226	2761
27	1274	1143	986	1196	1888	2209	2740
30	1216	1101	961	1187	1878	2195	2723
33	1165	1063	938	1180	1869	2184	2710
36	1119	1029	924	1174	1861	2175	2698
42	1092	985	1125	1467	2105	2767	3439
48	1023	936	1114	1457	2093	2753	3422
54	1015	895	1104	1449	2084	2742	3409
60	961	858	1096	1442	2077	2733	3398
66	965	858	1089	1436	2070	2726	3389
72	922	829	1082	1431	2065	2719	3382
78	882	802	1076	1426	2061	2714	3375
84	847	778	1071	1422	2057	2709	3370
90	786	786	1066	1418	2053	2705	3365
96	752	752	1061	1415	2050	2702	3361
102	753	712	1057	1412	2047	2699	3357
108	705	678	1053	1409	2044	2696	3354
114	671	671	1049	1406	2042	2693	3351
120	643	643	1046	1404	2040	2691	3348

NOTE: THESE PROOF LOADS INCLUDE A 1.43 SAFETY FACTOR FOR FIELD CRACK CONTROL.

NOTE : PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN (CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES RELY UPON THE MAXIMUM VS. MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES. SEE FIGURE "FLEXURE - SHEAR - CRACK CONTROL" AND EXAMPLE ON SHEET 2.

DESIGN TABLES AND PROOF TEST LOAD TABLE FOR CIRCULAR PIPES - TYPE A SHORING/TRENCH BOX INSTALLATION

TYPE B SHORING/TRENCH BOX - STEEL AREAS (in²/ft.)								
			Required Fill/Cover Height					
Dia.	Wall Thick.	f'c (psi)	H≤1.5'	1.5'≤H≤2'	2'≤H≤3'	3'≤H≤7'	7'≤H≤10'	15'
12"	2"	4000	IS REQUIRED	IS REQUIRED	←	←	0.08	→
12"	2¾"	4000			←	←	0.07	→
15"	2¼"	4000			←	←	0.08	→
15"	3"	4000			←	←	0.07	→
18"	2½"	4000			0.11	0.09	0.07	0.09
18"	3¼"	4000			0.09	0.07	0.07	0.07
21"	2¾"	4000			0.13	0.11	0.09	0.11
21"	3½"	4000			0.11	0.09	0.08	0.09
24"	3"	4000			0.16	0.13	0.11	0.13
24"	3¾"	4000			0.13	0.11	0.09	0.11
27"	3¼"	4000			0.19	0.15	0.13	0.16
27"	4"	4000			0.16	0.13	0.11	0.13
30"	3½"	4000	**	0.29	0.22	0.17	0.15	0.18
30"	4¼"	4000	**	0.25	0.18	0.15	0.13	0.16
33"	3¾"	4000	**	0.33	0.25	0.20	0.17	0.21
33"	4½"	4000	**	0.28	0.21	0.17	0.15	0.18

TYPE B SHORING/TRENCH BOX - STEEL AREAS (in²/ft.)								
			Required Fill/Cover Height					
Dia.	Wall Thick.	f'c (psi)	H≤1.5'	1.5'≤H≤2'	2'≤H≤3'	3'≤H≤7'	7'≤H≤10'	15'
36"	4"	4000	**	0.35	0.27	0.21	0.20	0.30
36"	4¾"	4000	**	0.29	0.24	0.19	0.17	0.24
36"	4"	4000	**	0.27	0.21	0.17	0.15	0.18
			**	0.15	0.07	0.08	0.07	0.08
36"	4¾"	4000	**	0.22	0.17	0.14	0.13	0.15
			**	0.12	0.09	0.07	0.07	0.07
42"	4½"	4000	**	0.28	0.24	0.22	0.22	0.33
			**	0.15	0.13	0.11	0.10	0.13
42"	5¼"	4000	**	0.23	0.21	0.18	0.19	0.23
			**	0.12	0.10	0.09	0.08	0.10
48"	5"	4000	**	0.29	0.28	0.25	0.26	0.41
			**	0.16	0.14	0.13	0.12	0.15
48"	5¾"	4000	**	0.24	0.24	0.22	0.22	0.28
			**	0.13	0.12	0.12	0.10	0.12

TYPE B
SHORING/TRENCH BOX INSTALLATION
REQUIRED FILL/COVER HEIGHT (FT.)/
PROOF TEST LOAD(lbs/LF/FT. OF DIAMETER)

FILL DIA.	1.5'≤H≤2'	2'≤H≤3'	3'≤H≤7'	7'≤H≤10'	10'≤H≤15'	15'≤H≤20'	20'≤H≤25'
12"	1674	1420	1131	1230	1727	2257	2798
15"	1540	1323	1078	1197	1683	2200	2728
18"	1434	1247	1033	1175	1654	2162	2681
21"	1347	1185	996	1159	1633	2135	2648
24"	1274	1132	964	1146	1617	2114	2622
27"	1211	1086	937	1136	1604	2098	2603
30"	1156	1046	913	1128	1594	2086	2587
33"	1107	1010	891	1121	1585	2075	2574
36"	1063	977	878	1115	1578	2066	2564
42"	1038	936	1068	1393	1999	2629	3268
48"	972	890	1058	1384	1989	2616	3251

NOTE: THESE PROOF LOADS INCLUDE A 1.43 SAFETY FACTOR FOR FIELD CRACK CONTROL.

DESIGN TABLES AND PROOF TEST LOAD TABLE FOR CIRCULAR PIPES -TYPE B SHORING/TRENCH BOX INSTALLATION

NOTES:

1) * INDICATES SAME STEEL AREA AS SHOWN FOR THE LESSER CONCRETE STRENGTH.
2) ** INDICATES A SPECIAL DESIGN IS REQUIRED. USE PENNDOT ACCEPTED SOFTWARE.
3) ELLIPTICAL REINFORCING IS NOT ALLOWED, EXCEPT FOR QUADRANT REINFORCEMENT AND REINFORCEMENT OF ELLIPTICAL PIPE.
4) FOR DOUBLE CIRCULAR STEEL REINFORCED PIPE, TWO AREAS ARE SHOWN. THE GREATER AREA IS FOR THE INNER CAGE STEEL AND LESSER AREA IS FOR OUTER CAGE STEEL.
5) FOR PIPE DIAMETERS GREATER THAN 48", USE TYPE A SHORING/TRENCH BOX DESIGN TABLES.
6) FOR FILL HEIGHTS GREATER THAN INDICATED, USE THE PENNDOT ACCEPTED SOFTWARE.
7) H = DESIGN FILL HEIGHT, FT.
8) SUBSTITUTION OF PIPES UNDER FILLS OF 3'-0" OR LESS IS PERMITTED ONLY WITH DESIGNER APPROVAL.
9) USE PENNDOT ACCEPTED SOFTWARE ONLY FOR PIPE DESIGNS NOT PROVIDED BY BD-636M.
10) STEEL AREAS SPECIFIED IN THE FILL HEIGHT / STEEL AREA TABLES ARE TO BE ACHIEVED USING ONE LAYER OF REINFORCEMENT FOR EACH CAGE. TWO LAYERS MAY BE SUBSTITUTED FOR ONE LAYER PROVIDED THE SUM OF THE STEEL AREAS OF THE 2 LAYERS IS EQUAL TO THE AREA OF STEEL FOR THE SINGLE LAYER CAGE. WHEN SUBSTITUTING, SPACING OF REINFORCEMENT IS TO REMAIN THE SAME. DESIGNING FOR 2 LAYERS OF REINFORCEMENT AND PROVIDING ONE LAYER OF REINFORCEMENT OF EQUIVALENT AREA IS NOT PERMITTED.
11) *** INDICATES A SHEAR CONTROL HAS BEEN REACHED, USE PENNDOT ACCEPTED SOFTWARE FOR SPECIAL DESIGN.

LEGEND

▨ = FOR INFORMATION ONLY. PROOF LOAD TEST MUST BE PERFORMED TO THE MAXIMUM PROOF TEST LOAD FOR THE RANGE OF ITEM NUMBER.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD REINFORCED CONCRETE PIPES

PAIDD DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
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SHEET 7 OF 10

BD-636M

TYPE A STANDARD INSTALLATION **HORIZONTAL** ELLIPTICAL PIPE H<1.5 ft					
Equi-valent Round	Rise /Span (in.)	Wall Thick.	f'c (psi)	Steel Area (in^2/ft.)	PROOF TEST Lbs/ft/ft
18"	14x23	2¾"	4000	**	1240
			5000	0.20	
24"	19x30	3¼"	4000	**	1303
27"	22x34	3½"	4000	**	1190
			5000	**	
			6000	**	
30"	24x38	3¾"	4000	0.22	1132
				0.22	
33"	27x42	3¾"	4000	0.25	972
				0.25	
36"	29x45	4½"	4000	0.21	875
				0.21	
42"	34x53	5"	4000	0.23	726
				0.23	
48"	38x60	5½"	4000	0.24	601
				0.24	
54"	43x68	6"	4000	0.26	531
				0.26	
60"	48x76	6½"	4000	0.28	452
				0.28	
66"	53x83	7"	4000	0.30	398
				0.30	
72"	58x91	7½"	4000	0.33	349
				0.33	
78"	63x98	8"	4000	0.36	358
				0.36	
84"	68x106	8½"	4000	0.44	321
				0.44	
90"	72x113	9"	4000	0.50	294
				0.50	
96"	77x121	9½"	4000	0.60	269
				0.60	
102"	82x128	9¾"	4000	0.71	250
				0.71	
108"	87x136	10"	4000	0.86	232
				0.86	
114"	92x143	10½"	4000	0.95	218
				0.95	
120"	97x151	11"	4000	1.08	216
				1.08	

TYPE B STANDARD INSTALLATION **HORIZONTAL** ELLIPTICAL PIPE H<1.5 ft.					
Equi-valent Round	Rise /Span (in.)	Wall Thick.	f'c (psi)	Steel Area (in^2/ft.)	PROOF TEST Lbs/ft/ft
18"	14x23	2¾"	4000	0.20	1178
24"	19x30	3¼"	4000	**	1237
			5000	**	
			6000	0.29	
27"	22x34	3½"	4000	**	1131
			5000	**	
			6000	**	
30"	24x38	3¾"	4000	0.21	1076
				0.21	
33"	27x42	3¾"	4000	0.23	924
				0.23	
36"	29x45	4½"	4000	0.20	832
				0.20	
42"	34x53	5"	4000	0.22	690
				0.22	
48"	38x60	5½"	4000	0.23	571
				0.23	
54"	43x68	6"	4000	0.25	504
				0.25	
60"	48x76	6½"	4000	0.27	429
				0.27	
66"	53x83	7"	4000	0.29	378
				0.29	
72"	58x91	7½"	4000	0.32	332
				0.32	
78"	63x98	8"	4000	0.34	340
				0.34	
84"	68x106	8½"	4000	0.42	305
				0.42	
90"	72x113	9"	4000	0.47	280
				0.47	
96"	77x121	9½"	4000	0.56	255
				0.56	
102"	82x128	9¾"	4000	0.71	238
				0.71	
108"	87x136	10"	4000	0.82	220
				0.82	
114"	92x143	10½"	4000	0.90	207
				0.90	
120"	97x151	11"	4000	1.02	206
				1.02	

NOTES:

1) * INDICATES SAME STEEL AREA AS SHOWN FOR THE LESSER CONCRETE STRENGTH.
2) ** INDICATES A SPECIAL DESIGN IS REQUIRED. USE PENNDOT ACCEPTED SOFTWARE.
3) ELLIPTICAL REINFORCING IS NOT ALLOWED, EXCEPT FOR QUADRANT REINFORCEMENT AND REINFORCEMENT OF ELLIPTICAL PIPE.
4) FOR DOUBLE CIRCULAR STEEL REINFORCED PIPE, TWO AREAS ARE SHOWN. THE GREATER AREA IS FOR THE INNER CAGE STEEL AND LESSER AREA IS FOR OUTER CAGE STEEL.
5) H = DESIGN FILL HEIGHT, FT.
6) SUBSTITUTION OF PIPES UNDER FILLS OF 3'-0" OR LESS IS PERMITTED ONLY WITH DESIGNER APPROVAL.
7) FOR DESIGN OF A TYPE A STANDARD ELLIPTICAL PIPE FOLLOW THESE STEPS:
   (a) USE CORRESPONDING VALUES IN PROOF TEST LOAD TABLE TO TEST CONCRETE PIPE. SELECT THE LARGER DIMENSION OF SPAN OR RISE FROM ELLIPTICAL PIPE SIZES SHOWN IN THE TYPE A SHORING/TRENCH BOX TABLE FOR ELLIPTICAL PIPES.
      I.E. RISE DIMENSION FOR VERTICAL ELLIPTICAL
      SPAN DIMENSION FOR HORIZONTAL ELLIPTICAL
   (b) GO TO TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPES.
   (c) USE THE RISE DIMENSION FOR VERTICAL ELLIPTICAL DESIGNS OR THE SPAN DIMENSION FOR THE HORIZONTAL ELLIPTICAL DESIGNS AS THE DIAMETER IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPE. [IF THE SELECTED DIAMETER IS NOT AVAILABLE IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPE, USE THE NEXT LARGER AVAILABLE DIAMETER IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPE TO DETERMINE THE STEEL AREA.]
   (d) FOR THE SELECTED DIAMETER, WALL THICKNESS, DESIGN FILL HEIGHT AND CONCRETE STRENGTH, DETERMINE THE AREA OF STEEL REQUIRED FOR THE INNER CAGE OF THE PIPE IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPES. USE THIS AREA FOR EACH, INNER AND OUTER, CAGE FOR THE ELLIPTICAL PIPE DESIGN.
8) USE PENNDOT ACCEPTED SOFTWARE ONLY FOR PIPE DESIGNS NOT PROVIDED BY BD-636M.
9) STEEL AREAS SPECIFIED IN THE FILL HEIGHT / STEEL AREA TABLES ARE TO BE ACHIEVED USING ONE LAYER OF REINFORCEMENT FOR EACH CAGE. TWO LAYERS MAY BE SUBSTITUTED FOR ONE LAYER PROVIDED THE SUM OF THE STEEL AREAS OF THE 2 LAYERS IS EQUAL TO THE AREA OF STEEL FOR THE SINGLE LAYER CAGE. WHEN SUBSTITUTING, SPACING OF REINFORCEMENT IS TO REMAIN THE SAME. DESIGNING FOR 2 LAYERS OF REINFORCEMENT AND PROVIDING ONE LAYER OF REINFORCEMENT OF EQUIVALENT AREA IS NOT PERMITTED.

DESIGN TABLES FOR HORIZONTAL ELLIPTICAL PIPE-STANDARD INSTALLATION- TYPE A / TYPE B

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD REINFORCED CONCRETE PIPES

PAIDD ELLIPTICAL PIPE DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

TYPE A SHORING/TRENCH BOX **VERTICAL** ELLIPTICAL PIPE -STEEL AREAS (in²/ft.)

Equivalent Round (in.)	Rise /Span (in.)	Wall Thick.	f'c (psi)	Required Fill/Cover Height H<1.5'	1.5'≤H<2'	2'≤H<3'	3'≤H<7'	7'≤H<10'	15'	20'	25'
36"	45/29	4½"	4000	**	0.23	0.19	0.14	0.12	0.15	0.19	0.23
				**	0.12	0.10	0.07	0.07	0.07	0.08	0.09
42"	53/34	5"	4000	**	0.28	0.23	0.17	0.15	0.18	0.23	0.28
				**	0.14	0.12	0.09	0.08	0.07	0.09	0.12
48"	60/38	5½"	4000	**	0.20	0.18	0.15	0.15	0.20	0.25	0.31
				**	0.10	0.09	0.08	0.08	0.08	0.11	0.13
54"	68/43	6"	4000	**	0.21	0.19	0.18	0.18	0.23	0.29	**
				**	0.11	0.10	0.09	0.09	0.10	0.12	**
			5000	**	*	*	*	*	*	*	0.30
				**	*	*	*	*	*	*	0.13
60"	76/48	6½"	4000	**	0.22	0.22	0.20	0.21	0.27	0.33	**
				**	0.11	0.11	0.10	0.11	0.11	0.14	**
			5000	**	*	*	*	*	*	*	0.34
				**	*	*	*	*	*	*	0.15
66"	83/53	7"	4000	**	0.24	0.23	0.22	0.23	0.31	0.38	**
				**	0.12	0.12	0.11	0.12	0.13	0.16	**
			5000	**	*	*	*	*	*	*	0.39
				**	*	*	*	*	*	*	0.17
72"	91/58	7½"	4000	**	0.25	0.25	0.25	0.26	0.34	**	**
				**	0.13	0.13	0.13	0.13	0.15	**	**
			5000	**	*	*	*	*	*	0.37	0.44
				**	*	*	*	*	*	0.16	0.19
78"	98/63	8"	4000	**	0.26	0.26	0.27	0.29	0.38	**	**
				**	0.13	0.13	0.14	0.15	0.16	**	**
			5000	**	*	*	*	*	*	0.41	0.48
				**	*	*	*	*	*	0.18	0.21
84"	106/68	8½"	4000	**	0.28	0.28	0.29	0.33	0.42	**	**
				**	0.14	0.14	0.15	0.17	0.18	**	**
			5000	**	*	*	*	*	*	0.45	**
				**	*	*	*	*	*	0.20	**
			6000	**	*	*	*	*	*	*	0.53
				**	*	*	*	*	*	*	0.23
90"	113/72	9"	4000	**	0.29	0.29	0.30	0.35	0.45	**	**
				**	0.15	0.15	0.15	0.18	0.19	**	**
			5000	**	*	*	*	*	*	0.48	**
				**	*	*	*	*	*	0.21	**
			6000	**	*	*	*	*	*	*	0.56
				**	*	*	*	*	*	*	0.24
96"	121/77	9½"	4000	**	0.31	0.31	0.33	0.38	0.49	**	**
				**	0.16	0.16	0.17	0.19	0.21	**	**
			5000	**	*	*	*	*	*	0.52	**
				**	*	*	*	*	*	0.23	**
			6000	**	*	*	*	*	*	*	0.61
				**	*	*	*	*	*	*	0.26
102"	128/82	9¾"	4000	**	0.34	0.34	0.37	0.43	**	**	**
				**	0.17	0.17	0.19	0.22	**	**	**
			5000	**	*	*	*	*	0.48	0.58	**
				**	*	*	*	*	0.21	0.25	**
			6000	**	*	*	*	*	*	*	0.73
				**	*	*	*	*	*	*	0.30
108"	136/87	10"	4000	**	0.36	0.36	0.41	0.49	*	**	**
				**	0.18	0.18	0.21	0.25	*	**	**
			5000	**	*	*	*	*	0.53	0.69	**
				**	*	*	*	*	0.24	0.28	**
			6000	**	*	*	*	*	*	*	0.86
				**	*	*	*	*	*	*	0.33
114"	143/92	10½"	4000	**	0.39	0.39	0.44	0.55	**	**	**
				**	0.20	0.20	0.22	0.28	**	**	**
			5000	**	*	*	*	*	0.57	**	**
				**	*	*	*	*	0.25	**	**
			6000	**	*	*	*	*	*	0.69	**
				**	*	*	*	*	*	0.30	**
120"	151/97	11"	4000	**	0.41	0.41	0.48	0.66	*	**	**
				**	0.21	0.21	0.24	0.33	*	**	**
			5000	**	*	*	*	*	0.61	**	**
				**	*	*	*	*	0.27	**	**
			6000	**	*	*	*	*	*	0.76	**
				**	*	*	*	*	*	0.32	**

PROOF TEST
LOAD TABLE FOR **VERTICAL** ELLIPTICAL PIPE
TYPE A SHORING TRENCH - BOX INSTALLATION (lbs/LF/FT. of DIAMETER)

REQUIRED FILL/COVER HEIGHT (FT.)/ PROOF TEST LOADS								
Equivalent Round (in.)	Rise /Span (in.)	1.5'≤H<2'	2'≤H<3'	3'≤H≤7'	7'<H≤10'	10'<H≤15'	15'<H≤20'	20'<H≤25'
36	14x29	1007	949	923	1181	1677	2198	2727
42	53x34	931	889	909	1168	1662	2179	2705
48	60x38	920	865	1113	1465	2110	2777	3453
54	68x43	864	823	1101	1454	2098	2762	3435
60	76x48	816	788	1091	1446	2088	2751	3421
66	83x53	812	757	1083	1438	2080	2741	3409
72	91x58	775	731	1075	1432	2074	2733	3400
78	98x63	778	731	1068	1426	2068	2726	3392
84	106x68	748	709	1062	1422	2063	2720	3385
90	113x72	725	694	1058	1418	2059	2716	3380
96	121x77	701	676	1053	1414	2055	2712	3374
102	128x82	678	660	1048	1410	2052	2708	3370
108	136x87	666	666	1043	1407	2048	2704	3365
114	143x92	652	652	1039	1404	2045	2701	3361
120	151x97	626	626	1036	1401	2043	2698	3358

NOTE : PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN (CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES RELY UPON THE MAXIMUM VS. MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES. SEE FIGURE "FLEXURE - SHEAR - CRACK CONTROL" AND EXAMPLE ON SHEET 2.

TYPE A SHORING/TRENCH BOX **HORIZONTAL** ELLIPTICAL PIPE -STEEL AREAS (in²/ft.)

Equivalent Round (in.)	Rise /Span (in.)	Wall Thick.	f'c (psi)	Required Fill/ Cover Height H<1.5'	1.5'≤H<2'	2'≤H<3'	3'≤H<7'	7'≤H<10'
18"	14x23	2¾"	4000	**	0.25	0.19	0.14	0.13
24"	19x30	3¼"	4000	**	0.37	0.27	0.20	0.18
27"	22x34	3½"	4000	**	0.39	0.33	0.25	0.22
30"	24x38	3¾"	4000	**	0.39	0.29	0.24	0.28
				**	0.39	0.29	0.24	0.28
33"	27x42	3¾"	4000	**	0.48	0.35	0.29	0.40
				**	0.48	0.35	0.29	0.40
36"	29x45	4½"	4000	**	0.33	0.32	0.27	0.32
				**	0.33	0.32	0.27	0.32
42"	34x53	5"	4000	**	0.35	0.35	0.33	0.45
				**	0.35	0.35	0.33	0.45
48"	38x60	5½"	4000	**	0.37	0.39	0.42	0.56
				**	0.37	0.39	0.42	0.56
54"	43x68	6"	4000	**	0.43	0.45	0.54	0.71
				**	0.43	0.45	0.54	0.71
60"	48x76	6½"	4000	**	0.50	0.54	0.66	**
				**	0.50	0.54	0.66	**
			5000	**	*	*	*	0.81
				**	*	*	*	0.81
66"	53x83	7"	4000	**	0.57	0.60	0.77	**
				**	0.57	0.60	0.77	**
			5000	**	*	*	*	0.94
				**	*	*	*	0.94
72"	58x91	7½"	4000	**	0.66	0.70	0.92	**
				**	0.66	0.70	0.92	**
			6000	**	*	*	*	1.03
				**	*	*	*	1.03
78"	63x98	8"	4000	**	0.73	0.78	**	**
				**	0.73	0.78	**	**
			5000	**	*	*	0.98	**
				**	*	*	0.98	**
			6000	**	*	*	*	1.16
				**	*	*	*	1.16
84"	68x106	8½"	4000	**	0.84	0.89	**	**
				**	0.84	0.89	**	**
			6000	**	*	*	1.07	**
				**	*	*	1.07	**
90"	72x113	9"	4000	**	0.92	0.99	**	**
				**	0.92	0.99	**	**
96"	77x121	9½"	4000	**	1.06	**	**	**
				**	1.06	**	**	**
			5000	**	*	1.04	**	**
				**	*	1.04	**	**
			7000	**	*	*	1.31	**
				**	*	*	1.31	**
102"	82x128	9¾"	5000	**	1.13	1.21	**	***
				**	1.13	1.21	**	***
			6000	**	*	*	1.52	***
				**	*	*	1.52	***
108"	87x136	10"	5000	**	1.32	**	**	***
				**	1.32	**	**	***
			6000	**	*	1.33	**	***
				**	*	1.33	**	***
114"	92x143	10½"	5000	**	1.43	**	**	***
				**	1.43	**	**	***
			6000	**	*	1.44	**	***
				**	*	1.44	**	***
120"	97x151	11"	4000	**	**	**	**	***
				**	**	**	**	***

PROOF TEST
LOAD TABLE FOR **HORIZONTAL** ELLIPTICAL PIPE
TYPE A SHORING TRENCH - BOX INSTALLATION (lbs/LF/FT. of DIAMETER)

REQUIRED FILL/COVER HEIGHT (FT.)/ PROOF TEST LOADS								
Equivalent Round (in.)	Rise /Span (in.)	1.5'≤H<2'	2'≤H<3'	3'≤H≤7'	7'<H≤10'	10'<H≤15'	15'<H≤20'	20'<H≤25'
18	14x23	1594	1364	1105	1216	1709	2233	2769
24	19x30	1447	1261	1046	1194	1680	2197	2724
27	22x34	1379	1213	1019	1185	1669	2182	2707
30	24x38	1388	1185	1149	1482	2117	2781	3455
33	27x42	1331	1147	1141	1475	2108	2769	3440
36	29x45	1293	1120	1136	1470	2102	2762	3431
42	34x53	1269	1059	1124	1459	2089	2746	3412
48	38x60	1198	1013	1116	1452	2081	2735	3399
54	43x68	1194	1008	1107	1445	2073	2726	3388
60	48x76	1130	966	1100	1439	2067	2718	3379
66	53x83	1080	933	1094	1434	2062	2713	3372
72	58x91	970	939	1088	1429	2058	2708	3366
78	63x98	1000	881	1083	1426	2054	2704	3361
84	68x106	908	817	1078	1422	2051	2700	3357
90	72x113	841	802	1074	1419	2048	2697	3353
96	77x121	777	753	1069	1416	2045	2694	3350
102	82x128	730	717	1066	1413	2043	2691	3347
108	87x136	683	681	1062	1411	2041	2689	3344
114	92x143	654	654	1059	1409	2039	2687	3342
120	97x151	627	627	1055	1406	2037	2685	3340

NOTES:

1) * INDICATES SAME STEEL AREA AS SHOWN FOR THE LESSER CONCRETE STRENGTH.
2) ** INDICATES A SPECIAL DESIGN IS REQUIRED. USE PENNDOT ACCEPTED SOFTWARE.
3) ELLIPTICAL REINFORCING IS NOT ALLOWED, EXCEPT FOR QUADRANT REINFORCEMENT AND REINFORCEMENT OF ELLIPTICAL PIPE.
4) FOR DOUBLE CIRCULAR STEEL REINFORCED PIPE, TWO AREAS ARE SHOWN. THE GREATER AREA IS FOR THE INNER CAGE STEEL AND LESSER AREA IS FOR OUTER CAGE STEEL.
5) *** INDICATES A SHEAR CONTROL HAS BEEN REACHED. USE PENNDOT ACCEPTED SOFTWARE FOR SPECIAL DESIGN.
6) H = DESIGN FILL HEIGHT, FT.
7) SUBSTITUTION OF PIPES UNDER FILLS OF 3'-0" OR LESS IS PERMITTED ONLY WITH DESIGNER APPROVAL.
8) FOR DESIGN OF A TYPE A STANDARD ELLIPTICAL PIPE FOLLOW THESE STEPS:
   (a) SELECT THE LARGER DIMENSION OF SPAN OR RISE FROM ELLIPTICAL PIPE SIZES SHOWN IN THE TYPE A SHORING/TRENCH BOX TABLE FOR ELLIPTICAL PIPES.
   I.E. RISE DIMENSION FOR VERTICAL ELLIPTICAL
   SPAN DIMENSION FOR HORIZONTAL ELLIPTICAL
   (b) GO TO TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPES.
   (c) USE THE RISE DIMENSION FOR VERTICAL ELLIPTICAL DESIGNS OR THE SPAN DIMENSION FOR THE HORIZONTAL ELLIPTICAL DESIGNS AS THE DIAMETER IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPE. [IF THE SELECTED DIAMETER IS NOT AVAILABLE IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPE, USE THE NEXT LARGER AVAILABLE DIAMETER IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPE TO DETERMINE THE STEEL AREA.]
   (d) FOR THE SELECTED DIAMETER, WALL THICKNESS, DESIGN FILL HEIGHT AND CONCRETE STRENGTH, DETERMINE THE AREA OF STEEL REQUIRED FOR THE INNER CAGE OF THE PIPE IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPES. USE THIS AREA FOR EACH, INNER AND OUTER, CAGE FOR THE ELLIPTICAL PIPE DESIGN.
9) USE PENNDOT ACCEPTED SOFTWARE ONLY FOR PIPE DESIGNS NOT PROVIDED BY BD-636M.
10) STEEL AREAS SPECIFIED IN THE FILL HEIGHT / STEEL AREA TABLES ARE TO BE ACHIEVED USING ONE LAYER OF REINFORCEMENT FOR EACH CAGE. TWO LAYERS MAY BE SUBSTITUTED FOR ONE LAYER PROVIDED THE SUM OF THE STEEL AREAS OF THE 2 LAYERS IS EQUAL TO THE AREA OF STEEL FOR THE SINGLE LAYER CAGE. WHEN SUBSTITUTING, SPACING OF REINFORCEMENT IS TO REMAIN THE SAME. DESIGNING FOR 2 LAYERS OF REINFORCEMENT AND PROVIDING ONE LAYER OF REINFORCEMENT OF EQUIVALENT AREA IS NOT PERMITTED.

DESIGN TABLES AND PROOF TEST LOAD TABLE FOR VERTICAL & HORIZONTAL ELLIPTICAL PIPES
-TYPE A SHORING/TRENCH BOX INSTALLATION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD REINFORCED CONCRETE PIPES

PAIDD ELLIPTICAL PIPE DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

TYPE B SHORING/TRENCH BOX **VERTICAL**
ELLIPTICAL PIPE -STEEL AREAS (in.²/ft.)

Equi-valent Round (in.)	Rise /Span (in.)	Wall Thick.	f'c (psi)	Required Fill/Cover Height H<1.5'	1.5'≤H<2'	2'≤H<3'	3'≤H<7'	7'≤H<10'	15'	20'	25'
36"	45/29	4½"	4000	**	0.22	0.18	0.13	0.11	0.16	0.20	0.25
				**	0.13	0.11	0.08	0.07	—	—	—
42"	53/34	5"	4000	**	0.27	0.22	0.16	0.14	0.20	0.25	0.32
				**	0.16	0.13	0.10	0.07	—	—	—
48"	60/38	5½"	4000	**	0.19	0.17	0.14	0.14	0.20	0.26	0.39
				**	0.10	0.09	0.07	0.07	0.10	0.13	0.20
54"	68/43	6"	4000	**	0.20	0.20	0.17	0.17	0.23	0.30	0.52
				**	0.10	0.10	0.08	0.07	0.12	0.15	0.26
60"	76/48	6½"	4000	**	0.21	0.21	0.19	0.19	0.27	0.38	0.67
				**	0.11	0.10	0.09	0.08	0.14	0.16	0.34
66"	83/53	7"	4000	**	0.22	0.22	0.21	0.22	0.30	0.49	**
				**	0.11	0.11	0.10	0.10	0.15	0.25	**
			5000	**	*	*	*	*	*	*	0.61
				**	*	*	*	*	*	*	0.31
72"	91/58	7½"	4000	**	0.23	0.23	0.23	0.25	0.34	0.61	**
				**	0.12	0.11	0.11	0.11	0.17	0.32	**
			6000	**	*	*	*	*	*	*	0.74
				**	*	*	*	*	*	*	0.37
78"	98/63	8"	4000	**	0.25	0.25	0.26	0.28	0.40	0.75	**
				**	0.12	0.12	0.12	0.12	0.20	0.38	**
			6000	**	*	*	*	*	*	*	0.71
				**	*	*	*	*	*	*	0.36
84"	106/68	8½"	4000	**	0.26	0.26	0.27	0.31	0.46	**	**
				**	0.13	0.13	0.13	0.14	0.23	**	**
			5000	**	*	*	*	*	*	0.63	**
				**	*	*	*	*	*	0.32	**
			6000	**	*	*	*	*	*	*	0.81
				**	*	*	*	*	*	*	0.42
90"	113/72	9"	4000	**	0.27	0.27	0.29	0.33	0.51	**	**
				**	0.13	0.13	0.13	0.15	0.26	**	**
			5000	**	*	*	*	*	*	0.71	*
				**	*	*	*	*	*	0.36	*
96"	121/77	9½"	4000	**	0.29	0.29	0.31	0.36	0.62	**	**
				**	0.14	0.14	0.14	0.16	0.31	**	**
			5000	**	*	*	*	*	*	0.83	*
				**	*	*	*	*	*	0.42	*
102"	128/82	9¾"	4000	**	0.31	0.32	0.35	0.40	0.79	**	**
				**	0.15	0.15	0.15	0.18	0.40	**	**
			6000	**	*	*	*	*	*	0.83	**
				**	*	*	*	*	*	0.42	**
108"	136/87	10"	4000	**	0.34	0.34	0.38	0.46	**	**	**
				**	0.16	0.16	0.17	0.20	**	**	**
			5000	**	*	*	*	*	0.72	*	**
				**	*	*	*	*	0.36	*	**
114"	143/92	10½"	4000	**	0.36	0.36	0.42	0.52	**	**	**
				**	0.17	0.17	0.19	0.22	**	**	**
			5000	**	*	*	*	*	0.80	*	**
				**	*	*	*	*	0.40	*	**
120"	151/97	11"	4000	**	0.38	0.39	0.45	0.58	**	**	**
				**	0.18	0.18	0.20	0.23	**	**	**
			5000	**	*	*	*	*	0.90	*	**
				**	*	*	*	*	0.45	*	**

PROOF TEST
LOAD TABLE FOR **VERTICAL** ELLIPTICAL PIPE
TYPE B SHORING TRENCH - BOX INSTALLATION (lbs/LF/FT. of DIAMETER)

REQUIRED FILL/COVER HEIGHT (FT.)/ PROOF TEST LOADS								
Equivalent Round (in.)	Rise /Span (in.)	1.5'≤H<2'	2'≤H<3'	3'≤H<7'	7'≤H<10'	10'≤H<15'	15'≤H<20'	20'≤H≤25'
36	45x29"	957	901	877	1122	1594	2088	2591
42	53x34"	884	845	863	1110	1579	2070	2569
48	60x38"	874	822	1057	1391	2004	2638	3280
54	68x43"	821	782	1046	1382	1993	2624	3263
60	76x48"	775	748	1037	1373	1984	2613	3250
66	83x53"	771	720	1029	1366	1976	2604	3239
72	91x58"	736	694	1021	1360	1970	2596	3230
78	98x63"	739	695	1015	1355	1964	2590	3222
84	106x68"	710	674	1009	1350	1960	2584	3215
90	113x72"	689	659	1005	1347	1956	2580	3211
96	121x77"	666	642	1000	1343	1952	2576	3206
102	128x82"	644	627	995	1340	1949	2572	3201
108	136x87"	633	633	991	1336	1946	2569	3197
114	143x92"	619	619	987	1333	1943	2566	3193
120	151x97"	599	595	984	1331	1940	2563	3190

NOTE : PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN (CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES RELY UPON THE MAXIMUM VS. MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES. SEE FIGURE "FLEXURE - SHEAR - CRACK CONTROL" AND EXAMPLE ON SHEET 2.

TYPE B SHORING/TRENCH BOX **HORIZONTAL**
ELLIPTICAL PIPE -STEEL AREAS (in²/ft.)

Equi-valent Round (in.)	Rise /Span (in.)	Wall Thick.	f'c (psi)	Required Fill/Cover Height H<1.5'	1.5'≤H<2'	2'≤H<3'	3'≤H<7'	7'≤H<10'
18"	14x23	2¾"	4000	**	0.22	0.18	0.13	0.12
24"	19x30	3¼"	4000	**	0.32	0.25	0.19	0.17
27"	22x34	3½"	4000	**	0.38	0.31	0.23	0.21
30"	24x38	3¾"	4000	**	0.34	0.27	0.22	0.26
				**	0.34	0.27	0.22	0.26
33"	27x42	3¾"	4000	**	0.37	0.33	0.27	0.38
				**	0.37	0.33	0.27	0.38
36"	29x45	4½"	4000	**	0.30	0.30	0.25	0.30
				**	0.30	0.30	0.25	0.30
42"	34x53	5"	4000	**	0.33	0.33	0.32	0.43
				**	0.33	0.33	0.32	0.43
48"	38x60	5½"	4000	**	0.37	0.37	0.40	0.53
				**	0.37	0.37	0.40	0.53
54"	43x68	6"	4000	**	0.43	0.43	0.51	0.67
				**	0.43	0.43	0.51	0.67
60"	48x76	6½"	4000	**	0.51	0.51	0.63	0.82
				**	0.51	0.51	0.63	0.82
66"	53x83	7"	4000	**	0.57	0.57	0.73	0.89
				**	0.57	0.57	0.73	0.89
72"	58x91	7½"	4000	**	0.67	0.67	0.87	1.03
				**	0.67	0.67	0.87	1.03
78"	63x98	8"	4000	**	0.74	0.74	**	**
				**	0.74	0.74	**	**
			5000	**	*	*	0.93	**
				**	*	*	0.93	**
			6000	**	*	*	*	1.10
				**	*	*	*	1.10
84"	68x106	8½"	4000	**	0.85	0.85	**	**
				**	0.85	0.85	**	**
			5000	**	*	*	1.08	**
				**	*	*	1.08	**
90"	72x113	9"	4000	**	0.94	0.94	**	**
				**	0.94	0.94	**	**
			6000	**	*	*	1.14	**
				**	*	*	1.14	**
96"	77x121	9½"	4000	**	1.06	1.06	**	**
				**	1.06	1.06	**	**
			6000	**	*	*	1.30	**
				**	*	*	1.30	**
102"	82x128	9¾"	5000	**	1.14	1.14	**	**
				**	1.14	1.14	**	**
108"	87x136	10"	5000	**	1.33	1.33	**	***
				**	1.33	1.33	**	***
114"	92x143	10½"	5000	**	1.44	1.44	**	***
				**	1.44	1.44	**	***
120"	97x151	11"	4000	**	**	**	**	***
				**	**	**	**	***

PROOF TEST
LOAD TABLE FOR **HORIZONTAL** ELLIPTICAL PIPE
TYPE B SHORING TRENCH - BOX INSTALLATION (lbs/LF/FT. of DIAMETER)

REQUIRED FILL/COVER HEIGHT (FT.)/ PROOF TEST LOADS								
Equivalent Round (in.)	Rise /Span (in.)	1.5'≤H<2'	2'≤H<3'	3'≤H<7'	7'≤H<10'	10'≤H<15'	15'≤H<20'	20'≤H≤25'
18	14x23"	1515	1296	1050	1155	1624	2122	2631
24	19x30"	1375	1198	994	1134	1596	2087	2588
27	22x34"	1310	1152	968	1125	1586	2073	2571
30	24x38"	1319	1126	1091	1408	2011	2642	3282
33	27x42"	1265	1089	1084	1401	2003	2631	3268
36	29x45"	1228	1064	1079	1396	1997	2624	3260
42	34x53"	1205	1006	1068	1386	1985	2608	3241
48	38x60"	1138	962	1060	1379	1977	2599	3229
54	43x68"	1134	957	1052	1372	1969	2590	3218
60	48x76"	1073	917	1045	1367	1963	2582	3210
66	53x83"	1026	887	1039	1362	1959	2577	3204
72	58x91"	921	892	1034	1358	1955	2572	3198
78	63x98"	950	837	1029	1355	1951	2568	3193
84	68x106"	863	776	1024	1351	1948	2565	3189
90	72x113"	799	762	1020	1348	1946	2562	3186
96	77x121"	738	715	1016	1345	1943	2559	3182
102	82x128"	693	681	1012	1343	1941	2557	3180
108	87x136"	649	647	1009	1340	1939	2554	3177
114	92x143"	621	621	1006	1338	1937	2552	3175
120	97x151"	595	595	1002	1336	1935	2550	3173

NOTES:

1) * INDICATES SAME STEEL AREA AS SHOWN FOR THE LESSER CONCRETE STRENGTH.
2) ** INDICATES A SPECIAL DESIGN IS REQUIRED. USE PENNDOT ACCEPTED SOFTWARE.
3) ELLIPTICAL REINFORCING IS NOT ALLOWED, EXCEPT FOR QUADRANT REINFORCEMENT AND REINFORCEMENT OF ELLIPTICAL PIPE.
4) FOR DOUBLE CIRCULAR STEEL REINFORCED PIPE, TWO AREAS ARE SHOWN. THE GREATER AREA IS FOR THE INNER CAGE STEEL AND LESSER AREA IS FOR OUTER CAGE STEEL.
5) *** INDICATES A SHEAR CONTROL HAS BEEN REACHED. USE PENNDOT ACCEPTED SOFTWARE FOR SPECIAL DESIGN.
6) H = DESIGN FILL HEIGHT, FT.
7) SUBSTITUTION OF PIPES UNDER FILLS OF 3'-0" OR LESS IS PERMITTED ONLY WITH DESIGNER APPROVAL.
8) FOR DESIGN OF A TYPE A STANDARD ELLIPTICAL PIPE FOLLOW THESE STEPS:
   (a) SELECT THE LARGER DIMENSION OF SPAN OR RISE FROM ELLIPTICAL PIPE SIZES SHOWN IN THE TYPE A SHORING/TRENCH BOX TABLE FOR ELLIPTICAL PIPES.
   I.E. RISE DIMENSION FOR VERTICAL ELLIPTICAL
   SPAN DIMENSION FOR HORIZONTAL ELLIPTICAL
   (b) GO TO TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPES.
   (c) USE THE RISE DIMENSION FOR VERTICAL ELLIPTICAL DESIGNS OR THE SPAN DIMENSION FOR THE HORIZONTAL ELLIPTICAL DESIGNS AS THE DIAMETER IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPE. [IF THE SELECTED DIAMETER IS NOT AVAILABLE IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPE, USE THE NEXT LARGER AVAILABLE DIAMETER IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPE TO DETERMINE THE STEEL AREA.]
   (d) FOR THE SELECTED DIAMETER, WALL THICKNESS, DESIGN FILL HEIGHT AND CONCRETE STRENGTH, DETERMINE THE AREA OF STEEL REQUIRED FOR THE INNER CAGE OF THE PIPE IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPES. USE THIS AREA FOR EACH, INNER AND OUTER, CAGE FOR THE ELLIPTICAL PIPE DESIGN.
9) USE PENNDOT ACCEPTED SOFTWARE ONLY FOR PIPE DESIGNS NOT PROVIDED BY BD-636M.
10) STEEL AREAS SPECIFIED IN THE FILL HEIGHT / STEEL AREA TABLES ARE TO BE ACHIEVED USING ONE LAYER OF REINFORCEMENT FOR EACH CAGE. TWO LAYERS MAY BE SUBSTITUTED FOR ONE LAYER PROVIDED THE SUM OF THE STEEL AREAS OF THE 2 LAYERS IS EQUAL TO THE AREA OF STEEL FOR THE SINGLE LAYER CAGE. WHEN SUBSTITUTING, SPACING OF REINFORCEMENT IS TO REMAIN THE SAME. DESIGNING FOR 2 LAYERS OF REINFORCEMENT AND PROVIDING ONE LAYER OF REINFORCEMENT OF EQUIVALENT AREA IS NOT PERMITTED.

DESIGN TABLES AND PROOF TEST LOAD TABLE FOR VERTICAL & HORIZONTAL ELLIPTICAL PIPES -TYPE B SHORING/TRENCH BOX INSTALLATION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD REINFORCED CONCRETE PIPES

PAIDD ELLIPTICAL PIPE DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

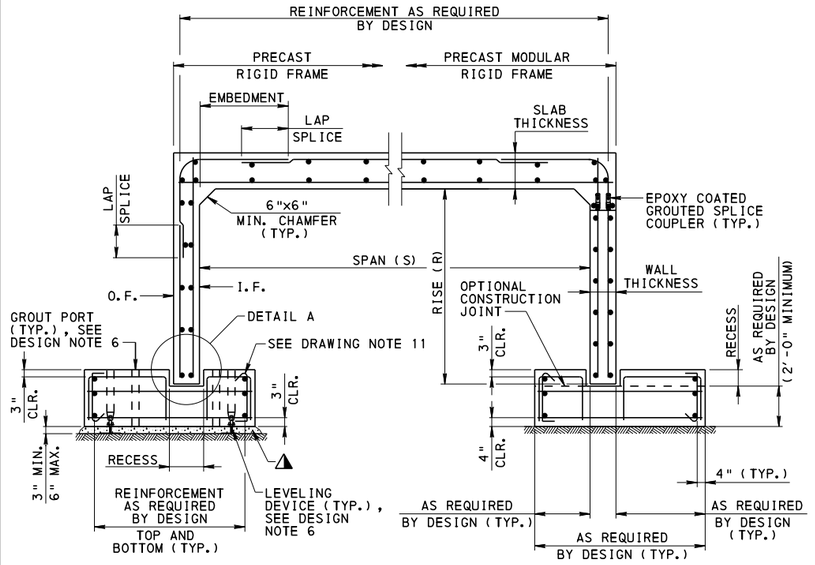
RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 10 OF 10

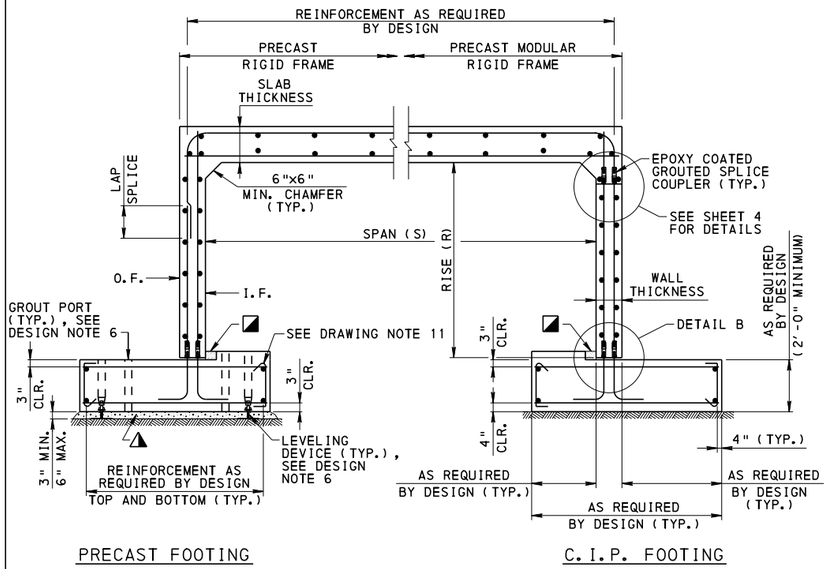
BD-636M

CHANGE 2

CHANGE 6



TYPICAL RIGID FRAME SECTION (PINNED SUPPORT)



TYPICAL RIGID FRAME SECTION (FIXED SUPPORT)

LEGEND

C.I.P. : DENOTES CAST-IN-PLACE
I.F. : DENOTES INSIDE FACE
O.F. : DENOTES OUTSIDE FACE
▲ : FLOWABLE BACKFILL, TYPE C
◪ : PROVIDE GAP (3" MIN. WIDTH) TO FACILITATE INSTALLATION OF SPLICE COUPLER GROUT. FILL GAP WITH NON-SHRINK GROUT AFTER POST-TENSIONING.

GENERAL NOTES

1. USE OF THIS STANDARD REQUIRES PERMISSION FROM THE DISTRICT BRIDGE ENGINEER. THE STANDARD IS INTENDED TO BE UTILIZED BY DESIGNERS OF ACCELERATED BRIDGE CONSTRUCTION PROJECTS AND BY CONTRACTORS FOR VALUE ENGINEERING OR DESIGN-BUILD PROJECTS.

DESIGN NOTES

1. DESIGN SPECIFICATIONS: AASHTO LRFD "BRIDGE DESIGN SPECIFICATIONS" AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
2. IN PRECAST CONCRETE, PROVIDE 1½" CONCRETE COVER ON REINFORCEMENT BARS AND GROUTED SPLICE COUPLERS, EXCEPT AS NOTED IN THE INSTRUCTIONS BELOW.
3. PLACE FOOTINGS IN ACCORDANCE WITH DESIGN MANUAL, PART 4.
4. INDICATE MAXIMUM FACTORED DESIGN FOUNDATION PRESSURE AND FACTORED BEARING RESISTANCE ON PLANS.
5. PRECAST AND C.I.P. FOOTING TYPES SHOWN ARE INTERCHANGABLE WITHIN THE PRECAST RIGID FRAME TYPES SHOWN.
6. FOR PRECAST CONCRETE SUBSTRUCTURE STANDARDS, REFER TO STANDARD DRAWING 12-603-BDTD.
7. FOR DETAILS A AND B, SEE SHEET 2.
8. FOR PRECAST RIGID FRAMES "AT GRADE" (i.e. ≤ 2'-0" OF FILL OR PAVEMENT) AN ADDITIONAL 5" MINIMUM CAST IN PLACE REINFORCED CONCRETE DECK MAY BE REQUIRED BY THE DISTRICT BRIDGE ENGINEER. FOR DECK CONNECTION DETAILS, SEE SHEET 3.
9. FOR DECK CONNECTION DETAIL FOR VARIABLE DEPTH CONCRETE DECKS, THE DECK REINFORCEMENT WILL BE INDEPENDENT OF ANCHOR HOOK AND MUST MAINTAIN CLEARANCE AND FOLLOW CROSS SLOPE.
10. DETAILS SHOWN ARE FOR REINFORCING STEEL BARS. IF WELDED WIRE FABRIC REINFORCEMENT IS USED, FOLLOW MATERIAL REQUIREMENTS AND PLACEMENT DETAILS ON BD-632M SHEET 5, AS APPLICABLE.
11. FOR HYDRAULIC DESIGN REFER TO DESIGN MANUAL, PART 2.
12. DESIGN PRECAST REINFORCED CONCRETE RIGID FRAMES TO HAVE A MINIMUM VERTICAL CLEARANCE OF 3'-0" FROM THE STREAM BED.
13. POST-TENSIONING DUCTS MAY BE PLACED AT EITHER CORNER OR HAUNCH TO SATISFY DESIGN AND CONSTRUCTION REQUIREMENTS. FOR HAUNCH AND POST-TENSIONING DETAILS, SEE SHEET 5 AND BC-798M. ALSO, POST-TENSIONING DUCTS MAY BE PLACED IN THE WALLS OR SLAB AS REQUIRED BY DESIGN.
14. SPECIFY 4'-0" MINIMUM SEGMENT LENGTH ON THE CONTRACT DRAWINGS.
15. USE THIS STANDARD DRAWING IN CONJUNCTION WITH THE APPLICABLE ROADWAY CONSTRUCTION STANDARDS FOR GUIDE RAIL.
16. THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3 AND MAY BE USED ON STRUCTURES ON NON-NHS ROADWAYS ONLY. WHERE BRIDGE BARRIERS WITH DESIGNATIONS GREATER THAN TL-3 ARE PROVIDED, A SEPARATE DESIGN IS REQUIRED.
17. FOR WINGWALL CONNECTION CORNER DETAILS, REFER TO BD-632M.
18. FOR BURIED STRUCTURES, A HEADWALL DESIGN IS REQUIRED.
19. IF PAVING NOTCH IS REQUIRED, REFER TO BD-632M.
20. FOR A PRECAST RIGID FRAME, THE FABRICATOR SHALL CHECK TRANSPORTATION AND ERECTION STRESSES, AND IF NECESSARY, PROVIDE ADDITIONAL STRUCTURAL CAPACITY TO MEET DEMAND OR INDICATE THAT TEMPORARY INTERNAL BRACING IS REQUIRED IN THE CONTRACT DOCUMENTS.
21. PEDESTALS MAY BE REQUIRED FOR DEEP FOOTING CONSTRUCTION.

DRAWING NOTES

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
2. DEAD LOADS: INCLUDE A SURFACE AREA WEIGHT OF 30 P.S.F. ON THE TOP SLAB FOR FUTURE WEARING SURFACE.
3. PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A 615, A 996 OR A 706. DO NOT WELD REINFORCING STEEL BARS UNLESS SPECIFIED. DO NOT USE RAIL STEEL (A 996) REINFORCING BARS WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
4. PROVIDE MINIMUM EMBEDMENT AND SPLICE LENGTHS IN ACCORDANCE WITH STANDARD DRAWING BC-736M, UNLESS OTHERWISE INDICATED.
5. USE EPOXY COATED REINFORCEMENT BARS IN THE FOLLOWING LOCATIONS:
   - IN THE CAST IN PLACE DECK IF A DECK IS USED.
   - IN THE TOP SLAB IF A CAST IN PLACE DECK IS NOT USED.
   - ALL CURBS AND BARRIERS.
   - WHERE THE BARS ARE SPLICED WITH EPOXY COATED GROUTED SPLICE COUPLERS.
   - ALL J-BARS AND L-BARS PROTRUDING FROM THE FOOTING INTO THE WALL.
6. USE EPOXY BONDING COMPOUND WHEREVER CAST-IN-PLACE CEMENT CONCRETE COMES IN CONTACT WITH PRECAST CEMENT CONCRETE. THE EPOXY BONDING COMPOUND IS TYPE 2, GRADE 2, AS DESCRIBED IN ASTM-C881-90
7. PROVIDE WATERPROOFING MEMBRANE AS PER PUB.408, SECTION 680.2(a) OR 680.2(b) FOR THE ENTIRE TOP WIDTH AND LENGTH OF THE RIGID FRAME AND 2'-0" MIN. WIDTH ALONG THE SIDE JOINTS. FOR ADDITIONAL WATERPROOFING DETAILS, SEE SHEET 2 AND BC-788M. OMIT ON TOP SLAB WHEN A CAST IN PLACE DECK IS USED.
8. USE 4"ø FORMED WEEPHOLES, AT A MAXIMUM SPACING OF 15'-0", PLACED AT A MINIMUM 6" ABOVE NORMAL FLOW LINE, FOR DETAILS, SEE BC-751M. FOR WEEPHOLE PLACEMENT, THE WEEPHOLE LOCATION MAY BE ADJUSTED BY A MAXIMUM OF 2" IN ANY DIRECTION, OR RELOCATE REINFORCEMENT BY A MAXIMUM OF ½". DO NOT CUT REINFORCEMENT BARS. NO ADDITIONAL WEEPHOLE REINFORCEMENT WILL BE REQUIRED.
9. THREADED INSERTS TO BE INCORPORATED IN PRECAST RIGID FRAME AND DETAILED BY THE FABRICATOR.
10. FOR BRIDGE RAILING POSTS, THOROUGHLY COAT ALL SURFACES OF THE BASE PLATES IN CONTACT WITH CONCRETE WITH CAULKING COMPOUND PRIOR TO ERECTION. AFTER ERECTION AND ALIGNMENT, SEAL OPENINGS BETWEEN THE METAL SURFACES AND THE CONCRETE WITH CAULKING COMPOUND MEETING THE REQUIREMENTS OF SECTION 705, PUB. 408.
11. FOR FOOTINGS, TIE TOP AND BOTTOM MATS OF REINFORCING STEEL WITH #4 TIE BARS AT A MAXIMUM SPACING OF 4'-0" IN BOTH DIRECTIONS. PROVIDE TIE BARS WITH 90°HOOK AT ONE END AND 135°HOOK AT THE OTHER END. ALTERNATE 90° AND 135° HOOKS AT TOP IN ALTERNATE TIES.

DESIGN DATA:

- f'c = 5,000 P.S.I. MINIMUM FOR PRECAST CONCRETE
- f'c = 3,000 P.S.I. MINIMUM FOR C.I.P. CONCRETE IN FOOTING (USE CLASS A CEMENT CONCRETE).
- f'c = 4,000 P.S.I. MINIMUM FOR C.I.P. CONCRETE IN REINFORCED CONCRETE DECK (USE CLASS AAAP CEMENT CONCRETE).
- fy = 60,000 P.S.I. FOR STEEL REINFORCING BARS

INSTRUCTIONS:

- MINIMUM WALL THICKNESS = 12"
- MINIMUM SLAB THICKNESS = 12"
- MINIMUM COVER FOR TOP REINFORCEMENT IN TOP SLAB OF PRECAST RIGID FRAME = 2" EXCEPT USE 2½" WHEN SLAB IS AT GRADE AND CAST-IN-PLACE DECK IS NOT PROVIDED.

REFERENCE DRAWINGS

RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-12M	BACKFILL AT STRUCTURES
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
BD-609M	PA 3-RAIL BRIDGE BARRIER
BD-628M	BRIDGE APPROACH SLABS
BD-632M	R.C. BOX CULVERT
BC-706M	PA 3-RAIL BRIDGE BARRIER
BC-734M	ANCHOR SYSTEMS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-751M	BRIDGE DRAINAGE
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
BC-798M	MECHANICAL CONNECTION DETAILS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

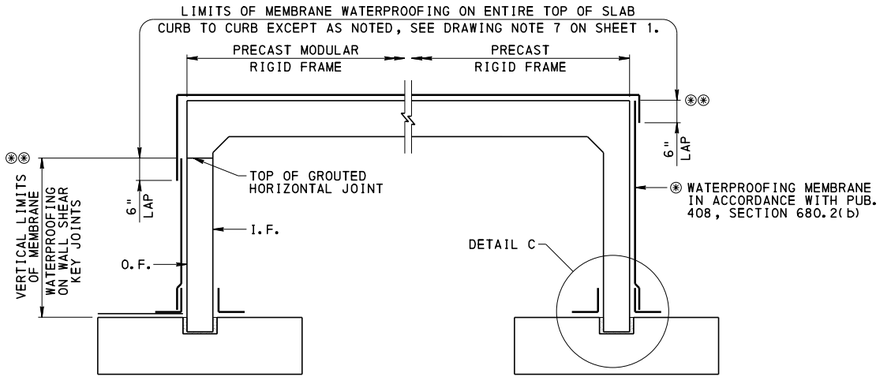
STANDARD
ACCELERATED BRIDGE CONSTRUCTION DETAILS FOR PRECAST RIGID FRAME

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 6

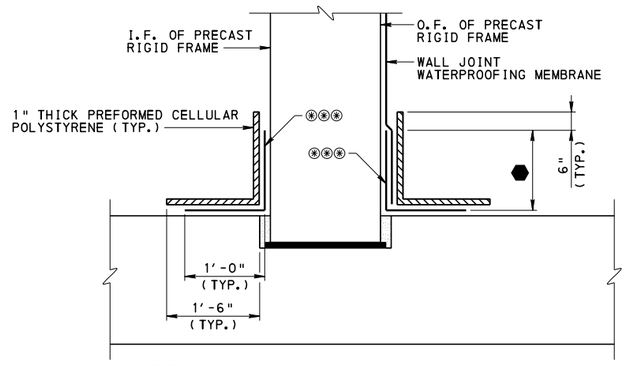
BD-637M



⊛ PROVIDE 2'-0" WIDTH MEMBRANE WATERPROOFING AS PER PUB. 408, SECTION 680.3 ALONG OUTSIDE FACE OF ALL WALL JOINTS. PLACE THE MEMBRANE WATERPROOFING ON THE WALLS BEFORE PLACING IT ON TOP OF THE RIGID FRAME.

⊛⊛ EXTEND WATERPROOFING MEMBRANE TO TOP OF CAST-IN-PLACE SLAB WHERE APPLICABLE.

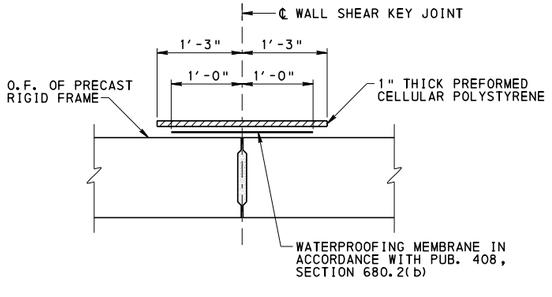
TYPICAL RIGID FRAME SECTION



⊛⊛⊛ MEMBRANE WATERPROOFING BENT TO FIT WALL AND TOP OF FOOTING AS SHOWN, FULL LENGTH.

⬢ 1'-0" OR, WHERE APPLICABLE, 6" ABOVE EPOXY COATED GROUTED SPLICE COUPLER GROUT PORTS MINIMUM.

DETAIL C



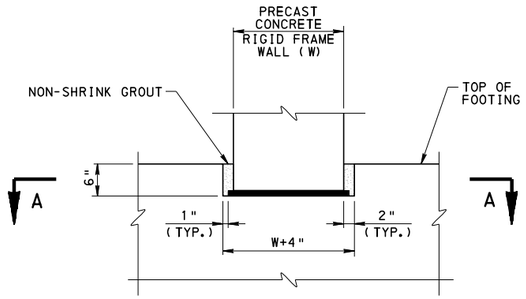
TYPICAL SECTION AT WALL SHEAR KEY JOINT

WATERPROOFING DETAILS

PINNED SUPPORT SHOWN, FIXED SUPPORT SIMILAR.

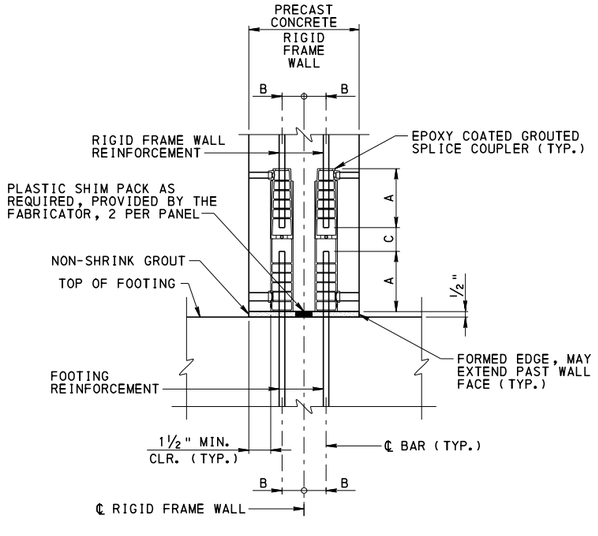
SUGGESTED CONSTRUCTION SEQUENCE NOTES FOR PRECAST MODULAR RIGID FRAME:

1. INSTALL/CONSTRUCT FOOTINGS.
2. SET AND BRACE WALL PANELS.
3. GROUT TOP SLAB PANELS ONTO WALL PANELS.
4. GROUT SLAB TO WALL CONNECTION SPLICE COUPLERS.
5. (FOR FIXED SUPPORT CONDITION ONLY) GROUT WALL TO FOOTING CONNECTION SPLICE COUPLERS.
6. GROUT KEYED JOINTS BETWEEN PANELS.
7. REMOVE WALL BRACING.
8. POST-TENSION RIGID FRAME.
9. (FOR PINNED SUPPORT CONDITION ONLY) PLACE GROUT IN FOOTING RECESS.
10. (FOR FIXED SUPPORT CONDITION ONLY) PLACE GROUT BETWEEN FOOTING AND I.F. WALLS.
11. INSTALL WATERPROOFING MEMBRANE.
12. BACKFILL.
13. PLACE OVERLAY OR CONSTRUCT C.I.P. CONCRETE DECK.



NOTE : PROVIDE (W+2") x 6" x ½" NEOPRENE LEVELING PADS/SHEAR KEY GROUT STOPS. PLACE PADS AT THE ENDS OF EACH SEGMENT, AS REQUIRED. FILL RECESS WITH NON-SHRINK EPOXY GROUT AFTER POST-TENSIONING.

DETAIL A

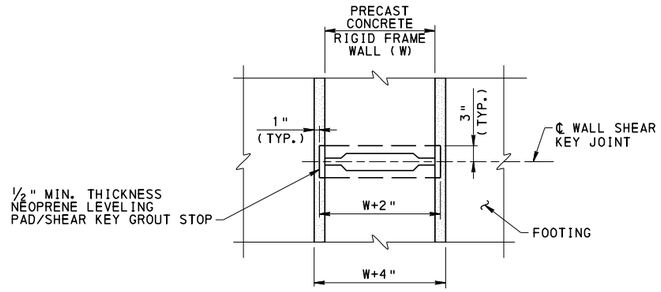


NOTE : NON-SHRINK GROUT IN FRONT OF I.F. WALL NOT SHOWN FOR CLARITY.

DETAIL B

SUGGESTED CONSTRUCTION SEQUENCE NOTES FOR PRECAST RIGID FRAME:

1. INSTALL/CONSTRUCT FOOTINGS.
2. SET RIGID FRAME SECTIONS IN PLACE.
3. (FOR FIXED SUPPORT CONDITION ONLY) GROUT WALL TO FOOTING CONNECTION SPLICE COUPLERS.
4. GROUT KEYED JOINTS BETWEEN SECTIONS.
5. POST-TENSION RIGID FRAME.
6. (FOR PINNED SUPPORT CONDITION ONLY) PLACE GROUT IN FOOTING RECESS.
7. (FOR FIXED SUPPORT CONDITION ONLY) PLACE GROUT BETWEEN FOOTING AND I.F. WALLS.
8. INSTALL WATERPROOFING MEMBRANE.
9. BACKFILL.
10. PLACE OVERLAY OR CONSTRUCT C.I.P. CONCRETE DECK.



SECTION A-A

EPOXY COATED GROUTED SPLICE COUPLER NOTES :

- USE MATCHING TEMPLATES FOR PLACEMENT OF PRECAST MODULAR RIGID FRAME REINFORCEMENT, FOOTING REINFORCEMENT, AND EPOXY COATED GROUTED SPLICE COUPLERS TO ENSURE PROPER FIT-UP.
- CONSULT MANUFACTURER OF EPOXY COATED GROUTED SPLICE COUPLER FOR FINAL DIMENSIONS, TOLERANCES, AND INSTALLATION RECOMMENDATIONS.
- USE A COUPLER FROM A BULLETIN 15 APPROVED MANUFACTURER.
- PLACE NON-SHRINK GROUT SLIGHTLY HIGHER THAN PLASTIC SHIMS TO ENSURE FULL CONTACT BETWEEN CONNECTED SURFACES.

EPOXY COATED GROUTED SPLICE COUPLER DIMENSION TOLERANCES		
A	EMBEDMENT LENGTH	CONSULT MANUFACTURER
B	LOCATIONS OF REINFORCEMENT AND GROUTED SPLICE COUPLER AS MEASURED FROM ℄ WALL	± ¼"
C	GAP BETWEEN REINFORCEMENT BARS	CONSULT MANUFACTURER

NOTES :

1. FOR LOCATION OF DETAILS A AND B, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD

ACCELERATED BRIDGE CONSTRUCTION DETAILS FOR PRECAST RIGID FRAME

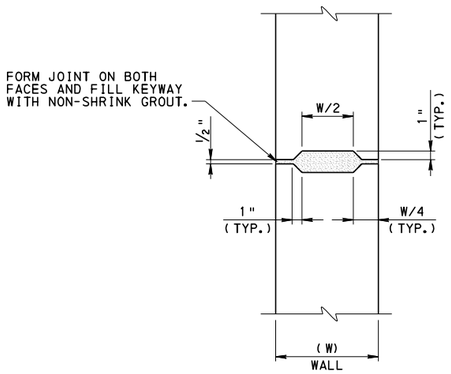
CONSTRUCTION NOTES, WATERPROOFING & FOOTING CONNECTION DETAILS

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

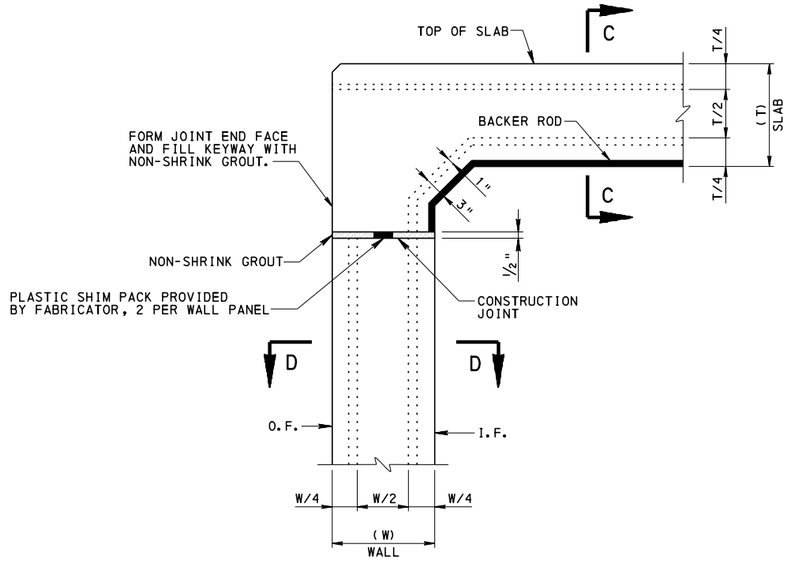
RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 6

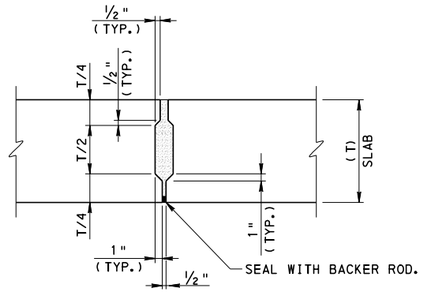
BD-637M



SECTION D-D



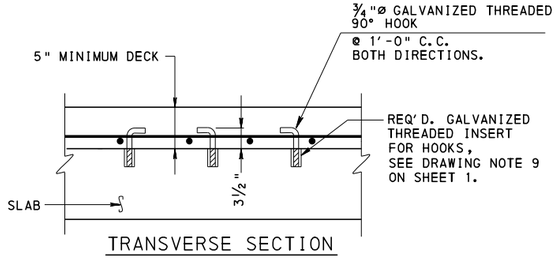
ELEVATION



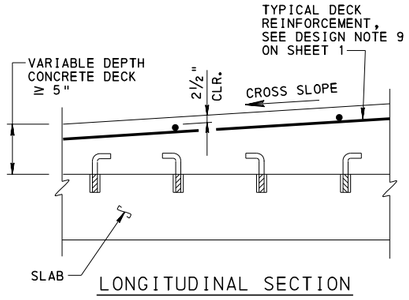
SECTION C-C

NOTE : REINFORCEMENT AND POST-TENSIONING SYSTEM ELEMENTS NOT SHOWN FOR CLARITY.

PRECAST SHEAR KEY DETAILS



TRANSVERSE SECTION



LONGITUDINAL SECTION

NOTE : FOR TYPICAL CAST-IN-PLACE DECK REINFORCEMENT, SEE BD-632M.

DECK CONNECTION DETAILS

NOTES :

1. THE INSIDE FACES OF ALL SHEAR KEYS AND ASSOCIATED POST-TENSIONING DUCT HAND HOLES SHALL HAVE AN EXPOSED AGGREGATE FINISH.
2. FOR ADDITIONAL DETAILS AND NOTES, SEE BC-798M.
3. PROVIDE FORMWORK FOR GROUTING WHICH IS LIQUID TIGHT.

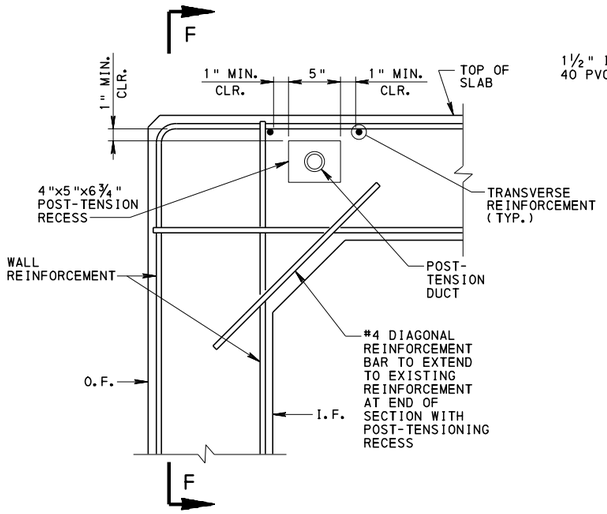
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD

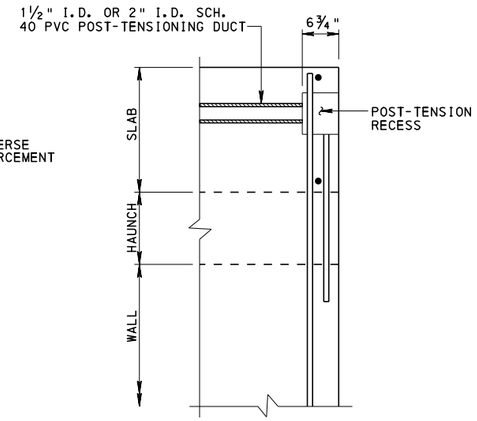
ACCELERATED BRIDGE CONSTRUCTION DETAILS FOR PRECAST RIGID FRAME

DECK CONNECTION & SHEAR KEY DETAILS

RECOMMENDED FEB. 14, 2023 CHIEF BRIDGE ENGINEER	RECOMMENDED FEB. 14, 2023 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 3 OF 6
		BD-637M

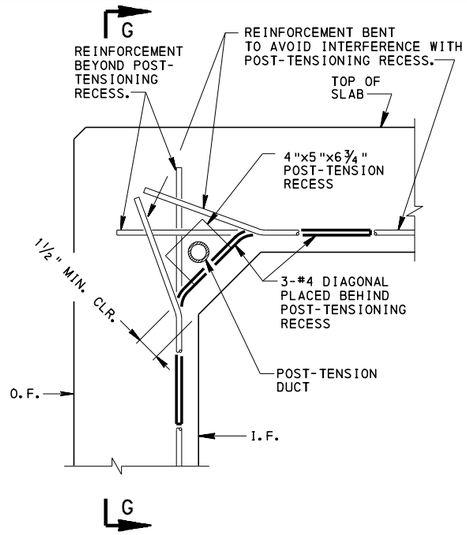


ELEVATION

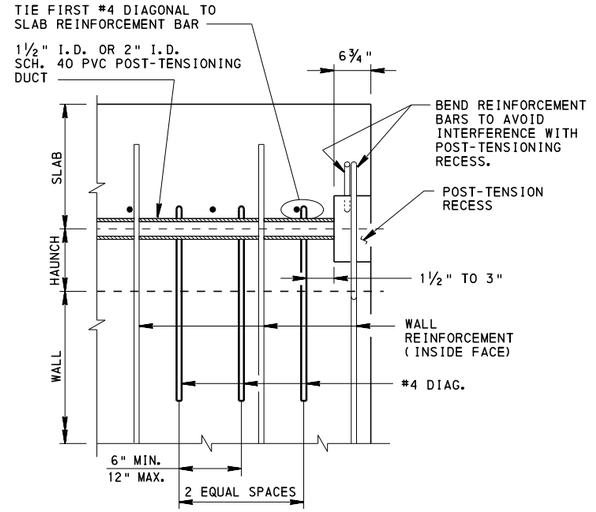


SECTION F-F

TYPICAL HAUNCH DETAIL ON PRECAST RIGID FRAME

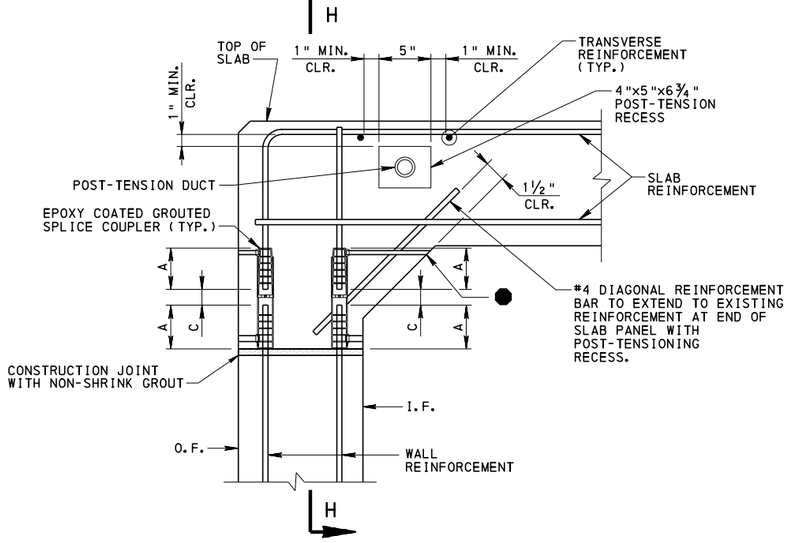


ELEVATION

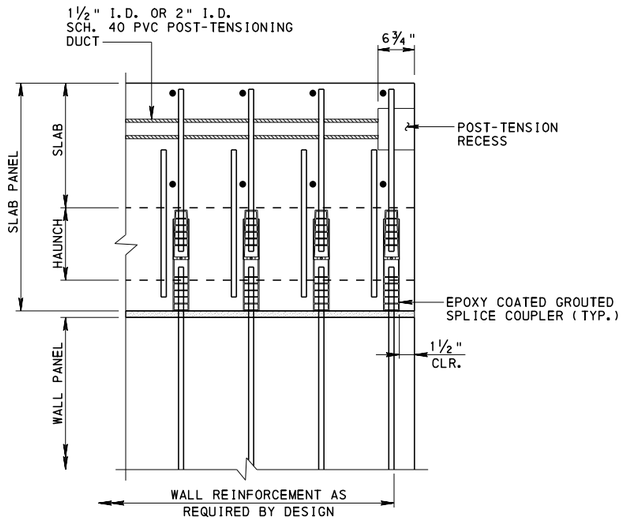


SECTION G-G

ALTERNATE HAUNCH DETAIL ON PRECAST RIGID FRAME



ELEVATION



SECTION H-H

● EPOXY COATED GROUTED SPLICE COUPLER MAY BE RE-ORIENTED WITH GROUT PORTS TO O.F. OF SLAB WHERE REQUIRED TO AVOID INTERFERENCE WITH POST-TENSIONING SYSTEM OR HAUNCH.

NOTE : PLACE NON-SHRINK GROUT SLIGHTLY HIGHER THAN PLASTIC SHIMS TO ENSURE FULL CONTACT BETWEEN CONNECTED SURFACES.

TYPICAL HAUNCH DETAIL ON PRECAST MODULAR RIGID FRAME

NOTES :

1. FOR EPOXY COATED GROUTED SPLICE COUPLER DETAILS, SEE SHEET 2.
2. FOR POST-TENSIONING DETAILS AND NOTES, SEE SHEET 5.
3. MODULAR RIGID FRAME INSIDE FACE AND OUTSIDE FACE GROUTED SPLICE COUPLERS MAY NOT NECESSARILY BE THE SAME SIZE; THEREFORE, THEIR RESPECTIVE "A" AND "C" DIMENSIONS, AS SHOWN HERE, MAY NOT BE THE SAME.
4. CHAMFER EXPOSED EDGES OF PRECAST CONCRETE ¾" BY ¾".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD

ACCELERATED BRIDGE CONSTRUCTION DETAILS FOR PRECAST RIGID FRAME

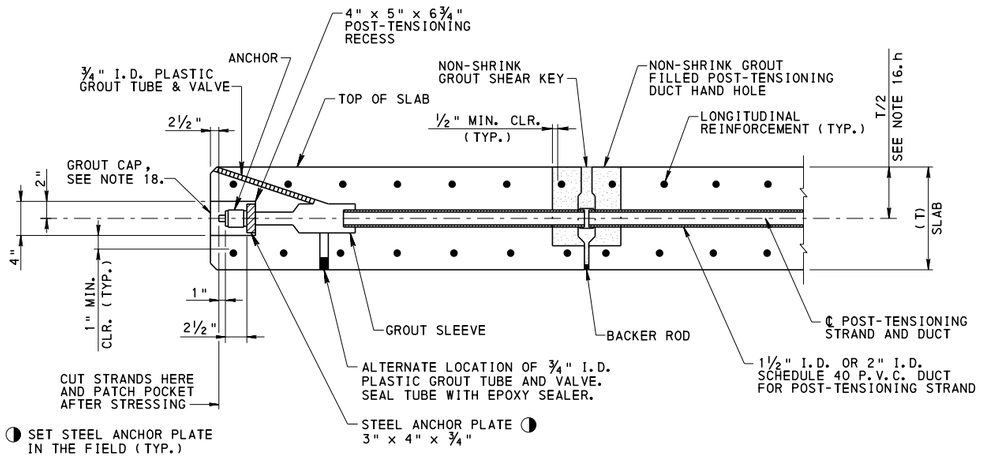
HAUNCH DETAILS

RECOMMENDED FEB. 14, 2023
CHIEF BRIDGE ENGINEER

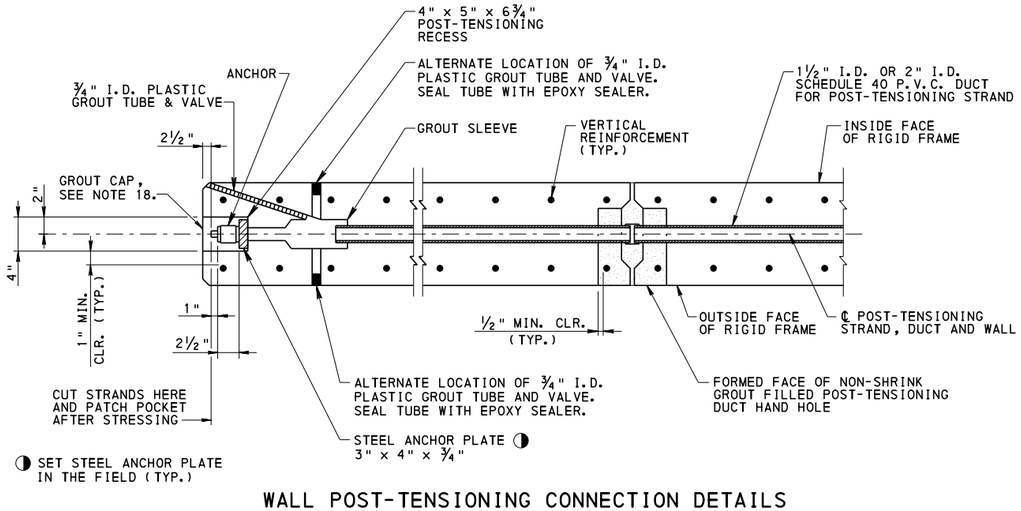
RECOMMENDED FEB. 14, 2023
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 4 OF 6

BD-637M



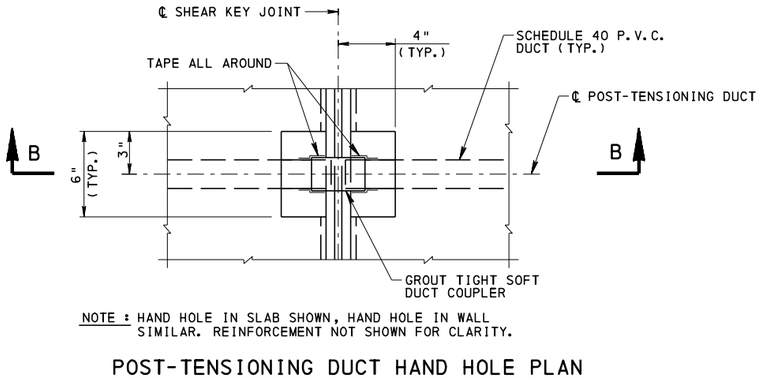
SLAB POST-TENSIONING CONNECTION DETAILS



WALL POST-TENSIONING CONNECTION DETAILS

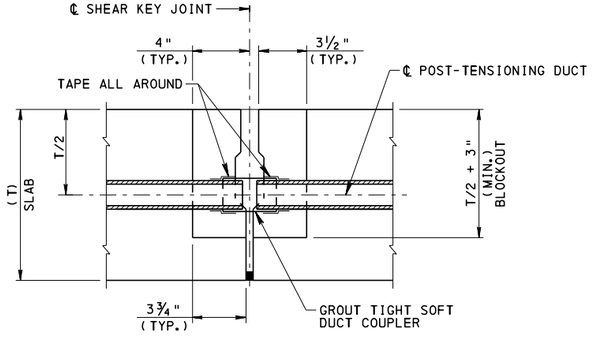
INSTRUCTIONS FOR POST-TENSIONING

1. PROVIDE POST-TENSIONING OPERATIONS AND MATERIALS IN ACCORDANCE WITH PUB. 408, SECTION 1108. SHOP DRAWINGS ARE REQUIRED.
2. SHOW ALL POST-TENSIONING CONNECTION DETAILS OF PRECAST RIGID FRAME SEGMENTS ON THE SHOP DRAWINGS.
3. THE CONTRACTOR IS RESPONSIBLE FOR THE FINAL POST-TENSIONING DESIGN, LAYOUT, AND SEQUENCE.
4. SUBMIT POST-TENSIONING COMPUTATIONS WITH A PLAN FOR POST-TENSIONING TO THE DEPARTMENT FOR REVIEW AND ACCEPTANCE WITH THE SHOP DRAWINGS IN ACCORDANCE WITH PUB. 408, SECTION 1108. DESIGN MUST BE SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA.
5. GROUT DUCT HAND HOLES ALONG WITH THEIR ASSOCIATED SHEAR KEYWAYS.
6. POST-TENSION AFTER THE SHEAR KEY JOINTS ARE FILLED WITH NON-SHRINK GROUT AND CURED A MINIMUM OF 24 HOURS.
7. PROVIDE THE INSIDE OF THE SHEAR KEYWAYS AND HAND HOLES WITH AN EXPOSED AGGREGATE FINISH TO IMPROVE THE BOND WITH THE NON-SHRINK GROUT. BEFORE SHIPPING, SAND OR WATER BLAST THE ENTIRE SHEAR KEYWAY AREA PROVIDING A ROUGH TEXTURE, AND COMPLETELY REMOVE ALL OIL, GREASE, DIRT, OR MATERIAL THAT WOULD PREVENT BONDING. JUST BEFORE ERECTION, CLEAN THE BLASTED SURFACE WITH COMPRESSED AIR, CLEAN STIFF-BRISTLE FIBER BRUSHES, OR VACUUM. BLAST CLEANING IS NOT TO BE USED WHERE THERE IS COATED PROJECTING REINFORCEMENT.
8. PROVIDE A BULLETIN 15 APPROVED, PREMIXED, NON-SHRINK GROUT (NON-METALLIC, NON-STAINING) WITH A 24 HOUR MINIMUM COMPRESSIVE STRENGTH ≥ 3,750 P.S.I. AND A 28 DAY MINIMUM COMPRESSIVE STRENGTH ≥ 10,000 P.S.I. CURE THE GROUT IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. DO NOT PERMIT CONSTRUCTION ACTIVITY OR OTHER LOADINGS ON THE RIGID FRAME UNTIL POST-TENSIONING OPERATIONS ARE COMPLETE. FOR VEHICULAR LOADING, SECTION 1080.3(d)5 OF PUB. 408 APPLIES.
9. PROVIDE ½" DIAMETER POLY STRANDS OR APPROVED EQUAL HAVING A YIELD STRENGTH OF 270 K.S.I.
10. INSTALL STRANDS IN PRECAST SECTIONS. STRESS EACH STRAND IN ACCORDANCE WITH THE APPROVED POST-TENSIONING DESIGN. CHECK RAM AREA AND CALIBRATION CURVES OF EQUIPMENT FURNISHED FOR GAGE PRESSURES.
11. TENSION THE STRANDS IN ACCORDANCE WITH SECTION 1108.03(e) OF PUB. 408 EXCEPT ACCOMPANY JACK GAGES WITH A CURRENT, CERTIFIED CALIBRATION CHART, NOT OLDER THAN 6 MONTHS.
12. TENSION STRAND AT CENTERLINE OF SPAN FIRST AND THEN PROGRESS UP FRAME WALLS TOWARD ENDS OF SPAN. ALTERNATE LEFT AND RIGHT OF CENTERLINE.
13. AFTER STRESSING, GROUT ALL STRAND DUCTS. REFER TO PUB. 408 SECTION 1085.3(o)1 FOR TIME LIMITATIONS ASSOCIATED WITH GROUTING.
14. PLACE GROUT MIX INTO TUBING USING PRESSURE GROUT.
15. BASE THE POST-TENSIONING DESIGN UPON THE FOLLOWING CRITERIA:
    a. THE TOTAL POST-TENSION FORCE IS THE FORCE REQUIRED TO CREATE A PRESSURE OF 10 P.S.I. OVER THE CROSS SECTION OF THE RIGID FRAME.
    b. MAXIMUM TOTAL POST-TENSION FORCE SHOULD NOT CREATE A PRESSURE GREATER THAN 100 P.S.I. OVER THE CROSS SECTION OF ANY SEGMENT.
    c. MINIMUM TOTAL POST-TENSION FORCE IS 100 KIPS.
    d. MAXIMUM LOAD ON A ½" DIAMETER STRAND IS 29 KIPS. USE 0.6" DIAMETER STRAND WITH HIGHER LOAD WHEN PERMITTED.
    e. PLACE STRANDS SYMMETRICALLY ABOUT THE CENTERLINE OF THE RIGID FRAME.
    f. USE A MINIMUM OF 5 STRANDS.
    g. MINIMUM STRAND SPACING IS 2'-0".
    h. PLACE CORNER STRANDS AT THE LOCATION OF CENTERLINES BETWEEN WALL AND SLAB OR AT A MAXIMUM DISTANCE OF 2'-0" FROM THIS LOCATION.
    i. LOCATE STRANDS SO AS TO NOT INTERFERE WITH REINFORCEMENT DETAILS.
16. PROVIDE SEALS AT THE DUCT JOINTS TO MAKE JOINTS GROUT TIGHT.
17. ALL POST-TENSIONING MUST BE WITNESSED BY THE ENGINEER.
18. AFTER POST-TENSIONING IS APPROVED, CUT STRANDS TO PROVIDE A MINIMUM OF 2½" CLEAR FROM OUTSIDE FACE OF CONCRETE AND COAT RECESS WITH EPOXY BONDING COMPOUND. FILL ALL RECESSES WITH AN APPROVED PRODUCT LISTED IN BULLETIN 15 UNDER MISCELLANEOUS POLYMER MODIFIED AND SPECIAL CEMENTS, MORTARS AND CONCRETE TO FORM A SEAL AND CAP.
19. POST-TENSION AND GROUT ALL DUCTS BEFORE BACKFILLING AND PLACING TRAFFIC OVER THE RIGID FRAME.
20. ALL POST-TENSIONING CHUCKS MUST BE OF THE REUSABLE TYPE. OPERATORS MUST EXERCISE PROPER PRECAUTIONS WHEN RE-ALIGNING WEDGES AFTER RELEASE OF TENDONS AND PRIOR TO RETENSIONING AND RE-SEATING.
21. REMOVE A MINIMAL AMOUNT OF POLYSTRAND TO ACCOMODATE SPLICES AT STAGED CONSTRUCTION JOINT ENDS, IF APPLICABLE.



NOTE : HAND HOLE IN SLAB SHOWN, HAND HOLE IN WALL SIMILAR. REINFORCEMENT NOT SHOWN FOR CLARITY.

POST-TENSIONING DUCT HAND HOLE PLAN



NOTE : REINFORCEMENT NOT SHOWN FOR CLARITY.

SECTION B-B

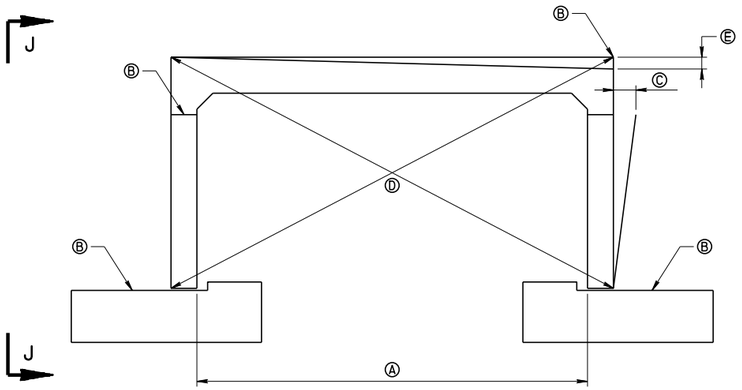
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD

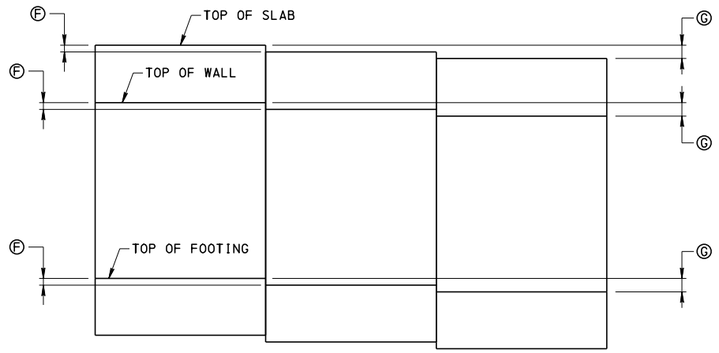
ACCELERATED BRIDGE CONSTRUCTION DETAILS FOR PRECAST RIGID FRAME

MECHANICAL CONNECTION DETAILS

RECOMMENDED FEB. 14, 2023	RECOMMENDED FEB. 14, 2023	SHEET 5 OF 6
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-637M



TYPICAL SECTION



VIEW J-J

RIGID FRAME ERECTION TOLERANCE DETAILS

PRECAST MODULAR RIGID FRAME SHOWN, PRECAST RIGID FRAME SIMILAR.

RIGID FRAME ERECTION TOLERANCES			
Ⓐ	CLEAR SPAN LENGTH BETWEEN WALL SEGMENTS	± ½"	
Ⓑ	MAXIMUM VARIATION FROM CONTRACT DRAWING VALUE IN TOP OF FOOTING, WALL, OR SLAB SEGMENT ELEVATION	± 0.01′	
Ⓒ	MAXIMUM VERTICAL VARIATION OVER HEIGHT OF WALL (MODULAR SECTION)	PLUMB	*
Ⓓ	MAXIMUM SQUARE VARIATION	± ½"	
Ⓔ	MAXIMUM LEVEL VARIATION ACROSS SPAN OF SLAB SEGMENTS	± ⅛"	
Ⓕ	MAXIMUM TOP OF WALL, SLAB, OR FOOTING ELEVATION BETWEEN ADJACENT SEGMENTS	± ¼"	
Ⓖ	MAXIMUM TOP OF WALL, SLAB, OR FOOTING ELEVATION BETWEEN ANY TWO SEGMENTS	± ¼"	

* FOR NON-MODULAR SECTIONS, "C" DIMENSION SHALL BE ± ⅛"

NOTES :

1. FOR EPOXY COATED GROUTED SPLICE COUPLER TOLERANCES, SEE SHEET 2.
2. FOR FABRICATION TOLERANCES, SEE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 145, "INSPECTION OF PRESTRESSED/PRECAST CONCRETE PRODUCTS AND REINFORCED CONCRETE PIPE".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE

STANDARD

ACCELERATED BRIDGE CONSTRUCTION DETAILS FOR PRECAST RIGID FRAME

ERECTION TOLERANCES

RECOMMENDED FEB. 14, 2023 CHIEF BRIDGE ENGINEER	RECOMMENDED FEB. 14, 2023 Gavin E. Gray CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 6 OF 6
		BD-637M

CHANGE 1

INFORMATIONAL NOTES

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS FOR OVERHEAD SIGN STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS. REFERENCE TO THESE STANDARDS ON OVERHEAD SIGN STRUCTURES PLANS IS PROHIBITED.
- THE DESIGNER MUST PROVIDE THE INFORMATION OBTAINED FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS. THE DESIGNER MUST PROVIDE THE SIGN AREA, STRUCTURE HEIGHT, AND SIGN LOCATION USED TO OBTAIN MEMBER SIZES FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS.
- DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE DESIGN TABLES CONTAINED IN THESE STANDARDS. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THESE DESIGN TABLES.
- ALL SIGN SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-741M, SHEET 2.
- AVOID BRIDGE-MOUNTED SIGN STRUCTURES WHENEVER POSSIBLE. IF AVOIDANCE IS NOT POSSIBLE, THE STRUCTURE SHOULD BE LOCATED AS CLOSE TO A PIER SUPPORT AS IS PRACTICAL. THE AFFECTED BRIDGE COMPONENTS SHALL BE DESIGNED TO CARRY THE ADDITIONAL LOADS DUE TO THE WEIGHT OF THE SIGN STRUCTURE AND THE LOADINGS APPLIED TO SIGN STRUCTURE. IF A BARRIER IS USED OR IS REQUIRED, THE SIGN STRUCTURE SHALL BE LOCATED JUST BEYOND THE DESIGN DEFLECTION DISTANCE OF THE BARRIER.

INFORMATION CONTAINED IN THE DESIGN TABLES

- DESIGN TABLES INCLUDED IN THIS STANDARD WERE DEVELOPED USING A COMPUTER PROGRAM AND ARE BASED ON THE DESIGN CRITERIA SHOWN ON THIS SHEET.
- THE MEMBER SIZES INDICATED IN THE DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY II. THE DESIGNER MUST CHECK THE ADEQUACY OF THE MEMBER SIZES INDICATED WHEN THE FATIGUE CATEGORY IS SPECIFIED TO BE I FOR THE PROJECT.
- THE SPAN RANGE INCLUDED IN THIS STANDARD IS AS FOLLOWS:

  BD-641M: CANTILEVER AND CENTER-MOUNT STRUCTURES, STRUT LENGTHS UP TO 40'
- THE DESIGN TABLES INCLUDE MEMBER SIZES FOR THE STRUCTURES FOR VARIOUS COMBINATIONS OF DESIGN HEIGHT, SPAN LENGTH, AND SIGN AREA. THEY ALSO INCLUDE SPREAD FOOTING DESIGNS. ALTERNATE CAISSON FOUNDATIONS ARE PERMITTED WHERE SITE CONDITIONS DO NOT ALLOW FOR THE SPREAD FOOTING. DESIGN COMPUTATIONS ARE REQUIRED TO DETERMINE THE REQUIRED CAISSON EMBEDMENT AND REINFORCEMENT. THE DESIGN COMPUTATION MUST BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR REVIEW AND APPROVAL AND THE CORRESPONDING INFORMATION SHOWN ON THE CONTRACT DRAWINGS. THE CORRESPONDING FABRICATION AND CONSTRUCTION DETAILS ARE CONTAINED ON STANDARD DRAWING BC-741M.

GENERAL NOTES

1. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE f'c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. VERIFY ALL DIMENSIONS AND GEOMETRY OF THE EXISTING STRUCTURES IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. SPREAD FOOTINGS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL, BOLTS, NUTS & WASHERS IN ACCORDANCE WITH PUB. 408, UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE WIDTH OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE CHECKED.
14. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
15. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
16. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
17. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

- DEAD LOADS — PENNDOT STD. DWGS. (U.N.O.) *

SIGN PANELS	TC-8701E OR TC-8701S
LIGHT FIXTURES	BC-741M, SHT. 6
SIGN SUPPORT BEAM	BC-741M, SHT. 6
COLUMNS, STRUTS	CALCULATED INTERNALLY WITHIN PROGRAM

- EXTERNAL LOADS — AASHTO SIGN SPECS.

ICE LOAD	3.7
WIND LOAD	APPENDIX C, SECTION C.3, EQ. C-1, WITH 80 MPH WIND AND 30% GUST FACTOR

- GROUP LOADS — AASHTO SIGN SPECS. 3.4
- STEEL CRITERIA — AASHTO SIGN SPECS

SECTION PROPERTIES FOR TUBULAR SHAPES	APPENDIX B, TABLE B-1
MAXIMUM STRESSES IN TUBULAR SHAPES	APPENDIX B, TABLE B-2
ALLOWABLE STRESSES FOR TUBULAR SHAPES	5.6 (TABLE 5-3) & 5.11
ALLOWABLE STRESSES FOR SIGN SUPPORTS	5.12
ALLOWABLE STRESSES FOR BASE PLATES	5.8
ALLOWABLE STRESSES FOR COMBINED STEEL STRESS	5.12
FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)	SECTION 11
ALLOWABLE DEFLECTION	10.4
PERMANENT CAMBER	10.5
ALLOWABLE STRESSES FOR STRUCTURAL STEEL	SECTION 5

- BOLT CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BOLT STRESSES	TABLE 10.32.3B
SLIP-CRITICAL BOLT ALLOWABLE	10.32.3.2.1
BOLT PRYING ACTION	10.32.3.3.2
COMBINED BOLT SHEAR AND TENSION	10.32.3.3.3
BOLT DESIGN CRITERIA	AASHTO SIGN SPECS. 5.16
ALLOWABLE ANCHOR BOLT STRESSES	AASHTO SIGN SPECS. 5.17

- CONCRETE CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BEARING STRESS	8.15.2.1.3
REINFORCEMENT TENSILE STRESS	8.15.2.2
SHEAR CAPACITY OF FOOTINGS	8.15.5.6.1
SHEAR STRESS IN FOOTINGS	8.15.5.6.2
ALLOWABLE SHEAR STRESS	8.15.5.6.4
SLENDERNESS OF COLUMNS	8.16.5.2
MINIMUM REINF. OF FLEXURAL MEMBERS	8.17.1
SPACING LIMITS FOR REINFORCEMENT	8.21
MINIMUM CONCRETE COVER	DM-4 D8.22.1*
PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS	FIG. 4.4.7.1.1.1C
DISTRIBUTION OF REINFORCEMENT	4.4.11.2.2
FOOTING STABILITY REQUIREMENTS	DM-4 D5.5.5
TORSION	ACI SECTION A.7.3*
COLUMN DESIGN (PEDESTALS)	8.15.4

- SPREAD FOOTINGS

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MINIMUM AREA IN BEARING	95%
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT

- DRILLED SHAFTS (CAISSONS) DM-4 SEC. D4.6, PENNDOT COM624P COMPUTER PROGRAM

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MAXIMUM DESIGN LATERAL DISPLACEMENT	0.5"
MODULUS OF SUBGRADE REACTION	10.0 POUNDS PER CUBIC INCH
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT
ANGLE OF INTERNAL FRICTION	25°
COHESION	0 KIPS PER SQUARE FOOT

- SEISMIC DESIGN CRITERIA

STRUCTURES ARE DESIGNED FOR A SEISMIC ACCELERATION COEFFICIENT = 0.15

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORKMANSHIP:

  PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

  COLUMNS & PIPE STRUTS: SEE PUBLICATION 408, SECTION 948.2.

  ANGLES, SHAPES, AND PLATES: AASHTO M270, GRADE 36 ASTM A709, GRADE 36
- ALTERNATE PRESS-BREAK MEMBERS:

  ALTERNATE PRESS-BREAK MEMBERS MUST HAVE THE EQUIVALENT STRENGTH OF THE MEMBER THEY ARE REPLACING. EQUIVALENT RADIUS FOR PRESS-BREAK MEMBERS IS MEASURED FROM THE CENTER OF THE MEMBER TO THE MID-POINT OF ANY CHORD OF THE MEMBER. MINIMUM THICKNESS OF PRESS-BREAK MEMBERS TO BE 5/16", PENNDOT'S SIGN STRUCTURE PROGRAM OR AN APPROVED FINITE ELEMENT ANALYSIS COMPUTER PROGRAM MUST BE RUN TO VERIFY THE ADEQUACY OF PRESS-BREAK MEMBERS FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR STRUTS.
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:

  ANCHOR BOLTS: ASTM, F1554 GRADE 55 PER PUBLICATION 408 SECTION 1105.02(c)3.

  BOLTS: AASHTO M164 (ASTM A325) H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS:

  AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 2001 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1996 WITH INTERIMS THROUGH AND INCLUDING 2000; PENNDOT DESIGN MANUAL - PART 4, AUGUST 1993 EDITION (INCLUDING AUGUST 1995 REVISIONS)
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- ANY PIPE SIZE OTHER THAN THAT SHOWN ON THE STANDARD IS A PROJECT SPECIFIC DESIGN. DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE RULING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN 1/2".
- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 - (INDICATE CHANGE NUMBER), AASHTO/AWS D1.5, BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5".
- DYNAMIC\VARIABLE MESSAGE SIGNS (DMS\VMS) ARE PROHIBITED ON OVERHEAD CANTILEVER STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS.

* LEGEND:

- AASHTO SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"
- DM-4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-99).
- CVN: CHARPY V-NOTCH.

REFERENCE DRAWINGS	
TC-8700C	SPACING CHARTS/DIRECT APPLIED LETTERS, NUMERALS, & ARROWS
TC-8701D	SIGN DETAILS/FREEWAY AND EXPRESSWAY GUIDE SIGNS
TC-8701E	EXTRUDED ALUMINUM CHANNEL SIGN
TC-8701S	FLAT SHEET ALUMINUM SIGNS WITH EXTRUDED ALUMINUM STIFFENERS
TC-8715	SIGN LIGHTING
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-741M	OVERHEAD SIGN STRUCTURES
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40'

NOTES AND DESIGN CRITERIA

RECOMMENDED AUG. 4, 2017 Thomas P. Macioce, CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brent D. Thompson, DIRECTOR, BUR. OF PROJECT DELIVERY	SHT. 1 OF 8 BD-641M

HOW TO USE THE DESIGN TABLES

SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL OR CAISSON ELEVATION APPROXIMATELY 6 INCHES ABOVE THE HIGHEST SURROUNDING FINISHED GRADE ELEVATION.
- SET THE TOP OF FOOTING ELEVATION SO THAT A MINIMUM 2'-0" COVER IS PROVIDED OVER THE FOOTING AT ALL LOCATIONS.

POSITIONING OF SIGN PANELS AND SIGN STRUCTURE

- SEE THE FOLLOWING DIAGRAMS FOR ADDITIONAL INSTRUCTIONS FOR POSITIONING THE SIGN PANELS AND SIGN STRUCTURE.
- DETERMINE THE DESIGN SIGN AREA FROM ONE OF THE FOLLOWING TWO CONDITIONS:

  1. THE FIRST CONDITION IS THE ACTUAL SIGN AREA TO BE PLACED ON THE STRUCTURE AT THE TIME OF CONSTRUCTION.

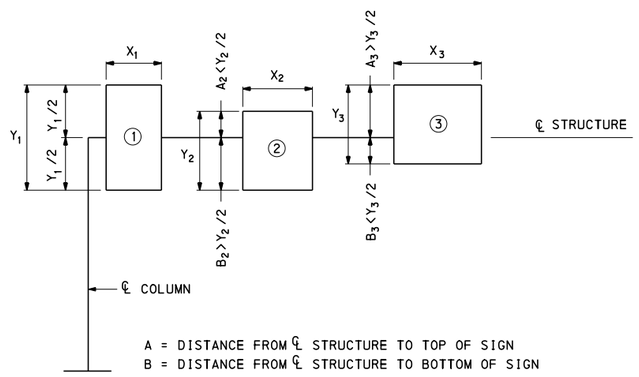
  2. THE SECOND CONDITION IS THE ULTIMATE SIGN AREA THAT COULD BE PLACED ON THE STRUCTURE IN THE FUTURE. THE ULTIMATE SIGN AREA IS EQUAL TO THE WIDTH OF THE ROADWAY UNDER THE STRUCTURE MULTIPLIED BY 18'-6" FOR THE 2-STRUT STRUCTURE AND 12'-0" FOR THE 1-STRUT STRUCTURE. THE ULTIMATE SIGN AREA IS TO BE USED WHEN THE DESIGNER DETERMINES THAT THE POSSIBILITY OF ADDING SIGNS ACROSS THE FULL SPAN LENGTH OF THE STRUCTURE IN THE FUTURE EXISTS. THIS WILL BE DETERMINED BY THE TRAFFIC ENGINEER.

- IF THE TRAFFIC ENGINEER DETERMINES THAT NO ADDITIONAL SIGNS WILL BE ADDED IN THE FUTURE, THE DESIGN SIGN AREA EQUALS THE ACTUAL SIGN AREA. IF THE TRAFFIC ENGINEER DETERMINES ADDITIONAL SIGNS MAY BE NEEDED IN THE FUTURE, THE DESIGN SIGN AREA EQUALS THE ULTIMATE SIGN AREA. HOWEVER, THE NEED FOR FUTURE SIGNS SHALL BE CAREFULLY CONSIDERED AS USE OF THE ULTIMATE SIGN AREA WILL INCREASE THE COST OF THE STRUCTURE.
- THE DESIGNER WILL SPECIFY WHICH CONDITION IS TO BE USED FOR DESIGN. THE DESIGN SIGN AREA WILL BE THE COMPUTED AREA (EITHER ACTUAL OR ULTIMATE) ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE. INDICATE WHETHER THE DESIGN SIGN AREA IS THE ACTUAL AREA OR THE ULTIMATE AREA.
- WHEN MULTIPLE SIGN PANELS ARE PLACED ON ONE STRUCTURE AND ONE OR MORE OF THE SIGN PANELS IS NOT CENTERED IN THE VERTICAL DIRECTION, COMPUTE THE DESIGN SIGN AREA IN THE FOLLOWING MANNER:

  THE SIGN AREA FOR ANY SIGN PANEL CENTERED IN THE VERTICAL DIRECTION IS (X) x (Y)

  THE SIGN AREA FOR ANY SIGN PANEL PLACED OFF-CENTER IN THE VERTICAL DIRECTION IS (X) x (B) x 2 WHEN B>A OR (X) x (A) x 2 WHEN A>B.

  EXAMPLE:
  AREA OF SIGN NO. 1 = (X_1) x (Y_1)
  AREA OF SIGN NO. 2 = (X_2) x (B_2) x 2
  AREA OF SIGN NO. 3 = (X_3) x (A_3) x 2

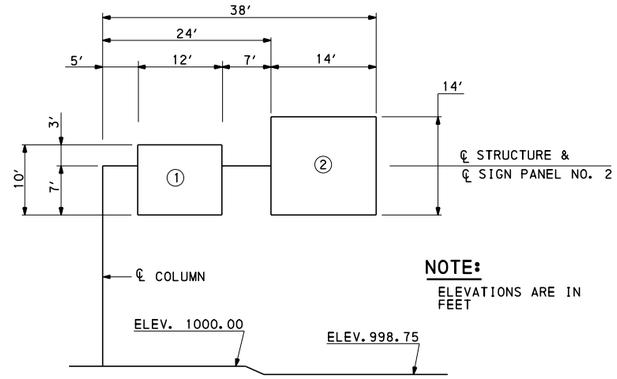


A = DISTANCE FROM ℄ STRUCTURE TO TOP OF SIGN
B = DISTANCE FROM ℄ STRUCTURE TO BOTTOM OF SIGN

DESIGN AREA OF SIGN NO. 1 = $X_1 Y_1$
DESIGN AREA OF SIGN NO. 2 = ($X_2 B_2$) x 2
DESIGN AREA OF SIGN NO. 3 = ($X_3 A_3$) x 2

- SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT THE MID-HEIGHT OF THE DEEPEST SIGN OR A MAXIMUM OF 9'-3" ABOVE THE BOTTOM OF THE SIGN PANEL. (SIGN HEIGHT INCLUDES "EXIT PANEL" SIGN IF PRESENT)
- SET THE STRUCTURE, SIGN PANELS, AND LUMINAIRES TO AN ELEVATION THAT WILL PROVIDE A MINIMUM OF 17'-6" VERTICAL CLEARANCE ABOVE THE HIGHEST POINT OF THE ENTIRE ROADWAY WIDTH (INCLUDING THE ROADWAY PAVEMENT AND SHOULDERS) PASSING UNDER THE STRUCTURE. SET THE BOTTOM OF ALL SIGN PANELS TO GENERALLY THE SAME ELEVATION. IN THE CASE OF A STRUCTURE SPANNING DUAL ROADWAYS WHERE THE DIFFERENCE IN ELEVATIONS OF THE HIGHEST POINT ON EACH ROADWAY IS GREATER THAN 2'-6", SET THE BOTTOM OF ALL SIGN PANELS OVER EACH ROADWAY TO THE SAME VERTICAL CLEARANCE.
- WHEN THE ULTIMATE SIGN AREA IS USED FOR DESIGN, SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS. WHEN THE STRUCTURE SPANS DUAL ROADWAYS WITH THE DIFFERENCE IN HIGH POINT ELEVATIONS GREATER THAN 2'-6", SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS OVER THE UPPER ROADWAY.
- FOR ILLUSTRATIVE EXAMPLES OF HOW TO POSITION SIGN PANELS AND SIGN STRUCTURES, SEE CASES A-F ON THE NEXT SHEET.
- THE DESIGN SIGN PANEL LENGTH AND "X" DIMENSION SHALL BE THE DIMENSIONS AS DETERMINED IN THE FOLLOWING EXAMPLE ROUNDED UP TO THE NEXT HIGHEST INCREMENTS SHOWN IN THE DESIGN TABLES.
- THE DESIGN POST HEIGHT SHALL BE THE ACTUAL DESIGN POST HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST HEIGHT SHOWN IN THE DESIGN TABLES.

EXAMPLE TO SHOW PROCEDURE FOR SELECTING SIGN AREA, SIGN LOCATION, & POST HEIGHT



- HEIGHT OF SIGN PANEL NO. 2 EXCEEDS 12', THEREFORE, USE 2-STRUT STRUCTURE.
- Δ ELEV. = 1000.00 - 998.75 = 1.25 < 2'-6"
  Y_1 = 10', Y_2 = 14' } $Y_1 < Y_2$ } USE CASE B
- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION
  ELEV. 1000.00 + 17'-6" + 1'-6" = 1019.00
  [1'-6" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL]
- SET ℄ STRUCTURE AT ℄ OF SIGN PANEL NO. 2
  ELEV. 1019.00 + 14'/2 = 1026.00
- DESIGN COLUMN HEIGHT (H):
  H = 1026.00 - 1000.00 = 26.00' → USE H = 28'
- BECAUSE SIGN PANEL NO. 1 IS NOT CENTERED VERTICALLY ON THE STRUCTURE, THE DESIGN AREAS ARE COMPUTED AS FOLLOWS:
  A_1 = 12' x 7' x 2 = 168.0 SF
  A_2 = 14' x 14' = 196.0 SF
  364.0 SF
  → USE 400.0 SF
- COMPUTE CENTER OF GRAVITY OF SIGN AREA (X):

$$X = \frac{[168.0 \text{ SF} \times (5' + 12'/2)] + [196.0 \text{ SF} \times (24' + 14'/2)]}{364 \text{ SF}}$$

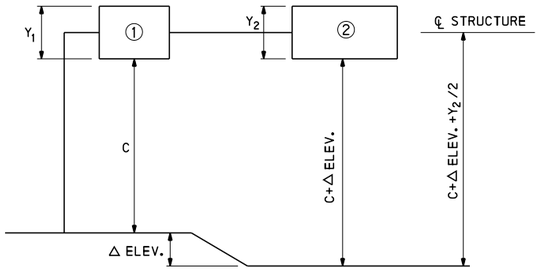
X = 21.77' → USE X = 24' WITH A SIGN AREA OF 400 SF

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40'

DESIGN INSTRUCTIONS

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 2 OF 8
Thomas P. Macioce	Brian D. Thompson	
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	BD-641M

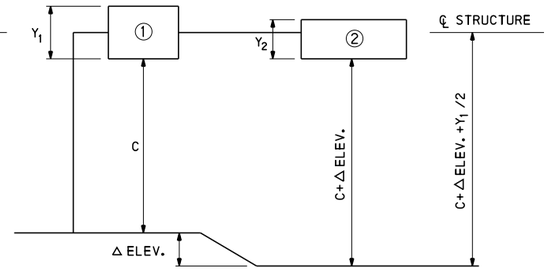


CASE A

$Y_1 = Y_2$

Δ ELEV. ≤ 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET ℄ OF STRUCTURE AT ℄ OF SIGN PANELS.

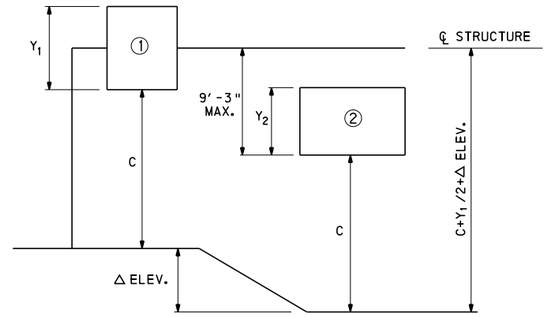


CASE C

$Y_1 \geq Y_2$

Δ ELEV. ≤ 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1.
THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF Y_1 AND Y_2 WHERE $Y_1 \geq Y_2$.



CASE E

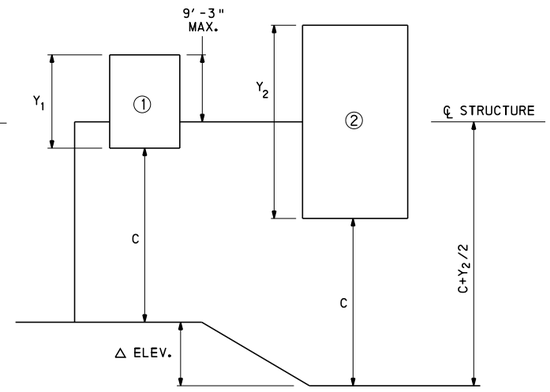
$Y_1 \geq Y_2$

Δ ELEV. > 2′-6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.
SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1.
THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF Δ ELEV. AND Y_2 WHERE $Y_1 \geq Y_2$:

Δ ELEV.	$Y_{1,2}$
3′-0"	6′-0" TO 12′-6"
4′-0"	6′-0" TO 10′-6"
5′-0"	6′-0" TO 8′-6"
6′-0"	6′-0" TO 6′-6"
6′-3"	6′-0"

WHEN $Y_{1,2}$ EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE FOR A PARTICULAR VALUE OF ΔELEV., THIS CASE DOES NOT APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A SPECIAL DESIGN.



CASE F

$Y_1 < Y_2$

Δ ELEV. > 2′-6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.
SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 2.
THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF ΔELEV., Y_1, AND Y_2 WHERE $Y_1 < Y_2$:

Δ ELEV.	LIMITS OF Y_1 AND Y_2
3′-0"	$2Y_1 - Y_2 \leq$ 12′-6"
4′-0"	$2Y_1 - Y_2 \leq$ 10′-6"
5′-0"	$2Y_1 - Y_2 \leq$ 8′-6"
6′-0"	$2Y_1 - Y_2 \leq$ 6′-6"
7′-0"	$2Y_1 - Y_2 \leq$ 4′-6"

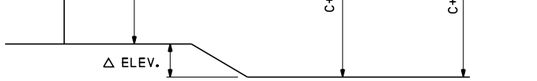
GENERAL EQUATION FOR CASE F:
$2(\Delta ELEV.) + 2(Y_1) - Y_2 \leq$ 18′-6"

IF THE PARAMETERS OF THE GENERAL EQUATION ARE EXCEEDED, ONE OF THE FOLLOWING STEPS IS REQUIRED:

1) RESET ℄ STRUCTURE SO THAT PARAMETERS ARE MET
2) USE SEPARATE STRUCTURES
3) USE A SPECIAL DESIGN
4) IN ALL CASES, THE MINIMUM VERTICAL CLEARANCE OF 17′-6" MUST BE MAINTAINED

NOTE:

C IS VERTICAL CLEARANCE FROM ROADWAY TO BOTTOM OF STRUCTURE, SIGN PANEL OR LUMINAIRE.

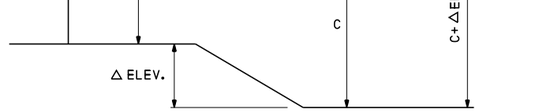


CASE B

$Y_1 \leq Y_2$

Δ ELEV. ≤ 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 2.
THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF Y_1 AND Y_2 WHERE $Y_1 \leq Y_2$.



CASE D

$Y_1 = Y_2$

Δ ELEV. > 2′-6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.
SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1.
THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF ΔELEV. AND $Y_{1,2}$:

Δ ELEV.	$Y_{1,2}$
3′-0"	6′-0" TO 12′-6"
4′-0"	6′-0" TO 10′-6"
5′-0"	6′-0" TO 8′-6"
6′-0"	6′-0" TO 6′-6"
6′-3"	6′-0"

WHEN $Y_{1,2}$ EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE FOR A PARTICULAR VALUE OF ΔELEV., THIS CASE DOES NOT APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A SPECIAL DESIGN.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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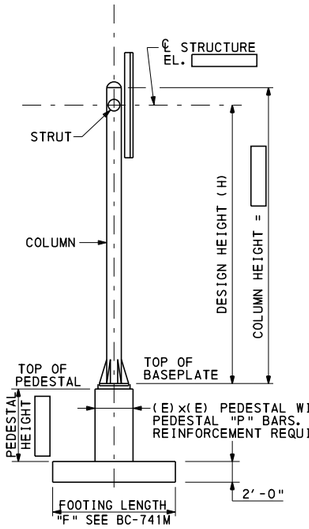
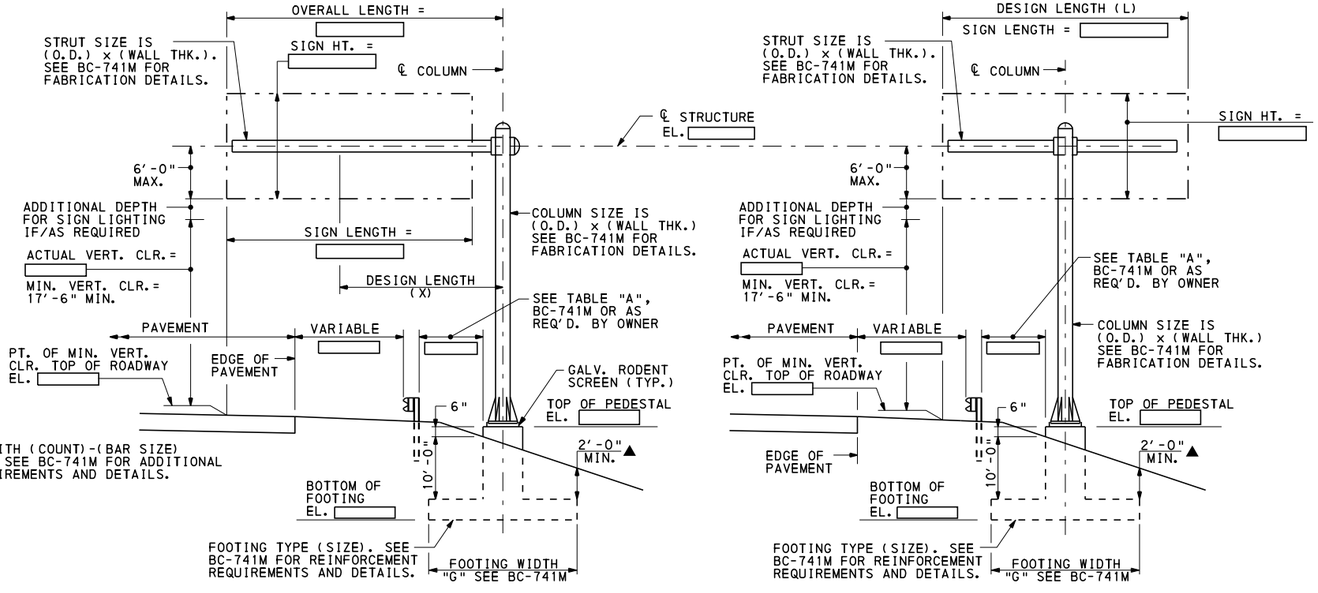
OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40′

INSTRUCTIONS FOR USE OF DESIGN TABLES

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 3 OF 8
Thomas P Macioce	Brent B Thompson	BD-641M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	



SIDE VIEW



TYPE A CANTILEVER

CENTER-MOUNT
(TYPE B CANTILEVER SIMILAR)

SINGLE STRUT SIGN STRUCTURES

▲ DESIGNER MUST CHECK ADEQUACY OF FOOTINGS FOR FILL HEIGHTS < 10'-0".

TABLE OF ESTIMATED QUANTITIES

ITEM NO.	ITEM	UNIT	QUANTITY
*	STEEL SIGN STRUCTURE	LBS	
0000-0000	STRUCTURE MOUNTED SIGNS	SF	
0000-0000	CLASS 3 EXCAVATION	CY	
0000-0000	CLASS A CEMENT CONCRETE	CY	
0000-0000	REINFORCEMENT BARS	LBS	

* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. 0000 - 0000

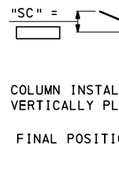
DESIGN CRITERIA

DESIGN SIGN AREA (A) =	
DESIGN LENGTH (X OR L) =	
DESIGN HEIGHT (H) =	
FATIGUE CATEGORY =	

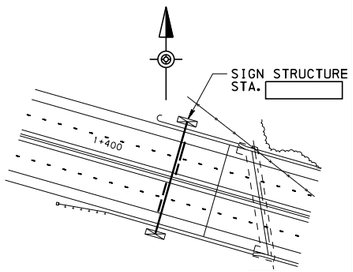
NOTE:
DESIGN FOR (ULTIMATE OR ACTUAL) SIGN AREA.
(DESIGNER TO INDICATE CONTROLLING CONDITION)

NOTES TO DESIGNER:

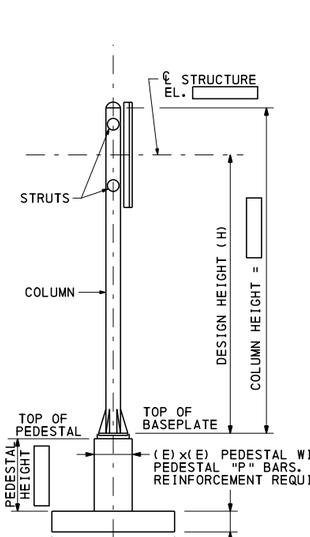
- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED. DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES.
  1. (E)x(E) PEDESTAL WITH (COUNT) - (BAR SIZE) PEDESTAL "P" BARS. SEE BC-741M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
  2. FOOTING TYPE (SIZE). SEE BC-741M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  3. COLUMN SIZE IS (O.D.) x (WALL THK.). SEE BC-741M FOR FABRICATION DETAILS.
  4. STRUT SIZE IS (O.D.) x (WALL THK.). SEE BC-741M FOR FABRICATION DETAILS.
- PLACE CAMBER DIAGRAM ON CONTRACT DRAWINGS AND SPECIFY REQUIRED CAMBER FROM DESIGN TABLE. DO NOT CAMBER TYPE B CANTILEVER STRUTS.
- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH [ ]



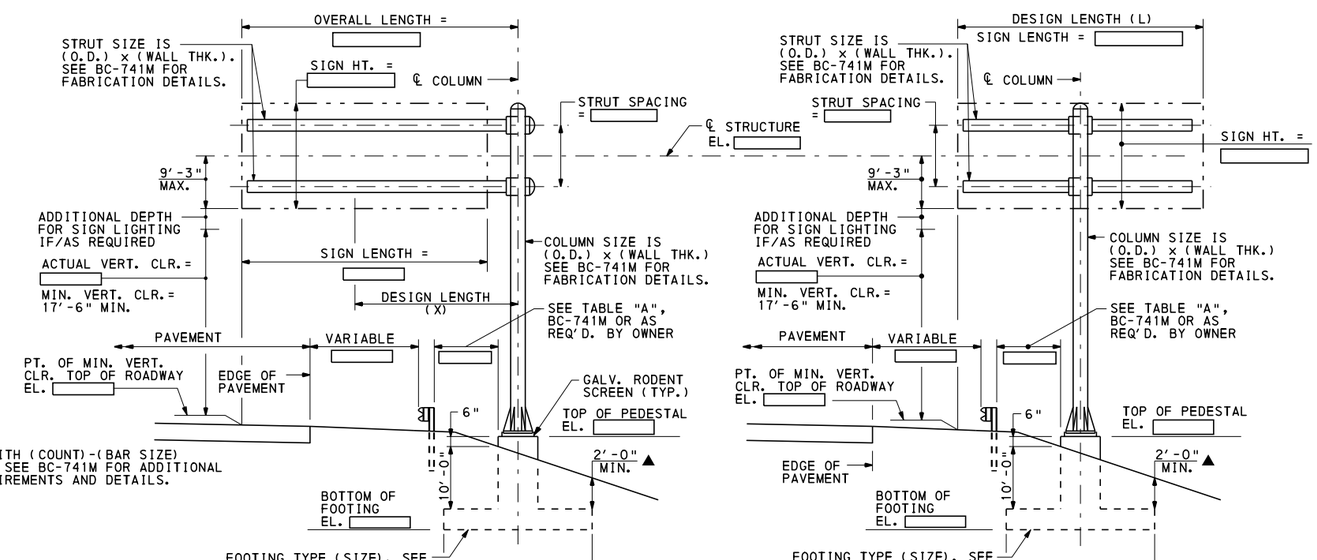
CAMBER DIAGRAM



LOCATION PLAN



SIDE VIEW



TYPE A CANTILEVER

CENTER-MOUNT
(TYPE B CANTILEVER SIMILAR)

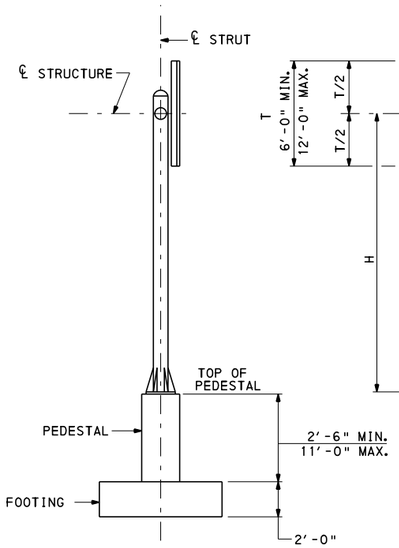
DOUBLE STRUT SIGN STRUCTURES

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

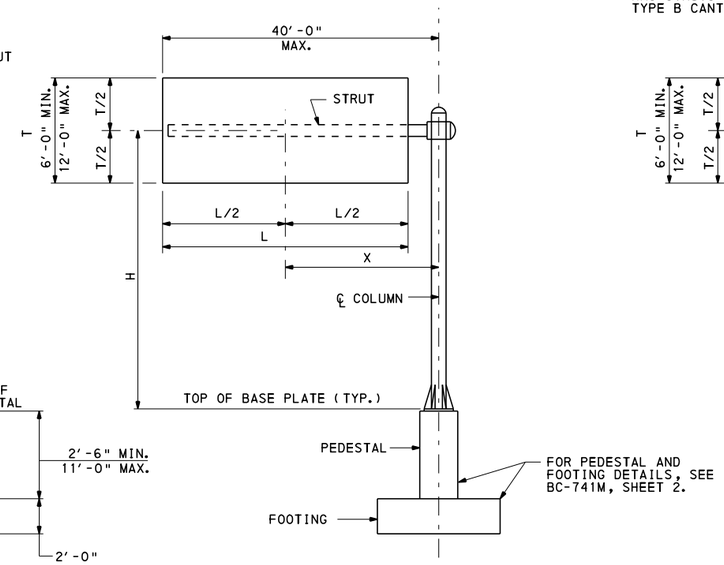
OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40'

SAMPLE CONTRACT DRAWING

RECOMMENDED AUG. 4, 2017 Thomas P Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brian D Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHT. 4 OF 8 BD-641M



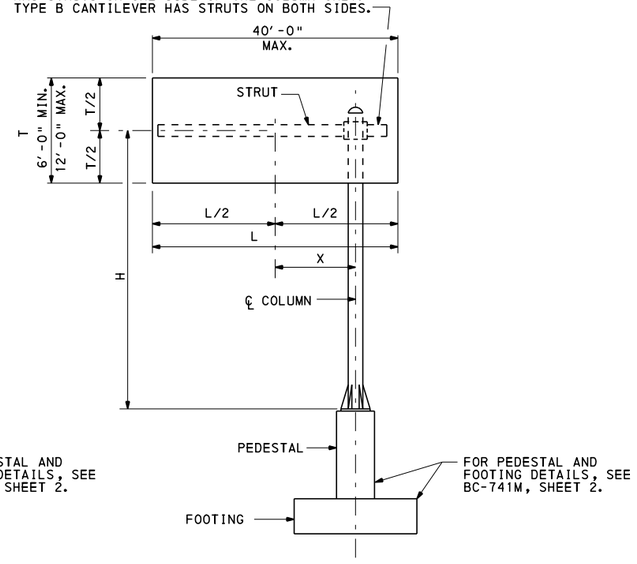
SIDE VIEW



FRONT VIEW (TYPE A)

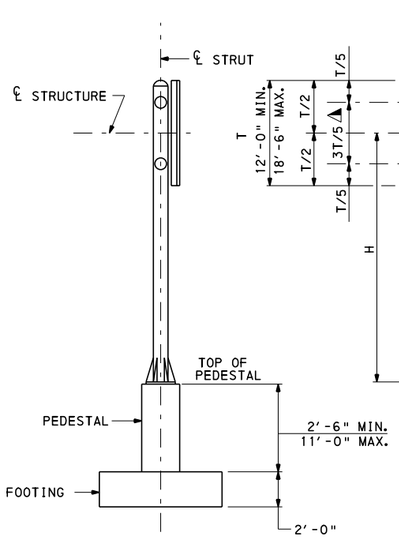
NOTE A:

PROVIDE STRUT(S) ON THIS SIDE OF COLUMN WHEN SIGN OVERHANG IS GREATER THAN 3′-0". SEE BC-741M, SHEET 5 FOR DETAILS. TYPE A CANTILEVER HAS STRUTS ON ONE SIDE OF THE COLUMN ONLY. TYPE B CANTILEVER HAS STRUTS ON BOTH SIDES.

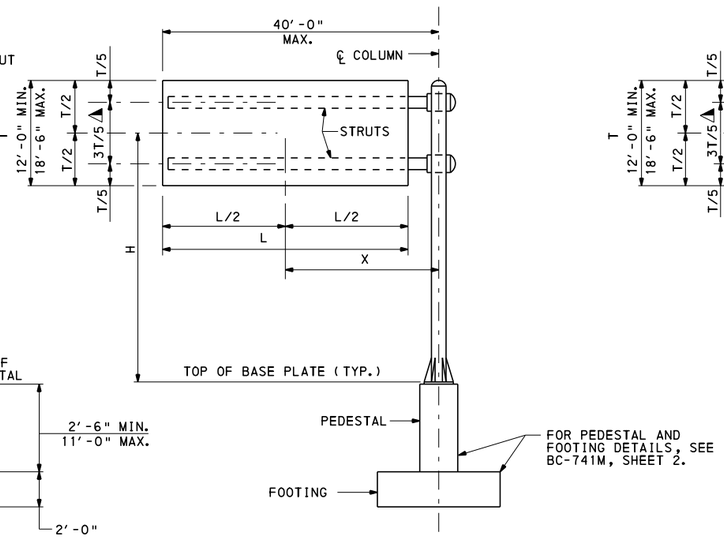


FRONT VIEW (TYPE B)

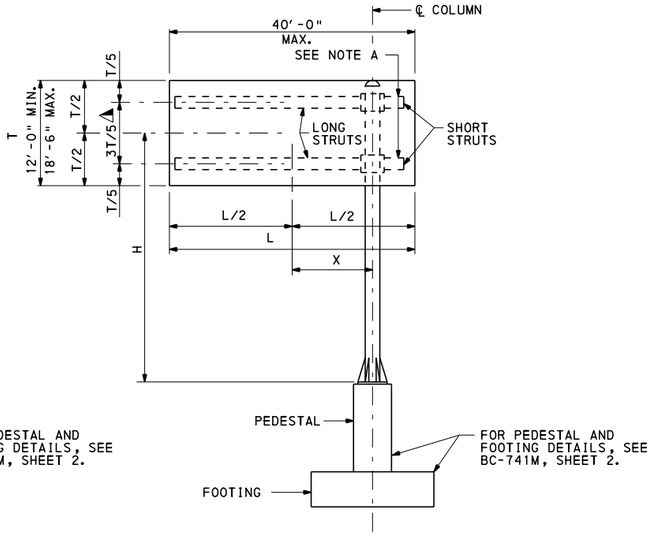
SINGLE STRUT SIGN



SIDE VIEW



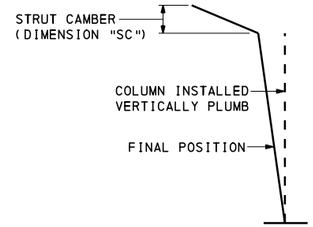
FRONT VIEW (TYPE A)



FRONT VIEW (TYPE B)

DOUBLE STRUT SIGN

▲ - ROUND UP TO NEAREST 3" INCREMENT



CAMBER DIAGRAM

NOTES:

CAMBERS SHOWN IN THE DESIGN TABLES ARE BASED ON SIGN HEIGHTS OF 12′-0" FOR THE SINGLE STRUT STRUCTURE AND 18′-6" FOR THE DOUBLE STRUT STRUCTURE.

STRUT CAMBER (SC) INCLUDES CAMBER OF STRUT FROM SIGN PROGRAM WHICH INCLUDES DOWNWARD MOVEMENT OF THE STRUT CAUSED BY THE DEFLECTION OF THE COLUMN.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40′

CANTILEVER SINGLE AND DOUBLE
STRUT STRUCTURES

RECOMMENDED AUG. 4, 2017 Thomas P. Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brent D. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHT. 5 OF 8 BD-641M

COLUMN AND FOOTING DATA

X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE
4′-0"	12′-0"	50	10x.365 *	0.50	16-#6	609
		100	12x.375 *	0.46	16-#8	609
		150	14x.375	0.51	16-#8	713
		200	14x.375	0.83	16-#8	1010
		250	16x.375 *	0.79	16-#9	1112
		300	18x.375 *	1.17	16-#10	1112
		400	20x.375 *	1.55	16-#11	917
		480	24x.375 *	1.51	16-#10	1215
		500	24x.375 *	1.05	16-#10	1215
		600	24x.375 *	1.21	16-#10	918
		740	24x.500 *	1.66	16-#11	1218
	16′-0"	50	12x.375 *	0.46	16-#8	609
		100	12x.375 *	0.51	16-#8	711
		150	14x.375	0.57	16-#8	713
		200	16x.375 *	0.78	16-#9	1112
		250	18x.375 *	0.77	16-#10	1112
		300	20x.375 *	1.16	16-#11	1114
		400	24x.375 *	1.47	16-#10	1215
		480	24x.375	1.61	16-#10	918
		500	24x.375 *	1.12	16-#10	1215
	20′-0"	50	16x.375 *	0.40	16-#9	609
		100	16x.375 *	0.44	16-#9	711
		150	16x.375 *	0.53	16-#9	713
		200	18x.375 *	0.73	16-#10	1112
		250	18x.375	0.84	16-#10	1114
		300	20x.375	1.23	16-#11	1114
		400	24x.375 *	1.53	16-#10	1215
	24′-0"	50	18x.375 *	0.39	16-#10	609
		100	18x.375 *	0.42	16-#10	713
		150	18x.375 *	0.50	16-#10	713
		200	18x.375	0.79	16-#10	1112
		250	20x.375	0.79	16-#11	1114
		300	24x.375 *	1.12	16-#10	1215
		480	24x.500	1.67	16-#11	922
		500	24x.500	1.16	16-#11	922
	28′-0"	50	20x.375 *	0.38	16-#11	609
		100	20x.375 *	0.41	16-#11	713
		150	20x.375 *	0.47	16-#11	1112
		200	20x.375 *	0.73	16-#11	1114
		250	24x.375 *	0.70	16-#10	916
		300	24x.375 *	1.16	16-#10	1215
		400	24x.500 *	1.56	16-#11	1317

X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE
8′-0"	12′-0"	50	12x.375 *	1.16	16-#8	609
		100	14x.375 *	1.09	16-#8	711
		150	16x.375 *	0.80	16-#9	711
		200	16x.375	1.35	16-#9	713
		250	18x.375	1.44	16-#10	1010
		300	24x.375 *	1.13	16-#10	1112
		400	24x.375 *	1.87	16-#10	1213
		480	24x.375 *	2.30	16-#10	1018
		600	24x.500	1.92	16-#11	1019
	16′-0"	50	12x.375 *	1.27	16-#8	609
		100	14x.375 *	1.21	16-#8	711
		150	16x.375 *	0.90	16-#9	713
		200	16x.375	1.53	16-#9	815
		250	18x.375	1.64	16-#10	1112
		300	24x.375 *	1.25	16-#10	1114
		400	24x.375	2.04	16-#10	1215
		600	24x.500	2.11	16-#11	1020
	20′-0"	50	16x.375 *	1.11	16-#9	609
		100	16x.375 *	1.13	16-#9	711
		150	16x.375 *	1.01	16-#9	713
		200	18x.375 *	1.44	16-#10	1112
		250	20x.375 *	1.56	16-#11	1114
		300	24x.375 *	1.37	16-#10	916
		480	24x.500 *	2.49	16-#11	1020
		500	24x.500 *	1.41	16-#11	1020
	24′-0"	50	18x.375 *	1.07	16-#10	609
		100	18x.375 *	1.06	16-#10	713
		150	18x.375 *	0.92	16-#10	713
		200	20x.375 *	1.36	16-#11	1114
		250	24x.375 *	1.34	16-#10	1015
		300	24x.375 *	1.49	16-#10	916
	28′-0"	50	20x.375 *	1.04	16-#11	711
		100	20x.375 *	1.01	16-#11	1010
		150	20x.375 *	0.85	16-#11	1112
		200	20x.375	1.45	16-#11	1114
		250	24x.375	1.42	16-#10	1213
		300	24x.375	1.61	16-#10	1215
		400	24x.500	2.27	16-#11	1020

X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE
12′-0"	12′-0"	50	14x.375 *	1.62	16-#8	609
		100	16x.375 *	1.48	16-#9	711
		150	18x.375 *	1.60	16-#10	711
		200	20x.375 *	1.66	16-#11	1010
		250	24x.375 *	1.67	16-#10	814
		300	24x.375	1.85	16-#10	1112
	16′-0"	50	14x.375 *	1.79	16-#8	609
		100	16x.375 *	1.66	16-#9	711
		150	18x.375 *	1.76	16-#10	1010
		200	20x.375 *	1.84	16-#11	1112
		250	24x.375 *	1.80	16-#10	1112
		300	24x.375	2.04	16-#10	1213
	20′-0"	50	16x.375 *	1.67	16-#9	609
		100	16x.375 *	1.84	16-#9	711
		150	18x.375 *	1.91	16-#10	713
		200	20x.375 *	2.01	16-#11	1112
		250	24x.375 *	1.94	16-#10	1114
		300	24x.375	2.22	16-#10	916
	24′-0"	50	18x.375 *	1.58	16-#10	711
		100	18x.375 *	1.69	16-#10	713
		150	18x.375 *	2.06	16-#10	713
		200	20x.375 *	2.19	16-#11	1114
		250	24x.375 *	2.08	16-#10	1213
		300	24x.375	2.41	16-#10	916
	28′-0"	50	20x.375 *	1.50	16-#11	711
		100	20x.375 *	1.57	16-#11	1010
		150	20x.375 *	1.92	16-#11	815
		200	24x.375 *	1.84	16-#10	815
		250	24x.375 *	2.22	16-#10	1213

X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE
16′-0"	12′-0"	50	14x.375 *	2.90	16-#8	609
		100	16x.375 *	2.43	16-#9	710
		150	20x.375 *	1.92	16-#11	812
		200	24x.375 *	1.93	16-#10	1112
		250	24x.375	2.32	16-#10	1112
		300	24x.500 *	2.32	16-#11	915
	16′-0"	50	14x.375 *	3.32	16-#8	609
		100	16x.375 *	2.70	16-#9	711
		150	20x.375 *	2.13	16-#11	1010
		200	24x.375 *	2.07	16-#10	1112
		250	24x.375	2.54	16-#10	1213
		300	24x.500 *	2.54	16-#11	915
	20′-0"	50	16x.375 *	3.03	16-#9	609
		100	16x.375 *	2.97	16-#9	711
		150	20x.375 *	2.34	16-#11	1010
		200	24x.375 *	2.22	16-#10	1112
		250	24x.375	2.77	16-#10	915
		300	24x.500 *	2.77	16-#11	1213
	24′-0"	50	18x.375 *	2.80	16-#10	710
		100	18x.375 *	2.75	16-#10	713
		150	20x.375 *	2.56	16-#11	814
		200	24x.375 *	2.36	16-#10	1112
		250	24x.375	3.00	16-#10	1213
		300	24x.500 *	2.99	16-#11	1215
	28′-0"	50	20x.375 *	2.62	16-#11	711
		100	20x.375 *	2.57	16-#11	713
		150	20x.375 *	2.77	16-#11	1112
		200	24x.375 *	2.50	16-#10	916
		250	24x.375	3.23	16-#10	1215
		300	24x.500 *	3.22	16-#11	1018

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-98, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS.

** - PIPE NOMINAL SIZE X WALL THICKNESS, SEE GENERAL NOTE 11 ON SHEET 1.

NOTES:

- FOR GENERAL NOTES, SEE SHEET 1.
- FOR DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
- COLUMN SIZES SHOWN ARE FOR SINGLE AND DOUBLE STRUT STRUCTURES.
- "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH (FOR EXAMPLE, FOOTING TYPE 609 INDICATES A FOOTING 6′-0" WIDE x 9′-0" LONG). SEE BC-741M, SHEET 2 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10′-0".
- STRUT AND COLUMN DESIGN BASED ON MAXIMUM SIGN HEIGHT FOR THE INDICATED SIGN AREA. DESIGNER MUST CHECK ADEQUACY OF STRUT AND COLUMN MEMBER SIZES FOR SIGN HEIGHTS LESS THAN 12′-0" FOR SINGLE STRUT STRUCTURES AND LESS THAN 18′-6" FOR DOUBLE STRUT STRUCTURES.
- CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40′

CANTILEVER SINGLE AND DOUBLE
STRUT STRUCTURES - DESIGN TABLES

RECOMMENDED AUG. 4, 2017
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
Brian S. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

BD-641M

COLUMN AND FOOTING DATA (CONTINUED)

X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE
20'-0"	12'-0"	50	16x.375 *	4.43	16-#9	906
		100	18x.375 *	3.12	16-#10	1010
		150	24x.375 *	2.84	16-#10	1010
		200	24x.375	2.84	16-#10	814
		250	24x.500 *	2.82	16-#11	913
	16'-0"	50	16x.375 *	4.87	16-#9	1008
		100	18x.375 *	3.51	16-#10	1010
		150	24x.375 *	3.04	16-#10	1010
		200	24x.375	3.10	16-#10	1112
		250	24x.500 *	3.08	16-#11	915
	20'-0"	50	16x.375 *	5.32	16-#9	710
		100	18x.375 *	3.91	16-#10	1010
		150	24x.375 *	3.23	16-#10	814
		200	24x.375	3.37	16-#10	1111
		250	24x.500 *	3.35	16-#11	915
	24'-0"	50	18x.375 *	4.95	16-#10	710
		100	18x.375 *	4.31	16-#10	812
		150	24x.375 *	3.42	16-#10	1112
		200	24x.375	3.63	16-#10	1213
		250	24x.500 *	3.61	16-#11	1016
	28'-0"	50	20x.375 *	4.66	16-#11	711
		100	20x.375 *	3.94	16-#11	1010
		150	24x.375 *	3.61	16-#10	814
		200	24x.375	3.89	16-#10	915
		250	24x.500 *	3.88	16-#11	1017

X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE
24'-0"	12'-0"	50	16x.375 *	5.37	16-#9	1008
		100	20x.375 *	4.49	16-#11	811
		150	24x.375 *	3.36	16-#10	1010
	16'-0"	50	16x.375 *	5.88	16-#9	1008
		100	20x.375 *	4.92	16-#11	1010
		150	24x.375 *	3.67	16-#10	1010
	20'-0"	50	16x.375 *	6.54	16-#9	1008
		100	20x.375 *	5.35	16-#11	1010
		150	24x.375 *	3.98	16-#10	1112
	24'-0"	50	18x.375 *	5.98	16-#10	1010
		100	20x.375 *	5.78	16-#11	1010
		150	24x.375 *	4.28	16-#10	1112
	28'-0"	50	20x.375 *	5.64	16-#11	1010
		100	20x.375 *	6.21	16-#11	1010
		150	24x.375 *	4.59	16-#10	915

X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE
28'-0"	12'-0"	50	18x.375 *	6.65	16-#10	1008
		100	20x.375	5.25	16-#11	1010
	16'-0"	50	18x.375 *	7.40	16-#10	1008
		100	20x.375	5.91	16-#11	1010
	20'-0"	50	18x.375 *	8.15	16-#10	1008
		100	20x.375	6.57	16-#11	1010
	24'-0"	50	18x.375 *	8.89	16-#10	811
		100	20x.375	7.23	16-#11	1010
	28'-0"	50	24x.375 *	6.58	16-#10	1010
		100	24x.375 *	5.92	16-#10	1010

X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE
32'-0"	12'-0"	50	18x.375 *	9.73	16-#10	1007
		100	24x.375 *	6.42	16-#10	1010
	16'-0"	50	18x.375 *	10.75	16-#10	1008
		100	24x.375 *	6.93	16-#10	1010
	20'-0"	50	18x.375 *	11.77	16-#10	1008
		100	24x.375 *	7.45	16-#10	1010
	24'-0"	50	20x.375 *	11.10	16-#11	1010
		100	24x.375 *	7.96	16-#10	1111
	28'-0"	50	24x.375 *	9.63	16-#10	1010
		100	24x.375 *	8.48	16-#10	1111
36'-0"	12'-0"	50	20x.375 *	9.47	16-#11	1107
		100	24x.375 *	7.73	16-#10	1109
		150	24x.500	6.56	16-#11	1210
	16'-0"	50	20x.375 *	10.55	16-#11	1108
		100	24x.375 *	8.45	16-#10	1109
		150	24x.500	7.21	16-#11	1111
	20'-0"	50	20x.375 *	11.62	16-#11	1109
		100	24x.375 *	9.17	16-#10	1010
		150	24x.500	7.86	16-#11	1212
	24'-0"	50	24x.375 *	9.94	16-#10	1010
		100	24x.375 *	9.89	16-#10	1111
		150	24x.500	8.52	16-#11	1212
	28'-0"	50	24x.375 *	10.56	16-#10	1010
		100	24x.500	9.41	16-#11	1111
		150	24x.500	9.17	16-#11	1212

NOTES:

- FOR GENERAL NOTES, SEE SHEET 1.
- FOR DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
- COLUMN SIZES SHOWN ARE FOR SINGLE AND DOUBLE STRUT STRUCTURES.
- "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH (FOR EXAMPLE, FOOTING TYPE 609 INDICATES A FOOTING 6'-0" WIDE x 9'-0" LONG). SEE BC-741M, SHEET 2 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10'-0".
- STRUT AND COLUMN DESIGN BASED ON MAXIMUM SIGN HEIGHT FOR THE INDICATED SIGN AREA. DESIGNER MUST CHECK ADEQUACY OF STRUT AND COLUMN MEMBER SIZES FOR SIGN HEIGHTS LESS THAN 12'-0" FOR SINGLE STRUT STRUCTURES AND LESS THAN 18'-6" FOR DOUBLE STRUT STRUCTURES.
- CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-98, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS.

** - PIPE NOMINAL DIA. X WALL THICKNESS, SEE GENERAL NOTE 11 ON SHEET 1.

SINGLE STRUT DATA **

SIGN AREA (SQ. FT.)	X								
	4'-0"	8'-0"	12'-0"	16'-0"	20'-0"	24'-0"	28'-0"	32'-0"	36'-0"
50	5x.258 *	6x.280	8x.322 *	10x.365 *	10x.365 *	10x.365 *	12x.375 *	12x.375 *	14x.375 *
100	6x.280 *	8x.322 *	10x.365 *	10x.365 *	12x.375 *	12x.375	14x.375	16x.375 *	———
150	8x.322 *	10x.365 *	10x.365 *	12x.375 *	14x.375 *	16x.375 *	18x.375 *	18x.375	———
200	10x.365 *	10x.365 *	12x.375 *	16x.375 *	16x.375	18x.375	20x.375 *	———	———
250	10x.365 *	12x.375 *	14x.375 *	16x.375	18x.375	20x.375 *	20x.500 *	———	———
300	10x.365 *	16x.375 *	16x.375 *	18x.375 *	20x.375	20x.500 *	———	———	———
400	12x.375	16x.375 *	20x.375 *	20x.500 *	20x.500	———	———	———	———
480	16x.375 *	18x.375 *	20x.375	20x.500	———	———	———	———	———

DOUBLE STRUT DATA **

SIGN AREA (SQ. FT.)	X								
	4'-0"	8'-0"	12'-0"	16'-0"	20'-0"	24'-0"	28'-0"	32'-0"	36'-0"
50	4x.237 *	6x.280 *	8x.322 *	8x.322 *	8x.322 *	10x.365 *	10x.365 *	10x.365	12x.375 *
100	5x.258 *	6x.280	8x.322 *	10x.365 *	10x.365 *	10x.365 *	12x.375 *	12x.375 *	14x.375 *
150	6x.280 *	8x.322 *	8x.322	10x.365 *	10x.365	12x.375 *	12x.375	14x.375	16x.375 *
200	8x.322 *	8x.322 *	10x.365 *	10x.365 *	12x.375 *	12x.375	14x.375	16x.375 *	———
250	8x.322 *	8x.322 *	10x.365 *	12x.375 *	12x.375	14x.375	16x.375 *	18x.375 *	———
300	8x.322 *	10x.365 *	12x.375 *	12x.375	16x.375 *	16x.375	18x.375 *	———	———
400	10x.365 *	12x.375 *	12x.375	16x.375 *	18x.375 *	18x.375	———	———	———
500	10x.365 *	14x.375 *	16x.375 *	18x.375 *	20x.375 *	———	———	———	———
600	12x.375 *	14x.375 *	18x.375 *	18x.375	———	———	———	———	———
700	12x.375	16x.375 *	18x.375 *	———	———	———	———	———	———
740	14x.375 *	16x.375	18x.375	———	———	———	———	———	———

PEDESTAL

COLUMN	PEDESTAL SIZE
10" DIA.	2'-6" x 2'-6"
12" DIA.	2'-9" x 2'-9"
14" DIA.	3'-0" x 3'-0"
16" DIA.	3'-3" x 3'-3"
18" DIA.	3'-3" x 3'-3"
20" DIA.	3'-9" x 3'-9"
24" DIA.	4'-3" x 4'-3"

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RECOMMENDED AUG. 4, 2017
Thomas P Macioce
CHIEF BRIDGE ENGINEER

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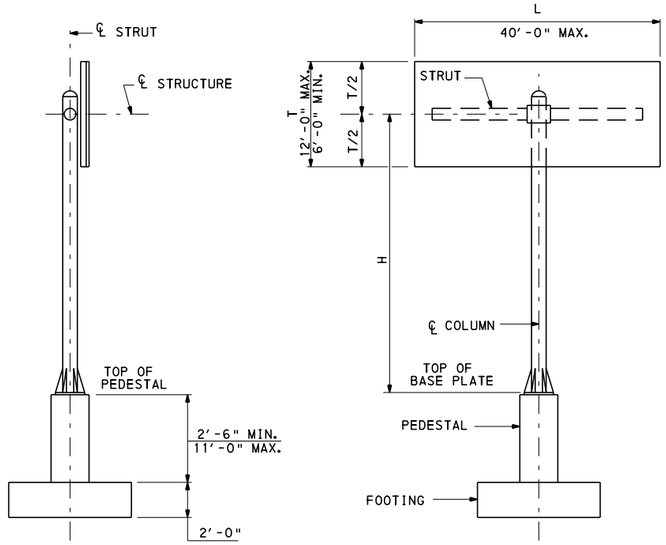
SHT. 7 OF 8

BD-641M



SINGLE STRUT SIGN

SINGLE STRUT DATA **

SIGN AREA (SQ. FT.)	L 8′-0"	12′-0"	16′-0"	20′-0"	24′-0"	28′-0"	32′-0"	36′-0"	40′-0"
50	4x.237 *	——	——	——	——	——	——	——	——
100	——	4x.237 *	5x.258 *	——	——	——	——	——	——
150	——	——	6x.280 *	6x.280 *	6x.280	——	——	——	——
200	——	——	——	8x.322 *	8x.322 *	8x.322 *	8x.322 *	——	——
250	——	——	——	——	8x.322 *	8x.322 *	10x.365 *	10x.365 *	10x.365 *
300	——	——	——	——	——	10x.365 *	10x.365 *	10x.365 *	10x.365 *
400	——	——	——	——	——	——	——	10x.365	12x.375 *
480	——	——	——	——	——	——	——	——	12x.375 *

PEDESTAL

COLUMN	PEDESTAL SIZE
10" DIA.	2′-6" x 2′-6"
12" DIA.	2′-9" x 2′-9"
14" DIA.	3′-0" x 3′-0"
16" DIA.	3′-3" x 3′-3"
18" DIA.	3′-3" x 3′-3"
20" DIA.	3′-9" x 3′-9"
24" DIA.	4′-3" x 4′-3"

DOUBLE STRUT DATA **

SIGN AREA (SQ. FT.)	L 4′-0"	8′-0"	12′-0"	16′-0"	20′-0"	24′-0"	28′-0"	32′-0"	36′-0"	40′-0"
50	3.5x.226	——	——	——	——	——	——	——	——	——
100	——	3.5x.226	——	——	——	——	——	——	——	——
150	——	——	3.5x.226	——	——	——	——	——	——	——
200	——	——	4x.237 *	5x.258 *	——	——	——	——	——	——
250	——	——	——	5x.258 *	6x.280 *	——	——	——	——	——
300	——	——	——	——	6x.280 *	6x.280	——	——	——	——
400	——	——	——	——	——	8x.322 *	8x.322 *	8x.322 *	——	——
500	——	——	——	——	——	——	8x.322 *	10x.365 *	10x.365 *	10x.365 *
600	——	——	——	——	——	——	——	——	10x.365 *	10x.365 *
700	——	——	——	——	——	——	——	——	——	12x.375 *
740	——	——	——	——	——	——	——	——	——	12x.375 *

COLUMN AND FOOTING DATA

H	SIGN AREA (SQ. FT.)	COLUMN **	PEDESTAL "P" BARS	FOOTING TYPE
12′-0"	50	10x.365 *	16-#6	609
	100	10x.365 *	16-#6	711
	150	12x.375 *	16-#8	713
	200	14x.375 *	16-#8	713
	250	16x.375 *	16-#9	815
	300	18x.375 *	16-#10	815
	400	20x.375 *	16-#11	916
	480	24x.375 *	16-#10	916
	500	24x.375 *	16-#10	918
	600	24x.375 *	16-#10	918
16′-0"	50	14x.375 *	16-#8	609
	100	14x.375 *	16-#8	711
	150	14x.375 *	16-#8	713
	200	16x.375 *	16-#9	713
	250	18x.375 *	16-#10	815
	300	20x.375 *	16-#11	817
	400	24x.375 *	16-#10	916
	480	24x.375 *	16-#10	918
	500	24x.375 *	16-#10	918
	700	24x.500	16-#11	922
20′-0"	50	16x.375 *	16-#9	609
	100	16x.375 *	16-#9	713
	150	16x.375 *	16-#9	713
	200	18x.375 *	16-#10	815
	250	20x.375 *	16-#11	817
	300	24x.375 *	16-#10	817
	400	24x.375 *	16-#10	918

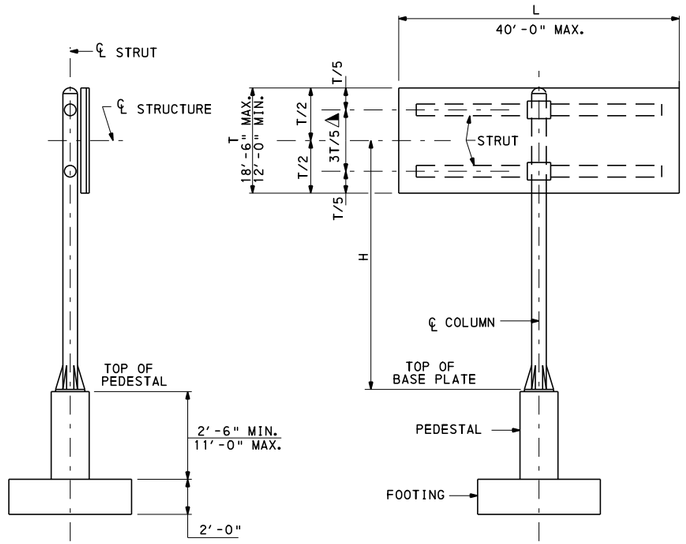
H	SIGN AREA (SQ. FT.)	COLUMN **	PEDESTAL "P" BARS	FOOTING TYPE
24′-0"	50	18x.375 *	16-#10	609
	100	18x.375 *	16-#10	713
	150	18x.375 *	16-#10	713
	200	20x.375 *	16-#11	815
	250	24x.375 *	16-#10	916
	300	24x.375 *	16-#10	918
	480	24x.500 *	16-#11	922
28′-0"	50	20x.375 *	16-#11	609
	100	20x.375 *	16-#11	713
	150	20x.375 *	16-#11	815
	200	20x.375	16-#11	817
	250	24x.375 *	16-#10	916
	300	24x.375	16-#10	918
	400	24x.500 *	16-#11	922

NOTES:

- FOR GENERAL NOTES, SEE SHEET 1.
- FOR DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
- COLUMN SIZES SHOWN ARE FOR SINGLE AND DOUBLE STRUT STRUCTURES.
- "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH (FOR EXAMPLE, FOOTING TYPE 609 INDICATES A FOOTING 6′-0" WIDE x 9′-0" LONG). SEE BC-741M, SHEET 2 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10′-0".
- STRUT AND COLUMN DESIGN BASED ON MAXIMUM SIGN HEIGHT FOR THE INDICATED SIGN AREA. DESIGNER MUST CHECK ADEQUACY OF STRUT AND COLUMN MEMBER SIZES FOR SIGN HEIGHTS LESS THAN 12′-0" FOR SINGLE STRUT STRUCTURES AND LESS THAN 18′-6" FOR DOUBLE STRUT STRUCTURES.
- CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING ½" (0.500").

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-98, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS.

** - PIPE NOMINAL DIA. X WALL THICKNESS, SEE GENERAL NOTE 11 ON SHEET 1.



DOUBLE STRUT SIGN

▲ - ROUND UP TO NEAREST 3" INCREMENT

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40′

CENTER-MOUNT DESIGN TABLES

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 8 OF 8
Thomas P Macioce	Bruce D Thompson	
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	BD-641M

CHANGE 1

INFORMATIONAL NOTES

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS FOR OVERHEAD SIGN STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS. REFERENCE TO THESE STANDARDS ON OVERHEAD SIGN STRUCTURES PLANS IS PROHIBITED.
- THE DESIGNER MUST PROVIDE THE INFORMATION OBTAINED FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS. THE DESIGNER MUST PROVIDE THE SIGN AREA, STRUCTURE HEIGHT, AND SIGN LOCATION USED TO OBTAIN MEMBER SIZES FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS.
- DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE DESIGN TABLES CONTAINED IN THESE STANDARDS. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THESE DESIGN TABLES.
- ALL SIGN SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-743M, SHEET 2.
- AVOID BRIDGE-MOUNTED SIGN STRUCTURES WHENEVER POSSIBLE. IF AVOIDANCE IS NOT POSSIBLE, THE STRUCTURE SHOULD BE LOCATED AS CLOSE TO A PIER SUPPORT AS IS PRACTICAL. THE AFFECTED BRIDGE COMPONENTS SHALL BE DESIGNED TO CARRY THE ADDITIONAL LOADS DUE TO THE WEIGHT OF THE SIGN STRUCTURE AND THE LOADINGS APPLIED TO SIGN STRUCTURE. IF A BARRIER IS USED OR IS REQUIRED, THE SIGN STRUCTURE SHALL BE LOCATED JUST BEYOND THE DESIGN DEFLECTION DISTANCE OF THE BARRIER.

INFORMATION CONTAINED IN THE DESIGN TABLES

- DESIGN TABLES INCLUDED IN THIS STANDARD WERE DEVELOPED USING A COMPUTER PROGRAM AND ARE BASED ON THE DESIGN CRITERIA SHOWN ON THIS SHEET.
- THE MEMBER SIZES INDICATED IN THE DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY II. THE DESIGNER MUST CHECK THE ADEQUACY OF THE MEMBER SIZES INDICATED WHEN THE FATIGUE CATEGORY IS SPECIFIED TO BE I FOR THE PROJECT.
- THE SPAN RANGE INCLUDED IN THIS STANDARD IS AS FOLLOWS:

  BD-643M: TWO-POST PLANAR TRUSS, SPANS FROM 30' TO 100'.
- THE DESIGN TABLES INCLUDE MEMBER SIZES FOR THE STRUCTURES FOR VARIOUS COMBINATIONS OF DESIGN HEIGHT, SPAN LENGTH, AND SIGN AREA. THEY ALSO INCLUDE SPREAD FOOTING DESIGNS. ALTERNATE CAISSON FOUNDATIONS ARE PERMITTED WHERE SITE CONDITIONS DO NOT ALLOW FOR THE SPREAD FOOTING. DESIGN COMPUTATIONS ARE REQUIRED TO DETERMINE THE REQUIRED CAISSON EMBEDMENT AND REINFORCEMENT. THE DESIGN COMPUTATION MUST BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR REVIEW AND APPROVAL AND THE CORRESPONDING INFORMATION SHOWN ON THE CONTRACT DRAWINGS. FABRICATION AND CONSTRUCTION DETAILS ARE CONTAINED ON STANDARD DRAWING BC-743M.

GENERAL NOTES

1. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE f'c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. VERIFY ALL DIMENSIONS AND GEOMETRY OF THE EXISTING STRUCTURES IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. SPREAD FOOTINGS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL, BOLTS, NUTS & WASHERS IN ACCORDANCE WITH PUB. 408, UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE WIDTH OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE CHECKED.
14. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
15. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
16. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
17. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

- DEAD LOADS — PENNDOT STD. DWGS. (U.N.O.)*

SIGN PANELS	TC-8701E OR TC-8701S
LIGHT FIXTURES	BC-743M, SHT. 9
SIGN SUPPORT BEAM	BC-743M, SHT. 10
COLUMNS, CHORDS	CALCULATED INTERNALLY WITHIN PROGRAM

- EXTERNAL LOADS — AASHTO SIGN SPECS. (U.N.O.)

ICE LOAD	3.7
WIND LOAD	APPENDIX C, SECTION C.3, EQ. C-1, WITH 80 MPH WIND AND 30% GUST FACTOR

- GROUP LOADS — AASHTO SIGN SPECS. 3.4
- STEEL CRITERIA — AASHTO SIGN SPECS.

SECTION PROPERTIES FOR TUBULAR SHAPES	APPENDIX B, TABLE B-1
MAXIMUM STRESSES IN TUBULAR SHAPES	APPENDIX B, TABLE B-2
ALLOWABLE STRESSES FOR TUBULAR SHAPES	5.6 (TABLE 5-3) & 5.11
ALLOWABLE STRESSES FOR SIGN SUPPORTS	5.12
ALLOWABLE STRESSES FOR BASE PLATES	5.8
ALLOWABLE STRESSES FOR COMBINED STEEL STRESS	5.12
FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)	SECTION 11
ALLOWABLE DEFLECTION	10.4
PERMANENT CAMBER	10.5
ALLOWABLE STRESSES FOR STRUCTURAL STEEL	SECTION 5

- BOLT CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BOLT STRESSES	TABLE 10.32.3B
SLIP-CRITICAL BOLT ALLOWABLE	10.32.3.2.1
BOLT PRYING ACTION	10.32.3.3.2
COMBINED BOLT SHEAR AND TENSION	10.32.3.3.3
BOLT DESIGN CRITERIA	AASHTO SIGN SPECS. 5.16
ALLOWABLE ANCHOR BOLT STRESSES	AASHTO SIGN SPECS. 5.17

- CONCRETE CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BEARING STRESS	8.15.2.1.3
REINFORCEMENT TENSILE STRESS	8.15.2.2
SHEAR CAPACITY OF FOOTINGS	8.15.5.6.1
SHEAR STRESS IN FOOTINGS	8.15.5.6.2
ALLOWABLE SHEAR STRESS	8.15.5.6.4
SLENDERNESS OF COLUMNS	8.16.5.2
MINIMUM REINF. OF FLEXURAL MEMBERS	8.17.1
SPACING LIMITS FOR REINFORCEMENT	8.21
MINIMUM CONCRETE COVER	DM-4 D8.22.1*
PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS	FIG. 4.4.7.1.1.1C
DISTRIBUTION OF REINFORCEMENT	4.4.11.2.2
FOOTING STABILITY REQUIREMENTS	DM-4 D5.5.5
TORSION	ACI SECTION A.7.3*
COLUMN DESIGN (PEDESTALS)	8.15.4

- SPREAD FOOTINGS

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MINIMUM AREA IN BEARING	95%
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT

- DRILLED SHAFTS (CAISSONS) DM-4 SEC. D4.6, PENNDOT COM624P COMPUTER PROGRAM

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MAXIMUM DESIGN LATERAL DISPLACEMENT	0.5"
MODULUS OF SUBGRADE REACTION	10.0 POUNDS PER CUBIC INCH
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT
ANGLE OF INTERNAL FRICTION	25°
COHESION	0 KIPS PER SQUARE FOOT

- SEISMIC DESIGN CRITERIA

  STRUCTURES ARE DESIGNED FOR A SEISMIC ACCELERATION COEFFICIENT = 0.15

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORKMANSHIP:

  PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

  COLUMNS & PIPE CHORDS: SEE PUBLICATION 408, SECTION 948.2.

  ANGLES, SHAPES, AND PLATES: AASHTO M270, GRADE 36 ASTM A709, GRADE 36
- ALTERNATE PRESS-BREAK MEMBERS:

  ALTERNATE PRESS-BREAK MEMBERS MUST HAVE THE EQUIVALENT STRENGTH OF THE MEMBER THEY ARE REPLACING. EQUIVALENT RADIUS FOR PRESS-BREAK MEMBERS IS MEASURED FROM THE CENTER OF THE MEMBER TO THE MID-POINT OF ANY CHORD OF THE MEMBER. MINIMUM THICKNESS OF PRESS-BREAK MEMBERS TO BE 5/16". PENNDOT'S SIGN STRUCTURE PROGRAM OR AN APPROVED FINITE ELEMENT ANALYSIS COMPUTER PROGRAM MUST BE RUN TO VERIFY THE ADEQUACY OF PRESS-BREAK MEMBER FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR CHORDS
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:

  ANCHOR BOLTS: ASTM, F1554 GRADE 55 PER PUBLICATION 408 SECTION 1105.02(c)3.

  BOLTS: AASHTO M164 (ASTM A325) H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS:

  AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 2001 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1996 WITH INTERIMS THROUGH AND INCLUDING 2000; PENNDOT DESIGN MANUAL - PART 4, AUGUST 1993 EDITION (INCLUDING AUGUST 1995 REVISIONS)
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- ANY PIPE SIZE OTHER THAN THAT SHOWN ON THE STANDARD IS A PROJECT SPECIFIC DESIGN. DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE RULING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN 1/2".
- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 - (INDICATE CHANGE NUMBER), AASHTO/AWS D1.5, BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5".
- DYNAMIC\VARIABLE MESSAGE SIGNS (DMS\VMS) ARE PROHIBITED ON 2-POST PLANAR TRUSS STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS.

* LEGEND:

- AASHTO SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"
- DM-4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-99).
- CVN: CHARPY V-NOTCH.

TC-8700C	SPACING CHARTS/DIRECT APPLIED LETTERS, NUMERALS, & ARROWS
TC-8701D	SIGN DETAILS/FREEWAY AND EXPRESSWAY GUIDE SIGNS
TC-8701E	EXTRUDED ALUMINUM CHANNEL SIGN
TC-8701S	FLAT SHEET ALUMINUM SIGNS WITH EXTRUDED ALUMINUM STIFFENERS
TC-8715	SIGN LIGHTING
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-743M	OVERHEAD SIGN STRUCTURES
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

2 POST PLANAR TRUSS
SPANS FROM 30' TO 100'

NOTES AND DESIGN CRITERIA

RECOMMENDED AUG. 4, 2017
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
Brian D Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

SHT. 1 OF 6

BD-643M

HOW TO USE THE DESIGN TABLES

SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL OR CAISSON ELEVATION APPROXIMATELY 6" ABOVE THE HIGHEST SURROUNDING FINISHED GRADE ELEVATION.
- SET THE TOP OF FOOTING ELEVATION SO THAT A MINIMUM 2'-0" COVER IS PROVIDED OVER THE FOOTING AT ALL LOCATIONS.

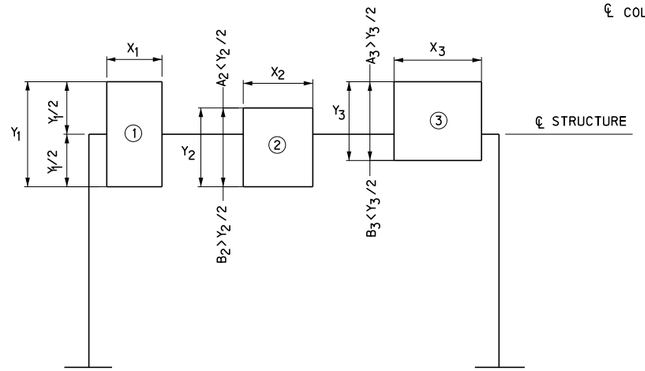
POSITIONING OF SIGN PANELS AND SIGN STRUCTURE

- SEE THE FOLLOWING DIAGRAMS FOR ADDITIONAL INSTRUCTIONS FOR POSITIONING THE SIGN PANELS AND SIGN STRUCTURE.
- THE TRAFFIC ENGINEER SETS THE DESIGN SIGN AREA USING ONE OF THE FOLLOWING OPTIONS:
  1. THE ACTUAL SIGN AREA TO BE PLACED ON THE STRUCTURE AT THE TIME OF CONSTRUCTION.
  2. THE ACTUAL SIGN AREA INCREASED BY 25%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (RURAL HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
  3. THE ACTUAL SIGN AREA INCREASED BY 50%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (URBAN HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
- THE DESIGN SIGN AREA WILL BE ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE.
- WHEN MULTIPLE SIGN PANELS ARE PLACED ON ONE STRUCTURE AND ONE OR MORE OF THE SIGN PANELS IS NOT CENTERED IN THE VERTICAL DIRECTION, COMPUTE THE DESIGN SIGN AREA IN THE FOLLOWING MANNER:

  THE SIGN AREA FOR ANY SIGN PANEL CENTERED IN THE VERTICAL DIRECTION IS (X) x (Y)

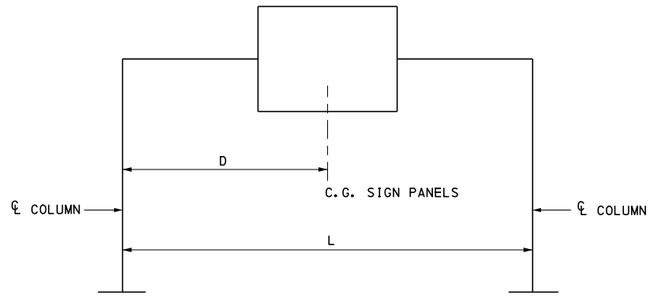
  THE SIGN AREA FOR ANY SIGN PANEL PLACED OFF-CENTER IN THE VERTICAL DIRECTION IS (X) x (B) x 2 WHEN B>A OR (X) x (A) x 2 WHEN A>B.

  EXAMPLE:
  AREA OF SIGN NO. 1 = (X1) x (Y1)
  AREA OF SIGN NO. 2 = (X2) x (B2) x 2
  AREA OF SIGN NO. 3 = (X3) x (A3) x 2



A = DISTANCE FROM ℄ STRUCTURE TO TOP OF SIGN
B = DISTANCE FROM ℄ STRUCTURE TO BOTTOM OF SIGN
DESIGN AREA OF SIGN NO. 1 = $X_1 Y_1$
DESIGN AREA OF SIGN NO. 2 = $(X_2 B_2) \times 2$
DESIGN AREA OF SIGN NO. 3 = $(X_3 A_3) \times 2$

- SET THE TRUSS BETWEEN COLUMNS TO AN ELEVATION THAT PLACES THE VERTICAL CENTERLINE OF THE TRUSS AT THE MID-HEIGHT OF THE DEEPEST SIGN OR A MAXIMUM OF 9'-3" ABOVE THE BOTTOM OF THE SIGN PANEL. (SIGN HEIGHT INCLUDES "EXIT PANEL" SIGN IF PRESENT)
- SET THE TRUSS BETWEEN COLUMNS, SIGN PANELS, AND LUMINAIRES TO AN ELEVATION THAT WILL PROVIDE A MINIMUM OF 17'-6" VERTICAL CLEARANCE ABOVE THE HIGHEST POINT OF THE ENTIRE ROADWAY WIDTH (INCLUDING THE ROADWAY PAVEMENT AND SHOULDERS) PASSING UNDER THE STRUCTURE. SET THE BOTTOM OF ALL SIGN PANELS TO GENERALLY THE SAME ELEVATION. IN THE CASE OF A STRUCTURE SPANNING DUAL ROADWAYS WHERE THE DIFFERENCE IN ELEVATIONS OF THE HIGHEST POINT ON EACH ROADWAY IS GREATER THAN 2'-6", SET THE BOTTOM OF ALL SIGN PANELS OVER EACH ROADWAY TO THE SAME VERTICAL CLEARANCE.
- WHEN THE MAXIMUM SIGN HEIGHT IS USED FOR DESIGN, SET THE TRUSS TO AN ELEVATION THAT PLACES THE VERTICAL CENTERLINE OF THE TRUSS AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS. WHEN THE STRUCTURE SPANS DUAL ROADWAYS WITH THE DIFFERENCE IN HIGH POINT ELEVATIONS GREATER THAN 2'-6", SET THE TRUSS TO AN ELEVATION THAT PLACES THE VERTICAL CENTERLINE OF THE TRUSS AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS OVER THE UPPER ROADWAY.
- FOR ILLUSTRATIVE EXAMPLES OF HOW TO POSITION SIGN PANELS AND SIGN STRUCTURES, SEE CASES A-F ON THE NEXT SHEET.
- DESIGNS FOR TWO TYPES OF LOADING CONDITIONS ARE PRESENTED IN THE DESIGN TABLES. TYPE 1 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE TOTAL DESIGN SIGN AREA LIES BETWEEN 0.42 x SPAN LENGTH AND 0.58 x SPAN LENGTH. TYPE 2 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA LIES BETWEEN THE END OF THE SPAN AND 0.42 x SPAN LENGTH OR THE OTHER END OF THE SPAN AND 0.58 x SPAN LENGTH. DETERMINE THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA AND USE THE APPROPRIATE LOADING CONDITION FOR SELECTING THE MEMBER SIZES. WHEN DETERMINING THE CENTER OF GRAVITY OF DESIGN SIGN AREA, USE THE INDIVIDUAL SIGN AREAS AS CALCULATED IN ACCORDANCE WITH THE PROCEDURE FOR CENTERED AND OFF-CENTER SIGNS.

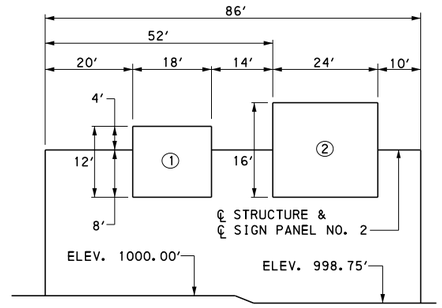


IF 0.42L ≤ D ≤ 0.58L, USE LOADING TYPE 1

IF D < 0.42L, OR D > 0.58L, USE LOADING TYPE 2

LOADING TYPE DIAGRAM

- THE DESIGN SPAN LENGTH SHALL BE THE ACTUAL SPAN LENGTH ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SPAN LENGTH SHOWN IN THE DESIGN TABLES.
- THE DESIGN POST HEIGHT SHALL BE THE ACTUAL DESIGN POST HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST HEIGHT SHOWN IN THE DESIGN TABLES.



EXAMPLE TO SHOW PROCEDURE FOR SELECTING SIGN AREA, SPAN LENGTH & POST HEIGHT

- △ ELEV. = 1000.00 - 998.75 = 1.25 < 2'-6" } USE CASE B
  $Y_1 = 12'$, $Y_2 = 16'$ } $Y_1 < Y_2$
- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION:
  ELEV. 1000.00 + 17'-6" + 1'-6" = 1019.00
  1'-6" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL
- SET ℄ STRUCTURE AT ℄ OF SIGN PANEL NO. 2
  ELEV = 1019.00 + 16/2 = 1027.00
- ACTUAL SPAN LENGTH = 86'. USE 90'
- POST HEIGHT = 1027.00-998.75 = 28.25'
  USE OVER 24' TO 33'
- FROM DESIGN TABLES, IT IS DETERMINED THAT THE TOTAL STRUCTURE DEPTH IS 9'-6".
  - ℄ SIGN TO BOTTOM OF LUMINAIRE SUPPORT = 8'-0" + 1'-6" = 9'-6"
  - ½ OF THE STRUCTURE DEPTH = 4'-9"
  - THEREFORE, STRUCTURE DEPTH DOES NOT GOVERN VERTICAL CLEARANCE; DO NOT RESET ℄ STRUCTURE.
- BECAUSE SIGN PANEL NO. 1 IS NOT CENTERED VERTICALLY ON THE STRUCTURE, THE DESIGN AREAS ARE COMPUTED AS FOLLOWS:
  A_1 = 18'-0" x 8'-0" x 2 = 288 SF
  A_2 = 24'-0" x 16'-0" = 384 SF
  TOTAL SIGN AREA = 672 SF; USE 750 SF
- LOCATE C.G. SIGN AREA:
  (FROM LEFT POST) C.G. = $\frac{[288\ SF \times (20' + 18'/2)] + [384\ SF \times (52' + 24'/2)]}{672\ SF}$
  = 49'/86' = 0.57 0.42<0.57<0.58
  THEREFORE, USE LOADING TYPE 1
- VERIFY LOADING TYPE BASED ON ACTUAL SIGN AREA AND C.G.
- IF LOADING TYPES DIFFER USE THE LARGEST MEMBER SIZES FROM EACH LOADING TYPE.

