



ESTIMATING GUIDELINES

Policies – Procedures - Guidelines

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Property of Massport Project Controls

Table of Contents

- Introduction 4
 - Purpose 4
 - Accuracy..... 4
 - Use and Structure of the Guidelines 4
 - Modifications to These Guidelines 5
- Section 1: Estimate Process & Lifecycle 6
 - Step 1 – Request for Estimate (RFE) package 6
 - Step 2 – Estimate and Scope Kick-Off Meeting..... 7
 - Step 3 – Plan and Specifications Readiness Review..... 7
 - Step 4 – Determine the Estimate Type and Level Required 8
 - Step 5 - Develop Estimate Quality Control Plan (EQCP) 11
 - Step 6 – Request for Bid Items and Procurement Plan (if applicable)..... 11
 - Step 7 – Establish WBS and Tree Level Quantities..... 12
 - Step 8 – Draft Basis of Estimate and Report 12
 - Step 9 – Final Estimate and Report..... 13
 - Step 10 – Estimate Reconciliation (as needed)..... 13
- Section 2: Estimate Composition 14
 - Project Delivery and Construction Types..... 14
 - Contingencies..... 15
 - Assumptions..... 15
 - Markups 15
 - Escalation 16
- Section 3: Estimate Considerations 17
 - Labor Rates 17
 - Equipment Rates..... 17
 - Estimate Work Breakdown Structure (WBS) 17
 - Typical Mistakes in Estimating 17
 - Target Value Design (TVD) / Continuous Estimating 17
- Appendix 19
 - Appendix A – Design Expectations Checklist 19
 - Appendix B – Sample Risk Register 25
 - Appendix C – Sample Estimate Quality Controls Plan 26

Appendix D – Sample Target Cost Estimate and Continuous Estimating Effort 27

*“The first number published is the only
number remembered.” – J. Oswell*

Introduction

Purpose

The purpose of this document is to establish the guidelines and expectations of all estimates produced for use by Massport in the manner of establishing project budgets. The intended purpose of this document is to address areas that are major causes for budgetary failure, where estimates provided do not represent the true cost of the project as the project's design progresses.

This document will address the major areas where the estimating process fails in the budget development and maintenance process as well as what steps should be taken to address these issues. The contributing factors that provide an unacceptable result are as follows:

- The estimate management process is lacking structure
- Estimating guidelines lack structure and are rarely enforced
- Little or no design expectations/ conditions of satisfaction are established at the concept and/or schematic design level
- General Contractor, Construction Manager, or Subcontractor markups include hidden contingencies and lack clarity
- Escalation factor does not accurately represent Past, Present, and Future market conditions
- Risk Register is rarely developed at the initial estimating phases
- Estimate reporting does not meet the needs of the project from beginning to end
- Unit pricing is based on incomplete or outdated estimate backup

Accuracy

The accepted accuracy for budget development varies greatly depending on the published source and the bar is set quite low with a plus or minus of 50% as the acceptable standard. This range provides a lot of room for poor estimating practices and estimate management. When adopted, the guidelines set forth in this document will reduce the accuracy range to plus or minus 5%-10%.

Use and Structure of the Guidelines

These Guidelines are intended for use by Massport staff and Massport consultants. They are to be used by managers, estimators, planners, programmers, and others involved in determining project cost estimates in support of developing and implementing Massport Capital projects.

These Guidelines are intended to be concise and easy to follow. Cross-references and links to other Massport documents, guidelines and manuals are included where applicable.

These Guidelines are not intended to be a comprehensive document on the science of cost estimating nor provide detailed instruction to an inexperienced estimator. This document is also not a user manual on any specific cost estimating system. Readers may wish to pursue outside sources, such as published materials or cost estimating courses, if they want to learn how to estimate.

