pennsylvania
DEPARTMENT OF TRANSPORTATION

PennDOT BridgeCare Treatment Criteria and Consequences

(Abridged)

4/14/2023 Edition

Summary

Using Lowest Life-Cycle Cost (LLCC) methodology, BridgeCare recommends specific treatments to bridges and culverts based on an established set of treatment parameters and consequences, combined with bridge risk. This document outlines the latest version (4/14/2023) of the parameters that PennDOT implements to define the bridge treatment logic and the latest version (4/14/2023) of the consequences that result from treatment selection. This document is divided into two major sections, "Bridge Treatment Logic" and "BridgeCare Consequence Tables".

Bridge Treatment Logic

This section outlines the parameters implemented for selection of treatment types. The following treatments are currently being utilized in PennDOT BridgeCare analyses:

- Epoxy Overlay
- Structural Overlay
- Bituminous Overlay
- Bridge Painting (steel superstructure) – Full Bridge
- Bridge Painting (steel superstructure) – Joint/Spot/Zone Painting
- General Preservation
- Leaking Deck Joint Replacement
- Deck Replacement
- Substructure Rehabilitation
- Superstructure Replacement/Rehabilitation
- Bridge Replacement
- Culvert Rehabilitation
- Culvert and Small Bridge (< 30') Replacement
- County Maintenance – Deck Work
- County Maintenance – Superstructure Work
- County Maintenance – Substructure Work

Due to variability in structure type, size, BPN, traffic volumes, condition, risk, and other characteristics, the treatments listed above contain several sets of rules to accommodate these differences. The treatment selection logic is displayed in two formats: flowcharts and summary tables. With exception to the County Maintenance treatments, all treatment types are displayed in both formats. The County Maintenance treatment rules are only shown in the summary table format.

BridgeCare Consequence Tables

This section outlines the consequences that result from the selection of each bridge treatment type. Consequences are the seeded condition rating changes that are expected to occur as a result of specific bridge treatments being selected during the BridgeCare analysis.

Additionally, a table is provided that shows the prescribed unit costs associated with each treatment type selected. The consequences and unit costs shown in the tables are the consequences and costs that Central Office currently utilizes in its BridgeCare simulations.

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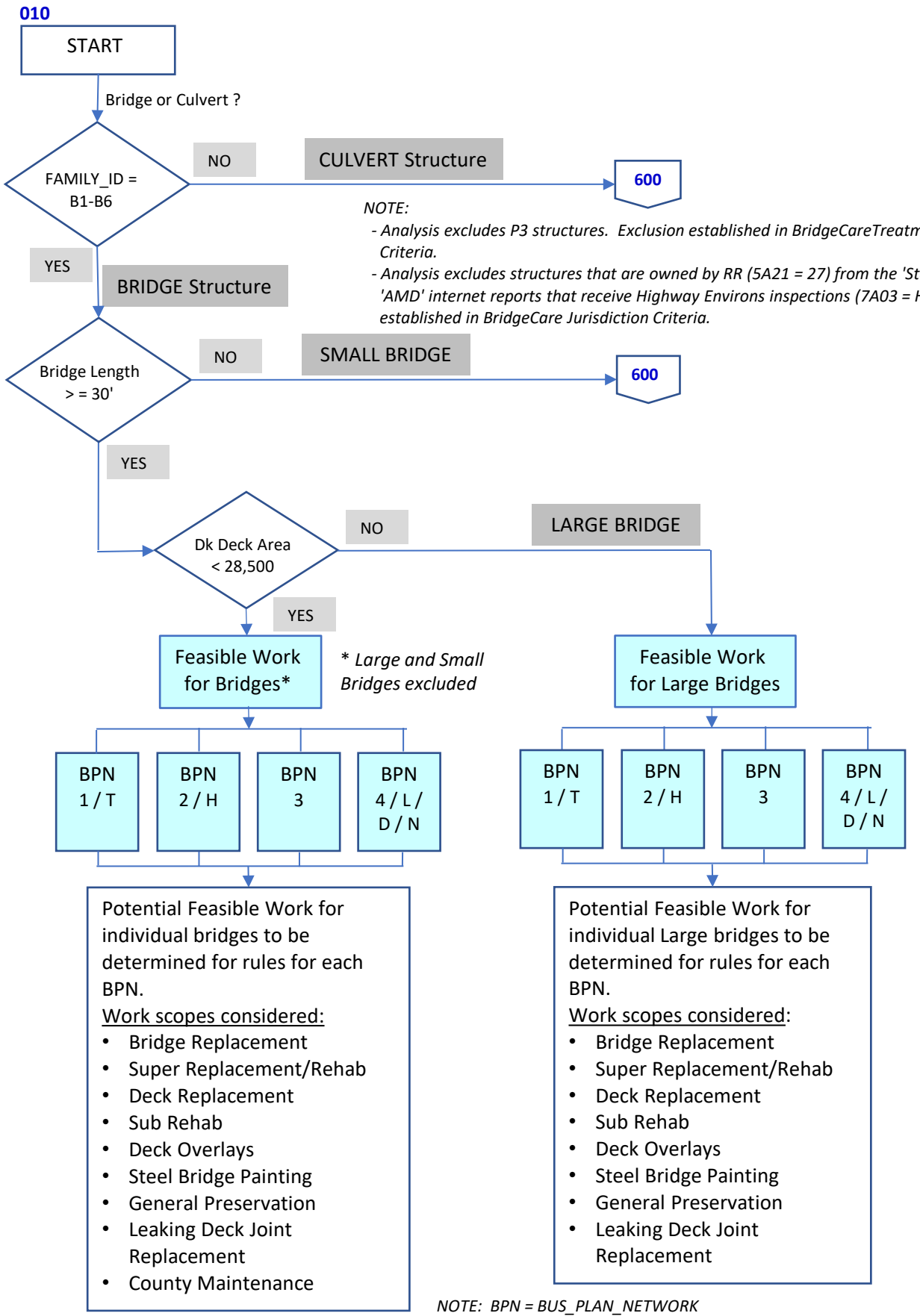
Bridge Treatment Logic

Bridge Treatment Logic

PROCESS OVERVIEW

DETERMINING FEASIBLE WORK - PROCESS OVERVIEW



NOTE:
- *Analysis excludes P3 structures. Exclusion established in BridgeCareTreatment Feasibility Criteria.*
- *Analysis excludes structures that are owned by RR (5A21 = 27) from the 'State', 'Local', and 'AMD' internet reports that receive Highway Environs inspections (7A03 = H). Exclusion established in BridgeCare Jurisdiction Criteria.*

Potential Feasible Work for individual bridges to be determined for rules for each BPN.