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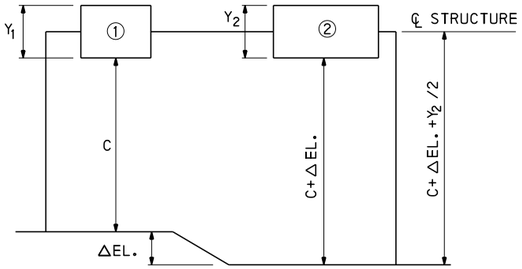
OVERHEAD SIGN STRUCTURES

2 POST PLANAR TRUSS
SPANS FROM 30' TO 100'

DESIGN INSTRUCTIONS

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 2 OF 6
Thomas P. Macioce	Brian D. Thompson	BD-643M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	



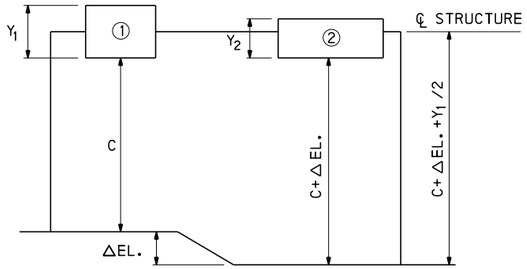
CASE A

$Y_1 = Y_2$

Δ EL. < 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANELS UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.



CASE C

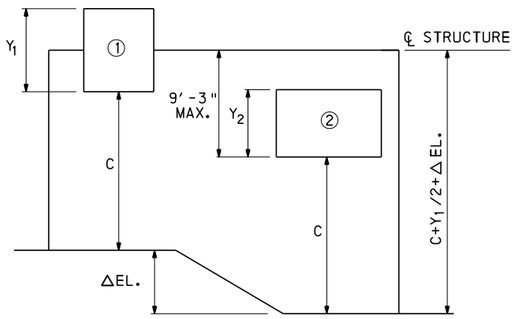
$Y_1 \geq Y_2$

Δ EL. < 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF Y_1 AND Y_2 WHERE $Y_1 \geq Y_2$.



CASE E

$Y_1 \geq Y_2$

Δ EL. > 2′-6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

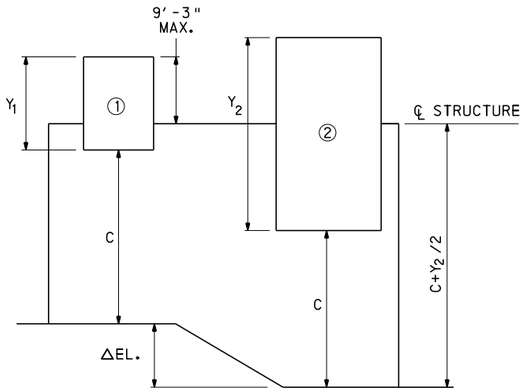
THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF ΔEL. AND Y_2 WHERE $Y_1 > Y_2$:

ΔEL.	$Y_{1,2}$
3′-0"	6′-0" TO 12′-6"
4′-0"	6′-0" TO 10′-6"
5′-0"	6′-0" TO 8′-6"
6′-0"	6′-0" TO 6′-6"
6′-3"	6′-0"

WHEN $Y_{1,2}$ EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE FOR A PARTICULAR VALUE OF ΔEL., THIS CASE DOES NOT APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A SPECIAL DESIGN.

NOTE:

C IS VERTICAL CLEARANCE FROM ROADWAY TO BOTTOM OF STRUCTURE, SIGN PANEL, OR LUMINAIRE.



CASE F

$Y_1 < Y_2$

Δ EL. > 2′-6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 2 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF ΔEL., Y_1, AND Y_2 WHERE $Y_1 < Y_2$:

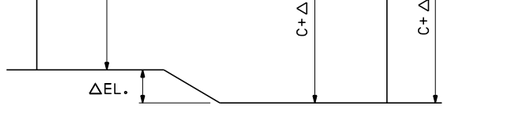
ΔEL.	LIMITS OF Y_1 AND Y_2
3′-0"	$2Y_1 - Y_2 \leq$ 12′-6"
4′-0"	$2Y_1 - Y_2 \leq$ 10′-6"
5′-0"	$2Y_1 - Y_2 \leq$ 8′-6"
6′-0"	$2Y_1 - Y_2 \leq$ 6′-6"
7′-0"	$2Y_1 - Y_2 \leq$ 4′-6"

GENERAL EQUATION FOR CASE F:

$2(\Delta EL.) + 2(Y_1) - Y_2 \leq$ 18′-6"

IF THE PARAMETERS OF THE GENERAL EQUATION ARE EXCEEDED, ONE OF THE FOLLOWING STEPS IS REQUIRED:

1) RESET ℄ STRUCTURE SO THAT PARAMETERS ARE MET
2) USE SEPARATE STRUCTURES
3) USE A SPECIAL DESIGN
4) IN ALL CASES, THE MINIMUM VERTICAL CLEARANCE OF 17′-6" MUST BE MAINTAINED



CASE B

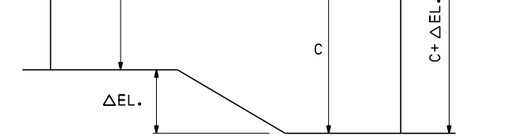
$Y_1 \leq Y_2$

Δ EL. < 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 2 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF Y_1 AND Y_2 WHERE $Y_1 \leq Y_2$.



CASE D

$Y_1 = Y_2$

Δ EL. > 2′-6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF ΔEL. AND $Y_{1,2}$:

ΔEL.	$Y_{1,2}$
3′-0"	6′-0" TO 12′-6"
4′-0"	6′-0" TO 10′-6"
5′-0"	6′-0" TO 8′-6"
6′-0"	6′-0" TO 6′-6"
6′-3"	6′-0"

WHEN $Y_{1,2}$ EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE FOR A PARTICULAR VALUE OF ΔEL., THIS CASE DOES NOT APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A SPECIAL DESIGN.

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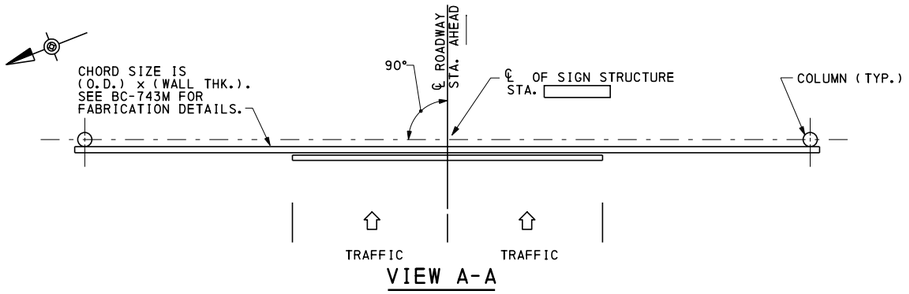
OVERHEAD SIGN STRUCTURES

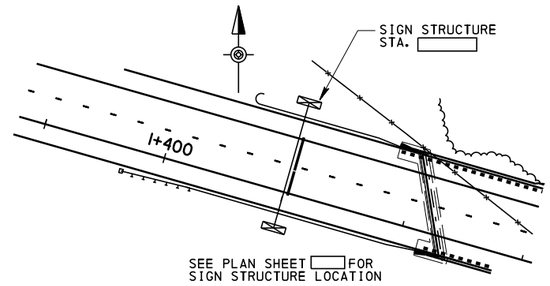
2 POST PLANAR TRUSS
SPANS FROM 30′ TO 100′

INSTRUCTIONS FOR USE OF DESIGN TABLES

RECOMMENDED AUG. 4, 2017 Thomas P Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brent D. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHT. 3 OF 6 BD-643M



VIEW A-A

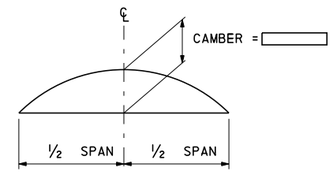


LOCATION PLAN

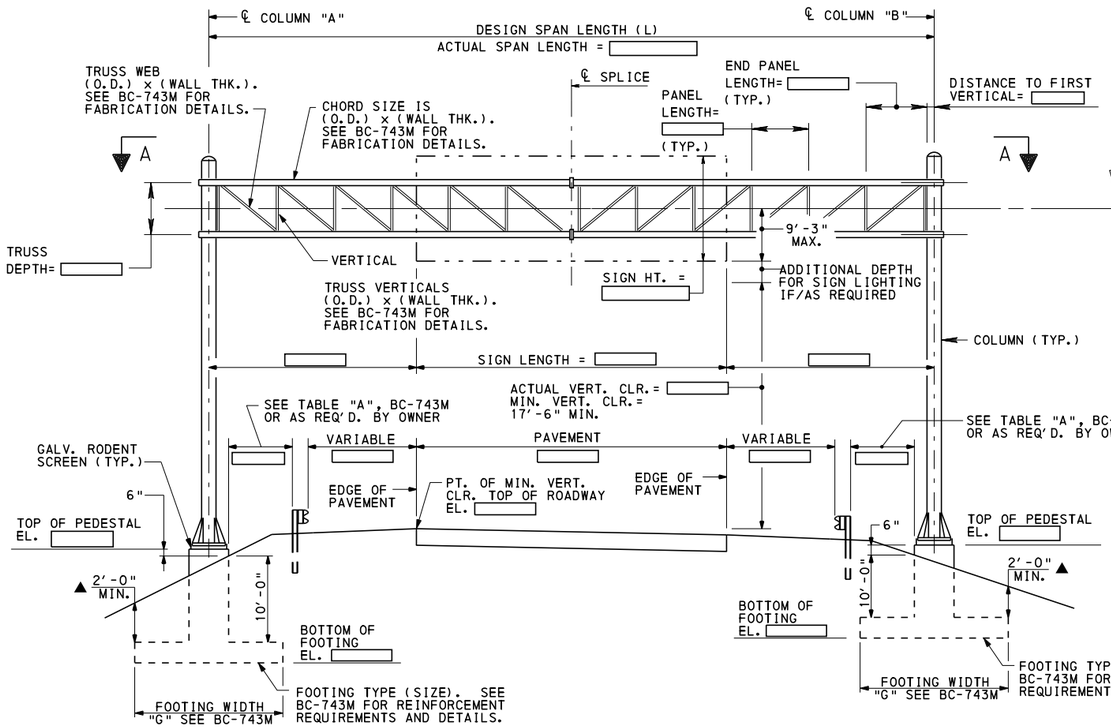
DESIGN CRITERIA

DESIGN SIGN AREA (A) =	
DESIGN SPAN LENGTH (L) =	
DESIGN HEIGHT (H) =	
LOADING TYPE =	(1 OR 2)
FATIGUE CATEGORY =	

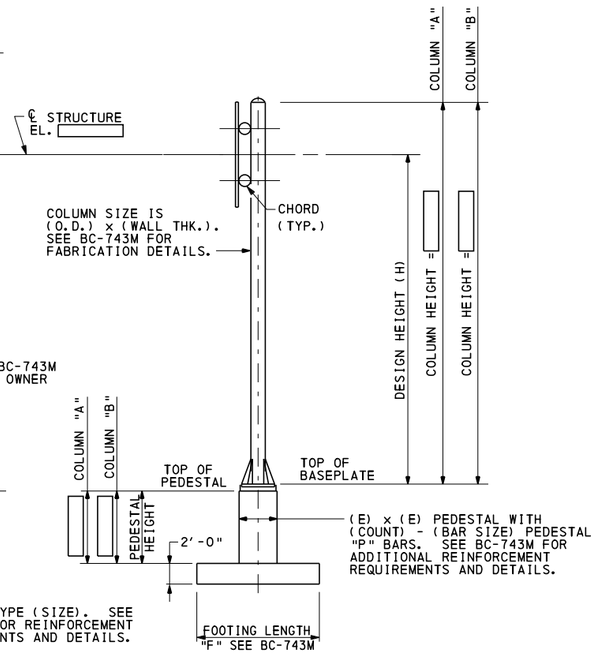
NOTE:
DESIGN FOR ACTUAL, ACTUAL INCREASED BY 25%,
OR ACTUAL INCREASED BY 50% SIGN AREA.
(DESIGNER TO INDICATE CONTROLLING CONDITION)



CAMBER DIAGRAM



ELEVATION



END VIEW

▲ DESIGNER MUST CHECK ADEQUACY OF FOOTINGS
FOR FILL HEIGHTS < 10'-0".

TABLE OF ESTIMATED QUANTITIES

ITEM NO.	ITEM	UNIT	QUANTITY
*	STEEL SIGN STRUCTURE	LBS	
0000-0000	STRUCTURE MOUNTED SIGNS	SF	
0000-0000	CLASS 3 EXCAVATION	CY	
0000-0000	CLASS A CEMENT CONCRETE	CY	
0000-0000	REINFORCEMENT BARS	LBS	

* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN
LUMP SUM ITEM NO. 0000 - 0000

NOTES TO DESIGNER:

- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED. DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES.
  1. (E)x(E) PEDESTAL WITH (COUNT) - (BAR SIZE) PEDESTAL "P" BARS. SEE BC-743M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
  2. FOOTING TYPE (SIZE). SEE BC-743M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  3. COLUMN SIZE IS (O.D.) x (WALL THK.). SEE BC-743M FOR FABRICATION DETAILS.
  4. CHORD SIZE IS (O.D.) x (WALL THK.). SEE BC-743M FOR FABRICATION DETAILS.
  5. TRUSS WEBS (O.D.)x(WALL THK.) AND TRUSS VERTICALS (O.D.)x(WALL THK.). SEE BC-743M FOR FABRICATION DETAILS.
- PLACE CAMBER DIAGRAM ON CONTRACT DRAWINGS AND SPECIFY REQUIRED CAMBER FROM CAMBER TABLE.
- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH ____
- DESIGNER TO PROVIDE DIMENSIONS ON CONTRACT DRAWINGS.

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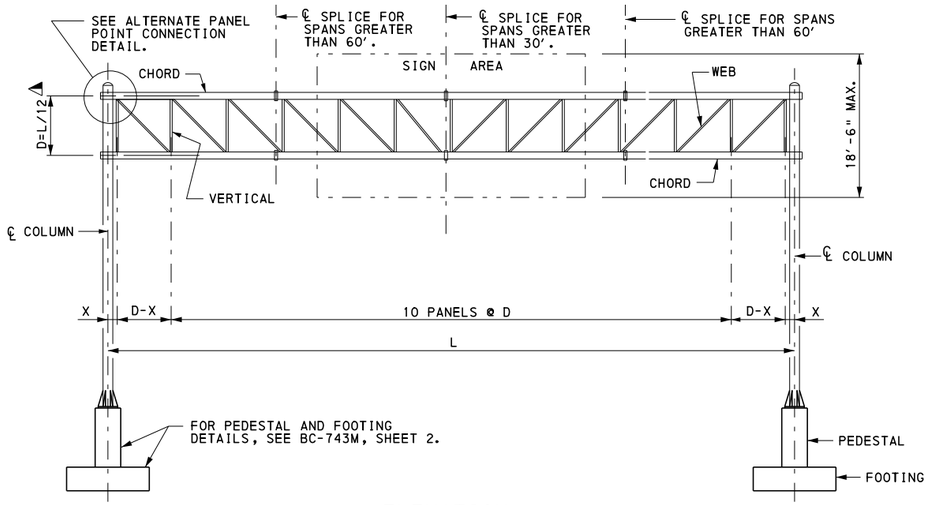
OVERHEAD SIGN STRUCTURES

2 POST PLANAR TRUSS
SPANS FROM 30' TO 100'

SAMPLE CONTRACT DRAWING

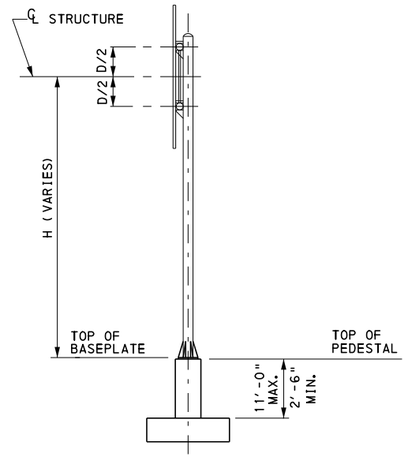
RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 4 OF 6
Thomas P. Macioce	Brian D. Thompson	BD-643M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	



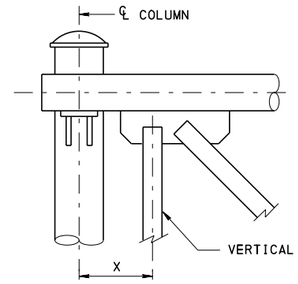
ELEVATION

X = 11" FOR STANDARD PIPE TO PIPE CONNECTIONS.

△ - ROUND UP TO NEAREST 3" INCREMENT



END VIEW



ALTERNATE PANEL POINT CONNECTION DETAIL

FOR VERTICALS LESS THAN 3" DIA., X = 12.5"
FOR VERTICALS 3" TO 4" DIA. AND
COLUMNS 20" DIA. OR LARGER, X=15"
FOR VERTICALS 5" DIA. OR LARGER, X=17"

NOTES:

- FOR GENERAL NOTES, SEE SHEET 1.
- FOR DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
- "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH. (FOR EXAMPLE, FOOTING TYPE 609 INDICATES A FOOTING 6'-0" WIDE x 9'-0" LONG.) SEE BC-743M, SHEET 2 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10'-0".
- FOR STRUCTURAL DETAILS SEE BC-743M.
- ONE OR MORE SPLICES IN THE TRUSS MAY BE ADDED OR ELIMINATED AT THE OPTION OF THE FABRICATOR.
- CVN REQUIRED FOR COLUMN AND CHORD WALL THICKNESSES EXCEEDING ½" (0.500").

LOADING TYPE 1

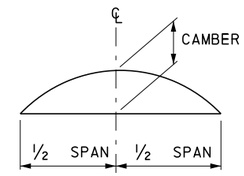
L	SIGN AREA (FT.²)	TRUSS			COLUMN				PEDESTAL "P" BARS				FOOTING TYPE			
		CHORD	WEB	VERTICAL	H TO 12'	H OVER 12' TO 18'	H OVER 18' TO 24'	H OVER 24' TO 33'	H TO 12'	H OVER 12' TO 18'	H OVER 18' TO 24'	H OVER 24' TO 33'	H TO 12'	H OVER 12' TO 18'	H OVER 18' TO 24'	H OVER 24' TO 33'
TO 30'	100	8x.322 *	2.5x.203	2.5x.203	8x.322 *	12x.375 *	16x.375 *	20x.375 *	16#5	16#8	16#9	16#11	508	609	609	711
	175	8x.322 *	2.5x.203	2.5x.203	10x.365 *	12x.375 *	16x.375 *	20x.375 *	16#6	16#8	16#9	16#11	609	711	713	713
	250	8x.322 *	2.5x.203	2.5x.203	10x.365	14x.375 *	16x.375 *	20x.375 *	16#6	16#8	16#9	16#11	711	713	713	815
	325	8x.322 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	815	1114
	400	8x.322 *	2.5x.203	2.5x.203	14x.375 *	16x.375	20x.375 *	24x.375 *	16#8	16#9	16#11	16#10	713	1112	1114	1215
	475	8x.322	2.5x.203	2.5x.203	16x.375 *	18x.375 *	20x.375	24x.375	16#9	16#10	16#11	16#10	815	1114	1114	918
	555	10x.365 *	2.5x.203	2.5x.203	16x.375 *	18x.375	20x.375	——	16#9	16#10	16#11	16#11	815	716	718	918
OVER 30' TO 40'	150	8x.322 *	2.5x.203	2.5x.203	10x.365 *	12x.375 *	16x.375 *	24x.375 *	16#6	16#8	16#9	16#10	609	711	713	812
	225	8x.322	2.5x.203	2.5x.203	10x.365	12x.375	16x.375 *	24x.375 *	16#6	16#8	16#9	16#10	711	713	713	814
	300	10x.365 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	815	815
	375	10x.365 *	2.5x.203	2.5x.203	14x.375 *	16x.375	20x.375 *	24x.375 *	16#8	16#9	16#11	16#10	713	1112	1114	916
	450	10x.365 *	2.5x.203	2.5x.203	16x.375 *	18x.375 *	20x.375	24x.375	16#9	16#10	16#11	16#10	815	1114	817	918
	525	10x.365	3x.216	3x.216	16x.375 *	20x.375 *	24x.375 *	——	16#9	16#11	16#10	16#11	815	817	916	1215
	600	10x.365	3x.216	3x.216	18x.375 *	20x.375	24x.375 *	24x.500	16#10	16#11	16#10	16#11	1114	718	918	1317
	675	12x.375 *	3x.216	3x.216	18x.375 *	20x.375	24x.375 *	——	16#10	16#11	16#10	20#11	718	718	1215	922
	740	12x.375 *	3x.216	3x.216	18x.375 *	24x.375 *	24x.375	——	16#10	16#10	16#10	20#11	718	916	920	922
OVER 40' TO 50'	150	10x.365 *	2.5x.203	2.5x.203	10x.365 *	12x.375 *	16x.375 *	24x.375 *	16#6	16#8	16#9	16#10	609	711	713	812
	250	10x.365 *	2.5x.203	2.5x.203	12x.375 *	14x.375 *	16x.375 *	24x.375 *	16#8	16#8	16#9	16#10	713	713	713	814
	350	12x.375 *	2.5x.203	2.5x.203	14x.375 *	16x.375 *	20x.375	24x.375 *	16#8	16#9	16#11	16#10	713	815	1114	916
	450	12x.375 *	2.5x.203	2.5x.203	16x.375 *	18x.375	24x.375 *	——	16#9	16#10	16#10	16#11	1112	1114	718	918
	550	12x.375	3x.216	3x.216	16x.375	20x.375 *	24x.375 *	24x.500 *	16#9	16#11	16#10	16#11	1114	718	918	1215
	650	14x.375 *	3x.216	3x.216	18x.375 *	24x.375 *	24x.375	——	16#10	16#10	16#10	20#11	817	916	1215	1317
	750	14x.375	3x.216	3x.216	20x.375 *	24x.375 *	——	——	16#11	16#10	16#11	24#11	718	1215	1317	922
	850	14x.375	3x.216	3x.216	20x.375 *	24x.375 *	——	——	16#11	16#10	16#11	24#11	820	918	922	922
	925	14x.375	3x.216	3x.216	20x.375 *	24x.375 *	24x.500 *	——	16#11	16#10	16#11	24#11	820	820	922	922
OVER 50' TO 60'	125	12x.375 *	2.5x.203	2.5x.203	10x.365 *	12x.375 *	16x.375 *	24x.375 *	16#6	16#8	16#9	16#10	609	711	713	812
	250	12x.375 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	713	814
	375	12x.375	2.5x.203	2.5x.203	14x.375	18x.375 *	20x.375 *	24x.375 *	16#8	16#10	16#11	16#10	713	1112	1114	916
	500	14x.375	3x.216	3x.216	16x.375 *	20x.375 *	24x.375 *	——	16#9	16#11	16#10	16#11	1114	718	916	918
	625	16x.375 *	3x.216	3x.216	18x.375 *	24x.375 *	24x.375	——	16#10	16#10	16#10	20#11	718	916	1215	922
	750	16x.375	3x.216	3x.216	20x.375 *	24x.375 *	——	——	16#11	16#10	16#11	24#11	718	1215	1317	922
	875	16x.375	3.5x.226	3.5x.226	20x.375 *	24x.375	24x.500	——	16#11	16#10	16#11	32#11	820	1020	922	1024
	1000	18x.375 *	3.5x.226	3.5x.226	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	918	922	922	924
	1110	18x.375 *	3.5x.226	3.5x.226	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	920	922	922	1026
OVER 60' TO 70'	175	16x.375 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	711	713	713	814
	300	16x.375 *	2.5x.203	2.5x.203	14x.375 *	18x.375 *	20x.375 *	24x.375 *	16#8	16#10	16#11	16#10	713	1112	1114	916
	425	16x.375 *	2.5x.203	2.5x.203	16x.375 *	20x.375 *	24x.375 *	——	16#9	16#11	16#10	16#11	815	815	1215	918
	550	16x.375	3x.216	3x.216	18x.375 *	20x.375	24x.375	24x.500	16#10	16#11	16#10	16#11	1114	718	918	1317
	675	18x.375 *	3x.216	3x.216	20x.375 *	24x.375 *	——	——	16#11	16#10	16#11	20#11	718	1215	1317	922
	800	18x.375	3.5x.226	3.5x.226	20x.375 *	24x.375	24x.500	——	16#11	16#10	16#11	32#11	820	1215	922	1024
	925	20x.375 *	3.5x.226	3.5x.226	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	918	922	922	924
	1050	20x.375 *	4x.237	4x.237	24x.375 *	24x.500 *	——	——	16#10	16#11	24#11	32#11	1317	922	1024	1221
	1175	20x.375	4x.237	4x.237	24x.375 *	24x.500	——	——	16#10	16#11	24#11	32#11	922	922	1024	1323
	1295	20x.375	4x.237	4x.237	24x.375 *	24x.500	——	——	16#10	16#11	24#11	32#11	922	922	1024	1323

FOR CONTINUATION OF CHART, SEE SHEET 6.

* MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-98, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

PEDESTAL	
COLUMN	PEDESTAL SIZE
8" DIA.	2'-6" x 2'-6"
10" DIA.	2'-6" x 2'-6"
12" DIA.	2'-9" x 2'-9"
14" DIA.	3'-0" x 3'-0"
16" DIA.	3'-3" x 3'-3"
18" DIA.	3'-3" x 3'-3"
20" DIA.	3'-9" x 3'-9"
24" DIA.	4'-3" x 4'-3"

CAMBER TABLE	
SPAN	CAMBER
30'	0.43"
40'	0.60"
50'	0.78"
60'	0.97"
70'	1.18"
80'	1.38"
90'	1.61"
100'	1.81"



CAMBER DIAGRAM

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

2 POST PLANAR TRUSS
SPANS FROM 30' TO 100'

DESIGN TABLE LOADING TYPE 1

RECOMMENDED AUG. 4, 2017
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
DIRECTOR, BUR. OF PROJECT DELIVERY

SHT. 5 OF 6

BD-643M

LOADING TYPE 2

L	SIGN AREA (FT. 2)	TRUSS			COLUMN				PEDESTAL "P" BARS				FOOTING TYPE			
		CHORD	WEB	VERTICAL	H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′	H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′	H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′
TO 30′	150	8x.322 *	2.5x.203	2.5x.203	10x.365 *	12x.375	16x.375 *	20x.375 *	16#6	16#8	16#9	16#11	711	713	713	713
	250	8x.322 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	815	815
	350	8x.322 *	2.5x.203	2.5x.203	14x.375 *	18x.375 *	20x.375 *	24x.375 *	16#8	16#10	16#11	16#10	713	815	815	916
	450	8x.322	2.5x.203	2.5x.203	16x.375 *	18x.375 *	20x.375	24x.375	16#9	16#10	16#11	16#10	815	1114	1114	918
OVER 30′ TO 40′	125	10x.365 *	2.5x.203	2.5x.203	10x.365 *	12x.375	16x.375 *	24x.375 *	16#6	16#8	16#9	16#10	711	713	713	814
	225	10x.365 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	815	815
	325	10x.365 *	2.5x.203	2.5x.203	14x.375	18x.375 *	20x.375	24x.375	16#8	16#10	16#11	16#10	713	815	817	916
	425	10x.365 *	2.5x.203	2.5x.203	16x.375 *	20x.375 *	24x.375 *	——	16#9	16#11	16#10	16#11	815	1114	916	918
	525	10x.365 *	3x.216	3x.216	16x.375	20x.375	24x.375 *	24x.500	16#9	16#11	16#10	16#11	815	817	1215	1317
	625	10x.365	3x.216	3x.216	18x.375 *	20x.375	24x.375 *	24x.500	16#10	16#11	16#10	16#11	1114	718	918	1317
OVER 40′ TO 50′	175	12x.375 *	2.5x.203	2.5x.203	12x.375	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	713	814
	275	12x.375 *	2.5x.203	2.5x.203	14x.375	18x.375 *	20x.375	24x.375	16#8	16#10	16#11	16#10	713	815	815	916
	375	12x.375 *	2.5x.203	2.5x.203	16x.375 *	20x.375 *	24x.375 *	——	16#9	16#11	16#10	16#11	815	817	916	918
	475	12x.375 *	2.5x.203	2.5x.203	18x.375 *	20x.375	24x.375 *	24x.500	16#10	16#11	16#10	16#11	815	1114	918	918
	575	12x.375 *	3x.216	3x.216	18x.375 *	24x.375 *	24x.375	——	16#10	16#10	16#10	20#11	817	918	918	1020
	675	12x.375	3x.216	3x.216	18x.375	24x.375 *	——	——	16#10	16#10	16#11	20#11	1114	1215	918	1317
	775	14x.375	3x.216	3x.216	20x.375 *	24x.375 *	——	——	16#11	16#10	16#11	24#11	718	918	1317	922
OVER 50′ TO 60′	200	14x.375 *	2.5x.203	2.5x.203	12x.375	16x.375	18x.375	24x.375 *	16#8	16#9	16#10	16#10	713	713	815	916
	325	14x.375 *	2.5x.203	2.5x.203	16x.375 *	18x.375	24x.375 *	——	16#9	16#10	16#10	16#11	815	815	916	918
	450	14x.375 *	3x.216	3x.216	18x.375 *	24x.375 *	24x.375	——	16#10	16#10	16#10	20#11	817	916	918	1020
	575	16x.375 *	3x.216	3x.216	20x.375 *	24x.375 *	——	——	16#11	16#10	16#11	24#11	1114	918	918	1020
	700	16x.375 *	3x.216	3x.216	20x.375 *	24x.375	24x.500 *	——	16#11	16#10	16#11	24#11	817	918	1317	1022
	825	16x.375	3.5x.226	3.5x.226	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	918	1317	1317	1024
	930	18x.375 *	3.5x.226	3.5x.226	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	1215	922	922	924
OVER 60′ TO 70′	225	16x.375 *	2.5x.203	2.5x.203	14x.375	18x.375 *	20x.375	24x.375	16#8	16#10	16#11	16#10	713	815	815	916
	350	16x.375 *	2.5x.203	2.5x.203	16x.375	20x.375	24x.375 *	24x.500	16#9	16#11	16#10	16#11	815	817	918	918
	475	16x.375 *	2.5x.203	2.5x.203	18x.375	24x.375 *	——	——	16#10	16#10	16#11	20#11	817	918	918	1020
	600	16x.375 *	3x.216	3x.216	20x.375 *	24x.375 *	24x.500 *	——	16#11	16#10	16#11	24#11	1114	918	1020	1020
	725	18x.375 *	3x.216	3x.216	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	918	1020	1020	1022
	850	18x.375	3.5x.226	3.5x.226	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	918	1020	1020	924
	975	20x.375 *	3.5x.226	3.5x.226	24x.375 *	24x.500 *	——	——	16#10	16#11	24#11	32#11	1317	1317	1024	1026
	1100	20x.375 *	4x.237	4x.237	24x.375 *	24x.500	——	——	16#10	16#11	24#11	32#11	1020	922	1024	1323
OVER 70′ TO 80′	200	18x.375 *	3x.216	3x.216	14x.375	18x.375 *	20x.375	24x.375	16#8	16#10	16#11	16#10	713	815	815	916
	350	18x.375 *	3x.216	3x.216	18x.375 *	20x.375	24x.375	24x.500	16#10	16#11	16#10	16#11	815	817	918	918
	500	18x.375 *	3x.216	3x.216	20x.375 *	24x.375 *	——	——	16#11	16#10	16#11	24#11	817	918	1020	1020
	650	18x.375 *	3x.216	3x.216	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	918	1020	1020	1022
	800	20x.375 *	3.5x.226	3.5x.226	24x.375 *	24x.500 *	——	——	16#10	16#11	24#11	32#11	918	1020	1022	1124
	950	20x.375	3.5x.226	3.5x.226	24x.375 *	24x.500	——	——	16#10	16#11	24#11	32#11	1317	1020	924	1323
OVER 80′ TO 90′	200	20x.375 *	3x.216	3x.216	16x.375 *	18x.375	24x.375 *	——	16#9	16#10	16#10	16#11	713	815	815	916
	350	20x.375 *	3x.216	3x.216	18x.375 *	24x.375 *	——	——	16#10	16#10	16#11	20#11	817	916	918	1020
	500	20x.375 *	3x.216	3x.216	20x.375 *	24x.375	24x.500	——	16#11	16#10	16#11	32#11	817	918	1020	1020
	650	20x.375 *	3.5x.226	3.5x.226	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	918	1020	1020	1022
	800	24x.375 *	4x.237	4x.237	24x.375 *	24x.500	——	——	16#10	16#11	24#11	32#11	1020	1020	1022	1026
OVER 90′ TO 100′	200	24x.375 *	3.5x.226	3.5x.226	16x.375	20x.375	24x.375 *	24x.500	16#9	16#11	16#10	16#11	713	815	916	916
	350	24x.375 *	3.5x.226	3.5x.226	18x.375	24x.375 *	——	——	16#10	16#10	16#11	24#11	817	916	918	1020
	500	24x.375 *	3.5x.226	3.5x.226	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	918	918	1020	1319
	650	24x.375 *	3.5x.226	3.5x.226	24x.375 *	24x.500 *	——	——	16#10	16#11	24#11	32#11	918	1020	1319	1319

* MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-98, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

LOADING TYPE 1 (CONTINUED)

L	SIGN AREA (FT. 2)	TRUSS			COLUMN				PEDESTAL "P" BARS				FOOTING TYPE			
		CHORD	WEB	VERTICAL	H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′	H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′	H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′
OVER 70′ TO 80′	150	18x.375 *	3x.216	3x.216	12x.375	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	711	713	713	814
	300	18x.375 *	3x.216	3x.216	14x.375	18x.375 *	20x.375	24x.375	16#8	16#10	16#11	16#10	713	815	815	916
	450	18x.375 *	3x.216	3x.216	16x.375	20x.375	24x.375 *	24x.500 *	16#9	16#11	16#10	16#11	1112	718	1215	1215
	600	18x.375	3x.216	3x.216	18x.375	24x.375 *	——	——	16#10	16#10	16#11	20#11	718	1215	918	922
	750	20x.375	3.5x.226	3.5x.226	20x.375 *	24x.375	24x.500	——	16#11	16#10	16#11	32#11	820	918	922	922
	900	24x.375 *	3.5x.226	3.5x.226	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	1215	922	922	1024
	1050	24x.375 *	4x.237	4x.237	24x.375 *	24x.500	——	——	16#10	16#11	24#11	32#11	1317	922	1024	1323
OVER 80′ TO 90′	150	20x.375 *	3x.216	3x.216	12x.375	16x.375	18x.375	24x.375 *	16#8	16#9	16#10	16#10	713	713	713	814
	300	20x.375 *	3x.216	3x.216	16x.375 *	18x.375	24x.375 *	——	16#9	16#10	16#10	16#11	713	815	716	916
	450	20x.375 *	3x.216	3x.216	18x.375 *	20x.375	24x.375	24x.500	16#10	16#11	16#10	16#11	815	718	916	918
	600	20x.375	3.5x.226	3.5x.226	18x.375	24x.375 *	——	——	16#10	16#10	16#11	20#11	718	1215	1215	922
	750	24x.375 *	4x.237	4x.237	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	1215	1317	922	1024
	900	24x.375 *	4x.237	4x.237	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	918	922	922	1024
	1050	24x.375	5x.258	5x.258	24x.375 *	24x.500	——	——	16#10	16#11	24#11	32#11	922	922	1024	1323
OVER 90′ TO 100′	200	24x.375 *	3.5x.226	3.5x.226	16x.375 *	18x.375	24x.375 *	——	16#9	16#10	16#10	16#11	713	713	716	916
	350	24x.375 *	3.5x.226	3.5x.226	18x.375 *	20x.375	24x.375	24x.500	16#10	16#11	16#10	16#11	815	716	916	918
	500	24x.375 *	3.5x.226	3.5x.226	18x.375	24x.375 *	——	——	16#10	16#10	16#11	20#11	818	916	1215	922
	650	24x.375 *	3.5x.226	3.5x.226	20x.375 *	24x.375	24x.500	——	16#11	16#10	16#11	24#11	718	918	922	922
	800	24x.375	4x.237	4x.237	24x.375 *	——	——	——	16#10	16#11	20#11	32#11	918	922	922	1024

NOTE:
FOR DESIGN TABLE NOTES, SEE SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

2 POST PLANAR TRUSS
SPANS FROM 30′ TO 100′

DESIGN TABLES LOADING TYPE 1 & 2

RECOMMENDED AUG. 4, 2017
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
Brian D. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

SHT. 6 OF 6

BD-643M

CHANGE 1

INFORMATIONAL NOTES

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS FOR OVERHEAD SIGN STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS. REFERENCE TO THESE STANDARDS ON OVERHEAD SIGN STRUCTURES PLANS IS PROHIBITED.
- THE DESIGNER MUST PROVIDE THE INFORMATION OBTAINED FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS. THE DESIGNER MUST PROVIDE THE SIGN AREA, STRUCTURE HEIGHT, AND SIGN LOCATION USED TO OBTAIN MEMBER SIZES FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS.
- DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE DESIGN TABLES CONTAINED IN THESE STANDARDS. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THESE DESIGN TABLES.
- ALL SIGN SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-744M, SHEET 2.
- AVOID BRIDGE-MOUNTED SIGN STRUCTURES WHENEVER POSSIBLE. IF AVOIDANCE IS NOT POSSIBLE, THE STRUCTURE SHOULD BE LOCATED AS CLOSE TO A PIER SUPPORT AS IS PRACTICAL. THE AFFECTED BRIDGE COMPONENTS SHALL BE DESIGNED TO CARRY THE ADDITIONAL LOADS DUE TO THE WEIGHT OF THE SIGN STRUCTURE AND THE LOADINGS APPLIED TO SIGN STRUCTURE. IF A BARRIER IS USED OR IS REQUIRED, THE SIGN STRUCTURE SHALL BE LOCATED JUST BEYOND THE DESIGN DEFLECTION DISTANCE OF THE BARRIER.

INFORMATION CONTAINED IN THE DESIGN TABLES

- DESIGN TABLES INCLUDED IN THIS STANDARD WERE DEVELOPED USING A COMPUTER PROGRAM AND ARE BASED ON THE DESIGN CRITERIA SHOWN ON THIS SHEET, EXCEPT, THE MEMBER SIZES INDICATED DO NOT INCLUDE THE FATIGUE REQUIREMENTS INDICATED IN THE DESIGN CRITERIA.
- THE MEMBER SIZES INDICATED IN THE DESIGN TABLES SHOULD MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY III. THE DESIGNER MUST CHECK THE ADEQUACY OF THE MEMBER SIZES INDICATED WHEN THE FATIGUE CATEGORY IS SPECIFIED TO BE I OR II FOR THE PROJECT.
- THE SPAN RANGES INCLUDED IN THIS STANDARD ARE AS FOLLOWS:

  BD-644M: TWO-POST TRI-CHORD TRUSS, SPANS FROM 60′ TO 100′. FOUR-POST TRI-CHORD TRUSS, SPANS FROM 60′ TO 200′.

- THE DESIGN TABLES INCLUDE MEMBER SIZES FOR THE STRUCTURES FOR VARIOUS COMBINATIONS OF DESIGN HEIGHT, SPAN LENGTH, AND SIGN AREA. THEY ALSO INCLUDE SPREAD FOOTING DESIGNS. ALTERNATE CAISSON FOUNDATIONS ARE PERMITTED FOR 2 POST STRUCTURES ONLY WHERE SITE CONDITIONS DO NOT ALLOW FOR THE SPREAD FOOTING. DESIGN COMPUTATIONS ARE REQUIRED TO DETERMINE THE REQUIRED CAISSON EMBEDMENT AND REINFORCEMENT. THE DESIGN COMPUTATION MUST BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR REVIEW AND APPROVAL. THE CORRESPONDING FABRICATION AND CONSTRUCTION DETAILS ARE CONTAINED ON STANDARD DRAWING BC-744M.

GENERAL NOTES

1. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE f′c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. VERIFY ALL DIMENSIONS AND GEOMETRY OF THE EXISTING STRUCTURES IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. SPREAD FOOTINGS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL, BOLTS, NUTS & WASHERS IN ACCORDANCE WITH PUB. 408, UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE WIDTH OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE CHECKED.
14. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
15. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
16. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
17. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

- DEAD LOADS — PENNDOT STD. DWGS. (U.N.O.)*

SIGN PANELS	TC-8701E OR TC-8701S
LIGHT FIXTURES	BC-744M, SHT. 12
SIGN SUPPORT BEAM	BC-744M, SHT. 8
COLUMNS, CHORDS	CALCULATED INTERNALLY WITHIN PROGRAM
CATWALK	BC-744M, SHT. 10

- EXTERNAL LOADS — AASHTO SIGN SPECS. (U.N.O.)

ICE LOAD	3.7
WIND LOAD	APPENDIX C, SECTION C.3, EQ. C-1, WITH 80 MPH WIND AND 30% GUST FACTOR
CATWALK	1994 SIGN SPEC. COMMENTARY 1.2.2

- GROUP LOADS — AASHTO SIGN SPECS. 3.4
- STEEL CRITERIA — AASHTO SIGN SPECS.

SECTION PROPERTIES FOR TUBULAR SHAPES	APPENDIX B, TABLE B-1
MAXIMUM STRESSES IN TUBULAR SHAPES	APPENDIX B, TABLE B-2
ALLOWABLE STRESSES FOR TUBULAR SHAPES	5.6 (TABLE 5-3) & 5.11
ALLOWABLE STRESSES FOR SIGN SUPPORTS	5.12
ALLOWABLE STRESSES FOR BASE PLATES	5.8
ALLOWABLE STRESSES FOR COMBINED STEEL STRESS	5.12
FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)	SECTION 11
ALLOWABLE DEFLECTION	10.4
PERMANENT CAMBER	10.5
ALLOWABLE STRESSES FOR STRUCTURAL STEEL	SECTION 5

- BOLT CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BOLT STRESSES	TABLE 10.32.3B
SLIP-CRITICAL BOLT ALLOWABLE	10.32.3.2.1
BOLT PRYING ACTION	10.32.3.3.2
COMBINED BOLT SHEAR AND TENSION	10.32.3.3.3
BOLT DESIGN CRITERIA	AASHTO SIGN SPECS. 5.16
ALLOWABLE ANCHOR BOLT STRESSES	AASHTO SIGN SPECS. 5.17

- CONCRETE CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BEARING STRESS	8.15.2.1.3
REINFORCEMENT TENSILE STRESS	8.15.2.2
SHEAR CAPACITY OF FOOTINGS	8.15.5.6.1
SHEAR STRESS IN FOOTINGS	8.15.5.6.2
ALLOWABLE SHEAR STRESS	8.15.5.6.4
SLENDERNESS OF COLUMNS	8.16.5.2
MINIMUM REINF. OF FLEXURAL MEMBERS	8.17.1
SPACING LIMITS FOR REINFORCEMENT	8.21
MINIMUM CONCRETE COVER	DM-4 D8.22.1*
PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS	FIG. 4.4.7.1.1.1C
DISTRIBUTION OF REINFORCEMENT	4.4.11.2.2
FOOTING STABILITY REQUIREMENTS	DM-4 D5.5.5
TORSION	ACI SECTION A.7.3*
COLUMN DESIGN (PEDESTALS)	8.15.4

- SPREAD FOOTINGS

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MINIMUM AREA IN BEARING	95%
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT

- DRILLED SHAFTS (CAISSONS) DM-4 SEC. D4.6, PENNDOT COM624P COMPUTER PROGRAM

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MAXIMUM DESIGN LATERAL DISPLACEMENT	0.5"
MODULUS OF SUBGRADE REACTION	10.0 POUNDS PER CUBIC INCH
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT
ANGLE OF INTERNAL FRICTION	25°
COHESION	0 KIPS PER SQUARE FOOT

- SEISMIC DESIGN CRITERIA

  STRUCTURES ARE DESIGNED FOR A SEISMIC ACCELERATION COEFFICIENT = 0.15

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORKMANSHIP:

  PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.

- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

COLUMNS & PIPE CHORDS:	SEE PUBLICATION 408, SECTION 948.2.
ANGLES, SHAPES, AND PLATES:	AASHTO M270, GRADE 36 ASTM A709, GRADE 36

- ALTERNATE PRESS-BREAK MEMBERS:

  ALTERNATE PRESS-BREAK MEMBERS MUST HAVE THE EQUIVALENT STRENGTH OF THE MEMBER THEY ARE REPLACING. EQUIVALENT RADIUS FOR PRESS-BREAK MEMBERS IS MEASURED FROM THE CENTER OF THE MEMBER TO THE MID-POINT OF ANY CHORD OF THE MEMBER. MINIMUM THICKNESS OF PRESS-BREAK MEMBERS TO BE 5/16". PENNDOT'S SIGN STRUCTURE PROGRAM OR AN APPROVED FINITE ELEMENT ANALYSIS COMPUTER PROGRAM MUST BE RUN TO VERIFY THE ADEQUACY OF PRESS-BREAK MEMBER FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR CHORDS

- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:

ANCHOR BOLTS:	ASTM, F1554 GRADE 55 PER PUBLICATION 408 SECTION 1105.02(c)3.
BOLTS:	AASHTO M164 (ASTM A325) H.S. BOLTS EXCEPT AS NOTED

- DESIGN SPECIFICATIONS:

  AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 2001 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1996 WITH INTERIMS THROUGH AND INCLUDING 2000; PENNDOT DESIGN MANUAL - PART 4, AUGUST 1993 EDITION (INCLUDING AUGUST 1995 REVISIONS)

- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- ANY PIPE SIZE OTHER THAN THAT SHOWN ON THE STANDARD IS A PROJECT SPECIFIC DESIGN. DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE RULING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN 1/2".
- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 - (INDICATE CHANGE NUMBER), AASHTO/AWS D1.5, BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5".
- DYNAMIC\VARIABLE MESSAGE SIGNS (DMS\VMS) ARE PROHIBITED ON 2-POST AND 4-POST TRI-CHORD STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS.

* LEGEND:

- AASHTO SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"
- DM-4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-99).
- CVN: CHARPY V-NOTCH.

REFERENCE DRAWINGS	
TC-8700C	SPACING CHARTS/DIRECT APPLIED LETTERS, NUMERALS, & ARROWS
TC-8701D	SIGN DETAILS/FREEWAY AND EXPRESSWAY GUIDE SIGNS
TC-8701E	EXTRUDED ALUMINUM CHANNEL SIGN
TC-8701S	FLAT SHEET ALUMINUM SIGNS WITH EXTRUDED ALUMINUM STIFFENERS
TC-8715	SIGN LIGHTING
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-744M	OVERHEAD SIGN STRUCTURES
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

2 POST AND 4 POST TRI-CHORD TRUSS SPANS FROM 60′ TO 240′

NOTES AND DESIGN CRITERIA

RECOMMENDED AUG. 4, 2017 Thomas P Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brian S. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHT. 1 OF 13 BD-644M

HOW TO USE THE DESIGN TABLES

SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL OR CAISSON ELEVATION IS APPROXIMATELY 6 INCHES ABOVE THE HIGHEST SURROUNDING FINISHED GRADE ELEVATION.
- SET THE TOP OF FOOTING ELEVATION SO THAT A MINIMUM 2'-0" COVER IS PROVIDED OVER THE FOOTING AT ALL LOCATIONS.

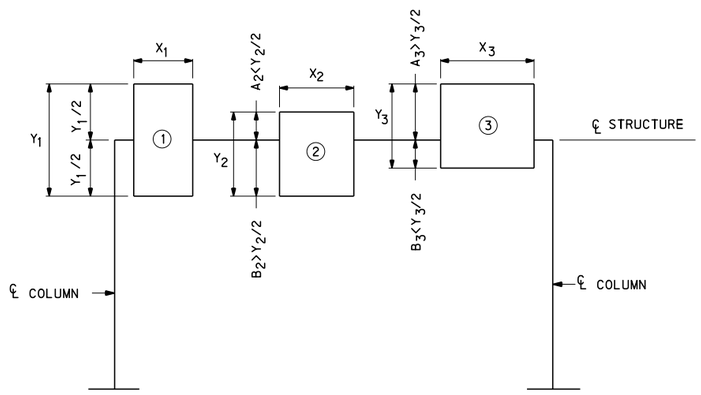
POSITIONING OF SIGN PANELS AND SIGN STRUCTURE

- SEE THE FOLLOWING DIAGRAMS FOR ADDITIONAL INSTRUCTIONS FOR POSITIONING THE SIGN PANELS AND SIGN STRUCTURE.
- THE TRAFFIC ENGINEER SETS THE DESIGN SIGN AREA USING ONE OF THE FOLLOWING OPTIONS:
  1. THE ACTUAL SIGN AREA TO BE PLACED ON THE STRUCTURE AT THE TIME OF CONSTRUCTION.
  2. THE ACTUAL SIGN AREA INCREASED BY 25%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (RURAL HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
  3. THE ACTUAL SIGN AREA INCREASED BY 50%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (URBAN HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
- THE DESIGN SIGN AREA WILL BE ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE.
- WHEN MULTIPLE SIGN PANELS ARE PLACED ON ONE STRUCTURE AND ONE OR MORE OF THE SIGN PANELS IS NOT CENTERED IN THE VERTICAL DIRECTION, COMPUTE THE DESIGN SIGN AREA IN THE FOLLOWING MANNER:

  THE SIGN AREA FOR ANY SIGN PANEL CENTERED IN THE VERTICAL DIRECTION IS (X) x (Y)

  THE SIGN AREA FOR ANY SIGN PANEL OFF-CENTER IN THE VERTICAL DIRECTION IS (X) x (B) x 2 WHEN B>A OR (X) x (A) x 2 WHEN A>B.

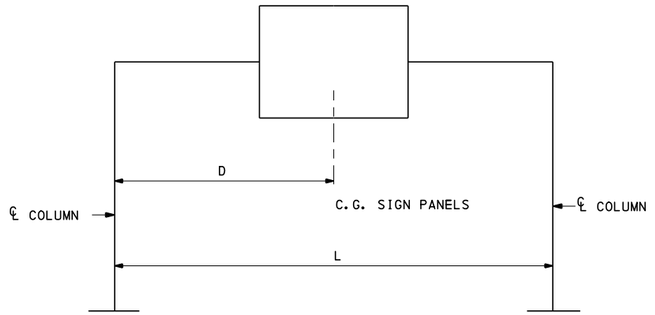
  EXAMPLE:
  AREA OF SIGN NO. 1 = (X_1) x (Y_1)
  AREA OF SIGN NO. 2 = (X_2) x (B_2) x 2
  AREA OF SIGN NO. 3 = (X_3) x (A_3) x 2



A = DISTANCE FROM ℄ STRUCTURE TO TOP OF SIGN
B = DISTANCE FROM ℄ STRUCTURE TO BOTTOM OF SIGN

DESIGN AREA OF SIGN NO. 1 = $X_1 Y_1$
DESIGN AREA OF SIGN NO. 2 = $(X_2 B_2) \times 2$
DESIGN AREA OF SIGN NO. 3 = $(X_3 A_3) \times 2$

- SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT THE MID-HEIGHT OF THE DEEPEST SIGN OR A MAXIMUM OF 9'-3" ABOVE THE BOTTOM OF THE SIGN PANEL. (SIGN HEIGHT INCLUDES "EXIT PANEL" SIGN IF PRESENT.)
- SET THE STRUCTURE, SIGN PANELS, AND LUMINAIRES TO AN ELEVATION THAT WILL PROVIDE A MINIMUM OF 17'-6" VERTICAL CLEARANCE ABOVE THE HIGHEST POINT OF THE ENTIRE ROADWAY WIDTH (INCLUDING THE ROADWAY PAVEMENT AND SHOULDERS) PASSING UNDER THE STRUCTURE. SET THE BOTTOM OF ALL SIGN PANELS TO GENERALLY THE SAME ELEVATION. IN THE CASE OF A STRUCTURE SPANNING DUAL ROADWAYS WHERE THE DIFFERENCE IN ELEVATIONS OF THE HIGHEST POINT ON EACH ROADWAY IS GREATER THAN 2'-6", SET THE BOTTOM OF ALL SIGN PANELS OVER EACH ROADWAY TO THE SAME VERTICAL CLEARANCE.
- WHEN THE MAXIMUM SIGN HEIGHT IS USED FOR DESIGN SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS. WHEN THE STRUCTURE SPANS DUAL ROADWAYS WITH THE DIFFERENCE IN HIGH POINT ELEVATIONS GREATER THAN 2'-6", SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS OVER THE UPPER ROADWAY.
- FOR ILLUSTRATIVE EXAMPLES OF HOW TO POSITION SIGN PANELS AND SIGN STRUCTURES, SEE CASES A-F ON THE NEXT SHEET.
- DESIGNS FOR TWO TYPES OF LOADING CONDITIONS ARE PRESENTED IN THE DESIGN TABLES. TYPE 1 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE TOTAL DESIGN SIGN AREA LIES BETWEEN 0.42 X SPAN LENGTH AND 0.58 X SPAN LENGTH. TYPE 2 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA LIES BETWEEN THE BEGINNING OF THE SPAN AND 0.42 X SPAN LENGTH OR 0.58 X SPAN LENGTH AND END OF SPAN. DETERMINE THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA AND USE THE APPROPRIATE LOADING CONDITION FOR SELECTING THE MEMBER SIZES. WHEN DETERMINING THE CENTER OF GRAVITY OF DESIGN SIGN AREA, USE THE INDIVIDUAL SIGN AREAS AS CALCULATED IN ACCORDANCE WITH THE PROCEDURE FOR CENTERED AND OFF-CENTER SIGNS.

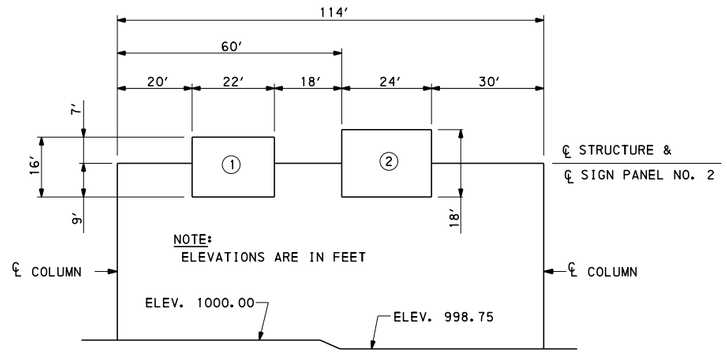


IF 0.42L ≤ D ≤ 0.58L, USE LOADING TYPE 1
IF D < 0.42L, OR D > 0.58L, USE LOADING TYPE 2

LOADING TYPE DIAGRAM

- THE DESIGN SPAN LENGTH SHALL BE THE ACTUAL SPAN LENGTH ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SPAN LENGTH SHOWN IN THE DESIGN TABLES.
- THE DESIGN POST HEIGHT SHALL BE THE ACTUAL DESIGN POST HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST HEIGHT SHOWN IN THE DESIGN TABLES.

EXAMPLE TO SHOW PROCEDURE FOR SELECTING SIGN AREA, SPAN LENGTH, & POST HEIGHT



- Δ ELEV. = 1000.00 - 998.75 = 1.25 < 2'-6"
  Y_1 = 16'
  Y_2 = 18'
  $Y_1 < Y_2$ → USE CASE B
- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION
  ELEV. 1000.00 + 17'-6" + 1'-8" = 1019.17
  [1'-8" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL]
- SET ℄ STRUCTURE AT ℄ OF SIGN PANEL NO. 2
  ELEV. 1019.17 + 18'/2 = 1028.17
- ACTUAL SPAN LENGTH = 114' → USE: 120'
- DESIGN COLUMN HEIGHT (H):
  H = 1028.17 - 998.750 = 29.42' → USE H = OVER 24' TO 33'
- ℄ SIGN TO BOTTOM OF CATWALK IS 9'-0" + 1'-8⅞" = 10'-8⅞"
- ½STRUCTURE DEPTH IS 2'-7½". THEREFORE FROM THE DESIGN TABLES, IT IS DETERMINED THAT THE TOTAL STRUCTURE DEPTH IS 5'-3"
- BECAUSE SIGN PANEL NO. 1 IS NOT CENTERED VERTICALLY ON THE STRUCTURE, THE DESIGN AREAS ARE COMPUTED AS FOLLOWS:
  A_1 = 22' x 9' x 2 = 396.0 SF
  A_2 = 24' x 18' = 432.0 SF
  828.0 SF
  → USE 830.0 SF
- LOCATE C.G. OF SIGN AREA (FROM LEFT)

$$X = \frac{[396.0 \text{ SF} \times (20' + 22'/2)] + [432.0 \text{ SF} \times (60' + 24'/2)]}{828 \text{ SF}}$$

  X = 52.40' 52.4'/114' = 0.46; 0.42 < 0.46 < 0.58
- VERIFY LOADING TYPE BASED ON ACTUAL SIGN AREA AND C.G.
- IF LOADING TYPES DIFFER USE THE LARGEST MEMBER SIZES FROM EACH LOADING TYPE.

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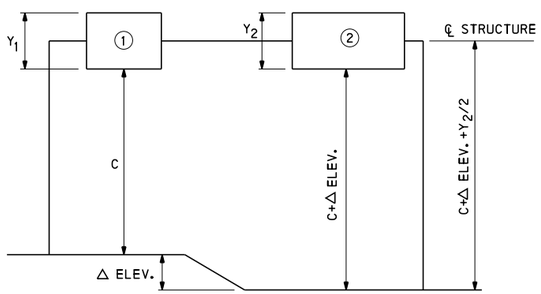
OVERHEAD SIGN STRUCTURES
2 POST AND 4 POST TRI-CHORD TRUSS
SPANS FROM 60' TO 240'

DESIGN INSTRUCTIONS

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 2 OF 13
Thomas P Macioce	Brian D Thompson	
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	BD-644M



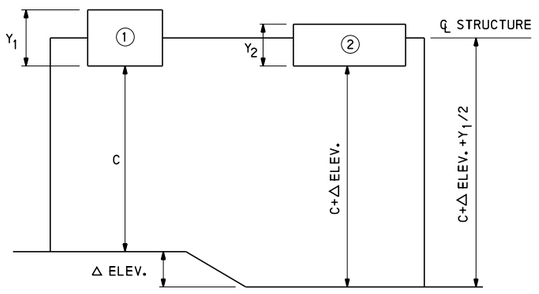
CASE A

$Y_1 = Y_2$

Δ ELEV. ≤ 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANELS UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.



CASE C

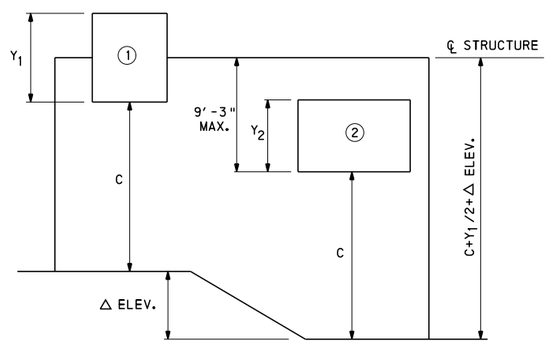
$Y_1 \geq Y_2$

Δ ELEV. ≤ 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF Y_1 AND Y_2 WHERE $Y_1 \geq Y_2$.



CASE E

$Y_1 \geq Y_2$

Δ ELEV. > 2′-6"

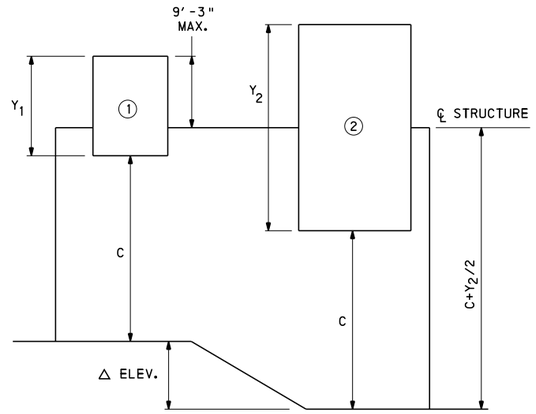
SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF Δ ELEV. AND Y_2 WHERE $Y_1 \geq Y_2$:

Δ ELEV.	$Y_{1,2}$
3′-0"	6′-0" TO 12′-6"
4′-0"	6′-0" 10′-6"
5′-0"	6′-0" TO 8′-6"
6′-0"	6′-0" TO 6′-6"
6′-3"	6′-0"

WHEN $Y_{1,2}$ EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE FOR A PARTICULAR VALUE OF Δ ELEV., THIS CASE DOES NOT APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A SPECIAL DESIGN.



CASE F

$Y_1 < Y_2$

Δ ELEV. > 2′-6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 2 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF Δ ELEV., Y_1, AND Y_2 WHERE $Y_1 < Y_2$:

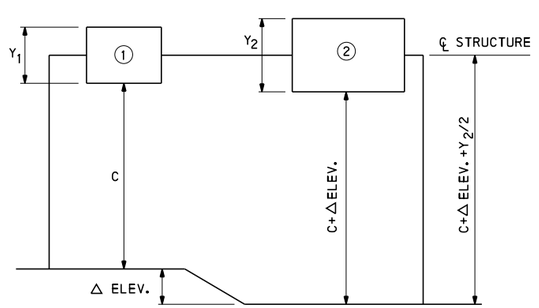
Δ ELEV.	LIMITS OF Y_1 AND Y_2
3′-0"	$2Y_1 - Y_2 \leq$ 12′-6"
4′-0"	$2Y_1 - Y_2 \leq$ 10′-6"
5′-0"	$2Y_1 - Y_2 \leq$ 8′-6"
6′-0"	$2Y_1 - Y_2 \leq$ 6′-6"
7′-0"	$2Y_1 - Y_2 \leq$ 4′-6"

GENERAL EQUATION FOR CASE F:

$$2(\Delta \text{ELEV.}) + 2(Y_1) - Y_2 \leq 18'\text{-}6"$$

IF THE PARAMETERS OF THE GENERAL EQUATION ARE EXCEEDED, ONE OF THE FOLLOWING STEPS IS REQUIRED:

1) RESET ℄ STRUCTURE SO THAT PARAMETERS ARE MET
2) USE SEPARATE STRUCTURES
3) USE A SPECIAL DESIGN
4) IN ALL CASES, THE MINIMUM VERTICAL CLEARANCE OF 17′-6" MUST BE MAINTAINED



CASE B

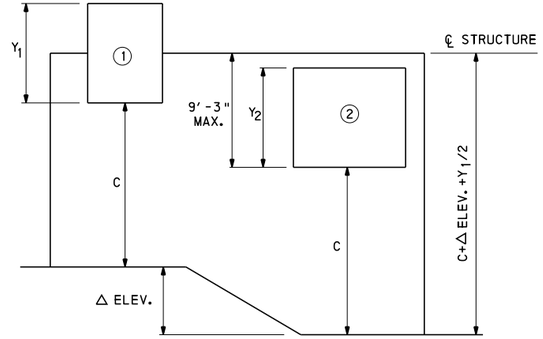
$Y_1 \leq Y_2$

Δ ELEV. ≤ 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 2 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF Y_1 AND Y_2 WHERE $Y_1 \leq Y_2$.



CASE D

$Y_1 = Y_2$

Δ ELEV. > 2′-6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF Δ ELEV. AND $Y_{1,2}$:

Δ ELEV.	$Y_{1,2}$
3′-0"	6′-0" TO 12′-6"
4′-0"	6′-0" TO 10′-6"
5′-0"	6′-0" TO 8′-6"
6′-0"	6′-0" TO 6′-6"
6′-3"	6′-0"

WHEN $Y_{1,2}$ EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE FOR A PARTICULAR VALUE OF Δ ELEV., THIS CASE DOES NOT APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A SPECIAL DESIGN.

NOTE:

C IS VERTICAL CLEARANCE FROM ROADWAY TO BOTTOM OF STRUCTURE, SIGN PANEL, OR LUMINAIRE.

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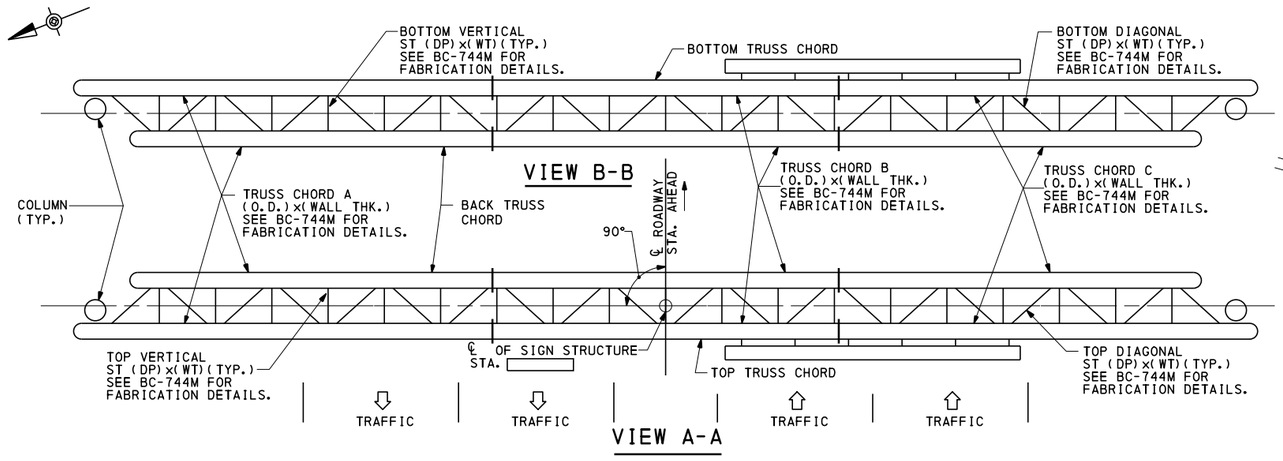
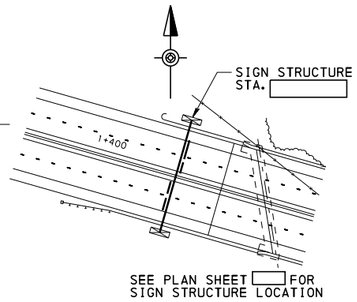
OVERHEAD SIGN STRUCTURES
2 POST AND 4 POST TRI-CHORD TRUSS SPANS FROM 60′ TO 240′
INSTRUCTIONS FOR USE OF DESIGN TABLES

RECOMMENDED AUG. 4, 2017
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
Brent D. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

BD-644M

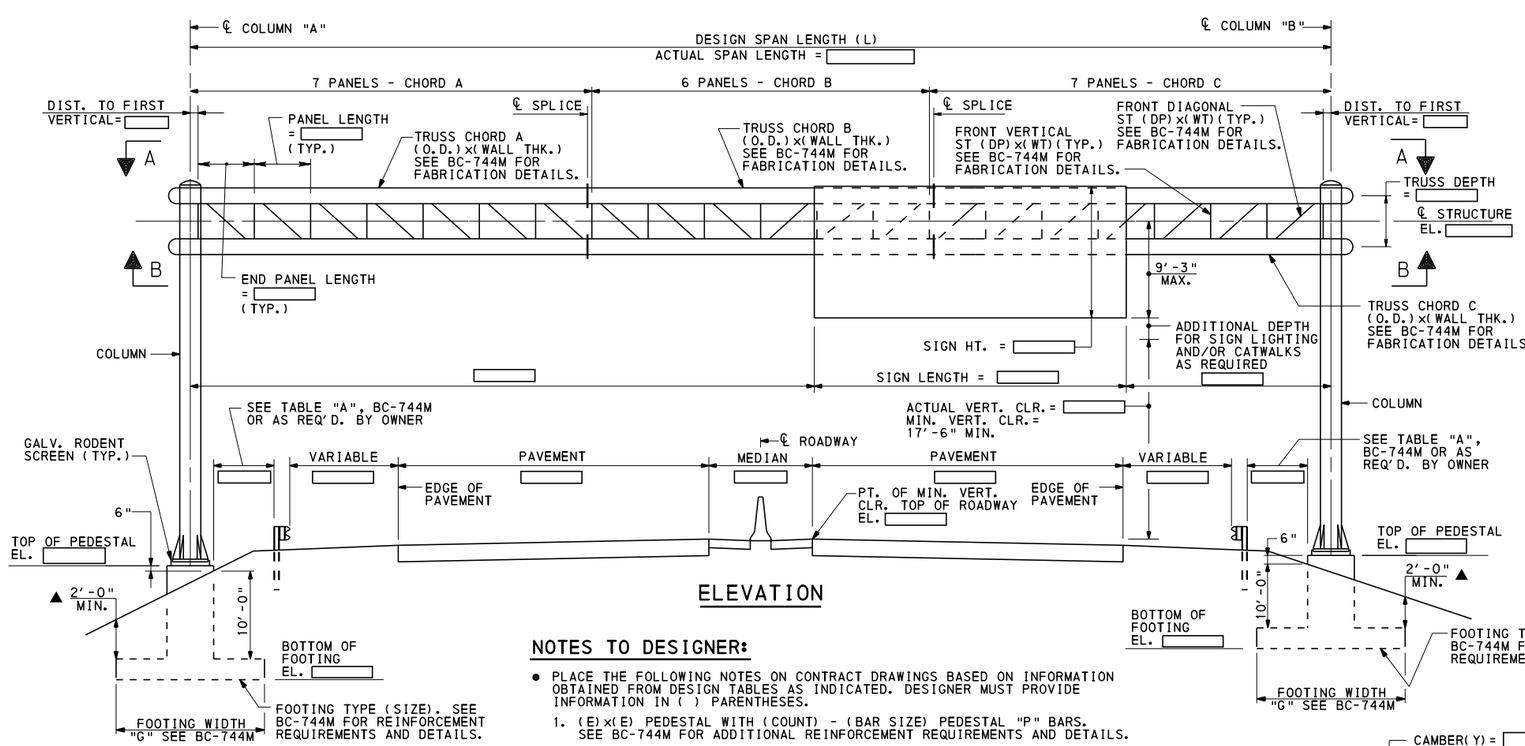




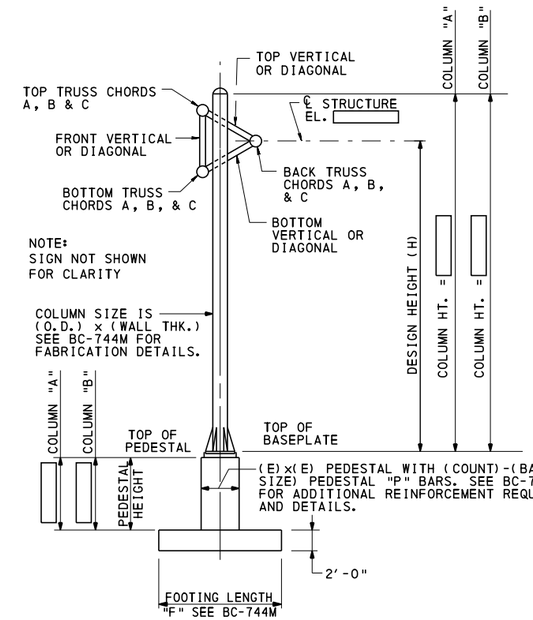
LOCATION PLAN

DESIGN CRITERIA	
DESIGN SIGN AREA (A) =	
DESIGN SPAN LENGTH (L) =	
DESIGN HEIGHT (H) =	
LOADING TYPE =	(1 OR 2)
FATIGUE CATEGORY =	

NOTE:
DESIGN FOR ACTUAL, ACTUAL INCREASED BY 25%, OR ACTUAL INCREASED BY 50% SIGN AREA. (DESIGNER TO INDICATE CONTROLLING CONDITION)



ELEVATION



END VIEW

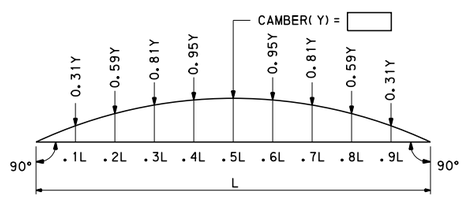
▲ DESIGNER MUST CHECK ADEQUACY OF FOOTINGS FOR FILL HEIGHTS < 10'-0".

TABLE OF ESTIMATED QUANTITIES			
ITEM NO.	ITEM	UNIT	QUANTITY
*	STEEL SIGN STRUCTURE	LBS	
0000-0000	STRUCTURE MOUNTED SIGNS	SF	
0000-0000	CLASS 3 EXCAVATION	CY	
0000-0000	CLASS A CEMENT CONCRETE	CY	
0000-0000	REINFORCEMENT BARS	LBS	

* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. 0000 - 0000

NOTES TO DESIGNER:

- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED. DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES.
  1. (E)x(E) PEDESTAL WITH (COUNT) - (BAR SIZE) PEDESTAL "P" BARS. SEE BC-744M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
  2. FOOTING TYPE (SIZE). SEE BC-744M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  3. COLUMN SIZE IS (O.D.) x (WALL THK.). SEE BC-744M FOR FABRICATION DETAILS.
  4. TRUSS CHORD A (O.D.) x (WALL THK.), TRUSS CHORD B (O.D.) x (WALL THK.), AND TRUSS CHORD C (O.D.) x (WALL THK.). SEE BC-744M FOR FABRICATION DETAILS.
  5. FRONT DIAGONALS ST (DP)x(WT) AND FRONT VERTICALS ST (DP)x(WT); TOP DIAGONALS ST (DP)x(WT) AND TOP VERTICALS ST (DP)x(WT); BOTTOM DIAGONALS ST (DP)x(WT) AND BOTTOM VERTICALS ST (DP)x(WT). SEE BC-744M FOR FABRICATION DETAILS.
- PLACE CAMBER DIAGRAM ON CONTRACT DRAWINGS AND SPECIFY REQUIRED CAMBER FROM CAMBER TABLE.
- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH ☐
- DESIGNER TO PROVIDE DIMENSIONS ON CONTRACT DRAWINGS.



CAMBER DIAGRAM

NOTE: PRIOR TO SHIPMENT OF TRUSS STRUCTURE TO THE SITE, SHOP ASSEMBLE TRUSSES IN AN UPRIGHT POSITION AND CHECK TRUSS CAMBER.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

2 POST TRI-CHORD TRUSS SPANS FROM 60' TO 240'

SAMPLE CONTRACT DRAWING

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 4 OF 13
Thomas P Macioce CHIEF BRIDGE ENGINEER	Bruce B Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	BD-644M

LOADING TYPE 1

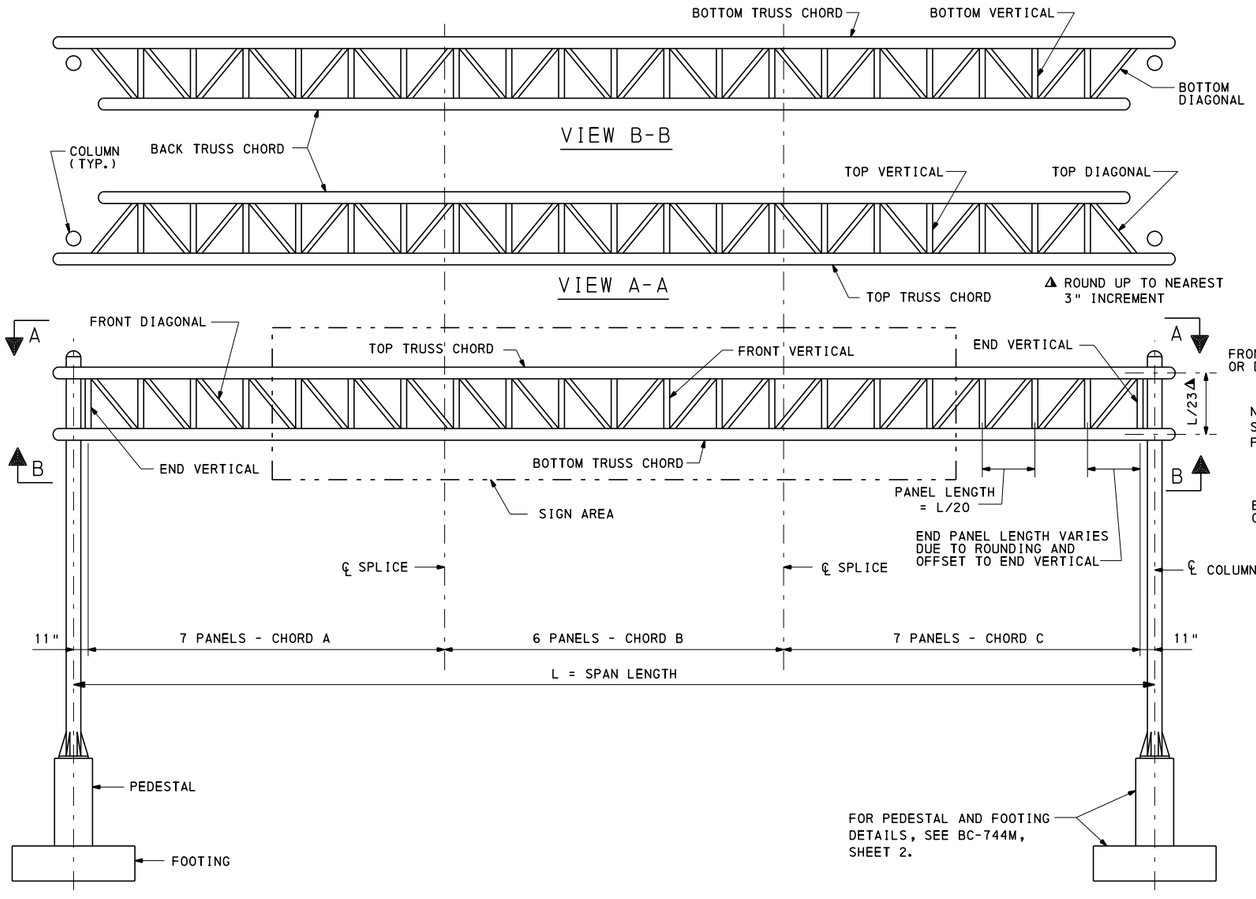
DESIGN SPAN	SIGN AREA (SQ.FT.)	TRUSS MEMBERS: CHORDS (PIPE NOMINAL SIZE x WALL THK.)** A	CHORDS B	CHORDS C	DIAGONALS ▲ FRONT	DIAGONALS ▲ TOP & BOTTOM	VERTICALS ▲ FRONT	VERTICALS ▲ TOP & BOTTOM	TOWER MEMBERS: COLUMNS (PIPE NOMINAL SIZE x WALL THK.) ** H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′	FOUNDATION: PEDESTAL "P" BARS H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′	FOOTING TYPE H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′
TO 60′	125	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	1.5x2.85	1.5x2.85	10x.365 *	12x.375 *	16x.375 *	24x.375 *	16-#6	16-#8	16-#9	16-#10	711	713	713	814
	250	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x3.75	1.5x3.75	1.5x3.75	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16-#8	16-#9	16-#10	16-#10	1010	1112	1112	916
	375	6x.432 *	6x.432	6x.432 *	1.5x3.75	1.5x3.75	3.0x8.625	2.0x4.75	16x.375 *	18x.375	20x.375	24x.375	16-#9	16-#10	16-#11	16-#10	1112	1114	1114	918
	500	8x.500	8x.322 *	8x.500	3.0x8.625	3.0x8.625	3.0x8.625	2.5x5.0	18x.375 *	20x.375	24x.375 *	24x.500	16-#10	16-#11	16-#10	16-#11	815	1114	918	1020
	625	8x.500	8x.322 *	8x.500	3.0x8.625	3.0x8.625	4.0x11.5	3.0x6.25	18x.375	24x.375 *	——	——	16-#10	16-#10	16-#11	20-#11	1114	1215	1317	922
	750	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	20x.375	24x.375	24x.500	——	16-#11	16-#10	16-#11	24-#11	1216	1215	1317	1024
	875	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x.375 *	24x.500 *	——	——	16-#10	16-#11	20-#11	32-#11	918	1317	922	924
	1000	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	4.0x11.5	24x.375 *	24x.500 *	——	——	16-#10	16-#11	24-#11	32-#11	1215	1317	1219	1221
	1110	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	4.0x9.2	24x.375 *	——	——	——	16-#10	20-#11	24-#11	32-#11	1317	1317	1219	1221
OVER 60′ TO 70′	175	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	2.0x3.85	1.5x2.85	12x.375 *	14x.375	16x.375	24x.375 *	16-#8	16-#8	16-#9	16-#10	713	713	713	814
	300	5x.375 *	5x.375 *	5x.375 *	2.0x3.85	2.0x3.85	2.0x4.75	2.0x3.85	14x.375	18x.375 *	20x.375 *	24x.375 *	16-#8	16-#10	16-#11	16-#10	713	815	1114	916
	425	8x.500	8x.322 *	8x.500	2.5x5.0	2.5x5.0	3.0x8.625	2.5x5.0	16x.375	20x.375 *	24x.375 *	——	16-#9	16-#11	16-#10	16-#11	1114	817	1215	1215
	550	8x.500	8x.322 *	8x.500	2.5x5.0	2.5x5.0	4.0x11.5	2.5x5.0	18x.375	24x.375 *	——	——	16-#10	16-#10	16-#11	24-#11	1114	918	1215	1317
	675	8x.500	8x.322	8x.500	3.0x8.625	3.0x8.625	4.0x11.5	3.0x6.25	20x.375 *	24x.375 *	24x.500 *	——	16-#11	16-#10	16-#11	24-#11	1213	1215	1020	922
	800	10x.500	10x.365 *	10x.500	3.0x6.25	3.0x6.25	5.0x12.7	3.0x8.625	24x.375 *	——	——	——	16-#10	16-#11	20-#11	32-#11	1018	1317	922	1024
	925	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x.375 *	24x.500 *	——	——	16-#10	16-#11	24-#11	32-#11	1317	1317	1024	1221
	1050	12x.500	12x.375 *	12x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.375	——	——	——	16-#10	20-#11	32-#11	32-#11	1019	1319	1221	1323
	1175	12x.500	12x.375 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	4.0x9.2	24x.500 *	——	——	24x1.219	16-#11	20-#11	32-#11	32-#11	1317	1319	1221	1323
	1295	12x.500	12x.375 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	4.0x9.2	24x.500 *	——	——	24x1.219	16-#11	24-#11	32-#11	32-#11	1317	1319	1221	1323

FOR CONTINUATION OF CHART, SEE SHEET 6

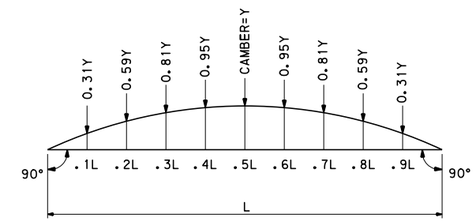
* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

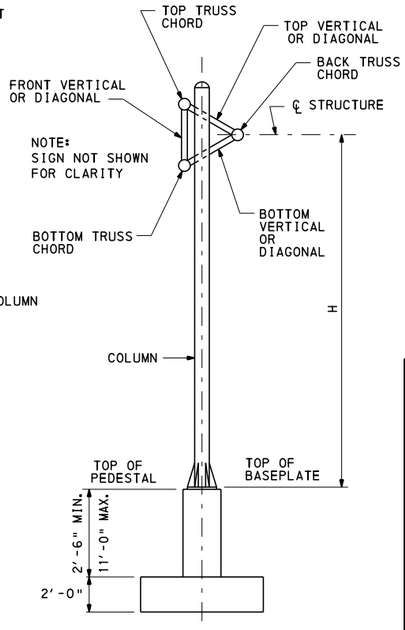
▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).



CAMBER TABLE	
SPAN	CAMBER (IN.)
60′	1.62
70′	1.90
80′	2.40
90′	2.75
100′	2.98



CAMBER DIAGRAM



NOTES:

- FOR GENERAL NOTES, SEE SHEET 1.
- FOR GENERAL DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
- ONE OR MORE SPLICES IN THE TRUSS MAY BE ADDED OR ELIMINATED AT THE OPTION OF THE FABRICATOR. IN CASE OF THE ADDITION OR ELIMINATION OF SPLICES, THE HEAVIER CHORD MATERIAL MUST BE EXTENDED TOWARD THE LIGHTER CHORD MATERIAL TO THE DESIRED SPLICE LOCATION.
- "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH (FOR EXAMPLE, FOOTING TYPE 711 INDICATES A FOOTING 7′-0" WIDE x 11′-0" LONG). SEE BC-744M, SHEET 2 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10′-0".
- FOR STRUCTURAL DETAILS, SEE BC-744M.
- FOR PEDESTAL SIZES, SEE SHEET 6.
- CVN REQUIRED FOR COLUMN AND CHORD WALL THICKNESSES EXCEEDING 1/2" (0.500").

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

2 POST TRI-CHORD TRUSS
SPANS FROM 60′ TO 100′

DESIGN TABLES
LOADING TYPE 1

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 5 OF 13
Thomas P. Macioce	Brenda S. Thompson	BD-644M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	

LOADING TYPE 1 (CONTINUED)

DESIGN SPAN	SIGN AREA (SQ.FT.)	TRUSS MEMBERS: CHORDS (PIPE NOMINAL SIZE x WALL THK.) ** A	CHORDS B	CHORDS C	DIAGONALS ▲ FRONT	DIAGONALS ▲ TOP & BOTTOM	VERTICALS ▲ FRONT	VERTICALS ▲ TOP & BOTTOM	TOWER MEMBERS: COLUMNS (PIPE NOMINAL SIZE x WALL THK.) ** H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′	FOUNDATION: PEDESTAL "P" BARS H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′	FOOTING TYPE H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′
OVER 70′ TO 80′	150	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	2.0x3.85	1.5x2.85	12x.375 *	14x.375	16x.375	24x.375 *	16-#8	16-#8	16-#9	16-#10	713	713	713	814
	300	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	2.0x3.85	2.0x4.75	1.5x3.75	16x.375 *	18x.375 *	20x.375 *	24x.375 *	16-#9	16-#10	16-#11	16-#10	814	815	1114	1215
	450	8x.500	8x.322 *	8x.500	2.0x4.75	3.0x8.625	3.0x8.625	2.5x5.0	18x.375 *	20x.375	24x.375 *	24x.500 *	16-#10	16-#11	16-#10	16-#11	1114	1114	918	1317
	600	8x.500	8x.500 *	8x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	20x.375 *	24x.375 *	—	—	16-#11	16-#10	16-#11	20-#11	1213	918	1317	922
	750	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x6.25	5.0x12.7	3.0x8.625	24x.375 *	—	—	—	16-#10	16-#11	20-#11	32-#11	1215	1020	1317	1024
	900	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.375 *	24x.500 *	—	—	16-#10	16-#11	24-#11	32-#11	1317	1020	1219	1221
	1050	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	24x.375	—	—	—	16-#10	20-#11	32-#11	32-#11	1317	1319	1221	1323
	1480	12x.500	12x.375	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500 *	—	—	—	16-#11	24-#11	32-#11	36-#11	1516	1420	1420	1522
OVER 80′ TO 90′	150	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x3.75	2.0x3.85	1.5x2.85	12x.375 *	16x.375 *	16x.375	24x.375 *	16-#8	16-#9	16-#9	16-#10	713	1010	713	814
	300	6x.432 *	6x.432 *	6x.432 *	1.5x2.85	2.0x3.85	2.5x5.0	1.5x3.75	16x.375 *	18x.375 *	20x.375	24x.375 *	16-#9	16-#10	16-#11	16-#10	814	815	1114	916
	450	8x.500	8x.322 *	8x.500	2.0x4.75	3.0x8.625	3.0x8.625	2.5x5.0	18x.375 *	20x.375	24x.375	24x.500	16-#10	16-#11	16-#10	16-#11	1114	817	918	1317
	600	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	20x.375 *	24x.375 *	24x.500 *	—	16-#11	16-#10	16-#11	24-#11	1213	918	1317	922
	750	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x6.25	5.0x12.7	3.0x8.625	24x.375 *	—	—	—	16-#10	16-#11	20-#11	32-#11	1215	1317	922	1221
	900	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.375 *	24x.500	—	—	16-#10	16-#11	24-#11	32-#11	1317	1317	1023	1026
	1200	12x.500	12x.375	12x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	24x.500 *	—	—	—	16-#11	24-#11	32-#11	32-#11	1516	1418	1323	1522
	1350	12x.500	12x.375	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500 *	—	—	—	16-#11	32-#11	32-#11	36-#11	1518	1420	1522	1522
	1500	12x.500	12x.500 *	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500	—	—	—	16-#11	32-#11	32-#11	36-#11	1518	1420	1522	1821
OVER 90′ TO 100′	200	6x.432 *	6x.432 *	6x.432 *	1.5x2.85	2.0x3.85	2.5x5.0	1.5x3.75	16x.375 *	16x.375	20x.375 *	24x.375 *	16-#9	16-#9	16-#11	16-#10	1010	1112	1114	1213
	350	8x.500	8x.322 *	8x.500	2.0x4.75	3.0x8.625	3.0x8.625	2.5x5.0	18x.375 *	20x.375 *	24x.375 *	—	16-#10	16-#11	16-#10	16-#11	1114	1114	1215	918
	500	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	20x.375 *	24x.375 *	—	—	16-#11	16-#10	16-#11	24-#11	1213	918	1317	922
	650	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x6.25	5.0x12.7	3.0x8.625	24x.375 *	24x.375	24x.500	—	16-#10	16-#10	16-#11	32-#11	1215	1020	1020	1024
	800	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.375 *	—	—	—	16-#10	16-#11	20-#11	32-#11	1317	1317	1219	1221
	1100	12x.500	12x.375	12x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	24x.500 *	—	—	—	16-#11	20-#11	32-#11	32-#11	1516	1418	1420	1522
	1250	12x.500	12x.500 *	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500 *	—	—	—	16-#11	24-#11	32-#11	36-#11	1518	1420	1420	1522
	1400	12x.500	12x.500 *	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500	—	—	—	16-#11	32-#11	32-#11	36-#11	1518	1420	1522	1524

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).

PEDESTAL	
COLUMN	PEDESTAL SIZE
10" DIA.	2′-6" x 2′-6"
12" DIA.	2′-9" x 2′-9"
14" DIA.	3′-0" x 3′-0"
16" DIA.	3′-3" x 3′-3"
18" DIA.	3′-3" x 3′-3"
20" DIA.	3′-9" x 3′-9"
24" DIA.	4′-3" x 4′-3"

NOTE:
FOR DESIGN TABLE NOTES, SEE SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

2 POST TRI-CHORD TRUSS
SPANS FROM 60′ TO 100′

DESIGN TABLES
LOADING TYPE 1

RECOMMENDED AUG. 4, 2017
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
DIRECTOR, BUR. OF PROJECT DELIVERY

SHT. 6 OF 13

BD-644M

LOADING TYPE 2

DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS							TOWER MEMBERS				FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.) **			DIAGONALS ▲		VERTICALS ▲		COLUMNS (PIPE NOMINAL SIZE x WALL THK.) **				PEDESTAL "P" BARS				FOOTING TYPE			
		A	B	C	FRONT	TOP & BOTTOM	FRONT	TOP & BOTTOM	H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′	H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′	H TO 12′	H OVER 12′ TO 18′	H OVER 18′ TO 24′	H OVER 24′ TO 33′
TO 60′	125	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	1.5x2.85	1.5x2.85	12x.375 *	14x.375	16x.375	24x.375 *	16-#8	16-#8	16-#9	16-#10	713	713	713	814
	250	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x3.75	1.5x3.75	1.5x3.75	14x.375	18x.375 *	20x.375	24x.375 *	16-#8	16-#10	16-#11	16-#10	713	815	817	918
	375	6x.432 *	6x.432 *	6x.432 *	2.0x3.85	2.5x5.00	3.0x8.625	3.0x6.25	18x.375 *	24x.375 *	24x.375	24x.562	16-#10	16-#10	16-#10	16-#11	817	916	918	1020
	500	6x.432	6x.432	6x.432	3.0x8.625	3.0x8.625	4.0x11.5	3.0x6.25	20x.375 *	24x.375 *	—	—	16-#11	16-#10	16-#11	24-#11	1114	918	1317	1020
	625	8x.500	8x.322 *	8x.500	3.0x8.625	3.0x8.625	4.0x11.5	4.0x11.5	20x.375	24x.375	24x.500	—	16-#11	16-#10	16-#11	24-#11	1216	918	1020	1022
	750	8x.500	8x.500 *	8x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x.375 *	—	—	—	16-#10	16-#11	16-#11	32-#11	1215	1317	1020	1022
	875	8x.500	8x.500 *	8x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x.375 *	24x.500 *	—	—	16-#10	16-#11	24-#11	32-#11	1215	1317	1319	1221
	930	8x.500	8x.500 *	8x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.375 *	24x.500 *	—	—	16-#10	16-#11	24-#11	32-#11	1019	1020	1319	1221
OVER 60′ TO 70′	175	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x3.75	2.0x3.85	1.5x2.85	14x.375 *	18x.375 *	20x.375 *	24x.375 *	16-#8	16-#10	16-#11	16-#10	713	815	815	916
	300	5x.375 *	5x.375 *	5x.375 *	2.0x3.85	2.0x4.75	3.0x8.625	2.0x3.85	16x.375	20x.375 *	24x.375 *	—	16-#9	16-#11	16-#10	16-#11	815	817	916	918
	425	6x.432 *	6x.432 *	6x.432 *	2.5x5.0	3.0x8.625	4.0x11.5	3.0x8.625	18x.375	24x.375 *	—	—	16-#10	16-#10	16-#11	24-#11	1114	918	918	1317
	550	8x.500	8x.322 *	8x.500	3.0x8.625	3.0x8.625	4.0x11.5	3.0x8.625	20x.375	24x.375	24x.500	—	16-#11	16-#10	16-#11	24-#11	1114	918	1020	1319
	675	8x.500	8x.322	8x.500	3.0x8.625	3.0x8.625	4.0x11.5	3.0x8.625	24x.375 *	—	—	—	16-#10	16-#11	20-#11	32-#11	918	1020	1319	1022
	800	8x.500	8x.500 *	8x.500	3.0x6.25	3.0x8.625	5.0x17.5	3.0x8.625	24x.375 *	24x.500 *	—	—	16-#10	16-#11	24-#11	32-#11	1019	1317	1319	1421
	925	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	—	24x.500	—	—	16-#11	16-#11	24-#11	32-#11	1317	1319	1319	1026
	1050	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.500 *	—	—	—	16-#11	20-#11	32-#11	32-#11	1516	1319	1319	1323
	1090	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.500 *	—	—	—	16-#11	20-#11	32-#11	32-#11	1516	1319	1319	1323
OVER 70′ TO 80′	150	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x3.75	2.0x3.85	1.5x2.85	14x.375 *	18x.375 *	18x.375	24x.375 *	16-#8	16-#10	16-#10	16-#10	713	713	815	916
	300	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	2.5x5.0	4.0x11.5	1.5x3.75	18x.375 *	20x.375	24x.375 *	—	16-#10	16-#11	16-#10	16-#11	815	1114	918	918
	450	6x.432	6x.432	6x.432	2.0x4.75	3.0x8.625	4.0x11.5	2.5x5.0	20x.375 *	24x.375 *	—	—	16-#11	16-#10	16-#11	24-#11	1114	918	1020	1020
	600	8x.500	8x.500 *	8x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x.375 *	—	—	—	16-#10	16-#11	20-#11	32-#11	918	1317	1020	1319
	750	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	4.0x11.5	24x.375 *	24x.500	—	—	16-#10	16-#11	24-#11	32-#11	1317	1020	1022	1421
	900	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.375	—	—	—	16-#10	20-#11	32-#11	32-#11	1019	1319	1022	1720
	1200	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	24x.500 *	—	—	—	16-#11	24-#11	32-#11	32-#11	1516	1518	1221	1522
	1240	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	24x.500 *	—	—	—	16-#11	24-#11	32-#11	32-#11	1516	1518	1420	1522
OVER 80′ TO 90′	150	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x3.75	2.0x3.85	1.5x2.85	14x.375 *	18x.375 *	24x.375 *	24x.375 *	16-#8	16-#10	16-#10	16-#10	713	815	814	916
	300	6x.432 *	6x.432 *	6x.432 *	1.5x2.85	2.5x5.0	4.0x11.5	1.5x3.75	18x.375 *	24x.375 *	24x.375 *	24x.500	16-#10	16-#10	16-#10	16-#11	1114	1215	918	918
	450	6x.432	6x.432	6x.432	2.0x4.75	3.0x8.625	4.0x11.5	2.5x5.0	20x.375 *	24x.375	24x.500 *	—	16-#11	16-#10	16-#11	24-#11	1114	918	1020	1020
	600	8x.500	8x.500 *	8x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x.375 *	24x.500 *	—	—	16-#10	16-#10	20-#11	32-#11	918	1317	1020	1022
	750	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	4.0x11.5	24x.375	—	—	—	16-#10	20-#11	24-#11	32-#11	1317	1319	1022	1124
	1200	12x.500	12x.375	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500 *	—	—	—	16-#11	32-#11	32-#11	36-#11	1518	1518	1522	1522
	1350	12x.500	12x.375	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500	—	—	—	16-#11	32-#11	32-#11	36-#11	1518	1620	1522	1522
	1400	12x.500	12x.375	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500	—	—	—	16-#11	32-#11	32-#11	36-#11	1518	1620	1522	1624
OVER 90′ TO 100′	200	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	2.5x5.0	2.5x5.0	1.5x3.75	16x.375 *	18x.375	24x.375 *	24x.375	16-#9	16-#10	16-#10	16-#10	815	1114	916	918
	350	6x.432 *	6x.432 *	6x.432 *	2.0x4.75	3.0x8.625	4.0x11.5	2.5x5.0	18x.375	24x.375 *	—	—	16-#10	16-#10	16-#11	20-#11	1114	918	918	1317
	500	8x.500	8x.322	8x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x.375 *	—	—	—	16-#10	16-#11	20-#11	32-#11	1018	1317	1317	1022
	650	8x.500	8x.500 *	8x.500	3.0x8.625	4.0x11.5	5.0x12.7	3.0x8.625	24x.375 *	—	—	—	16-#10	20-#11	24-#11	32-#11	1317	1020	1319	1421
	800	10x.500	10x.500 *	10x.500	3.0x8.625	4.0x11.5	5.0x17.5	4.0x11.5	24x.375	—	—	24x1.219	16-#10	20-#11	32-#11	32-#11	1317	1319	1421	1421
	1100	12x.500	12x.375	12x.500	3.0x8.625	4.0x11.5	6.0x17.5	4.0x11.5	24x.500 *	—	—	—	16-#11	32-#11	32-#11	36-#11	1518	1518	1620	1522
	1250	12x.500	12x.500 *	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500	—	—	—	16-#11	32-#11	32-#11	36-#11	1518	1620	1522	1524

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).

NOTE:
FOR DESIGN TABLE NOTES, SEE SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
2 POST TRI-CHORD TRUSS
SPANS FROM 60′ TO 100′

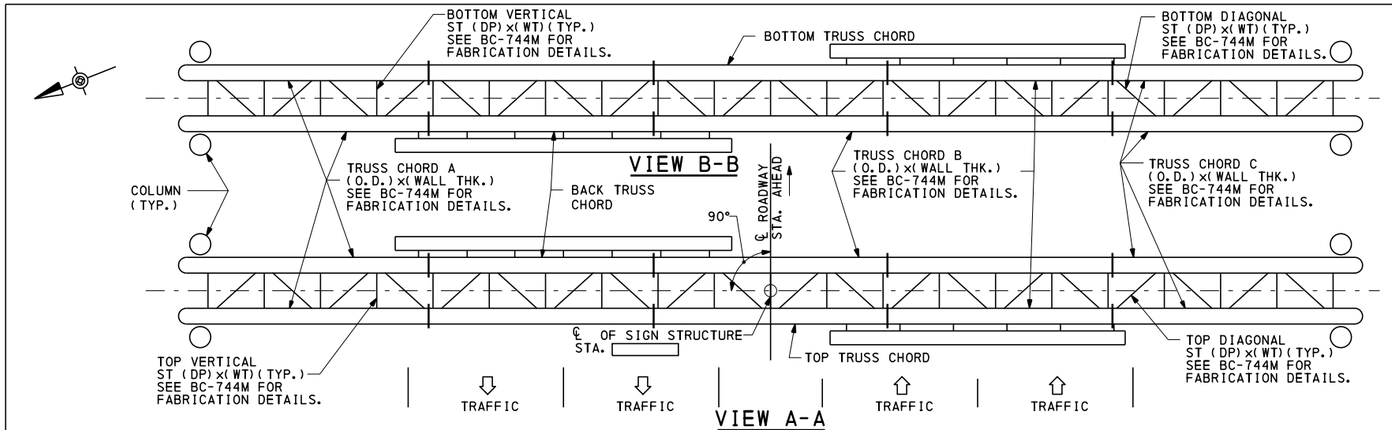
DESIGN TABLES
LOADING TYPE 2

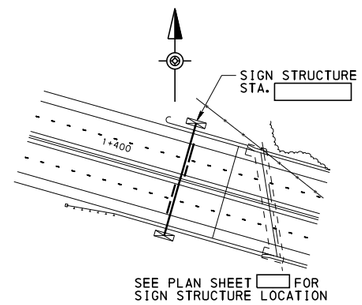
RECOMMENDED AUG. 4, 2017
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
DIRECTOR, BUR. OF PROJECT DELIVERY

SHT. 7 OF 13

BD-644M

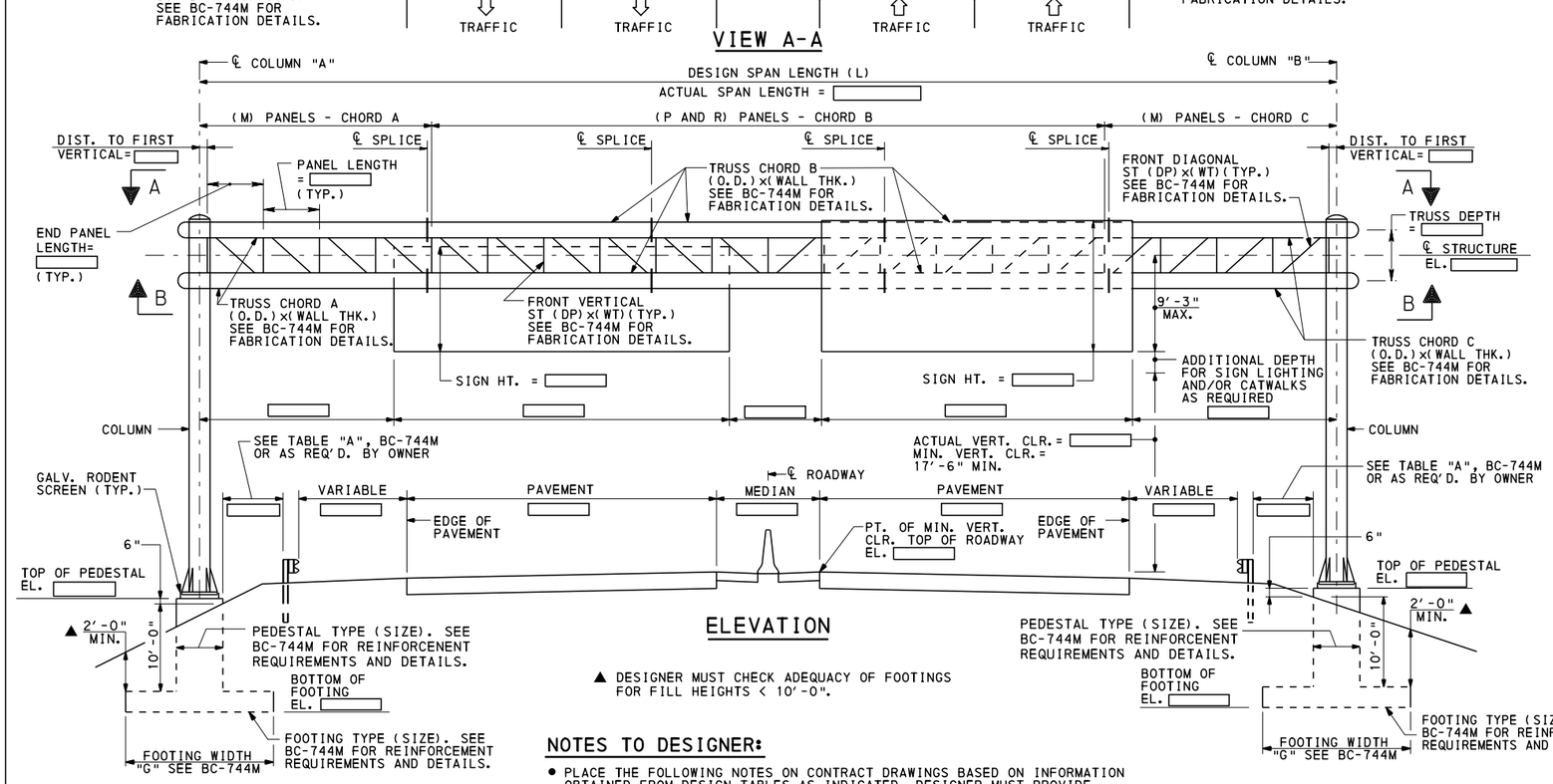




LOCATION PLAN

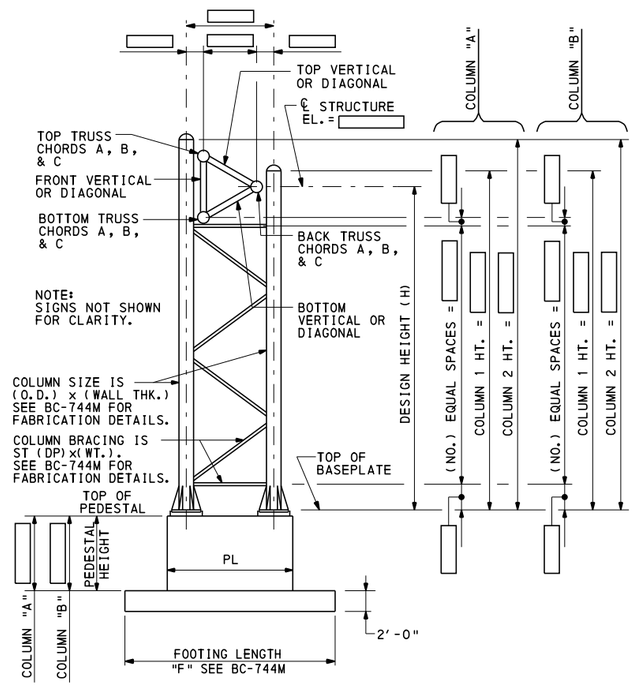
DESIGN CRITERA	
SIGN AREA (A) =	
SPAN LENGTH (L) =	
STRUCTURE HEIGHT (H) =	
LOADING TYPE=	(1 OR 2)
FATIGUE CATEGORY=	

NOTE:
DESIGN FOR ACTUAL, ACTUAL INCREASED BY 25%, OR ACTUAL INCREASED BY 50% SIGN AREA.
(DESIGNER TO INDICATE CONTROLLING CONDITION)



ELEVATION

▲ DESIGNER MUST CHECK ADEQUACY OF FOOTINGS FOR FILL HEIGHTS < 10'-0".



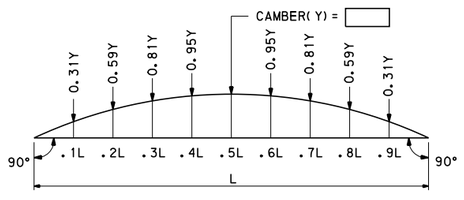
END VIEW

NOTES TO DESIGNER:

- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED. DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES.
  1. PEDESTAL TYPE (SIZE). SEE BC-744M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  2. FOOTING TYPE (SIZE). SEE BC-744M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  3. COLUMN SIZE IS (O.D.) x (WALLTHK.). SEE BC-744M FOR FABRICATION DETAILS.
  4. COLUMN BRACING IS ST (DP)x(WT.). SEE BC-744M FOR FABRICATION DETAILS.
  5. TRUSS CHORD A (O.D.) x (WALLTHK.), TRUSS CHORD B (O.D.) x (W.THK.), AND TRUSS CHORD C (O.D.) x (WALLTHK.). SEE BC-744M FOR FABRICATION DETAILS.
  6. FRONT DIAGONALS ST (DP)x(WT) AND FRONT VERTICALS ST (DP)x(WT); TOP DIAGONALS ST (DP)x(WT) AND TOP VERTICALS ST (DP)x(WT); BOTTOM DIAGONALS ST (DP)x(WT) AND BOTTOM VERTICALS ST (DP)x(WT). SEE BC-744M FOR FABRICATION DETAILS.
- PLACE CAMBER DIAGRAM ON CONTRACT DRAWINGS AND SPECIFY REQUIRED CAMBER FROM CAMBER TABLE.
- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH ☐
- DESIGNER TO PROVIDE DIMENSIONS ON CONTRACT DRAWINGS.

TABLE OF ESTIMATED QUANTITIES			
ITEM NO.	ITEM	UNIT	QUANTITY
*	STEEL SIGN STRUCTURE	LBS	
0000-0000	STRUCTURE MOUNTED SIGNS	SF	
0000-0000	CLASS 3 EXCAVATION	CY	
0000-0000	CLASS A CEMENT CONCRETE	CY	
0000-0000	REINFORCEMENT BARS	LBS	

* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. 9948-0106.



CAMBER DIAGRAM

NOTE: PRIOR TO SHIPMENT OF TRUSS STRUCTURE TO THE SITE, SHOP ASSEMBLE TRUSSES IN AN UPRIGHT POSITION AND CHECK TRUSS CAMBER.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

4 POST TRI-CHORD TRUSS
SPANS FROM 60' TO 240'

SAMPLE CONTRACT DRAWING

RECOMMENDED AUG. 4, 2017 Thomas P. Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brenda S. Thomas DIRECTOR, BUR. OF PROJECT DELIVERY	SHT. 8 OF 13 BD-644M

LOADING TYPE 1

DESIGN SPAN	SIGN AREA (SQ.FT.)	TRUSS MEMBERS: CHORDS (PIPE NOMINAL SIZE x WALL THK.)** A	CHORDS B	CHORDS C	DIAGONALS▲ FRONT	DIAGONALS▲ TOP & BOTTOM	VERTICALS▲ FRONT	VERTICALS▲ TOP & BOTTOM	TOWER MEMBERS: H TO 12′ COLUMN **	H TO 12′ BRACING▲	H OVER 12′ TO 18′ COLUMN **	H OVER 12′ TO 18′ BRACING▲	H OVER 18′ TO 24′ COLUMN **	H OVER 18′ TO 24′ BRACING▲	H OVER 24′ TO 33′ COLUMN **	H OVER 24′ TO 33′ BRACING▲	FOUNDATION: H TO 12′ PED. TYPE	H TO 12′ FTG.	H OVER 12′ TO 18′ PED. TYPE	H OVER 12′ TO 18′ FTG.	H OVER 18′ TO 24′ PED. TYPE	H OVER 18′ TO 24′ FTG.	H OVER 24′ TO 33′ PED. TYPE	H OVER 24′ TO 33′ FTG.
TO 60′	125	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	1.5x3.75	1.5x2.85	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	612	FP122	612	FP126	614	FP131	714
	250	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	2.0x4.75	1.5x3.75	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	614	FP122	614	FP126	716	FP131	716
	375	6x.432 *	6x.432 *	6x.432 *	1.5x2.85	1.5x3.75	3.0x8.625	3.0x6.25	8x.322 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.0x4.75	FP116	716	FP122	716	FP126	718	FP131	818
	500	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x3.85	3.0x8.625	4.0x11.5	10x.365 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x4.75	20x.375 *	2.5x5.0	FP122	716	FP122	718	FP126	820	FP131	820
	625	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x3.85	3.0x8.625	6.0x15.9	10x.365 *	2.0x3.85	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	3.0x8.625	FP122	718	FP122	820	FP126	820	FP131	922
	750	8x.500	8x.500 *	8x.500	2.5x5.0	2.0x3.85	3.0x8.625	6.0x20.4	10x.365 *	2.0x4.75	12x.375	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	820	FP122	820	FP126	1119	FP131	1024
	875	8x.500	8x.500 *	8x.500	3.0x8.625	2.0x3.85	3.0x8.625	6.0x25.0	12x.375 *	2.0x4.75	14x.375 *	3.0x8.625	16x.375	3.0x8.625	24x.375 *	3.0x8.625	FP122	820	FP126	922	FP126	924	FP136	924
	1000	10x.500	10x.365 *	10x.500	3.0x8.625	2.0x3.85	3.0x8.625	9.0x27.35	12x.375 *	3.0x8.625	14x.375	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	820	FP126	1119	FP131	1221	FP136	1026
	1100	10x.500	10x.365 *	10x.500	3.0x8.625	2.0x4.75	4.0x11.5	9.0x27.35	12x.375 *	3.0x8.625	14x.375	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	820	FP126	1119	FP131	1221	FP136	1323
OVER 60′ TO 70′	175	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x2.85	1.5x3.75	1.5x2.85	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	613	FP122	613	FP126	615	FP131	715
	300	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x3.75	2.0x4.75	1.5x3.75	8x.322 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	615	FP122	717	FP126	717	FP131	819
	425	6x.432 *	6x.432 *	6x.432 *	2.0x3.85	1.5x3.75	2.0x4.75	3.0x6.25	8x.322 *	2.0x4.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.0x4.75	FP116	717	FP122	717	FP126	719	FP131	819
	550	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	4.0x11.5	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.5x5.0	20x.375 *	2.5x5.0	FP122	717	FP122	719	FP126	821	FP131	821
	675	8x.500	8x.322	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	6.0x15.9	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.5x5.0	20x.375 *	3.0x8.625	FP122	719	FP122	821	FP126	1118	FP131	923
	800	8x.500	8x.500 *	8x.500	3.0x8.625	2.0x4.75	3.0x8.625	6.0x20.4	10x.365	2.0x4.75	14x.375 *	3.0x8.625	16x.375	3.0x8.625	20x.375	3.0x8.625	FP122	821	FP126	1118	FP126	1120	FP131	1025
	925	10x.500	10x.365 *	10x.500	3.0x8.625	2.0x4.75	3.0x8.625	6.0x25.0	12x.375 *	3.0x8.625	14x.375	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	821	FP126	1118	FP131	1120	FP136	1025
	1050	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	3.0x8.625	9.0x27.35	12x.375*	3.0x8.625	16x.375 *	3.0x8.625	18x.375	3.0x8.625	24x.375 *	3.0x8.625	FP122	821	FP126	1120	FP131	1222	FP136	1324
	1175	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	12x.375	3.0x8.625	16x.375 *	3.0x8.625	18x.375	3.0x8.625	24x.375 *	3.0x8.625	FP122	1118	FP126	1120	FP131	1222	FP136	1324
	1295	10x.500	10x.365	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	12x.375	4.0x11.5	16x.375 *	4.0x9.2	18x.375	4.0x9.2	24x.375 *	4.0x9.2	FP122	1118	FP126	1120	FP131	1222	FP136	1324

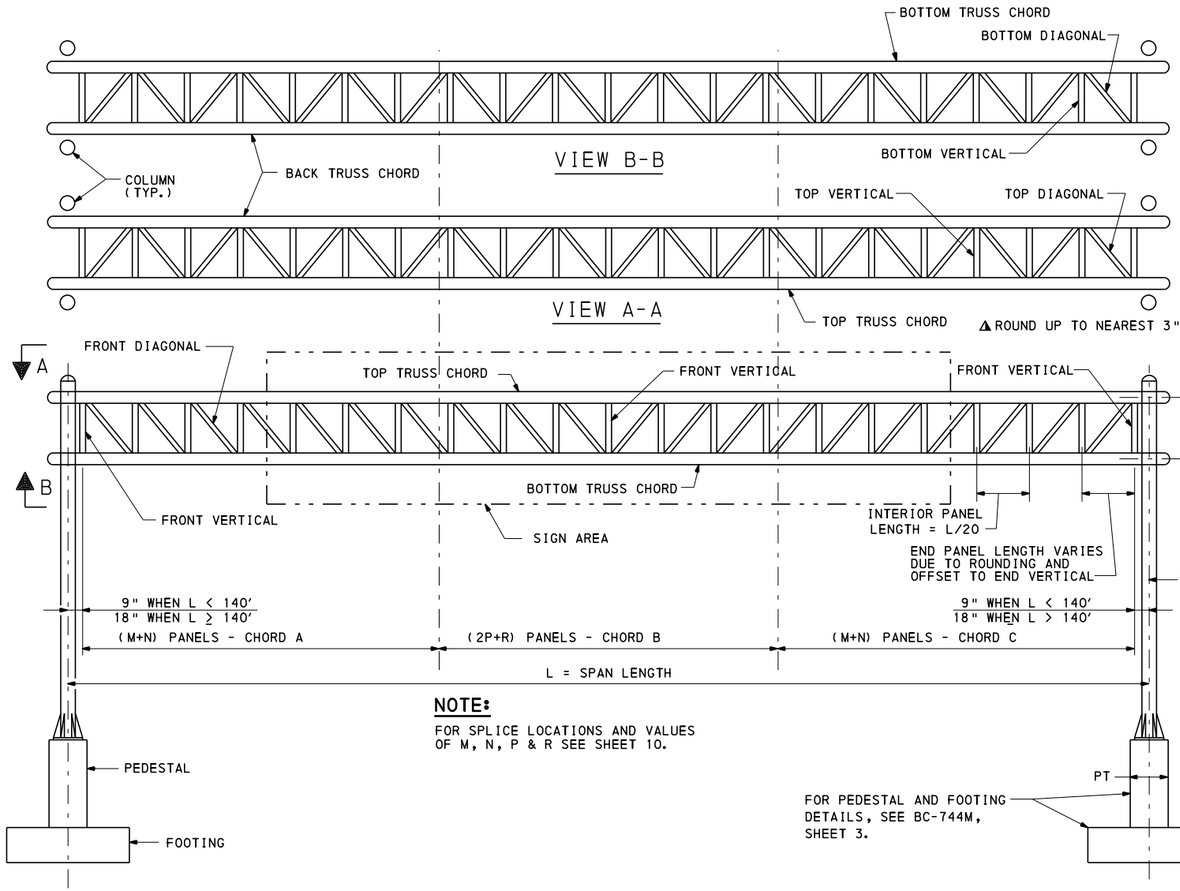
FOR CONTINUATION OF CHART, SEE SHEETS 10 AND 11.

PED. TYPE - INDICATES FOUNDATION PEDESTAL TYPE.

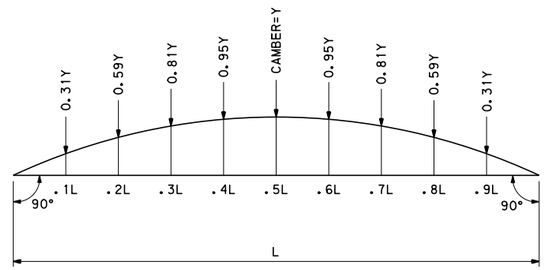
* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

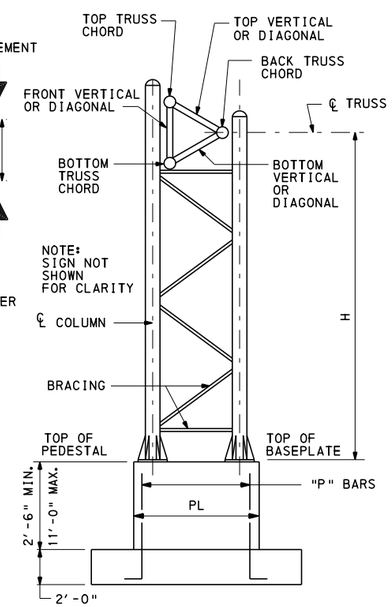
▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).



CAMBER TABLE			
SPAN	CAMBER (IN.)	SPAN	CAMBER (IN.)
60′	1.66	120′	3.67
70′	1.94	140′	4.53
80′	2.41	160′	5.21
90′	2.71	180′	6.13
100′	2.90	200′	7.47



CAMBER DIAGRAM



NOTES:

- FOR GENERAL NOTES, SEE SHEET 1.
- FOR GENERAL DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
- ONE OR MORE SPLICES IN THE TRUSS MAY BE ADDED OR ELIMINATED AT THE OPTION OF THE FABRICATOR. IN CASE OF THE ADDITION OR ELIMINATION OF SPLICES, THE HEAVIER CHORD MATERIAL MUST BE EXTENDED TOWARD THE LIGHTER CHORD MATERIAL TO THE DESIRED SPLICE LOCATION.
- "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH (FOR EXAMPLE, FOOTING TYPE 612 INDICATES A FOOTING 6′-0" WIDE x 12′-0" LONG). SEE BC-744M, SHEET 3 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10′-0".
- FOR STRUCTURAL DETAILS, SEE BC-744M.
- CVN REQUIRED FOR COLUMN AND CHORD WALL THICKNESSES EXCEEDING 1/2" (0.500").

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST TRI-CHORD TRUSS
SPANS FROM 60′ TO 240′

DESIGN TABLES
LOADING TYPE 1

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 9 OF 13
Thomas P Macioce	Brent D. Thompson	BD-644M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	

LOADING TYPE 1 (CONTINUED)

DESIGN SPAN	SIGN AREA (SQ.FT.)	TRUSS MEMBERS: CHORDS (PIPE NOMINAL SIZE x WALL THK.)** A	CHORDS B	CHORDS C	DIAGONALS▲ FRONT	DIAGONALS▲ TOP & BOTTOM	VERTICALS▲ FRONT	VERTICALS▲ TOP & BOTTOM	TOWER MEMBERS: H TO 12' COLUMN **	H TO 12' BRACING▲	H OVER 12' TO 18' COLUMN **	H OVER 12' TO 18' BRACING▲	H OVER 18' TO 24' COLUMN **	H OVER 18' TO 24' BRACING▲	H OVER 24' TO 33' COLUMN **	H OVER 24' TO 33' BRACING▲	FOUNDATION: H TO 12' PED. TYPE	H TO 12' FTG.	H OVER 12' TO 18' PED. TYPE	H OVER 12' TO 18' FTG.	H OVER 18' TO 24' PED. TYPE	H OVER 18' TO 24' FTG.	H OVER 24' TO 33' PED. TYPE	H OVER 24' TO 33' FTG.
OVER 70' TO 80'	150	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x2.85	1.5x3.75	1.5x2.85	8x.322 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.0x4.75	FP116	613	FP122	613	FP126	615	FP131	715
	300	5x.375 *	5x.375 *	5x.375 *	2.0x3.85	1.5x3.75	2.0x4.75	2.0x4.75	8x.322 *	2.0x3.85	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.5x5.0	FP116	615	FP122	717	FP126	717	FP131	819
	450	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	5.0x12.7	10x.365 *	2.0x3.85	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	3.0x8.625	FP122	717	FP122	819	FP126	821	FP131	921
	600	8x.500	8x.500 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	5.0x12.7	10x.365 *	2.0x4.75	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	819	FP122	821	FP126	1118	FP131	923
	750	10x.500	10x.365 *	10x.500	2.0x3.85	3.0x8.625	3.0x8.625	6.0x15.9	10x.365 *	3.0x8.625	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	4.0x11.5	FP122	821	FP126	821	FP126	1120	FP131	1025
	900	10x.500	10x.365 *	10x.500	2.0x4.75	3.0x8.625	4.0x11.5	6.0x25.0	12x.375 *	3.0x8.625	14x.375 *	3.0x8.625	18x.375 *	4.0x11.5	24x.375 *	4.0x11.5	FP122	821	FP126	923	FP131	1120	FP136	1025
	1050	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	3.0x8.625	7.5x25.0	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	18x.375	4.0x11.5	24x.375 *	4.0x11.5	FP122	1118	FP126	1120	FP131	1222	FP136	1324
	1200	12x.500	12x.375 *	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	12x.375	3.0x8.625	16x.375	3.0x8.625	20x.375 *	4.0x9.2	24x.375 *	5.0x12.7	FP122	1120	FP126	1222	FP131	1027	FP136	1324
	1350	12x.500	12x.375	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	14x.375 *	3.0x8.625	16x.375	3.0x8.625	20x.375 *	4.0x9.2	24x.375	5.0x12.7	FP126	1120	FP126	1222	FP131	1027	FP136	1324
	1480	12x.500	12x.375	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	14x.375	3.0x8.625	18x.375 *	3.0x8.625	20x.375	4.0x9.2	24x.375	5.0x12.7	FP126	1120	FP131	1222	FP131	1222	FP136	1324
OVER 80' TO 90'	150	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x3.75	2.0x4.75	1.5x2.85	8x.322 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.5x5.0	FP116	613	FP122	615	FP126	615	FP131	715
	300	6x.432 *	6x.432 *	6x.432 *	2.0x3.85	1.5x3.75	3.0x8.625	2.0x4.75	8x.322 *	2.0x3.85	12x.375 *	2.0x3.85	16x.375 *	2.5x5.0	20x.375 *	2.5x5.0	FP116	615	FP122	717	FP126	717	FP131	819
	450	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	5.0x12.7	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	717	FP122	719	FP126	821	FP231	821
	600	8x.500	8x.500 *	8x.500	2.0x3.85	2.0x4.75	4.0x11.5	5.0x12.7	10x.365 *	2.0x4.75	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	819	FP122	821	FP126	821	FP231	923
	750	10x.500	10x.365 *	10x.500	2.0x3.85	3.0x8.625	4.0x11.5	6.0x15.9	10x.365 *	4.0x9.2	14x.375 *	4.0x9.2	16x.375 *	4.0x9.2	20x.375 *	4.0x11.5	FP122	821	FP126	1118	FP226	1120	FP231	1025
	900	10x.500	10x.365	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	6.0x25.0	12x.375 *	4.0x9.2	14x.375	4.0x9.2	18x.375 *	4.0x11.5	24x.375 *	4.0x11.5	FP222	821	FP126	1120	FP131	1120	FP136	1027
	1050	12x.500	12x.375 *	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	12x.375 *	4.0x9.2	16x.375 *	4.0x9.2	18x.375	4.0x11.5	24x.375 *	4.0x11.5	FP222	1118	FP226	1120	FP131	1222	FP136	1324
	1200	12x.500	12x.375	12x.500	4.0x11.5	3.0x8.625	4.0x11.5	9.0x27.35	12x.375	4.0x9.2	16x.375	4.0x9.2	20x.375 *	4.0x9.2	24x.375 *	5.0x12.7	FP222	1120	FP226	1222	FP231	1222	FP136	1324
	1350	12x.500	12x.500 *	12x.500	4.0x11.5	3.0x8.625	5.0x17.5	9.0x27.35	14x.375	4.0x11.5	18x.375 *	4.0x11.5	20x.375	5.0x12.7	24x.375	5.0x12.7	FP126	1120	FP131	1222	FP231	1324	FP136	1426
	1500	12x.500	12x.500 *	12x.500	4.0x11.5	3.0x8.625	5.0x17.5	9.0x27.35	14x.375	5.0x12.7	18x.375 *	4.0x11.5	20x.375	5.0x12.7	—	—	FP126	1222	FP131	1222	FP231	1027	—	—
	1665	12x.500	12x.500 *	12x.500	4.0x11.5	3.0x8.625	5.0x17.5	9.0x27.35	16x.375 *	5.0x12.7	18x.375	4.0x11.5	20x.375	5.0x12.7	—	—	FP226	1222	FP131	1222	FP231	1324	—	—
OVER 90' TO 100'	200	6x.432 *	6x.432 *	6x.432 *	2.0x4.75	2.0x4.75	3.0x6.25	2.5x5.0	10x.365 *	3.0x6.25	12x.375 *	3.0x6.25	16x.375 *	3.0x6.25	24x.375 *	3.0x6.25	FP122	614	FP222	616	FP226	718	FP136	718
	350	6x.432 *	6x.432	6x.432 *	2.5x5.0	2.0x4.75	4.0x11.5	3.0x6.25	10x.365 *	3.0x6.25	12x.375 *	3.0x6.25	16x.375 *	3.0x6.25	24x.375 *	3.0x6.25	FP122	717	FP222	718	FP226	820	FP136	820
	500	8x.500	8x.500 *	8x.500	3.0x6.25	2.5x5.0	4.0x11.5	3.0x8.625	10x.365 *	3.0x6.25	12x.375 *	3.0x6.25	16x.375 *	3.0x6.25	24x.375 *	3.0x8.625	FP222	718	FP222	820	FP226	822	FP136	922
	650	10x.500	10x.365 *	10x.500	3.0x6.25	3.0x6.25	4.0x11.5	4.0x9.2	10x.365 *	3.0x6.25	14x.375 *	3.0x6.25	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP222	820	FP226	822	FP231	1119	FP236	924
	800	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	12x.375 *	4.0x9.2	14x.375 *	4.0x9.2	18x.375 *	4.0x9.2	24x.375 *	4.0x11.5	FP222	1017	FP226	1119	FP231	1121	FP236	1026
	950	12x.500	12x.375 *	12x.500	4.0x11.5	4.0x11.5	5.0x17.5	4.0x11.5	12x.375 *	4.0x9.2	16x.375 *	4.0x11.5	20x.375 *	4.0x9.2	24x.375 *	4.0x11.5	FP222	1119	FP226	924	FP231	924	FP236	1223
	1100	12x.500	12x.500 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	5.0x17.5	14x.375 *	4.0x11.5	16x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x12.7	FP226	1119	FP226	1121	FP231	1026	FP236	1325
	1250	12x.500	12x.500 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	5.0x17.5	14x.375 *	4.0x11.5	18x.375 *	5.0x12.7	24x.375 *	5.0x12.7	24x.375 *	5.0x12.7	FP226	924	FP231	1223	FP236	1223	FP236	1325
	1400	14x.500	14x.500 *	14x.500	4.0x11.5	4.0x11.5	5.0x17.5	5.0x17.5	16x.375 *	4.0x11.5	18x.375 *	5.0x12.7	24x.375 *	5.0x12.7	—	—	FP226	1121	FP231	1223	FP236	1028	—	—
	1550	14x.500	14x.500 *	14x.500	5.0x12.7	5.0x12.7	6.0x20.4	5.0x17.5	18x.375 *	5.0x12.7	20x.375 *	5.0x12.7	24x.375 *	5.0x12.7	24x.500 *	5.0x17.5	FP231	1223	FP231	1223	FP236	1325	FP236	1327
	1700	14x.500	14x.500 *	14x.500	5.0x12.7	5.0x12.7	6.0x25.0	5.0x17.5	20x.375 *	5.0x12.7	24x.375 *	5.0x12.7	—	—	24x.500 *	5.0x17.5	FP231	1221	FP236	1127	—	—	FP236	1327
	1850	16x.500	16x.500 *	16x.500	5.0x17.5	5.0x17.5	6.0x25.0	6.0x15.9	20x.375 *	5.0x12.7	24x.375 *	5.0x12.7	—	—	24x.500 *	5.0x17.5	FP231	1125	FP236	1325	—	—	FP236	1429
OVER 100' TO 120'	300	8x.500	8x.322 *	8x.500	2.5x5.0	2.0x4.75	4.0x11.5	3.0x6.25	10x.365 *	3.0x8.625	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	24x.375 *	4.0x11.5	FP222	717	FP226	719	FP226	719	FP236	821
	600	10x.500	10x.365 *	10x.500	3.0x6.25	3.0x6.25	4.0x11.5	4.0x9.2	14x.375 *	3.0x8.625	14x.375 *	4.0x11.5	16x.375 *	4.0x11.5	24x.375 *	4.0x9.2	FP226	1016	FP226	1018	FP226	1120	FP236	925
	900	12x.500	12x.375	12x.500	4.0x11.5	4.0x11.5	5.0x17.5	4.0x11.5	14x.375 *	4.0x9.2	16x.375 *	4.0x11.5	18x.375 *	4.0x11.5	24x.375 *	5.0x12.7	FP226	1120	FP226	1120	FP231	1122	FP236	1027
	1200	14x.500	14x.500 *	14x.500	4.0x11.5	4.0x11.5	5.0x17.5	5.0x17.5	14x.375	5.0x12.7	16x.375	5.0x12.7	20x.375 *	5.0x12.7	24x.375 *	5.0x12.7	FP226	1120	FP226	1122	FP231	1324	FP236	1326
	1500	16x.500	16x.500 *	16x.500	5.0x12.7	5.0x12.7	6.0x25.0	5.0x17.5	18x.375 *	5.0x12.7	20x.375 *	5.0x12.7	24x.375 *	5.0x12.7	24x.375	5.0x17.5	FP231	1224	FP231	1027	FP236	1029	FP236	1428
	1800	18x.500	18x.500 *	18x.500	5.0x17.5	5.0x17.5	6.0x25.0	6.0x15.9	24x.375 *	6.0x20.4	24x.375 *	6.0x20.4	24x.375 *	6.0x20.4	24x.500	6.0x20.4	FP236	1324	FP236	1326	FP236	1428	FP236	1430
	2100	18x.500	18x.500 *	18x.500	6.0x15.9	5.0x17.5	6.0x25.0	6.0x25.0	24x.375 *	6.0x20.4	24x.375 *	6.0x20.4	24x.375	6.0x20.4	—	—	FP236	1324	FP236	1326	FP236	1428	—	—
	2220	18x.500	18x.500 *	18x.500	6.0x15.9	6.0x15.9	6.0x25.0	6.0x25.0	24x.375 *	6.0x20.4	24x.375 *	6.0x20.4	—	—	—	—	FP236	1324	FP236	1326	—	—	—	—
OVER 120' TO 140'	300	8x.500	8x.322 *	8x.500	2.5x5.0	3.0x8.625	4.0x11.5	3.0x6.25	10x.365 *	3.0x8.625	14x.375 *	4.0x11.5	16x.375 *	4.0x9.2	24x.375 *	4.0x9.2	FP222	717	FP226	719	FP326	720	FP336	822
	600	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	4.0x9.2	12x.375 *	4.0x9.2	14x.375 *	4.0x11.5	16x.375 *	5.0x12.7	24x.375 *	5.0x12.7	FP226	1017	FP226	1019	FP326	1121	FP336	926
	900	12x.500	12x.500 *	12x.500	4.0x9.2	4.0x11.5	5.0x17.5	4.0x11.5	16x.375 *	5.0x12.7	16x.375 *	5.0x12.7	18x.375 *	5.0x12.7	24x.375 *	5.0x12.7	FP326	1121	FP326	925	FP331	1123	FP336	1028
	1200	14x.500	14x.500 *	14x.500	4.0x11.5	4.0x11.5	5.0x17.5	5.0x17.5	16x.375 *	5.0x12.7	18x.375 *	5.0x12.7	20x.375 *	5.0x17.5	24x.375	5.0x17.5	FP326	1121	FP331	1123	FP331	1028	FP336	1030
	1500	16x.500	16x.500 *	16x.500	5.0x12.7	5.0x17.5	6.0x25.0	5.0x17.5	18x.375 *	5.0x17.5	20x.375 *	5.0x17.5	24x.375 *	6.0x15.9	—	—	FP331	1223	FP331	1325	FP336	1327	—	—
	1800	18x.500	18x.500 *	18x.500	5.0x17.5	5.0x17.5	6.0x25.0	6.0x20.4	20x.375 *	5.0x17.5	24x.375 *	6.0x15.9	24x.375	6.0x20.4	24x.500	6.0x20.4	FP331	1325	FP336	1327	FP336	1327	FP436	1431
	2100	18x.500	18x.500 *	18x.500	6.0x15.9	5.0x17.5	6.0x25.0	6.0x25.0	24x.375 *	6.0x15.9	24x.375 *	6.0x17.5	—	—	—	—	FP336	1425	FP336	1327	—	—	—	—
	2400	18x.500	18x.500	18x.500	6.0x15.9	6.0x15.9	6.0x25.0	6.0x25.0	24x.375 *	6.0x17.5	24x.375	6.0x25.0	—	—	—	—	FP336	1425	FP336	1429	—	—	—	—

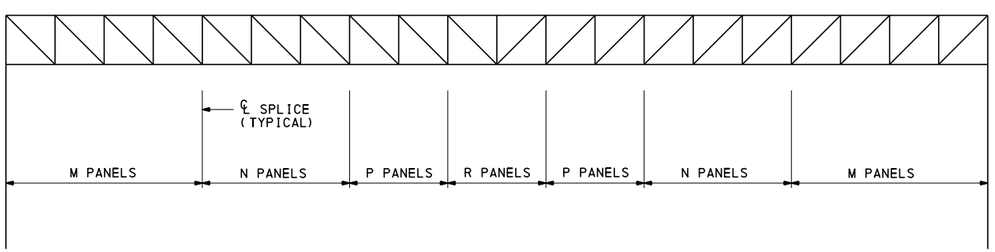
PED. TYPE - INDICATES FOUNDATION PEDESTAL TYPE.

FOR CONTINUATION OF CHART, SEE SHEET 11.

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).



ACTUAL SPAN (FEET)	DESIGN SPAN (FEET)	NUMBER OF SPLICES	NO. OF PANELS M	N	P	R
UP TO 60	60	2	7	0	0	6
60+ TO 70	70	2	7	0	0	6
70+ TO 80	80	2	7	0	0	6
80+ TO 90	90	2	7	0	0	6
90+ TO 100	100	2	7	0	0	6
100+ TO 120	120	3	6	0	4	0
120+ TO 140	140	3	5	0	5	0
140+ TO 160	160	3	5	0	5	0
160+ TO 180	180	4	4	0	4	4
180+ TO 200	200	4	4	0	4	4
200+ TO 220	220	6	3	3	3	2
220+ TO 240	240	6	3	3	3	2

▨ - STRUCTURES WITH A DESIGN SPAN LENGTH GREATER THAN 200' MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE CHIEF BRIDGE ENGINEER FOR REVIEW AND APPROVAL. MEMBERS SIZES INDICATED IN DESIGN TABLES MAYBE USED AS PRELIMINARY MEMBER SIZES.

NOTES:

FOR DESIGN TABLE NOTES, SEE SHEET 9.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST TRI-CHORD TRUSS
SPANS FROM 60' TO 240'

DESIGN TABLES
LOADING TYPE 1

RECOMMENDED AUG. 4, 2017
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
Brian S. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

BD-644M

LOADING TYPE 1 (CONTINUED)

DESIGN SPAN	SIGN AREA	TRUSS MEMBERS							TOWER MEMBERS								FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.)**			DIAGONALS▲		VERTICALS▲		H TO 12′		H OVER 12′ TO 18′		H OVER 18′ TO 24′		H OVER 24′ TO 33′		H TO 12′		H OVER 12′ TO 18′		H OVER 18′ TO 24′		H OVER 24′ TO 33′	
	(SQ.FT.)	A	B	C	FRONT	TOP & BOTTOM	FRONT	TOP & BOTTOM	COLUMN **	BRACING▲	COLUMN **	BRACING▲	COLUMN **	BRACING▲	COLUMN **	BRACING▲	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.
OVER 140′ TO 160′	300	14x.500	14x.375 *	14x.500	4.0x11.5	4.0x11.5	5.0x12.7	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	FP326	720	FP331	821	FP331	822	FP436	824
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	5.0x17.5	5.0x12.7	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP326	1018	FP331	1020	FP331	925	FP436	1028
	900	16x.500	16x.500 *	16x.500	4.0x11.5	5.0x17.5	6.0x25.0	5.0x17.5	16x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	6.0x25.0	FP326	1122	FP331	1122	FP331	1028	FP436	1030
	1200	20x.500	20x.500 *	20x.500	4.0x11.5	6.0x17.5	9.0x35.0	6.0x20.4	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	—	—	FP331	1224	FP431	1225	FP436	1225	—	—
	1500	20x.500	20x.500 *	20x.500	5.0x17.5	6.0x25.0	9.0x35.0	6.0x25.0	18x.375	4.0x11.5	20x.375	5.0x17.5	24x.375 *	6.0x25.0	—	—	FP331	1224	FP431	1225	FP436	1327	—	—
	1800	24x.500	24x.500 *	24x.500	5.0x17.5	6.0x25.0	9.0x35.0	7.5x25.0	20x.375	4.0x11.5	24x.375 *	5.0x17.5	24x.375	6.0x25.0	—	—	FP431	1225	FP436	1327	FP436	1329	—	—
OVER 160′ TO 180′	300	14x.500	14x.375 *	14x.500	4.0x11.5	5.0x12.7	5.0x17.5	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	FP426	822	FP431	1019	FP431	823	FP536	925
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	5.0x17.5	5.0x12.7	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP426	1019	FP431	1021	FP431	925	FP536	1225
	900	16x.500	16x.500 *	16x.500	4.0x11.5	5.0x17.5	6.0x25.0	5.0x17.5	16x.375 *	4.0x11.5	18x.375 *	5.0x17.5	20x.375 *	5.0x17.5	24x.375 *	6.0x25.0	FP426	1121	FP431	1123	FP431	1225	FP536	1327
	1200	20x.500	20x.500 *	20x.500	4.0x11.5	6.0x25.0	10.0x48.0	6.0x20.4	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	6.0x25.0	—	—	FP431	1224	FP431	1225	FP536	1327	—	—
	1500	24x.500	24x.500 *	24x.500	5.0x17.5	6.0x25.0	10.0x48.0	6.0x25.0	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	24x.375	6.0x25.0	—	—	FP431	1225	FP536	1327	FP536	1329	—	—
	1800	24x.500	24x.500	24x.500	5.0x17.5	6.0x25.0	10.0x48.0	7.5x25.0	24x.375 *	4.0x11.5	24x.375	5.0x17.5	—	—	—	—	FP536	1426	FP536	1327	—	—	—	—
OVER 180′ TO 200′	300	14x.500	14x.375 *	14x.500	4.0x11.5	5.0x12.7	5.0x17.5	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP426	1019	FP431	1019	FP431	923	FP536	926
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	6.0x25.0	5.0x12.7	14x.375 *	4.0x11.5	18x.375 *	5.0x17.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP426	1121	FP431	1123	FP431	926	FP536	1226
	900	16x.500	16x.500	16x.500	4.0x11.5	6.0x25.0	6.0x25.0	5.0x17.5	16x.375 *	4.0x11.5	18x.375	5.0x17.5	20x.375	5.0x17.5	24x.375	6.0x25.0	FP426	1122	FP431	1225	FP431	1226	FP536	1328
	1200	24x.500	24x.500 *	24x.500	6.0x25.0	6.0x25.0	10.0x48.0	6.0x25.0	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	24x.375 *	6.0x25.0	24x.500 *	6.0x25.0	FP531	1324	FP536	1226	FP536	1328	FP536	1330
OVER 200′ TO 220′	300	14x.500	14x.500 *	14x.500	4.0x11.5	6.0x25.0	6.0x25.0	5.0x17.5	14x.375 *	4.0x11.5	18x.375 *	5.0x17.5	20x.375 *	6.0x25.0	24x.375 *	5.0x17.5	FP526	1020	FP531	1122	FP531	925	FP636	1225
	600	18x.500	18x.500 *	18x.500	5.0x17.5	6.0x25.0	9.0x35.0	5.0x17.5	16x.375 *	5.0x17.5	18x.375 *	5.0x17.5	20x.375	6.0x25.0	24x.375 *	6.0x25.0	FP526	1122	FP531	1124	FP531	1224	FP636	1226
	900	20x.500	20x.500 *	20x.500	6.0x25.0	6.0x25.0	9.0x35.0	5.0x17.5	18x.375	5.0x17.5	20x.375	6.0x25.0	24x.375 *	6.0x25.0	26x.375	6.0x25.0	FP531	1224	FP531	1224	FP636	1226	FP438	1329
OVER 220′ TO 240′	300	18x.500	18x.500 *	18x.500	5.0x17.5	6.0x25.0	9.0x35.0	5.0x17.5	16x.375 *	5.0x17.5	18x.375 *	5.0x17.5	20x.375 *	6.0x25.0	24x.375 *	6.0x25.0	FP526	1121	FP531	1123	FP531	926	FP636	1225

PED. TYPE - INDICATES FOUNDATION PEDESTAL TYPE.

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).

▨ - STRUCTURES WITH A DESIGN SPAN LENGTH GREATER THAN 200′ MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE CHIEF BRIDGE ENGINEER FOR REVIEW AND APPROVAL. MEMBERS SIZES INDICATED IN DESIGN TABLES MAYBE USED AS PRELIMINARY MEMBER SIZES.

NOTES:

FOR DESIGN TABLE NOTES, SEE SHEET 9.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST TRI-CHORD TRUSS
SPANS FROM 60′ TO 240′

DESIGN TABLES
LOADING TYPE 1

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 11 OF 13
Thomas P Macioce	Bruce B Thompson	BD-644M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	

LOADING TYPE 2

DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS: CHORDS (PIPE NOMINAL SIZE x WALL THK.) ** A	CHORDS B	CHORDS C	DIAGONALS ▲ FRONT	DIAGONALS ▲ TOP & BOTTOM	VERTICALS ▲ FRONT	VERTICALS ▲ TOP & BOTTOM	TOWER MEMBERS: H TO 12' COLUMN **	H TO 12' BRACING ▲	H OVER 12' TO 18' COLUMN **	H OVER 12' TO 18' BRACING ▲	H OVER 18' TO 24' COLUMN **	H OVER 18' TO 24' BRACING ▲	H OVER 24' TO 33' COLUMN **	H OVER 24' TO 33' BRACING ▲	FOUNDATION: H TO 12' PED. TYPE	H TO 12' FTG.	H OVER 12' TO 18' PED. TYPE	H OVER 12' TO 18' FTG.	H OVER 18' TO 24' PED. TYPE	H OVER 18' TO 24' FTG.	H OVER 24' TO 33' PED. TYPE	H OVER 24' TO 33' FTG.
TO 60'	125	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	2.0x3.85	1.5x2.85	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	614	FP122	614	FP126	614	FP131	716
	250	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	3.0x8.625	2.0x4.75	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	614	FP122	716	FP126	718	FP131	818
	375	6x.432 *	6x.432 *	6x.432 *	2.0x3.85	2.0x4.75	3.0x8.625	3.0x8.625	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	2.0x4.75	FP122	718	FP122	718	FP126	820	FP131	820
	500	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	4.0x11.5	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	2.5x5.0	FP122	718	FP122	820	FP126	820	FP131	1219
	625	8x.500	8x.322 *	8x.500	2.0x4.75	2.0x4.75	3.0x8.625	6.0x20.4	10x.365 *	2.0x4.75	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	820	FP126	820	FP126	1119	FP131	922
	750	8x.500	8x.500 *	8x.500	3.0x8.625	2.0x4.75	3.0x8.625	6.0x20.4	12x.375 *	3.0x8.625	14x.375 *	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	820	FP126	1119	FP131	1119	FP136	924
	875	8x.500	8x.500 *	8x.500	3.0x8.625	2.0x4.75	4.0x11.5	7.5x25.0	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	1117	FP126	1119	FP131	924	FP136	1026
	930	10x.500	10x.365 *	10x.500	3.0x8.625	2.0x4.75	4.0x11.5	9.0x35.0	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	820	FP126	1119	FP131	922	FP136	1026
OVER 60' TO 70'	175	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x2.85	2.0x3.85	1.5x3.75	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	615	FP122	615	FP126	717	FP131	717
	300	5x.375 *	5x.375	5x.375 *	1.5x3.75	2.0x4.75	3.0x8.625	4.0x11.5	8x.322 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	2.0x4.75	FP116	717	FP122	717	FP126	719	FP131	819
	425	6x.432 *	6x.432 *	6x.432 *	2.0x3.85	2.0x4.75	3.0x8.625	5.0x17.5	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	2.5x5.0	FP122	717	FP122	719	FP126	821	FP131	923
	550	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	5.0x17.5	10x.365 *	2.0x4.75	12x.375	2.0x4.75	16x.375 *	2.5x5.0	20x.375 *	3.0x8.625	FP122	719	FP122	821	FP126	821	FP131	923
	675	8x.500	8x.322 *	8x.500	2.0x4.75	2.0x4.75	3.0x8.625	6.0x20.4	10x.365 *	3.0x8.625	14x.375 *	3.0x8.625	16x.375	3.0x8.625	20x.375	3.0x8.625	FP122	821	FP126	821	FP126	1120	FP131	1025
	800	8x.500	8x.500 *	8x.500	3.0x8.625	2.0x4.75	3.0x8.625	6.0x20.4	12x.375 *	3.0x8.625	14x.375	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	821	FP126	923	FP131	1120	FP136	925
	925	10x.500	10x.365 *	10x.500	3.0x8.625	2.0x4.75	4.0x11.5	7.5x25.0	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	821	FP126	1120	FP131	1222	FP136	1027
	1050	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x35.0	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP126	1118	FP126	1120	FP131	1025	FP136	1324
	1090	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x35.0	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP126	1118	FP126	1120	FP131	1025	FP136	1324
OVER 70' TO 80'	150	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x2.85	1.5x3.75	2.0x3.85	8x.322 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.0x4.75	FP116	615	FP122	615	FP126	717	FP131	717
	300	5x.375 *	5x.375 *	5x.375 *	2.0x3.85	1.5x3.75	4.0x11.5	5.0x12.7	10x.365 *	2.0x3.85	12x.375 *	2.0x3.85	16x.375 *	2.0x4.75	20x.375 *	2.5x5.0	FP122	717	FP122	719	FP126	719	FP131	821
	450	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	5.0x12.7	10x.365 *	2.5x5.0	12x.375 *	2.0x4.75	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	719	FP122	821	FP126	821	FP131	923
	600	8x.500	8x.500 *	8x.500	2.0x3.85	2.0x4.75	5.0x17.5	6.0x20.4	10x.365 *	3.0x8.625	14x.375 *	3.0x8.625	16x.375	3.0x8.625	20x.375	3.0x8.625	FP122	821	FP126	821	FP126	1120	FP131	1025
	750	10x.500	10x.365 *	10x.500	2.0x3.85	3.0x8.625	5.0x17.5	6.0x20.4	12x.375 *	3.0x8.625	14x.375	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	4.0x11.5	FP122	821	FP126	823	FP131	1120	FP136	1027
	900	10x.500	10x.365 *	10x.500	2.0x4.75	3.0x8.625	5.0x17.5	6.0x25.0	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	18x.375 *	4.0x11.5	24x.375 *	4.0x11.5	FP122	821	FP126	925	FP131	925	FP136	1027
	1050	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	7.5x25.0	12x.375	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	4.0x11.5	24x.375 *	4.0x11.5	FP122	923	FP126	1120	FP131	1025	FP136	1324
	1200	12x.500	12x.375 *	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	14x.375 *	3.0x8.625	18x.375 *	3.0x8.625	20x.375 *	4.0x9.2	24x.375 *	5.0x12.7	FP126	1120	FP131	1222	FP131	1027	FP136	1324
	1240	12x.500	12x.375 *	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	14x.375 *	3.0x8.625	18x.375 *	3.0x8.625	20x.375 *	4.0x9.2	24x.375 *	5.0x12.7	FP126	1120	FP131	1222	FP131	1027	FP136	1324
OVER 80' TO 90'	150	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x3.75	3.0x8.625	2.0x3.85	8x.322 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.0x3.85	20x.375 *	2.5x5.0	FP116	615	FP122	615	FP126	717	FP131	717
	300	6x.432 *	6x.432 *	6x.432 *	2.0x3.85	1.5x3.75	4.0x11.5	5.0x12.7	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.5x5.0	20x.375 *	2.5x5.0	FP122	717	FP122	719	FP126	821	FP131	821
	450	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	4.0x11.5	5.0x12.7	10x.365 *	2.0x4.75	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	719	FP122	821	FP126	821	FP231	923
	600	8x.500	8x.500 *	8x.500	2.0x3.85	2.0x4.75	5.0x17.5	6.0x20.4	12x.375 *	3.0x8.625	14x.375 *	3.0x8.625	16x.375	3.0x8.625	20x.375	3.0x8.625	FP122	821	FP126	821	FP126	823	FP231	1025
	750	10x.500	10x.365 *	10x.500	2.0x3.85	3.0x8.625	5.0x17.5	6.0x20.4	12x.375 *	4.0x9.2	14x.375	4.0x9.2	18x.375 *	4.0x9.2	24x.375 *	4.0x11.5	FP222	821	FP126	1120	FP131	1222	FP136	1027
	900	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	6.0x25.0	12x.375 *	4.0x9.2	16x.375 *	4.0x9.2	18x.375	4.0x11.5	24x.375 *	4.0x11.5	FP222	923	FP226	925	FP131	1222	FP136	1027
	1050	12x.500	12x.375 *	12x.500	3.0x8.625	3.0x8.625	5.0x17.5	9.0x27.35	14x.375 *	4.0x9.2	16x.375	4.0x9.2	20x.375 *	4.0x11.5	24x.375 *	4.0x11.5	FP126	1120	FP226	1222	FP231	1027	FP136	1324
	1200	12x.500	12x.375	12x.500	4.0x11.5	3.0x8.625	5.0x17.5	9.0x27.35	14x.375	4.0x9.2	18x.375 *	4.0x11.5	24x.375 *	4.0x9.2	—	—	FP126	1120	FP131	1222	FP136	1027	—	—
	1350	12x.500	12x.500 *	12x.500	4.0x11.5	3.0x8.625	5.0x17.5	9.0x27.35	16x.375 *	4.0x11.5	18x.375 *	4.0x11.5	24x.375 *	5.0x12.7	—	—	FP226	1222	FP131	1222	FP136	1027	—	—
	1400	12x.500	12x.500 *	12x.500	4.0x11.5	3.0x8.625	5.0x17.5	9.0x27.35	16x.375 *	4.0x11.5	18x.375 *	4.0x11.5	24x.375 *	5.0x12.7	—	—	FP226	1222	FP131	1222	FP136	1027	—	—
TO 100'	200	6x.432 *	6x.432 *	6x.432 *	2.0x4.75	2.0x4.75	3.0x6.25	2.5x5.0	10x.365 *	3.0x6.25	12x.375 *	3.0x6.25	16x.375 *	3.0x6.25	24x.375 *	3.0x6.25	FP122	616	FP222	718	FP226	718	FP136	820
	350	6x.432 *	6x.432	6x.432 *	2.5x5.0	2.0x4.75	4.0x11.5	4.0x11.5	10x.365 *	3.0x6.25	12x.375 *	3.0x6.25	16x.375 *	3.0x6.25	24x.375 *	3.0x6.25	FP122	718	FP222	720	FP226	822	FP136	822
	500	8x.500	8x.500 *	8x.500	3.0x6.25	3.0x6.25	4.0x11.5	5.0x12.7	10x.365 *	3.0x8.625	12x.375	3.0x8.625	16x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP222	720	FP222	822	FP226	924	FP136	924
	650	10x.500	10x.365 *	10x.500	3.0x6.25	3.0x6.25	4.0x11.5	5.0x12.7	12x.375 *	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	24x.375 *	4.0x11.5	FP222	822	FP226	822	FP231	926	FP236	1026
	800	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	5.0x17.5	12x.375 *	4.0x11.5	16x.375 *	4.0x11.5	18x.375 *	4.0x11.5	24x.375 *	4.0x11.5	FP222	822	FP226	926	FP231	1223	FP236	1028
	950	12x.500	12x.375 *	12x.500	4.0x11.5	4.0x11.5	5.0x17.5	5.0x17.5	12x.375	4.0x11.5	16x.375 *	4.0x9.2	20x.375 *	4.0x9.2	24x.375 *	4.0x11.5	FP222	924	FP226	1121	FP231	1026	FP236	1028
	1100	12x.500	12x.500 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	6.0x20.4	14x.375	4.0x9.2	16x.375	4.0x11.5	20x.375 *	4.0x11.5	24x.375	4.0x11.5	FP226	924	FP226	1223	FP231	1028	FP236	1325
	1250	12x.500	12x.500 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	6.0x20.4	14x.375	4.0x11.5	18x.375 *	5.0x12.7	24x.375 *	5.0x12.7	24x.375	5.0x12.7	FP226	1121	FP231	1223	FP236	1028	FP236	1427
	1400	14x.500	14x.500 *	14x.500	4.0x11.5	4.0x11.5	5.0x17.5	6.0x20.4	16x.375 *	5.0x12.7	18x.375 *	5.0x12.7	24x.375 *	5.0x12.7	—	—	FP226	1223	FP231	1223	FP236	1028	—	—
	1550	14x.500	14x.500 *	14x.500	5.0x12.7	5.0x12.7	6.0x20.4	6.0x25.0	18x.375 *	5.0x12.7	20x.375 *	5.0x12.7	24x.375 *	5.0x12.7	24x.500 *	5.0x12.7	FP231	1223	FP231	1223	FP236	1130	FP236	1327

PED. TYPE - INDICATES FOUNDATION PEDESTAL TYPE.

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).

FOR CONTINUATION OF CHART, SEE SHEET 13.

NOTES:

FOR DESIGN TABLE NOTES, SEE SHEET 9.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST TRI-CHORD TRUSS
SPANS FROM 60' TO 240'

DESIGN TABLES
LOADING TYPE 2

RECOMMENDED AUG. 4, 2017
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
DIRECTOR, BUR. OF PROJECT DELIVERY

BD-644M

LOADING TYPE 2 (CONTINUED)

DESIGN SPAN	SIGN AREA (SQ.FT.)	TRUSS MEMBERS: CHORDS (PIPE NOMINAL SIZE x WALL THK.)** A	B	C	DIAGONALS▲ FRONT	DIAGONALS▲ TOP & BOTTOM	VERTICALS▲ FRONT	VERTICALS▲ TOP & BOTTOM	TOWER MEMBERS: H TO 12' COLUMN **	H TO 12' BRACING▲	H OVER 12' TO 18' COLUMN **	H OVER 12' TO 18' BRACING▲	H OVER 18' TO 24' COLUMN **	H OVER 18' TO 24' BRACING▲	H OVER 24' TO 33' COLUMN **	H OVER 24' TO 33' BRACING▲	FOUNDATION: H TO 12' PED. TYPE	H TO 12' FTG.	H OVER 12' TO 18' PED. TYPE	H OVER 12' TO 18' FTG.	H OVER 18' TO 24' PED. TYPE	H OVER 18' TO 24' FTG.	H OVER 24' TO 33' PED. TYPE	H OVER 24' TO 33' FTG.
OVER 100' TO 120'	300	8x.500	8x.322 *	8x.500	2.5x5.0	2.0x4.75	4.0x11.5	3.0x6.25	10x.365 *	3.0x8.625	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	24x.375 *	4.0x11.5	FP222	719	FP222	719	FP226	721	FP236	821
	600	10x.500	10x.365 *	10x.500	3.0x6.25	3.0x6.25	4.0x11.5	5.0x17.5	14x.375 *	3.0x8.625	14x.375 *	4.0x11.5	16x.375	4.0x11.5	24x.375 *	4.0x9.2	FP226	823	FP226	823	FP226	825	FP236	1027
	900	12x.500	12x.375 *	12x.500	4.0x11.5	4.0x11.5	5.0x17.5	6.0x17.5	14x.375 *	4.0x9.2	16x.375	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x12.7	FP226	925	FP226	927	FP231	1027	FP236	1029
	1200	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x12.7	5.0x17.5	6.0x20.4	16x.375 *	5.0x12.7	18x.375	5.0x12.7	24x.375 *	5.0x12.7	—	—	FP226	1122	FP231	1224	FP236	1029	—	—
	1500	16x.500	16x.500 *	16x.500	5.0x12.7	5.0x17.5	6.0x25.0	6.0x20.4	18x.375 *	5.0x12.7	20x.375 *	5.0x12.7	24x.375 *	5.0x12.7	24x.500 *	5.0x17.5	FP231	1224	FP231	1027	FP236	1131	FP236	1430
	1800	18x.500	18x.500 *	18x.500	5.0x17.5	5.0x17.5	6.0x25.0	6.0x20.4	24x.375 *	6.0x20.4	24x.375 *	6.0x20.4	24x.375 *	6.0x20.4	24x.500	6.0x20.4	FP236	1324	FP236	1326	FP236	1428	FP236	1430
	1865	18x.500	18x.500 *	18x.500	6.0x15.9	5.0x17.5	6.0x25.0	6.0x25.0	24x.375 *	6.0x20.4	24x.375 *	6.0x20.4	24x.375	6.0x20.4	24x.562	6.0x20.4	FP236	1324	FP236	1326	FP236	1428	FP138	1430
OVER 120' TO 140'	300	8x.500	8x.322 *	8x.500	2.5x5.0	3.0x8.625	4.0x11.5	3.0x8.625	10x.365 *	3.0x8.625	16x.375 *	4.0x9.2	18x.375 *	4.0x9.2	24x.375 *	4.0x9.2	FP222	720	FP326	720	FP231	722	FP336	924
	600	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	5.0x12.7	12x.375 *	4.0x11.5	18x.375 *	5.0x12.7	20x.375 *	5.0x12.7	24x.375 *	5.0x17.5	FP226	824	FP231	1121	FP331	926	FP336	1028
	900	12x.500	12x.500 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	6.0x20.4	16x.375 *	5.0x12.7	20x.375 *	5.0x12.7	20x.375 *	5.0x12.7	24x.375 *	5.0x17.5	FP326	1121	FP331	926	FP331	1028	FP336	1030
	1200	14x.500	14x.500 *	14x.500	5.0x12.7	4.0x11.5	5.0x17.5	6.0x25.0	16x.375 *	5.0x12.7	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	—	—	FP326	1123	FP331	1325	FP336	1030	—	—
	1500	16x.500	16x.500 *	16x.500	5.0x12.7	5.0x17.5	6.0x25.0	6.0x25.0	18x.375 *	5.0x17.5	24x.375 *	6.0x17.5	24x.375 *	6.0x20.4	24x.500 *	6.0x20.4	FP331	1225	FP336	1130	FP336	1132	FP436	1431
	1800	18x.500	18x.500 *	18x.500	5.0x17.5	5.0x17.5	6.0x25.0	6.0x25.0	20x.375 *	5.0x17.5	24x.375 *	6.0x17.5	24x.375	6.0x20.4	—	—	FP331	1325	FP336	1327	FP336	1429	—	—
	2100	18x.500	18x.500 *	18x.500	6.0x15.9	5.0x17.5	6.0x25.0	6.0x25.0	24x.375 *	6.0x15.9	24x.375 *	6.0x17.5	—	—	—	—	FP336	1425	FP336	1327	—	—	—	—
	2175	18x.500	18x.500 *	18x.500	6.0x15.9	6.0x15.9	6.0x25.0	6.0x25.0	24x.375 *	6.0x17.5	24x.375 *	6.0x25.0	—	—	—	—	FP336	1425	FP336	1429	—	—	—	—
OVER 140' TO 160'	300	14x.500	14x.375 *	14x.500	4.0x11.5	4.0x11.5	5.0x12.7	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	FP326	721	FP331	823	FP331	824	FP436	926
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	5.0x17.5	5.0x12.7	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP326	1020	FP331	927	FP331	926	FP436	1030
	900	16x.500	16x.500 *	16x.500	4.0x11.5	5.0x17.5	6.0x25.0	5.0x17.5	16x.375 *	4.0x11.5	18x.375 *	5.0x17.5	20x.375	5.0x17.5	24x.375	6.0x25.0	FP326	1122	FP331	929	FP331	1030	FP436	1032
	1200	20x.500	20x.500 *	20x.500	5.0x17.5	6.0x17.5	9.0x35.0	6.0x25.0	18x.375 *	4.0x11.5	20x.375	5.0x17.5	24x.375 *	5.0x17.5	24x.500 *	6.0x25.0	FP331	1226	FP431	1225	FP436	1329	FP436	1134
	1500	20x.500	20x.500 *	20x.500	5.0x17.5	6.0x25.0	9.0x35.0	6.0x25.0	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	—	—	—	—	FP431	1225	FP436	1327	—	—	—	—
	1800	24x.500	24x.500 *	24x.500	5.0x17.5	6.0x25.0	9.0x35.0	7.5x25.0	24x.375 *	5.0x17.5	—	—	24x.500 *	6.0x25.0	—	—	FP436	1326	—	—	FP436	1431	—	—
OVER 160' TO 180'	300	14x.500	14x.375 *	14x.500	4.0x11.5	5.0x12.7	5.0x17.5	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP426	822	FP431	1019	FP431	824	FP536	926
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	5.0x17.5	5.0x17.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP426	1021	FP431	1123	FP431	928	FP536	1030
	900	16x.500	16x.500 *	16x.500	4.0x11.5	5.0x17.5	6.0x25.0	6.0x20.4	16x.375	4.0x11.5	18x.375	5.0x17.5	20x.375	5.0x17.5	24x.375	6.0x25.0	FP426	1123	FP431	1125	FP431	1030	FP536	1329
	1200	20x.500	20x.500 *	20x.500	4.0x11.5	6.0x25.0	10.0x48.0	6.0x20.4	20x.375	4.0x11.5	24x.375 *	5.0x17.5	24x.375 *	6.0x25.0	24x.500	6.0x25.0	FP431	1225	FP536	1327	FP536	1329	FP536	1431
	1500	24x.500	24x.500 *	24x.500	5.0x17.5	6.0x25.0	10.0x48.0	6.0x25.0	24x.375 *	4.0x11.5	24x.375 *	5.0x17.5	—	—	—	—	FP536	1326	FP536	1329	—	—	—	—
	1800	24x.500	24x.500 *	24x.500	5.0x17.5	6.0x25.0	10.0x48.0	7.5x25.0	—	—	—	—	24x.500 *	6.0x25.0	—	—	—	—	—	—	FP536	1431	—	—
OVER 180' TO 200'	300	14x.500	14x.375 *	14x.500	4.0x11.5	5.0x12.7	5.0x17.5	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP426	822	FP431	1121	FP431	825	FP536	927
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	6.0x25.0	5.0x17.5	16x.375 *	4.0x11.5	18x.375 *	5.0x17.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP426	1123	FP431	928	FP431	1029	FP536	1226
	900	16x.500	16x.500 *	16x.500	6.0x25.0	6.0x25.0	6.0x25.0	6.0x25.0	18x.375	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	6.0x25.0	—	—	FP431	1225	FP431	1226	FP536	1328	—	—
	1200	24x.500	24x.500 *	24x.500	6.0x25.0	6.0x25.0	10.0x48.0	6.0x25.0	20x.375	5.0x17.5	24x.375 *	5.0x17.5	24x.375	6.0x25.0	—	—	FP531	1226	FP536	1328	FP536	1330	—	—
OVER 200' TO 220'	300	14x.500	14x.500 *	14x.500	4.0x11.5	6.0x25.0	6.0x25.0	5.0x17.5	16x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	6.0x25.0	24x.375 *	5.0x17.5	FP526	1020	FP531	1122	FP531	926	FP636	929
	600	18x.500	18x.500 *	18x.500	5.0x17.5	6.0x25.0	9.0x35.0	5.0x17.5	18x.375 *	5.0x17.5	20x.375 *	5.0x17.5	24x.375 *	6.0x25.0	26x.375 *	6.0x25.0	FP531	1124	FP531	1028	FP636	1226	FP438	1133
	900	20x.500	20x.500 *	20x.500	6.0x25.0	6.0x25.0	9.0x35.0	6.0x25.0	20x.375 *	5.0x17.5	24x.375 *	6.0x25.0	24x.375 *	6.0x25.0	24x.500 *	6.0x25.0	FP531	1224	FP636	1328	FP636	1328	FP636	1330
OVER 220' TO 240'	300	18x.500	18x.500 *	18x.500	5.0x17.5	6.0x25.0	9.0x35.0	5.0x17.5	16x.375 *	5.0x17.5	18x.375 *	5.0x17.5	20x.375 *	6.0x25.0	24x.375 *	6.0x25.0	FP526	1123	FP531	1125	FP531	928	FP636	1227

PED. TYPE - INDICATES FOUNDATION PEDESTAL TYPE.

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).

▨ - STRUCTURES WITH A DESIGN SPAN LENGTH GREATER THAN 200' MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE CHIEF BRIDGE ENGINEER FOR REVIEW AND APPROVAL. MEMBERS SIZES INDICATED IN DESIGN TABLES MAYBE USED AS PRELIMINARY MEMBER SIZES.

NOTES:

FOR DESIGN TABLE NOTES, SEE SHEET 9.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST TRI-CHORD TRUSS
SPANS FROM 60' TO 240'

DESIGN TABLES
LOADING TYPE 2

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 13 OF 13
Thomas P. Macioce	Brent D. Thompson	BD-644M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	

CHANGE 1

INFORMATIONAL NOTES

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS FOR OVERHEAD SIGN STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS. REFERENCE TO THESE STANDARDS ON OVERHEAD SIGN STRUCTURES PLANS IS PROHIBITED.
- THE DESIGNER MUST PROVIDE THE INFORMATION OBTAINED FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS. THE DESIGNER MUST PROVIDE THE SIGN AREA, STRUCTURE HEIGHT, AND SIGN LOCATION USED TO OBTAIN MEMBER SIZES FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS.
- DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE DESIGN TABLES CONTAINED IN THESE STANDARDS. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THESE DESIGN TABLES.
- ALL SIGN SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-745M, SHEET 2.
- AVOID BRIDGE-MOUNTED SIGN STRUCTURES WHENEVER POSSIBLE. IF AVOIDANCE IS NOT POSSIBLE, THE STRUCTURE SHOULD BE LOCATED AS CLOSE TO A PIER SUPPORT AS IS PRACTICAL. THE AFFECTED BRIDGE COMPONENTS SHALL BE DESIGNED TO CARRY THE ADDITIONAL LOADS DUE TO THE WEIGHT OF THE SIGN STRUCTURE AND THE LOADINGS APPLIED TO SIGN STRUCTURE. IF A BARRIER IS USED OR IS REQUIRED, THE SIGN STRUCTURE SHALL BE LOCATED JUST BEYOND THE DESIGN DEFLECTION DISTANCE OF THE BARRIER.

INFORMATION CONTAINED IN THE DESIGN TABLES

- DESIGN TABLES INCLUDED IN THIS STANDARD WERE DEVELOPED USING A COMPUTER PROGRAM AND ARE BASED ON THE DESIGN CRITERIA SHOWN ON THIS SHEET.
- THE MEMBER SIZES INDICATED IN THE DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY II. THE DESIGNER MUST CHECK THE ADEQUACY OF THE MEMBER SIZES INDICATED WHEN THE FATIGUE CATEGORY IS SPECIFIED TO BE I FOR THE PROJECT.
- THE SPAN RANGE INCLUDED IN THIS STANDARD IS AS FOLLOWS:

  BD-645M: FOUR-POST FOUR-CHORD TRUSS, SPANS FROM 100' TO 200'.
- THE DESIGN TABLES INCLUDE MEMBER SIZES FOR THE STRUCTURES FOR VARIOUS COMBINATIONS OF DESIGN HEIGHT, SPAN LENGTH, AND SIGN AREA. THEY ALSO INCLUDE SPREAD FOOTING DESIGNS. THE CORRESPONDING FABRICATION AND CONSTRUCTION DETAILS ARE CONTAINED ON STANDARD DRAWING BC-745M.

GENERAL NOTES

1. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE f'c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. VERIFY ALL DIMENSIONS AND GEOMETRY OF THE EXISTING STRUCTURES IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. SPREAD FOOTINGS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL, BOLTS, NUTS AND WASHERS IN ACCORDANCE WITH PUB. 408 UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE WIDTH OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE CHECKED.
14. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
15. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
16. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
17. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

- DEAD LOADS — PENNDOT STD. DWGS. (U.N.O.)*

SIGN PANELS	TC-8701E OR TC-8701S
LIGHT FIXTURES	BC-745M, SHT. 10
SIGN SUPPORT BEAM	BC-745M, SHT. 8
COLUMNS, CHORDS	CALCULATED INTERNALLY WITHIN PROGRAM
CATWALK	BC-745M, SHT. 8 & 9

- EXTERNAL LOADS — AASHTO SIGN SPECS. (U.N.O.)

ICE LOAD	3.7
WIND LOAD	APPENDIX C, SECTION C.3, EQ. C-1, WITH 80 MPH WIND AND 30% GUST FACTOR
CATWALK	3.6

- GROUP LOADS — AASHTO SIGN SPECS. 3.4
- STEEL CRITERIA — AASHTO SIGN SPECS.

SECTION PROPERTIES FOR TUBULAR SHAPES	APPENDIX B, TABLE B-1
MAXIMUM STRESSES IN TUBULAR SHAPES	APPENDIX B, TABLE B-2
ALLOWABLE STRESSES FOR TUBULAR SHAPES	5.6 (TABLE 5-3) & 5.11
ALLOWABLE STRESSES FOR SIGN SUPPORTS	5.12
ALLOWABLE STRESSES FOR BASE PLATES	5.8
ALLOWABLE STRESSES FOR COMBINED STEEL STRESS	5.12
FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)	SECTION 11
ALLOWABLE DEFLECTION	10.4
PERMANENT CAMBER	10.5
ALLOWABLE STRESSES FOR STRUCTURAL STEEL	SECTION 5

- BOLT CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BOLT STRESSES	TABLE 10.32.3B
SLIP-CRITICAL BOLT ALLOWABLE	10.32.3.2.1
BOLT PRYING ACTION	10.32.3.3.2
COMBINED BOLT SHEAR AND TENSION	10.32.3.3.3
BOLT DESIGN CRITERIA	AASHTO SIGN SPECS. 5.16
ALLOWABLE ANCHOR BOLT STRESSES	AASHTO SIGN SPECS. 5.17

- CONCRETE CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BEARING STRESS	8.15.2.1.3
REINFORCEMENT TENSILE STRESS	8.15.2.2
SHEAR CAPACITY OF FOOTINGS	8.15.5.6.1
SHEAR STRESS IN FOOTINGS	8.15.5.6.2
ALLOWABLE SHEAR STRESS	8.15.5.6.4
SLENDERNESS OF COLUMNS	8.16.5.2
MINIMUM REINF. OF FLEXURAL MEMBERS	8.17.1
SPACING LIMITS FOR REINFORCEMENT	8.21
MINIMUM CONCRETE COVER	DM-4 D8.22.1*
PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS	FIG. 4.4.7.1.1.1C
DISTRIBUTION OF REINFORCEMENT	4.4.11.2.2
FOOTING STABILITY REQUIREMENTS	DM-4 D5.5.5
TORSION	ACI SECTION A.7.3*
COLUMN DESIGN (PEDESTALS)	8.15.4

- SPREAD FOOTINGS

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MINIMUM AREA IN BEARING	95%
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT

- DRILLED SHAFTS (CAISSONS) DM-4 SEC. D4.6, PENNDOT COM624P COMPUTER PROGRAM

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MAXIMUM DESIGN LATERAL DISPLACEMENT	0.5"
MODULUS OF SUBGRADE REACTION	10.0 POUNDS PER CUBIC INCH
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT
ANGLE OF INTERNAL FRICTION	25°
COHESION	0 KIPS PER SQUARE FOOT

- SEISMIC DESIGN CRITERIA

  STRUCTURES ARE DESIGNED FOR A SEISMIC ACCELERATION COEFFICIENT = 0.15

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORKMANSHIP:

  PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

COLUMNS, PIPE CHORDS & PIPE BRACING:	SEE PUBLICATION 408, SECTION 948.2.
ANGLES, SHAPES, AND PLATES:	AASHTO M270, GRADE 36 ASTM A709, GRADE 36

- ALTERNATE PRESS-BREAK MEMBERS:

  ALTERNATE PRESS-BREAK MEMBERS MUST HAVE THE EQUIVALENT STRENGTH OF THE MEMBER THEY ARE REPLACING. EQUIVALENT RADIUS FOR PRESS-BREAK MEMBERS IS MEASURED FROM THE CENTER OF THE MEMBER TO THE MID-POINT OF ANY CHORD OF THE MEMBER. MINIMUM THICKNESS OF PRESS-BREAK MEMBERS TO BE 5/16". PENNDOT'S SIGN STRUCTURE PROGRAM OR AN APPROVED FINITE ELEMENT ANALYSIS COMPUTER PROGRAM MUST BE RUN TO VERIFY THE ADEQUACY OF PRESS-BREAK MEMBER FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR CHORDS.
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:

ANCHOR BOLTS:	ASTM, F1554 GRADE 55 PER PUBLICATION 408 SECTION 1105.02(c)3.
BOLTS:	AASHTO M164 (ASTM A325) H.S. BOLTS EXCEPT AS NOTED

- DESIGN SPECIFICATIONS:

  AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 2001 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1996 WITH INTERIMS THROUGH AND INCLUDING 2000; PENNDOT DESIGN MANUAL - PART 4, AUGUST 1993 EDITION (INCLUDING AUGUST 1995 REVISIONS)
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- ANY PIPE SIZE OTHER THAN THAT SHOWN ON THE STANDARD IS A PROJECT SPECIFIC DESIGN. DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE RULING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN 1/2".
- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 - (INDICATE CHANGE NUMBER), AASHTO/AWS D1.5 BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5".
- 4-POST 4-CHORD STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS ARE RECOMMENDED TO CARRY DMS\VMS. SEE BD-650M FOR INFORMATION ON USE OF THIS SIGN STRUCTURE TYPE TO CARRY DMS\VMS.

* LEGEND:

- AASHTO SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"
- DM-4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-99).
- CVN: CHARPY V-NOTCH.

REFERENCE DRAWINGS

TC-8700C	SPACING CHARTS/DIRECT APPLIED LETTERS, NUMERALS, & ARROWS
TC-8701D	SIGN DETAILS/FREEWAY AND EXPRESSWAY GUIDE SIGNS
TC-8701E	EXTRUDED ALUMINUM CHANNEL SIGN
TC-8701S	FLAT SHEET ALUMINUM SIGNS WITH EXTRUDED ALUMINUM STIFFENERS
TC-8715	SIGN LIGHTING
BD-650M	DYNAMIC MESSAGE SIGNS TRUSS SIGN STRUCTURES
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-745M	OVERHEAD SIGN STRUCTURES
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

4 POST 4 CHORD TRUSS SPANS FROM 100' TO 200'

NOTES AND DESIGN CRITERIA

RECOMMENDED AUG. 4, 2017 Thomas P. Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brian D. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHT. 1 OF 7 BD-645M

HOW TO USE THE DESIGN TABLES

SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL OR CAISSON ELEVATION IS APPROXIMATELY 6 INCHES ABOVE THE HIGHEST SURROUNDING FINISHED GRADE ELEVATION.
- SET THE TOP OF FOOTING ELEVATION SO THAT A MINIMUM 2'-0" COVER IS PROVIDED OVER THE FOOTING AT ALL LOCATIONS.

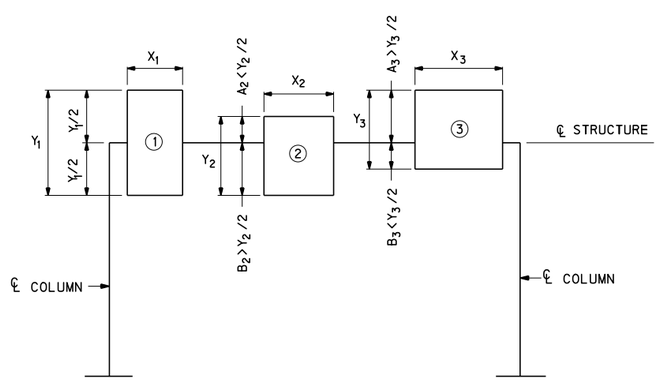
POSITIONING OF SIGN PANELS AND SIGN STRUCTURE

- SEE THE FOLLOWING DIAGRAMS FOR ADDITIONAL INSTRUCTIONS FOR POSITIONING THE SIGN PANELS AND SIGN STRUCTURE.
- THE TRAFFIC ENGINEER SETS THE DESIGN SIGN AREA USING ONE OF THE FOLLOWING OPTIONS:
  1. THE ACTUAL SIGN AREA TO BE PLACED ON THE STRUCTURE AT THE TIME OF CONSTRUCTION.
  2. THE ACTUAL SIGN AREA INCREASED BY 25%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (RURAL HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
  3. THE ACTUAL SIGN AREA INCREASED BY 50%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (URBAN HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
- THE DESIGN SIGN AREA WILL BE ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE.
- WHEN MULTIPLE SIGN PANELS ARE PLACED ON ONE STRUCTURE AND ONE OR MORE OF THE SIGN PANELS IS NOT CENTERED IN THE VERTICAL DIRECTION, COMPUTE THE DESIGN SIGN AREA IN THE FOLLOWING MANNER:

  THE SIGN AREA FOR ANY SIGN PANEL CENTERED IN THE VERTICAL DIRECTION IS (X) x (Y)

  THE SIGN AREA FOR ANY SIGN PANEL OFF-CENTER IN THE VERTICAL DIRECTION IS (X) x (B) x 2 WHEN B>A OR (X) x (A) x 2 WHEN A>B.