These guidelines are divided into four major sections:

- Estimate Lifecycle
- Estimate Composition
- Estimate Considerations
- Appendix

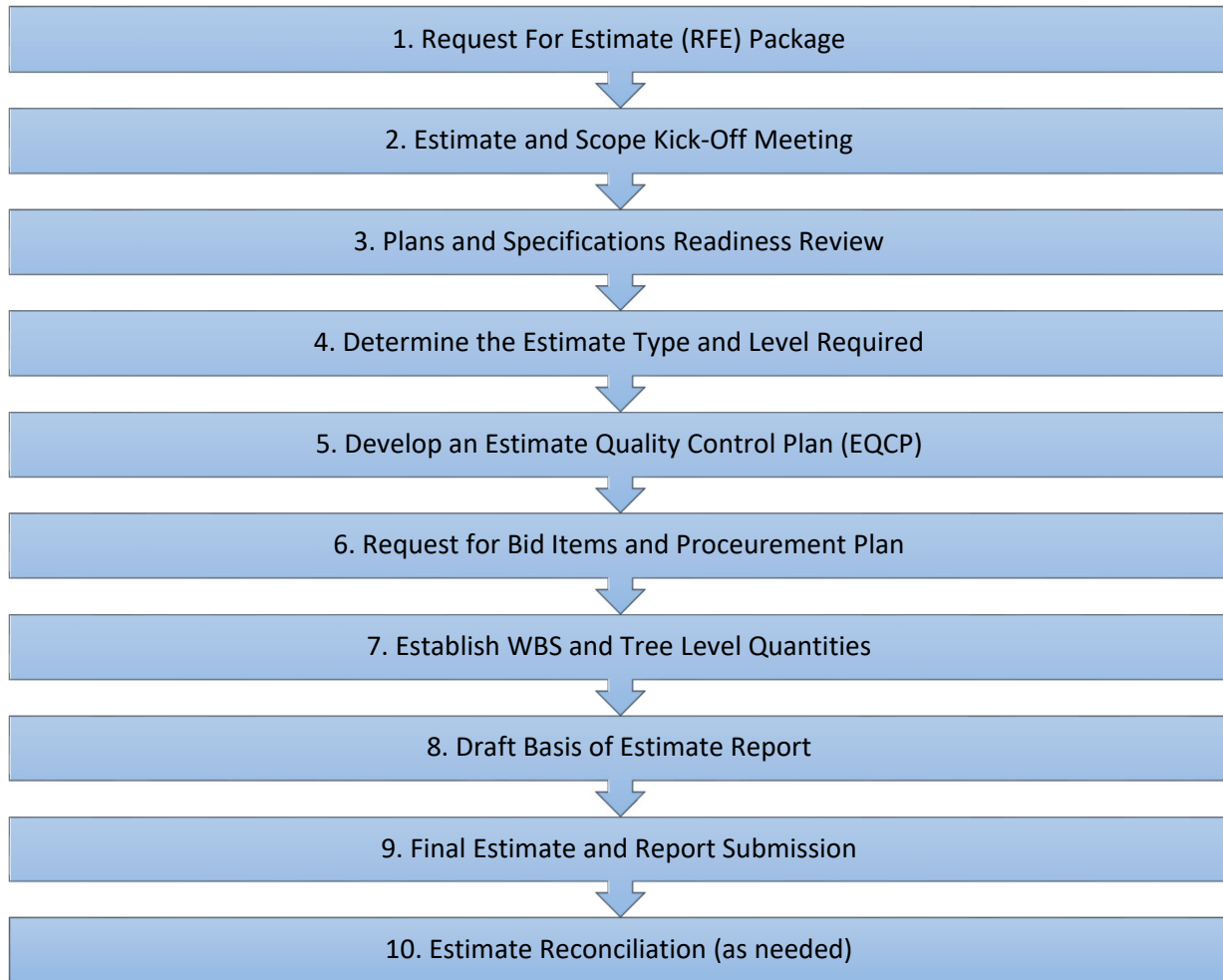
Modifications to These Guidelines

This is a dynamic document subject to ongoing review and continuous improvement. It resides on Massport's external website www.massport.com. Modifications to this document such as, but not limited to, amendments, additions, or changes will be issued by Massport. All changes to these guidelines will be underlined.