Work scopes considered:

- Bridge Replacement
- Super Replacement/Rehab
- Deck Replacement
- Sub Rehab
- Deck Overlays
- Steel Bridge Painting
- General Preservation
- Leaking Deck Joint Replacement
- County Maintenance

Potential Feasible Work for individual Large bridges to be determined for rules for each BPN.

Work scopes considered:

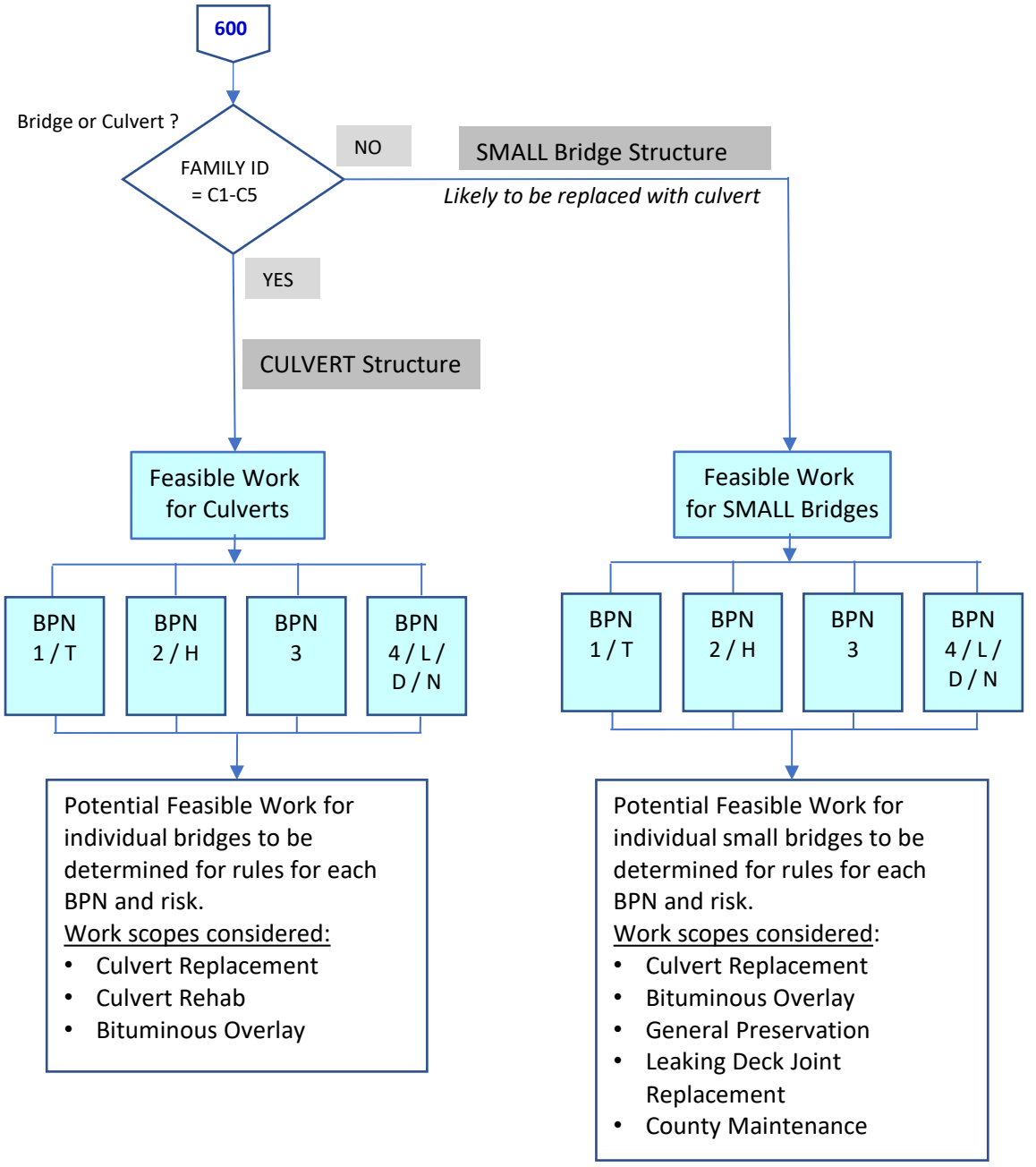
- Bridge Replacement
- Super Replacement/Rehab
- Deck Replacement
- Sub Rehab
- Deck Overlays
- Steel Bridge Painting
- General Preservation
- Leaking Deck Joint Replacement

NOTE: BPN = BUS_PLAN_NETWORK

Bridge Treatment Logic

PROCESS OVERVIEW

DETERMINING FEASIBLE WORK - PROCESS OVERVIEW



Bridge Treatment Logic

PROCESS OVERVIEW

DETERMINING FEASIBLE WORK - PROCESS OVERVIEW

Threshold Risk Scores for High Priority Bridges
(Deck Area <= 28,500 SF; Length > = 30')

Network	High
BPN 1 / T	25,000
BPN 2 / H	15,000
BPN 3	7,000
BPN 4 / L / D / N	2,000
LARGE Bridges	ALL

Threshold Risk Scores for High Priority Culverts and Small Bridges (Length < 30')

Network	High
BPN 1 / T	14,000
BPN 2 / H	5,000
BPN 3	2,500
BPN 4 / L / D / N	800

BridgeCare allows for prioritization of bridges/culverts to be analyzed. The following analysis priorities are currently implemented in the BridgeCare simulations:

Priority 1: All NHS bridges and culverts with a minimum seeded value <= 3.50 (deck/sup/sub/culv); All non-NHS bridges and culverts with a risk score >= 15,000 and minimum seeded value <= 3.50 (deck/sup/sub/culv)

Priority 2: All bridges and culverts with a minimum seeded value < 3.00 (deck/sup/sub/culv) and posting status ≠ 'Closed'