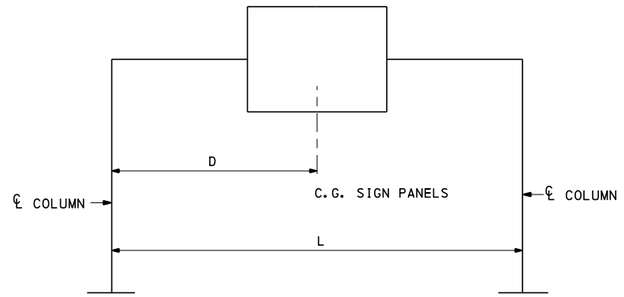
  EXAMPLE:
  AREA OF SIGN NO. 1 = (X_1) x (Y_1)
  AREA OF SIGN NO. 2 = (X_2) x (B_2) x 2
  AREA OF SIGN NO. 3 = (X_3) x (A_3) x 2



A = DISTANCE FROM ℄ STRUCTURE TO TOP OF SIGN
B = DISTANCE FROM ℄ STRUCTURE TO BOTTOM OF SIGN

DESIGN AREA OF SIGN NO. 1 = $X_1 Y_1$
DESIGN AREA OF SIGN NO. 2 = ($X_2 B_2$) x 2
DESIGN AREA OF SIGN NO. 3 = ($X_3 A_3$) x 2

- SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT THE MID-HEIGHT OF THE DEEPEST SIGN OR A MAXIMUM OF 9'-3" ABOVE THE BOTTOM OF THE SIGN PANEL. (SIGN HEIGHT INCLUDES "EXIT PANEL" SIGN IF PRESENT.)
- SET THE STRUCTURE, SIGN PANELS, AND LUMINAIRES TO AN ELEVATION THAT WILL PROVIDE A MINIMUM OF 17'-6" VERTICAL CLEARANCE ABOVE THE HIGHEST POINT OF THE ENTIRE ROADWAY WIDTH (INCLUDING THE ROADWAY PAVEMENT AND SHOULDERS) PASSING UNDER THE STRUCTURE. SET THE BOTTOM OF ALL SIGN PANELS TO GENERALLY THE SAME ELEVATION. IN THE CASE OF A STRUCTURE SPANNING DUAL ROADWAYS WHERE THE DIFFERENCE IN ELEVATIONS OF THE HIGHEST POINT ON EACH ROADWAY IS GREATER THAN 2'-6", SET THE BOTTOM OF ALL SIGN PANELS OVER EACH ROADWAY TO THE SAME VERTICAL CLEARANCE.
- WHEN THE MAXIMUM SIGN HEIGHT IS USED FOR DESIGN SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS. WHEN THE STRUCTURE SPANS DUAL ROADWAYS WITH THE DIFFERENCE IN HIGH POINT ELEVATIONS GREATER THAN 2'-6", SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS OVER THE UPPER ROADWAY.
- FOR ILLUSTRATIVE EXAMPLES OF HOW TO POSITION SIGN PANELS AND SIGN STRUCTURES, SEE CASES A-F ON THE NEXT SHEET.
- DESIGNS FOR TWO TYPES OF LOADING CONDITIONS ARE PRESENTED IN THE DESIGN TABLES. TYPE 1 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE TOTAL DESIGN SIGN AREA LIES BETWEEN 0.42 X SPAN LENGTH AND 0.58 X SPAN LENGTH. TYPE 2 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA LIES BETWEEN THE BEGINNING OF THE SPAN AND 0.42 X SPAN LENGTH OR 0.58 X SPAN LENGTH AND END OF SPAN. DETERMINE THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA AND USE THE APPROPRIATE LOADING CONDITION FOR SELECTING THE MEMBER SIZES. WHEN DETERMINING THE CENTER OF GRAVITY OF DESIGN SIGN AREA, USE THE INDIVIDUAL SIGN AREAS AS CALCULATED IN ACCORDANCE WITH THE PROCEDURE FOR CENTERED AND OFF-CENTER SIGNS.

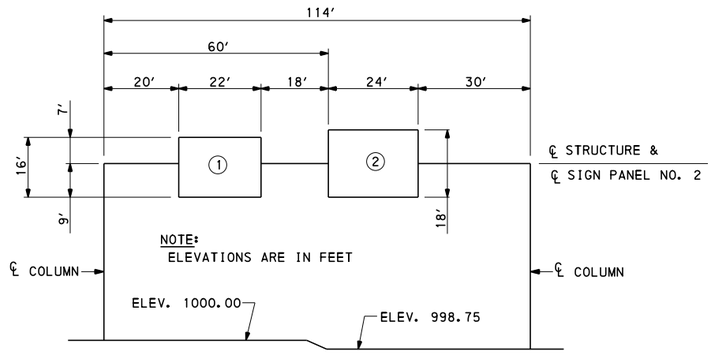


IF 0.42L < D < 0.58L, USE LOADING TYPE 1
IF D < 0.42L, OR D > 0.58L, USE LOADING TYPE 2

LOADING TYPE DIAGRAM

- THE DESIGN SPAN LENGTH SHALL BE THE ACTUAL SPAN LENGTH ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SPAN LENGTH SHOWN IN THE DESIGN TABLES.
- THE DESIGN POST HEIGHT SHALL BE THE ACTUAL DESIGN POST HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST HEIGHT SHOWN IN THE DESIGN TABLES.

EXAMPLE TO SHOW PROCEDURE FOR SELECTING SIGN AREA, SPAN LENGTH, & POST HEIGHT



- Δ ELEV. = 1000.00 - 998.75 = 1.25 < 2'-6"
  Y_1 = 16'
  Y_2 = 18'
  $Y_1 < Y_2$
  → USE CASE B
- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION
  ELEV. 1000.00 + 17'-6" + 1'-8" = 1019.17
  [1'-8" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL]
- SET ℄ STRUCTURE AT ℄ OF SIGN PANEL NO. 2
  ELEV. 1019.17 + 18'/2 = 1028.17
- ACTUAL SPAN LENGTH = 114' → USE: 120'
- DESIGN COLUMN HEIGHT (H):
  H = 1028.17 - 998.750 = 29.42' → USE H = OVER 24' TO 33'
- ℄ SIGN TO BOTTOM OF CATWALK IS 9'-0" + 1'-8⅞" = 10'-8⅞"
- ½STRUCTURE DEPTH IS 2'-7½". THEREFORE FROM THE DESIGN TABLES, IT IS DETERMINED THAT THE TOTAL STRUCTURE DEPTH IS 5'-3"
- BECAUSE SIGN PANEL NO. 1 IS NOT CENTERED VERTICALLY ON THE STRUCTURE, THE DESIGN AREAS ARE COMPUTED AS FOLLOWS:
  A_1 = 22' x 9' x 2 = 396.0 SF
  A_2 = 24' x 18' = 432.0 SF
  828.0 SF
  → USE 830.0 SF
- LOCATE C.G. OF SIGN AREA (FROM LEFT)

$$\left(X = \frac{[396.0\ SF \times (20' + 22'/2)] + [432.0\ SF \times (60' + 24'/2)]}{828\ SF}\right)$$

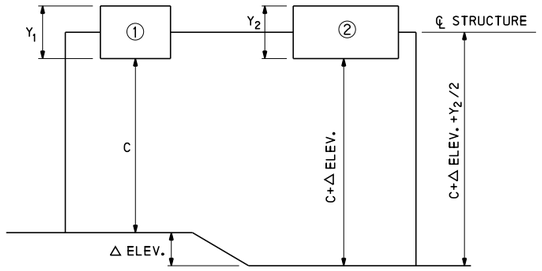
  X = 52.40' 52.4'/114' = 0.46; 0.42 < 0.46 < 0.58
- VERIFY LOADING TYPE BASED ON ACTUAL SIGN AREA AND C.G.
- IF LOADING TYPES DIFFER USE THE LARGEST MEMBER SIZES FROM EACH LOADING TYPE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST 4 CHORD TRUSS
SPANS FROM 100' TO 200'

DESIGN INSTRUCTIONS

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 2 OF 7
Thomas P Macioce	Brian D Thompson	BD-645M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	



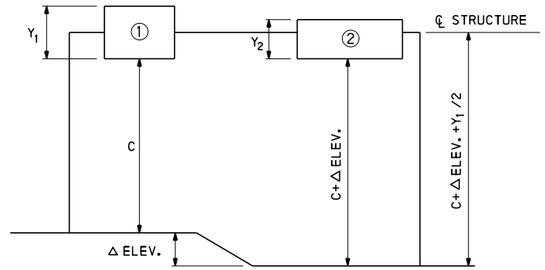
CASE A

$Y_1 = Y_2$

Δ ELEV. < 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANELS UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.



CASE C

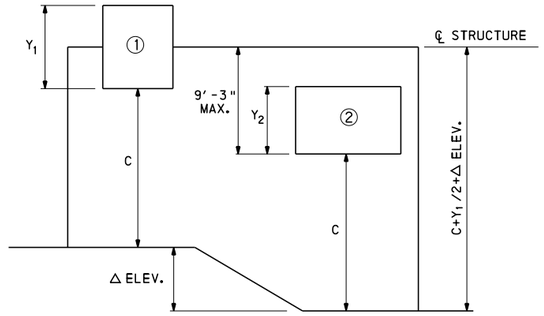
$Y_1 > Y_2$

Δ ELEV. < 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF Y_1 AND Y_2 WHERE $Y_1 > Y_2$.



CASE E

$Y_1 \geq Y_2$

Δ ELEV. > 2′-6"

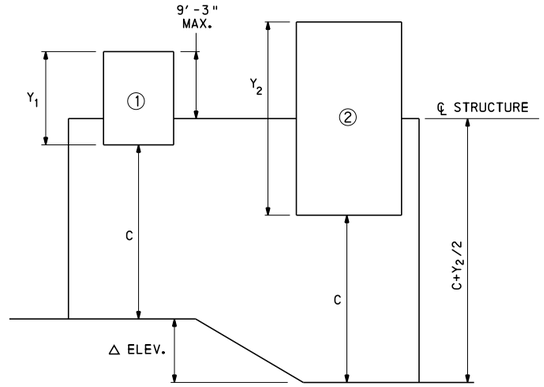
SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF Δ ELEV. AND Y_2 WHERE $Y_1 > Y_2$:

Δ ELEV.	$Y_{1,2}$
3′-0"	6′-0" TO 12′-6"
4′-0"	6′-0" TO 10′-6"
5′-0"	6′-0" TO 8′-6"
6′-0"	6′-0" TO 6′-6"
6′-3"	6′-0"

WHEN $Y_{1,2}$ EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE FOR A PARTICULAR VALUE OF Δ ELEV., THIS CASE DOES NOT APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A SPECIAL DESIGN.



CASE F

$Y_1 < Y_2$

Δ ELEV. > 2′-6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 2 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF ΔELEV. , Y_1 , AND Y_2 WHERE $Y_1 < Y_2$:

Δ ELEV.	LIMITS OF Y_1 AND Y_2
3′-0"	$2Y_1 - Y_2 \leq$ 12′-6"
4′-0"	$2Y_1 - Y_2 \leq$ 10′-6"
5′-0"	$2Y_1 - Y_2 \leq$ 8′-6"
6′-0"	$2Y_1 - Y_2 \leq$ 6′-6"
7′-0"	$2Y_1 - Y_2 \leq$ 4′-6"

GENERAL EQUATION FOR CASE F:

$2(\Delta ELEV.) + 2(Y_1) - Y_2 \leq$ 18′-6"

IF THE PARAMETERS OF THE GENERAL EQUATION ARE EXCEEDED, ONE OF THE FOLLOWING STEPS IS REQUIRED:

1) RESET ℄ STRUCTURE SO THAT PARAMETERS ARE MET
2) USE SEPARATE STRUCTURES
3) USE A SPECIAL DESIGN
4) IN ALL CASES, THE MINIMUM VERTICAL CLEARANCE OF 17′-6" MUST BE MAINTAINED

CASE B

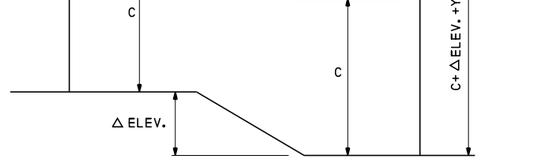
$Y_1 < Y_2$

Δ ELEV. < 2′-6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 2 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF Y_1 AND Y_2 WHERE $Y_1 < Y_2$.



CASE D

$Y_1 = Y_2$

Δ ELEV. > 2′-6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ℄ OF STRUCTURE AT ℄ OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ℄ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF Δ ELEV. AND $Y_{1,2}$:

WHEN $Y_{1,2}$ EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE FOR A PARTICULAR VALUE OF Δ ELEV., THIS CASE DOES NOT APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A SPECIAL DESIGN.

NOTE:

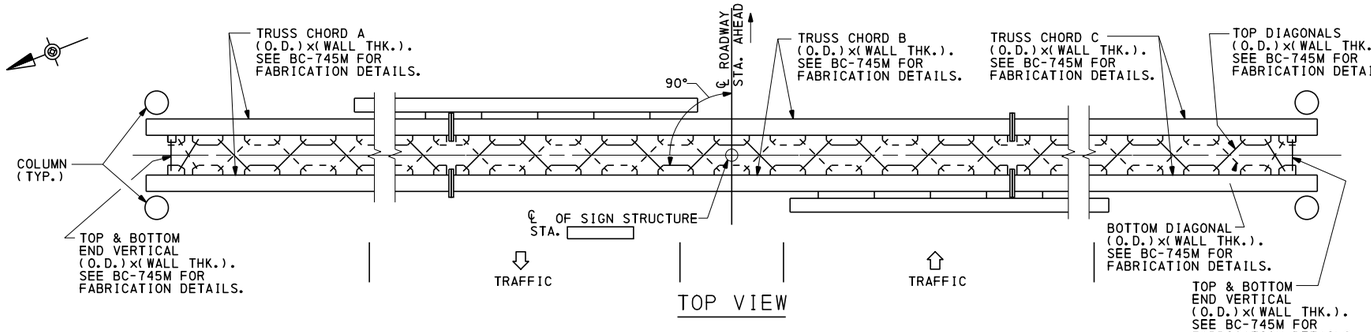
C IS VERTICAL CLEARANCE FROM ROADWAY TO BOTTOM OF STRUCTURE, SIGN PANEL, OR LUMINAIRE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

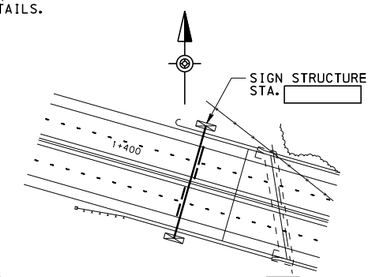
OVERHEAD SIGN STRUCTURES
4 POST 4 CHORD TRUSS
SPANS FROM 100′ TO 200′

INSTRUCTIONS FOR USE OF DESIGN TABLES

RECOMMENDED AUG. 4, 2017 Thomas P Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brent D Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHT. 3 OF 7 BD-645M



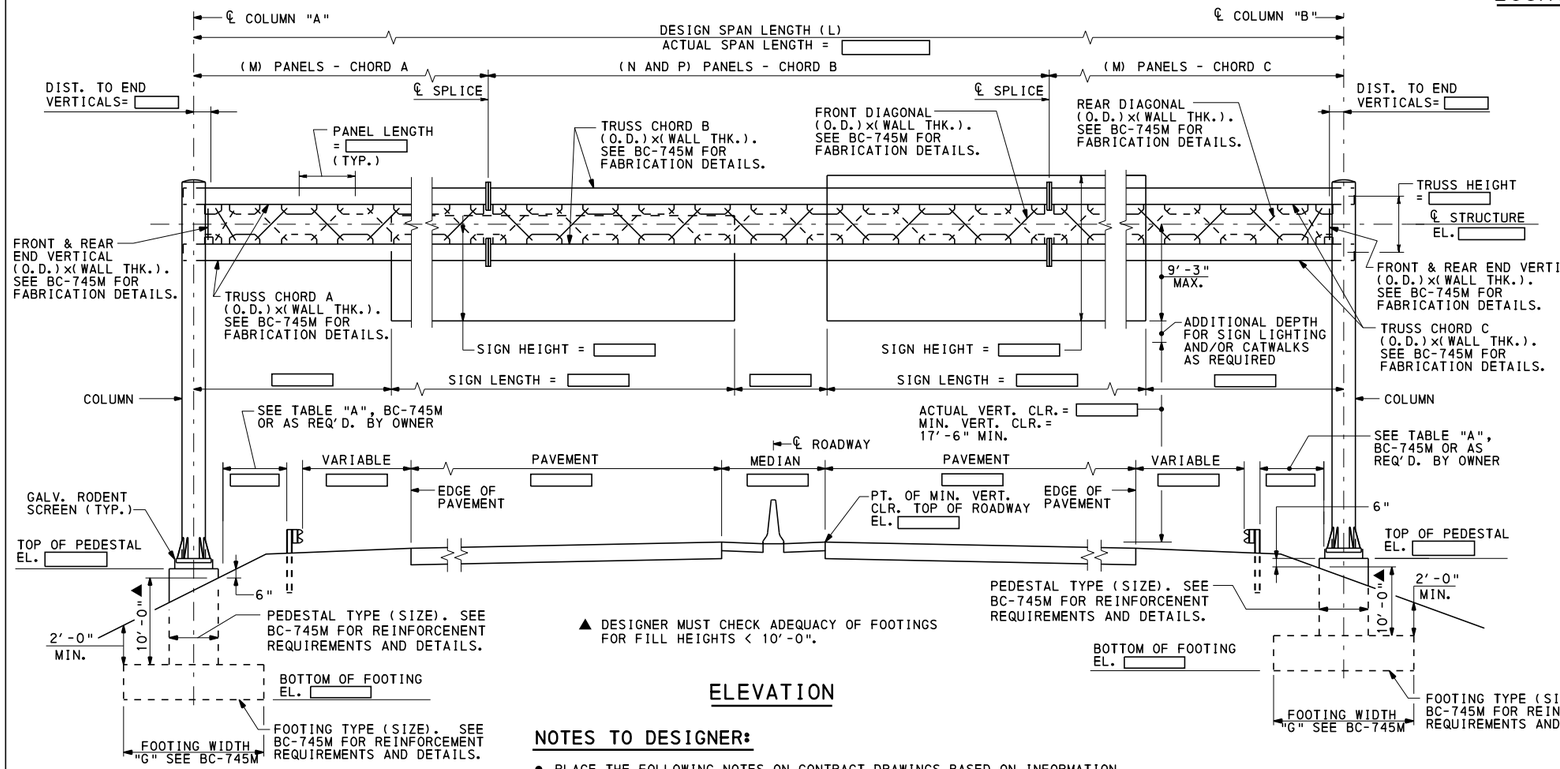
TOP VIEW



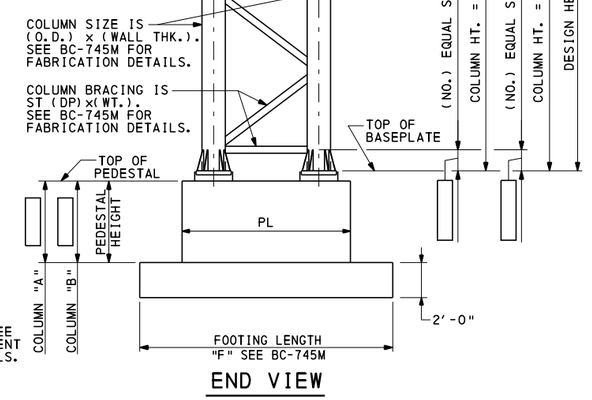
LOCATION PLAN

DESIGN CRITERA	
SIGN AREA (A) =	
SPAN LENGTH (L) =	
STRUCTURE HEIGHT (H) =	
LOADING TYPE=	(1 OR 2)
FATIGUE CATEGORY=	

NOTE:
DESIGN FOR ACTUAL, ACTUAL INCREASED BY 25%, OR ACTUAL INCREASED BY 50% SIGN AREA. (DESIGNER TO INDICATE CONTROLLING CONDITION)



ELEVATION



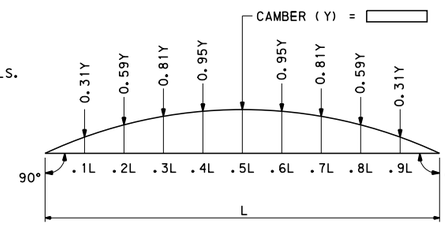
END VIEW

NOTES TO DESIGNER:

- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED. DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES.
  1. PEDESTAL TYPE (SIZE). SEE BC-745M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  2. FOOTING TYPE (SIZE). SEE BC-745M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  3. COLUMN SIZE IS (O.D.) x (WALL THK.). SEE BC-745M FOR FABRICATION DETAILS.
  4. COLUMN BRACING IS ST(DP)x(WT.). SEE BC-745M FOR FABRICATION DETAILS.
  5. TRUSS CHORD A (O.D.) x (WALL THK.), TRUSS CHORD B (O.D.) x (W.THK.), AND TRUSS CHORD C (O.D.) x (WALL THK.). SEE BC-745M FOR FABRICATION DETAILS.
  6. FRONT & REAR DIAGONALS (O.D.) x (WALL THK.) AND FRONT & REAR END VERTICALS (O.D.) x (WALL THK.); TOP & BOTTOM DIAGONALS (O.D.) x (WALL THK.) AND TOP & BOTTOM END VERTICALS (O.D.) x (WALL THK.). SEE BC-745M FOR FABRICATION DETAILS.
- PLACE CAMBER DIAGRAM ON CONTRACT DRAWINGS AND SPECIFY REQUIRED CAMBER FROM CAMBER TABLE.
- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH ☐
- DESIGNER TO PROVIDE DIMENSIONS ON CONTRACT DRAWINGS.

TABLE OF ESTIMATED QUANTITIES			
ITEM NO.	ITEM	UNIT	QUANTITY
*	STEEL SIGN STRUCTURE	LBS	
0000-0000	STRUCTURE MOUNTED SIGNS	SF	
0000-0000	CLASS 3 EXCAVATION	CF	
0000-0000	CLASS A CEMENT CONCRETE	CF	
0000-0000	REINFORCEMENT BARS	LBS	

* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. 0000 - 0000.



CAMBER DIAGRAM

NOTE: PRIOR TO SHIPMENT OF TRUSS STRUCTURE TO THE SITE, SHOP ASSEMBLE TRUSSES IN AN UPRIGHT POSITION AND CHECK TRUSS CAMBER.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST 4 CHORD TRUSS
SPANS FROM 100' TO 200'

SAMPLE CONTRACT DRAWING

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 4 OF 7
Thomas P Macioce	Brent D. Thompson	
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	BD-645M

LOADING TYPE 1

DESIGN SPAN	SIGN AREA (SQ.FT.)	TRUSS MEMBERS ** CHORDS (PIPE NOMINAL SIZE x WALL THK.) A	B	C	DIAGONALS FRONT & REAR	DIAGONALS TOP & BOTTOM	END VERTICALS FRONT & REAR	END VERTICALS TOP & BOTTOM	TRUSS CROSS BRACING	TOWER MEMBERS H TO 12′ COLUMN **	H TO 12′ BRACING ▲	H OVER 12′ TO 18′ COLUMN **	H OVER 12′ TO 18′ BRACING ▲	H OVER 18′ TO 24′ COLUMN **	H OVER 18′ TO 24′ BRACING ▲	H OVER 24′ TO 33′ COLUMN **	H OVER 24′ TO 33′ BRACING ▲	FOUNDATION H TO 12′ PED. TYPE	H TO 12′ FTG.	H OVER 12′ TO 18′ PED. TYPE	H OVER 12′ TO 18′ FTG.	H OVER 18′ TO 24′ PED. TYPE	H OVER 18′ TO 24′ FTG.	H OVER 24′ TO 33′ PED. TYPE	H OVER 24′ TO 33′ FTG.
TO 100′	200	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2x3.85	12x.375*	2x4.75	16x.375*	3x6.25	24x.375*	3x6.25	FP12	716	FP12	718	FP16	819	FP24	820
	350	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2x4.75	12x.375*	2.5x5.0	16x.375*	3x6.25	24x.375*	3x8.625	FP12	718	FP12	718	FP16	819	FP24	922
	500	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2.5x5.0	12x.375*	3x6.25	16x.375*	3x8.625	24x.375*	4x9.2	FP12	718	FP12	720	FP16	921	FP24	924
	650	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	3x6.25	12x.375*	3x6.25	16x.375*	4x9.2	24x.375*	4x9.2	FP12	820	FP12	822	FP16	923	FP24	924
	800	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x6.25	14x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	822	FP16	923	FP16	923	FP24	1026
	950	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	12x.375	3x8.625	16x.375*	4x11.5	18x.375*	4x11.5	24x.375*	4x11.5	FP12	822	FP16	923	FP20	1025	FP24	1223
	1100	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	14x.375*	3x8.625	16x.375*	4x11.5	18x.375*	4x11.5	24x.375*	5x17.5	FP16	923	FP16	923	FP20	1025	FP24	1325
	1250	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	3x8.625	18x.375*	4x11.5	20x.375*	6x17.5	24x.375*	5x17.5	FP16	923	FP20	1025	FP20	1324	FP24	1325
	1400	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x9.2	18x.375*	5x17.5	20x.375*	5x17.5	24x.500	5x17.5	FP16	1025	FP20	1025	FP20	1324	FP24	1325
	1550	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x9.2	18x.375*	5x17.5	20x.375*	5x17.5	24x.500	5x17.5	FP16	1025	FP20	1025	FP20	1324	FP24	1325
	1700	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	18x.375*	4x9.2	20x.375*	5x17.5	24x.375*	5x17.5	24x.500	5x17.5	FP20	1025	FP20	1222	FP24	1325	FP24	1427
	1850	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	20x.375*	4x9.2	20x.375*	5x17.5	24x.375*	5x17.5	24x.500	6x17.5	FP20	1125	FP20	1324	FP24	1325	FP24	1429

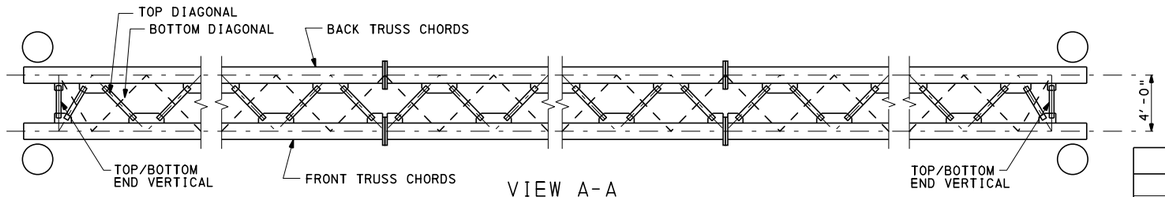
FOR CONTINUATION OF CHART, SEE SHEET 6.

PED. TYPE - INDICATES FOUNDATION PEDESTAL TYPE.

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

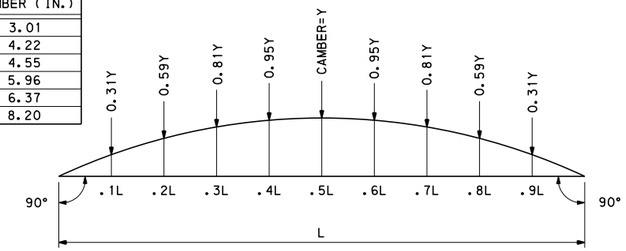
▲ - COLUMN BRACING MEMBERS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).



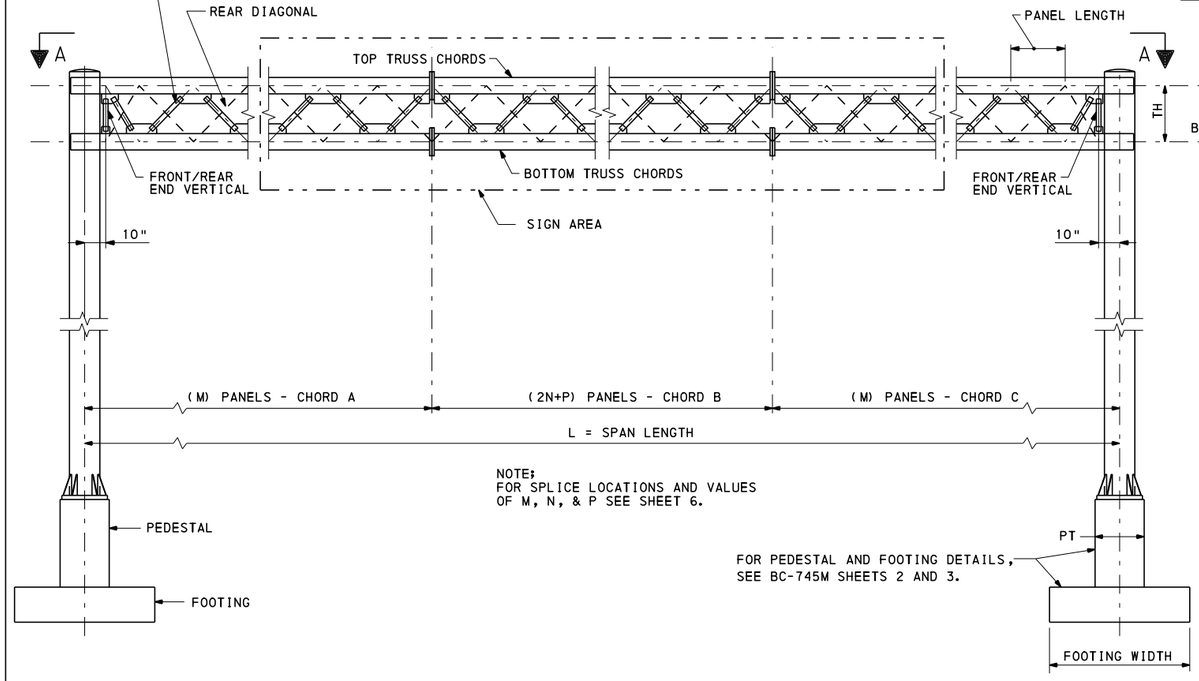
VIEW A-A

TRUSS HEIGHT	
SPAN	TH
UP TO 120′	4′-0"
120′ + TO 160′	5′-0"
160′ + TO 200′	6′-0"

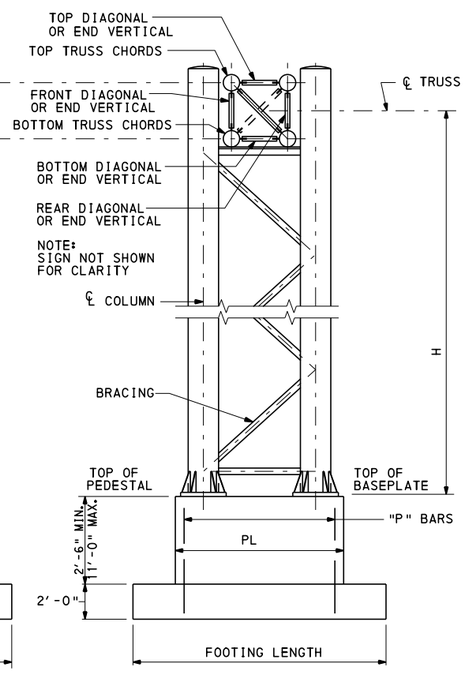
CAMBER TABLE	
SPAN	CAMBER (IN.)
100′	3.01
120′	4.22
140′	4.55
160′	5.96
180′	6.37
200′	8.20



CAMBER DIAGRAM



ELEVATION



SIDE VIEW

NOTES:

- FOR GENERAL NOTES, SEE SHEET 1.
- FOR GENERAL DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
- ONE OR MORE SPLICES IN THE TRUSS MAY BE ADDED OR ELIMINATED AT THE OPTION OF THE FABRICATOR. IN CASE OF THE ADDITION OR ELIMINATION OF SPLICES, THE HEAVIER CHORD MATERIAL MUST BE EXTENDED TOWARD THE LIGHTER CHORD MATERIAL TO THE DESIRED SPLICE LOCATION.
- "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH (FOR EXAMPLE, FOOTING TYPE 716 INDICATES A FOOTING 7′-0" WIDE x 16′-0" LONG). SEE BC-745M, SHEET 2 AND 3 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10′-0".
- FOR STRUCTURAL DETAILS, SEE BC-745M.
- CVN REQUIRED FOR COLUMN AND CHORD WALL THICKNESSES EXCEEDING ½" (0.500").

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST 4 CHORD TRUSS
SPANS FROM 100′ TO 200′

DESIGN TABLES
LOADING TYPE 1

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHT. 5 OF 7
Thomas P. Macioce CHIEF BRIDGE ENGINEER	Brent D. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	BD-645M

LOADING TYPE 1 (CONTINUED)

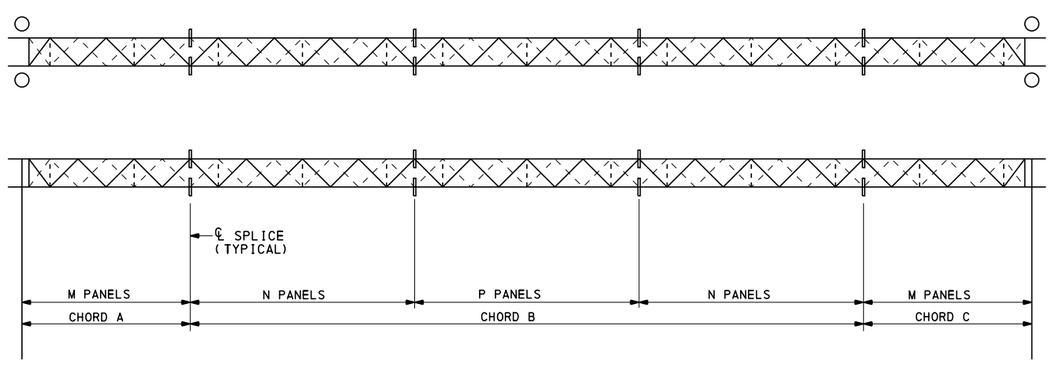
DESIGN SPAN	SIGN AREA (SQ.FT.)	TRUSS MEMBERS ** CHORDS (PIPE NOMINAL SIZE x WALL THK.) A	B	C	DIAGONALS FRONT & REAR	TOP & BOTTOM	END VERTICALS FRONT & REAR	TOP & BOTTOM	TRUSS CROSS BRACING	TOWER MEMBERS H TO 12′ COLUMN **	BRACING ▲	H OVER 12′ TO 18′ COLUMN **	BRACING ▲	H OVER 18′ TO 24′ COLUMN **	BRACING ▲	H OVER 24′ TO 33′ COLUMN **	BRACING ▲	FOUNDATION H TO 12′ PED. TYPE	FTG.	H OVER 12′ TO 18′ PED. TYPE	FTG.	H OVER 18′ TO 24′ PED. TYPE	FTG.	H OVER 24′ TO 33′ PED. TYPE	FTG.
OVER 100′ TO 120′	300	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2.5x5.0	12x.375*	3x6.25	16x.375*	3x8.625	24x.375*	3x8.625	FP12	717	FP12	718	FP16	819	FP24	922
	600	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x6.25	12x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	820	FP12	822	FP16	923	FP24	924
	900	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x8.625	16x.375*	4x9.2	18x.375*	4x11.5	24x.375*	4x11.5	FP12	822	FP16	923	FP20	1025	FP24	1026
	1200	8x.500*	8x.500*	8x.500*	3x.216	3x.216	3x.216	3x.216	3x.216	14x.375	4x9.2	16x.375*	5x17.5	18x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP16	1025	FP20	1222	FP24	1325
	1500	8x.500*	8x.500*	8x.500*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375	4x9.2	18x.375*	5x17.5	24x.375*	6x17.5	24x.500*	6x17.5	FP16	1025	FP20	1222	FP24	1325	FP24	1427
	1800	8x.500	8x.500	8x.500	3x.300	3x.300	3x.300	3x.300	3x.300	18x.375*	4x11.5	20x.375*	6x17.5	24x.375*	6x17.5	24x.500*	6x17.5	FP20	1025	FP20	1324	FP24	1427	FP26	1528
	2100	8x.500	8x.500	8x.500	3x.300	3x.300	3x.300	3x.300	3x.300	18x.375*	4x11.5	20x.375*	6x17.5	24x.375*	6x17.5	24x.500	6x17.5	FP20	1324	FP20	1324	FP24	1427	FP26	1528
	2220	8x.500	8x.500	8x.500	3x.300	3x.300	3x.300	3x.300	3x.300	20x.375*	4x11.5	20x.375*	6x17.5	24x.375*	6x17.5	—	—	FP20	1324	FP20	1324	FP24	1427	—	—
OVER 120′ TO 140′	300	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	2.5x5.0	12x.375*	3x6.25	16x.375*	3x8.625	24x.375*	3x8.625	FP12	717	FP12	820	FP16	921	FP24	922
	600	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x6.25	14x.375*	4x9.2	16x.375*	4x9.2	24x.375*	4x9.2	FP12	819	FP16	921	FP16	923	FP24	924
	900	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	14x.375*	3x8.625	16x.375*	4x11.5	18x.375*	4x11.5	24x.375*	4x11.5	FP16	921	FP16	923	FP20	1025	FP24	1223
	1200	12x.375*	12x.375*	12x.375*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	5x17.5	18x.375*	5x17.5	20x.375	5x17.5	24x.500*	5x17.5	FP16	923	FP20	1222	FP20	1324	FP24	1325
	1500	12x.375	12x.375	12x.375	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	18x.375*	6x17.5	18x.375*	6x17.5	24x.375	6x17.5	24x.500*	6x17.5	FP20	1323	FP20	1324	FP24	1426	FP26	1429
	1800	12x.500*	12x.500*	12x.500*	4x.237	4x.237	4x.237	4x.237	4x.237	20x.375*	6x17.5	24x.375*	6x17.5	24x.375*	6x17.5	—	—	FP20	1324	FP24	1324	FP24	1427	—	—
	2100	12x.500*	12x.500*	12x.500*	5x.258	5x.258	5x.258	5x.258	5x.258	20x.375*	6x17.5	24x.375*	6x17.5	24x.500*	6x17.5	—	—	FP20	1324	FP24	1427	FP24	1429	—	—
	2400	12x.500*	12x.500*	12x.500*	5x.258	5x.258	5x.258	5x.258	5x.258	20x.375*	6x17.5	24x.375*	6x17.5	—	—	—	—	FP20	1324	FP24	1427	—	—	—	—
OVER 140′ TO 160′	300	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	2.5x5.0	14x.375*	3x8.625	16x.375*	3x8.625	24x.375*	4x9.2	FP12	818	FP16	819	FP16	921	FP24	922
	600	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	14x.375*	3x6.25	16x.375*	4x9.2	18x.375*	4x9.2	24x.375*	4x9.2	FP16	921	FP16	921	FP20	923	FP24	1026
	900	12x.375*	12x.375*	12x.375*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	4x11.5	16x.375*	4x11.5	20x.375*	5x17.5	24x.375*	5x17.5	FP16	1024	FP16	1025	FP20	1025	FP24	1325
	1200	12x.500*	12x.500*	12x.500*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375*	5x17.5	18x.375*	5x17.5	24x.375*	5x17.5	24x.500*	5x17.5	FP16	1024	FP20	1222	FP24	1325	FP24	1427
	1500	12x.500	12x.500	12x.500	4x.237	4x.237	4x.237	4x.237	4x.237	18x.375*	6x17.5	20x.375*	6x17.5	24x.375*	6x17.5	24x.500*	6x17.5	FP20	1125	FP20	1324	FP24	1325	FP26	1429
	1800	12x.562	12x.562	12x.562	4x.237	4x.237	4x.237	4x.237	4x.237	20x.375*	6x17.5	24x.375*	6x17.5	24x.375*	6x17.5	—	—	FP20	1324	FP24	1325	FP24	1427	—	—
	2100	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	24x.375*	6x17.5	—	—	—	—	FP24	1325	FP24	1427	—	—	—	—
	2400	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	—	—	24x.500*	6x20.4	—	—	FP24	1426	—	—	FP26	1530	—	—
OVER 160′ TO 180′	300	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	14x.375*	3x8.625	14x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP16	818	FP16	819	FP16	921	FP24	924
	600	12x.375*	12x.375*	12x.375*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	4x9.2	16x.375*	4x9.2	18x.375	4x9.2	24x.375*	4x11.5	FP16	922	FP16	923	FP20	923	FP24	1026
	900	12x.500*	12x.500*	12x.500*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375*	4x11.5	16x.375*	4x11.5	18x.375	5x17.5	24x.375*	5x17.5	FP16	1024	FP16	1025	FP20	1222	FP24	1325
	1200	12x.500	12x.500	12x.500	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	20x.375*	5x17.5	20x.375*	5x17.5	24x.375*	5x17.5	—	—	FP20	1222	FP20	1222	FP24	1325	—	—
	1500	12x.688	12x.688	12x.688	4x.237	4x.237	4x.237	4x.237	4x.237	20x.375*	5x17.5	24x.375*	6x17.5	24x.375*	6x17.5	—	—	FP20	1323	FP24	1325	FP24	1325	—	—
	1800	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	5x17.5	24x.375*	6x17.5	—	—	—	—	FP24	1324	FP24	1325	—	—	—	—
	2100	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	—	—	24x.500*	6x20.4	—	—	FP24	1325	—	—	FP24	1429	—	—
	2400	12x.844	12x.844	12x.844	4x.337	4x.337	4x.337	4x.337	4x.337	24x.375	6x17.5	—	—	—	—	—	—	FP24	1426	—	—	—	—	—	—
OVER 180′ TO 200′	300	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	16x.375*	3x8.625	16x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP16	1016	FP16	1016	FP16	1117	FP24	1117
	600	12x.500*	12x.500*	12x.500*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375*	4x9.2	16x.375*	4x9.2	20x.375*	4x9.2	24x.375*	4x11.5	FP16	1117	FP16	1117	FP20	1118	FP24	1221
	900	12x.562	12x.562	12x.562	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375*	4x9.2	18x.375	4x9.2	20x.375*	4x11.5	24x.500*	5x17.5	FP16	1117	FP20	1220	FP20	1120	FP24	1221
	1200	12x.688	12x.688	12x.688	4x.237	4x.237	4x.237	4x.237	4x.237	18x.375*	5x17.5	20x.375*	5x17.5	24x.375*	5x17.5	24x.500*	5x17.5	FP20	1219	FP20	1221	FP24	1221	FP26	1324
	1500	12x.844	12x.844	12x.844	5x.258	5x.258	5x.258	5x.258	5x.258	18x.375*	5x17.5	24x.375*	5x17.5	24x.375*	5x17.5	—	—	FP20	1219	FP24	1425	FP24	1221	—	—
	1800	12x.844	12x.844	12x.844	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	5x17.5	—	—	—	—	—	—	FP24	1323	—	—	—	—	—	—

PED. TYPE - INDICATES FOUNDATION PEDESTAL TYPE.

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - COLUMN BRACING MEMBERS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).



ELEVATION

ACTUAL SPAN	DESIGN SPAN	NUMBER OF SPLICES	NO. OF PANELS M	N	P
UP TO 100′	100′	2	8	0	10
100′ + TO 120′	120′	2	10	0	10
120′ + TO 140′	140′	4	6	8	8
140′ + TO 160′	160′	4	8	8	8
160′ + TO 180′	180′	4	8	10	10
180′ + TO 200′	200′	4	10	10	10

NOTE:
FOR DESIGN TABLE NOTES, SEE SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST 4 CHORD TRUSS
SPANS FROM 100′ TO 200′

DESIGN TABLES
LOADING TYPE 1

RECOMMENDED AUG. 4, 2017
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
Brian D Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

SHT. 6 OF 7

BD-645M

LOADING TYPE 2

DESIGN SPAN	SIGN AREA (SQ.FT.)	TRUSS MEMBERS **								TOWER MEMBERS								FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.)			DIAGONALS		END VERTICALS		TRUSS CROSS BRACING	H TO 12'		H OVER 12' TO 18'		H OVER 18' TO 24'		H OVER 24' TO 33'		H TO 12'		H OVER 12' TO 18'		H OVER 18' TO 24'		H OVER 24' TO 33'	
		A	B	C	FRONT & REAR	TOP & BOTTOM	FRONT & REAR	TOP & BOTTOM		COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.
TO 100'	200	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2x3.85	12x.375*	2x4.75	16x.375*	3x6.25	24x.375*	3x6.25	FP12	717	FP12	718	FP16	819	FP24	820
	350	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2.5x5.0	12x.375*	3x6.25	16x.375*	3x8.625	24x.375*	4x9.2	FP12	718	FP12	720	FP16	821	FP24	822
	500	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	3x6.25	12x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	720	FP12	822	FP16	923	FP24	924
	650	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x6.25	14x.375*	3x8.625	18x.375*	4x9.2	24x.375*	4x11.5	FP12	822	FP16	923	FP20	923	FP24	1026
	800	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	12x.375*	3x8.625	16x.375*	4x9.2	18x.375*	4x11.5	24x.375*	5x17.5	FP12	822	FP16	923	FP20	1025	FP24	1028
	950	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	12x.375*	3x8.625	16x.375*	4x11.5	18x.375*	5x17.5	24x.375*	5x17.5	FP12	923	FP16	1025	FP20	1027	FP24	1028
	1100	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	14x.375*	3x8.625	16x.375*	5x17.5	18x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP16	1025	FP20	1027	FP24	1130
	1250	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	3x8.625	18x.375*	5x17.5	20x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP20	1027	FP20	1027	FP24	1325
	1400	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x9.2	18x.375*	5x17.5	20x.375*	5x17.5	24x.500*	5x17.5	FP16	1025	FP20	1027	FP20	1324	FP24	1427
	1550	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x9.2	18x.375*	5x17.5	24x.375*	5x17.5	24x.500*	5x17.5	FP16	1025	FP20	1222	FP24	1325	FP24	1427
OVER 100' TO 120'	300	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	3x6.25	12x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	718	FP12	720	FP16	819	FP24	822
	600	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x8.625	14x.375*	4x9.2	18x.375*	4x11.5	24x.375*	4x11.5	FP12	820	FP16	923	FP20	923	FP24	1026
	900	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	14x.375*	4x9.2	16x.375*	5x17.5	20x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP16	1025	FP20	1027	FP24	1028
	1200	8x.500*	8x.500*	8x.500*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x9.2	18x.375*	5x17.5	20x.375	6x17.5	24x.500*	6x17.5	FP16	1025	FP20	1027	FP20	1324	FP24	1427
	1500	8x.500*	8x.500*	8x.500*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x11.5	18x.375*	6x17.5	24x.375	6x17.5	24x.500	6x17.5	FP16	1025	FP20	1027	FP24	1130	FP24	1429
	1800	8x.500	8x.500	8x.500	3x.300	3x.300	3x.300	3x.300	3x.300	18x.375*	4x11.5	20x.375*	6x17.5	24x.375*	6x17.5	—	—	FP20	1127	FP20	1324	FP24	1427	—	—
	1865	8x.500	8x.500	8x.500	3x.300	3x.300	3x.300	3x.300	3x.300	18x.375	4x11.5	20x.375*	6x17.5	24x.375*	6x17.5	—	—	FP20	1324	FP20	1324	FP24	1427	—	—
OVER 120' TO 140'	300	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	2.5x5.0	12x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	718	FP12	720	FP16	821	FP24	924
	600	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x8.625	14x.375*	4x11.5	18x.375*	4x11.5	24x.375*	4x11.5	FP12	821	FP16	923	FP20	923	FP24	926
	900	10x.365*	10x.365*	10x.365*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	5x17.5	16x.375*	5x17.5	20x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP16	1025	FP20	1027	FP24	1130
	1200	12x.375*	12x.375*	12x.375*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375*	6x17.5	18x.375*	6x17.5	24x.375*	6x17.5	24x.500	6x17.5	FP16	1025	FP20	1027	FP24	1130	FP24	1429
	1500	12x.375*	12x.375*	12x.375*	4x.237	4x.237	4x.237	4x.237	4x.237	18x.375*	6x17.5	20x.375*	6x17.5	24x.375*	6x17.5	—	—	FP20	1323	FP20	1129	FP24	1427	—	—
	1800	12x.500*	12x.500*	12x.500*	4x.237	4x.237	4x.237	4x.237	4x.237	20x.375*	6x17.5	24x.375*	6x17.5	24x.375*	6x17.5	—	—	FP20	1324	FP24	1325	FP24	1429	—	—
	2100	12x.500*	12x.500*	12x.500*	5x.258	5x.258	5x.258	5x.258	5x.258	20x.375*	6x17.5	24x.375*	6x17.5	24x.500	6x17.5	—	—	FP20	1324	FP24	1427	FP24	1429	—	—
	2175	12x.500*	12x.500*	12x.500*	5x.258	5x.258	5x.258	5x.258	5x.258	20x.375*	6x17.5	24x.375*	6x17.5	24x.500	6x20.4	—	—	FP20	1324	FP24	1427	FP26	1429	—	—
OVER 140' TO 160'	300	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x6.25	14x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	819	FP16	819	FP16	821	FP24	924
	600	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	14x.375*	3x8.625	16x.375*	4x11.5	18x.375*	4x11.5	24x.375*	5x17.5	FP16	821	FP16	923	FP20	1025	FP24	1028
	900	12x.375*	12x.375*	12x.375*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	5x17.5	18x.375*	5x17.5	20x.375	6x17.5	24x.375*	6x17.5	FP16	1024	FP20	1027	FP20	1027	FP24	1130
	1200	12x.500*	12x.500*	12x.500*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	18x.375*	6x17.5	20x.375*	6x17.5	24x.375	6x17.5	24x.500	6x17.5	FP20	1025	FP20	1027	FP24	1130	FP24	1429
	1500	12x.500*	12x.500*	12x.500*	4x.237	4x.237	4x.237	4x.237	4x.237	20x.375*	6x17.5	24x.375*	6x17.5	24x.375*	6x17.5	—	—	FP20	1324	FP24	1130	FP24	1429	—	—
	1800	12x.562	12x.562	12x.562	5x.258	5x.258	5x.258	5x.258	5x.258	20x.375	6x17.5	24x.375*	6x17.5	24x.500	6x20.4	—	—	FP20	1324	FP24	1427	FP24	1429	—	—
	2100	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	24x.375	6x17.5	—	—	—	—	FP24	1325	FP24	1427	—	—	—	—
	2400	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	—	—	—	—	—	—	FP24	1427	—	—	—	—	—	—
OVER 160' TO 180'	300	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	14x.375*	4x9.2	14x.375*	4x9.2	16x.375*	4x9.2	24x.375*	4x9.2	FP16	819	FP16	819	FP16	923	FP24	924
	600	12x.375*	12x.375*	12x.375*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	4x11.5	16x.375*	4x11.5	18x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP16	923	FP20	925	FP24	1028
	900	12x.500*	12x.500*	12x.500*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375	5x17.5	18x.375	5x17.5	24x.375*	6x17.5	24x.500	6x17.5	FP16	1025	FP20	1027	FP24	1028	FP24	1427
	1200	12x.500*	12x.500*	12x.500*	4x.237	4x.237	4x.237	4x.237	4x.237	20x.375*	6x17.5	20x.375	6x17.5	24x.375*	6x17.5	—	—	FP20	1223	FP20	1129	FP24	1427	—	—
	1500	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	20x.375*	6x17.5	24x.375*	6x17.5	24x.500	6x17.5	—	—	FP20	1324	FP24	1325	FP24	1429	—	—
	1800	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	—	—	—	—	—	—	FP24	1325	—	—	—	—	—	—
	2100	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375	6x17.5	—	—	24x.500*	6x20.4	—	—	FP24	1427	—	—	FP24	1531	—	—
	2400	12x.844	12x.844	12x.844	4x.337	4x.337	4x.337	4x.337	4x.337	24x.375	6x17.5	—	—	—	—	—	—	FP24	1427	—	—	—	—	—	—
OVER 180' TO 200'	300	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	16x.375*	3x8.625	16x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP16	819	FP16	819	FP16	819	FP24	822
	600	12x.500*	12x.500*	12x.500*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375*	4x9.2	18x.375*	4x9.2	20x.375*	4x11.5	24x.375*	5x17.5	FP16	923	FP20	1025	FP20	923	FP24	1028
	900	12x.562	12x.562	12x.562	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	18x.375*	5x17.5	20x.375*	5x17.5	24x.375*	5x17.5	24x.500	6x17.5	FP20	1025	FP20	1027	FP24	1028	FP24	1325
	1200	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	18x.375*	5x17.5	20x.375*	5x17.5	24x.375*	6x17.5	—	—	FP20	1223	FP20	1222	FP24	1325	—	—
	1500	12x.844	12x.844	12x.844	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	—	—	—	—	—	—	FP24	1323	—	—	—	—	—	—
	1800	12x.844	12x.844	12x.844	4x.337	4x.337	4x.337	4x.337	4x.337	24x.375*	6x17.5	—	—	—	—	—	—	FP24	1325	—	—	—	—	—	—

PED. TYPE - INDICATES FOUNDATION PEDESTAL TYPE.

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - COLUMN BRACING MEMBERS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).

NOTE:

FOR DESIGN TABLE NOTES, SEE SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST 4 CHORD TRUSS
SPANS FROM 100' TO 200'

DESIGN TABLES
LOADING TYPE 2

RECOMMENDED AUG. 4, 2017
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
Brent D. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

SHT. 7 OF 7

BD-645M

CHANGE 1

GENERAL NOTES

1. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE f'c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. VERIFY ALL DIMENSIONS AND GEOMETRY OF THE EXISTING STRUCTURES IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. PIPE DIAMETERS SHOWN IN THE DESIGN TABLES ARE OUTSIDE DIAMETERS.
10. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16 ". FOR BOLTS 1" DIAMETER AND LARGER, THE WIDTH OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8 ".
11. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE CHECKED.
12. PROVIDE ANCHOR BOLT HOLES 1/4 " LARGER THAN BOLT DIAMETER.
13. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
14. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
15. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN

1. SPECIFICATIONS: "AASHTO 4TH EDITION STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS" (2001 WITH INTERIMS THROUGH 2003) AND "AASHTO 17TH EDITION STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES" (2002).
2. WIND LOADS ARE BASED ON 90 MPH (3 SECOND GUST) BASIC WIND SPEED.
3. CAISSON FOUNDATIONS ARE BASED ON A MAXIMUM ½" LATERAL DEFLECTION AT TOP OF CAISSON AND ON THE FOLLOWING SOIL PARAMETERS:
   A) LOOSE GRANULAR SOIL WITH 100 PCF UNIT WEIGHT, 28 DEGREE INTERNAL FRICTION ANGLE, 0 PSF COHESION, AND 25 PCI MODULUS OF SUBGRADE REACTION.
   B) SOFT COHESIVE SOIL WITH 100 PCF UNIT WEIGHT, 0 DEGREE INTERNAL FRICTION ANGLE, 800 PSF COHESION, 200 PCI MODULUS OF SUBGRADE REACTION, AND 0.02 E50 STRAIN.
4. THE MEMBER SIZES INDICATED IN THE DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY I.
5. THE TRAFFIC ENGINEER SETS THE DESIGN SIGN AREA USING ONE OF THE FOLLOWING OPTIONS:
   A. THE ACTUAL SIGN AREA TO BE PLACED ON THE STRUCTURE AT THE TIME OF CONSTRUCTION.
   B. THE ACTUAL SIGN AREA INCREASED BY 25%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (RURAL HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
   C. THE ACTUAL SIGN AREA INCREASED BY 50%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (URBAN HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
6. THE DESIGN SIGN AREA WILL BE ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE.
7. ANY SPAN LENGTH OR CANTILEVER LENGTH GREATER THAN THAT SHOWN ON THE STANDARD IS A PROJECT SPECIFIC DESIGN. DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE RULING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN 1/2 ".

MATERIAL

1. PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.
2. PROVIDE STRUCTURAL STEEL CONFORMING TO AASHTO M270, GRADE 36 (ASTM A709, GRADE 36) DESIGNATION EXCEPT WHEN NOTED OTHERWISE.
3. PROVIDE WELDED OR SEAMLESS STEEL PIPE CONFORMING TO PUBLICATION 408, SECTION 948.2(a)1.
4. PROVIDE HIGH-STRENGTH STEEL BOLTS CONFORMING TO AASHTO M164 (ASTM A325). MECHANICALLY GALVANIZE ALL BOLTS (EXCEPT ANCHOR BOLTS), NUTS AND WASHERS. EITHER MECHANICALLY GALVANIZE ALL ANCHOR BOLTS OR HOT-DIP GALVANIZE ALL ANCHOR BOLTS IN ACCORDANCE WITH FABRICATION NOTE 6 ON THIS SHEET. PROVIDE U-BOLTS CONFORMING TO ASTM A449. PROVIDE ANCHOR BOLTS CONFORMING TO ASTM F1554, GRADE 55.

FABRICATION

1. CONSTRUCT SIGN STRUCTURES TRUE TO DIMENSION, FREE FROM KINKS, TWISTS OR BENDS, AND UNIFORM IN APPEARANCE. ASSEMBLE COMPLETED SECTIONS IN THE SHOP AND CHECK FOR STRAIGHTNESS, ALIGNMENT, DIMENSION, AND THE FIRM SEATING OF THE SPLICE PLATES. CORRECT ANY VARIATIONS TO THE SATISFACTION OF THE ENGINEER.
2. FORM MASTS FOR SIGN STRUCTURES TO THE RADII SHOWN ON THE PLANS IN ACCORDANCE WITH THE TUBE AND PIPE ASSOCIATION INTERNATIONAL RECOMMENDED STANDARDS FOR INDUCTION BENDING OF PIPE AND TUBE (TPA-IBS-98).
3. AFFIX CLIPS, EYES, OR REMOVABLE BRACKETS TO ALL MASTS AND MAST ARMS, AS NECESSARY, TO SECURE THE SIGN STRUCTURE DURING SHIPPING AND FOR LIFTING AND MOVING DURING ERECTION. THIS IS TO PREVENT DAMAGE TO THE FINISHED GALVANIZED OR PAINTED SURFACES. REMOVE BRACKETS ON SIGN STRUCTURES AFTER ERECTION. INCLUDE DETAILS OF SUCH DEVICES ON THE SHOP DRAWINGS.
4. FABRICATE ALL SIGN STRUCTURES INTO THE LARGEST PRACTICAL SECTIONS PRIOR TO GALVANIZING. SUBMIT SPLICE LOCATIONS TO THE ENGINEER FOR APPROVAL. DO NOT COMMENCE FABRICATION UNTIL SUCH SPLICE LOCATIONS ARE APPROVED.
5. GRIND ALL AREAS TO BE WELDED TO BRIGHT METAL. BUTT WELD SPLICES ARE NOT PERMITTED, UNLESS SHOWN ON THE PLANS. COMPLETE ALL WELDING AND REQUIRED TESTING BEFORE ANY MATERIAL IS GALVANIZED. NON-DESTRUCTIVELY TEST ALL CIRCUMFERENTIAL AND STIFFENER WELDS USING THE METHODS AND PROCEDURES IN ACCORDANCE WITH SECTION 948. THE ACCEPTABLE CRITERIA ARE STATED IN TABLE 6.1 OF AASHTO/AWS D1.1. PROVIDE FULL PENETRATION GROOVE WELDS FOR ALL LONGITUDINAL WELDS WITHIN 6" OF A FULL PENETRATION CIRCUMFERENTIAL GROOVE WELD AND INSPECT AS SPECIFIED ABOVE. PROVIDE MAXIMUM WELD UNDERCUT OF 0.01".
6. HOT-DIP GALVANIZE ALL COMPONENTS (EXCEPT REINFORCEMENT BARS, ALUMINUM, AND NON-FERROUS INCIDENTALS) AFTER FABRICATION PER ASTM A123 OR ASTM A153, AS APPROPRIATE.

CONSTRUCTION

1. USE TEMPLATES TO ACCURATELY SET BASE PLATE ANCHOR BOLTS TO CORRECT ELEVATION AND ALIGNMENT. SECURELY BRACE ANCHOR BOLTS AGAINST DISPLACEMENT BEFORE CAISSON CONCRETE IS PLACED AND DURING CONCRETE CURING.
2. ERECT SIGN STRUCTURE ONLY AFTER CAISSON CONCRETE MEETS 7 DAY STRENGTH REQUIREMENTS.
3. TEMPORARILY SUPPORT MAST ARMS TO RELIEVE LOAD FROM THE SPLICES WHILE HIGH-STRENGTH BOLTS ARE BEING TIGHTENED IN ORDER TO FIRMLY SEAT THE CONNECTION PLATES.
4. PRIOR TO ERECTION, DEMONSTRATE TO THE ENGINEER BY PREASSEMBLY OR OTHER APPROVED METHOD THAT FRAME STRUCTURE LENGTH IN A NO-LOAD CONDITION MATCHES FIELD MEASURED CAISSON SPACING WITHIN 1/2".
5. ADEQUATELY SUSPEND FRAME STRUCTURES TO AVOID DISTORTIONS OR CHANGES IN SPAN LENGTH IF ERECTED ONTO FOUNDATIONS AS ONE UNIT.

NOTES TO DESIGNER

- WHEN SIZING FRAME COMPONENTS AND THE HORIZONTAL CENTERLINE OF THE SIGN PANEL IS NOT LOCATED AT THE CENTERLINE OF MAST ARM, CALCULATE PANEL AREA AS TWICE THE VERTICAL DIMENSION FROM THE CENTERLINE OF MAST ARM TO EITHER THE TOP OR BOTTOM OF THE SIGN PANEL, WHICHEVER IS GREATER, MULTIPLIED BY THE SIGN PANEL LENGTH.
- DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS) ARE PROHIBITED ON MONOPIPE STRUCTURES.
- USE A MINIMUM OF 2" THICKNESS FOR ALL SPLICE PLATES TO PREVENT DISTORTION DURING WELDING.

REFERENCE DRAWINGS

TC-8700C	SPACING CHARTS/DIRECT APPLIED LETTERS, NUMERALS, & ARROWS
TC-8701D	SIGN DETAILS/FREEWAY AND EXPRESSWAY GUIDE SIGNS
TC-8701E	EXTRUDED ALUMINUM CHANNEL SIGN
TC-8701S	FLAT SHEET ALUMINUM SIGNS WITH EXTRUDED ALUMINUM STIFFENERS
TC-8715	SIGN LIGHTING
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-747M	MONOPIPE SIGN STRUCTURES
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

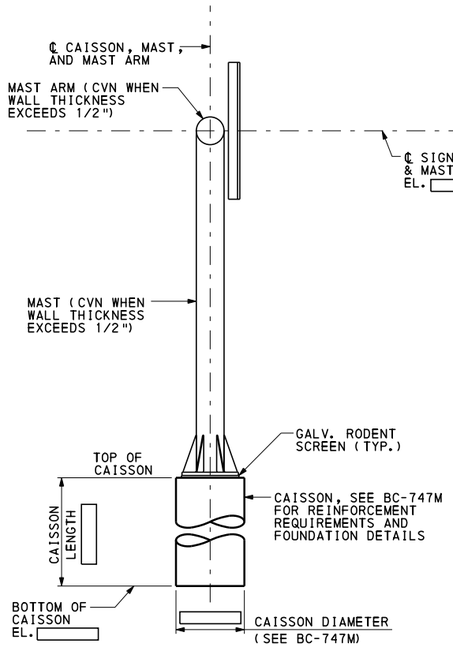
MONOPIPE SIGN STRUCTURES
FRAME STRUCTURE SPANS UP TO 160' AND CANTILEVER MONOPIPE STRUCTURE STRUT LENGTHS UP TO 27'
GENERAL NOTES

RECOMMENDED AUG. 4, 2017
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

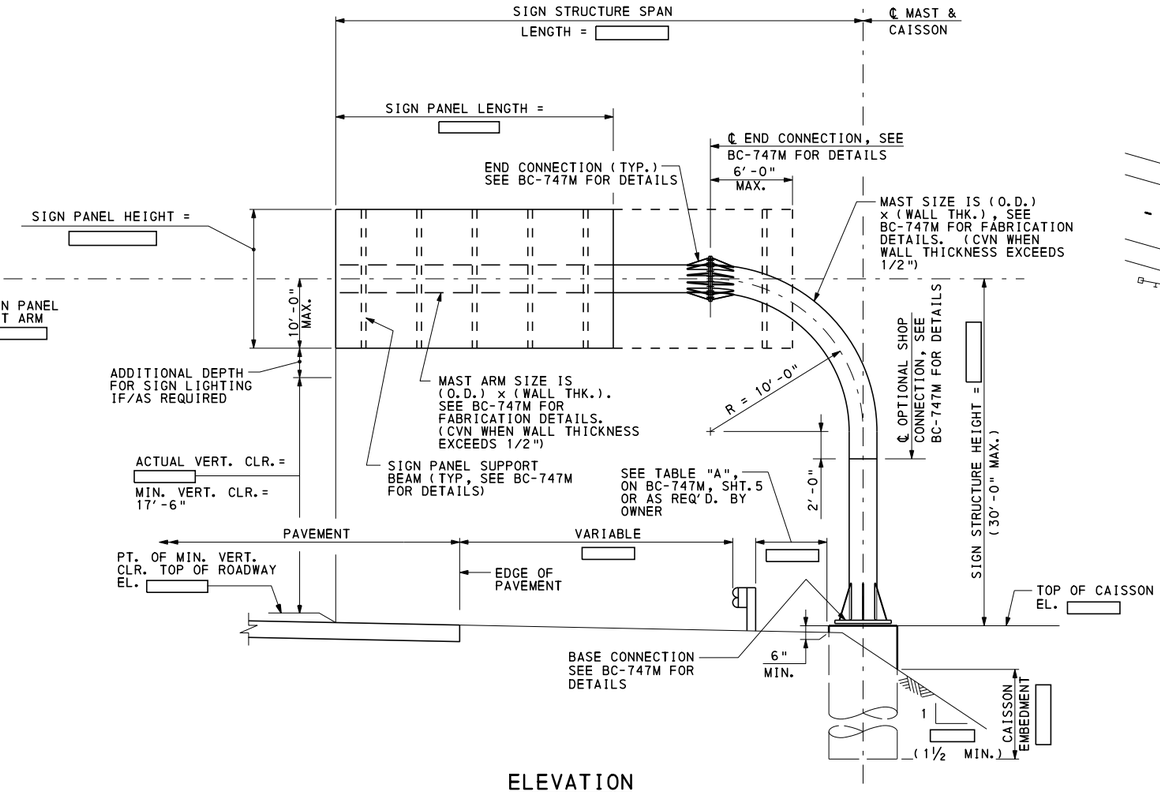
RECOMMENDED AUG. 4, 2017
Brian D. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 5

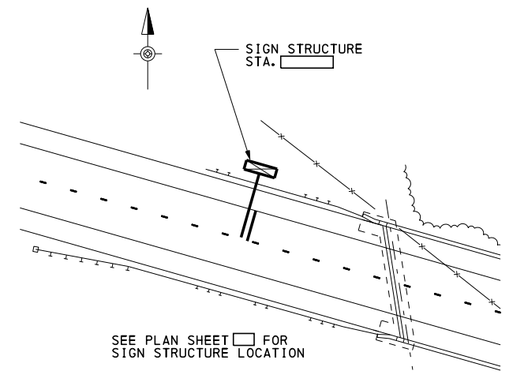
BD-647M



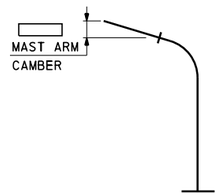
SIDE VIEW



ELEVATION



LOCATION PLAN



CAMBER DIAGRAM

MAST ARM CAMBER MUST INCLUDE BOTH MAST ARM AND MAST (COLUMN) DEFLECTION. BACK RAKING OF MAST IS NOT PERMITTED.

NOTES TO DESIGNER:

- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH ☐
- DESIGNER MUST PROVIDE INFORMATION IN () PARENTHESES ON ELEVATION BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED.
- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS:

GENERAL NOTES:

1. FOR GENERAL NOTES, SEE BC-747M.
2. ☐ DIAMETER CAISSON WITH ☐ - NO. 8 REINFORCING BARS. SEE BC-747M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
3. PROVIDE A SPACE OF 2'-0" OR LESS, OR ONE-HALF THE TALLER PANEL HEIGHT OR MORE, BETWEEN ADJACENT SIGN PANELS WHEN PRESENT.
4. TERMINATE WELDS 1/4" SHORT OF STIFFENER ENDS AND STIFFENER CHAMFER.
5. SEAL BASE PLATE TO FOUNDATION GAP WITH GALVANIZED STEEL SCREEN, 1/2" BY 1/2" MESH AND 0.063" DIAMETER WIRES. SCREEN IS TO PREVENT ENTRY OF RODENTS WHILE PERMITTING DRAINAGE. SCREEN IS TO BE REMOVABLE AND ATTACHED TO BASEPLATE WITH STAINLESS STEEL HARDWARE.

- DESIGNER IS REQUIRED TO PROVIDE MAST ARM CAMBER ON DESIGN PLAN FOR EACH SPECIFIC STRUCTURE SPAN.

DESIGN CRITERIA	
DESIGN SIGN AREA (A) =	☐
DESIGN SPAN =	☐
FATIGUE CATEGORY =	☐

NOTE:
DESIGN FOR ACTUAL SIGN AREA, ACTUAL SIGN AREA INCREASED BY 25%, OR ACTUAL SIGN AREA INCREASED BY 50%.
(DESIGNER TO INDICATE CONTROLLING CONDITION)

TABLE OF ESTIMATED QUANTITIES

ITEM NO.	ITEM	UNIT	QUANTITY
*	STEEL SIGN STRUCTURE	LBS	
0000-0000	STRUCTURE MOUNTED SIGNS	SF	
0000-0000	CLASS 3 EXCAVATION	CY	
0000-0000	CLASS A CEMENT CONCRETE	CY	
0000-0000	REINFORCEMENT BARS	LBS	

* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. ☐0000 - ☐0000

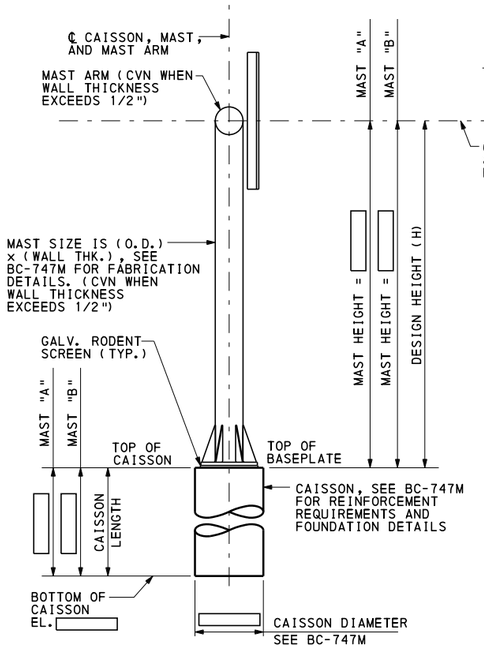
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

MONOPIPE SIGN STRUCTURES

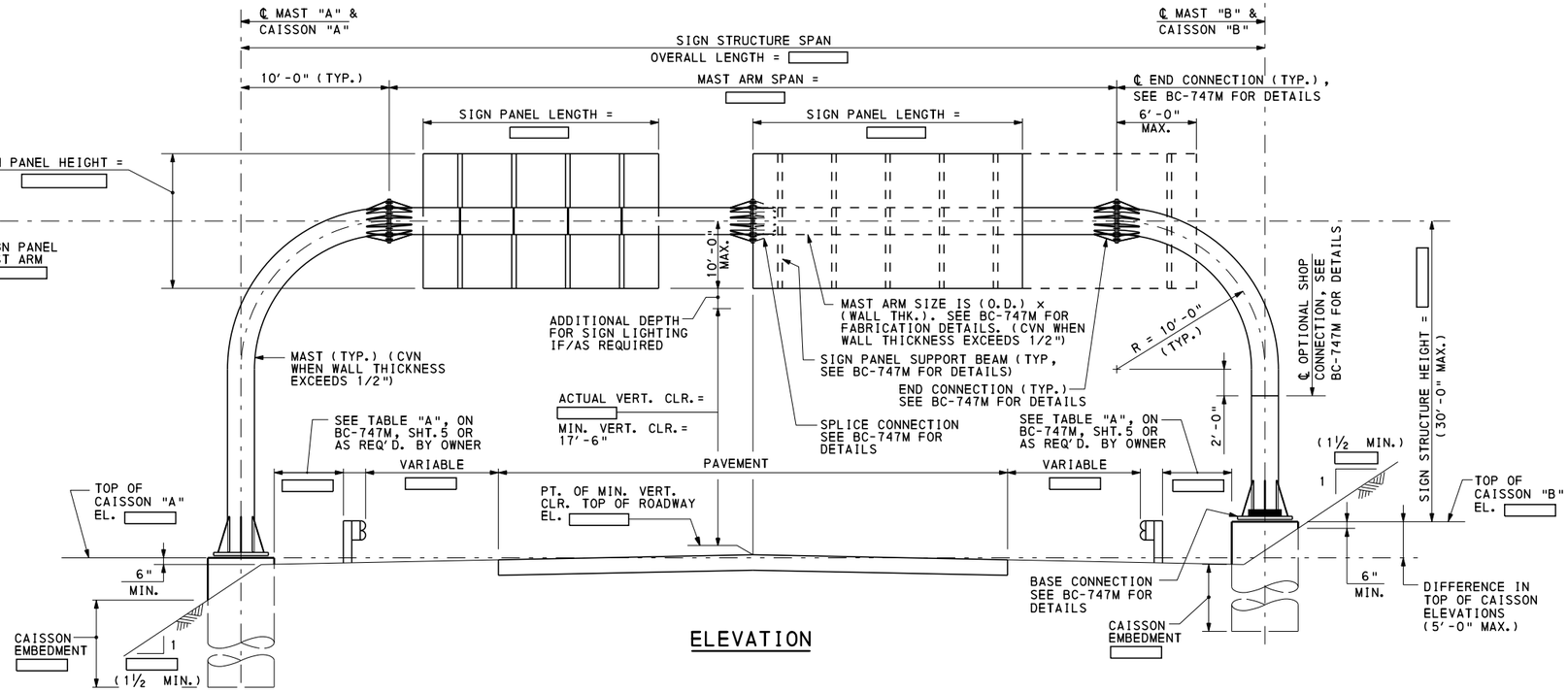
CANTILEVER MONOPIPE STRUCTURE STRUT LENGTHS UP TO 27'

CANTILEVER STRUCTURE SAMPLE CONTRACT DRAWING

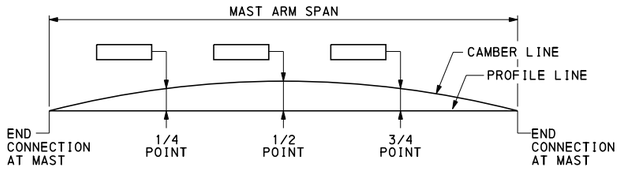
RECOMMENDED AUG. 4, 2017 Thomas P. Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brian D. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHEET 2 OF 5 BD-647M



SIDE VIEW

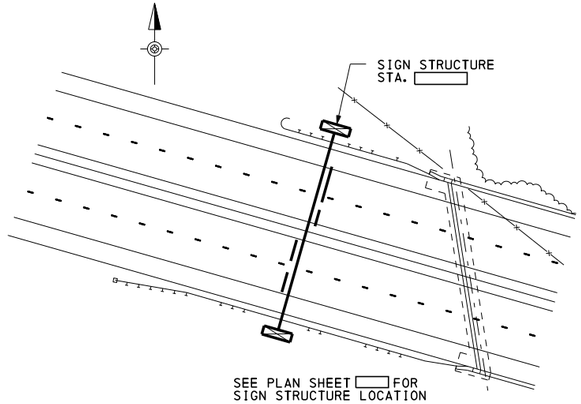


ELEVATION



CAMBER DIAGRAM

CAMBER VALUES REPRESENTS MAXIMUM DEAD LOAD DEFLECTION BETWEEN END CONNECTIONS AND SPAN LENGTH EQUALS DISTANCE BETWEEN MASTS.



LOCATION PLAN

NOTES TO DESIGNER:

- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH ☐
- DESIGNER MUST PROVIDE INFORMATION IN () PARENTHESES ON ELEVATION AND SIDE VIEW BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED.
- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS:

GENERAL NOTES:

1. FOR GENERAL NOTES, SEE BC-747M.
2. ☐ DIAMETER CAISSON WITH ☐ - NO. 8 REINFORCING BARS. SEE BC-747M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
3. PROVIDE A SPACE OF 2'-0" OR LESS, OR ONE-HALF THE TALLER PANEL HEIGHT OR MORE, BETWEEN ADJACENT SIGN PANELS WHEN PRESENT.
4. TERMINATE WELDS 1/4" SHORT OF STIFFENER ENDS AND STIFFENER CHAMFER.
5. SEAL BASE PLATE TO FOUNDATION GAP WITH GALVANIZED STEEL SCREEN, 1/2" BY 1/2" MESH AND 0.063" DIAMETER WIRES. SCREEN IS TO PREVENT ENTRY OF RODENTS WHILE PERMITTING DRAINAGE. SCREEN IS TO BE REMOVABLE AND ATTACHED TO BASEPLATE WITH STAINLESS STEEL HARDWARE.

- DESIGNER IS REQUIRED TO PROVIDE MAST ARM CAMBER ON DESIGN PLAN FOR EACH SPECIFIC STRUCTURE SPAN.

DESIGN CRITERIA	
DESIGN SIGN AREA (A) =	☐
DESIGN SPAN =	☐
FATIGUE CATEGORY =	☐

NOTE:
DESIGN FOR ACTUAL SIGN AREA, ACTUAL SIGN AREA INCREASED BY 25%, OR ACTUAL SIGN AREA INCREASED BY 50%.
(DESIGNER TO INDICATE CONTROLLING CONDITION)

TABLE OF ESTIMATED QUANTITIES

ITEM NO.	ITEM	UNIT	QUANTITY
*	STEEL SIGN STRUCTURE	LBS	
0000-0000	STRUCTURE MOUNTED SIGNS	SF	
0000-0000	CLASS 3 EXCAVATION	CY	
0000-0000	CLASS A CEMENT CONCRETE	CY	
0000-0000	REINFORCEMENT BARS	LBS	

* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. ☐ - ☐

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

MONOPIPE SIGN STRUCTURES

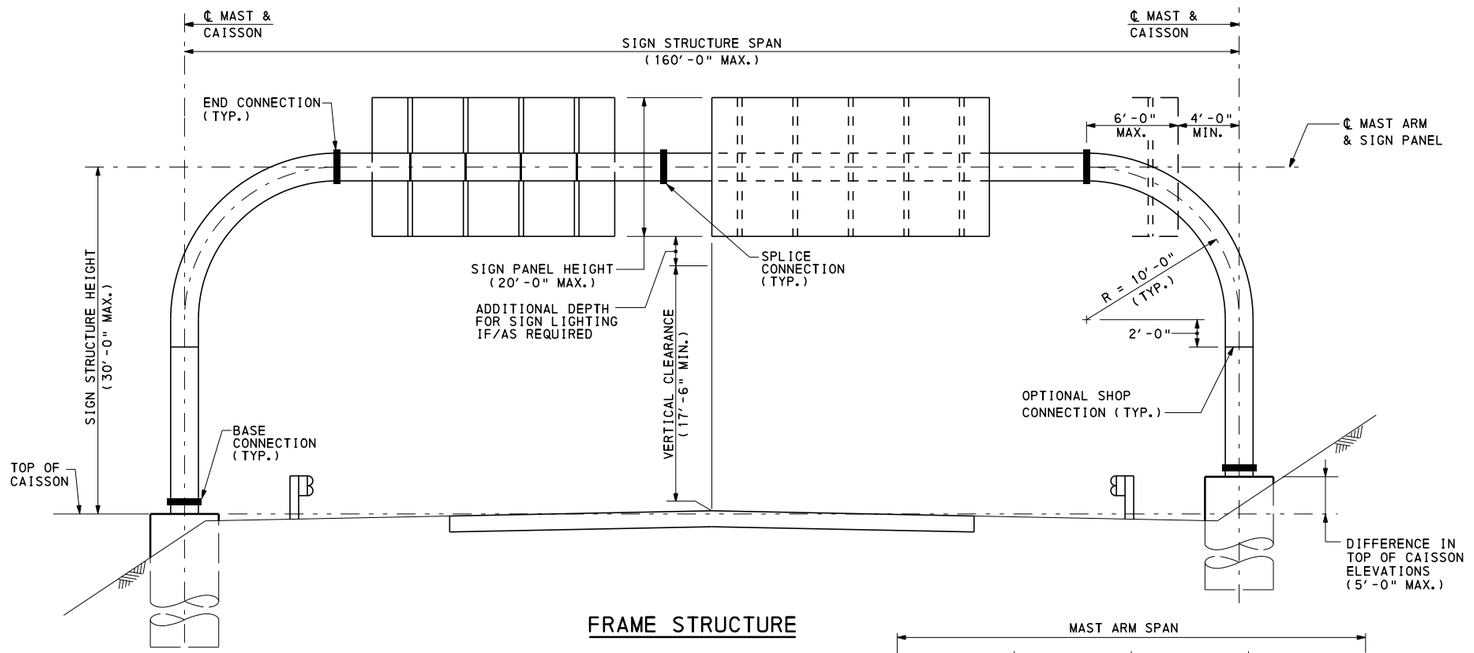
FRAME STRUCTURE SPANS UP TO 160'

FRAME STRUCTURE SAMPLE CONTRACT DRAWING

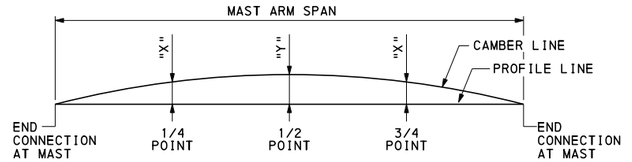
RECOMMENDED AUG. 4, 2017 Thomas P Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brian D Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHEET 3 OF 5 BD-647M

MAST & MAST ARM SELECTION TABLE (FRAME STRUCTURES)

SPAN (FEET)	PANEL AREA (S.F.)	MAST		MAST ARM					
				USING MAXIMUM LENGTH OF MAST ARM SEGMENTS			USING MINIMUM LENGTH OF MAST ARM SEGMENTS		
		DIAMETER (INCHES)	THICKNESS (INCHES)	DIAMETER (INCHES)	THICKNESS (INCHES)	SEGMENT ARRANGEMENT	DIAMETER (INCHES)	THICKNESS (INCHES)	SEGMENT ARRANGEMENT
60	1,040	24	0.500 (WT. XS)	24	0.375 (SCH. 20)	A	24	0.375 (SCH. 20)	B
	760	24	0.375 (SCH. 20)	24	0.375 (SCH. 20)	A	24	0.375 (SCH. 20)	B
	440	20	0.375 (SCH. 20)	20	0.375 (SCH. 20)	A	20	0.375 (SCH. 20)	B
80	1,000	24	0.500 (WT. XS)	24	0.500 (WT. XS)	B	24	0.500 (WT. XS)	C
	880	24	0.500 (WT. XS)	24	0.500 (WT. XS)	B	24	0.500 (WT. XS)	C
	600	24	0.375 (SCH. 20)	24	0.375 (SCH. 20)	B	24	0.375 (SCH. 20)	C
	360	20	0.375 (SCH. 20)	20	0.375 (SCH. 20)	B	20	0.375 (SCH. 20)	C
100	740	24	0.500 (WT. XS)	—	—	—	24	0.500 (WT. XS)	C
	520	24	0.500 (WT. XS)	24	0.500 (WT. XS)	B	24	0.375 (SCH. 20)	C
	280	20	0.375 (SCH. 20)	20	0.500 (SCH. 30)	B	20	0.375 (SCH. 20)	C
120	520	24	0.500 (WT. XS)	24	0.500 (WT. XS)	C	—	—	—
	360	24	0.375 (SCH. 20)	24	0.375 (SCH. 20)	C	24	0.500 (WT. XS)	D
140	420	24	0.500 (WT. XS)	24	0.500 (WT. XS)	C	—	—	—
	300	24	0.375 (SCH. 20)	24	0.375 (SCH. 20)	C	24	0.500 (WT. XS)	D
160	300	24	0.500 (WT. XS)	24	0.500 (WT. XS)	D	24	0.500 (WT. XS)	E



FRAME STRUCTURE



MAST ARM SEGMENT ARRANGEMENT TABLE (FRAME STRUCTURES)

ARRANGEMENT	SEGMENT LENGTH / MAST ARM LENGTH
A	1.00
B	0.50 | 0.50
C	0.33 | 0.33 | 0.33
D	0.25 | 0.25 | 0.25 | 0.25
E	0.20 | 0.20 | 0.20 | 0.20 | 0.20

CAMBER DIAGRAM

CAMBER		
SPAN* (FEET)	X (INCHES)	Y (INCHES)
60	5/8	7/8
80	7/8	1 1/4
100	1 1/2	2 1/8
120	2 1/8	3
140	3 1/2	5
160	5 1/4	7 7/8

* SIGN STRUCTURE SPAN

CAMBER VALUES REPRESENTS MAXIMUM DEAD LOAD DEFLECTION BETWEEN END CONNECTIONS AND SPAN LENGTH EQUALS DISTANCE BETWEEN MASTS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

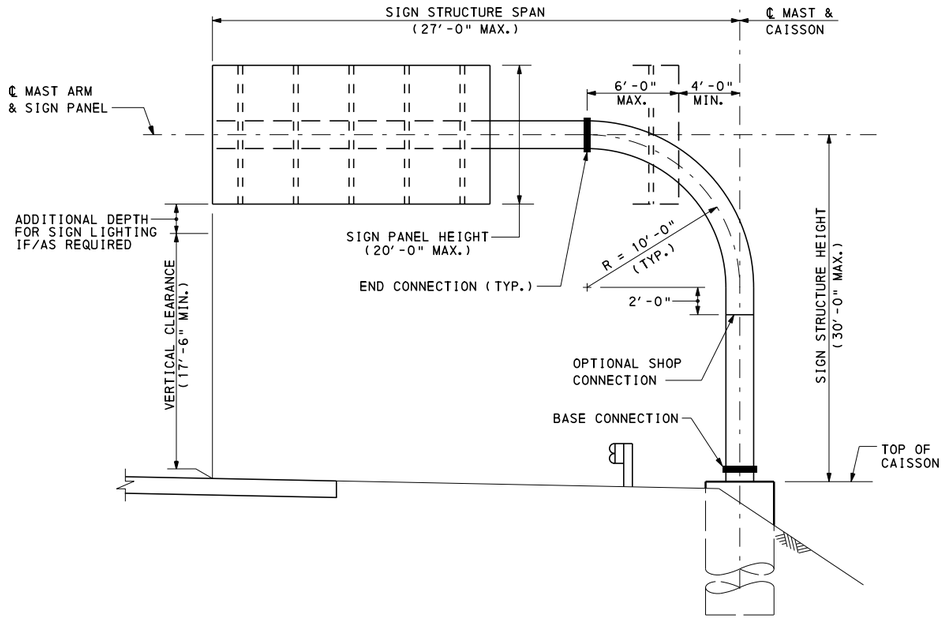
MONOPIPE SIGN STRUCTURES

FRAME STRUCTURE SPANS UP TO 160'

DESIGN TABLES
MAST AND MAST ARM SELECTION

RECOMMENDED AUG. 4, 2017 Thomas P. Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brent D. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHEET 4 OF 5 BD-647M

MAST & MAST ARM SELECTION TABLE (CANTILEVER STRUCTURES)					
SPAN (FEET)	PANEL AREA (S.F.)	MAST		MAST ARM	
		DIAMETER (INCHES)	THICKNESS (INCHES)	DIAMETER (INCHES)	THICKNESS (INCHES)
27	350	24	0.562 (SCH. 30)	24	0.375 (SCH. 20)
	250	24	0.500 (WT. XS)	24	0.375 (SCH. 20)



CANTILEVER STRUCTURE

NOTES:

1. FOR GENERAL NOTES, SEE SHEET 1.
2. FABRICATOR OPTION TO ADD OR ELIMINATE SPLICES.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

MONOPIPE SIGN STRUCTURES

CANTILEVER MONOPIPE STRUCTURE
STRUT LENGTHS UP TO 27'

DESIGN TABLES
MAST AND MAST ARM SELECTION

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHEET 5 OF 5
Thomas P. Macioce	Brian D. Thompson	
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	BD-647M

CHANGE 1

INFORMATIONAL NOTES:

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS.
- ALL DMS SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-741M SHEET 2.
- PROVIDE CRASHWORTHY BARRIER IN ACCORDANCE WITH PENNDOT PUB 13M (DM-2). CHAPTER 12 GUIDE RAIL, MEDIAN BARRIER AND ROADSIDE SAFETY DEVICES. USE OF GUIDE RAIL AND/OR CONCRETE BARRIER SHALL MEET APPLICABLE PENNDOT WARRANTS FOR INSTALLATION.
- FOR DETAILS NOT SHOWN SEE BC-741M.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN U.S. CUSTOMARY UNITS.
2. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
3. USE CLASS A CEMENT CONCRETE f'c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
4. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
5. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. SPREAD FOOTINGS OR CAISSONS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL BOLTS, NUTS & WASHERS IN ACCORDANCE WITH PENNDOT PUB 408 UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. ALL BOLT HOLES SHALL BE DRILLED.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE WIDTH OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE CHECKED.
14. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.
15. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
16. PROVIDE A CERTIFICATION LETTER, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA, CERTIFYING THAT THE INTERNAL STRUCTURE OF THE DMS AND THE CONNECTION TO THE SIGN STRUCTURE MEET THE REQUIREMENT OF THE AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS AS AMENDED BY PENNDOT." THE CERTIFICATION LETTER SHALL BE PREPARED BY THE DMS MANUFACTURER'S PROFESSIONAL ENGINEER AND SUBMITTED BY THE CONTRACTOR.
17. ONE TEST BORING SHALL BE PROVIDED AT EACH DMS FOUNDATION LOCATION.

CONSTRUCTION GENERAL NOTES:

- MATERIALS AND WORKMANSHIP:

  PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNDOT PUB 408, (LET DATE EDITION), AASHTO/AWS D1.5 BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.

- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

  PIPE COLUMNS & PIPE CHORDS,
  PIPE BRACING, ANGLES, SHAPES,
  AND PLATES, ANCHOR BOLTS, BOLTS: PER PENNDOT PUB 408 SECTION 1230.2(K).

  U-BOLT INSTALLATION: PER FHWA PUB GUIDELINES FOR THE INSTALLATION, INSPECTION, MAINTENANCE, AND REPAIR OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES, AND TRAFFIC SIGNALS (2005).

- DESIGN SPECIFICATIONS:

  AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, 4TH EDITION, 2001, INCLUDING INTERIMS THROUGH 2006 (UNLESS NOTED OTHERWISE); AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17TH EDITION; PENNDOT DESIGN MANUAL - PART 4.

- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

DESIGN CRITERIA FOR PENNDOT DMS STRUCTURES

- LOADING — *AASHTO 2001 SIGN SPECS. (U.N.O.)

DEAD LOAD	3.5
LIVE LOAD (CATWALKS)	3.6
ICE LOAD	3.7
WIND LOAD	APPENDIX C, SECTION C.3, EQ. C-1, WITH 80 MPH WIND AND 30% GUST FACTOR
DMS SIZE AND DEAD LOAD PER SUPPLIER	
WIND DRAG COEFFICIENT C_d = 1.7 FOR DMS (STRENGTH DESIGN AND FATIGUE DESIGN)	

- GROUP LOADS — *AASHTO 2001 SIGN SPECS. 3.4
- STEEL CRITERIA — *AASHTO 2001 SIGN SPECS. (U.N.O.)

STRENGTH CRITERIA

SECTION PROPERTIES FOR TUBULAR SHAPES	APPENDIX B, TABLE B-1
MAXIMUM STRESSES IN TUBULAR SHAPES	APPENDIX B, TABLE B-2
ALLOWABLE STRESSES FOR TUBULAR SHAPES	5.6 (TABLE 5-3) & 5.11
ALLOWABLE STRESSES FOR DMS SUPPORTS	5.12
ALLOWABLE STRESSES FOR BASE PLATES	5.8
ALLOWABLE STRESSES FOR COMBINED STEEL STRESS	5.12
ALLOWABLE STRESSES FOR STRUCTURAL STEEL	SECTION 5

FATIGUE CRITERIA

FATIGUE REQUIREMENTS (FATIGUE CATEGORY I)	SECTION 11
FATIGUE IMPORTANCE FACTOR (I_F = 1)	11.6
GALLOPING	11.7.1
NATURAL WIND GUST	11.7.3
TRUCK-INDUCED GUST	11.7.4

SERVICEABILITY CRITERIA

ALLOWABLE DEFLECTION	10.4

- BOLT CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BOLT STRESSES	TABLE 10.32.3B
SLIP-CRITICAL BOLT ALLOWABLE	10.32.3.2.1
BOLT PRYING ACTION	10.32.3.3.2
COMBINED BOLT SHEAR AND TENSION	10.32.3.3.3
BOLT DESIGN CRITERIA	AASHTO 2001 SIGN SPECS. 5.16
ALLOWABLE ANCHOR BOLT STRESSES	AASHTO 2001 SIGN SPECS. 5.17

- CONCRETE CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BEARING STRESS	8.15.2.1.3
REINFORCEMENT TENSILE STRESS	8.15.2.2
SHEAR CAPACITY OF FOOTINGS	8.15.5.6.1
SHEAR STRESS IN FOOTINGS	8.15.5.6.2
ALLOWABLE SHEAR STRESS	8.15.5.6.4
SLENDERNESS OF COLUMNS	8.16.5.2
MINIMUM REINF. OF FLEXURAL MEMBERS	8.17.1
SPACING LIMITS FOR REINFORCEMENT	8.21
MINIMUM CONCRETE COVER	DM4 D8.22.1*
PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS	FIG. 4.4.7.1.1.1C
DISTRIBUTION OF REINFORCEMENT	4.4.11.2.2
FOOTING STABILITY REQUIREMENTS	DM4 D5.5.5
TORSION	ACI SECTION A.7.3*
COLUMN DESIGN (PEDESTALS)	8.15.4

- SPREAD FOOTINGS: — DM4 SEC. 10.6

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT (FOR FOOTINGS FOLLOWING THE DESIGN TABLES IN THIS STANDARD)
MINIMUM AREA IN BEARING	95%
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT

- DRILLED SHAFTS (CAISSONS): — DM4 SEC. D10.8.3.8, PENNDOT COM624P COMPUTER PROGRAM OR L-PILE

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MAXIMUM DESIGN LATERAL DISPLACEMENT	0.5"
MODULUS OF SUBGRADE REACTION	10.0 POUNDS PER CUBIC INCH
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT
ANGLE OF INTERNAL FRICTION	25°
COHESION	0 KIPS PER SQUARE FOOT

*LEGEND

- AASHTO 2001 SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, 4TH EDITION, INCLUDING INTERIMS THRU 2006
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17TH EDITION
- DM4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES.
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-99).
- CVN: CHARPY V-NOTCH.
- DMS: DYNAMIC MESSAGE SIGN

REFERENCE DRAWINGS	
ITS-1201	ITS DEVICES - GENERAL
ITS-1230	GENERAL NOTES FOR CANTILEVER STRUCTURES
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-741M	OVERHEAD SIGN STRUCTURES - CANTILEVER AND CENTER-MOUNT STRUCTURES STRUT LENGTHS UP TO 40'
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD DYNAMIC MESSAGE SIGNS CENTER-MOUNT SIGN STRUCTURES

DESIGN CRITERIA AND GENERAL NOTES

RECOMMENDED AUG. 4, 2017
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 6

BD-649M

NOTES TO DESIGNER

1. PREPARE CONTRACT DRAWING IN ACCORDANCE WITH PENNDOT DESIGN MANUAL PART 4, AND THESE STANDARDS.
2. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE CONTRACT DRAWINGS (IF APPLICABLE):
   - LATITUDE AND LONGITUDE OR STATION AND OFFSET OF THE CENTER OF THE POLE
   - DMS HEIGHT AND LENGTH
   - DMS AREA
   - DESIGN HEIGHT
   - DESIGN ECCENTRICITY
   - DESIGN WEIGHT OF DMS
   - ACCESS CONFIGURATION (FRONT ACCESS CATWALK OR WALK-IN)
   - IF THE STRUCTURE IS TO SUPPORT A BACK TO BACK MOUNT
   - TOP OF PEDESTAL ELEVATION
   - BOTTOM OF FOOTING ELEVATION
   - MINIMUM VERTICAL CLEARANCE PROJECTED TO EDGE OF PAVEMENT
3. IDENTIFY IF AN ENCLOSURE IS REQUIRED AND SPECIFY TYPE.
4. IDENTIFY IF A MAINTAINER PAD IS REQUIRED AND LOCATE.
5. IDENTIFY IF A SEPARATE DMS CABINET IS REQUIRED AND LOCATE.
6. IDENTIFY IF A LADDER IS REQUIRED AND LOCATE.
7. DESIGN COMPUTATIONS AND DETAILS ARE REQUIRED FOR ANY PORTION OF THE STRUCTURE NOT TAKEN FROM THE DMS CENTER-MOUNT STRUCTURE STANDARDS, BD-649M OR ITS STANDARDS.
8. IDENTIFY THE PRESENCE OF GUIDERAIL, BARRIER OR PLACEMENT OUTSIDE THE CLEAR ZONE.
9. THE DESIGNER MUST DETAIL THE LEAST DISTANCE FROM EDGE OF PEDESTAL TO REAR OF GUIDERAIL POST OR BARRIER AND INSURE IT IS IN ACCORDANCE WITH BC-741M, SEE SHEET 2 TABLE A.
10. IF NEEDED DETAILS ARE NOT FOUND IN THE DMS CENTER-MOUNT STRUCTURE STANDARDS OR BC-741M A SPECIAL SUBMISSION REQUESTING APPROVAL MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.
11. SUPPORT SIGN STRUCTURES INTENDED TO CARRY DMS NOT COVERED IN THESE STANDARDS MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR REVIEW AND APPROVAL. THIS STANDARD MAY BE USED FOR PRELIMINARY MEMBER SIZES ONLY; DESIGN COMPUTATION MUST BE SUBMITTED FOR ALL COMPONENTS OF SUPPORT STRUCTURES CARRYING NON-STANDARD DMS.
12. ENSURE CATWALK CAN BE ACCESSIBLE FROM SHOULDER WHEN CONDITIONS PERMIT. CATWALK IS LOCATED ON THE FRONT FACE OF EACH SIGN ON A FRONT AND BACK DMS. WALK-IN ACCESS PLATFORMS ARE LOCATED ON ONE END ONLY AT EACH DMS. IDENTIFY CATWALK AND WALK-IN ACCESS PLATFORM LOCATIONS ON CONTRACT DRAWINGS BASED ON SITE SPECIFIC REQUIREMENTS. MAINTAIN MINIMUM VERTICAL CLEARANCE.
13. FOR CAISSON ALTERNATIVE, PROVIDE CAISSON DIAMETER, TOP OF CAISSON ELEVATION, BOTTOM OF CAISSON ELEVATION, EMBEDMENT DEPTH, TOTAL CAISSON LENGTH, VERTICAL AND TIE REINFORCEMENT BAR NUMBER AND SIZE, AND ROCK SOCKET REQUIREMENTS AS REQUIRED.
14. ANY PIPE SIZE OTHER THAN THAT SHOWN ON THE STANDARD IS A PROJECT SPECIFIC DESIGN. DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE RULING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN $\frac{1}{2}$".

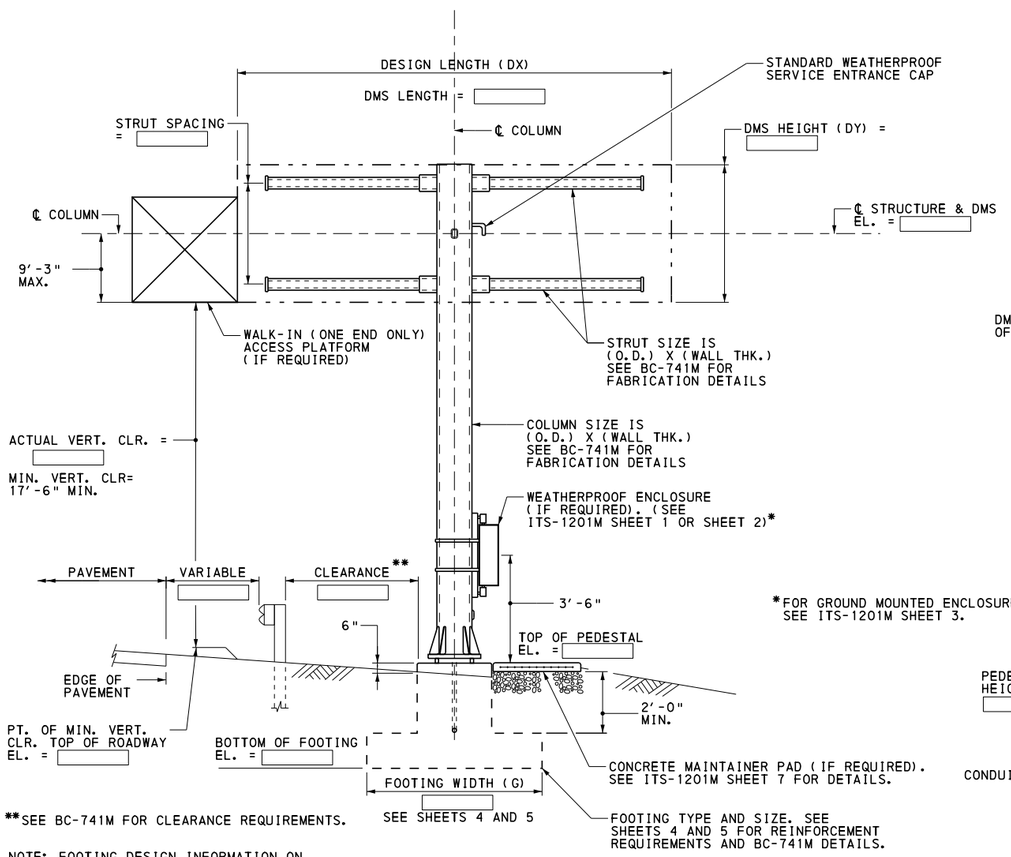
NOTES TO FABRICATOR

1. PROVIDE SHOP DRAWINGS IN ACCORDANCE WITH PUBLICATION 408, SECTION 105.02(D) AND CONTRACT SPECIAL PROVISIONS.
2. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE SHOP DRAWINGS:
   - GENERAL NOTES AND CONSTRUCTION NOTES, SEE SHEET 1 (AS APPLICABLE)
   - FABRICATION NOTES
   - PROVIDE A TABLE OF QUANTITIES INCLUDING:
     - WEIGHT OF STEEL SIGN STRUCTURE
     - CLASS 3 EXCAVATION
     - CLASS A CEMENT CONCRETE
     - POUNDS OF REINFORCEMENT BARS
   - FRONT AND SIDE ELEVATIONS WITH THE MINIMUM INFORMATION LISTED BELOW:
     - COLUMN SIZE
     - COLUMN HEIGHT
     - STRUT SIZE
     - STRUT SPACING
     - ACTUAL VERTICAL CLEAR
     - ACTUAL OFFSET FROM EDGE OF SHOULDER
     - FOOTING ELEVATION
     - FOOTING LENGTH AND WIDTH
     - PEDESTAL LENGTH AND WIDTH
     - PEDESTAL HEIGHT
     - TOP OF PEDESTAL ELEVATION
     - SIZE, NUMBER AND EMBEDMENT OF ANCHOR BOLTS
     - ECCENTRICITY
     - LATITUDE AND LONGITUDE OR STATION AND OFFSET OR THE CENTER OF THE COLUMN
     - DMS HEIGHT AND LENGTH
     - DMS AREA
     - DESIGN HEIGHT
     - DESIGN ECCENTRICITY
     - DESIGN WEIGHT OF DMS
     - SIZE AND TYPE OF PIPE CAPS
     - IDENTIFY ALL WELDS BY SIZE AND TYPE
3. IF AN ALTERNATE CAISSON FOUNDATION IS TO BE USED, THE DRAWINGS MUST INCLUDE THE FOLLOWING:
   - CONTROLING LIMIT STATE FOR AXIAL LOAD
   - LOAD CASE
   - FACTORED LOAD
   - RESISTANCE
   - CONTROLLING STATE FOR LATERAL LOAD
   - LOAD CASE
   - DEFLECTION
   - ALLOWABLE DEFLECTION
4. ALUMINUM DMS SUPPORT STRUCTURES ARE PROHIBITED.
5. TELESCOPING (SLIP-FIT) FIELD SPLICES FOR DMS SUPPORT STRUCTURES ARE PROHIBITED.
6. INDICATE THE SUPPLIER FOR CATWALK GRATING ON THE SHOP DRAWINGS.
7. PROVIDE HAND HOLE, WEATHERPROOF ENCLOSURE, AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP SIZE AND LOCATIONS ON SHOP DRAWINGS BASED ON SITE SPECIFIC REQUIREMENTS. ALTERNATE DETAILS MAY BE REQUIRED TO MEET CABLE BENDING RADIUS AND PROJECT SPECIFIC REQUIREMENTS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
DYNAMIC MESSAGE SIGNS
CENTER-MOUNT SIGN STRUCTURES
NOTES TO DESIGNER AND FABRICATOR

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHEET 2 OF 6
Thomas P Macioce CHIEF BRIDGE ENGINEER	Brian B Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	BD-649M



**SEE BC-741M FOR CLEARANCE REQUIREMENTS.

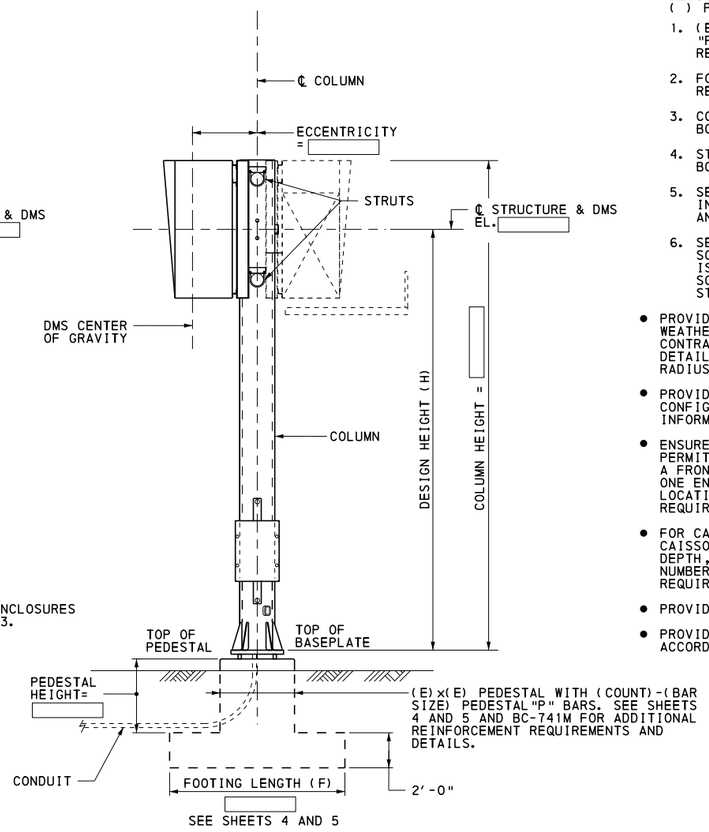
NOTE: FOOTING DESIGN INFORMATION ON SHEETS 4 AND 5 ARE BASED ON 10'-0" FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS <10'-0".

FRONT ELEVATION

WALK-IN ACCESS PLATFORM SHOWN (FRONT/BACK CATWALK SIMILAR)

LADDER (IF REQUIRED) NOT SHOWN FOR CLARITY

*FOR GROUND MOUNTED ENCLOSURES SEE ITS-1201M SHEET 3.



SIDE ELEVATION

FRONT/BACK CATWALK SIMILAR (WALK-IN ACCESS PLATFORM SHOWN)

LADDER (IF REQUIRED) NOT SHOWN FOR CLARITY

NOTES TO DESIGNER:

- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON DESIGN REQUIREMENTS. DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES.
  1. (E)x(E) PEDESTAL WITH (COUNT) - (BAR SIZE) PEDESTAL "P" BARS. SEE BC-741M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
  2. FOOTING TYPE (SIZE). SEE SHEETS 4 AND 5 FOR REINFORCEMENT REQUIREMENTS AND BC-741M FOR DETAILS.
  3. COLUMN SIZE IS (O.D.) x (WALL THK.). SEE BC-741M FOR FABRICATION DETAILS.
  4. STRUT SIZE IS (O.D.) x (WALL THK.). SEE BC-741M FOR FABRICATION DETAILS.
  5. SEE BC-741M FOR ADDITIONAL FABRICATION DETAILS INCLUDING HAND HOLE, WEATHERPROOF ENCLOSURE, AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP.
  6. SEAL BASE PLATE TO FOUNDATION GAP WITH GALVANIZED STEEL SCREEN, ½" BY ½" MESH AND 0.063" DIAMETER WIRES. SCREEN IS TO PREVENT ENTRY OF RODENTS WHILE PERMITTING DRAINAGE. SCREEN IS TO BE REMOVABLE AND ATTACHED TO BASEPLATE WITH STAINLESS STEEL HARDWARE.
- PROVIDE HAND HOLE, WEATHERPROOF ENCLOSURE, AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP SIZE AND LOCATIONS ON CONTRACT PLANS BASED ON SITE SPECIFIC REQUIREMENTS. ALTERNATE DETAILS FROM BC-741M MAY BE REQUIRED TO MEET CABLE BENDING RADIUS AND PROJECT SPECIFIC REQUIREMENTS.
- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH [ ].
- ENSURE CATWALK CAN BE ACCESSIBLE FROM SHOULDER WHEN CONDITIONS PERMIT. CATWALK IS LOCATED ON THE FRONT FACE OF EACH SIGN ON A FRONT AND BACK DMS. WALK-IN ACCESS PLATFORMS ARE LOCATED ON ONE END ONLY AT EACH DMS. IDENTIFY CATWALK AND WALK-IN ACCESS LOCATIONS ON CONTRACT DRAWINGS BASED ON SITE SPECIFIC REQUIREMENTS. MAINTAIN MINIMUM VERTICAL CLEARANCE.
- FOR CAISSON ALTERNATIVE, PROVIDE CAISSON DIAMETER, TOP OF CAISSON ELEVATION, BOTTOM OF CAISSON ELEVATION, EMBEDMENT DEPTH, TOTAL CAISSON LENGTH, VERTICAL AND TIE REINFORCEMENT NUMBER OF BARS AND BAR SIZE, AND ROCK SOCKET REQUIREMENTS AS REQUIRED.
- PROVIDE GENERAL NOTES FROM SHEET 1 ON THE CONTRACT DRAWINGS.
- PROVIDE DMS CONNECTION DETAILS ON THE CONTRACT DRAWINGS IN ACCORDANCE WITH SHEET 6.

CENTER-MOUNT DMS SUPPORT STRUCTURE

WITH WALK-IN ACCESS PLATFORM OR CATWALK

DESIGN CRITERIA

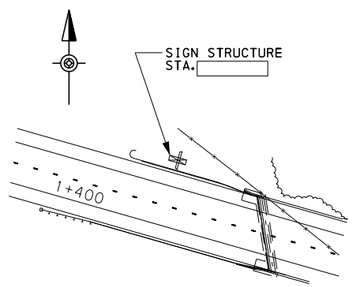
DESIGN DMS AREA (A) =	
DESIGN DMS LENGTH (DX) =	
DESIGN DMS HEIGHT (DY) =	
DESIGN HEIGHT (H) =	
DMS ECCENTRICITY =	
DESIGN WEIGHT OF DMS (W) =	
LATITUDE [ ] LONGITUDE [ ]▲	
OR	
STATION [ ] OFFSET [ ]▲	

▲PROVIDE EITHER LATITUDE/LONGITUDE OR STATION AND OFFSET.

TABLE OF ESTIMATED QUANTITIES

ITEM NO.	ITEM	UNIT	QUANTITY
■	STEEL SIGN STRUCTURE	LBS	
0000-0000	CLASS 3 EXCAVATION	CY	
0000-0000	CLASS A CEMENT CONCRETE	CY	
0000-0000	REINFORCEMENT BARS	LBS	

■ ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. [0000] - [0000]



SEE PLAN SHEET [ ] FOR SIGN STRUCTURE LOCATION

LOCATION PLAN

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD DYNAMIC MESSAGE SIGNS CENTER-MOUNT SIGN STRUCTURES

SAMPLE CONTRACT PLAN FOR CENTER MOUNT STRUCTURES

RECOMMENDED AUG. 4, 2017 Thomas P Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Bruce B Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHEET 3 OF 6 BD-649M

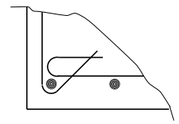
TABLE 1: SINGLE SIGN FRONT DMS PANEL WITH FRONT ACCESS CATWALK

DESIGN HEIGHT ft	SIGN AREA sf	MAX DMS LENGTH (DX) ft	MAX DMS HEIGHT (DY) ft	MAX DMS THICKNESS ft	MAXIMUM DMS WEIGHT (W) lbs	MAXIMUM ECCENTRICITY ft	STRUT SIZE	COLUMN SIZE	PEDESTAL SIZE E	PEDESTAL REINFORCEMENT #4 BARS TYPE 'M' LENGTH	B	#4 BARS TYPE 'N' LENGTH	B	FOOTING REINFORCEMENT G WIDTH	F LENGTH	'L' BARS L_1 BARS No.	SIZE	L_2 BARS No.	SIZE	LENGTH	'T' BARS T_1 BARS No.	SIZE	T_2 BARS No.	SIZE	LENGTH
16	50	10	5	2	550	2.21	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"
	100	17.5	5.71	2	1030	2.29	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"
	150	20	7.5	1.17	1800	1.88	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	12'-0"	9	6	9	5	11'-6"	9	4	9	5	7'-6"
	200	25	8	2	2300	2.46	10" x 0.365"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	14'-0"	12	6	12	5	13'-6"	10	4	10	5	7'-6"
	250	31.25	8	2	2105	2.46	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	14	6	14	5	14'-6"	11	4	11	5	8'-6"
	300	40	7.5	1.17	2660	2.05	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	16	6	16	5	14'-6"	12	4	12	5	8'-6"
20	50	10	5	2	550	2.21	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"
	100	17.5	5.71	2	1030	2.29	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	12'-0"	7	6	7	5	11'-6"	9	4	9	5	7'-6"
	150	20	7.5	1.17	1800	1.88	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	14'-0"	11	6	11	5	13'-6"	10	4	10	5	7'-6"
	200	25	8	2	2300	2.38	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	14	6	12	5	14'-6"	11	4	11	5	8'-6"
	250	31.25	8	2	2105	2.46	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	15	6	15	5	14'-6"	12	4	12	5	8'-6"
	300	40	7.5	1.17	2660	2.05	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	10'-0"	17'-0"	16	7	16	6	16'-6"	12	5	12	5	9'-6"
24	50	10	5	2	550	2.21	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"
	100	17.5	5.71	2	1030	2.29	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	12'-0"	8	6	8	5	11'-6"	9	4	9	5	7'-6"
	150	20	7.5	1.17	1800	1.88	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	14'-0"	12	6	12	5	13'-6"	10	4	10	5	7'-6"
	200	25	8	2	2300	2.38	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	15	6	15	5	14'-6"	11	4	11	5	8'-6"
	250	31.25	8	2	2105	2.46	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	17	6	17	5	14'-6"	13	4	13	5	8'-6"
	300	40	7.5	1.17	2660	2.05	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	10'-0"	17'-0"	17	7	15	6	16-'6"	12	5	12	5	9'-6"
28	50	10	5	2	550	2.21	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"
	100	17.5	5.71	2	1030	2.29	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	12'-0"	8	6	8	5	11'-6"	9	4	9	5	7'-6"
	150	20	7.5	1.17	1800	1.88	6" x 0.280"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	13'-0"	10	6	10	5	12'-6"	10	4	10	5	8'-6"
	200	25	8	2	2300	2.38	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	12	7	12	6	14'-6"	12	4	12	5	8'-6"

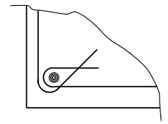
TABLE 2: DOUBLE SIGN FRONT AND BACK DMS PANELS WITH FRONT ACCESS CATWALK

DESIGN HEIGHT ft	SIGN AREA sf	MAX DMS LENGTH (DX) ft	MAX DMS HEIGHT (DY) ft	MAX DMS THICKNESS ft	MAXIMUM DMS WEIGHT (W) lbs	MAXIMUM ECCENTRICITY ft	STRUT SIZE	COLUMN SIZE	PEDESTAL SIZE E	PEDESTAL REINFORCEMENT #4 BARS TYPE 'M' LENGTH	B	#4 BARS TYPE 'N' LENGTH	B	FOOTING REINFORCEMENT G WIDTH	F LENGTH	'L' BARS L_1 BARS No.	SIZE	L_2 BARS No.	SIZE	LENGTH	'T' BARS T_1 BARS No.	SIZE	T_2 BARS No.	SIZE	LENGTH
16	50 •	10	5	2	1100	0	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	7'-0"	8'-0"	6	5	6	5	7'-6"	6	4	6	5	6'-6"
	100 •	17.5	5.71	2	2060	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"
	150 •	20	7.5	1.17	3600	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	12'-0"	8	6	8	5	11'-6"	9	4	9	5	7'-6"
	200 •	25	8	2	4600	0	10" x 0.365"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	14'-0"	11	6	11	5	13'-6"	10	4	10	5	7'-6"
	250	31.25	8	2	4210	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	14	6	14	5	14'-6"	11	4	11	5	8'-6"
	300	40	7.5	1.17	5320	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	16	6	16	5	14'-6"	12	4	12	5	8'-6"
20	50 •	10	5	2	1100	0	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"
	100 •	17.5	5.71	2	2060	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"
	150 •	20	7.5	1.17	3600	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	14'-0"	11	6	11	5	13'-6"	10	4	10	5	7'-6"
	200 •	25	8	2	4600	0	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	13'-0"	10	6	10	5	12'-6"	10	4	10	5	8'-6"
	250	31.25	8	2	4210	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	15	6	15	5	14'-6"	11	4	11	5	8'-6"
	300	40	7.5	1.17	5320	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	16	6	16	5	14'-6"	13	4	13	5	8'-6"
24	50 •	10	5	2	1100	0	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"
	100 •	17.5	5.71	2	2060	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	12'-0"	7	6	7	5	11'-6"	9	4	9	5	7'-6"
	150 •	20	7.5	1.17	3600	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	14'-0"	12	6	12	5	13'-6"	10	4	10	5	7'-6"
	200 •	25	8	2	4600	0	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	14	6	14	5	14'-6"	11	4	11	5	8'-6"
	250	31.25	8	2	4210	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	16	6	16	5	14'-6"	12	4	12	5	8'-6"
	300	40	7.5	1.17	5320	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	10'-0"	17'-0"	17	7	17	6	16'-6"	12	5	12	5	9'-6"
28	50 •	10	5	2	1100	0	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"
	100 •	17.5	5.71	2	2060	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	12'-0"	8	6	8	5	11'-6"	9	4	9	5	7'-6"
	150 •	20	7.5	1.17	3600	0	6" x 0.280"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	13'-0"	10	6	10	5	12'-6"	10	4	10	5	8'-6"
	200 •	25	8	2	4600	0	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	15	6	15	5	14'-6"	11	4	11	5	8'-6"
	250	31.25	8	2	4210	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	10'-0"	17'-0"	16	7	16	6	16'-6"	12	5	12	5	9'-6"

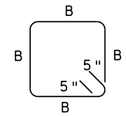
• MAXIMUM LOAD FOR DMS WEIGHT AND CATWALK RESTRICTED TO 40 PSF



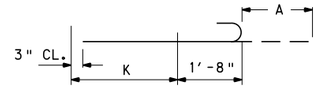
DETAIL A



DETAIL B

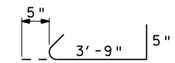


BAR TYPES "M" & "N"



A= 1'-7"
LENGTH = K + 3'-0"
16 REQUIRED PER PEDESTAL

BAR TYPE "P"



LENGTH = 4'-7"

BAR TYPE "X"

HOW TO USE THE TABLES:

1. DETERMINE THE DESIGN HEIGHT AND MAXIMUM DIMENSIONS (AREA, LENGTH, HEIGHT, ECCENTRICITY AND WEIGHT). SIGN HEIGHT SHOULD BE CHOSEN AS TO SATISFY ALL VERTICAL CLEARANCE REQUIREMENTS.
2. DETERMINE IF THE SIGN STRUCTURE WILL HAVE A SIGN MOUNTED ON ONE SIDE ONLY OR ON BOTH SIDES (CONSIDER FUTURE USE).
3. DETERMINE IF THE SIGN STRUCTURE WILL UTILIZE A FRONT ACCESS CATWALK OR A WALK-IN ACCESS PLATFORM.
4. LOCATE THESE PARAMETERS IN THE APPROPRIATE DESIGN TABLE. IF ANY OF THE PARAMETERS EXCEEDS THE VALUES SHOWN IN THE DESIGN TABLE, USE THE NEXT LARGER VALUE. ANY DEVIATION FROM THE DESIGN ASSUMPTIONS USED IN PRODUCING THESE TABLES REQUIRES ADDITIONAL ANALYSIS TO BE PERFORMED BY THE DESIGNER.

NOTES:

- PROVIDE 90° OR 180° HOOKS ON ALL "L" AND "T" BARS.
- LENGTH FOR "L" AND "T" BARS DOES NOT INCLUDE 90° OR 180° HOOK LENGTHS.
- FOOTING DESIGN INFORMATION ON THIS SHEET BASED ON 10 FOOT FILL HEIGHT. FABRICATOR MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10 FT.
- SEE STANDARD DRAWING BC-736M FOR REINFORCEMENT BAR FABRICATION DETAILS.
- SEE STANDARD DRAWING RC-11M FOR LIMITS OF CLASS 3 EXCAVATION.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD DYNAMIC MESSAGE SIGNS CENTER-MOUNT SIGN STRUCTURES

DESIGN TABLES FRONT ACCESS

RECOMMENDED AUG. 4, 2017
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
Brent D. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

BD-649M

TABLE 3: SINGLE SIGN DMS PANEL WITH WALK-IN ACCESS PLATFORM

DESIGN HEIGHT ft	SIGN AREA sf	MAX DMS LENGTH (DX) ft	MAX DMS HEIGHT (DY) ft	MAX DMS THICKNESS ft	MAXIMUM DMS WEIGHT (W) lbs	MAXIMUM ECCENTRICITY ft	STRUT SIZE	COLUMN SIZE	PEDESTAL SIZE E	PEDESTAL REINFORCEMENT				FOOTING REINFORCEMENT												
										#4 BARS TYPE 'M'		#4 BARS TYPE 'N'		G WIDTH	F LENGTH	'L' BARS					'T' BARS					
										LENGTH	B	LENGTH	B			L_1 BARS		L_2 BARS		LENGTH	T_1 BARS		T_2 BARS		LENGTH
																No.	SIZE	No.	SIZE		No.	SIZE	No.	SIZE	
16	200	25	8	4	3530	3.54	12" x 0.375"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	14'-0"	13	6	13	5	13'-6"	10	4	10	5	7'-6"
	250	31.25	8	4	4080	3.63	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	15	6	15	5	14'-6"	12	4	12	5	8'-6"
	300	37.5	8	4	4750	3.79	18" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	10'-0"	17'-0"	16	7	16	6	16'-6"	12	5	12	5	9'-6"
20	200	25	8	4	3530	3.54	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	15	6	15	5	14'-6"	11	4	11	5	8'-6"
	250	31.25	8	4	4080	3.63	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	17	6	17	5	14'-6"	11	5	11	5	8'-6"
	300	37.5	8	4	4750	3.79	18" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	10'-0"	17'-0"	18	7	18	6	16'-6"	13	5	13	5	9'-6"
24	200	25	8	4	3530	3.54	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	16	6	16	5	14'-6"	12	4	12	5	8'-6"
	250	31.25	8	4	4080	3.63	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	10'-0"	17'-0"	17	7	17	6	16'-6"	12	5	12	5	9'-6"
28	200	25	8	4	3530	3.54	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	10'-0"	17'-0"	12	8	12	7	16'-6"	12	5	12	5	9'-6"

TABLE 4: DOUBLE SIGN DMS PANELS WITH WALK-IN ACCESS PLATFORMS

DESIGN HEIGHT ft	SIGN AREA sf	MAX DMS LENGTH (DX) ft	MAX DMS HEIGHT (DY) ft	MAX DMS THICKNESS ft	MAXIMUM DMS WEIGHT (W) lbs	MAXIMUM ECCENTRICITY ft	STRUT SIZE	COLUMN SIZE	PEDESTAL SIZE E	PEDESTAL REINFORCEMENT				FOOTING REINFORCEMENT												
										#4 BARS TYPE 'M'		#4 BARS TYPE 'N'		G WIDTH	F LENGTH	'L' BARS					'T' BARS					
										LENGTH	B	LENGTH	B			L_1 BARS		L_2 BARS		LENGTH	T_1 BARS		T_2 BARS		LENGTH
																No.	SIZE	No.	SIZE		No.	SIZE	No.	SIZE	
16	200	25	8	4	7060	0	12" x 0.375"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4½"	8'-0"	14'-0"	12	6	12	5	13'-6"	10	4	10	5	7'-6"
	250	31.25	8	4	8160	0	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	11	7	11	6	14'-6"	12	4	12	5	8'-6"
	300	37.5	8	4	9500	0	18" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	12	7	12	6	14'-6"	11	5	11	5	8'-6"
20	200	25	8	4	7060	0	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	11	7	11	6	14'-6"	11	4	11	5	8'-6"
	250	31.25	8	4	8160	0	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	12	7	12	6	14'-6"	11	5	11	5	8'-6"
	300	37.5	8	4	9500	0	18" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	10'-0"	17'-0"	13	8	13	7	16'-6"	13	5	13	5	9'-6"
24	200	25	8	4	7060	0	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	11	7	11	6	14'-6"	12	4	12	5	8'-6"
	250	31.25	8	4	8160	0	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	10'-0"	17'-0"	13	8	13	7	16'-6"	12	5	12	5	9'-6"
28	200	25	8	4	7060	0	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8¾"	9'-0"	15'-0"	12	7	12	6	14'-6"	11	5	11	5	8'-6"

NOTES:

1. FOR GENERAL NOTES SEE SHEET 1.
2. THE SIGN AREA REPRESENTS THE AREA FOR ONE DMS.
3. THE TABLES FOR DOUBLE SIGN PANELS REPRESENT THE USE OF THE SAME SIZE FOR BOTH FRONT AND BACK PANELS. USE MEMBERS LISTED IN THE TABLE FOR EACH SIGN PANEL.
4. ALL SIGNS ARE TO BE CENTERED ON THE COLUMN.
5. ALL DESIGN WAS PERFORMED UTILIZING PENNDOT'S SIGN PROGRAM VERSION 1.4. THE FOLLOWING ASSUMPTIONS WERE MADE TO COMPLETE THE DESIGN:
6. SEE NOTES ON SHEET 4.

A. GENERAL

- SINGLE SIGNS ASSUMED AN OFFSET (ECCENTRICITY) OF ½ OF THE STRUT DIAMETER + 1.5" + SIGN SUPPORT BRACKET DEPTH + 3" + ½ SIGN PANEL THICKNESS (SEE SHEET 6).
- AN ADDITIONAL 75 LBS/FT WAS ADDED TO ALL DESIGNS USED TO ACCOUNT FOR CATWALK/WALK-IN ACCESS PLATFORM AND RAILING LOADS.
- DOUBLE SIGN PANELS ASSUMED SAME SIZE DMS ON FRONT AND BACK WITH ZERO ECCENTRICITY.
- THE DEAD LOAD DUE TO THE DMS AND CATWALK/WALK-IN ACCESS PLATFORM WAS DOUBLED TO ACCOUNT FOR FRONT AND BACK DMS.

B. CATWALKS

- CATWALKS ASSUMED TO BE THE LENGTH OF THE DMS MINUS 1'-0" FROM EACH END OF THE SIGN.

C. WALK-IN ACCESS PLATFORMS

- WALK-IN ACCESS PLATFORMS ARE ASSUMED TO BE 4' WIDE (IN ELEVATION VIEW, AND A MAXIMUM PLATFORM LENGTH EQUAL TO THE TOTAL DEPTH OF THE SIGN (4' SINGLE, 8' DOUBLE).
- THE STRUT LENGTHS WERE MODELED ASYMMETRICALLY TO ACCOUNT FOR THE PLATFORM BEING PLACED ON ONE SIDE OF THE SIGN ENCLOSURE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

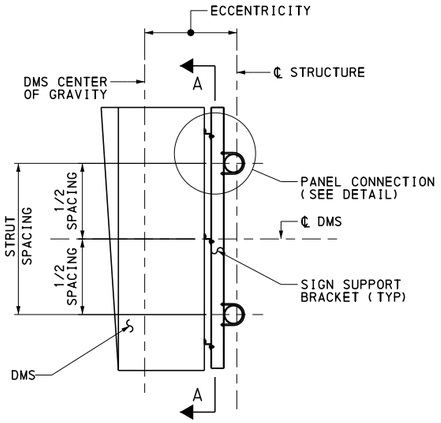
STANDARD
DYNAMIC MESSAGE SIGNS
CENTER-MOUNT SIGN STRUCTURES
DESIGN TABLES
WALK-IN ACCESS

RECOMMENDED AUG. 4, 2017
Thomas P Macioce
CHIEF BRIDGE ENGINEER

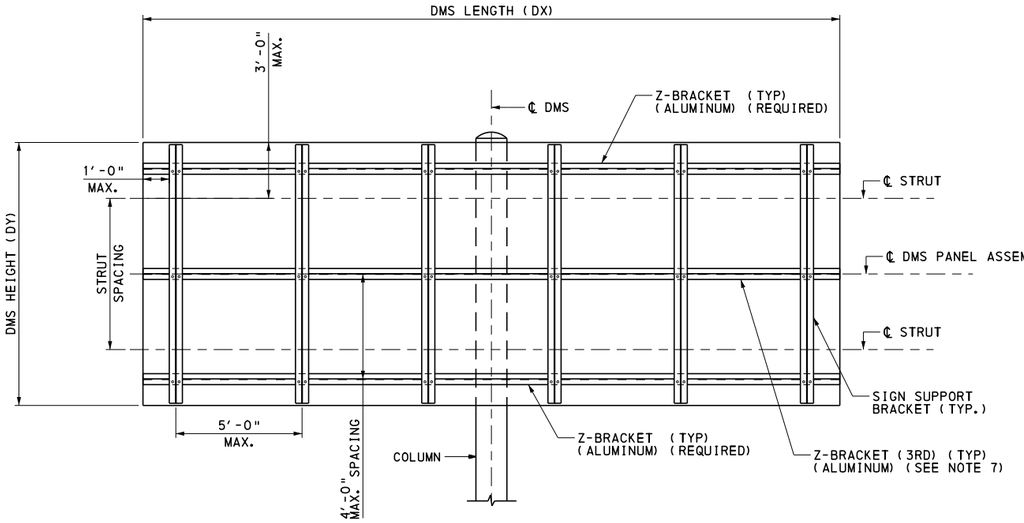
RECOMMENDED AUG. 4, 2017
Brian S. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 5 OF 6

BD-649M



PANEL CONNECTION



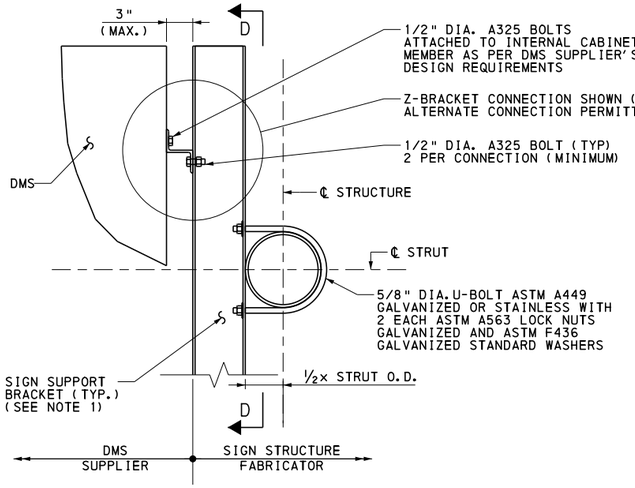
VIEW A-A

NOTES TO DESIGNER:

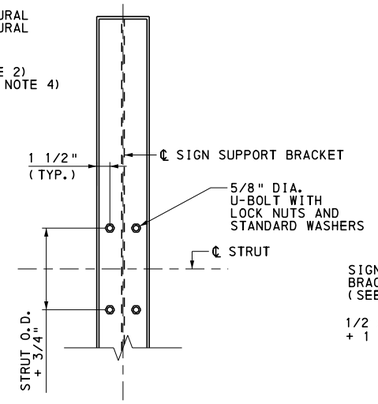
1. MINIMUM SIZE OF SIGN SUPPORT BRACKET IS W6x15. LARGER SIGN SUPPORTS MAY BE REQUIRED FOR CENTER-MOUNT STRUCTURE TO PROVIDE CLEARANCE BETWEEN HORIZONTAL Z-BRACKETS AND COLUMN.
2. HORIZONTAL Z-BRACKETS SHALL BE MADE OF ALUMINUM ALLOY 6061-T6 OR AS APPROVED BY THE DISTRICT BRIDGE ENGINEER AND SHALL BE A MINIMUM OF 1/4" THICK.
3. CONNECTION DETAILS PROVIDED ON THIS SHEET HAVE BEEN DESIGNED BASED ON THE FOLLOWING DMS ASSUMPTIONS:

MAXIMUM DEAD LOAD	6000 LBS
MAXIMUM ECCENTRICITY	5'-0"
MAXIMUM LENGTH (DX)	30'-0"
MAXIMUM HEIGHT (DY)	10'-0"
MAXIMUM DEPTH	4'-0"

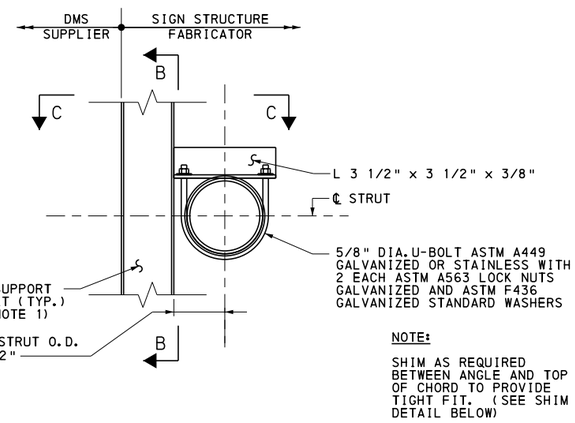
   DESIGN CALCULATIONS ARE REQUIRED FOR DEVIATIONS TO THESE ASSUMPTIONS.
4. ALTERNATE CONNECTION DETAILS ARE PERMITTED, BUT REQUIRE CALCULATIONS PREPARED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA AND VERIFIED BY A SECONDARY INDEPENDENT PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA. THE DMS MANUFACTURER IS RESPONSIBLE FOR PROVIDING THESE CALCULATIONS AND HAVING THEM SIGNED AND SEALED BY BOTH THE PROFESSIONAL ENGINEERS.
5. DETAILS PROVIDED ARE THE MINIMUM REQUIREMENTS. ANY DEVIATIONS REQUIRE SPECIAL DESIGN.
6. FIELD WELDED DMS CONNECTIONS ARE NOT PERMITTED.
7. USE OF 3RD Z-BRACKET IS BASED ON PROJECT AND WIND LOADING REQUIREMENTS. MOUNTING CALCULATIONS TO BE COMPLETED TO AASHTO STANDARDS (SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS, 4TH EDITION, 2001, INCLUDING INTERIMS THROUGH 2006) AND SUBMITTED BY THE FABRICATOR.



PANEL CONNECTION DETAIL



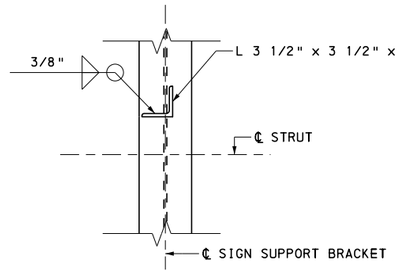
VIEW D-D



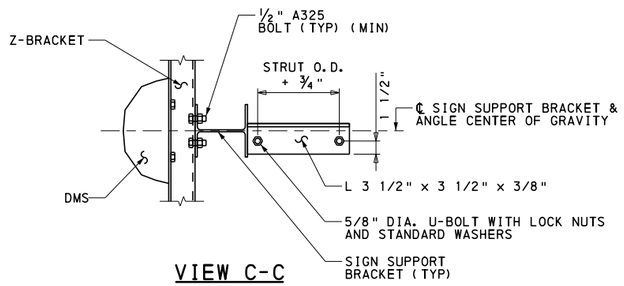
NOTE:

SHIM AS REQUIRED BETWEEN ANGLE AND TOP OF CHORD TO PROVIDE TIGHT FIT. (SEE SHIM DETAIL BELOW)

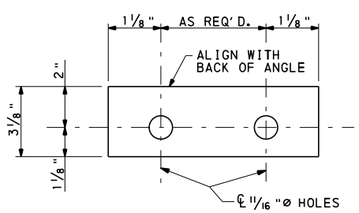
ALTERNATE PANEL CONNECTION DETAIL



VIEW B-B



VIEW C-C



SHIM DETAIL

PROVIDE 1 AT 1/4", 3 AT 1/8" AND 1 AT 1/16" THICKNESS FOR EACH UPPER SIGN SUPPORT CONNECTION ANGLE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD DYNAMIC MESSAGE SIGNS CENTER-MOUNT SIGN STRUCTURES

DMS ATTACHMENT DETAILS

RECOMMENDED AUG. 4, 2017 Thomas P Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brian D. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHEET 6 OF 6 BD-649M

CHANGE 1

INFORMATIONAL NOTES:

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS.
- ALL DMS SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-745M SHEET 2.
- PROVIDE CRASHWORTHY BARRIER IN ACCORDANCE WITH PENNDOT PUB 13M (DM-2). CHAPTER 12 GUIDE RAIL, MEDIAN BARRIER AND ROADSIDE SAFETY DEVICES. USE OF GUIDE RAIL AND/OR CONCRETE BARRIER SHALL MEET APPLICABLE PENNDOT WARRANTS FOR INSTALLATION.
- FOR DETAILS NOT SHOWN SEE BC-745M, ADJUST DIMENSIONS TO ACCOMMODATE THE ACTUAL DMS DIMENSIONS. ALL DETAILING AND COMPONENT SIZING TAKEN FROM BC-745M MUST BE VALIDATED BY INDEPENDENT COMPUTATIONS FOLLOWING THE DESIGN CRITERIA.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN U.S. CUSTOMARY UNITS.
2. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
3. USE CLASS A CEMENT CONCRETE f'c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
4. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
5. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. SPREAD FOOTINGS OR CAISSONS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL BOLTS, NUTS & WASHERS IN ACCORDANCE WITH PENNDOT PUB 408 UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. ALL BOLT HOLES SHALL BE DRILLED.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE WIDTH OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE CHECKED.
14. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
15. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
16. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.
17. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
18. PROVIDE A CERTIFICATION LETTER, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA, CERTIFYING THAT THE INTERNAL STRUCTURE OF THE DMS AND THE CONNECTION TO THE SIGN STRUCTURE MEET THE REQUIREMENT OF THE AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS AS AMENDED BY PENNDOT." THE CERTIFICATION LETTER SHALL BE PREPARED BY THE DMS MANUFACTURER'S PROFESSIONAL ENGINEER AND SUBMITTED BY THE CONTRACTOR.
19. ONE TEST BORING SHALL BE PROVIDED AT EACH DMS FOUNDATION LOCATION.

CONSTRUCTION GENERAL NOTES:

- MATERIALS AND WORKMANSHIP:

  PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNDOT PUB 408, (LET DATE EDITION), AASHTO/AWS D1.5M/D1.5 BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1/D1.1M FOR WELDING NOT COVERED IN AASHTO/AWS D1.5M/D1.5.

- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

  PIPE COLUMNS & PIPE CHORDS, PIPE BRACING, ANGLES, SHAPES, AND PLATES, ANCHOR BOLTS, BOLTS: PER PENNDOT PUB 408 SECTION 1230.2(k).

  U-BOLT INSTALLATION: PER FHWA PUB GUIDELINES FOR THE INSTALLATION, INSPECTION, MAINTAINENACE, AND REPAIR OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES, AND TRAFFIC SIGNALS (2005).

- DESIGN SPECIFICATIONS:

  AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, 4TH EDITION, 2001, INCLUDING INTERIMS THROUGH 2006 (UNLESS NOTED OTHERWISE); AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17TH EDITION; PENNDOT DESIGN MANUAL - PART 4.

- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

DESIGN CRITERIA FOR PENNDOT DMS STRUCTURES

- LOADING — ✱ AASHTO 2001 SIGN SPECS.(U.N.O.)

DEAD LOAD	3.5
LIVE LOAD (CATWALKS)	3.6
ICE LOAD	3.7
WIND LOAD	APPENDIX C, SECTION C.3, EQ. C-1, WITH 80 MPH WIND AND 30% GUST FACTOR

DMS SIZE AND DEAD LOAD PER SUPPLIER
WIND DRAG COEFFICIENT C_d = 1.7 FOR DMS
(STRENGTH DESIGN AND FATIGUE DESIGN)

- GROUP LOADS — ✱ AASHTO 2001 SIGN SPECS. 3.4
- STEEL CRITERIA — ✱ AASHTO 2001 SIGN SPECS. (U.N.O.)

STRENGTH CRITERIA

SECTION PROPERTIES FOR TUBULAR SHAPES	APPENDIX B, TABLE B-1
MAXIMUM STRESSES IN TUBULAR SHAPES	APPENDIX B, TABLE B-2
ALLOWABLE STRESSES FOR TUBULAR SHAPES	5.6 (TABLE 5-3) & 5.11
ALLOWABLE STRESSES FOR DMS SUPPORTS	5.12
ALLOWABLE STRESSES FOR BASE PLATES	5.8
ALLOWABLE STRESSES FOR COMBINED STEEL STRESS	5.12
ALLOWABLE STRESSES FOR STRUCTURAL STEEL	SECTION 5

FATIGUE CRITERIA

FATIGUE REQUIREMENTS (FATIGUE CATEGORY I)	SECTION 11
FATIGUE IMPORTANCE FACTOR (I_F = 1)**	11.6
GALLOPING	11.7.1
NATURAL WIND GUST	11.7.3
TRUCK-INDUCED GUST	11.7.4

DMS SUPPORT STRUCTURE SHALL BE DESIGNED FOR NATURAL WIND GUSTS AND TRUCK-INDUCED GUSTS.

**A FATIGUE IMPORTANCE FACTOR OF II MAY BE USED FOR DMS SUPPORT STRUCTURES LOCATED ON MINOR ARTERIALS, COLLECTORS, OR LOCAL ROADS.

SERVICEABILITY CRITERIA

ALLOWABLE DEFLECTION	10.4
PERMANENT CAMBER	10.5

- BOLT CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BOLT STRESSES	TABLE 10.32.3B
SLIP-CRITICAL BOLT ALLOWABLE	10.32.3.2.1
BOLT PRYING ACTION	10.32.3.3.2
COMBINED BOLT SHEAR AND TENSION	10.32.3.3.3
BOLT DESIGN CRITERIA	AASHTO 2001 SIGN SPECS. 5.16
ALLOWABLE ANCHOR BOLT STRESSES	AASHTO 2001 SIGN SPECS. 5.17

- CONCRETE CRITERIA — AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BEARING STRESS	8.15.2.1.3
REINFORCEMENT TENSILE STRESS	8.15.2.2
SHEAR CAPACITY OF FOOTINGS	8.15.5.6.1
SHEAR STRESS IN FOOTINGS	8.15.5.6.2
ALLOWABLE SHEAR STRESS	8.15.5.6.4
SLENDERNESS OF COLUMNS	8.16.5.2
MINIMUM REINF. OF FLEXURAL MEMBERS	8.17.1
SPACING LIMITS FOR REINFORCEMENT	8.21
MINIMUM CONCRETE COVER	DM4 D8.22.1✱
PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS	FIG. 4.4.7.1.1.1C
DISTRIBUTION OF REINFORCEMENT	4.4.11.2.2
FOOTING STABILITY REQUIREMENTS	DM4 D5.5.5
TORSION	ACI SECTION A.7.3✱
COLUMN DESIGN (PEDESTALS)	8.15.4

- FOUNDATION NOTES

SPREAD FOOTINGS:		DM4 SEC.10.6
MINIMUM AREA IN BEARING	95%	
DRILLED SHAFTS (CAISSONS):		DM4 SEC.10.8, PENNDOT COM624 OR L-PILE
MAXIMUM DESIGN LATERAL DISPLACEMENT	0.5"	

✱LEGEND

- AASHTO 2001 SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, 4TH EDITION, INCLUDING INTERIMS THRU 2006
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17TH EDITION
- DM4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES.
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - METRIC BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-08).
- CVN: CHARPY V-NOTCH.
- DMS: DYNAMIC MESSAGE SIGN

REFERENCE DRAWINGS

ITS-1201	ITS DEVICES - GENERAL
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-745M	OVERHEAD SIGN STRUCTURES - 4 POST 4 CHORD TRUSS SPANS FROM 100' TO 200'
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD DYNAMIC MESSAGE SIGNS TRUSS SIGN STRUCTURES

DESIGN CRITERIA AND GENERAL NOTES

RECOMMENDED AUG. 4, 2017
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 4, 2017
Bruce B Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 4

BD-650M

NOTES TO DESIGNER

1. PREPARE CONTRACT DRAWING IN ACCORDANCE WITH PENNDOT DESIGN MANUAL PART 4, AND THESE STANDARDS
2. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE CONTRACT DRAWINGS (IF APPLICABLE):
   - LATITUDE AND LONGITUDE OR STATION AND OFFSET OF THE CENTER OF BOTH FOUNDATIONS
   - DMS HEIGHT AND LENGTH
   - DMS AREA
   - DESIGN HEIGHT
   - DESIGN ECCENTRICITY
   - DESIGN WEIGHT OF DMS
   - ACCESS CONFIGURATION (FRONT ACCESS CATWALK OR WALK-IN)
   - IF THE STRUCTURE IS TO SUPPORT A BACK TO BACK MOUNT
   - TOP OF PEDESTAL ELEVATION(S)
   - BOTTOM OF FOOTING ELEVATION(S)
   - MINIMUM VERTICAL CLEARANCE(S) PROJECTED TO EDGE OF PAVEMENT
3. IDENTIFY IF AN ENCLOSURE IS REQUIRED AND SPECIFY TYPE
4. IDENTIFY IF A MAINTAINER PAD IS REQUIRED AND LOCATE
5. IDENTIFY IF A SEPARATE DMS CABINET IS REQUIRED AND LOCATE
6. IDENTIFY IF A LADDER IS REQUIRED AND LOCATE
7. IDENTIFY THE PRESENCE OF GUIDERAIL, BARRIER OR PLACEMENT OUTSIDE THE CLEAR ZONE
8. THE DESIGNER MUST DETAIL THE LEAST DISTANCE FROM EDGE OF PEDESTAL TO REAR OF GUIDERAIL POST OR BARRIER AND INSURE IT IS IN ACCORDANCE WITH BC-745M, SHEET 2 TABLE A
9. IF NEEDED DETAILS ARE NOT FOUND IN THIS DMS TRUSS SIGN STRUCTURE STANDARD OR BC-745M A SPECIAL SUBMISSION REQUESTING APPROVAL MUST BE MADE TO THE CHIEF BRIDGE ENGINEER
10. TRUSS SUPPORT SIGN STRUCTURES INTENDED TO CARRY DMS MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE CHIEF BRIDGE ENGINEER FOR REVIEW AND APPROVAL. THIS STANDARD AND BD-645M STANDARD MAY BE USED FOR PRELIMINARY MEMBER SIZES ONLY; DESIGN COMPUTATION MUST BE SUBMITTED FOR ALL COMPONENTS OF SUPPORT STRUCTURES CARRYING DMS.
11. ENSURE CATWALK CAN BE ACCESSIBLE FROM SHOULDER WHEN CONDITIONS PERMIT. WALK-IN ACCESS PLATFORMS ARE LOCATED ON ONE END ONLY AT EACH DMS. IDENTIFY CATWALK AND WALK-IN ACCESS PLATFORM LOCATIONS ON CONTRACT DRAWINGS BASED ON SITE SPECIFIC REQUIREMENTS. MAINTAIN MINIMUM VERTICAL CLEARANCE.

NOTES TO FABRICATOR

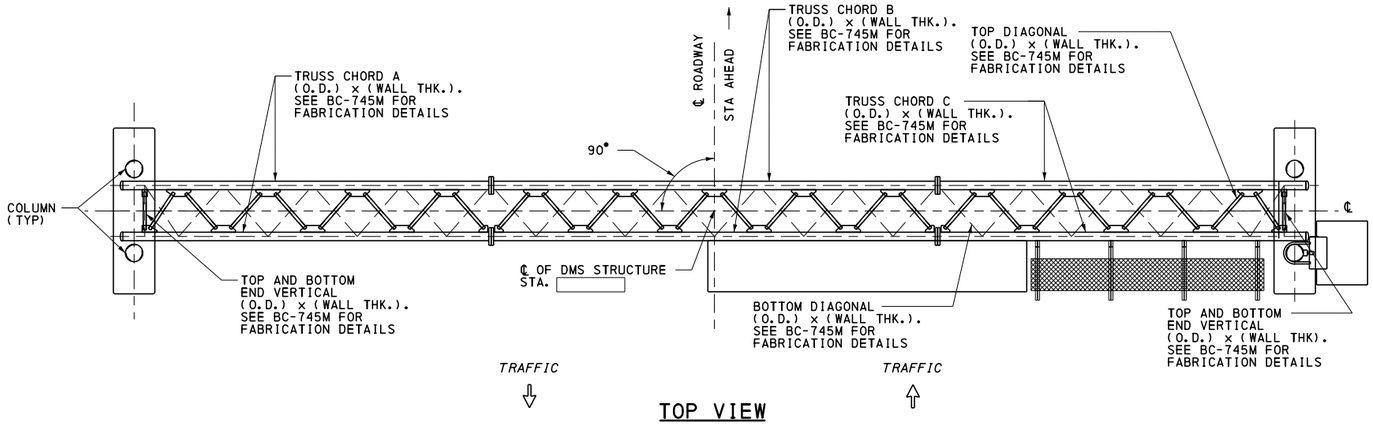
1. PROVIDE SHOP DRAWINGS IN ACCORDANCE WITH PUBLICATION 408, SECTION 105.02(D) AND CONTRACT SPECIAL PROVISIONS
2. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE SHOP DRAWINGS
   - GENERAL NOTES AND CONSTRUCTION NOTES, SEE SHEET 1 (AS APPLICABLE)
   - FABRICATION NOTES
   - TRANSPORTATION NOTES
   - LIFTING AND ERECTION NOTES
   - INSTALLATION NOTES
   - PROVIDE A TABLE OF QUANTITIES INCLUDING
     - WEIGHT OF STEEL SIGN STRUCTURE
     - CLASS 3 EXCAVATION
     - CLASS A CEMENT CONCRETE
     - POUNDS OF REINFORCEMENT BARS
   - FRONT AND SIDE ELEVATIONS WITH THE MINIMUM INFORMATION LISTED BELOW
     - COLUMN SIZE
     - COLUMN BRACING
     - DMS HEIGHT
     - TRUSS SPACING AND CONFIGURATION
     - CHORD DIAMETER
     - PANEL LENGTHS
     - ACTUAL MINIMUM VERTICAL CLEAR
     - ACTUAL OFFSET(S) FROM EDGE OF SHOULDER
     - FOOTING ELEVATION(S)
     - FRONT AND REAR DIAGONALS DIAMETER
     - VERTICAL DIAMETER
     - BOTTOM DIAGONAL DIAMETER
     - TOP AND BOTTOM VERTICALS DIAMETER
     - FOOTING(S) LENGTH AND WIDTH(S)
     - PEDESTAL(S) LENGTH AND WIDTH(S)
     - PEDESTAL HEIGHT(S)
     - TOP OF PEDESTAL ELEVATION(S)
     - SIZE, NUMBER AND EMBEDMENT OF ANCHOR BOLTS
     - ECCENTRICITY
     - LATITUDE AND LONGITUDE OR STATION AND OFFSET OR THE CENTER OF THE COLUMNS
     - DMS HEIGHT AND LENGTH
     - DMS AREA
     - DESIGN HEIGHT
     - DESIGN ECCENTRICITY
     - DESIGN WEIGHT OF DMS
     - SIZE AND TYPE OF PIPE CAPS
     - IDENTIFY ALL WELDS BY SIZE AND TYPE
     - COMPLETED CAMBER DIAGRAM
3. ALUMINUM DMS SUPPORT STRUCTURES ARE PROHIBITED.
4. TELESCOPING (SLIP-FIT) FIELD SPLICES FOR DMS SUPPORT STRUCTURES ARE PROHIBITED.
5. INDICATE THE SUPPLIER FOR CATWALK GRATING ON THE SHOP DRAWINGS.
6. PROVIDE HAND HOLE, WEATHERPROOF ENCLOSURE, AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP SIZE AND LOCATIONS ON SHOP DRAWINGS BASED ON SITE SPECIFIC REQUIREMENTS. ALTERNATE DETAILS MAY BE REQUIRED TO MEET CABLE BENDING RADIUS AND PROJECT SPECIFIC REQUIREMENTS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
DYNAMIC MESSAGE SIGNS
TRUSS SIGN STRUCTURES

NOTES TO DESIGNER AND FABRICATOR

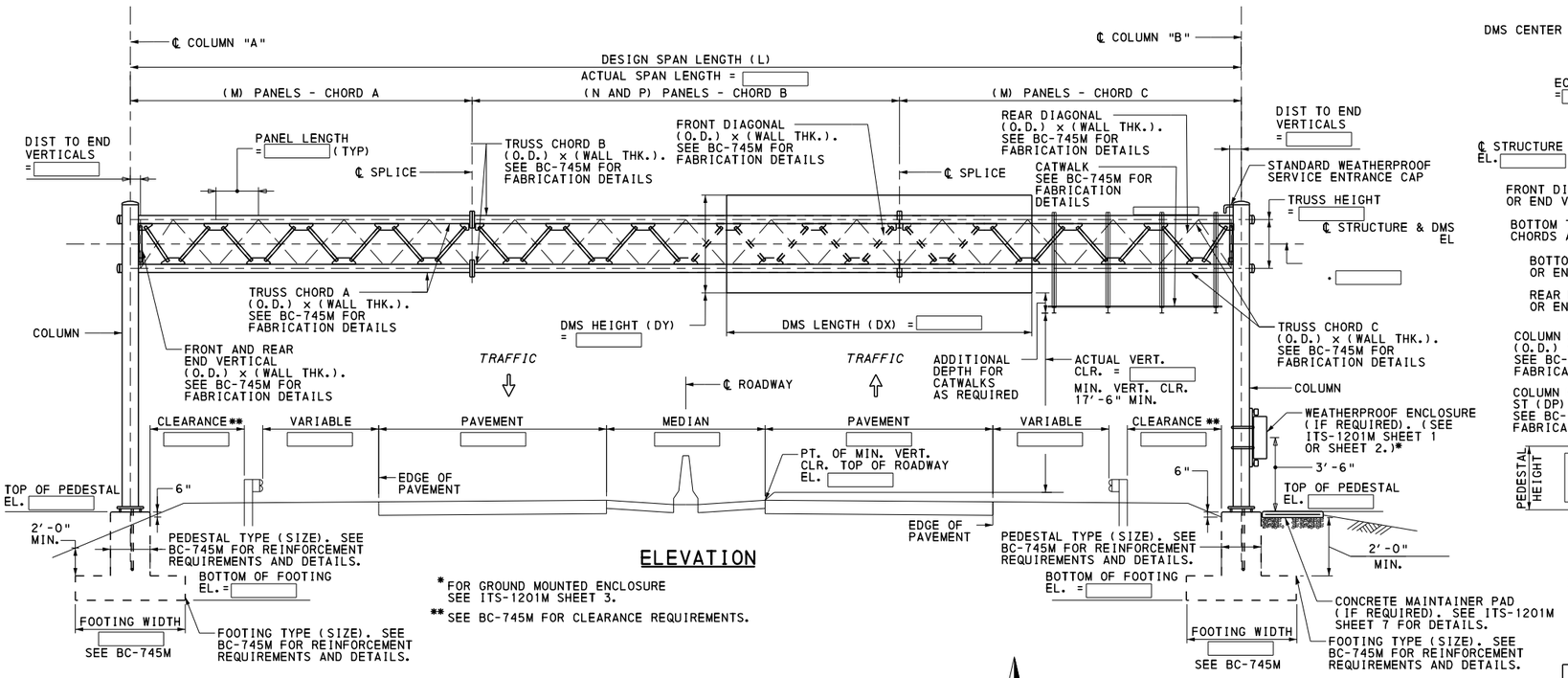
RECOMMENDED AUG. 4, 2017 Thomas P. Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brian D. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHEET 2 OF 4 BD-650M



TOP VIEW

NOTES TO DESIGNER:

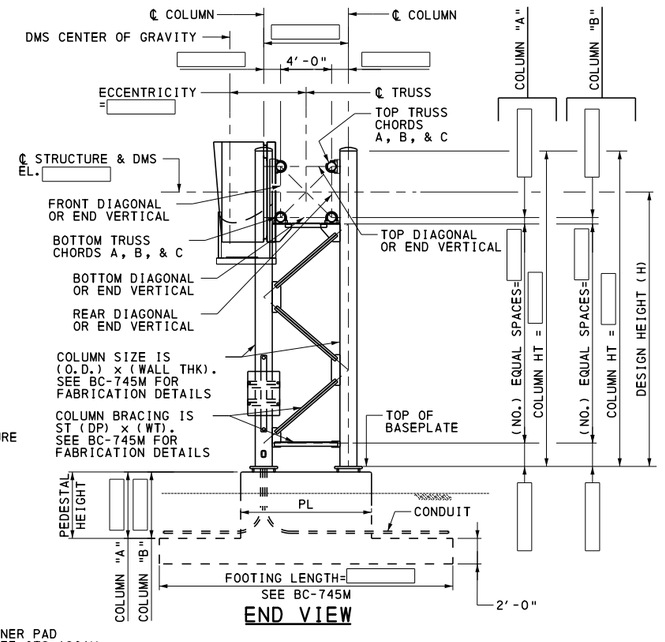
- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED. DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES.
  1. PEDESTAL TYPE (SIZE). SEE BC-745M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  2. FOOTING TYPE (SIZE). SEE BC-745M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  3. COLUMN SIZE IS (O.D.) x (WALL THK.). SEE BC-745M FOR FABRICATION DETAILS.
  4. COLUMN BRACING IS ST(DP)x(WT.). SEE BC-745M FOR FABRICATION DETAILS.
  5. TRUSS CHORD A (O.D.) x (WALL THK.), TRUSS CHORD B (O.D.) x (W.THK.), AND TRUSS CHORD C (O.D.) x (WALL THK.). SEE BC-745M FOR FABRICATION DETAILS.
  6. FRONT & REAR DIAGONALS (O.D.) x (WALL THK.) AND FRONT & REAR END VERTICALS (O.D.) x (WALL THK.); TOP & BOTTOM DIAGONALS (O.D.) x (WALL THK.) AND TOP & BOTTOM END VERTICALS (O.D.) x (WALL THK.). SEE BC-745M FOR FABRICATION DETAILS.
  7. SEE BC-745M FOR ADDITIONAL FABRICATION DETAILS INCLUDING HAND HOLE, WEATHERPROOF ENCLOSURE, AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP.
  8. SEAL BASE PLATE TO FOUNDATION GAP WITH GALVANIZED STEEL SCREEN, ½" BY ½" MESH AND 0.063" DIAMETER WIRES. SCREEN IS TO PREVENT ENTRY OF RODENTS WHILE PERMITTING DRAINAGE. SCREEN IS TO BE REMOVABLE AND ATTACHED TO BASEPLATE WITH STAINLESS STEEL HARDWARE.
- PROVIDE HAND HOLE, WEATHERPROOF ENCLOSURE, AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP SIZE AND LOCATIONS ON CONTRACT PLANS BASED ON SITE SPECIFIC REQUIREMENTS. ALTERNATE DETAILS FROM BC-741M MAY BE REQUIRED TO MEET CABLE BENDING RADIUS AND PROJECT SPECIFIC REQUIREMENTS.
- PLACE CAMBER DIAGRAM ON CONTRACT DRAWINGS AND SPECIFY REQUIRED CAMBER FROM DESIGN TABLE.
- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH [ ]
- PROVIDE GENERAL NOTES FROM SHEET 1 ON THE CONTRACT DRAWINGS.
- PROVIDE DMS CONNECTION DETAILS ON THE CONTRACT DRAWINGS IN ACCORDANCE WITH SHEET 4.
- SEE BD-645M FOR STRUCTURE COMPONENT DESIGNATIONS.



ELEVATION

* FOR GROUND MOUNTED ENCLOSURE SEE ITS-1201M SHEET 3.

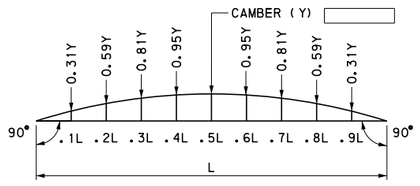
** SEE BC-745M FOR CLEARANCE REQUIREMENTS.



END VIEW

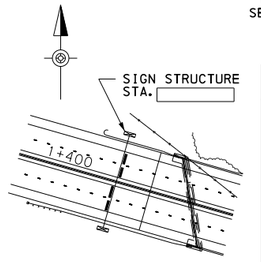
TABLE OF ESTIMATED QUANTITIES			
ITEM NO.	ITEM	UNIT	QUANTITY
■	STEEL SIGN STRUCTURE	LBS	
0000-0000	CLASS 3 EXCAVATION	CY	
0000-0000	CLASS A CEMENT CONCRETE	CY	
0000-0000	REINFORCEMENT BARS	LBS	

■ ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. [0000] - [0000]



CAMBER DIAGRAM

NOTE: PRIOR TO SHIPMENT OF TRUSS STRUCTURE TO THE SITE, SHOP ASSEMBLE TRUSSES IN AN UPRIGHT POSITION AND CHECK TRUSS CAMBER.



SEE PLAN SHEET [ ] FOR SIGN STRUCTURE LOCATION

LOCATION PLAN

DESIGN CRITERIA	
DESIGN DMS AREA (A) =	[ ]
DESIGN DMS LENGTH (DX) =	[ ]
DESIGN DMS HEIGHT (DY) =	[ ]
DESIGN HEIGHT (H) =	[ ]
DMS ECCENTRICITY =	[ ]
DESIGN WEIGHT OF DMS (W) =	[ ]
LATITUDE [ ]	LONGITUDE [ ] ▲
OR	
STATION [ ]	OFFSET [ ] ▲

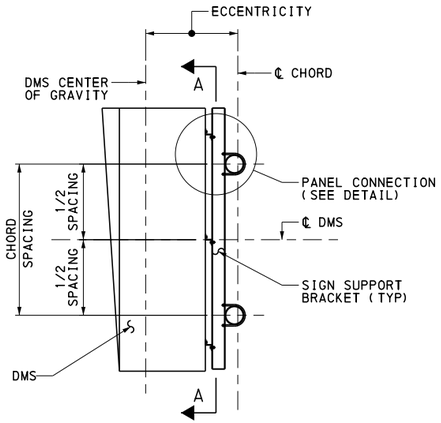
▲PROVIDE EITHER LATITUDE/LONGITUDE OR STATION AND OFFSET.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

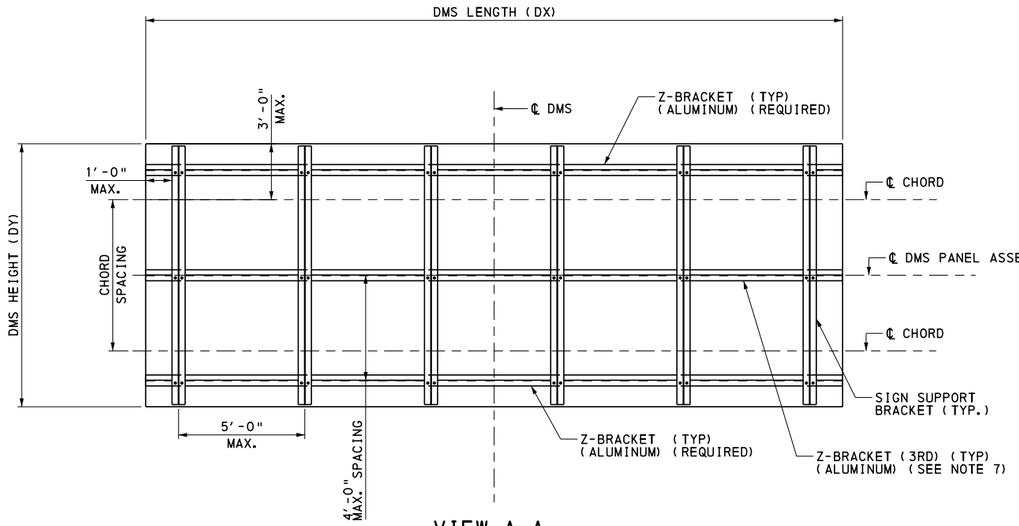
STANDARD DYNAMIC MESSAGE SIGNS TRUSS SIGN STRUCTURES

SAMPLE CONTRACT PLAN FOR TRUSS STRUCTURES

RECOMMENDED AUG. 4, 2017	RECOMMENDED AUG. 4, 2017	SHEET 3 OF 4
Thomas P Macioce CHIEF BRIDGE ENGINEER	Bruce D Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	BD-650M



PANEL CONNECTION



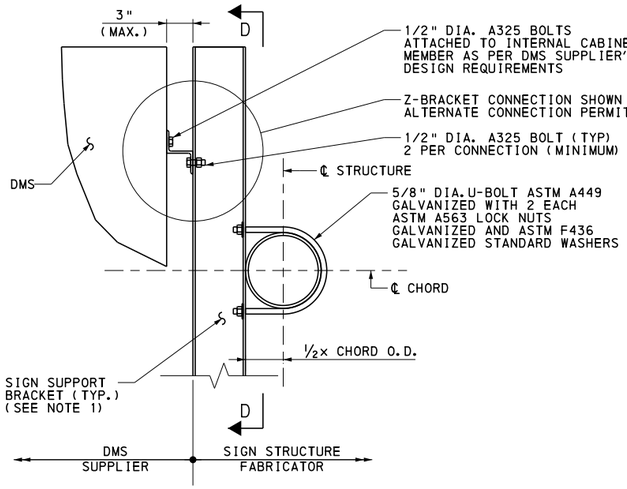
VIEW A-A

NOTES TO DESIGNER:

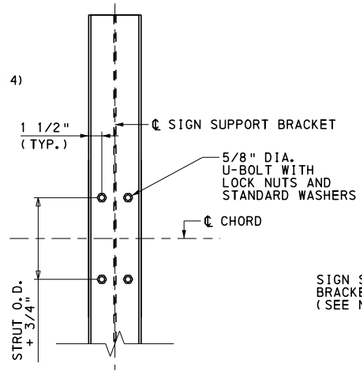
1. MINIMUM SIZE OF SIGN SUPPORT BRACKET IS W6x15. LARGER SIGN SUPPORTS MAY BE REQUIRED TO PROVIDE CLEARANCE BETWEEN HORIZONTAL Z-BRACKETS AND COLUMN.
2. HORIZONTAL Z-BRACKETS SHALL BE MADE OF ALUMINUM ALLOY 6061-T6 OR AS APPROVED BY THE CHIEF BRIDGE ENGINEER AND SHALL BE A MINIMUM OF 1/4" THICK.
3. CONNECTION DETAILS PROVIDED ON THIS SHEET HAVE BEEN

MAXIMUM DEAD LOAD	6000 LBS
MAXIMUM ECCENTRICITY	5'-0"
MAXIMUM LENGTH (DX)	30'-0"
MAXIMUM HEIGHT (DY)	10'-0"
MAXIMUM DEPTH	4'-0"

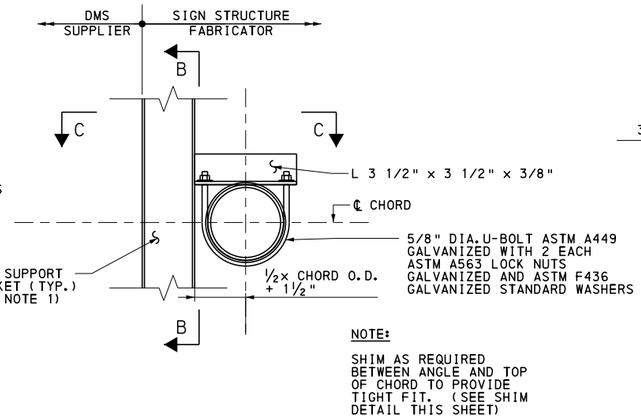
DESIGN CALCULATIONS ARE REQUIRED FOR DEVIATIONS TO THESE ASSUMPTIONS.
4. ALTERNATE CONNECTION DETAILS ARE PERMITTED, BUT REQUIRE CALCULATIONS PREPARED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA AND VERIFIED BY A SECONDARY INDEPENDENT PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA. THE DMS MANUFACTURER IS RESPONSIBLE FOR PROVIDING THESE CALCULATIONS AND HAVING THEM SIGNED AND SEALED BY BOTH THE PROFESSIONAL ENGINEERS.
5. DETAILS PROVIDED ARE THE MINIMUM REQUIREMENTS. ANY DEVIATIONS REQUIRE SPECIAL DESIGN.
6. FIELD WELDED DMS CONNECTIONS ARE NOT PERMITTED.
7. USE OF 3RD Z-BRACKET IS BASED ON PROJECT AND WIND LOADING REQUIREMENTS. MOUNTING CALCULATIONS TO BE COMPLETED TO AASHTO STANDARDS (SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS, 4TH EDITION, 2001, INCLUDING INTERIMS THROUGH 2006) AND SUBMITTED BY THE FABRICATOR.



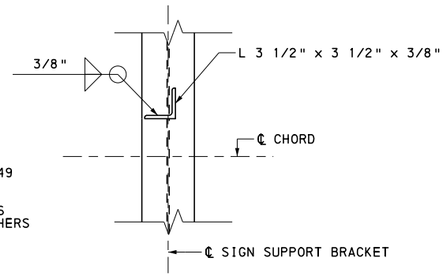
PANEL CONNECTION DETAIL



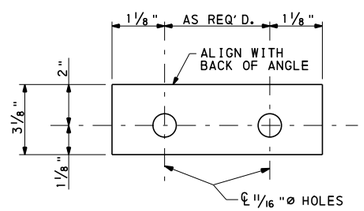
VIEW D-D



ALTERNATE PANEL CONNECTION DETAIL

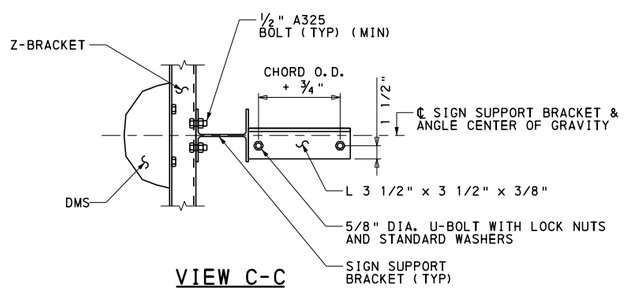


VIEW B-B



SHIM DETAIL

PROVIDE 1 AT 1/4", 3 AT 1/8" AND 1 AT 1/16" THICKNESS FOR EACH UPPER SIGN SUPPORT CONNECTION ANGLE.



VIEW C-C

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD DYNAMIC MESSAGE SIGNS TRUSS SIGN STRUCTURES

DMS ATTACHMENT DETAILS

RECOMMENDED AUG. 4, 2017 Thomas P. Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 4, 2017 Brent L. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHEET 4 OF 4 BD-650M

CHANGE 5

STANDARD BEAM SIZES AND ALLOWABLE SKEW LIMITATIONS

SIZE OF BEAM SECTION																								
BEAM DEPTH (IN)	12		17		21 & 24		27 & 30		33		36		39		42		45		48		>48	
BEAM WIDTH (IN)	36	48	36	48	36	48	36	48	36	48	36	48	36	48	36	48	36	48	36	48	36	48
ADJ. BOX (COMP.)	60°	60°	60°	60°	60°	60°	55°	60°	50°	55°	45°	50°	45°	50°	45°	50°	40°	50°	40°	50°	40°	50°
SPREAD BOX			35°	40°	35°	45°	35°	45°	35°	45°	35°	45°	35°	45°	35°	45°	40°	50°	50°	55°	50°	55°
I-BEAMS & PA BULB-TEE BEAMS	FOR ALL SIZES - 30°																					

NOTE:

FOR BOX BEAMS WITH SKEW ANGLES SHARPER THAN THOSE LISTED IN THE ABOVE TABLE IT IS PERMITTED TO SKEW THE END OF BEAM AT THE LIMIT SHOWN ABOVE AND PLACE THE BEARING PAD(S) AND BEAM ENDS AT THE REQUIRED SKEW ANGLE. SEE "SHARP SKEW DETAIL" ON THIS SHEET. DESIGNERS ARE TO VERIFY THAT THE COST OF ADDITIONAL BRIDGE SEAT WIDTH IS CONSIDERED IN EVALUATING THE COST SAVINGS OBTAINED BY USE OF THIS DETAIL.

MID-SPAN DIAPHRAGM REQUIREMENTS FOR SPREAD BOX BEAMS, PA BULB-TEE BEAMS AND I-BEAMS (SIMPLE AND CONTINUOUS SPAN BRIDGES)

	INTERIOR DIAPHRAGMS	EXTERIOR DIAPHRAGMS
BOX BEAMS	(1)(2) PROVIDE AT ℄ FOR SPANS GREATER THAN 45′	PROVIDE AT ℄ FOR SPANS 80′ AND GREATER
I-BEAMS & PA BULB-TEE	NOT APPLICABLE	(3) PROVIDE AT ℄ FOR SPANS 40′ AND GREATER

(1) PROVIDE ADDITIONAL INTERNAL DIAPHRAGMS AS NEEDED, WITH MAX. DIAPHRAGM SPACING OF 45′.

(2) PROVIDE DIAPHRAGMS AT DRAPE POINTS. WHEN INTERNAL DIAPHRAGMS ARE PROVIDED AT DRAPE POINTS, AN ADDITIONAL MIDSPAN INTERNAL DIAPHRAGM WILL ONLY BE REQUIRED WHEN AN EXTERNAL DIAPHRAGM IS USED AT MIDSPAN.

(3) PROVIDE EXTERIOR DIAPHRAGMS @ 1/3 POINTS FOR SPANS GREATER THAN 160′.

BACKWALL REQUIREMENTS

ALL BEAM TYPES	
FIX	GIRDER DEPTH EXCEEDS 6′ OR THE TOP OF THE DECK MOVEMENT CAUSED BY THE ROTATION DUE TO DESIGN LIVE LOAD PLUS IMPACT EXCEEDS 0.5", WHICHEVER CONTROLS.
EXP.	GIRDER DEPTH EXCEEDS 6′ OR THE TOP OF THE DECK MOVEMENT CAUSED BY THE COMBINATION OF THE MOVEMENTS DUE TO TEMPERATURE CHANGE AND ROTATION DUE TO THE DESIGN LIVE LOAD PLUS IMPACT EXCEEDS 0.5", WHICHEVER CONTROLS.

END DIAPHRAGMS, SHEAR BLOCKS AND DOWEL REQUIREMENTS FOR SPREAD BOX BEAMS, PA BULB-TEE BEAMS AND I-BEAMS (SIMPLE AND CONTINUOUS SPAN BRIDGES)

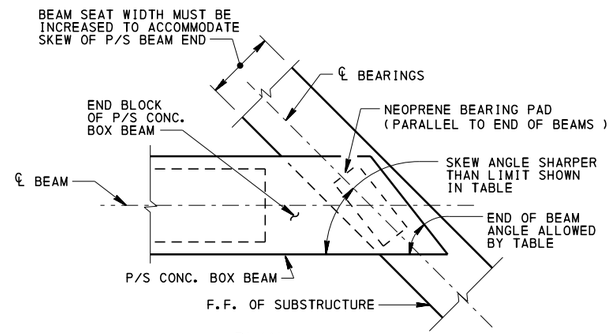
		ABUTMENTS				PIERS	
		FIXED (1) WITHOUT BACKWALL	FIXED WITH BACKWALL	EXPANSION (1) WITHOUT BACKWALL	EXPANSION WITH BACKWALL	FIXED	EXPANSION
DIAPHRAGMS, SHEAR BLOCKS AND CHEEKWALLS	SPREAD BOX BEAM	FULL DEPTH DIAPHRAGMS	ALTERNATING FULL AND PARTIAL DEPTH DIAPHRAGMS	FULL DEPTH DIAPHRAGMS, SHEAR BLKS, & CURTAIN WALLS	PARTIAL DEPTH DIAPHRAGMS, SHEAR BLKS, & CURTAIN WALLS (IF NEEDED)	(2) ALTERNATING FULL AND PARTIAL DEPTH DIAPHRAGMS AND CHEEKWALLS	(2) PARTIAL DEPTH DIAPHRAGMS, SHEAR BLKS, & CURTAIN WALLS
	I-BEAMS & PA BULB-TEE						
DOWELS	(3) SPREAD BOX BEAM	USE 3-1"ø DOWELS PER DIAPHRAGM	(4) USE 3-1"ø DOWELS PER DIAPHRAGM	NONE REQUIRED		(4) USE 3-1"ø DOWELS PER FULL DEPTH DIAPHRAGM	NONE REQUIRED
	I-BEAMS & PA BULB-TEE	(4) USE 3-1"ø DOWELS PER FULL DEPTH DIAPHRAGM					

SYMBOLS

(1) DENOTES CONDITIONS THAT PERTAIN TO SIMPLE SPAN BRIDGES.
(2) FULL DEPTH DIAPHRAGMS ARE TO BE USED FOR CONTINUOUS SPAN BRIDGES.
(3) THE DOWELS IN THE DIAPHRAGMS MAY BE REPLACED WITH DOWELS IN THE BEAMS. (SEE DOWEL REQUIREMENTS FOR ADJACENT BOX BEAM BRIDGES)
(4) THE DOWELS SHOWN ARE FOR A MAXIMUM DIAPHRAGM LENGTH OF 10′. FOR EACH 2′ OR PART THEREOF, ADD AN ADDITIONAL DOWEL.

NOTES:

1. FOR CONTINUOUS SPAN BRIDGES, DESIGN THE DOWELS AT THE FIXED ENDS TO RESIST ALL LONGITUDINAL FORCES.
2. USE STAINLESS STEEL DOWEL BARS PER PUB 408 SECTION 709.1(f).



PLAN

SHARP SKEW DETAIL

NO SCALE

GENERAL NOTES:

1. REFER TO BD-668M FOR PRECAST CHANNEL BEAM TIE BOLT REQUIREMENTS.

DEFINITIONS

SHEAR BLOCK: A REINFORCED CONCRETE BLOCK, GENERALLY HAVING HEIGHT TO WIDTH OR LENGTH RATIO EQUAL TO OR LESS THAN 1. ITS PURPOSE IS TO RESIST SHEAR.

CURTAIN WALL: A REINFORCED CONCRETE WALL TO CONCEAL UNSIGHTLY DETAILS.

CHEEKWALL: A REINFORCED CONCRETE WALL WHICH ACCOMPLISHES THE FUNCTIONS OF SHEAR BLOCK AND CURTAIN WALL.

REFERENCE DRAWINGS	
BD-668M	PRECAST CHANNEL BEAM
BC-775M	MISCELLANEOUS PRESTRESS DETAILS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCKS, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS P/S CONCRETE I-BEAM, PA BULB-TEE BEAM AND BOX BEAM BRIDGES

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

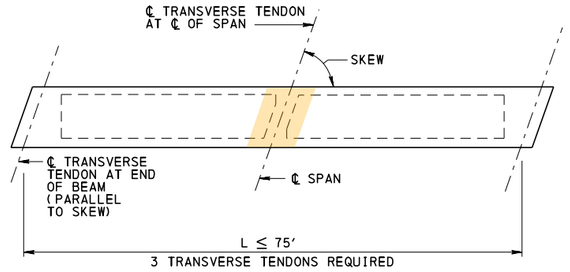
BD-651M

TENDON AND DIAPHRAGM REQUIREMENTS FOR ADJACENT BOX BEAM BRIDGES

(SIMPLE AND CONTINUOUS SPAN BRIDGES)

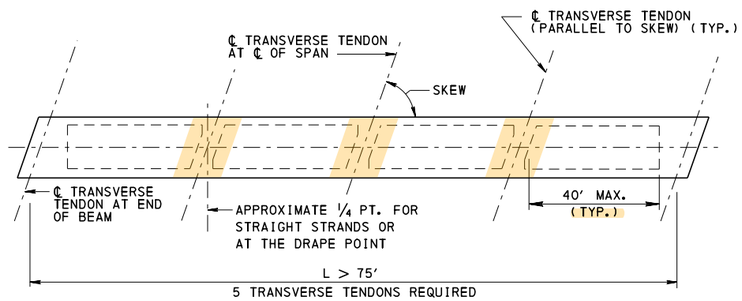
SPANS UP TO 75′

(3 TRANSVERSE TENDONS REQUIRED)



SPANS GREATER THAN 75′

(5 TRANSVERSE TENDONS REQUIRED)



NOTES:

1. FOR DIAPHRAGM DETAILS, SEE BC-775M.
2. DETAILS ALSO APPLY TO PLANK BEAMS.
3. BEAMS WITH DRAPED STRANDS ARE TO HAVE DIAPHRAGMS PLACED AT THE DRAPE POINTS.
4. INTERMEDIATE DIAPHRAGM IS NOT REQUIRED FOR SPANS LESS THAN OR EQUAL TO 40 FEET.