Section 1: Estimate Process & Lifecycle

This section outlines the process by which estimators are expected to follow in preparing estimates through the project lifecycle.

Throughout the project lifecycle and whenever estimates are requested, estimators are expected to follow the below outlined process:



Step 1 – Request for Estimate (RFE) package

The estimate lifecycle begins with a Request for Estimate (RFE) package initiated by the Authority. A Capital Programs and Environmental Affairs (CP&EA) Project Manager or Project Controls staff will generate a request for an estimate of probable cost. The request for an estimate will likely include the following:

1. A project title and description
2. Definition of project scope & narrative
3. Latest set of drawings
4. Specifications (as developed as available but no less than a Basis of Design Narrative for each Building System)
5. Projected schedule of pre-bid activities and post-bid activities (if available)

6. Preliminary bid item schedule (if applicable)
7. Additional documentation as deemed appropriate by the Authority
8. Project Deliverable and Review Schedule
9. Major restrictions to work such as premium work hours and/or traffic phasing
10. Anticipated award type (low bid, best value, change order to existing contract, etc.)

Step 2 – Estimate and Scope Kick-Off Meeting

Once the estimator receives the Request for Estimate (RFE) package, a kick-off meeting will be scheduled as deemed necessary in order to introduce the project team, brief the team on the project scope and establish a process for answering questions during the estimate development. During the meeting, the Project Manager will provide an overview of the project and outline any specific concerns the team may have. Other items that may be discussed are as follows:

1. Project access during construction
2. Construction work hours
3. Temporary Construction requirements
4. Interface with other packages and/or ongoing projects
5. Phasing (incl. off hour work requirements)
6. Procurement options
7. Stakeholder impacts to projects
8. Project Constraints
9. Current and future market conditions
10. Specific information that may require special attention
11. Required Estimate Type & Level
12. Required Estimate Sorts/ WBS
13. Required Alternates
14. CM/GC vs. Owner's Scope
15. Any preliminary questions the estimating team may have

Step 3 – Plan and Specifications Readiness Review

Following an understanding of the scope, a review of the available materials must occur. Depending on the project, this review may occur with the project team present (simultaneously reviewing the drawings and specifications) or it may be a standalone effort by the estimator. Too often, a design is declared to be at a particular level, even though that design level has not yet been achieved. When this happens, the estimating team is requested to provide an estimate at a level that is not supported by the design presented. Conducting a plan and specification review is very important as it allows the requestor and the estimator to ensure that the design is developed to the appropriate level required in order to generate the requested level of estimate.

Plan Specification Readiness Review Concerns

If during the Plan and Specification Readiness Review process the design is found to be inadequate as defined in **Appendix A** (Design Expectation Checklist), a memo shall be presented to the Authority Requestor for disposition. The memo shall be formally submitted to the requestor via PMWeb.

Drawing and Specification Adjustments

The requestor will take the steps necessary to resolve concerns identified in the memo and, if necessary, will request for the estimator to reissue the estimating package to reflect the appropriate estimate level. If any concerns cannot be resolved, the Authority Project Manager or Project Controls staff will instruct the estimating team to include the impact and effect of the unresolved concerns in the projects Risk Register for later deposition. A sample Risk Register is located in **APPENDIX B**.

Step 4 – Determine the Estimate Type and Level Required

There are many factors involved in the development of estimates regardless of whether they are done in-house or by an independent estimating service. The establishment of estimating protocols is vital. It is highly recommended that the highest level of detail estimate option, for the level of design, be selected whenever possible. There are several guiding parameters that should drive the appropriate level and type of estimate required. The factors for determination are outlined below:

Important: In order to ensure a consistent review, establishment of **design expectations checklist** for each design phase is critical. It usually prevents a major portion of excessive allowances and contingencies that influences the accuracy, dependability and integrity of the projected project cost in the estimate. A recommended design checklist is provided in **APPENDIX A** to help overcome this. The checklist should be reviewed, edited, and shared with the team as necessary prior to the preparation of the estimate resulting in the final checklist being adopted for use in the design review process.

