



Pennsylvania

Department of General Services

Cost Estimating Standards for Capital Projects

DGS Capital Programs

1 Introduction

The purpose of the Cost Estimating Standards is to establish expectations for cost estimates provided to the Department of General Services (DGS) in conjunction with capital projects.

The Cost Estimating Standards promote effective decision making and collaboration in the planning and design phase with an emphasis on achieving the Project Values within the project budget.

The Professional and the Cost Estimator each play a critical role in project cost management. The Cost Estimator is an integral part of the design team, collaborating and interacting on design decisions at each stage of the design process. The Professional must welcome the Cost Estimator into design discussions and maintain an accurate description of the project scope, requirements, design alternatives, risks, and opportunities so the Cost Estimator can provide accurate cost information.

The Cost Estimating Standards apply to all cost estimates provided on DGS managed Capital Projects.

2 Cost Estimate Format

Cost estimate formats must be consistent to facilitate effective analysis and monitoring of construction costs from programming through the completion of the construction documents. DGS uses Work Breakdown Structures (WBS) and Cost Breakdown Structures (CBS) to assist project teams in reviewing cost estimates.

2.1 Work Breakdown Structures (WBS)

The WBS organizes the scope of work to analyze bids, confirm appropriate use of funding sources, plan for phased construction procurements, and inform effective decision making. The WBS can be tailored to each project depending on how the project team requires cost information. Below are several WBS's that may be required in the cost estimate deliverable.

Costs by Prime Contract. The Separations Act requires the Commonwealth to enter separate prime contracts for general construction, HVAC, plumbing, and electrical work. Occasionally, the Department may determine that additional prime contracts, more than the standard four (4) primes, may benefit the project. To conduct an effective bid analysis, work will need to be assigned to each prime contractor and the estimator will be required to report the estimated costs of each prime contract.

Base Bids. The estimate needs to assign work and costs to Base Bids. The scope of work related to each Base Bid is additive and arranged like the following:

- Base Bid 1 (BB1) – scope that is considered the minimum viable project by the Client Agency
- Base Bid 2 (BB2) – scope of BB1 + additional scope
- Base Bid 3 (BB3) – scope of BB2 + additional scope
- The Department may require more than three (3) Base Bids.

Multiple Funding Sources. The project budget may be funded by multiple funding sources. The cost estimate may be required to report the estimated costs of work associated with each funding source so the Department can track funds apportioned according to the work and amounts authorized for each funding source.

Phased Construction.

When project work is divided into more than one construction phase, separate estimates are required for each phase.

Multiple Buildings/Major Project Elements. If a project includes multiple buildings or structures, it may be advantageous to organize the cost estimate by building or major project elements. Each building must have its own detailed line-item cost report.

2.2 Cost Breakdown Structure (CBS)

The cost breakdown structure is how detailed line-item cost information is organized and presented. DGS requires the cost estimate in the following formats:

CSI Uniformat (2010). Uniformat is a standard classification system for building systems and assemblies. The classification provides a common reference that allows the project team to effectively compare different systems by design, performance and cost during planning and early design stages. This approach allows for informed design decisions within the constraints of the Owner’s Project Requirements and the project budget. Uniformat uses levels to describe the level of detail associated with each element. For example, the Uniformat cost element **D (Services)** represents Level 1 and is further delineated as follows:

UNIFORMAT II	
A	SUBSTRUCTURE
B	SHELL
C	INTERIORS
D	SERVICES
	D10 Conveying
	D20 Plumbing
	D30 HVAC
	<i>D3010 Fuel Systems</i>
	<i>D3020 Heating Systems</i>
	<i>D3030 Cooling Systems</i>
	<i>D3050 HVAC Distribution Systems</i>
	<i>D3060 Ventilation</i>
	D40 Fire Protection
	D50 Electrical
	D60 Communications
	D70 Electronic Safety and Security
	D80 Integrated Automation
E	EQUIPMENT AND FURNISHINGS
F	SPECIAL CONSTRUCTION AND DEMOLITION
G	SITWORK

Level 1 - D (Services)
Level 2 - D30 (HVAC)
Level 3 - D3030 (Cooling Systems)

CSI MasterFormat. MasterFormat is a specification writing standard which documents the contractor's work results not systems and assemblies. The standard is commonly used by cost estimators and contractors to estimate costs and develop bids when a project has a fully detailed set of drawings and specifications.