DOWEL AND SHEAR BLOCK REQUIREMENTS FOR COMPOSITE ADJACENT BOX BEAMS

(SIMPLE AND CONTINUOUS SPAN BRIDGES)

FIXED END	EXPANSION END
1-1¼"ø DOWEL PER BEAM	1¼"ø DOWEL ONLY REQUIRED WHEN USED TO MEET TOTAL ANCHORAGE FOR SPAN LENGTHS LESS THAN OR EQUAL TO 50 FT. FOR SPAN LENGTHS GREATER THAN 50 FT. CHIEF BRIDGE ENGINEER APPROVAL IS REQUIRED.

NOTES:

1. INVESTIGATE THE ADEQUACY OF DOWELS AND SHEAR BLOCKS WHEN BRIDGE IS SUBJECT TO INUNDATION DURING FLOOD CONDITIONS (100 YEAR MINIMUM).
2. FOR MINIMUM ALLOWABLE SKEW, SEE STANDARD BEAM SIZES AND ALLOWABLE SKEW LIMITATIONS, THIS SHEET.
3. SINGLE SPAN BRIDGES WITH SPANS OF 35′ AND LESS, PROVIDE FIXED CONDITION AT BOTH ABUTMENTS.
4. ARRANGE FIXED AND EXPANSION CONDITIONS SO THAT THE BRIDGE IS EXPANDING UPHILL.
5. FOR CONTINUOUS SPANS, PROVIDE DOWELS AT FIXED LOCATIONS. DESIGN DOWELS TO RESIST ALL LONGITUDINAL FORCES.
6. FOR MULTI-SPAN BRIDGES (NON-CONTINUOUS), WITHOUT BACKWALLS, ABUTMENTS ARE TO BE FIXED.
7. THE SHEAR BLOCK AND DOWEL REQUIREMENTS ARE APPLICABLE TO BRIDGES WITH OR WITHOUT BACKWALLS.
8. IF A CHEEKWALL IS TO BE USED AS A SHEAR BLOCK, IT IS TO BE DESIGNED ACCORDINGLY.
9. USE STAINLESS STEEL DOWEL BARS PER PUB 408 SECTION 709.1(f).

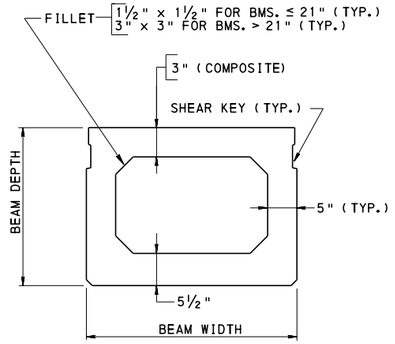
SKEW LIMITATIONS FOR INTEGRAL ABUTMENT BRIDGES

NO. OF SPANS	SPAN LENGTH, L	MINIMUM SKEW
1	L ≤ 90 FT.	45°
1	90 FT. < L ≤ 130 FT.	60°
1	L > 130 FT.	70°
>1	ALL SPAN LENGTHS	70°

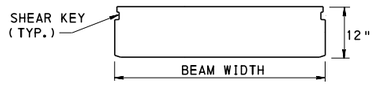
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCKS, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS P/S CONCRETE I-BEAM, PA BULB-TEE BEAM AND BOX BEAM BRIDGES

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 2 OF 2
		BD-651M



ADJACENT BOX BEAM



PLANK BEAM

ADJACENT BOX BEAM DATA (COMPOSITE CONSTRUCTION)

BEAM DEPTH (in.)	BASIC BEAM DATA - 48" BEAMS (COMPOSITE)							BASIC BEAM DATA - 36" BEAMS (COMPOSITE)						
	CONC. (CY/ft.)	AREA (in.²)	WT/FT. (KIPS)	Yb (in.)	I (in.⁴)	St (in.³)	Sb (in.³)	CONC. (CY/ft.)	AREA (in.²)	WT/FT. (KIPS)	Yb (in.)	I (in.⁴)	St (in.³)	Sb (in.³)
17	0.126	489	0.510	7.61	16693	1778	2193	0.100	387	0.403	7.71	12697	1366	1648
21	0.136	529	0.551	9.29	29123	2487	3136	0.110	427	0.445	9.44	22344	1933	2368
24	0.147	573	0.579	10.64	41828	3131	3932	0.121	471	0.490	10.84	32444	2465	2993
27	0.155	603	0.628	11.95	56630	3763	4740	0.129	501	0.522	12.19	44213	2985	3627
30	0.163	633	0.659	13.28	74106	4432	5581	0.137	531	0.553	13.56	58215	3540	4295
33	0.169	658	0.685	14.57	94221	5112	6467	0.143	556	0.579	14.88	74436	4107	5004
36	0.177	688	0.716	15.92	117332	5842	7372	0.151	586	0.610	16.26	93196	4721	5732
39	0.185	718	0.747	17.28	143507	6606	8306	0.158	616	0.641	17.65	114576	5367	6491
42	0.192	748	0.779	18.65	172885	7404	9271	0.166	646	0.672	19.06	138713	6046	7279
45	0.200	778	0.810	20.03	205604	8234	10265	0.174	676	0.704	20.47	165744	6756	8098
48	0.208	808	0.841	21.42	241802	9097	11289	0.181	706	0.735	21.89	195805	7498	8946
54	0.223	868	0.904	24.22	325181	10921	13424	0.197	766	0.797	24.74	265562	9077	10732
60	0.239	928	0.966	27.05	424117	12872	15678	0.212	826	0.860	27.62	349072	10782	12637
66	0.254	988	1.029	29.90	539700	14951	18049	0.228	886	0.922	30.52	447420	12610	14661

PLANK BEAM DATA (COMPOSITE CONSTRUCTION)

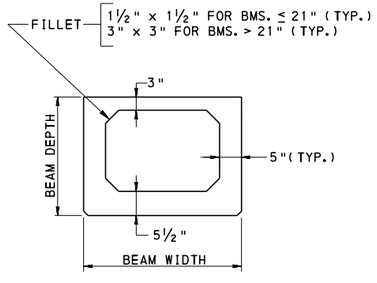
BEAM DEPTH (in.)	BASIC BEAM DATA - 48" BEAMS (COMPOSITE)							BASIC BEAM DATA - 36" BEAMS (COMPOSITE)						
	CONC. (CY/ft.)	AREA (in.²)	WT/FT. (KIPS)	Yb (in.)	I (in.⁴)	St (in.³)	Sb (in.³)	CONC. (CY/ft.)	AREA (in.²)	WT/FT. (KIPS)	Yb (in.)	I (in.⁴)	St (in.³)	Sb (in.³)
12	0.146	568	0.591	5.97	6850	1136	1147	0.109	424	0.441	5.96	5122	848	859

NOTES:

1. SHOWN ARE THE BEAM SIZES WHICH ACCOMMODATE MOST DESIGN SITUATIONS. SPECIAL BEAMS CAN BE UTILIZED IF JUSTIFIED BY ECONOMICS AND APPROVED BY THE CHIEF BRIDGE ENGINEER.
2. SHOWN DIMENSIONS ARE FOR BOX BEAMS, PA BULB-TEE BEAMS, AND I-BEAMS WITH REGULAR AND OVERSIZED 1/2 " ø STRANDS. CERTIFY AS SPECIFIED PUBLICATION 408 SECTION 106.03.
3. SHOWN WEIGHTS ARE FOR 150 LBS. PER CUBIC FOOT CONCRETE.
4. FOR DAP BEAM DESIGN, LIMIT THE MAXIMUM DAP THICKNESS TO 1.5" AND MAINTAIN A 1" MINIMUM CONCRETE COVER ON THE CONFINEMENT REINFORCEMENT. ADJUST STRAND PATTERNS AND VOID DIMENSIONS. BEAM PROPERTIES MUST BE RECOMPUTED.
5. ALL CHAMFERS ¾" x ¾" UNLESS AS NOTED.

TABLE NOTATION

in. = INCHES
CY = CUBIC YARD
I = MOMENT OF INERTIA
Yb = DISTANCE FROM BOTTOM OF BEAM TO CENTER OF GRAVITY
St = SECTION MODULUS, TOP BEAM
Sb = SECTION MODULUS, BOTTOM BEAM



SPREAD BOX BEAM

SPREAD BOX BEAM DATA

BEAM DEPTH (in.)	BASIC BEAM DATA - 48" BEAMS							BASIC BEAM DATA - 36" BEAMS						
	CONC. (CY/ft.)	AREA (in.²)	WT/FT. (KIPS)	Yb (in.)	I (in.⁴)	St (in.³)	Sb (in.³)	CONC. (CY/ft.)	AREA (in.²)	WT/FT. (KIPS)	Yb (in.)	I (in.⁴)	St (in.³)	Sb (in.³)
17	0.128	498	0.519	7.70	16955	1823	2202	0.102	396	0.412	7.82	12949	1410	1657
21	0.138	538	0.560	9.41	29630	2556	3150	0.112	436	0.454	9.58	22831	1999	2383
24	0.149	581	0.605	10.77	42564	3218	3952	0.123	479	0.499	11.0	33148	2549	3015
27	0.157	611	0.636	12.10	57646	3868	4765	0.131	509	0.530	12.36	45183	3087	3655
30	0.165	641	0.668	13.44	75444	4556	5613	0.139	539	0.561	13.75	59493	3660	4328
33	0.173	671	0.699	14.80	96098	5280	6493	0.146	569	0.593	15.14	76215	4267	5034
36	0.180	701	0.730	16.17	119747	6038	7406	0.154	599	0.624	16.55	95487	4908	5771
39	0.188	731	0.761	17.55	146528	6831	8350	0.162	629	0.655	17.96	117444	5582	6539
42	0.196	761	0.793	18.94	176579	7657	9324	0.169	659	0.686	19.38	142223	6288	7338
45	0.203	791	0.824	20.34	210038	8516	10328	0.177	689	0.718	20.81	169961	7026	8167
48	0.211	821	0.855	21.74	247041	9408	11362	0.185	719	0.749	22.25	200793	7797	9026
54	0.227	881	0.918	24.57	332226	11290	13520	0.200	779	0.811	25.13	272281	9431	10835
60	0.242	941	0.980	27.42	433225	13299	15797	0.215	839	0.874	28.03	357774	11192	12763
66	0.257	1001	1.043	30.29	551125	15435	18193	0.231	899	0.936	30.95	458355	13076	14811

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

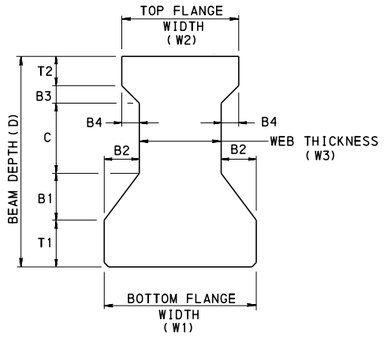
STANDARD PRESTRESSED BEAM SIZES AND SECTION PROPERTIES

RECOMMENDED APR. 29, 2016
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016
Brian S. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 3

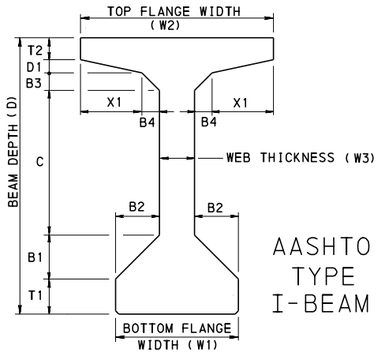
BD-652M



PA. I-BEAM

PA. I-BEAMS

BEAM DESIGNATION	TOP FLANGE WIDTH (In.) W2	BOTTOM FLANGE WIDTH (In.) W1	DEPTH (In.) D	DEPTH DATA (In.)					FLANGE DATA (In.)		WEB THICKNESS (In.) W3	BASIC BEAM PROPERTIES						
				T2	B3	C	B1	T1	B4	B2		CONC. (CY/ft.)	AREA (In.2)	Yb (In.)	I (In.4)	St (In.3)	Sb (In.3)	WT/FT. (KIPS)
18/30	12	18	30	3	3	12	8	4	3	6	6	0.078	303	12.75	28032	1625	2199	0.316
20/30	14	20	30	3	3	12	8	4	3	6	8	0.093	363	13.12	32786	1942	2499	0.377
18/33	12	18	33	4	3	12	8	6	3	6	6	0.090	351	13.95	38405	2016	2754	0.365
20/33	14	20	33	4	3	12	8	6	3	6	8	0.107	417	14.35	44757	2400	3119	0.433
24/33	18	24	33	4	3	12	8	6	3	6	12	0.141	549	14.87	57200	3155	3847	0.571
26/33	20	26	33	4	3	12	8	6	3	6	14	0.158	615	15.04	63346	3528	4211	0.640
18/36	12	18	36	5	3	12	8	8	3	6	6	0.103	399	15.18	50818	2442	3347	0.417
20/36	14	20	36	5	3	12	8	8	3	6	8	0.121	471	15.61	59077	2898	3783	0.490
24/36	18	24	36	5	3	12	8	8	3	6	12	0.158	615	16.17	75256	3796	4653	0.640
26/36	20	26	36	5	3	12	8	8	3	6	14	0.177	687	16.36	83247	4240	5087	0.717
20/39	14	20	39	8	3	12	8	8	3	6	8	0.132	513	17.41	77576	3593	4457	0.535
24/42	18	24	42	4	4	17	10	7	5	8	8	0.151	588	18.04	107967	4504	5985	0.612
24/45	18	24	45	7	4	17	10	7	5	8	8	0.165	642	20.18	140065	5644	6940	0.668
24/48	18	24	48	8	4	17	10	9	5	8	8	0.182	708	21.39	172712	6491	8075	0.737
24/51	18	24	51	11	4	17	10	9	5	8	8	0.196	762	23.39	212399	7691	9084	0.794
24/54	18	24	54	14	4	17	10	9	5	8	8	0.210	816	25.31	255194	8895	10083	0.850
26/54	20	26	54	8	6	23	9	8	6	9	8	0.203	789	24.73	260741	8908	10543	.822
24/60	24	24	60	6	6	29	10	9	8	8	8	0.218	848	28.31	355185	11206	12549	0.883
26/60	26	26	60	6	6	29	10	9	8	8	10	0.249	968	28.52	391487	12434	13729	1.008
24/63	24	24	63	9	6	29	10	9	8	8	8	0.237	920	30.90	428367	13346	13862	0.958
26/63	26	26	63	9	6	29	10	9	8	8	10	0.269	1046	30.97	470081	14678	15176	1.090



AASHTO TYPE I-BEAM

AASHTO I-BEAMS

BEAM DESIGNATION	TOP FLANGE WIDTH (In.) W2	BOTTOM FLANGE WIDTH (In.) W1	DEPTH (In.) D	DEPTH DATA (In.)						FLANGE DATA (In.)			WEB THICKNESS (In.) W3	BASIC BEAM PROPERTIES						
				T2	D1	B3	C	B1	T1	X1	B4	B2		CONC. (CY/ft.)	AREA (In.2)	Yb (In.)	I (In.4)	St (In.3)	Sb (In.3)	WT/FT. (KIPS)
28/63	42	28	63	5	3	4	33	10	8	13	4	10	8	0.261	1013	31.96	521162	16788	16308	1.057
28/66	42	28	66	5	3	4	36	10	8	13	4	10	8	0.267	1037	33.43	587180	18028	17564	1.081
28/72	42	28	72	5	3	4	42	10	8	13	4	10	8	0.279	1085	36.38	733319	20588	20157	1.130
28/78	42	28	78	5	3	4	48	10	8	13	4	10	8	0.291	1133	39.34	898984	23251	22854	1.178
28/84	42	28	84	5	3	4	54	10	8	13	4	10	8	0.304	1181	42.29	1085040	26016	25655	1.231
28/90	42	28	90	5	3	4	60	10	8	13	4	10	8	0.316	1229	45.26	1292348	28883	28557	1.280
28/96	42	28	96	5	3	4	66	10	8	13	4	10	8	0.328	1277	48.22	1521775	31850	31559	1.328

NOTE:

FOR NOTES, SEE SHEET 1.

TABLE NOTATION

In. = INCHES
CY = CUBIC YARD
I = MOMENT OF INERTIA
Yb = DISTANCE FROM BOTTOM OF BEAM TO CENTER OF GRAVITY
St = SECTION MODULUS, TOP BEAM
Sb = SECTION MODULUS, BOTTOM BEAM

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD PRESTRESSED BEAM SIZES AND SECTION PROPERTIES

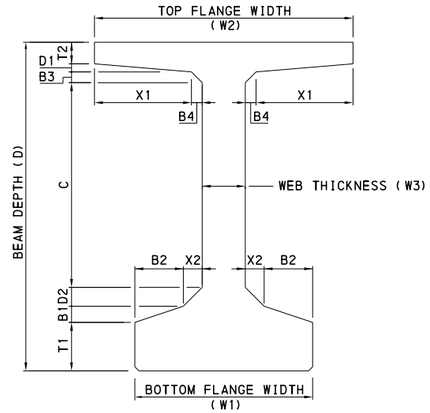
RECOMMENDED APR. 29, 2016
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016
Brent D. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

BD-652M

PA BULB-TEE BEAM

BEAM DESIGNATION	TOP FLANGE WIDTH (in.) W2	BOTTOM FLANGE WIDTH (in.) W1	DEPTH (in.) D	DEPTH DATA (in.)							FLANGE DATA (in.)				WEB THICKNESS (in.) W3	BASIC BEAM PROPERTIES						
				T2	D1	B3	C	D2	B1	T1	X1	B4	B2	X2		CONC. (CY/ft.)	AREA (in.2)	Yb (in.)	I (in.4)	St (in.3)	Sb (in.3)	WT/FT. (KIPS)
33/31	36	33	31	4.5	1	2	8	3.5	3	9	12	2	9	3.5	8	0.175	679	14.20	73400	4369	5169	0.708
33/39	36	33	39	4.5	1	2	16	3.5	3	9	12	2	9	3.5	8	0.191	743	17.57	135418	6319	7707	0.774
33/47	36	33	47	4.5	1	2	24	3.5	3	9	12	2	9	3.5	8	0.208	807	21.03	220711	8499	10495	0.841
33/55	36	33	55	4.5	1	2	32	3.5	3	9	12	2	9	3.5	8	0.224	871	24.57	331440	10892	13490	0.908
33/63	36	33	63	4.5	1	2	40	3.5	3	9	12	2	9	3.5	8	0.241	935	28.18	469733	13490	16669	0.974
33/71	36	33	71	4.5	1	2	48	3.5	3	9	12	2	9	3.5	8	0.257	999	31.83	637700	16280	20035	1.041
33/79	36	33	79	4.5	1	2	56	3.5	3	9	12	2	9	3.5	8	0.273	1063	35.53	837434	19265	23570	1.108
33/87	36	33	87	4.5	1	2	64	3.5	3	9	12	2	9	3.5	8	0.290	1127	39.26	1071018	22434	27280	1.174
33/95	36	33	95	4.5	1	2	72	3.5	3	9	12	2	9	3.5	8	0.306	1191	43.02	1340530	25789	31161	1.241
33/29	36	33	29	4.5	1	2	8	3.5	3	7	12	2	9	3.5	8	0.158	613	13.63	60633	3945	4448	0.639
33/37	36	33	37	4.5	1	2	16	3.5	3	7	12	2	9	3.5	8	0.174	677	17.18	115518	5828	6724	0.705
33/45	36	33	45	4.5	1	2	24	3.5	3	7	12	2	9	3.5	8	0.191	741	20.81	191854	7931	9219	0.772
33/53	36	33	53	4.5	1	2	32	3.5	3	7	12	2	9	3.5	8	0.207	805	24.50	291741	10237	11908	0.839
33/61	36	33	61	4.5	1	2	40	3.5	3	7	12	2	9	3.5	8	0.224	869	28.24	417265	12737	14776	0.905
33/69	36	33	69	4.5	1	2	48	3.5	3	7	12	2	9	3.5	8	0.240	933	32.01	570500	15423	17823	0.972
33/77	36	33	77	4.5	1	2	56	3.5	3	7	12	2	9	3.5	8	0.256	997	35.81	753516	18294	21042	1.039
33/85	36	33	85	4.5	1	2	64	3.5	3	7	12	2	9	3.5	8	0.273	1061	39.64	968374	21349	24429	1.105
33/93	36	33	93	4.5	1	2	72	3.5	3	7	12	2	9	3.5	8	0.289	1125	43.49	1217135	24584	27987	1.172
33/31.25	42	33	31.25	4.5	1.25	2	8	3.5	3	9	15	2	9	3.5	8	0.184	716	14.99	81610	5018	5445	0.746
33/39.25	42	33	39.25	4.5	1.25	2	16	3.5	3	9	15	2	9	3.5	8	0.200	780	18.50	149377	7200	8073	0.813
33/47.25	42	33	47.25	4.5	1.25	2	24	3.5	3	9	15	2	9	3.5	8	0.217	844	22.09	241794	9612	10944	0.879
33/55.25	42	33	55.25	4.5	1.25	2	32	3.5	3	9	15	2	9	3.5	8	0.233	908	25.74	360976	12233	14023	0.946
33/63.25	42	33	63.25	4.5	1.25	2	40	3.5	3	9	15	2	9	3.5	8	0.250	972	29.44	509017	15053	17293	1.013
33/71.25	42	33	71.25	4.5	1.25	2	48	3.5	3	9	15	2	9	3.5	8	0.266	1036	33.17	688003	18066	20743	1.079
33/79.25	42	33	79.25	4.5	1.25	2	56	3.5	3	9	15	2	9	3.5	8	0.283	1100	36.93	900010	21267	24371	1.146
33/87.25	42	33	87.25	4.5	1.25	2	64	3.5	3	9	15	2	9	3.5	8	0.299	1164	40.72	1147106	24653	28171	1.213
33/95.25	42	33	95.25	4.5	1.25	2	72	3.5	3	9	15	2	9	3.5	8	0.316	1228	44.53	1431357	28221	32143	1.279
33/29.25	42	33	29.25	4.5	1.25	2	8	3.5	3	7	15	2	9	3.5	8	0.167	650	14.41	67363	4539	4675	0.677
33/37.25	42	33	37.25	4.5	1.25	2	16	3.5	3	7	15	2	9	3.5	8	0.183	714	18.12	127264	6653	7023	0.744
33/45.25	42	33	45.25	4.5	1.25	2	24	3.5	3	7	15	2	9	3.5	8	0.200	778	21.88	209914	8984	9592	0.810
33/53.25	42	33	53.25	4.5	1.25	2	32	3.5	3	7	15	2	9	3.5	8	0.216	842	25.68	317386	11512	12359	0.877
33/61.25	42	33	61.25	4.5	1.25	2	40	3.5	3	7	15	2	9	3.5	8	0.233	906	29.51	451742	14231	15310	0.944
33/69.25	42	33	69.25	4.5	1.25	2	48	3.5	3	7	15	2	9	3.5	8	0.249	970	33.36	615042	17135	18439	1.010
33/77.25	42	33	77.25	4.5	1.25	2	56	3.5	3	7	15	2	9	3.5	8	0.266	1034	37.22	809344	20220	21743	1.077
33/85.25	42	33	85.25	4.5	1.25	2	64	3.5	3	7	15	2	9	3.5	8	0.282	1098	41.11	1036702	23485	25220	1.144
33/93.25	42	33	93.25	4.5	1.25	2	72	3.5	3	7	15	2	9	3.5	8	0.299	1162	45.00	1299169	26927	28869	1.210
33/31.5	48	33	31.5	4.5	1.5	2	8	3.5	3	9	18	2	9	3.5	8	0.194	754	15.74	89649	5688	5696	0.786
33/39.5	48	33	39.5	4.5	1.5	2	16	3.5	3	9	18	2	9	3.5	8	0.210	818	19.41	163021	8113	8401	0.852
33/47.5	48	33	47.5	4.5	1.5	2	24	3.5	3	9	18	2	9	3.5	8	0.227	882	23.12	262423	10764	11350	0.919
33/55.5	48	33	55.5	4.5	1.5	2	32	3.5	3	9	18	2	9	3.5	8	0.243	946	26.88	389933	13622	14509	0.986
33/63.5	48	33	63.5	4.5	1.5	2	40	3.5	3	9	18	2	9	3.5	8	0.260	1010	30.66	547622	16676	17861	1.052
33/71.5	48	33	71.5	4.5	1.5	2	48	3.5	3	9	18	2	9	3.5	8	0.276	1074	34.47	737558	19918	21396	1.119
33/79.5	48	33	79.5	4.5	1.5	2	56	3.5	3	9	18	2	9	3.5	8	0.293	1138	38.30	961802	23347	25110	1.186
33/87.5	48	33	87.5	4.5	1.5	2	64	3.5	3	9	18	2	9	3.5	8	0.309	1202	42.15	1222412	26957	28999	1.252
33/95.5	48	33	95.5	4.5	1.5	2	72	3.5	3	9	18	2	9	3.5	8	0.325	1266	46.02	1521445	30748	33062	1.319
33/29.5	48	33	29.5	4.5	1.5	2	8	3.5	3	7	18	2	9	3.5	8	0.177	688	15.15	73916	5152	4878	0.717
33/37.5	48	33	37.5	4.5	1.5	2	16	3.5	3	7	18	2	9	3.5	8	0.193	752	19.02	138679	7504	7291	0.784
33/45.5	48	33	45.5	4.5	1.5	2	24	3.5	3	7	18	2	9	3.5	8	0.210	816	22.91	227492	10070	9930	0.850
33/53.5	48	33	53.5	4.5	1.5	2	32	3.5	3	7	18	2	9	3.5	8	0.226	880	26.82	342409	12832	12769	0.917
33/61.5	48	33	61.5	4.5	1.5	2	40	3.5	3	7	18	2	9	3.5	8	0.243	944	30.73	485479	15779	15796	0.984
33/69.5	48	33	69.5	4.5	1.5	2	48	3.5	3	7	18	2	9	3.5	8	0.259	1008	34.66	658755	18909	19005	1.050
33/77.5	48	33	77.5	4.5	1.5	2	56	3.5	3	7	18	2	9	3.5	8	0.276	1072	38.60	864286	22218	22391	1.117
33/85.5	48	33	85.5	4.5	1.5	2	64	3.5	3	7	18	2	9	3.5	8	0.292	1136	42.54	1104121	25703	25953	1.184
33/93.5	48	33	93.5	4.5	1.5	2	72	3.5	3	7	18	2	9	3.5	8	0.308	1200	46.49	1380310	29364	29688	1.250



PA
BULB-TEE
BEAM

NOTE:

FOR NOTES, SEE SHEET 1.

TABLE NOTATION

In. = INCHES
CY = CUBIC YARD
I = MOMENT OF INERTIA
Yb = DISTANCE FROM BOTTOM OF BEAM TO CENTER OF GRAVITY
St = SECTION MODULUS, TOP BEAM
Sb = SECTION MODULUS, BOTTOM BEAM

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
PRESTRESSED BEAM SIZES
AND SECTION PROPERTIES

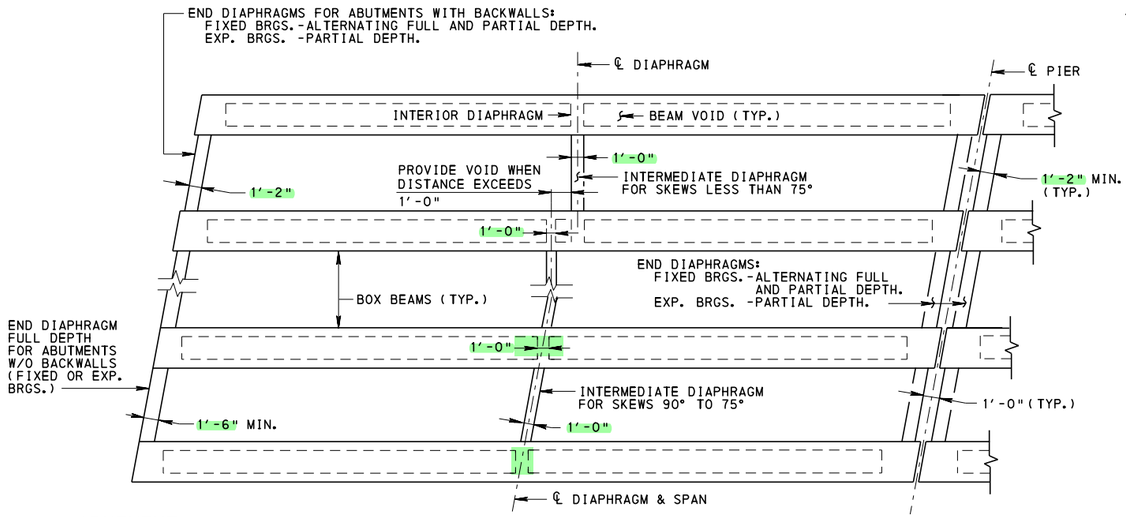
RECOMMENDED APR. 29, 2016
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016
Brent D. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

BD-652M

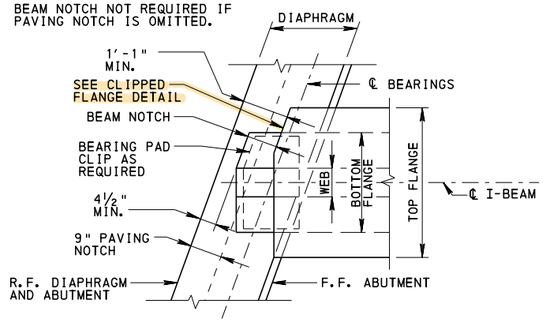
CHANGE 2

CHANGE 5



FRAMING PLAN FOR SPREAD BOX BEAMS

NOTE:
BEAM NOTCH NOT REQUIRED IF PAVING NOTCH IS OMITTED.

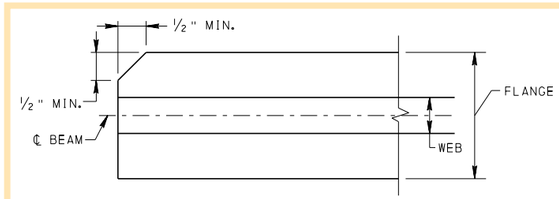


DETAIL A - WITH PAVING NOTCH AND WITHOUT BACKWALL

(AASHTO TYPE I-BEAM SHOWN; OTHERS SIMILAR)

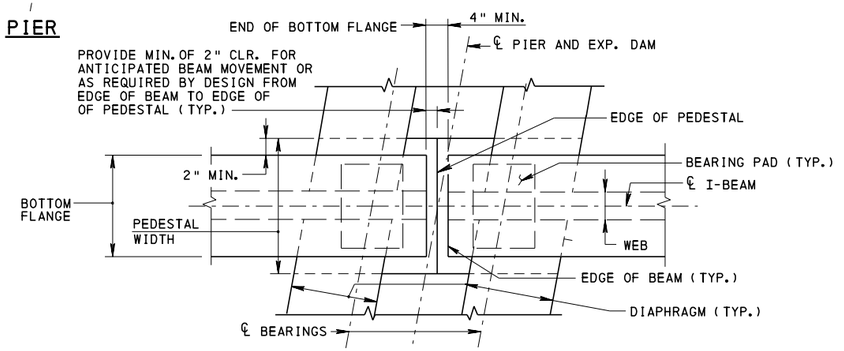
NOTES:

1. INTERMEDIATE DIAPHRAGMS (INT. OR EXT.) AND END DIAPHRAGMS WITH BACKWALLS AND WITHOUT BACKWALLS ARE IDENTICAL FOR SIMPLE AND CONTINUOUS BRIDGES. FOR DETAILS OF DIAPHRAGMS AT PIERS FOR CONTINUOUS BRIDGES, SEE BD-664M & BD-665M.
2. FOR DIAPHRAGM REQUIREMENTS FOR SPREAD BOX AND I-BEAMS, SEE BD-651M.
3. SHOW ALL APPLICABLE DETAILS ON THE DESIGN DRAWINGS.
4. FOR ADDITIONAL CLIPPED FLANGE DETAILS, SEE BD-662M.



CLIPPED FLANGE DETAIL

(BOTTOM FLANGE SHOWN, TOP FLANGE SIMILAR)
(SEE NOTE 4)



DETAIL B

NOTE:
TOP FLANGE NOT SHOWN.

SIMPLE SPAN DIAPHRAGM SCHEMATICS FIXED CONDITIONS

ABUTMENTS WITH BACKWALL

BAY (TYP.) — ℄ BEAM (TYP.)

TYP. FOR 4,8,12 BAY ETC. | F | P | P | F |

TYP. FOR 5,7,9 BAY ETC. | F | P | F | P | F |

TYP. FOR 6,10,14 BAY ETC. | F | P | F | F | P | F |

PIERS

TYP. FOR 4,8,12 BAY ETC. | F | P | P | F | ℄ PIER
| P | F | F | P |

TYP. FOR 5,7,9 BAY ETC. | F | P | F | P | F | ℄ PIER
| P | F | P | F | P |

TYP. FOR 6,10,14 BAY ETC. | F | P | F | F | P | F | ℄ PIER
| P | F | P | P | F | P |

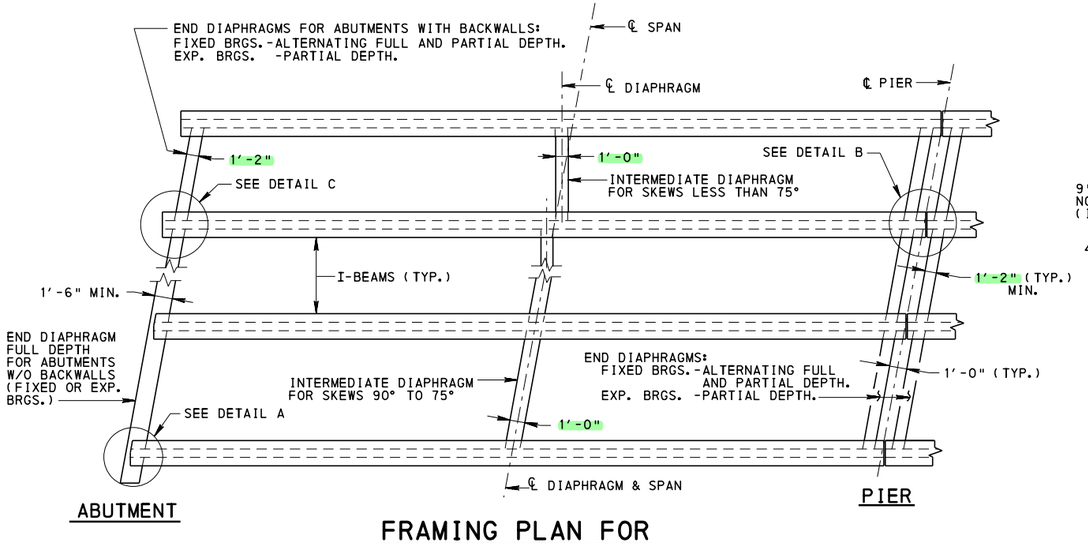
SYMBOLS

F - DENOTES FULL DEPTH DIAPHRAGM

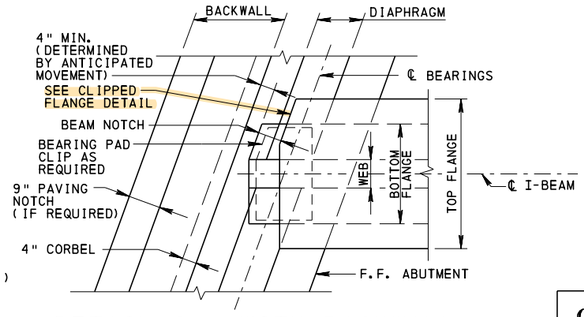
P - DENOTES PARTIAL DEPTH DIAPHRAGM

NOTES:

1. FOR BAY CONFIGURATION NOT SHOWN, USE A PATTERN SIMILAR TO THAT SHOWN ABOVE.
2. ADDITIONAL FULL DEPTH DIAPHRAGMS MAY BE PROVIDED, IF REQUIRED, ONLY IF THEY ARE PLACED SYMMETRICALLY AT THE ABUTMENT OR PIER.



FRAMING PLAN FOR I-BEAMS



DETAIL C - WITH BACKWALL

BD-651M	REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCKS, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-660M	DECK SLAB AND STEEL REINFORCEMENT PLACEMENT
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-662M	I-BEAM AND PA-BULB-TEE BEAM REINFORCEMENT DETAILS
BD-664M	CONTINUITY FOR LIVE LOAD DETAILS I- BEAMS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS BOX BEAMS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

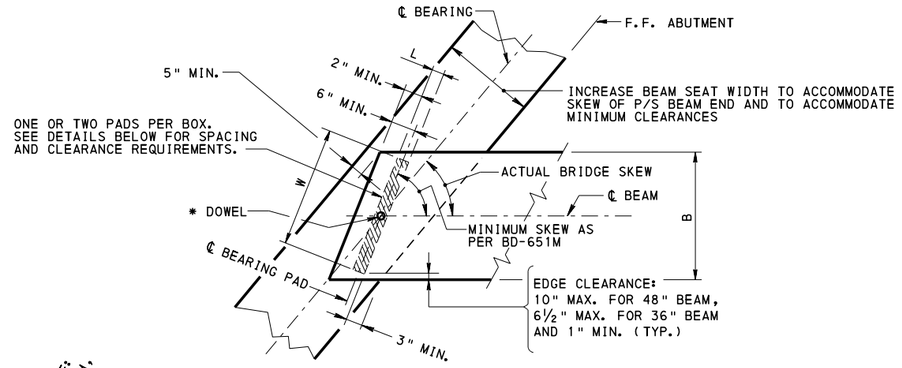
STANDARD TYPICAL FRAMING PLANS AND DETAILS P/S CONCRETE I-BEAM AND SPREAD BOX BEAM BRIDGES

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 2

BD-653M



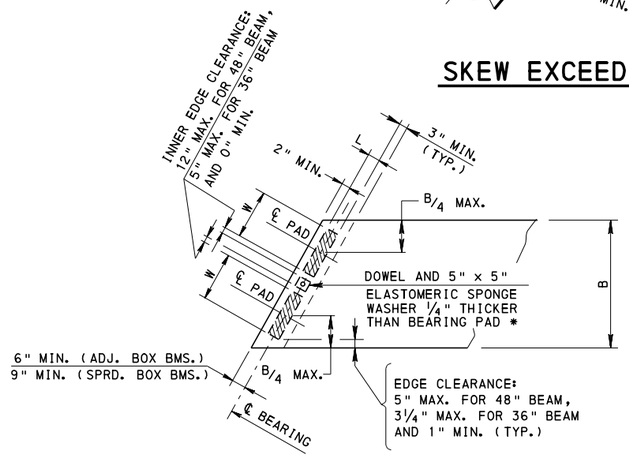
SKEW EXCEEDING BEAM LIMITS

NOTE:

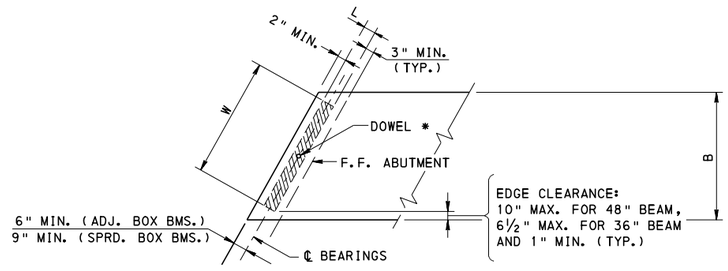
1. FOR WATERPROOFING AND EXPANSION DETAILS AT BEARING AREA, SEE BC-788M.

LEGEND

L = BEARING PAD LENGTH
W = BEARING PAD WIDTH
B = BEAM FLANGE WIDTH



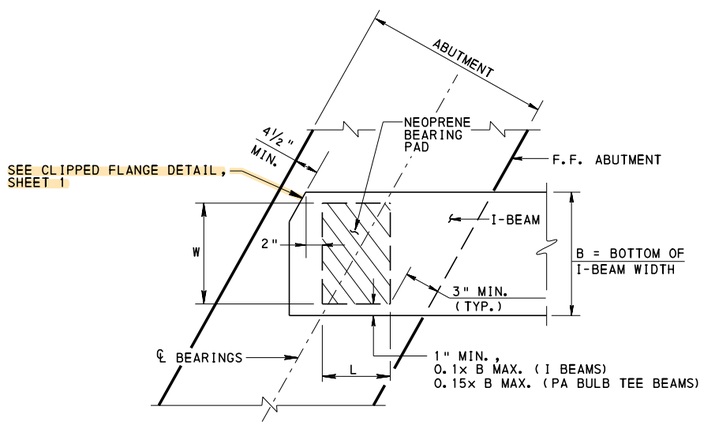
TWO PADS PER BOX



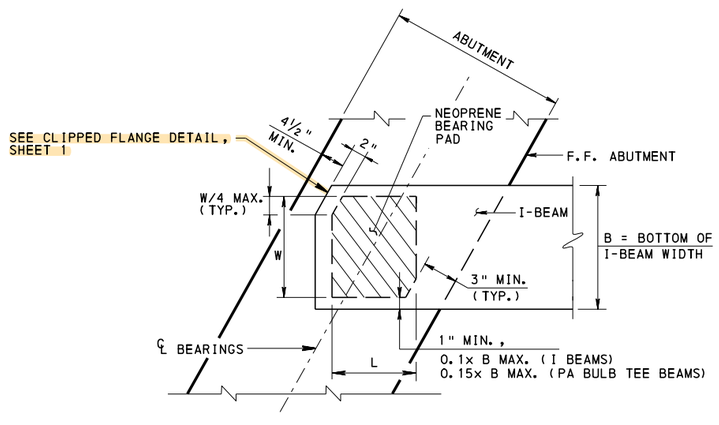
ONE PAD PER BOX

* IF REQUIRED BY BD-651M

ELASTOMERIC BEARING PAD ARRANGEMENTS (BOX BEAMS)



ELASTOMERIC BEARING PAD ARRANGEMENTS (I - BEAMS AND PA BULB TEE BEAMS)



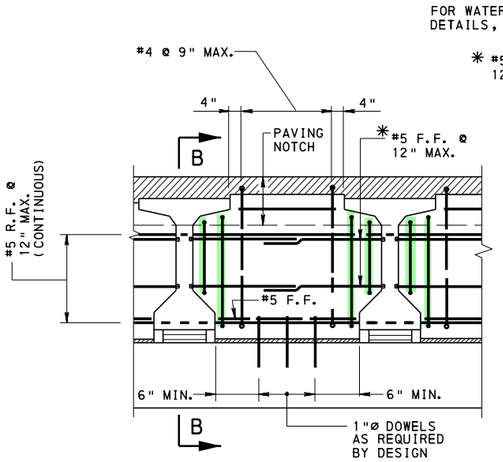
ALTERNATE BEARING PAD ARRANGEMENTS (I - BEAMS AND PA BULB TEE BEAMS)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
TYPICAL FRAMING
PLANS AND DETAILS
BEARING DETAILS FOR
P/S CONCRETE BEAM BRIDGES

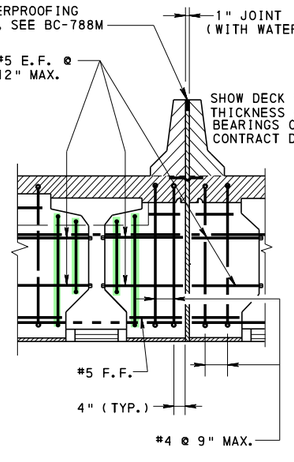
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 2 OF 2
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-653M

CHANGE 2

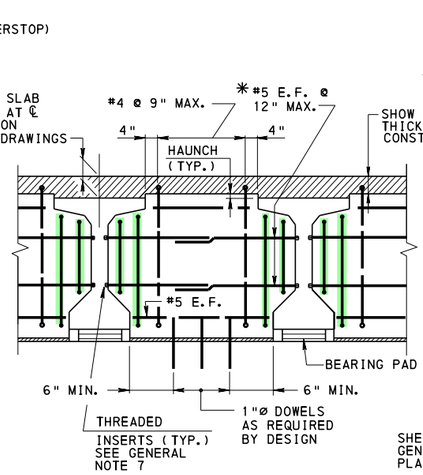


* IN THE WEB AREA ABOVE STRANDS, THREADED INSERTS MAY BE REPLACED WITH 2½" DIA. HOLES THROUGH ENTIRE WEB AND #5 MADE CONTINUOUS.

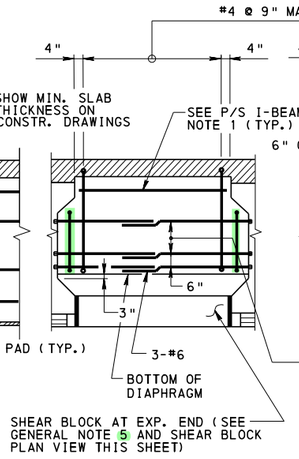
FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL



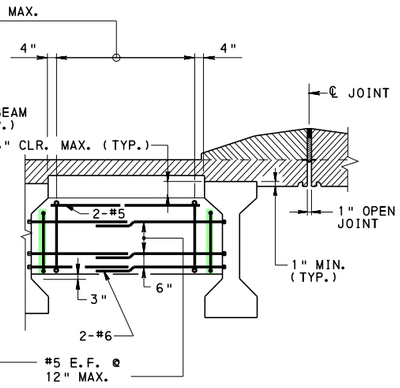
FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL WITH MEDIAN



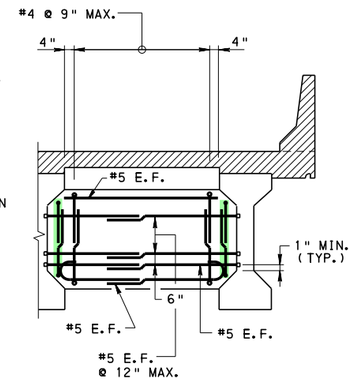
FULL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL OR AT PIER



PARTIAL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL OR PIER
(SEE P/S I-BEAM NOTE 2)



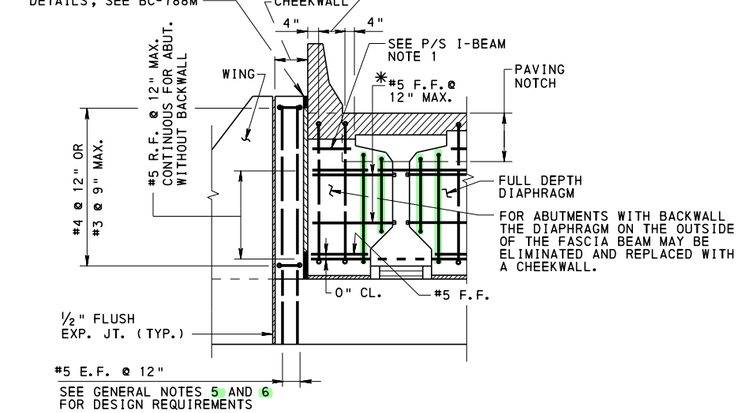
TYPICAL



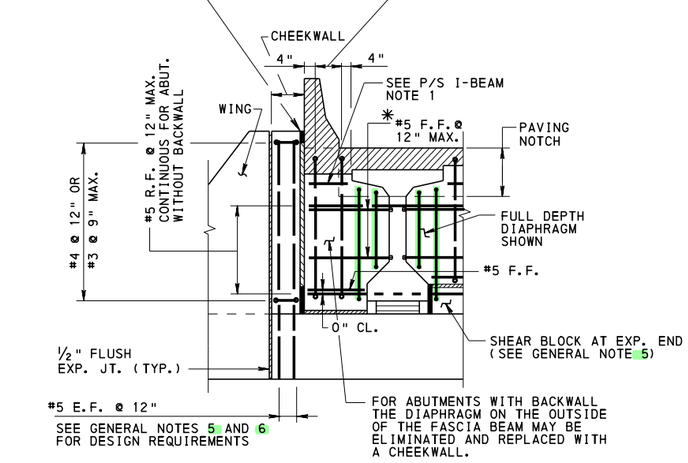
EXTERNAL BAYS
FOR SPANS WITH VERTICAL CLEARANCE LESS THAN 16'-0" OVER VEHICULAR TRAFFIC.

INTERMEDIATE DIAPHRAGM

TYPICAL STRUCTURE SECTIONS - I-BEAMS



CORNER DETAIL AT ABUTMENT WITH OR WITHOUT BACKWALL
(FIXED END)



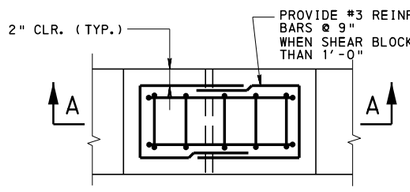
CORNER DETAIL AT ABUTMENT WITH OR WITHOUT BACKWALL
(EXP. END)

GENERAL NOTES:

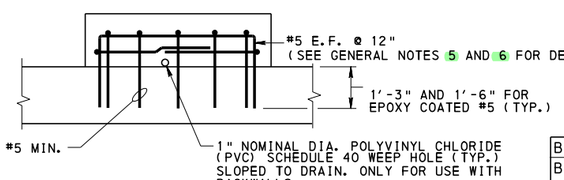
1. SHOW ALL APPLICABLE DETAILS ON CONSTRUCTION DRAWINGS.
2. PROVIDE DRIP NOTCH ON BEAM FOR OVERHANGS LESS THAN 8" (TYP. FOR BOX BEAMS).
3. SEE BC-775M FOR DOWEL AND DRIP NOTCH DETAILS.
4. SEE BD-667M FOR INSERT LOCATIONS AT END OF GIRDERS ON INTEGRAL ABUTMENTS.
5. DESIGN THE CHEEKWALL AND SHEAR BLOCKS TO RESIST THE LATERAL FORCES AT THE EXPANSION END OF THE BRIDGE. REINFORCEMENTS SHOWN ARE MINIMUMS.
6. IF THE DESIGN REQUIRES A GREATER SHEAR REINFORCEMENT, #6 REINF. BAR MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.
7. USE ONE SIZE SMALLER INSERT FOR DEFORMED BARS. THE MINIMUM LENGTH OF THE INSERT IS 3". INSERTS TO BE GALVANIZED OR COMPLETELY ZINC-ELECTROPLATED.
8. FOR SECTION B-B, SEE SHEET 2.

P/S I-BEAM NOTES:

1. IF THE DISTANCE FROM THE TOP OF WEB TO THE BOTTOM OF DECK SLAB IS >1'-0", PLACE 1 - #5 REINFORCEMENT BAR, EACH FACE 3" FROM BOTTOM OF DECK SLAB.
2. FOR ABUTMENT WITHOUT BACKWALL EXTEND DIAPHRAGM TO TOP OF THE PREFORMED CELLULAR POLYSTYRENE PLACED ON TOP OF SHEAR BLOCK.



SHEAR BLOCK PLAN VIEW



SECTION A-A

BD-601M	CONCRETE DECK SLAB DESIGN
BD-651M	REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCKS, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BD-667M	INTEGRAL ABUTMENTS
BC-775M	MISCELLANEOUS PRESTRESS DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

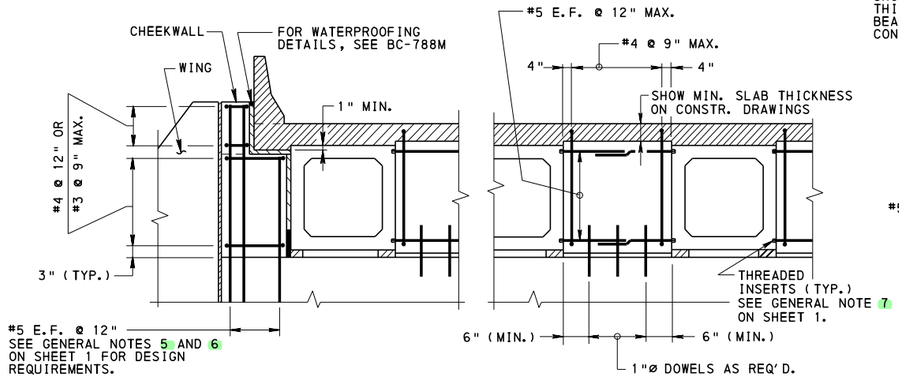
STANDARD TYPICAL SUPERSTRUCTURE SECTIONS I BEAM BRIDGES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 2

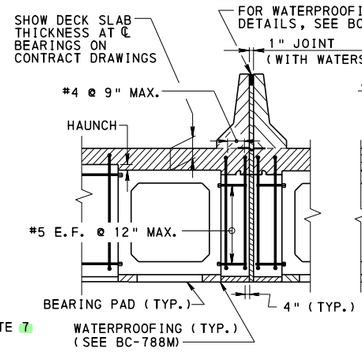
BD-655M



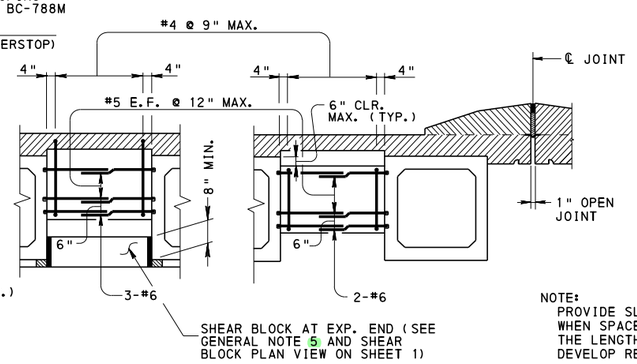
CORNER DETAIL AT ABUTMENT WITH OR WITHOUT BACKWALL

(FIXED END)

FULL DEPTH DIAPHRAGM AT ABUTMENT WITH OR WITHOUT BACKWALL OR AT PIER



FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL WITH MEDIAN



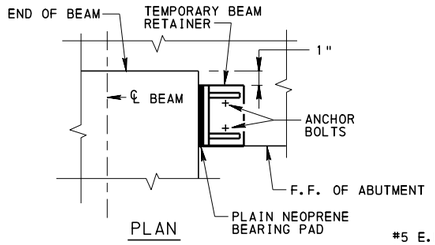
PARTIAL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL OR PIER

(SEE P/S BOX BEAM NOTE 2)

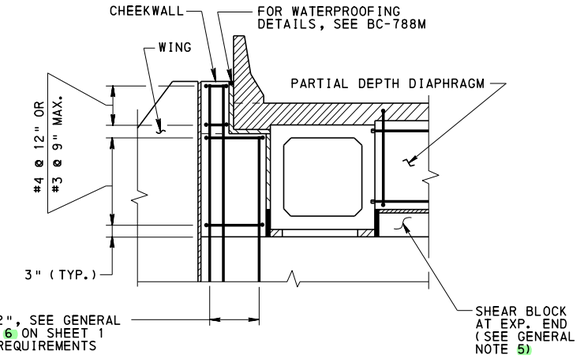
INTERMEDIATE DIAPHRAGM

NOTE:
PROVIDE SLEEVES THROUGH ENDS OF BEAMS WHEN SPACE BETWEEN BEAMS IS LESS THAN THE LENGTH NEEDED TO ADEQUATELY DEVELOP REINFORCEMENT.

TYPICAL STRUCTURE SECTIONS - SPREAD BOX BEAMS

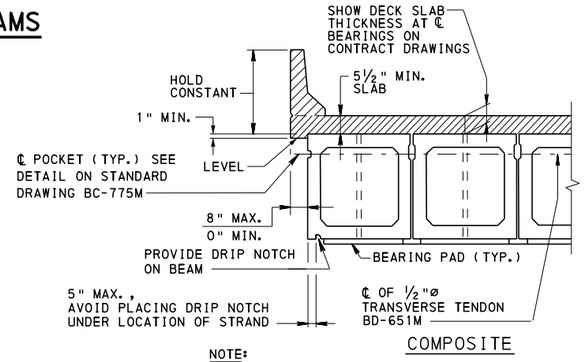


PLAN



CORNER DETAIL AT ABUTMENT WITH OR WITHOUT BACKWALL

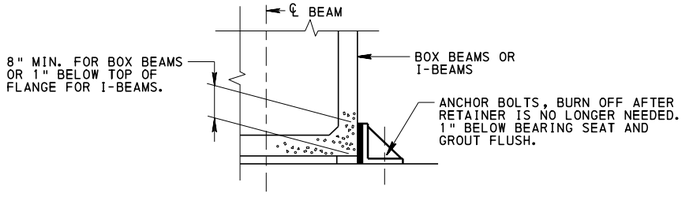
(EXP. END)



COMPOSITE

NOTE:
CHEEKWALL AND REINFORCEMENT IS IDENTICAL TO TYP. SECTION FOR SPREAD BOX BEAMS.

TYPICAL SUPERSTRUCTURE SECTIONS ADJACENT BOX-BEAMS

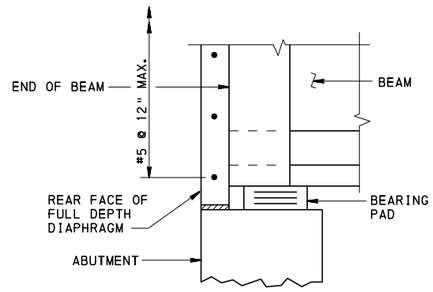


ELEVATION

STAGED CONSTRUCTION TEMPORARY BEAM RETAINER

NOTES:

- STEEL MEMBERS, SIZES AND NUMBER OF ANCHOR BOLTS AS REQUIRED BY DESIGN.
- CONSTRUCT TEMPORARY RETAINER TO PROVIDE FULL BEARING ON SURFACES OF BEAM AND ABUTMENT.



SECTION B-B

FOR LOCATION OF SECTION B-B SEE SHEET 1.

P/S BOX BEAM NOTES:

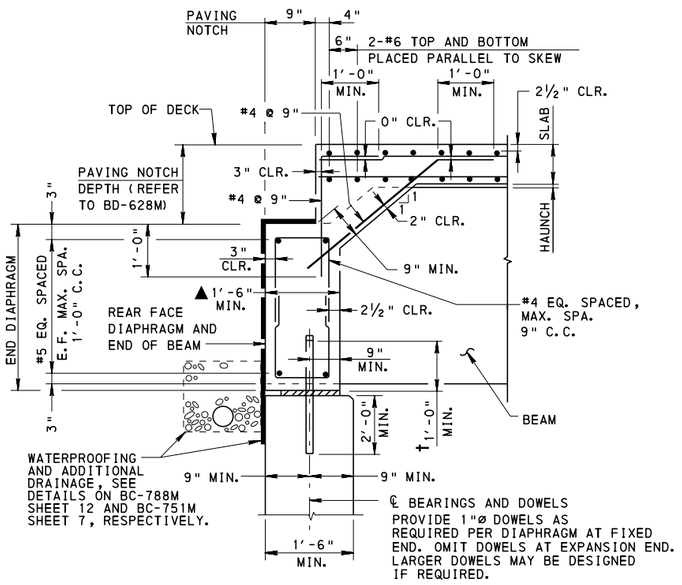
1. SLOPE BRIDGE SEATS AS REQUIRED, TO PROVIDE THE DESIRED CROSS SLOPE OR SUPERELEVATION TRANSITION FOR VARIABLE SUPERELEVATION.
2. FOR ABUTMENT WITHOUT BACKWALL EXTEND DIAPHRAGM TO TOP OF THE PREFORMED CELLULAR POLYSTYRENE PLACED ON TOP OF SHEAR BLOCK.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
TYPICAL SUPERSTRUCTURE SECTIONS
BOX BEAM BRIDGES

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 2 OF 2
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-655M

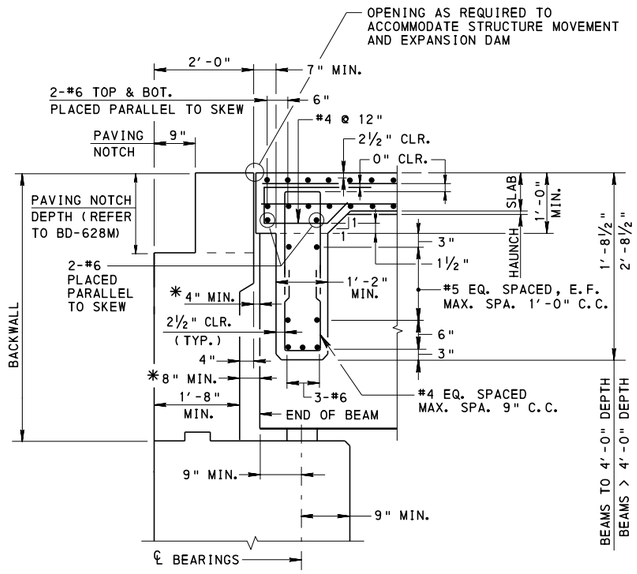
CHANGE 2



FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL

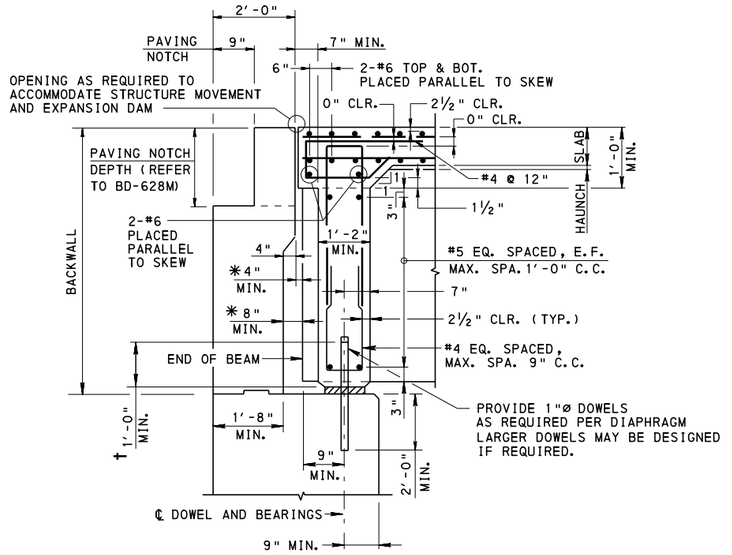
- FOR FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL AND WITHOUT PAVING NOTCH, SEE SHEET 4.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

▲ BRADD DESIGNS PERMITTED TO USE END DIAPHRAGM MINIMUM THICKNESS OF 1'-3".



PARTIAL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL (FIXED AND EXP.)

- SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



FULL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL (FIXED)

- SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

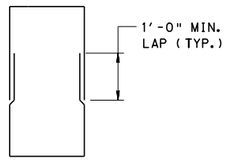
GENERAL NOTES:

1. PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615, ASTM A996, OR A706. DO NOT WELD REINFORCEMENT BARS. DO NOT USE RAIL STEEL A996 WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
2. ALL DIMENSIONS SHOWN ARE NORMAL TO THE ABUTMENT OR PIER.
3. ALL SECTIONS WERE DRAWN LEVEL. THE EFFECTS OF THE SLOPE OF BEAMS MUST BE TAKEN INTO ACCOUNT.
4. FOR SIZE AND SPACING OF DECK SLAB REINFORCEMENT, SEE BD-601M.
5. ALL BACKWALLS ARE SHOWN CHAMFERED. FOR OPTIONAL TREATMENT, SEE BD-621M.
6. FOR DEPTH OF PAVING NOTCHES FOR VARIOUS DEPTH I-BEAMS AND BOX BEAMS, REFER TO BD-628M, BD-661M, BD-662M AND BC-775M.
7. FOR DOWEL DETAIL IN DIAPHRAGM, SEE BC-775M.
8. PAVING NOTCHES MAY BE OMITTED WHEN NO FUTURE CONCRETE APPROACH PAVEMENT IS CONTEMPLATED.
9. SHOW APPLICABLE DETAILS ON CONSTRUCTION DRAWINGS.
10. FOR LOCATION OF LONGITUDINAL DECK SLAB BARS WITH RESPECT TO EXPANSION DAM, SEE BC-762M AND BC-767M.

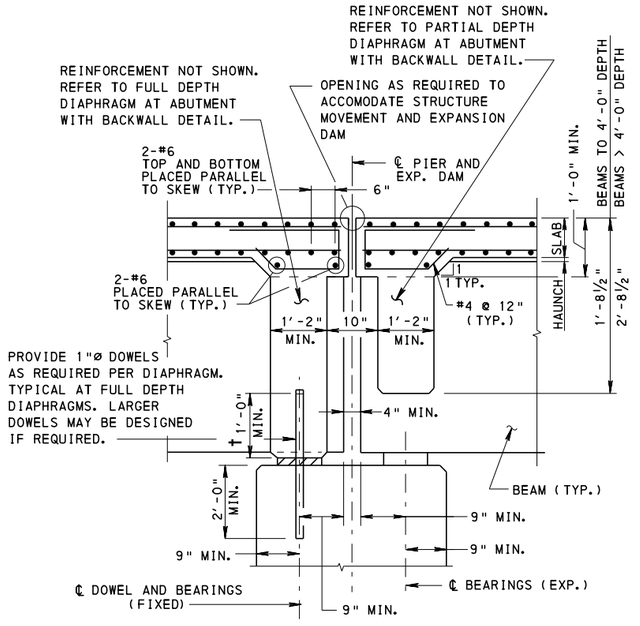
LEGEND:

✳ DETERMINED BY ANTICIPATED MOVEMENT

† 6" FOR 17" DEEP BEAM & 10" FOR 21" DEEP BEAM

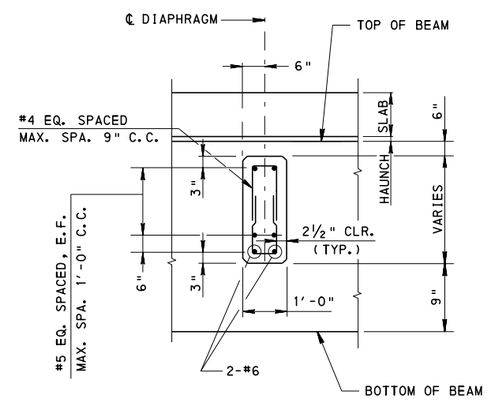


TYPICAL DIAPHRAGM BAR



FULL AND PARTIAL DEPTH DIAPHRAGM AT PIER (FIXED AND EXP.)

- FOR CONTINUITY DIAPHRAGM DETAIL, SEE BD-665M.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP. SIMILAR WHEN LONGITUDINAL BARS ON TOP.



INTERMEDIATE DIAPHRAGM

TYPICAL LONGITUDINAL SECTIONS FOR SPREAD BOX BEAMS

BD-601M	CONCRETE DECK SLAB
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-628M	BRIDGE APPROACH SLABS
BD-651M	REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCKS, DIAPHRAGMS, SKEW LIMITATIONS & BACKWALLS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-660M	DECK SLAB & STEEL REINFORCEMENT PLACEMENT
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-662M	I-BEAM AND PA BULB-TEE BEAM REINFORCEMENT DETAILS
BD-664M	CONTINUITY FOR LIVE LOAD DETAILS, I-BEAM AND BULB-TEE BEAM BRIDGES
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS, BOX BEAMS
BC-751M	BRIDGE DRAINAGE
BC-762M	TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE AND STEEL BEAM BRIDGES
BC-766M	PREFORMED NEOPRENE COMPRESSION SEAL JOINT
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE AND STEEL I-BEAM BRIDGES
BC-775M	MISCELLANEOUS PRESTRESS DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-23M	BRIDGE APPROACH SLABS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

TYPICAL LONGITUDINAL SECTIONS

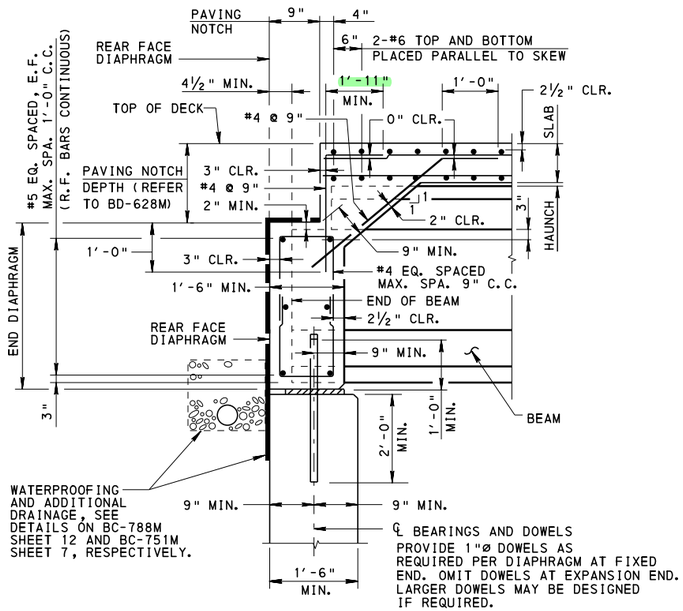
I-BEAM AND BOX BEAM BRIDGES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

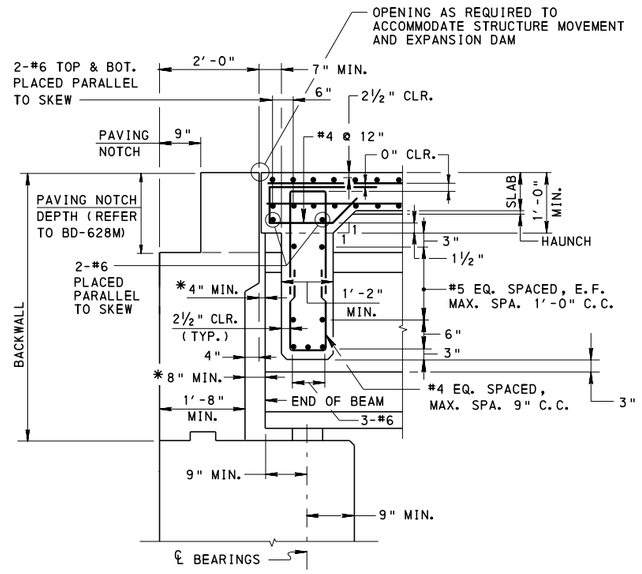
SHEET 1 OF 7

BD-656M



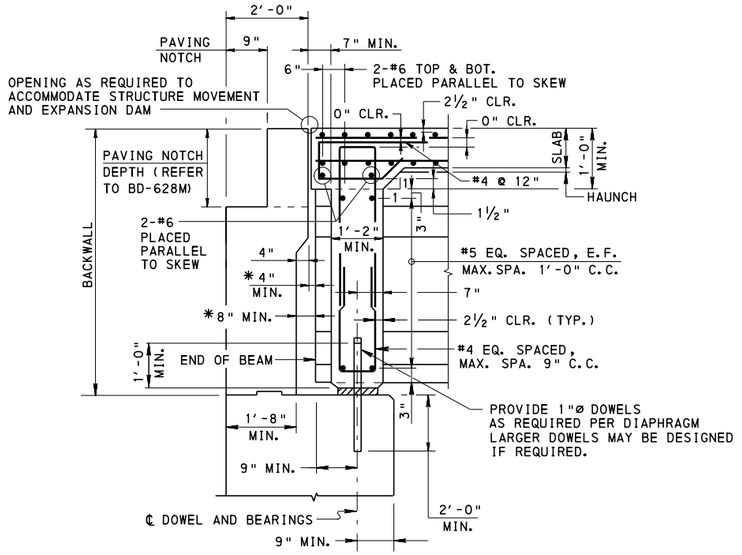
FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL

- FOR FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL AND WITHOUT PAVING NOTCH, SEE SHEET 4.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



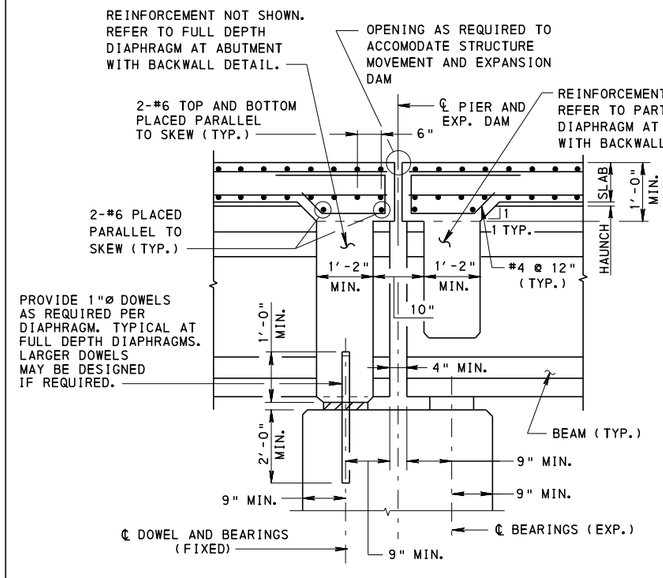
PARTIAL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL (FIXED AND EXP.)

- SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



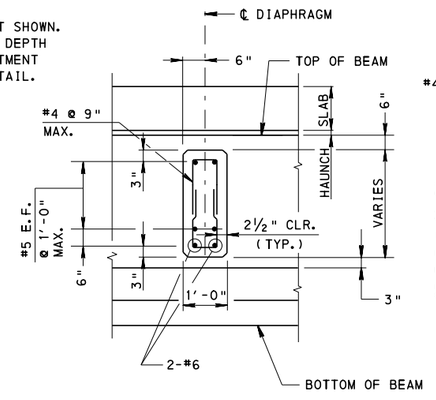
FULL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL (FIXED)

- SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

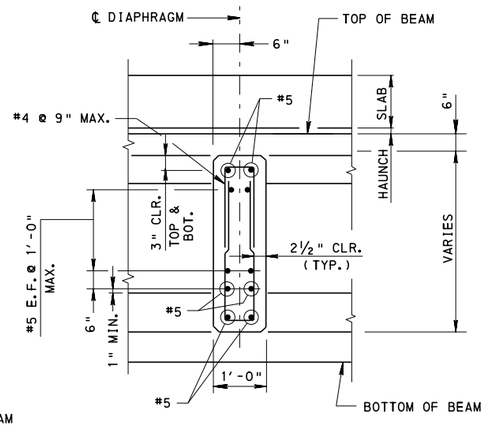


FULL AND PARTIAL DEPTH DIAPHRAGM AT PIER (FIXED AND EXP.)

- FOR CONTINUITY DIAPHRAGM DETAIL, SEE BD-664M.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP. SIMILAR WHEN LONGITUDINAL BARS ON TOP.



TYPICAL



EXTERNAL BAYS

FOR SPANS WITH VERTICAL CLEARANCE LESS THAN 16'-0" OVER VEHICULAR TRAFFIC.

INTERMEDIATE DIAPHRAGM

LEGEND:

* DETERMINED BY ANTICIPATED MOVEMENT

NOTE:

FOR TYPICAL DIAPHRAGM BAR DETAIL, SEE SHEET 1.

TYPICAL LONGITUDINAL SECTIONS FOR I-BEAMS

SEE SHEET 1 FOR NOTES

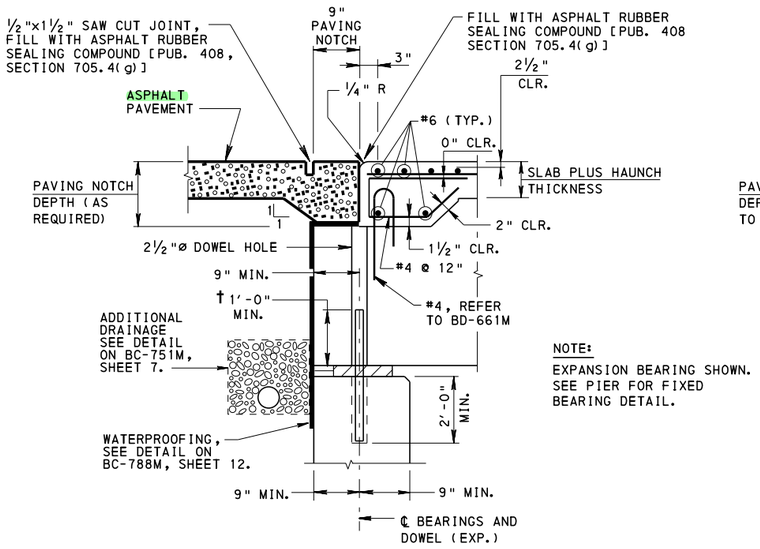
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

TYPICAL LONGITUDINAL SECTIONS

I-BEAM AND BOX BEAM BRIDGES

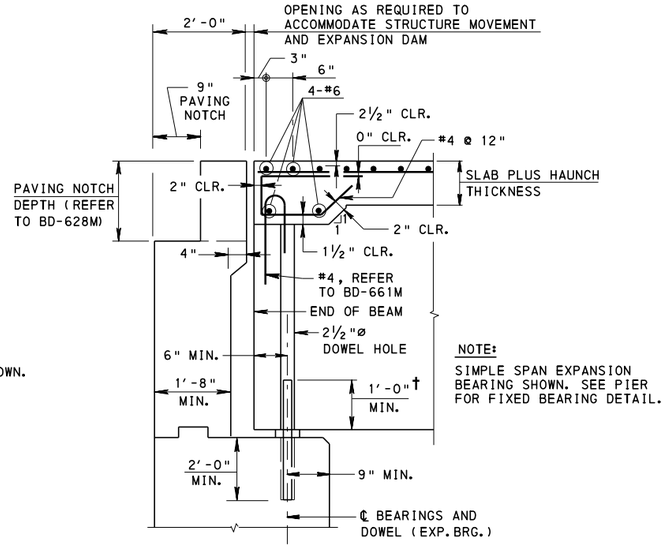
RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 2 OF 7
		BD-656M



NOTE:
EXPANSION BEARING SHOWN. SEE PIER FOR FIXED BEARING DETAIL.

ABUTMENT WITHOUT BACKWALL

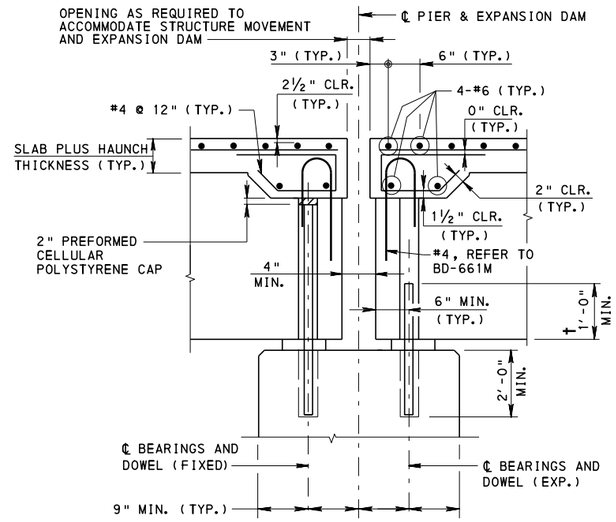
FOR ABUTMENT WITHOUT BACKWALL AND WITHOUT PAVING NOTCH, SEE SHEET 4.



NOTE:
SIMPLE SPAN EXPANSION BEARING SHOWN. SEE PIER FOR FIXED BEARING DETAIL.

ABUTMENT WITH BACKWALL

SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.



PIER

FOR CONTINUITY DIAPHRAGM DETAIL, SEE BD-665M.

TYPICAL LONGITUDINAL SECTIONS FOR ADJACENT BOX BEAMS (COMPOSITE)

ADJACENT BOX BEAM NOTES:

1. FOR DOWEL, TENDON AND SHEAR BLOCK REQUIREMENTS, SEE BD-651M.
2. DOWEL HOLES IN SUBSTRUCTURE UNITS:
   PIER BENTS AND HAMMERHEAD PIERS - 3"ø PREFORMED HOLES. FILL HOLES WITH NON-SHRINK GROUT AFTER SHEAR KEYS ARE GROUTED.
   OTHER SUBSTRUCTURE UNITS - DRILL 2"ø HOLES AFTER SHEAR KEYS ARE GROUTED. FILL HOLES WITH NON-SHRINK GROUT
3. DOWEL HOLES IN BEAMS :
   EXP. BRGS. - FILL HOLE WITH AN APPROVED RUBBERIZED JOINT SEALING MATERIAL.
   FIXED BRGS. - FILL HOLE WITH NON-SHRINK GROUT (APPLY BOND BREAKER TO PORTION OF DOWEL THAT IS ABOVE THE BRIDGE SEAT.)

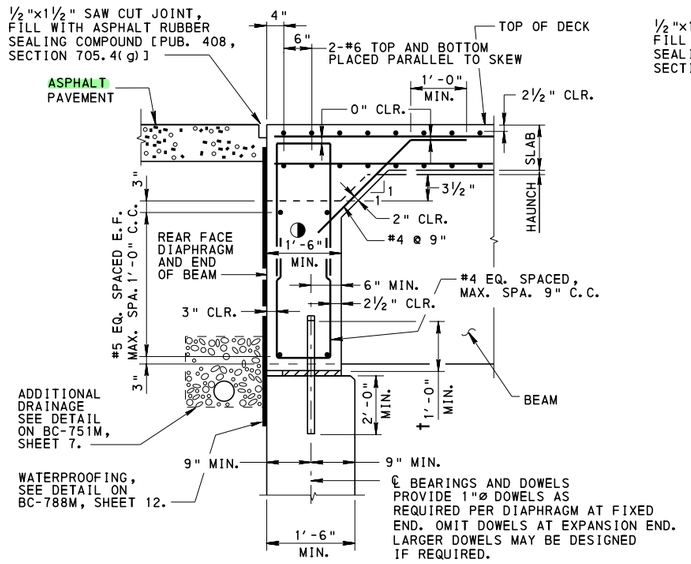
LEGEND:

† 6" FOR 17" DEEP BEAM &
10" FOR 21" DEEP BEAM

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
TYPICAL LONGITUDINAL SECTIONS
I-BEAM AND BOX BEAM BRIDGES

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 3 OF 7
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-656M



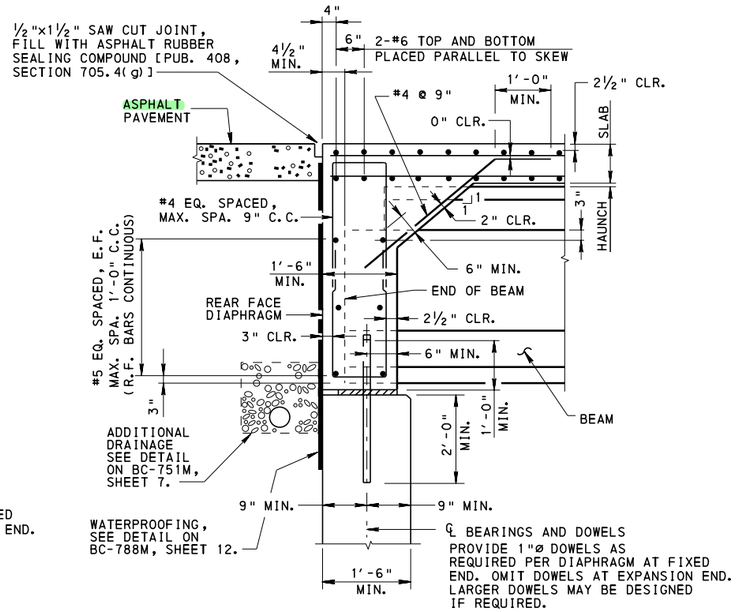
FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL

(WITHOUT PAVING NOTCH)

TYPICAL LONGITUDINAL SECTION FOR SPREAD BOX BEAMS

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

◑ BRADD DESIGNS PERMITTED TO USE END DIAPHRAGM MINIMUM THICKNESS OF 1'-3".

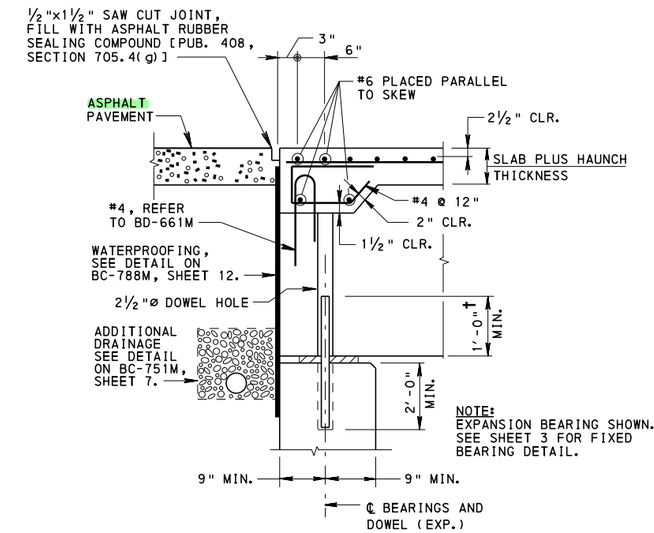


FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL

(WITHOUT PAVING NOTCH)

TYPICAL LONGITUDINAL SECTION FOR I-BEAMS

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



ABUTMENT WITHOUT BACKWALL

(WITHOUT PAVING NOTCH)

TYPICAL LONGITUDINAL SECTION FOR ADJACENT BOX BEAMS (COMPOSITE)

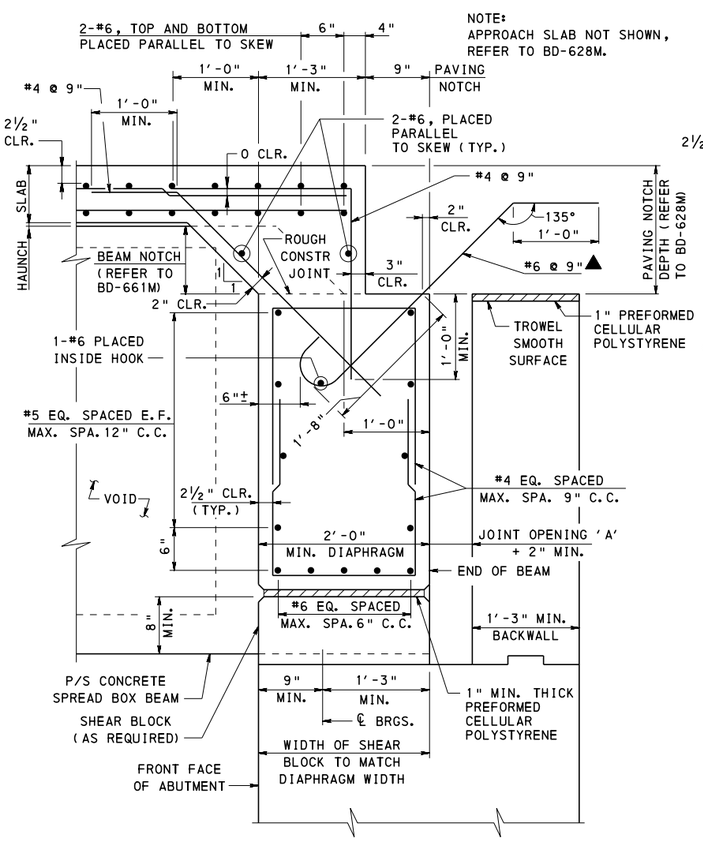
LEGEND:

† 6" FOR 17" DEEP BEAM & 10" FOR 21" DEEP BEAM

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

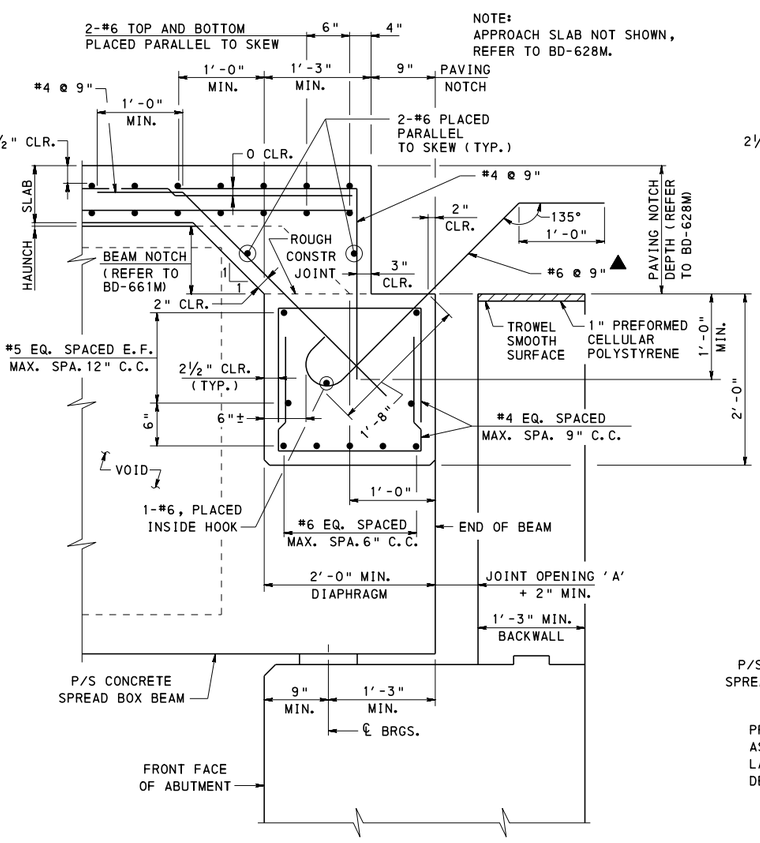
STANDARD
TYPICAL LONGITUDINAL SECTIONS
I-BEAM AND BOX BEAM BRIDGES

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 4 OF 7
		BD-656M



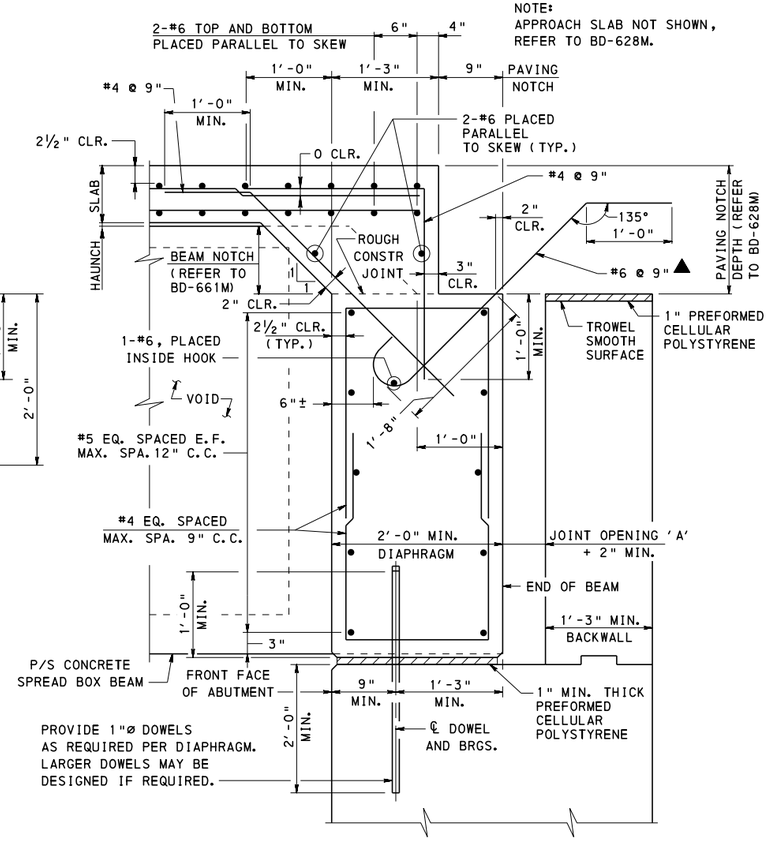
PARTIAL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL AND SHEAR BLOCK (EXPANSION)

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



PARTIAL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL AND WITHOUT SHEAR BLOCK (FIXED AND EXPANSION)

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



FULL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL (FIXED)

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

TYPICAL LONGITUDINAL SECTIONS FOR SPREAD BOX BEAMS WITH TYPE 3 APPROACH SLABS

(REFER TO BD-628M FOR BEAM DEPTH LIMITATIONS)

NOTES

1. FOR GENERAL NOTES, SEE SHEET 1.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAMS. FOR ALTERNATE REBAR DETAIL, SEE BD-628M, SHEET 24.

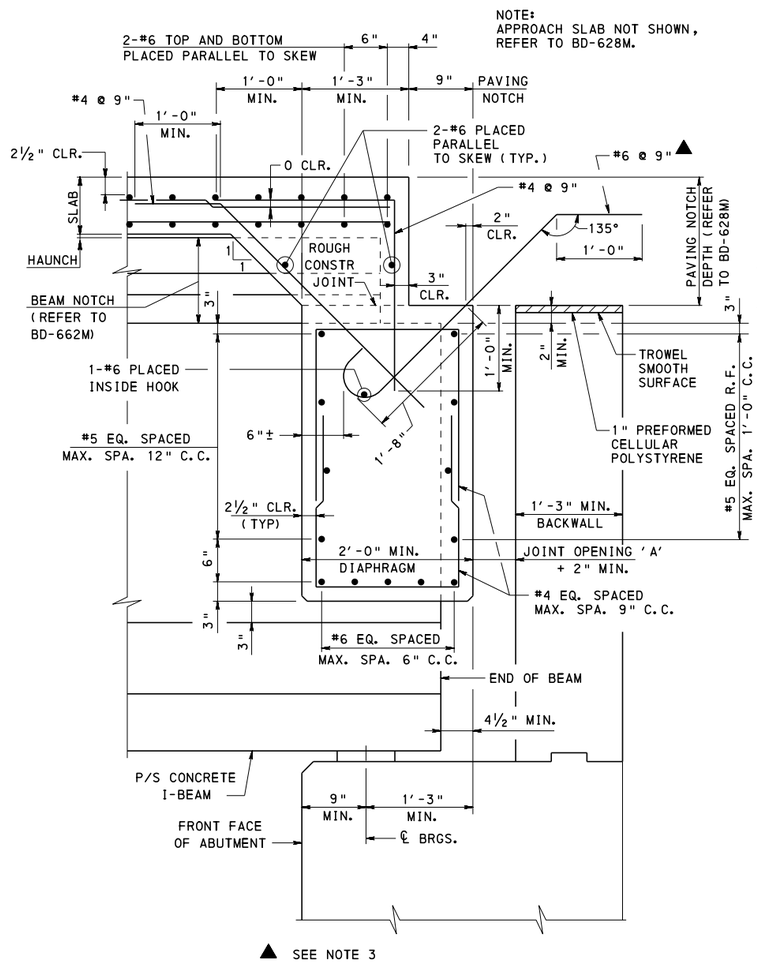
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

TYPICAL LONGITUDINAL SECTIONS

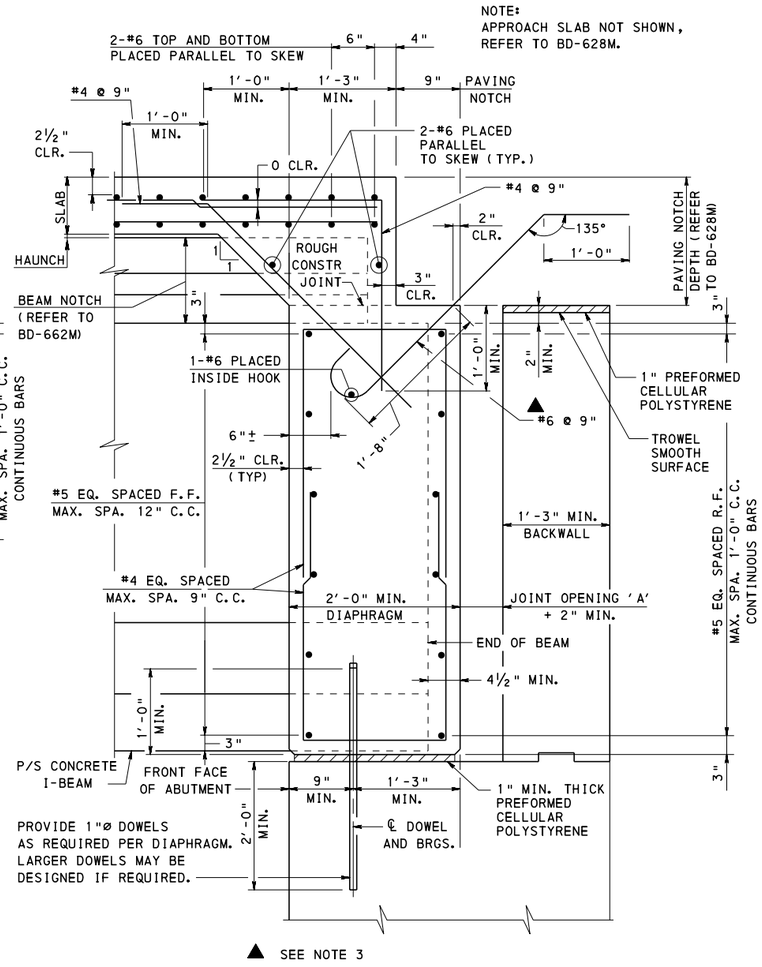
I-BEAM AND BOX BEAM BRIDGES

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 5 OF 7
		BD-656M



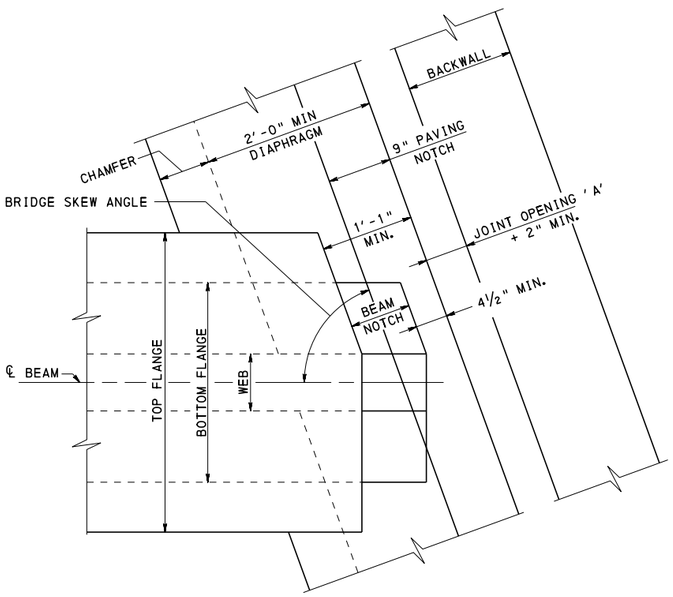
PARTIAL DEPTH DIAPHRAGM AT ABUTMENT
WITH BACKWALL (FIXED AND EXPANSION)

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



FULL DEPTH DIAPHRAGM AT ABUTMENT
WITH BACKWALL (FIXED)

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



PLAN - SKEWED STRUCTURES

(AASHTO TYPE I-BEAM SHOWN; OTHERS SIMILAR)

NOTES

1. FOR GENERAL NOTES, SEE SHEET 1.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAMS. FOR ALTERNATE REBAR DETAIL, SEE BD-628M, SHEET 24.

TYPICAL LONGITUDINAL SECTIONS FOR I-BEAMS WITH TYPE 3 APPROACH SLABS

(REFER TO BD-628M FOR BEAM DEPTH LIMITATIONS)

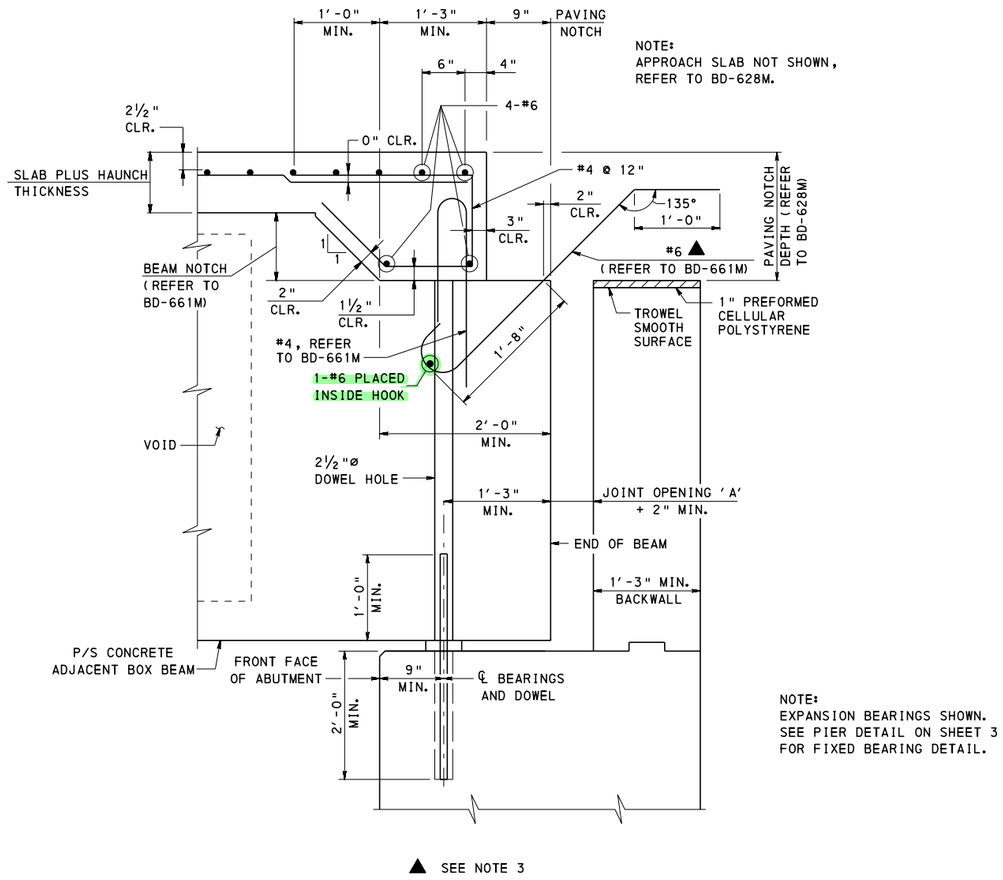
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

TYPICAL LONGITUDINAL SECTIONS

I-BEAM AND BOX BEAM BRIDGES

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 6 OF 7
		BD-656M



NOTE:
APPROACH SLAB NOT SHOWN, REFER TO BD-628M.

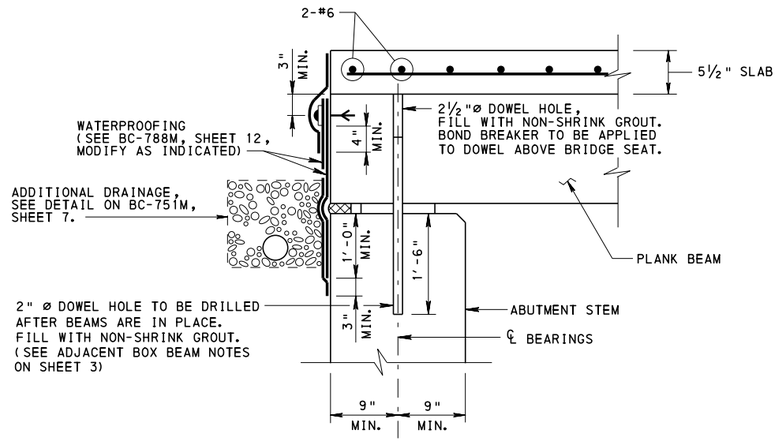
NOTE:
EXPANSION BEARINGS SHOWN. SEE PIER DETAIL ON SHEET 3 FOR FIXED BEARING DETAIL.

▲ SEE NOTE 3

ABUTMENT WITH BACKWALL

TYPICAL LONGITUDINAL SECTION FOR ADJACENT BOX BEAMS WITH TYPE 3 APPROACH SLABS

(REFER TO BD-628M FOR BEAM DEPTH LIMITATIONS)



TYPICAL LONGITUDINAL SECTION FOR PLANK BEAMS

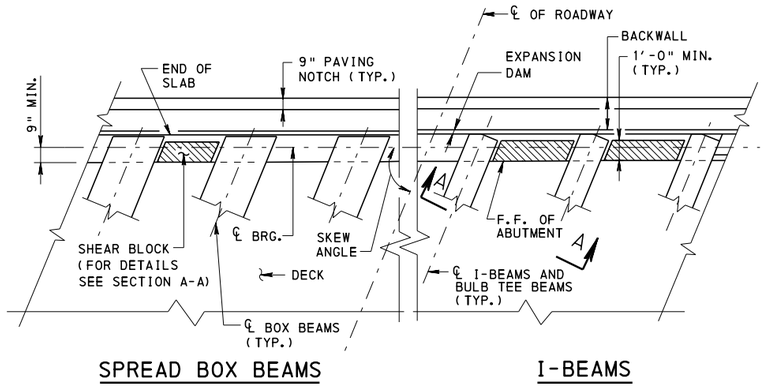
NOTES

1. FOR GENERAL NOTES, SEE SHEET 1.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. PLACED PARALLEL TO BEAMS. FOR ALTERNATE REBAR DETAIL, SEE BD-628M, SHT. 24.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD TYPICAL LONGITUDINAL SECTIONS I-BEAM, BOX BEAM AND PLANK BEAM BRIDGES

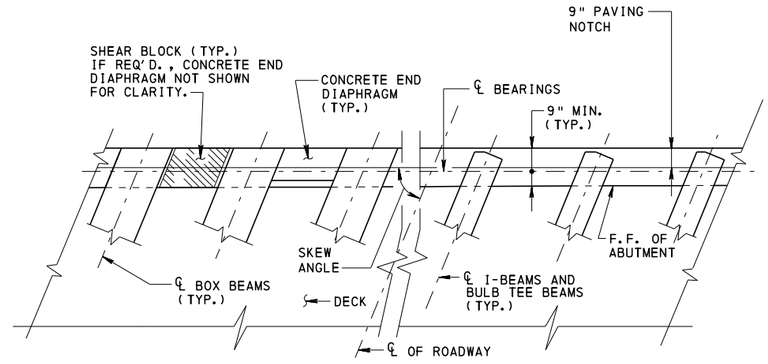
RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 7 OF 7
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-656M



SPREAD BOX BEAMS I-BEAMS

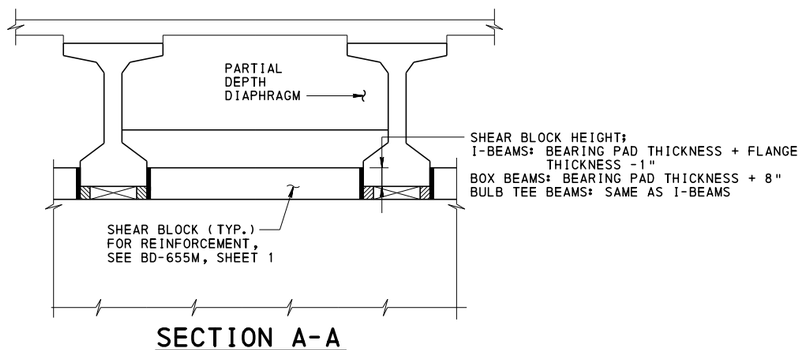
ABUTMENT PLAN - WITH BACKWALL (SKEWED)

NOTE: END DIAPHRAGMS NOT SHOWN FOR CLARITY



SPREAD BOX BEAMS I-BEAMS

ABUTMENT PLAN - WITHOUT BACKWALL (SKEWED)



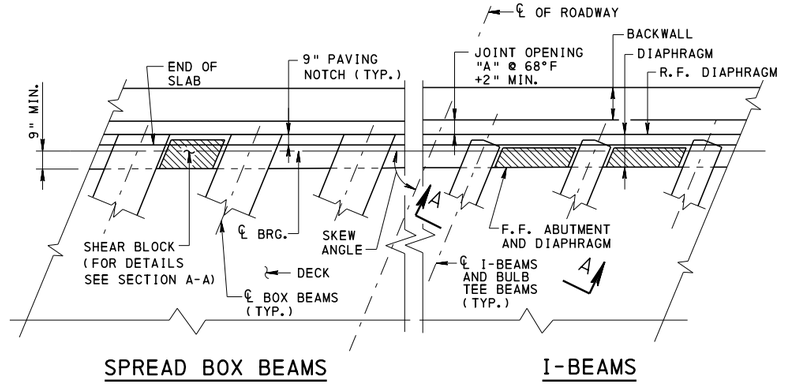
SECTION A-A

SECTION A-A NOTE:

1. SECTION FOR SPREAD BOX BEAM AND FOR BULB TEE BEAM IS SIMILAR TO THE SECTION FOR I-BEAM AS SHOWN ABOVE.

GENERAL NOTES:

1. PAVING NOTCHES MAY BE OMITTED WHEN NO FUTURE CONCRETE APPROACH IS CONTEMPLATED.
2. FOR DOWEL, SHEAR BLOCK AND BACKWALL REQUIREMENTS, SEE BD-651M.
3. EXPANSION CONDITIONS AT ABUTMENTS WITH OR WITHOUT BACKWALL REQUIRE AS A MINIMUM SHEAR BLOCKS BETWEEN THE FASCIA AND FIRST INTERIOR BEAM FOR I-BEAM, BULB TEE BEAM AND BOX BEAM BRIDGES. FIXED CONDITIONS REQUIRE FULL AND PARTIAL DEPTH DIAPHRAGMS. FOR REQUIREMENTS, SEE BD-651M.
4. SKEWED CONDITION IS SHOWN. FOR 90° SKEWS, END OF BEAMS ARE CUT PERPENDICULAR TO ℄ OF BEAMS
5. DETAILS AND SHEAR BLOCK LOCATIONS ARE TYPICAL FOR SIMPLE OR CONTINUOUS SPANS. SEE BD-655M FOR ADDITIONAL DETAILS.
6. FOR EXPANSION CONDITIONS AT ABUTMENTS WITH OR WITHOUT BACKWALL, PROVIDE ADDITIONAL SHEAR BLOCK IN A MIN. OF 50% OF THE TOTAL NO. OF BAYS AT THE ACUTE ANGLE SIDE OF THE DECK FOR SKEWS 75° AND LESS (TYP. FOR I-BEAM, BULB TEE BEAM AND SPREAD BOX BEAM BRIDGES).
7. REFER TO BD-653M AND BD-656M FOR I-BEAM AND BULB TEE BEAM CLIPPING DETAILS.



SPREAD BOX BEAMS I-BEAMS

ABUTMENT PLAN - WITH BACKWALL (SKEWED) FOR TYPE 3 AND 4 APPROACH SLABS

REFERENCE DRAWINGS	
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	R. C. ABUTMENTS WITH BACKWALL
BD-624M	R. C. ABUTMENTS WITHOUT BACKWALL
BD-628M	BRIDGE APPROACH SLABS
BD-651M	REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCK, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS
BD-653M	TYPICAL FRAMING PLANS AND DETAILS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-23M	BRIDGE APPROACH SLABS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

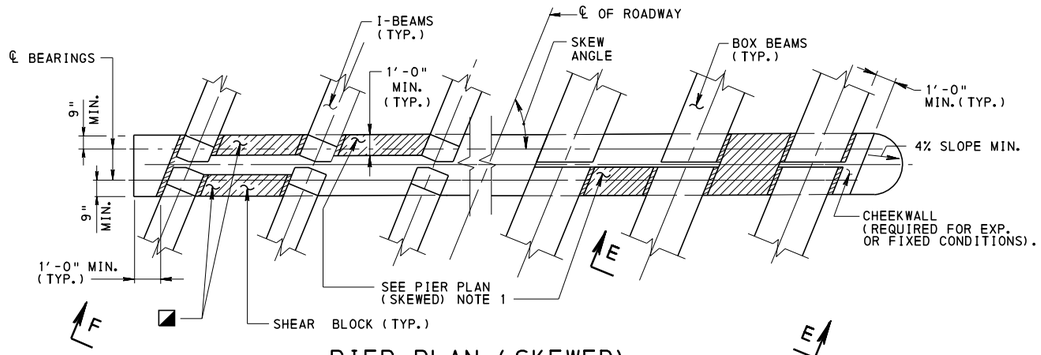
STANDARD I-BEAM AND BOX BEAM BRIDGES WITH BACKWALL AND WITHOUT BACKWALL

RECOMMENDED APR. 29, 2016
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016
Brian B Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 1

BD-657M

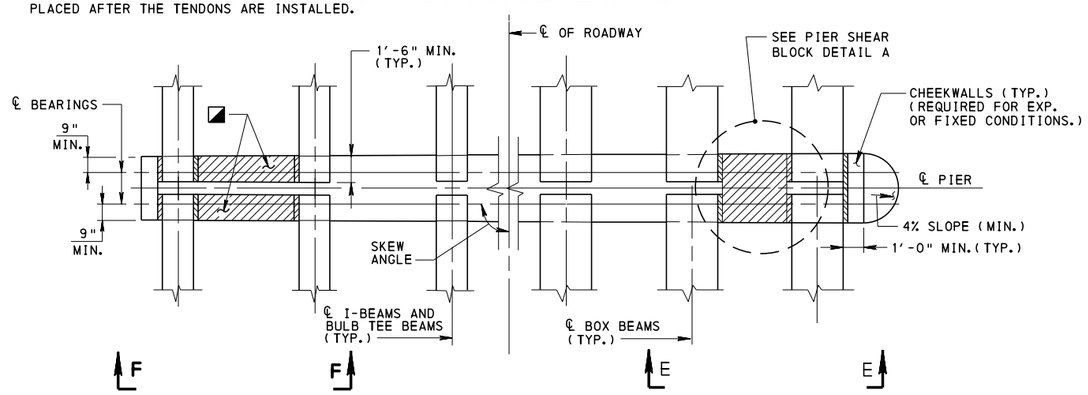


PIER PLAN (SKEWED)
(EXPANSION)

PIER PLAN (SKEWED) NOTES:

1. PROVIDE THIS ADDITIONAL SHEAR BLOCK AT THE ACUTE ANGLE SIDE OF THE DECK FOR SKEW 75° AND LESS (TYP. FOR I-BEAM, BULB TEE BEAM AND SPREAD BOX BEAM BRIDGES).
2. ADJACENT BOX BEAM BRIDGES ARE SIMILAR EXCEPT THAT THE CHEEKWALL AT THE ACUTE SIDE OF THE DECK OR AT EITHER SIDE OF A 90° BRIDGE MUST BE PLACED BEFORE THE BEAMS ARE SET. (EXP. END ONLY). THE OPPOSING CHEEKWALL IS TO BE PLACED AFTER THE TENDONS ARE INSTALLED.

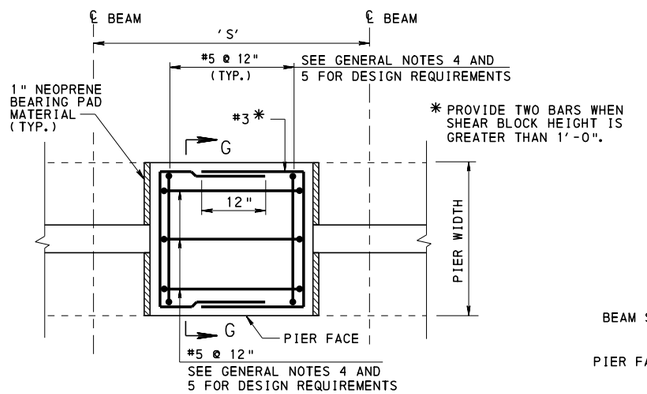
◪ TWO SEPARATE SHEAR BLOCKS SHOWN FOR I-BEAMS AND BULB TEE BEAMS. ONE SINGLE SHEAR BLOCK, EXTENDING THE FULL WIDTH OF THE PIER, IS PERMITTED.



PIER PLAN (90°)
(EXPANSION)

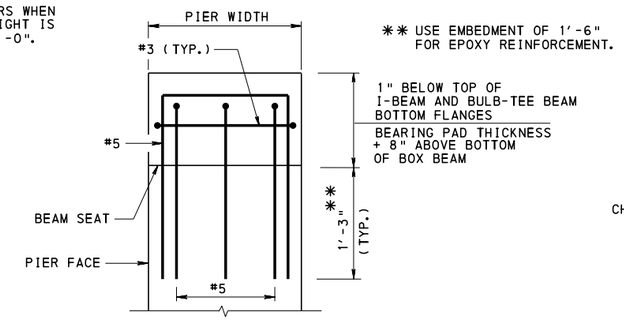
PIER PLAN (90°) NOTE:

- ADJACENT BOX BEAM BRIDGES ARE SIMILAR.

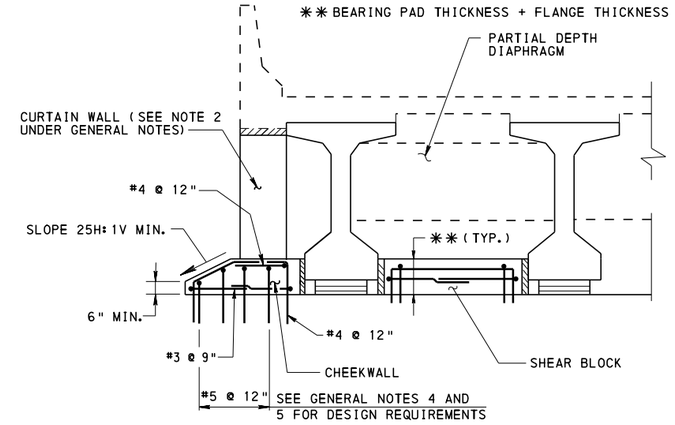


PIER SHEAR BLOCK DETAIL A
PLAN VIEW

ALL SPANS OF EQUAL 'S' DIMENSION

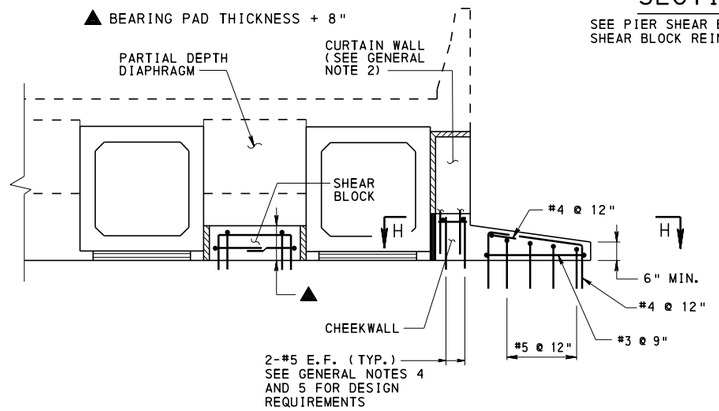


SECTION G-G



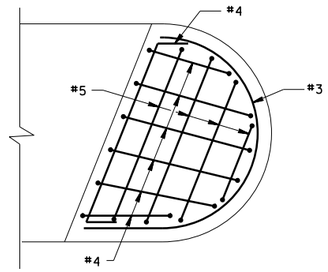
SECTION F-F

SEE PIER SHEAR BLOCK DETAIL A FOR SHEAR BLOCK REINFORCEMENT



SECTION E-E

SEE PIER SHEAR BLOCK DETAIL A FOR SHEAR BLOCK REINFORCEMENT



SECTION H-H

CHEEKWALL REINFORCEMENT NOT SHOWN FOR CLARITY

GENERAL NOTES:

1. ALL REINFORCEMENT STEEL BARS SHOWN MEET THE REQUIREMENTS OF ASTM A 615, A 996, OR A 706.
2. EXTEND CURTAIN WALL, WHEN REQUIRED FOR AESTHETICS, A MAXIMUM OF 1" FROM BOTTOM OF SLAB.
3. FOR WATERPROOFING AND EXPANSION DETAILS, SEE BC-788M.
4. DESIGN THE CHEEKWALL AND SHEAR BLOCKS TO RESIST THE LATERAL FORCES AT THE EXPANSION END OF THE BRIDGE. REINFORCEMENTS SHOWN ARE MINIMUMS.
5. IF THE DESIGN REQUIRES A GREATER SHEAR REINFORCEMENT, #6 REINFORCEMENT BAR MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
SHEAR BLOCK DETAILS AT PIER PRESTRESSED CONCRETE I-BEAM, BULB-TEE BEAM AND BOX BEAM BRIDGES

BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS	

RECOMMENDED APR.29, 2016
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED APR.29, 2016
Brent B Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 1

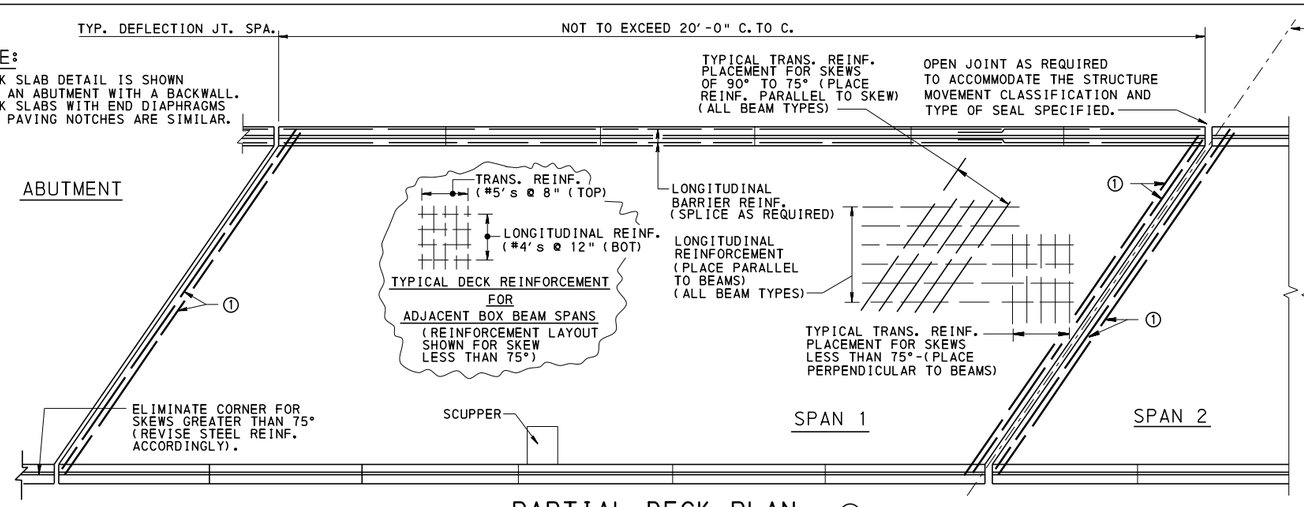
BD-658M

CHANGE 2

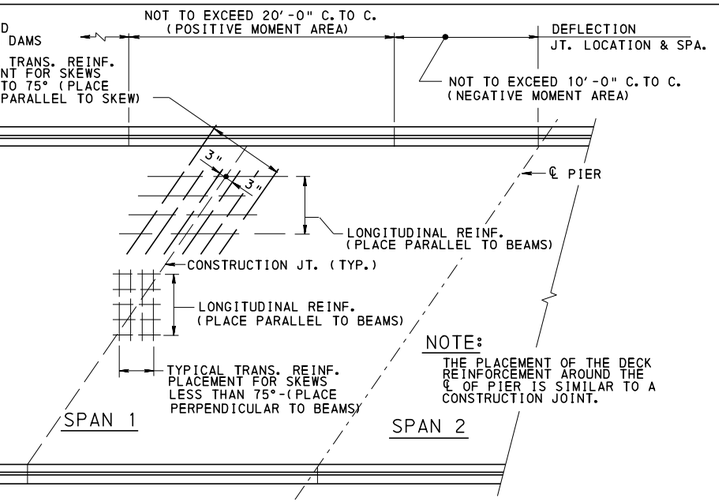
CHANGE 3

CHANGE 5

NOTE:
DECK SLAB DETAIL IS SHOWN FOR AN ABUTMENT WITH A BACKWALL. DECK SLABS WITH END DIAPHRAGMS AND PAVING NOTCHES ARE SIMILAR.



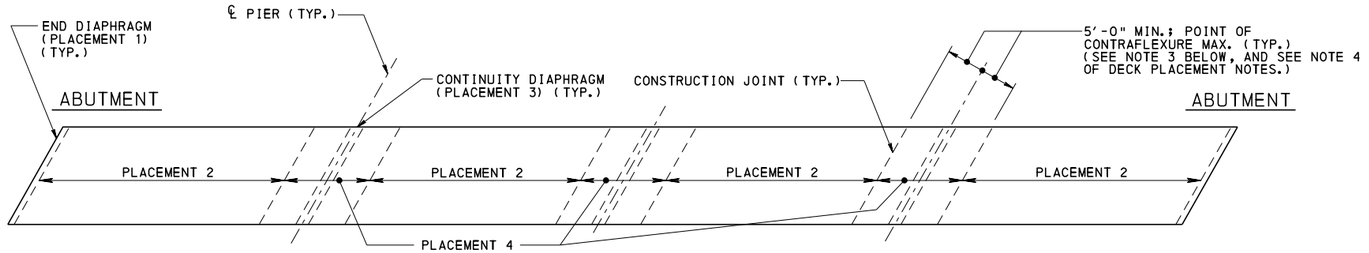
PARTIAL DECK PLAN SIMPLE SPANS



NOTE:
THE PLACEMENT OF THE DECK REINFORCEMENT AROUND THE ℄ OF PIER IS SIMILAR TO A CONSTRUCTION JOINT.

PARTIAL DECK PLAN CONTINUOUS SPANS

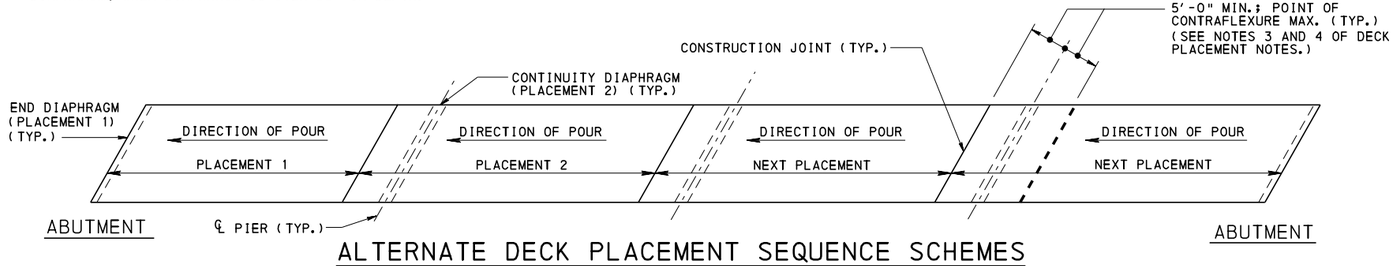
NOTE:
FOR SKEWS LESS THAN 75°, PLACE END BARS AT ABUTMENTS IDENTICAL TO REQUIREMENT FOR SIMPLE SPAN BRIDGES.



PLACEMENT SEQUENCE

DECK PLACEMENT SEQUENCE SCHEMES FOR CONTINUOUS BRIDGES

STEP NO.	ITEM
1.	CAST PLACEMENT 1 (INTERMEDIATE DIAPHRAGMS, SHEAR BLOCKS BETWEEN BEAMS AND END DIAPHRAGMS AT ABUTMENTS).
2.	CAST PLACEMENT 2 (POSITIVE MOMENT REGION).
3.	CAST PLACEMENT 3 (CONTINUITY DIAPHRAGMS AT PIERS).
4.	CAST PLACEMENT 4 (NEGATIVE MOMENT REGION) : MINIMUM 2 HOURS AFTER PLACEMENT OF CONTINUITY DIAPHRAGM, WHEN DIAPHRAGM IS OVER 36" IN DEPTH.



ALTERNATE DECK PLACEMENT SEQUENCE SCHEMES FOR PRESTRESSED CONCRETE CONTINUOUS BRIDGES

ALTERNATE PLACEMENT SEQUENCE

STEP NO.	ITEM
1.	CAST PLACEMENT 1 (POSITIVE MOMENT AREA). CAST END DIAPHRAGM 2 HOURS PRIOR TO PLACING DECK CONCRETE OVER END DIAPHRAGM.
2.	CAST ADJACENT PLACEMENT 2 (POSITIVE MOMENT AREA, CONTINUITY DIAPHRAGM, THEN NEGATIVE AREA). CAST CONTINUITY DIAPHRAGM 2 HOURS PRIOR TO PLACING DECK CONCRETE OVER CONTINUITY DIAPHRAGM.
3.	NEXT PLACEMENT(S) TO BE CAST A MINIMUM OF 2 DAYS AFTER PREVIOUS PLACEMENT (PLACEMENT 2) AND TO CONSIST OF ADJACENT SPAN'S POSITIVE MOMENT, CONTINUITY DIAPHRAGMS AT ENVELOPED PIER, AND NEGATIVE MOMENT REGION OVER PIER. CAST CONTINUITY DIAPHRAGM 2 HOURS PRIOR TO PLACING DECK CONCRETE OVER CONTINUITY DIAPHRAGM.

NOTES:

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
2. DESIGN TOP LONGITUDINAL STEEL OVER THE PIERS, IN ACCORDANCE WITH LRFD SPECIFICATIONS AND DESIGN SECTION 5.12.3.3.
3. FOR TYPICAL LONGITUDINAL SECTIONS, SEE BD-656M.
4. POURING SEQUENCE IS SHOWN FOR A FOUR SPAN BRIDGE. ALL OTHER SPAN COMBINATIONS ARE SIMILAR.
5. SEE BD-601M FOR PLACEMENT OF TRANSVERSE STEEL REINFORCEMENT OVER FASCIA BEAM, AND ALSO FOR MAXIMUM LENGTH OF DECK REINFORCEMENT. BARS LISTED AS S7 ON BD-601M ARE NOT PERMITTED TO BE SHORTENED IN THE ACUTE CORNER OF SKEWED DECK SLABS.
6. FOR SCUPPER DETAILS AND DECK REINFORCEMENT AT SCUPPER, SEE BC-751M.
7. FOR DEFLECTION JOINT AND CONSTRUCTION JOINT DETAILS, SEE BC-752M.

DECK PLACEMENT NOTES:

1. DESIGNER TO ADD A NOTE TO CONSTRUCTION DRAWINGS ALLOWING ALTERNATE DECK PLACEMENT SEQUENCE BY THE CONTRACTOR.
2. IF DETERMINED FEASIBLE BASED ON SPAN LENGTHS, FIRST CONSIDERATION SHOULD BE GIVEN TO A CONTINUOUS POUR OF THE ENTIRE DECK IF CONCRETE CAN BE MAINTAINED IN A PLASTIC STATE THROUGHOUT THE POUR.
3. WHEN CONTINUOUS DECK IS CAST IN PARTIAL WIDTH CONSTRUCTION, 5'-0" MINIMUM DOES NOT APPLY.
4. SHOW POINT OF CONTRAFLEXURE ON EACH SIDE OF THE PIER. THE POINT OF CONTRAFLEXURE FOR PRESTRESSED CONCRETE CONTINUOUS BRIDGES SHALL BE CALCULATED AS THE SUM OF SIMPLE SPAN MOMENTS DUE TO DL1 AND CONTINUOUS SPAN MOMENTS FROM DL2.

BD-601M	CONCRETE DECK SLAB FOR BEAM BRIDGES
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-667M	INTEGRAL ABUTMENT
BC-732M	PERMANENT METAL DECK FORMS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-751M	BRIDGE DRAINAGE
BC-752M	CONCRETE DECK SLAB DETAILS
BC-754M	STEEL DIAPHRAGMS FOR STEEL BEAM/GIRDER STRUCTURES (STRAIGHT GIRDER ONLY)
BC-762M	TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE & STEEL BEAM BRIDGES
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE & STEEL I-BEAM BRIDGES

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

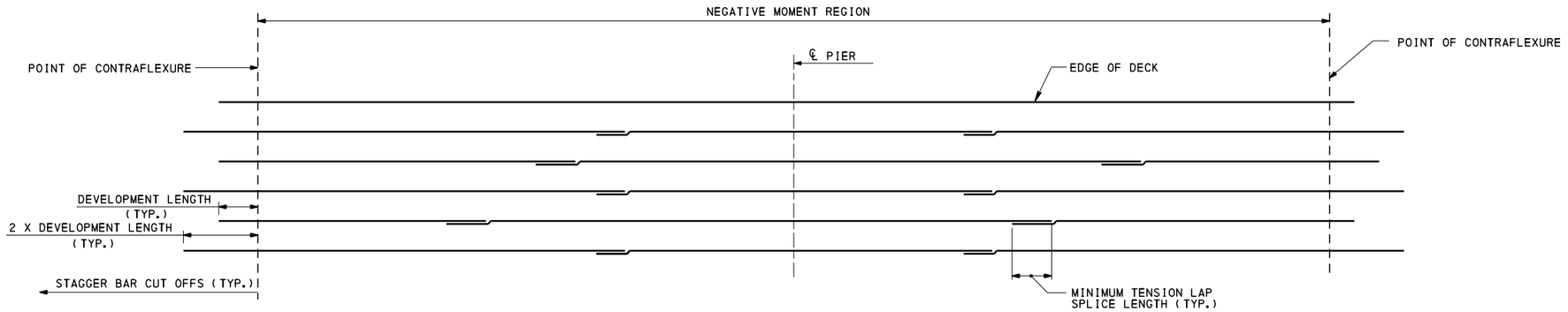
STANDARD DECK SLAB, FORMS AND STEEL REINFORCEMENT PLACEMENT PRESTRESSED CONCRETE AND STEEL I-BEAM AND BOX BEAM BRIDGES

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

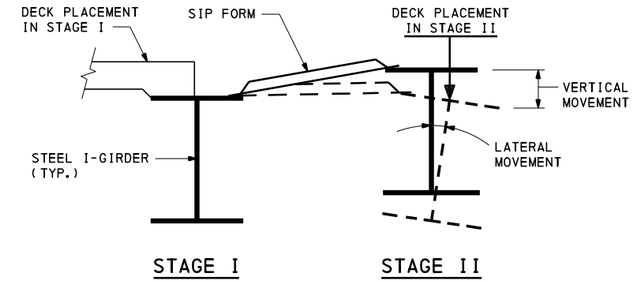
SHEET 1 OF 2

BD-660M



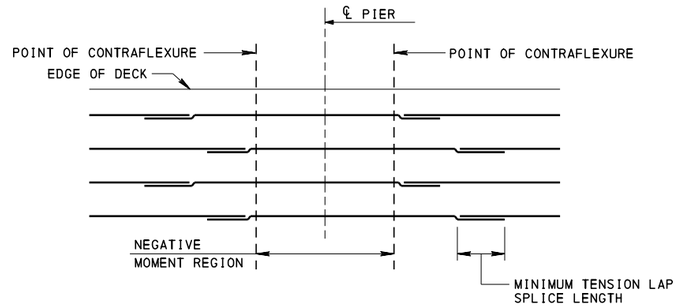
LONGITUDINAL REINFORCEMENT STAGGER DETAIL IN NEGATIVE MOMENT REGION

NOTES:
1. DETAIL SHOWN REPRESENTS A LARGE NEGATIVE MOMENT REGION. IF THE NEGATIVE MOMENT REGION IS SMALL ENOUGH, STAGGER LONGITUDINAL REINFORCEMENT OUTSIDE THE NEGATIVE MOMENT REGION.
2. USE MAXIMUM REINFORCEMENT BAR LENGTH UP TO 60′ TO MINIMIZE SPLICES AND TO KEEP SPLICES AS FAR FROM THE PIER AS PRACTICAL.
3. LOCATE SPLICES AS FAR AWAY FROM CENTERLINE OF PIER AS POSSIBLE.



DECK PLACEMENT FOR STEEL GIRDER DURING PHASED/STAGED CONSTRUCTION

NOTE: DESIGNER SHALL INVESTIGATE AND ADDRESS THE VERTICAL AND POTENTIAL LATERAL MOVEMENTS DURING PHASED/STAGED CONSTRUCTION. VERTICAL DEFLECTION AND LATERAL MOVEMENT, IF ANY, AT EACH STAGE SHALL BE SHOWN ON THE PLANS.



LONGITUDINAL REINFORCEMENT STAGGER DETAIL IN NEGATIVE MOMENT REGION

ONLY FOR SPANS < 100′.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD DECK SLAB, FORMS AND STEEL REINFORCEMENT PLACEMENT PRESTRESSED CONCRETE AND STEEL I-BEAM AND BOX BEAM BRIDGES

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

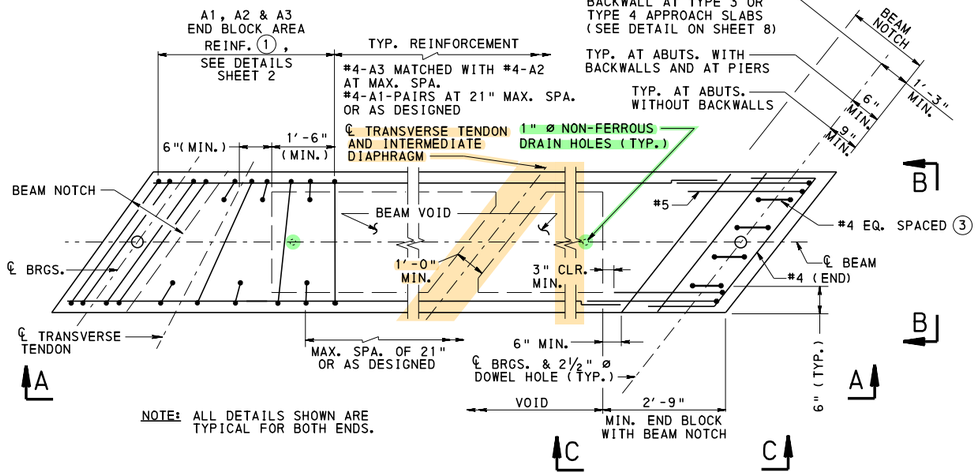
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-660M

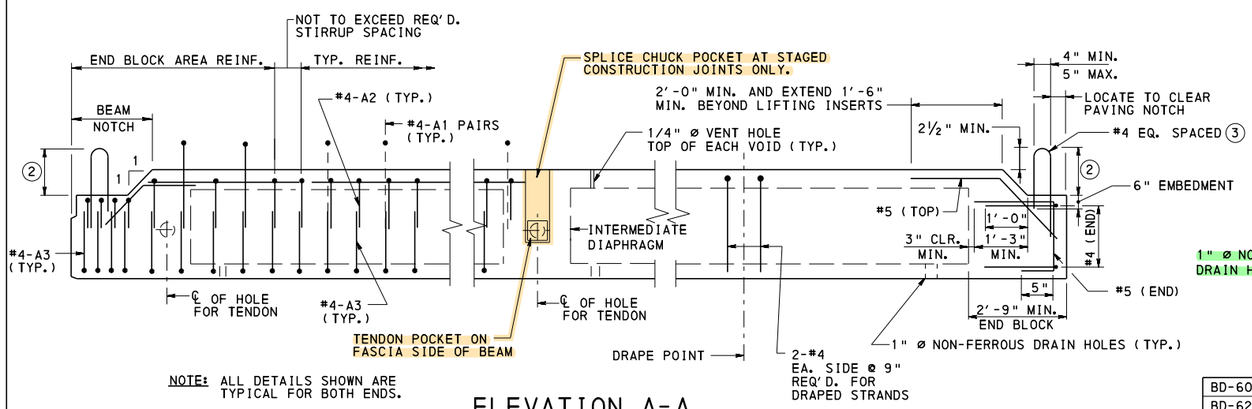
CHANGE 2

CHANGE 3

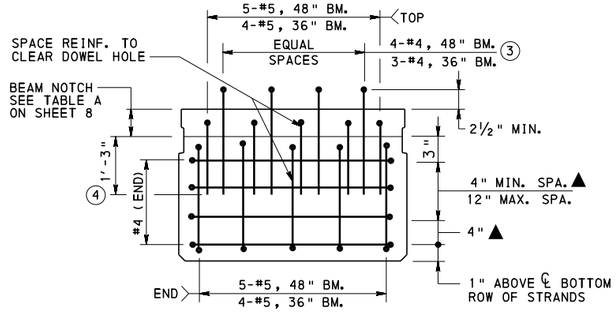
CHANGE 5



ADJACENT BOX BEAMS
PLAN-TYPICAL BEAM
(COMPOSITE)

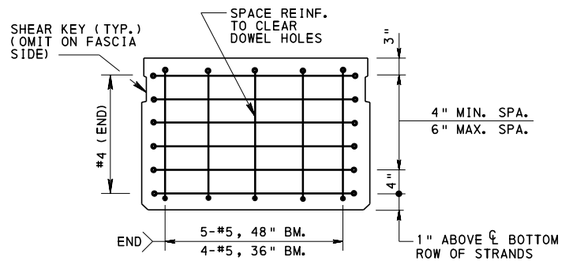


ELEVATION A-A

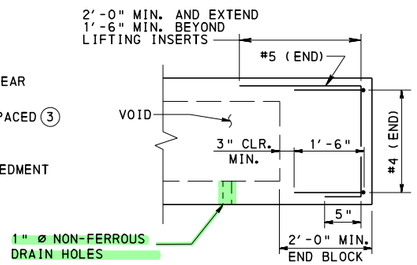


VIEW B-B
WITH BEAM NOTCH
(COMPOSITE)

▲ 3" MIN. FOR 17" DEEP BEAM



VIEW B-B
WITHOUT BEAM NOTCH
(COMPOSITE)



VIEW C-C
END ELEVATION
WITHOUT BEAM NOTCH

LEGEND:

(1) A1 MATCHED WITH A3 IS CONSIDERED A STIRRUP ONLY IN THE END BLOCK AREA. A2 MATCHED WITH A3 IS CONSIDERED A STIRRUP ALONG THE ENTIRE LENGTH OF THE BEAM. A1 IS SPACED AT 21" OR AS DESIGNED INDEPENDENTLY OF A2 AND A3 OUTSIDE THE END BLOCK AREA.

(2) TO BE DETAILED ON THE SHOP DRAWINGS.

(3) BARS MAY BE ROTATED PARALLEL TO BEAM END ALONG CENTERLINE OF BEARINGS.

(4) #4 BARS TO TERMINATE ¼" ABOVE THE TOP OF THE BOTTOM SLAB OR 1'-3" BELOW BEAM NOTCH, WHICHEVER IS LESS. #5 (TOP) BARS TO TERMINATE TO PROVIDE 2" MIN. COVER TO BEAM REAR FACE OR 1'-3" BELOW BEAM NOTCH, WHICHEVER IS LESS.

GENERAL NOTES:

1. DESIGNER TO SPECIFY STEEL CORROSION PROTECTION AS PER DESIGN MANUAL, PART 4, D5.4.3.6P.
2. EPOXY COAT ALL REBARS FOR A DISTANCE OF 9'-0" FROM BEAM ENDS ADJACENT TO DECK JOINTS.
3. EPOXY COAT ALL REINFORCEMENT WHICH PROTRUDES INTO BRIDGE DECK FROM TOP OF BEAMS.
4. SHOW DESIGN LENGTH AND CASTING LENGTH ON SHOP DRAWINGS.
5. SHOW PLAN, ELEVATION, SECTIONS AND ALL REINFORCEMENT DETAILS ON SHOP DRAWINGS.
6. SHOW ANY MODIFICATIONS TO REINFORCEMENT SPLICE AND BENDING DETAILS ON SHOP DRAWINGS.
7. CALCULATE BEARING SEAT ELEVATION, DAPPING DIMENSIONS, SLOPE AND HAUNCH DEPTH USING THE FINAL NET CAMBER - "C".
8. SHOW THE FOLLOWING DATA ON THE SHOP DRAWINGS:
   1) THE SIZE AND LOCATION OF THE TEMPORARY STORAGE SUPPORTS.
   2) THE TYPE AND LOCATION OF THE BRACING AND TEMPORARY SUPPORTS USED FOR THE TRANSPORTATION AND ERECTION OF THE BEAMS.
9. END ZONE REINFORCEMENT MAY BE INCREASED BY FABRICATOR TO REFLECT FABRICATOR'S EXPERIENCE AND/OR TO CONTROL CRACKING. WIRE MESH OF EQUIVALENT AREA IS PERMISSIBLE FOR CRACK CONTROL REINFORCEMENT.
10. FABRICATOR TO CHECK STABILITY FOR HANDLING AND TRANSPORTING OF THE MEMBERS.
11. END REINFORCEMENT SPACING MAY BE REDUCED AS REQUIRED TO SATISFY SHEAR REINF. REQUIREMENTS, BUT DO NOT REDUCE THE MINIMUM AREA TO BE REINFORCED.
12. MINIMUM COVER ON REINFORCEMENT BARS:
    TOP SLAB - 1"
    INSIDE VOID - 1"
    ELSEWHERE - 2" UNLESS OTHERWISE NOTED
13. THE VERTICAL MILD-STEEL REINFORCEMENT (BARS A1, A2, AND A3) SHOWN ARE MINIMUMS. THE DESIGN MAY REQUIRE ADDITIONAL VERTICAL MILD-STEEL REINFORCEMENT.
14. INTERFACE SHEAR REINFORCEMENT SHOWN ARE #4 BARS, A1, WITH 21" MAXIMUM SPACING. FOR #5 BARS, THE MAXIMUM SPACING IS 21".
15. FOR BEAM CAMBER DIAGRAM, SEE BD-662M.

REFERENCE DRAWINGS

BD-601M	CONCRETE DECK SLAB
BD-628M	BRIDGE APPROACH SLABS
BD-651M	REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCK, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS
BD-652M	P/S BEAM SIZES AND SECTION PROPERTIES
BD-653M	TYPICAL FRAMING PLANS AND DETAILS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BD-662M	I-BEAM REINFORCEMENT DETAILS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS - BOX BEAM BRIDGES
BC-701M	PROTECTIVE FENCE
BC-711M	ALUMINUM PROTECTIVE BARRIER
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-720M	ALUMINUM OR STEEL BRIDGE HAND RAILING
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-755M	BEARINGS
BC-775M	MISCELLANEOUS PRESTRESS DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

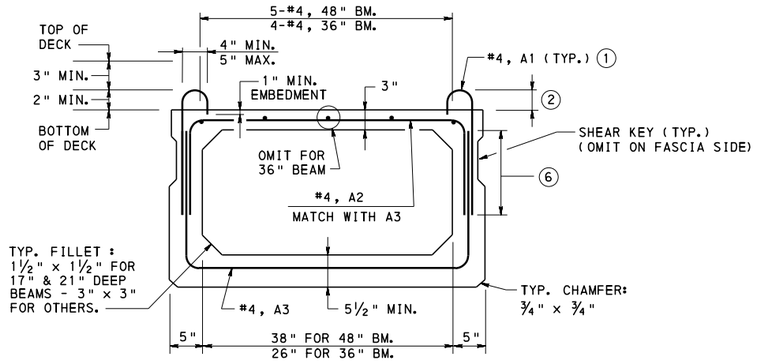
STANDARD
BOX BEAM REINFORCEMENT DETAILS
ADJACENT BOX BEAM

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 8

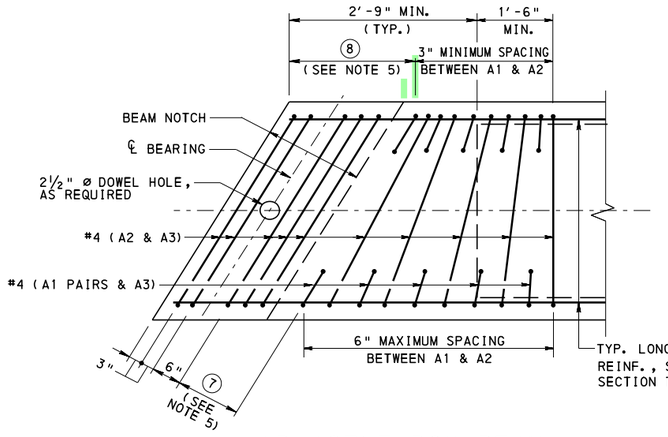
BD-661M



ADJACENT BOX BEAM SECTION

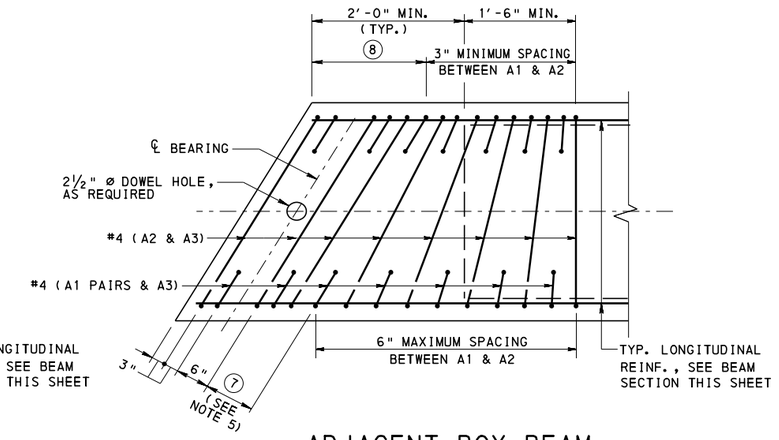
(COMPOSITE)

- FOR ADJACENT BOX BEAMS SUPPORTING BARRIERS, SEE SHEETS 4 AND 5.
- FOR PLANK BEAM DETAIL, SEE SHEET 7.



ADJACENT BOX BEAM

WITH BEAM NOTCH
(COMPOSITE)



ADJACENT BOX BEAM

WITHOUT BEAM NOTCH

END BLOCK REINFORCEMENT

ADJACENT BOX BEAM NOTES:

1. FOR ALTERNATE END BLOCK REINFORCEMENT DETAIL, SEE SHEET 6.
2. #4 BARS, A1, WITH 21" MAXIMUM SPACING ARE SHOWN AS INTERFACE SHEAR REINFORCEMENT. IF THE DESIGN REQUIRES A GREATER SHEAR REINFORCEMENT, #5 WITH A 21" MAXIMUM SPACING BARS MAY BE USED INDICATING THE APPROPRIATE MINIMUM LAP SPLICE LENGTH.
3. OMIT SHEAR KEY ON THE FASCIA SIDE OF BEAMS.
4. FOR TYPICAL CORNER BLOCKOUT DETAIL, SEE BC-775M.
5. IF THE 3" SPACING OF THE STIRRUPS AT THE END OF THE BEAM IS REQUIRED TO GO BEYOND THAT SHOWN IN THE END BLOCK REINFORCEMENT DETAIL TO SATISFY THE SPLITTING RESISTANCE REQUIREMENT IN DESIGN MANUAL, PART 4, D5.10.10.1, ALTERNATE A1 AND A2 WITH A3 TO THE END OF THE 3" STIRRUP SPACING.

LEGEND:

(1) A1 MATCHED WITH A3 IS CONSIDERED A STIRRUP ONLY IN THE END BLOCK AREA OR UP TO WHERE THE BEAM DESIGN REQUIRES 3" SPACING OF STIRRUPS. A2 MATCHED WITH A3 IS CONSIDERED A STIRRUP ALONG THE ENTIRE LENGTH OF THE BEAM. A1 IS SPACED AT 21" OR AS DESIGNED INDEPENDENTLY OF A2 AND A3 OUTSIDE THE END BLOCK.

(2) TO BE DETAILED ON THE SHOP DRAWINGS

(6) DENOTES MIN. LAP SPLICE FOR THE VERTICAL LEG OF A1 AND A2 WITH A3. A1 AND A2 WILL TERMINATE ¼" ABOVE THE TOP OF THE BOTTOM SLAB, OR 21" MULTIPLIED BY 1.2 FOR EPOXY COATED REINFORCEMENT BARS, WHICHEVER IS LESS.

(7) 3" SPACINGS AS REQUIRED FOR SPLITTING RESISTANCE REINFORCEMENT IN ACCORDANCE WITH DM-4 D5.10.10.1, 6" MAX. SPACING THEREAFTER

(8) MIN. 3" BEYOND BEAM NOTCH, IF PRESENT, AND EXTENDED AS REQUIRED TO PROVIDE SPLITTING RESISTANCE REINFORCEMENT IN ACCORDANCE WITH DESIGN MANUAL, PART 4, D5.10.10.1.

COMMONWEALTH OF PENNSYLVANIA
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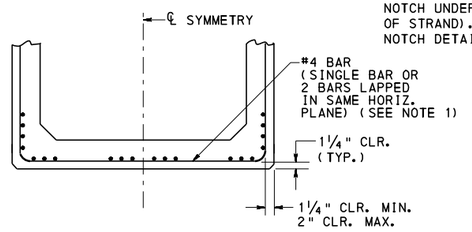
STANDARD
BOX BEAM REINFORCEMENT DETAILS
ADJACENT BOX BEAM

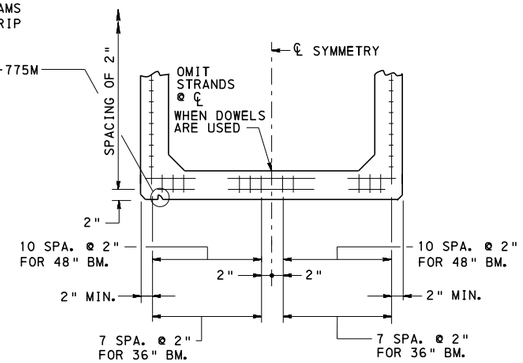
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 2 OF 8
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-661M



TYPICAL STRAND CONFINEMENT ALL BEAMS

STRAND CONFINEMENT NOTES:

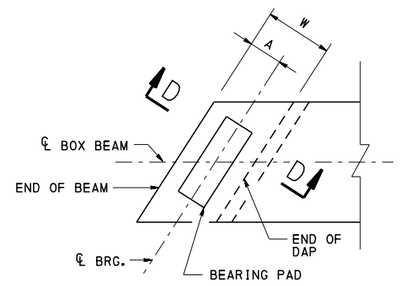
1. FOR LIMITS OF STRAND CONFINEMENT REINFORCEMENT, REFER TO DESIGN MANUAL, PART 4, D5.9.4.4.2.



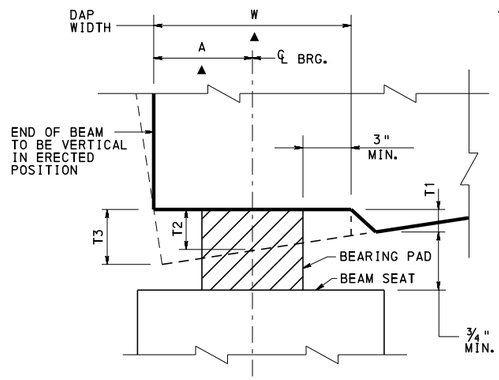
TYPICAL STRAND PATTERN ALL BEAMS

STRAND PATTERN NOTES:

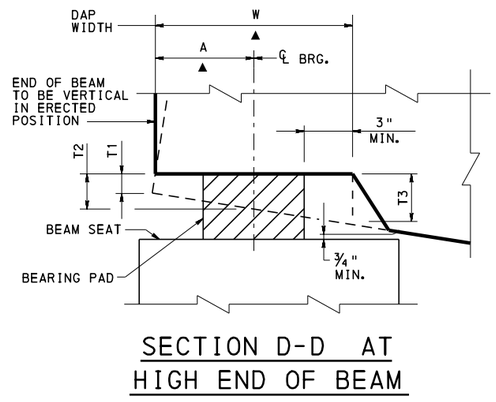
1. DO NOT PLACE MORE THAN ONE COLUMN OF PRESTRESSING STRANDS IN THE WEBS.
2. DO NOT PLACE PRESTRESSING STRANDS AT CORNER LOCATION IN BOTTOM ROW.
3. DO NOT PLACE PRESTRESSING STRANDS AT LOCATIONS THAT CONFLICT WITH TRANSVERSE TENDON POCKET.
4. IF SPLICE CHUCK POCKET IS REQUIRED FOR STAGING, PLACE NO STRANDS ABOVE THE TRANSVERSE TENDON POCKET.



PLAN



SECTION D-D AT LOW END OF BEAM



SECTION D-D AT HIGH END OF BEAM

▲ - MEASURED NORMAL TO ℄ BEARINGS

BEAM DAP DETAILS

BEAM DAP NOTES:

1. T1 IS DAP THICKNESS AT END OF BEAM FOR HIGHER END OF BEAM AND DAP THICKNESS AT BEGINNING OF DAP FOR LOWER END OF BEAM. T1 MINIMUM IS ¼".
2. T2 IS DAP THICKNESS AT CENTERLINE OF BEARING.
3. T3 IS DEFINED AS THE DAP THICKNESS BASED ON THE SLOPE OF THE BEAM DUE TO THE GRADE AND CAMBER.
4. BEAM SEAT AND BOTTOM OF BEAM BEARING AREA REQUIREMENTS AS PER DESIGN MANUAL, PART 4, SECTION 14.7.6.3.9dP.
5. MAXIMUM GRADE FOR USE OF DAPPING IS BASED ON LIMITING THE MAXIMUM DAP THICKNESS TO 1½"AND MAINTAINING 1" MINIMUM CONCRETE COVER ON CONFINEMENT REINFORCEMENT IN THE PROPOSED BEAM DAPPING AREA.
6. FOR BEAM DAPPING, A MINIMUM CLEARANCE OF ¾" MUST BE PROVIDED BETWEEN THE BOTTOM OF THE BEAM (WITHOUT CONSIDERATION OF THE DAP) AND THE TOP OF BEAM SEAT TO ENSURE INSPECTABILITY OF BEARING PAD.
7. PARTIAL-WIDTH BEAM DAPS ARE NOT PERMITTED.
8. THE MAXIMUM DAP THICKNESS IS 1½".
9. ENSURE THAT ALL CONCRETE COVER REQUIREMENTS ON STEEL CONFINEMENT REINFORCEMENT AND PRESTRESSING STRANDS ARE SATISFIED WHEN USING BEAM DAPS TO MODIFY THE BOTTOM OF BEAM AREA.
10. WHEN BEAM DAPS ARE USED AND THE BEAM (AND BEARING PAD) IS ON THE SKEW, THE BEAM SEAT MUST SLOPE TO ENSURE EVEN BEARING PRESSURE ON THE PADS.

MAXIMUM REQUIRED DAP DEPTH (T3)	DISTANCE TO FIRST ROW OF STRANDS (IN.)	BOTTOM FLANGE THICKNESS (BOX BEAMS) (IN.)
¼ < (T3) ≤ ¾	2½	6
¾ < (T3) ≤ 1¼	3	6½
1¼ < (T3) ≤ 1½	3¼	7
1½ < (T3) *	2	5½*

*USE BEVELED SOLE PLATE, SEE BC-755M.

BOX BEAM DAP DESIGN PARAMETERS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

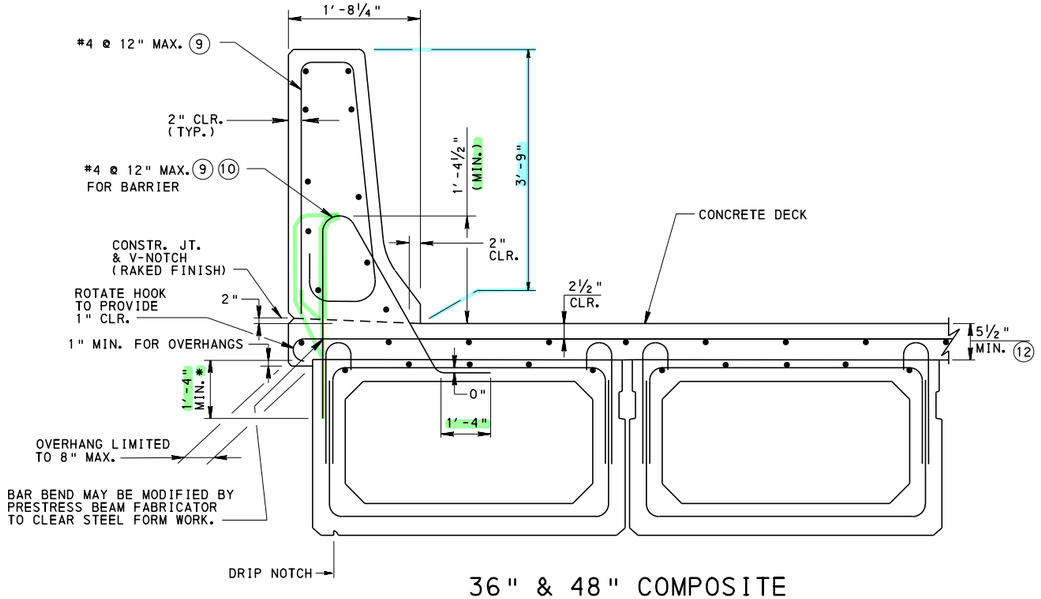
STANDARD
BOX BEAM REINFORCEMENT DETAILS
STRAND PATTERN AND BEAM DAP

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 3 OF 8

BD-661M

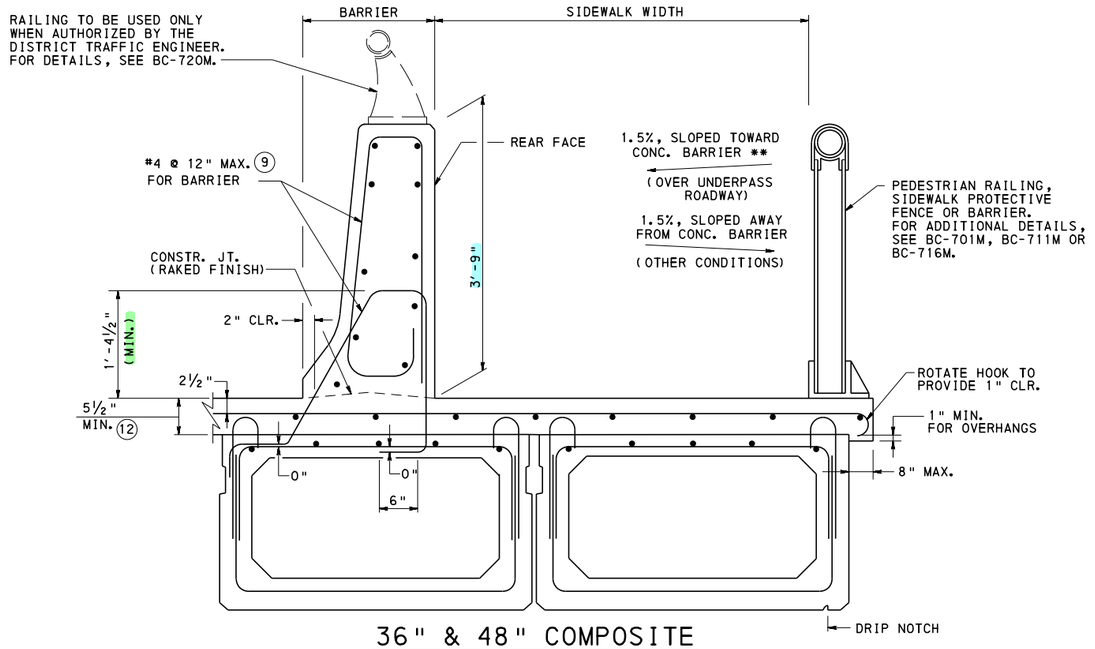


36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING F-SHAPE BARRIER

NOTES:

- 45" F-SHAPE CONCRETE BARRIER SHOWN, 32" AND 42" F-SHAPE CONCRETE BARRIER AND PLANK BEAM IS SIMILAR.

* OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM

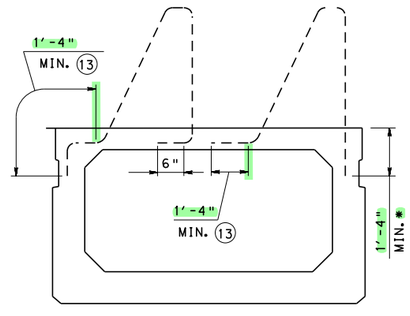


36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING TYPICAL SIDEWALK (11)

NOTES:

- 45" F-SHAPE CONCRETE BARRIER SHOWN, 32" AND 42" F-SHAPE CONCRETE BARRIER AND PLANK BEAM IS SIMILAR. (14)

** DRAIN RUNOFF THROUGH CONC. BARRIER WITH CURB DRAIN. SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR TRANSVERSE DECK REINFORCEMENT BARS.



REINFORCEMENT DETAIL FOR BARRIERS WITH TYPICAL SIDEWALK

* OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM

NOTES

1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BRIDGE BARRIERS NOT SHOWN, SEE BD-601M.
2. FOR WATERPROOFING DETAIL AT SHEAR KEY, SEE BC-788M.

LEGEND

(9) WITHIN 10' ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE, REDUCE SPACING OF REINFORCING BARS TO HALF THE SPACING SHOWN. FOR END OF BARRIER TRANSITIONING TO GUIDE RAIL, FOLLOW DETAILS SHOWN ON BD-622M AND BD-624M.

(10) BEND AS REQUIRED TO ACCOMMODATE OVERHANG. SEE BC-736M.

(11) USE ONLY WHEN ROADWAY AND SIDEWALK WIDTHS PERMIT THE HORIZONTAL LEGS OF THE BARRIER BAR TO BE EMBEDDED ENTIRELY WITHIN ONE BEAM. ROADWAY/SIDEWALK WIDTHS MAY NEED ADJUSTED TO ACCOMMODATE THIS CONDITION.

(12) INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD PER DESIGN MANUAL, PART 4, DC5.12.3.3.8.

(13) MAINTAIN MIN. EMBEDMENT LENGTH OF 1'-4" FROM TOP OF BEAM TO END OF REINFORCEMENT (MEASURED ALONG OUTSIDE EDGE OF THE REINFORCEMENT).

(14) IF THE 32" F-SHAPE CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF THE BARRIER AND RAILING MUST BE 3'-6" MINIMUM.

REINFORCEMENT BAR NOTES

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

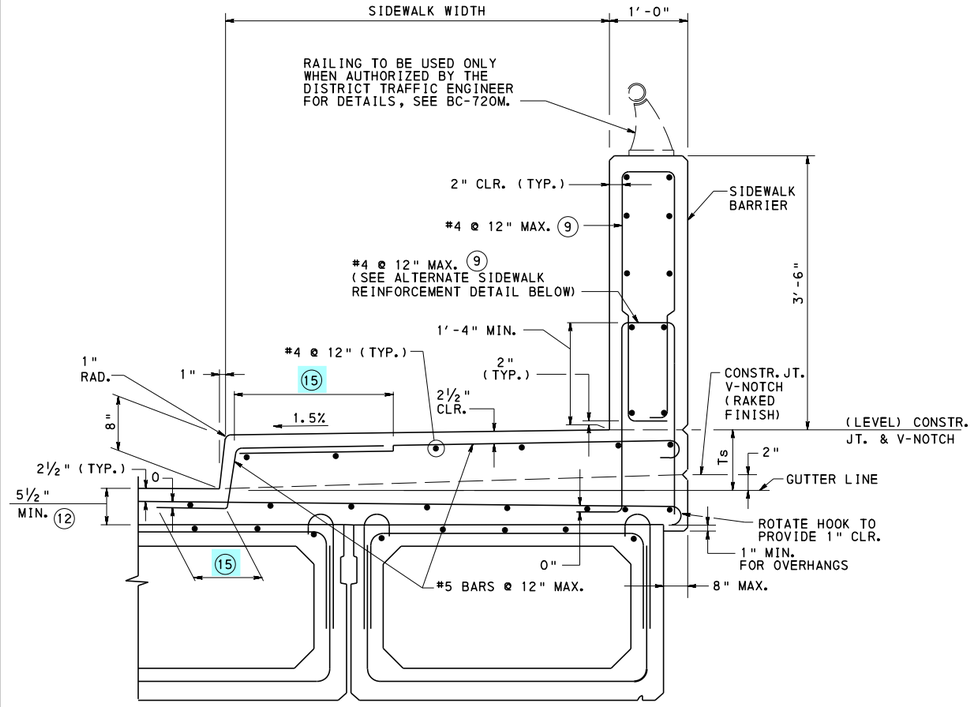
ADJACENT BOX BEAM SUPPORTING BARRIER/SIDEWALK NOTES:

1. FOR BEAM DIMENSIONS AND BEAM REINFORCEMENT, SEE SHEET 2.
2. REINFORCEMENT BARS PROTRUDING FROM THE BOX BEAM TO THE BARRIER MUST RESIDE IN ONE BEAM.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD BOX BEAM REINFORCEMENT DETAILS ADJACENT BOX BEAM

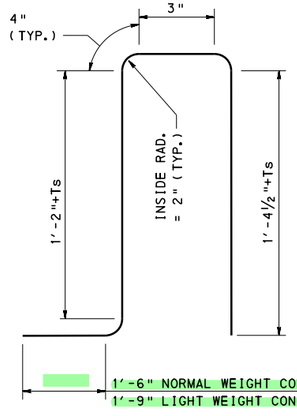
RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 Gavin E. Gray CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 4 OF 8 BD-661M



36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK WITH 42" VERTICAL WALL CONCRETE BARRIER

ADJACENT BOX BEAM SUPPORTING BARRIER/SIDEWALK NOTES:

1. FOR BEAM DIMENSIONS AND BEAM REINFORCEMENT, SEE SHEET 2.
2. FOR REINFORCEMENT BAR DETAILS OF THE SIDEWALK BARRIER, SEE BD-601M.



Ts= THICKNESS OF SIDEWALK SLAB UNDER BARRIER

REINFORCEMENT BAR NOTES:

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

ALTERNATE SIDEWALK REINFORCEMENT DETAIL

LEGEND

(9) WITHIN 10' ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE, REDUCE SPACING OF REINFORCING BARS TO HALF THE SPACING SHOWN. FOR END OF BARRIER TRANSITIONING TO GUIDE RAIL, FOLLOW DETAILS ON BD-622M AND BD-624M.

(12) INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD PER DESIGN MANUAL, PART 4, DC5.12.3.3.8.

(15) FOR DIMENSION, SEE BD-601M, SHEET 4.

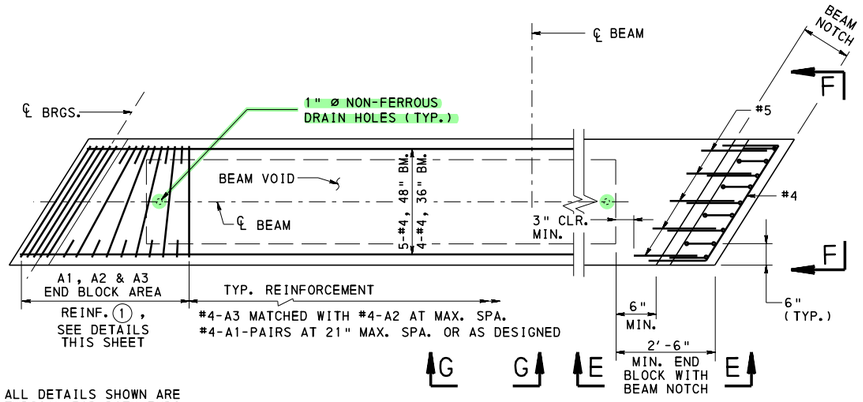
NOTES

1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BRIDGE BARRIERS NOT SHOWN, SEE BD-601M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

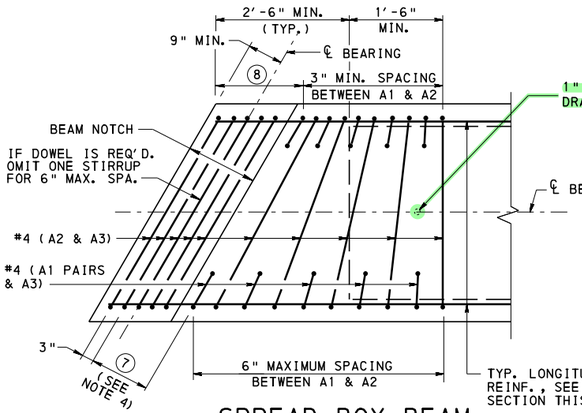
STANDARD
BOX BEAM REINFORCEMENT DETAILS
ADJACENT BOX BEAM

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 5 OF 8
		BD-661M

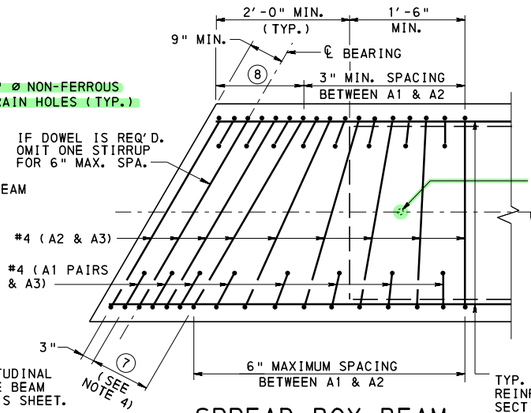


NOTE: ALL DETAILS SHOWN ARE TYPICAL FOR BOTH ENDS.

PLAN - SPREAD BOX BEAM BEAM REINFORCEMENT

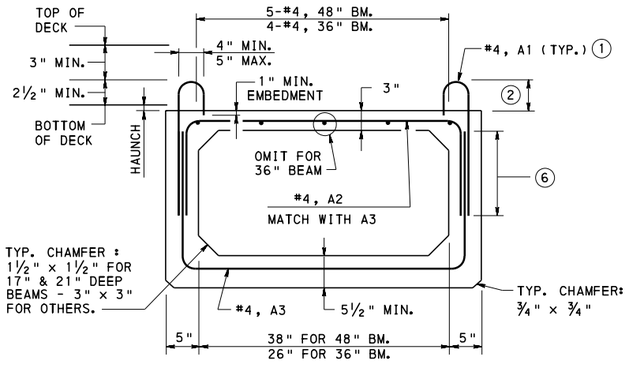


SPREAD BOX BEAM WITH BEAM NOTCH

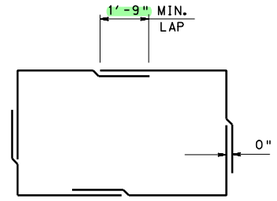


SPREAD BOX BEAM WITHOUT BEAM NOTCH

END BLOCK REINFORCEMENT



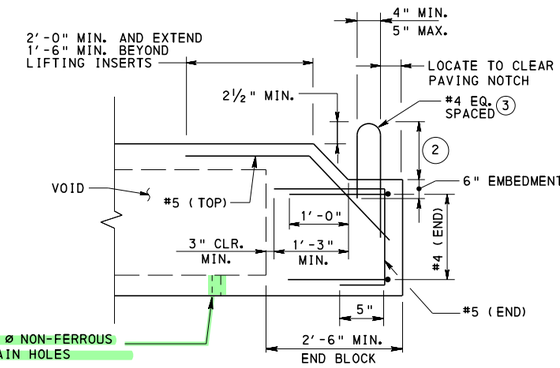
SPREAD BOX BEAM SECTION



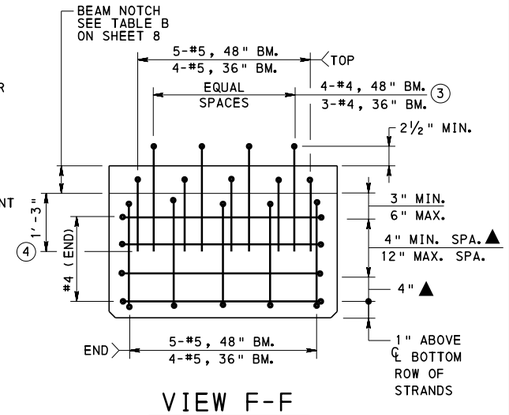
ALTERNATE END BLOCK REINFORCEMENT SPLICING DETAIL

SPREAD BOX BEAM NOTES:

1. SEE THIS SHEET FOR ALTERNATE END BLOCK REINFORCEMENT DETAIL.
2. #4 BARS, A1, WITH 21" MAXIMUM SPACING ARE SHOWN AS INTERFACE SHEAR REINFORCEMENT. IF THE DESIGN REQUIRES A GREATER SHEAR REINFORCEMENT, #5 WITH A 21" MAXIMUM SPACING BARS MAY BE USED INDICATING THE APPROPRIATE MINIMUM LAP SPLICE LENGTH.
3. FOR TYPICAL CORNER BLOCKOUT DETAIL, SEE BC-775M.
4. IF THE 3" SPACING OF THE STIRRUPS AT THE END OF THE BEAM IS REQUIRED TO GO BEYOND THAT SHOWN IN THE END BLOCK REINFORCEMENT DETAIL TO SATISFY THE SPLITTING RESISTANCE REQUIREMENT IN DESIGN MANUAL, PART 4, D5.10.10.1, ALTERNATE A1 AND A2 WITH A3 TO THE END OF THE 3" STIRRUP SPACING.
5. FOR LEGEND NOTES (1), (2), (3), (4), (6), (7) AND (8) SEE LEGEND ON SHEETS 1 AND 2.

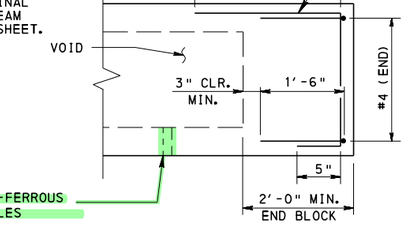


VIEW E-E END ELEVATION WITH BEAM NOTCH

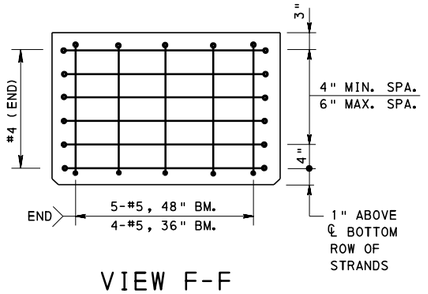


VIEW F-F WITH BEAM NOTCH

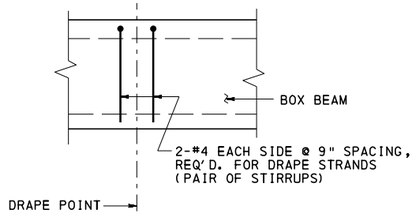
▲ 3" MIN. FOR 17" DEEP BEAM



VIEW E-E END ELEVATION WITHOUT BEAM NOTCH



VIEW F-F WITHOUT BEAM NOTCH



BEAM ELEVATION SECTION G-G

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

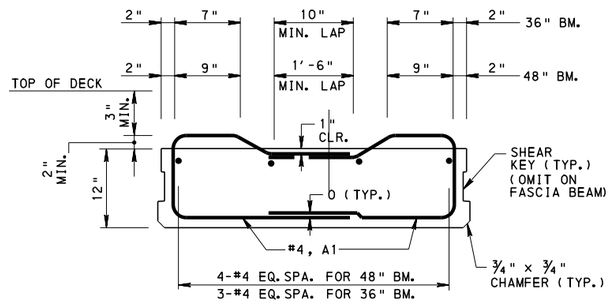
STANDARD BOX BEAM REINFORCEMENT DETAILS SPREAD BOX BEAM

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

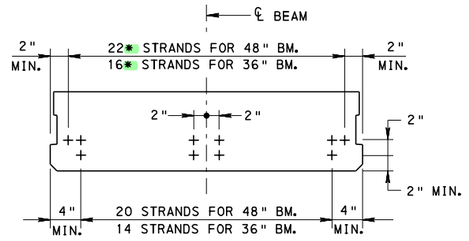
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 8

BD-661M



PLANK BEAM
(COMPOSITE)

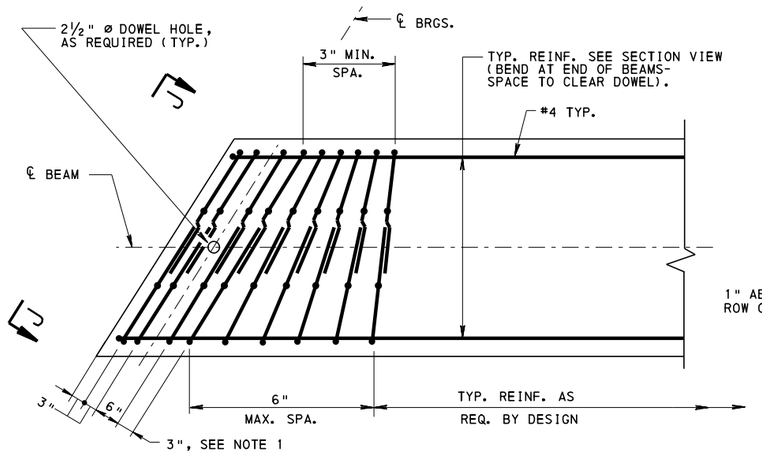


TYPICAL STRAND PATTERN
PLANK BEAM

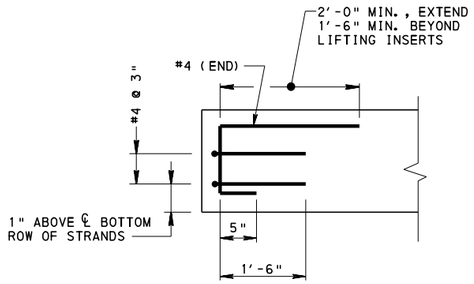
* TRANSVERSE TENDON POCKET SIZE AND LOCATION COULD REDUCE AVAILABLE STRANDS IN SECOND ROW

PLANK BEAM NOTE:

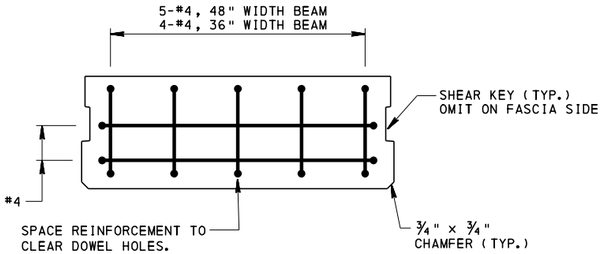
1. IF THE 3" SPACING OF THE STIRRUPS AT THE END OF THE BEAM IS REQUIRED TO GO BEYOND THAT SHOWN TO SATISFY THE SPLITTING RESISTANCE REQUIREMENT IN DM-4 D5.10.10.1, CONTINUE THE 3" STIRRUP SPACING.