Level of Design

The following table represents the suggested level of design in correlation to estimate expectations and format.

Estimate Level	Design Development	Project Phase	Typical Purpose of Estimate	Estimating Methodology	Basis	Estimate Type
Feasibility	0%-20%	Initial Early Planning	Feasibility study, justification for project, planning and/or funding.	Parametric, Cost Indices	OME or Historical Cost	Uniformat Level I
Conceptual	0%-20%	Initial Early Planning	Support investment decision	Parametric, Cost Indices	OME or Historical costs	Uniformat Level I
Schematic Design	20%-30%	Preliminary Design	Preliminary Cost Development	Parametric Cost Indexing, Detailed Costing	Detailed Unit Cost (where possible)	Uniformat Level II with CSI Summary

Design Development (DD)	30%-60%	Detailed design on-going	Construction Cost Progression	Detailed Costing	N/A	CSI
Construction Documents (CD)	60%-90%	Detailed design furthered	Construction Cost Progression	Detailed Costing	N/A	CSI
Bid Documents	90%-100%	Design Complete	Final Cost Estimate. Used to compare bid results.	Detailed Costing	N/A	CSI
Bulletins	Post Bid	Post Bid	Change Pricing	Detailed Costing	N/A	CSI

Estimate Types and Attributes

Feasibility/ Conceptual (0%-30%)

These estimates are generally used to establish the project budget, support an investment decision, or for project justification/planning. The accuracy of the estimate is limited and a large contingency may be required depending on the contract's database.

- Parametric**
 This type of estimate is usually based on simple parameters such as gross area multiplied by the square foot cost for similar projects.
- Cost Indices**
 This type of estimate shows changes of cost over time by upgrading the cost of similar facilities from the past to the present.
- Required Backup**
 Estimates and final value fees for all referenced projects. Square footage takeoffs and calculations of parameters and indices used.

Accuracy	Ability to Reconcile
+/- 30%	Poor

Schematic (0%-30%)

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- Parametric**
 This type of estimate is usually based on simple parameters such as gross area multiplied by the square foot cost for similar projects.
- Cost Indices**
 This type of estimate shows changes of cost over time by upgrading the cost of similar facilities from the past to the present.

- **Required Backup**

Estimates and final value fees for all referenced projects. Square footage takeoffs and calculations of parameters and indices used.

Accuracy	Ability to Reconcile
+/- 15%	Poor

Design Development (30%-60%)

- **Bid Item Unit Cost/Unit Cost**

This type of estimate provides no estimate details and is inclusive of all general contractor and/or construction manager costs, subcontractor markups, allowances, taxes and contingencies. Some, if not all, items have a unit measure lump sum and a quantity of one.

- **Required Backup**

Quantity takeoff sheets and backup calculations. Bid tab data and estimates referenced to derive unit prices.

Accuracy	Ability to Reconcile
+/- 10%	Poor

Construction Documents (60%-90%)

- **Expanded Unit Cost**

This type of estimate provides a combined unit cost for labor, material, equipment and sub-quotes and may, in some cases, have a quantity and unit of measure that is quantifiable. The unit prices provided are usually rounded off to a level that renders the information unverifiable and is of little use in reconciliation or for use as true value engineering. CM's should be encourage to estimate using the "Market Unit Cost" they track. These costs are often all inclusive of all labor and material costs including sub markup. They should not be "split apart" unless accuracy of the breakdown is validated by market feedback.

Accuracy	Ability to Reconcile
+/- 5%	Fair

- **Low Level of Detail Estimates**

This estimate provides some detail items that have man-hours, labor rates, material unit costs, equipment unit costs that are applied to items in the quantity survey (if applicable). Too often these types of estimates contain a large amount of lump sum items particularly in areas where the design is not developed to the point where a quantity take off survey is practical. Projecting quantities in deficient areas of design is difficult, and the estimator may not have the skill set or the budget to forecast quantities for pricing purposes.