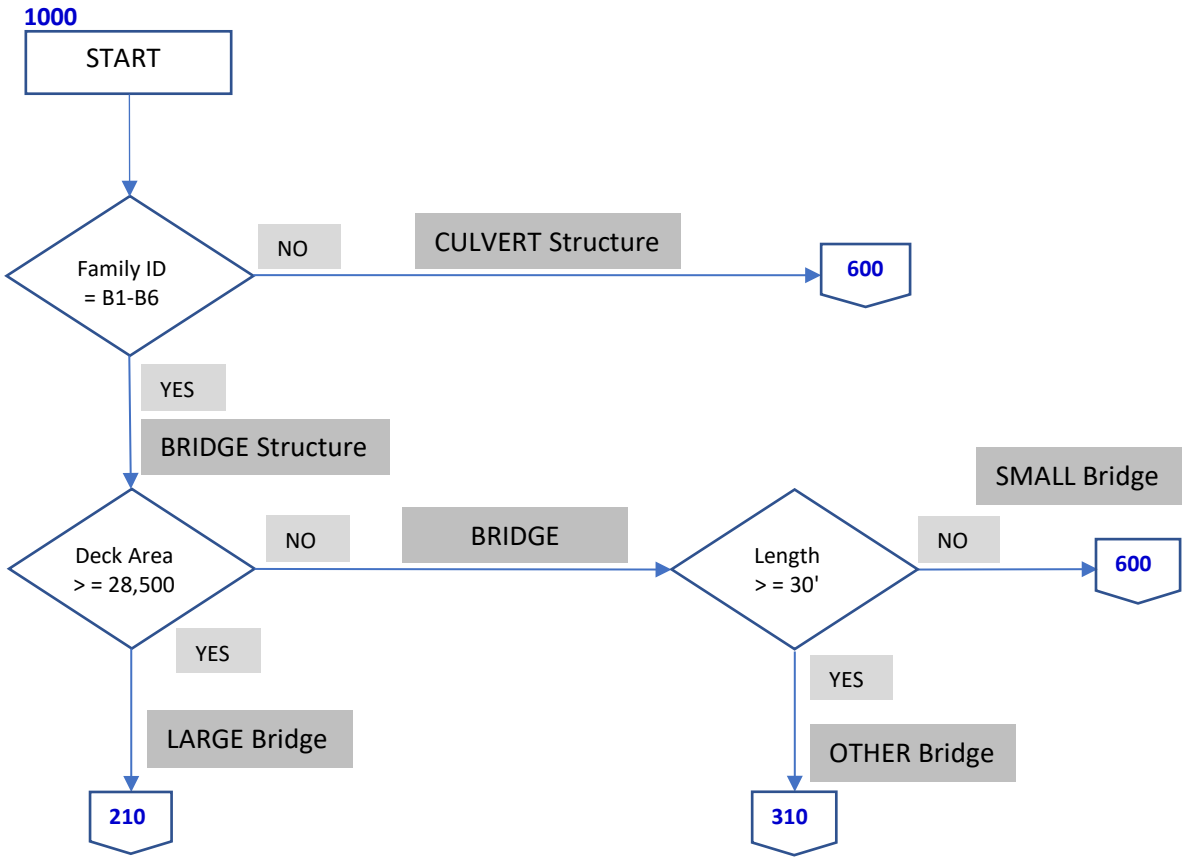
Priority 3: All other bridges and culverts

Bridge Treatment Logic

PROCESS OVERVIEW

DETERMINING FEASIBLE WORK - PROCESS OVERVIEW

Determination of Structure Categories



Bridge Treatment Logic

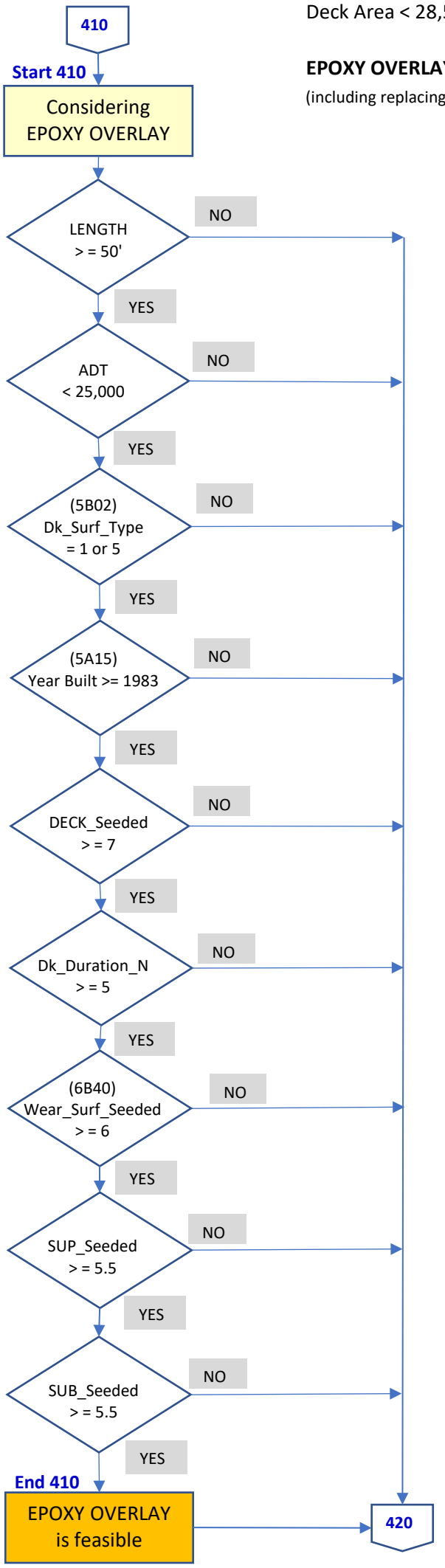
BPN 2 / H - Other Bridges

DETERMINING FEASIBLE WORK FOR OTHER BRIDGES

Deck Area < 28,500 SF and Length > = 30'