PLAN - 12" DEEP PLANK BEAM



VIEW H-H



VIEW J-J

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BOX BEAM REINFORCEMENT DETAILS
PLANK BEAM

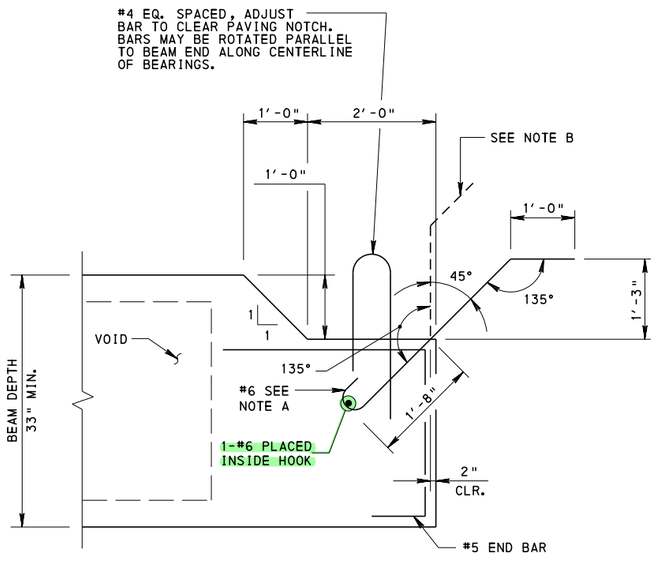
RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 7 OF 8
		BD-661M

TABLE A
BEAM NOTCH DEPTHS FOR COMPOSITE ADJACENT BOX BEAMS

APPROACH SLAB TYPE (SEE NOTE 1)	BACKWALL	BEAM NOTCH DEPTH	REMARKS
1	YES	4½" FOR 17" BEAM DEPTHS	
		6" FOR BEAM DEPTHS > 17"	
1	NO	4½" FOR 17" BEAM DEPTHS	SEE NOTE 2
		6" FOR 21" AND 24" BEAM DEPTHS	
		10" FOR BEAM DEPTHS 27" AND GREATER	
2	YES	4½" FOR 17" BEAM DEPTHS	
		6" FOR BEAM DEPTHS > 17"	
2	NO	4½" FOR 17" BEAM DEPTHS	SEE NOTE 3
		6" FOR 21", 24" AND 27" BEAM DEPTHS	
		1'-3" FOR BEAM DEPTHS 30" AND GREATER	
3	YES	1'-0" FOR BEAM DEPTHS 33" AND GREATER	SEE NOTES 4 AND 5
4	YES	1'-0" FOR BEAM DEPTHS 33" AND GREATER	SEE NOTES 4 AND 5
5	N/A	N/A	
RC-23M	N/A	4½" FOR 17" BEAM DEPTHS	SEE NOTE 6
		6" FOR BEAM DEPTHS > 17"	
NO APPROACH SLAB	N/A	4½" FOR 17" BEAM DEPTHS	SEE NOTES 7 AND 8
		6" FOR BEAM DEPTHS > 17"	

BEAM NOTCH NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. SUPPORT APPROACH SLAB ON ABUTMENT FOR 17", 21" AND 24" DEEP BEAMS.
3. SUPPORT APPROACH SLAB ON ABUTMENT FOR 17", 21", 24" AND 27" DEEP BEAMS.
4. BACKWALL PLACED UNDER APPROACH SLAB.
5. TYPE 3 AND 4 APPROACH SLABS ARE NOT PERMITTED FOR BEAM DEPTHS LESS THAN 33". USE TYPE 1 OR 2 APPROACH SLAB WITH BACKWALL.
6. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.
7. OMIT BEAM NOTCH FOR PLANK BEAMS AND PIER ENDS FOR BEAMS MADE CONTINUOUS.
8. BEAM NOTCH MAY BE OMITTED WHEN PAVING NOTCH IS NOT REQUIRED.
9. ADJUST BEAM NOTCHES AS REQUIRED TO ACCOMMODATE EXPANSION DAMS.



ADJACENT BOX BEAM WITH TYPE 3 OR 4 APPROACH SLAB
(ADDITIONAL REINFORCEMENT BAR)

NOTE A:

PROVIDE 5 BARS FOR 48" WIDE BEAMS.
PROVIDE 4 BARS FOR 36" WIDE BEAMS.
MATCH WITH #5 END BAR.

NOTE B:

LOCATION OF BAR FOR BEAM CASTING. AFTER BEAM IS CAST, BEND BAR AS REQUIRED TO SHAPE SHOWN. FOR ALTERNATE REBAR DETAILS, SEE BD-628M, SHEET 24.

TABLE B
BEAM NOTCH DEPTHS FOR SPREAD BOX BEAMS

APPROACH SLAB TYPE (SEE NOTE 1)	BACKWALL	BEAM NOTCH DEPTH	REMARKS
1	YES	3½"	
1	NO	3½" FOR 17" AND 21" BEAM DEPTHS	SEE NOTE 2
		7½" FOR BEAM DEPTHS 24" AND GREATER	
2	YES	3½"	
2	NO	3½" FOR 17", 21", 24" AND 27" BEAM DEPTHS	SEE NOTE 3
		1'-0½" FOR BEAM DEPTHS 30" AND GREATER	
3	YES	9½" FOR BEAM DEPTHS 39" AND GREATER	SEE NOTES 4 AND 5
4	YES	9½" FOR BEAM DEPTHS 39" AND GREATER	SEE NOTES 4 AND 5
5	N/A	N/A	
RC-23M	N/A	3½"	SEE NOTE 6
NO APPROACH SLAB	N/A	3½"	SEE NOTES 7 AND 8

BEAM NOTCH NOTES:

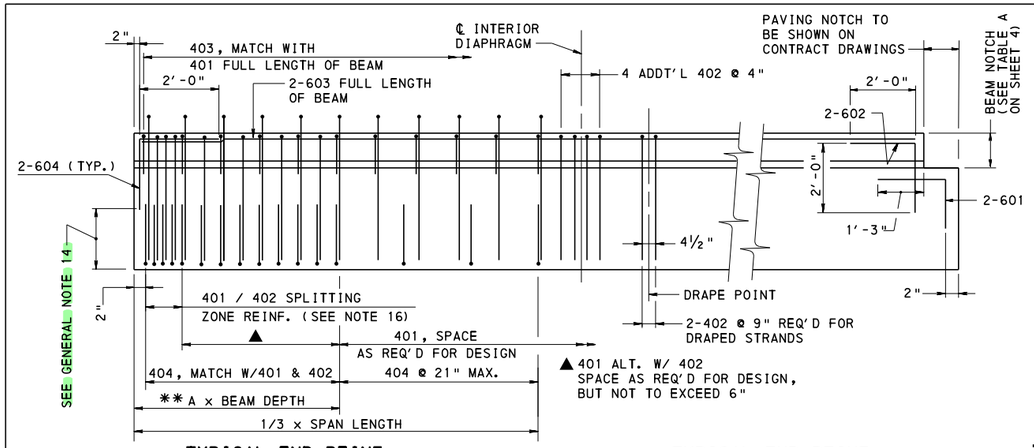
1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. SUPPORT APPROACH SLAB ON ABUTMENT FOR 17" AND 21" DEEP BEAMS.
3. SUPPORT APPROACH SLAB ON ABUTMENT FOR 17", 21", 24" AND 27" DEEP BEAMS.
4. BACKWALL PLACED UNDER APPROACH SLAB.
5. TYPE 3 AND 4 APPROACH SLABS ARE NOT PERMITTED FOR BEAM DEPTHS LESS THAN 39". USE TYPE 1 OR 2 APPROACH SLAB WITH BACKWALL.
6. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.
7. OMIT BEAM NOTCH FOR PLANK BEAMS AND PIER ENDS FOR BEAMS MADE CONTINUOUS.
8. BEAM NOTCH MAY BE OMITTED WHEN PAVING NOTCH IS NOT REQUIRED.
9. ADJUST BEAM NOTCHES AS REQUIRED TO ACCOMMODATE EXPANSION DAMS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
BOX BEAM REINFORCEMENT DETAILS
BEAM NOTCH TABLES

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 8 OF 8
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-661M

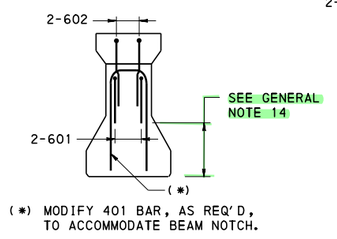
CHANGE 2



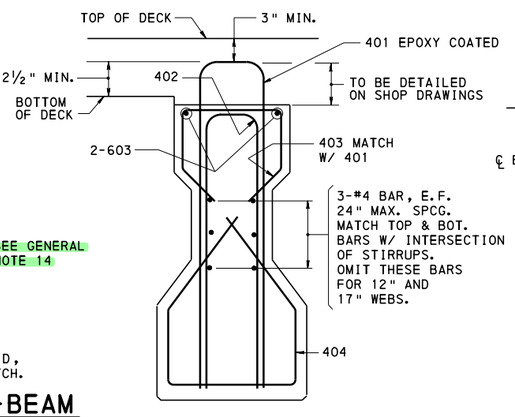
TYPICAL END REINF. WITHOUT NOTCH

TYPICAL END REINF. WITH NOTCH

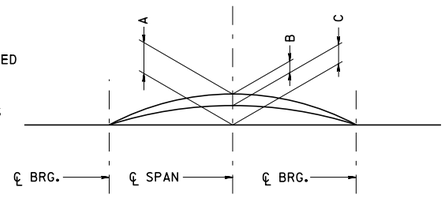
STANDARD PA I-BEAM - ELEVATION



STANDARD PA I-BEAM ADDITIONAL NOTCH REINF. END VIEW



STANDARD PA I-BEAM TYPICAL SECTION



BEAM CAMBER DIAGRAM

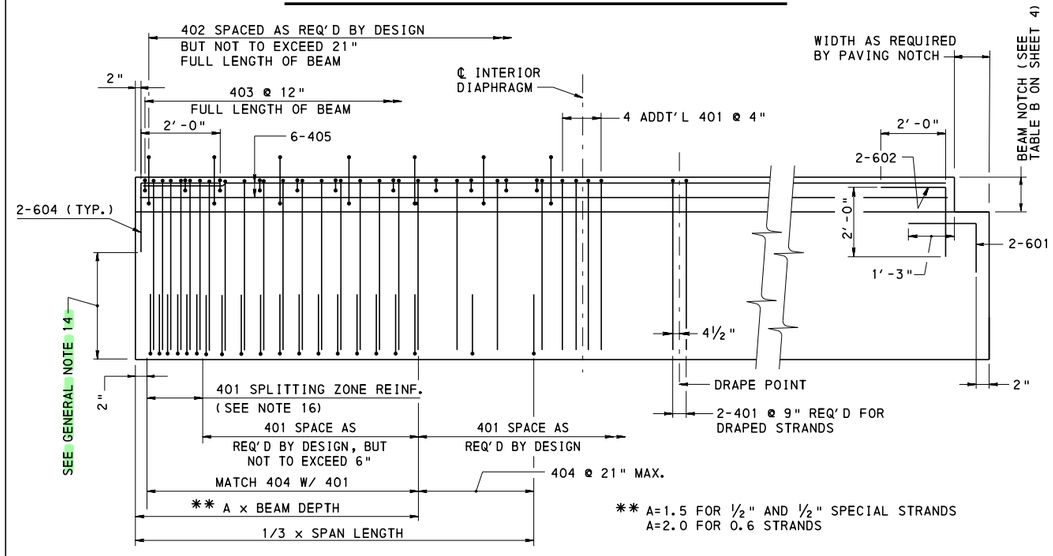
A = ESTIMATED PRESTRESS CAMBER LESS DEFLECTION DUE TO DEAD LOAD OF BEAM TIMES CREEP FACTOR. (CHECK IN FIELD.)

B = DEFLECTION DUE TO ALL DEAD LOAD EXCEPT BEAM WEIGHT AND FUTURE WEARING SURFACE.

C = A - B = NET FINAL CAMBER.
VARY THE THICKNESS OF THE CONCRETE HAUNCH TO COMPENSATE FOR ANY INACCURACIES IN BEAM CAMBER.

A, B AND C ARE THEORETICAL VALUES AND MAY VARY WITH ACTUAL CONCRETE STRENGTH (AGE), VARIOUS PRESTRESSING CONDITIONS, CREEP FACTOR AND PRESTRESS LOSSES.

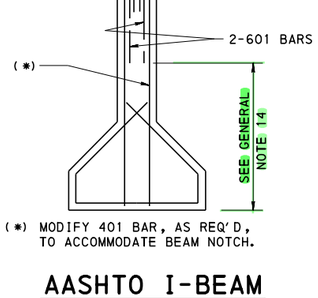
USE A CREEP FACTOR EQUAL TO 1.6 AND P/S LOSS EQUAL TO 10%.



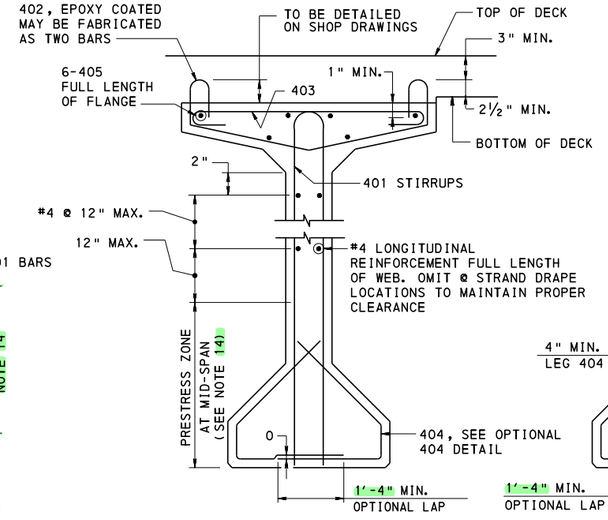
TYPICAL END REINF. WITHOUT NOTCH

TYPICAL END REINF. WITH NOTCH

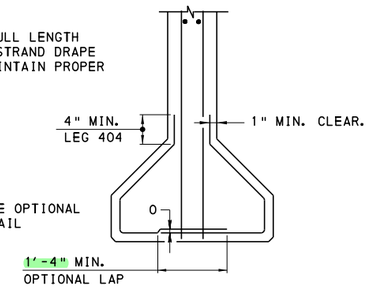
AASHTO I-BEAM - ELEVATION



AASHTO I-BEAM ADDITIONAL NOTCH REINF. END VIEW



AASHTO I-BEAM TYPICAL SECTION



OPTIONAL 404 DETAIL

GENERAL NOTES:

1. PROVIDE MATERIAL AND WORK QUALITY IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATIONS AS OUTLINED IN THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
2. DESIGNER TO SPECIFY STEEL CORROSION PROTECTION AS PER DESIGN MANUAL PART 4, D5.4.3.6P.
3. EPOXY COAT ALL REBARS FOR A DISTANCE OF 9'-0" FROM BEAM ENDS ADJACENT TO DECK JOINTS.
4. EPOXY COAT ALL REINFORCEMENT WHICH PROTRUDES INTO BRIDGE DECK FROM TOP OF BEAMS.
5. SHOW DESIGN LENGTH AND CASTING LENGTH ON SHOP DRAWINGS.
6. SHOW PLAN, ELEVATION, SECTIONS AND ALL REINFORCEMENT DETAILS ON SHOP DRAWINGS.
7. SHOW ANY MODIFICATIONS TO REINFORCEMENT SPLICE AND BENDING DETAILS ON SHOP DRAWINGS.
8. CALCULATE BEARING SEAT ELEVATION, SLOPE AND HAUNCH DEPTH USING THE NET FINAL CAMBER - "C".
9. SHOW THE FOLLOWING DATA ON THE SHOP DRAWINGS:
   1) THE SIZE AND LOCATION OF THE TEMPORARY STORAGE SUPPORTS.
   2) THE TYPE AND LOCATION OF THE BRACING AND TEMPORARY SUPPORTS USED FOR THE TRANSPORTATION AND ERECTION OF THE BEAMS.
10. END ZONE REINFORCEMENT MAY BE INCREASED BY FABRICATOR TO REFLECT FABRICATOR'S EXPERIENCE AND/OR TO CONTROL CRACKING.
11. FABRICATOR TO CHECK STABILITY FOR HANDLING AND TRANSPORTING OF THE MEMBERS.
12. TEMPERATURE REINFORCEMENT IN WEB MAY BE OMITTED, BUT ONLY IN THE AREA WHERE IT INTERFERS WITH DRAPED PRESTRESSING STRANDS.
13. MIN. COVER : STIRRUPS - 1" MIN.
    ALL OTHERS - 1½" MIN.
14. PRESTRESS ZONE IS DEFINED AS THE DISTANCE FROM THE BOTTOM OF BEAM TO THE TOP ROW OF STRANDS.
15. #5 SIZE BARS MAY BE USED FOR SHEAR STIRRUPS IF THE REQUIRED SPACING FOR #4 BARS IS LESS THAN 3".
16. TO SATISFY THE AREA REQUIREMENTS IN AASHTO LRFD ARTICLE 5.9.4.4.1, USE 3" SPACING FOR 401 AS LONG AS REQUIRED BY DESIGN.
17. BEAM FABRICATORS ARE REQUIRED TO SHOW SUPPLEMENTAL WEB REINFORCEMENT ON SHOP DRAWINGS AT THE ENDS OF 96" DEEP I-BEAMS ADJACENT TO CONTINUITY DIAPRHAGMS.
18. FOR PA BULB-TEE BEAM DETAILS, SEE SHEET 2.

REFERENCE DRAWINGS	
BD-601M	CONCRETE DECK SLAB
BD-628M	BRIDGE APPROACH SLABS
BD-651M	REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCK, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS
BD-652M	P/S BEAM SIZES AND SECTION PROPERTIES
BD-653M	TYPICAL FRAMING PLANS AND DETAILS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BD-664M	CONTINUITY FOR LIVE LOAD DETAILS - I-BEAM AND PA BULB-TEE BEAM BRIDGES
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-755M	BEARINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

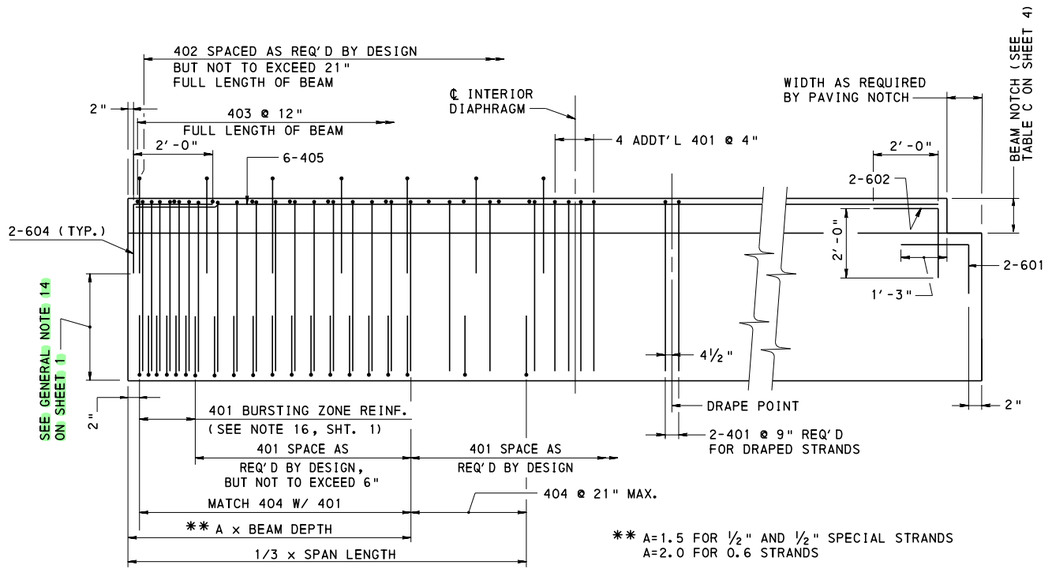
STANDARD I-BEAM & PA BULB-TEE BEAM REINFORCEMENT DETAILS

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 4

BD-662M



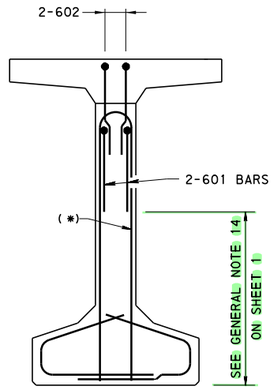
TYPICAL END REINF. WITHOUT NOTCH

TYPICAL END REINF. WITH NOTCH

PA BULB-TEE BEAM - ELEVATION

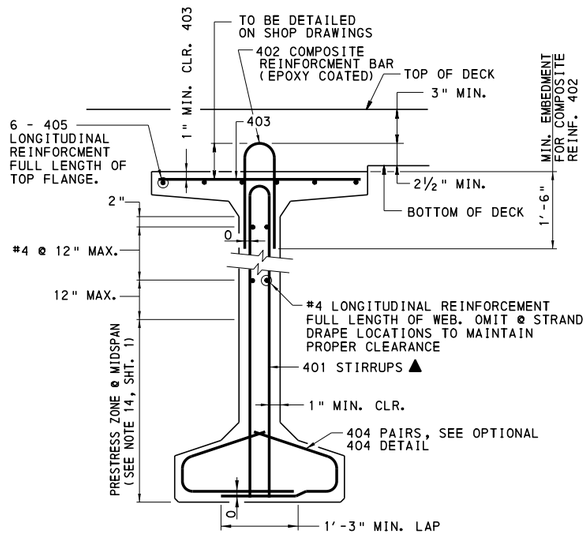
NOTES:

1. FOR GENERAL NOTES AND TYPICAL CAMBER DIAGRAM SEE SHEET 1.
2. FOR AASHTO AND PA I-BEAM DETAILS, SEE SHEET 1.
3. BEAM ENDS ARE PERMITTED TO BE CLIPPED TO AVOID INTERFERENCE WITH ANOTHER BEAM OR BACKWALL. CLIP MUST NOT EXTEND INTO THE WEB UNLESS THE REQUIRED BEAM NOTCH EXTENDS TO THE WEB.



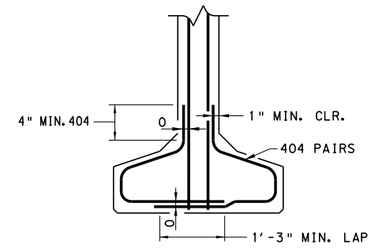
(*) MODIFY 401 BAR, AS REQ'D, TO ACCOMMODATE BEAM NOTCH.

PA BULB-TEE ADDITIONAL NOTCH REINF. END VIEW

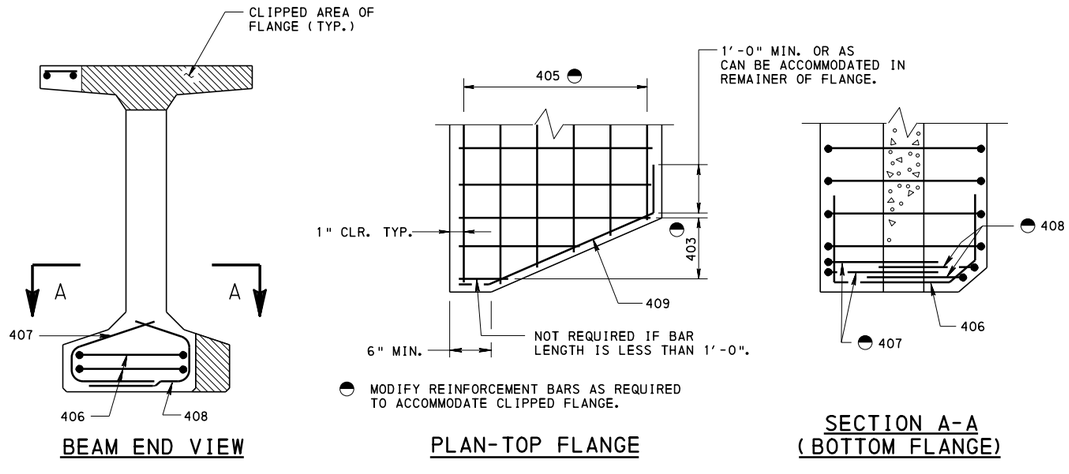


PA BULB-TEE (8" WEB) TYPICAL SECTION

▲ 401 MAY BE UTILIZED BY FABRICATOR TO REPLACE 402 COMPOSITE REINFORCEMENT. ALL 401 REINFORCEMENT BARS PROJECTING INTO THE DECK SLAB MUST BE EPOXY COATED FOR ENTIRE LENGTH.



OPTIONAL 404 DETAIL



BEAM END VIEW

PLAN-TOP FLANGE

SECTION A-A (BOTTOM FLANGE)

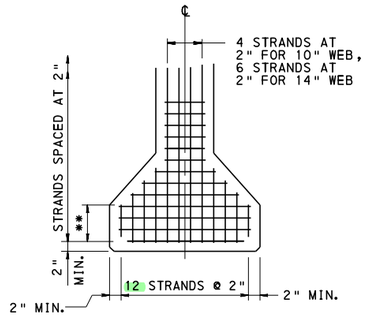
TYPICAL CLIPPED FLANGE REINFORCEMENT DETAILS

BULB TEE SHOWN, SIMILAR FOR AASHTO AND PA I-BEAMS.

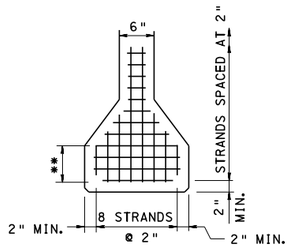
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
I-BEAM & PA BULB-TEE BEAM
REINFORCEMENT DETAILS

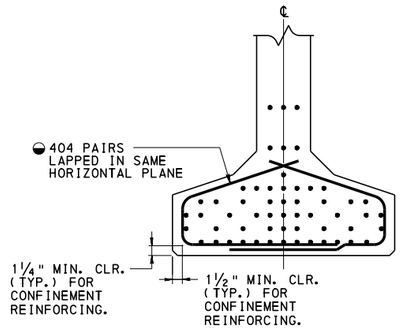
RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 2 OF 4
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-662M



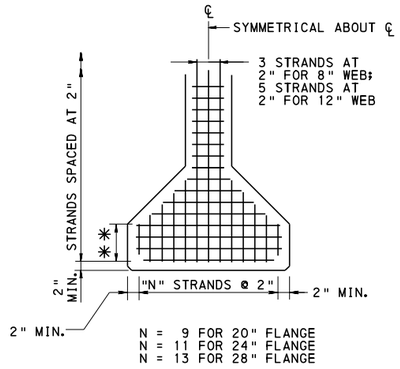
26" BOTTOM FLANGE



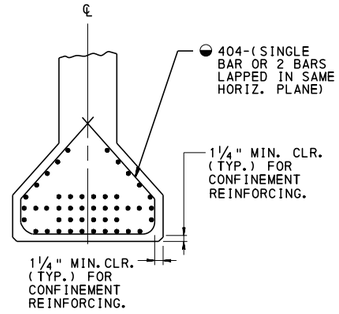
18" BOTTOM FLANGE



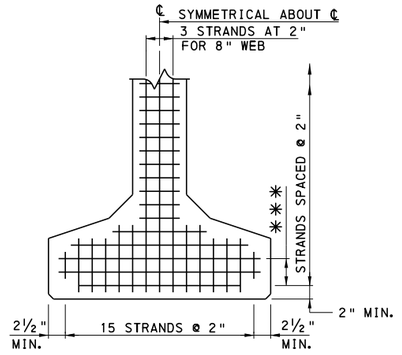
PA BULB-TEE TYP. STRAND CONFINEMENT



20", 24" OR 28" BOTTOM FLANGE



TYP. STRAND CONFINEMENT



33" PA BULB-TEE BOTTOM FLANGE

TYPICAL STRAND LOCATIONS

NOTE: DO NOT PLACE PRESTRESSING STRANDS AT CORNER LOCATION IN BOTTOM ROW.

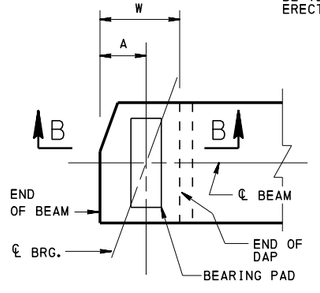
◒ FOR LIMITS OF STRAND CONFINEMENT REINFORCEMENT, REFER TO DESIGN MANUAL PART 4, D5.10.10.2.

** STRAND LOCATION IS 4 ROWS FOR 9" FLANGE; 3 ROWS FOR 7" AND 8" FLANGES; 2 ROWS FOR 4" AND 6" FLANGES.

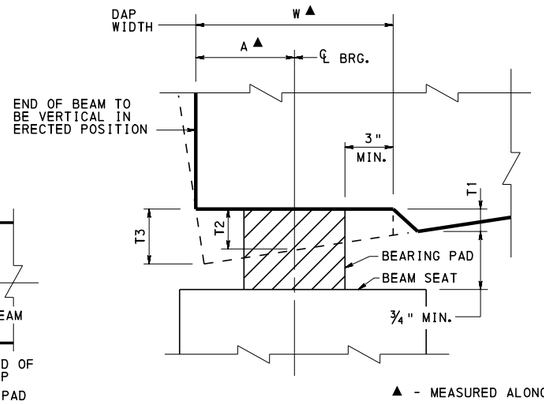
*** STRAND LOCATION IS 3 ROWS FOR 9" FLANGE; 2 ROWS FOR 7" FLANGE.

BEAM DAP NOTES:

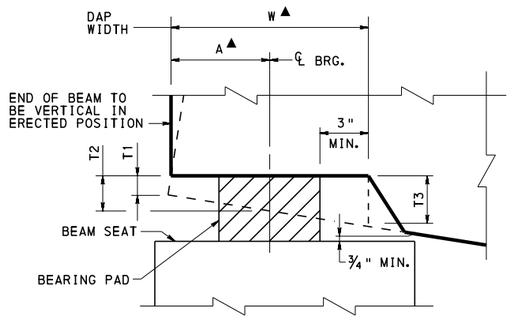
1. T1 IS DAP THICKNESS AT END OF BEAM FOR HIGHER END OF BEAM AND DAP THICKNESS AT BEGINNING OF DAP FOR LOWER END OF BEAM. T1 MINIMUM IS ¼".
2. T2 IS DAP THICKNESS AT CENTERLINE OF BEARING.
3. T3 IS DEFINED AS THE DAP THICKNESS BASED ON THE SLOPE OF THE BEAM DUE TO THE GRADE AND CAMBER.
4. INCREASE IN DISTANCE TO FIRST ROW OF STRANDS COULD RESULT IN STRAND PATTERNS DIFFERENT FROM WHAT IS SHOWN.
5. BEAM SEAT AND BOTTOM OF BEAM BEARING AREA REQUIREMENTS AS PER DESIGN MANUAL PART 4, SECTION 14.7.5.3.8dP
6. MAXIMUM GRADE FOR USE OF DAPPING IS BASED ON LIMITING THE MAXIMUM DAP THICKNESS TO 1½" AND MAINTAINING 1" MINIMUM CONCRETE COVER ON CONFINEMENT REINFORCEMENT IN THE PROPOSED BEAM DAPPING AREA.
7. FOR BEAM DAPPING, A MINIMUM CLEARANCE OF ¾" MUST BE PROVIDED BETWEEN THE BOTTOM OF THE BEAM (WITHOUT CONSIDERATION OF THE DAP) AND THE TOP OF BEAM SEAT TO ENSURE INSPECTABILITY OF BEARING PAD.
8. PARTIAL-WIDTH BEAM DAPS ARE NOT PERMITTED.
9. THE MAXIMUM DAP THICKNESS IS 1½".
10. ENSURE THAT ALL CONCRETE COVER REQUIREMENTS ON STEEL CONFINEMENT REINFORCEMENT AND PRESTRESSING STRANDS ARE SATISFIED WHEN USING BEAM DAPS TO MODIFY THE BOTTOM OF BEAM AREA.



PLAN



SECTION B-B AT LOW END OF BEAM



SECTION B-B AT HIGH END OF BEAM

▲ - MEASURED ALONG ℄ OF BEAM

BEAM DAP DETAILS

MAXIMUM REQUIRED DAP DEPTH (T3) (IN.)	DISTANCE TO FIRST ROW OF STRANDS (IN.)
¼ < (T3) ≤ ¾	2½
¾ < (T3) ≤ 1¼	3
1¼ < (T3) ≤ 1½	3¼
1½ < (T3) *	2

* USE BEVELED SOLE PLATE, SEE BC-755M.

I-BEAM AND PA BULB-TEE BEAM DAP DESIGN PARAMETERS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD I-BEAM & PA BULB-TEE BEAM REINFORCEMENT DETAILS

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 3 OF 4

BD-662M

TABLE A
BEAM NOTCH DEPTHS FOR PA I-BEAMS

APPROACH SLAB TYPE (SEE NOTE 1)	BACKWALL	BEAM NOTCH DEPTH (SEE NOTE 2)	REMARKS
1	YES	T2 + B3	
1	NO	T2 + B3 IF GREATER THAN 9½"	
		9½" IF T2 + B3 IS LESS THAN 9½" (NOTCH TO EXTEND INTO WEB)	
2	YES	T2 + B3	
2	NO	T2 + B3 IF GREATER THAN 1'-2½"	
		1'-2½" IF T2 + B3 IS LESS THAN 1'-2½" (NOTCH TO EXTEND INTO WEB)	
3	YES	T2 + B3 IF GREATER THAN 11½"	
		11½" IF T2 + B3 IS LESS THAN 11½" (NOTCH TO EXTEND INTO WEB)	SEE NOTES 3 AND 4
4	YES	T2 + B3 IF GREATER THAN 11½"	
		11½" IF T2 + B3 IS LESS THAN 11½" (NOTCH TO EXTEND INTO WEB)	SEE NOTES 3 AND 4
5	N/A	N/A	
RC-23M	N/A	T2 + B3	SEE NOTE 5
NO APPROACH SLAB	N/A	T2 + B3	SEE NOTES 6 AND 7

BEAM NOTCH NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. REFER TO BD-652M FOR DIMENSIONS T2 AND B3.
3. BACKWALL PLACED UNDER APPROACH SLAB.
4. TYPE 3 AND 4 APPROACH SLABS ARE ONLY PERMITTED FOR BEAM DEPTHS 26/54, 24/60, 26/60, 24/63 AND 26/63. IF BEAM DEPTH IS NOT INDICATED USE TYPE 1 OR 2 APPROACH SLAB WITH BACKWALL.
5. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.
6. OMIT BEAM NOTCH AT PIER ENDS FOR BEAMS MADE CONTINUOUS.
7. BEAM NOTCH MAY BE OMITTED WHEN PAVING NOTCH IS NOT REQUIRED.
8. ADJUST BEAM NOTCHES AS REQUIRED TO ACCOMMODATE EXPANSION DAMS.

TABLE B
BEAM NOTCH DEPTHS FOR AASHTO I-BEAMS

APPROACH SLAB TYPE (SEE NOTE 1)	BACKWALL	BEAM NOTCH DEPTH (SEE NOTE 2)	REMARKS
1	YES	T2 + D1 + B3	
1	NO	T2 + D1 + B3	
2	YES	T2 + D1 + B3	
2	NO	1'-2½" (NOTCH TO EXTEND INTO WEB)	
3	YES	T2 + D1 + B3	SEE NOTE 3
4	YES	T2 + D1 + B3	SEE NOTE 3
5	N/A	N/A	
RC-23M	N/A	T2 + D1 + B3	SEE NOTE 4
NO APPROACH SLAB	N/A	T2 + D1 + B3	SEE NOTES 5 AND 6

BEAM NOTCH NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. REFER TO BD-652M FOR DIMENSIONS T2, D1 AND B3.
3. BACKWALL PLACED UNDER APPROACH SLAB.
4. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.
5. OMIT BEAM NOTCH AT PIER ENDS FOR BEAMS MADE CONTINUOUS.
6. BEAM NOTCH MAY BE OMITTED WHEN PAVING NOTCH IS NOT REQUIRED.
7. ADJUST BEAM NOTCHES AS REQUIRED TO ACCOMMODATE EXPANSION DAMS.

TABLE C
BEAM NOTCH DEPTHS FOR PA BULB-TEE BEAMS

APPROACH SLAB TYPE (SEE NOTE 1)	BACKWALL	BEAM NOTCH DEPTH (SEE NOTE 2)	REMARKS
1	YES	T2 + D1 + B3	
1	NO	9½" (NOTCH TO EXTEND INTO WEB)	
2	YES	T2 + D1 + B3	
2	NO	1'-2½" (NOTCH TO EXTEND INTO WEB)	
3	YES	11½" (NOTCH TO EXTEND INTO WEB)	SEE NOTES 3 AND 4
4	YES	11½" (NOTCH TO EXTEND INTO WEB)	SEE NOTES 3 AND 4
5	N/A	N/A	
RC-23M	N/A	T2 + D1 + B3	SEE NOTE 5
NO APPROACH SLAB	N/A	T2 + D1 + B3	SEE NOTES 6 AND 7

BEAM NOTCH NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. REFER TO BD-652M FOR DIMENSIONS T2, D1 AND B3.
3. BACKWALL PLACED UNDER APPROACH SLAB.
4. TYPE 3 AND 4 APPROACH SLABS ARE NOT PERMITTED FOR BEAM DEPTHS LESS THAN 47.25" USE TYPE 1 OR 2 APPROACH SLAB WITH BACKWALL.
5. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.
6. OMIT BEAM NOTCH AT PIER ENDS FOR BEAMS MADE CONTINUOUS.
7. BEAM NOTCH MAY BE OMITTED WHEN PAVING NOTCH IS NOT REQUIRED.
8. ADJUST BEAM NOTCHES AS REQUIRED TO ACCOMMODATE EXPANSION DAMS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
I-BEAM & PA BULB-TEE BEAM REINFORCEMENT DETAILS

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 4 OF 4
		BD-662M

CHANGE 4

NOTES:

1. DESIGN SPECIFICATIONS:
   -AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AND COMMENTARY 7TH EDITION
   -PENNDOT DESIGN MANUAL, PART 4 (DM-4) APRIL 29, 2015.
   -AASHTO/AWS D1.5M/D1.5: 2008-BRIDGE WELDING CODE.

2. MATERIAL STRENGTH:
   -REINFORCEMENT STEEL: GRADE 60, EPOXY COATED
   -STRUCTURAL STEEL: ASTM A709 GRADE 50
   -CONCRETE f'c = 4 KSI (CLASS AAAP CONCRETE) FOR DECK SLABS AND CONCRETE END DIAPHRAGMS AND f'c = 3.5 KSI (CLASS AA CONCRETE) FOR BARRIERS
   -MODULAR RATIO (Es/Ec) N = 8
   -ALL BOLTS TO BE ASTM F3125 GRADE A325, HAVING AN UNTHREADED SHANK OF SUFFICIENT LENGTH TO NOT ALLOW ANY THREADS TO EXIST IN THE PLANE BETWEEN THE CONNECTED PARTS (SHEAR PLANE)

3. LIVE LOAD: -AS PER DESIGN MANUAL PART 4.

4. DESIGN LOAD:
   -NORMAL WEIGHT CONCRETE = 150 LB./FT³
   -F-SHAPE BARRIER, MODIFIED = 700 LB./FT.
   -FUTURE WEARING SURFACE = 30 LB./FT²
   -MAXIMUM OVERLAY/WEARING SURFACE PLACED AT TIME OF INITIAL CONSTRUCTION. = 23 LB./FT²
   -DECK SLAB AND BARRIER LOADS ARE ASSUMED TO BE PLACED USING SHORED CONSTRUCTION.

5. DESIGN CONTROLS:
   -CONCRETE COVER: DECK TOTAL TOP COVER = 2"; DECK BOTTOM COVER = 1"; BARRIER = 2"
   -MIN. CLEAR DISTANCE BETWEEN REINFORCEMENT MATS = 2"
   -BAR SIZE: MAXIMUM BAR SIZE: #6; MINIMUM BAR SIZE: #4; S1 AND S2, BARS: #6; S3 AND S4 BARS: #4
   -BAR SPACINGS: MAXIMUM SPACING = 12" SLAB, 12" BARRIER
   -PLACE A 1¼" LATEX MODIFIED CONCRETE OR POLYESTER POLYMER CONCRETE (PPC) WEARING SURFACE ON THE 7½" PRECAST DECK PRIOR TO OPENING BRIDGE TO TRAFFIC. AN EPOXY OVERLAY, IF EQUIVALENT IN WEIGHT, IS ALSO ALLOWED AS AN ALTERNATIVE.

6. USE ONLY FUSION BONDED EPOXY COATED REINFORCEMENT IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.

7. REINFORCEMENT IN SOME SECTIONS NOT SHOWN FOR CLARITY.

8. DYNAMIC LOAD ALLOWANCE FOR DECK SLAB DESIGN (IM) = 50%
   DYNAMIC LOAD ALLOWANCE STEEL BEAM DESIGN (IM) = 33%

9. DRAWINGS ARE NOT TO SCALE.

10. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68°F.

11. ALL DIMENSIONS SHOWN ARE HORIZONTAL, UNLESS OTHERWISE NOTED.

12. FOR STANDARD TYPICAL WATERPROOFING AND EXPANSION DETAILS SEE BC-788M.

13. SUBMIT SHOP DRAWINGS FOR FLEX BEAM PANELS AND ASSOCIATED COMPONENTS.

14. NO-LOAD CAMBER TOLERANCE AT MIDSPAN SHALL BE 0 IN. TO +0.5 IN. NO-LOAD CAMBER OF GIRDERS SHALL MEET THE REQUIREMENTS SPECIFIED IN THE DESIGN DRAWINGS. CAMBER PRIOR TO WELDING AND PRIMING.

15. HOLES SHALL BE DRILLED. PUNCHING MAY BE ALLOWED BUT WILL BE SUBJECT TO APPROVAL. IF PUNCHING IS USED, CUT HOLES CLEAN WITHOUT TORN OR RAGGED EDGES.

16. LIFTING DEVICES SHALL BE DESIGNED BY THE CONTRACTOR AND SUBMITTED AS PART OF THE SHOP DRAWING SUBMISSION.

17. DO NOT MAKE WELDS BY MANUAL SHIELDED METAL ARC PROCESS FOR PRIMARY GIRDER WELDS, SUCH AS FLANGE-TO-WEB WELDS OR FOR SHOP SPLICES OF WEBS AND FLANGES.

18. PAINT STRUCTURAL STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 1060.

19. CASTING OF THE DECK SHALL BE FULLY SUPPORTED.

20. STEEL T REQUIRES MIDSPAN SUPPORT TO NO LOAD CONDITION DURING CASTING.

21. INTERFACE OF PRECAST PANELS ALONG THE TRANSVERSE AND LONGINTUDINAL JOINTS SHALL BE BLAST CLEANED TO CREATE AN EXPOSED AGGREGATE FINISH.

22. PRE-WET PRECAST INTERFACE OF JOINT WITH WATER TO CREATE A SATURATED SURFACE CONDITION.

23. PLACE THE FOLLOWING NOTE ON THE CONTRACT DRAWINGS - "THE STEEL SUPERSTRUCTURE SHALL BE DETAILED AND FABRICATED FOR TOTAL DEAD LOAD FIT (TDLF). GIRDER WEBS SHALL BE PLUMB UNDER THE FULL DEAD LOAD EXISTING AT THE END OF CONSTRUCTION."

24. PROVIDE CHARPY V-NOTCH (CVN) TESTING FOR ZONE 2 FOR WEB AND FLANGE PLATES PER PUB. 408, SECTION 1105.02(a)5.

25. FILLET WELD SIZES ARE GOVERNED BY MATERIAL THICKNESS IN ACCORDANCE WITH AASHTO/AWS EXCEPT AS NOTED.

26. SLIGHTLY STAGGER LONGITUDINAL REBARS IN THE BRIDGE DECK SUCH THAT NO REBAR IN THE TOP MAT IS DIRECTLY ABOVE A REBAR IN THE BOTTOM MAT.

LEGEND:

DIA.	-	DIAMETER
ø	-	DIAMETER
U.H.P.C.	-	ULTRA-HIGH PERFORMANCE CONCRETE
EQ.	-	EQUAL
SPA.	-	SPACING

DESIGN NOTES:

1. IF NEEDED DETAILS ARE NOT FOUND IN THIS STANDARD, A SPECIAL SUBMISSION REQUESTING APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.

2. THE INFORMATION SHOWN IN THIS STANDARD IS PROVIDED FOR USE IN THE DEVELOPMENT OF THE CONTRACT DOCUMENTS. THE DESIGNER IS RESPONSIBLE FOR THE PRESENTATION OF ALL DESIGN INFORMATION.

3. USE THIS STANDARD FOR FLEXBEAM STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THIS STANDARD AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS.

4. THE DESIGNER MUST PROVIDE THE INFORMATION OBTAINED FROM THE DESIGN TABLES AND DETAILS ON THE CONTRACT DRAWINGS.

5. DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF THE STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE DESIGN TABLES CONTAINED IN THIS STANDARD. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THESE DESIGN TABLES.

6. DESIGN TABLES INCLUDED IN THIS STANDARD ARE BASED ON THE DESIGN CRITERIA SHOWN ON THIS SHEET.

7. THE SPAN RANGE INCLUDED IN THIS STANDARD IS AS FOLLOWS:
   BD-663M: FLEXBEAM STRUCTURES FROM 30' TO 70'

8. THE DESIGN TABLES INCLUDE ACCEPTABLE MEMBER AND MODULE SIZES AND SPACINGS FOR VARIOUS STRUCTURE WIDTHS.

9. CAMBERS ARE GIVEN ASSUMING PRECAST BARRIERS ARE USED AND ARE PLACED USING SHORED CONSTRUCTION. IF CAST-IN-PLACE BARRIERS ARE USED, THE DESIGNER IS TO MODIFY DEAD LOAD CAMBERS ACCORDINGLY.

10. FLEX BEAMS ARE DESIGNED TO SATISFY LIVE LOAD DEFLECTION REQUIREMENT:
    ΔMAX ≤ L/800

11. BEARINGS ARE TO BE DESIGNED BY THE ENGINEER AND ARE NOT INCLUDED AS PART OF THIS STANDARD.

12. SUBSTRUCTURE UNITS ARE TO BE DESIGNED BY THE ENGINEER AND ARE NOT INCLUDED AS PART OF THIS STANDARD.

13. THIS STANDARD APPLIES TO STRAIGHT BRIDGES WITH A SKEW OF 90 DEGREES.

14. DETAIL ALL BARS ON THE CONTRACT DRAWINGS.

15. FOR STANDARD DOUBLE MODULE DESIGN, SEE SHEET NO. 2.

16. STEEL END DIAPHRAGM DESIGN AVAILABLE. FOR STEEL END DIAPHRAGM DETAILS, SEE SHEET NO. 4.

17. CONCRETE END DIAPHRAGM DESIGN AVAILABLE. FOR CONCRETE DIAPHRAGM DETAILS, SEE SHEET NO. 5.

18. FOR BEAM AND SHEAR CONNECTOR DESIGN TABLES, SEE SHEET NO. 3.

19. FOR CAMBER DESIGN TABLES, SEE SHEET NO. 6.

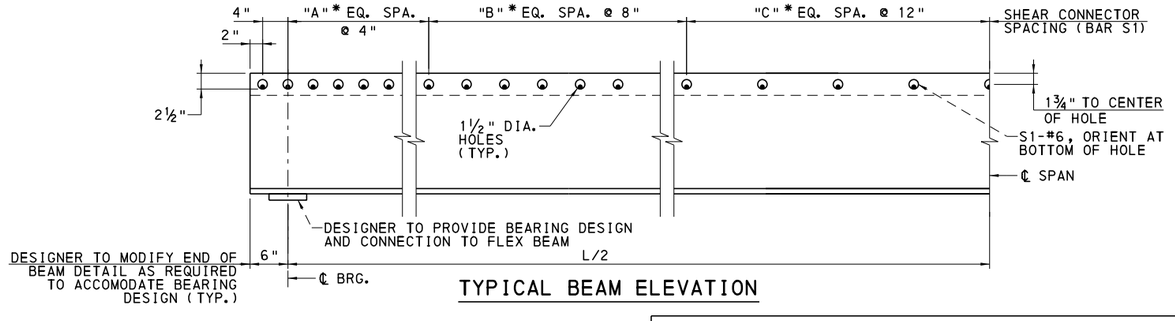
20. ULTRA HIGH PERFORMANCE CONCRETE STRENGTH VARIES WITH TIME, DESIGNER SHOULD CHECK WITH MANUFACTURER TO DETERMINE APPROPRIATE MATERIAL FOR PROJECT SCHEDULE.

21. MASH COMPLIANT F-SHAPED BARRIER SHOWN. OTHER MASH COMPLIANT BARRIERS MAY BE SUBSTITUTED AT THE DISCRETION OF THE DISTRICT BRIDGE ENGINEER.

22. LATEX MODIFIED CONCRETE, PPC OVERLAY, OR EPOXY OVERLAY ARE ALL ACCEPTABLE AS A FINAL RIDING SURFACE AT THE DISCRETION OF THE DISTRICT BRIDGE ENGINEER.

23. IN ORDER TO MAKE MINOR CHANGES TO THE CROSS SLOPE, THE THICKNESS OF THE OVERLAY CAN BE VARIED WITHIN THE FOLLOWING PARAMETERS:
    -MINIMUM OVERLAY THICKNESS OF 1¼"
    -MAXIMUM OVERLAY THICKNESS OF 4" AND AVERAGE OVERLAY THICKNESS OF 2" OR LESS.

24. LIVE LOAD DISTRIBUTION FACTOR FOR FLEXURE IS 0.30. LIVE LOAD DISTRIBUTION FACTOR FOR SHEAR IS FROM AASHTO 8TH EDITION/DM-4 2019. FOR STEEL TEE SPACINGS OR SPANS OUTSIDE THE RANGES SHOWN IN THESE STANDARDS, DISTRIBUTION FACTORS SHALL BE DETERMINED BY THE ENGINEER.



TYPICAL BEAM ELEVATION

* FOR NUMBER OF SPACES, "A", "B", AND "C", SEE DESIGN TABLES ON SHEET NO. 3.

BD-601M	CONCRETE DECK SLAB
BD-660M	DECK SLAB, FORMS AND STEEL REINFORCEMENT PLACEMENT
BC-752M	CONCRETE DECK SLAB DETAILS
BC-754M	STEEL DIAPHRAGMS FOR STEEL BEAM/GIRDER STRUCTURES
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

REFERENCE DRAWINGS

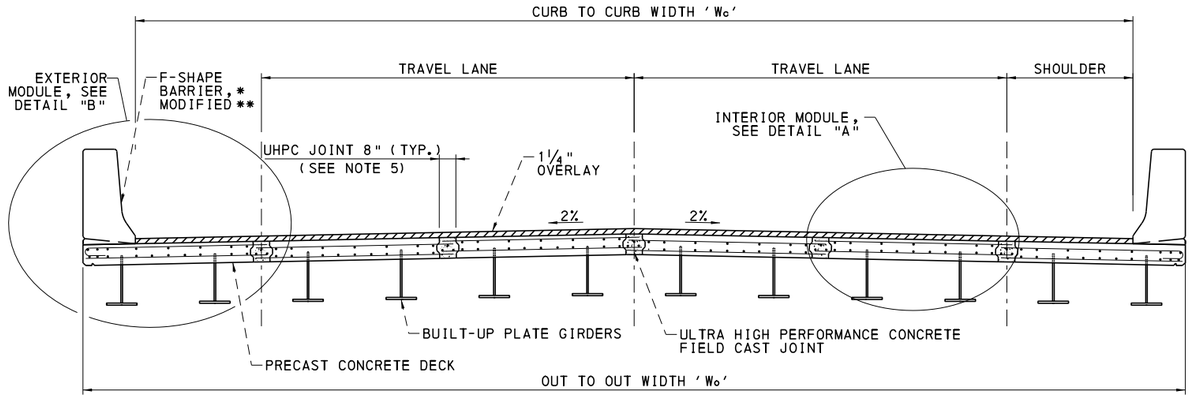
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR FLEX BEAM BRIDGES GENERAL NOTES

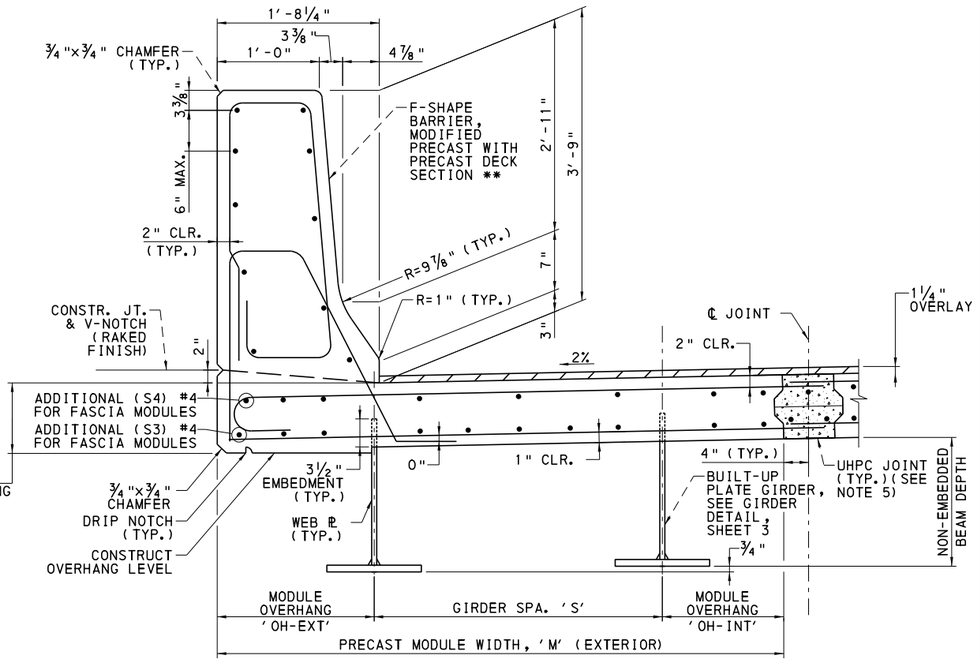
RECOMMENDED JUNE 1, 2021
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED JUNE 1, 2021
Bruce B. Thyson
DIRECTOR, BUR. OF PROJECT DELIVERY

BD-663M

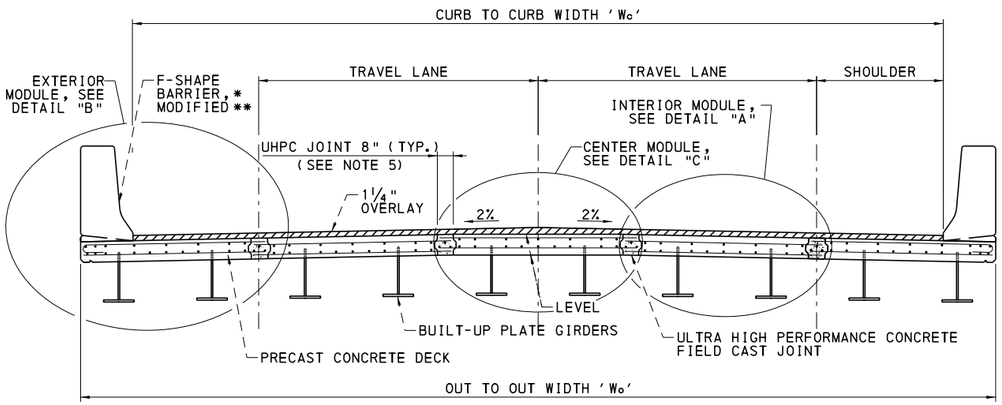


TYPICAL DECK SECTION - DOUBLE MODULE (EVEN NUMBER OF MODULES)

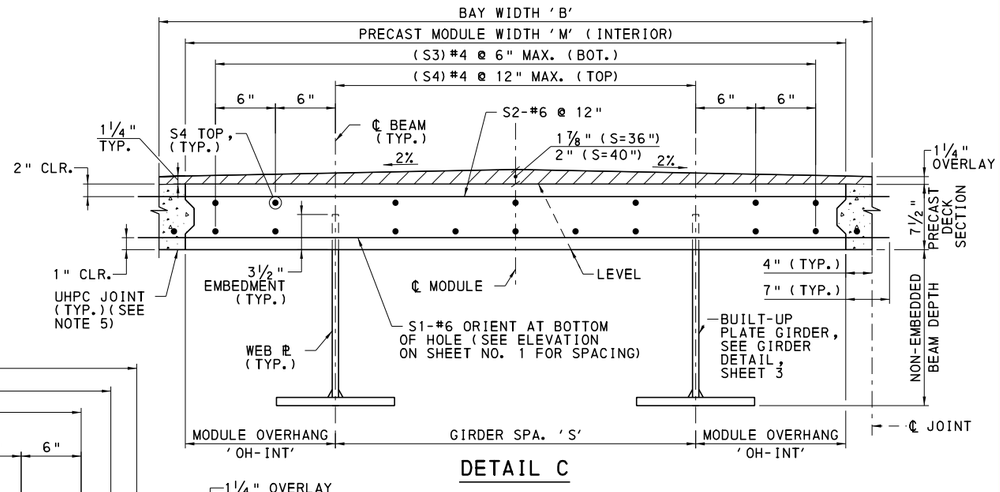


DETAIL B

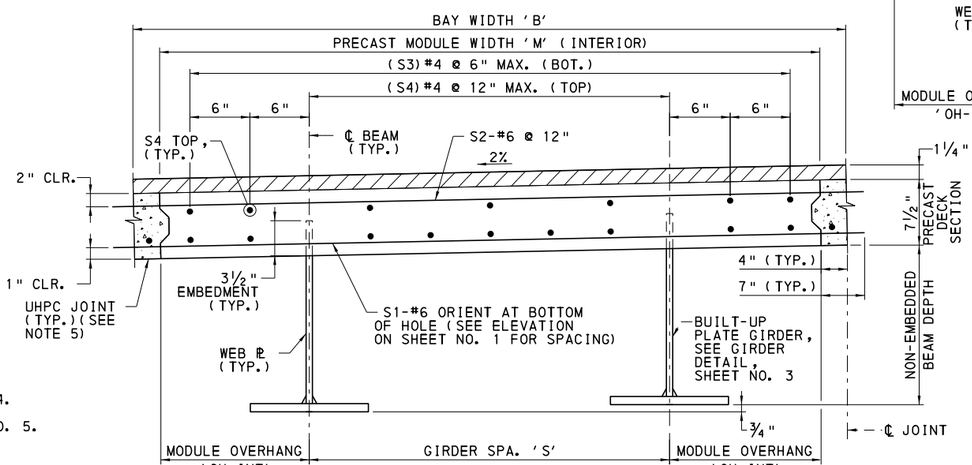
(UNLESS OTHERWISE NOTED, SEE DETAIL A, THIS SHEET FOR DECK REINFORCEMENT)



TYPICAL DECK SECTION - DOUBLE MODULE (ODD NUMBER OF MODULES)



DETAIL C



DETAIL A

LEGEND:

- ULTRA HIGH PERFORMANCE CONCRETE
- WEARING SURFACE/OVERLAY

* 45" F-SHAPED BARRIER, MODIFIED SHOWN. OTHER MASH COMPLIANT BARRIERS PERMITTED AS PER THE DISTRICT BRIDGE ENGINEER.

** REFER TO BD-601M FOR REINFORCEMENT.

NOTES:

1. FOR DESIGN TABLES, SEE SHEET NO. 3.
2. FOR STEEL END DIAPHRAGM DETAILS, SEE SHEET NO. 4.
3. FOR CONCRETE END DIAPHRAGM DETAILS, SEE SHEET NO. 5.
4. FOR GENERAL AND DESIGN NOTES, SEE SHEET NO. 1.
5. SEE LONGITUDINAL JOINT AND CLOSURE POUR DETAIL, SHEET NO. 3.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR FLEX BEAM BRIDGES TYPICAL SECTIONS

RECOMMENDED JUNE 1, 2021
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED JUNE 1, 2021
Bruce B. Thyson
DIRECTOR, BUR. OF PROJECT DELIVERY

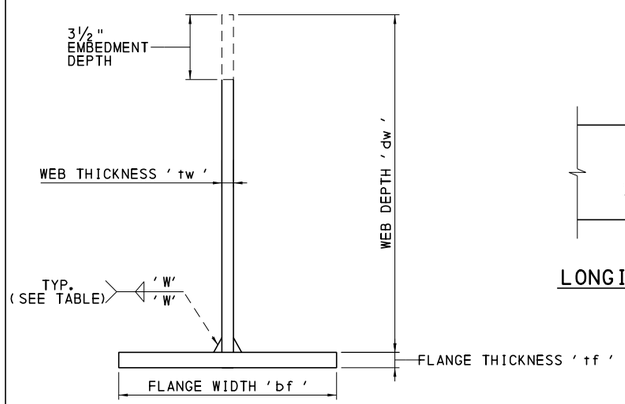
BD-663M

NOTES:

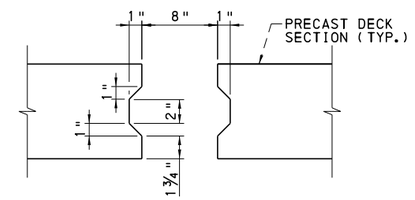
1. FOR STEEL END DIAPHRAGM DETAILS, SEE SHEET NO. 4.
2. FOR CONCRETE END DIAPHRAGM DETAILS, SEE SHEET NO. 5.
3. FOR GENERAL AND DESIGN NOTES, SEE SHEET NO. 1.
4. FOR TYPICAL SECTIONS, SEE SHEET NO. 2.
5. FOR CAMBER TABLES, SEE SHEET NO. 6.

SPAN LENGTH, 'L' (C/C BRGS., FT.)	DESIGN ROADWAY WIDTH, 'W' (FT)	GIRDER SPACING, 'S' (IN)	BAY WIDTH, 'B' (IN)	PRECAST MODULE WIDTH		NUMBER OF MODULES	OUT TO OUT WIDTH, 'Wo' (FT)	ACTUAL CURB TO CURB WIDTH, 'Wc' (FT)	OVERHANG WIDTH		STEEL PLATE GIRDER					SHEAR CONNECTOR SPACING INFORMATION		
				INTERIOR MODULE WIDTH, 'M' (IN)	EXTERIOR MODULE WIDTH, 'M' (IN)				INTERIOR OVERHANG 'OH-INT' (IN)	EXTERIOR OVERHANG, 'OH-EXT' (IN)	BOTTOM FLANGE		WEB		STIFFENER DEPTH, 'ds' (IN)	'A' SPACES @ 4"	'B' SPACES @ 8"	'C' SPACES @ 12"
											THICKNESS, 'tf' (IN)	WIDTH, 'bf' (IN)	DEPTH, 'dw' (IN)	THICKNESS, 'tw' (IN)				
30	24	36	72	64	68	5	30.00	26.63	14	18	0.500	12	17.500	0.375	13.40	25	7	2
	28	40	80	72	76	5	33.33	29.96	16	20	0.500	12	17.500	0.375	13.40	26	8	1
	32	36	72	64	68	6	36.00	32.63	14	18	0.500	12	17.500	0.375	13.40	25	7	2
	36	40	80	72	76	6	40.00	36.63	16	20	0.500	12	17.500	0.375	13.40	26	8	1
	40	40	80	72	76	7	46.67	43.29	16	20	0.500	12	17.500	0.375	13.40	26	8	1
40	24	36	72	64	68	5	30.00	26.63	14	18	0.500	12	20.500	0.375	16.40	30	12	2
	28	40	80	72	76	5	33.33	29.96	16	20	0.750	12	20.250	0.375	16.15	31	10	3
	32	36	72	64	68	6	36.00	32.63	14	18	0.500	12	20.500	0.375	16.40	30	12	2
	36	40	80	72	76	6	40.00	36.63	16	20	0.750	12	20.250	0.375	16.15	31	10	3
	40	40	80	72	76	7	46.67	43.29	16	20	0.750	12	20.250	0.375	16.15	31	10	3
50	24	36	72	64	68	5	30.00	26.63	14	18	0.625	12	24.375	0.500	20.28	30	12	7
	28	40	80	72	76	5	33.33	29.96	16	20	1.000	12	24.000	0.500	19.90	31	13	6
	32	36	72	64	68	6	36.00	32.63	14	18	0.625	12	24.375	0.500	20.28	30	12	7
	36	40	80	72	76	6	40.00	36.63	16	20	1.000	12	24.000	0.500	19.90	31	13	6
	40	40	80	72	76	7	46.67	43.29	16	20	1.000	12	24.000	0.500	19.90	31	13	6
60	24	36	72	64	68	5	30.00	26.63	14	18	0.750	12	30.250	0.625	26.15	30	15	10
	28	40	80	72	76	5	33.33	29.96	16	20	0.875	12	30.125	0.625	26.03	33	18	7
	32	36	72	64	68	6	36.00	32.63	14	18	0.750	12	30.250	0.625	26.15	30	15	10
	36	40	80	72	76	6	40.00	36.63	16	20	0.875	12	30.125	0.625	26.03	33	18	7
	40	40	80	72	76	7	46.67	43.29	16	20	0.875	12	30.125	0.625	26.03	33	18	7
70	24	36	72	64	68	5	30.00	26.63	14	18	0.750	12	33.250	0.625	29.15	38	17	11
	28	40	80	72	76	5	33.33	29.96	16	20	1.125	12	32.875	0.625	28.78	39	15	12
	32	36	72	64	68	6	36.00	32.63	14	18	0.750	12	33.250	0.625	29.15	38	17	11
	36	40	80	72	76	6	40.00	36.63	16	20	1.125	12	32.875	0.625	28.78	39	15	12
	40	40	80	72	76	7	46.67	43.29	16	20	1.125	12	32.875	0.625	28.78	39	15	12

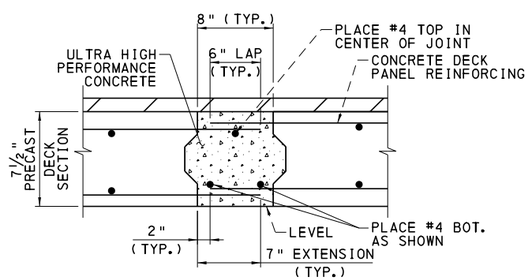
BASE METAL OF THICKER PART JOINED (T)(IN.)	'W', MIN. SIZE OF FILLET WELD (IN.)
$T \leq \frac{3}{4}$	$\frac{1}{4}$
$\frac{3}{4} < T$	$\frac{5}{16}$



GIRDER DETAIL



LONGITUDINAL JOINT DETAIL



LONGITUDINAL CLOSURE POUR

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

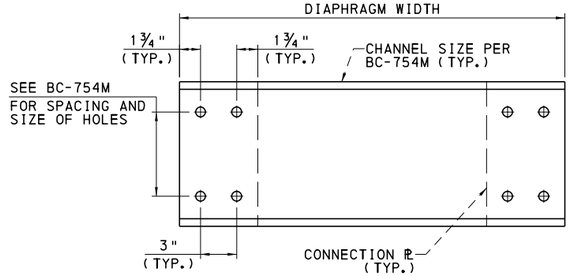
STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR FLEX BEAM BRIDGES DESIGN TABLES

RECOMMENDED JUNE 1, 2021
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

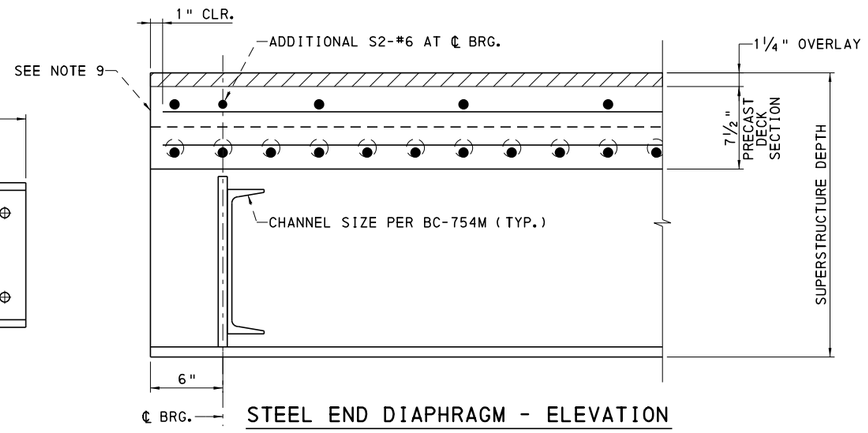
RECOMMENDED JUNE 1, 2021
Bruce B. Thorsen
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 3 OF 6

BD-663M



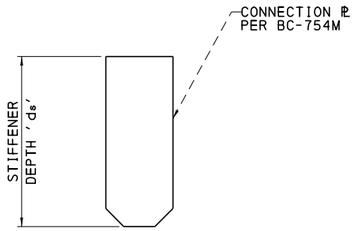
DIAPHRAGM DETAIL



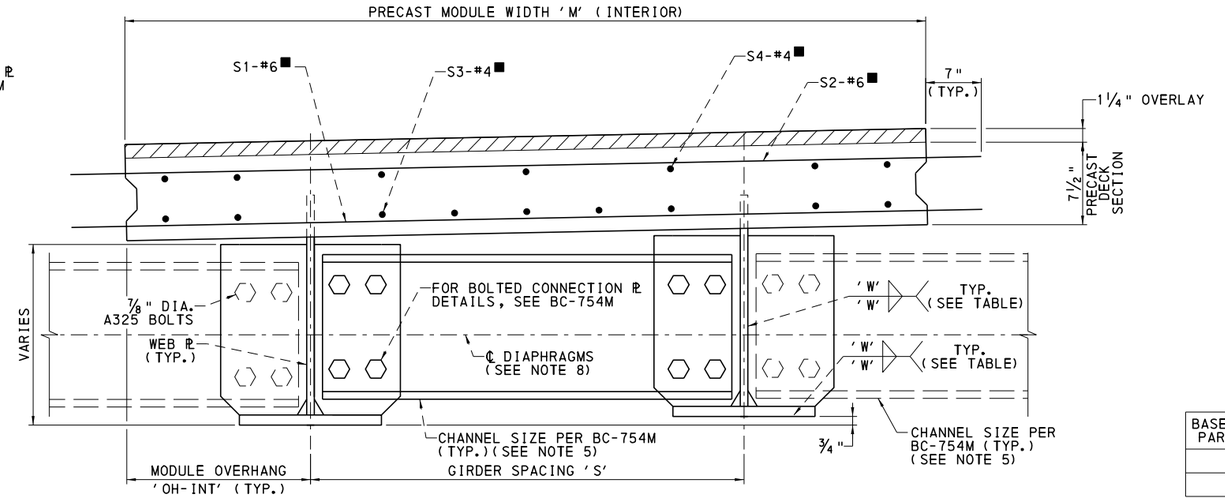
STEEL END DIAPHRAGM - ELEVATION

NOTES:

1. FOR TYPICAL SECTIONS, SEE SHEET NO. 2.
2. FOR GENERAL AND DESIGN NOTES, SEE SHEET NO. 1.
3. FOR DESIGN TABLES, SEE SHEET NO. 3.
4. FOR CAMBER TABLES, SEE SHEET NO. 6.
5. DIAPHRAGMS TO BE PLACED AND CONNECTED TO STIFFENERS PRIOR TO PLACEMENT OF PRECAST MODULES. DESIGNER TO CONFIRM DIAPHRAGM DEPTH IS SUITABLE FOR CONSTRUCTABILITY AND MAINTENANCE PURPOSES FOR EACH INDIVIDUAL DESIGN APPLICATION.
6. DIAPHRAGMS BETWEEN PRECAST MODULES TO BE PLACED AND CONNECTED TO STIFFENERS IN THE FIELD AFTER PLACEMENT OF PRECAST MODULES.
7. FOR CONCRETE END DIAPHRAGMS, SEE SHEET NO. 5.
8. PLACE STEEL END DIAPHRAGMS CENTERED VERTICALLY ABOUT THE ℄ OF THE STIFFENERS.
9. WHEN A NEOPRENE STRIP SEAL IS TO BE USED, ADJUST AND COORDINATE LOCATION OF LAST TWO TRANSVERSE BARS BEYOND ℄ BRG. TO ALLOW PLACEMENT OF STEEL EXTRUSION.



STIFFENER DETAIL



STEEL END DIAPHRAGM - SECTION

BASE METAL OF THICKER PART JOINED (T) (IN.)	'W', MIN. SIZE OF FILLET WELD (IN.)
T≤¾	¼
¾<T	5/16

LEGEND:

■ FOR SPACING AND LOCATION DETAILS, SEE SHEET NO. 2.

WEARING SURFACE/OVERLAY

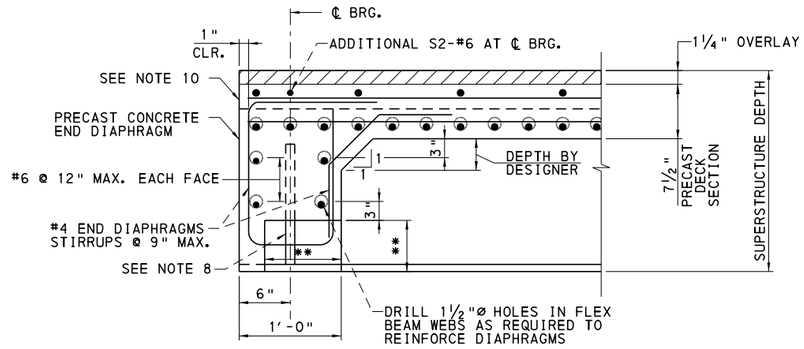
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR FLEX BEAM BRIDGES STEEL END DIAPHRAGMS

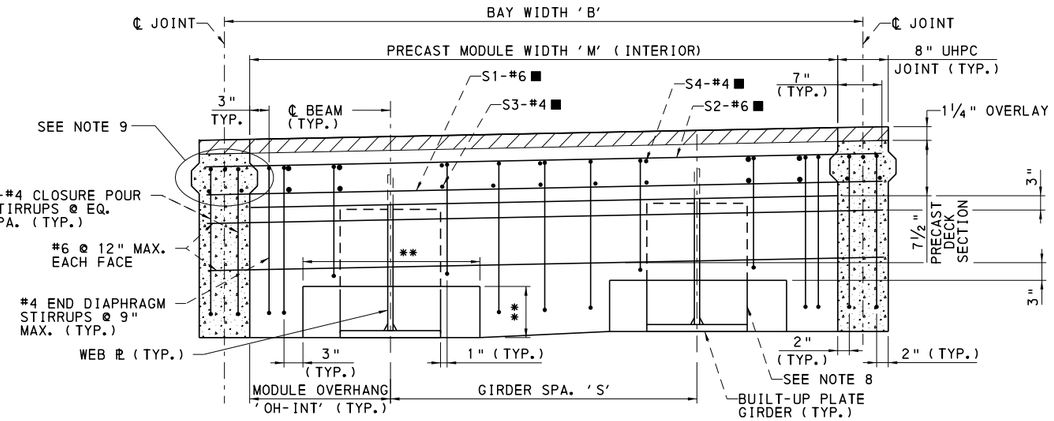
RECOMMENDED JUNE 1, 2021
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED JUNE 1, 2021
Bruce B. Thyson
DIRECTOR, BUR. OF PROJECT DELIVERY

BD-663M



CONCRETE END DIAPHRAGM - ELEVATION



CONCRETE END DIAPHRAGM - SECTION

NOTES:

1. BLOCKOUT SIZE TO BE DETERMINED BY THE ENGINEER.
2. FOR TYPICAL SECTIONS, SEE SHEET NO. 2.
3. FOR GENERAL AND DESIGN NOTES, SEE SHEET NO. 1.
4. FOR DESIGN TABLES, SEE SHEET NO. 3.
5. FOR CAMBER TABLES, SHEET NO. 6.
6. CONCRETE END DIAPHRAGMS TO BE PRECAST WITH THE MODULES. ULTRA HIGH PERFORMANCE CONCRETE LONGITUDINAL JOINT TO BE CAST IN THE FIELD AFTER PLACEMENT OF PRECAST MODULES.
7. FOR STEEL END DIAPHRAGMS, SEE SHEET NO. 4.
8. FOR STIFFENER DETAIL, SEE SHEET NO. 4.
9. FOR REINFORCEMENT OF LONGITUDINAL DECK CLOSURE POUR, SEE SHEET NO. 3.
10. WHEN A NEOPRENE STRIP SEAL IS TO BE USED, ADJUST AND COORDINATE LOCATION OF LAST TWO TRANSVERSE BARS BEYOND ℄ BRG. TO ALLOW PLACEMENT OF STEEL EXTRUSION.

LEGEND:

- ■ FOR SPACING AND LOCATION DETAILS, SEE SHEET NO. 2.
- ** FORMED BLOCKOUT FOR BEARING (SEE NOTE 1) (TYP.)
- ULTRA HIGH PERFORMANCE CONCRETE
- WEARING SURFACE/OVERLAY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR FLEX BEAM BRIDGES CONCRETE END DIAPHRAGMS

RECOMMENDED JUNE 1, 2021	RECOMMENDED JUNE 1, 2021	SHEET 5 OF 6
Thomas P. Macioce	Bruce B. Thyson	BD-663M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	

CAMBER AND THEORETICAL DEAD LOAD DEFLECTIONS, INCHES - FOR L = 30′ SPAN																					
DEFLECTION / CAMBER	LOCATION																				
	0		0.1		0.2		0.3		0.4		0.5		0.6		0.7		0.8		0.9		1.0	
GIRDER SPACING 'S' (IN.)	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40
DEAD LOAD DEFLECTIONS (TYPE 1)	0	0	1/16	1/16	1/16	1/16	1/8	1/8	1/8	1/8	1/8	3/16	1/8	1/8	1/8	1/8	1/16	1/16	1/16	1/16	0	0
DEAD LOAD DEFLECTIONS (TYPE 2)	0	0	1/16	1/16	1/16	1/16	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/16	1/16	1/16	1/16	0	0
VERTICAL PROFILE CAMBER (NOTE A)																						
TOTAL CAMBER (NOTE B)																						

CAMBER AND THEORETICAL DEAD LOAD DEFLECTIONS, INCHES - FOR L = 40′ SPAN																					
DEFLECTION / CAMBER	LOCATION																				
	0		0.1		0.2		0.3		0.4		0.5		0.6		0.7		0.8		0.9		1.0	
GIRDER SPACING 'S' (IN.)	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40
DEAD LOAD DEFLECTIONS (TYPE 1)	0	0	1/8	1/8	3/16	3/16	5/16	1/4	5/16	5/16	3/8	5/16	5/16	5/16	5/16	1/4	3/16	3/16	1/8	1/8	0	0
DEAD LOAD DEFLECTIONS (TYPE 2)	0	0	1/8	1/16	3/16	3/16	1/4	3/16	5/16	1/4	5/16	1/4	5/16	1/4	1/4	3/16	3/16	3/16	1/8	1/16	0	0
VERTICAL PROFILE CAMBER (NOTE A)																						
TOTAL CAMBER (NOTE B)																						

CAMBER AND THEORETICAL DEAD LOAD DEFLECTIONS, INCHES - FOR L = 50′ SPAN																					
DEFLECTION / CAMBER	LOCATION																				
	0		0.1		0.2		0.3		0.4		0.5		0.6		0.7		0.8		0.9		1.0	
GIRDER SPACING 'S' (IN.)	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40
DEAD LOAD DEFLECTIONS (TYPE 1)	0	0	3/16	1/8	5/16	5/16	7/16	3/8	1/2	7/16	9/16	1/2	1/2	7/16	7/16	3/8	5/16	5/16	3/16	1/8	0	0
DEAD LOAD DEFLECTIONS (TYPE 2)	0	0	1/8	1/8	5/16	1/4	3/8	5/16	7/16	3/8	1/2	3/8	7/16	3/8	3/8	5/16	5/16	1/4	1/8	1/8	0	0
VERTICAL PROFILE CAMBER (NOTE A)																						
TOTAL CAMBER (NOTE B)																						

CAMBER AND THEORETICAL DEAD LOAD DEFLECTIONS, INCHES - FOR L = 60′ SPAN																					
DEFLECTION / CAMBER	LOCATION																				
	0		0.1		0.2		0.3		0.4		0.5		0.6		0.7		0.8		0.9		1.0	
GIRDER SPACING 'S' (IN.)	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40
DEAD LOAD DEFLECTIONS (TYPE 1)	0	0	3/16	3/16	3/8	3/8	9/16	9/16	5/8	5/8	11/16	11/16	5/8	5/8	9/16	9/16	3/8	3/8	3/16	3/16	0	0
DEAD LOAD DEFLECTIONS (TYPE 2)	0	0	3/16	3/16	5/16	5/16	7/16	7/16	1/2	1/2	9/16	1/2	1/2	1/2	7/16	7/16	5/16	5/16	3/16	3/16	0	0
VERTICAL PROFILE CAMBER (NOTE A)																						
TOTAL CAMBER (NOTE B)																						

CAMBER AND THEORETICAL DEAD LOAD DEFLECTIONS, INCHES - FOR L = 70′ SPAN																					
DEFLECTION / CAMBER	LOCATION																				
	0		0.1		0.2		0.3		0.4		0.5		0.6		0.7		0.8		0.9		1.0	
GIRDER SPACING 'S' (IN.)	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40	36	40
DEAD LOAD DEFLECTIONS (TYPE 1)	0	0	5/16	5/16	5/8	9/16	13/16	3/4	15/16	7/8	1	15/16	15/16	7/8	13/16	3/4	5/8	9/16	5/16	5/16	0	0
DEAD LOAD DEFLECTIONS (TYPE 2)	0	0	1/4	1/4	1/2	7/16	11/16	9/16	13/16	11/16	13/16	11/16	13/16	11/16	11/16	9/16	1/2	7/16	1/4	1/4	0	0
VERTICAL PROFILE CAMBER (NOTE A)																						
TOTAL CAMBER (NOTE B)																						

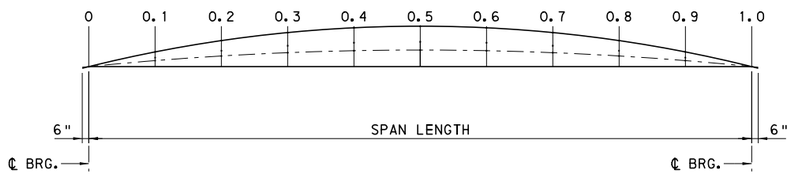
CAMBER DEFLECTION NOTES:

TYPE 1 = THEORETICAL DEAD LOAD DEFLECTION CALCULATED USING THE LONG TERM MOMENT OF INERTIA DUE TO SELF-WT OF STEEL BEAM, (INCLUDING DIAPHRAGMS), AND THE TRIBUTARY WIDTH OF THE DECK (ASSUMING SHORED CONSTRUCTION). ALSO INCLUDES DEAD LOAD DEFLECTION USING THE LONG TERM MOMENT OF INERTIA DUE TO SELF-WT OF 1¼" WEARING SURFACE/OVERLAY PLACED AT TIME OF CONSTRUCTION.

TYPE 2 = THEORETICAL DEAD LOAD DEFLECTION CALCULATED USING THE LONG TERM MOMENT OF INERTIA DUE TO SELF-WT OF BARRIER (ASSUMING SHORED CONSTRUCTION). NOTE THAT TYPE 2 DEAD LOAD DEFLECTIONS ARE ONLY APPLICABLE TO THE OUTERMOST FLEX BEAM UNITS (FASCIA GIRDER AND FIRST INTERIOR GIRDER).

NOTE A: AS REQUIRED BY DESIGN, TO BE PROVIDED BY FINAL DESIGN ENGINEER.

NOTE B: TOTAL CAMBER TO INCLUDE CAMBER REQUIRED FOR DEAD LOAD DEFLECTIONS TYPE 1 AND TYPE 2, AND FOR VERTICAL PROFILE, AS REQUIRED BY DESIGN.



NO-LOAD CAMBER TOLERANCE = 0 TO +0.5 IN. AT MIDSPAN. POSITIVE CAMBER IS UPWARD.

———— INITIAL CAMBER - THE INITIAL, NO LOAD CAMBER.

— - — - LONG-TERM CAMBER - THE ACTUAL PROFILE OF THE COMPOSITE SPAN UNDER DEAD LOAD OF STEEL WT AND CONCRETE DECK USING THE LONG TERM MOMENT OF INERTIA.

NOTES:

1. FOR GENERAL AND DESIGN NOTES, SEE SHEET NO. 1.
2. FOR DESIGN TABLES, SEE SHEET NO. 3.
3. DEAD LOAD OF STEEL T COMPONENTS AND CONCRETE SLAB IS CARRIED ON A COMPOSITE SECTION.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR FLEX BEAM BRIDGES

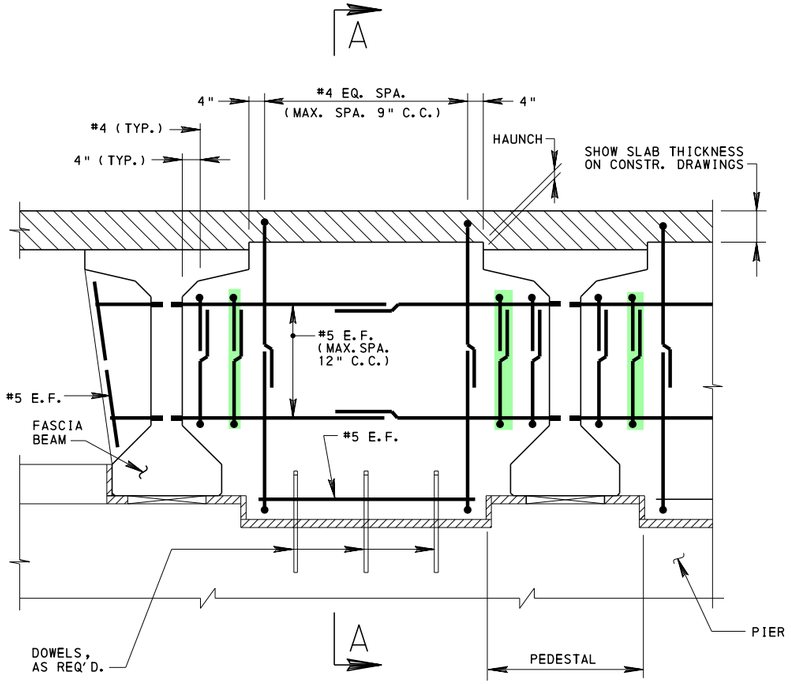
BEAM CAMBER

RECOMMENDED JUNE 1, 2021
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

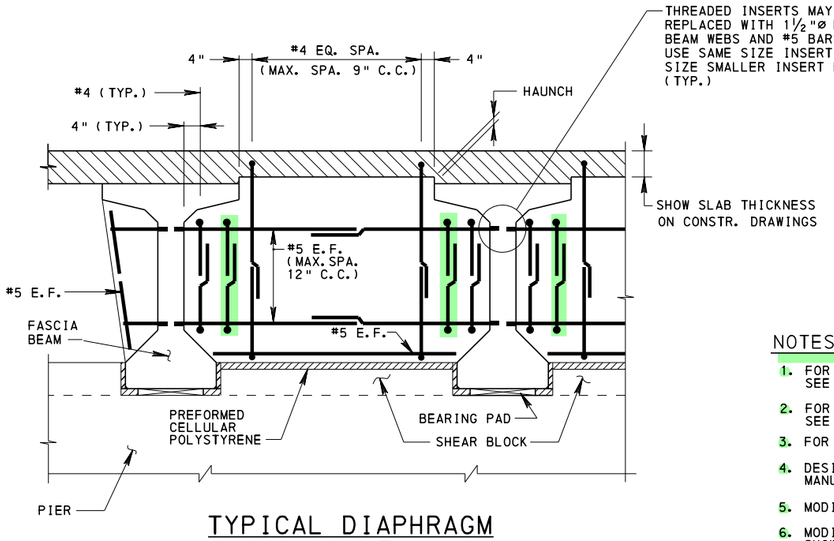
RECOMMENDED JUNE 1, 2021
Bruce B. Thyson
DIRECTOR, BUR. OF PROJECT DELIVERY

BD-663M

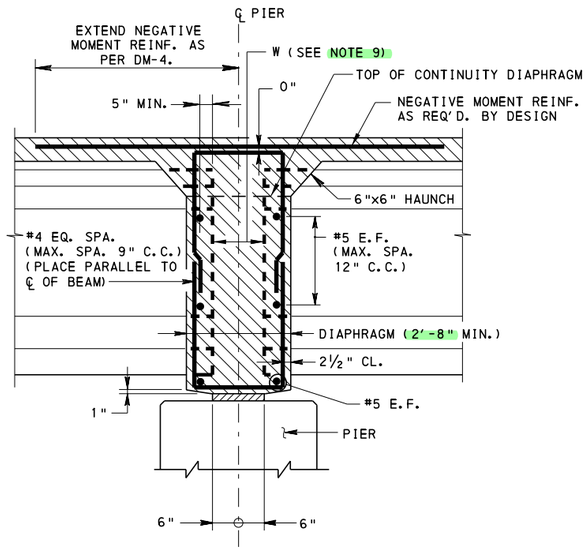
CHANGE 2



TYPICAL DIAPHRAGM AT PIER
(FIXED)



TYPICAL DIAPHRAGM AT PIER
(EXP.)



SECTION A-A
(DOWELS NOT SHOWN)

TYPICAL LONGITUDINAL SECTION AT PIER
(FIXED CONDITION SHOWN)
(EXPANSION CONDITION SIMILAR)

NOTES:

1. FOR LOCATION OF DOWELS, SHEAR BLOCKS OR CURTAIN WALLS, SEE BD-658M.
2. FOR SLAB REINFORCEMENT AND PLACEMENT OF DIAPHRAGM CONCRETE, SEE BD-660M.
3. FOR BEAM REINFORCEMENT, SEE BD-662M.
4. DESIGNER TO SPECIFY STEEL CORROSION PROTECTION AS PER DESIGN MANUAL PART 4, DESIGN SPECIFICATIONS, D5.4.3.6P.
5. MODIFY DETAILS AS REQUIRED FOR BRIDGES ON SKEWS.
6. MODIFY DOWELS AS REQUIRED TO RESIST HORIZONTAL FORCES. DOWELS SHOWN ARE THE MINIMUM REQUIRED.
7. FOR DOWEL DETAIL, SEE BC-775M.
8. FOR WATERPROOFING AND EXPANSION DETAILS, SEE BC-788M.
9. PROVIDE MIMIMUM CLEAR DISTANCE (W) BETWEEN THE ENDS OF BEAMS AS FOLLOWS:

   WITH POSITIVE MOMENT REINFORCEMENT

   SINGLE LAYER OF POSITIVE MOMENT REINFORCEMENT:
   10" WIDTH FOR #4 AND #5
   12" WIDTH FOR #6 AND #7
   14" WIDTH FOR #8

   TWO LAYERS OF POSITIVE MOMENT REINFORCEMENT:
   12" WIDTH FOR #4 AND #5
   14" WIDTH FOR #6 AND #7
   16" WIDTH FOR #8

   WITHOUT POSITIVE MOMENT REINFORCEMENT

   4"

10. POSITIVE MOMENT REINFORCEMENT BARS MUST BE THE SAME SIZE WITHIN A BEAM.
11. WHEN KINKED BEAMS ARE USED, DESIGN THE BRIDGE AS SIMPLE SPAN MADE CONTINUOUS WITHOUT THE NEED FOR POSITIVE MOMENT REINFORCEMENT. FULL CONTINUITY WITH POSITIVE MOMENT REINFORCEMENT WILL BE PERMITTED ONLY WITH THE CHIEF BRIDGE ENGINEER'S APPROVAL. FOR ALTERNATE DESIGNS AND DESIGN-BUILD PROJECTS, KINKING THE GIRDERS WITH FULL CONTINUITY MAY ONLY BE PROPOSED IF SPECIFICALLY PERMITTED IN THE CONTRACT SPECIAL PROVISIONS.
12. HORIZONTAL OFFSETS OF OPPOSING GIRDERS ARE NOT PERMITTED.

BD-656M	TYPICAL LONGITUDINAL SECTIONS I-BEAM AND BOX BEAM BRIDGES
BD-658M	SHEAR BLOCK DETAILS AT PIER
BD-660M	DECK SLAB AND STEEL REINFORCEMENT PLACEMENT
BD-662M	I-BEAM & PA BULB-TEE BEAM REINFORCEMENT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-775M	MISCELLANEOUS PRESTRESS DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

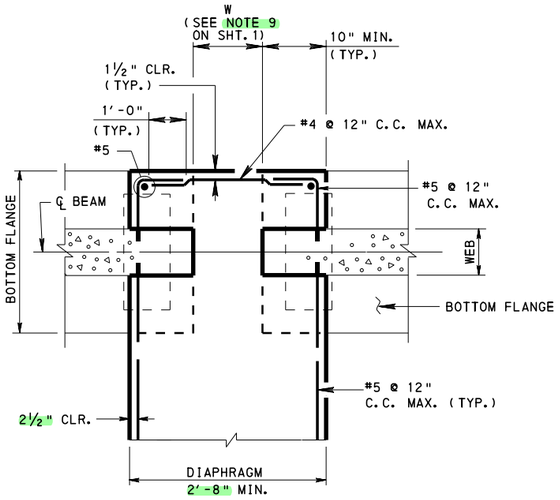
REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CONTINUITY FOR LIVE LOAD DETAILS I-BEAM & PA BULB-TEE BEAM BRIDGES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

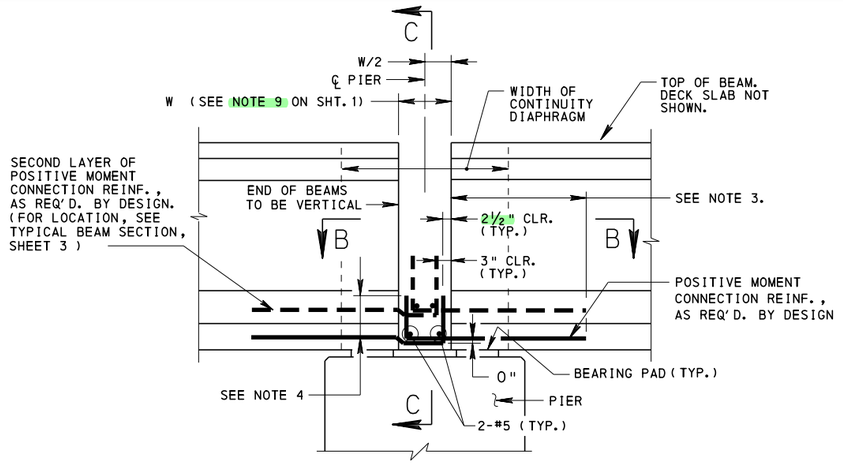


PLAN

TOP FLANGE OF BEAM NOT SHOWN FOR CLARITY

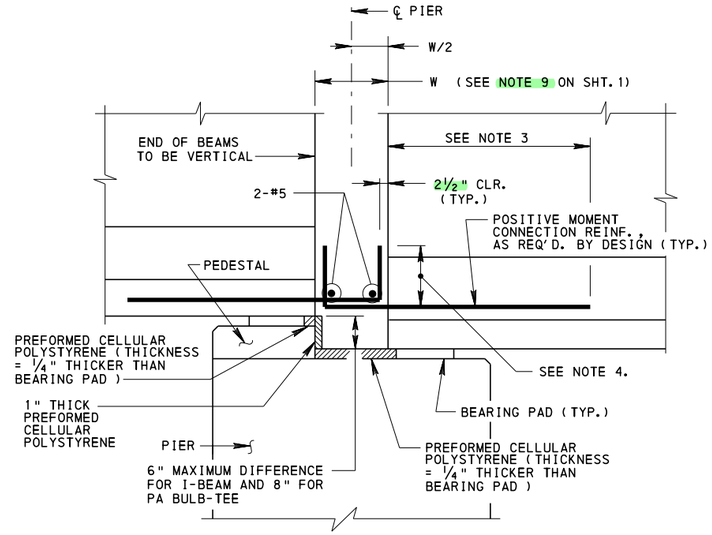
TYPICAL DIAPHRAGM DETAIL FASCIA BEAM

(FASCIA DIAPHRAM TO BE NORMAL TO BEAMS FOR SKEWED BRIDGES)



POSITIVE MOMENT CONNECTION DETAIL AT PIER

(SAME BEAM DEPTH)



POSITIVE MOMENT CONNECTION DETAIL AT PIER

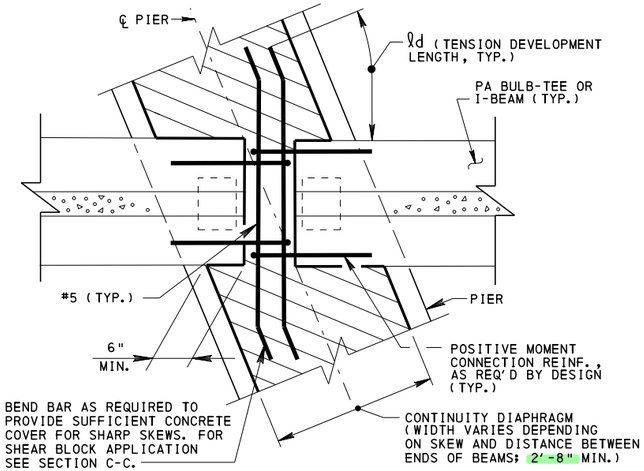
(DIFFERENT BEAM DEPTH-FIXED)

POSITIVE MOMENT CONNECTION NOTES:

1. PLACE POSITIVE MOMENT REINFORCEMENT SYMMETRICAL ABOUT THE CENTERLINE OF BEAM.
2. MAXIMUM SIZE FOR POSITIVE MOMENT REINFORCEMENT IS #8. LARGER SIZE MAY BE USED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.
3. EMBED POSITIVE MOMENT REINFORCEMENT BARS INTO THE PRESTRESSED BEAM A MINIMUM OF TWO TIMES THE TRANSFER LENGTH OF THE PRESTRESSING STRANDS PLUS THE TENSION DEVELOPMENT LENGTH OF THE POSITIVE MOMENT REINFORCEMENT BAR. EXTEND EVERY OTHER BAR AN ADDITIONAL 9" TO PROVIDE A STAGGERED CUTOFF CONDITION.
4. PROVIDE VERTICAL LEG AS FOLLOWS:

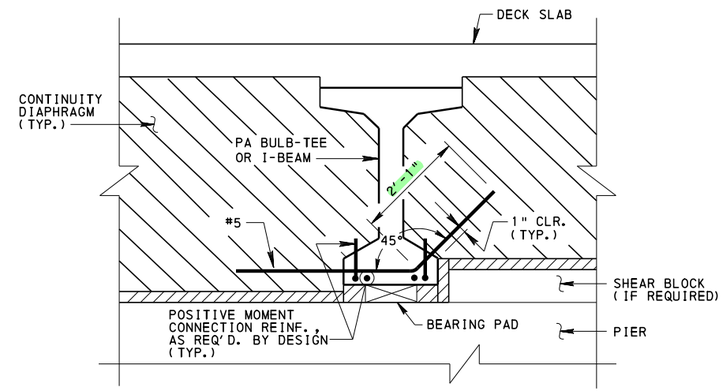
   #4 AND #5 BAR: 1'-2"
   #6 BAR: 1'-5"
   #7 BAR: 1'-9"
   #8 BAR: 1'-11"

   A 180° HOOK MAY BE USED IN THE FLANGE AREA OF THE BEAM WHEN THE VERTICAL LEG OF A 90° HOOK WOULD PROTRUDE THROUGH THE BEAM FORMS.
5. FOR BEAMS OF DIFFERENT DEPTHS, POSITIVE MOMENT REINFORCEMENT IN THE DEEPER BEAM SHOULD BE PLACED AT THE SAME VERTICAL LOCATION AS THE POSITIVE MOMENT REINFORCEMENT IN THE SHALLOWER BEAM.
6. FOR OPTIONAL POSITIVE MOMENT CONNECTION DETAILS AND NOTES, SEE SHT. 4.



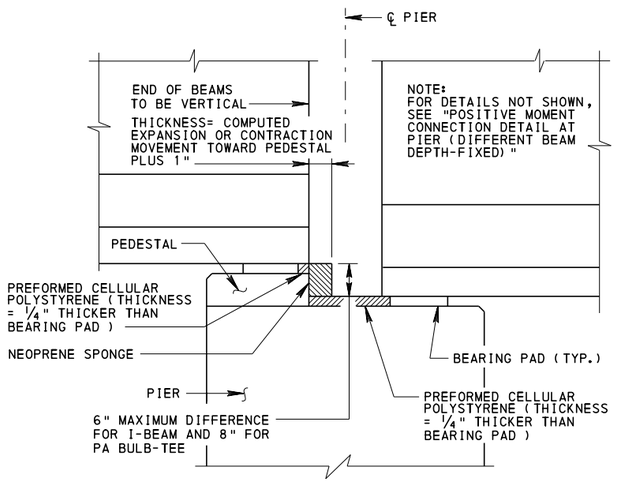
SECTION B-B

(SKEWED)



SECTION C-C

(SHOWN WITH SHEAR BLOCK)



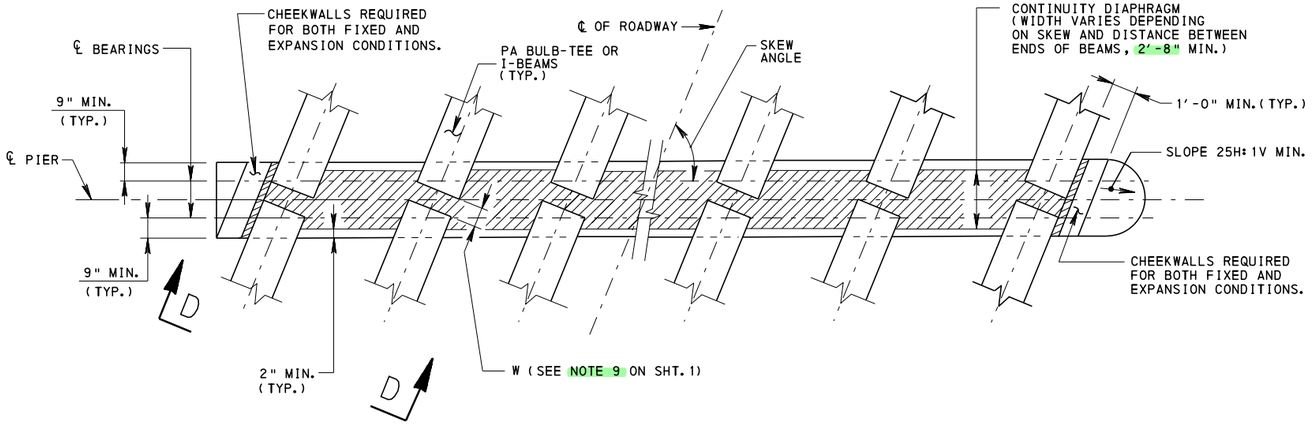
POSITIVE MOMENT CONNECTION DETAIL AT PIER

(DIFFERENT BEAM DEPTH-EXPANSION)

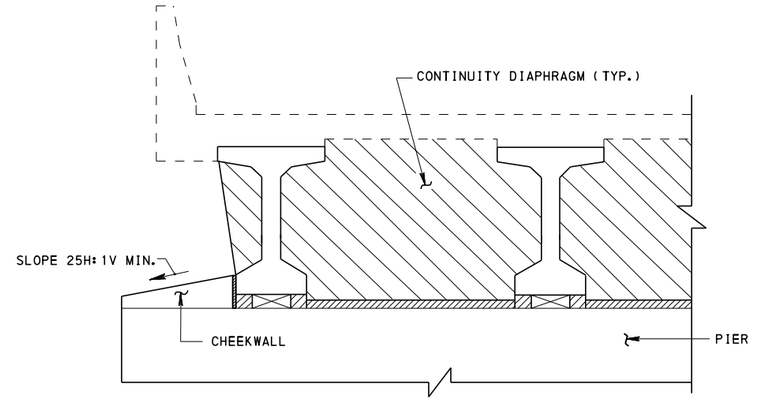
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CONTINUITY FOR LIVE LOAD DETAILS I-BEAM & PA BULB-TEE BEAM BRIDGES

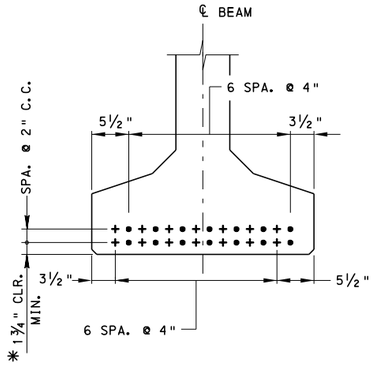
RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 2 OF 4
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-664M



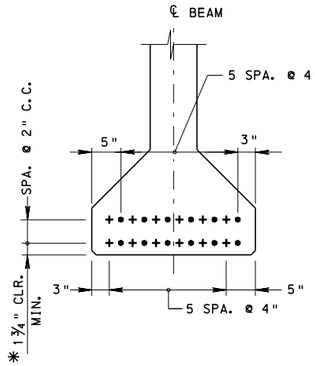
PIER PLAN - (SKEWED)



SECTION D-D



TYPICAL PA BULB-TEE SECTION POSITIVE MOMENT REINF. LOCATIONS



TYPICAL I-BEAM SECTION POSITIVE MOMENT REINF. LOCATIONS

TYPICAL BEAM SECTION NOTES:

+ DENOTES LOCATION OF POSITIVE MOMENT REINF. AT ONE END OF BEAM.

● DENOTES LOCATION OF POSITIVE MOMENT REINF. AT END OF OPPOSING BEAM.

✳ ADJUST VERTICAL LOCATION OF POSITIVE MOMENT REINFORCEMENT AS REQUIRED TO ACCOUNT FOR PRESTRESS STRAND DUE TO BEAM DAPS OR BAR SIZE OF POSITIVE REINFORCEMENT.

1. BEND EPOXY COATED POSITIVE MOMENT REINFORCEMENT IN THE SHOP PRIOR TO BEAM FABRICATION. BENDING AFTER BEAM FABRICATION WILL BE PERMITTED ONLY IF APPROVED BY THE CHIEF BRIDGE ENGINEER. WHERE POST FABRICATION BENDING IS PERMITTED, A HEAT BENDING PROCEDURE MUST BE USED.
2. PLACE NOTE ON CONSTRUCTION DRAWINGS ALLOWING THE FABRICATOR TO USE ALTERNATE POSITIVE REINFORCEMENT, IF DESIGN IS PROVIDED.
3. FOR OPTIONAL POSITIVE MOMENT REINF. LOCATIONS, SEE SHT. 4.

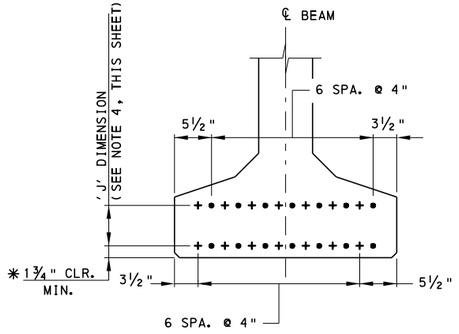
NOTE:

1. FOR TYPICAL LONGITUDINAL SECTIONS AT ABUTMENT, SEE BD-656M.

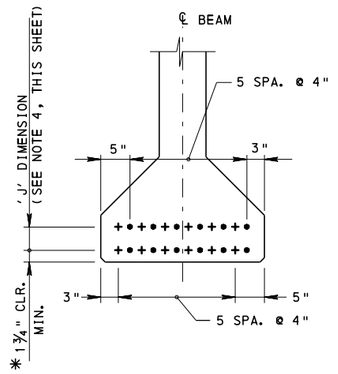
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
CONTINUITY FOR LIVE LOAD DETAILS
I-BEAM & PA BULB-TEE
BEAM BRIDGES

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 3 OF 4
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-664M



TYPICAL PA BULB-TEE SECTION
OPTIONAL POSITIVE MOMENT REINF. LOCATIONS▲



TYPICAL I-BEAM SECTION
OPTIONAL POSITIVE MOMENT REINF. LOCATIONS▲

TYPICAL BEAM SECTION NOTES:

+ DENOTES LOCATION OF POSITIVE MOMENT REINF. AT ONE END OF BEAM.

● DENOTES LOCATION OF POSITIVE MOMENT REINF. AT END OF OPPOSING BEAM.

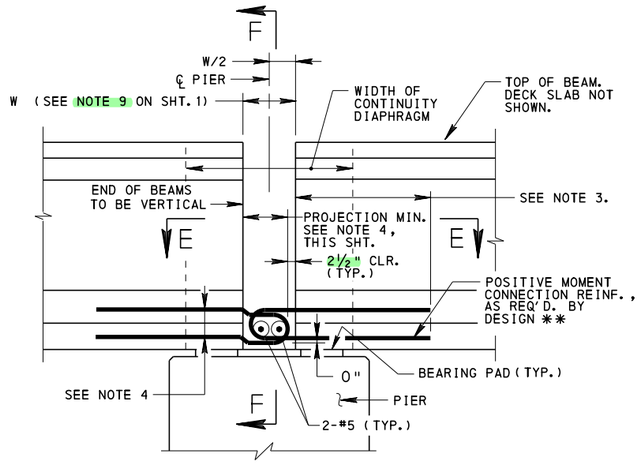
▲ LOCATIONS ARE LIMITED BY BOTTOM FLANGE CONFIGURATION AND 'J' DIMENSION FOR POSITIVE MOMENT REINFORCEMENT (SEE NOTE 4, THIS SHEET)

✱ ADJUST VERTICAL LOCATION OF POSITIVE MOMENT REINFORCEMENT AS REQUIRED TO ACCOUNT FOR PRESTRESS STRAND DUE TO BEAM DAPS OR BAR SIZE OF POSITIVE REINFORCEMENT.

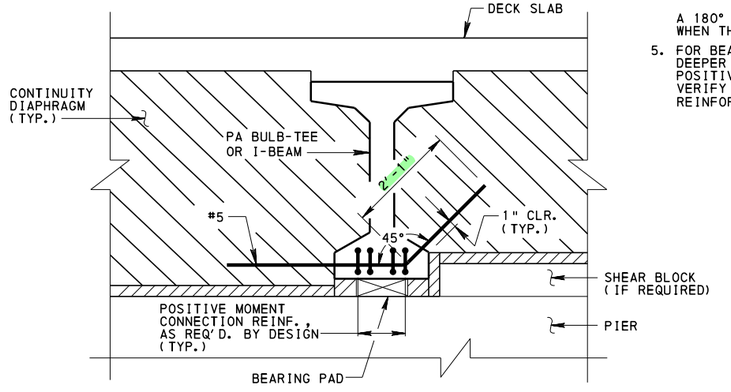
1. BEND EPOXY COATED POSITIVE MOMENT REINFORCEMENT IN THE SHOP PRIOR TO BEAM FABRICATION. BENDING AFTER BEAM FABRICATION WILL BE PERMITTED ONLY IF APPROVED BY THE CHIEF BRIDGE ENGINEER. WHERE POST FABRICATION BENDING IS PERMITTED, A HEAT BENDING PROCEDURE MUST BE USED.
2. PLACE NOTE ON CONSTRUCTION DRAWINGS ALLOWING THE FABRICATOR TO USE ALTERNATE POSITIVE REINFORCEMENT, IF DESIGN IS PROVIDED.

NOTE:

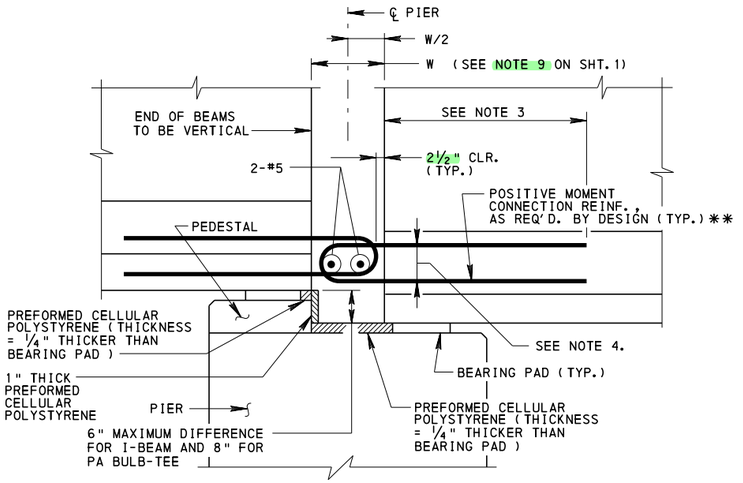
1. FOR TYPICAL LONGITUDINAL SECTIONS AT ABUTMENT, SEE BD-656M.



OPTIONAL POSITIVE MOMENT CONNECTION DETAIL AT PIER
(SAME BEAM DEPTH)



SECTION F-F
(SHOWN WITH SHEAR BLOCK)



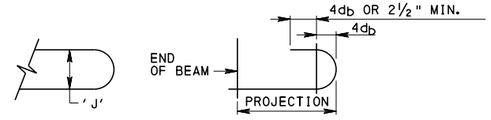
OPTIONAL POSITIVE MOMENT CONNECTION DETAIL AT PIER
(DIFFERENT BEAM DEPTH-FIXED)

OPTIONAL POSITIVE MOMENT CONNECTION NOTES:

✱✱ THE CALCULATED AREA OF POSITIVE MOMENT REINFORCEMENT PROVIDED TO BE BASED ON ONE LEG OF REINFORCEMENT. IF BOTH LEGS OF THE REQUIRED REINFORCEMENT WILL FALL ABOVE THE BOTTOM FLANGE AND OUTSIDE THE BEAMS WEB, THIS DETAIL MAY NOT BE USED.

1. PLACE POSITIVE MOMENT REINFORCEMENT SYMMETRICAL ABOUT THE CENTERLINE OF BEAM. ONLY ONE LAYER OF HAIRPIN REINFORCEMENT IS PERMITTED.
2. MAXIMUM SIZE FOR POSITIVE MOMENT REINFORCEMENT IS #8. LARGER SIZE MAY BE USED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.
3. EMBED POSITIVE MOMENT REINFORCEMENT BARS INTO THE PRESTRESSED BEAM A MINIMUM OF TWO TIMES THE TRANSFER LENGTH OF THE PRESTRESSING STRANDS PLUS THE TENSION DEVELOPMENT LENGTH (ℓ_d) OF THE POSITIVE MOMENT REINFORCEMENT BAR. EXTEND EVERY OTHER BAR AN ADDITIONAL 9" TO PROVIDE A STAGGERED CUTOFF CONDITION.
4. PROVIDE 'J' DIMENSION, PROJECTION, AND TENSION DEVELOPMENT LENGTH (ℓ_d) FOR POSITIVE MOMENT REINFORCEMENT AS FOLLOWS:

	'J'	PROJECTION	TENSION DEVELOPEMENT (ℓ_d) (SEE NOTE 3)
#4 BAR:	4"	8"	12"
#5 BAR:	5"	8"	15"
#6 BAR:	6"	10"	18"
#7 BAR:	7"	10"	21"
#8 BAR:	8"	12"	24"



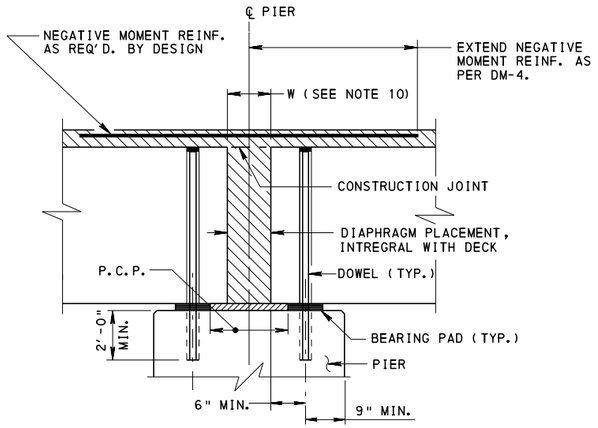
A 180° HOOK MAY BE USED IN THE FLANGE AREA OF THE BEAM WHEN THE HAIRPIN BAR WOULD PROTRUDE THROUGH THE BEAM FORMS.

5. FOR BEAMS OF DIFFERENT DEPTHS, POSITIVE MOMENT REINFORCEMENT IN THE DEEPER BEAM SHOULD BE PLACED AT THE SAME VERTICAL LOCATION AS THE POSITIVE MOMENT REINFORCEMENT IN THE SHALLOWER BEAM. DESIGNER MUST VERIFY CONSTRUCTIBILITY FOR THE NUMBER AND SIZE OF POSITIVE MOMENT REINFORCEMENT BARS USED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
CONTINUITY FOR LIVE LOAD DETAILS
I-BEAM & PA BULB-TEE
BEAM BRIDGES

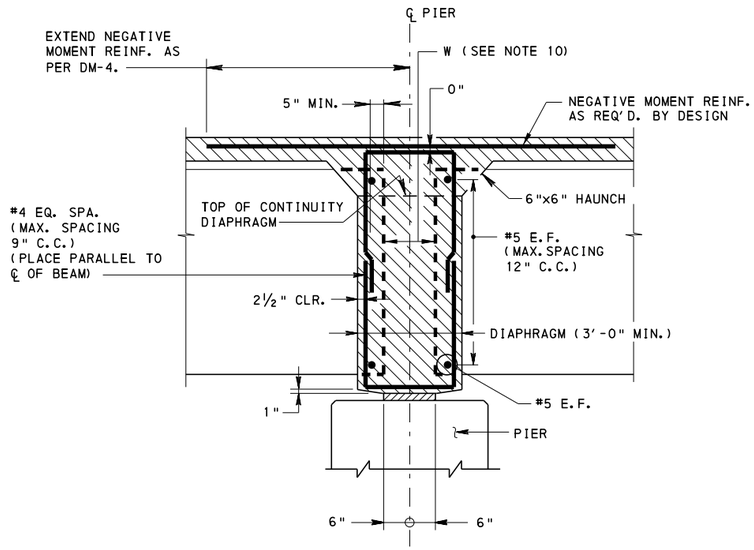
RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 4 OF 4
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-664M



TYPICAL LONGITUDINAL SECTION ADJACENT BOX BEAMS AT PIER

(FIXED)

NOTE:
DRILL 2" DIA. HOLE IN PIER AFTER SHEAR KEY GROUT REPLACEMENT, PLACE 1¼" DIA. DOWEL BARS, AND FILL HOLE WITH NON-SHRINK GROUT. USE PREFORMED HOLES FOR PIER BENTS OR HAMMERHEAD PIERS. SEE BC-775M FOR ADDITIONAL DETAILS.



SECTION A-A

(DOWELS NOT SHOWN)

TYPICAL LONGITUDINAL SECTION SPREAD BOX BEAMS AT PIER

(FIXED CONDITION SHOWN)
(EXPANSION CONDITION SIMILAR)

NOTES:

1. ALL REINFORCEMENT STEEL BARS SHOWN MEET THE REQUIREMENTS OF ASTM A615/A615M, A996/A996M OR A706/A706M.
2. FOR LOCATION OF DOWELS, SHEAR BLOCKS OR CURTAIN WALLS, SEE BD-658M.
3. FOR SLAB REINFORCEMENT AND PLACEMENT OF DIAPHRAGM CONCRETE, SEE BD-660M.
4. FOR BEAM REINFORCMENT, SEE BD-661M.
5. DESIGNER TO SPECIFY STEEL CORROSION PROTECTION AS PER DESIGN MANUAL PART 4, D5.4.3.6P.
6. MODIFY DETAILS AS REQUIRED FOR BRIDGES ON SKEWS.
7. MODIFY DOWELS AS REQUIRED TO RESIST HORIZONTAL FORCES. DOWELS SHOWN ARE THE MINIMUM REQUIRED.
8. FOR DOWEL DETAIL, SEE BC-775M.
9. FOR WATERPROOFING AND EXPANSION DETAILS, SEE BC-788M.
10. PROVIDE MIMIMUM CLEAR DISTANCE (W) BETWEEN THE ENDS OF BEAMS AS FOLLOWS:

    WITH POSITIVE MOMENT REINFORCEMENT

    SINGLE LAYER OF POSITIVE MOMENT REINFORCEMENT:
    10" WIDTH FOR #4 AND #5
    12" WIDTH FOR #6 AND #7
    14" WIDTH FOR #8

    TWO LAYERS OF POSITIVE MOMENT REINFORCEMENT:
    12" WIDTH FOR #4 AND #5
    14" WIDTH FOR #6 AND #7
    16" WIDTH FOR #8

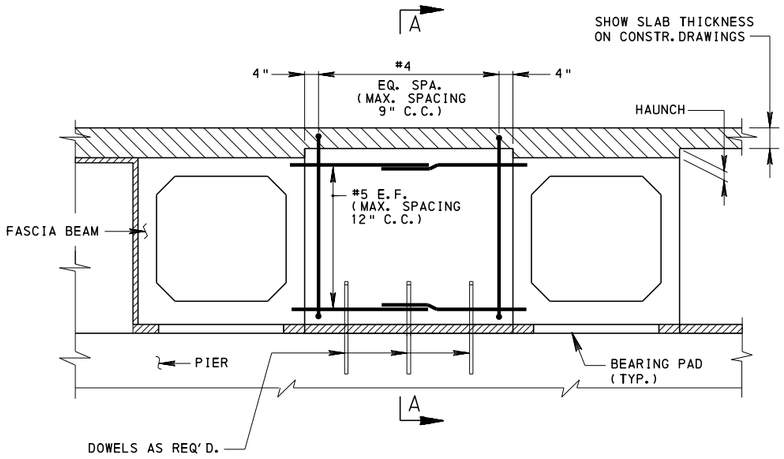
    WITHOUT POSITIVE MOMENT REINFORCEMENT

    4"

11. POSITIVE MOMENT REINFORCEMENT BARS MUST BE THE SAME SIZE WITHIN A BEAM.
12. WHEN KINKED BEAMS ARE USED, DESIGN THE BRIDGE AS SIMPLE SPAN MADE CONTINUOUS WITHOUT THE NEED FOR POSITIVE MOMENT REINFORCEMENT. FULL CONTINUITY WITH POSITIVE MOMENT REINFORCEMENT WILL BE PERMITTED ONLY WITH THE CHIEF BRIDGE ENGINEER'S APPROVAL. FOR ALTERNATE DESIGNS AND DESIGN-BUILD PROJECTS, KINKING THE GIRDERS WITH FULL CONTINUITY MAY ONLY BE PROPOSED IF SPECIFICALLY PERMITTED IN THE CONTRACT SPECIAL PROVISIONS.
13. HORIZONTAL OFFSETS OF OPPOSING GIRDERS ARE NOT PERMITTED.

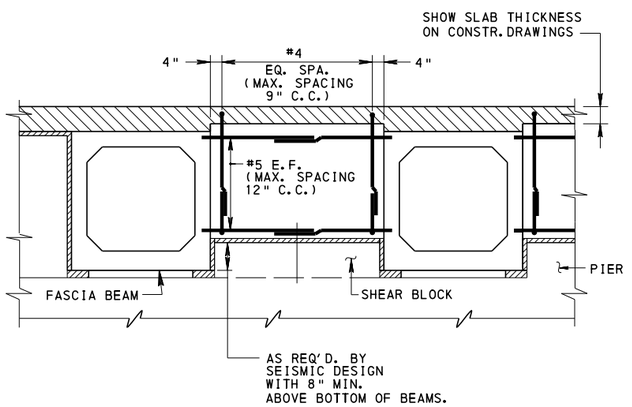
ABBREVIATIONS:

P.C.P. - PREFORMED CELLULAR POLYSTYRENE



TYPICAL DIAPHRAGM SPREAD BOX BEAMS AT PIER

(FIXED)



TYPICAL DIAPHRAGM SPREAD BOX BEAMS AT PIER

(EXPANSION)

BD-656M	TYPICAL LONGITUDINAL SECTIONS I-BEAMS AND BOX BEAM SECTIONS
BD-658M	SHEAR BLOCK DETAILS AT PIER
BD-660M	DECK SLAB AND STEEL REINFORCEMENT PLACEMENT
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-775M	MISCELLANEOUS PRESTRESS DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

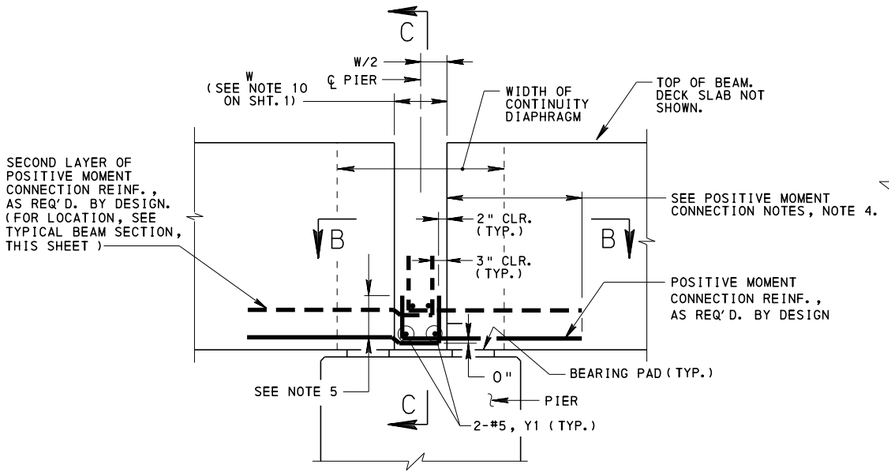
STANDARD CONTINUITY FOR LIVE LOAD DETAILS BOX BEAM BRIDGES

RECOMMENDED APR. 29, 2016
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016
Brent D. Thompson
DIRECTOR, BUR. OF PROJECT DELIVERY

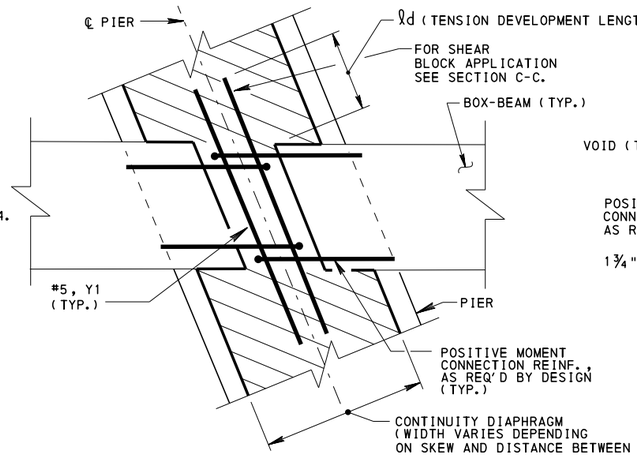
SHEET 1 OF 3

BD-665M



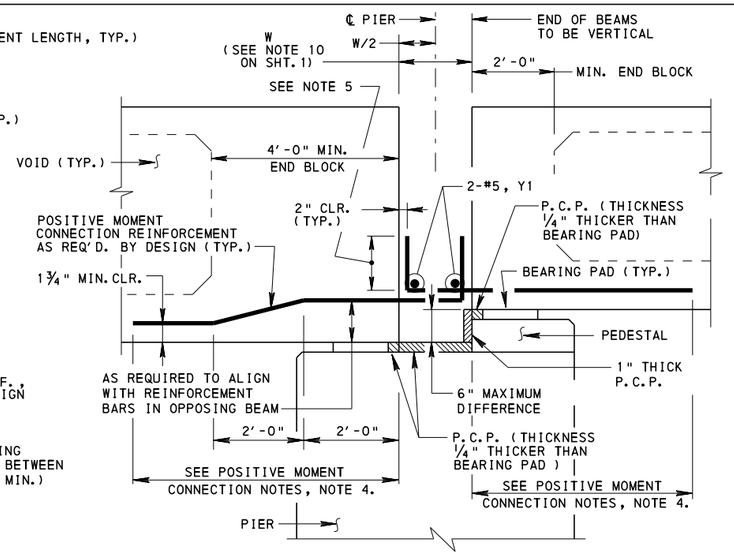
POSITIVE MOMENT CONNECTION DETAIL AT PIER

(SAME BEAM DEPTH)



SECTION B-B

(SKEWED)



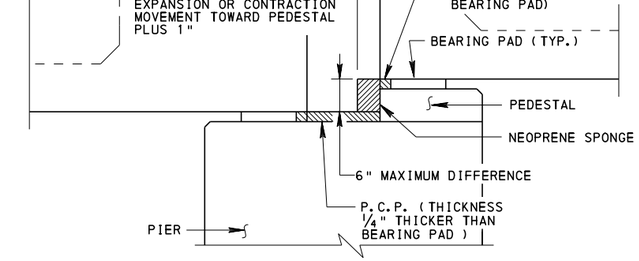
POSITIVE MOMENT CONNECTION DETAIL AT PIER

(DIFFERENT BEAM DEPTH-FIXED)

POSITIVE MOMENT CONNECTION NOTES:

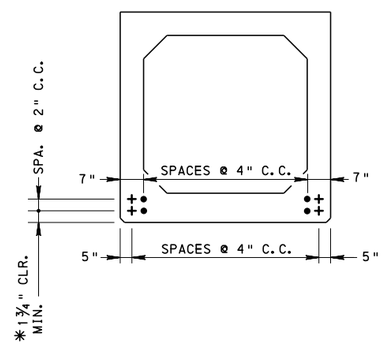
1. PLACE POSITIVE MOMENT REINFORCEMENT SYMMETRICAL ABOUT THE CENTERLINE OF BEAM.
2. FOR BEAMS OF DIFFERENT DEPTHS, POSITIVE MOMENT REINFORCEMENT IN THE DEEPER BEAM SHOULD BE PLACED AT THE SAME VERTICAL LOCATION AS THE POSITIVE MOMENT REINFORCEMENT IN THE SHALLOWER BEAM.
3. MAXIMUM SIZE FOR POSITIVE MOMENT REINFORCEMENT IS #8. LARGER SIZE MAY BE USED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.
4. EMBED POSITIVE MOMENT REINFORCEMENT BARS INTO THE PRESTRESSED BEAM A MINIMUM OF TWO TIMES THE TRANSFER LENGTH OF THE PRESTRESSING STRANDS PLUS THE TENSION DEVELOPMENT LENGTH OF THE POSITIVE MOMENT REINFORCEMENT BAR. EXTEND EVERY OTHER BAR AN ADDITIONAL 9" TO PROVIDE A STAGGERED CUTOFF CONDITION.
5. PROVIDE VERTICAL LEG AS FOLLOWS:

   #4 AND #5 BAR: 1'-2"
   #6 BAR: 1'-5"
   #7 BAR: 1'-9"
   #8 BAR: 1'-11"



POSITIVE MOMENT CONNECTION DETAIL AT PIER

(DIFFERENT BEAM DEPTH-EXPANSION)



TYPICAL BEAM SECTION POSITIVE MOMENT REINF. LOCATIONS

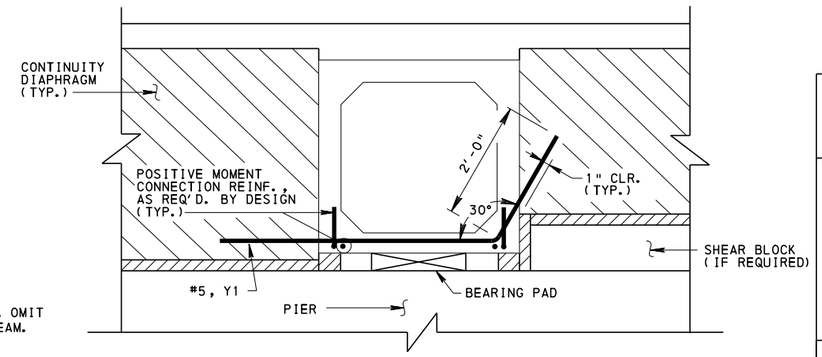
TYPICAL BEAM SECTION NOTES:

\+ DENOTES LOCATION OF POSITIVE MOMENT REINF. AT ONE END OF BEAM.

● DENOTES LOCATION OF POSITIVE MOMENT REINF. AT END OF OPPOSING BEAM.

* ADJUST VERTICAL LOCATION OF POSITIVE MOMENT REINFORCEMENT AS REQUIRED TO ACCOUNT FOR PRESTRESS STRAND DUE TO BEAM DAPS.

1. BEND EPOXY COATED POSITIVE MOMENT REINFORCEMENT IN THE SHOP PRIOR TO BEAM FABRICATION. BENDING AFTER BEAM FABRICATION WILL BE PERMITTED ONLY IF APPROVED BY THE CHIEF BRIDGE ENGINEER. WHERE POST FABRICATION BENDING IS PERMITTED, A HEAT BENDING PROCEDURE MUST BE USED.
2. PLACE NOTE ON CONSTRUCTION DRAWINGS ALLOWING THE FABRICATOR TO USE ALTERNATE POSITIVE MOMENT REINFORCEMENT IF DESIGN IS PROVIDED.
3. IF DOWEL IS USED FOR ADJACENT BOX BEAMS, OMIT POSITIVE MOMENT REINFORCEMENT AT ℄ OF BEAM.

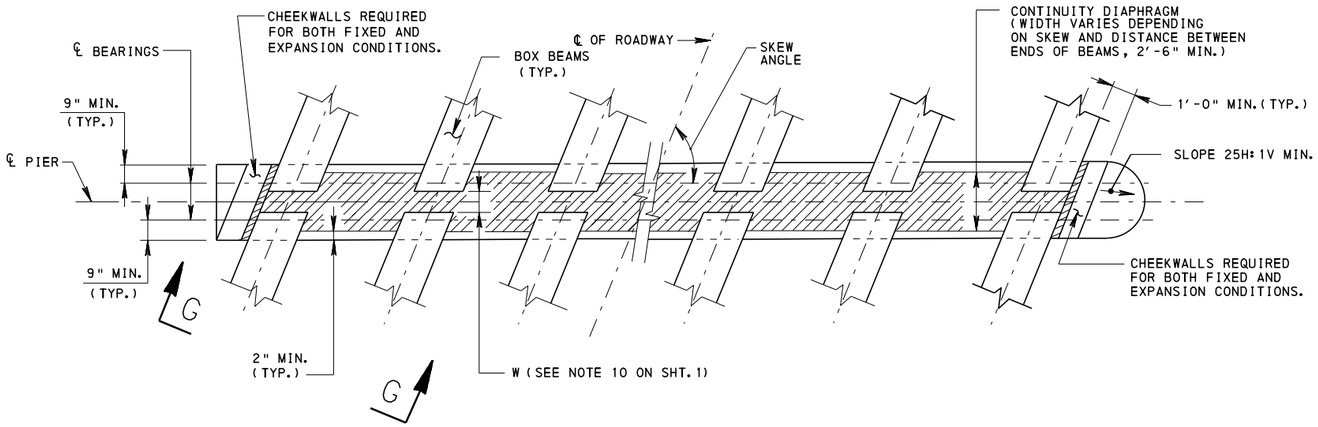


SECTION C-C

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CONTINUITY FOR LIVE LOAD DETAILS BOX BEAM BRIDGES

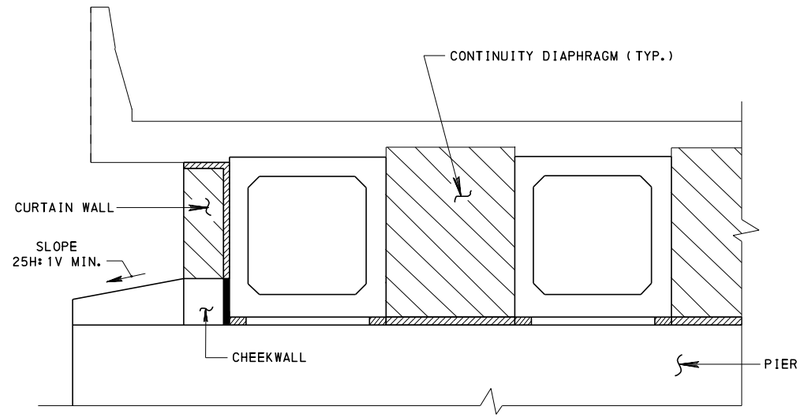
RECOMMENDED APR. 29, 2016	RECOMMENDED APR. 29, 2016	SHEET 2 OF 3
Thomas P Macioce	Bruce D Thompson	BD-665M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	



PIER PLAN - (SKEWED)

NOTE:

ADJACENT BOX BEAM BRIDGES ARE SIMILAR. PLACE CHEEKWALLS ON ONE SIDE OF BRIDGE BEFORE THE BEAMS ARE SET. PLACE CHEEKWALLS ON OTHER SIDE OF BRIDGE AFTER THE POST-TENSIONING TENDONS ARE INSTALLED.



SECTION G-G

NOTE:

1. FOR TYPICAL LONGITUDINAL SECTIONS AT ABUTMENT, SEE BD-656M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
CONTINUITY FOR LIVE LOAD DETAILS
BOX BEAM BRIDGES

RECOMMENDED APR. 29, 2016 Thomas P Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED APR. 29, 2016 Brian D. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	SHEET 3 OF 3 BD-665M

CHANGE 2

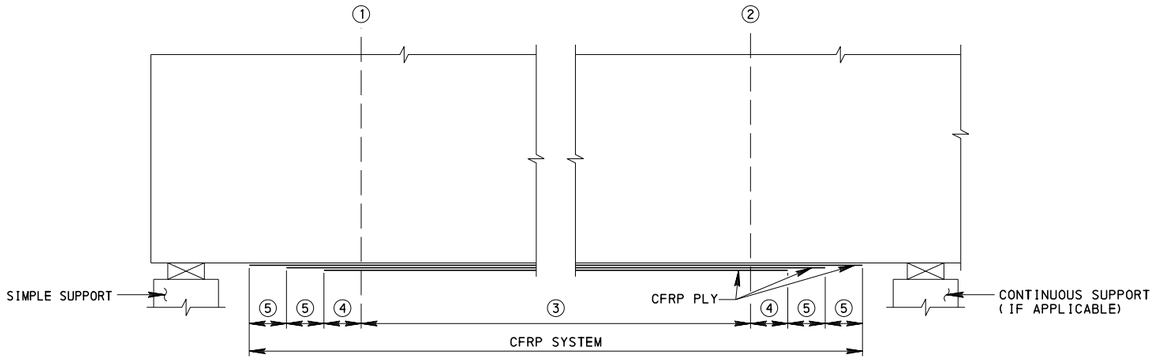
CHANGE 5

DESIGN NOTES:

1. THE PROJECT DESIGNER WILL DETERMINE IF A CARBON FIBER REINFORCEMENT POLYMER (CFRP) SYSTEM IS A SUITABLE STRENGTHENING REPAIR TECHNIQUE FOR THE SPECIFIC PROJECT. PERFORM A CONDITION ASSESSMENT OF THE EXISTING BRIDGE THAT INCLUDES ESTABLISHING ITS LOAD-CARRYING CAPACITY, IDENTIFYING DEFICIENCIES AND THEIR CAUSES, AND DETERMINING THE CONDITION AND STRENGTH OF THE CONCRETE SUBSTRATE.
2. THE PROJECT DESIGNER WILL PROVIDE CONCEPTUAL DESIGN CALCULATIONS, CONTRACT DRAWINGS AND PERFORMANCE SPECIFICATIONS THAT ARE SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA. THE PROJECT DESIGNER MUST PROVIDE CALCULATIONS THAT SUMMARIZE THE ASSUMPTIONS AND PARAMETERS USED FOR THE CONCEPTUAL DESIGN OF THE CFRP SYSTEM. THE FINAL DESIGN OF THE CFRP SYSTEM WILL BE PREPARED BY THE CONTRACTOR'S PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA.
3. DESIGN THE STRENGTHENING REPAIR IN ACCORDANCE WITH AASHTO LRFD GUIDE SPECIFICATIONS FOR DESIGN OF BONDED FRP SYSTEMS FOR REPAIR AND STRENGTHENING OF CONCRETE BRIDGE ELEMENTS, 1ST EDITION.
4. REFER TO NCHRP REPORT 609 RECOMMENDED CONSTRUCTION SPECIFICATIONS AND PROCESS CONTROL MANUAL FOR REPAIR AND RETROFIT OF CONCRETE STRUCTURES USING BONDED FRP COMPOSITES FOR PREPARING THE CONTRACT DRAWINGS AND PERFORMANCE SPECIFICATIONS.
5. REFER TO ACI 440.2R-17 GUIDE FOR THE DESIGN AND CONSTRUCTION OF EXTERNALLY BONDED FRP SYSTEMS FOR STRENGTHENING CONCRETE STRUCTURES FOR ADDITIONAL GUIDANCE IN PREPARING THE DESIGN, CONTRACT DRAWINGS, AND PERFORMANCE SPECIFICATIONS.
6. TO PREVENT SUDDEN FAILURE OF THE BEAM IN CASE THE CFRP SYSTEM IS DAMAGED. LIMIT THE STRENGTHENING OBTAINED BY THE CFRP SYSTEM SO THAT THE LOSS OF THE CFRP REINFORCEMENT WILL NOT CAUSE MEMBER FAILURE UNDER SUSTAINED SERVICE LOADS.
7. ANALYSIS MUST BE PERFORMED ON THE MEMBER STRENGTHENED BY THE CFRP SYSTEM TO CHECK THAT UNDER OVERLOAD CONDITIONS THE STRENGTHENED MEMBER WILL FAIL IN A FLEXURE MODE RATHER THAN A SHEAR MODE.
8. INCLUDE GENERAL NOTES ON THE CONTRACT DRAWINGS THAT LIST DESIGN LOADS AND ALLOWABLE STRAINS IN THE CFRP SYSTEM USED IN THE CONCEPTUAL DESIGN.
9. DESCRIBE THE MATERIAL PROPERTIES OF THE CFRP LAMINATES AND CONCRETE SUBSTRATE USED IN THE CONCEPTUAL DESIGN. THE EXISTING CONCRETE SUBSTRATE MUST POSSESS THE NECESSARY STRENGTH TO DEVELOP THE DESIGN STRESSES OF THE CFRP SYSTEM THROUGH BOND.
10. CONSIDER BEAM REPLACEMENT WHEN 25% OF THE STRANDS IN A BEAM NO LONGER CONTRIBUTE TO ITS CAPACITY. LIKEWISE, CONSIDER BEAM REPLACEMENT IF EXCESSIVE FLEXURE CRACKS ARE PRESENT INDICATING SUBSTANTIAL LOSS OF PRESTRESS.

GENERAL NOTES:

1. USE AN EXTERNALLY BONDED CFRP SYSTEM TO STRENGTHEN EXISTING STRUCTURE COMPONENTS.
2. CONSTRUCT CONCRETE REPAIRS IN ACCORDANCE WITH BC-783M PRIOR TO INSTALLING THE CFRP SYSTEM. IF REPAIR OF BEAM DETERIORATION IS NEEDED, CONFIRM THAT THE SPECIFIED BEAM DETERIORATION REPAIR MATERIAL IS COMPATIBLE WITH THE CFRP SYSTEM.
3. USE A BOND-CRITICAL CFRP SYSTEM. DO NOT USE MECHANICAL ANCHORAGES.
4. THE APPLICATION OF THE CFRP SYSTEM WILL NOT STOP THE ONGOING CORROSION OF EXISTING REINFORCEMENT STEEL. IF STEEL CORROSION IS EVIDENT OR IS DEGRADING THE CONCRETE SUBSTRATE, PLACEMENT OF CFRP REINFORCEMENT IS NOT RECOMMENDED WITHOUT ARRESTING THE ONGOING CORROSION AND REPAIRING ANY DEGRADATION TO THE SUBSTRATE.
5. IDENTIFY THE CAUSE(S) OF THE BEAM DETERIORATION AND TAKE CORRECTIVE ACTION TO EXTEND THE DESIGN LIFE OF THE STRENGTHENING. FOR EXAMPLE, LEAKING EXPANSION JOINTS SHOULD BE REPAIRED.
6. ONLY SPECIFY WELL-DOCUMENTED CFRP SYSTEMS THAT HAVE SUFFICIENT TEST DATA TO DEMONSTRATE ADEQUATE PERFORMANCE OF THE ENTIRE SYSTEM IN SIMILAR APPLICATIONS, INCLUDING METHODS OF INSTALLATION.
7. INDICATE THE LOCATION OF THE CFRP SYSTEM RELATIVE TO THE EXISTING STRUCTURE.
8. PROVIDE THE CONCEPTUAL DIMENSIONS AND ORIENTATION OF EACH PLY OR LAMINATE, THE NUMBER OF PLIES, AND THE SEQUENCE OF INSTALLATION.
9. PROVIDE THE LOCATIONS OF SPLICES AND LAP LENGTHS.
10. SPECIFY THE CONCRETE SURFACE PREPARATION REQUIREMENTS, INCLUDING CORNER PREPARATION AND MAXIMUM IRREGULARITIES LIMITATIONS.
11. SPECIFY PULL-OFF TESTS OF INSTALLED CFRP.
12. PROVIDE AN ULTRAVIOLET LIGHT PROTECTION COATING SYSTEM OF SIMILAR COLOR AS THE SURROUNDING EXISTING CONCRETE. THE COATING MUST BE A NON-VAPOR-BARRIER, FLEXIBLE, WATERPROOFING, AND COMPATIBLE WITH THE CFRP SYSTEM.
13. FILL ANY SURFACE VOID IN THE EXISTING CONCRETE WITH A DIAMETER LARGER THAN 1/2" OR A DEPTH GREATER THAN 1/8".
14. REPAIR CRACKS WITH A WIDTH OF 1/8" OR GREATER IN EXISTING CONCRETE PRIOR TO CONSTRUCTING THE CFRP STRENGTHENING. SPECIFY EPOXY INJECTION CRACK REPAIR IN ACCORDANCE WITH PUBLICATION 408, SECTION 1091.
15. FILL ANY SURFACE OUT-OF FLATNESS DEPRESSION DEEPER THAN 1/8 IN. OVER A LENGTH OF 12 IN.
16. THE MAXIMUM SURFACE ROUGHNESS OF THE CONCRETE SHALL NOT EXCEED CSP-3 AS DEFINED BY ICRI/ACI (1999).
17. PROVIDE SPACES BETWEEN CFRP SHEAR REINFORCEMENT U-WRAP STRIPS TO ALLOW FOR MOISTURE EVAPORATION AND INSPECTION OF THE CFRP SYSTEM AND BEAM.
18. USE U-WRAPS WITH NO MECHANICAL ANCHORAGE FOR CFRP SHEAR CAPACITY STRENGTHENING SYSTEMS.
19. IF THE DECK IS NOT TO BE REMOVED AS PART OF THE PROJECT, THEN USE A THREE-SIDED U-WRAP FOR SHEAR STRENGTHENING. IF THE DECK IS TO BE REMOVED, THEN COMPLETELY WRAP THE BEAM SECTION.
20. DO NOT USE THE CFRP SYSTEM AS COMPRESSION REINFORCEMENT.
21. THE CFRP SYSTEM CAN ALSO BE APPLIED TO REINFORCED CONCRETE T-BEAM BRIDGES. THE CAUSE OF THE BEAM DETERIORATION AND THE REPAIR OF SUBSTRATE CONCRETE AND REINFORCEMENT BARS MUST BE ADDRESSED PRIOR TO APPLYING THE CFRP SYSTEM.



ELEVATION - TYPICAL FLEXURE STRENGTHENING OF CONCRETE BEAM

LEGEND:

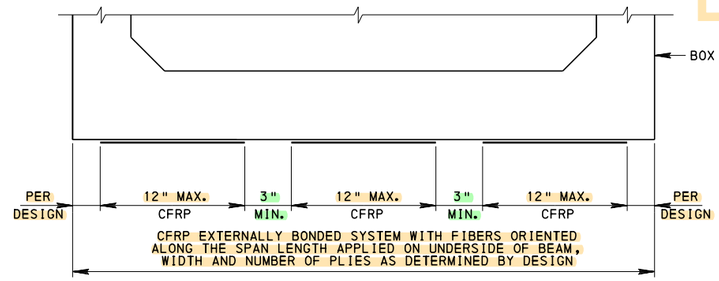
① LOCATION TOWARD THE NEAREST SIMPLE SUPPORT, AT WHICH THE FACTORED MOMENT FALLS BELOW THE CRACKING MOMENT OF THE STRENGTHENED BEAM ($M_u \leq M_{cr}$).

② LOCATION TOWARD THE NEAREST CONTINUOUS SUPPORT, AT WHICH THE FACTORED MOMENT IS AT AN INFLECTION POINT ($M_u = 0$).

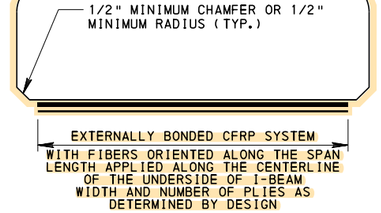
③ CFRP BONDED LENGTH BETWEEN LOCATION ① AND ② BUT NO LESS THAN STRENGTHENING LENGTH AS DETERMINED BY DESIGN.

④ DEVELOPMENT LENGTH PER AASHTO GUIDE (SEE DESIGN NOTE 3), 12 IN. MIN.

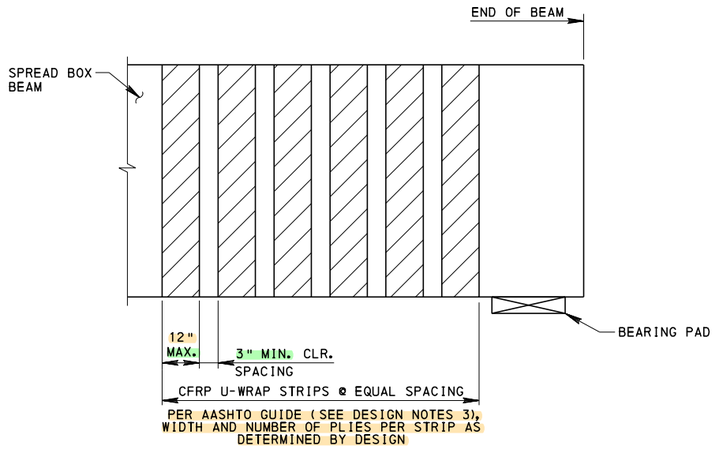
⑤ 6 IN. MIN.



SECTION - FLEXURE STRENGTHENING OF BOX BEAM



SECTION - FLEXURE STRENGTHENING OF I-BEAM



ELEVATION - SHEAR STRENGTHENING OF SPREAD BOX BEAM

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

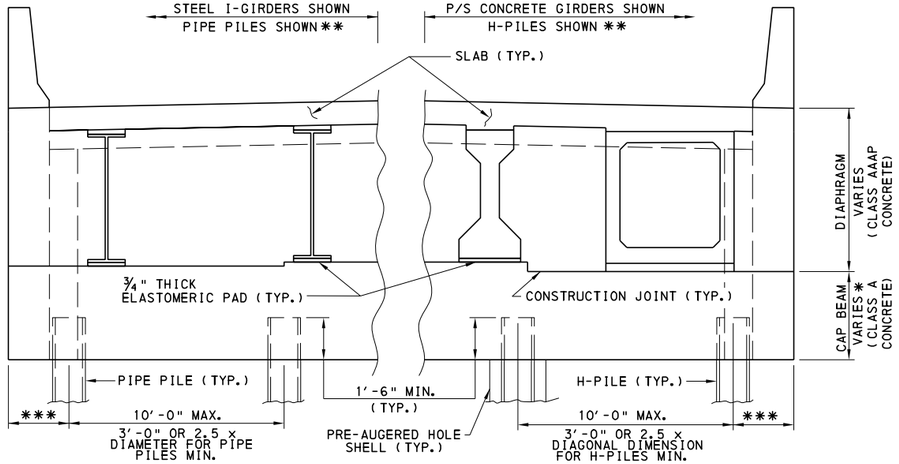
STANDARD CFRP STRENGTHENING PRESTRESSED CONCRETE BEAMS

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 1 OF 1
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-666M

CHANGE 2

CHANGE 3

CHANGE 5



TYPICAL ELEVATION

* DEPTH OF ABUTMENT BELOW CONSTRUCTION JOINT IS 3'-3" AT SHALLOWEST POINT (SEE DESIGN MANUAL, PART 4, AP.G.1.4.1). THE MAXIMUM DIFFERENCE BETWEEN THE MINIMUM AND MAXIMUM CAP DEPTH WILL NOT EXCEED 1'-0" FOR SKEW < 80° OR 1'-6" FOR SKEW ≥ 80°.

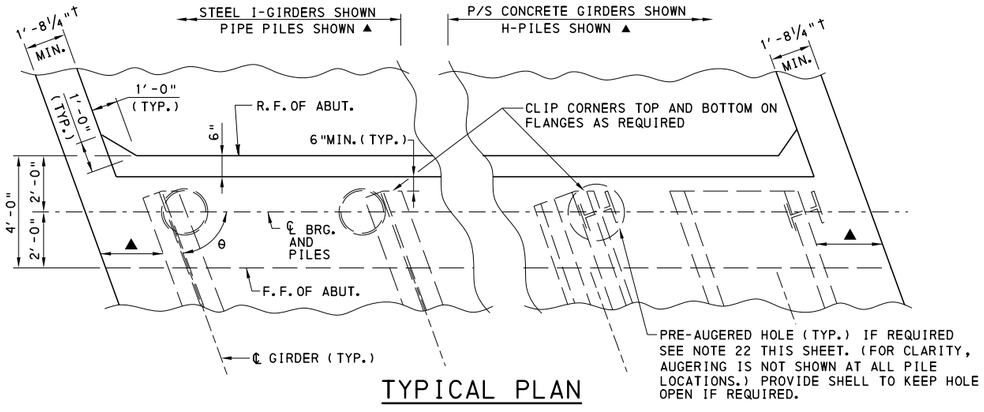
** BOTH H-PILES AND PIPE PILES MAY BE USED WITH STEEL OR CONCRETE GIRDERS. GALVANIZE TOP 15'-0" LENGTH OF THE PILES OR ENTIRE PILES LENGTH.

*** THE MAXIMUM EDGE DISTANCE BETWEEN THE CENTERLINE OF THE PILE AND THE END OF THE ABUTMENT, MEASURED ALONG THE SKEW, SHALL BE THE LARGER OF:

- 2'-6" AND $\frac{(W+dpile/2)}{\sin(\theta)}$ (ROUNDED UP TO THE NEXT 3" INCREMENT)
- WHERE: W: WIDTH OF WINGWALL AT REAR FACE OF INTEGRAL ABUTMENT, NEGLECTING THE 1' HAUNCH (ft.)
- dpile: OUTSIDE DIAMETER FOR PIPE PILES OR PILE DEPTH FOR H-PILES (ft.)

THE MINIMUM EDGE DISTANCE BETWEEN THE CENTERLINE OF THE PILE AND THE END OF THE ABUTMENT, MEASURED ALONG THE SKEW, SHALL BE THE LARGER OF:

- 1'-6"
- THE DISTANCE REQUIRED TO PROVIDE 3" CLEARANCE FROM THE PILES TO THE HORIZONTAL REINFORCEMENT EXTENDING FROM THE WINGWALL.



TYPICAL PLAN

† WINGWALL WIDTH MAY VARY BASED ON BARRIER TYPE SELECTED.

▲ EXTERIOR BEAMS TO BE LOCATED TO PROVIDE 3" CLEAR TO THE HORIZONTAL REINFORCEMENT EXTENDING FROM THE WINGWALLS.

DETACHED WINGWALL NOTES

1. DETERMINE THE MOVEMENT REQUIREMENTS AND THE OPENING OF THE EXPANSION DAM FOR THE EXPANSION JOINT BETWEEN THE ABUTMENT AND DETACHED WINGWALLS, AT THE TIME OF CONSTRUCTION, IN ACCORDANCE WITH DESIGN MANUAL, PART 4 AP.G.1.6.
2. BOND THE PREFORMED NEOPRENE COMPRESSION SEAL BETWEEN THE ABUTMENT AND THE DETACHED WINGWALL EXPANSION JOINTS (SEE SECTION M-M ON SHEET 6) TO BOTH THE ABUTMENT AND THE DETACHED WINGWALL.
3. BOND THE CLOSED CELL NEOPRENE SPONGE IN THE DETACHED WINGWALL EXPANSION JOINTS (SEE SECTION M-M ON SHEET 6) TO THE WINGWALL. RECESS THE NEOPRENE SPONGE ½" INTO THE WINGWALL.
4. THE WATERPROOFING MEMBRANE ACROSS THE EXPANSION JOINT BETWEEN THE INTEGRAL ABUTMENT AND DETACHED WINGWALLS WILL BE IN ACCORDANCE WITH PUBLICATION 408, SECTION 680. THE MEMBRANE SHALL SPAN THE WIDTH OF THE RECESS IN THE ABUTMENT AND IN THE DETACHED WALL, AND SHALL HAVE 8" BONDED ON EACH SIDE. THE LENGTH OF THE MEMBRANE SHALL BE 6" LONGER THAN THE SPANNED LENGTH (i.e. 6" SLACK) AT THE TIME OF INSTALLATION. SEE DETAIL P ON SHEET 7.
5. PAINT THE CONTACT SURFACE BETWEEN THE APPROACH SLAB AND WINGWALL WITH AN APPROVED BOND BREAKER AND SEAL WITH AN APPROVED SEALER.

GENERAL NOTES

1. ALL DIMENSIONS GIVEN IN U.S. CUSTOMARY UNITS.
2. DESIGN SPECIFICATIONS
   - -AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
   - -PENNDOT DESIGN MANUAL PART 4, VOLUME 1, PART B: DESIGN SPECIFICATIONS AND VOLUME 2, APPENDIX G
3. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408 AND CONTRACT SPECIAL PROVISIONS.
4. MATERIAL STRENGTH
   - -REINFORCEMENT STEEL fy = 60 KSI
   - -CONCRETE f'c = 4000 PSI (CLASS AAAP CONCRETE) FOR DECK SLABS, APPROACH SLABS, AND END DIAPHRAGMS AND WINGWALLS ABOVE CONSTRUCTION JOINT, MODULAR RATIO (Es/Ec) n = 8.
   - f'c = 3500 PSI (CLASS AA CONCRETE) FOR BARRIERS, MODULAR RATIO (Es/Ec) n = 8.
   - f'c = 3000 PSI (CLASS A CONCRETE) FOR CAP BEAM AND WINGWALLS BELOW CONSTRUCTION JOINT, MODULAR RATIO (Es/Ec) n = 9.
5. DEAD LOAD
   - -DENSITY OF NORMAL WEIGHT CONCRETE = 150 PCF
   - -FUTURE WEARING SURFACE = 30 PSF
6. LIVE LOAD
   - -LIVE LOAD IS CALCULATED ASSUMING ALL POTENTIAL LANES ARE LOADED. USE A MULTIPLE PRESENCE FACTOR OF 1.0 FOR DESIGN OF THE INTEGRAL ABUTMENT CAP AND SUPPORTING PILES.
   - -THE LIVE LOAD IS ASSUMED TO BE EVENLY DISTRIBUTED TO ALL PILES.
7. DYNAMIC LOAD ALLOWANCE (IM) = 33% IS APPLIED TO LIVE LOADS ON THE ABUTMENTS AND THE PILES ACCORDING TO ARTICLES A3.6.2.1 AND D3.6.2.1.
8. DESIGN CONTROLS
   - -CONCRETE COVER: INTEGRAL ABUTMENT (i.e., CAP BEAM AND END DIAPHRAGM) AND WINGWALLS = 3"
   - -DETAIL MINIMUM EMBEDMENT AND SPLICE LENGTHS IN ACCORDANCE WITH STANDARD DRAWING BC-736M.
   - -BAR SIZE: MAXIMUM BAR SIZE #11
   - MINIMUM BAR SIZE #4
9. FOR DESIGN CONTROLS OF DECK AND BARRIERS, SEE BD-601M.
10. USE ONLY ONE ROW OF VERTICAL PILES PER ABUTMENT. PILES MAY BE H-PILES OR PIPE PILES. FOR H-PILES, ORIENT THE WEB PERPENDICULAR TO THE LONGITUDINAL AXIS OF THE GIRDER OF THE END SPAN. TAPERED PILES MAY BE USED PROVIDED THE TAPER POINT IS BELOW THE POINT OF CONTRAFLEXURE.
11. ALL REINFORCING BARS ARE TO BE EPOXY COATED.
12. USE ONLY NORMAL WEIGHT CONCRETE FOR WINGWALLS AND ABUTMENTS.
13. DETAIL ALL BARS ON THE CONTRACT DRAWINGS.
14. PROVIDE A TROWEL SMOOTH SURFACE OF THE CONSTRUCTION JOINT DIRECTLY UNDER THE GIRDERS AND THE AREA EXTENDING 2" OUTSIDE OF THAT AREA. ON ALL OTHER CONSTRUCTION JOINTS, PROVIDE A RAKED SURFACE.
15. PROVIDE ¾" THICK, 50 DUROMETER NEOPRENE PADS UNDER ALL GIRDERS. ALL PADS WILL BE 12" ALONG THE LENGTH OF THE BEAM AND MATCH THE WIDTH OF THE BEAM MINUS ANY CHAMFERS. BLOCK THE AREAS UNDER THE GIRDERS NOT IN CONTACT WITH THE BEARING PADS USING 1" THICK BACKER RODS.
16. TAKE LIMITS OF FILL BEHIND THE ABUTMENT AND THE WINGWALLS AS SHOWN ON RC-12M.
17. FOR DETAILS OF INSERTS IN PRECAST CONCRETE BEAMS, SEE BD-655M IN ADDITION TO SHEETS 2, 4 AND 9 OF THIS STANDARD.
18. FOR DETAILS OF APPROACH SLABS FOR INTEGRAL ABUTMENT BRIDGES, SEE BD-628M.
19. PLACE ALL GIRDERS, INCLUDING BOX BEAMS, WITH THEIR WEBS VERTICAL. STEP TOP OF CAP BEAM TO PROVIDE THE CORRECT BEAM SEAT ELEVATION. CHANGE HAUNCH THICKNESS ACROSS THE WIDTH OF THE GIRDERS TO PROVIDE THE CORRECT ROADWAY CROSS-SLOPE AND SUPERELEVATION. SLOPE BEAM SEAT IN THE LONGITUDINAL DIRECTION TO MATCH BOTTOM OF BEAM. FOR ADJACENT BOX BEAMS, ENSURE SHEAR KEYS AND TENDONS ALIGN ACROSS BEAM SEAT STEPS.
20. THE BOTTOM OF THE ABUTMENT MAY BE HORIZONTAL. HOWEVER, THE VARIATION IN THE PILE CAP DEPTH FROM ONE END OF THE ABUTMENT TO THE OTHER DUE TO SUPERELEVATION IS LIMITED TO 1'-6" [1'-0" FOR SKEWS LESS THAN 80 DEGREES]. FOR SUPERELEVATIONS THAT WOULD RESULT IN GREATER VARIATIONS, THE BOTTOM OF THE ABUTMENT MUST BE PARALLEL TO THE SLOPE OF THE ROADWAY. FOR THE REINFORCEMENT SHOWN, THE PILE CAP IS TO BE A MINIMUM 3'-3" THICK, WITH A MAXIMUM DEPTH OF 4'-3" FOR SKEWS LESS THAN 80 DEGREES, AND A MAXIMUM DEPTH OF 4'-9" FOR SKEWS GREATER THAN OR EQUAL TO 80 DEGREES. PILE CAP DEPTHS GREATER THAN 4'-3" FOR SKEWS LESS THAN 80 DEGREES AND PILE CAP DEPTHS GREATER THAN 4'-9" FOR SKEWS GREATER THAN OR EQUAL TO 80 DEGREES MUST BE APPROVED BY CHIEF BRIDGE ENGINEER.
21. INTEGRAL ABUTMENTS AT OPPOSITE ENDS OF A BRIDGE SHALL BE THE SAME DEPTH EXCEPT FOR VARIATIONS DUE TO DIFFERENCES IN ROADWAY CROSS SLOPE OR SUPERELEVATION. THE BEAM SEAT MUST BE PARALLEL TO THE ROADWAY GRADE, IN THE LONGITUDINAL DIRECTION.
22. DETERMINE THE MINIMUM DIAMETER OF THE PRE-AUGERED HOLES IN ACCORDANCE WITH DESIGN MANUAL, PART 4 AP.G.1.4.2.1.
23. BEAM DEPTH IS RESTRICTED TO A 6'-0" MAXIMUM DEPTH WHEN USED FOR INTEGRAL ABUTMENT UNLESS APPROVED BY CHIEF BRIDGE ENGINEER.
24. DETAILS FOR BEAMS LESS THAN 1'-5" ARE NOT INCLUDED IN THIS STANDARD.
25. SKEW LIMITATION FOR INTEGRAL ABUTMENTS PER SECTION 1.2.2 OF DESIGN MANUAL, PART 4 APPENDIX "G".
26. FLARED WINGWALLS ARE NOT TO BE USED WITH INTEGRAL ABUTMENTS. REFERENCE APPENDIX "G" OF DESIGN MANUAL PART 4 SECTION 1.4.4.
27. BOTH THE TYPICAL AND ALTERNATE SIDEWALK DETAILS MAY BE USED ON INTEGRAL ABUTMENT BRIDGES. IF USED, THOSE DETAILS MUST BE CARRIED THROUGH THE APPROACH SLAB.
28. THE STLRFD SOFTWARE REQUIRES BEARING STIFFENERS AT THE CENTERLINE OF BEARING AND ALSO CONSIDERS THE GIRDERS TO BE LATERALLY BRACED AT THE CENTERLINE OF BEARING. THE DESIGNER IS RESPONSIBLE FOR DETAILING THE BEARING STIFFENERS. THE LATERAL BRACING (END DIAPHRAGM) IS TO BE OMITTED AND THE FOLLOWING NOTE ADDED TO THE CONSTRUCTION DRAWINGS:
    - THE CONTRACTOR IS RESPONSIBLE FOR TEMPORARY BRACING OF THE GIRDERS. PLACE THE #8 REINFORCEMENT BARS THROUGH THE BEAMS AND THE CAP FORMWORK PRIOR TO PLACING ANY DECK CONCRETE.
29. SUPERSTRUCTURE MUST BE ERECTED AND CONNECTED TO THE INTEGRAL ABUTMENTS PRIOR TO PLACING BACKFILL BEHIND THE ABUTMENTS.
30. ADD THE FOLLOWING NOTE TO THE CONSTRUCTION DRAWINGS:
    - DURING REDECKING, CONCRETE END DIAPHRAGMS MUST BE REMOVED COMPLETELY PRIOR TO DECK REMOVAL TO AVOID SUBJECTING THE GIRDERS TO STRUCTURE AND PAVEMENT TEMPERATURE FORCES AND EARTH PRESSURE.

REFERENCE DRAWINGS	
BD-601M	CONCRETE DECK SLAB
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-628M	BRIDGE APPROACH SLABS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-751M	BRIDGE DRAINAGE
BC-754M	STEEL DIAPHRAGMS FOR STEEL BEAM/GIRDER STRUCTURES (STRAIGHT GIRDERS ONLY)
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-12M	BACKFILL AT STRUCTURES
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

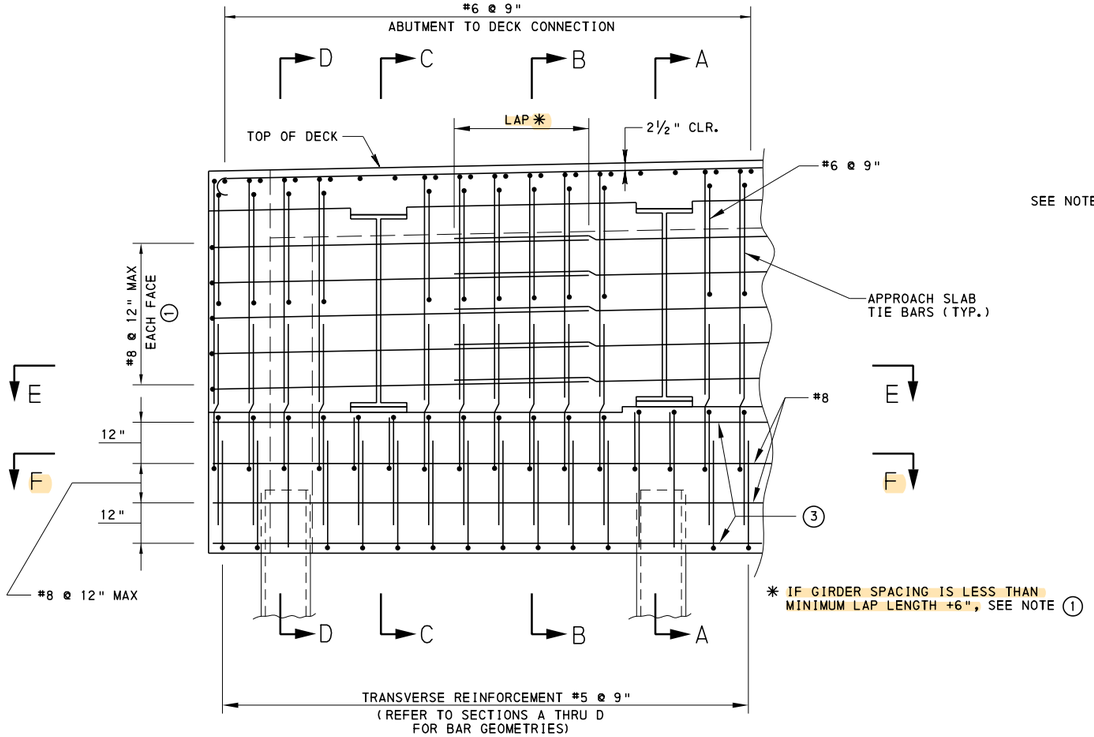
STANDARD INTEGRAL ABUTMENT LAYOUT AND GENERAL NOTES

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

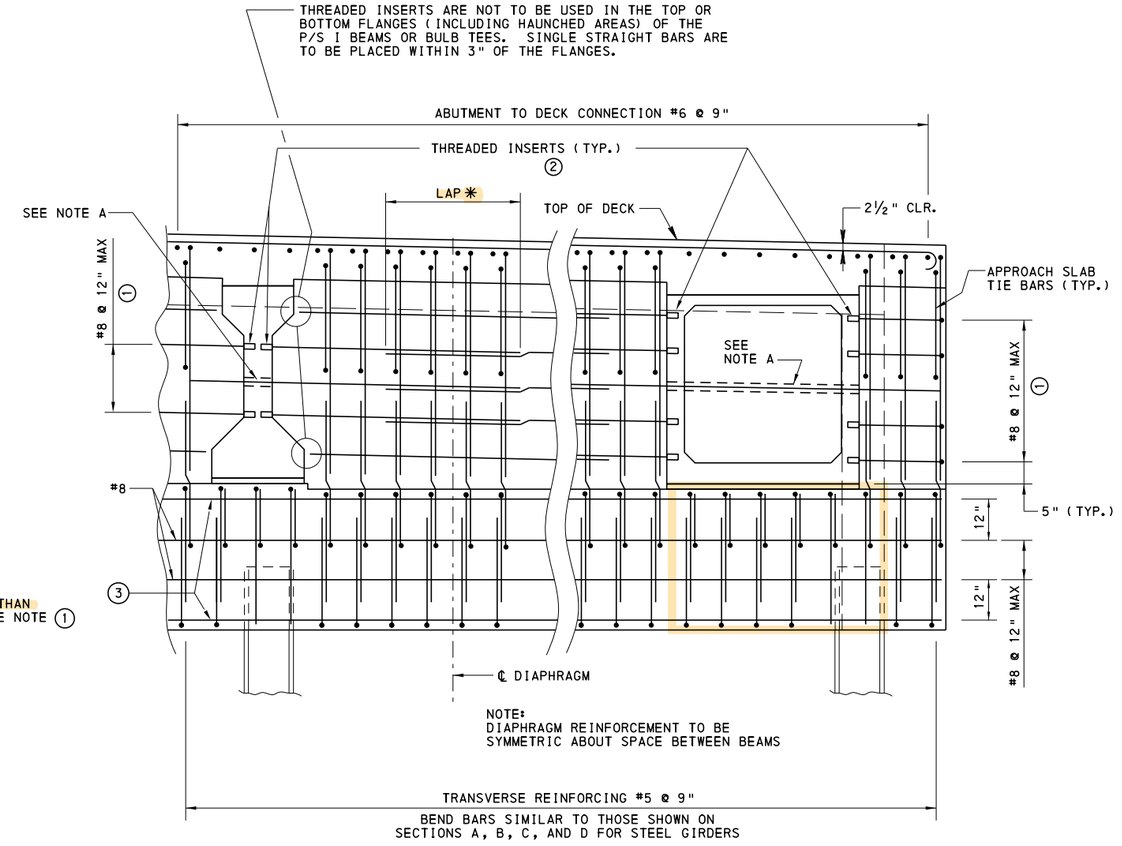
SHEET 1 OF 10

BD-667M



PARTIAL SECTION THRU ABUTMENT STEEL GIRDERS

NOTE: FOR SECTION A-A, SEE SHEET 3.
FOR SECTION B-B, SEE SHEET 3.
FOR SECTION C-C, SEE SHEET 3.
FOR SECTION D-D, SEE SHEET 3.
FOR SECTION E-E, SEE SHEET 5.
DECK REINFORCEMENT NOT SHOWN FOR CLARITY

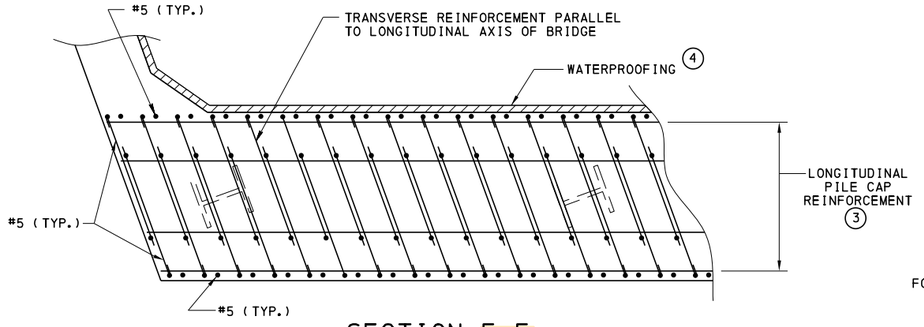


PARTIAL SECTION THRU ABUTMENT CONCRETE GIRDERS

NOTE: DECK REINFORCEMENT NOT SHOWN FOR CLARITY

NOTE A:

AS AN ALTERNATE TO THREADED INSERTS AND BAR LAPS, SLEEVES MAY BE PROVIDED IN P/S BEAMS.



SECTION F-F

LEGEND:

① LENGTH OF BARS BETWEEN GIRDERS:

FOR P/S BEAMS:
- FOR BARS BETWEEN INTERIOR BEAMS, USE MINIMUM BAR LENGTH EQUAL TO 3" THREADING + ½ GIRDER CLEAR SPACING + ½ LAP SPLICE LENGTH. IF THE LAP SPLICE LENGTH IS GREATER THAN THE GIRDER CLEAR SPACING THE BARS SHOULD EXTEND TO WITHIN 3" OF THE ADJACENT BEAMS.
- BAR LENGTH ON THE FASCIA SIDE OF THE FASCIA BEAM SHOULD BE TO WITHIN 3" OF THE END OF DIAPHRAGM WITH A 9" BENT LEG AND INCLUDE 3" THREADED.

FOR STEEL BEAMS:
- FOR BARS BETWEEN INTERIOR BEAMS, USE MINIMUM BAR LENGTH EQUAL TO THE CLEAR SPACING + LAP LENGTH. IF THE LAP SPLICE LENGTH IS GREATER THAN THE GIRDER CLEAR SPACING EXTEND BARS TO WITHIN 3" OF THE ADJACENT BEAMS ON EACH SIDE.
- BAR LENGTH ON THE FASCIA SIDE OF THE FASCIA BEAM SHOULD BE TO WITHIN 3" OF THE END OF DIAPHRAGM WITH A 9" BENT LEG.

② FOR INSERT DETAILS, SEE BD-655M AND BD-656M FULL DEPTH DIAPHRAGM WITHOUT BACKWALL AND INTEGRAL ABUTMENT DETAILS. FOR INSERT LOCATIONS, SEE SHEET 9.

③ FOR BAR SIZES OF PILE CAP BEAM TOP AND BOTTOM REINFORCEMENT, SEE DESIGN MANUAL, PART 4, AP. G 1.4.3

④ REFER TO WATERPROOFING DETAIL ON SHEET 5 FOR ADDITIONAL INFORMATION.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD INTEGRAL ABUTMENT TYPICAL SECTIONS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

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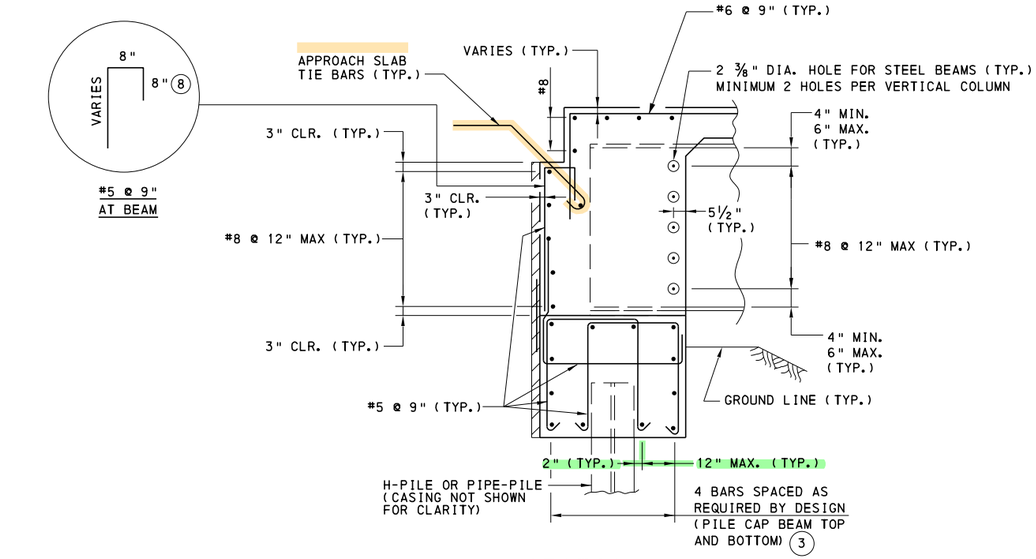
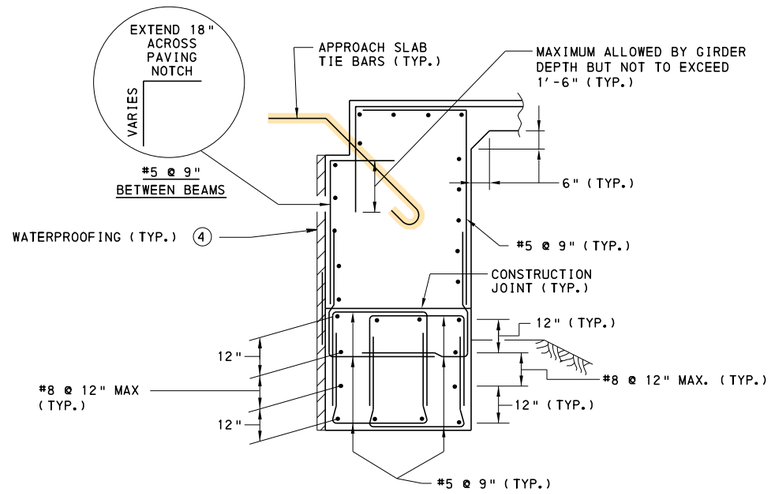


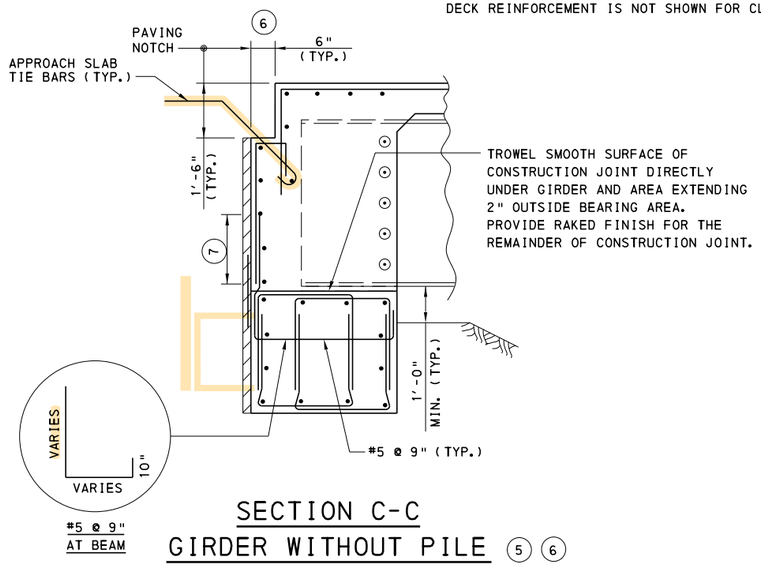
SECTION A-A
GIRDER WITH PILE (5) (6)

DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.



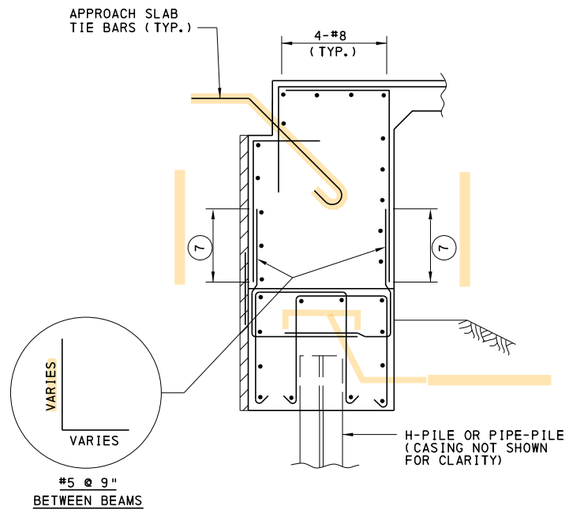
SECTION B-B
NO GIRDER, NO PILE (5)

DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.



SECTION C-C
GIRDER WITHOUT PILE (5) (6)

DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.



SECTION D-D
PILE WITHOUT GIRDER (5)

DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.