CSI MasterFormat Division

Division 2 - Existing Conditions	Division 22 - Plumbing
Division 3 - Concrete	Division 23 - Heating, Ventilation and Air Conditioning
Division 4 - Masonry	Division 25 - Integrated Automation
Division 5 - Metals	Division 26 - Electrical
Division 6 - Wood, Plastics, and Composites	Division 27 - Communications
Division 7 - Thermal and Moisture Protection	Division 28 - Electronic Safety and Security
Division 8 - Openings	Division 31 - Earthwork
Division 9 - Finishes	Division 32 - Exterior Improvements
Division 10 - Specialties	Division 33 - Utilities
Division 11 - Equipment	
Division 12 - Furnishings	
Division 13 - Special Construction	
Division 14 - Conveying Equipment	
Division 21 - Fire Suppression	

3 Types of Costs

Cost estimates must address factors unique to the project, including Client Agency operations, when estimating project costs. The following are common types of costs that are incurred by contractors on construction projects.

3.1 Material & Labor

Material costs are based on the best information available for each project at a particular stage in design. Published cost data, references, and historic cost data are required documentation for material costs. For materials that have significant cost impacts, a manufacturer or suppliers' quotes are beneficial documentation.

Labor estimates should be based on Prevailing Wage rates and productivity appropriate to the scope of work and site constraints. Prevailing Wages are determined based on the county of the project. Where local wage rate exceeds Prevailing wage, a location wage rate adjustment may be required.

3.2 General Conditions, Overhead and Profit

General Conditions, Overhead and Profit represent the non-permanent portion of the construction activity that is essential to allow the physical implementation of the required work to take place. They may be estimated as a percentage or by using a detailed cost build-up. In many cases it may be appropriate to begin itemizing the anticipated costs starting with the Design Development estimate rather than relying solely on a percentage mark-up.

This cost type is further defined in *ASTM E2083-05 (2016) Standard Classification for Building Construction Field Requirements, and Office Overhead & Profit*. Below is a summary of these types of costs:

General Conditions. Costs associated with General Conditions typically vary depending on the project scope and complexity. DGS projects may require an additional markup due to the indirect costs of doing business with the Commonwealth of Pennsylvania. The Cost Estimator must read the DGS General Conditions to the Construction Contract and justify their percentage used for General Conditions in the Basis of Cost Estimate.

Below are costs that may be considered General Conditions:

- Bonds, Permits, Fees and Insurances
- Field/Site Set-Up and Accommodation
- Management, Supervision and Field Engineering
- Personnel Travel and Lodging
- Safety and Protection
- Construction Aids, Equipment and Tools
- Temporary Construction
- Climatic and Environmental Requirements
- Quality Control, Inspection and Testing
- Maintenance and Housekeeping
- Other Contractual Requirements

Office Overhead. Office Overhead includes a portion of the contractors' home office costs (corporate overhead) allocated to the construction contract including rental, purchase, taxes, insurance, office staff, utilities, transportation, marketing, office equipment/supplies, communications, and financing.

Profit. The contractor's expected return included within a contractor's bid for undertaking specific work. Profit is highly variable and dependent on numerous factors including the local market conditions, size of the job, the amount of risk associated with the work, the contractor's total work volume, and company size. Profit estimating should include the profits of the Prime Contractor and their subcontractors and installers.

3.3 Allowances

An allowance is a sum of money applied to a specific line item in the estimate that is known to be in-scope but lack the definition or specifications to provide a precise estimated cost. As design progresses, the work is further detailed and specified, and allowances are reduced and eliminated.

3.4 Contingencies

A contingency is a sum of money provided for the occurrence of unintended departures from the planned scope of work. Contingencies assist in mitigating the effects of unplanned events and other risks that are external to and outside the control of the project. Contingencies are not provided for end-user scope changes.