- **Required Backup**

Quantity takeoff sheets and backup calculations. Bid tab data to derive unit prices. Estimating software output, which includes labor and equipment hours for items estimated using bottom-up methods. Backup for equipment, labor, and material rates used.

Accuracy	Ability to Reconcile
+/- 5% (depending of level of design and scope of work)	Moderate

Bid Documents (90%-100%)

- High Level of Detail Estimate / Bottoms-Up**
 This form of estimate provides the highest level of detail and is sometimes called a bottoms-up estimate. The level of detail should allow for detailed quantity takeoffs and a lower use of lump sum items or allowances.
- Required Backup**
 Quantity takeoff sheets and backup calculations. Estimating software output, which includes labor and equipment hours. Backup for equipment, labor, and material rates used. Bid tab data for any items not priced using bottom-up methods.

Accuracy	Ability to Reconcile
+/- 3%	High

Bulletins (Post Bid)

- High Level of Detail Estimate**
 As with the Bid Documents, a bulletin estimate must reflect the highest level of detail.

Accuracy	Ability to Reconcile
+/- 3%	High

Step 5 - Develop Estimate Quality Control Plan (EQCP)

Once the Authority and the Estimator agree to the type of estimate required, the development of an Estimate Quality Control Plan (EQCP) is initiated. The plan is very important and may require adjustments on a project-by-project basis as not all projects are the same. This plan establishes the expectations for the estimating teams and provides guidance as to what is acceptable and what will be rejected for revision and resubmission. A sample Estimate Quality Control Plan (EQCP) is shown in **APPENDIX C**. Review and adaptation of the Estimate Quality Control Plan warrant serious attention. Once completed the list should be shared with the project team.

Step 6 – Request for Bid Items and Procurement Plan (if applicable)

This step is critical in the development of the requested estimate. With numerous stakeholders having specific needs, it is mandatory to have a WBS and Bid Item List (if applicable) that satisfy each stakeholders needs without having to revise the estimate several times in order to complete the tasks. Take-off of quantities is required in order to provide estimates that are more detailed. Quantities are used to estimate labor, material, and equipment costs.

Takeoff quantities should be developed from onscreen cad/tiff/pdf files or BIM models.

Level of detail for quantity takeoffs should correspond to appropriate use of allowances.

Allowances

The use of allowance items (lump sums is limited to the following):

- Schematic Design : 15% of Direct Cost
- Design Development: 10% of Direct Cost
- 75-90% Construction Documents: 5% of Direct Cost
- Construction Documents: 1% or less of Direct Cost

All allowances items must be listed in the risk register.

Step 7 – Establish WBS and Tree Level Quantities

The Estimator must develop the Work Breakdown Structure (WBS) in order to satisfy the needs of the Authority and other stakeholders as deemed necessary by the Authority. The development of the WBS, Tree Level Quantities, and associated bid items is necessary in order to answer all of the various estimate stakeholder needs. It is encouraged to review and finalize the WBS and Tree Level Quantities at the Kick-Off meeting. If this step is not taken, there may be a lot of rework required after the estimate is completed. The trick is to provide all of the information needed by the Authority.

Specific notes:

- Locations breakdowns are determined by Massport and the designer prior to starting the estimating process.
- Preliminary Bid Items (if applicable) are provided by Massport prior to starting the estimating process whenever possible.
- Alternate items (if applicable) should be provided by Massport prior to starting estimating process whenever possible.
- Supplemental codes should be determined prior to starting the estimate process to prevent additional effort and restructuring of the estimate during the estimating process.
- Tree quantities are to be found in the design documents prior to starting estimate and should be based on the area for each location. These quantities will generate the unit pricing for each level of the estimate.
- MPA Standard specifications provided by MPA for certain fixtures, facilities, and amenities.