NOTES:

1. FOR SECTIONS A-A, B-B, C-C, AND D-D THE REINFORCEMENT AND WATERPROOFING INDICATED AS TYPICAL IN THE SECTIONS IS PRESENT IN ALL SECTIONS WHETHER SPECIFICALLY STATED OR NOT.
2. DETAILS SHOWN ARE FOR STEEL BEAMS, DETAILS SIMILAR FOR P/S BEAMS. SEE SHEET 9 FOR INSERT LOCATIONS.
3. FOR SECTION CUTS A-A, B-B, C-C AND D-D SEE SHEET 2.

LEGEND:

(3) FOR BAR SIZES OF PILE CAP BEAM TOP AND BOTTOM REINFORCEMENT, SEE DESIGN MANUAL, PART 4, AP. G 1.4.3.

(4) REFER TO WATERPROOFING DETAIL ON SHEET 5 FOR ADDITIONAL INFORMATION.

(5) SECTIONS ARE DRAWN SHOWING STEEL I-GIRDERS AND H-PILES. SECTIONS WITH CONCRETE GIRDERS AND/OR PIPE PILES WOULD BE SIMILAR EXCEPT FOR THE THREADED INSERTS REQUIRED FOR CONCRETE GIRDERS (SEE NOTE 2) AND THE REINFORCEMENT REQUIRED TO ANCHOR PIPE PILES (SEE DETAIL ON SHEET 9).

(6) STEEL BEAM SHOWN P/S BEAMS SIMILAR. SEE SHEET 9 AND PARTIAL SECTION THRU ABUTMENT CONCRETE GIRDERS ON SHEET 2 FOR INSERT/SLEEVE LOCATIONS.

(7) ELIMINATE LAP SPLICE IF GIRDERS ARE TOO SHALLOW TO PERMIT LAP. ELIMINATING THE SPLICE IS OPTIONAL IN ALL OTHER CASES.

(8) IF BAR EXTENDS INTO CAP EXTEND BAR TO PROVIDE 2" MIN. EMBEDMENT.

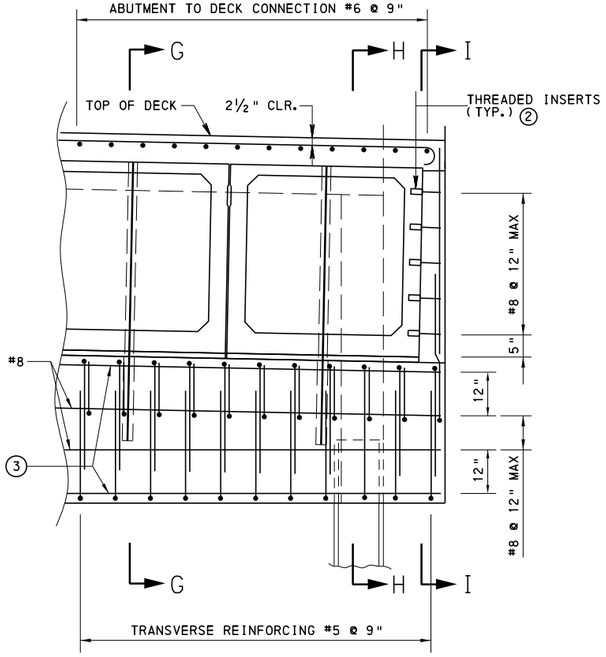
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
INTEGRAL ABUTMENT
TYPICAL SECTIONS
SPREAD BEAMS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

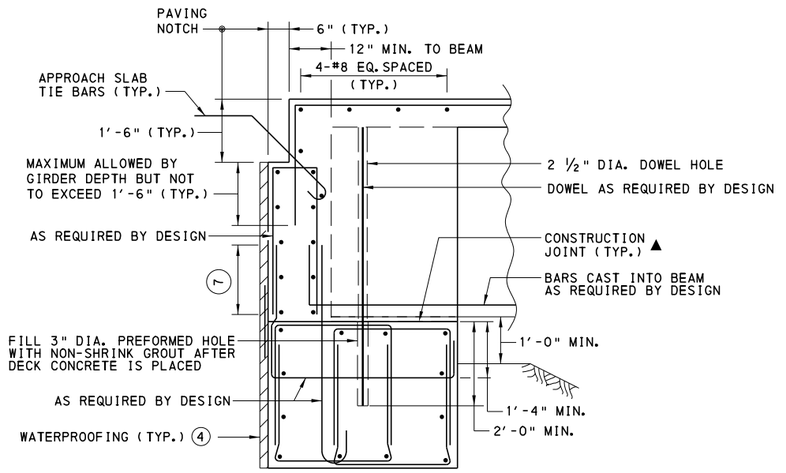
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-667M



PARTIAL SECTION THRU ABUTMENT CONCRETE ADJACENT BOX BEAMS

NOTE: DECK REINFORCEMENT NOT SHOWN FOR CLARITY



SECTION G-G GIRDER WITHOUT PILE (5)

DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.

▲ TROWEL SMOOTH SURFACE OF CONSTRUCTION JOINT DIRECTLY UNDER GIRDER AND AREA EXTENDING 2" OUTSIDE BEARING AREA. PROVIDE RAKED FINISH FOR THE REMAINDER OF CONSTRUCTION JOINT.

LEGEND:

(2) FOR INSERT DETAILS, SEE BD-655M AND BD-656M FULL DEPTH DIAPHRAGM WITHOUT BACKWALL AND INTEGRAL ABUTMENT DETAILS.

(3) FOR BAR SIZES OF PILE CAP BEAM TOP AND BOTTOM REINFORCEMENT, SEE DESIGN MANUAL, PART 4, AP. G 1.4.3.

(4) REFER TO WATERPROOFING DETAIL ON SHEET 5 FOR ADDITIONAL INFORMATION.

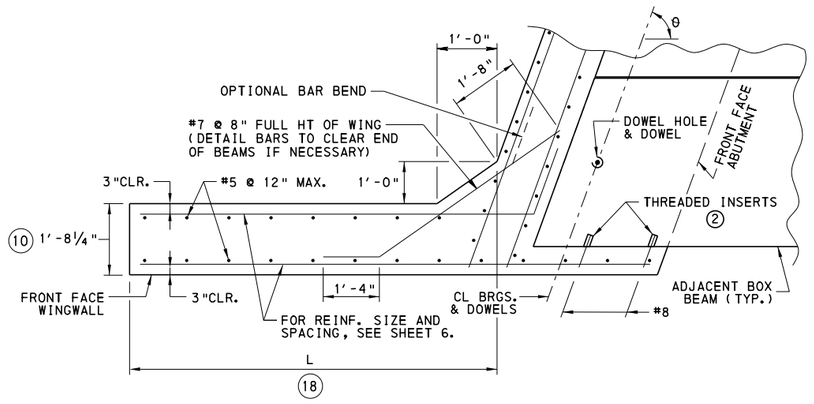
(5) SECTIONS ARE DRAWN SHOWING H-PILES. SECTIONS WITH PIPE PILES WOULD BE SIMILAR EXCEPT FOR THE REINFORCEMENT REQUIRED TO ANCHOR PIPE PILES (SEE DETAIL ON SHEET 9).

(7) ELIMINATE LAP SPLICE IF GIRDERS ARE TOO SHALLOW TO PERMIT LAP. ELIMINATING THE SPLICE IS OPTIONAL IN ALL OTHER CASES.

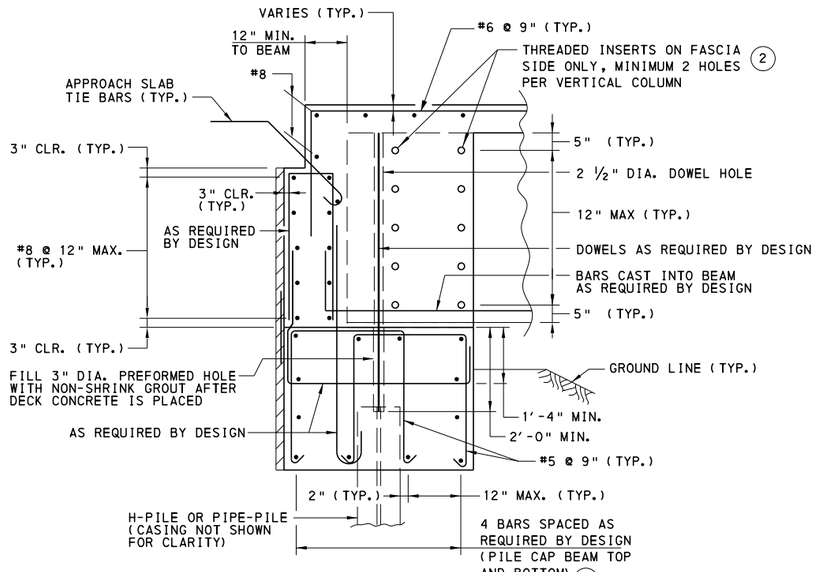
(8) IF BAR EXTENDS INTO CAP EXTEND BAR TO PROVIDE 2" MIN. EMBEDMENT.

(10) WINGWALL WIDTH MAY VARY BASED ON BARRIER TYPE. MINIMUM WINGWALL WIDTH EQUALS 1'-8¼".

(18) SEE SHEET 6 FOR ADDITIONAL WINGWALL DETAILS AND REQUIREMENTS INCLUDING MINIMUM AND MAXIMUM WINGWALL LENGTHS.

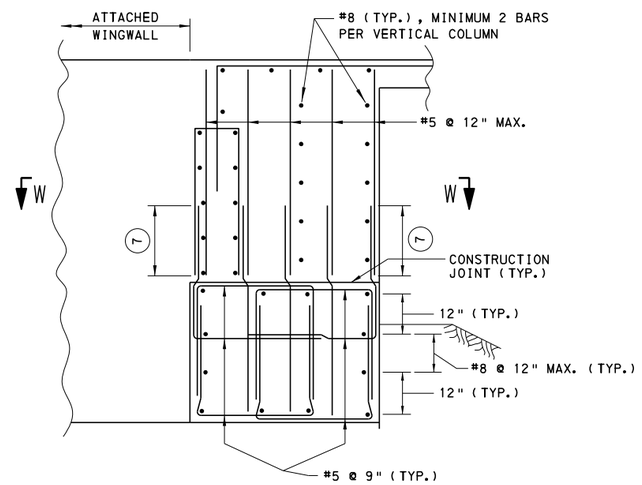


SECTION W-W (18)



SECTION H-H GIRDER WITH PILE (5)

DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.



SECTION I-I NO GIRDER, NO PILE

DECK AND WINGWALL REINFORCEMENT IS NOT SHOWN FOR CLARITY.
SEE SECTION W-W THIS SHEET AND SHEET 6 FOR WINGWALL REINFORCEMENT

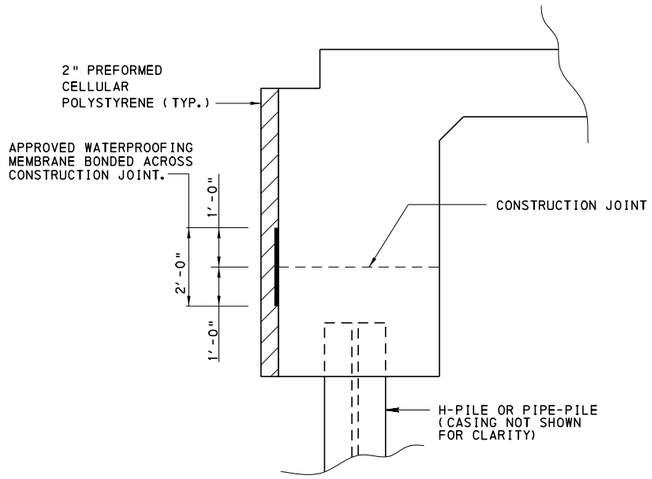
NOTES:

1. ADJACENT BOX BEAMS WITH INTEGRAL ABUTMENTS MAY ONLY BE USED WITH THE APPROVAL OF THE DISTRICT BRIDGE ENGINEER.
2. ADJUST THE PILE CAP WIDTH FOR ADJACENT BOX BEAMS AS REQUIRED. 4'-0" MAY NOT BE SUFFICIENT.
3. FOR SECTIONS G-G, H-H, AND I-I THE REINFORCEMENT AND WATERPROOFING INDICATED AS TYPICAL IN THE SECTIONS IS PRESENT IN ALL SECTIONS WHETHER SPECIFICALLY STATED OR NOT.

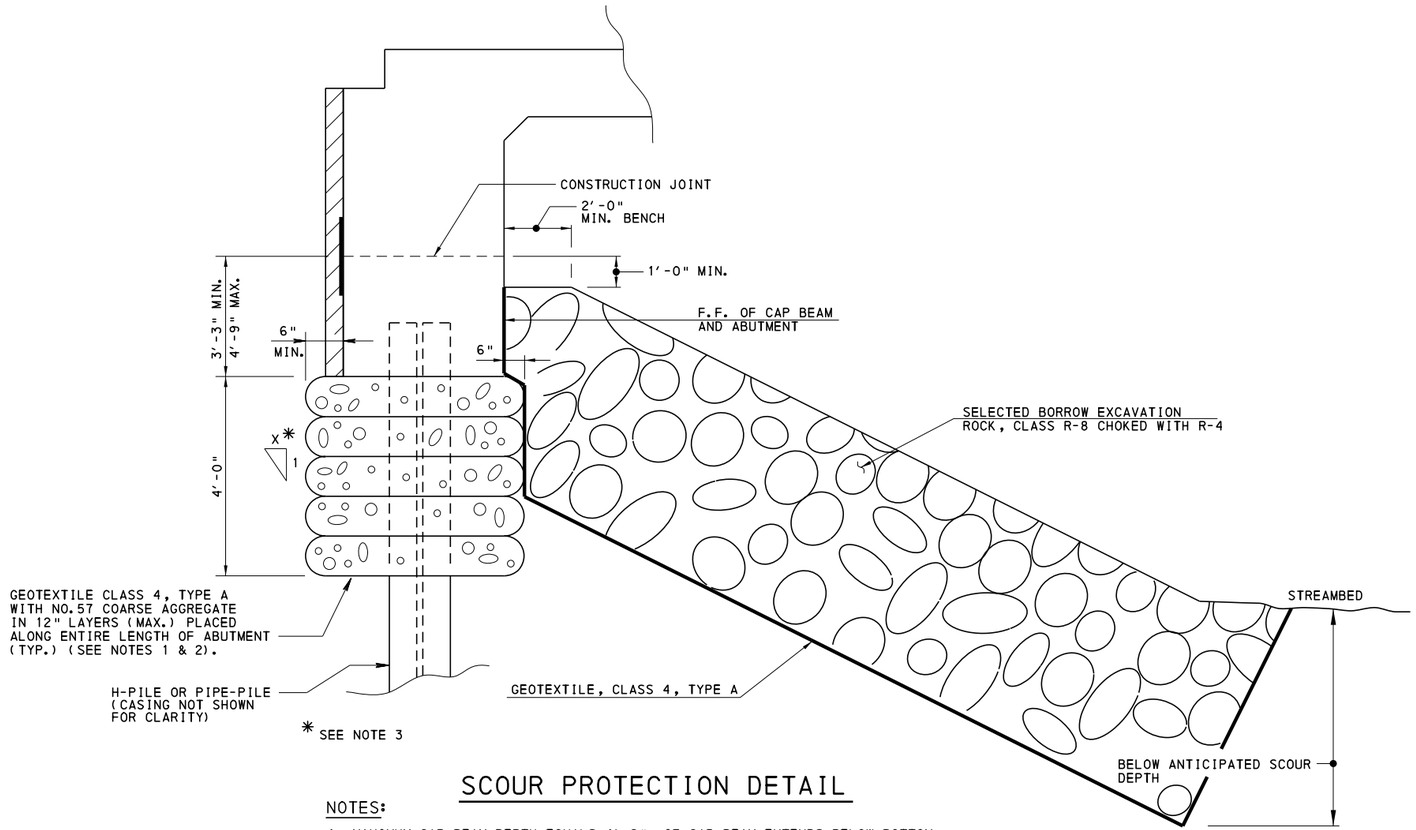
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD INTEGRAL ABUTMENT TYPICAL SECTIONS ADJACENT BEAMS

RECOMMENDED NOV. 23, 2022 CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 4 OF 10
		BD-667M



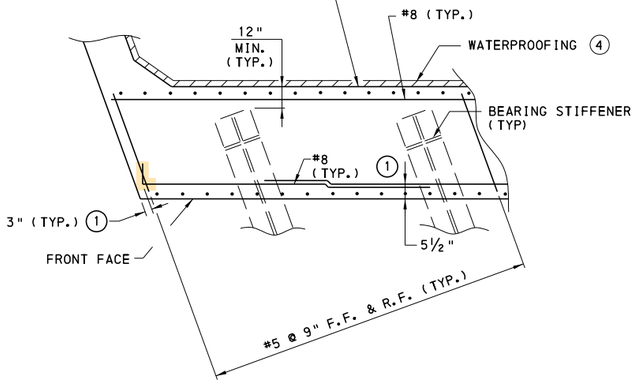
WATERPROOFING DETAIL



SCOUR PROTECTION DETAIL

NOTES:

1. MAXIMUM CAP BEAM DEPTH EQUALS 4'-9". IF CAP BEAM EXTENDS BELOW BOTTOM OF SELECT BORROW EXCAVATION ROCK, R-8, THE INDICATED GEOTEXTILE, CLASS 4 (TYPE A) WITH NO.57 COARSE AGGREGATE CAN BE ELIMINATED.
2. NO.8 COARSE AGGREGATE MAY BE USED IN LIEU OF THE NO.57 COURSE AGGREGATE FOR THE GEOTEXTILE.
3. PLACE GEOTEXTILE ALONG A VERTICAL REAR EXCAVATION FACE IF POSSIBLE. IF A VERTICAL EXCAVATION FACE CANNOT BE OBTAINED, GEOTEXTILE MAY BE PLACED ALONG THE EXCAVATION SLOPE NOT TO EXCEED 1.5H TO 1.0V.



SECTION E-E

NOTE: PROVIDE WATERPROOFING MEMBRANE IN ACCORDANCE WITH PUBLICATION 408, SECTION 680.2(b) ADHESIVE BACKED PREFORMED MEMBRANE.

LEGEND:

(1) LENGTH OF BARS BETWEEN GIRDERS:

FOR P/S BEAMS:
- FOR BARS BETWEEN INTERIOR BEAMS, USE MINIMUM BAR LENGTH EQUAL TO 3" THREADING + ½ GIRDER CLEAR SPACING + ½ LAP SPLICE LENGTH. IF THE LAP SPLICE LENGTH IS GREATER THAN THE GIRDER CLEAR SPACING THE BARS SHOULD EXTEND TO WITHIN 3" OF THE ADJACENT BEAMS.
- BAR LENGTH ON THE FASCIA SIDE OF THE FASCIA BEAM SHOULD BE TO WITHIN 3" OF THE END OF DIAPHRAGM WITH A 9" BENT LEG AND INCLUDE 3" THREADED.

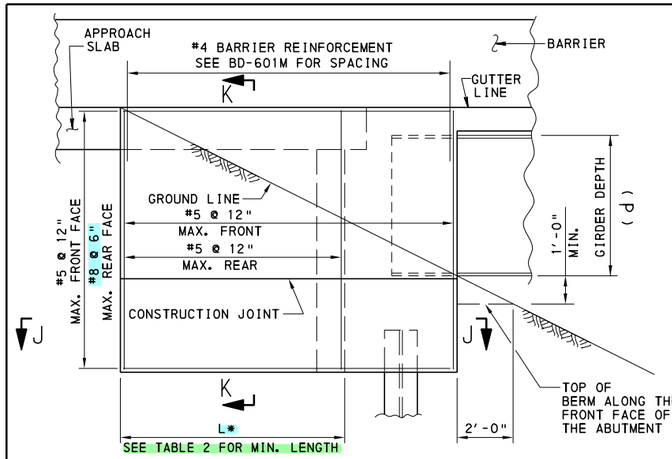
FOR STEEL BEAMS:
- FOR BARS BETWEEN INTERIOR BEAMS, USE MINIMUM BAR LENGTH EQUAL TO THE CLEAR SPACING + LAP LENGTH. IF THE LAP SPLICE LENGTH IS GREATER THAN THE GIRDER CLEAR SPACING EXTEND BARS TO WITHIN 3" OF THE ADJACENT BEAMS ON EACH SIDE.
- BAR LENGTH ON THE FASCIA SIDE OF THE FASCIA BEAM SHOULD BE TO WITHIN 3" OF THE END OF DIAPHRAGM WITH A 9" BENT LEG.

(4) REFER TO WATERPROOFING DETAIL FOR ADDITIONAL INFORMATION.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD INTEGRAL ABUTMENT DETAILS

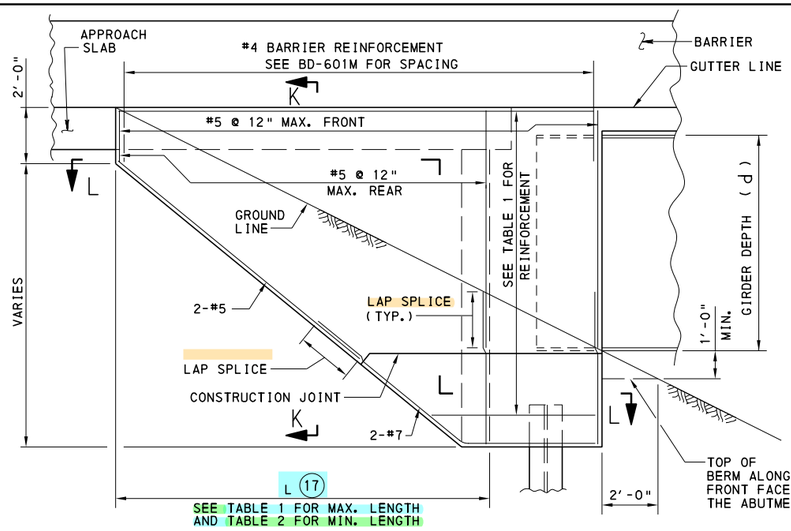
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 5 OF 10
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-667M



ATTACHED RECTANGULAR WINGWALL ELEVATION

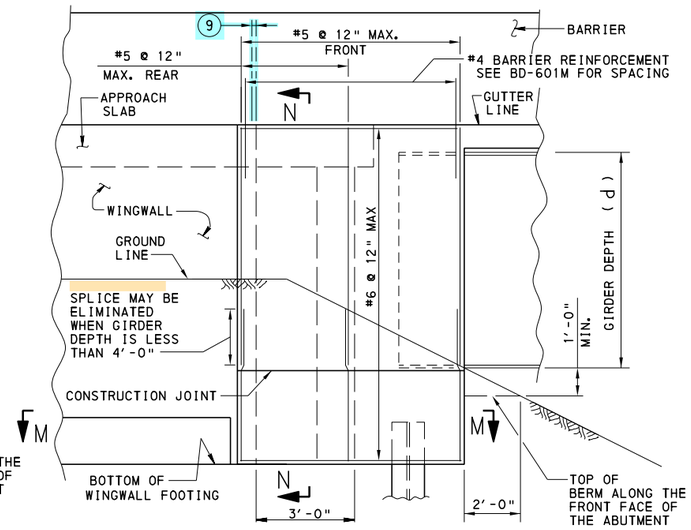
(FOR GIRDER DEPTH d < 5'-0")

NOTE TO DESIGNER: THE BEAM DEPTH AND MAXIMUM WINGWALL LENGTHS ARE BASED ON STRUCTURAL CAPACITY OF THE WING WALL ATTACHEMENT TO THE CAP. THEREFORE THE BARRIER END TRANSITION LENGTH INDICATED IN TABLE 3 MAY CONTROL THE MINIMUM BEAM DEPTH.

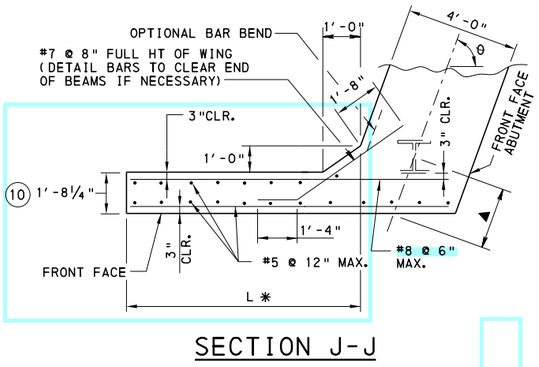


ATTACHED TAPERED WINGWALL ELEVATION

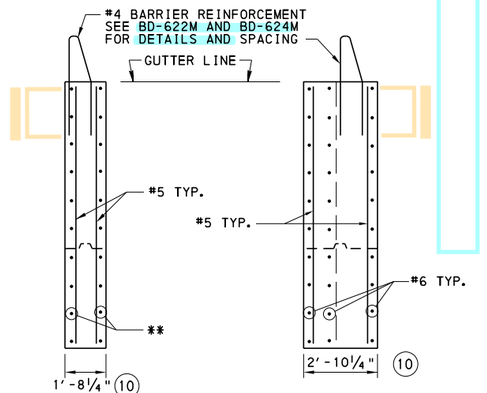
(FOR GIRDER DEPTH 5'-0" ≤ d < 8'-0")



DETACHED WINGWALL ELEVATION



SECTION J-J



SECTION K-K

(RECTANGULAR OR TAPERED WING)

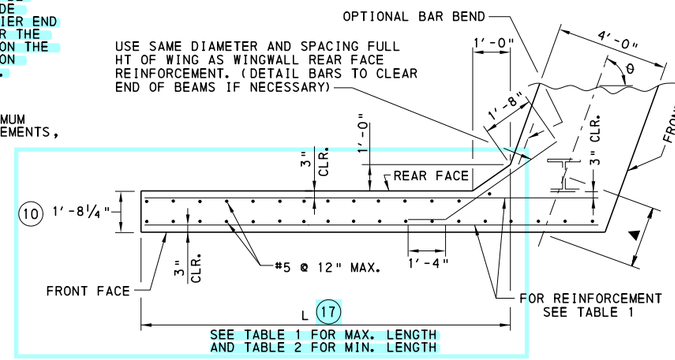
SECTION N-N

(DETACHED WING)

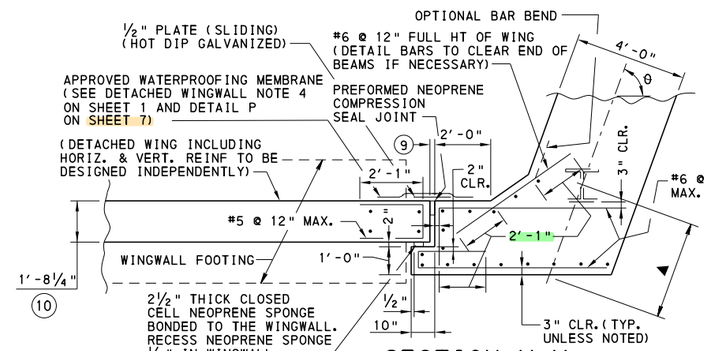
** FOR RECTANGULAR WINGWALL REINFORCEMENT: SEE SECTION J-J.
FOR TAPERED WINGWALL REINFORCEMENT: SEE TABLE 1 THIS SHEET.

* THE WING LENGTH MUST BE LONG ENOUGH TO INCLUDE THE APPROPRIATE BARRIER END TRANSITION LENGTH FOR THE BRIDGE BARRIER TYPE ON THE STRUCTURE. SEE NOTE ON SHEET 7. SEE TABLE 3.

▲ FOR MINIMUM AND MAXIMUM EDGE DISTANCE REQUIREMENTS, SEE SHEET 1.



SECTION L-L



SECTION M-M

FOR MEMBRANE SLACK, SEE DETAIL P ON SHEET 7.

TABLE 1: TAPERED WINGWALL REINFORCEMENT

GIRDER DEPTH (d)	WINGWALL LENGTH BEYOND THE REAR FACE OF THE ABUTMENT (L)	REINFORCEMENT	
(in)	(ft)	REAR FACE	FRONT FACE
60 ≤ d < 72	L ≤ 14'-2"	#8 @ 6"	#5 @ 12"
72 ≤ d* < 84	L ≤ 15'-0"	#8 @ 6"	#5 @ 12"
84 ≤ d* < 96	L ≤ 15'-10"	#8 @ 6"	#5 @ 12"
96 = d*	L ≤ 16'-7"	#8 @ 6"	#5 @ 12"

* CHIEF BRIDGE ENGINEER APPROVAL IS REQUIRED FOR BEAM DEPTHS GREATER THAN 6'-0"

TABLE 2: MINIMUM ATTACHED WINGWALL LENGTH (L) ***

WALL	GIRDER DEPTH (d)	SKEW=90°	45° ≤ SKEW < 90°
RECTANGULAR	d < 48"	7'-6"	7'-6"
	48" ≤ d < 60"	7'-8"	9'-0"
TAPERED	60" ≤ d < 72"	9'-8"	10'-8"
	72" ≤ d* < 84"	11'-8"	12'-8"
	84" ≤ d* < 96"	13'-8"	14'-8"
	d = 96"*	14'-0"	15'-0"

*** ACTUAL WINGWALL LENGTH SHALL BE DETERMINED BASED ON GRADING-CONTOURS AND THE MINIMUM BARRIER END TRANSITION LENGTH IN TABLE 3.

TABLE 3: RECTANGULAR WINGWALL

BARRIER TYPE	PERMISSIBLE BEAM DEPTH (d)	MINIMUM BARRIER END TRANSITION LENGTH (L)	MAXIMUM WINGWALL LENGTH
32" F-SHAPE CONCRETE BARRIER	21" ≤ d < 60"	12'-0"	15'-6"
42" AND 45" F-SHAPE CONCRETE BARRIER	48" ≤ d < 60"	12'-0"	12'-0"
32" VERTICAL WALL CONCRETE BARRIER	21" ≤ d < 60"	7'-0"	15'-6"
42" VERTICAL WALL CONCRETE BARRIER	48" ≤ d < 60"	10'-0"	12'-0"
PA BRIDGE BARRIER	48" ≤ d < 60"	9'-0"	12'-0"
PA TYPE 10M BRIDGE BARRIER	21" ≤ d < 60"	9'-0"	15'-6"

LEGEND:

(9) DISTANCES TO BE DETERMINED BASED ON DESIGN MOVEMENT, CONSTRUCTION TEMPERATURE, AND COMPRESSION SEAL JOINT MINIMUM INSTALLATION OPENING REQUIREMENTS. SEE NOTE 1 OF DETACHED WINGWALL NOTES, ON SHEET 1.

(10) WINGWALL WIDTH MAY VARY BASED ON BARRIER TYPE. MINIMUM WINGWALL WIDTH EQUALS 1'-8¼".

(17) FOR MINIMUM BARRIER END TRANSITION LENGTH (L), REFER TO TABLE 3.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

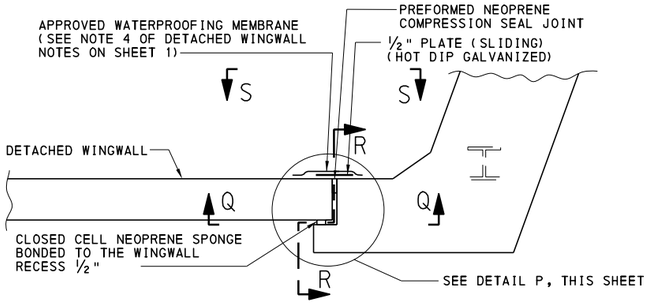
STANDARD INTEGRAL ABUTMENT WINGWALL DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

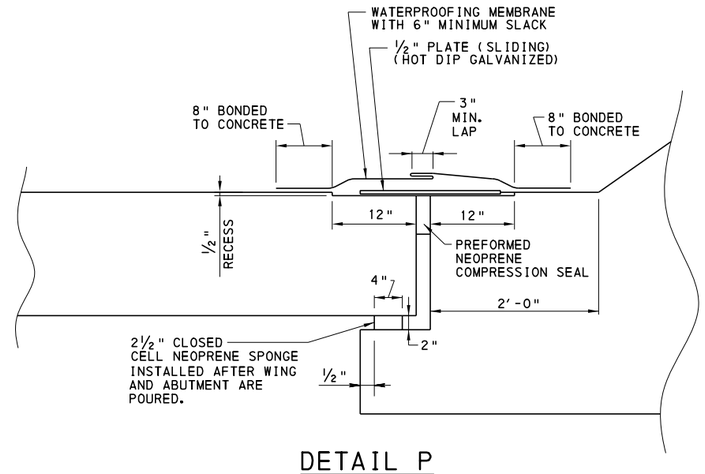
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 10

BD-667M



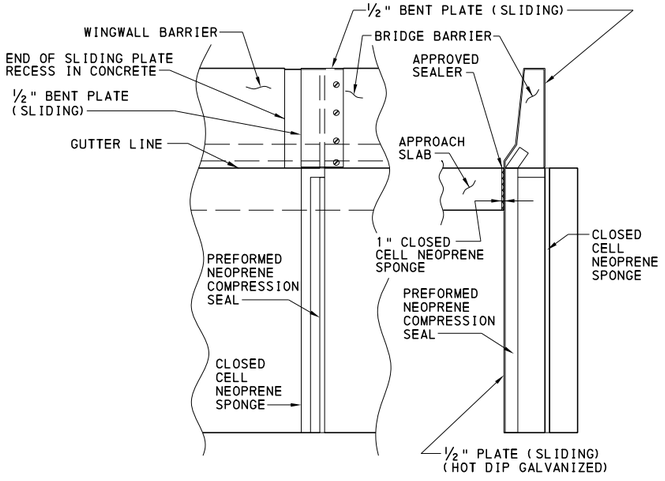
PARTIAL SECTION THRU DETACHED WINGWALL EXPANSION JOINT



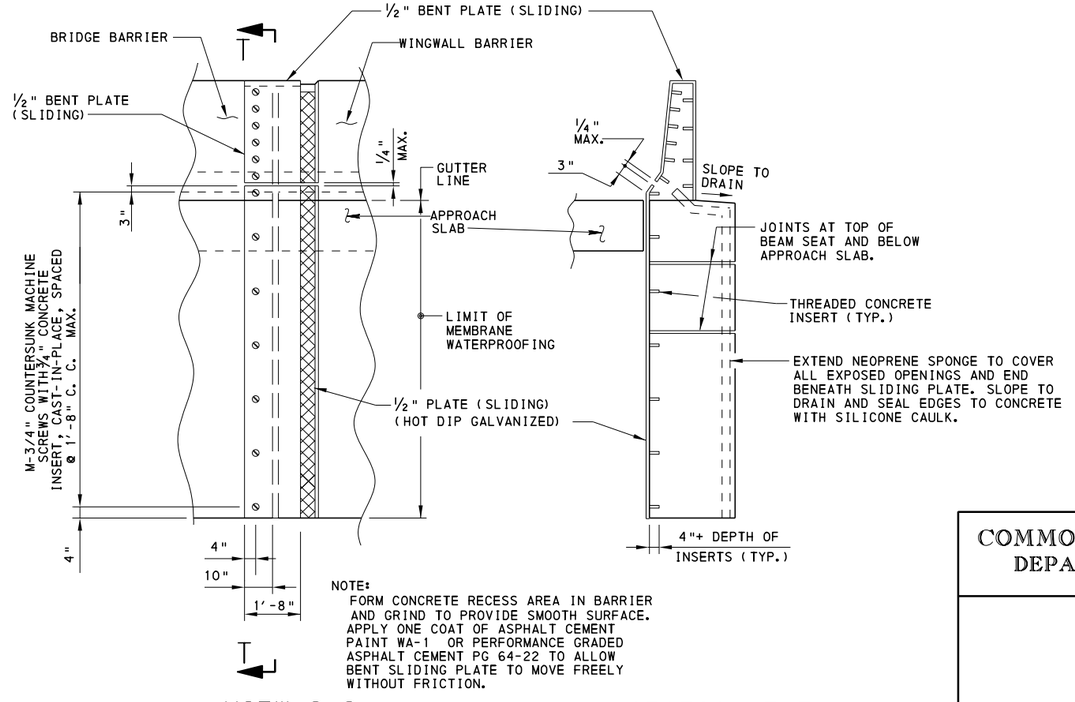
DETAIL P

NOTE:

IF THE ATTACHED RECTANGULAR WINGWALL CANNOT ACCOMMODATE THE REQUIRED TRANSITION LENGTH, USE THE ATTACHED TAPERED WINGWALL OR DETACHED WINGWALL.



SECTION Q-Q SECTION R-R



VIEW S-S

(WATERPROOFING MEMBRANE AND LIMITS OF RECESS IN CONCRETE REMOVED FOR CLARITY)

SECTION T-T

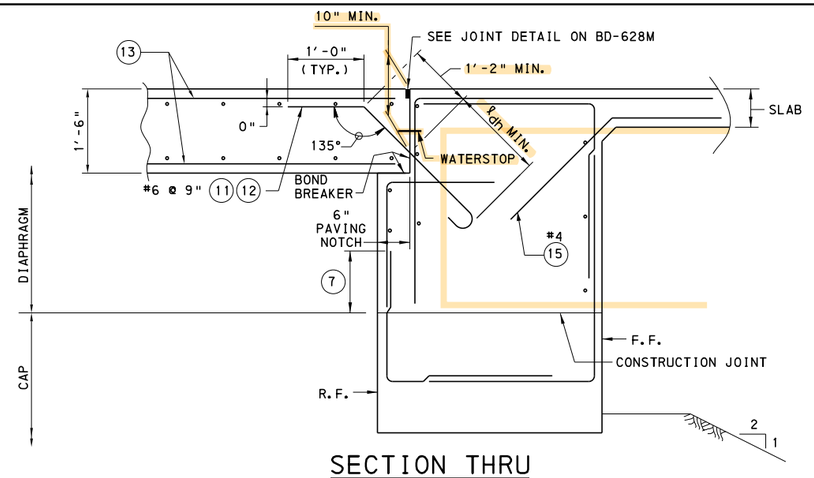
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD INTEGRAL ABUTMENT DETACHED WINGWALL DETAILS

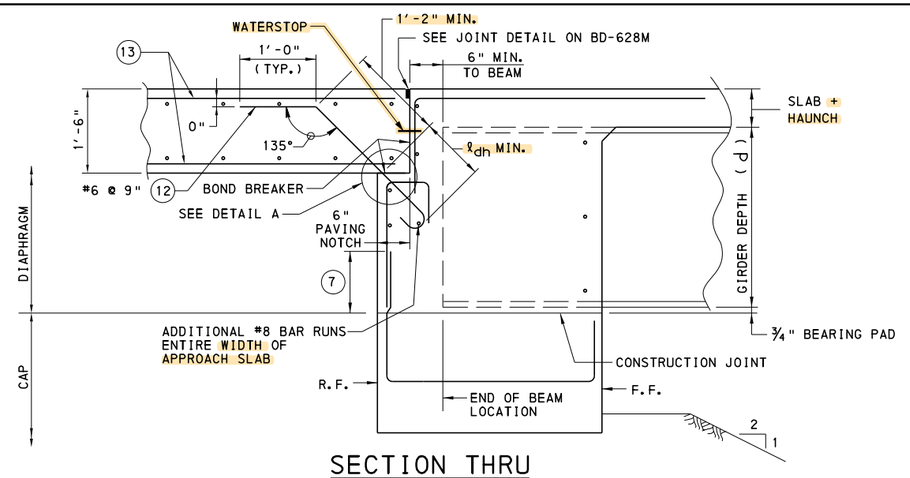
RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-667M

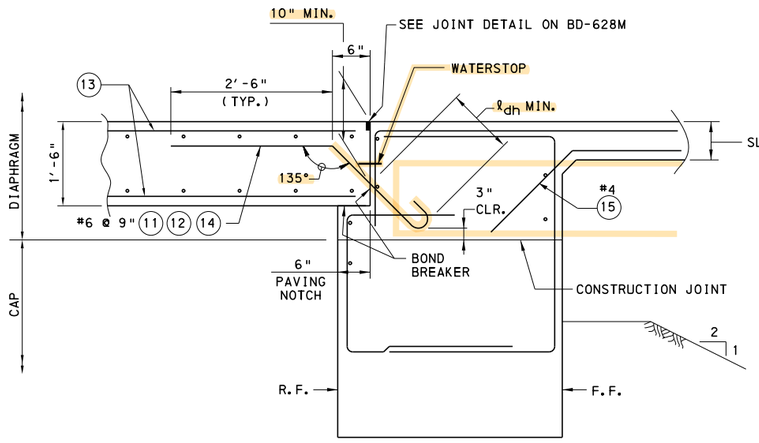


SECTION THRU END DIAPHRAGM BETWEEN BEAMS GIRDER DEPTH ≥ 2'-0"

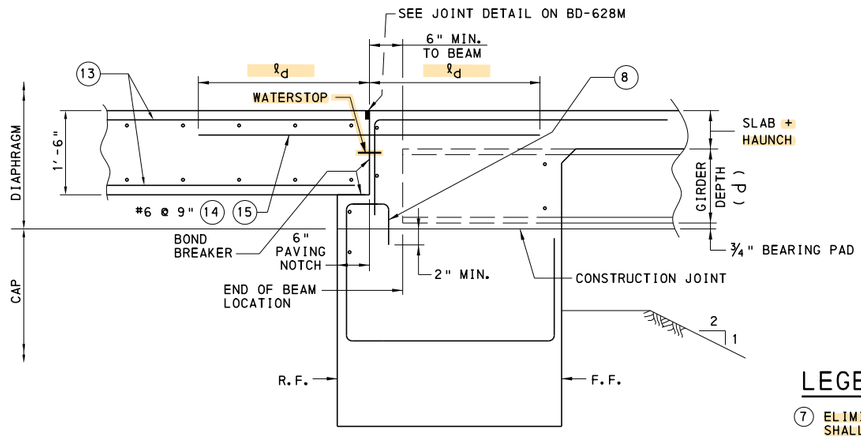


SECTION THRU END DIAPHRAGM AT BEAMS GIRDER DEPTH ≥ 2'-0"

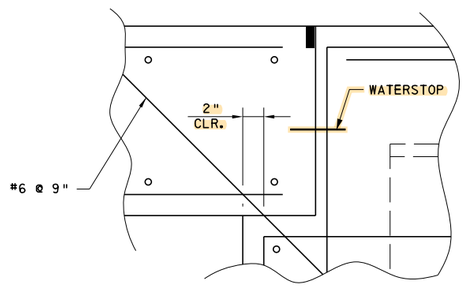
NOTE: DECK AND CAP REINFORCEMENT NOT SHOWN FOR CLARITY.



SECTION THRU END DIAPHRAGM BETWEEN BEAMS GIRDER DEPTH < 2'-0"



SECTION THRU END DIAPHRAGM AT BEAMS GIRDER DEPTH < 2'-0"



DETAIL A

MINIMUM APPROACH SLAB LENGTH ALONG ℄			
GIRDER DEPTH (d)	SKEW = 90°	SKEW = 60°	SKEW = 45°
17" ≤ d ≤ 24"	12'-0"	14'-0"	18'-0"
24" < d ≤ 36"	14'-0"	16'-0"	20'-0"
36" < d ≤ 48"	15'-0"	18'-0"	22'-0"
48" < d ≤ 60"	17'-0"	20'-0"	24'-0"
60" < d ≤ 72"	18'-0"	22'-0"	25'-0"
72" < d* ≤ 84"	20'-0"	24'-0"	----
84" < d* ≤ 96"	22'-0"	25'-0"	----

NOTES FOR USE OF TABLE:

1. THE 25'-0" APPROACH SLAB LENGTH SHOWN ON BD-628M, SHEET 35 OF 35 (TYPE 5), MAY BE REDUCED TO THE VALUE INDICATED ABOVE WHEN SITE CONDITIONS EXIST THAT RESTRICT THE USE OF THE 25'-0" APPROACH SLAB LENGTH OR WHEN DIRECTED BY THE DISTRICT BRIDGE ENGINEER.
2. DO NOT CHANGE THE APPROACH SLAB REINFORCEMENT SPECIFIED ON BD-628M IF THE APPROACH SLAB LENGTH IS REDUCED.
3. FOR SKEW ANGLES OTHER THAN THOSE INDICATED, USE THE NEXT LARGER APPROACH SLAB LENGTH INDICATED (i.e. FOR A 70° SKEW, USE THE 60° SKEW LENGTH).

* - CHIEF BRIDGE ENGINEER APPROVAL IS REQUIRED FOR BEAM DEPTHS GREATER THAN 6'-0"

LEGEND:

(7) ELIMINATE LAP SPLICE IF GIRDERS ARE TOO SHALLOW TO PERMIT LAP. ELIMINATING THE SPLICE IS OPTIONAL IN ALL OTHER CASES.

(8) IF BAR EXTENDS INTO CAP EXTEND BAR TO PROVIDE 2" MIN. EMBEDMENT.

(11) DETAIL SPACING TO CLEAR GIRDERS.

(12) FOR 180° HOOK DIMENSIONS, REFER TO BC-736M.

(13) FOR DIMENSIONS AND REINFORCEMENT OF APPROACH SLAB, SEE BD-628M.

(14) THE HORIZONTAL LEG OF THE BAR IS TO BE LOCATED AT THE SAME PLANE AS THE LONGITUDINAL DECK REINFORCEMENT IN THE BOTTOM MAT OF THE DECK.

(15) SPACED WITH LONGITUDINAL DECK REINFORCEMENT

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

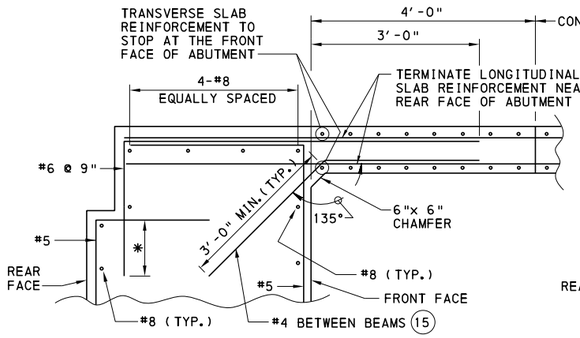
STANDARD INTEGRAL ABUTMENT APPROACH SLAB DETAILS

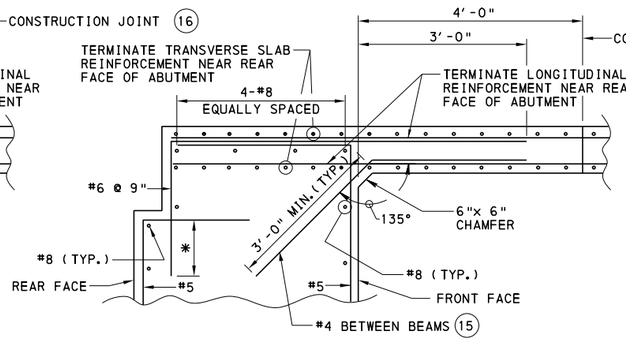
RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 8 OF 10

BD-667M





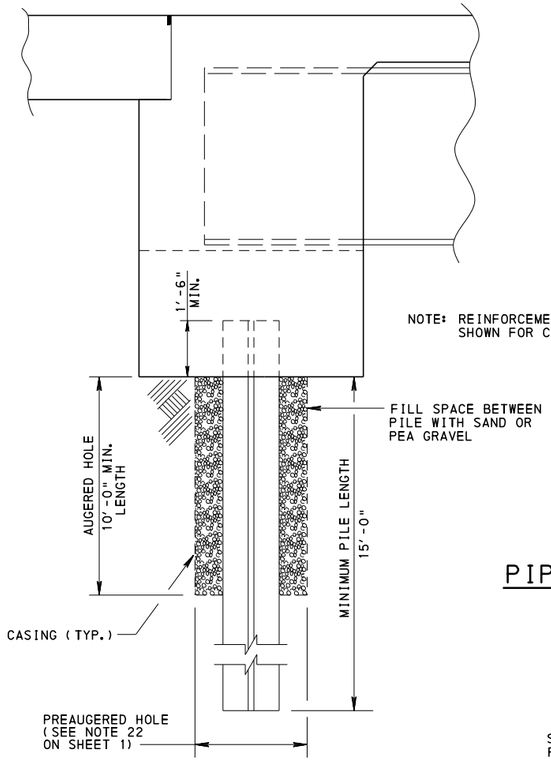
* 1'-6" MAXIMUM LENGTH ALLOWED DUE TO GIRDER DEPTH.

TRANSVERSE SLAB REINFORCEMENT PARALLEL TO ABUTMENT (SKEWS OF 75° TO 90°)

TRANSVERSE SLAB REINFORCEMENT NOT PARALLEL TO ABUTMENT (SKEWS < 75°)

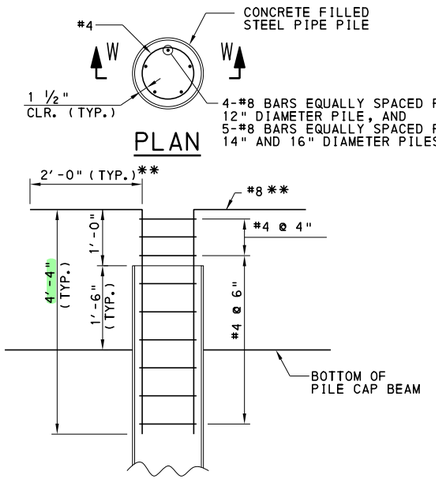
SLAB-ABUTMENT CONNECTION DETAIL

- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.
- SECTIONS BETWEEN GIRDERS SHOWN



INTEGRAL ABUTMENT PILE INSTALLATION DETAIL

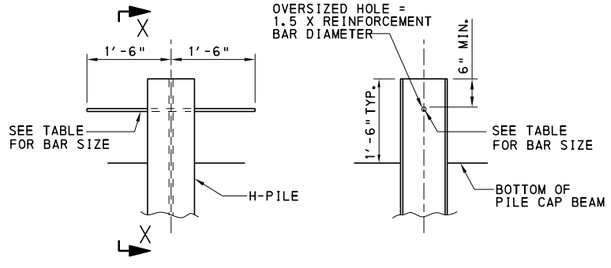
- SEE APPENDIX G OF DESIGN MANUAL PART 4 SECTION 1.4.2 FOR PRE AUGERING REQUIREMENTS
- PREDRILL OVERSIZED HOLES FOR ALL PILES IN ACCORDANCE WITH DESIGN MANUAL PART 4 AP.G.1.4.2.1. PLACE PILES VERTICAL IN THE HOLES BEFORE FILLING THE HOLES. FILL THE HOLES WITH DRY LOOSE SAND OR PEA GRAVEL BEFORE DRIVING THE PILES.



SECTION W-W

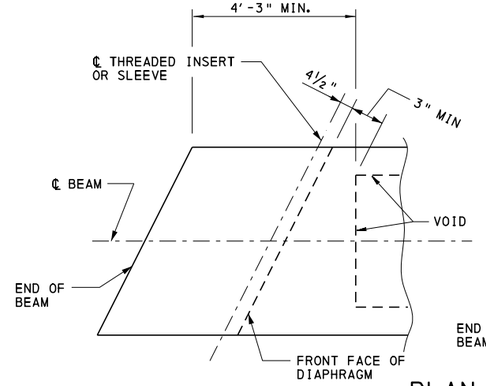
** HOOK 180° PER BC-736M OR ROTATE TO FIT SHORTER CAP WIDTHS

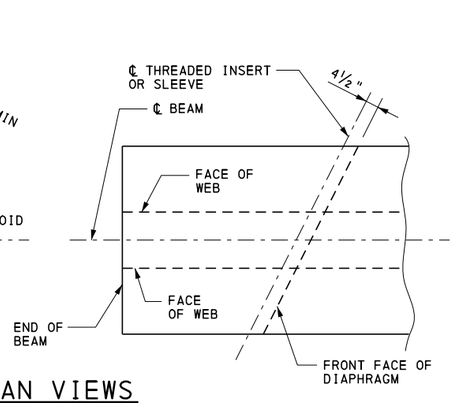
PIPE PILE-TO-PILE CAP CONNECTION DETAIL



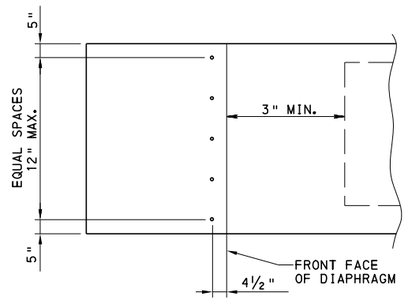
ELEVATION VIEW X-X

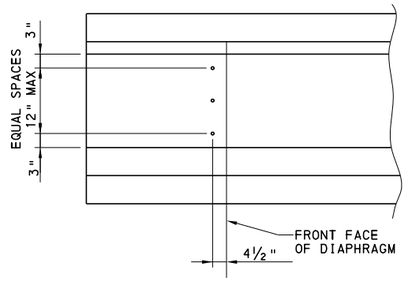
H-PILE-TO-PILE CAP CONNECTION DETAIL





PLAN VIEWS





CONCRETE BOX BEAMS

CONCRETE I-BEAMS

ELEVATION VIEWS

THREADED INSERT LOCATIONS IN SPREAD PRESTRESS BEAMS BEAM ENDS SUPPORTED ON INTEGRAL ABUTMENTS

(SEE SHEET 3 FOR HOLE LOCATION IN WEBS OF STEEL BEAMS)

H-PILE TO PILE CAP CONNECTION REINFORCEMENT	
PILE SIZE	BAR
HP 10 x 57	#6
HP 12 x 53	#6
HP 12 x 63	#6
HP 12 x 74	#6
HP 12 x 84	#7
HP 14 x 73	#6
HP 14 x 89	#7
HP 14 x 102	#7
HP 14 x 117	#8

LEGEND:

(15) SPACED WITH LONGITUDINAL DECK REINFORCEMENT

(16) DECK PLACEMENT SEQUENCE:
1. POUR THE ENTIRE DECK EXCEPT THE PORTIONS WITHIN 4'-0" FROM THE FRONT FACES OF THE ABUTMENTS.
2. THEN POUR THE END DIAPHRAGMS.
3. FOR GIRDER DEPTHS >36", WAIT A MINIMUM OF 2 HOURS BEFORE POURING THE REMAINER OF THE DECK. FOR GIRDER DEPTHS ≤36" THE REMAINDER OF THE DECK CAN BE POURED SIMULTANOUSLY WITH THE END DIAPHRAGMS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

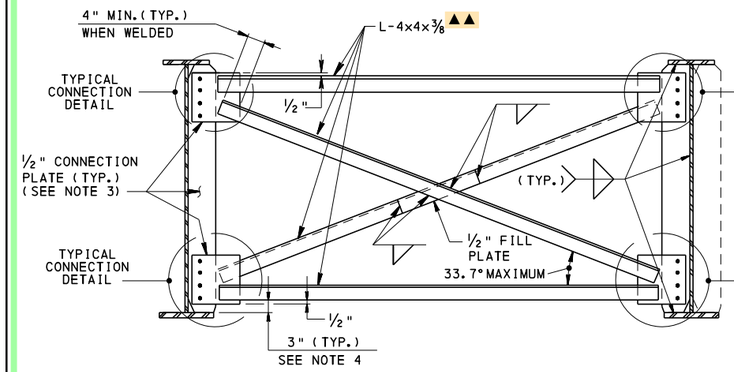
STANDARD
INTEGRAL ABUTMENT SLAB-ABUTMENT CONNECTION AND PILE-ABUTMENT CONNECTION DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
Gavin E. Gray
CHIEF ENGINEER, HIGHWAY ADMIN.

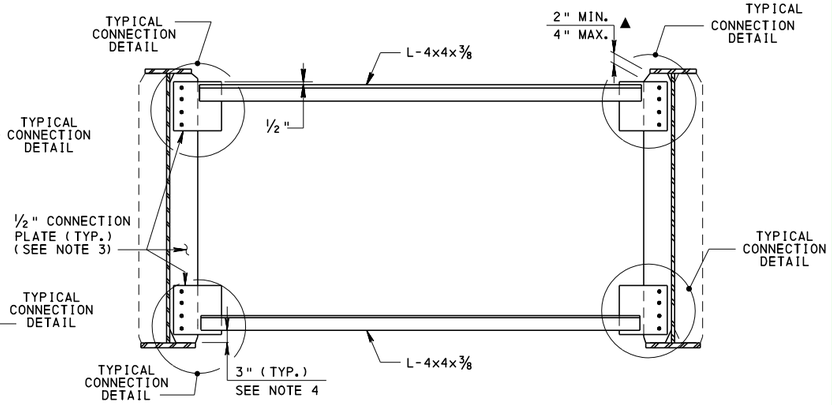
SHEET 9 OF 10

BD-667M



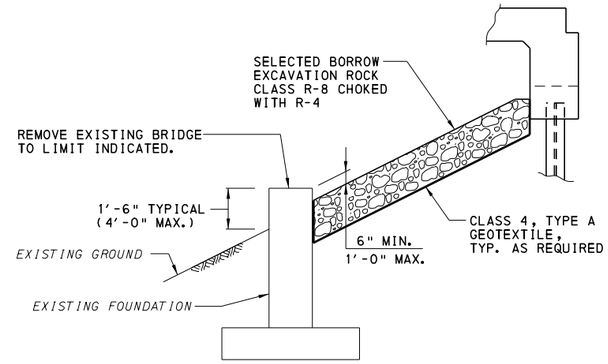
CONNECTION DETAIL - FIRST BAY ERECTED

▲▲ DIAGONALS ARE NOT REQUIRED FOR GIRDER DEPTHS < 3'-0"



CONNECTION DETAIL - ADDITIONAL BAY

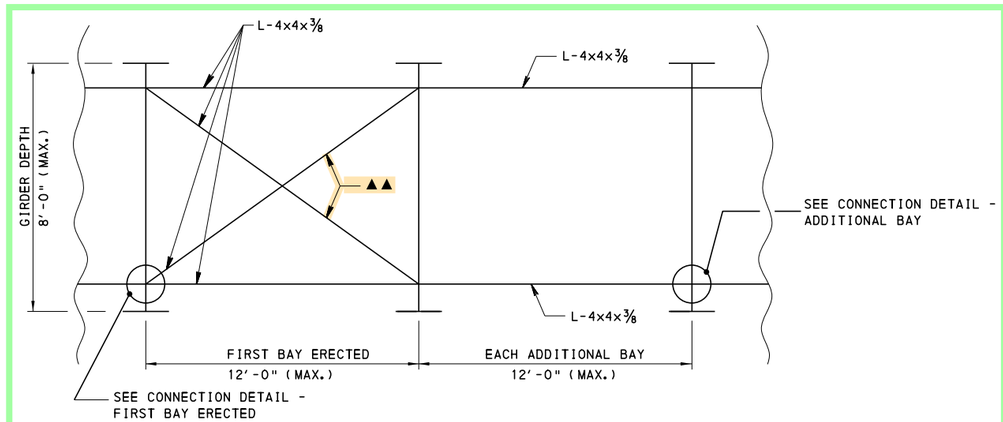
▲ MAY BE EXCEEDED UP TO DECK PAN DEPTH PLUS 1".



DETAIL FOR USING EXISTING SUBSTRUCTURE UNIT FOR SLOPE PROTECTION

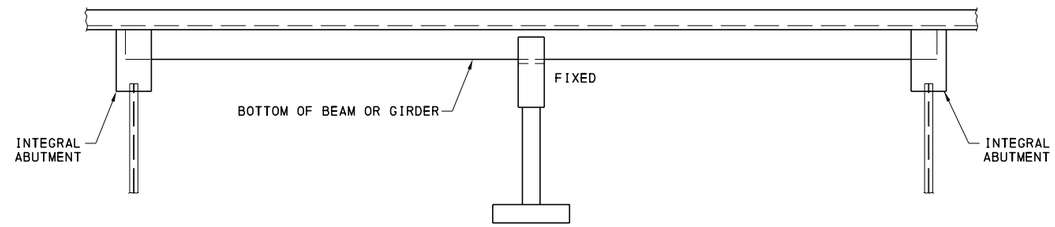
NOTE:

THE ABOVE DETAIL HAS PROVEN AN ECONOMICAL OPTION FOR MANY BRIDGE REPLACEMENTS. STABILITY OF THE REMAINING EXISTING STRUCTURE FOR PROPOSED CONDITIONS NEEDS TO BE CHECKED.
ADDITIONAL RIPRAP CAN BE ADDED TO AUGMENT THE EXISTING SUBSTRUCTURE UNIT IF THE LENGTH OR POSITION DOES NOT MEET SITE NEEDS COMPLETELY.



END DIAPHRAGM BRACING (STAY-IN PLACE)

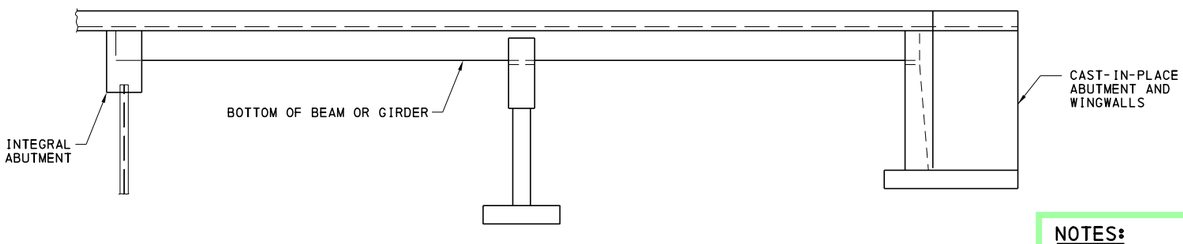
▲▲ DIAGONALS ARE NOT REQUIRED FOR GIRDER DEPTHS < 3'-0"



FIXITY ARRANGEMENT FOR MULTI SPAN STRUCTURES

NOTES:

- FOR TWO SPAN ARRANGEMENT THE PIER SHOULD BE FIXED TO MINIMIZE LONGITUDINAL SUPERSTRUCTURE FORCES AT ABUTMENTS.
- FOR ADDITIONAL SPANS, PIER STIFFNESS MUST BE CONSIDERED TO DEVELOP THE MOST EFFICIENT DESIGNS AND MINIMIZE MOVEMENT.



MIXED SUBSTRUCTURE TYPES

NOTE:

INTEGRAL ABUTMENTS MAY BE USED WITH OTHER ABUTMENT TYPES TO MEET SITE REQUIREMENTS FOR GEOMETRY OR GEOTECHNICAL FEATURES. FIXITY SHOULD BE CAREFULLY CONSIDERED TO MINIMIZE JOINTS AND FOUNDATION PRESSURES.

NOTES:

1. CONFIGURATION IS VALID FOR SKEWS 70 TO 90 AND SPANS LENGTH UP TO 200 FEET.
2. MEMBERS, WELDS AND PLATE SIZES SHOWN ARE VALID FOR STRAIGHT GIRDERS WITH MAXIMUM GIRDER SPACING OF 12'-0" AND FOR SKEW ANGLES BETWEEN 70° AND 90°. PROVIDE SPECIAL DESIGNS FOR ALL THE DIAPHRAM MEMBERS, WELDS AND PLATE SIZES WHEN THE GIRDER SPACING EXCEEDS 12'-0"AND/OR THE SKEW ANGLE IS LESS THAN 70°.
3. SEE BC-753M FOR THE BEARING STIFFENER AND CONNECTION PLATE INSTALLATION DETAILS.
4. MODIFY THE DISTANCE BETWEEN THE GIRDER BOTTOM FLANGE AND THE LOWER DIAPHRAGM COMPONENT WHEN LOWER LATERAL BRACING IS USED. INDICATE MODIFICATIONS ON THE DESIGN DRAWINGS.
5. FOR "TYPICAL CONNECTION DETAIL" SEE BC-754M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
INTEGRAL ABUTMENT
MISCELLANEOUS DETAILS

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 10 OF 10
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-667M

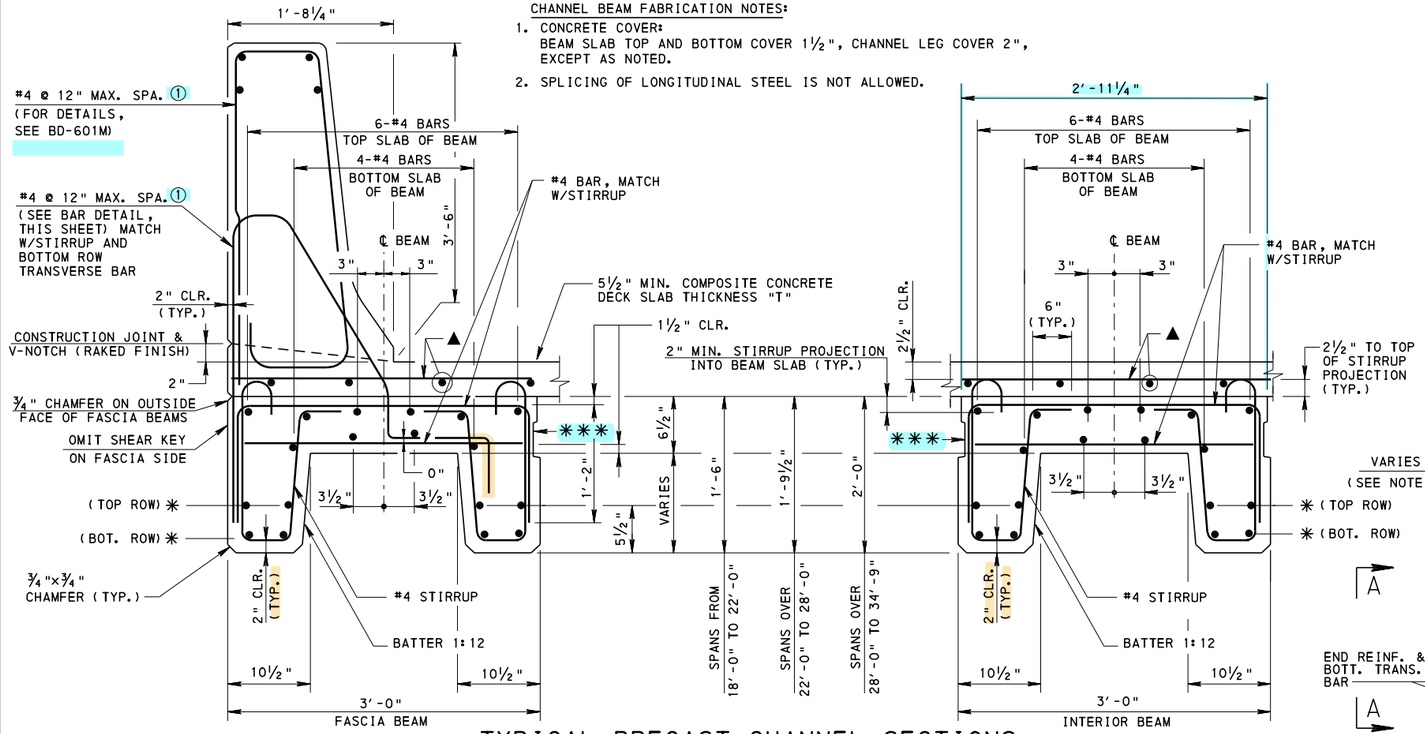
CHANGE 2

CHANGE 3

CHANGE 5

CHANNEL BEAM FABRICATION NOTES:

1. CONCRETE COVER:
   BEAM SLAB TOP AND BOTTOM COVER 1½", CHANNEL LEG COVER 2", EXCEPT AS NOTED.
2. SPLICING OF LONGITUDINAL STEEL IS NOT ALLOWED.



TYPICAL PRECAST CHANNEL SECTIONS

PRECAST CHANNEL BEAM SHOWN SUPPORTING 42" F-SHAPE CONCRETE BARRIER. OTHER F-SHAPE BARRIERS SIMILAR. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE 32", 42" AND 45" F-SHAPE BARRIERS NOT SHOWN, SEE BD-601M. SEE SHEET 3 FOR PA TYPE 10M BRIDGE BARRIER DETAILS AND VERTICAL WALL CONCRETE BARRIER DETAILS.

LEGEND

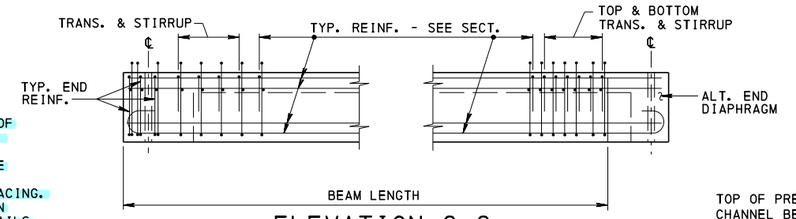
✳ VARIES, SEE DESIGN CHART ON SHEET 2 FOR PRECAST CHANNEL BEAMS.

✳✳ CANNOT BE USED WITH SMALLEST BEAM SECTION.

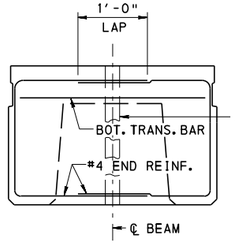
✳✳✳ FOR SHEAR KEY DETAILS, SEE BC-775M.

▲ DECK SLAB REINFORCEMENT PER BD-660M.

① WITHIN 10' ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON BD-622M AND BD-624M.

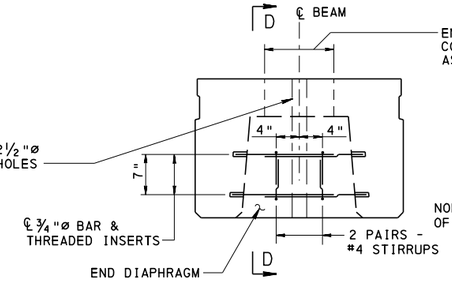


ELEVATION C-C



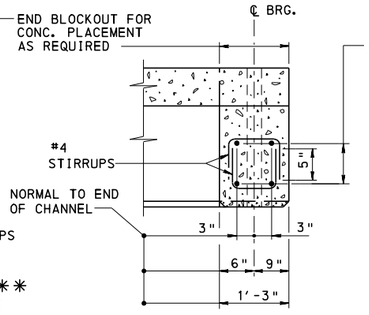
INTEGRAL END DIAPH.

SECTION A-A



ALTERNATE END DIAPH.**

SECTION B-B **

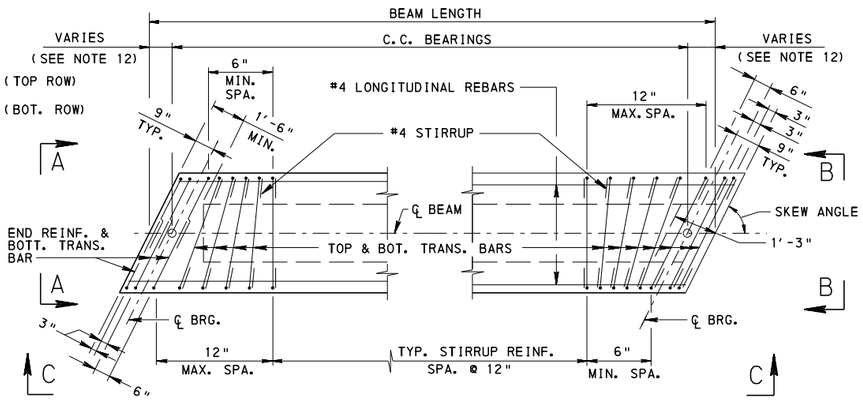


SECTION D-D**

- POUR DIAPHRAGM CONCRETE BEFORE SETTING THE BEAM ON THE ABUTMENT.
- PLACE BEAM WHEN DIAPH. HAS ATTAINED 80% OF ITS DESIGN STRENGTH.
- BEAM REINFORCEMENT NOT SHOWN FOR CLARITY.

NOTES:

1. PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615, A996, OR A706. DO NOT WELD REINFORCEMENT BARS. DO NOT USE RAIL STEEL A996 IN BARRIERS OR WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).
2. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
3. DESIGN SPECIFICATIONS - "AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS" AS SUPPLEMENTED BY THE DESIGN MANUAL PART 4.
4. LIVE LOADS - AS PER DESIGN MANUAL PART 4.
5. LIVE LOAD DISTRIBUTION FACTOR USED IS BASED ON 30 FT. OUT-TO-OUT BRIDGE WIDTH.
6. DEAD LOADS - INCLUDES 30 LB/SQ. FT. WEIGHT FOR FUTURE WEARING SURFACE
   - INCLUDES 1" ADDITIONAL CONCRETE FOR HAUNCH
   - INCLUDES 42" F-SHAPE CONCRETE BARRIER LOAD OF 217 LB/FT (3 BEAM DISTRIBUTION)
7. CONCRETE - CLASS AAA, f_c'=4000 psi.
8. STEEL REINFORCEMENT TO BE GRADE 60, Fy= 60,000 psi.
9. VARY THE THICKNESS OF THE HAUNCH/SLAB TO COMPENSATE FOR ANY IRREGULARITIES IN THE TOP OF BEAM ELEVATIONS TO OBTAIN ROADWAY CROSS-SLOPE.
10. PREPARE BEARING AREAS AS SPECIFIED IN PUBLICATION 408, SECTION 1001.3(k)9.
11. SHOW VARIATION ON PLAN.
12. TIE BEAMS TOGETHER WITH STEEL TIE BOLT, SEE BC-798M FOR DETAILS.

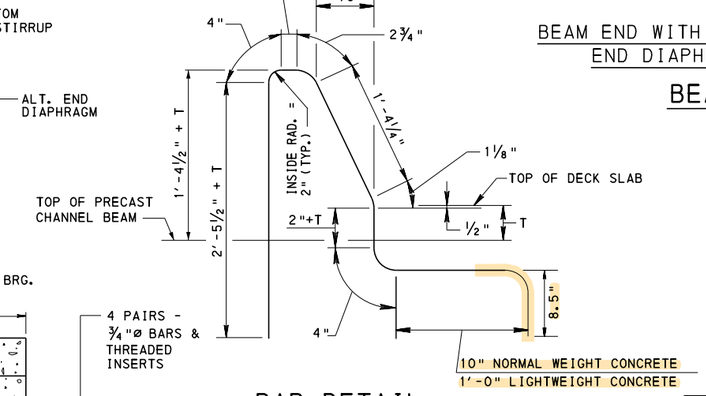


BEAM END WITH INTEGRAL END DIAPHRAGM

BEAM END WITH ALTERNATE END DIAPHRAGM

BEAM REINFORCEMENT PLAN

SEE TABLE ON SHEET 2 FOR SECTION CAPACITIES FOR VARIOUS REGIONS.



BAR DETAIL

REINFORCEMENT BAR NOTES

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.

REFERENCE DRAWINGS	
BD-601M	CONC. DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES
BD-617M	PA TYPE 10M BRIDGE BARRIER
BD-618M	VERTICAL WALL CONCRETE BARRIER
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-660M	DECK SLAB AND STEEL REINFORCEMENT PLACEMENT
BC-734M	ANCHOR SYSTEMS
BC-775M	MISCELLANEOUS PRESTRESS DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
BC-798M	MECHANICAL CONNECTION DETAILS

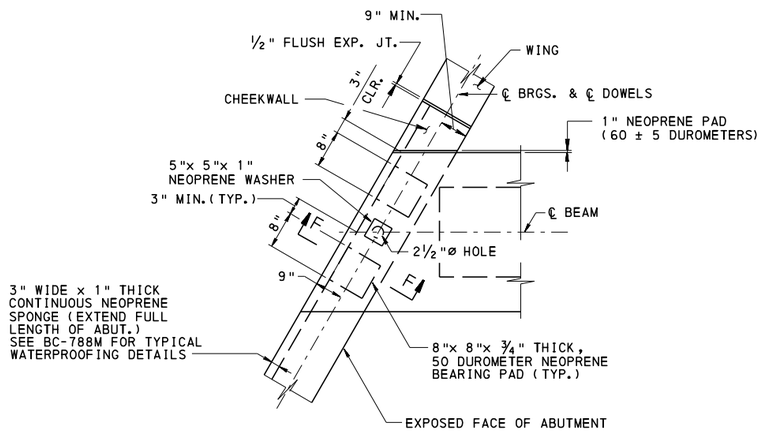
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD PRECAST CHANNEL BEAM BRIDGES BEAM SIZES & DETAILS

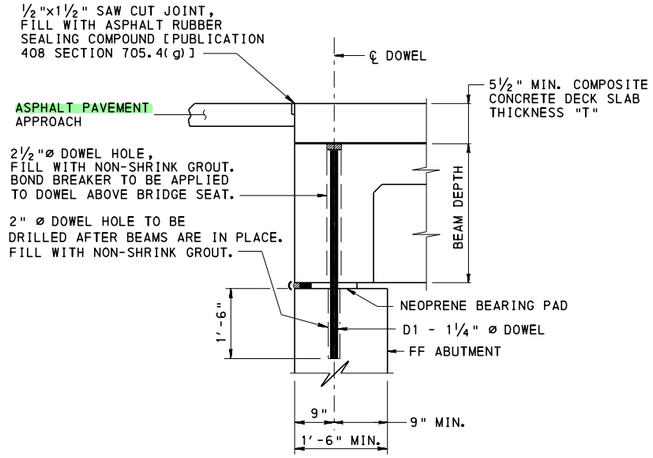
RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

BD-668M



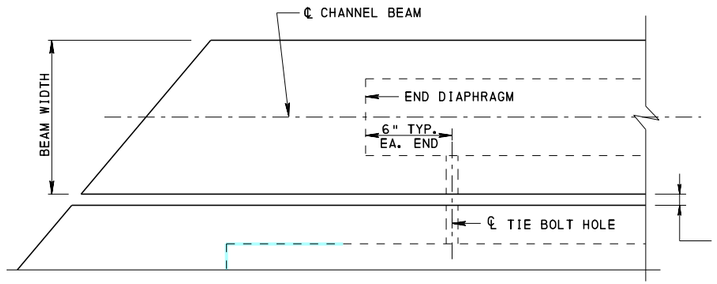
BEARING PAD DETAIL



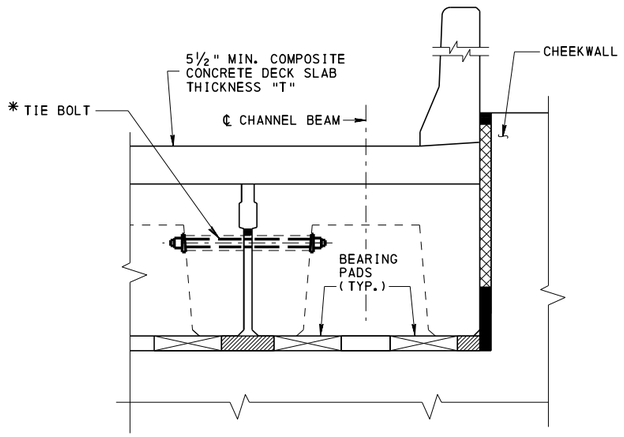
SECTION F-F

DESIGN CHART FOR PRECAST CHANNEL BEAMS		
BEAM DEPTH	CHANNEL LEG REINFORCEMENT	
	TOP ROW REINFORCEMENT	BOTTOM ROW REINFORCEMENT
1'-6"	#8	#8
1'-9½"	#9	#8
2'-0"	#9	#9

PRECAST CHANNEL BEAMS MAXIMUM CAPACITIES				
BEAM DEPTH	END (AT DISTANCE d/2)		MID SPAN	
	SHEAR CAPACITY (KIPS)	MOMENT CAPACITY (K-FT)	SHEAR CAPACITY (KIPS)	MOMENT CAPACITY (K-FT)
1'-6"	80	54	31	293
1'-9½"	89	59	33	412
2'-0"	97	65	34	568



PARTIAL PLAN



TYPICAL SECTION

TIEBOLT LOCATION DETAILS

* TIE BOLTS TO BE INSTALLED 48 HOURS AFTER PLACEMENT OF SHEAR KEYS BUT NOT BEFORE GROUT HAS OBTAINED A MINIMUM STRENGTH OF 2500 PSI. SEE BC-798M FOR ADDITIONAL DETAILS.

NOTES:

1. FOR SHEAR KEY DETAIL, SEE BC-775M.
2. FOR STANDARD TYPICAL WATERPROOFING AND EXPANSION DETAILS, SEE BC-788M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD
PRECAST CHANNEL BEAM BRIDGES
BEAM SIZES & DETAILS

RECOMMENDED NOV. 23, 2022
CHIEF BRIDGE ENGINEER

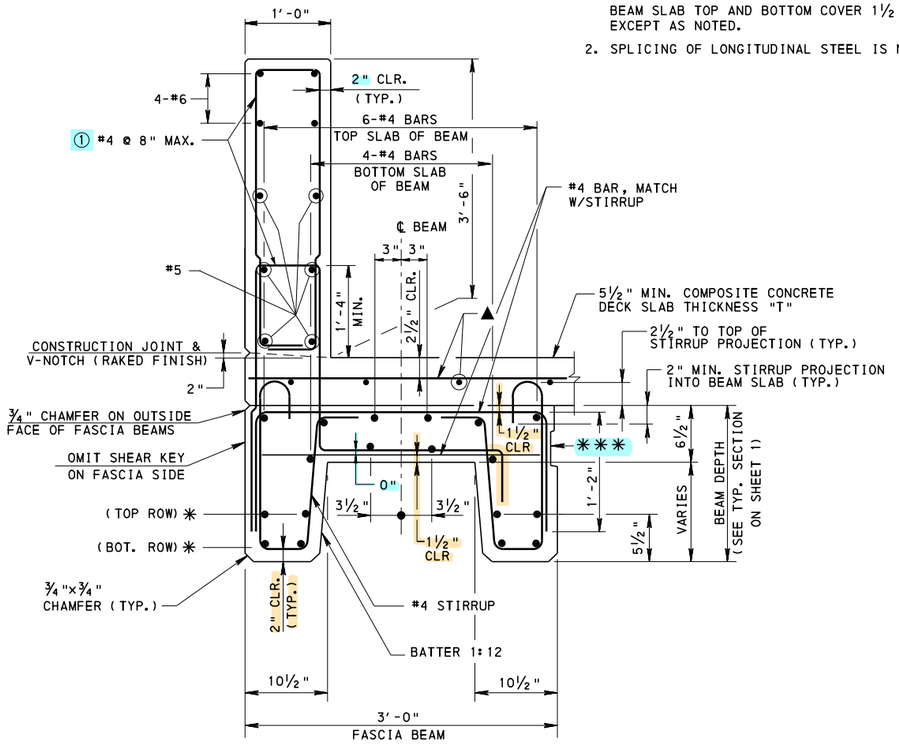
RECOMMENDED NOV. 23, 2022
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 3

BD-668M

CHANNEL BEAM FABRICATION NOTES:

1. CONCRETE COVER:
   BEAM SLAB TOP AND BOTTOM COVER 1½", CHANNEL LEG COVER 2", EXCEPT AS NOTED.
2. SPLICING OF LONGITUDINAL STEEL IS NOT ALLOWED.



TYPICAL PRECAST CHANNEL SECTION WITH 42" VERTICAL WALL CONCRETE BARRIER

(42" VERTICAL WALL CONCRETE BARRIER SHOWN, 32" VERTICAL WALL CONCRETE BARRIER SIMILAR)

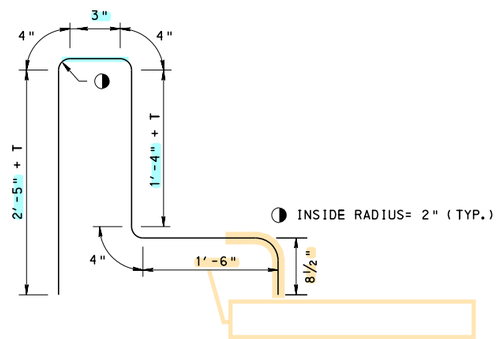
PRECAST CHANNEL BEAM SHOWN SUPPORTING VERTICAL WALL CONCRETE BARRIER. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BARRIER NOT SHOWN, SEE BD-618M.

✱ VARIES, SEE DESIGN CHART ON SHEET 2 FOR PRECAST CHANNEL BEAMS.

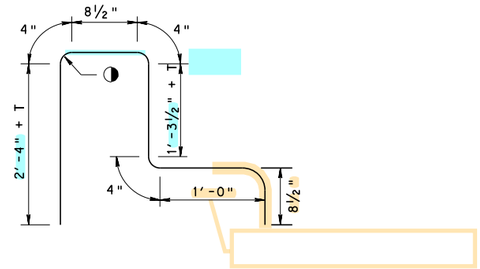
✱✱✱ FOR SHEAR KEY DETAILS, SEE BC-775M.

▲ DECK SLAB REINFORCEMENT PER BD-660M.

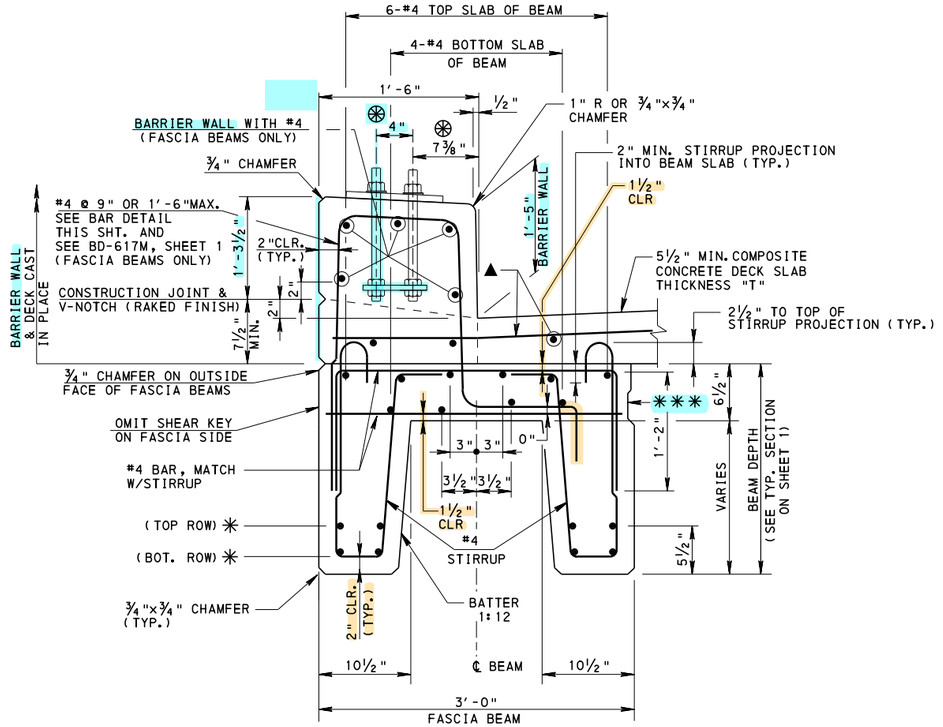
① WITHIN 10' ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON BD-622M AND BD-624M.



VERTICAL BARRIER BAR DETAIL
NTS



PA TYPE 10M BARRIER BAR DETAIL
NTS



TYPICAL PRECAST CHANNEL SECTION WITH PA TYPE 10M BRIDGE BARRIER

PRECAST CHANNEL BEAM SHOWN SUPPORTING PA TYPE 10M BRIDGE BARRIER. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BARRIER NOT SHOWN, SEE BD-617M.

⊛ ℄ 2 - 1"ø X 1'-3" ASTM F1554 GRADE 105, ANCHOR BOLTS WITH ASTM A563 NUTS. PROJ 2½". (TYPE B ANCHOR BOLT PER BC-734M MAY BE USED)

✱ VARIES, SEE DESIGN CHART ON SHEET 2 FOR PRECAST CHANNEL BEAMS.

✱✱✱ FOR SHEAR KEY DETAILS, SEE BC-775M.

▲ DECK SLAB REINFORCEMENT PER BD-660M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD PRECAST CHANNEL BEAM BRIDGES BARRIER DETAILS

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 3 OF 3
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-668M

CHANGE 2

GENERAL NOTES

1. DESIGN SPECIFICATIONS:
   - PENNDOT DESIGN MANUAL, PART 4, STRUCTURES.
   - 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS", INCLUDING THE 1992 AND 2002 INTERIMS.
   - 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION, INCLUDING THE 1993 AND 1994 INTERIMS.
   - 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
   - DESIGN IS IN ACCORDANCE WITH THE WORKING STRESS DESIGN METHOD. (NO INCREASE IN ALLOWABLE UNIT STRESSES ARE PERMITTED EXCEPT FOR GROUP III LOADINGS WHICH PERMITS A 33% OVERSTRESS.)

2. CONSTRUCTION SPECIFICATIONS AND WORK QUALITY:
   - PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5)

3. DESIGN LOADS:
   - WIND LOAD:
     - THE WIND LOAD INCLUDES A GUST FACTOR OF 1.3 AND A DRAG FACTOR OF 1.2 AND IS BASED ON A MAXIMUM 50-YEAR MEAN WIND VELOCITY AT 30'-0" ABOVE THE GROUND SURFACE OF 80 MPH.
     - PRECAST CONCRETE PANELS ARE DESIGNED FOR A WIND PRESSURE OF 28 PSF.
   - ICE LOAD: 3 PSF APPLIED TO ONE SIDE OF PANEL AND POST.
   - SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO 0.15.

4. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.

5. PANEL HEIGHTS:
   - 2'-0" MINIMUM TO 9'-0" MAXIMUM.
   - PROVIDE STACKED PANELS WHEN THE WALL HEIGHT EXCEEDS 9'-0".

6. HORIZONTAL PANEL JOINTS:
   - MINIMIZE THE NUMBER OF HORIZONTAL PANEL JOINTS.
   - PROVIDE UNIFORM STEPS.
   - IF STEPS ARE REQUIRED, THE ELEVATION DIFFERENCE BETWEEN ADJACENT PANELS IS NOT PERMITTED TO BE LESS THAN 6" OR GREATER THAN 2'-0".

7. GROUND MOUNTED SOUND BARRIER WALLS MUST BE PROTECTED BY CONCRETE BARRIERS UNLESS THE WALL IS LOCATED BEYOND THE HORIZONTAL CLEAR ZONE OR IF THE BOTTOM OF PANELS ARE A MINIMUM OF 5'-0" ABOVE THE EDGE OF PAVEMENT.

8. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN THE PANELS WHERE THE WALL IS WITHIN 14'-0" OF THE EDGE OF TRAVEL LANE. EPOXY COATED OR GALVANIZED REINFORCEMENT MAY BE REQUIRED IF FUTURE WIDENING IS ANTICIPATED.

9. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.

10. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.

11. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.

12. FOR ADDITIONAL INFORMATION REFER TO BC-776M.

MATERIAL NOTES

1. REFER TO BC-776M FOR MATERIAL NOTES.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE PRECAST CONCRETE PANELS ARE DEVELOPED FOR A WIND PRESSURE OF 28 PSF. USE THE INFORMATION SHOWN IN THE TABLES FOR ALL HEIGHT ZONES.

2. THE DESIGN POST SPACING (CENTER TO CENTER OF POST) IS TO BE THE ACTUAL POST SPACING ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST SPACING SHOWN ON THE DESIGN TABLES.

3. THE DESIGN WALL HEIGHT IS TO BE THE ACTUAL WALL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF WALL HEIGHT SHOWN ON THE DESIGN TABLES.

4. THE DESIGN PANEL HEIGHT IS TO BE THE ACTUAL PANEL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF PANEL HEIGHT SHOWN ON THE DESIGN TABLES.

5. PANEL HEIGHTS ARE PERMITTED TO BE ANY DIMENSION REQUIRED, BUT ARE NOT PERMITTED TO BE LESS THAN 2'-0" OR GREATER THAN 9'-0".

INDEX OF SHEETS

REFERENCE DRAWINGS

BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-776M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS
BC-777M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS
BC-778M	GROUND MOUNTED SOUND BARRIERS STEEL POSTS
BC-779M	STRUCTURE MOUNTED SOUND BARRIER WALLS
BD-627M	MOMENT SLABS
BD-677M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS
BD-678M	GROUND MOUNTED SOUND BARRIERS STEEL POSTS
BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS

GENERAL NOTES - 1

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 6

BD-676M

NOTES TO DESIGNER

1. PREPARE CONTRACT DRAWINGS IN ACCORDANCE WITH THE DESIGN MANUAL, PART 4 AND THESE STANDARDS.

2. THE FOLLOWING NOTE MUST BE PLACED ON THE DESIGN PLANS FOR SIGNATURE BY THE DISTRICT ENVIRONMENTAL MANAGER INDICATING THAT THE DESIGN PLANS HAVE BEEN REVIEWED AND ACCEPTED:

> THE DISTRICT ENVIRONMENTAL MANAGER HAS REVIEWED AND ACCEPTED THE ACOUSTIC REQUIREMENTS OF THE PROPOSED WALL.
>
> _____
> DISTRICT ENVIRONMENTAL MANAGER

3. DETERMINE HEIGHT ZONE AND WIND PRESSURE REQUIRED FOR WALL DESIGN AND INDICATE ON CONTRACT DRAWINGS.

4. DETERMINE ACCEPTABLE POST TYPE. PROVIDE EITHER PRECAST CONCRETE POSTS OR STEEL POSTS. DO NOT MIX POST TYPES WITHOUT PERMISSION FROM THE DISTRICT BRIDGE ENGINEER.

5. SPECIFY IF THE REINFORCEMENT BARS ARE UNCOATED, EPOXY COATED OR GALVANIZED.

6. SPECIFY IF THE WELDED WIRE FABRIC IS UNCOATED, EPOXY COATED OR GALVANIZED.

7. PROVIDE A CONSTANT POST SPACING FOR THE ENTIRE LENGTH OF WALL. THE CONSTANT POST SPACING MAY BE INTERRUPTED TO MISS DRAINAGE PIPES, UTILITIES, AND/OR ANY OTHER PHYSICAL FEATURES. VARIATIONS MUST BE ACCEPTED BY THE DISTRICT BRIDGE ENGINEER.

8. GROUND MOUNTED SOUND WALLS MUST BE PROTECTED BY CONCRETE BARRIERS UNLESS THE WALL IS LOCATED BEYOND THE HORIZONTAL CLEAR ZONE OR IF THE BOTTOM OF PANELS ARE A MINIMUM OF 5'-0" ABOVE THE EDGE OF PAVEMENT.

9. INDICATE IF THE TOP OF PANELS ARE STEPPED OR SLOPED. SLOPED PANELS ARE THE PREFERRED OPTION FOR MOST ARCHITECTURAL SURFACE TREATMENTS.

10. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE CONTRACT DRAWINGS (IF APPLICABLE):
    - OVERALL WALL LENGTH
    - HORIZONTAL GEOMETRY
    - VERTICAL GEOMETRY
    - ACOUSTIC PROFILE ELEVATIONS
    - EXISTING GROUND LINE ELEVATIONS
    - FINISHED GROUND LINE ELEVATIONS
    - GENERAL NOTES
    - FOUNDATION NOTES
    - STAKE-OUT PLAN
    - DETAILS
    - REINFORCEMENT BAR SCHEDULE FOR ALL CAST-IN-PLACE CONCRETE
    - ANY OTHER INFORMATION REQUIRED TO CONSTRUCT THE SOUND BARRIER WALL

11. THE FOLLOWING GEOTECHNICAL INFORMATION MUST BE INDICATED ON THE DESIGN PLANS:
    - PERMITTED FOUNDATION TYPES (SPREAD FOOTINGS AND/OR DRILLED CAISSONS)
    - FOUNDATION DESIGN PARAMETERS (SITE SPECIFIC)
    - APPROXIMATE TOP OF ROCK ELEVATIONS ALONG LENGTH OF WALL
    - APPROXIMATE GROUND WATER ELEVATIONS ALONG LENGTH OF WALL
    - TYPE OF SOIL TO DETERMINE CAISSON LENGTH IF NO FOUNDATION DESIGN PARAMETERS ARE SPECIFIED
    - TOP AND BOTTOM CAISSON ELEVATIONS
    - TOP AND BOTTOM OF FOOTING ELEVATIONS
    - ANY OTHER INFORMATION REQUIRED TO CONSTRUCT THE SOUND BARRIER WALL

12. PROVIDE FIRE HYDRANT OPENINGS OR OTHER HIGHWAY ACCESS OPENINGS AS REQUIRED IN THE PRECAST CONCRETE PANELS. PROVIDE REINFORCEMENT AROUND OPENINGS IN ACCORDANCE WITH DETAILS SHOWN ON BC-776M TO PRECLUDE CRACKING.

13. SLOPE THE FINISHED GROUND LINE AWAY FROM THE SOUND BARRIER WALL.

14. INDICATE IF THE ARCHITECTURAL SURFACE TREATMENT TOLERANCES AS PROVIDED IN PUBLICATION 408, SECTION 1086.3 ARE APPLICABLE.

15. THE FOLLOWING INFORMATION MUST BE SPECIFIED ON THE DESIGN PLANS OR INDICATED IN THE CONTRACT SPECIAL PROVISIONS:
    - ARCHITECTURAL SURFACE TREATMENTS ON THE RESIDENTIAL AND ROADWAY SIDES OF THE PRECAST CONCRETE SOUND BARRIER PANELS AND POSTS. INDICATE THE MINIMUM, MAXIMUM AND AVERAGE DEPTHS. ARCHITECTURAL SURFACE TREATMENTS ARE NOT RECOMMENDED ON PRECAST CONCRETE POSTS WITHOUT APPROVAL FROM THE DISTRICT BRIDGE ENGINEER.
    - COLOR OF THE INTEGRAL PIGMENTATION FOR PRECAST CONCRETE SOUND BARRIER PANELS AND THE PRECAST CONCRETE POSTS.
    - COLOR OF JOINT SEALANT AND/OR CAULKING COMPOUND, NON-SHRINK GROUT, AND ANTIGRAFFITI COATING.
    - LIMITS OF ANTIGRAFFITI COATING.
    - PAINT COLOR OF STEEL COMPONENTS.

16. PROVIDE FEDERAL COLOR NUMBERS IN ACCORDANCE WITH FEDERAL STANDARD NUMBER 595A OR 595B.

17. PROVIDE COMPLETE DETAILS AND DESIGN, IF REQUIRED, WHERE A GROUND MOUNTED SOUND BARRIER IS CONNECTED TO A STRUCTURE MOUNTED SOUND BARRIER. REFER TO BD-679M FOR DETAILS.

18. DESIGN COMPUTATIONS AND DETAILS ARE REQUIRED FOR ANY PORTION OF THE STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE SOUND BARRIER STANDARDS.

19. SPECIFY IF A SOUND BARRIER ABSORPTIVE CONCRETE FACING IS REQUIRED ON THE FACE OF THE PRECAST CONCRETE PANELS. SOUND ABSORPTIVE PANELS MUST BE APPROVED BY THE DEPARTMENT USING THE NEW PRODUCT EVALUATION PROCESS. DESIGNER MUST PREPARE DESIGN CALCULATIONS FOR THE FOUNDATIONS DUE TO THE INCREASED PANEL WEIGHT.

20. IF NEEDED DETAILS ARE NOT FOUND IN THE SOUND BARRIER STANDARDS A SPECIAL SUBMISSION REQUESTING APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.

DESIGN PARAMETERS

1. PRECAST CONCRETE PANELS:
    - PANELS ARE DESIGNED FOR WIND PRESSURE EQUAL TO 28 PSF.
    - PANELS ARE DESIGNED USING A 5 INCH STRUCTURAL THICKNESS.
    - PANELS ARE DESIGNED FOR AN ADDITIONAL CONCRETE WEIGHT OF 1½ INCH TO ACCOUNT FOR ARCHITECTURAL SURFACE TREATMENTS.
        - THE AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0 TO 1½ INCH BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 1½ INCH.
        - DESIGN CALCULATIONS ARE REQUIRED FOR PANELS WHICH HAVE A TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT GREATER THAN 1½ INCH.
    - PANELS ARE DESIGNED AS SIMPLY SUPPORTED BEAMS SPANNING BETWEEN POSTS.
    - PANELS ARE DESIGNED USING A 1'-0" STRIP WIDTH.
    - PANELS ARE DESIGNED FOR THE FOLLOWING IN ACCORDANCE WITH THE PCI DESIGN HANDBOOK, 5th EDITION, 1999:
        - PANELS ARE DESIGNED FOR STRIPPING FORCES CAUSED BY FORM SUCTION AND IMPACT WHEN THE PANELS ARE STRIPPED FROM THE FORMS IN ACCORDANCE WITH SECTION 5.2.3 AND TABLE 5.2.1 USING AN EQUIVALENT STATIC LOAD MULTIPLIER EQUAL TO 1.50.
            - PROVIDE A MINIMUM CONCRETE STRENGTH, AT TIME OF STRIPPING, EQUAL TO 4,000 PSI.
        - PANEL THICKNESS AND REINFORCING IS DESIGNED FOR STRIPPING AND LIFTING AT TOP OF PANEL USING A TWO-POINT PICK-UP OR FOUR-POINT PICK-UP IN ACCORDANCE WITH FIGURE 5.2.4.
        - PANELS ARE DESIGNED FOR TRANSPORTATION IN ACCORDANCE WITH SECTION 5.2.11 AND TABLE 5.2.1 USING AN EQUIVALENT STATIC LOAD MULTIPLIER EQUAL TO 1.50.
        - THE FLEXURAL TENSILE STRESSES IN THE CONCRETE ARE CALCULATED USING THE UNCRACKED GROSS SECTION BASED ON THE STRUCTURAL THICKNESS. THE STRESSES ARE COMPARED AGAINST THE MODULUS OF RUPTURE REDUCED BY A SAFETY FACTOR OF 1.50 IN ACCORDANCE WITH SECTION 5.2.4.1.
    - PANELS ARE NOT DESIGNED FOR TRAFFIC IMPACT LOADING.

ARCHITECTURAL SURFACE TREATMENTS

1. THE FOLLOWING ARCHITECTURAL SURFACE TREATMENTS ARE PERMITTED ON THE FACE OF THE PRECAST CONCRETE PANELS AND ARE TO BE INDICATED ON THE CONTRACT DRAWINGS AND IN THE CONTRACT SPECIAL PROVISIONS IF REQUIRED:
    - NON-FORM LINER FINISHES:
        - SMOOTH FINISH
        - BROOMED FINISH
        - FUZZY OR RAKED FINISH (PERMITTED ON ONE SIDE ONLY)
        - EXPOSED AGGREGATE
    - FORM LINER FINISHES:
        - ASHLAR STONE
        - CUT STONE
        - FRACTURE FIN
        - GRAPE STAKE
        - SHIP LAP
        - ANY OTHER TREATMENT PERMITTED BY THE DEPARTMENT

2. THE AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0 TO 1½ INCH, BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 1½ INCH UNLESS OTHERWISE INDICATED ON THE CONTRACT DRAWINGS.

3. FORM LINER ARCHITECTURAL SURFACE TREATMENTS ARE NOT RECOMMENDED ON THE PRECAST CONCRETE POSTS.

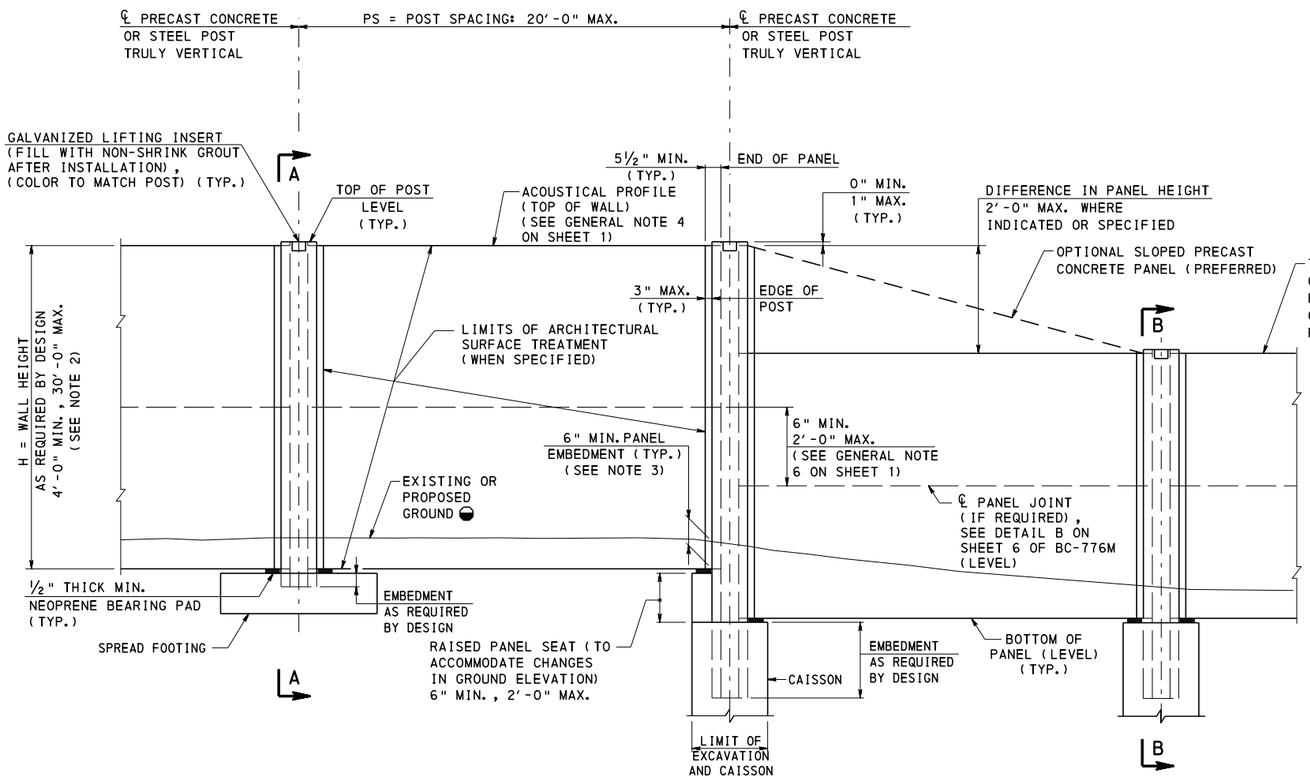
4. AVOID USING FORM LINER FINISHES ON BOTH SIDES OF THE PRECAST CONCRETE PANELS. A FORM LINER FINISH, ON ONE SIDE OF THE PANEL, ALONG WITH A STAMPED FINISH, ON THE OTHER SIDE OF THE PANEL, IS PERMITTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS

GENERAL NOTES - 2

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 2 OF 6 BD-676M



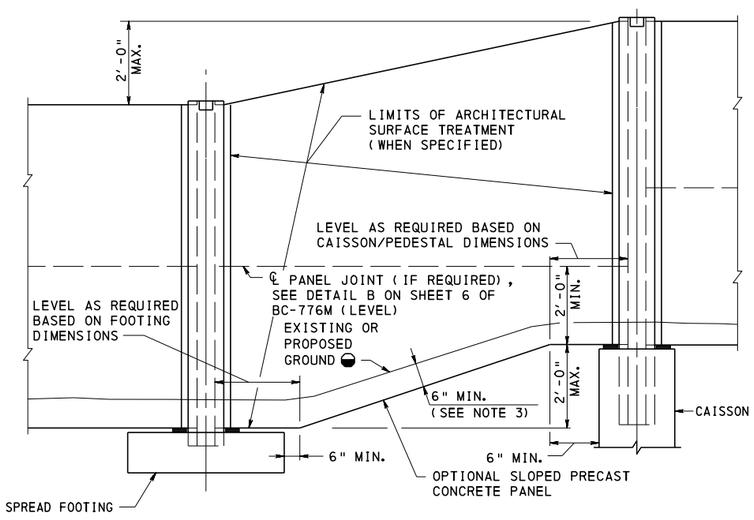
LEVEL PANEL

LEVEL OR SLOPED TOP PANEL

(SLOPED TOP PANEL PREFERRED)

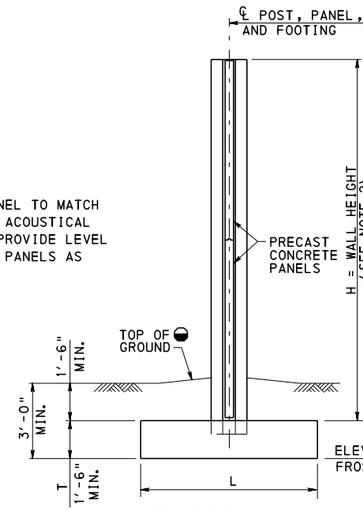
GROUND MOUNTED SOUND BARRIER ELEVATION

(PRECAST CONCRETE POST SHOWN, STEEL POST SIMILAR)

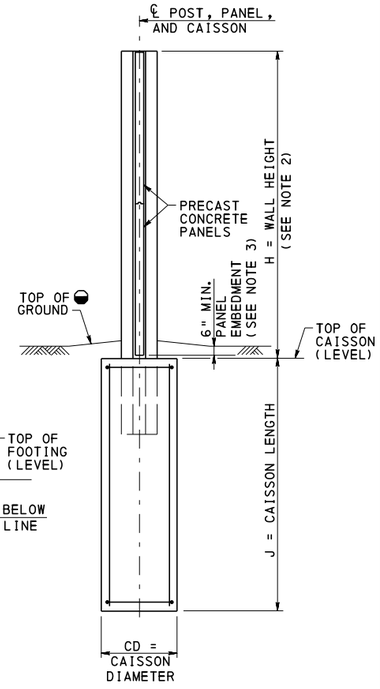


OPTIONAL SLOPED BOTTOM PANEL ELEVATION

(USE IN PLACE OF RAISED PANEL SEAT)



SECTION A-A



SECTION B-B

LEGEND:

◒ GRADE GROUND TO DRAIN WATER AWAY FROM THE WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 1'-0" DIFFERANCE.

NOTES:

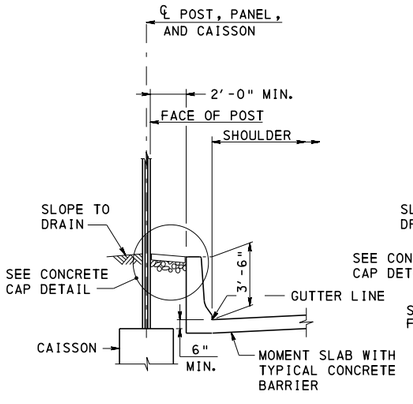
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. WALL HEIGHT IS DEFINED AS FOLLOWS:
   - POST WITH BASE PLATE: H = HEIGHT FROM TOP OF BASE PLATE TO TOP OF WALL
   - POST WITHOUT BASE PLATE: H = HEIGHT FROM TOP OF FOOTING/CAISSON TO TOP OF WALL
3. PANEL EMBEDMENT MAY NEED TO BE INCREASED TO ACCOMMODATE BASE PLATES AND ANCHOR BOLT PROJECTIONS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

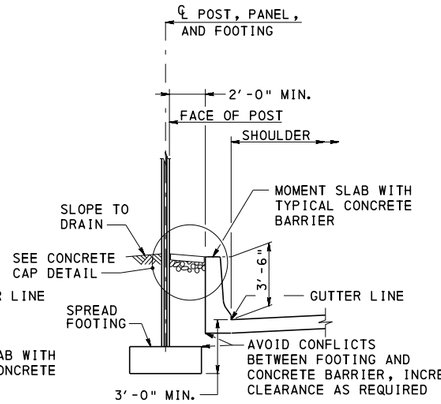
STANDARD GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS

GEOMETRY AND LAYOUT -1

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 3 OF 6
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-676M



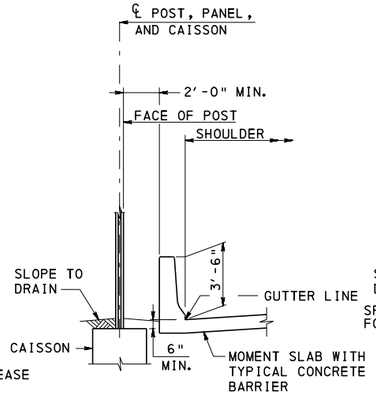
FOR CAISSON



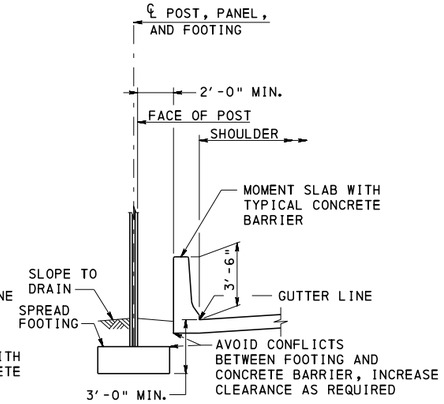
FOR SPREAD FOOTING

SECTION - GROUND MOUNTED SOUND BARRIER WALL ADJACENT TO ROADWAY BARRIER

OPTION 1 (SEE NOTE 2)



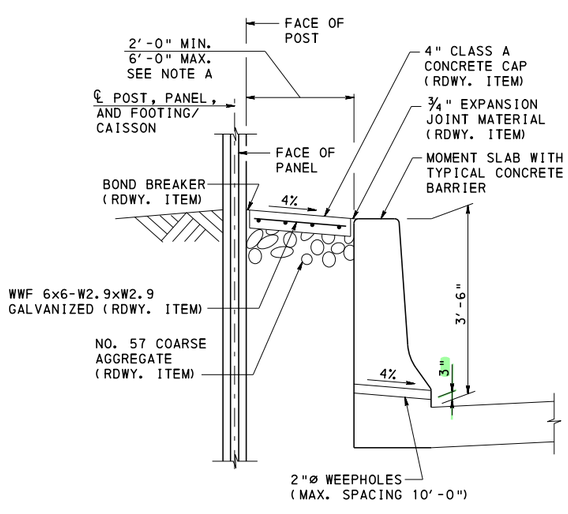
FOR CAISSON

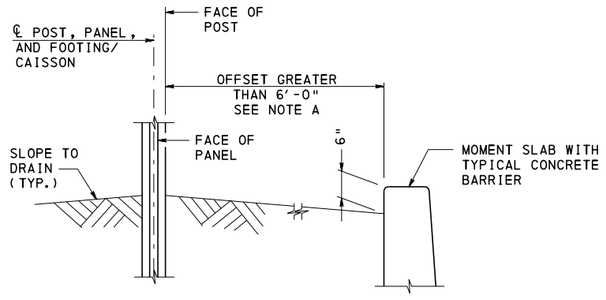


FOR SPREAD FOOTING

SECTION - GROUND MOUNTED SOUND BARRIER WALL ADJACENT TO ROADWAY BARRIER

OPTION 2 (SEE NOTE 2)





NOTE A:
IF OFFSET IS GREATER THAN 6′-0" CONCRETE CAP MAY BE ELIMINATED AND SUBSTITUTED WITH PLANTINGS OR ROCK SLOPE PROTECTION. ALTERNATE DETAILS MUST BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR ACCEPTANCE.

CONCRETE CAP DETAIL

NOTES:

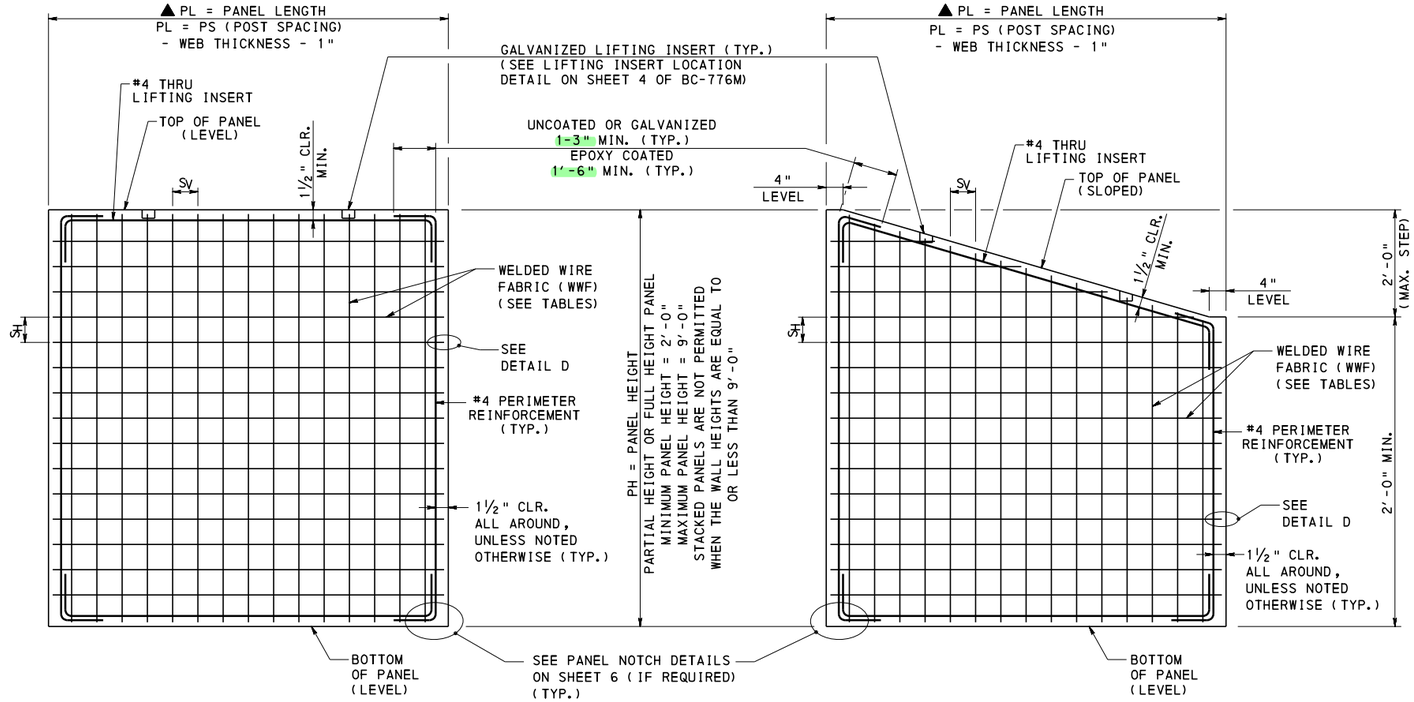
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. DESIGNER TO SELECT WHICH OPTION IS USED BASED ON THE ROADWAY GEOMETRICS, RIGHT-OF-WAY REQUIREMENTS AND ANY ADDITIONAL CONSTRAINTS. OBTAIN ACCEPTANCE FROM THE DISTRICT BRIDGE ENGINEER. (THE DEPARTMENT PREFERS OPTION 1 USING THE CONCRETE CAP.)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS

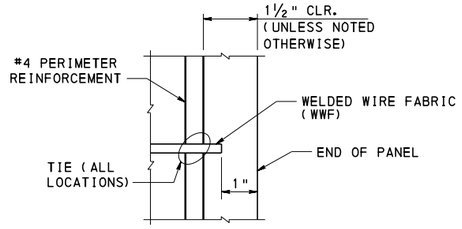
GEOMETRY AND LAYOUT - 2

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 4 OF 6
		BD-676M

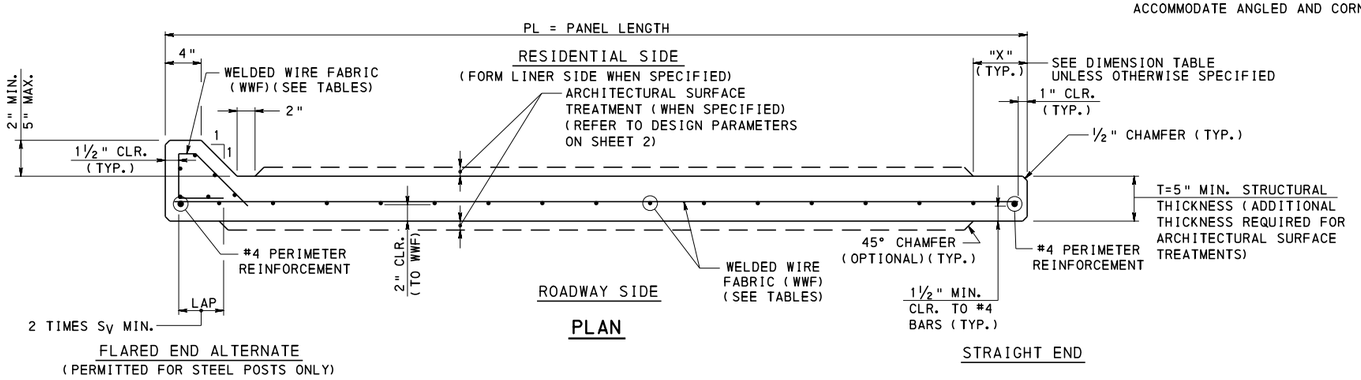


PRECAST CONCRETE PANEL

DIMENSION TABLE	
POST SIZE	"X" (IN.)
PRECAST CONCRETE	5½
W8 (STEEL)	5½
W10 (STEEL)	6½
W12 (STEEL)	7½
20" DIA. PIPE (STEEL)	5½



DETAIL D



PRECAST CONCRETE PANEL

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. IF STACKED PANELS ARE REQUIRED REFER TO DETAIL B ON SHEET 6 OF BC-776M.
3. DESIGNER TO SPECIFY THE WELDED WIRE FABRIC REQUIREMENTS, INCLUDING THE AREA OF STEEL, AND THE MINIMUM NUMBER OF LIFTING INSERTS REQUIRED FOR ALL PANEL SIZES AS REQUIRED ON THE CONTRACT DRAWINGS. INFORMATION IS PERMITTED TO BE IN TABLE FORM SIMILAR TO THE TABLES SHOWN..

LEGEND:

S_H= SPACING OF HORIZONTAL BARS
S_V= SPACING OF VERTICAL BARS
▲ PANEL LENGTH MAY NEED ADJUSTED TO ACCOMMODATE ANGLED AND CORNER POSTS

PRECAST CONCRETE PANEL REINFORCEMENT
U.S. CUSTOMARY UNITS
WIND PRESSURE = 28 PSF

POST SPACING PS (FT.)	PANEL HEIGHT PH (FT.)	WELDED WIRE FABRIC ** WWF AxB-WCxWD	WELDED WIRE STEEL AREA (IN²/FT)		MIN. NUMBER OF LIFTING INSERTS
			HORIZONTAL	VERTICAL	
12.0	2.0	WWF 6x6-W8xW4	0.16	0.08	2
	4.0	WWF 6x6-W8xW4	0.16	0.08	2
	6.0	WWF 6x6-W8xW8	0.16	0.16	2
	8.0	WWF 6x4-W8xW12	0.16	0.36	2
	9.0	WWF 6x4-W8xW12	0.16	0.36	4
16.0	2.0	WWF 4x6-W8xW4	0.24	0.08	2
	4.0	WWF 4x6-W8xW4	0.24	0.08	2
	6.0	WWF 4x6-W8xW8	0.24	0.16	2
	8.0	WWF 4x4-W8xW12	0.24	0.36	4
	9.0	WWF 4x4-W8xW12	0.24	0.36	4
20.0	2.0	WWF 6x6-W20xW4	0.40	0.08	2
	4.0	WWF 6x6-W20xW4	0.40	0.08	2
	6.0	WWF 6x6-W20xW8	0.40	0.16	4
	8.0	WWF 6x4-W20xW12	0.40	0.36	4
	9.0	WWF 6x4-W20xW12	0.40	0.36	4

** A = SPACING OF HORIZONTAL BARS (S_H)
B = SPACING OF VERTICAL BARS (S_V)
C = HORIZONTAL WIRE SIZE
D = VERTICAL WIRE SIZE
WWF = WELDED WIRE FABRIC

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS

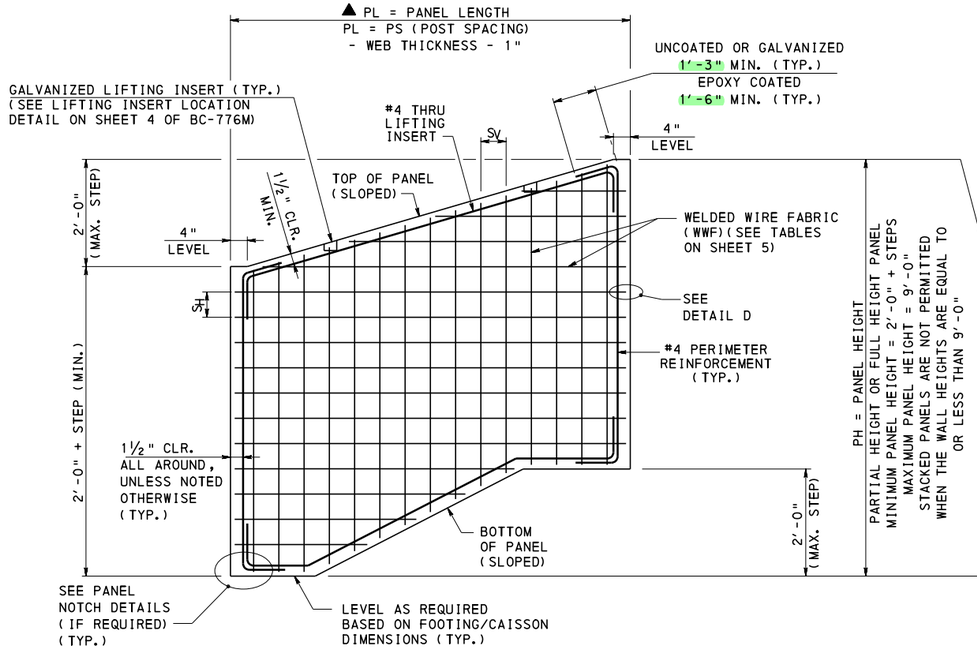
PRECAST CONCRETE PANEL DETAILS - 1

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

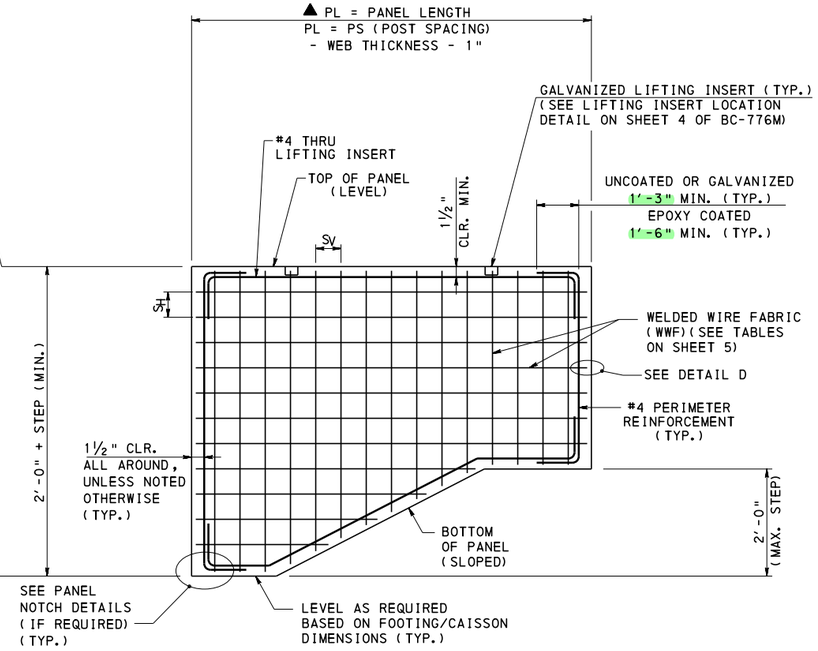
RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 5 OF 6

BD-676M

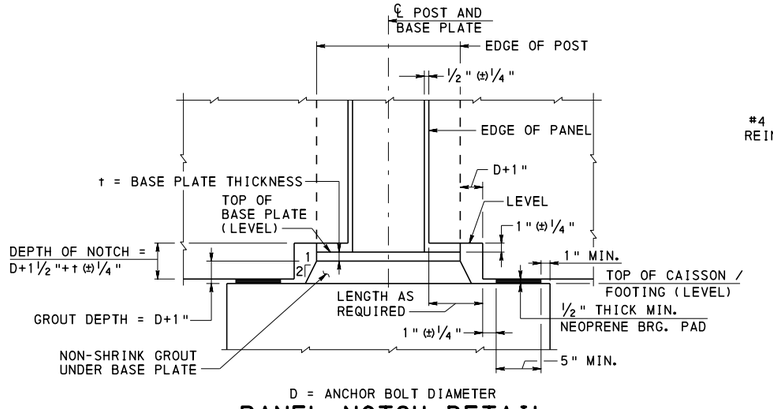


ELEVATION - SLOPED TOP



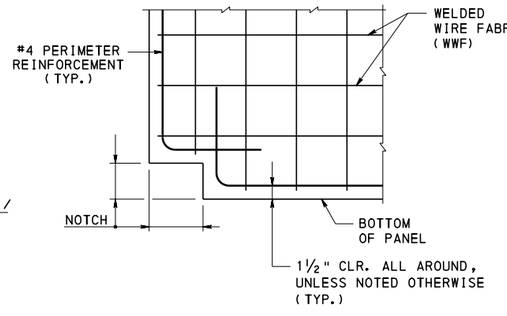
ELEVATION - LEVEL TOP

PRECAST CONCRETE PANEL
WITH OPTIONAL SLOPED BOTTOM



PANEL NOTCH DETAIL
FOR BASE PLATE CONNECTIONS

(FOR DETAILS 1 AND 2)
(PRECAST POST SHOWN / STEEL POST SIMILAR)



REINFORCEMENT DETAIL
FOR PANEL NOTCH

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAIL D, REFER TO SHEET 5.

LEGEND:

▲ PANEL LENGTH MAY NEED ADJUSTED TO ACCOMMODATE ANGLED AND CORNER POSTS

S_H = SPACING OF HORIZONTAL BARS

S_V = SPACING OF VERTICAL BARS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE PANELS

PRECAST CONCRETE PANEL DETAILS - 2

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 6 OF 6
		BD-676M

CHANGE 2

GENERAL NOTES

1. DESIGN SPECIFICATIONS:
   - PENNDOT DESIGN MANUAL, PART 4, STRUCTURES APRIL 2015 EDITION.
   - 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS", INCLUDING THE 1992 AND 2002 INTERIMS.
   - 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.
   - 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
   - DESIGN IS IN ACCORDANCE WITH THE WORKING STRESS DESIGN METHOD. (NO INCREASE IN ALLOWABLE UNIT STRESSES ARE PERMITTED EXCEPT FOR GROUP III LOADINGS WHICH PERMITS A 33% OVERSTRESS.)
2. CONSTRUCTION SPECIFICATIONS AND WORK QUALITY:
   - PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5)
3. DESIGN LOADS:
   - WIND LOAD:
     - THE WIND LOAD INCLUDES A GUST FACTOR OF 1.3 AND A DRAG FACTOR OF 1.2 AND IS BASED ON A MAXIMUM 50-YEAR MEAN WIND VELOCITY AT 30'-0" ABOVE THE GROUND SURFACE OF 80 MPH.
       - GROUND MOUNTED SOUND BARRIER WALLS:
         HEIGHT ZONE: 0' TO 14'-0" = 20 PSF
         HEIGHT ZONE: OVER 14'-0" = 28 PSF
   - ICE LOAD: 3 PSF APPLIED TO ONE SIDE OF PANEL AND POST.
   - SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO 0.15.
4. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.
5. PROVIDE EITHER PRECAST CONCRETE POSTS OR STEEL POSTS. DO NOT MIX POST TYPES WITHOUT PERMISSION OF THE DISTRICT BRIDGE ENGINEER.
6. PROVIDE UNCOATED REINFORCEMENT BARS IN THE FOOTING AND CAISSONS.
7. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN THE POSTS AND PEDESTALS WHERE THE WALL IS WITHIN 14'-0" OF THE EDGE OF TRAVEL LANE. EPOXY COATED OR GALVANIZED REINFORCEMENT MAY BE REQUIRED IF FUTURE WIDENING IS ANTICIPATED.
8. DO NOT SPLICE VERTICAL POST REINFORCEMENT.
9. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
10. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.
11. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.

MATERIAL NOTES

1. REFER TO BC-777M FOR MATERIAL NOTES.

ARCHITECTURAL SURFACE TREATMENTS NOTES

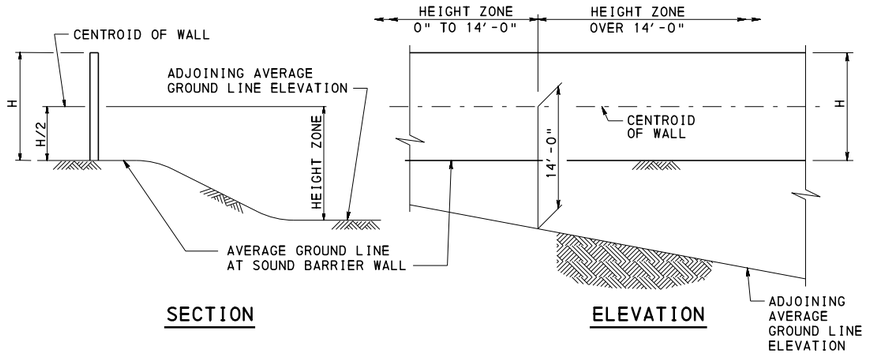
1. FORM LINER ARCHITECTURAL SURFACE TREATMENTS ARE NOT RECOMMENDED ON THE PRECAST CONCRETE POSTS.

GEOMETRY NOTES

1. CAISSON, FOOTING AND PEDESTAL LOCATIONS MUST BE PROPERLY SET FOR WALL PANEL ALIGNMENT. NOTCHES FOR PANELS ARE NOT CENTERED IN CORNER POST.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE POSTS AND SPREAD FOOTINGS ARE DEVELOPED FOR TWO SEPARATE WIND PRESSURES OF 20 PSF AND 28 PSF.
2. DESIGN TABLES SHOWN FOR CAISSONS ARE DEVELOPED FOR A WIND PRESSURE OF 28 PSF. USE THE INFORMATION SHOWN IN THE TABLES FOR ALL HEIGHT ZONES.
3. THE DESIGN POST SPACING (CENTER-TO-CENTER POSTS) IS TO BE THE ACTUAL POST SPACING ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST SPACING SHOWN ON THE DESIGN TABLES.
4. THE DESIGN WALL HEIGHT IS TO BE THE ACTUAL WALL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF WALL HEIGHT SHOWN ON THE DESIGN TABLES.
5. FOR ANGLED AND CORNER POST NOTES REFER TO SHEET 16.



SECTION ELEVATION

HEIGHT ZONE (FEET)	WIND PRESSURE (PSF)
0 TO 14	20
OVER 14	28

HEIGHT ZONES FOR GROUND MOUNTED SOUND BARRIERS

INDEX OF SHEETS

DESCRIPTION OF DETAILS

DETAIL	DESCRIPTION
1	PRECAST CONCRETE POST TYPES A, B, C AND D WITH BASE PLATE CONNECTION TO CAISSON
2	PRECAST CONCRETE POST TYPES A, B, C AND D WITH BASE PLATE CONNECTION TO SPREAD FOOTING
3	PRECAST CONCRETE POST TYPES A, B, C AND D EMBEDDED IN CAISSON
4	PRECAST CONCRETE POST TYPES A, B, C AND D EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL)
5	ANGLED PRECAST CONCRETE POST TYPE E EMBEDDED IN CAISSON
6	CORNER PRECAST CONCRETE POST TYPE F EMBEDDED IN CAISSON
7	ANGLED PRECAST CONCRETE POST TYPE E EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL)
8	CORNER PRECAST CONCRETE POST TYPE F EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL)

REFERENCE DRAWINGS	
BC-734M	ANCHOR SYSTEMS
BC-735M	WALL CONSTRUCTION AND EXPANSION JOINT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-776M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS
BC-777M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS
BC-778M	GROUND MOUNTED SOUND BARRIERS STEEL POSTS
BC-779M	STRUCTURE MOUNTED SOUND BARRIER WALLS
BD-676M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS
BD-678M	GROUND MOUNTED SOUND BARRIERS STEEL POSTS
BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

GENERAL NOTES - 1

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 20

BD-677M

DESIGN PARAMETERS

1. PRECAST CONCRETE POSTS:
   - POSTS ARE DESIGNED AS VERTICAL CANTILEVER BEAMS.
   - POSTS ARE DESIGNED FOR WIND PRESSURES EQUAL TO 20 PSF AND 28 PSF.
   - MAXIMUM PERMITTED POST DEFLECTION EQUALS POST HEIGHT (H) IN INCHES DIVIDED BY 360.
   - POSTS AND CONNECTIONS ARE NOT DESIGNED FOR TRAFFIC IMPACT LOADING.

2. ANCHOR BOLTS:
   - ANCHOR BOLTS ARE DESIGNED IN ACCORDANCE WITH SECTION 5.17 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
   - MINIMUM ANCHOR BOLT EMBEDMENT LENGTH IS CALCULATED BASED ON THE DEVELOPMENT LENGTH OF A HOOKED BAR IN TENSION (WITHOUT ANY MODIFICATION FACTORS). REFER TO SECTION 8.29 IN THE 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.
   - THE ANCHOR BOLT EMBEDMENT LENGTH MUST EXTEND TO A DEPTH WHERE THE FOOTING/ CAISSON REINFORCEMENT IS FULLY DEVELOPED. DESIGNER MUST INCREASE EMBEDMENT LENGTH AS REQUIRED.

3. BASE PLATES:
   - BASE PLATES ARE DESIGNED FOR BENDING DUE TO THE APPLIED BOLTS FORCES, COMPRESSION AND TENSION.
   - BASE PLATES ARE NOT DESIGNED TO SUPPORT THE VERTICAL LOAD OF THE PRECAST CONCRETE PANELS.
   - BASE PLATE THICKNESS IS DETERMINED USING THE ALLOWABLE BENDING STRESS IN ACCORDANCE WITH SECTION 5.8 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
   - BASE PLATE IS SUPPORTED ON THE LEVELING NUTS. THE NON-SHRINK GROUT IS NOT CONSIDERED AS A LOAD-CARRYING ELEMENT.
   - EDGE DISTANCE OF ANCHOR BOLTS:
     - THE CLEAR DISTANCE BETWEEN THE EDGES OF HOLES AND EDGES OF THE BASE PLATE SHALL NOT BE LESS THAN THE DIAMETER OF THE ANCHOR BOLT WHEN OVERSIZED OR SLOTTED HOLES ARE SPECIFIED.

4. SPREAD FOOTINGS:
   - SPREAD FOOTINGS ARE DESIGNED BEARING ON SOIL WITH AN ALLOWABLE BEARING PRESSURE EQUAL TO 1.50 TONS/SQ. FT. AND A COEFFICIENT OF SLIDING FRICTION EQUAL TO 0.30.
   - SPREAD FOOTINGS ARE DESIGNED FOR WIND PRESSURES EQUAL TO 20 PSF AND 28 PSF.
   - FACTOR OF SAFETY AGAINST SLIDING = 1.50 MINIMUM
   - FACTOR OF SAFETY AGAINST SLIDING FOR SEISMIC LOADING = 1.125 MINIMUM
   - FACTOR OF SAFETY AGAINST OVERTURNING = 2.00 MINIMUM
   - FACTOR OF SAFETY AGAINST OVERTURNING FOR SEISMIC LOADING = 1.50 MINIMUM
   - WEIGHT OF BACKFILL MATERIAL = 100 LB. / CU. FT.
   - PROVIDE A MINIMUM SOIL DEPTH OF 1'-6" ABOVE THE TOP OF FOOTING.
   - SPREAD FOOTINGS ARE DESIGNED FOR NO UPLIFT.
   - SPREAD FOOTINGS ARE DESIGNED FOR LEVEL GROUND. A SITE SPECIFIC DESIGN IS REQUIRED IF GROUND IS SLOPED.
   - SPREAD FOOTINGS ARE DESIGNED WITHOUT LIVE LOAD SURCHARGE. REDESIGN FOOTINGS IF LIVE LOAD SURCHARGE IS REQUIRED.
   - ALTERNATE SPREAD FOOTING DESIGNS ARE PERMITTED IF SUPPORTED ON ROCK. FOUNDATION DESIGN PARAMETERS MUST BE ACCEPTED BY THE DISTRICT BRIDGE ENGINEER.

5. CAISSONS:
   - CAISSONS ARE DESIGNED IN SOIL USING THE INDICATED SOIL PROPERTIES.
   - CASSIONS ARE DESIGNED FOR A WIND PRESSURE EQUAL TO 28 PSF.
   - FACTOR OF SAFETY AGAINST OVERTURNING = 2.0 MINIMUM
   - MAXIMUM ALLOWABLE LATERAL DESIGN DISPLACEMENT AT TOP OF CAISSON = ½ INCH
   - CAISSON LENGTHS DETERMINED USING COM624P COMPUTER PROGRAM. FINAL CAISSON LENGTHS INDICATED INCLUDE AN ADDITIONAL 3'-0" LENGTH TO ACCOUNT FOR FREEZING AND THAWING, WEATHERING, AND OTHER SHALLOW GROUND DISTURBANCE.
   - CAISSON MAXIMUM ALLOWABLE VERTICAL DISPLACEMENT = 1.0 INCH
   - DRILLED CAISSONS ARE DESIGNED FOR LEVEL GROUND. A SITE SPECIFIC DESIGN IS REQUIRED IF GROUND IS SLOPED.
   - DRILLED CAISSONS ARE DESIGNED WITHOUT LIVE LOAD SURCHARGE. REDESIGN CAISSONS IF LIVE LOAD SURCHARGE IS REQUIRED.
   - ALTERNATE CAISSON DESIGNS ARE PERMITTED IF SOIL PROPERTIES DIFFER FROM THOSE INDICATED OR IF CAISSON EXTENDS PARTIALLY OR ENTIRELY INTO ROCK. FOUNDATION DESIGN PARAMETERS MUST BE ACCEPTED BY THE DISTRICT BRIDGE ENGINEER.

NOTES TO DESIGNER

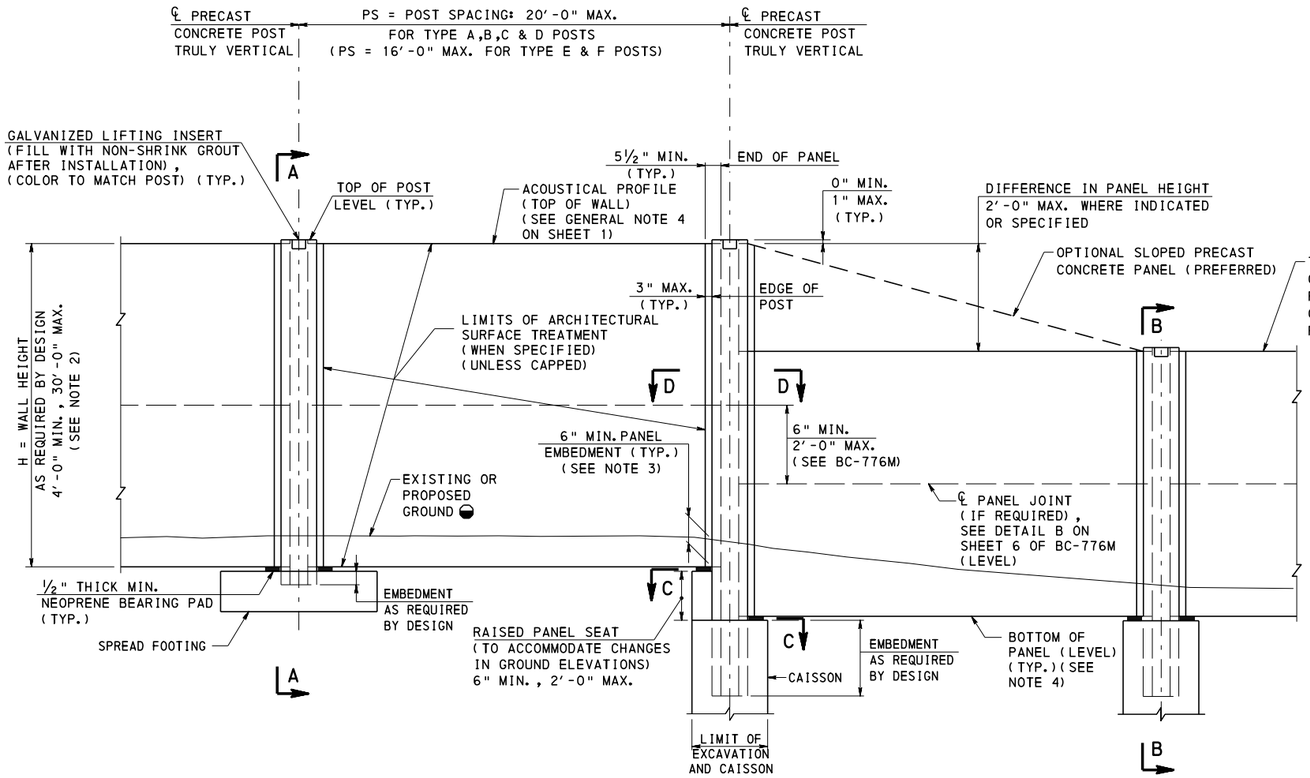
1. REFER TO SHEET 2 OF BD-676M FOR NOTES TO DESIGNER.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

GENERAL NOTES - 2

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 2 OF 20
		BD-677M



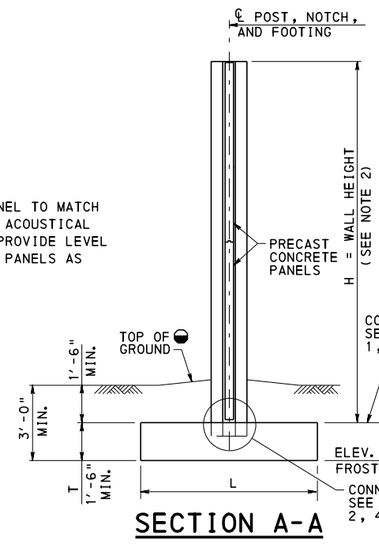
LEVEL PANEL

LEVEL OR SLOPED TOP PANEL

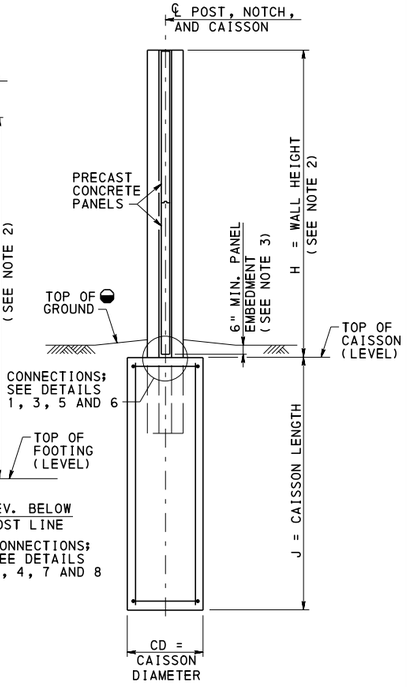
(SLOPED TOP PANEL PREFERRED)

GROUND MOUNTED SOUND BARRIER ELEVATION

FOR POSTS WITH BASE PLATES REFER TO "PANEL NOTCH DETAIL FOR BASE PLATE CONNECTIONS" ON BD-676M, SHT. 6.



SECTION A-A



SECTION B-B

LEGEND:

◒ GRADE GROUND TO DRAIN WATER AWAY FROM THE WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 1'-0" DIFFERANCE.

NOTES:

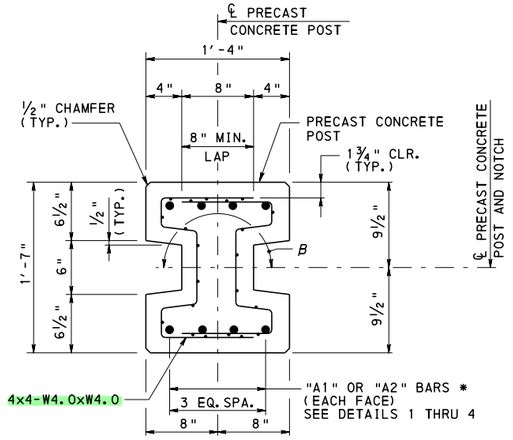
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. WALL HEIGHT IS DEFINED AS FOLLOWS:
   - POST WITH BASE PLATE: H = HEIGHT FROM TOP OF BASE PLATE TO TOP OF WALL
   - POST WITHOUT BASE PLATE: H = HEIGHT FROM TOP OF FOOTING/ CAISSON TO TOP OF WALL
3. PANEL EMBEDMENT MAY NEED TO BE INCREASED TO ACCOMMODATE BASE PLATES AND ANCHOR BOLT PROJECTIONS.
4. FOR OPTIONAL SLOPED BOTTOM PANEL REFER TO BD-676M, SHEET 3.
5. FOR SECTIONS C-C AND D-D REFER TO BC-777M, SHEETS 2 AND 3.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS

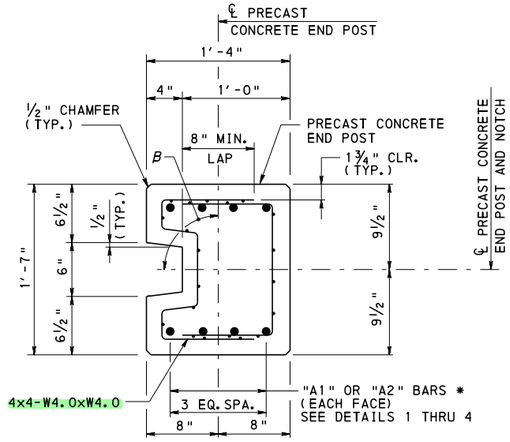
GEOMETRY AND LAYOUT

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 3 OF 20
		BD-677M



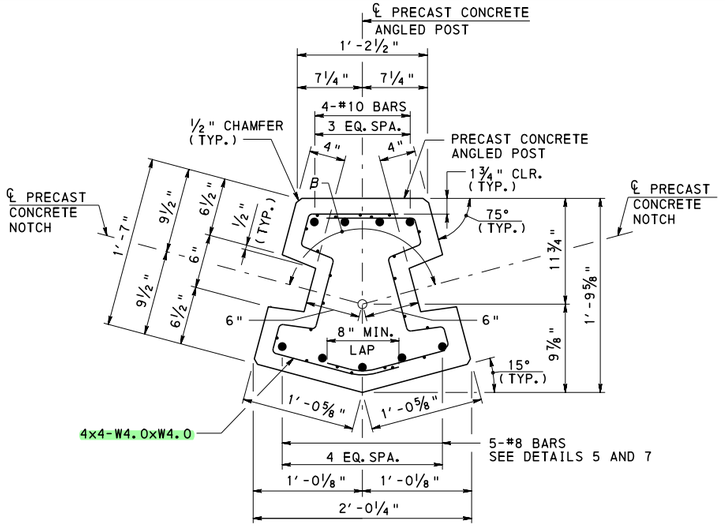
POST TYPE A - IN-LINE

β = 180° (±) 12°



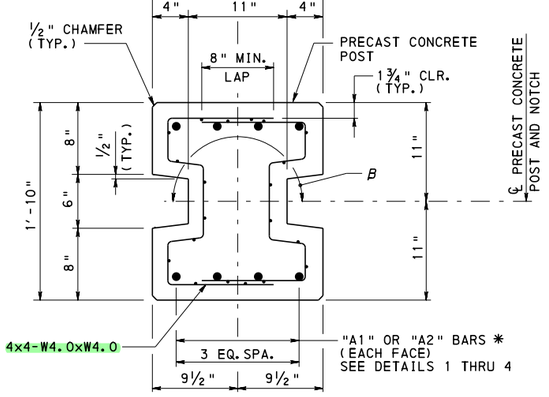
POST TYPE B - END POST

β = 90° (±) 6°



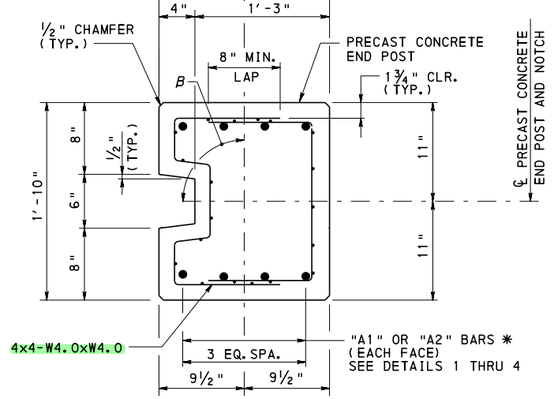
POST TYPE E - ANGLED IN-LINE

β = 150° (±) 12°



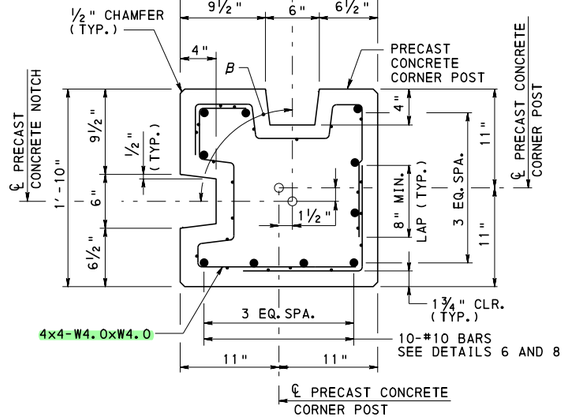
POST TYPE C - IN-LINE

β = 180° (±) 12°



POST TYPE D - END POST

β = 90° (±) 6°



POST TYPE F - CORNER

β = 90° (±) 12°

* "A1" BARS ARE USED WITH BASE PLATE CONNECTIONS, BARS ARE EITHER EPOXY COATED OR GALVANIZED AND ARE THREADED AT ONE END. DESIGNER TO USE BAR SIZE SPECIFIED WITH THREADED END OR USE ONE BAR SIZE SMALLER WHEN USING UPSET THREADED END. (SEE DETAILS 1 AND 2)

"A2" BARS ARE NOT THREADED. (SEE DETAILS 3 AND 4)

NOTES:

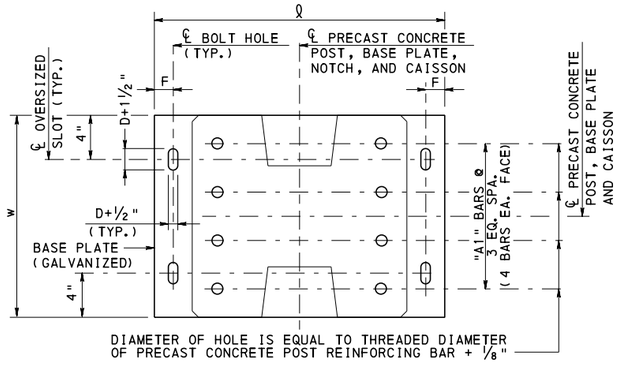
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. β REFERS TO THE PANEL ORIENTATION. THE MAXIMUM VARIATION IN THE ANGLE BETWEEN THE CENTERLINE OF PANEL AND CENTERLINE OF POST IS 6 DEGREES. REFER TO BC-777M FOR ADDITIONAL INFORMATION.
3. POST TYPES A, B, C, D & E ARE PERMITTED A MAXIMUM OF TWO LAP SPLICES FOR ITS HORIZONTAL WIRE MESH TO CREATE A CLOSED STIRRUP. POST TYPE F IS PERMITTED A MAXIMUM OF THREE LAP SPLICE LOCATIONS TO CREATE ITS CLOSED STIRRUP.
4. OTHER HORIZONTAL WIRE MESH LAP SPLICE LOCATIONS THAN THOSE SHOWN ARE ALLOWED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS

POST DETAILS

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 4 OF 20
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-677M



PLAN

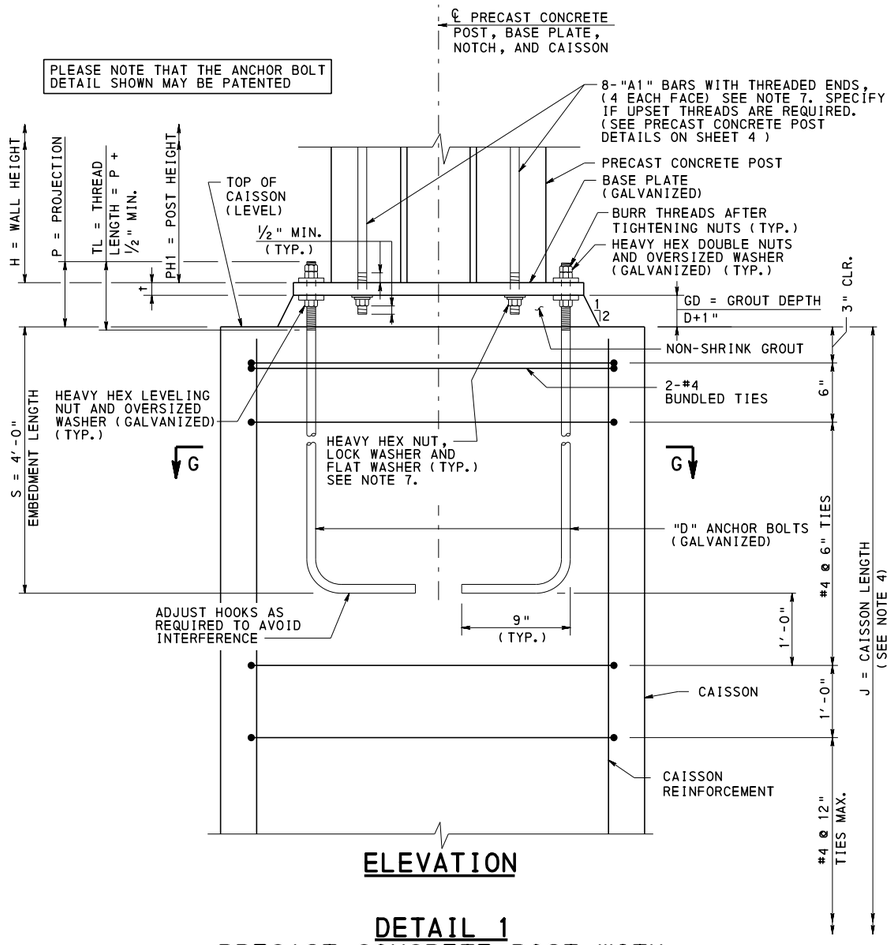
PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO CAISSON DIMENSION TABLE

HEIGHT ZONE =
WIND PRESSURE =

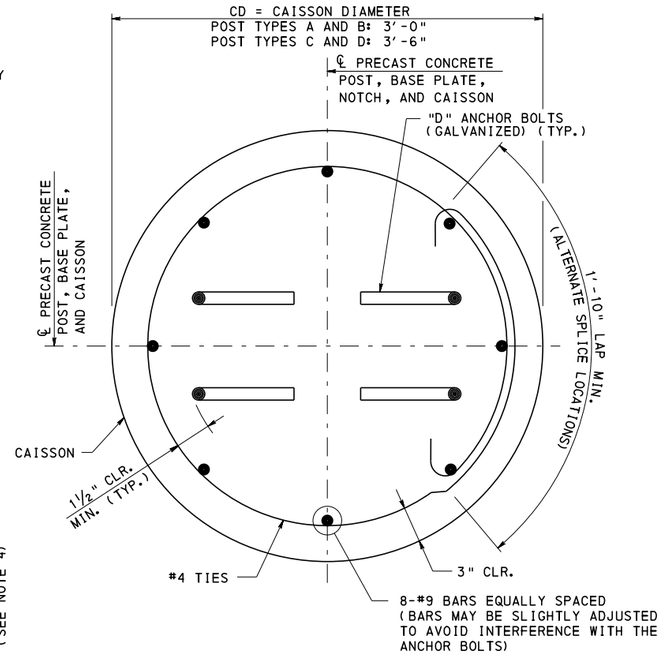
CONCRETE POST					BASE PLATE				ANCHOR BOLTS				GROUT	CAISSON			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	POST HEIGHT PH1 (FT.)	"A1" (BAR SIZE)	THICKNESS t (IN.)	LENGTH Q (IN.)	WIDTH w (IN.)	F (IN.)	DIAMETER D (IN.)	EMBEDMENT LENGTH S (IN.)	PROJECTION P (IN.)	THREAD LENGTH TL (IN.)	GROUT DEPTH GD (IN.)	CAISSON DIAMETER CD (FT.-IN.)	CAISSON LENGTH J (FT.)	VERTICAL REINFORCEMENT	
																NUMBER OF BARS	BAR SIZE

TABLE NOTES:

1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. SPECIFY IF UPSET THREADS ARE REQUIRED FOR THE "A1" BARS. (REFER TO SHEET 4)
4. CAISSON REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
5. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.



ELEVATION



SECTION G-G

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. FOR DESIGN TABLES REFER TO SHEETS 6 AND 7.
4. FOR CAISSON LENGTHS REFER TO SHEET 20.
5. FOR PANEL SEAT DETAILS REFER TO BC-777M, SHEET 4.
6. FOR OVERSIZED WASHER DETAIL REFER TO BC-777M, SHEET 6.
7. POST "A1" BARS AND HARDWARE OPTIONS:
   A. GALVANIZED BARS - IF THE THREADED BAR IS HOT DIP GALVANIZED, INCLUDING THE THREADED PORTION, USE NUTS AND WASHERS THAT ARE HOT-DIP GALVANIZED. IF THREADING IS PERFORMED AFTER GALVANIZING, COAT THE THREADED AREA WITH A COLD GALVANIZING REPAIR COMPOUND PER ASTM A780 AND USE EITHER MECHANICALLY GALVANIZED OR HOT DIP GALVANIZED WASHERS AND MECHANICALLY (ONLY) GALVANIZED NUTS. (WASHER - ASTM F436; NUT-ASTM A563).
   B. EPOXY COATED BARS - COAT THREADS WITH COLD GALVANIZING REPAIR COMPOUND PER ASTM A780. USE EITHER MECHANICALLY GALVANIZED OR HOT DIP GALVANIZED WASHERS AND MECHANICALLY (ONLY) GALVANIZED NUTS. (WASHER - ASTM F436; NUT - ASTM A563)

DETAIL 1
PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO CAISSON

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 1

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 5 OF 20
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-677M

DETAIL 1
PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO CAISSON

POST TYPES A AND B

HEIGHT ZONE 0' TO 14'
WIND PRESSURE = 20 PSF

CONCRETE POST			BASE PLATE				ANCHOR BOLTS	
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	P (IN.)
12.0	6.0	#5	3/4	26	16	1 1/2	3/4	5
	8.0	#5	3/4	26	16	1 1/2	3/4	5
	10.0	#5	3/4	27	16	2	1	5 3/4
	12.0	#5	7/8	27	16	2	1	5 3/4
	14.0	#5	1	27	16	2	1	6
	16.0	#6	1 1/8	28	16	2 1/4	1 1/4	6 3/4
	18.0	#6	1 3/8	28	16	2 1/4	1 1/4	7
	20.0	#7	1 1/2	28	16	2 1/4	1 1/4	7 1/4
	22.0	#8	1 3/4	28	16	2 1/4	1 1/4	7 1/4
	24.0	#8	1 7/8	29	16	2 3/4	1 1/2	8 1/4
16.0	6.0	#5	3/4	26	16	1 1/2	3/4	5
	8.0	#5	3/4	27	16	2	1	5 3/4
	10.0	#5	7/8	27	16	2	1	5 3/4
	12.0	#5	1	27	16	2	1	6
	14.0	#6	1 1/4	28	16	2 1/4	1 1/4	6 3/4
	16.0	#7	1 3/8	28	16	2 1/4	1 1/4	7
	18.0	#7	1 5/8	28	16	2 1/4	1 1/4	7 1/4
	20.0	#8	1 3/4	29	16	2 3/4	1 1/2	8 1/4
20.0	6.0	#5	3/4	26	16	1 1/2	3/4	5
	8.0	#5	3/4	27	16	2	1	5 3/4
	10.0	#5	7/8	27	16	2	1	5 3/4
	12.0	#6	1 1/8	28	16	2 1/4	1 1/4	6 3/4
	14.0	#6	1 3/8	28	16	2 1/4	1 1/4	7
	16.0	#7	1 5/8	28	16	2 1/4	1 1/4	7 1/4
	18.0	#8	1 7/8	29	16	2 3/4	1 1/2	8 1/4

DETAIL 1
PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO CAISSON

POST TYPES A AND B

HEIGHT ZONES OVER 14'
WIND PRESSURE = 28 PSF

CONCRETE POST			BASE PLATE				ANCHOR BOLTS	
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	P (IN.)
12.0	6.0	#5	3/4	26	16	1 1/2	3/4	5
	8.0	#5	3/4	27	16	2	1	5 3/4
	10.0	#5	7/8	27	16	2	1	5 3/4
	12.0	#5	1	27	16	2	1	6
	14.0	#6	1 1/4	28	16	2 1/4	1 1/4	7
	16.0	#7	1 3/8	28	16	2 1/4	1 1/4	7
	18.0	#8	1 5/8	28	16	2 1/4	1 1/4	7 1/4
	20.0	#8	1 7/8	29	16	2 3/4	1 1/2	8 1/4
16.0	6.0	#5	3/4	26	16	1 1/2	3/4	5
	8.0	#5	3/4	27	16	2	1	5 3/4
	10.0	#5	1	27	16	2	1	6
	12.0	#6	1 1/4	28	16	2 1/4	1 1/4	7
	14.0	#7	1 1/2	28	16	2 1/4	1 1/4	7
	16.0	#8	1 3/4	28	16	2 1/4	1 1/4	7 1/4
	17.0	#8	1 7/8	29	16	2 3/4	1 1/2	8 1/4
20.0	6.0	#5	3/4	27	16	2	1	5 3/4
	8.0	#5	7/8	27	16	2	1	5 3/4
	10.0	#6	1 1/8	28	16	2 1/4	1 1/4	6 3/4
	12.0	#7	1 3/8	28	16	2 1/4	1 1/4	7
	14.0	#8	1 5/8	28	16	2 1/4	1 1/4	7 1/4
	15.0	#8	1 3/4	29	16	2 3/4	1 1/2	8 1/4

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 1 - POST TYPES A AND B
DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 6 OF 20

BD-677M

DETAIL 1
PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO CAISSON

POST TYPES C AND D

HEIGHT ZONE 0' TO 14'
WIND PRESSURE = 20 PSF

CONCRETE POST			BASE PLATE				ANCHOR BOLTS	
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	P (IN.)
12.0	6.0	#5	3/4	29	19	1 1/2	3/4	5
	8.0	#5	3/4	29	19	1 1/2	3/4	5
	10.0	#5	3/4	30	19	2	1	5 3/4
	12.0	#5	7/8	30	19	2	1	5 3/4
	14.0	#6	1	30	19	2	1	6
	16.0	#6	1 1/8	31	19	2 1/4	1 1/4	6 3/4
	18.0	#6	1 1/8	31	19	2 1/4	1 1/4	6 3/4
	20.0	#7	1 1/4	31	19	2 1/4	1 1/4	7
	22.0	#7	1 3/8	31	19	2 1/4	1 1/4	7
	24.0	#8	1 1/2	32	19	2 3/4	1 1/2	8
	26.0	#8	1 5/8	32	19	2 3/4	1 1/2	8
	28.0	#9	1 7/8	32	19	2 3/4	1 1/2	8 1/4
16.0	6.0	#5	3/4	29	19	1 1/2	3/4	5
	8.0	#5	3/4	30	19	2	1	5 3/4
	10.0	#5	3/4	30	19	2	1	5 3/4
	12.0	#6	7/8	30	19	2	1	5 3/4
	14.0	#6	1	31	19	2 1/4	1 1/4	6 3/4
	16.0	#6	1 1/8	31	19	2 1/4	1 1/4	6 3/4
	18.0	#7	1 3/8	31	19	2 1/4	1 1/4	7
	20.0	#7	1 1/2	31	19	2 1/4	1 1/4	7 1/4
	22.0	#8	1 5/8	32	19	2 3/4	1 1/2	8
	24.0	#9	1 7/8	32	19	2 3/4	1 1/2	8 1/4
	26.0	#10	2	33	19	3	1 3/4	9 1/4
	28.0	#10	2 1/4	33	19	3	1 3/4	9 1/2
20.0	6.0	#5	3/4	29	19	1 1/2	3/4	5
	8.0	#5	3/4	30	19	2	1	5 3/4
	10.0	#5	7/8	30	19	2	1	5 3/4
	12.0	#6	1	31	19	2 1/4	1 1/4	6 3/4
	14.0	#6	1 1/8	31	19	2 1/4	1 1/4	6 3/4
	16.0	#7	1 3/8	31	19	2 1/4	1 1/4	7
	18.0	#8	1 1/2	31	19	2 1/4	1 1/4	7 1/4
	20.0	#8	1 3/4	32	19	2 3/4	1 1/2	8 1/4
	22.0	#9	1 7/8	32	19	2 3/4	1 1/2	8 1/4
	24.0	#10	2 1/8	33	19	3	1 3/4	9 1/4
	26.0	#11	2 3/8	33	19	3	1 3/4	9 1/2
	27.0	#11	2 1/2	34	19	3 1/2	2	10 1/2

DETAIL 1
PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO CAISSON

POST TYPES C AND D

HEIGHT ZONES OVER 14'
WIND PRESSURE = 28 PSF

CONCRETE POST			BASE PLATE				ANCHOR BOLTS	
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	P (IN.)
12.0	6.0	#5	3/4	29	19	1 1/2	3/4	5
	8.0	#5	3/4	30	19	2	1	5 3/4
	10.0	#5	3/4	30	19	2	1	5 3/4
	12.0	#6	7/8	30	19	2	1	5 3/4
	14.0	#6	1	31	19	2 1/4	1 1/4	6 3/4
	16.0	#6	1 1/4	31	19	2 1/4	1 1/4	7
	18.0	#7	1 3/8	31	19	2 1/4	1 1/4	7
	20.0	#8	1 1/2	32	19	2 3/4	1 1/2	8
	22.0	#8	1 3/4	32	19	2 3/4	1 1/2	8 1/4
	24.0	#9	1 7/8	32	19	2 3/4	1 1/2	8 1/4
	26.0	#10	2 1/8	33	19	3	1 3/4	9 1/4
	28.0	#11	2 3/8	33	19	3	1 3/4	9 1/2
	30.0	#11	2 1/2	34	19	3 1/2	2	10 1/2
16.0	6.0	#5	3/4	29	19	1 1/2	3/4	5
	8.0	#5	3/4	30	19	2	1	5 3/4
	10.0	#5	7/8	30	19	2	1	5 3/4
	12.0	#6	1	31	19	2 1/4	1 1/4	6 3/4
	14.0	#6	1 1/4	31	19	2 1/4	1 1/4	7
	16.0	#7	1 3/8	31	19	2 1/4	1 1/4	7
	18.0	#8	1 5/8	32	19	2 3/4	1 1/2	8
	20.0	#9	1 7/8	32	19	2 3/4	1 1/2	8 1/4
	22.0	#10	2 1/8	33	19	3	1 3/4	9 1/4
	24.0	#10	2 1/4	33	19	3	1 3/4	9 1/2
	26.0	#11	2 1/2	34	19	3 1/2	2	10 1/2
20.0	6.0	#5	3/4	30	19	2	1	5 3/4
	8.0	#5	3/4	30	19	2	1	5 3/4
	10.0	#6	1	31	19	2 1/4	1 1/4	6 3/4
	12.0	#6	1 1/8	31	19	2 1/4	1 1/4	6 3/4
	14.0	#7	1 3/8	31	19	2 1/4	1 1/4	7
	16.0	#8	1 5/8	32	19	2 3/4	1 1/2	8
	18.0	#9	1 7/8	32	19	2 3/4	1 1/2	8 1/4
	20.0	#10	2 1/8	33	19	3	1 3/4	9 1/4
	22.0	#11	2 3/8	33	19	3	1 3/4	9 1/2
	23.0	#11	2 1/2	34	19	3 1/2	2	10 1/2

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

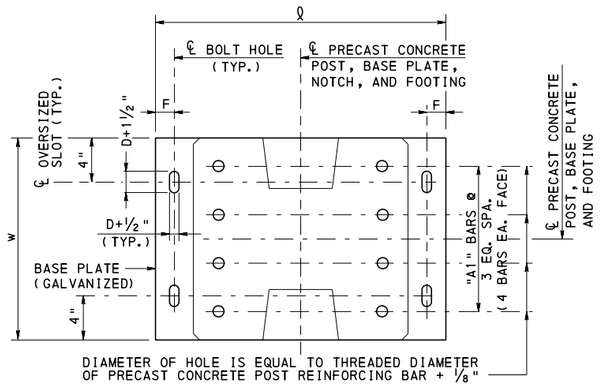
DETAIL 1 - POST TYPES C AND D
DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 7 OF 20

BD-677M



PLAN

PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING DIMENSION TABLE

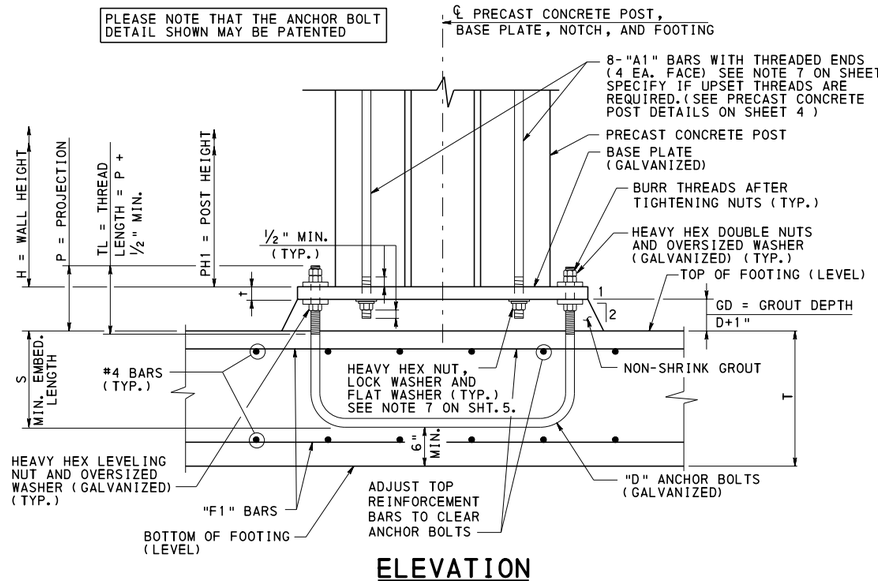
HEIGHT ZONE =
WIND PRESSURE =

CONCRETE POST					BASE PLATE				ANCHOR BOLTS				GROUT	SPREAD FOOTING			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	POST HEIGHT PH1 (FT.)	"A1" (BAR SIZE)	THICKNESS t (IN.)	LENGTH Q (IN.)	WIDTH w (IN.)	F (IN.)	DIAMETER D (IN.)	EMBEDMENT LENGTH S (IN.)	PROJECTION P (IN.)	THREAD LENGTH TL (IN.)	GROUT DEPTH GD (IN.)	THICKNESS T (FT.)	LENGTH L (FT.)	WIDTH W (FT.)	"F1" (BAR SIZE)

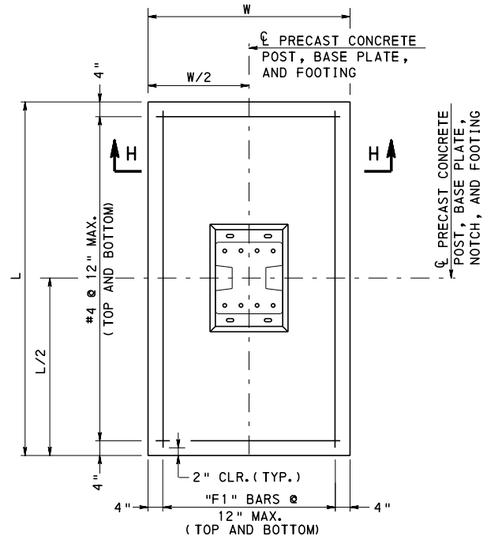
TABLE NOTES:

1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. SPECIFY IF UPSET THREADS ARE REQUIRED FOR THE "A1" BARS. (REFER TO SHEET 4)
4. SPREAD FOOTING REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
5. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.

PLEASE NOTE THAT THE ANCHOR BOLT DETAIL SHOWN MAY BE PATENTED



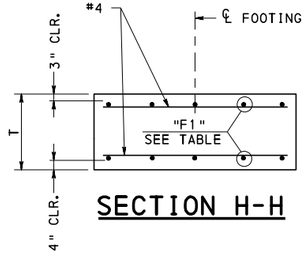
ELEVATION



SPREAD FOOTING PLAN

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. FOR DESIGN TABLES REFER TO SHEETS 9 AND 10.
4. FOR OVERSIZED WASHER DETAIL REFER TO BC-777M, SHEET 6.
5. FOR PANEL SEAT DETAILS REFER TO BC-777M, SHEET 4.