Estimator's Design Contingency

A sum of money applied to the overall project costs to address incomplete design. The Design Contingency is applied as a percentage of the sum of all the unit costs and prior to applying markups, overhead and profit, and escalation. The costs associated with the Estimator's Design Contingency never go away, instead it is absorbed into the line items of an estimate as design progresses.

In general DGS allows the following application of an Estimator's Design Contingency:

- Programming/Concept Estimate: 15-20%
- Schematic Design Estimate: 10-15%
- Design Development Estimate: 5-10%
- Interim/Construction Documents Estimate: 0%

The cost estimator is required to justify application of a design contingency in the Basis of Cost Estimate.

Construction Contingency

Construction contingency is held by the Department for construction change orders during construction. The Construction Contingency is not included in the cost estimate.

Owner's Contingency

The Department applies an owner's contingency to each project by putting constraints on the estimated construction costs for each base bid. Base Bid 1 must be 90% or less of the Base Construction Allocation while Base Bids 2 and Base Bids 3 must be within the Base Construction Allocation. Deviations from this contingency must be approved prior by the DGS Director of Design Management.

3.5 Project Specific Markups

A markup is a percentage added to a line item or the overall project costs to address cost data that insufficiently addresses unique project characteristics. A markup can be applied to the estimated construction costs based on an analysis of the following characteristics:

Cost Escalation

Cost Escalation is a markup to address future costs due to market inflation, cost increases, and changes in cost due to code or practice. Direct unit costs within the estimate should be priced using costs as of the date of the estimate (without escalation). Typically, an adjustment for escalation is added to the bottom-line total of the estimate, however in some instances an escalation adjustment can be made for a specific line item if market conditions and impact on costs are significant.

The adjustment for escalation must be based on careful analysis of current market trends and published construction economic predictions for labor and materials. Escalation should be dated to the proposed mid-point of construction.

The escalation methods or rates used must be documented and justified in the Basis of Cost Estimate.

State and Local Sales Taxes. State and local taxes are applied as a markup to all materials and equipment costs. Although contractors on DGS projects are permitted to seek state tax reimbursements through the Department of Revenue and are required to credit the reimbursements back to the Department by change order, those reimbursements are rarely provided in a project. Therefore, state sales tax must be applied to each project cost estimate.

Proprietary Systems. The use of proprietary systems must be addressed in the cost estimate. Proprietary systems in specifications create advantageous contracting scenarios for proprietary system vendors that may increase project costs. This markup would be applied to the line item of the part of the scope of work that has a proprietary product approval. In some instances, it may benefit projects to negotiate the costs of proprietary systems with proprietary vendors prior to bidding and including those costs in the project specifications.

Location. Location specific cost impacts for materials and equipment are applied as a markup on the total project costs and are based on local market conditions and remoteness of the project site.

Security/Controlled Access Facility. A markup applied to the labor portion of the estimate that covers lost time due to entering and exiting the jobsite within a secure facility.

Productivity Markup. A markup applied to the labor portion of the estimate that covers constraints on productivity due to client agency operations. For example, the building is occupied during construction, equipment must be removed each day, etc.

Occupied Facility. A markup applied to a project that will be partially occupied or fully occupied during construction.

Phasing Premium. A markup for a project that is completed in multiple phases versus completing the entire project in one construction period. The markup accounts for mobilizing and demobilizing, the setup of temporary protection, the difficulty in coordinating and maintaining labor over multiple phases, etc.

Historic Preservation Factor. If the project involves additions or repairs to historic structures or is near a historic or cultural site, it may be necessary to apply a historic preservation markup to account for data that does not include the costs associated with protecting and/or matching the historic fabric of the resources.

3.6 Utility Costs

Costs related to the work required by utility companies to extend utilities to the project site. These costs are paid by the Commonwealth to the utility company through a Utility Agreement. Utility Agreements are not part of the construction costs and should be noted separately from the construction costs in the cost estimate deliverable. Tapping Fees and other connection fees typically paid by the construction contractors are included in the cost estimate.

3.7 Furniture, Fixtures and Equipment (FFE)

Costs associated with procuring furnishings or equipment necessary to complete the project are considered FFE costs. These items also include Information Technology Equipment and Audio Visual (AV) equipment and are paid for by the FFE Budget Allocation. These costs are not part of the cost estimate deliverable.