Step 8 – Draft Basis of Estimate and Report

The estimate must be submitted to the Authority with the following components:

- Cover Sheet
- Narrative
- Executive Summary
- Declaration of all Assumptions and Clarifications
- Estimate Summary For Each Element
Detail Summary for Each Element
- Preconstruction Services (if applicable)
- General Conditions (if applicable)
- General Requirements (if applicable)
- Bonds and Insurance (if applicable)

- Overhead and Profit (if applicable)
- Building Permit (if applicable)
- Drawing List (for reference)
- Construction Management Fee
- Contingency

The draft estimate and report must be submitted to the Authority on or prior to the requested date. The Authority shall review the initial submission, if found acceptable, the Authority shall request the Estimator to submit a final estimate package.

Step 9 – Final Estimate and Report

The Estimator shall submit the final Estimate and Report to the Authority electronically. Hard copies of the estimate package may be requested on an as needed basis.

Step 10 – Estimate Reconciliation (as needed)

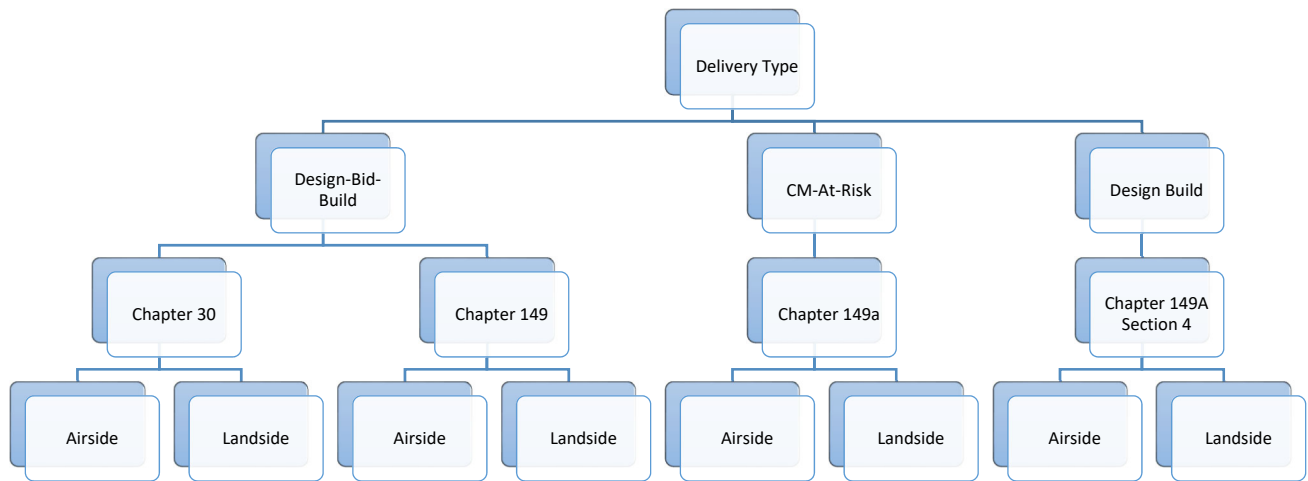
If multiple estimates are developed for the same scope by different entities, a reconciliation of those estimates will be required. A Massport representative will be in charge of overseeing the reconciliation process and facilitating discrepancies between estimating teams

Section 2: Estimate Composition

Estimates are composed of two primary components: Fixed (Cost of Work) and Variable (Indirect costs and contingencies). Fixed elements remain constant regardless of project delivery method or construction type. Variable elements may vary based on the project delivery, design level, or construction type.

Project Delivery and Construction Types

The following structure defines the various project delivery types and Construction Types in correlation to the estimate expectations and format.



Contingencies are determined by estimate level and are not inclusive of escalation contingency.

Level of Design	Contingency
Feasibility	Risk Register or 25%
Conceptual	Risk Register or 20%
Schematic Design	Risk Register or 15%
Design Development	Risk Register or 12%
Construction Documents	Risk Register or 10%
Bid Documents	Risk Register or 7.5%

Delivery Types influence indirects, assumptions and markups. However, it is important for estimators to correlate design expectations based on each delivery type.