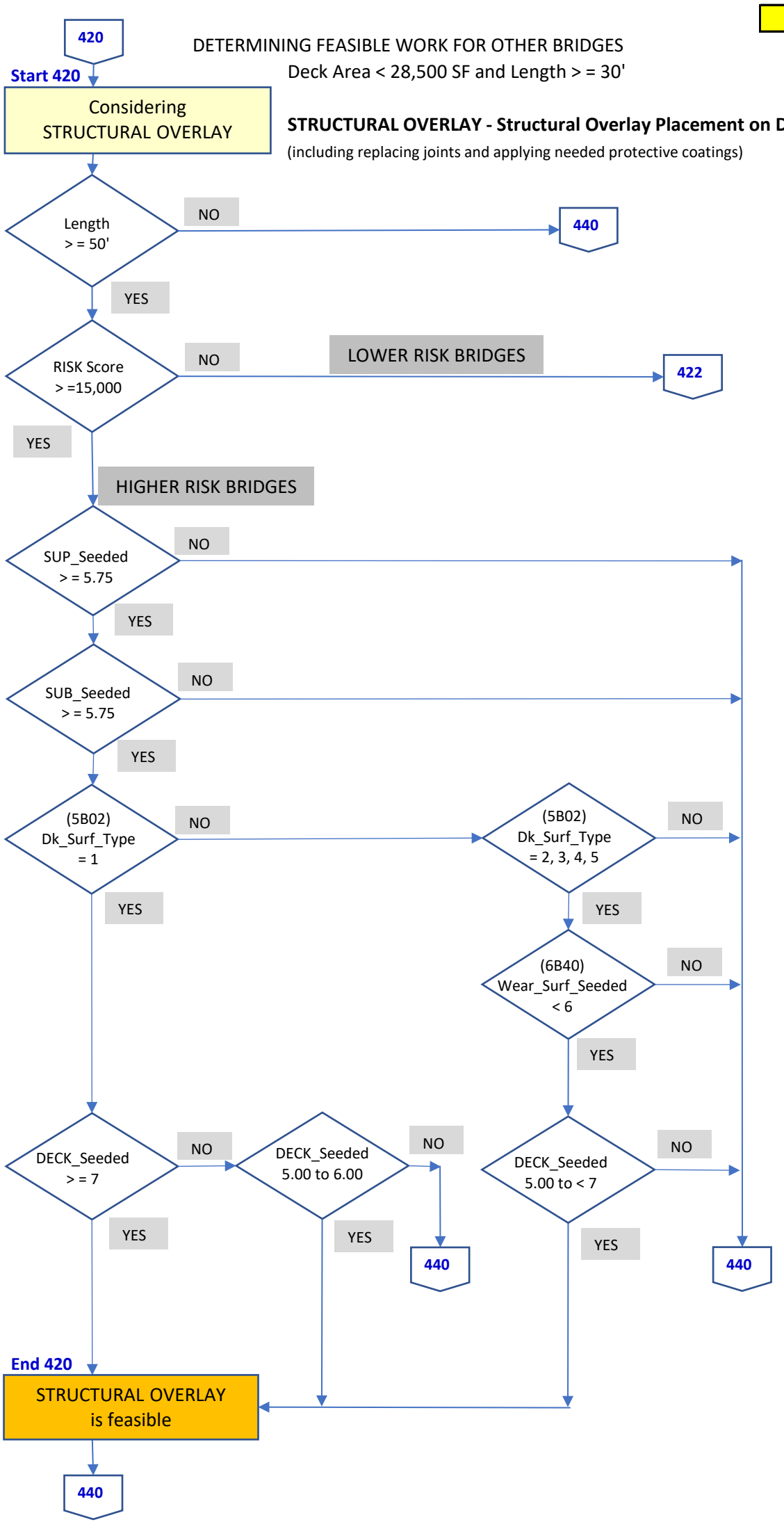
EPOXY OVERLAY - Epoxy Overlay Placement on Deck

(including replacing joint glands and applying needed protective coatings)



Bridge Treatment Logic

BPN 2 / H - Other Bridges



Bridge Treatment Logic

BPN 2 / H - Other Bridges

DETERMINING FEASIBLE WORK FOR OTHER BRIDGES
Deck Area < 28,500 SF and Length > = 30'

STRUCTURAL OVERLAY - Structural Overlay Placement on Deck (CONT.)

(including replacing joints and applying needed protective coatings)