4 Risk Assessment and Contingency

The cost estimator plays a key role in the project team's Risk Management strategy by providing estimated costs for project risks. Risks are documented in the project's Risk Register. The Professional is responsible for maintaining and updating the Risk Register throughout the design phase.

4.1 Risk Identification

The Professional will facilitate discussions to identify risks with the Project Team, including the Cost Estimator, at the onset of the design phase based on change orders from similar past projects and the experiences of the Project Team. Risks are populated in the Risk Register.

4.2 Risk Assessment

During the design phase, the Project Team will discuss the priority of each risk based on its impact to the budget, schedule and its probability of occurrence. The Cost Estimator will provide a budgetary cost estimate for each risk.

4.3 Risk Mitigation

The Project Team will document actions the team will take to mitigate risks. Responsible parties for mitigation activities and key dates are assigned to each risk.

4.4 Risk Management and Construction Contingency

Contingencies are established by assessing the risks associated with the project and assigning a contingency budget to accommodate the impact of project risks.

The construction contingency is established by the Department. The typical construction contingency is 10% of the Base Construction Allocation, however the Department will consider the project risks when determining the project's construction contingency. Deviations from the 10% construction contingency must be approved by the DGS Director of Design Management.

5 Project Delivery and the Role of the Cost Estimator

As the Design phase progresses, the Cost Estimator will provide cost estimates that will assist the team in making key decisions about the project's scope of work, ensuring the project is designed within budget.

To do this effectively, it requires careful documentation and collaboration between the Professional and the Cost Estimator. The Professional must maintain accurate documentation of project scope, risks, and

changes to ensure that cost estimates are well informed and based on the most recent development of design phase.

5.1 Cost Estimator Onboarding

At the start of the design phase, the DGS Design Project Manager (DPM) will onboard the Cost Estimator prior to the Design Phase Kickoff and review the Cost Estimating Standards.

5.2 Estimating Activities in Support of the Design Process

As the Project Team executes the work plan for each design stage, the Cost Estimator may be asked to assist the team by providing cost information including the following activities:

- Provide input on the cost impacts of risks
- Estimate costs of alternatives to include in Alternative Analysis Documents during the Schematic and Design Development stage
- Estimate cost saving measures to assist in value engineering exercises.

The Cost Estimator must maintain awareness of the design progress by participating in design progress meetings or reviewing meeting minutes.

5.3 Programming

During programming and concept design the Cost Estimator will review the project program to become familiar with space types, functions and the estimated square footage of each space. The Cost Estimator will establish a cost framework and use benchmarking and parametric (\$/GSF) data to estimate costs of the project and options under consideration.

The programming cost estimate is provided in Unifomat and based on the program and a sufficiently detailed Project Design Criteria (DC). DGS uses the programming estimate to reconcile the program and the budget before advancing to schematic design.

5.4 Schematic Design

During Schematic Design, the Cost Estimator will participate in scope-cost alignment and value engineering activities with the design team and the Department to clarify design assumptions and narrow down alternatives to provide confidence that the project can be delivered within the budget.

The schematic design cost estimate is based on the schematic drawings and a detailed Project Design Criteria (DC). The DC must describe the expected size, capacity, function, performance and quality requirements of all components of the project. The cost estimate is provided in Unifomat. DGS uses schematic cost estimate to determine project feasibility, compare alternative concepts in the context of the Project Values and budget, and decide which concepts will move into the design development stage.

At the conclusion of the schematic design phase, the Cost Estimator and the Design Professional will establish budgets at the element level and document the budgets in the Cost Summary. As design progresses, the design team will be required to design elements and their systems and assemblies within their assigned budgets.

5.5 Design Development

During Design Development, the Cost Estimator will participate in scope-cost alignment and value engineering activities with the design team and the Department to clarify **all design assumptions** and make decisions on **all alternatives**.

The Design Development cost estimate is based on design development drawings, the Project Design Criteria (DC) and the draft specifications. The DC, drawings and specifications must describe the size, capacity, function, performance, and quality requirements of all assemblies of the project allowing the Cost Estimator to estimate costs of all alternatives. The cost estimate is provided in both Uniformat and MasterFormat formats.