SECTION H-H

DETAIL 2
PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 2

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 8 OF 20
		BD-677M

DETAIL 2
PRECAST CONCRETE POST WITH BASE PLATE
CONNECTION TO SPREAD FOOTING

POST TYPES A AND B

HEIGHT ZONE 0' TO 14'
WIND PRESSURE = 20 PSF

CONCRETE POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	#5	3/4	26	16	1 1/2	3/4	17	5	2.0	5.0	5.0	#4
	8.0	#5	3/4	26	16	1 1/2	3/4	17	5	2.0	5.0	5.0	#4
	10.0	#5	3/4	27	16	2	1	22	5 3/4	2.5	5.0	5.0	#4
	12.0	#5	7/8	27	16	2	1	22	5 3/4	2.5	6.0	5.0	#4
	14.0	#5	1	27	16	2	1	22	6	2.5	6.5	5.0	#4
	16.0	#6	1 1/8	28	16	2 1/4	1 1/4	28	6 3/4	3.0	7.0	5.0	#4
	18.0	#6	1 3/8	28	16	2 1/4	1 1/4	28	7	3.0	8.0	5.0	#4
	20.0	#7	1 1/2	28	16	2 1/4	1 1/4	28	7 1/4	3.0	8.5	5.0	#4
	22.0	#8	1 3/4	28	16	2 1/4	1 1/4	28	7 1/4	3.0	9.5	5.0	#5
	24.0	#8	1 7/8	29	16	2 3/4	1 1/2	33	8 1/4	3.25	10.0	5.0	#5
16.0	6.0	#5	3/4	26	16	1 1/2	3/4	17	5	2.0	5.0	5.0	#4
	8.0	#5	3/4	27	16	2	1	22	5 3/4	2.5	5.0	5.0	#4
	10.0	#5	7/8	27	16	2	1	22	5 3/4	2.5	5.5	5.0	#4
	12.0	#5	1	27	16	2	1	22	6	2.5	6.5	5.0	#4
	14.0	#6	1 1/4	28	16	2 1/4	1 1/4	28	6 3/4	3.0	7.0	5.0	#4
	16.0	#7	1 3/8	28	16	2 1/4	1 1/4	28	7	3.0	8.0	5.0	#4
	18.0	#7	1 5/8	28	16	2 1/4	1 1/4	28	7 1/4	3.0	9.0	5.0	#5
	20.0	#8	1 3/4	29	16	2 3/4	1 1/2	33	8 1/4	3.25	9.5	5.0	#5
20.0	6.0	#5	3/4	26	16	1 1/2	3/4	17	5	2.0	5.0	5.0	#4
	8.0	#5	3/4	27	16	2	1	22	5 3/4	2.5	5.0	5.0	#4
	10.0	#5	7/8	27	16	2	1	22	5 3/4	2.5	6.0	5.0	#4
	12.0	#6	1 1/8	28	16	2 1/4	1 1/4	28	6 3/4	3.0	7.0	5.0	#4
	14.0	#6	1 3/8	28	16	2 1/4	1 1/4	28	7	3.0	8.0	5.0	#4
	16.0	#7	1 5/8	28	16	2 1/4	1 1/4	28	7 1/4	3.0	8.5	5.0	#5
	18.0	#8	1 7/8	29	16	2 3/4	1 1/2	33	8 1/4	3.25	9.5	5.0	#5

DETAIL 2
PRECAST CONCRETE POST WITH BASE PLATE
CONNECTION TO SPREAD FOOTING

POST TYPES A AND B

HEIGHT ZONES OVER 14'
WIND PRESSURE = 28 PSF

CONCRETE POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	#5	3/4	26	16	1 1/2	3/4	17	5	2.0	5.0	5.0	#4
	8.0	#5	3/4	27	16	2	1	22	5 3/4	2.5	5.5	5.0	#4
	10.0	#5	7/8	27	16	2	1	22	5 3/4	2.5	6.5	5.0	#4
	12.0	#5	1	27	16	2	1	22	6	2.5	7.5	5.0	#4
	14.0	#6	1 1/4	28	16	2 1/4	1 1/4	28	7	3.0	8.0	5.0	#4
	16.0	#7	1 3/8	28	16	2 1/4	1 1/4	28	7	3.0	9.0	5.0	#4
	18.0	#8	1 5/8	28	16	2 1/4	1 1/4	28	7 1/4	3.0	10.0	5.0	#5
	20.0	#8	1 7/8	29	16	2 3/4	1 1/2	33	8 1/4	3.25	10.5	5.5	#5
16.0	6.0	#5	3/4	26	16	1 1/2	3/4	17	5	2.0	5.0	5.0	#4
	8.0	#5	3/4	27	16	2	1	22	5 3/4	2.5	6.0	5.0	#4
	10.0	#5	1	27	16	2	1	22	6	2.5	7.0	5.0	#4
	12.0	#6	1 1/4	28	16	2 1/4	1 1/4	28	7	3.0	8.0	5.0	#4
	14.0	#7	1 1/2	28	16	2 1/4	1 1/4	28	7	3.0	9.0	5.0	#4
	16.0	#8	1 3/4	28	16	2 1/4	1 1/4	28	7 1/4	3.0	10.0	5.0	#5
	17.0	#8	1 7/8	29	16	2 3/4	1 1/2	33	8 1/4	3.25	10.0	5.5	#5
20.0	6.0	#5	3/4	27	16	2	1	22	5 3/4	2.5	5.5	5.0	#4
	8.0	#5	7/8	27	16	2	1	22	5 3/4	2.5	6.5	5.0	#4
	10.0	#6	1 1/8	28	16	2 1/4	1 1/4	28	6 3/4	3.0	7.5	5.0	#4
	12.0	#7	1 3/8	28	16	2 1/4	1 1/4	28	7	3.0	8.5	5.0	#4
	14.0	#8	1 5/8	28	16	2 1/4	1 1/4	28	7 1/4	3.0	10.0	5.0	#5
	15.0	#8	1 3/4	29	16	2 3/4	1 1/2	33	8 1/4	3.25	10.0	5.0	#5

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 8.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 2 - POST TYPES A AND B
DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

BD-677M

DETAIL 2
PRECAST CONCRETE POST WITH BASE PLATE
CONNECTION TO SPREAD FOOTING

POST TYPES C AND D

HEIGHT ZONE 0' TO 14'
WIND PRESSURE = 20 PSF

CONCRETE POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	#5	3/4	29	19	1 1/2	3/4	17	5	2.0	5.5	5.5	#4
	8.0	#5	3/4	29	19	1 1/2	3/4	17	5	2.0	5.5	5.5	#4
	10.0	#5	3/4	30	19	2	1	22	5 3/4	2.5	5.5	5.5	#4
	12.0	#5	7/8	30	19	2	1	22	5 3/4	2.5	5.5	5.5	#4
	14.0	#6	1	30	19	2	1	22	6	2.5	6.5	5.5	#4
	16.0	#6	1 1/8	31	19	2 1/4	1 1/4	28	6 3/4	3.0	7.0	5.5	#4
	18.0	#6	1 1/8	31	19	2 1/4	1 1/4	28	6 3/4	3.0	7.5	5.5	#4
	20.0	#7	1 1/4	31	19	2 1/4	1 1/4	28	7	3.0	8.0	5.5	#4
	22.0	#7	1 3/8	31	19	2 1/4	1 1/4	28	7	3.0	9.0	5.5	#5
	24.0	#8	1 1/2	32	19	2 3/4	1 1/2	33	8	3.25	9.5	5.5	#5
	26.0	#8	1 5/8	32	19	2 3/4	1 1/2	33	8	3.25	10.0	5.5	#5
	28.0	#9	1 7/8	32	19	2 3/4	1 1/2	33	8 1/4	3.25	10.5	5.5	#5
16.0	6.0	#5	3/4	29	19	1 1/2	3/4	17	5	2.0	5.5	5.5	#4
	8.0	#5	3/4	30	19	2	1	22	5 3/4	2.5	5.5	5.5	#4
	10.0	#5	3/4	30	19	2	1	22	5 3/4	2.5	5.5	5.5	#4
	12.0	#6	7/8	30	19	2	1	22	5 3/4	2.5	6.0	5.5	#4
	14.0	#6	1	31	19	2 1/4	1 1/4	28	6 3/4	3.0	7.0	5.5	#4
	16.0	#6	1 1/8	31	19	2 1/4	1 1/4	28	6 3/4	3.0	7.5	5.5	#4
	18.0	#7	1 3/8	31	19	2 1/4	1 1/4	28	7	3.0	8.5	5.5	#4
	20.0	#7	1 1/2	31	19	2 1/4	1 1/4	28	7 1/4	3.0	9.0	5.5	#5
	22.0	#8	1 5/8	32	19	2 3/4	1 1/2	33	8	3.25	10.0	5.5	#5
	24.0	#9	1 7/8	32	19	2 3/4	1 1/2	33	8 1/4	3.25	10.5	5.5	#6
	26.0	#10	2	33	19	3	1 3/4	39	9 1/4	3.75	11.0	5.5	#6
	28.0	#10	2 1/4	33	19	3	1 3/4	39	9 1/2	3.75	11.5	6.0	#6
20.0	6.0	#5	3/4	29	19	1 1/2	3/4	17	5	2.0	5.5	5.5	#4
	8.0	#5	3/4	30	19	2	1	22	5 3/4	2.5	5.5	5.5	#4
	10.0	#5	7/8	30	19	2	1	22	5 3/4	2.5	6.0	5.5	#4
	12.0	#6	1	31	19	2 1/4	1 1/4	28	6 3/4	3.0	6.5	5.5	#4
	14.0	#6	1 1/8	31	19	2 1/4	1 1/4	28	6 3/4	3.0	7.5	5.5	#4
	16.0	#7	1 3/8	31	19	2 1/4	1 1/4	28	7	3.0	8.0	5.5	#4
	18.0	#8	1 1/2	31	19	2 1/4	1 1/4	28	7 1/4	3.0	9.0	5.5	#5
	20.0	#8	1 3/4	32	19	2 3/4	1 1/2	33	8 1/4	3.0	10.0	5.5	#5
	22.0	#9	1 7/8	32	19	2 3/4	1 1/2	33	8 1/4	3.25	10.5	5.5	#6
	24.0	#10	2 1/8	33	19	3	1 3/4	39	9 1/4	3.75	11.0	5.5	#6
	26.0	#11	2 3/8	33	19	3	1 3/4	39	9 1/2	3.75	11.5	6.0	#6
	27.0	#11	2 1/2	34	19	3 1/2	2	44	10 1/2	4.25	12.0	6.0	#6

DETAIL 2
PRECAST CONCRETE POST WITH BASE PLATE
CONNECTION TO SPREAD FOOTING

POST TYPES C AND D

HEIGHT ZONES OVER 14'
WIND PRESSURE = 28 PSF

CONCRETE POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	#5	3/4	29	19	1 1/2	3/4	17	5	2.0	5.5	5.5	#4
	8.0	#5	3/4	30	19	2	1	22	5 3/4	2.5	5.5	5.5	#4
	10.0	#5	3/4	30	19	2	1	22	5 3/4	2.5	6.0	5.5	#4
	12.0	#6	7/8	30	19	2	1	22	5 3/4	2.5	7.0	5.5	#4
	14.0	#6	1	31	19	2 1/4	1 1/4	28	6 3/4	3.0	7.5	5.5	#4
	16.0	#6	1 1/4	31	19	2 1/4	1 1/4	28	7	3.0	8.5	5.5	#4
	18.0	#7	1 3/8	31	19	2 1/4	1 1/4	28	7	3.0	9.5	5.5	#4
	20.0	#8	1 1/2	32	19	2 3/4	1 1/2	33	8	3.25	10.0	5.5	#5
	22.0	#8	1 3/4	32	19	2 3/4	1 1/2	33	8 1/4	3.25	11.0	5.5	#5
	24.0	#9	1 7/8	32	19	2 3/4	1 1/2	33	8 1/4	3.25	11.5	6.0	#5
	26.0	#10	2 1/8	33	19	3	1 3/4	39	9 1/4	3.75	12.0	6.0	#5
	28.0	#11	2 3/8	33	19	3	1 3/4	39	9 1/2	3.75	12.0	6.5	#5
	30.0	#11	2 1/2	34	19	3 1/2	2	44	10 1/2	4.25	12.5	6.5	#5
16.0	6.0	#5	3/4	29	19	1 1/2	3/4	17	5	2.0	5.5	5.5	#4
	8.0	#5	3/4	30	19	2	1	22	5 3/4	2.5	5.5	5.5	#4
	10.0	#5	7/8	30	19	2	1	22	5 3/4	2.5	6.5	5.5	#4
	12.0	#6	1	31	19	2 1/4	1 1/4	28	6 3/4	3.0	7.5	5.5	#4
	14.0	#6	1 1/4	31	19	2 1/4	1 1/4	28	7	3.0	8.5	5.5	#4
	16.0	#7	1 3/8	31	19	2 1/4	1 1/4	28	7	3.0	9.5	5.5	#5
	18.0	#8	1 5/8	32	19	2 3/4	1 1/2	33	8	3.25	10.5	5.5	#5
	20.0	#9	1 7/8	32	19	2 3/4	1 1/2	33	8 1/4	3.25	11.0	6.0	#5
	22.0	#10	2 1/8	33	19	3	1 3/4	39	9 1/4	3.75	11.5	6.0	#5
	24.0	#10	2 1/4	33	19	3	1 3/4	39	9 1/2	3.75	12.0	6.5	#5
	26.0	#11	2 1/2	34	19	3 1/2	2	44	10 1/2	4.25	12.5	6.5	#6
20.0	6.0	#5	3/4	30	19	2	1	22	5 3/4	2.5	5.5	5.5	#4
	8.0	#5	3/4	30	19	2	1	22	5 3/4	2.5	6.0	5.5	#4
	10.0	#6	1	31	19	2 1/4	1 1/4	28	6 3/4	3.0	7.0	5.5	#4
	12.0	#6	1 1/8	31	19	2 1/4	1 1/4	28	6 3/4	3.0	8.5	5.5	#4
	14.0	#7	1 3/8	31	19	2 1/4	1 1/4	28	7	3.0	9.5	5.5	#5
	16.0	#8	1 5/8	32	19	2 3/4	1 1/2	33	8	3.25	10.0	5.5	#5
	18.0	#9	1 7/8	32	19	2 3/4	1 1/2	33	8 1/4	3.25	11.0	5.5	#6
	20.0	#10	2 1/8	33	19	3	1 3/4	39	9 1/4	3.75	11.5	6.0	#6
	22.0	#11	2 3/8	33	19	3	1 3/4	39	9 1/2	3.75	12.5	6.5	#6
	23.0	#11	2 1/2	34	19	3 1/2	2	44	10 1/2	4.25	12.5	6.5	#6

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 8.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

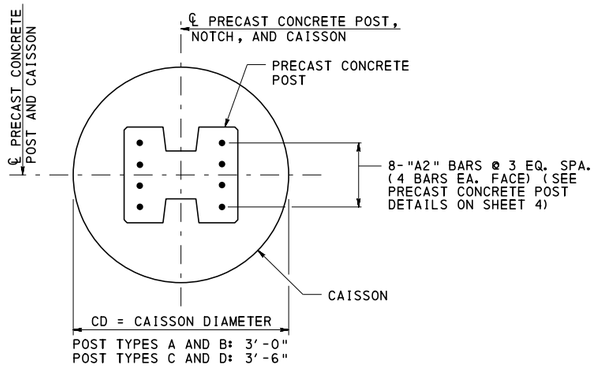
DETAIL 2 - POST TYPES C AND D
DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

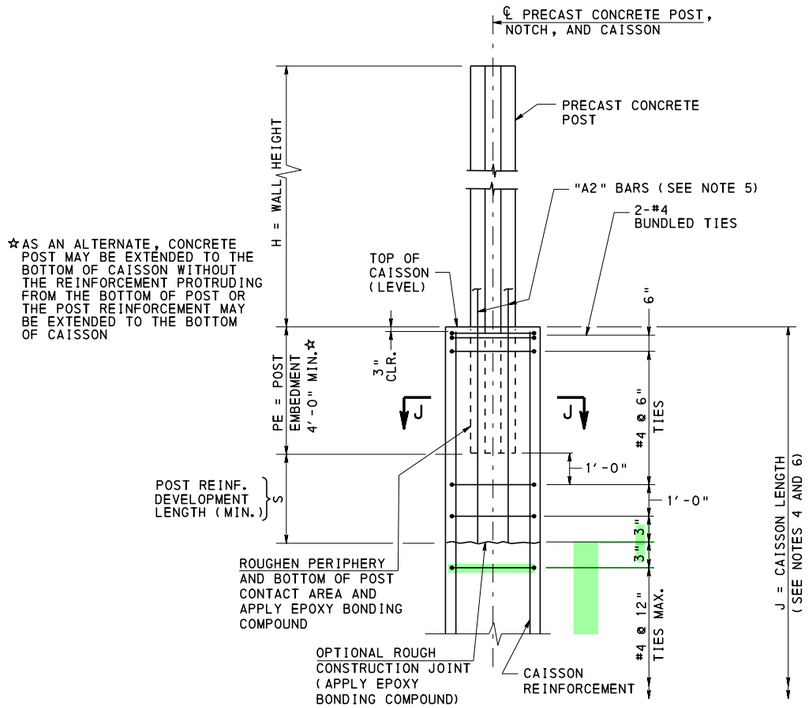
RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 10 OF 20

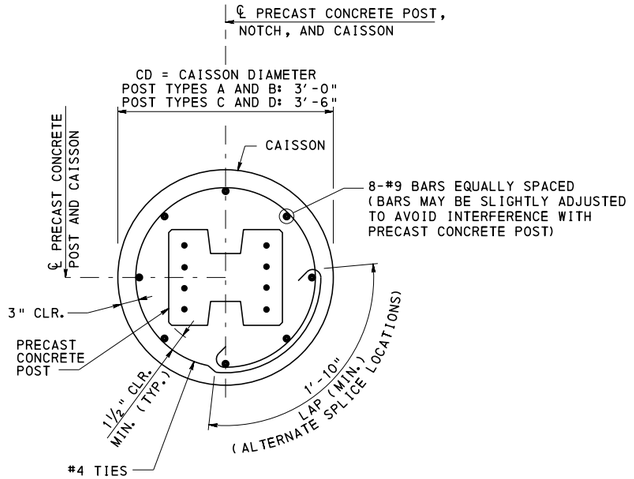
BD-677M



PLAN



ELEVATION



SECTION J-J

DETAIL 3
PRECAST CONCRETE POST EMBEDDED IN CAISSON

PRECAST CONCRETE POST EMBEDDED IN CAISSON DIMENSION TABLE

HEIGHT ZONE =
WIND PRESSURE =

CONCRETE POST						CAISSON			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	POST EMBEDMENT PE (FT.-IN.)	"A2" (BAR SIZE)	POST REINFORCEMENT DEVELOPMENT LENGTH S (FT.-IN.)	CAISSON DIAMETER CD (FT.-IN.)	CAISSON LENGTH J (FT.)	VERTICAL REINFORCEMENT	
								NUMBER OF BARS	BAR SIZE

TABLE NOTES:

1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. CAISSON REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
4. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. FOR DESIGN TABLES REFER TO SHEET 12.
4. FOR CAISSON LENGTHS REFER TO SHEET 20.
5. PROVIDE UNCOATED, EPOXY COATED, OR GALVANIZED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS.
6. DESIGNER TO VERIFY IF REQUIRED CAISSON LENGTH NEEDS TO BE INCREASED TO ACCOMMODATE THE POST EMBEDMENT PLUS POST REINFORCEMENT DEVELOPMENT LENGTH PLUS 6".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 3

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 11 OF 20
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-677M

DETAIL 3
PRECAST CONCRETE POST
EMBEDDED IN CAISSON

POST TYPES A AND B

HEIGHT ZONE 0′ TO 14′
WIND PRESSURE = 20 PSF

CONCRETE POST REINFORCEMENT

POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	S (IN.) UNCOATED OR GALVANIZED BARS	S (IN.) EPOXY COATED BARS
12.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#4	12	18
	12.0	#4	12	18
	14.0	#4	12	18
	16.0	#5	15	23
	18.0	#6	20	29
	20.0	#6	20	29
	22.0	#7	26	39
	24.0	#7	26	39
	26.0	#8	35	52
	28.0	#9	44	65
16.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#4	12	18
	12.0	#4	12	18
	14.0	#5	15	23
	16.0	#6	20	29
	18.0	#7	26	39
	20.0	#7	26	39
	22.0	#8	35	52
	24.0	#9	44	65
	25.0	#9	44	65
20.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#4	12	18
	12.0	#5	15	23
	14.0	#6	20	29
	16.0	#6	20	29
	18.0	#7	26	39
	20.0	#8	35	52
	22.0	#9	44	65
	24.0	#10	55	83

DETAIL 3
PRECAST CONCRETE POST
EMBEDDED IN CAISSON

POST TYPES A AND B

HEIGHT ZONES OVER 14′
WIND PRESSURE = 28 PSF

CONCRETE POST REINFORCEMENT

POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	S (IN.) UNCOATED OR GALVANIZED BARS	S (IN.) EPOXY COATED BARS
12.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#4	12	18
	12.0	#4	12	18
	14.0	#5	15	23
	16.0	#6	20	29
	18.0	#7	26	39
	20.0	#7	26	39
	22.0	#8	35	52
	24.0	#9	44	65
	25.0	#10	55	83
16.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#4	12	18
	12.0	#5	15	23
	14.0	#6	20	29
	16.0	#7	26	39
	18.0	#8	35	52
	20.0	#8	35	52
	22.0	#9	44	65
	23.0	#10	55	83
20.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#5	15	23
	12.0	#6	20	29
	14.0	#7	26	39
	16.0	#8	35	52
	18.0	#9	44	65
	20.0	#10	55	83

DETAIL 3
PRECAST CONCRETE POST
EMBEDDED IN CAISSON

POST TYPES C AND D

HEIGHT ZONE 0′ TO 14′
WIND PRESSURE = 20 PSF

CONCRETE POST REINFORCEMENT

POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	S (IN.) UNCOATED OR GALVANIZED BARS	S (IN.) EPOXY COATED BARS
12.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#4	12	18
	12.0	#4	12	18
	14.0	#5	15	23
	16.0	#5	15	23
	18.0	#5	15	23
	20.0	#6	20	29
	22.0	#6	20	29
	24.0	#7	26	39
	26.0	#7	26	39
	28.0	#8	35	52
16.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#4	12	18
	12.0	#5	15	23
	14.0	#5	15	23
	16.0	#5	15	23
	18.0	#6	20	29
	20.0	#7	26	39
	22.0	#7	26	39
	24.0	#8	35	52
	26.0	#9	44	65
	28.0	#9	44	65
20.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#4	12	18
	12.0	#5	15	23
	14.0	#5	15	23
	16.0	#6	20	29
	18.0	#7	26	39
	20.0	#7	26	39
	22.0	#8	35	52
	24.0	#9	44	65
	26.0	#10	55	83
	28.0	#10	55	83

DETAIL 3
PRECAST CONCRETE POST
EMBEDDED IN CAISSON

POST TYPES C AND D

HEIGHT ZONES OVER 14′
WIND PRESSURE = 28 PSF

CONCRETE POST REINFORCEMENT

POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	S (IN.) UNCOATED OR GALVANIZED BARS	S (IN.) EPOXY COATED BARS
12.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#4	12	18
	12.0	#5	15	23
	14.0	#5	15	23
	16.0	#5	15	23
	18.0	#6	20	29
	20.0	#7	26	39
	22.0	#7	26	39
	24.0	#8	35	52
	26.0	#9	44	65
	28.0	#9	44	65
	30.0	#10	55	83
16.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#5	15	23
	12.0	#5	15	23
	14.0	#5	15	23
	16.0	#6	20	29
	18.0	#7	26	39
	20.0	#8	35	52
	22.0	#9	44	65
	24.0	#9	44	65
	26.0	#10	55	83
	28.0	#11	68	102
20.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#5	15	23
	12.0	#5	15	23
	14.0	#6	20	29
	16.0	#7	26	39
	18.0	#8	35	52
	20.0	#9	44	65
	22.0	#10	55	83
	24.0	#10	55	83
	25.0	#11	68	102

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 11.

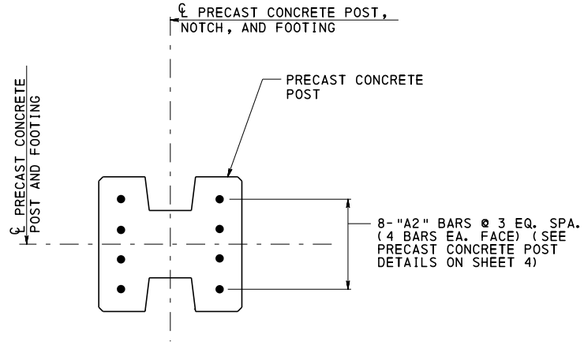
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

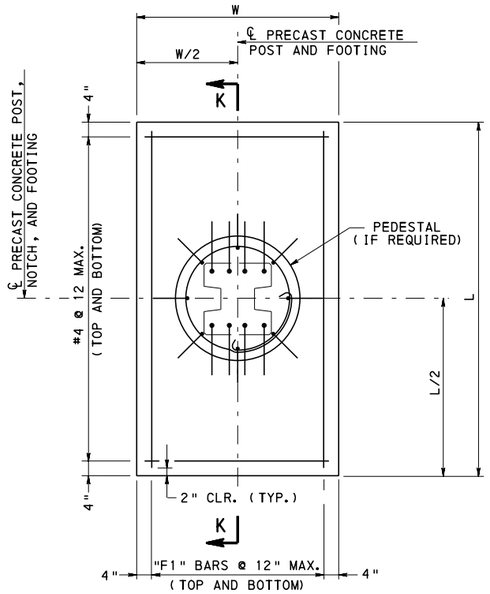
DETAIL 3 - POST TYPES A, B, C AND D
DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY



PLAN



SPREAD FOOTING PLAN

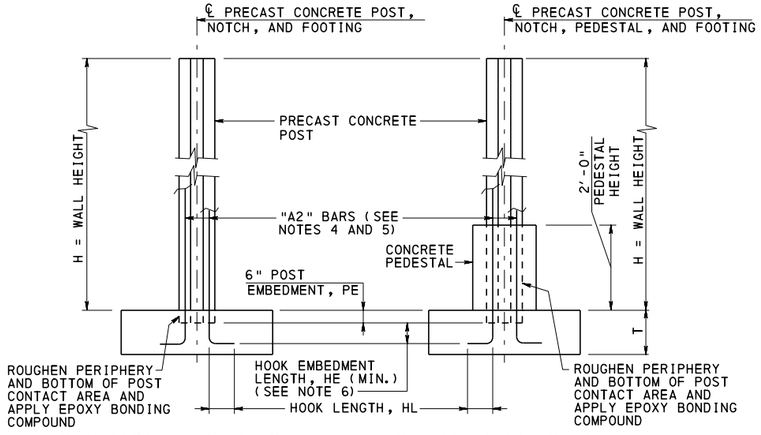
PRECAST CONCRETE POST EMBEDDED IN SPREAD FOOTING DIMENSION TABLE

HEIGHT ZONE =
WIND PRESSURE =

CONCRETE POST							SPREAD FOOTING			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	POST EMBEDMENT PE (FT.-IN.)	"A2" (BAR SIZE)	HOOK EMBEDMENT LENGTH HE (IN.)	HOOK LENGTH HL (IN.)	THICKNESS T (FT.)	LENGTH L (FT.)	WIDTH W (FT.)	"F1" (BAR SIZE)

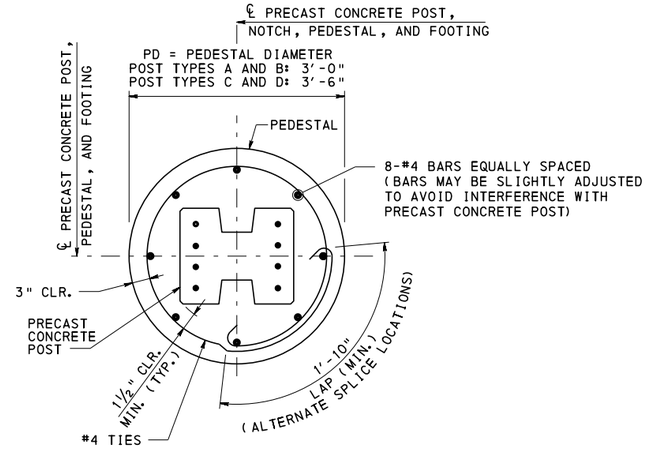
TABLE NOTES:

1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. SPREAD FOOTING REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
4. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.
5. INDICATE AND DETAIL PEDESTAL IF REQUIRED.



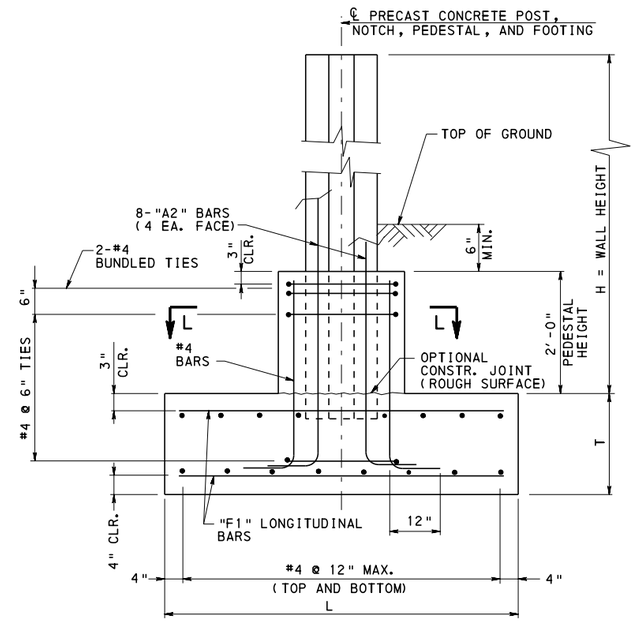
WITHOUT PEDESTAL WITH PEDESTAL

ELEVATION



SECTION L-L

PEDESTAL (IF SPECIFIED)



SECTION K-K (WITH PEDESTAL)

ADJUST FOOTING TOP REINFORCING SPACING TO CLEAR POST.

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. FOR DESIGN TABLES REFER TO SHEETS 14 AND 15.
4. PROVIDE UNCOATED OR EPOXY COATED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS. GALVANIZED BARS NOT PERMITTED.
5. BARS MAY BE BENT AFTER FABRICATION OF POST. TOUCH-UP EPOXY COATED BARS WITH AN APPROVED EPOXY PAINT.
6. DESIGNER IS PERMITTED TO INCREASE THE EMBEDMENT LENGTH OF THE POST REINFORCEMENT BARS SO BARS CAN BE TIED TO THE BOTTOM FOOTING REINFORCEMENT BARS.

DETAIL 4
PRECAST CONCRETE POST EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 4

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 13 OF 20
		BD-677M

DETAIL 4
PRECAST CONCRETE POST
EMBEDDED IN SPREAD FOOTING

POST TYPES A AND B

HEIGHT ZONE 0′ TO 14′
WIND PRESSURE = 20 PSF

CONCRETE POST REINFORCEMENT						SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	HE (IN.)(MIN.) UNCOATED	HE (IN.)(MIN.) EPOXY	HL (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	#4	8	10	8	2.0	5.0	5.0	#4
	8.0	#4	8	10	8	2.0	5.0	5.0	#4
	10.0	#4	8	10	8	2.5	5.0	5.0	#4
	12.0	#4	8	10	8	2.5	6.0	5.0	#4
	14.0	#4	8	10	8	2.5	6.5	5.0	#4
	16.0	#5	10	12	10	3.0	7.0	5.0	#4
	18.0	#6	12	14	12	3.0	8.0	5.0	#4
	20.0	#6	12	14	12	3.0	8.5	5.0	#4
	22.0	#7	14	17	14	3.0	9.5	5.0	#5
	24.0	#7	14	17	14	3.25	10.0	5.0	#5
	26.0	#8	16	19	16	3.25	10.5	5.5	#5
	28.0	#9	18	21	19	3.75	10.5	5.5	#5
16.0	6.0	#4	8	10	8	2.0	5.0	5.0	#4
	8.0	#4	8	10	8	2.5	5.0	5.0	#4
	10.0	#4	8	10	8	2.5	5.5	5.0	#4
	12.0	#4	8	10	8	2.5	6.5	5.0	#4
	14.0	#5	10	12	10	3.0	7.0	5.0	#4
	16.0	#6	12	14	12	3.0	8.0	5.0	#4
	18.0	#7	14	17	14	3.0	9.0	5.0	#5
	20.0	#7	14	17	14	3.25	9.5	5.0	#5
	22.0	#8	16	19	16	3.25	10.0	5.5	#5
	24.0	#9	18	21	19	3.75	10.5	5.5	#5
	25.0	#9	18	21	19	3.75	11.0	5.5	#5
20.0	6.0	#4	8	10	8	2.0	5.0	5.0	#4
	8.0	#4	8	10	8	2.5	5.0	5.0	#4
	10.0	#4	8	10	8	2.5	6.0	5.0	#4
	12.0	#5	10	12	10	3.0	7.0	5.0	#4
	14.0	#6	12	14	12	3.0	8.0	5.0	#4
	16.0	#6	12	14	12	3.0	8.5	5.0	#5
	18.0	#7	14	17	14	3.25	9.5	5.0	#5
	20.0	#8	16	19	16	3.25	10.0	5.0	#6
	22.0	#9	18	21	19	3.75	10.5	5.5	#6
	24.0	#10	20	24	22	3.75	11.0	6.0	#6

DETAIL 4
PRECAST CONCRETE POST
EMBEDDED IN SPREAD FOOTING

POST TYPES A AND B

HEIGHT ZONES OVER 14′
WIND PRESSURE = 28 PSF

CONCRETE POST REINFORCEMENT						SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	HE (IN.)(MIN.) UNCOATED	HE (IN.)(MIN.) EPOXY	HL (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	#4	8	10	8	2.0	5.0	5.0	#4
	8.0	#4	8	10	8	2.5	5.5	5.0	#4
	10.0	#4	8	10	8	2.5	6.5	5.0	#4
	12.0	#4	8	10	8	2.5	7.5	5.0	#4
	14.0	#5	10	12	10	3.0	8.0	5.0	#4
	16.0	#6	12	14	12	3.0	9.0	5.0	#4
	18.0	#7	14	17	14	3.0	10.0	5.0	#5
	20.0	#7	14	17	14	3.25	10.5	5.5	#5
	22.0	#8	16	19	16	3.25	11.0	5.5	#5
	24.0	#9	18	21	19	3.75	11.5	6.0	#5
	25.0	#10	20	24	22	3.75	11.5	6.0	#5
16.0	6.0	#4	8	10	8	2.0	5.0	5.0	#4
	8.0	#4	8	10	8	2.5	6.0	5.0	#4
	10.0	#4	8	10	8	2.5	7.0	5.0	#4
	12.0	#5	10	12	10	3.0	8.0	5.0	#4
	14.0	#6	12	14	12	3.0	9.0	5.0	#4
	16.0	#7	14	17	14	3.0	10.0	5.0	#5
	18.0	#8	16	19	16	3.25	11.0	5.5	#5
	20.0	#8	16	19	16	3.25	11.0	6.0	#5
	22.0	#9	18	21	19	3.75	12.0	6.0	#5
	23.0	#10	20	24	22	3.75	12.0	6.0	#6
20.0	6.0	#4	8	10	8	2.5	5.5	5.0	#4
	8.0	#4	8	10	8	2.5	6.5	5.0	#4
	10.0	#5	10	12	10	3.0	7.5	5.0	#4
	12.0	#6	12	14	12	3.0	8.5	5.0	#4
	14.0	#7	14	17	14	3.0	10.0	5.0	#5
	16.0	#8	16	19	16	3.25	10.5	5.5	#5
	18.0	#9	18	21	19	3.25	11.0	6.0	#5
	20.0	#10	20	24	22	3.75	12.0	6.0	#6

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 13.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 4 - POST TYPES A AND B
DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

BD-677M

DETAIL 4
PRECAST CONCRETE POST
EMBEDDED IN SPREAD FOOTING

POST TYPES C AND D

HEIGHT ZONE 0′ TO 14′
WIND PRESSURE = 20 PSF

CONCRETE POST REINFORCEMENT						SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	HE (IN.)(MIN.) UNCOATED	HE (IN.)(MIN.) EPOXY	HL (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	#4	8	10	8	2.0	5.5	5.5	#4
	8.0	#4	8	10	8	2.0	5.5	5.5	#4
	10.0	#4	8	10	8	2.5	5.5	5.5	#4
	12.0	#4	8	10	8	2.5	5.5	5.5	#4
	14.0	#5	10	12	10	2.5	6.5	5.5	#4
	16.0	#5	10	12	10	3.0	7.0	5.5	#4
	18.0	#5	10	12	10	3.0	7.5	5.5	#4
	20.0	#6	12	14	12	3.0	8.0	5.5	#4
	22.0	#6	12	14	12	3.0	9.0	5.5	#5
	24.0	#7	14	17	14	3.25	9.5	5.5	#5
	26.0	#7	14	17	14	3.25	10.0	5.5	#5
	28.0	#8	16	19	16	3.25	10.5	5.5	#5
16.0	6.0	#4	8	10	8	2.0	5.5	5.5	#4
	8.0	#4	8	10	8	2.5	5.5	5.5	#4
	10.0	#4	8	10	8	2.5	5.5	5.5	#4
	12.0	#5	10	12	10	2.5	6.0	5.5	#4
	14.0	#5	10	12	10	3.0	7.0	5.5	#4
	16.0	#5	10	12	10	3.0	7.5	5.5	#4
	18.0	#6	12	14	12	3.0	8.5	5.5	#4
	20.0	#7	14	17	14	3.0	9.0	5.5	#5
	22.0	#7	14	17	14	3.25	10.0	5.5	#5
	24.0	#8	16	19	16	3.25	10.5	5.5	#6
	26.0	#9	18	21	19	3.75	11.0	5.5	#6
	28.0	#9	18	21	19	3.75	11.5	6.0	#6
20.0	6.0	#4	8	10	8	2.0	5.5	5.5	#4
	8.0	#4	8	10	8	2.5	5.5	5.5	#4
	10.0	#4	8	10	8	2.5	6.0	5.5	#4
	12.0	#5	10	12	10	3.0	6.5	5.5	#4
	14.0	#5	10	12	10	3.0	7.5	5.5	#4
	16.0	#6	12	14	12	3.0	8.0	5.5	#4
	18.0	#7	14	17	14	3.0	9.0	5.5	#5
	20.0	#7	14	17	14	3.0	10.0	5.5	#5
	22.0	#8	16	19	16	3.25	10.5	5.5	#6
	24.0	#9	18	21	19	3.75	11.0	5.5	#6
	26.0	#10	20	24	22	3.75	11.5	6.0	#6
	28.0	#10	20	24	22	4.25	12.0	6.0	#6

DETAIL 4
PRECAST CONCRETE POST
EMBEDDED IN SPREAD FOOTING

POST TYPES C AND D

HEIGHT ZONES OVER 14′
WIND PRESSURE = 28 PSF

CONCRETE POST REINFORCEMENT						SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	HE (IN.)(MIN.) UNCOATED	HE (IN.)(MIN.) EPOXY	HL (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	#4	8	10	8	2.0	5.5	5.5	#4
	8.0	#4	8	10	8	2.5	5.5	5.5	#4
	10.0	#4	8	10	8	2.5	6.0	5.5	#4
	12.0	#5	10	12	10	2.5	7.0	5.5	#4
	14.0	#5	10	12	10	3.0	7.5	5.5	#4
	16.0	#5	10	12	10	3.0	8.5	5.5	#4
	18.0	#6	12	14	12	3.0	9.5	5.5	#4
	20.0	#7	14	17	14	3.25	10.0	5.5	#5
	22.0	#7	14	17	14	3.25	11.0	5.5	#5
	24.0	#8	16	19	16	3.25	11.5	6.0	#5
	26.0	#9	18	21	19	3.75	12.0	6.0	#5
	28.0	#9	18	21	19	3.75	12.0	6.5	#5
	30.0	#10	20	24	22	4.25	12.5	6.5	#5
16.0	6.0	#4	8	10	8	2.0	5.5	5.5	#4
	8.0	#4	8	10	8	2.5	5.5	5.5	#4
	10.0	#5	10	12	10	2.5	6.5	5.5	#4
	12.0	#5	10	12	10	3.0	7.5	5.5	#4
	14.0	#5	10	12	10	3.0	8.5	5.5	#4
	16.0	#6	12	14	12	3.0	9.5	5.5	#5
	18.0	#7	14	17	14	3.25	10.5	5.5	#5
	20.0	#8	16	19	16	3.25	11.0	6.0	#5
	22.0	#9	18	21	19	3.75	11.5	6.0	#5
	24.0	#9	18	21	19	3.75	12.0	6.5	#5
	26.0	#10	20	24	22	4.25	12.5	6.5	#6
	28.0	#11	22	26	24	4.25	13.0	7.0	#6
20.0	6.0	#4	8	10	8	2.5	5.5	5.5	#4
	8.0	#4	8	10	8	2.5	6.0	5.5	#4
	10.0	#5	10	12	10	3.0	7.0	5.5	#4
	12.0	#5	10	12	10	3.0	8.5	5.5	#4
	14.0	#6	12	14	12	3.0	9.5	5.5	#5
	16.0	#7	14	17	14	3.25	10.0	5.5	#5
	18.0	#8	16	19	16	3.25	11.0	5.5	#6
	20.0	#9	18	21	19	3.75	11.5	6.0	#6
	22.0	#10	20	24	22	3.75	12.5	6.5	#6
	24.0	#10	20	24	22	4.25	13.0	6.5	#6
	25.0	#11	22	26	24	4.25	13.0	7.0	#6

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 13.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

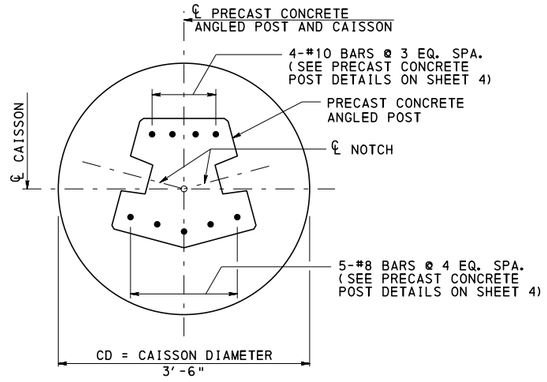
STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 4 - POST TYPES C AND D
DESIGN TABLES

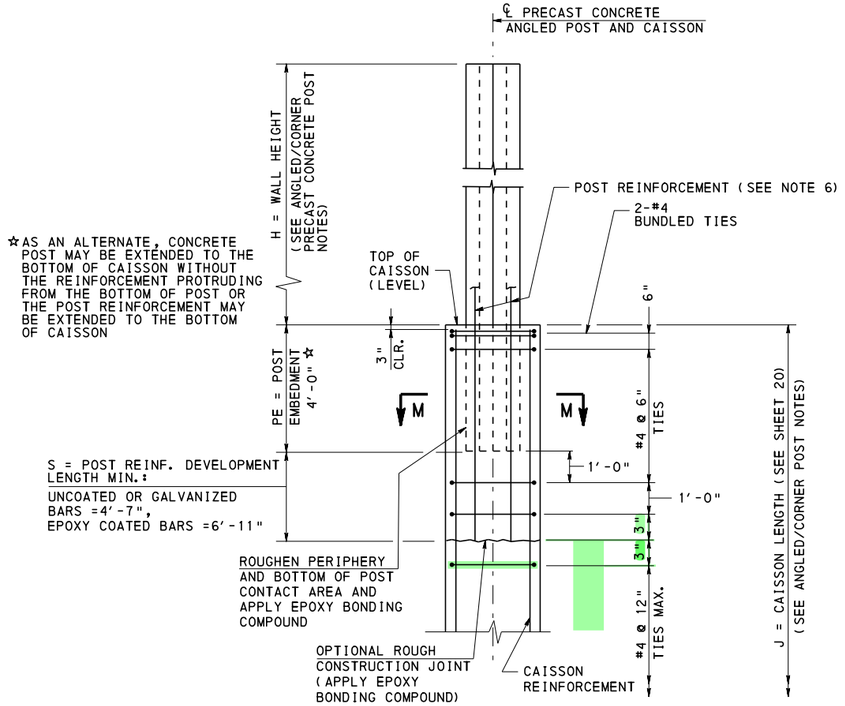
RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

BD-677M

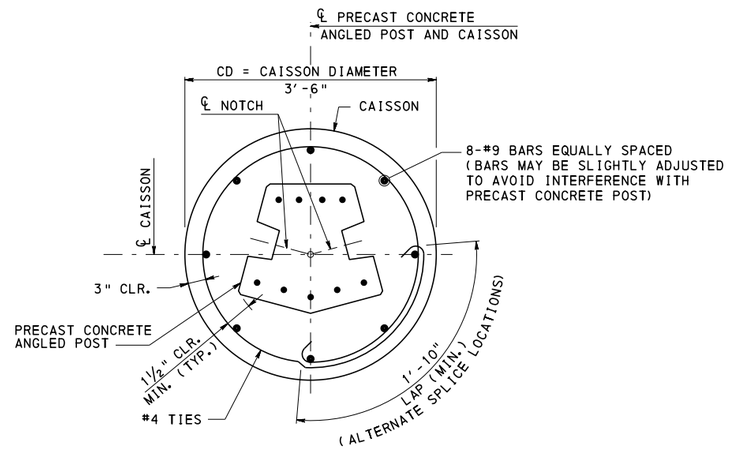


PLAN



ELEVATION

DETAIL 5
ANGLED PRECAST CONCRETE POST TYPE E EMBEDDED IN CAISSON



SECTION M-M

ANGLED/CORNER PRECAST CONCRETE POST NOTES:

1. THE ANGLED IN-LINE PRECAST CONCRETE POST (POST TYPE E) MAY ONLY BE USED WHEN THE INTERSECTING ANGLES BETWEEN THE PRECAST CONCRETE PANELS IS GREATER THAN 138 DEGREES AND LESS THAN 162 DEGREES.

2. THE CORNER PRECAST CONCRETE POST (POST TYPE F) MAY ONLY BE USED WHEN THE INTERSECTING ANGLE BETWEEN THE PRECAST CONCRETE PANELS IS GREATER THAN 78 DEGREES AND LESS THAN 102 DEGREES.

3. THE ANGLED/CORNER PRECAST CONCRETE POSTS WERE DESIGNED FOR THE FOLLOWING POST SPACINGS, WIND PRESSURES, AND MAXIMUM WALL HEIGHTS:
   - 12'-0" POST SPACING:
     - WIND PRESSURE = 20 PSF: MAXIMUM WALL HEIGHT = 28'-0"
     - WIND PRESSURE = 28 PSF: MAXIMUM WALL HEIGHT = 24'-0"
   - 16'-0" POST SPACING:
     - WIND PRESSURE = 20 PSF: MAXIMUM WALL HEIGHT = 24'-0"
     - WIND PRESSURE = 28 PSF: MAXIMUM WALL HEIGHT = 20'-0"

4. DETAILS 5 AND 6 - ANGLED/CORNER PRECAST CONCRETE POST EMBEDDED IN CAISSON:
   - INDICATE THE REQUIRED WALL HEIGHT ON THE CONTRACT PLANS.
   - DETERMINE CAISSON LENGTH BASED ON THE POST SPACING AND WALL HEIGHT. REFER TO DESIGN TABLES ON SHEET 20.
   - PROVIDE DIMENSION TABLE SIMILAR TO TABLE SHOWN FOR DETAIL 3 OR COMPLETELY DETAIL POST AND CAISSON ON THE CONTRACT DRAWINGS.

5. DETAILS 7 AND 8 - ANGLED/CORNER PRECAST CONCRETE POST EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL):
   - INDICATE THE REQUIRED WALL HEIGHT ON THE CONTRACT PLANS.
   - PROVIDE SPREAD FOOTING DESIGN COMPUTATIONS TO DETERMINE THE FOOTING DIMENSIONS AND REINFORCEMENT REQUIREMENTS FOR THE REQUIRED POST SPACING AND WALL HEIGHT. PROVIDE THE FOLLOWING MINIMUM FOOTING DIMENSIONS:
     - MINIMUM FOOTING LENGTH (L) = 6'-6"
     - MINIMUM FOOTING WIDTH (W) = 6'-6"
     - MINIMUM FOOTING THICKNESS (T) = 3'-0"
     - REFER TO DESIGN PARAMETERS ON SHEET 2 FOR ADDITIONAL INFORMATION.
   - PROVIDE DIMENSION TABLE SIMILAR TO TABLE SHOWN FOR DETAIL 4 OR COMPLETELY DETAIL POST AND SPREAD FOOTING ON THE CONTRACT DRAWINGS.

NOTES:

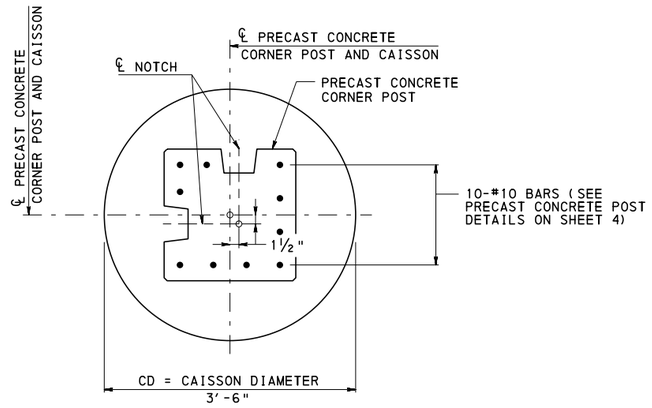
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAIL 6, REFER TO SHEET 17.
3. FOR DETAIL 7, REFER TO SHEET 18.
4. FOR DETAIL 8, REFER TO SHEET 19.
5. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
6. PROVIDE UNCOATED, EPOXY COATED, OR GALVANIZED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

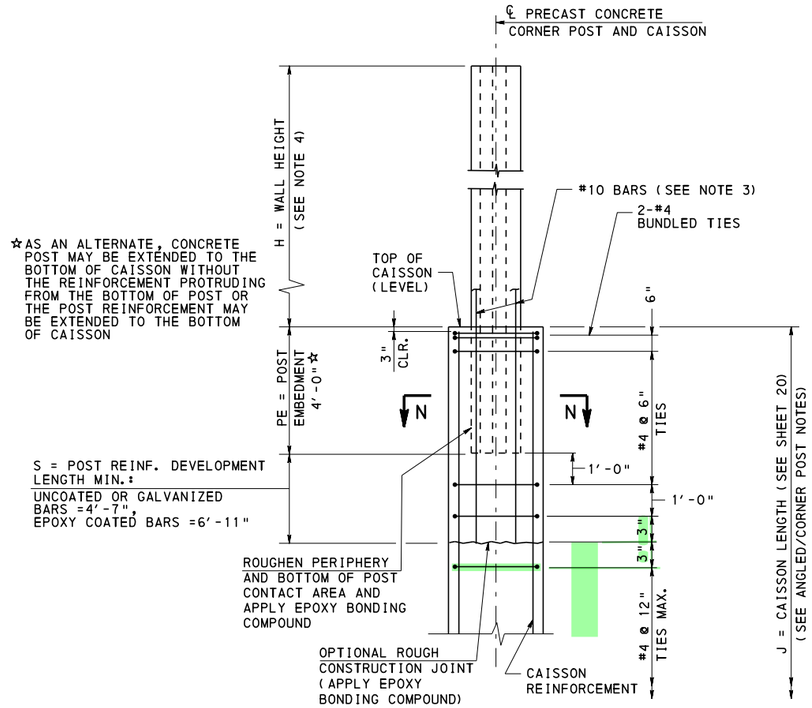
STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 5

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 16 OF 20
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-677M

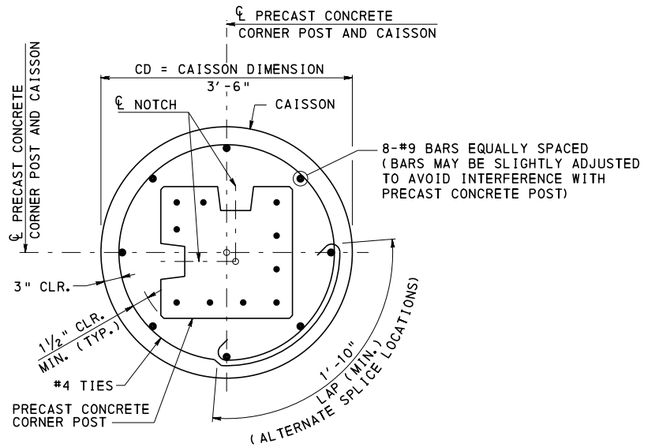


PLAN



ELEVATION

DETAIL 6
CORNER PRECAST CONCRETE POST TYPE F EMBEDDED IN CAISSON



SECTION N-N

NOTES:

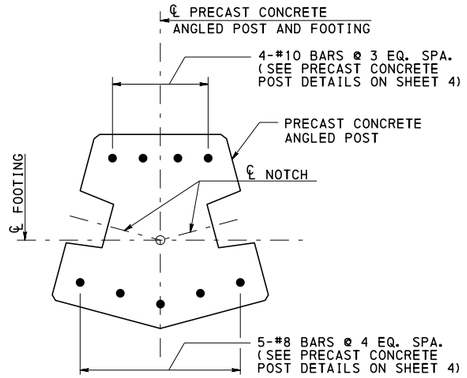
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. PROVIDE UNCOATED, EPOXY COATED, OR GALVANIZED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS.
4. FOR ANGLED/CORNER PRECAST CONCRETE POST NOTES REFER TO SHEET 16.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

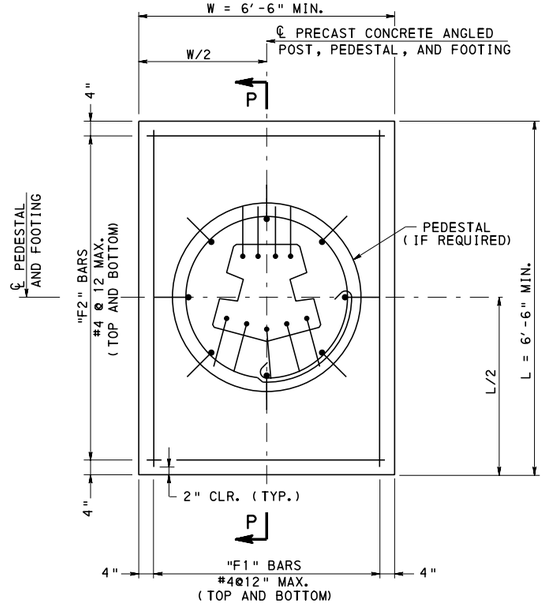
STANDARD GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS

DETAIL 6

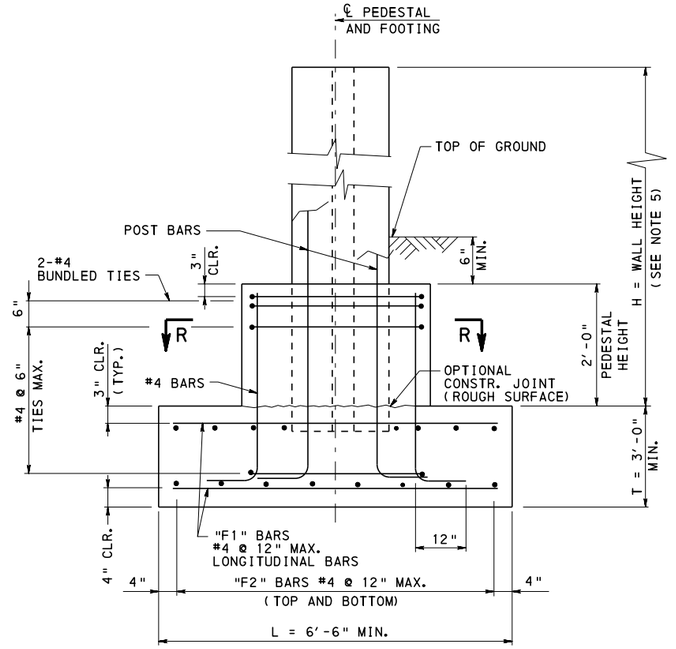
RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 17 OF 20
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-677M



PLAN

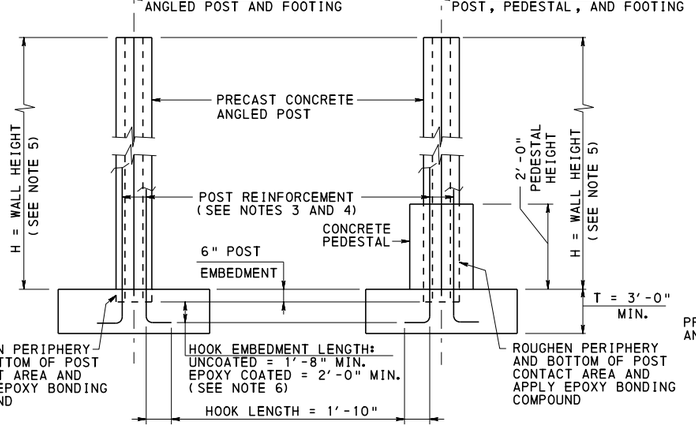


SPREAD FOOTING PLAN

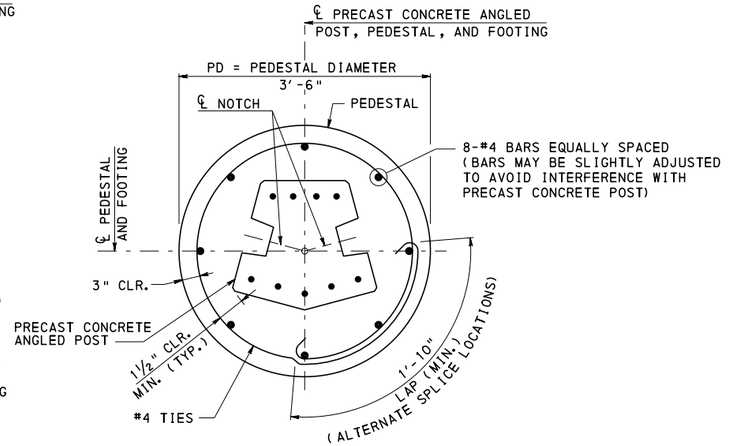


SECTION P-P (WITH PEDESTAL)

ADJUST FOOTING TOP REINFORCING SPACING TO CLEAR POST.



WITHOUT PEDESTAL WITH PEDESTAL
ELEVATION



SECTION R-R

PEDESTAL (IF REQUIRED)

DETAIL 7
ANGLED PRECAST CONCRETE POST TYPE E EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL)

NOTES:

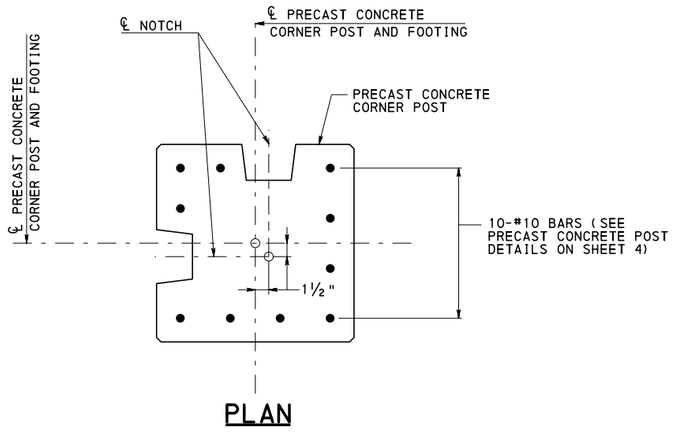
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. PROVIDE UNCOATED OR EPOXY COATED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS. GALVANIZED BARS NOT PERMITTED.
4. BARS MAY BE BENT AFTER FABRICATION OF POST. TOUCH-UP EPOXY COATED BARS WITH AN APPROVED EPOXY PAINT.
5. FOR ANGLED/CORNER PRECAST CONCRETE POST NOTES REFER TO SHEET 16.
6. DESIGNER IS PERMITTED TO INCREASE THE EMBEDMENT LENGTH OF THE POST REINFORCEMENT BARS SO BARS CAN BE TIED TO THE BOTTOM FOOTING REINFORCEMENT BARS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

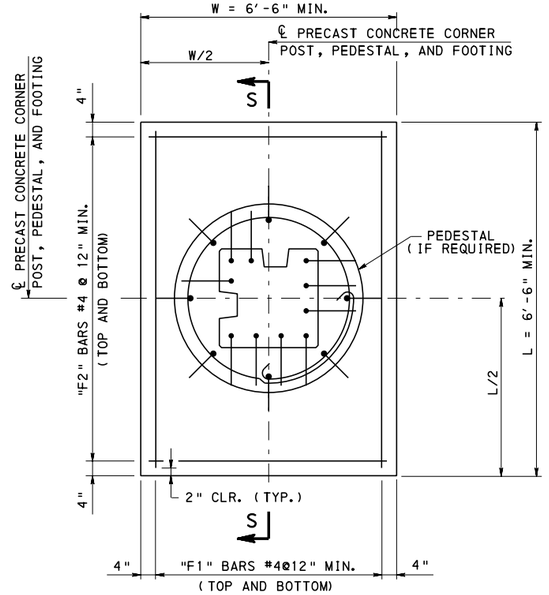
STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 7

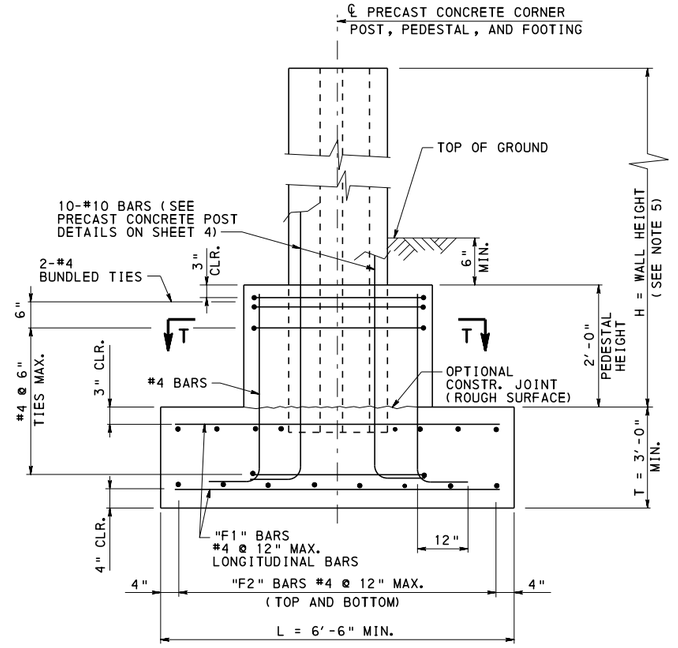
RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 18 OF 20 BD-677M



PLAN

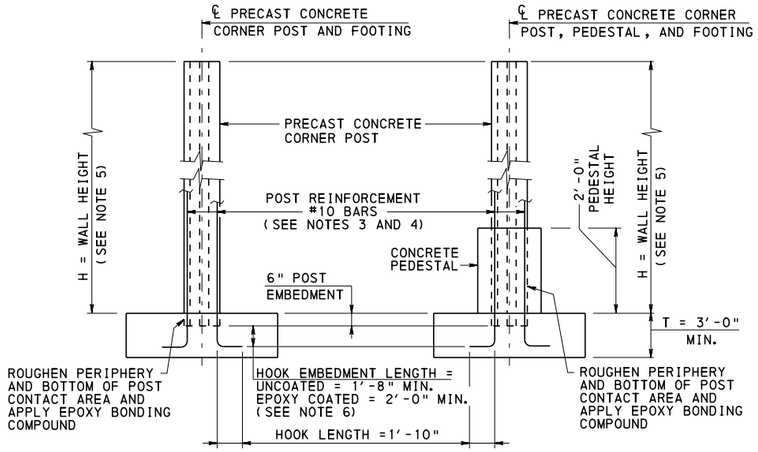


SPREAD FOOTING PLAN



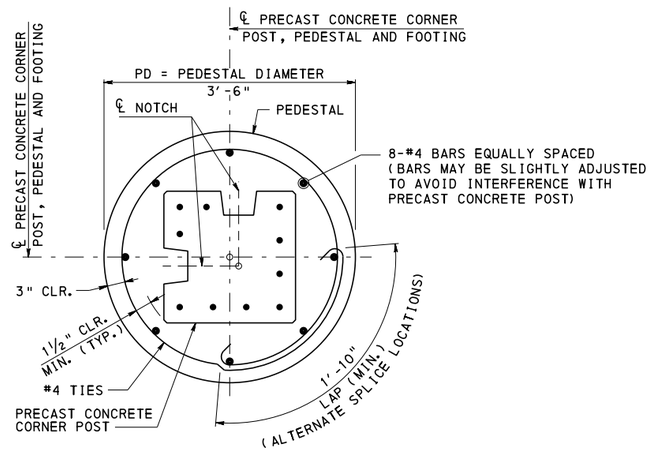
SECTION S-S (WITH PEDESTAL)

ADJUST FOOTING TOP REINFORCING SPACING TO CLEAR POST.



WITHOUT PEDESTAL WITH PEDESTAL

ELEVATION



SECTION T-T

PEDESTAL (IF REQUIRED)

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. PROVIDE UNCOATED OR EPOXY COATED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS. GALVANIZED BARS NOT PERMITTED.
4. BARS MAY BE BENT AFTER FABRICATION OF POST. TOUCH-UP EPOXY COATED BARS WITH AN APPROVED EPOXY PAINT.
5. FOR ANGLED/CORNER PRECAST CONCRETE POST NOTES REFER TO SHEET 16.
6. DESIGNER IS PERMITTED TO INCREASE THE EMBEDMENT LENGTH OF THE POST REINFORCEMENT BARS SO BARS CAN BE TIED TO THE BOTTOM FOOTING REINFORCEMENT BARS.

DETAIL 8
CORNER PRECAST CONCRETE POST TYPE F EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 8

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 19 OF 20
		BD-677M

CAISSON LENGTH

PRECAST CONCRETE POST TYPES A AND B

WIND PRESSURE = 28 PSF

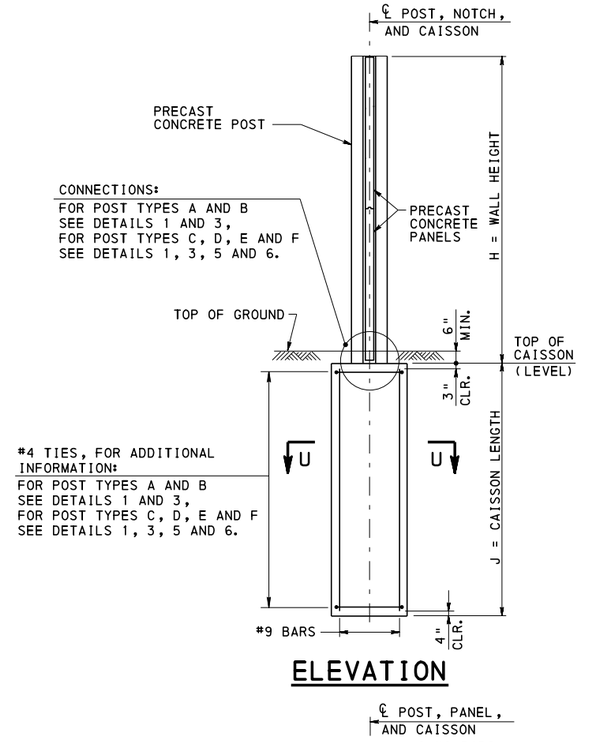
TYPE 1 SOIL SATURATED LOOSE SAND			TYPE 2 SOIL DRY MEDIUM DENSE SAND			TYPE 3 SOIL SATURATED SOFT CLAY			TYPE 4 SOIL DRY MEDIUM STIFF CLAY		
SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 30° 2. C = 0 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. K = 20 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 34° 2. C = 0.0 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 4. K = 90 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 500 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. K = 100 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 1000 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 4. K = 200 LB./CU. IN.		
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)	POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)	POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)	POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)
12.0	6.0	12.0	12.0	6.0	9.0	12.0	6.0	9.5	12.0	6.0	9.0
	8.0	13.0		8.0	9.0		8.0	11.0		8.0	9.0
	10.0	14.5		10.0	10.0		10.0	13.0		10.0	9.0
	12.0	15.5		12.0	10.5		12.0	14.5		12.0	10.0
	14.0	16.5		14.0	11.0		14.0	16.0		14.0	10.5
	16.0	17.5		16.0	11.5		16.0	18.0		16.0	11.5
	18.0	18.5		18.0	12.0		18.0	19.5		18.0	12.5
	20.0	19.0		20.0	12.5		20.0	21.0		20.0	13.5
	22.0	20.0		22.0	13.0		22.0	22.5		22.0	14.5
	24.0	21.0		24.0	13.5		24.0	24.0		24.0	15.0
	26.0	22.0		26.0	14.0		26.0	25.5		26.0	16.0
	28.0	23.0		28.0	14.5		28.0	27.0		28.0	17.0
16.0	6.0	13.0	16.0	6.0	9.0	16.0	6.0	10.5	16.0	6.0	9.0
	8.0	14.0		8.0	9.5		8.0	13.0		8.0	9.0
	10.0	15.5		10.0	10.5		10.0	15.0		10.0	10.0
	12.0	17.0		12.0	11.0		12.0	17.0		12.0	11.0
	14.0	18.0		14.0	12.0		14.0	18.5		14.0	12.0
	16.0	19.0		16.0	12.5		16.0	20.5		16.0	13.0
	18.0	20.0		18.0	13.0		18.0	22.0		18.0	14.0
	20.0	21.0		20.0	13.5		20.0	24.0		20.0	15.0
	22.0	22.0		22.0	14.5		22.0	26.0		22.0	16.0
	24.0	23.5		24.0	15.0		24.0	28.0		24.0	17.0
	26.0	24.5		26.0	15.5		26.0	29.5		26.0	18.0
20.0	6.0	13.5	20.0	6.0	9.5	20.0	6.0	12.0	20.0	6.0	9.0
	8.0	15.5		8.0	10.5		8.0	14.0		8.0	9.5
	10.0	17.0		10.0	11.0		10.0	16.5		10.0	10.5
	12.0	18.0		12.0	12.0		12.0	18.5		12.0	12.0
	14.0	19.0		14.0	12.5		14.0	21.0		14.0	13.0
	16.0	20.5		16.0	13.5		16.0	23.0		16.0	14.5
	18.0	22.0		18.0	14.0		18.0	25.0		18.0	15.5
	20.0	23.5		20.0	14.5		20.0	27.0		20.0	17.0
	22.0	25.0		22.0	15.5		22.0	29.5		22.0	18.0

CAISSON LENGTH

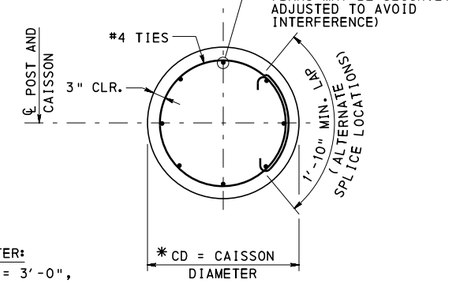
PRECAST CONCRETE POST TYPES C, D, E AND F

WIND PRESSURE = 28 PSF

TYPE 1 SOIL SATURATED LOOSE SAND			TYPE 2 SOIL DRY MEDIUM DENSE SAND			TYPE 3 SOIL SATURATED SOFT CLAY			TYPE 4 SOIL DRY MEDIUM STIFF CLAY		
SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 30° 2. C = 0 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. K = 20 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 34° 2. C = 0.0 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 4. K = 90 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 500 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. K = 100 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 1000 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 4. K = 200 LB./CU. IN.		
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)	POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)	POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)	POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)
12.0	6.0	11.5	12.0	6.0	10.5**	12.0	6.0	10.5**	12.0	6.0	10.5**
	8.0	13.0		8.0	10.5**		8.0	11.0**		8.0	10.5**
	10.0	14.0		10.0	10.5**		10.0	12.5		10.0	10.5**
	12.0	15.0		12.0	10.5**		12.0	14.0		12.0	10.5**
	14.0	16.0		14.0	11.0**		14.0	15.5		14.0	10.5**
	16.0	17.0		16.0	11.5		16.0	17.0		16.0	11.5
	18.0	18.0		18.0	12.0		18.0	18.5		18.0	12.0
	20.0	19.0		20.0	12.5		20.0	20.0		20.0	13.0
	22.0	20.0		22.0	13.0		22.0	21.5		22.0	14.0
	24.0	20.5		24.0	13.5		24.0	23.0		24.0	14.5
	26.0	21.5		26.0	14.0		26.0	24.0		26.0	15.5
	28.0	22.0		28.0	14.5		28.0	25.5		28.0	16.5
	30.0	23.0		30.0	15.0		30.0	27.0		30.0	17.0
16.0	6.0	12.5	16.0	6.0	10.5**	16.0	6.0	10.5**	16.0	6.0	10.5**
	8.0	14.0		8.0	10.5**		8.0	12.5		8.0	10.5**
	10.0	15.5		10.0	10.5**		10.0	14.5		10.0	10.5**
	12.0	16.5		12.0	11.0**		12.0	16.0		12.0	10.5**
	14.0	18.0		14.0	12.0		14.0	18.0		14.0	11.5
	16.0	19.0		16.0	12.5		16.0	19.5		16.0	12.5
	18.0	20.0		18.0	13.0		18.0	21.5		18.0	13.5
	20.0	21.0		20.0	13.5		20.0	23.0		20.0	14.5
	22.0	22.0		22.0	14.0		22.0	25.0		22.0	15.5
	24.0	23.0		24.0	14.5		24.0	26.5		24.0	16.5
	26.0	24.0		26.0	15.0		26.0	28.0		26.0	17.5
	28.0	25.0		28.0	15.5		28.0	29.5		28.0	18.5
20.0 (FOR TYPES C & D ONLY)	6.0	13.5	20.0 (FOR TYPES C & D ONLY)	6.0	10.5	20.0 (FOR TYPES C & D ONLY)	6.0	11.5	20.0 (FOR TYPES C & D ONLY)	6.0	10.5
	8.0	15.0		8.0	10.5		8.0	13.5		8.0	10.5
	10.0	16.5		10.0	11.0		10.0	16.0		10.0	10.5
	12.0	18.0		12.0	12.0		12.0	18.0		12.0	11.5
	14.0	19.0		14.0	12.5		14.0	20.0		14.0	12.5
	16.0	20.0		16.0	13.0		16.0	22.0		16.0	14.0
	18.0	21.0		18.0	14.0		18.0	24.0		18.0	15.0
	20.0	22.5		20.0	14.5		20.0	26.0		20.0	16.0
	22.0	23.5		22.0	15.0		22.0	28.0		22.0	17.5
	24.0	24.5		24.0	15.5		24.0	30.0		24.0	18.5
	26.0	25.5		26.0	16.0		26.0	32.0		26.0	19.5
	28.0	27.0		28.0	17.0		28.0	34.0		28.0	20.5



ELEVATION



* CD = CAISSON DIAMETER:
POST TYPES A AND B = 3'-0",
POST TYPES C, D, E AND F = 3'-6".

SECTION U-U
CAISSON

INSTRUCTIONS FOR DETERMINING CAISSON LENGTHS:

1. DETERMINE REQUIRED POST SPACING AND WALL HEIGHT.
2. DETERMINE SOIL TYPE BASED ON THE INFORMATION SHOWN IN THE ACCEPTED STRUCTURE FOUNDATION GEOTECHNICAL REPORT. SELECT THE SOIL TYPE WHICH HAS A STRENGTH LESS THAN OR EQUAL TO THE ACTUAL SOIL STRENGTH. ALTERNATE CAISSON DESIGNS ARE PERMITTED IF SOIL PROPERTIES DIFFER FROM THOSE INDICATED FOR THE FOUR SOIL TYPES.
3. DETERMINE GROUND WATER LEVEL. IF GROUND WATER IS WITHIN THE CAISSON LENGTH INDICATED IN THE TABLES FOR TYPE 2 AND TYPE 4 SOILS, USE THE CAISSON LENGTH IN THE TABLES FOR TYPE 1 OR TYPE 3 SOILS. IF GROUND WATER IS NOT WITHIN CAISSON LENGTH, USE THE CAISSON LENGTH INDICATED IN THE TABLES FOR TYPE 2 OR TYPE 4 SOILS.
4. MINIMUM CAISSON LENGTH IN SOIL:
   POST TYPES A AND B = 9'-0"
   POST TYPES C AND D = 10'-6"
   POST TYPES E AND F WITH UNCOATED OR GALVANIZED BARS IN POST = 10'-6"
   ** POST TYPES E AND F WITH COATED BARS IN POST = 11'-6"

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. FOR DETAIL 1 REFER TO SHEET 5.
4. FOR DETAIL 3 REFER TO SHEET 11.
5. FOR DETAIL 5 REFER TO SHEET 16.
6. FOR DETAIL 6 REFER TO SHEET 17.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS

CAISSON DESIGN TABLES

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 20 OF 20
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-677M

CHANGE 2

GENERAL NOTES

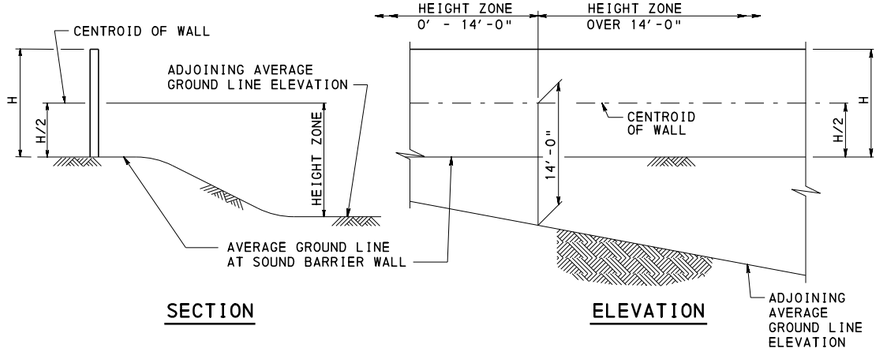
1. DESIGN SPECIFICATIONS:
   - PENNDOT DESIGN MANUAL, PART 4, STRUCTURES APRIL 2015 EDITION.
   - 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS" INCLUDING THE 1992 AND 2002 INTERIMS.
   - 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.
   - 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
   - DESIGN IS IN ACCORDANCE WITH THE WORKING STRESS DESIGN METHOD. (NO INCREASE IN ALLOWABLE UNIT STRESSES ARE PERMITTED EXCEPT FOR GROUP III LOADINGS WHICH PERMITS A 33% OVERSTRESS.)
2. CONSTRUCTION SPECIFICATIONS AND WORK QUALITY:
   - PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5.)
3. DESIGN LOADS:
   - WIND LOAD:
     - THE WIND LOAD INCLUDES A GUST FACTOR OF 1.3 AND A DRAG FACTOR OF 1.2 AND IS BASED ON A MAXIMUM 50-YEAR MEAN WIND VELOCITY AT 30'-0" ABOVE THE GROUND SURFACE OF 80 MPH.
       - GROUND MOUNTED SOUND BARRIER WALLS:
         HEIGHT ZONE: 0' TO 14'-0" = 20 PSF
         HEIGHT ZONE: OVER 14'-0" = 28 PSF
   - ICE LOAD: 3 PSF APPLIED TO ONE SIDE OF PANEL AND POST.
   - SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO 0.15.
4. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.
5. PROVIDE EITHER PRECAST CONCRETE POSTS OR STEEL POSTS. DO NOT MIX POST TYPES WITHOUT PERMISSION FROM THE DISTRICT BRIDGE ENGINEER.
6. PROVIDE UNCOATED REINFORCEMENT BARS IN THE FOOTING AND CAISSONS.
7. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN THE PEDESTALS WHERE THE WALL IS WITHIN 14'-0" OF THE EDGE OF TRAVEL LANE. EPOXY COATED OR GALVANIZED REINFORCEMENT MAY BE REQUIRED IF FUTURE WIDENING IS ANTICIPATED.
8. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
9. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.
10. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.

MATERIAL NOTES

1. REFER TO SHEET 1 OF BC-778M, FOR MATERIAL NOTES.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE POSTS AND SPREAD FOOTINGS ARE DEVELOPED FOR TWO SEPARATE WIND PRESSURES OF 20 PSF AND 28 PSF.
2. DESIGN TABLES SHOWN FOR CAISSONS ARE DEVELOPED FOR A 28 PSF. USE THE INFORMATION SHOWN IN THE TABLES FOR ALL HEIGHT ZONES.
3. THE DESIGN POST SPACING (CENTER-TO-CENTER POSTS) IS TO BE THE ACTUAL POST SPACING ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST SPACING SHOWN ON THE DESIGN TABLES.
4. THE DESIGN WALL HEIGHT IS TO BE THE ACTUAL WALL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF WALL HEIGHT SHOWN ON THE DESIGN TABLES.
5. FOR CORNER/ANGLED STEEL PIPE POST NOTES REFER TO SHEET 13.



HEIGHT ZONE (FEET)	WIND PRESSURE (PSF)
0-14	20
OVER 14	28

HEIGHT ZONES FOR GROUND MOUNTED SOUND BARRIERS

INDEX OF SHEETS	
SHT. NO.	SHEET TITLE
1	GENERAL NOTES - 1
2	GENERAL NOTES - 2
3	GEOMETRY AND LAYOUT
4	DETAIL 1
5	DETAIL 1 DESIGN TABLES
6	DETAIL 2
7	DETAIL 2 DESIGN TABLES
8	DETAIL 3
9	DETAIL 4
10	DETAIL 3 AND DETAIL 4 DESIGN TABLES
11	DETAIL 5
12	DETAIL 6
13	STEEL PIPE POST DETAILS
14	CAISSON DESIGN TABLES

DESCRIPTION OF DETAILS	
DETAIL	DESCRIPTION
1	STEEL POST WITH BASE PLATE CONNECTION TO CAISSON
2	STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING
3	STEEL POST EMBEDDED IN CAISSON
4	STEEL POST EMBEDDED IN SPREAD FOOTING WITH PEDESTAL
5	CORNER/ANGLED STEEL PIPE POST EMBEDDED IN CAISSON
6	CORNER/ANGLED STEEL PIPE POST EMBEDDED IN SPREAD FOOTING WITH PEDESTAL

REFERENCE DRAWINGS	
BC-734M	ANCHOR SYSTEMS
BC-735M	WALL CONSTRUCTION AND EXPANSION JOINT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-776M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS
BC-777M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS
BC-778M	GROUND MOUNTED SOUND BARRIERS STEEL POSTS
BC-779M	STRUCTURE MOUNTED SOUND BARRIER WALLS
BD-676M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS
BD-677M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS
BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GROUND MOUNTED SOUND BARRIERS STEEL POSTS

GENERAL NOTES - 1

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 14

BD-678M

DESIGN PARAMETERS

1. STEEL POSTS:
   - POSTS ARE DESIGNED AS VERTICAL CANTILEVER BEAMS.
   - POSTS ARE DESIGNED FOR WIND PRESSURES EQUAL TO 20 PSF AND 28 PSF.
   - MAXIMUM PERMITTED POST DEFLECTION EQUALS POST HEIGHT (H) DIVIDED BY 360.
   - POSTS AND CONNECTIONS ARE NOT DESIGNED FOR TRAFFIC IMPACT LOADING.
   - FATIGUE DESIGN FOR WELDED STUDS IS EVALUATED AT TWO MILLION CYCLES, NON-REDUNDANT, CATEGORY C.

2. ANCHOR BOLTS:
   - ANCHOR BOLTS ARE DESIGNED IN ACCORDANCE WITH SECTION 5.17 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
   - MINIMUM ANCHOR BOLT EMBEDMENT LENGTH IS CALCULATED BASED ON THE DEVELOPMENT LENGTH OF A HOOKED BAR IN TENSION (WITHOUT ANY MODIFICATION FACTORS). REFER TO SECTION 8.29 IN THE 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.
   - THE ANCHOR BOLT EMBEDMENT LENGTH MUST EXTEND TO A DEPTH WHERE THE FOOTING/ CAISSON REINFORCEMENT IS FULLY DEVELOPED. DESIGNER MUST INCREASE EMBEDMENT LENGTH AS REQUIRED.

3. BASE PLATES:
   - BASE PLATES ARE DESIGNED FOR BENDING DUE TO THE APPLIED BOLTS FORCES, COMPRESSION AND TENSION.
   - BASE PLATES ARE NOT DESIGNED TO SUPPORT THE VERTICAL LOAD OF THE PRECAST CONCRETE PANELS.
   - BASE PLATE THICKNESS IS DETERMINED USING THE ALLOWABLE BENDING STRESS IN ACCORDANCE WITH SECTION 5.8 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
   - BASE PLATE IS SUPPORTED ON THE LEVELING NUTS. THE NON-SHRINK GROUT IS NOT CONSIDERED AS A LOAD-CARRYING ELEMENT.
   - EDGE DISTANCE OF ANCHOR BOLTS:
     - THE CLEAR DISTANCE BETWEEN THE EDGES OF HOLES AND EDGES OF THE BASE PLATE SHALL NOT BE LESS THAN THE DIAMETER OF THE ANCHOR BOLT WHEN OVERSIZED OR SLOTTED HOLES ARE SPECIFIED.

4. SPREAD FOOTINGS:
   - SPREAD FOOTINGS ARE DESIGNED BEARING ON SOIL WITH AN ALLOWABLE BEARING PRESSURE EQUAL TO 1.50 TONS/SQ. FT. AND A COEFFICIENT OF SLIDING FRICTION EQUAL TO 0.30.
   - SPREAD FOOTINGS ARE DESIGNED FOR WIND PRESSURES EQUAL TO 20 PSF AND 28 PSF.
   - FACTOR OF SAFETY AGAINST SLIDING = 1.50 MINIMUM
   - FACTOR OF SAFETY AGAINST SLIDING FOR SEISMIC LOADING = 1.125 MINIMUM
   - FACTOR OF SAFETY AGAINST OVERTURNING = 2.00 MINIMUM
   - FACTOR OF SAFETY AGAINST OVERTURNING FOR SEISMIC LOADING = 1.50 MINIMUM
   - WEIGHT OF BACKFILL MATERIAL = 100 LB. / CU. FT.
   - PROVIDE A MINIMUM SOIL DEPTH OF 1'-6" ABOVE THE TOP OF FOOTING.
   - SPREAD FOOTINGS ARE DESIGNED FOR NO UPLIFT.
   - SPREAD FOOTINGS ARE DESIGNED FOR LEVEL GROUND. A SITE SPECIFIC DESIGN IS REQUIRED IF GROUND IS SLOPED.
   - SPREAD FOOTINGS ARE DESIGNED WITHOUT LIVE LOAD SURCHARGE. REDESIGN FOOTINGS IF LIVE LOAD SURCHARGE IS REQUIRED.
   - ALTERNATE SPREAD FOOTING DESIGNS ARE PERMITTED IF SUPPORTED ON ROCK. FOUNDATION DESIGN PARAMETERS MUST BE ACCEPTED BY THE DEPARTMENT.

5. CAISSONS:
   - CAISSONS ARE DESIGNED IN SOIL USING THE INDICATED SOIL PROPERTIES.
   - CASSIONS ARE DESIGNED FOR A WIND PRESSURE EQUAL TO 28 PSF.
   - FACTOR OF SAFETY AGAINST OVERTURNING = 2.0 MINIMUM
   - MAXIMUM ALLOWABLE LATERAL DESIGN DISPLACEMENT AT TOP OF CAISSON = ½"
   - CAISSON LENGTHS DETERMINED USING COM624P COMPUTER PROGRAM. FINAL CAISSON LENGTHS INDICATED INCLUDES AN ADDITIONAL 3'-0" LENGTH TO ACCOUNT FOR FREEZING AND THAWING, WEATHERING, AND OTHER SHALLOW GROUND DISTURBANCE.
   - CAISSON MAXIMUM ALLOWABLE VERTICAL DISPLACEMENT = 1.0 INCH
   - DRILLED CAISSONS ARE DESIGNED FOR LEVEL GROUND. A SITE SPECIFIC DESIGN IS REQUIRED IF GROUND IS SLOPED.
   - DRILLED CAISSONS ARE DESIGNED WITHOUT LIVE LOAD SURCHARGE. REDESIGN CAISSONS IF LIVE LOAD SURCHARGE IS REQUIRED.
   - ALTERNATE CAISSON DESIGNS ARE PERMITTED IF SOIL PROPERTIES DIFFER FROM THOSE INDICATED OR IF CAISSON EXTENDS PARTIALLY OR ENTIRELY INTO ROCK. FOUNDATION DESIGN PARAMETERS MUST BE ACCEPTED BY THE DEPARTMENT.

NOTES TO DESIGNER

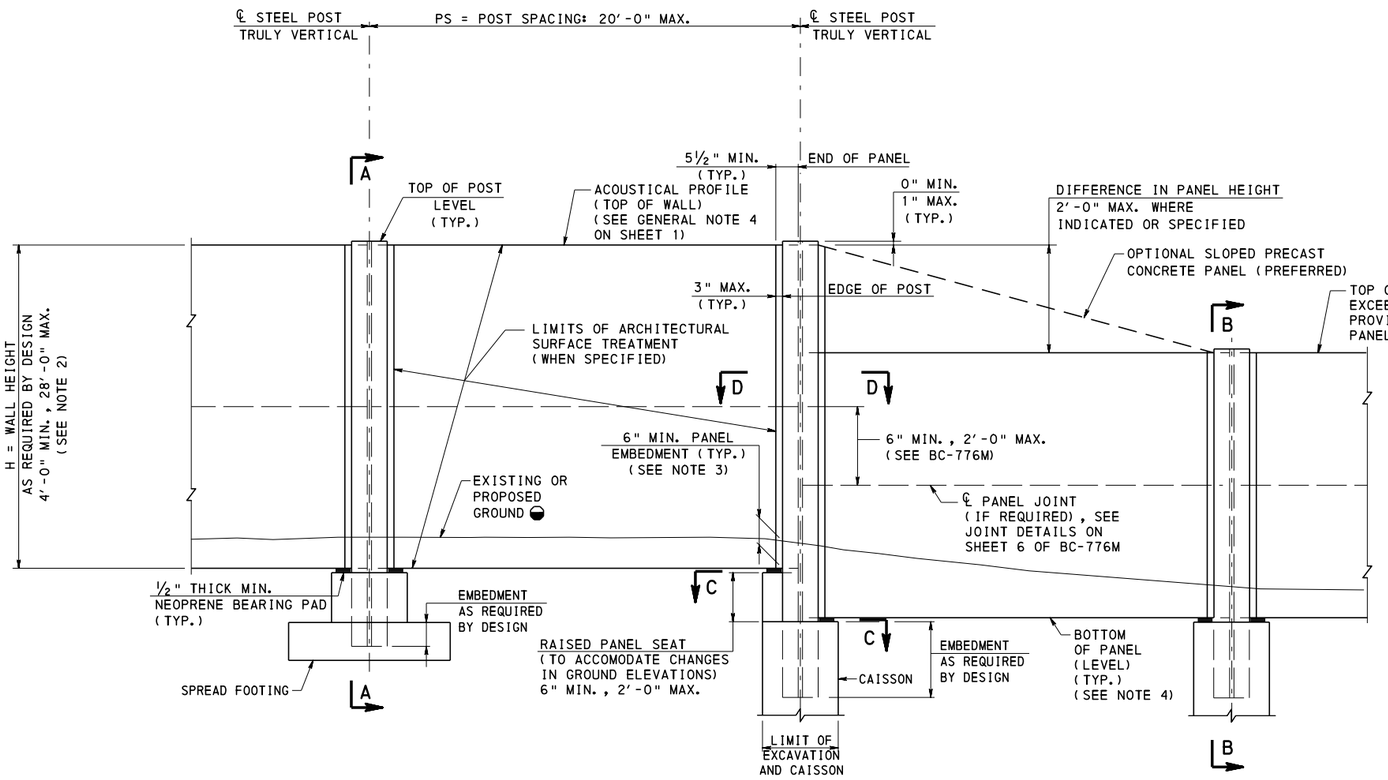
1. REFER TO SHEET 2 OF BD-676M, FOR NOTES TO DESIGNER.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

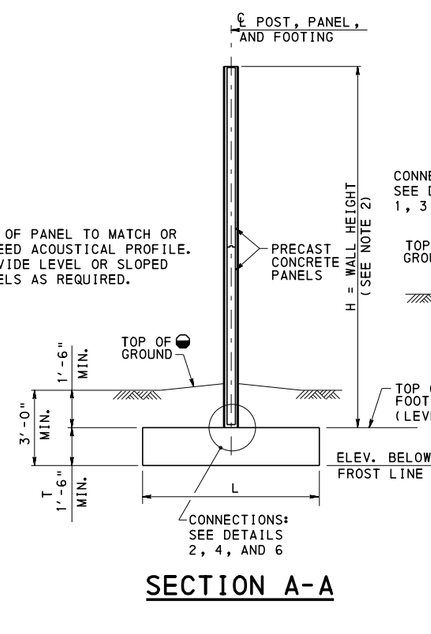
GENERAL NOTES - 2

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 2 OF 14 BD-678M

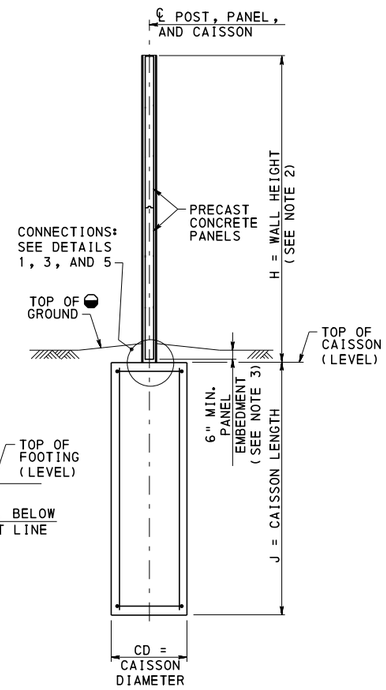


GROUND MOUNTED SOUND BARRIER ELEVATION

FOR POSTS WITH BASE PLATES REFER TO "PANEL
NOTCH DETAIL FOR BASE PLATE CONNECTIONS"
ON BD-676M, SHEET 6.



SECTION A-A



SECTION B-B

LEGEND:

◒ GRADE GROUND TO DRAIN AWAY FROM WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 1'-0" DIFFERENCE.

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. WALL HEIGHT IS DEFINED AS FOLLOWS:
   - POST WITH BASE PLATE: H = HEIGHT FROM TOP OF BASE PLATE TO TOP OF WALL.
   - POST WITHOUT BASE PLATE: H = HEIGHT FROM TOP OF FOOTING/CAISSON TO TOP OF WALL.
3. PANEL EMBEDMENT MAY NEED TO BE INCREASED TO ACCOMODATE BASE PLATES AND ANCHOR BOLT PROJECTIONS.
4. FOR OPTIONAL SLOPED BOTTOM PANEL REFER TO BD-676M.
5. FOR SECTION C-C AND D-D, REFER TO BC-778M SHEETS 2 AND 3.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

GEOMETRY AND LAYOUT

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 3 OF 14
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-678M

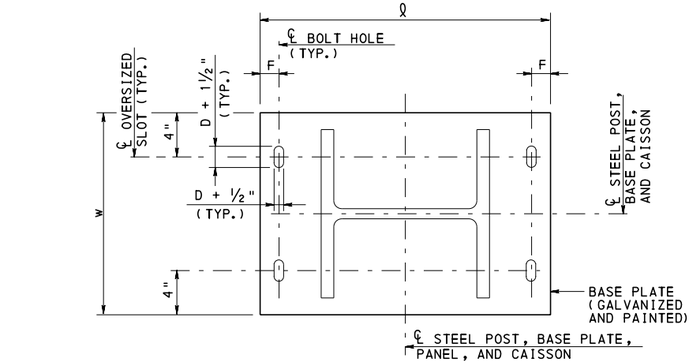
STEEL POST WITH BASE PLATE CONNECTION TO CAISSON DIMENSION TABLE

HEIGHT ZONE=
WIND PRESSURE =

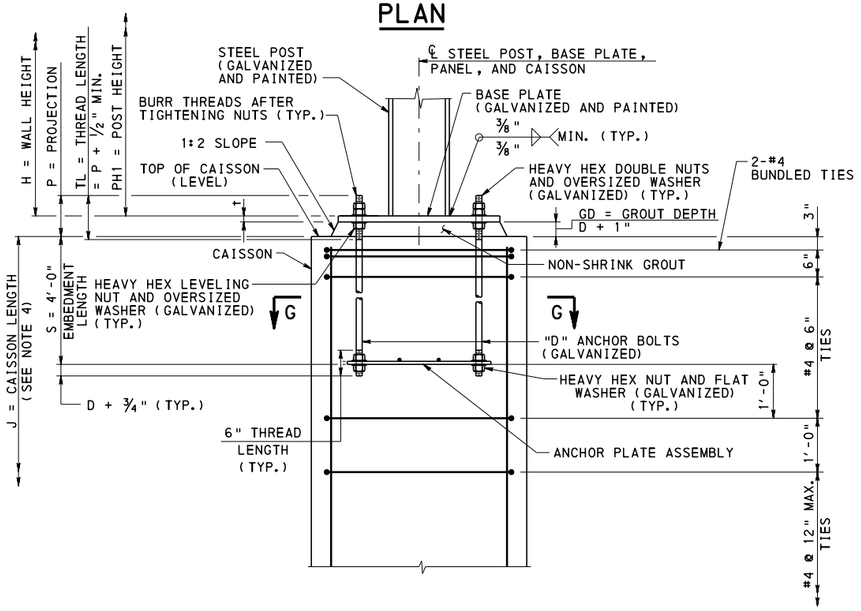
STEEL POST					BASE PLATE				ANCHOR PLATE		ANCHOR BOLTS				GROUT	CAISSON			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	STEEL POST SIZE	POST HEIGHT PH1 (FT.)	THICKNESS t (IN.)	LENGTH Q (IN.)	WIDTH w (IN.)	F (IN.)	LENGTH Q (IN.)	F1 (IN.)	DIAMETER D (IN.)	EMBEDMENT LENGTH S (IN.)	PROJECTION P (IN.)	THREAD LENGTH TL (IN.)	GROUT DEPTH GD (IN.)	CAISSON DIAMETER CD (FT.-IN.)	CAISSON LENGTH J (FT.)	VERTICAL REINFORCEMENT	
																		NUMBER OF BARS	BAR SIZE

TABLE NOTES:

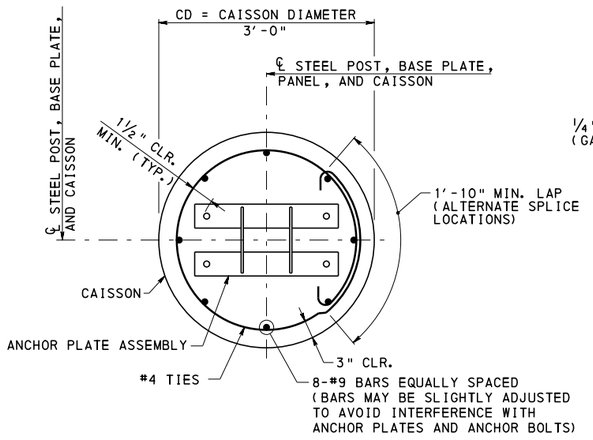
1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. SPECIFY IF ANCHOR PLATES ARE REQUIRED.
4. CAISSON REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
5. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.



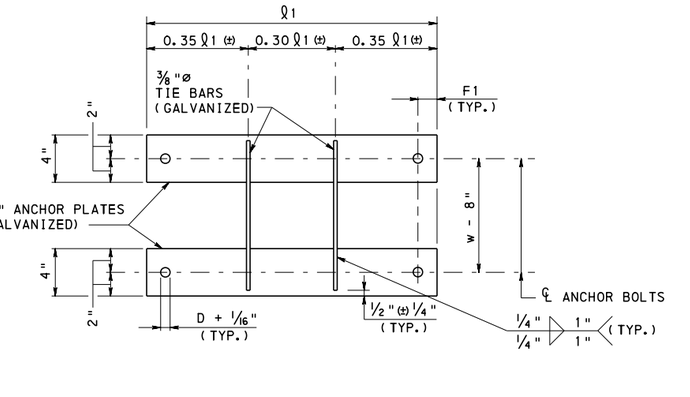
PLAN



ELEVATION (ANCHOR BOLTS W/ANCHOR PLATE ASSEMBLY)



SECTION G-G

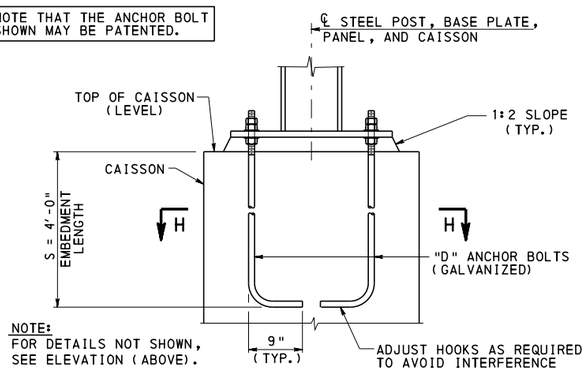


PLAN - ANCHOR PLATE ASSEMBLY

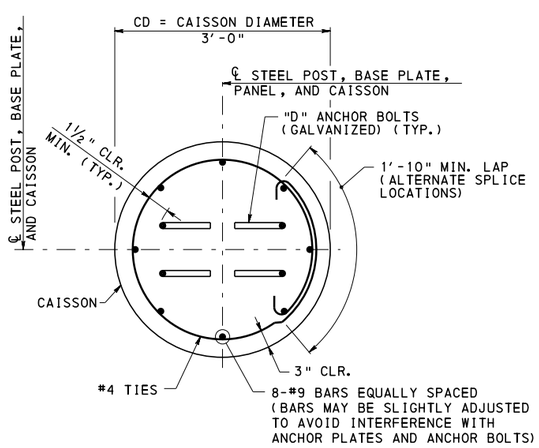
NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. DESIGNER TO DETERMINE WHICH DETAIL IS TO BE USED. ONLY USE ONE DETAIL ON THE CONTRACT DRAWINGS.
3. FOR DESIGN TABLES REFER TO SHEET 5 .
4. FOR CAISSON LENGTHS REFER TO SHEET 14.
5. FOR PANEL SEAT DETAILS REFER TO BC-778M.
6. FOR OVERSIZED WASHER DETAIL REFER TO BC-778M.

PLEASE NOTE THAT THE ANCHOR BOLT DETAIL SHOWN MAY BE PATENTED.



ELEVATION (ANCHOR BOLTS W/HOOKS)



SECTION H-H

DETAIL 1
STEEL POST WITH BASE PLATE CONNECTION TO CAISSON

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

DETAIL 1

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 4 OF 14
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-678M

DETAIL 1
DESIGN TABLE

STEEL POST WITH BASE PLATE CONNECTION TO CAISSON
HEIGHT ZONE 0'-14' WIND PRESSURE = 20 PSF

STEEL POST			BASE PLATE				ANCHOR BOLTS		ANCHOR PLATES	
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	P (IN.)	Q1 (IN.)	F1 (IN.)
12.0	6.0	W8x31	3/4	16	12	1 1/2	3/4	5	15	1
	8.0	W8x31	3/4	17	13	2	1	5 3/4	15	1
	10.0	W8x31	7/8	17	13	2	1	5 3/4	15	1
	12.0	W8x31	1	18	14	2 1/4	1 1/4	6 3/4	16	1 1/4
	14.0	W8x48	1 1/8	18	14	2 1/4	1 1/4	6 3/4	16	1 1/4
	16.0	W10x49	1 1/4	20	14	2 1/4	1 1/4	7	18	1 1/4
	18.0	W10x60	1 3/8	21	14	2 3/4	1 1/2	7 3/4	18 1/2	1 1/2
	20.0	W10x77	1 1/2	22	14	2 3/4	1 1/2	8	19 1/2	1 1/2
	22.0	W10x100	1 5/8	22	14	2 3/4	1 1/2	8	19 1/2	1 1/2
	24.0	W12x120	1 3/4	25	15	3	1 3/4	9	22 1/2	1 3/4
	26.0	W12x120	1 3/4	25	15	3	1 3/4	9	22 1/2	1 3/4
	28.0	W12x136	1 7/8	25	15	3	1 3/4	9	22 1/2	1 3/4
16.0	6.0	W8x31	3/4	17	13	2	1	5 3/4	15	1
	8.0	W8x31	7/8	17	13	2	1	5 3/4	15	1
	10.0	W8x31	1	18	14	2 1/4	1 1/4	6 3/4	16	1 1/4
	12.0	W8x35	1 1/8	18	14	2 1/4	1 1/4	6 3/4	16	1 1/4
	14.0	W10x49	1 1/4	21	14	2 3/4	1 1/2	7 3/4	18 1/2	1 1/2
	16.0	W10x54	1 3/8	21	14	2 3/4	1 1/2	7 3/4	18 1/2	1 1/2
	18.0	W10x77	1 5/8	22	14	2 3/4	1 1/2	8	19 1/2	1 1/2
	20.0	W10x100	1 3/4	22	14	2 3/4	1 1/2	8 1/4	19 1/2	1 1/2
	22.0	W12x120	1 7/8	25	15	3	1 3/4	9	22 1/2	1 3/4
	24.0	W12x120	1 7/8	25	15	3	1 3/4	9	22 1/2	1 3/4
	26.0	W12x152	2	27	16	3 1/2	2	10	24	2
	28.0	W12x170	2 1/8	27	16	3 1/2	2	10	24	2
20.0	6.0	W8x31	3/4	17	13	2	1	5 3/4	15	1
	8.0	W8x31	7/8	18	14	2 1/4	1 1/4	6 1/2	16	1 1/4
	10.0	W8x31	1 1/8	18	14	2 1/4	1 1/4	6 3/4	16	1 1/4
	12.0	W8x48	1 1/4	19	14	2 3/4	1 1/2	7 3/4	16 1/2	1 1/2
	14.0	W10x49	1 3/8	21	14	2 3/4	1 1/2	7 3/4	18 1/2	1 1/2
	16.0	W10x68	1 5/8	21	14	2 3/4	1 1/2	8	18 1/2	1 1/2
	18.0	W10x88	1 3/4	23	15	3	1 3/4	9	20 1/2	1 3/4
	20.0	W12x120	1 7/8	25	15	3	1 3/4	9	22 1/2	1 3/4
	22.0	W12x120	1 7/8	25	15	3	1 3/4	9	22 1/2	1 3/4
	24.0	W12x152	2	27	16	3 1/2	2	10	24	2
	26.0	W12x170	2 1/4	27	16	3 1/2	2	10 1/4	24	2

DETAIL 1
DESIGN TABLE

STEEL POST WITH BASE PLATE CONNECTION TO CAISSON
HEIGHT ZONES OVER 14' WIND PRESSURE = 28 PSF

STEEL POST			BASE PLATE				ANCHOR BOLTS		ANCHOR PLATES	
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	P (IN.)	Q1 (IN.)	F1 (IN.)
12.0	6.0	W8x31	3/4	17	13	2	1	5 3/4	15	1
	8.0	W8x31	7/8	17	13	2	1	5 3/4	15	1
	10.0	W8x31	1	18	14	2 1/4	1 1/4	6 3/4	16	1 1/4
	12.0	W8x40	1 1/8	18	14	2 1/4	1 1/4	6 3/4	16	1 1/4
	14.0	W10x49	1 1/4	21	14	2 3/4	1 1/2	7 3/4	18 1/2	1 1/2
	16.0	W10x60	1 3/8	21	14	2 3/4	1 1/2	7 3/4	18 1/2	1 1/2
	18.0	W10x77	1 5/8	22	14	2 3/4	1 1/2	8	19 1/2	1 1/2
	20.0	W10x100	1 3/4	23	15	3	1 3/4	9	20 1/2	1 3/4
	22.0	W12x120	1 7/8	25	15	3	1 3/4	9	22 1/2	1 3/4
	24.0	W12x120	1 7/8	25	15	3	1 3/4	9	22 1/2	1 3/4
	26.0	W12x152	2	27	16	3 1/2	2	10	24	2
	28.0	W12x190	2 1/4	27	16	3 1/2	2	10 1/4	24	2
16.0	6.0	W8x31	3/4	17	13	2	1	5 3/4	15	1
	8.0	W8x31	7/8	18	14	2 1/4	1 1/4	6 1/2	16	1 1/4
	10.0	W8x31	1 1/8	18	14	2 1/4	1 1/4	6 3/4	16	1 1/4
	12.0	W8x48	1 3/8	19	14	2 3/4	1 1/2	7 3/4	16 1/2	1 1/2
	14.0	W10x54	1 1/2	21	14	2 3/4	1 1/2	8	18 1/2	1 1/2
	16.0	W10x77	1 5/8	22	14	2 3/4	1 1/2	8	19 1/2	1 1/2
	18.0	W10x100	1 3/4	23	15	3	1 3/4	9	20 1/2	1 3/4
	20.0	W12x120	1 7/8	25	15	3	1 3/4	9	22 1/2	1 3/4
	22.0	W12x120	2	26	16	3 1/2	2	10	23	2
	24.0	W12x152	2 1/8	27	16	3 1/2	2	10	24	2
20.0	6.0	W8x31	3/4	17	13	2	1	5 3/4	15	1
	8.0	W8x31	1	18	14	2 1/4	1 1/4	6 3/4	16	1 1/4
	10.0	W8x35	1 1/4	19	14	2 3/4	1 1/2	7 3/4	16 1/2	1 1/2
	12.0	W10x49	1 3/8	21	14	2 3/4	1 1/2	7 3/4	18 1/2	1 1/2
	14.0	W10x68	1 5/8	21	14	2 3/4	1 1/2	8	18 1/2	1 1/2
	16.0	W10x88	1 3/4	23	15	3	1 3/4	9	20 1/2	1 3/4
	18.0	W12x120	1 7/8	25	15	3	1 3/4	9	22 1/2	1 3/4
	20.0	W12x136	2 1/8	26	16	3 1/2	2	10	23	2
	22.0	W12x170	2 1/4	27	16	3 1/2	2	10 1/4	24	2

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 4.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

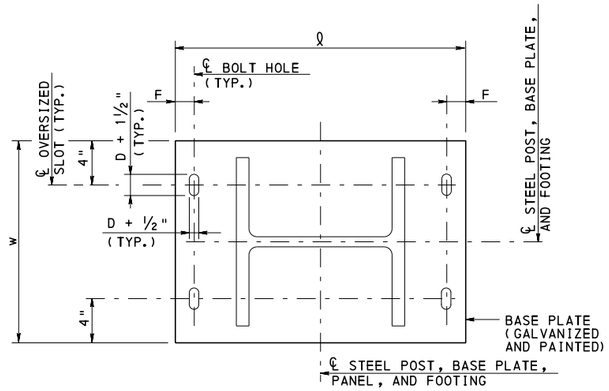
DETAIL 1 DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

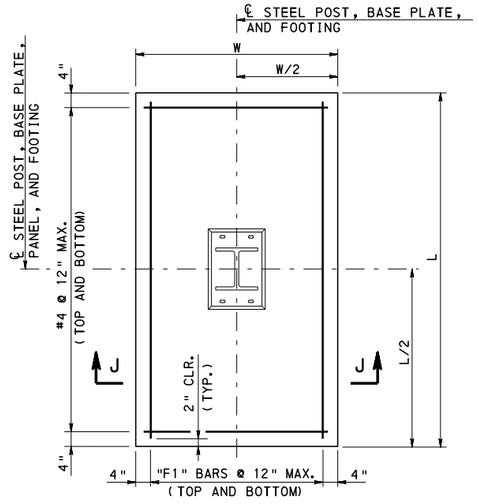
RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 5 OF 14

BD-678M

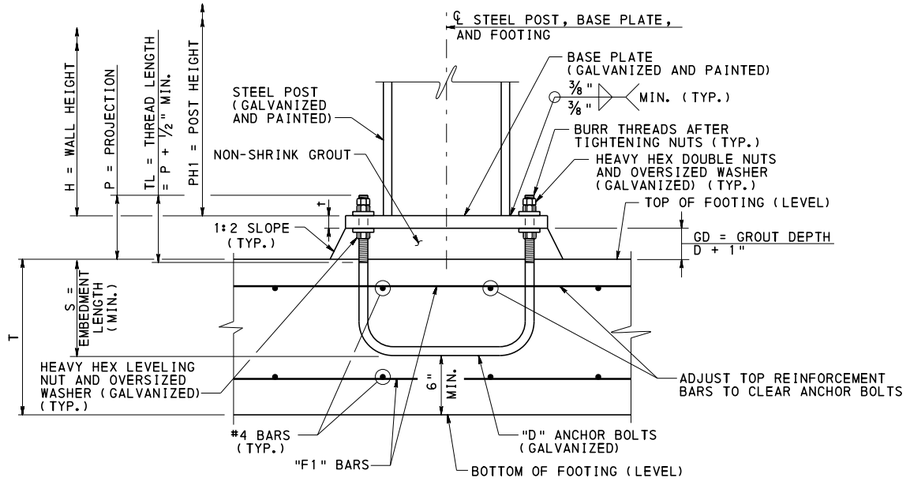


PLAN

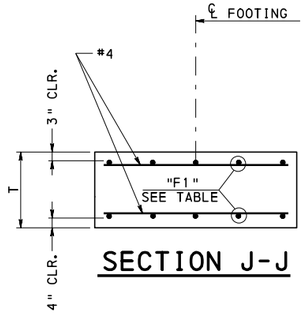


SPREAD FOOTING PLAN

PLEASE NOTE THAT THE ANCHOR BOLT DETAIL SHOWN MAY BE PATENTED.



ELEVATION



SECTION J-J

DETAIL 2
STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING

STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING
DIMENSION TABLE

HEIGHT ZONE=
WIND PRESSURE =

STEEL POST					BASE PLATE				ANCHOR BOLTS				GROUT	SPREAD FOOTING			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	STEEL POST SIZE	POST HEIGHT PH1 (FT.)	THICKNESS t (IN.)	LENGTH Q (IN.)	WIDTH w (IN.)	F (IN.)	DIAMETER D (IN.)	EMBEDMENT LENGTH S (IN.)	PROJECTION P (IN.)	THREAD LENGTH TL (IN.)	GROUT DEPTH GD (IN.)	THICKNESS T (FT.-IN.)	LENGTH L (FT.)	WIDTH W (FT.)	"F1" BAR SIZE

TABLE NOTES:

1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. SPREAD FOOTING REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
4. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DESIGN TABLES REFER TO SHEET 7.
3. FOR PANEL SEAT DETAILS REFER TO BC-778M.
4. FOR OVERSIZED WASHER DETAIL REFER TO BC-778M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

DETAIL 2

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 6 OF 14

BD-678M

DETAIL 2
DESIGN TABLE

STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING
HEIGHT ZONE 0'-14' WIND PRESSURE = 20 PSF

STEEL POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	W8x31	3/4	16	12	1 1/2	3/4	17	5	2.0	4.5	3.0	#4
	8.0	W8x31	3/4	17	13	2	1	22	5 3/4	2.5	5.5	3.0	#4
	10.0	W8x31	7/8	17	13	2	1	22	5 3/4	2.5	6.0	3.5	#4
	12.0	W8x31	1	18	14	2 1/4	1 1/4	28	6 3/4	3.0	6.5	3.5	#4
	14.0	W8x48	1 1/8	18	14	2 1/4	1 1/4	28	6 3/4	3.0	7.5	4.0	#4
	16.0	W10x49	1 1/4	20	14	2 1/4	1 1/4	28	7	3.0	8.0	4.0	#4
	18.0	W10x60	1 3/8	21	14	2 3/4	1 1/2	33	7 3/4	3.25	8.5	4.5	#5
	20.0	W10x77	1 1/2	22	14	2 3/4	1 1/2	33	8	3.25	9.0	4.5	#5
	22.0	W10x100	1 5/8	22	14	2 3/4	1 1/2	33	8	3.25	9.5	5.0	#5
	24.0	W12x120	1 3/4	25	15	3	1 3/4	39	9	3.75	10.0	5.0	#5
	26.0	W12x120	1 3/4	25	15	3	1 3/4	39	9	3.75	10.5	5.5	#5
	28.0	W12x136	1 7/8	25	15	3	1 3/4	39	9	3.75	11.0	5.5	#5
16.0	6.0	W8x31	3/4	17	13	2	1	22	5 3/4	2.5	5.0	3.0	#4
	8.0	W8x31	7/8	17	13	2	1	22	5 3/4	2.5	6.0	3.0	#4
	10.0	W8x31	1	18	14	2 1/4	1 1/4	28	6 3/4	3.0	6.5	3.5	#4
	12.0	W8x35	1 1/8	18	14	2 1/4	1 1/4	28	6 3/4	3.0	7.0	4.0	#4
	14.0	W10x49	1 1/4	21	14	2 3/4	1 1/2	33	7 3/4	3.25	8.0	4.0	#5
	16.0	W10x54	1 3/8	21	14	2 3/4	1 1/2	33	7 3/4	3.25	8.5	4.5	#5
	18.0	W10x77	1 5/8	22	14	2 3/4	1 1/2	33	8	3.25	9.0	5.0	#5
	20.0	W10x100	1 3/4	22	14	2 3/4	1 1/2	33	8 1/4	3.25	10.0	5.0	#5
	22.0	W12x120	1 7/8	25	15	3	1 3/4	39	9	3.75	10.5	5.5	#5
	24.0	W12x120	1 7/8	25	15	3	1 3/4	39	9	3.75	11.0	5.5	#5
	26.0	W12x152	2	27	16	3 1/2	2	44	10	4.25	11.0	6.0	#5
	28.0	W12x170	2 1/8	27	16	3 1/2	2	44	10	4.25	11.5	6.0	#6
20.0	6.0	W8x31	3/4	17	13	2	1	22	5 3/4	2.5	5.0	3.0	#4
	8.0	W8x31	7/8	18	14	2 1/4	1 1/4	28	6 1/2	3.0	6.0	3.5	#4
	10.0	W8x31	1 1/8	18	14	2 1/4	1 1/4	28	6 3/4	3.0	7.0	3.5	#4
	12.0	W8x48	1 1/4	19	14	2 3/4	1 1/2	33	7 3/4	3.25	7.5	4.0	#5
	14.0	W10x49	1 3/8	21	14	2 3/4	1 1/2	33	7 3/4	3.25	8.5	4.5	#5
	16.0	W10x68	1 5/8	21	14	2 3/4	1 1/2	33	8	3.25	9.0	4.5	#5
	18.0	W10x88	1 3/4	23	15	3	1 3/4	39	9	3.75	9.5	5.0	#5
	20.0	W12x120	1 7/8	25	15	3	1 3/4	39	9	3.75	10.0	5.5	#5
	22.0	W12x120	1 7/8	25	15	3	1 3/4	39	9	3.75	11.0	5.5	#6
	24.0	W12x152	2	27	16	3 1/2	2	44	10	4.25	11.5	6.0	#6
	26.0	W12x170	2 1/4	27	16	3 1/2	2	44	10 1/4	4.25	12.0	6.0	#6

DETAIL 2
DESIGN TABLE

STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING
HEIGHT ZONES OVER 14' WIND PRESSURE = 28 PSF

STEEL POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	W8x31	3/4	17	13	2	1	22	5 3/4	2.5	5.5	3.0	#4
	8.0	W8x31	7/8	17	13	2	1	22	5 3/4	2.5	6.5	3.5	#4
	10.0	W8x31	1	18	14	2 1/4	1 1/4	28	6 3/4	3.0	7.0	4.0	#4
	12.0	W8x40	1 1/8	18	14	2 1/4	1 1/4	28	6 3/4	3.0	8.0	4.0	#4
	14.0	W10x49	1 1/4	21	14	2 3/4	1 1/2	33	7 3/4	3.25	8.5	4.5	#4
	16.0	W10x60	1 3/8	21	14	2 3/4	1 1/2	33	7 3/4	3.25	9.0	5.0	#4
	18.0	W10x77	1 5/8	22	14	2 3/4	1 1/2	33	8	3.25	10.0	5.0	#5
	20.0	W10x100	1 3/4	23	15	3	1 3/4	39	9	3.75	10.5	5.5	#5
	22.0	W12x120	1 7/8	25	15	3	1 3/4	39	9	3.75	11.0	6.0	#5
	24.0	W12x120	1 7/8	25	15	3	1 3/4	39	9	3.75	11.5	6.0	#5
	26.0	W12x152	2	27	16	3 1/2	2	44	10	4.25	12.0	6.0	#5
	28.0	W12x190	2 1/4	27	16	3 1/2	2	44	10 1/4	4.25	12.5	6.5	#5
16.0	6.0	W8x31	3/4	17	13	2	1	22	5 3/4	2.5	6.0	3.0	#4
	8.0	W8x31	7/8	18	14	2 1/4	1 1/4	28	6 1/2	3.0	7.0	3.5	#4
	10.0	W8x31	1 1/8	18	14	2 1/4	1 1/4	28	6 3/4	3.0	8.0	4.0	#4
	12.0	W8x48	1 3/8	19	14	2 3/4	1 1/2	33	7 3/4	3.25	8.5	4.5	#4
	14.0	W10x54	1 1/2	21	14	2 3/4	1 1/2	33	8	3.25	9.0	5.0	#5
	16.0	W10x77	1 5/8	22	14	2 3/4	1 1/2	33	8	3.25	10.0	5.0	#5
	18.0	W10x100	1 3/4	23	15	3	1 3/4	39	9	3.75	10.5	5.5	#5
	20.0	W12x120	1 7/8	25	15	3	1 3/4	39	9	3.75	11.0	6.0	#5
	22.0	W12x120	2	26	16	3 1/2	2	44	10	4.25	12.0	6.0	#5
	24.0	W12x152	2 1/8	27	16	3 1/2	2	44	10	4.25	12.0	6.5	#5
20.0	6.0	W8x31	3/4	17	13	2	1	22	5 3/4	2.5	6.0	3.5	#4
	8.0	W8x31	1	18	14	2 1/4	1 1/4	28	6 3/4	3.0	7.0	4.0	#4
	10.0	W8x35	1 1/4	19	14	2 3/4	1 1/2	33	7 3/4	3.25	8.0	4.5	#4
	12.0	W10x49	1 3/8	21	14	2 3/4	1 1/2	33	7 3/4	3.25	9.0	4.5	#5
	14.0	W10x68	1 5/8	21	14	2 3/4	1 1/2	33	8	3.25	10.0	5.0	#5
	16.0	W10x88	1 3/4	23	15	3	1 3/4	39	9	3.75	10.5	5.5	#5
	18.0	W12x120	1 7/8	25	15	3	1 3/4	39	9	3.75	11.0	6.0	#5
	20.0	W12x136	2 1/8	26	16	3 1/2	2	44	10	4.25	12.0	6.0	#5
	22.0	W12x170	2 1/4	27	16	3 1/2	2	44	10 1/4	4.25	12.5	6.5	#6

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 6.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

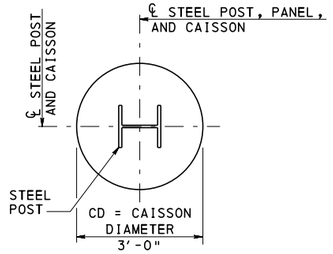
DETAIL 2 DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

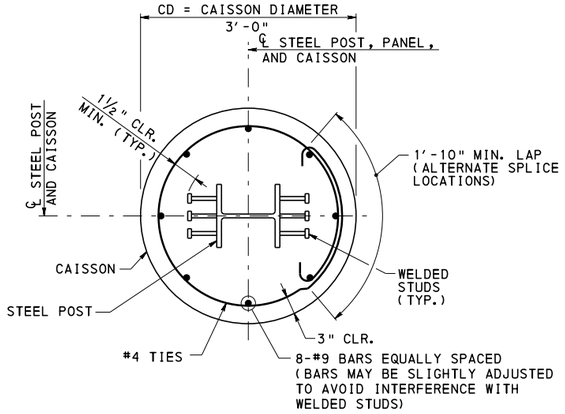
RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 7 OF 14

BD-678M



PLAN



SECTION K-K

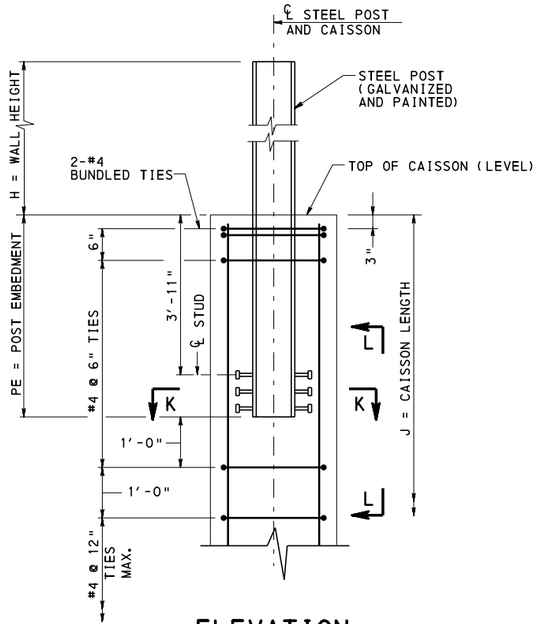
STEEL POST EMBEDDED IN CAISSON DIMENSION TABLE

HEIGHT ZONE=
WIND PRESSURE =

STEEL POST						CAISSON			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	STEEL POST SIZE	NUMBER OF WELDED STUDS	POST EMBEDMENT PE (FT.-IN.)	CAISSON DIAMETER CD (FT.-IN.)	CAISSON LENGTH J (FT.)	VERTICAL REINFORCEMENT	
								NUMBER OF BARS	BAR SIZE

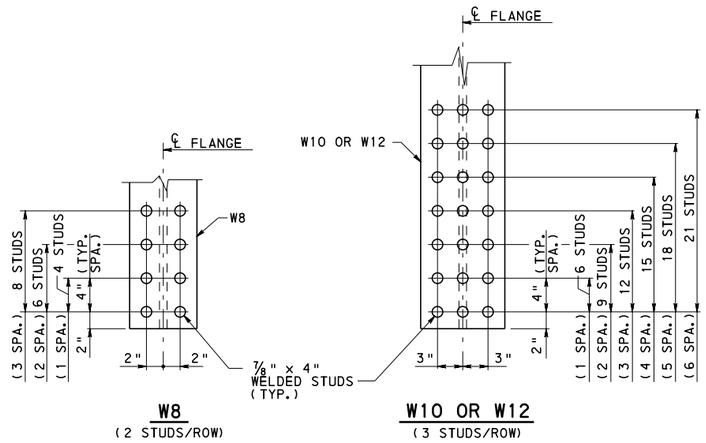
TABLE NOTES:

1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. CAISSON REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
4. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.



ELEVATION

DETAIL 3
STEEL POST
EMBEDDED IN CAISSON



W8
(2 STUDS/ROW)

W10 OR W12
(3 STUDS/ROW)

SECTION L-L
WELDED STUDS
(REQUIRED ON BOTH FLANGES)

NOTES:

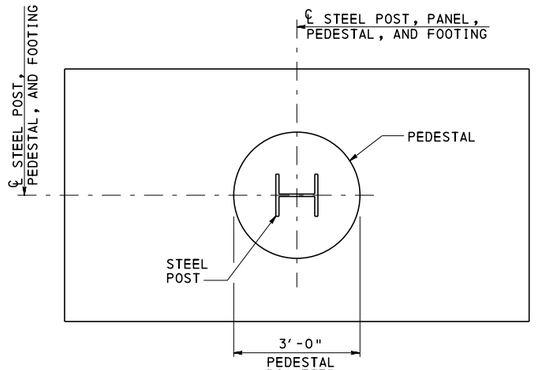
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DESIGN TABLES REFER TO SHEET 10.
3. FOR CAISSON LENGTHS REFER TO SHEET 14.
4. FOR PANEL SEAT DETAILS REFER TO BC-778M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

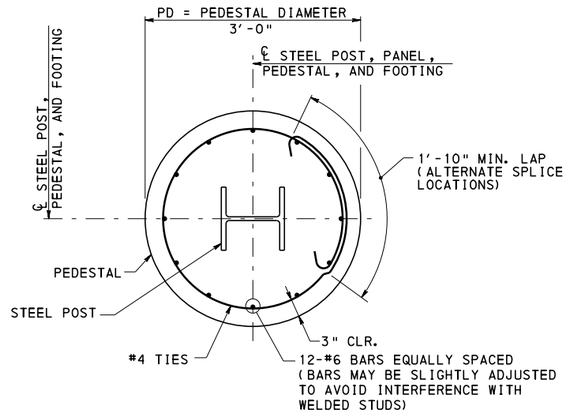
STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

DETAIL 3

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 8 OF 14
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-678M



PLAN



SECTION M-M

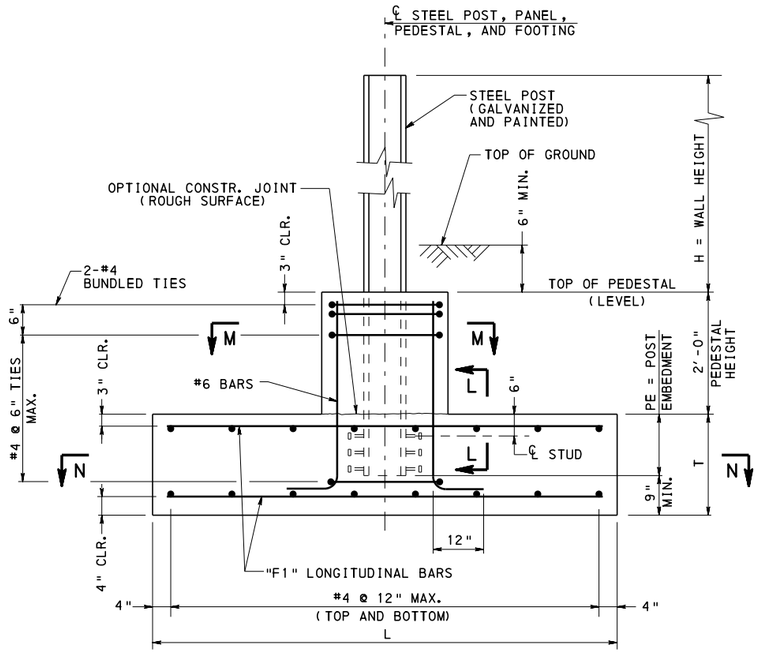
STEEL POST EMBEDDED IN SPREAD FOOTING WITH PEDESTAL DIMENSION TABLE

HEIGHT ZONE=
WIND PRESSURE =

STEEL POST						SPREAD FOOTING			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	STEEL POST SIZE	NUMBER OF WELDED STUDS	POST EMBEDMENT PE (FT.-IN.)	THICKNESS T (FT.)	LENGTH L (FT.)	WIDTH W (FT.)	"F1" BAR SIZE

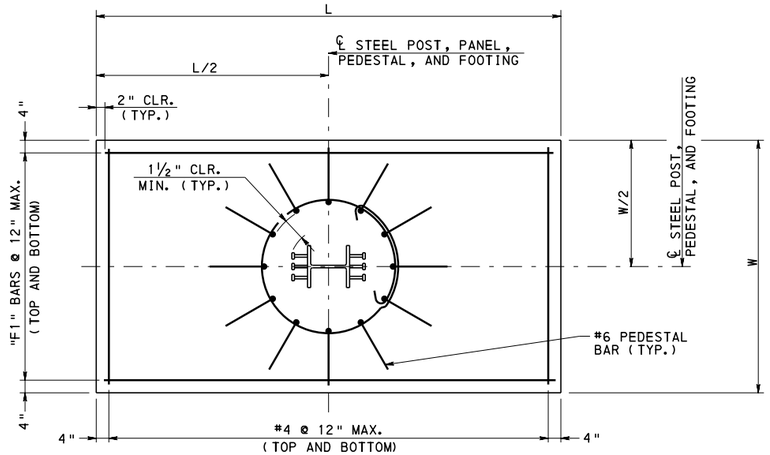
TABLE NOTES:

1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. SPREAD FOOTING REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
4. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.



ELEVATION

ADJUST FOOTING TOP REINFORCEMENT SPACING TO CLEAR POST.



SECTION N-N

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR SECTION L-L REFER TO SHEET 8.
3. FOR DESIGN TABLES REFER TO SHEET 10.
4. FOR PANEL SEAT DETAILS REFER TO BC-778M.

DETAIL 4
STEEL POST EMBEDDED IN SPREAD FOOTING WITH PEDESTAL

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

DETAIL 4

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 9 OF 14

BD-678M

DETAIL 3

STEEL POST
EMBEDDED IN CAISSON
HEIGHT ZONE 0′-14′
WIND PRESSURE = 20 PSF

STEEL POST				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	NUMBER OF WELDED STUDS	POST EMBEDMENT PE (IN.)
12.0	6.0	W8x31	4	53
	8.0	W8x31	4	53
	10.0	W8x31	4	53
	12.0	W8x31	6	57
	14.0	W8x48	6	57
	16.0	W10x49	9	57
	18.0	W10x60	9	57
	20.0	W10x77	12	61
	22.0	W10x100	12	61
	24.0	W12x120	12	61
	26.0	W12x120	15	65
	28.0	W12x136	15	65
16.0	6.0	W8x31	4	53
	8.0	W8x31	4	53
	10.0	W8x31	4	53
	12.0	W8x35	6	57
	14.0	W10x49	9	57
	16.0	W10x54	9	57
	18.0	W10x77	12	61
	20.0	W10x100	12	61
	22.0	W12x120	12	61
	24.0	W12x120	15	65
	26.0	W12x152	18	69
	28.0	W12x170	18	69
20.0	6.0	W8x31	4	53
	8.0	W8x31	4	53
	10.0	W8x31	6	57
	12.0	W8x48	8	61
	14.0	W10x49	9	57
	16.0	W10x68	12	61
	18.0	W10x88	12	61
	20.0	W12x120	15	65
	22.0	W12x120	15	65
	24.0	W12x152	18	69
	26.0	W12x170	21	73

DETAIL 3

STEEL POST
EMBEDDED IN CAISSON
HEIGHT ZONES OVER 14′
WIND PRESSURE = 28 PSF

STEEL POST				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	NUMBER OF WELDED STUDS	POST EMBEDMENT PE (IN.)
12.0	6.0	W8x31	4	53
	8.0	W8x31	4	53
	10.0	W8x31	6	57
	12.0	W8x40	6	57
	14.0	W10x49	9	57
	16.0	W10x60	9	57
	18.0	W10x77	12	61
	20.0	W10x100	15	65
	22.0	W12x120	15	65
	24.0	W12x120	15	65
	26.0	W12x152	18	69
	28.0	W12x190	21	73
16.0	6.0	W8x31	4	53
	8.0	W8x31	4	53
	10.0	W8x31	6	57
	12.0	W8x48	8	61
	14.0	W10x54	9	57
	16.0	W10x77	12	61
	18.0	W10x100	15	65
	20.0	W12x120	15	65
	22.0	W12x120	18	69
	24.0	W12x152	21	73
20.0	6.0	W8x31	4	53
	8.0	W8x31	6	57
	10.0	W8x35	8	61
	12.0	W10x49	9	57
	14.0	W10x68	12	61
	16.0	W10x88	15	65
	18.0	W12x120	15	65
	20.0	W12x136	18	69
	22.0	W12x170	21	73

DETAIL 4

STEEL POST
EMBEDDED IN SPREAD FOOTING WITH PEDESTAL
HEIGHT ZONE 0′-14′
WIND PRESSURE 20 PSF

STEEL POST					SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	NUMBER OF WELDED STUDS	POST EMBEDMENT PE (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	W8x31	4	12	1.75	5.0	5.0	#4
	8.0	W8x31	4	12	1.75	5.0	5.0	#4
	10.0	W8x31	4	12	1.75	5.5	5.0	#4
	12.0	W8x31	6	16	2.25	6.5	5.0	#4
	14.0	W8x48	6	16	2.25	7.0	5.0	#4
	16.0	W10x49	9	16	2.25	8.0	5.0	#4
	18.0	W10x60	9	16	2.25	8.5	5.0	#5
	20.0	W10x77	12	20	2.5	9.0	5.0	#5
	22.0	W10x100	12	20	2.5	9.5	5.0	#5
	24.0	W12x120	12	20	2.5	10.0	5.0	#5
	26.0	W12x120	15	24	2.75	10.5	5.5	#5
	28.0	W12x136	15	24	2.75	11.0	5.5	#6
16.0	6.0	W8x31	4	12	1.75	5.0	5.0	#4
	8.0	W8x31	4	12	1.75	5.5	5.0	#4
	10.0	W8x31	4	12	1.75	6.5	5.0	#4
	12.0	W8x35	6	16	2.25	7.0	5.0	#4
	14.0	W10x49	9	16	2.25	8.0	5.0	#4
	16.0	W10x54	9	16	2.25	8.5	5.0	#5
	18.0	W10x77	12	20	2.5	9.0	5.0	#5
	20.0	W10x100	12	20	2.5	10.0	5.0	#5
	22.0	W12x120	12	20	2.5	10.0	5.5	#6
	24.0	W12x120	15	24	2.75	11.0	5.5	#6
	26.0	W12x152	18	28	3.25	11.0	6.0	#6
	28.0	W12x170	18	28	3.25	11.5	6.0	#6
20.0	6.0	W8x31	4	12	1.75	5.0	5.0	#4
	8.0	W8x31	4	12	1.75	6.0	5.0	#4
	10.0	W8x31	6	16	2.25	7.0	5.0	#4
	12.0	W8x48	8	20	2.5	7.5	5.0	#4
	14.0	W10x49	9	16	2.5	8.5	5.0	#5
	16.0	W10x68	12	20	2.5	9.0	5.0	#5
	18.0	W10x88	12	20	2.5	10.0	5.0	#6
	20.0	W12x120	15	24	2.75	10.5	5.5	#6
	22.0	W12x120	15	24	2.75	11.0	5.5	#6
	24.0	W12x152	18	28	3.25	11.0	6.0	#6
	26.0	W12x170	21	32	3.5	12.0	6.0	#6

DETAIL 4

STEEL POST
EMBEDDED IN SPREAD FOOTING WITH PEDESTAL
HEIGHT ZONES OVER 14′
WIND PRESSURE 28 PSF

STEEL POST					SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	NUMBER OF WELDED STUDS	POST EMBEDMENT PE (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR SIZE)
12.0	6.0	W8x31	4	12	1.75	5.0	5.0	#4
	8.0	W8x31	4	12	1.75	6.0	5.0	#4
	10.0	W8x31	6	16	2.25	7.0	5.0	#4
	12.0	W8x40	6	16	2.25	8.0	5.0	#4
	14.0	W10x49	9	16	2.25	9.0	5.0	#4
	16.0	W10x60	9	16	2.25	9.5	5.0	#5
	18.0	W10x77	12	20	2.5	10.0	5.0	#5
	20.0	W10x100	15	24	2.75	10.5	5.5	#5
	22.0	W12x120	15	24	2.75	11.0	5.5	#5
	24.0	W12x120	15	24	2.75	11.5	6.0	#6
	26.0	W12x152	18	28	3.25	12.0	6.0	#6
	28.0	W12x190	21	32	3.5	12.0	6.5	#6
16.0	6.0	W8x31	4	12	1.75	5.5	5.0	#4
	8.0	W8x31	4	12	1.75	6.5	5.0	#4
	10.0	W8x31	6	16	2.25	7.5	5.0	#4
	12.0	W8x48	8	20	2.5	8.5	5.0	#4
	14.0	W10x54	9	16	2.5	9.5	5.0	#5
	16.0	W10x77	12	20	2.5	10.0	5.5	#5
	18.0	W10x100	15	24	2.75	10.5	5.5	#5
	20.0	W12x120	15	24	2.75	11.0	6.0	#6
	22.0	W12x120	18	28	3.25	12.0	6.0	#6
	24.0	W12x152	21	32	3.5	12.0	6.5	#6
20.0	6.0	W8x31	4	12	1.75	6.0	5.0	#4
	8.0	W8x31	6	16	2.25	7.0	5.0	#4
	10.0	W8x35	8	20	2.5	8.5	5.0	#4
	12.0	W10x49	9	16	2.5	9.0	5.0	#5
	14.0	W10x68	12	20	2.5	10.0	5.0	#5
	16.0	W10x88	15	24	2.75	10.5	5.5	#6
	18.0	W12x120	15	24	2.75	11.5	6.0	#6
	20.0	W12x136	18	28	3.25	12.0	6.0	#6
	22.0	W12x170	21	32	3.5	12.5	6.5	#6

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEETS 8 AND 9.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

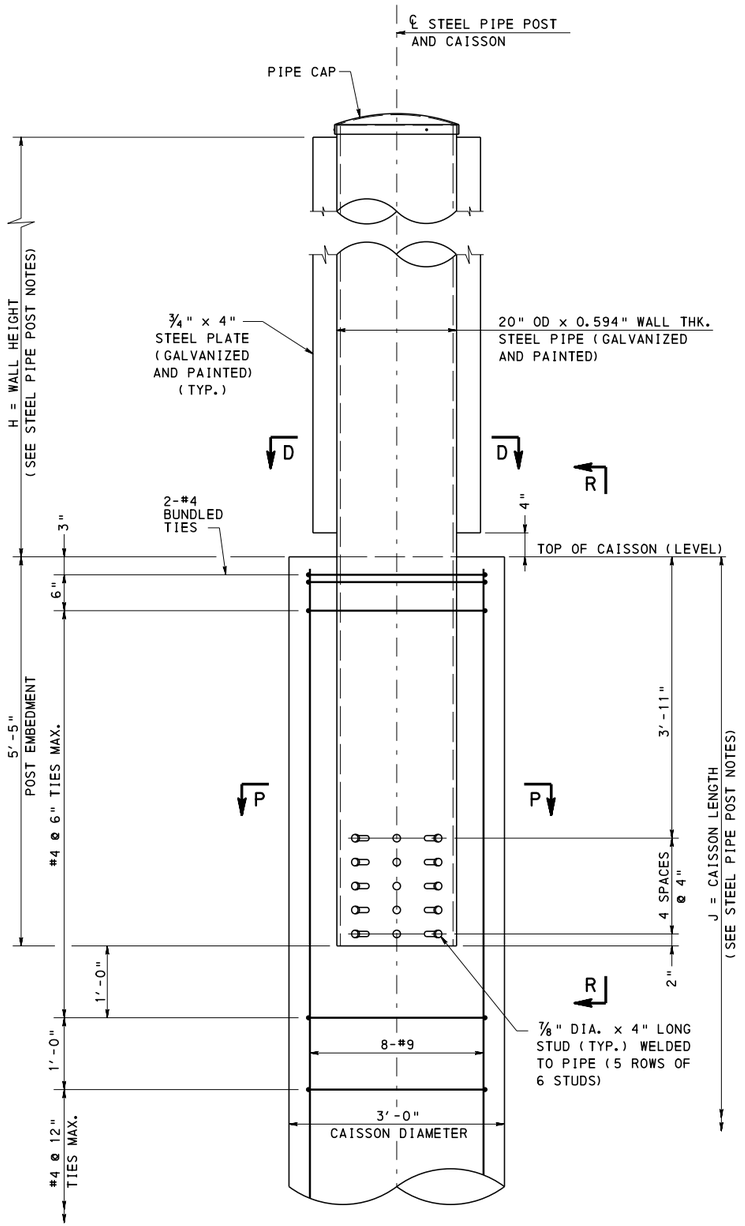
STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

DETAIL 3 AND DETAIL 4 DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

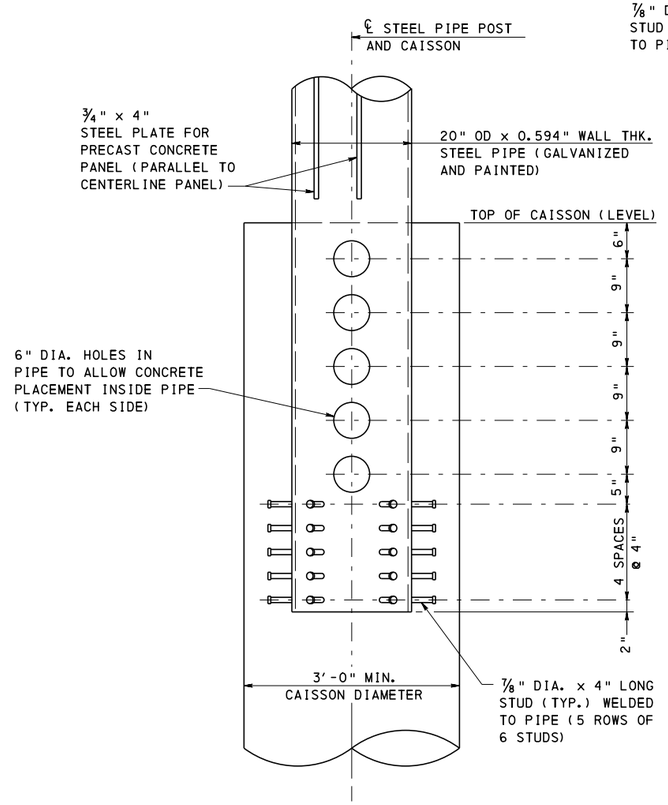
RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

BD-678M

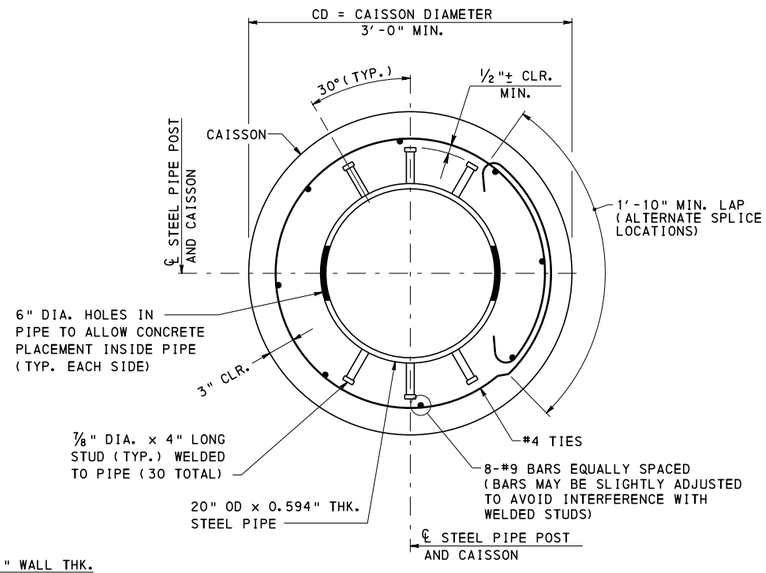


ELEVATION

DETAIL 5
CORNER/ANGLED STEEL PIPE POST EMBEDDED IN CAISSON



SECTION R-R



SECTION P-P

NOTES:

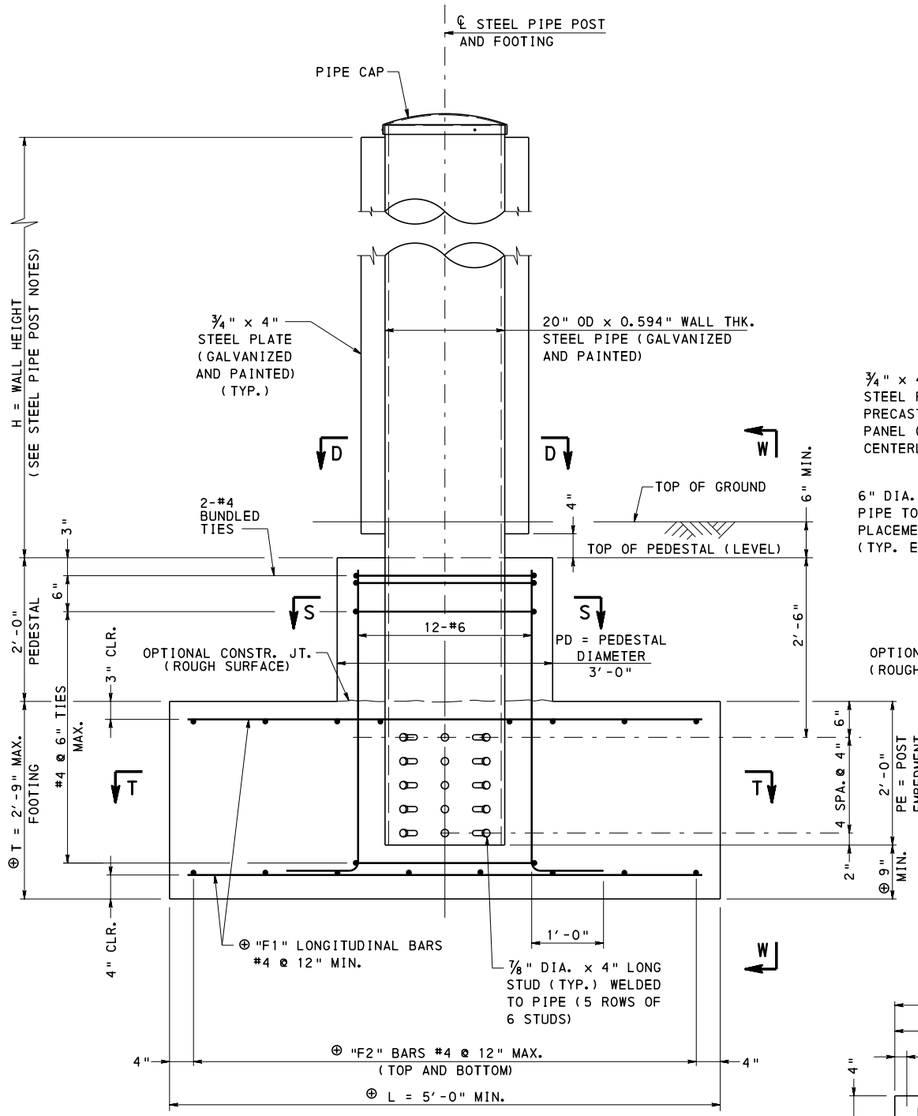
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR SECTION D-D REFER TO SHEET 13.
3. FOR STEEL PIPE POST NOTES REFER TO SHEET 13.
4. FOR PIPE CAP DETAIL REFER TO BC-778M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GROUND MOUNTED SOUND BARRIERS STEEL POSTS

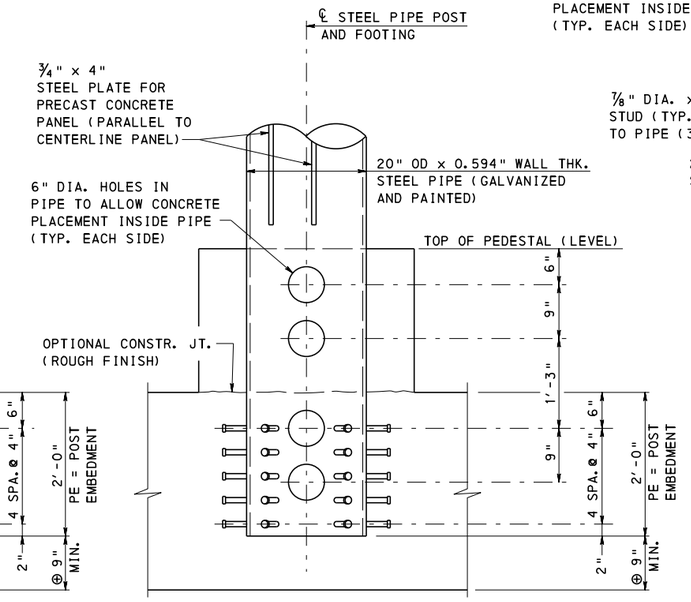
DETAIL 5

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 11 OF 14 BD-678M

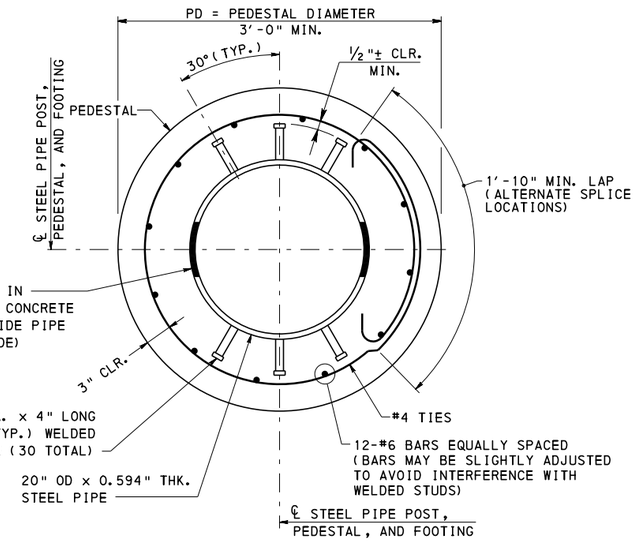


ELEVATION

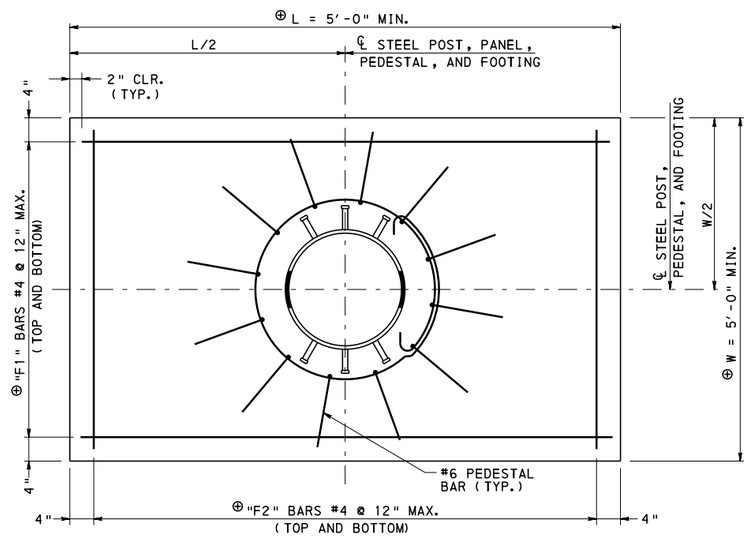
ADJUST FOOTING TOP REINFORCEMENT SPACING TO CLEAR POST.



SECTION W-W



SECTION S-S



SECTION T-T

DETAIL 6
CORNER/ANGLED STEEL PIPE POST EMBEDDED IN SPREAD FOOTING WITH PEDESTAL

LEGEND:

⊕ MIN. SIZE SHOWN, PROVIDE SIZE REQUIRED PER DESIGN

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR SECTION D-D REFER TO SHEET 13.
3. FOR STEEL PIPE POST NOTES REFER TO SHEET 13.
4. FOR PIPE CAP DETAIL REFER TO BC-778M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

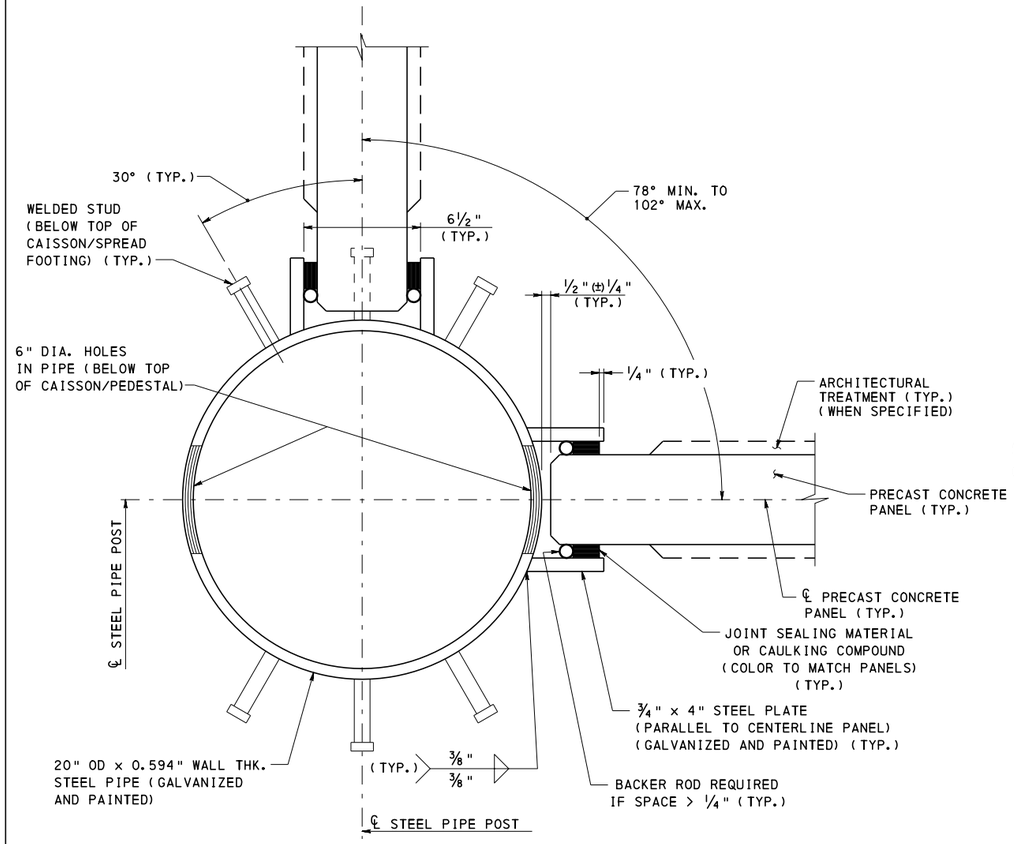
STANDARD GROUND MOUNTED SOUND BARRIERS STEEL POSTS

DETAIL 6

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

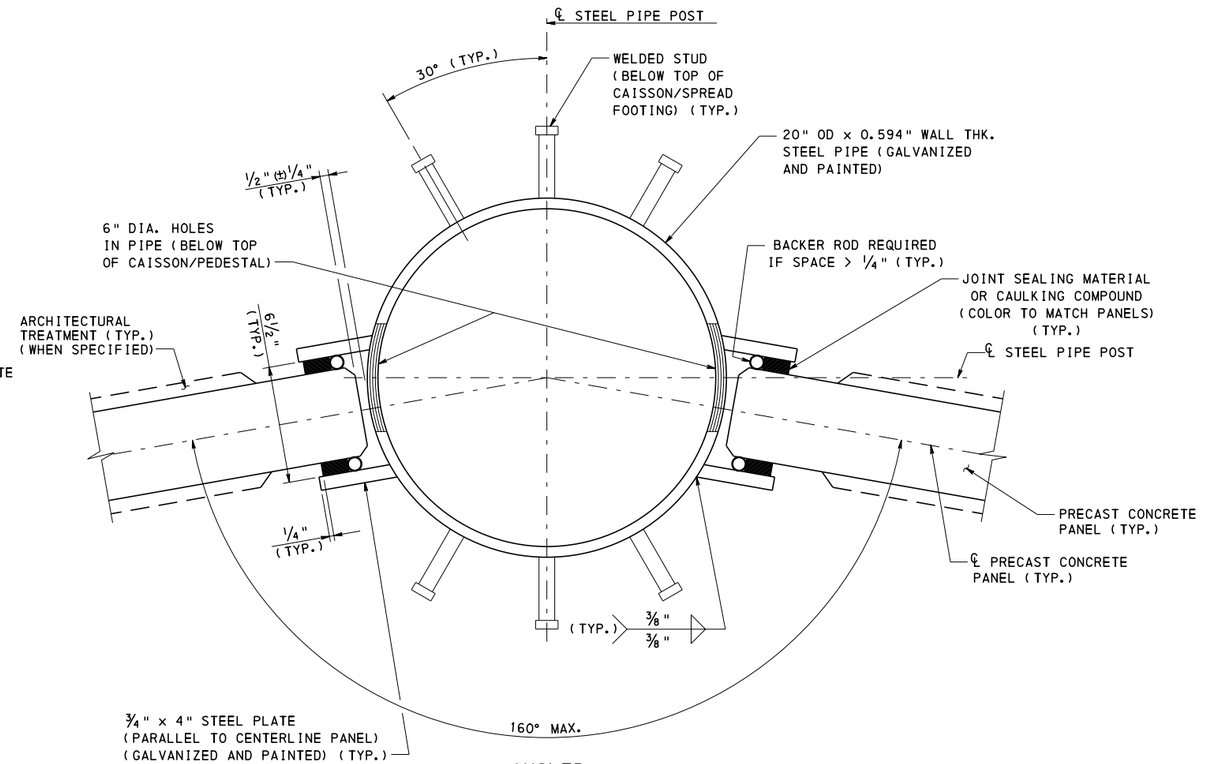
RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

BD-678M



CORNER

SECTION D-D



ANGLED

SECTION D-D

STEEL PIPE POST NOTES:

1. THE STEEL PIPE POST DETAIL MAY ONLY BE USED WHEN THE INTERSECTING ANGLE BETWEEN THE PRECAST CONCRETE PANELS IS GREATER THAN 78 DEGREES AND LESS THAN 160 DEGREES.
2. THE STEEL PIPE POST WAS DESIGNED FOR THE FOLLOWING POST SPACINGS, WIND PRESSURES, AND MAXIMUM WALL HEIGHTS:
   - 12′-0" POST SPACING:
     - WIND PRESSURE = 20 PSF: MAXIMUM WALL HEIGHT = 28′-0"
     - WIND PRESSURE = 28 PSF: MAXIMUM WALL HEIGHT = 28′-0 "
   - 16′-0" POST SPACING:
     - WIND PRESSURE = 20 PSF: MAXIMUM WALL HEIGHT = 28′-0"
     - WIND PRESSURE = 28 PSF: MAXIMUM WALL HEIGHT = 25′-0"
3. DETAIL 5 - STEEL PIPE POST EMBEDDED IN CAISSON:
   - INDICATE THE REQUIRED WALL HEIGHT ON THE CONTRACT PLANS.
   - DETERMINE CAISSON LENGTH BASED ON THE POST SPACING AND WALL HEIGHT. REFER TO DESIGN TABLES ON SHEET 14.
   - PROVIDE DIMENSION TABLE SIMILAR TO TABLE SHOWN FOR DETAIL 3 OR COMPLETELY DETAIL POST AND CAISSON ON THE CONTRACT DRAWINGS.
4. DETAIL 6 - STEEL PIPE POST EMBEDDED IN SPREAD FOOTING WITH PEDESTAL:
   - INDICATE THE REQUIRED WALL HEIGHT ON THE CONTRACT PLANS.
   - PROVIDE SPREAD FOOTING DESIGN COMPUTATIONS TO DETERMINE THE FOOTING DIMENSIONS AND REINFORCEMENT REQUIREMENTS FOR THE REQUIRED POST SPACING AND WALL HEIGHT. PROVIDE THE FOLLOWING MINIMUM FOOTING DIMENSIONS:
     - MINIMUM FOOTING LENGTH (L) = 5′-0"
     - MINIMUM FOOTING WIDTH (W) = 5′-0"
     - MINIMUM FOOTING DEPTH (T) = 2′-9"
     - REFER TO DESIGN PARAMETERS ON SHEET 2 FOR ADDITIONAL INFORMATION.
   - PROVIDE DIMENSION TABLE SIMILAR TO TABLE SHOWN FOR DETAIL 4 OR COMPLETELY DETAIL DETAIL POST AND SPREAD FOOTING ON THE CONTRACT DRAWINGS.

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAIL 5 REFER TO SHEET 11.
3. FOR DETAIL 6 REFER TO SHEET 12.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GROUND MOUNTED SOUND BARRIERS STEEL POSTS

STEEL PIPE POST DETAILS

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 13 OF 14
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-678M

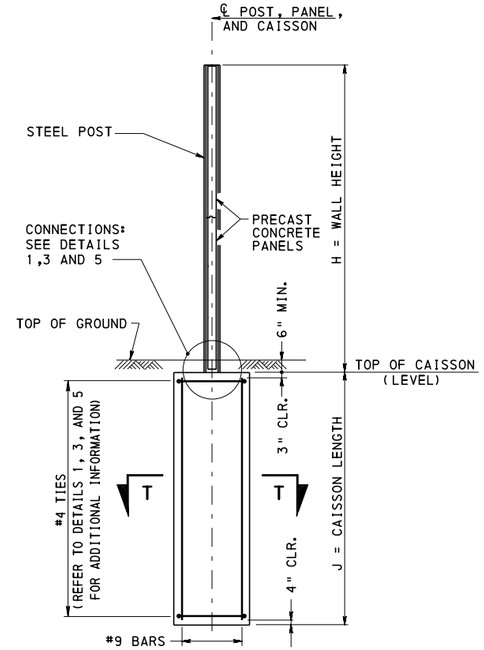
CAISSON LENGTH

WIND PRESSURE = 28 PSF

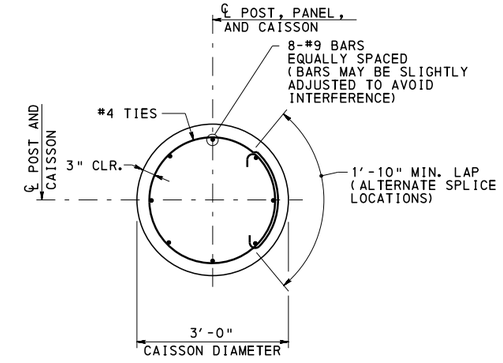
TYPE 1 SOIL SATURATED LOOSE SAND			TYPE 2 SOIL DRY MEDIUM DENSE SAND			TYPE 3 SOIL SATURATED SOFT CLAY			TYPE 4 SOIL DRY MEDIUM STIFF CLAY		
SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 30° 2. C = 0 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. k = 20 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 34° 2. C = 0.0 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 4. K = 90 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 500 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. k = 100 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 1000 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 4. k = 200 LB./CU. IN.		
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)	POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)	POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)	POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	J (FT.)
12.0	6.0	12.0	12.0	6.0	9.0	12.0	6.0	9.5	12.0	6.0	9.0
	8.0	13.0		8.0	9.0		8.0	11.0		8.0	9.0
	10.0	14.5		10.0	10.0		10.0	13.0		10.0	9.0
	12.0	15.5		12.0	10.5		12.0	14.5		12.0	10.0
	14.0	16.5		14.0	11.0		14.0	16.0		14.0	10.5
	16.0	17.5		16.0	11.5		16.0	18.0		16.0	11.5
	18.0	18.5		18.0	12.0		18.0	19.5		18.0	12.5
	20.0	19.0		20.0	12.5		20.0	21.0		20.0	13.5
	22.0	20.0		22.0	13.0		22.0	22.5		22.0	14.5
	24.0	21.0		24.0	13.5		24.0	24.0		24.0	15.0
	26.0	22.0		26.0	14.0		26.0	25.5		26.0	16.0
	28.0	23.0		28.0	14.5		28.0	27.0		28.0	17.0
16.0	6.0	13.0	16.0	6.0	9.0	16.0	6.0	10.5	16.0	6.0	9.0
	8.0	14.0		8.0	9.5		8.0	13.0		8.0	9.0
	10.0	15.5		10.0	10.5		10.0	15.0		10.0	10.0
	12.0	17.0		12.0	11.0		12.0	17.0		12.0	11.0
	14.0	18.0		14.0	12.0		14.0	18.5		14.0	12.0
	16.0	19.0		16.0	12.5		16.0	20.5		16.0	13.0
	18.0	20.0		18.0	13.0		18.0	22.0		18.0	14.0
	20.0	21.0		20.0	13.5		20.0	24.0		20.0	15.0
	22.0	22.0		22.0	14.5		22.0	26.0		22.0	16.0
	24.0	23.5		24.0	15.0		24.0	28.0		24.0	17.0
	26.0	24.5		26.0	15.5		26.0	29.5		26.0	18.0
	28.0	25.5		28.0	16.0		28.0	31.5		28.0	19.0
20.0	6.0	13.5	20.0	6.0	9.5	20.0	6.0	12.0	20.0	6.0	9.0
	8.0	15.5		8.0	10.5		8.0	14.0		8.0	9.5
	10.0	17.0		10.0	11.0		10.0	16.5		10.0	10.5
	12.0	18.0		12.0	12.0		12.0	18.5		12.0	12.0
	14.0	19.0		14.0	12.5		14.0	21.0		14.0	13.0
	16.0	20.5		16.0	13.5		16.0	23.0		16.0	14.5
	18.0	22.0		18.0	14.0		18.0	25.0		18.0	15.5
	20.0	23.5		20.0	14.5		20.0	27.0		20.0	17.0
	22.0	25.0		22.0	15.5		22.0	29.5		22.0	18.0
	24.0	26.5		24.0	16.0		24.0	32.0		24.0	19.0
	26.0	28.0		26.0	16.5		26.0	34.5		26.0	20.0

INSTRUCTIONS FOR DETERMINING CAISSON LENGTHS:

1. DETERMINE REQUIRED POST SPACING AND WALL HEIGHT.
2. DETERMINE SOIL TYPE BASED ON THE INFORMATION SHOWN IN THE ACCEPTED STRUCTURE FOUNDATION GEOTECHNICAL REPORT. SELECT THE SOIL TYPE WHICH HAS A STRENGTH LESS THAN OR EQUAL TO THE ACTUAL SOIL STRENGTH. ALTERNATE CAISSON DESIGNS ARE PERMITTED IF SOIL PROPERTIES DIFFER FROM THOSE INDICATED FOR THE FOUR SOIL TYPES.
3. DETERMINE GROUND WATER LEVEL. IF GROUND WATER IS WITHIN THE CAISSON LENGTH INDICATED IN THE TABLES FOR TYPE 2 AND TYPE 4 SOILS, USE THE CAISSON LENGTH IN THE TABLES FOR TYPE 1 OR TYPE 3 SOILS. IF GROUND WATER IS NOT WITHIN CAISSON LENGTH, USE THE CAISSON LENGTH INDICATED IN THE TABLES FOR TYPE 2 OR TYPE 4 SOILS.
4. MINIMUM CAISSON LENGTH IN SOIL = 9′-0".



ELEVATION



SECTION T-T
CAISSON

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAIL 1 REFER TO SHEET 4.
3. FOR DETAIL 3 REFER TO SHEET 8.
4. FOR DETAIL 5 REFER TO SHEET 11.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD GROUND MOUNTED SOUND BARRIERS STEEL POSTS

CAISSON DESIGN TABLES

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 14 OF 14

BD-678M

CHANGE 2

CHANGE 3

GENERAL NOTES

1. DESIGN SPECIFICATIONS:
   - PENNDOT DESIGN MANUAL, PART 4, STRUCTURES APRIL 2015 EDITION.
   - 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS", INCLUDING THE 1992 AND 2002 INTERIMS.
   - 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION,
   - 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERMINS THROUGH 2006.
   - DESIGN IS IN ACCORDANCE WITH THE WORKING STRESS DESIGN METHOD. (NO INCREASE IN ALLOWABLE UNIT STRESSES ARE PERMITTED EXCEPT FOR GROUP III LOADINGS WHICH PERMITS A 33% OVERSTRESS.)

2. CONSTRUCTION SPECIFICATIONS AND WORK QUALITY:
   - PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5)

3. DESIGN LOADS:
   - WIND LOAD:
     - THE WIND LOAD INCLUDES A GUST FACTOR OF 1.3 AND A DRAG FACTOR OF 1.2 AND IS BASED ON A MAXIMUM 50-YEAR MEAN WIND VELOCITY AT 30'-0" ABOVE THE GROUND SURFACE OF 80 MPH.
     - STRUCTURE MOUNTED SOUND BARRIERS ARE DESIGNED FOR A WIND PRESSURE OF 37 PSF.
   - ICE LOAD: 3 PSF APPLIED TO ONE SIDE OF PANEL AND POST.
   - SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO 0.15.

4. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.

5. PANEL HEIGHTS:
   - BARRIERS MOUNTED ON BRIDGES:
     - 2'-0" MINIMUM TO 10'-0" MAXIMUM
       - PROVIDE A MAXIMUM POST SPACING OF 8'-0" WHEN PANEL HEIGHT IS GREATER THAN 9'-0" AND LESS THAN OR EQUAL TO 10'-0"
     - STACKED PANELS ARE NOT PERMITTED
   - BARRIERS MOUNTED ON RETAINING WALLS AND MOMENT SLABS:
     - 2'-0" MINIMUM TO 9'-0" MAXIMUM
     - PROVIDE STACKED PANELS WHEN THE WALL HEIGHT EXCEEDS 9'-0"

6. PANEL JOINTS:
   - PROVIDE FULL HEIGHT PANELS ON BARRIERS MOUNTED ON BRIDGES.
   - MINIMIZE THE NUMBER OF PANEL JOINTS.
   - PROVIDE UNIFORM STEPS.
   - IF STEPS ARE REQUIRED, THE ELEVATION DIFFERENCE BETWEEN ADJACENT PANELS IS NOT PERMITTED TO BE LESS THAN 6" OR GREATER THAN 2'-0" AND MAY NOT OCCUR MORE FREQUENTLY THAN ONCE EVERY 50'-0" OF WALL LENGTH.

7. PRECAST CONCRETE POSTS ARE NOT PERMITTED FOR STRUCTURE MOUNTED SOUND BARRIERS, PROVIDE STEEL POSTS.

8. STEEL CABLES ARE REQUIRED IN ALL STRUCTURE MOUNTED PRECAST CONCRETE PANELS UNLESS BOTH SIDES OF THE PANEL ARE LOCATED BEYOND THE HORIZONTAL CLEAR ZONE OR IF THE BOTTOM OF PANELS ARE A MINIMUM OF 5'-0" ABOVE THE EDGE OF PAVEMENT. STEEL CABLES ARE ALWAYS REQUIRED IN THE BRIDGE MOUNTED PRECAST CONCRETE PANELS.

9. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN THE PANELS WHERE THE WALL IS WITHIN 14'-0" OF THE EDGE OF TRAFFIC LANE. EPOXY COATED OR GALVANIZED REINFORCEMENT MAY BE REQUIRED IF FUTURE WIDENING IS ANTICIPATED.

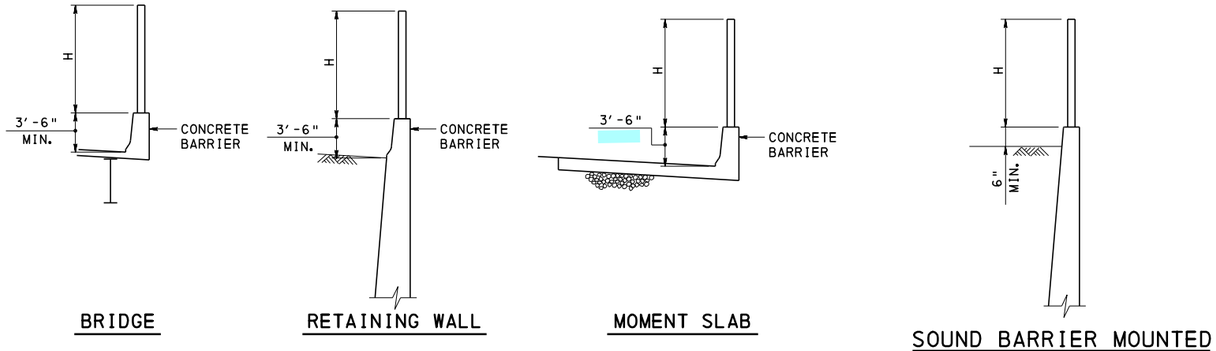
10. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
11. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.
12. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.
13. FOR ADDITIONAL INFORMATION REFER TO BC-779M.

MATERIAL NOTES

1. REFER TO BC-779M FOR MATERIAL NOTES.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE PRECAST CONCRETE PANELS AND STEEL POSTS ARE DEVELOPED FOR A WIND PRESSURE OF 37 PSF.
2. THE INFORMATION SHOWN IN THE TABLES MUST BE USED FOR ALL HEIGHT ZONES.
3. THE DESIGN POST SPACING (CENTER-TO-CENTER POSTS) IS TO BE THE ACTUAL POST SPACING ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST SPACING SHOWN ON THE DESIGN TABLES.
4. THE DESIGN WALL HEIGHT IS TO BE THE ACTUAL WALL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF WALL HEIGHT SHOWN ON THE DESIGN TABLES.
5. THE DESIGN PANEL HEIGHT IS TO BE THE ACTUAL PANEL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF PANEL HEIGHT SHOWN ON THE DESIGN TABLES.



SOUND BARRIER MOUNTED ON CONCRETE BARRIER

SOUND BARRIER MOUNTED ON RETAINING WALL

STRUCTURE MOUNTED SOUND BARRIERS

INDEX OF SHEETS

REFERENCE DRAWINGS

BD-601M	CONCRETE DECK SLAB
BD-618M	VERTICAL WALL CONCRETE BARRIER
BD-622M	R. C. ABUTMENTS WITH BACKWALL
BD-624M	R. C. ABUTMENTS WITHOUT BACKWALL
BD-677M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS
BD-678M	GROUND MOUNTED SOUND BARRIERS STEEL POSTS
BC-734M	ANCHOR SYSTEMS
BC-735M	WALL CONSTRUCTION & EXPANSION JOINT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-752M	CONCRETE DECK SLAB DETAILS
BC-762M	TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE & STEEL BEAM BRIDGES
BC-766M	PREFORMED NEOPRENE COMPRESSION SEAL JOINT FOR APPROACH SLABS
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE & STEEL I-BEAM BRIDGES
BC-776M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS
BC-777M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS
BC-778M	GROUND MOUNTED SOUND BARRIERS STEEL POSTS
BC-779M	STRUCTURE MOUNTED SOUND BARRIER WALLS
BC-799M	MECHANICALLY STABILIZED EARTH RETAINING WALLS
RC-20M	CONCRETE PAVEMENT JOINTS
RC-24M	PAVEMENT RELIEF JOINTS
RC-25M	SHOULDERS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
GENERAL NOTES - 1

RECOMMENDED FEB. 19, 2021
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 19, 2021
Bruce B. Thigpen
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 11

BD-679M

NOTES TO DESIGNER

1. PREPARE CONTRACT DRAWINGS IN ACCORDANCE WITH THE DESIGN MANUAL, PART 4 AND THESE STANDARDS.

2. THE FOLLOWING NOTE MUST BE PLACED ON THE PLANS FOR SIGNATURE BY THE DISTRICT ENVIRONMENTAL MANAGER INDICATING THAT THE PLANS HAVE BEEN REVIEWED AND ACCEPTED:

   THE DISTRICT ENVIRONMENTAL MANAGER HAS REVIEWED AND ACCEPTED THE ACOUSTIC REQUIREMENTS OF THE PROPOSED WALL.

   _____
   DISTRICT ENVIRONMENTAL MANAGER

3. SPECIFY IF THE REINFORCEMENT BARS ARE UNCOATED, EPOXY COATED, OR GALVANIZED.

4. SPECIFY IF THE WELDED WIRE FABRIC IS UNCOATED, EPOXY COATED, OR GALVANIZED.

5. PROVIDE A CONSTANT POST SPACING FOR THE ENTIRE LENGTH OF WALL. THE CONSTANT POST SPACING MAY BE INTERRUPTED TO MISS EXPANSION JOINTS, CONSTRUCTION JOINTS, AND/OR ANY OTHER PHYSICAL FEATURES. VARIATIONS MUST BE ACCEPTED BY THE DISTRICT BRIDGE ENGINEER.

6. INDICATE IF STEEL CABLES ARE REQUIRED IN THE PRECAST CONCRETE PANELS. (SEE GENERAL NOTE 8, ON SHEET 1) REFER TO BC-779M FOR DETAILS.

7. INDICATE IF LOW-DENSITY (LIGHTWEIGHT) CONCRETE IS REQUIRED IN THE PRECAST CONCRETE PANELS.

8. INDICATE IF THE TOP OF PANELS ARE STEPPED OR SLOPED. SLOPED PANELS ARE THE PREFERRED OPTION FOR MOST ARCHITECTURAL SURFACE TREATMENTS.

9. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE CONTRACT DRAWINGS IF APPLICABLE:
   - OVERALL WALL LENGTH
   - HORIZONTAL GEOMETRY
   - VERTICAL GEOMETRY
   - ACOUSTIC PROFILE ELEVATIONS
   - EXISTING GROUND LINE ELEVATIONS
   - FINISHED GROUND ELEVATIONS
   - TOP OF BARRIER / WALL ELEVATIONS
   - POST SPACINGS
   - GENERAL NOTES
   - DETAILS
   - REINFORCEMENT BAR SCHEDULE FOR ALL CAST-IN-PLACE CONCRETE
   - ANY OTHER INFORMATION REQUIRED TO CONSTRUCT THE SOUND BARRIER WALL

10. PROVIDE FIRE HYDRANT OPENINGS OR OTHER HIGHWAY ACCESS AS REQUIRED IN THE PRECAST CONCRETE PANELS. PROVIDE REINFORCEMENT AROUND OPENINGS IN ACCORDANCE WITH DETAILS SHOWN ON BC-776M TO PRECLUDE CRACKING.

11. INDICATE IF THE ARCHITECTURAL SURFACE TREATMENT TOLERANCES AS SPECIFIED IN PUBLICATION 408, SECTION 1086.3 ARE APPLICABLE.

12. THE FOLLOWING INFORMATION MUST BE SPECIFIED ON THE CONTRACT DRAWINGS OR INDICATED IN THE CONTRACT SPECIAL PROVISIONS:
    - ARCHITECTURAL SURFACE TREATMENTS ON THE RESIDENTIAL AND ROADWAY SIDES OF THE PRECAST CONCRETE SOUND BARRIER PANELS. INDICATE THE MINIMUM, MAXIMUM, AND AVERAGE DEPTHS.
    - COLOR OF THE INTEGRAL PIGMENTATION FOR PRECAST CONCRETE SOUND BARRIER PANELS.
    - COLOR OF JOINT SEALANT AND/OR CAULKING COMPOUND, NON-SHRINK GROUT, AND ANTIGRAFFITI COATING.
    - LIMITS OF ANTIGRAFFITI COATING.
    - PAINT COLOR OF STEEL COMPONENTS.

13. PROVIDE FEDERAL COLOR NUMBERS IN ACCORDANCE WITH FEDERAL STANDARD NUMBER 595A OR 595B.

14. PREPARE DESIGN CALCULATIONS CONSIDERING THE ADDITIONAL LOADS ON THE BEAMS/GIRDERS DUE TO THE BRIDGE MOUNTED SOUND BARRIER.

15. PREPARE DESIGN CALCULATIONS CONSIDERING THE ADDITIONAL LOADS ON THE MOMENT SLAB DUE TO THE MOMENT SLAB MOUNTED SOUND BARRIER.

16. PREPARE DESIGN CALCULATIONS CONSIDERING THE ADDITIONAL LOADS ON THE RETAINING WALL DUE TO THE RETAINING WALL MOUNTED SOUND BARRIER.

17. PROVIDE COMPLETE DETAILS AND DESIGN WHERE AN EXPANSION PANEL IS REQUIRED.

18. PROVIDE COMPLETE DETAILS WHERE A GROUND MOUNTED SOUND BARRIER IS CONNECTED TO A STRUCTURE MOUNTED SOUND BARRIER.

19. DESIGN COMPUTATIONS AND DETAILS ARE REQUIRED FOR ANY PORTION OF THE STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THIS STANDARD.

20. SPECIFY IF A SOUND ABSORPTIVE CONCRETE FACING IS REQUIRED ON THE FACE OF THE PRECAST CONCRETE PANELS. SOUND ABSORPTIVE PANELS MUST BE APPROVED, PRIOR TO BIDDING, BY THE DEPARTMENT USING THE NEW PRODUCT EVALUATION PROCESS. DESIGNER MUST PREPARE DESIGN CALCULATIONS FOR THE SUPPORTING COMPONENTS DUE TO THE INCREASED PANEL WEIGHT.

21. IF NEEDED DETAILS ARE NOT FOUND IN THE SOUND BARRIER STANDARDS A SPECIAL SUBMISSION REQUESTING APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.

DESIGN PARAMETERS

1. PRECAST CONCRETE PANELS:
   - PANELS ARE DESIGNED FOR NORMAL DENSITY (WEIGHT) CONCRETE AND LOW-DENSITY (LIGHTWEIGHT) CONCRETE AS INDICATED IN THE PANEL REINFORCEMENT TABLES.
     - USE LOW-DENSITY (LIGHTWEIGHT) CONCRETE PANELS FOR SOUND BARRIERS MOUNTED ON BRIDGES WHEN REQUIRED IN ACCORDANCE WITH BD-601M, SHEET 1, NOTE 25.
     - DESIGNER TO INDICATE IF LOW-DENSITY (LIGHTWEIGHT) CONCRETE IS REQUIRED ON THE CONTRACT DRAWINGS.
   - PANELS ARE DESIGNED FOR A WIND PRESSURE EQUAL TO 37 PSF.
   - PANELS ARE DESIGNED USING A 5 INCH STRUCTURAL THICKNESS.
   - PANELS ARE DESIGNED FOR THE ADDITIONAL CONCRETE WEIGHT OF 1½" TO ACCOUNT FOR ARCHITECTURAL SURFACE TREATMENTS.
     - THE AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0 TO 1½" BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 1½".
     - DESIGN CALCULATIONS ARE REQUIRED FOR PANELS WHICH HAVE A TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT GREATER THAN 1½".
   - PANELS ARE DESIGNED AS SIMPLY SUPPORTED BEAMS SPANNING BETWEEN POSTS.
   - PANELS ARE DESIGNED USING A 1'-0" STRIP WIDTH.
   - PANELS ARE DESIGNED FOR THE FOLLOWING IN ACCORDANCE WITH THE PCI DESIGN HANDBOOK, 5TH EDITION, 1999.
     - PANELS ARE DESIGNED FOR STRIPPING FORCES CAUSED BY FORM SUCTION AND IMPACT WHEN THE PANELS ARE STRIPPED FROM THE FORMS IN ACCORDANCE WITH SECTION 5.2.3 AND TABLE 5.2.1 USING AN EQUIVALENT STATIC LOAD MULTIPLIER EQUAL TO 1.50.
       - PROVIDE A MINIMUM CONCRETE STRENGTH, AT TIME OF STRIPPING, EQUAL TO 4,000 PSI.
     - PANEL THICKNESS AND REINFORCING, FOR PANELS LESS THAN OR EQUAL TO 9'-0", IS DESIGNED FOR STRIPPING AND LIFTING AT TOP OF PANEL USING A TWO-POINT PICKUP OR FOUR-POINT PICKUP IN ACCORDANCE WITH FIGURE 5.2.4.
     - PANEL THICKNESS AND REINFORCING, FOR PANELS GREATER THAN 9'-0" AND LESS THAN OR EQUAL TO 10'-0", IS DESIGNED FOR STRIPPING AND LIFTING AT TOP OR SIDE OF PANEL USING A TWO-POINT OR FOUR-POINT PICKUP IN ACCORDANCE WITH FIGURE 5.2.4.
     - PANELS ARE DESIGNED FOR TRANSPORTATION IN ACCORDANCE WITH SECTION 5.2.11 AND TABLE 5.2.1 USING AN EQUIVALENT STATIC LOAD MULTIPLIER EQUAL TO 1.50.
     - THE FLEXURAL TENSILE STRESSES IN THE CONCRETE ARE CALCULATED USING THE UNCRACKED GROSS SECTION BASED ON THE STRUCTURAL THICKNESS. THE STRESSES ARE COMPARED AGAINST THE MODULUS OF RUPTURE REDUCED BY A SAFETY FACTOR OF 1.50 IN ACCORDANCE WITH SECTION 5.2.4.1.
   - PANELS ARE NOT DESIGNED FOR TRAFFIC IMPACT LOADING.