Estimating Factors by Delivery Type

Project Delivery Type and Location	Mobilization	Security Factor	Insurance	Bonds	GC	GR	Fee	Overhead & Profit	Building Permit
Chapter 30 Airside	X	X						X	
Chapter 30 Landside	X							X	
Chapter 149 Airside			X	X				X	X
Chapter 149 Landside		X	X	X				X	X
CMR (Ch.149a) Landside			X	X	X	X	X		X
CMR (Ch.149a) Airside		X	X	X	X	X	X		X

Contingencies

Project Contingencies are determined as a result of comprehensive and continuous project risk assessment exercise that occur at each milestone (at a minimum). Risks are categorized into three fundamental categories: External, Managerial, and Operational. Contingency is adjusted as risks are mitigated or new risks are identified. Under no circumstances shall estimates have any hidden or unaccounted for contingencies hidden within the estimate.

Assumptions

The estimate should specify a list of assumptions and clarifications for the level of design.

Markups

These markups are applied to all trade markups regardless if the work is self-performed or subcontracted. The logic here is the general contractor is entitled to the subcontractor markup/risk if he

is assuming that risk. In most cases, if a general contractor is self-performing the work, this scope will be performed by a division of the company that is bidding on and performing the work.

Two elements to be analyzed – markups for subcontractors and general contractors. It is recommended not to lose objectivity with less analysis, as these determinations will impact the projected cost. Too often estimators and managers seem to think that undervaluing these percentages is a way to keep the project in budget. This generally does not work out well after the bids come in and the Budget/Bid has a large spread. Items that should be considered are listed below.

Markup Elements	General Contractor (GC)	Subcontractor (Lump Sum/ DBB)
Overhead	N/A	3.5%-5.5%
Prime Home Office Overhead	5.5%-7.5%	N/A
Prime Profit	5.5%-7.5%	N/A
General Liability	N/A	4.5%-7.5%
Profit on Labor	N/A	12%-20%
Profit on Material	N/A	10%-15%
Profit on Equipment	N/A	8%-15%
Liability Insurance	1.5%-2.1%	2%-2.5%
Bonds	.3%-1%	1.5%-2.5%
Local Taxes & Fees	N/A	3%-5.5%
Mobilization / Demobilization	3.5%-5%	3%-5%
Punch List Warranty	N/A	3%-5%

Escalation

Escalation forecasting is more of an art before anything else, and it should be thought of as painting an economic future using mathematics. Overreaction and Under-Reaction are the biggest detriments to providing a meaningful Escalation forecast. Estimates for projects up to 24 months in duration are to include 4% compounded escalation to the anticipated project GMP date/sub bids. Estimates for projects longer than 24 months are to use a 4% compounded escalation through midpoint of construction unless a different percentage can be justified. Should a different percentage be used, the estimate backup should include sufficient evidence or documentation to support it. Escalation should also be calculated on top of contingency and markups to account for market increases on all aspects of the work.

Section 3: Estimate Considerations

Labor Rates

Please see the Authority Labor Rate Guidelines posted on the Authority's website.

Equipment Rates

Equipment rates cannot exceed Equipment Watch Rental values. Equipment rates must be available to the Authority (if requested).

Estimate Work Breakdown Structure (WBS)

The organization of estimates is a critical component of the estimating process, and the recommendation is to adopt a modified Uniformat WBS. The coding structure proposed has some unique features in that it identifies a location as well as the System, Subsystem, and Elements. The element level is where the elements are actually priced using the Construction Specification Institute (CSI) element references. If adopted, the proposed Uniformat coding structure will provide the end users with system unit costs by location as well as CSI unit costs by location.

Typical Mistakes in Estimating

- Inaccurate calculation of quantity of material (too high or too low).
- Use of non-qualified or responsive material suppliers
- Inaccurate prediction of productivity and labor cost
- Scope gaps not identified between subcontractors
- Use of non-qualified subcontractors
- Shortage of equipment or personnel
- Unanticipated time delays and inefficiencies
- Mis-Interpretation of contract clauses
- Mis-calculation of labor required to meet schedule
- Failure to assess development of design
- Inaccurate assessment of markets
- Double counting of line items
- Procurement schedule does not allow for buying large quantity of material at once due to phasing
- Misunderstanding of site access constraints

Target Value Design (TVD) / Continuous Estimating

Target Value Design is a project management approach, as well as a lean construction tool, that drives the design process to deliver to defined values within Project constraints including, cost, schedule, functional requirements, and quality. A sample of a Target Cost Estimate and Continuous Estimating effort is included in **Appendix D**.