DGS uses the Design Development cost estimate to finalize the project scope including all site work, space layouts and floorplans, building systems, and material selections and finishes.

During the DD stage, the project team also establishes three base bids.

5.6 Interim Construction Documents (ICD) and Construction Documents (CD) Estimates.

During the Interim Construction Document and Construction Document stage, the Cost Estimator maintains awareness of design progress as the Design Professional prepares the drawings and specifications for bidding.

The cost estimate at the ICD or CD stages is provided in MasterFormat and based on a complete and coordinated set of drawings and specifications.

In this stage the project team focuses on what adjustments need to be made to the bidding documents based on how a bidder may price and bid the project. The ICD submission is the Department's final design review prior to releasing the project for bidding. The CD submission is used to ensure all comments at the ICD submission were incorporated prior to bidding.

5.7 Estimate Production & Scope-Cost Alignment

Creating the cost estimate deliverable and aligning the scope and cost estimate is an iterative process. Prior to submitting each milestone submission, the Professional will send a preliminary package of deliverables to the Cost Estimator. It's important the Professional provides enough time and documentation that is complete for the Cost Estimator to create the cost estimate. The Cost Estimator will create a cost estimate and engage the Professional in cost scope-cost alignment discussions prior to submitting the milestone submission. These discussions include the Professional and the Cost Estimator reviewing the project documents together to clarify and gain a mutual understanding of the characteristics of the Project Work.

These discussions occur in formal meetings and meeting minutes are required. Scope-Cost alignment is complete when the Cost Estimator has a firm understanding of the scope, risks and opportunities developed by the Project Team to effectively produce the Cost Estimate Deliverable.

5.8 Estimate Presentation

The Cost Estimator will attend the design stage workshop/page turn and present the Cost Estimate Deliverable to the Project Team. The design workshops are critical meetings, and the Cost Estimator

must be prepared to present the estimate in detail, so the team understands the deliverable. The Cost Estimator will gather feedback and make any corrections/update to the estimate prior to making a formal submission in accordance with the Professional Agreement.

5.9 Quality Assurance/Quality Control

Upon completion of the cost estimate deliverable and scope-cost alignment, the estimator will complete a QA/QC review. The Cost Estimator must have a QA/QC plan and provide documentation to the Department that they completed a QA/QC review of the cost estimate deliverable.

6 Cost Estimate Deliverables

Cost Estimate Deliverables includes the Cost Estimate and the Basis of Estimate (BoE). Each must be of sufficient quality and detail to assist the Department and Client Agency in making effective decisions. Acceptance criteria for the Cost Estimate Deliverables at each design stage are provided in the links below:

- [Schematic Design Deliverable Acceptance Criteria](#)
- [Design Development Deliverables Acceptance Criteria](#)
- [Construction Documents Acceptance Criteria](#)

Failure to meet the acceptance criteria for the cost estimate will result in the entire submission being rejected by the Department.

6.1 Inputs to the Cost Estimate Deliverables

In preparation for the submission and approval of design milestone submissions, the Cost Estimator is required to prepare the Cost Estimate Deliverable. To prepare the Cost Estimate, the Professional provides, at a minimum, the following documents:

- Project Design Criteria (DC)
- Drawings
- Specifications (if available)
- Risk Register (RR)
- Change Log, including a narrative of changes from the last submission.

The Professional must provide the documents to the cost estimator with sufficient time to prepare the cost estimate deliverable for scope-cost alignment discussions and the presentation of the estimate to the Project Team at the design workshop. Cost Estimating time must be incorporated into the project schedule.

6.2 Cost Estimate

The [Cost Estimate](#) is a Microsoft Excel file that includes a cost summary and detailed cost breakdown. The cost summary provides an overview of the project costs associated with each component of the WBS. Most cost summaries will include costs by base bids, prime contract and the project's functional

elements/systems (Unifomat). The cost breakdown is the detailed supporting cost data that supports the summary and is organized in the Cost Breakdown Structure (Unifomat and/or MasterFormat) and level of detail commensurate with the stage of design.