Bridge Treatment Logic

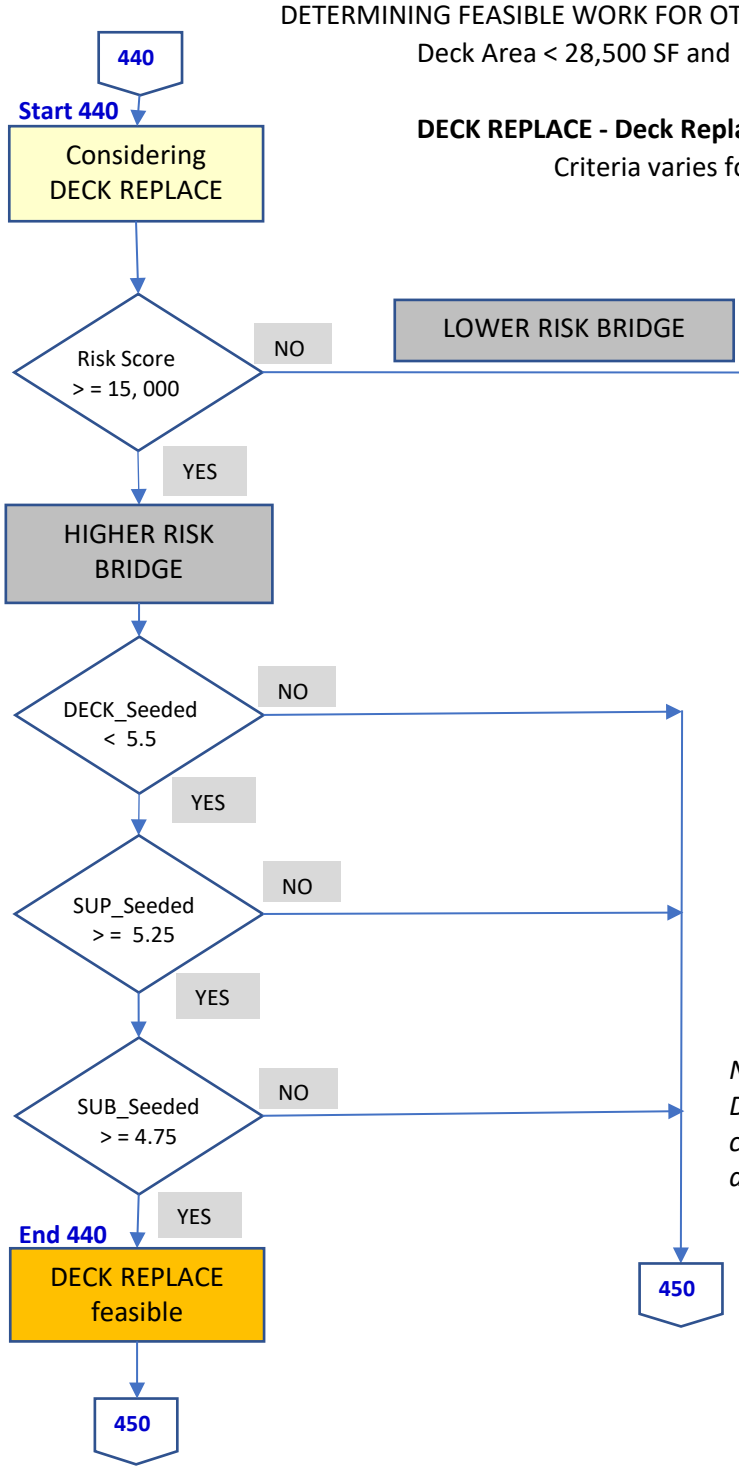
BPN 2 / H - Other Bridges

DETERMINING FEASIBLE WORK FOR OTHER BRIDGES

Deck Area < 28,500 SF and Length > = 30'

DECK REPLACE - Deck Replacement

Criteria varies for risk categories



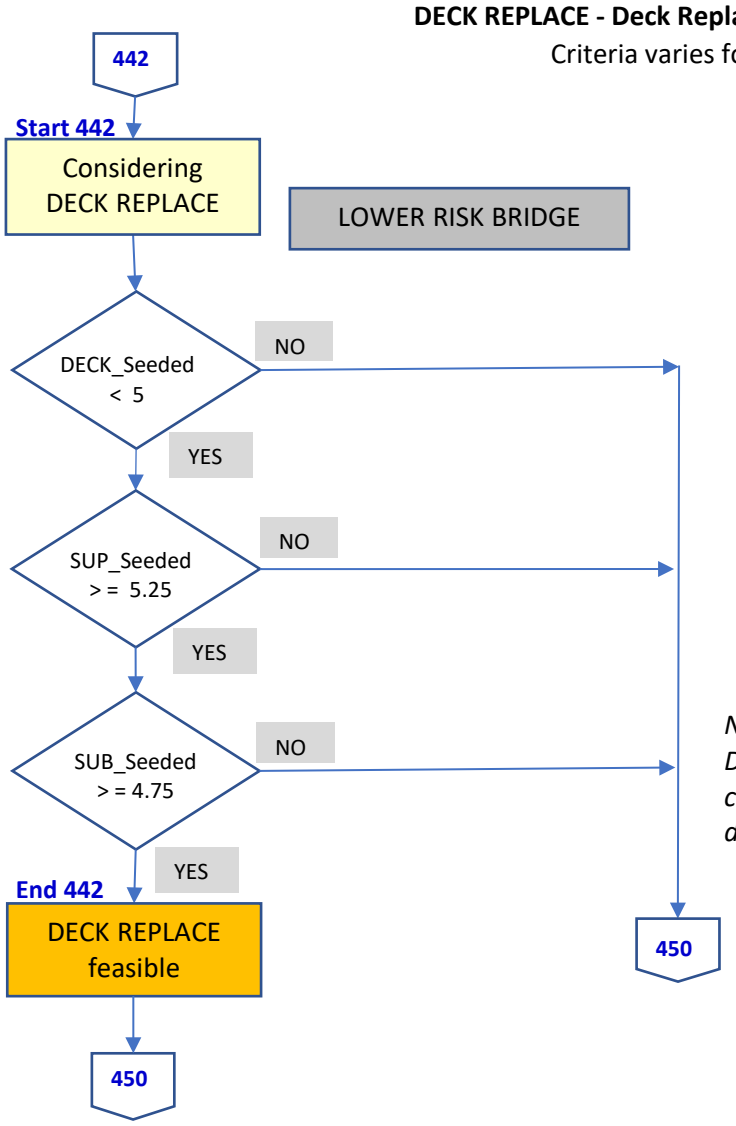
NOTE:
Deck replacements are not applicable to cast-in-place (CIP) concrete T-beam bridges. CIP concrete T-beam bridges are defined as bridges with 6A26 = 2 and 6A29 = 03.

Bridge Treatment Logic

BPN 2 / H - Other Bridges

DETERMINING FEASIBLE WORK FOR OTHER BRIDGES
Deck Area < 28,500 SF and Length > = 30'

DECK REPLACE - Deck Replacement
Criteria varies for risk categories



NOTE:
Deck replacements are not applicable to cast-in-place (CIP) concrete T-beam bridges. CIP concrete T-beam bridges are defined as bridges with 6A26 = 2 and 6A29 = 03.