2. STEEL SOUND BARRIER POSTS:
   - POSTS ARE DESIGNED AS VERTICAL CANTILEVER BEAMS.
   - POSTS ARE DESIGNED FOR A WIND PRESSURE EQUAL TO 37 PSF.
   - MAXIMUM PERMITTED POST DEFLECTION EQUALS POST HEIGHT (H) IN INCHES DIVIDED BY 360.
   - POSTS AND CONNECTIONS ARE NOT DESIGNED FOR TRAFFIC IMPACT LOADING.

3. ANCHOR BOLTS:
   - ANCHOR BOLTS ARE DESIGNED IN ACCORDANCE WITH SECTION 5.17 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
   - MINIMUM ANCHOR BOLT EMBEDMENT LENGTH IS CALCULATED BASED ON THE DEVELOPMENT LENGTH OF A HOOKED BAR IN TENSION (WITHOUT ANY MODIFICATION FACTORS). REFER TO SECTION 8.29 IN THE 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.
   - THE ANCHOR BOLT EMBEDMENT LENGTH MUST EXTEND TO A DEPTH WHERE THE BARRIER/WALL REINFORCEMENT IS FULLY DEVELOPED. DESIGNER MUST INCREASE EMBEDMENT LENGTH AS REQUIRED.

4. BASE PLATES:
   - BASE PLATES ARE DESIGNED FOR BENDING DUE TO APPLIED BOLTS FORCES, COMPRESSION AND TENSION.
   - BASE PLATES ARE NOT DESIGNED TO SUPPORT THE VERTICAL LOAD OF THE PRECAST CONCRETE PANELS EVEN THOUGH THE PANEL RESTS ON THE BASE PLATE. THE REASON FOR THIS IS THAT THE PANEL IS CONTINUOUSLY SUPPORTED ON TOP OF THE BARRIER OR RETAINING WALL, THUS THE BASE PLATE IS NOT INDUCED TO ANY ADDITIONAL LOADING.
   - BASE PLATE THICKNESS IS DETERMINED USING THE ALLOWABLE BENDING STRESS IN ACCORDANCE WITH SECTION 5.8 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING THE 2002 AND 2003 INTERIMS.
   - BASE PLATE IS SUPPORTED ON THE LEVELING NUTS. THE NON-SHRINK GROUT IS NOT CONSIDERED AS A LOAD-CARRYING ELEMENT.
   - EDGE DISTANCE OF ANCHOR BOLTS:
     - THE CLEAR DISTANCE BETWEEN THE EDGE OF HOLES AND EDGES OF THE BASE PLATE SHALL NOT BE LESS THAN THE DIAMETER OF THE ANCHOR BOLT WHEN OVER SIZE OR SLOTTED HOLES ARE SPECIFIED.

ARCHITECTURAL SURFACE TREATMENTS

1. THE FOLLOWING ARCHITECTURAL SURFACE TREATMENTS ARE PERMITTED ON THE FACE OF THE PRECAST CONCRETE PANELS AND ARE TO BE INDICATED ON THE CONTRACT DRAWINGS AND/OR IN THE CONTRACT SPECIAL PROVISIONS IF REQUIRED:
   - NON-FORM LINER FINISHES:
     - SMOOTH FINISH
     - BROOMED FINISH
     - FUZZY OR RAKED FINISH (PERMITTED ON ONE SIDE ONLY)
     - EXPOSED AGGREGATE
   - FORM LINER FINISHES:
     - ASHLAR STONE
     - CUT STONE
     - FRACTURE FIN
     - GRAPE STAKE
     - SHIP LAP
     - ANY OTHER TREATMENT PERMITTED BY THE DEPARTMENT

2. THE AVERAGE ARCHITECTURAL SURFACE TREATMENT, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0" TO 1½", BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 1½" UNLESS OTHERWISE INDICATED ON THE CONTRACT DRAWINGS.

3. AVOID USING FORM LINER FINISHES ON BOTH SIDES OF THE PRECAST CONCRETE PANELS. A FORM LINER FINISH, ON ONE SIDE OF THE PANEL, ALONG WITH A STAMPED FINISH, ON THE OTHER SIDE OF THE PANEL, IS PERMITTED.

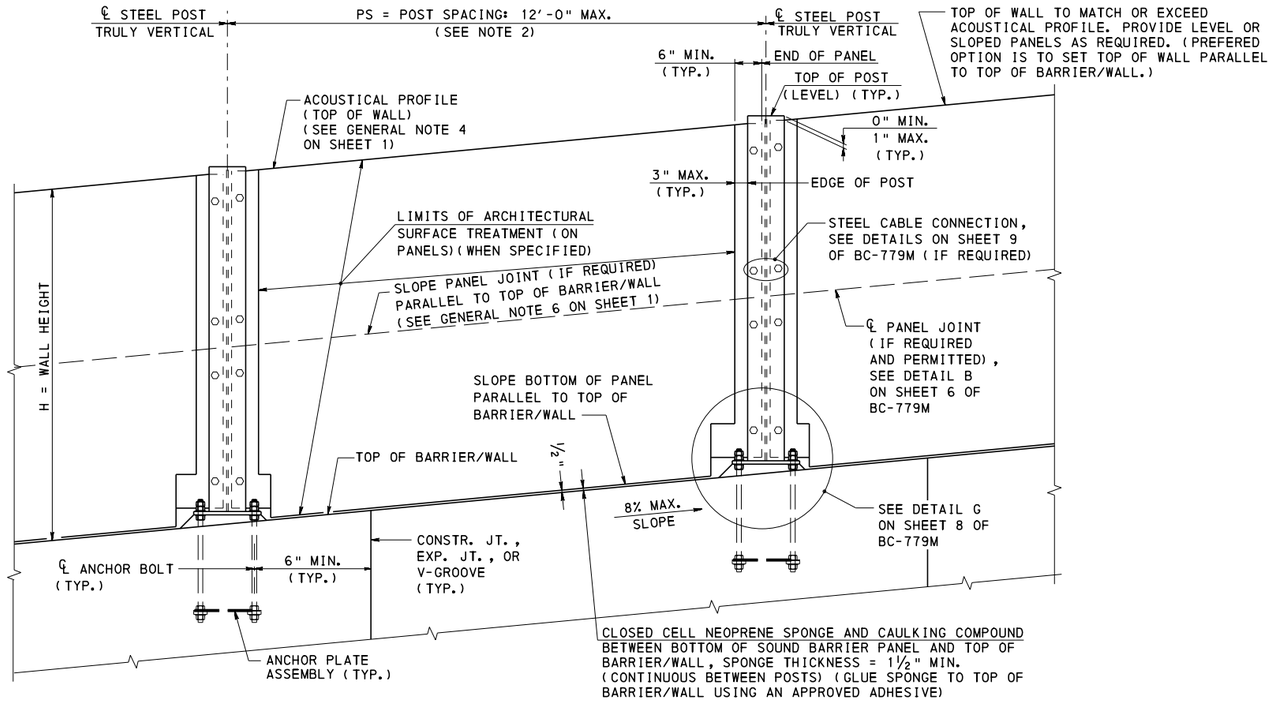
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

STRUCTURE MOUNTED SOUND BARRIER WALLS

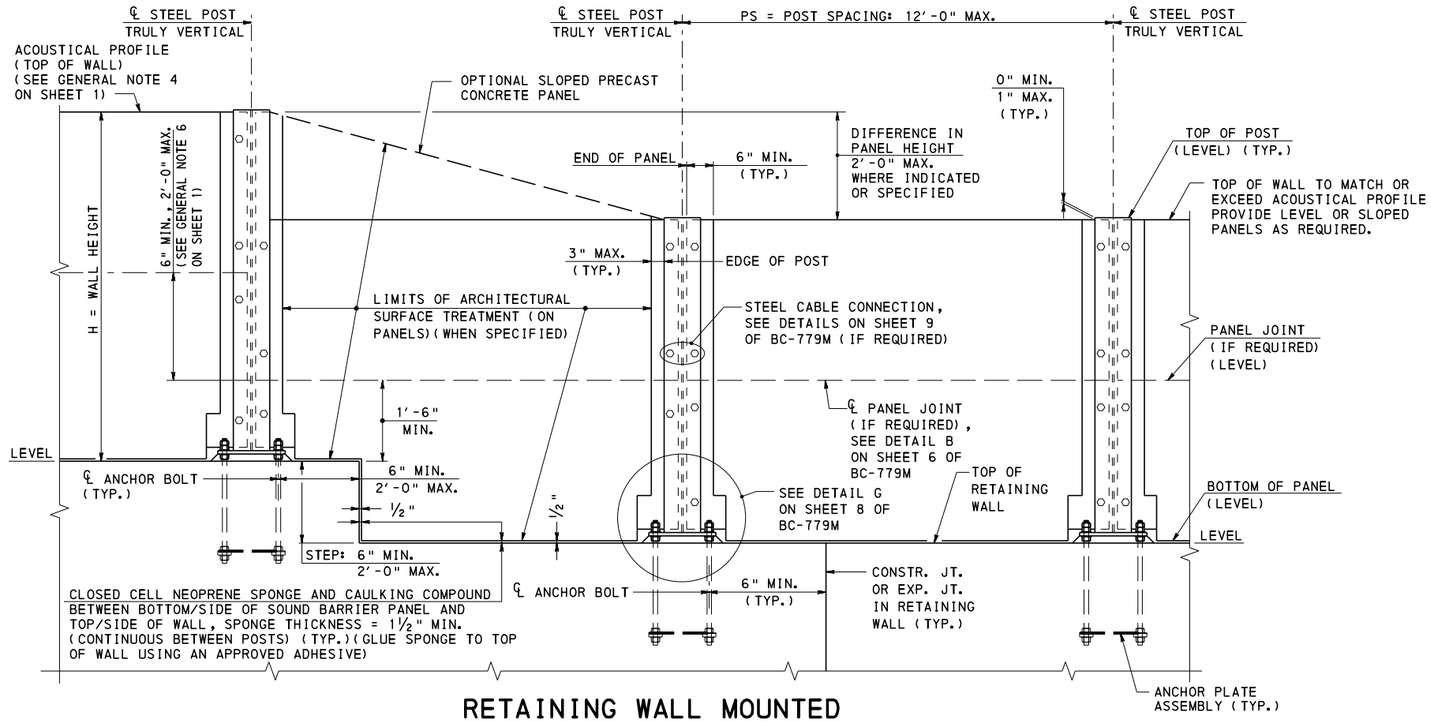
GENERAL NOTES - 2

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 2 OF 11
Thomas P. Macioce CHIEF BRIDGE ENGINEER	Bruce B. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	BD-679M



BARRIER MOUNTED/RETAINING WALL MOUNTED SOUND BARRIER ELEVATION

(TOP OF BARRIER/WALL SLOPED)



RETAINING WALL MOUNTED SOUND BARRIER ELEVATION (STEPPED ALTERNATE)

(TOP OF WALL LEVEL)

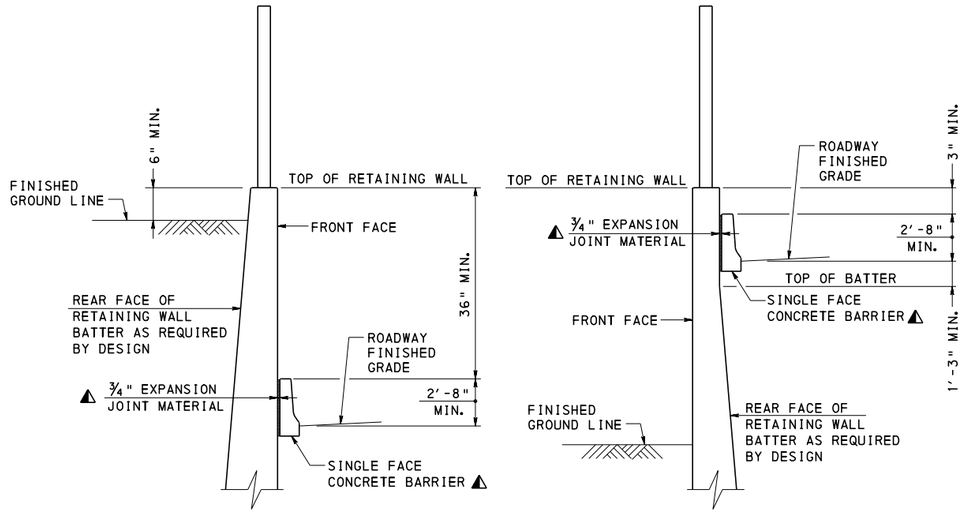
NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. MAXIMUM POST SPACING IS 8'-0" FOR BRIDGE MOUNTED SOUND BARRIER WHEN PANEL HEIGHT IS GREATER THAN 9'-0" AND LESS THAN OR EQUAL TO 10'-0".

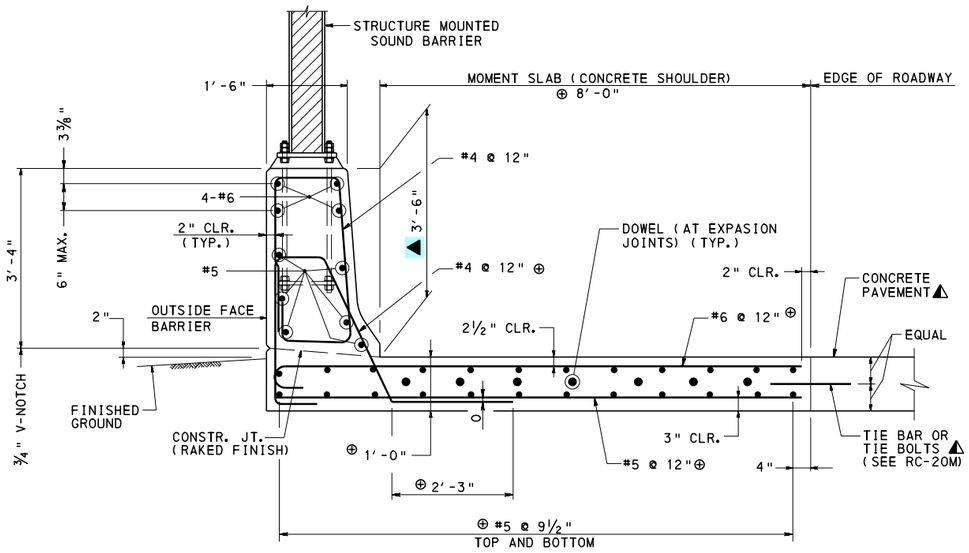
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
GEOMETRY AND LAYOUT

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 3 OF 11
Thomas P. Macioce	Bruce B. Thyssen	BD-679M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	



PROTECTION OF RETAINING WALLS WITH ROADWAY BARRIER



TYPICAL C.I.P. MOMENT SLAB AND BARRIER SECTION

STRUCTURE MOUNTED SOUND BARRIER DIMENSION TABLE

WIND PRESSURE =

POST					BASE PLATE				ANCHOR BOLTS		ANCHOR PLATES			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	STEEL POST SIZE	POST HEIGHT PH1 (FT.)	THICKNESS t (IN.)	LENGTH Q (IN.)	WIDTH w (IN.)	F (IN.)	DIAMETER D (IN.)	EMBEDMENT LENGTH S (IN.)	LENGTH Q1 (IN.)	F1 (IN.)	SLOPE AT POST	GROUT DEPTH AT CL POST GD (IN.)

DIMENSION TABLE NOTES:

1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.

LEGEND:

- ◭ ROADWAY ITEM
- ⊕ MIN. SIZE SHOWN, PROVIDE SIZE REQUIRED PER DESIGN
- ▲ 45" F-SHAPE CONCRETE BARRIER NOT PERMITTED ON MOMENT SLAB.

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.

MOMENT SLAB NOTES:

1. DESIGNER MUST INCLUDE ALL DETAILS REQUIRED FOR THE MOMENT SLAB AND BARRIER ON THE CONTRACT DRAWINGS.
2. FOR ADDITIONAL MOMENT SLAB DETAILS, REFER TO BC-799M.
3. CONCRETE SHOULDER SHOWN, ASPHALT-PAVED SHOULDER SIMILAR, REFER TO BD-627M AND BC-799M FOR ADDITIONAL DETAILS.
4. FOR CONCRETE SHOULDER AT GRADE, CONSTRUCT ROADWAY PAVEMENT PRIOR TO THE MOMENT SLAB, BARRIER, AND SOUND BARRIER WALL.

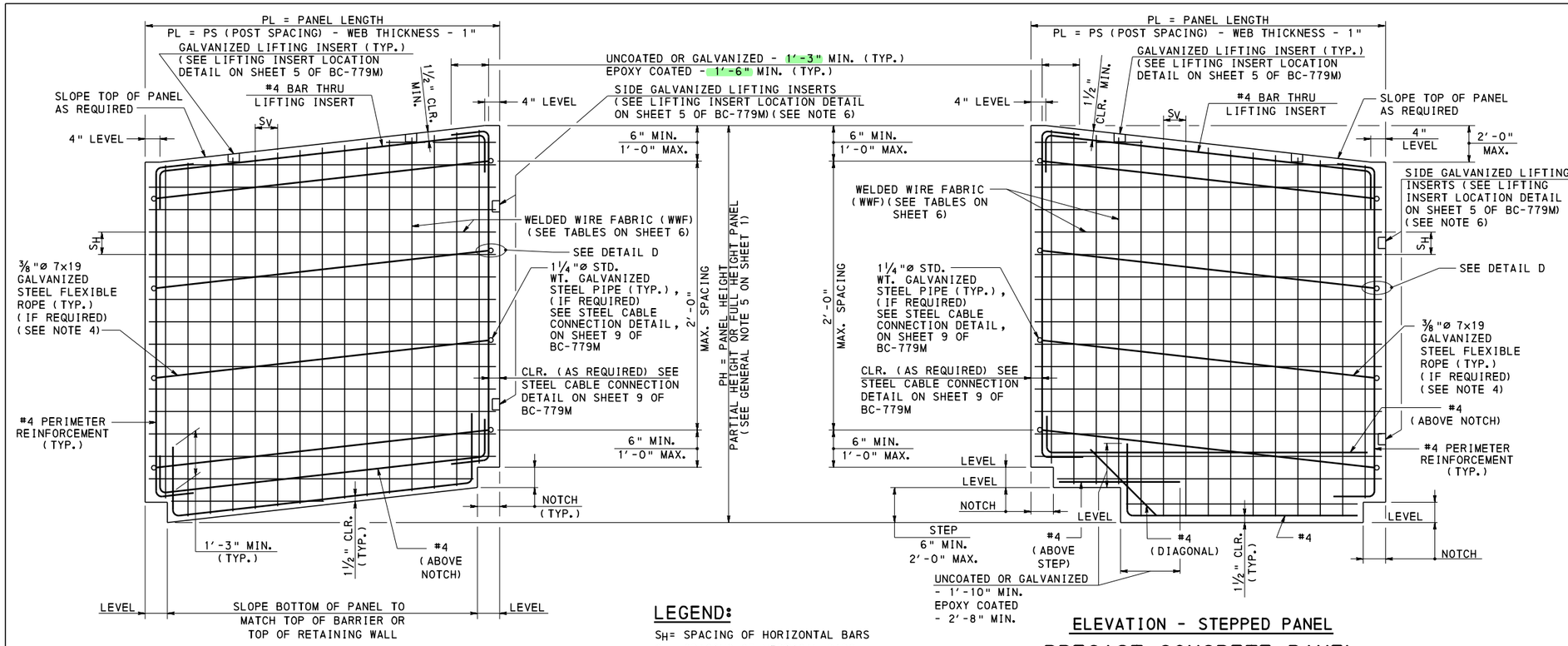
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
MISCELLANEOUS DETAILS

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 4 OF 11
Thomas A. Maciora	Bruce E. Thigpen	BD-679M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	

ELEVATION - SLOPE PANEL

PRECAST CONCRETE PANEL



ELEVATION - STEPPED PANEL

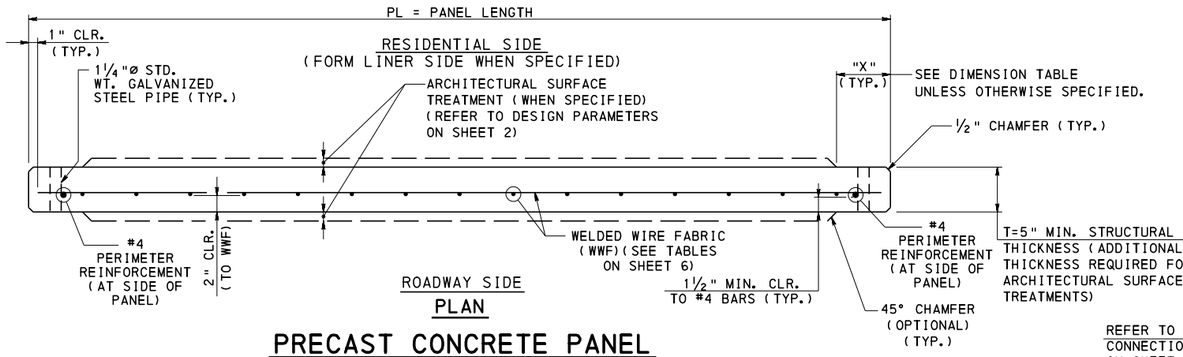
PRECAST CONCRETE PANEL

DIMENSION TABLE	
POST SIZE	X
W8x48	6"
W10x68	6½"
W10x88	6½"

LEGEND:

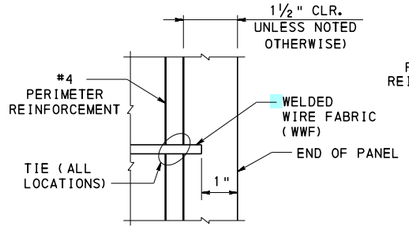
S_H= SPACING OF HORIZONTAL BARS

S_V= SPACING OF VERTICAL BARS

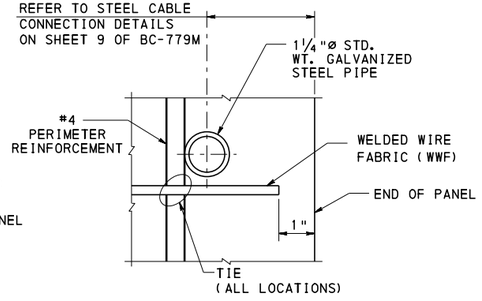


PLAN

PRECAST CONCRETE PANEL



DETAIL D (WITHOUT CABLE CONNECTION)



DETAIL D WITH CABLE CONNECTION

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. DESIGNER TO DETERMINE NOTCH DIMENSIONS BASED ON BASE PLATE DIMENSIONS, GROUT THICKNESS, AND GROUT LENGTH. REFER TO DETAIL G ON SHEET 8 OF BC-779M.
3. IF STACKED PANELS ARE REQUIRED REFER TO DETAIL B ON SHEET 6 OF BC-779M.
4. STEEL ROPE IS PERMITTED TO BE LEVEL OR SLOPED. PROVIDE LEVEL STEEL ROPE IF BOTH TOP AND BOTTOM OF PANEL IS LEVEL.
5. DESIGNER TO SPECIFY THE WELDED WIRE FABRIC REQUIREMENTS, INCLUDING THE AREA OF STEEL, AND THE MINIMUM NUMBER OF LIFTING INSERTS REQUIRED FOR ALL PANEL SIZES AS REQUIRED ON THE CONTRACT DRAWINGS. INFORMATION IS PERMITTED TO BE IN TABLE FORM SIMILAR TO THE TABLES SHOWN.
6. LIFTING INSERTS ARE REQUIRED ON THE SIDE OF THE CONCRETE PANEL FOR STRIPPING WHEN THE PANEL HEIGHT IS GREATER THAN 9'-0" AND LESS THAN OR EQUAL TO 10'-0".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
PRECAST CONCRETE PANEL DETAILS - 1

RECOMMENDED FEB. 19, 2021
Thomas A. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 19, 2021
Bruce E. Thigpen
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 5 OF 11

BD-679M

PRECAST CONCRETE PANEL REINFORCEMENT FOR LIGHT WEIGHT CONCRETE (115 LB./CU.FT.)

WIND PRESSURE = 37 PSF

POST SPACING PS (FT.)	PANEL HEIGHT PH (FT.)	WELDED WIRE FABRIC ** WWF AxB-WCxWD	WELDED WIRE STEEL AREA (IN²/FT)		MIN. NUMBER OF LIFTING INSERTS
			HORIZONTAL	VERTICAL	
6.0	2.0	WWF 6x6-W4xW4	0.08	0.08	2
	4.0	WWF 6x6-W4xW4	0.08	0.08	2
	6.0	WWF 6x6-W4xW8	0.08	0.16	2
	8.0	WWF 6x4-W4xW8	0.08	0.24	2
	9.0	WWF 6x4-W4xW12	0.08	0.36	2
8.0	2.0	WWF 6x6-W4xW4	0.08	0.08	2
	4.0	WWF 6x6-W4xW4	0.08	0.08	2
	6.0	WWF 6x6-W4xW8	0.08	0.16	2
	8.0	WWF 6x4-W4xW8	0.08	0.24	2
	9.0	WWF 6x4-W4xW12	0.08	0.36	2
10.0	2.0	WWF 4x6-W4xW4	0.12	0.08	2
	4.0	WWF 4x6-W4xW4	0.12	0.08	2
	6.0	WWF 4x6-W4xW8	0.12	0.16	2
	8.0	WWF 4x4-W4xW8	0.12	0.24	2
	9.0	WWF 4x4-W4xW12	0.12	0.36	2
12.0	2.0	WWF 4x6-W8xW4	0.24	0.08	2
	4.0	WWF 4x6-W8xW4	0.24	0.08	2
	6.0	WWF 4x6-W8xW8	0.24	0.16	2
	8.0	WWF 4x4-W8xW8	0.24	0.24	2
	9.0	WWF 4x4-W8xW12	0.24	0.36	2

PRECAST CONCRETE PANEL REINFORCEMENT FOR NORMAL WEIGHT CONCRETE (150 LB./CU.FT.)

WIND PRESSURE = 37 PSF

POST SPACING PS (FT.)	PANEL HEIGHT PH (FT.)	WELDED WIRE FABRIC ** WWF AxB-WCxWD	WELDED WIRE STEEL AREA (IN²/FT)		MIN. NUMBER OF LIFTING INSERTS
			HORIZONTAL	VERTICAL	
6.0	2.0	WWF 6x6-W4xW4	0.08	0.08	2
	4.0	WWF 6x6-W4xW4	0.08	0.08	2
	6.0	WWF 6x6-W4xW8	0.08	0.16	2
	8.0	WWF 6x4-W4xW12	0.08	0.36	2
	9.0	WWF 6x4-W4xW12	0.08	0.36	2
8.0	2.0	WWF 4x6-W4xW4	0.12	0.08	2
	4.0	WWF 4x6-W4xW4	0.12	0.08	2
	6.0	WWF 4x6-W4xW8	0.12	0.16	2
	8.0	WWF 4x4-W4xW12	0.12	0.36	2
	9.0	WWF 4x4-W4xW12	0.12	0.36	2
10.0	2.0	WWF 6x6-W8xW4	0.16	0.08	2
	4.0	WWF 6x6-W8xW4	0.16	0.08	2
	6.0	WWF 6x6-W8xW8	0.16	0.16	2
	8.0	WWF 6x4-W8xW12	0.16	0.36	2
	9.0	WWF 6x4-W8xW12	0.16	0.36	2
12.0	2.0	WWF 4x6-W8xW4	0.24	0.08	2
	4.0	WWF 4x6-W8xW4	0.24	0.08	2
	6.0	WWF 4x6-W8xW8	0.24	0.16	2
	8.0	WWF 4x4-W8xW12	0.24	0.36	2
	9.0	WWF 4x4-W8xW12	0.24	0.36	4

** WWF AxB-WCxWD

WHERE A = SPACING OF HORIZONTAL BARS (S_H)
B = SPACING OF VERTICAL BARS (S_V)
C = HORIZONTAL WIRE SIZE
D = VERTICAL WIRE SIZE
WWF = WELDED WIRE FABRIC

BRIDGE MOUNTED PRECAST CONCRETE PANELS PANEL HEIGHT GREATER THAN 9'-0" AND LESS THAN OR EQUAL TO 10'-0"

1. IN ORDER TO PROVIDE A SINGLE PANEL HEIGHT GREATER THAN 9'-0" AND LESS THAN OR EQUAL TO 10'-0" THE POST SPACING MUST NOT EXCEED 8'-0" FOR THE BRIDGE MOUNTED BARRIER. (STACKED PANELS ARE NOT PERMITTED.)

2. PRECAST CONCRETE PANEL REINFORCEMENT:
   - PROVIDE THE FOLLOWING WELDED WIRE FABRIC IN THE PRECAST CONCRETE PANEL FOR NORMAL DENSITY (WEIGHT) AND LOW-DENSITY (LIGHTWEIGHT) CONCRETE WITH A POST SPACING LESS THAN OR EQUAL TO 8'-0":
     - WWF 4x4-W12xW12
       - AREA OF STEEL:
         - HORIZONTAL = 0.36 IN²/FT
         - VERTICAL = 0.36 IN²/FT

3. LIFTING INSERTS:
   - PROVIDE A MINIMUM OF TWO LIFTING INSERTS ON THE SIDE OF THE PANEL FOR STRIPPING.
   - PROVIDE A MINIMUM OF TWO LIFTING INSERTS ON THE TOP OF THE PANEL FOR ERECTION.
   - REFER TO SHEET 5 OF BC-779M FOR LOCATIONS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

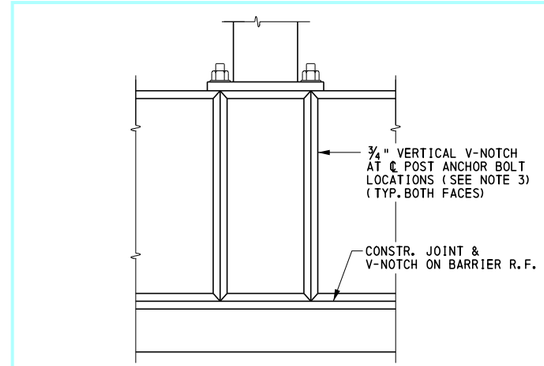
STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
PRECAST CONCRETE PANEL DETAILS - 2

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 6 OF 11
Thomas P. Macioce	Bruce B. Thigpen	BD-679M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	

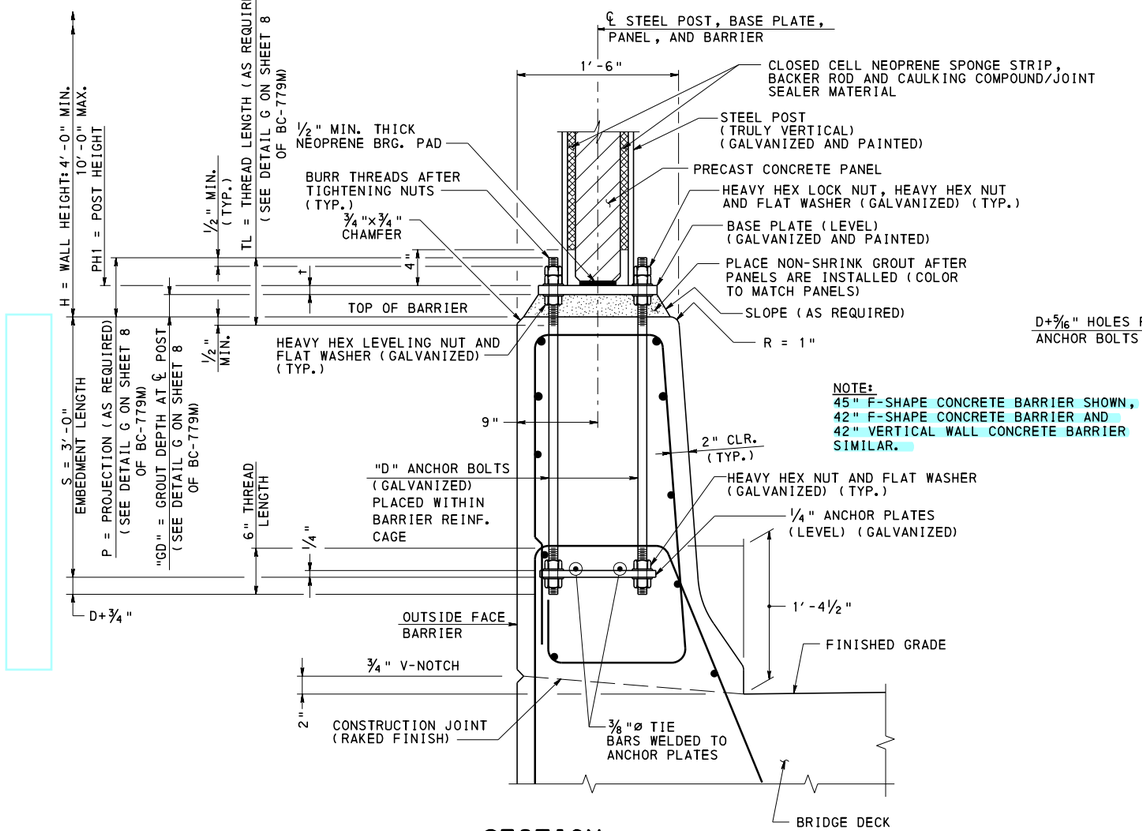
BARRIER MOUNTED SOUND BARRIER ON BRIDGES

STEEL POST, BASE PLATE, ANCHOR BOLT, AND ANCHOR PLATE GEOMETRY
WIND PRESSURE = 37 PSF

POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	BASE PLATE				ANCHOR BOLTS	ANCHOR PLATES	
			t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	Q1 (IN.)	F1 (IN.)
6.0	6.0	W8×48	1	13½	16	2⅛	1¼	11¾	1¼
	8.0	W8×48	1⅛	14	18	2½	1½	12	1½
	10.0	W8×48	1⅜	14	18	2½	1½	12	1½
8.0	6.0	W8×48	1	13½	16	2⅛	1¼	11¾	1¼
	8.0	W8×48	1¼	14	18	2½	1½	12	1½
	10.0	W8×48	1⅝	14½	19	2⅞	1¾	12¼	1¾
10.0	6.0	W8×48	1⅛	14	18	2½	1½	12	1½
	8.0	W8×48	1½	14½	19	2⅞	1¾	12¼	1¾
	9.0	W8×48	1¾	14½	19	2⅞	1¾	12¼	1¾
12.0	6.0	W8×48	1⅛	14	18	2½	1½	12	1½
	8.0	W8×48	1½	14½	19	2⅞	1¾	12¼	1¾

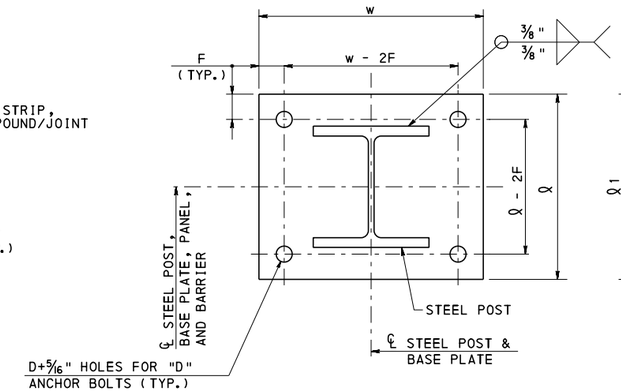


VERTICAL V-NOTCH DETAIL
(BARRIER REAR FACE SHOWN, FRONT FACE SIMILAR)

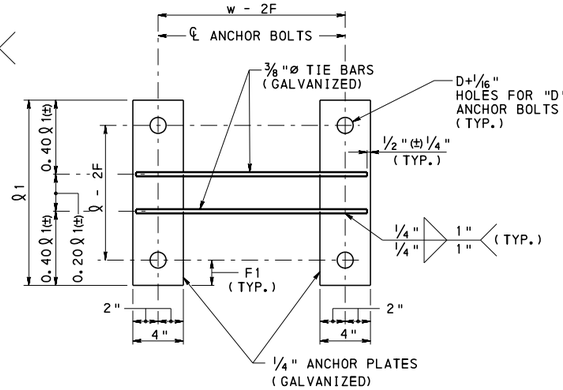


SECTION

NOTE:
45" F-SHAPE CONCRETE BARRIER SHOWN, 42" F-SHAPE CONCRETE BARRIER AND 42" VERTICAL WALL CONCRETE BARRIER SIMILAR.



PLAN - BASE PLATE



PLAN - ANCHOR PLATE ASSEMBLY

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. REFER TO SHEET 4 FOR DIMENSION TABLE TO BE SHOWN ON THE CONTRACT DRAWINGS.
3. PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL THIS SHEET.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

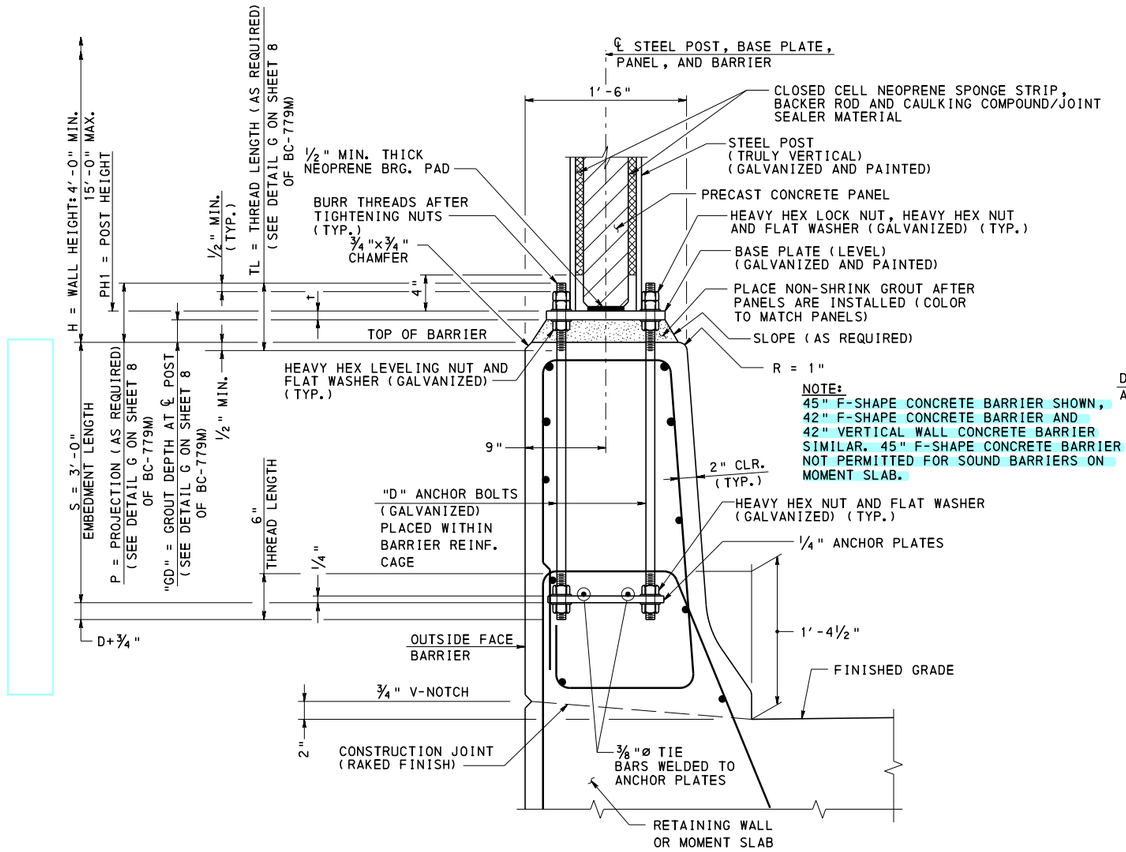
STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
BARRIER MOUNTED ON BRIDGES
DESIGN TABLES AND DETAILS

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 7 OF 11
Thomas P. Macioce	Bruce B. Thigpen	
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	BD-679M

BARRIER MOUNTED SOUND BARRIER ON RETAINING WALLS OR MOMENT SLABS

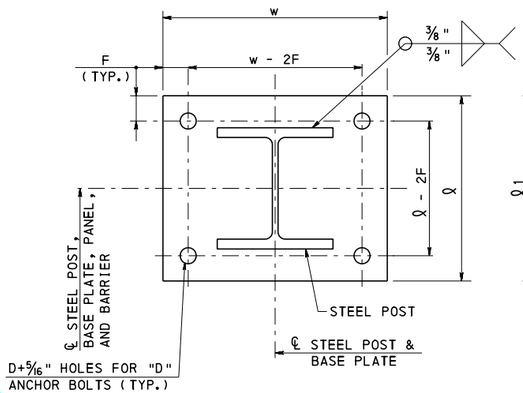
STEEL POST, BASE PLATE, ANCHOR BOLT, AND ANCHOR PLATE GEOMETRY WIND PRESSURE = 37 PSF

POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	BASE PLATE				ANCHOR BOLTS	ANCHOR PLATES	
			† (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	Q1 (IN.)	F1 (IN.)
6.0	6.0	W8x48	3/4	12 3/4	15	1 5/8	1	11 1/2	1
	8.0	W8x48	1	13 1/2	16	2 1/8	1 1/4	11 3/4	1 1/4
	10.0	W8x48	1 1/8	13 1/2	16	2 1/8	1 1/4	11 3/4	1 1/4
	12.0	W8x48	1 3/8	14	18	2 1/2	1 1/2	12	1 1/2
	14.0	W8x48	1 1/2	14 1/2	19	2 7/8	1 3/4	12 1/4	1 3/4
	15.0	W8x48	1 5/8	14 1/2	19	2 7/8	1 3/4	12 1/4	1 3/4
8.0	6.0	W8x48	3/4	13 1/2	16	2 1/8	1 1/4	11 3/4	1 1/4
	8.0	W8x48	1	13 1/2	16	2 1/8	1 1/4	11 3/4	1 1/4
	10.0	W8x48	1 1/4	14	18	2 1/2	1 1/2	12	1 1/2
	12.0	W8x48	1 1/2	14 1/2	19	2 7/8	1 3/4	12 1/4	1 3/4
	13.0	W8x48	1 3/4	14 1/2	19	2 7/8	1 3/4	12 1/4	1 3/4
10.0	6.0	W8x48	7/8	13 1/2	16	2 1/8	1 1/4	11 3/4	1 1/4
	8.0	W8x48	1 1/8	14	18	2 1/2	1 1/2	12	1 1/2
	10.0	W8x48	1 3/8	14	18	2 1/2	1 1/2	12	1 1/2
	12.0	W8x48	1 3/4	14 1/2	19	2 7/8	1 3/4	12 1/4	1 3/4
12.0	6.0	W8x48	7/8	13 1/2	16	2 1/8	1 1/4	11 3/4	1 1/4
	8.0	W8x48	1 1/4	14	18	2 1/2	1 1/2	12	1 1/2
	10.0	W8x48	1 1/2	14 1/2	19	2 7/8	1 3/4	12 1/4	1 3/4
	11.0	W8x48	1 3/4	14 1/2	19	2 7/8	1 3/4	12 1/4	1 3/4

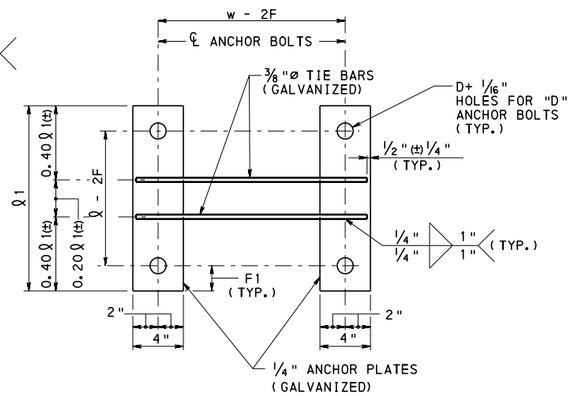


NOTE:
45" F-SHAPE CONCRETE BARRIER SHOWN, 42" F-SHAPE CONCRETE BARRIER AND 42" VERTICAL WALL CONCRETE BARRIER SIMILAR. 45" F-SHAPE CONCRETE BARRIER NOT PERMITTED FOR SOUND BARRIERS ON MOMENT SLAB.

SECTION



PLAN - BASE PLATE



PLAN - ANCHOR PLATE ASSEMBLY

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. REFER TO SHEET 4 FOR DIMENSION TABLE TO BE SHOWN ON THE CONTRACT DRAWINGS.
3. PROVIDE VERTICAL V-NOTCHES ON BARRIER FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS, SEE DETAIL SHEET 7.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

STRUCTURE MOUNTED SOUND BARRIER WALLS

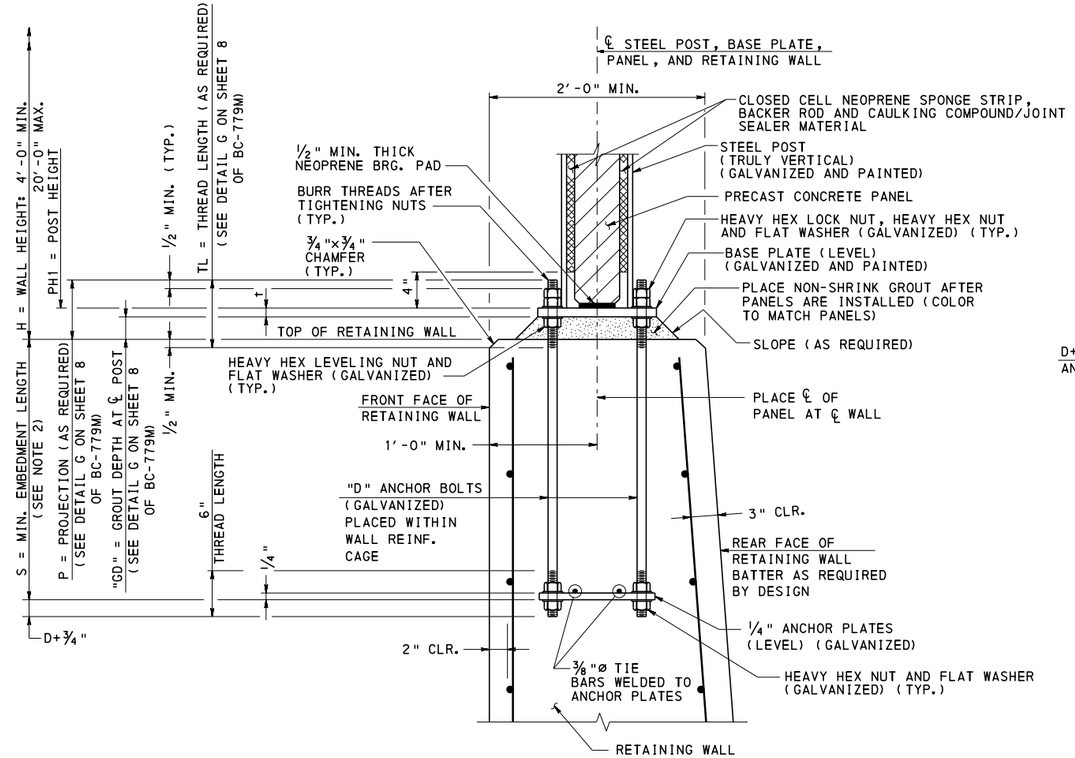
BARRIER MOUNTED ON WALLS AND MOMENT SLABS DESIGN TABLE AND DETAILS

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 8 OF 11
Thomas P. Macioce	Bruce B. Thigpen	BD-679M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	

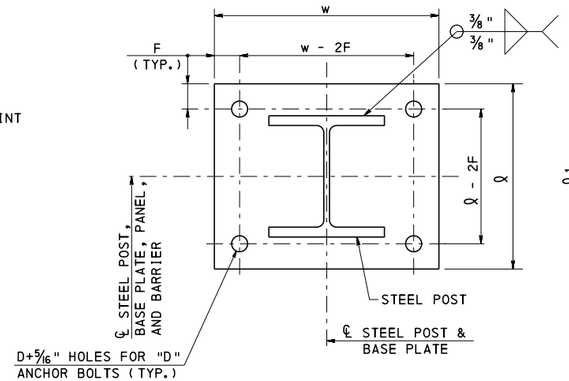
WALL MOUNTED SOUND BARRIER

STEEL POST, BASE PLATE, ANCHOR BOLT, AND ANCHOR PLATE GEOMETRY
WIND PRESSURE = 37 PSF

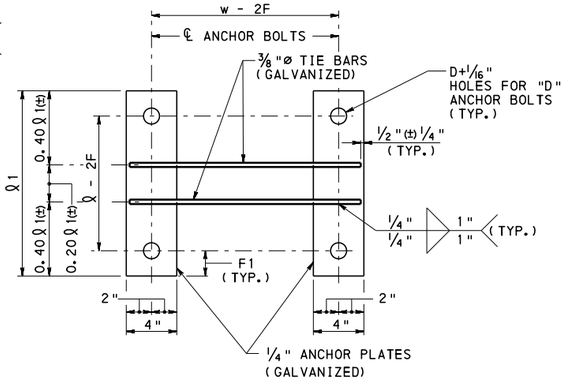
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	BASE PLATE				ANCHOR BOLTS		ANCHOR PLATES	
			t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	Q1 (IN.)	F1 (IN.)
6.0	6.0	W8x48	3/4	15 1/4	15	1 5/8	1	24	14	1
	8.0	W8x48	7/8	16	16	2 1/8	1 1/4	30	14 1/4	1 1/4
	10.0	W8x48	1	16	16	2 1/8	1 1/4	30	14 1/4	1 1/4
	12.0	W8x48	1 1/8	16 1/2	18	2 1/2	1 1/2	33	14 1/2	1 1/2
	14.0	W8x48	1 3/8	16 1/2	18	2 1/2	1 1/2	33	14 1/2	1 1/2
	16.0	W10x68	1 5/8	17	21	2 7/8	1 3/4	39	14 3/4	1 3/4
	18.0	W10x68	1 3/4	17 1/2	22	3 1/4	2	45	14 3/4	1 7/8
	20.0	W10x88	2	17 1/2	22	3 1/4	2	45	14 3/4	1 7/8
8.0	6.0	W8x48	3/4	15 1/4	15	1 5/8	1	24	14	1
	8.0	W8x48	7/8	16	16	2 1/8	1 1/4	30	14 1/4	1 1/4
	10.0	W8x48	1 1/8	16 1/2	18	2 1/2	1 1/2	33	14 1/2	1 1/2
	12.0	W8x48	1 3/8	16 1/2	18	2 1/2	1 1/2	33	14 1/2	1 1/2
	14.0	W8x48	1 5/8	17	19	2 7/8	1 3/4	39	14 3/4	1 3/4
	16.0	W10x68	1 7/8	17 1/2	22	3 1/4	2	45	14 3/4	1 7/8
	17.0	W10x68	2	17 1/2	22	3 1/4	2	45	14 3/4	1 7/8
10.0	6.0	W8x48	3/4	16	16	2 1/8	1 1/4	30	14 1/4	1 1/4
	8.0	W8x48	1	16	16	2 1/8	1 1/4	30	14 1/4	1 1/4
	10.0	W8x48	1 1/4	16 1/2	18	2 1/2	1 1/2	33	14 1/2	1 1/2
	12.0	W8x48	1 1/2	17	19	2 7/8	1 3/4	39	14 3/4	1 3/4
	14.0	W10x68	1 3/4	17 1/2	22	3 1/4	2	45	14 3/4	1 7/8
	15.0	W10x68	2	17 1/2	22	3 1/4	2	45	14 3/4	1 7/8
12.0	6.0	W8x48	7/8	16	16	2 1/8	1 1/4	30	14 1/4	1 1/4
	8.0	W8x48	1 1/8	16 1/2	18	2 1/2	1 1/2	33	14 1/2	1 1/2
	10.0	W8x48	1 3/8	17	19	2 7/8	1 3/4	39	14 3/4	1 3/4
	12.0	W8x48	1 5/8	17	22	2 7/8	1 3/4	39	14 3/4	1 3/4
	14.0	W10x68	1 7/8	17 1/2	22	3 1/4	2	45	14 3/4	1 7/8



SECTION



PLAN - BASE PLATE



PLAN - ANCHOR PLATE ASSEMBLY

NOTES:

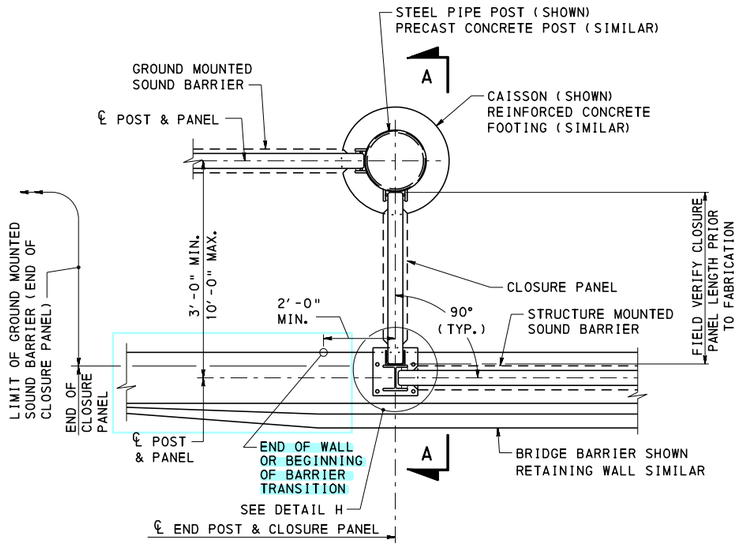
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. EMBEDMENT LENGTH OF ANCHOR BOLTS MUST EXTEND TO A DEPTH WHERE THE VERTICAL WALL REINFORCEMENT IS FULLY DEVELOPED. INCREASE EMBEDMENT LENGTH AS REQUIRED.
3. REFER TO SHEET 4 FOR DIMENSION TABLE TO BE SHOWN ON THE CONTRACT DRAWINGS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

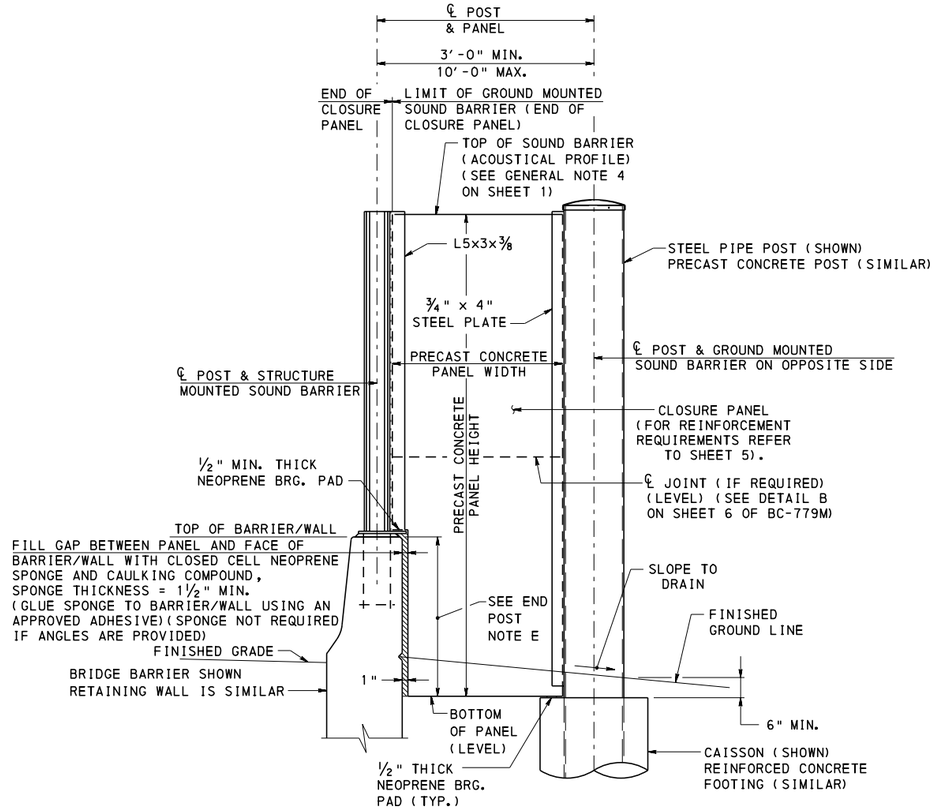
STRUCTURE MOUNTED SOUND BARRIER WALLS
WALL MOUNTED
DESIGN TABLE AND DETAILS

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 9 OF 11
Thomas A. Maciore	Bruce E. Thigpen	BD-679M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	

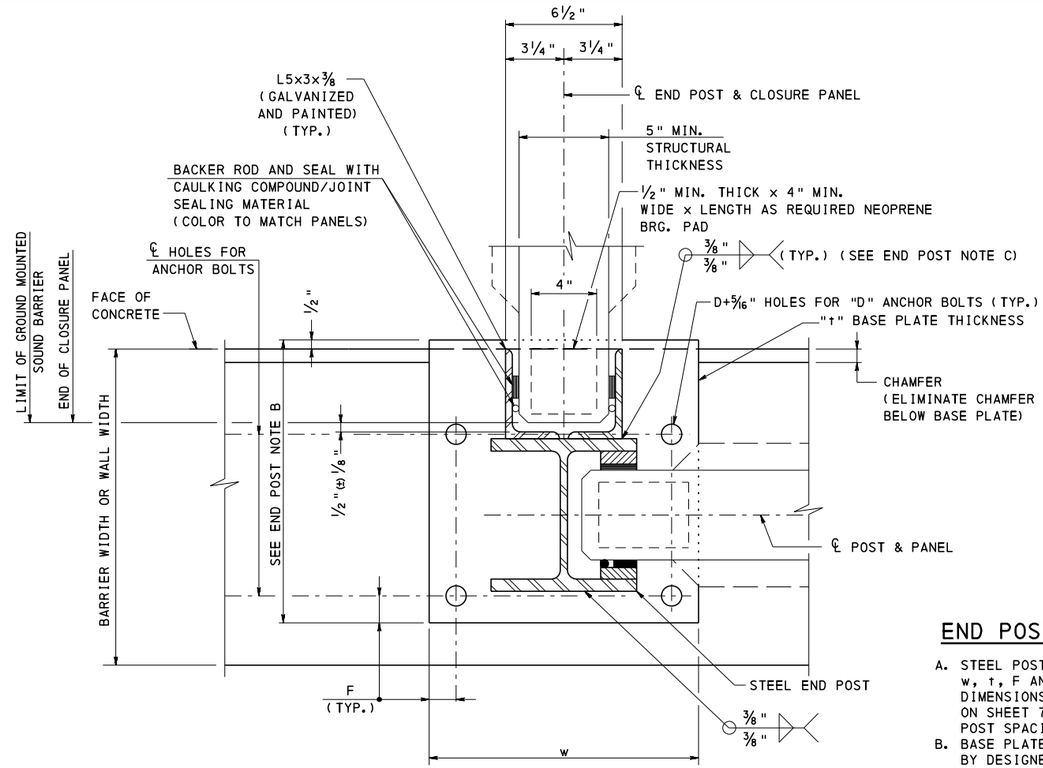


PLAN - STRUCTURE MOUNTED SOUND BARRIER TO GROUND MOUNTED SOUND BARRIER

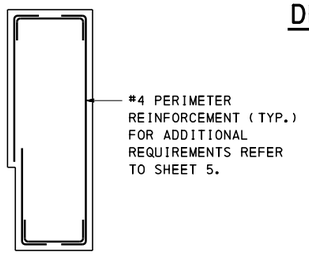
(BARRIER/RETAINING WALL WITH BARRIER TRANSITION)



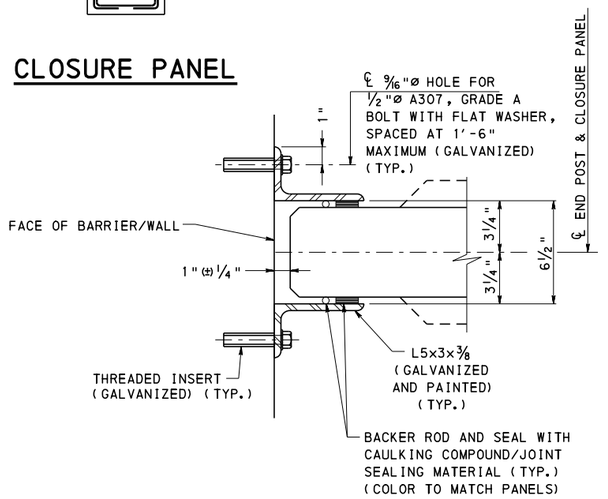
SECTION A-A



DETAIL H



CLOSURE PANEL



DETAIL J

END POST NOTES:

A. STEEL POST SIZE AND DIMENSIONS FOR w, t, F AND D IS TO BE BASED ON THE DIMENSIONS SHOWN IN THE DESIGN TABLES ON SHEET 7, 8 AND 9 FOR THE REQUIRED POST SPACING AND ALL HEIGHTS.
B. BASE PLATE DIMENSION TO BE DETERMINED BY DESIGNER.
C. FILL GAP BETWEEN ANGLES WITH WELD MATERIAL.
D. ELIMINATE THRU BOLTS FOR STEEL CABLES IN END POST. STEEL CABLES ARE STILL REQUIRED IN THE PANEL.
E. IF HEIGHT BETWEEN TOP OF BARRIER/WALL AND BOTTOM OF PANEL IS GREATER THAN 4'-0" PROVIDE ANGLES, REFER TO DETAIL J.

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. DETAILS SHOWN ARE FOR INFORMATION AND REFERENCE ONLY. ALTERNATE DETAILS ARE PERMITTED AND MUST BE APPROVED BY THE CHIEF BRIDGE ENGINEER.
3. DESIGNER MUST PROVIDE DESIGN CALCULATIONS FOR COMPONENTS NOT DESIGNED IN THE STANDARDS.
4. DESIGNER MUST INCLUDE ALL DETAILS REQUIRED ON THE CONTRACT DRAWINGS.
5. FOR GROUND MOUNTED CORNER POST DETAILS REFER TO BD-677M AND BD-678M.
6. DESIGNER MUST CONSIDER HOW INSPECTION ACCESS IS OBTAINED FOR THE ADJACENT STRUCTURE.

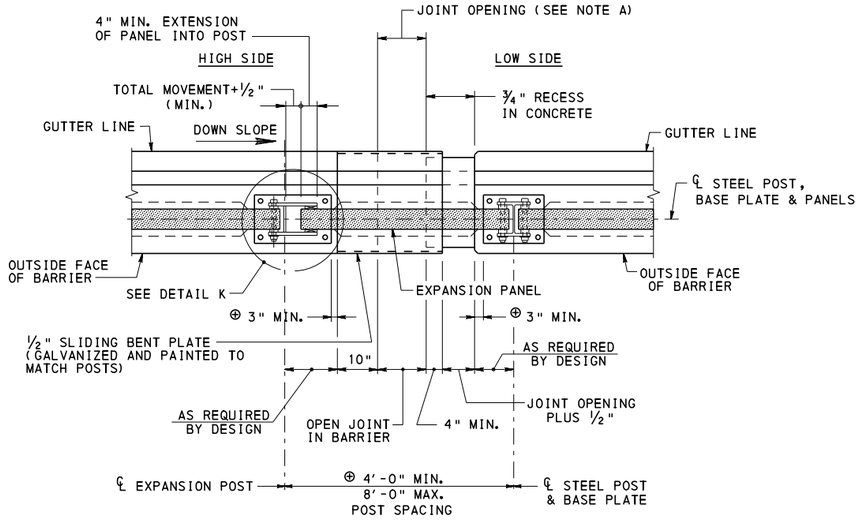
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

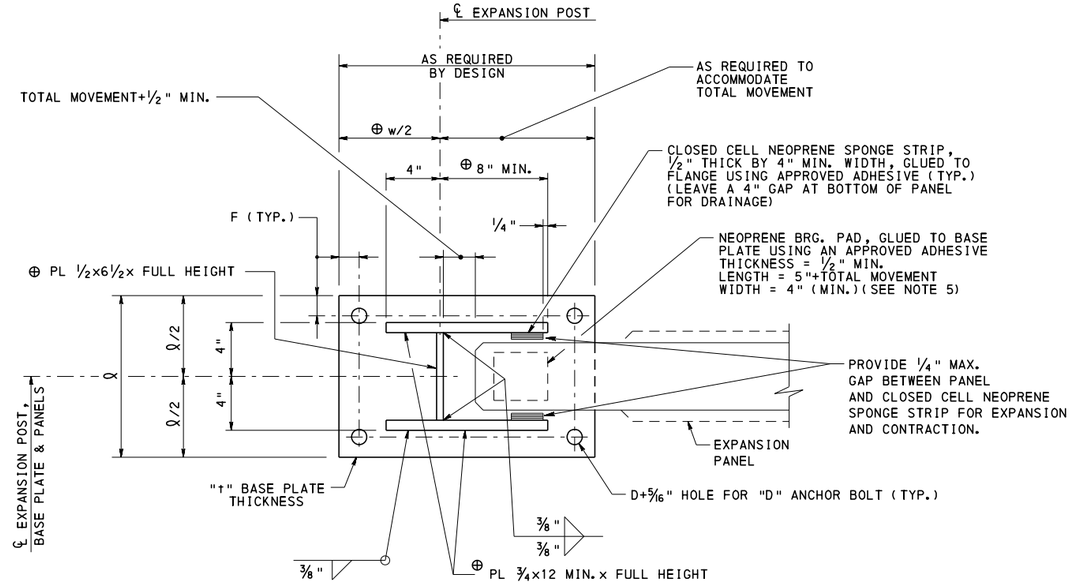
STRUCTURE MOUNTED SOUND BARRIER WALLS
STRUCTURE MOUNTED TO GROUND MOUNTED
DETAILS

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 10 OF 11
Thomas P. Macioce	Bruce B. Thyssen	BD-679M
CHIEF BRIDGE ENGINEER	DIRECTOR, BUR. OF PROJECT DELIVERY	

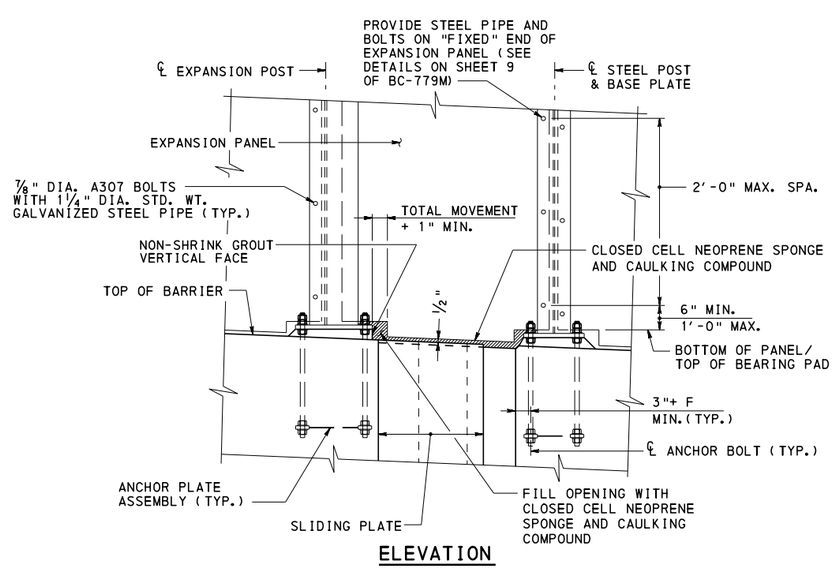
NOTE A:
- JOINT OPENING AS REQUIRED FOR BRIDGE EXPANSION AND CONTRACTION AT 68 DEGREES F.
- JOINT OPENING FOR SHOULDER OR PAVEMENT RELIEF JOINT = 1'-0" (REFER TO RC-20M AND RC-24M).



PLAN

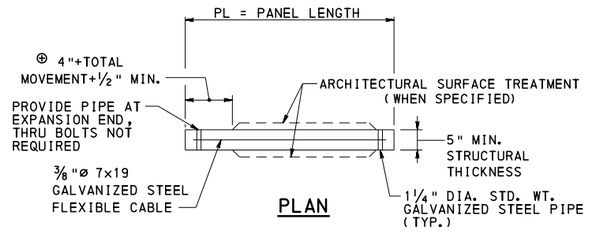


DETAIL K
EXPANSION POST



ELEVATION

EXPANSION PANEL DETAILS



PLAN

PRECAST CONCRETE EXPANSION PANEL
(FOR ADDITIONAL PANEL DETAILS SEE SHEET 5)

FABRICATED POST, BASE PLATE AND ANCHOR BOLT SIZES:
A. DIMENSIONS FOR ℓ, t, F AND D IS TO BE BASED ON THE DIMENSIONS SHOWN IN THE DESIGN TABLES ON SHEETS 7, 8 AND 9 FOR THE REQUIRED POST SPACING AND WALL HEIGHT.
B. DIMENSION w/2 IS TO BE BASED ON ONE-HALF THE w DIMENSION SHOWN IN THE DESIGN TABLES ON SHEETS 7, 8 AND 9 FOR THE REQUIRED POST SPACING AND WALL HEIGHT.
C. REMAINING DIMENSIONS TO BE DETERMINED BY THE ENGINEER.

LEGEND:
⊕ MIN. SIZE SHOWN, PROVIDE SIZE REQUIRED PER DESIGN

NOTES:
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. DETAILS SHOWN ARE FOR INFORMATION AND REFERENCE ONLY. ALTERNATE DETAILS ARE PERMITTED AND MUST BE APPROVED BY THE CHIEF BRIDGE ENGINEER.
3. DESIGNER TO DETERMINE TOTAL MOVEMENT REQUIRED.
4. DESIGNER MUST INCLUDE ALL DETAILS REQUIRED ON THE CONTRACT DRAWINGS.
5. DESIGNER TO DESIGN NEOPRENE BEARING PAD TO ACCOMMODATE MOVEMENT OF EXPANSION PANEL.
6. GALVANIZE AND PAINT ALL FABRICATED STRUCTURAL STEEL.
7. IF STRUCTURE MOUNTED SOUND BARRIER ENDS AT THE EXPANSION POST AND CONNECTS TO A GROUND MOUNTED BARRIER PROVIDE ADDITIONAL DETAILS AS REQUIRED IN ACCORDANCE WITH THESE STANDARDS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
EXPANSION PANEL DETAILS

RECOMMENDED FEB. 19, 2021	RECOMMENDED FEB. 19, 2021	SHEET 11 OF 11
Thomas P. Macioce CHIEF BRIDGE ENGINEER	Bruce D. Thompson DIRECTOR, BUR. OF PROJECT DELIVERY	BD-679M

CHANGE 2

GENERAL NOTES

1. DESIGN SPECIFICATIONS:
   - PENNDOT DESIGN MANUAL, PART 4, STRUCTURES, APRIL 2015 EDITION.
   - 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS", INCLUDING THE 1992 AND 2002 INTERIMS.
   - 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.
   - 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
   - DESIGN IS IN ACCORDANCE WITH THE WORKING STRESS DESIGN METHOD. (NO INCREASE IN ALLOWABLE UNIT STRESSES ARE PERMITTED EXCEPT FOR GROUP III LOADINGS WHICH PERMITS A 33% OVERSTRESS).

2. CONSTRUCTION SPECIFICATIONS AND WORK QUALITY:
   - PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5).

3. DESIGN LOADS:
   - WIND LOAD:
     - THE WIND LOAD INCLUDES A GUST FACTOR OF 1.3 AND A DRAG FACTOR OF 1.2 AND IS BASED ON A MAXIMUM 50-YEAR MEAN WIND VELOCITY AT 30'-0" ABOVE THE GROUND SURFACE OF 80 MPH.
       - OFFSET SOUND BARRIER WALLS (GROUND MOUNTED):
         HEIGHT ZONE: 0' TO 14'-0" = 20 PSF
         HEIGHT ZONE: OVER 14'-0" = 28 PSF
     - ICE LOAD: 3 PSF APPLIED TO ONE SIDE OF PANEL
     - SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO 0.15.

4. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.

5. STANDARD PANEL HEIGHTS:
   - 4'-0" MINIMUM TO 12'-0" MAXIMUM.
   - PROVIDE STACKED PANELS WHEN THE WALL HEIGHT EXCEEDS 12'-0".

6. END PANEL HEIGHTS:
   - 6'-0" MINIMUM TO 22'-0" MAXIMUM.
   - PROVIDE SINGLE END PANELS, STACKED PANELS ARE NOT PERMITTED.
   - IF WALL HEIGHT IS GREATER THAN 22'-0", ADJUST WALL LENGTH AS REQUIRED SO THE MAXIMUM END PANEL HEIGHT IS 22'-0" OR LESS.

7. HORIZONTAL PANELS JOINT:
   - MINIMIZE THE NUMBER OF HORIZONTAL PANEL JOINTS.
   - PROVIDE UNIFORM STEPS.
   - IF STEPS ARE REQUIRED, THE ELEVATION DIFFERENCE BETWEEN ADJACENT PANELS IS NOT PERMITTED TO BE LESS THAN 6" OR GREATER THAN 2'-0".

8. PROVIDE A MINIMUM OF TWO CABLE CONNECTIONS FOR EACH PANEL-TO-PANEL CONNECTION.

9. OFFSET SOUND BARRIER WALLS MUST BE PROTECTED BY CONCRETE BARRIERS UNLESS THE WALL IS LOCATED BEYOND THE HORIZONTAL CLEAR ZONE OR IF THE BOTTOM OF PANELS ARE A MINIMUM OF 5'-0" ABOVE THE EDGE OF PAVEMENT.

10. PROVIDE UNCOATED REINFORCEMENT BARS IN THE FOOTING.

11. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN PANELS WHERE THE WALL IS WITHIN 14'-0" OF THE EDGE OF TRAVEL LANE. EPOXY COATED OR GALVANIZED REINFORCEMENT MAY BE REQUIRED IF FUTURE WIDENING IS ANTICIPATED.

12. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.

13. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.

14. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.

15. FOR ADDITIONAL INFORMATION, REFER TO BC-780M.

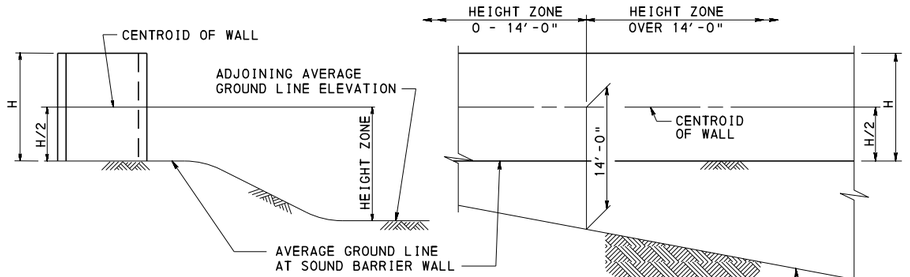
MATERIAL NOTES

1. REFER TO BC-780M FOR MATERIAL NOTES.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE WALL SYSTEM ARE DEVELOPED FOR TWO SEPARATE WIND PRESSURES OF 20 PSF AND 28 PSF.
2. DESIGN TABLES SHOWN FOR THE PRECAST CONCRETE PANELS (STANDARD AND END PANELS) ARE DEVELOPED FOR A WIND PRESSURE OF 28 PSF. USE THE INFORMATION SHOWN IN THE TABLES FOR ALL HEIGHT ZONES.
3. THE DESIGN WALL HEIGHT IS TO BE THE ACTUAL WALL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF WALL HEIGHT SHOWN ON THE DESIGN TABLES.
4. THE DESIGN PANEL HEIGHT IS TO BE THE ACTUAL PANEL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF PANEL HEIGHT SHOWN ON THE DESIGN TABLES.
5. STANDARD PANEL HEIGHTS ARE PERMITTED TO BE ANY DIMENSION REQUIRED, BUT ARE NOT PERMITTED TO BE LESS THAN 4'-0" OR GREATER THAN 12'-0".
6. END PANEL HEIGHTS ARE PERMITTED TO BE ANY DIMENSION REQUIRED, BUT ARE NOT PERMITTED TO BE LESS THAN 6'-0" OR GREATER THAN 22'-0".

INDEX OF SHEETS



SECTION

ELEVATION

HEIGHT ZONE (FEET)	WIND PRESSURE (PSF)
0-14	20
OVER 14	28

HEIGHT ZONES FOR OFFSET SOUND BARRIERS (GROUND MOUNTED)

BC-734M	ANCHOR SYSTEMS
BC-735M	WALL CONSTRUCTION AND EXPANSION JOINT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-776M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS
BC-780M	OFFSET SOUND BARRIER WALLS
BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD OFFSET SOUND BARRIER WALLS GENERAL NOTES - 1

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

BD-680M

DESIGN PARAMETERS

1. GENERAL:
   - THE WALL SYSTEM IS DESIGNED BASED ON A 4 PANEL UNIT LENGTH (WHICH MAY INCLUDE THE END PANEL) WITH A 2'-0" MINIMUM WALL EMBEDMENT FOR WIND PRESSURES EQUAL TO 20 PSF AND 28 PSF.
   - THE STABILITY OF THE WALL IS CHECKED AT THE TOP OF THE FOOTING.

2. STANDARD PRECAST CONCRETE PANELS:
   - PANELS ARE DESIGNED FOR A WIND PRESSURE EQUAL TO 28 PSF.
   - PANELS ARE DESIGNED USING A 10 INCH STRUCTURAL THICKNESS.
   - PANELS ARE DESIGNED FOR AN ADDITIONAL CONCRETE WEIGHT OF 1½ INCH TO ACCOUNT FOR ARCHITECTURAL SURFACE TREATMENTS.
     - THE AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0 TO 1½ INCH BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 1½ INCH.
     - DESIGN CALCULATIONS ARE REQUIRED FOR PANELS WHICH HAVE A TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT GREATER THAN 1½ INCH.
   - PANELS ARE DESIGNED AS SIMPLY SUPPORTED BEAMS SPANNING 15'-0".
   - PANELS ARE DESIGNED ON A 1'-0" STRIP WIDTH.
   - BOTTOM PANELS ARE DESIGNED FOR AN EARTH LOAD ON ONE SIDE OF PANEL ONLY. MAXIMUM FILL DIFFERENTIAL BETWEEN SIDES OF PANEL WAS SET AT 2'-0" FOR DESIGN.
   - PANELS ARE DESIGNED FOR THE FOLLOWING IN ACCORDANCE WITH THE PCI DESIGN HANDBOOK, 5TH EDITION, 1999:
     - PANELS ARE DESIGNED FOR STRIPPING FORCES CAUSED BY FORM SUCTION AND IMPACT WHEN THE PANELS ARE STRIPPED FROM THE FORMS IN ACCORDANCE WITH SECTION 5.2.3 AND TABLE 5.2.1. USING AN EQUIVALENT STATIC LOAD MULTIPLIER OF 1.50.
       - PROVIDE A MINIMUM CONCRETE STRENGTH AT TIME OF STRIPPING EQUAL TO 4,000 PSI.
     - PANEL THICKNESS AND REINFORCING, FOR STANDARD PANELS, IS DESIGNED FOR STRIPPING AND LIFTING AT TOP OF PANEL USING A TWO-POINT PICKUP OR FOUR-POINT PICKUP IN ACCORDANCE WITH FIGURE 5.2.4.
     - PANEL THICKNESS AND REINFORCING, FOR END PANELS, IS DESIGNED FOR STRIPPING AND LIFTING AT TOP OR SIDE OF PANEL USING A TWO-POINT PICKUP OR FOUR-POINT PICKUP IN ACCORDANCE WITH FIGURE 5.2.4.
     - PANELS ARE DESIGNED FOR TRANSPORTATION IN ACCORDANCE WITH SECTION 5.2.11 AND TABLE 5.2.1 USING AN EQUIVALENT STATIC LOAD MULTIPLIER EQUAL TO 1.50.
     - THE FLEXURAL TENSILE STRESSES IN THE CONCRETE ARE CALCULATED USING THE UNCRACKED GROSS SECTION BASED ON THE STRUCTURAL THICKNESS. THE STRESSES ARE COMPARED AGAINST THE MODULUS OF RUPTURE REDUCED BY A SAFETY FACTOR OF 1.50 IN ACCORDANCE WITH SECTION 5.2.4.1.
   - PANELS ARE NOT DESIGNED FOR A TRAFFIC IMPACT LOAD.

3. END PRECAST CONCRETE PANELS:
   - END PANEL LENGTH SET AT 10'-0" (WORKING POINT TO END OF PANEL)
   - FOR ADDITIONAL REQUIREMENTS REFER TO ABOVE PARAMETERS FOR THE STANDARD PRECAST CONCRETE SOUND BARRIER PANELS.

4. PANEL CONNECTIONS:
   - CABLE CONNECTION IS DESIGNED FOR WIND, EARTH, AND SEISMIC LOADS IN CONJUNCTION WITH 2 DEGREE WALL TILT.

5. SPREAD FOOTINGS:
   - SPREAD FOOTINGS ARE DESIGNED BEARING ON SOIL WITH AN ALLOWABLE BEARING PRESSURE EQUAL TO 1.50 TONS/SQ. FT. AND A COEFFICIENT OF SLIDING FRICTION EQUAL TO 0.30.
   - MAXIMUM ALLOWABLE BEARING PRESSURE ON CONCRETE = 0.900 KSI
   - COEFFICIENT OF FRICTION BETWEEN PANEL AND FOOTING = 0.45
   - FACTOR OF SAFETY AGAINST SLIDING = 1.50 MINIMUM
   - FACTOR OF SAFETY AGAINST SLIDING FOR SEISMIC LOADING = 1.125 MINIMUM
   - FACTOR OF SAFETY AGAINST OVERTURNING = 2.00 MINIMUM
   - FACTOR OF SAFETY AGAINST OVERTURNING FOR SEISMIC LOADING = 1.50 MINIMUM
   - WEIGHT OF BACKFILL MATERIAL = 100 LB. / CU. FT.
   - PROVIDE A MINIMUM SOIL DEPTH OF 2'-0" ABOVE THE TOP OF FOOTING.
   - PROVIDE A MINIMUM FOOTING THICKNESS OF 1'-0".
   - PROVIDE A MINIMUM FOOTING WIDTH OF 3'-0".
   - SPREAD FOOTINGS ARE DESIGNED FOR NO UPLIFT.
   - SPREAD FOOTINGS ARE DESIGNED FOR LEVEL GROUND. A SITE SPECIFIC DESIGN IS REQUIRED IF GROUND IS SLOPED.
   - SPREAD FOOTINGS ARE DESIGNED WITHOUT LIVE LOAD SURCHARGE. REDESIGN FOOTINGS IF LIVE LOAD SURCHARGE IS REQUIRED.

ARCHITECTURAL SURFACE TREATMENTS

1. THE FOLLOWING ARCHITECTURAL SURFACE TREATMENTS ARE PERMITTED ON THE FACE OF THE PRECAST CONCRETE PANELS AND ARE TO BE INDICATED ON THE CONTRACT DRAWINGS AND/OR IN THE CONTRACT SPECIAL PROVISIONS (IF REQUIRED):
   - NON-FORM LINER FINISHES:
     - SMOOTH FINISH
     - BROOMED FINISH
     - FUZZY OR RAKED FINISH (PERMITTED ON ONE SIDE ONLY)
     - EXPOSED AGGREGATE
   - FORM LINER FINISHES:
     - ASHLER STONE
     - CUT STONE
     - FRACTURE FIN
     - GRAPE STAKE
     - SHIP LAP
     - ANY OTHER TREATMENT PERMITTED BY THE DEPARTMENT

2. THE AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0 TO 1½", BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT ON BOTH SIDES OF THE PANEL MUST NOT BE GREATER THAN 1½ INCH UNLESS OTHERWISE INDICATED ON THE CONTRACT DRAWINGS.

3. AVOID USING FORM LINER FINISHES ON BOTH SIDES OF THE PRECAST CONCRETE PANELS. A FORM LINER FINISH ON ONE SIDE OF THE PANEL, ALONG WITH A STAMPED FINISH ON THE OTHER SIDE OF PANEL, IS PERMITTED.

NOTES TO DESIGNER

1. PREPARE CONTRACT DRAWINGS IN ACCORDANCE WITH THE DESIGN MANUAL, PART 4 AND THESE STANDARDS.

2. THE FOLLOWING NOTE MUST BE PLACED ON THE PLANS FOR SIGNATURE BY THE DISTRICT ENVIRONMENTAL MANAGER INDICATING THAT THE PLANS HAVE BEEN REVIEWED AND ACCEPTED:

   THE DISTRICT ENVIRONMENTAL MANAGER HAS REVIEWED AND ACCEPTED THE ACOUSTIC REQUIREMENTS OF THE PROPOSED WALL.

   _____
   DISTRICT ENVIRONMENTAL MANAGER

3. DETERMINE HEIGHT ZONE AND WIND PRESSURE REQUIRED FOR WALL DESIGN AND INDICATE ON THE CONTRACT DRAWINGS.

4. SPECIFY IF THE REIFORCEMENT BARS ARE UNCOATED, EPOXY COATED OR GALVANIZED.

5. SPECIFY IF THE WELDED WIRE FABRIC IS UNCOATED, EPOXY COATED OR GALVANIZED.

6. OFFSET SOUND BARRIER WALLS MUST BE PROTECTED BY CONCRETE BARRIERS UNLESS THE WALL IS LOCATED BEYOND THE HORIZONTAL CLEAR ZONE OR IF THE BOTTOM OF PANELS ARE A MINIMUM OF 5'-0" ABOVE THE EDGE OF PAVEMENT.

7. PROVIDE SLOPED TOP PANELS. STEPPED PANELS ARE NOT PERMITTED.

8. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE CONTRACT DRAWINGS (IF APPLICABLE):
   - OVERALL WALL LENGTH
   - HORIZONTAL GEOMETRY
   - VERTICAL GEOMETRY
   - SOUND BARRIER CONTROL LINE
   - WALL OFFSET - "D"
   - LENGTH OF 4-PANEL UNITS - "L"
   - ACOUSTIC PROFILE ELEVATIONS
   - TOP OF WALL ELEVATIONS
   - HORIZONTAL JOINT LOCATIONS (IF PERMITTED)
   - PANEL CONNECTION LOCATIONS
   - PANEL DETAILS
   - BERM WIDTH
   - EXISTING GROUND LINE ELEVATIONS
   - FINISHED GROUND LINE ELEVATIONS
   - TOP AND BOTTOM OF FOOTING ELEVATIONS
   - FOOTING PLAN
   - FOOTING DETAILS
   - FOOTING STEP LOCATIONS
   - GENERAL NOTES
   - FOUNDATION NOTES
   - STAKE-OUT PLAN
   - DETAILS
   - REINFORCEMENT BAR SCHEDULE FOR ALL CAST-IN-PLACE CONCRETE
   - ANY OTHER INFORMATION REQUIRED TO CONSTRUCT THE SOUND BARRIER WALL

9. PROVIDE FIRE HYDRANT OPENINGS OR OTHER HIGHWAY ACCESS AS REQUIRED IN THE PRECAST CONCRETE PANELS. PROVIDE REINFORCEMENT AROUND OPENINGS IN ACCORDANCE WITH DETAILS SHOWN ON BC-776M TO PRECLUDE CRACKING.

10. SLOPE THE FINISHED GROUND LINE AWAY FROM THE SOUND BARRIER WALL.

11. INDICATE IF THE ARCHITECTURAL SURFACE TREATMENT TOLERANCES, AS PROVIDED IN PUBLICATION 408, SECTION 1086.3, ARE APPLICABLE.

12. THE FOLLOWING INFORMATION MUST BE SPECIFIED ON THE CONTRACT DRAWINGS OR INDICATED IN THE CONTRACT SPECIAL PROVISIONS:
    - ARCHITECTURAL SURFACE TREATMENTS ON THE RESIDENTIAL AND ROADWAY SIDES OF THE PRECAST CONCRETE SOUND BARRIER PANELS. INDICATE THE MINIMUM, MAXIMUM AND AVERAGE DEPTHS.
    - COLOR OF THE INTEGRAL PIGMENTATION FOR PRECAST CONCRETE SOUND BARRIER PANELS.
    - COLOR OF JOINT SEALANT AND/OR CAULKING COMPOUND, NON-SHRINK GROUT, AND ANTI-GRAFFITI COATING.
    - LIMITS OF ANTIGRAFFITI COATING.

13. PROVIDE FEDERAL COLOR NUMBERS IN ACCORDANCE WITH FEDERAL STANDARD NUMBER 595A OR 595B.

14. PROVIDE COMPLETE DETAILS AND DESIGN, IF REQUIRED, WHERE A OFFSET SOUND BARRIER IS CONNECTED TO A STRUCTURE MOUNTED SOUND BARRIER OR A LINEAR GROUND MOUNTED SOUND BARRIER. REFER TO BD-679M FOR DETAILS.

15. DESIGN COMPUTATIONS AND DETAILS ARE REQUIRED FOR ANY PORTION OF THE STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THIS STANDARD.

16. SPECIFY IF A SOUND ABSORPTIVE CONCRETE FACING IS REQUIRED ON THE FACE OF THE PRECAST CONCRETE PANELS. SOUND ABSORPTIVE PANELS MUST BE APPROVED, PRIOR TO BIDDING, BY THE DEPARTMENT USING THE NEW PRODUCT EVALUATION PROCESS. DESIGNER MUST PREPARE DESIGN CALCULATIONS FOR THE WALL SYSTEM AND SPREAD FOOTING DUE TO THE INCREASED PANEL WEIGHT.

17. IF NEEDED DETAILS ARE NOT FOUND IN THE SOUND BARRIER STANDARDS, A SPECIAL SUBMISSION REQUESTING APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.

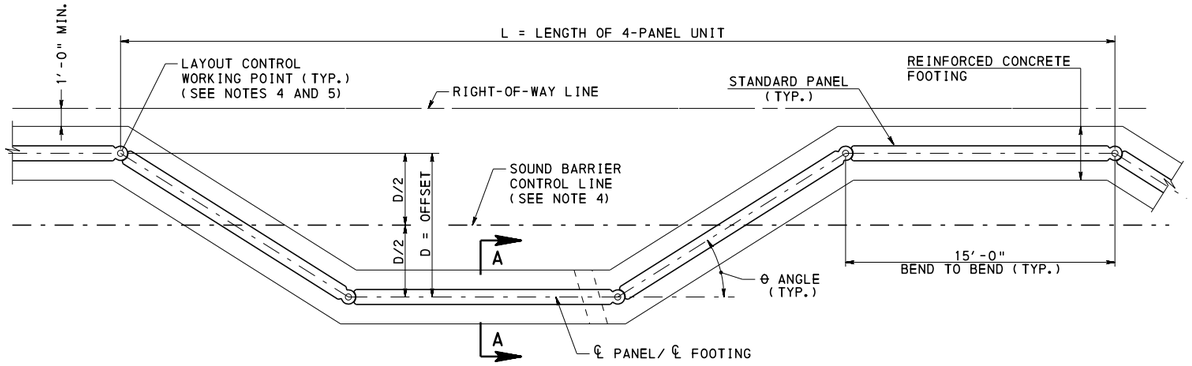
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

OFFSET SOUND BARRIER WALLS

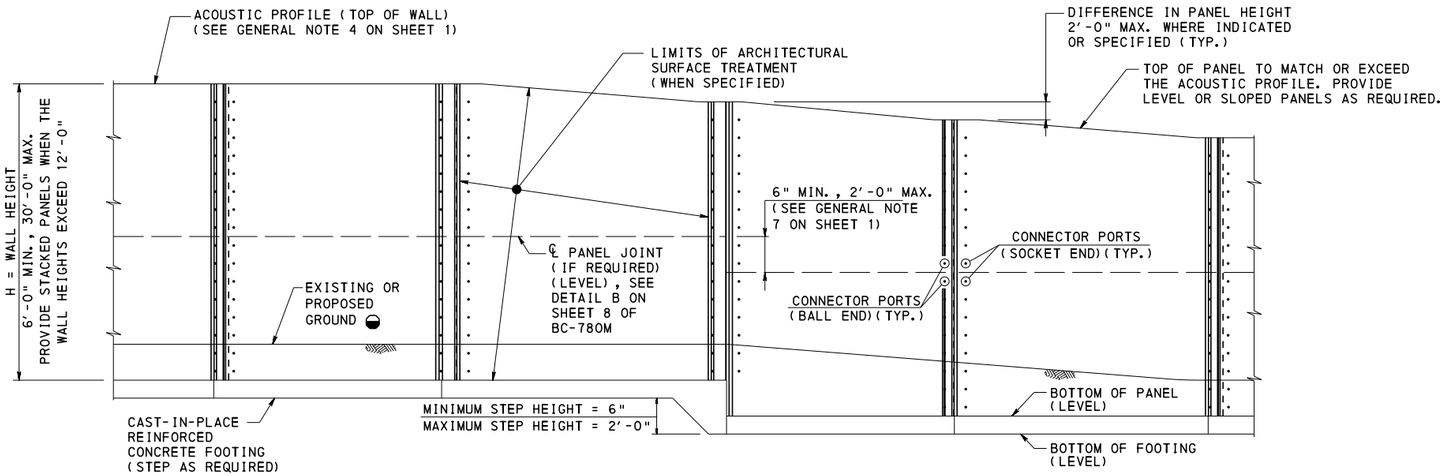
GENERAL NOTES - 2

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 2 OF 8
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-680M



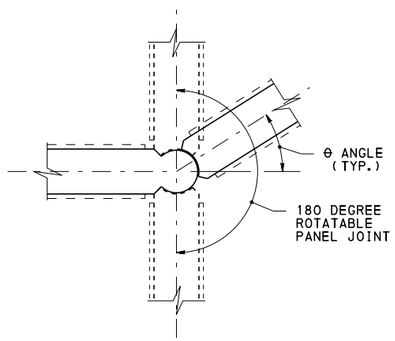
PLAN - OFFSET SOUND BARRIER

(END PANEL NOT SHOWN)

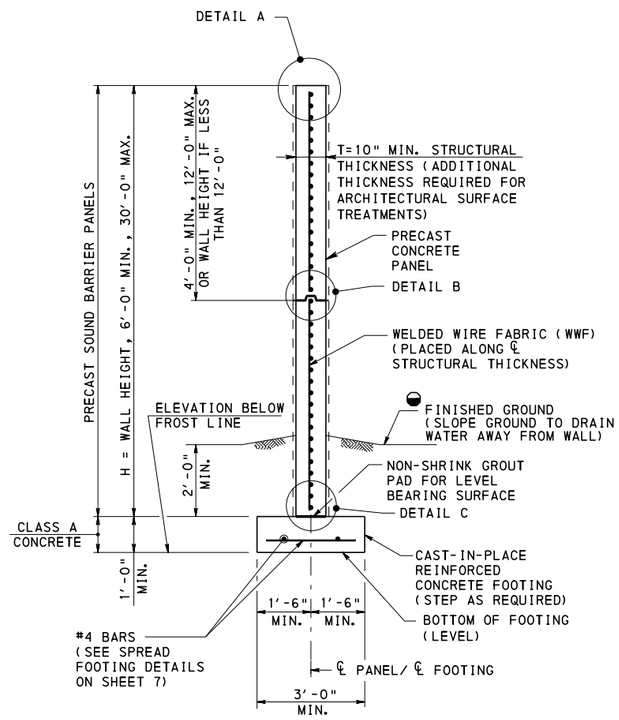


ELEVATION - OFFSET SOUND BARRIER

(END PANEL NOT SHOWN)



PANEL JOINT



SECTION A-A

LEGEND:

◒ GRADE GROUND TO DRAIN WATER AWAY FROM THE WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 1'-0" DIFFERANCE.

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DESIGN TABLES REFER TO SHEET 4.
3. FOR DETAILS A, B, AND C REFER TO BC-780M, SHEET 8.
4. LOCATE SOUND BARRIER CONTROL LINE AND WORKING POINTS BASED ON THE ROADWAY GEOMETRY ON THE STAKE-OUT PLAN.
5. WALL DIRECTION IS PERMITTED TO CHANGE AT ANY PANEL JOINT AS LONG AS THERE IS A "4 PANEL UNIT" ON BOTH SIDES OF THE PANEL JOINT.
6. DESIGNER TO INDICATE THE GEOMETRY OF THE WALL ON THE CONTRACT DRAWINGS.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
OFFSET SOUND BARRIER WALLS
GEOMETRY AND LAYOUT - 1

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 3 OF 8
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-680M

OFFSET SOUND BARRIER DESIGN TABLE

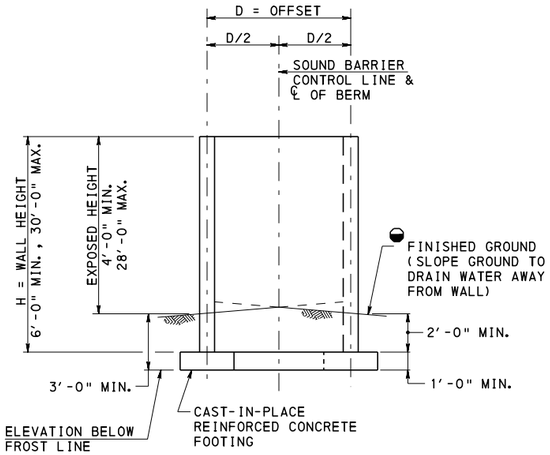
HEIGHT ZONE 0′-14′
WIND PRESSURE = 20 PSF

WALL HEIGHT H (FT.)	OFFSET D (FT.)	ANGLE θ (DMS)	4-PANEL UNIT LENGTH L (FT.)	MINIMUM NUMBER OF CABLES ▲
6.0	2.0	07°39′44.1"	59.7321	4
8.0	2.5	09°35′38.6"	59.5804	5
10.0	3.0	11°32′13.1"	59.3939	5
12.0	3.5	13°29′36.2"	59.1719	5
14.0	3.5	13°29′36.2"	59.1719	6
16.0	4.0	15°27′57.6"	58.9137	6
18.0	4.5	17°27′27.4"	58.6182	6
20.0	5.0	19°28′16.4"	58.2843	6
22.0	5.5	21°30′36.7"	57.9106	6
24.0	6.0	23°34′41.4"	57.4955	6
26.0	6.5	25°40′45.4"	57.0370	6
28.0	7.0	27°49′05.3"	56.5330	6

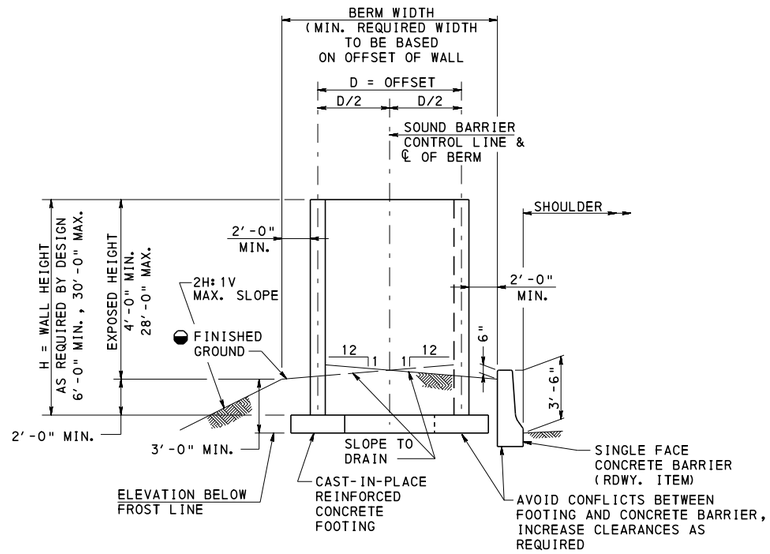
OFFSET SOUND BARRIER DESIGN TABLE

HEIGHT ZONES OVER 14′
WIND PRESSURE = 28 PSF

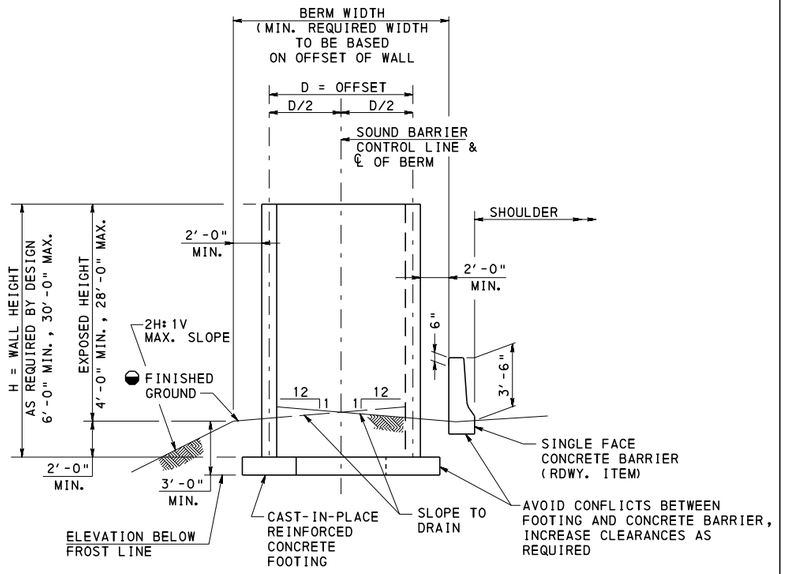
WALL HEIGHT H (FT.)	OFFSET D (FT.)	ANGLE θ (DMS)	4-PANEL UNIT LENGTH L (FT.)	MINIMUM NUMBER OF CABLES ▲
6.0	2.5	09°35′38.6"	59.5804	4
8.0	3.0	11°32′13.1"	59.3939	5
10.0	3.5	13°29′36.2"	59.1719	5
12.0	4.5	17°27′27.4"	58.6182	5
14.0	5.0	19°28′16.4"	58.2843	6
16.0	5.5	21°30′36.7"	57.9106	6
18.0	6.0	23°34′41.4"	57.4955	6
20.0	7.0	27°49′05.3"	56.5330	6
22.0	7.5	30°00′00.0"	55.9808	6
24.0	8.0	32°13′51.4"	55.3772	6
26.0	8.5	34°31′05.2"	54.7184	6
28.0	9.0	36°52′11.6"	54.0000	7
30.0	10.0	41°48′37.1"	52.3607	7



SECTION - OFFSET SOUND BARRIER



SECTION - OFFSET SOUND BARRIER ON BERM ADJACENT TO ROADWAY BARRIER OPTION 1 (SEE NOTE 2)



SECTION - OFFSET SOUND BARRIER ON BERM ADJACENT TO ROADWAY BARRIER OPTION 2 (SEE NOTE 2)

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. DESIGNER TO SELECT WHICH OPTION IS USED BASED ON ROADWAY GEOMETRICS, RIGHT-OF-WAY REQUIREMENTS AND ALL OTHER CONSTRAINTS. OBTAIN ACCEPTANCE FROM THE DISTRICT BRIDGE ENGINEER. (THE DEPARTMENT PREFERS OPTION 1)

LEGEND:

DMS = DEGREES, MINUTES, AND SECONDS

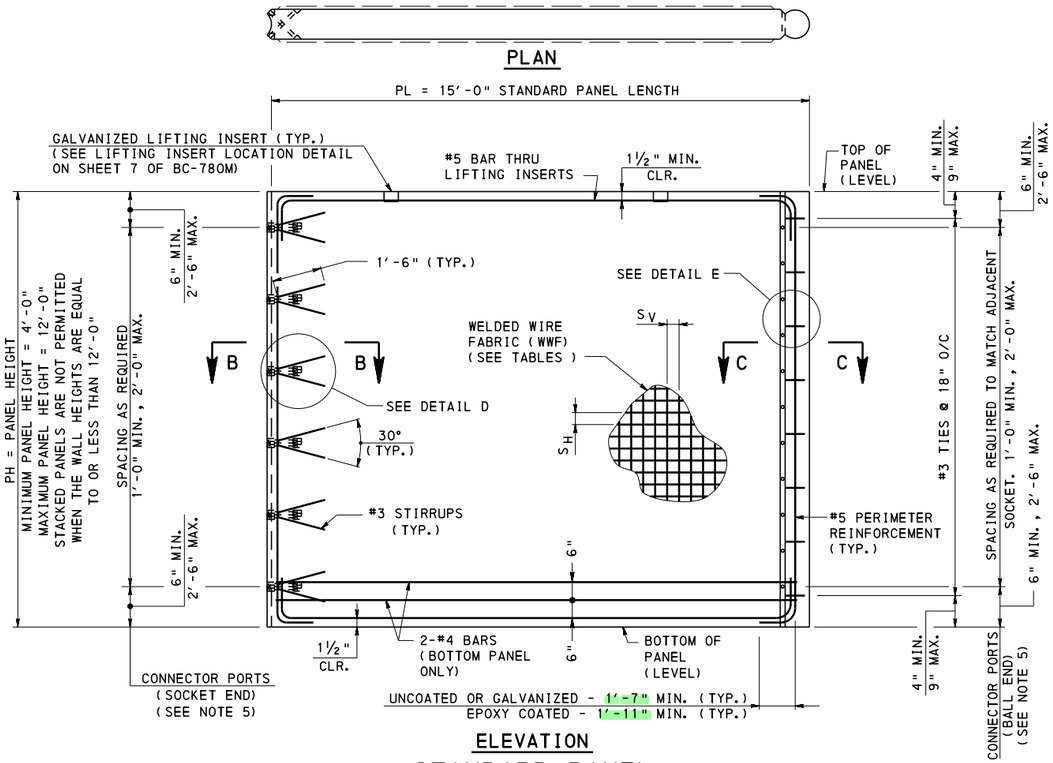
▲ - PROVIDE A MINIMUM OF TWO CABLE CONNECTIONS FOR EACH PANEL-TO-PANEL CONNECTION.

◒ - GRADE GROUND TO DRAIN WATER AWAY FROM THE WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 1′-0" DIFFERANCE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

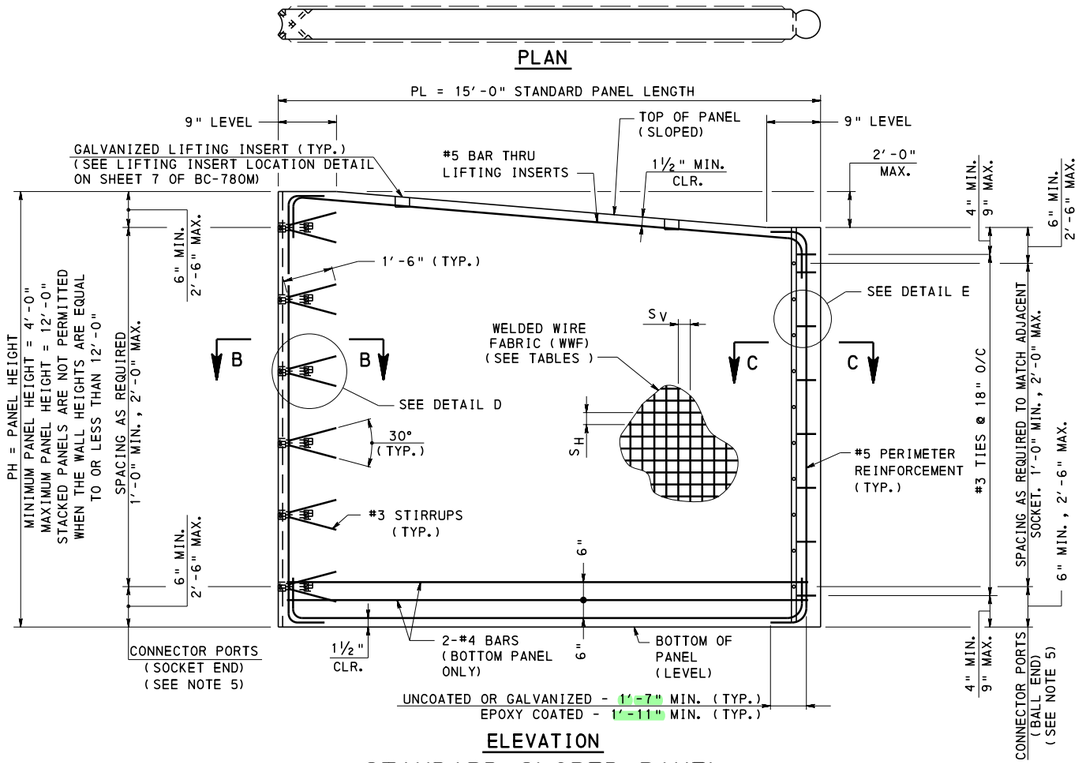
STANDARD
OFFSET SOUND BARRIER WALLS
GEOMETRY AND LAYOUT - 2

RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 4 OF 8
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-680M



ELEVATION

STANDARD PANEL



ELEVATION

STANDARD SLOPED PANEL

LEGEND:

S_H = SPACING OF HORIZONTAL BARS
S_V = SPACING OF VERTICAL BARS

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR SECTION B-B AND C-C, REFER TO BC-780M, SHEET 6.
3. FOR DETAILS D AND E, REFER TO BC-780M, SHEET 6.
4. WELDED WIRE FABRIC TO BE PLACED ALONG ℄ STRUCTURAL THICKNESS.
5. LOCATION OF CONNECTOR PORTS MUST BE DETAILED ON THE SHOP DRAWINGS. PORTS LOCATIONS TO MATCH ADJACENT PANELS. PROVIDE A MINIMUM OF TWO CABLE CONNECTIONS FOR EACH PANEL TO PANEL CONNECTION (PER SIDE OF PANEL).
6. IF STACKED PANELS ARE REQUIRED REFER TO DETAIL B ON SHEET 8 OF BC-780M.
7. DESIGNER TO SPECIFY THE WELDED WIRE FABRIC REQUIREMENTS, INCLUDING THE AREA OF STEEL, AND THE MINIMUM NUMBER OF LIFTING INSERTS REQUIRED ON THE CONTRACT DRAWINGS. INFORMATION IS PERMITTED TO BE IN TABLE FORM SIMILAR TO THE TABLES SHOWN.

PRECAST CONCRETE PANEL REINFORCEMENT FOR STANDARD UPPER PANELS

WIND PRESSURE = 28 PSF

PANEL HEIGHT PH (FT.)	WELDED WIRE FABRIC WWF AxB-WCxWD	WELDED WIRE STEEL AREA (IN^2/FT.)		MIN. NUMBER OF LIFTING INSERTS
		HORIZONTAL	VERTICAL	
4.0	WWF 6x6-W8xW8	0.16	0.16	2
6.0	WWF 6x6-W8xW8	0.16	0.16	2
8.0	WWF 6x4-W8xW8	0.16	0.24	4
10.0	WWF 6x4-W8xW12	0.16	0.36	4
12.0	WWF 6x4-W8xW20	0.16	0.60	4

PRECAST CONCRETE PANEL REINFORCEMENT FOR STANDARD BOTTOM PANELS

WIND PRESSURE = 28 PSF

PANEL HEIGHT PH (FT.)	WELDED WIRE FABRIC WWF AxB-WCxWD	WELDED WIRE STEEL AREA (IN^2/FT.)		MIN. NUMBER OF LIFTING INSERTS
		HORIZONTAL	VERTICAL	
4.0	WWF 4x6-W8xW8	0.24	0.16	2
6.0	WWF 4x6-W8xW8	0.24	0.16	2
8.0	WWF 4x4-W8xW8	0.24	0.24	4
10.0	WWF 4x4-W8xW12	0.24	0.36	4
12.0	WWF 4x4-W8xW20	0.24	0.60	4

WHERE A = SPACING OF HORIZONTAL BARS (S_H)
B = SPACING OF VERTICAL BARS (S_V)
C = HORIZONTAL WIRE SIZE
D = VERTICAL WIRE SIZE
WWF = WELDED WIRE FABRIC

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

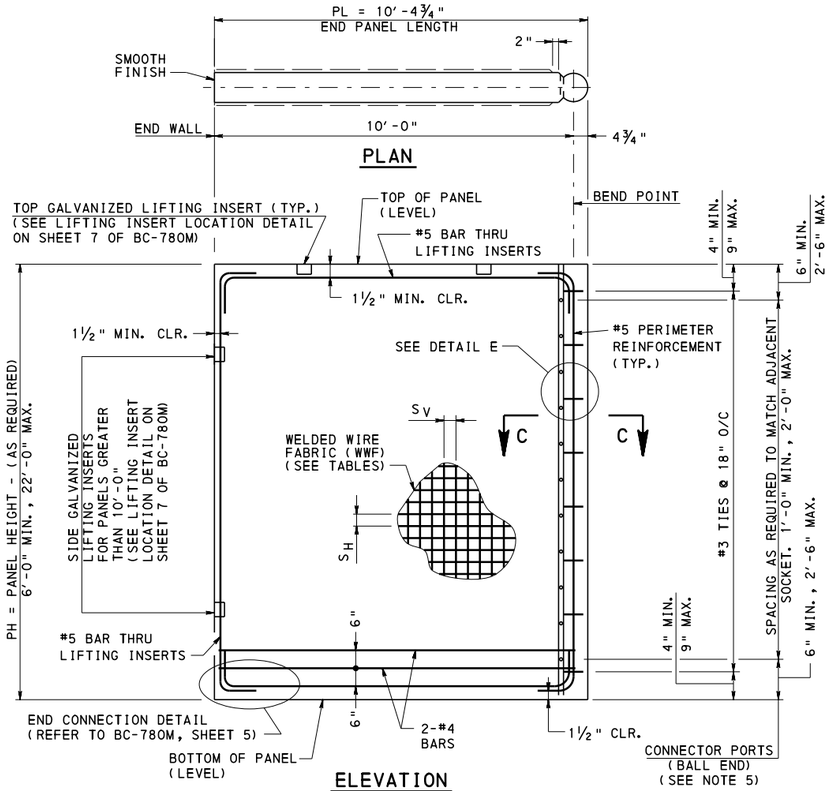
STANDARD
OFFSET SOUND BARRIER WALLS
PRECAST CONCRETE STANDARD PANEL DETAILS

RECOMMENDED AUG. 30, 2019
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019
ACT. DIR., BUR. OF PROJECT DELIVERY

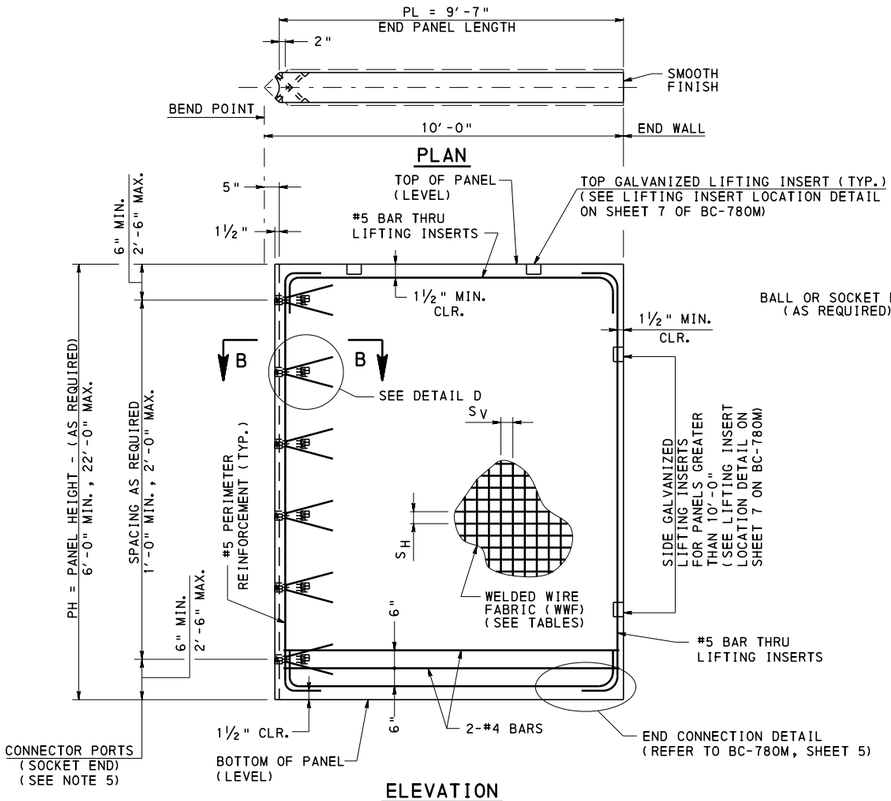
SHEET 5 OF 8

BD-680M

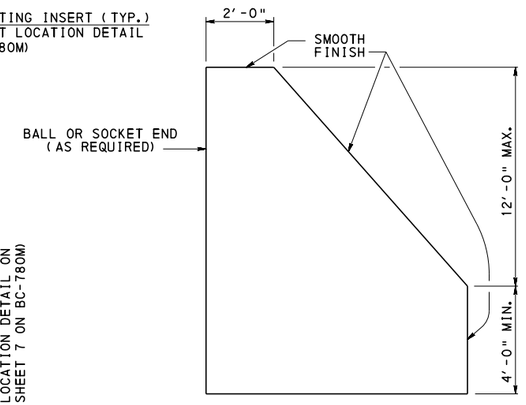


END PANEL (FULL HEIGHT) (BALL END)

NOTE:
FOR INFORMATION NOT SHOWN, SEE STANDARD PANEL DETAILS ON SHEET 5.



END PANEL (FULL HEIGHT) (SOCKET END)



ALTERNATE SLOPED END PANEL

(FABRICATOR TO LOCATE LIFTING INSERTS, AS REQUIRED)

LEGEND:

S_H = SPACING OF HORIZONTAL BARS
S_V = SPACING OF VERTICAL BARS

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR SECTION B-B AND C-C, REFER TO BC-780M, SHEET 6.
3. FOR DETAILS D AND E, REFER TO BC-780M, SHEET 6.
4. WELDED WIRE FABRIC TO BE PLACED ALONG ℄ STRUCTURAL THICKNESS.
5. LOCATION OF CONNECTOR PORTS MUST BE DETAILED ON THE SHOP DRAWINGS. PORTS LOCATIONS TO MATCH ADJACENT PANELS. PROVIDE A MINIMUM OF THREE CABLE CONNECTIONS FOR THE END PANEL TO ADJACENT PANEL(S) CONNECTION.
6. PROVIDE SINGLE END PANELS, STACKED PANELS NOT PERMITTED.
7. DESIGNER TO SPECIFY THE WELDED WIRE FABRIC REQUIREMENTS, INCLUDING THE AREA OF STEEL, AND THE MINIMUM NUMBER OF LIFTING INSERTS REQUIRED ON THE CONTRACT DRAWINGS. INFORMATION IS PERMITTED TO BE IN TABLE FORM SIMILAR TO THE TABLES SHOWN.

PRECAST CONCRETE PANEL REINFORCEMENT FOR END PANELS

WIND PRESSURE = 28 PSF

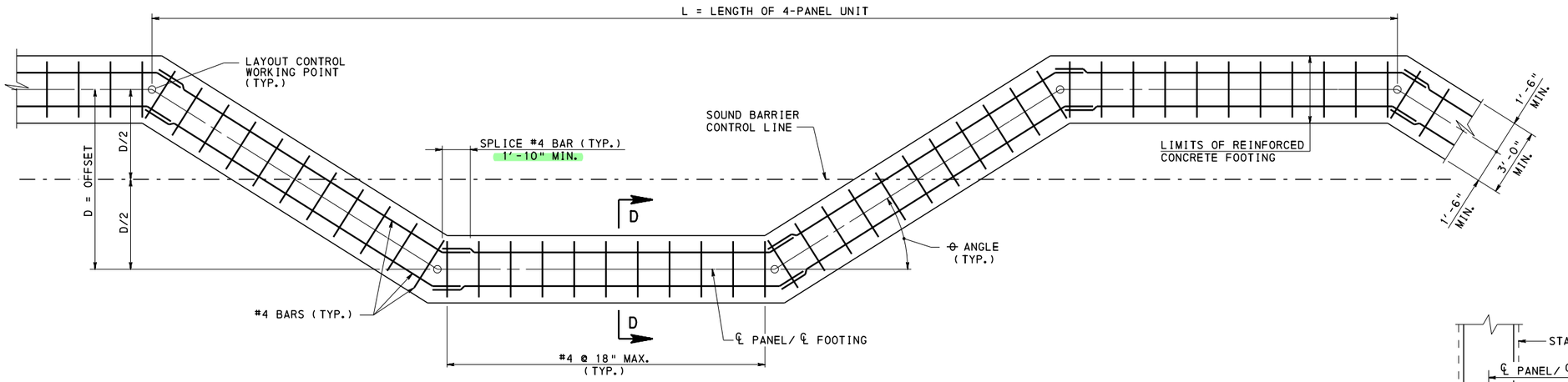
PANEL HEIGHT PH (FT.)	WELDED WIRE FABRIC ** WWF AxB-WCxWD	WELDED WIRE STEEL AREA (IN^2 /FT.)		MIN. NUMBER OF LIFTING INSERTS	
		HORIZONTAL	VERTICAL	TOP OF PANEL	SIDE OF PANEL
6.0	WWF 6x6-W8xW8	0.16	0.16	2	——
8.0	WWF 6x4-W8xW8	0.16	0.24	2	——
10.0	WWF 6x4-W8xW12	0.16	0.36	2	——
12.0	WWF 4x4-W12xW12	0.36	0.36	4	4
14.0	WWF 4x4-W12xW12	0.36	0.36	4	4
16.0	WWF 4x4-W12xW12	0.36	0.36	4	4
18.0	WWF 4x4-W12xW12	0.36	0.36	4	4
20.0	WWF 4x4-W12xW12	0.36	0.36	4	4
22.0	WWF 4x4-W12xW12	0.36	0.36	4	4

WHERE A = SPACING OF HORIZONTAL BARS (S_H)
B = SPACING OF VERTICAL BARS (S_V)
C = HORIZONTAL WIRE SIZE
D = VERTICAL WIRE SIZE
WWF = WELDED WIRE FABRIC

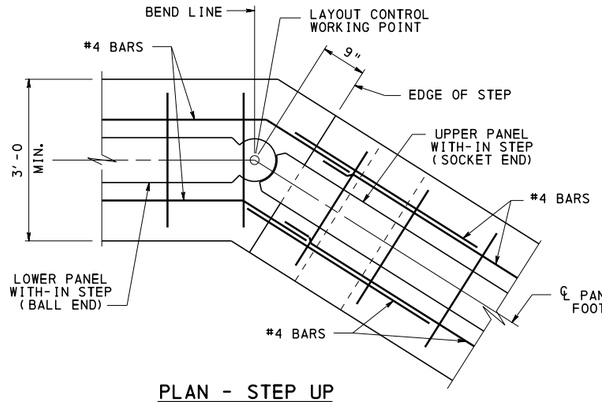
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
OFFSET SOUND BARRIER WALLS
PRECAST CONCRETE END PANEL DETAILS

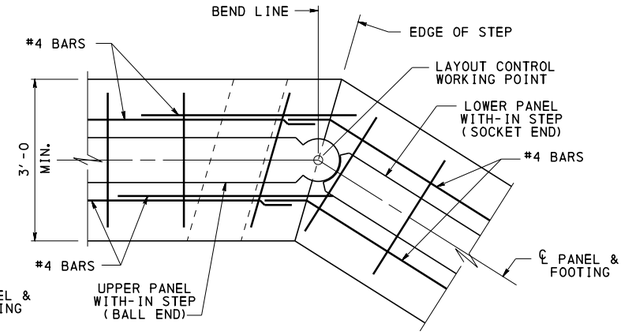
RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 6 OF 8
ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	BD-680M



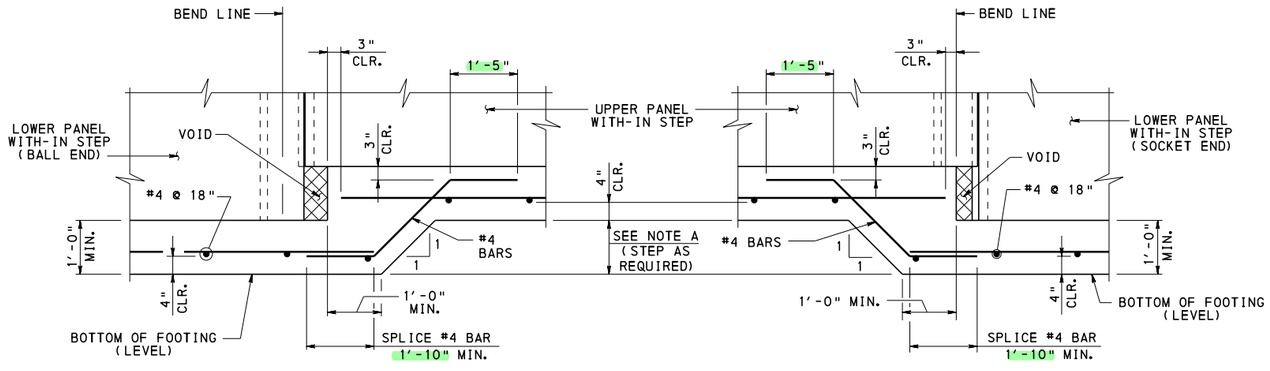
FOOTING REINFORCEMENT LAYOUT FOR STANDARD PANELS



PLAN - STEP UP



PLAN - STEP DOWN

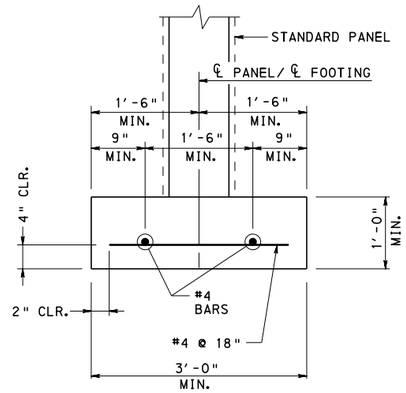


SECTION ALONG ℄ PANEL

SECTION ALONG ℄ PANEL

FOOTING STEP DETAILS FOR STANDARD PANELS

NOTE A:
MINIMUM STEP HEIGHT = 6"
MAXIMUM STEP HEIGHT = 2'-0"
MINIMIZE THE NUMBER OF STEPS ALONG LENGTH OF WALL.



SECTION D-D

NOTES:

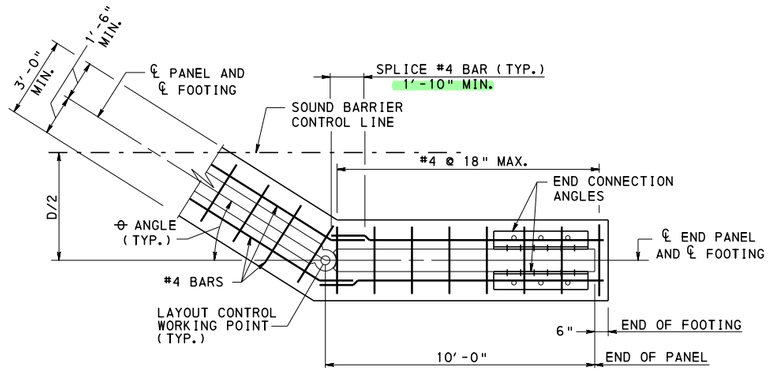
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

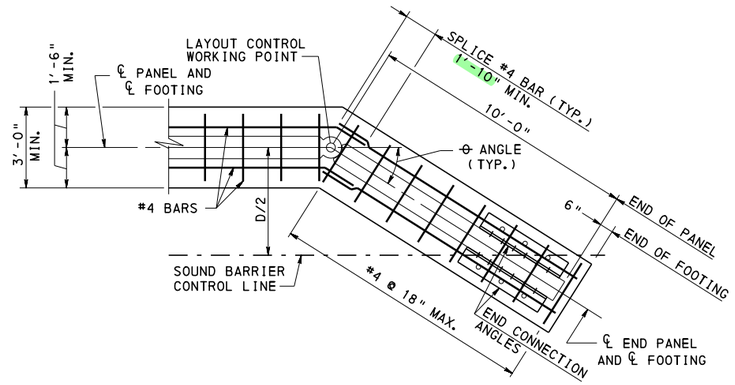
STANDARD

OFFSET SOUND BARRIER WALLS
SPREAD FOOTING DETAILS
FOR STANDARD PANELS

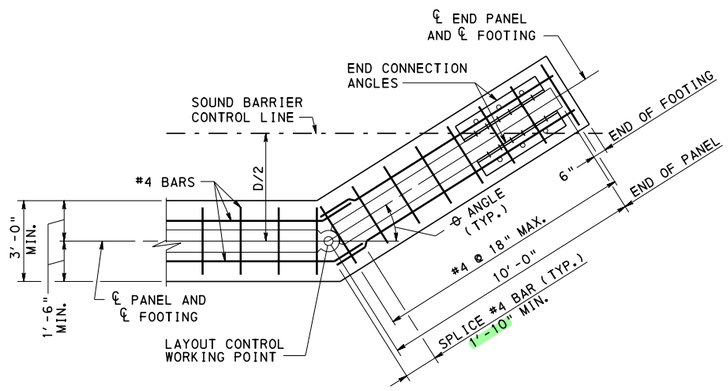
RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 7 OF 8 BD-680M



OPTION 1



OPTION 2



OPTION 3

FOOTING PLANS AT END PANELS

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR END PANEL CONNECTION DETAILS, REFER TO SHEET 5 OF BC-780M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

OFFSET SOUND BARRIER WALLS
SPREAD FOOTING DETAILS
FOR END PANELS

RECOMMENDED AUG. 30, 2019 ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 8 OF 8 BD-680M

CHANGE 2

CHANGE 5

GENERAL NOTES

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH SPECIFICATIONS PUBLICATION 408, AASHTO/AWS D1.5 BRIDGE WELDING CODE AND THE SPECIAL PROVISIONS.

2. DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AS SUPPLEMENTED BY DESIGN MANUAL PART 4, STRUCTURES.

3. USE CLASS A CEMENT CONCRETE FOR CONCRETE MASONRY UNIT FILL AND COPING.

4. PROVIDE GRADE 60 REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A 615, A 996, OR A 706. DO NOT USE RAIL STEEL (A 996) FOR BENT BARS. USE EPOXY COATED OR GALVANIZED BARS IN ACCORDANCE WITH PUBLICATION 408 SECTION 1002.

5. REINFORCED SOIL FOUNDATION (RSF) BACKFILL: PENNDOT 2A COARSE AGGREGATE OR DRIVING SURFACE AGGREGATE (LOCAL JURISDICTION BRIDGES ONLY), WITH ALL AGGREGATES TYPE A.

6. REINFORCED BACKFILL GRADATION: AASHTO #8, #57, #67 OR A COMBINATION THEREOF, WITH ALL AGGREGATES TYPE A.

7. INTEGRATED APPROACH BACKFILL: PENNDOT 2A COARSE AGGREGATE OR DRIVING SURFACE AGGREGATE (LOCAL JURISDICTION BRIDGES ONLY), WITH ALL AGGREGATES TYPE C OR BETTER.

8. GEOSYNTHETIC REINFORCEMENT TO BE IN ACCORDANCE WITH PUBLICATION 408, SECTION 735, CLASS 4, TYPE C, WITH THE FOLLOWING ADDITIONAL PROPERTIES:
   - USE BIAXIAL GEOTEXTILE MADE FROM POLYPROPYLENE
   - TENSILE PROPERTIES DETERMINED BY ASTM D 4595 WITH ULTIMATE TENSILE STRENGTH GREATER THAN OR EQUAL TO 4,800 LB/FT IN BOTH DIRECTIONS TESTED AT A STRAIN RATE OF 10% PER MINUTE. TENSILE STRENGTH AT 2% STRAIN GREATER THAN OR EQUAL TO TENSILE STRENGTH REQUIRED BY DESIGN.
   - PROVIDE CERTIFIED TEST DATA DEMONSTRATING COMPLIANCE WITH THIS STANDARD AND PUBLICATION 408.

9. CONCRETE MASONRY UNITS (CMU):
   - CONDUCT FREEZE-THAW TEST IN ACCORDANCE WITH ASTM C1262-10 TO ESTABLISH CONFORMANCE WITH ASTM C1372.
   - PREVENT EXPOSURE TO DEICING CHEMICALS. ADDITIVES CAN BE USED TO REDUCE EFFLORESCENCE AT THE FACE OF THE BLOCKS IF THERE IS POTENTIAL EXPOSURE TO DEICING CHEMICALS.
   - COMPRESSIVE STRENGTH = 3,000 PSI MINIMUM
   - WATER ABSORPTION LIMIT LESS THAN OR EQUAL TO 5% AFTER 24 HOURS
   - NOMINAL DIMENSIONS = 8"x8"x16" SMALL CMU, 24"x24"x72" SOLID CONCRETE BLOCKS; ACTUAL DIMENSIONS SHOULD BE USED WHEN DETERMINING ABUTMENT GEOMETRY (SMALL CMU = 7⅝"x7⅝"x15⅝" - TYPICALLY)
   - HEIGHT TOLERANCE ±1/16", LENGTH AND WIDTH TOLERANCE ±⅛"
   - MINIMUM FACE SHELL THICKNESS 1¼" AND MINIMUM WEB THICKNESS ¾"
   - SPECIFY SPLIT FACE CMU IF DESIRED FOR AESTHETICS

10. PREFORMED CELLULAR POLYSTYRENE (P.C.P.) FOAM BOARD: IN ACCORDANCE WITH ASTM C 578; MINIMUM COMPRESSIVE STRENGTH = 10 PSI.

DESIGN METHODOLOGY

1. DESIGN LIMITATIONS:
   - LIMIT TO SITES WHERE ADT IS LESS THAN 400 VEHICLES/DAY.
   - LIMIT TO SINGLE SPAN BRIDGES WITH SPAN LENGTH LESS THAN OR EQUAL TO 70 FEET.
   - LIMIT ABUTMENT HEIGHTS TO 30 FEET MAXIMUM MEASURED FROM TOP OF REINFORCED SOIL FOUNDATION TO TOP OF BEAM SEAT.
   - LIMIT TO SITES WITH LOW SCOUR POTENTIAL.
   - LIMIT TO SITES WITH MAXIMUM WATER VELOCITIES LESS THAN OR EQUAL TO 7 FPS FOR TYPICAL DETAILS SHOWN (SMALL SOLID, HOLLOW AND FILLED CMU).
   - LIMIT TO SITES WITH MAXIMUM WATER VELOCITIES GREATER THAN 7 FPS AND LESS THAN OR EQUAL TO 10 FPS, WHEN ALL ROWS OF SMALL HOLLOW CONCRETE MASONRY UNITS ARE USED AND FILLED WITH REBAR AND CONCRETE (SEE SHEET 4 OF 4 FOR DETAIL).
   - LIMIT TO SITES WITH MAXIMUM WATER VELOCITIES GREATER THAN 10 FPS AND LESS THAN OR EQUAL TO 12 FPS, WHEN SOLID CONCRETE BLOCKS ARE USED (SEE SHEET 4 OF 4 FOR DETAIL).
   - LIMIT TO SITES WITH SOIL PH OF 5 TO 9.
   - IF A PROJECT REQUIRES A 75 YEAR FACING ELEMENT SERVICE LIFE, IT MAY BE NECESSARY TO UTILIZE A DIFFERENT FACING TYPE. IF HOLLOW OR FILLED CONCRETE MASONRY UNITS ARE USED, HAVE A VIABLE PLAN FOR CONCRETE MASONRY UNIT REPAIR.

2. USE THE METHODOLOGY AND GUIDELINES PROVIDED IN THE GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM INTERIM IMPLEMENTATION GUIDE, FHWA-HRT-11-026, JUNE 2012 AND GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM SYNTHESIS REPORT, FHWA-HRT-11-027, JANUARY 2011.

DESIGN METHODOLOGY (CONTINUED)

3. LOAD & RESISTANCE FACTOR DESIGN METHODOLOGY:
   BEARING RESISTANCE FACTOR = 0.65
   SLIDING RESISTANCE FACTOR (SOIL ON SOIL) = 1.0
   GLOBAL STABILITY RESISTANCE FACTOR = 0.65
   INTERNAL STABILITY RESISTANCE FACTOR = 0.45
   REINFORCEMENT TENSION RESISTANCE FACTOR = 0.90
   REINFORCEMENT STRENGTH REDUCTION FACTOR = 2.25

   ALLOWABLE STRESS DESIGN METHODOLOGY:
   BEARING FACTOR OF SAFETY = 2.5
   SLIDING FACTOR OF SAFETY = 1.5
   GLOBAL STABILITY FACTOR OF SAFETY = 1.5
   INTERNAL STABILITY FACTOR OF SAFETY = 3.5
   REINFORCEMENT TENSION FACTOR OF SAFETY = 3.5

4. PERFORMANCE CRITERIA:
   - TOLERABLE VERTICAL STRAIN = 0.5% OF WALL HEIGHT (H)
   - TOLERABLE LATERAL STRAIN = 1.0% OF b AND q_s (BEARING WIDTH AND SETBACK)

5. LIMIT SERVICE 1 BEARING STRESS ON THE BEAM SEAT TO LESS THAN OR EQUAL TO 4,000 PSF.

6. FOR STRUCTURES OVER ROAD OR RAIL, ADD ESTIMATED GRS MASS VERTICAL STRAIN FROM DEAD LOAD AND FOUNDATION SETTLEMENT TO REQUIRED VERTICAL CLEARANCE.

7. DEPENDANT ON SUPERSTRUCTURE TYPE (I.e. STEEL BEAMS, SPREAD CONCRETE BEAMS OR TIMBER BEAMS) AND/OR BEARING STRESSES, A PRECAST OR CAST IN PLACE CONCRETE BEAM SEAT MAY BE REQUIRED, SEE SHEET 4 FOR DETAILS.

8. STEEL OR SPREAD CONCRETE BEAM SUPERSTRUCTURES REQUIRE THE DESIGN OF A CONCRETE END DIAPHRAGM OR BACKWALL.

9. PERFORM CORE BORINGS OR EXPLORATORY EXCAVATIONS AS NECESSARY TO DETERMINE FOUNDATION AND SCOURABILITY OF BEDDING MATERIAL. IF BEDROCK IS ENCOUNTERED, KEY RSF INTO BEDROCK 6"-12" BASED ON ROCK QUALITY AND ERODIBILITY.

CONSTRUCTION METHODOLOGY

1. SITE LAYOUT/SURVEY: CONSTRUCT THE BASE OF THE GRS ABUTMENT AND WINGWALLS WITHIN 1.0 INCH OF THE STAKED ELEVATIONS. CONSTRUCT THE EXTERNAL GRS ABUTMENT AND WINGWALLS TO WITHIN ±0.5 INCHES OF THE SURVEYED STAKE DIMENSIONS.

2. COMPACTION: COMPACT BACKFILL TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DRY DENSITY ACCORDING TO AASHTO T99 AND ±2 PERCENT OPTIMUM MOISTURE CONTENT. IN THE BEARING REINFORCEMENT ZONE, COMPACT TO 100 PERCENT OF THE MAXIMUM DRY DENSITY ACCORDING TO AASHTO T99. THE COMPACTED THICKNESS SHALL BE 8 INCHES PER LIFT IN THE REINFORCED BACKFILL. THE MAXIMUM COMPACTED THICKNESS SHALL BE 6 INCHES PER LIFT IN THE RSF AND INTEGRATED APPROACH. ONLY HAND-OPERATED COMPACTION EQUIPMENT IS ALLOWED WITHIN 3 FEET OF THE WALL FACE. REINFORCEMENT EXTENDS DIRECTLY BENEATH EACH LAYER OF CMU BLOCKS, EXTENDING TO 1 INCH OR LESS FROM THE FRONT FACE OF THE WALL. COMPACT OPEN-GRADED MATERIAL TO OBTAIN A STATE OF NON-MOVEMENT AND A MINIMUM OF 3 PASSES OF VIBRATION EQUIPMENT.

3. GEOSYNTHETIC REINFORCEMENT PLACEMENT: PULL THE GEOSYNTHETIC TAUGHT TO REMOVE ANY WRINKLES AND LAY FLAT PRIOR TO PLACING AND COMPACTING THE BACKFILL MATERIAL. STAGGER SPLICES AT LEAST 24 INCHES APART AND SPLICES ARE NOT ALLOWED IN THE BEARING REINFORCEMENT ZONE. NO EQUIPMENT IS ALLOWED DIRECTLY ON THE GEOSYNTHETIC. PLACE A MINIMUM 6 INCH LAYER OF GRANULAR FILL PRIOR TO OPERATING ONLY RUBBER-TIRED EQUIPMENT OVER THE GEOSYNTHETIC AT SPEEDS LESS THAN 5 MILES PER HOUR WITH NO SUDDEN BRAKING OR SHARP TURNING.

4. REINFORCED SOIL FOUNDATION CONSTRUCTION: ENCAPSULATE THE RSF IN GEOTEXTILE REINFORCEMENT ON ALL SIDES WITH MINIMUM OVERLAPS OF 3.0 FEET TO PREVENT WATER INFILTRATION AND BACKFILL MIGRATION. WRAPPED CORNERS NEED TO BE TIGHT WITHOUT EXPOSED SOIL. COMPACT BACKFILL MATERIAL IN LIFTS THAT RESULT IN 6 INCHES IN COMPACTED HEIGHT. PLACE GEOSYNTHETIC REINFORCEMENT AT 12 INCH SPACING. GRADE AND LEVEL THE TOP OF THE RSF PRIOR TO FINAL ENCAPSULATION, AS THIS WILL SERVE AS THE LEVELING PAD FOR THE CMU BLOCKS OF THE GRS ABUTMENT. ALTHOUGH IT IS NOT PREFERABLE, IF BUILDING GRS WALL ON EXISTING FOUNDATIONS, CONSIDER PROVIDING A VERTICAL CONTROL JOINT TO ALLOW FOR DIFFERENTIAL SETTLEMENT.

5. GRS WALL FACE ALIGNMENT: CHECK FOR LEVEL ALIGNMENT OF THE CMU BLOCK ROW AT LEAST EVERY OTHER LAYER OF THE GRS ABUTMENT. CORRECT ANY ALIGNMENT DEVIATIONS GREATER THAN 0.25 INCHES. WHERE DIFFERENTIAL SETTLEMENT IS ANTICIPATED, OR ENCOUNTERED, PROVIDE A VERTICAL CONTROL JOINT IN THE WALL FACE TO REDUCE OR ELIMINATE CRACKING OF BLOCKS.

6. BEAM SEAT PLACEMENT: FOR FLAT GRADED BEAM SEATS, THE THICKNESS OF THE BEAM SEAT IS APPROXIMATELY 8 TO 12 INCHES AND CONSISTS OF A MINIMUM OF TWO 4 INCH COMPACTED THICKNESSES OF WRAPPED-FACE GRS. PLACE PRECUT 4 INCH THICK P.C.P. FOAM BOARD ON THE TOP OF THE BEARING BED REINFORCEMENT BUTT AGAINST THE BACK FACE OF THE CMU BLOCK. SET HALF HEIGHT OR FULL HEIGHT (DEPENDING ON WALL HEIGHT AND REQUIRED CLEAR SPACE) SOLID CMU BLOCKS ON TOP OF THE P.C.P. FOAM BOARD. WRAP TWO APPROXIMATELY 4 INCH COMPACTED THICKNESSES ACROSS THE BEAM SEAT. BEFORE FOLDING THE FINAL WRAP, IT MAY BE NECESSARY TO GRADE THE SURFACE AGGREGATE OF THE BEAM SEAT SLIGHTLY HIGH, TO ABOUT 0.5 INCHES, TO AID IN SEATING THE SUPERSTRUCTURE AND TO MAXIMIZE CONTACT WITH THE BEARING AREA.

7. SUPERSTRUCTURE PLACEMENT: THE CRANE USED FOR THE PLACEMENT OF THE SUPERSTRUCTURE CAN BE POSITIONED ON THE GRS ABUTMENT PROVIDED THE OUTRIGGER PADS ARE SIZED FOR LESS THAN 4,000 PSF NEAR THE FACE OF THE ABUTMENT WALL. GREATER LOADS COULD BE SUPPORTED WITH INCREASING DISTANCE FROM THE ABUTMENT FACE IF CHECKED BY THE ENGINEER. AN ADDITIONAL LAYOUT OF GEOSYNTHETIC REINFORCEMENT CAN BE PLACED BETWEEN THE BEAM SEAT AND THE CONCRETE OR STEEL BEAMS TO PROVIDE ADDITIONAL PROTECTION OF THE BEAM SEAT. SET BEAMS SQUARE AND LEVEL WITHOUT DRAGGING ACROSS THE BEAM SEAT SURFACE.

CONSTRUCTION METHODOLOGY (CONTINUED)

8. INTEGRATED APPROACH PLACEMENT: GEOTEXTILE REINFORCEMENT LAYERS ARE PLACED ALONG THE BACK OF THE SUPERSTRUCTURE, BUILT IN COMPACTED THICKNESSES OF 6-INCHES (MAXIMUM VERTICAL SPACING OF REINFORCEMENT IS 6 INCHES). THE TOP OF THE FINAL WRAP SHOULD BE A MINIMUM OF 2 INCHES BELOW THE TOP OF THE SUPERSTRUCTURE TO ALLOW AT LEAST 2 INCHES OF AGGREGATE BASE COVER OVER THE GEOSYNTHETIC TO PROTECT IT FROM HOT MIX ASPHALT.

9. DRIVE STEEL GUIDERAIL POSTS THROUGH GEOTEXTILE.

ABBREVIATIONS

a_b = SETBACK DISTANCE BETWEEN BACK OF FACING ELEMENT AND BEAM SEAT; 8 INCHES MINIMUM

B = BASE LENGTH OF REINFORCEMENT NOT INCLUDING THE WALL FACE; B/H IS GREATER THAN OR EQUAL TO 0.3 AND SATISFY GLOBAL STABILITY

b = BEARING WIDTH FOR BRIDGE, BEAM SEAT; 2.0 FEET MINIMUM FOR SPANS LESS THAN 25 FEET, 2.5 FEET MINIMUM FOR SPANS GREATER THAN OR EQUAL TO 25 FEET.

B_b = WIDTH OF THE BRIDGE

b_{block} = WIDTH OF CMU

b_r = LENGTH OF BEARING BED REINFORCEMENT; LENGTH = $2q_s$ + b

B_{RSF} = WIDTH OF RSF

B_{total} = TOTAL WIDTH AT BASE OF GRS ABUTMENT INCLUDING THE WALL FACING

CMU = CONCRETE MASONRY UNIT

d_e = CLEAR SPACE FROM TOP OF WALL TO BOTTOM OF SUPERSTRUCTURE GREATER OF 3 INCHES OR 2 PERCENT OF ABUTMENT HEIGHT (H); ACCOMMODATES VERTICAL DEFORMATION OF REINFORCED BACKFILL AND DIFFERENTIAL SETTLEMENT.

D_{RSF} = DEPTH OF RSF BELOW BOTTOM OF WALL ELEVATION; 0.25 x B_{total} MINIMUM

GRS = GEOSYNTHETIC REINFORCED SOIL

H = WALL HEIGHT MEASURED FROM TOP OF RSF TO TOP OF BEAM SEAT

H_{block} = HEIGHT OF CMU

h_{rb} = HEIGHT OF ROAD BASE (EQUALS HEIGHT OF SUPERSTRUCTURE AND PAVEMENT THICKNESS)

IBS = INTEGRATED BRIDGE SYSTEM

L = LENGTH OF GEOSYNTHETIC REINFORCEMENT

L_{abut} = ABUTMENT WIDTH

L_{block} = LENGTH OF CMU

L_{ww} = WINGWALL LENGTH

RSF = REINFORCED SOIL FOUNDATION

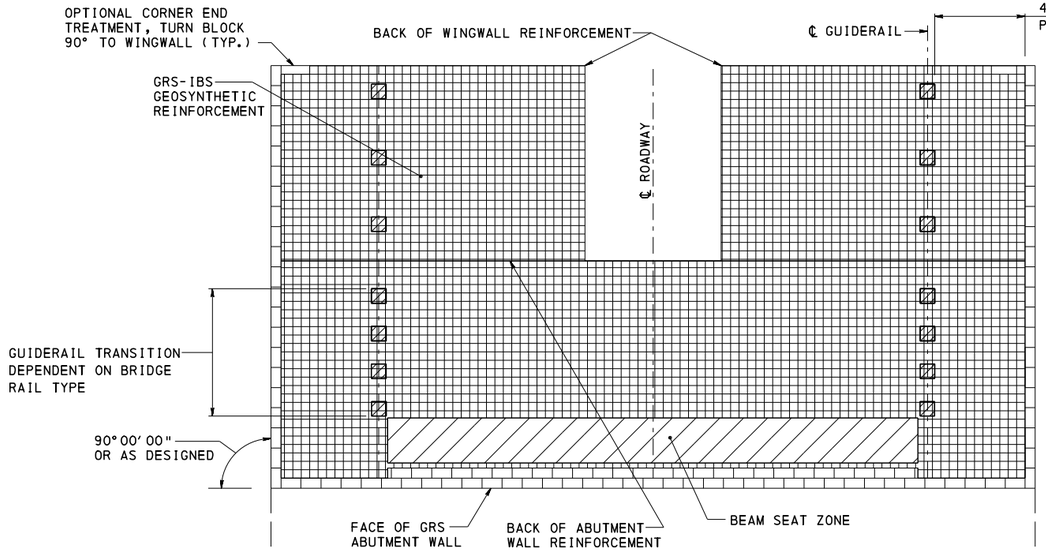
X_{RSF} = LENGTH OF RSF IN FRONT OF THE ABUTMENT WALL FACE; 0.25 x B_{total} MINIMUM

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

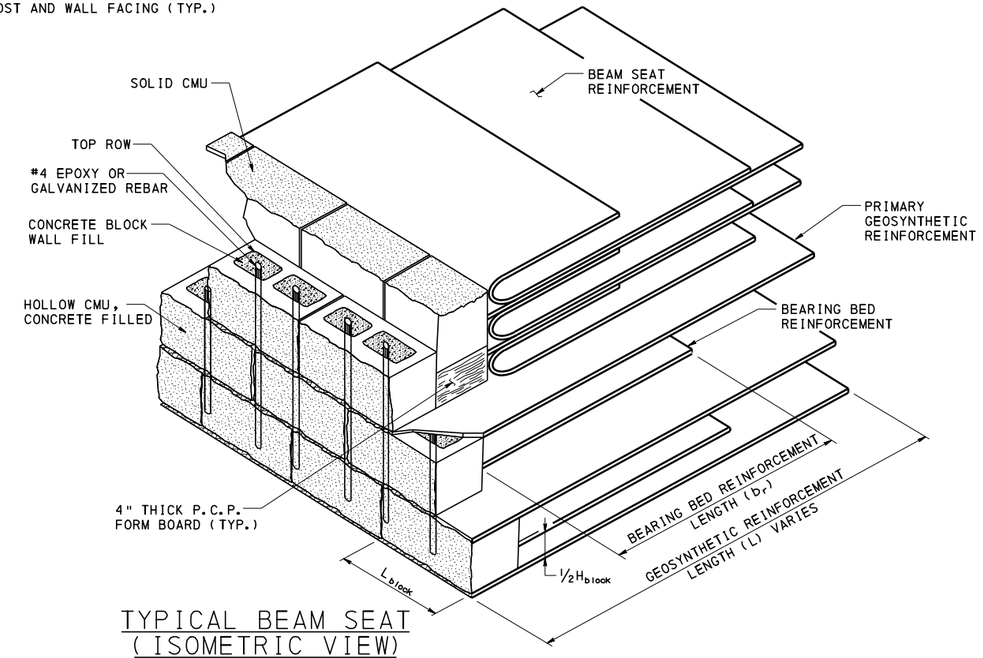
STANDARD

GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM NOTES

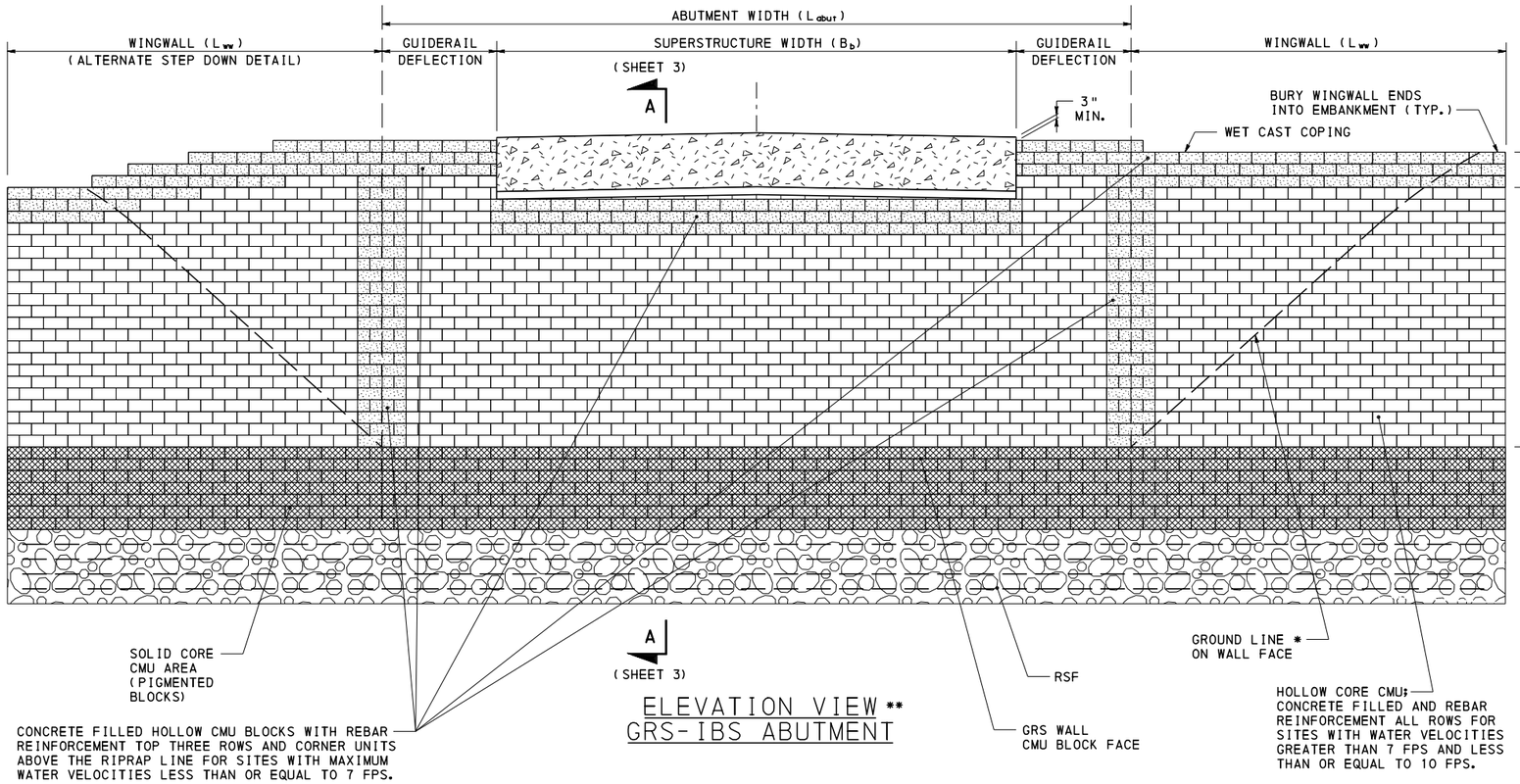
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 1 OF 5
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-697M



PLAN VIEW GRS-IBS ABUTMENT



TYPICAL BEAM SEAT (ISOMETRIC VIEW)



ELEVATION VIEW ** GRS-IBS ABUTMENT

* BENCH WINGWALL AS NECESSARY.

** WINGWALLS FOLDED OUT FOR ELEVATION VIEW.

NOTES

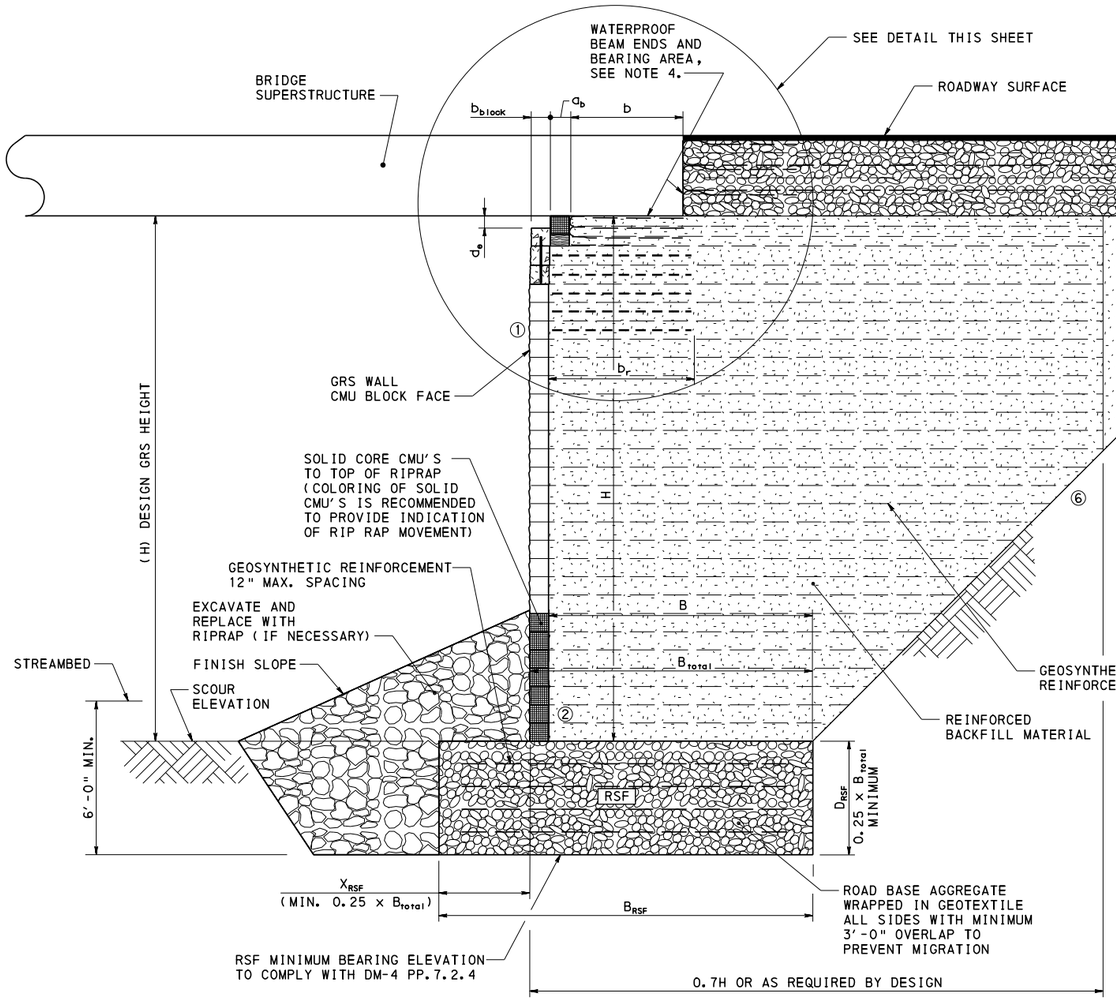
1. INSERT #4 REBARS INTO THE TOP 3 ROWS OF CMU'S AND ALL ROWS OF CORNER CMU'S ABOVE THE RIPRAP LINE AND FILL WITH CONCRETE.
2. SUPERSTRUCTURE CROWN OR SUPERELEVATION CAN BE PROVIDED BY GRADING THE REINFORCED FILL, PROVIDING REINFORCING FOR FILL THICKNESS GREATER THAN 4 INCH THICKNESS, COVERING TOP OF GRADED FILL WITH GEOSYNTHETIC, AND INDIVIDUALLY STEPPING OR CUTTING BLOCKS TO MATCH GRADE USING A CONCRETE CUT-OFF OR CIRCULAR SAW.
3. ADJUST LENGTH AND ANGLE OF WINGWALLS FOR SITE SPECIFIC CONDITIONS. WINGWALL LENGTH CONSIDERATION SHOULD INCLUDE PREVENTING EROSION OF GRS ABUTMENT FILL FROM STREAM FLOW INCLUDING THE EFFECTS OF ESTIMATED CHANNEL MIGRATION.
4. IF RSF IS NOT USED BENEATH THE WINGWALLS, THEN ADDITIONAL INDEPENDENT RETAINING WALL CALCULATIONS SHOULD BE PERFORMED TO DETERMINE THE STABILITY OF THE WINGWALLS.
5. SOLID CORE CMU'S SHALL BE PLACED UP TO THE RIPRAP HEIGHT.
6. CMU BLOCKS ARE STAGGERED, INCLUDING CORNERS, SO THERE ARE NO VERTICAL JOINTS GREATER THAN 1 CMU BLOCK HEIGHT.
7. GUIDERAIL TYPE AND LOCATION TO BE DESIGNED BY OTHERS IN ACCORDANCE WITH REQUIRED SAFETY STANDARDS.
8. WHEN NECESSARY, GRADE A DRAINAGE CHANNEL OFFSET FROM THE BACK OF THE WINGWALLS AND LINED WITH GEOTEXTILE AND CHANNEL ROCK. GRADE IN COMPACTED SOIL AWAY FROM WINGWALLS WITH A SLOPE LEADING TO THE CHANNEL.
9. SET WINGWALL HEIGHT A MINIMUM OF 6" BELOW THE ROADWAY SURFACE TO ALLOW FOR DRAINAGE AWAY FROM THE ROADWAY.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

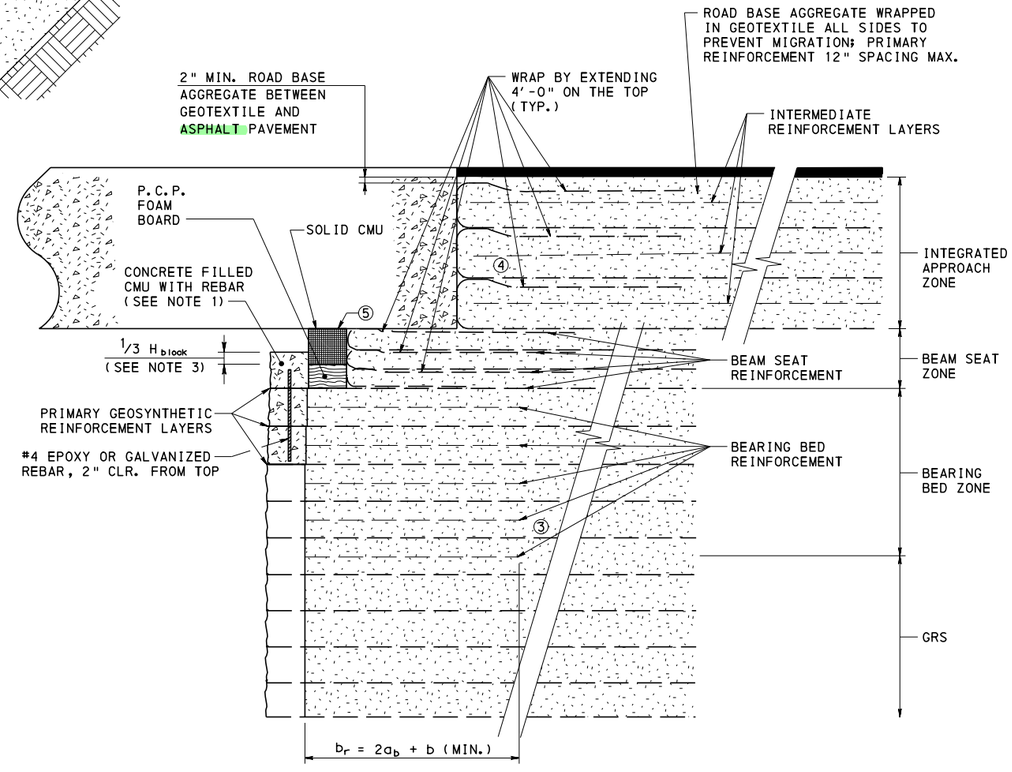
STANDARD

GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM PLAN AND ELEVATION

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 2 OF 5
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-697M



SECTION A-A



BEAM SEAT & INTEGRATED APPROACH DETAIL

LEGEND

- REINFORCED BACKFILL MATERIAL
- ROAD BASE AGGREGATE
- PAVEMENT
- RIPRAP
- HOLLOW CONCRETE MASONRY UNIT (CMU)
- PIGMENTED SOLID CONCRETE MASONRY UNIT (CMU)
- CONCRETE FILLED CONCRETE MASONRY UNIT (CMU)

NOTES

1. FINISH CMU CONCRETE FILL AT TOP OF CMU'S UNDER BRIDGE GIRDERS SLOPED TO DRAIN.
2. ON TOP ROW OF CMU'S CREATE A MORTAR CAPPING APPROXIMATELY 1½" THICK. SEE COPING DETAIL ON SHEET 4.
3. THE SOLID CMU IN BEAM SEAT MUST ENGAGE THE UPPER-MOST CONCRETE FILLED CMU FACING BY 1/3 OF THE BLOCK HEIGHT.
4. WATERPROOFING METHODS ARE DEPENDANT ON THE SUPERSTRUCTURE TYPE, BUT CAN INCLUDE WATERPROOFING MEMBRANES, WATERPROOFING ASPHALT BINDERS, INCREASED CONCRETE COVER FOR CONCRETE MEMBERS OR A CAST IN PLACE BEAM SEAT AND END DIAPHRAGM (SEE SHEET 4).

① VERTICAL WALL FACE BATTER = 0°

② SOLID CMU'S BEHIND RIPRAP.

③ DEPTH DESIGNED TO SATISFY INTERNAL STABILITY WITH MINIMUM OF 5 LAYERS OF BEARING BED REINFORCEMENT.

④ PRIMARY WRAP REINFORCEMENT VERTICAL SPACING FOR THE INTEGRATED APPROACH IS A MAXIMUM OF 12 INCHES.

⑤ FULL HEIGHT BLOCK IS TYPICAL IN FRONT OF BEARING SEAT BUT A HALF HEIGHT BLOCK AND A SPECIAL P.C.P. FOAM BOARD THICKNESS MAY BE REQUIRED IN SOME APPLICATIONS. CUT BLOCK TO HALF HEIGHT USING CONCRETE CUT-OFF OR CIRCULAR SAW OR PURCHASE AS HALF HEIGHT.

⑥ EXCAVATION SLOPE IN ACCORDANCE WITH RC-11M OR OSHA SAFETY REGULATION (29 CFR, PART 1926, SUBPART P, EXCAVATION). TEMPORARY SUPPORT OF EXCAVATION (SHORING) MAY BE REQUIRED FOR CERTAIN SITE CONDITIONS.

⑦ EXTEND INTEGRATED APPROACH ZONE LAYERS PAST CUT SLOPE.

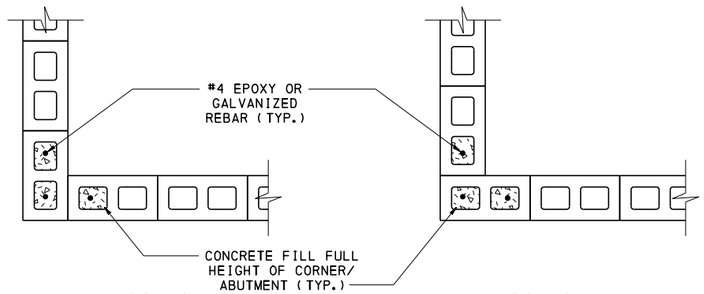
⑧ PLACE HIGH QUALITY FILL IN THIS AREA.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM DETAILS

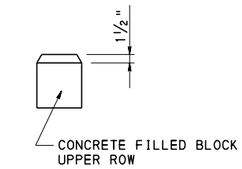
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 3 OF 5
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-697M



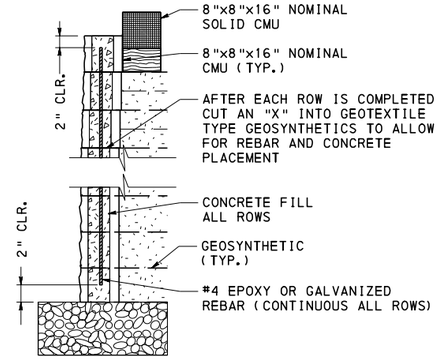
ROW 1 ROW 2

CORNER DETAIL (90°)

NOTES
1. SELECT AN ABUTMENT WIDTH THAT ACCOMMODATES A WHOLE NUMBER OF BLOCKS.
2. ALTERNATE ROW 1 AND ROW 2.



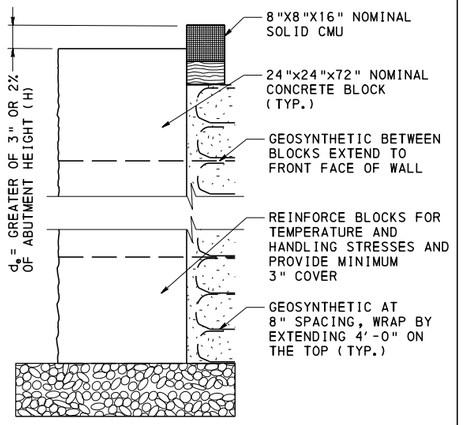
COPING DETAIL



NOTE:
FOR SITES WITH MAXIMUM WATER VELOCITIES LESS THAN OR EQUAL TO 7 FPS, ONLY TOP 3 ROWS AND ALL CORNER UNITS MUST CONTAIN REBAR AND BE CONCRETE FILLED.

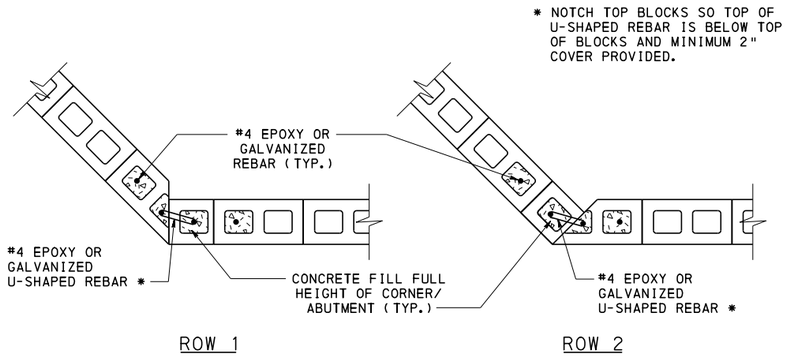
8"x8"x16" NOMINAL CMU ALL ROWS CONCRETE FILLED

(SITES WITH MAXIMUM WATER VELOCITIES GREATER THAN 7 FPS AND LESS THAN OR EQUAL TO 10 FPS)



24"x24"x72" NOMINAL SOLID BLOCK

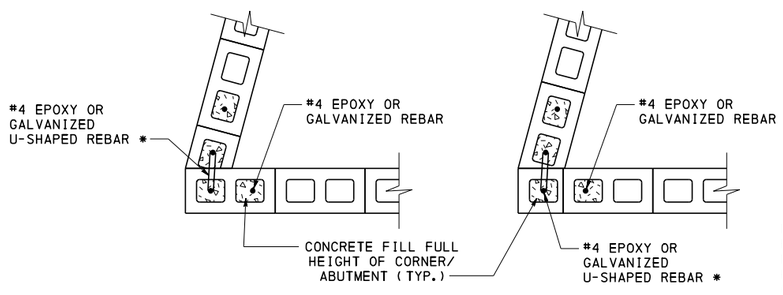
(SITES WITH MAXIMUM WATER VELOCITIES GREATER THAN 10 FPS AND LESS THAN OR EQUAL TO 12 FPS)



ROW 1 ROW 2

CORNER DETAIL (> 90°)

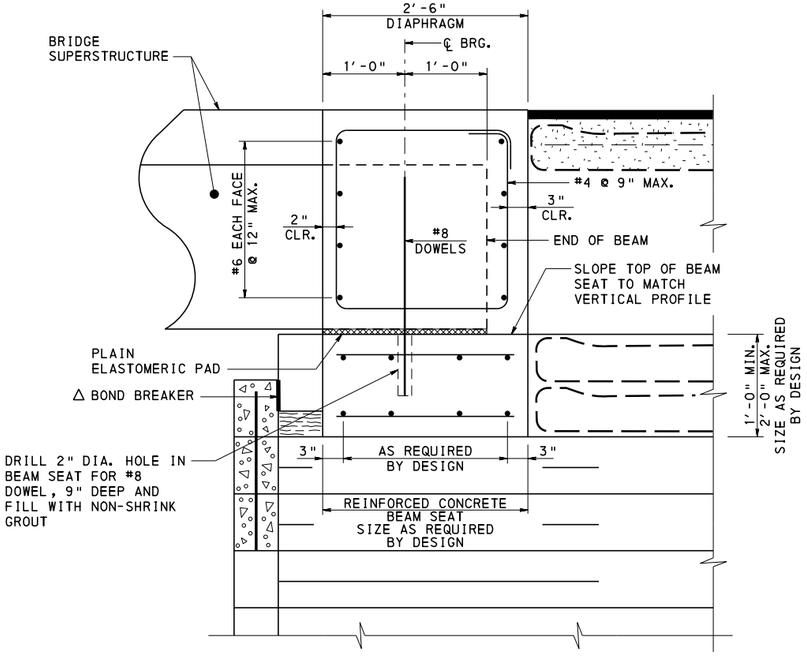
NOTE: MANUFACTURED ANGLED CORNER UNITS ARE ALSO POSSIBLE. CHECK AVAILABILITY BEFORE SPECIFYING.



ROW 1 ROW 2

CORNER DETAIL (< 90°)

NOTE: MANUFACTURED ANGLED CORNER UNITS ARE ALSO POSSIBLE. CHECK AVAILABILITY BEFORE SPECIFYING.



CONCRETE BEAM SEAT DETAIL

△ CLOSURE POURS MUST PROVIDE BOND BREAKER BETWEEN FACING UNITS AND CONCRETE INTERFACE.

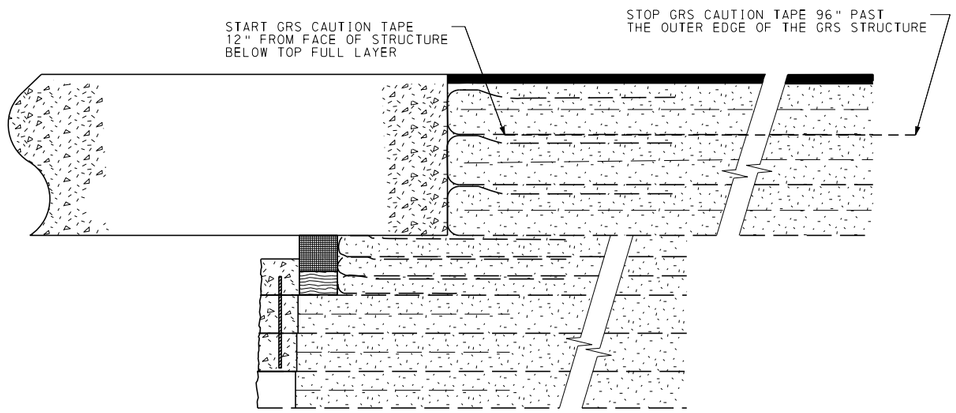
FACING REQUIREMENTS & DETAILS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

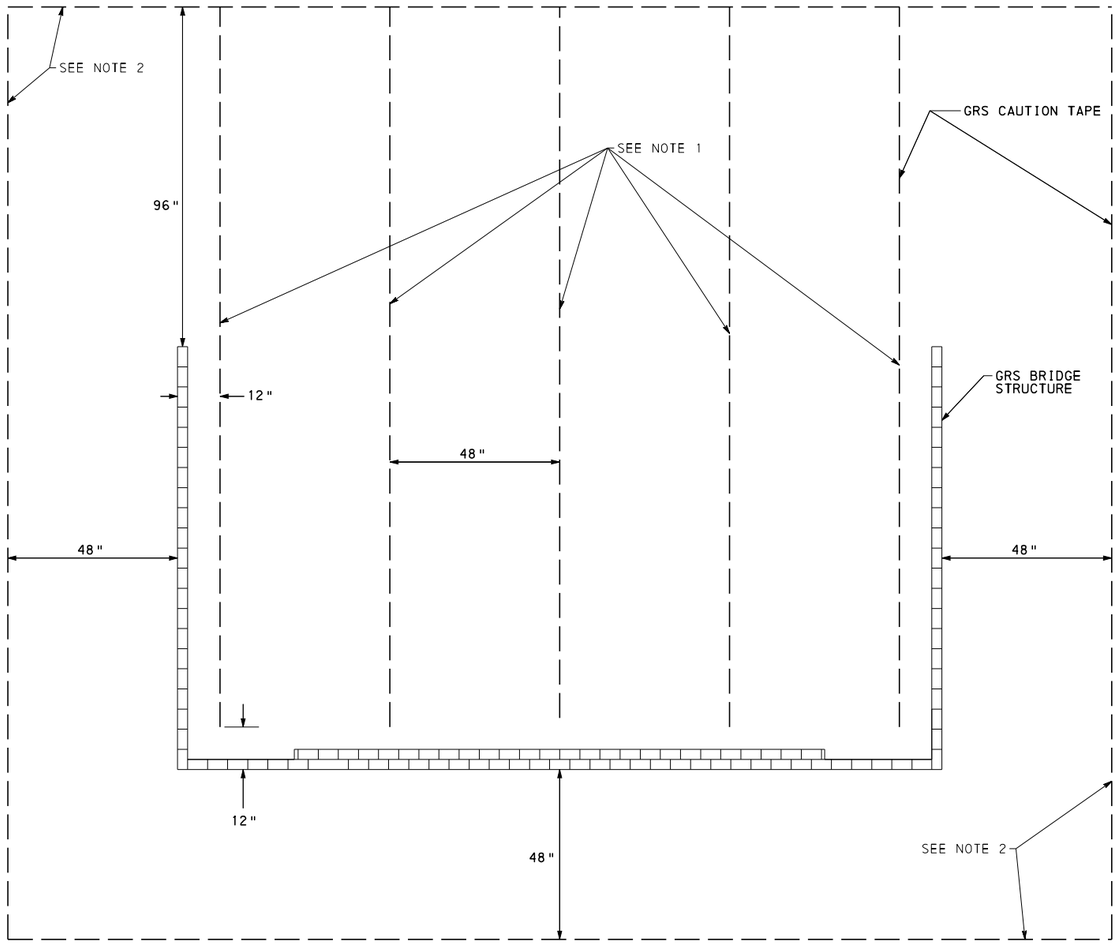
STANDARD

GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM DETAILS

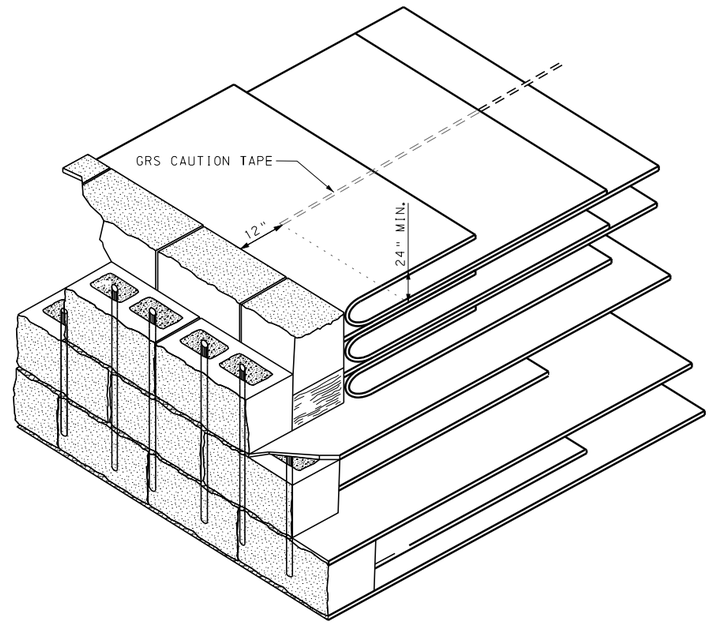
RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 4 OF 5
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-697M



GRS CATION TAPE (SIDE VIEW)



GRS CAUTION TAPE
(PLAN VIEW)



GRS CAUTION TAPE
(ISOMETRIC VIEW)

NOTES
1. GRS CAUTION TAPE IS PLACED ON THE TOP LAYER OF INTERGRATED APPROACH (IA) GEOTEXTILE. EXTEND TAPE 96" BEYOND THE END OF THE WINGWALLS AS SHOWN.
2. FOR GRS CAUTION TAPE OUTSIDE OF THE FRONT FACE OF THE GRS BRIDGE STRUCTURE, EMBED THE CAUTION TAPE 24" BELOW FINISHED GRADE AND IN THE LOCATIONS SHOWN.
3. GRS CAUSTION TAPE IS TO BE CUSTOMIZED DETECTABLE UNDERGROUND WARNING TAPE, 3 INCHES WIDE, WHITE (PREFERRED) OR GREEN IN COLOR WITH SOLID BLACK LETTERING. THE TEXT ON THE TAPE SHALL BE: "STOP DIGGING - GRS ABUTMENT - CALL OWNER"

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BRIDGE OFFICE

STANDARD

GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM CAUTION TAPE PLACEMENT

RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 5 OF 5
CHIEF BRIDGE ENGINEER	CHIEF ENGINEER, HIGHWAY ADMIN.	BD-697M