The Cost Estimator is required to use the Department's template for the cost summary but may use their own format for the cost breakdown with approval from the Design Project Manager.

6.3 Basis of Estimate

The Basis of Estimate (BoE) is a single PDF file prepared by the Cost Estimator to assist the Department and Client Agency in reviewing and understanding the Cost Estimate. The BOE establishes context to the cost estimate and should be factually complete but concise. The following sections are required in the BoE.

Cost Estimating Organization. List the team members that worked on the estimate. Include the name of the individual responsible for the estimator's QA/QC review.

Scope of the Estimate. The estimator should describe, in their own words, the project's scope of work that is included in the cost estimate.

Work Breakdown Structure. The estimator should describe the approved Work Breakdown Structure used in the cost estimate.

Estimating Methods. The estimator must provide a description of the approach and methods used to create the cost estimate including, at a minimum, the following information:

- Describe the tools, techniques, and estimating methodology used to develop the estimate.
- List of documents used to create the estimate
- List and describe all assumptions included in the estimate.
- Describe any uncertainty in the estimate.
- Justify the estimator's design contingency (if applicable)
- List and describe what is excluded from the estimate
- List all the allowances and describe how they were calculated for this specific project
- List the mark-up factors that were applied to the estimate. Describe, the rationale for using the factors and how they were determined

Sources of Cost Data. Provide a narrative description of the sources of the cost data used within the estimate. Describe in the narrative how the data relates to the project including date, location, and other project specific details. It is not required to provide individual source references and proprietary information for each itemized. **The estimator must be willing to discuss the applicability of any quantity or unit cost within an estimate.**

The estimator should provide current quotes and lead-time information, when available, for major pieces of equipment included in the project scope to validate the estimated costs. Documentation may include records of telephone/email communications with a vendor.

Benchmarks. Provide cost data for projects with a similar scope of work as benchmarks for discussion.

Cost Drivers. A narrative describing the major cost drivers of the project scope. Cost drivers include scope items, equipment, constraints, or other environmental conditions that make up a significant part of the construction costs. Additionally, the Cost Estimator must provide a list of opportunities and the estimated cost savings that could reduce the project's cost to 10 percent below the Base Construction Amount.

Analysis of Cost Risk. Risks are documented in the project's Risk Register (RR) provided by the Design Professional. The Cost Estimator shall document the estimated cost impact of each risk, provide a narrative of how each risk is addressed in the cost estimate and opinion on the adequacy of the Department's Construction Contingency.

Cost Variance Analysis. A table includes changes to the total project costs from previous estimates. The variance analysis shall provide a quantitative and qualitative comparison of an estimate's changes from one stage of design to the next. The cost estimator is expected to describe changes to scope, assumptions, estimating errors, modified conditions, and any other items that may have resulted in a change to the estimated costs from one stage to the next. A variance analysis is required in all Cost Estimate Deliverables except the first estimate on a project.

Utility Costs. During the schematic and design development stage, the Professional will provide a written narrative and utility drawing for all work on the project that will be required of utility providers. The Cost Estimator will provide budgetary cost estimates for this work in the BoE. These costs are provided separately and not included in the cost summary of cost breakdown.

Quality Assurance/Quality Control Documentation. Provide a description of internal quality assurance and quality control practices and document that the QA/QC process was followed and completed prior to submitting the cost estimate to the Department.

The QA/QC documentation must include evidence of internal review of take-off, calculations, data input, transfer to summaries, gross quantity validation (bulk checks), and overall estimate outcome. The QA/QC documentation must be signed by an authorized representative from the estimator's organization.

Other Studies. Other studies included in the cost estimate deliverable may include a procurement analysis, operations and maintenance estimates, and life cycle costs analyses.

7 Cost Estimator Performance Evaluations

The Cost Estimator's performance is evaluated in accordance with the contract or agreement that includes cost estimating services.

For Cost Estimators that are consultants to a Design Professional, performance is evaluated in conjunction with the performance of the Design Professional. These evaluations occur at various stages throughout the design and construction phase.

For Cost Estimators that are under direct contract with the Department, evaluations are provided in accordance with the Invitation to Qualify (ITQ) contract.