Bridge Treatment Logic

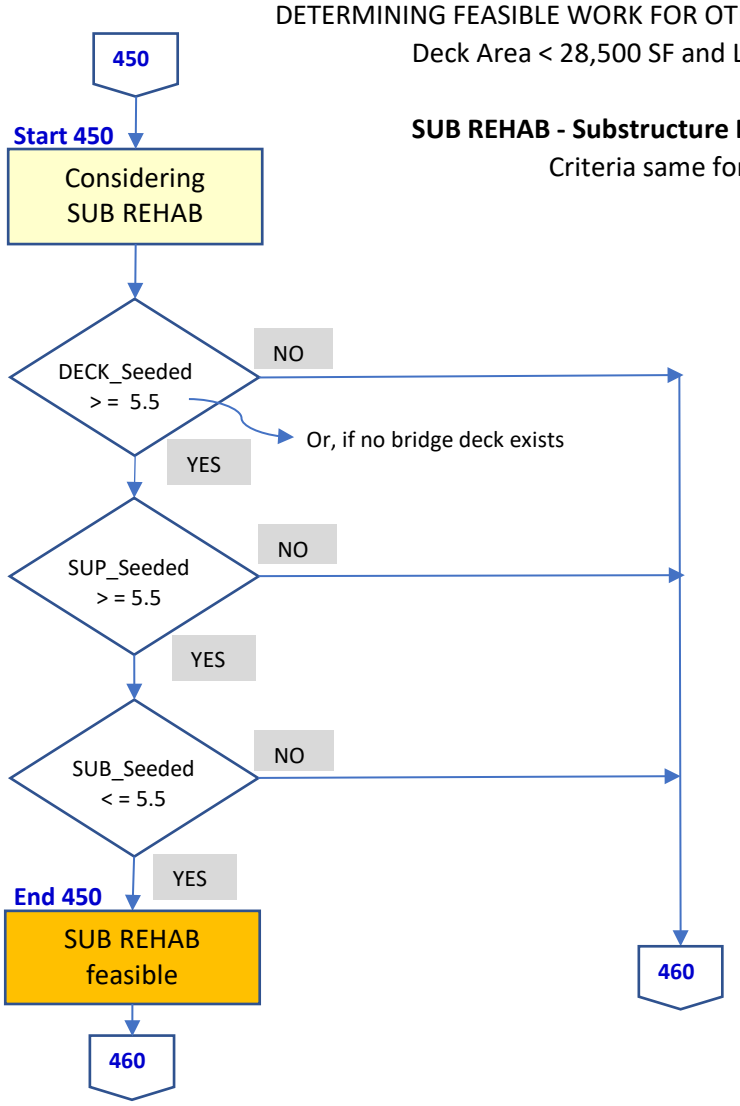
BPN 2 / H - Other Bridges

DETERMINING FEASIBLE WORK FOR OTHER BRIDGES

Deck Area < 28,500 SF and Length > = 30'

SUB REHAB - Substructure Rehabilitation

Criteria same for all risk categories



Bridge Treatment Logic

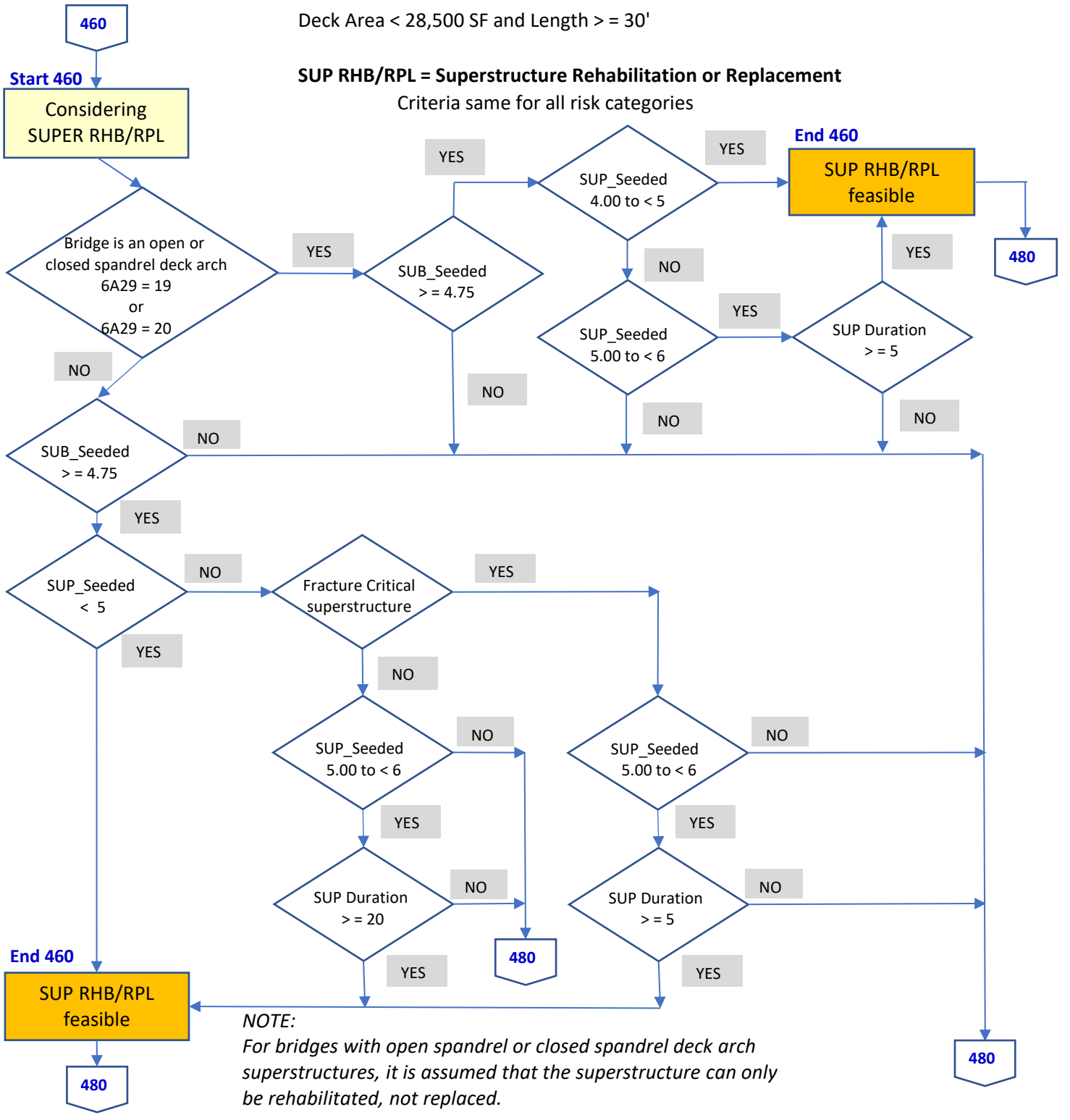
BPN 2 / H - Other Bridges

DETERMINING FEASIBLE WORK FOR OTHER BRIDGES

Deck Area < 28,500 SF and Length > = 30'

SUP RHB/RPL = Superstructure Rehabilitation or Replacement

Criteria same for all risk categories



NOTE:
For bridges with open spandrel or closed spandrel deck arch superstructures, it is assumed that the superstructure can only be rehabilitated, not replaced.

Bridge Treatment Logic

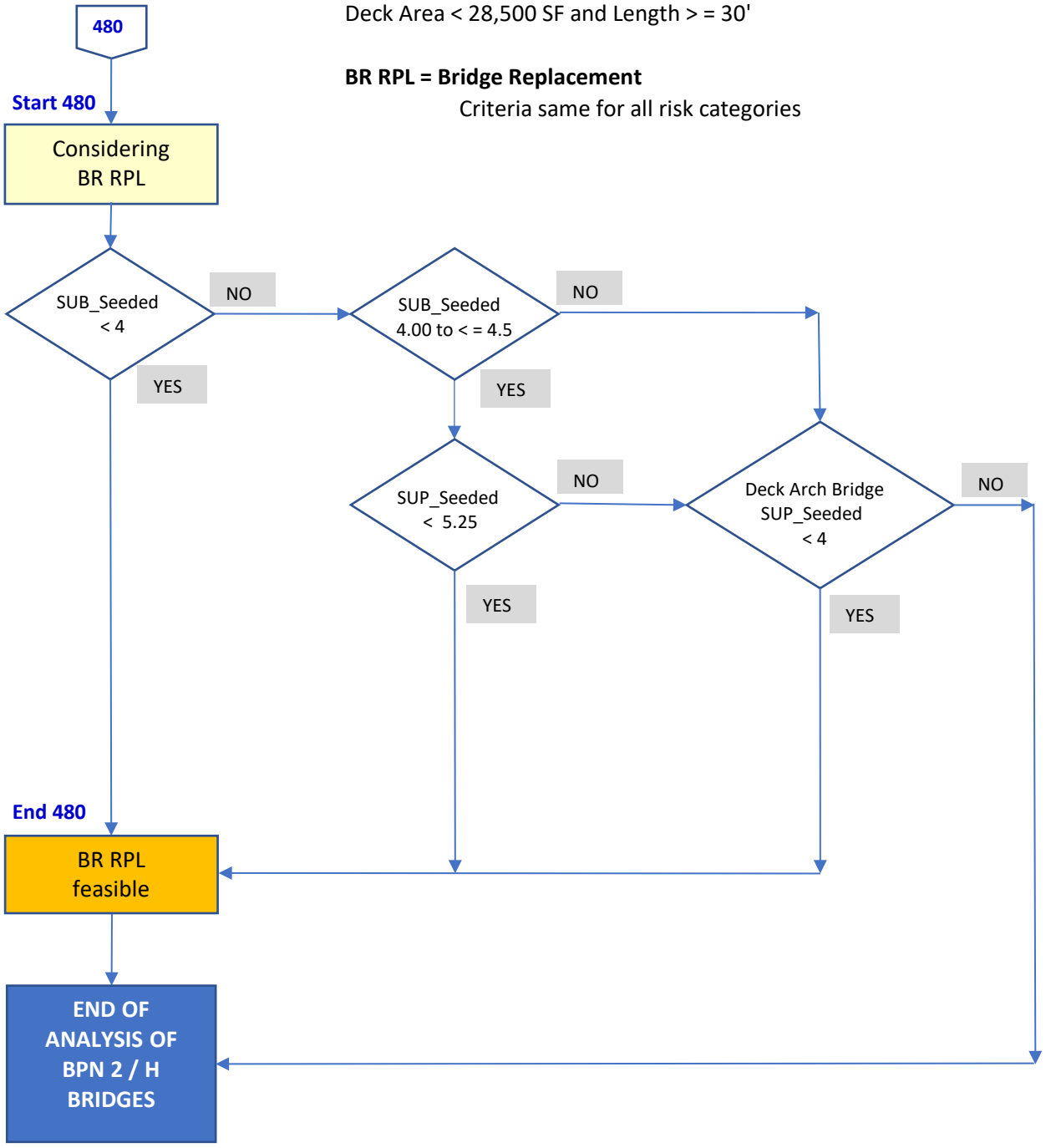
BPN 2 / H - Other Bridges

DETERMINING FEASIBLE WORK FOR OTHER BRIDGES

Deck Area < 28,500 SF and Length > = 30'

BR RPL = Bridge Replacement

Criteria same for all risk categories



NOTE:
Deck arch bridges are defined as bridges with either open spandrel deck arches (6A29 = 19) or closed spandrel deck arches (6A29 = 20).

Bridge Treatment Logic

Bridge Replacements and Rehabilitations

	Deck Replacement *(N/A to cast-in-place concrete T-beam bridges)*	**Sub Rehab**	**Super Repl/Rehab** *(Applicable to all bridges except deck arch bridges)*	**Super Rehab** *(Applicable to deck arch bridges only)*	**Bridge Replacement**
Large Bridges *(deck area >= 28,500 SF)*					
BPN 1/T *(deck area < 28,500 SF) (length >= 30')*					
BPN 2/H *(deck area < 28,500 SF) (length >= 30')*	**Higher Risk** Deck < 5.5 Super >= 5.25 Sub >= 4.75 **Lower Risk** Deck < 5 Super >= 5.25 Sub >= 4.75	Deck >= 5.5 or No Bridge Deck Super >= 5.5 Sub <= 5.5	Super = '5', >= 20 years (non-fracture critical) Sub >= 4.75 ***OR*** Super = '5', >= 5 years (fracture critical) Sub >= 4.75 ***OR*** Super < 5 Sub >= 4.75	Super = '5', >= 5 years Sub >= 4.75 ***OR*** Super = '4' Sub >= 4.75	Super < 5.25 Sub = 4 to <= 4.5 ***OR*** Sub < 4 ***OR*** Super < 4 (deck arch bridges)
BPN 3 *(deck area < 28,500 SF) (length >= 30')*					
BPN 4/L/D/N *(deck area < 28,500 SF) (length >= 30')*					

NOTES:

Higher/Lower Risk score thresholds:

BPN 2/H Higher Risk Bridges: Risk score >= 15,000 — *BPN 2/H Lower Risk Bridges: Risk score < 15,000*

BPN 3 Higher Risk Bridges: Risk score >= 7,000 — *BPN 3 Lower Risk Bridges: Risk score < 7,000*

BPN 4/L/D/N Higher Risk Bridges: Risk score >= 2,000 — *BPN 4/L/D/N Lower Risk Bridges: Risk score < 2,000*

Deck arch bridges are defined as bridges with either open spandrel deck arches (6A29 = 19) or closed spandrel deck arches (6A29 = 20).

Cast-in-place concrete T-beam bridges are defined as bridges with 6A26 = 2 and 6A29 = 03.

Deck, Superstructure, and Substructure condition ratings above are seeded values, unless denoted as 'X'.

Excludes P3 structures.

Excludes structures that are owned by RR (5A21 = 27) from the 'State', 'Local', and 'AMD' internet reports that receive Highway Environs inspections (7A03 = H).

BridgeCare Consequence Tables

BridgeCare Consequence Tables

BridgeCare recommends a specific treatment to be performed on structures that meet the given selection criteria (LLCC). The seeded values of the condition ratings (such as deck, super, sub, etc.) will change in the year in which the treatment is recommended to be performed in the output tables. Listed below are the work types and associated consequences for the various treatments used in BridgeCare, as well as the structural treatment unit costs.

Epoxy Overlay

Attribute	Criteria	Consequence
Deck	7.00 <= Deck_Seeded < 7.50 OR 8.00 <= Deck_Seeded < 8.50 OR Deck_Seeded >= 9.00	Ceiling
	7.50 <= Deck_Seeded < 8.00 OR 8.50 <= Deck_Seeded < 9.00	+1
Superstructure		No change
Substructure		No change
Deck Wearing Surface		9.99
IJ10 Joint Leaking?		Reset all joints to 'Unchecked'

NOTES:

1) "Ceiling" is the highest seeded value of any particular condition rating. For example, a bridge component with a seeded value of 7.13 has a "Ceiling" seeded value of 7.99.
2) After this treatment is performed, BridgeCare will not allow for additional treatments or this treatment to be performed again in the simulation according to the following schedule:
   - Years before any treatment = 5
   - Years before same treatment = 10

Structural Overlay

Attribute	Criteria	Consequence
Deck	Deck_Seeded >= 8.00	Ceiling
	Deck_Seeded < 8.00	8
Superstructure (Bridge Families B1, B3, B4, B5, and B6)	6.00 <= Sup_Seeded < 6.50	Ceiling
	6.50 <= Sup_Seeded < 7.00 OR 5.75 <= Sup_Seeded < 6.00	+1
Superstructure (Bridge Family B2)	6.00 <= Sup_Seeded < 6.50	Ceiling
	6.50 <= Sup_Seeded < 7.00	+1
	5.75 <= Sup_Seeded < 6.00	Ceiling + 1
Substructure	6.00 <= Sub_Seeded < 6.50	Ceiling
	6.50 <= Sub_Seeded < 7.00 OR 5.75 <= Sub_Seeded < 6.00	+1
Deck Wearing Surface		9.99
IJ10 Joint Leaking?		Reset all joints to 'Unchecked'

NOTES:

1) "Ceiling" is the highest seeded value of any particular condition rating. For example, a bridge component with a seeded value of 7.13 has a "Ceiling" seeded value of 7.99.
2) After this treatment is performed, BridgeCare will not allow for additional treatments or this treatment to be performed again in the simulation according to the following schedule:
   - Years before any treatment = 5
   - Years before same treatment = 15

BridgeCare Consequence Tables

Deck Replacement

Attribute	Criteria	Consequence
Deck		9.99
Superstructure	Sup_Seeded >= 7.00 OR 6.00 <= Sup_Seeded < 6.50	Ceiling
	6.50 <= Sup_Seeded < 7.00	+1
	5.50 <= Sup_Seeded < 6.00	Ceiling + 1
	5.00 <= Sup_Seeded < 5.50	+1.5
Substructure	Sub_Seeded >= 7.00 OR 6.00 <= Sub_Seeded < 6.50	Ceiling
	6.50 <= Sub_Seeded < 7.00	+1
	5.50 <= Sub_Seeded < 6.00	Ceiling + 1
	5.00 <= Sub_Seeded < 5.50	+1.5
	Sub_Seeded < 5.00	+2
Deck Wearing Surface		9.99
IJ10 Joint Leaking?		Reset all joints to 'Unchecked'

NOTES:

1) "Ceiling" is the highest seeded value of any particular condition rating. For example, a bridge component with a seeded value of 7.13 has a "Ceiling" seeded value of 7.99.
2) After this treatment is performed, BridgeCare will not allow for additional treatments or this treatment to be performed again in the simulation according to the following schedule:
   - Years before any treatment = 10
   - Years before same treatment = 50

Substructure Rehabilitation

Attribute	Criteria	Consequence
Deck	Deck_Seeded >= 6.00	Ceiling
	5.50 <= Deck_Seeded < 6.00	+1
	No Bridge Deck	No change
Superstructure	Sup_Seeded >= 7.00 OR 6.00 <= Sup_Seeded < 6.50	Ceiling
	5.50 <= Sup_Seeded < 6.00 OR 6.50 <= Sup_Seeded < 7.00	+1
Substructure	Sub_Seeded >= 3.50	+2
	Sub_Seeded < 3.50	5.50
Deck Wearing Surface		No change
IJ10 Joint Leaking?		Reset all joints to 'Unchecked'

NOTES:

1) "Ceiling" is the highest seeded value of any particular condition rating. For example, a bridge component with a seeded value of 7.13 has a "Ceiling" seeded value of 7.99.
2) After this treatment is performed, BridgeCare will not allow for additional treatments or this treatment to be performed again in the simulation according to the following schedule:
   - Years before any treatment = 10
   - Years before same treatment = 20

BridgeCare Consequence Tables

Bridge Replacement

Attribute	Criteria	Consequence
Deck		9.99
Superstructure		9.99
Substructure		9.99
Deck Wearing Surface		9.99
6B36 Paint Condition		9
6B37 Paint (Extent)		N
IJ10 Joint Leaking?		Reset all joints to 'Unchecked'

NOTES:

1) After this treatment is performed, BridgeCare will not allow for additional treatments or this treatment to be performed again in the simulation according to the following schedule:
   - Years before any treatment = 10
   - Years before same treatment = 100

Culvert Rehabilitation – Culvert Family ID = C5 (culverts not specified in C1, C2, C3, and C4)

Attribute	Criteria	Consequence
Culvert		+1.5

NOTES:

1) After this treatment is performed, BridgeCare will not allow for additional treatments or this treatment to be performed again in the simulation according to the following schedule:
   - Years before any treatment = 10
   - Years before same treatment = 15

Culvert Replacement and Small Bridge (< 30' length) Replacement

Attribute	Criteria	Consequence
Culvert		9.99
Deck		9.99
Superstructure		9.99
Substructure		9.99
Deck Wearing Surface		9.99
IJ10 Joint Leaking?		Reset all joints to 'Unchecked'

NOTES:

1) It is assumed that small bridges needing replacement are to be replaced with concrete culverts even though the seeded values for all "Attributes", except for Culvert, return to '9.99' in the BridgeCare simulation.
2) After this treatment is performed, BridgeCare will not allow for additional treatments or this treatment to be performed again in the simulation according to the following schedule:
   - Years before any treatment = 50
   - Years before same treatment = 50

For more information regarding this product or the full version of this product, please contact:

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