The goal of the design team should be to initially design the project to produce MVP (Minimum Value Product). This technique forces the design team to develop documents that meet the minimum requirement for a successful project or meet the original conditions of satisfaction. Afterwards, the estimate of that product can be compared to the budget and the design team can look at what more can be added from that point and still fit within the project constraints.

Appendix

Appendix A – Design Expectations Checklist

Buildings, Airfield, & Port Work

Area indicates the area of work (Building, Airfield, or Port)

Line Item & Header Description	Description & Area of Work Area (Bldg, AF, Port)	Design Development				
		Concept Design 0-20%	Schem. Design 20-30%	Design Dev. 30-60%	Const. Docs 60-90%	Const. Docs 90-100%
General Information & Architectural Plans						
Area Summary	All	X				
Area / Zone definition	All	X				
Structural Grid	All	X				
Vertical Circulation Elements	Bldg	X				
Core Elements	Bldg	X				
Vertical Shafts	Bldg	X				
Sketches of alternative approaches considered	Bldg	X				
Provide existing/new building sections. Construction details and sections	Bldg	X				
Basic Urban Design analysis plan showing site with context illustrating adjacent land-use and building heights	All	X				
Conceptual landscape design for primary and secondary open spaces. Streetscape design in relationship with master plan guidelines	All	X				
Conceptual Design Plan, ground level plan illustrating public/civic uses and landscape areas, floor plans of each level, fire protection and egress, proposed lab module.	All	X				
Code analysis, review and respond in writing to all pre-design comments. Submit for review.	All	X				
Floor Elevations	Bldg		X			
Key dimensions, bay sizes and overall dimensions	Bldg		X			
Provide preliminary phasing plan	Bldg,AF		X			
Accessibility routes	Bldg		X			
Solar orientation diagrams	Bldg		X			
Owner occupant report explaining design rationale and assumptions	Bldg		X			
Provide a copy of facility standard details for use in basis of estimate	All		X			
Provide existing / new paving sections	AF,Port		X			
Provide site access plan and haul route	AF,Port		X			
Provide preliminary track plan	Port		X			
Provide track profiles	Port		X			
Provide preliminary plan for new structures	Port		X			
Provide preliminary plan for dock / pier construction	Port		X			
Context plans illustrating how proposed project contributes to so surrounding urban context (building height and land uses)	All		X			
Schematic design for opens paces and streetscape improvements and water management	All		X			
Ground level plan with public/civic uses and landscape areas, reflected ceiling plan, proposed lab module	All		X			
Energy study	All		X			
Asbestos report	All		X			
Wind analysis and exhaust plume study	All		X			
Cost Analysis	All		X			
General and supplemental conditions of contract, outline specs in marked up form, request for justification for proprietary items. List of specifications	All		X			
Construction schedule, project schedule diagram with phasing	All		X			
Design calculations presentation	All		X			
Review and approve general architectural materials, respond in writing to all design materials submitted in this phase	All		X			
All drawings will be produced with english system scales. Scales should also be illustrated graphically on the drawings. Scale drawings should be appropriate for high resolution and legibility to include half-size reduced copies	All		X			
Preliminary Specifications	All			X		
Entire project on one architectural sheet for reference, general notes, reference and coordination symbols, enlarged plan bubbles, all dimensions, partitions.	All			X		
Floor plans of each level, fire extinguishers, sinks, reflected ceiling plans, enlarged plans, davits	All			X		
Coordination utility cross-section at a minimum 12.5 mm scale, corridors, utility discipline zones, vertical circulation, dimensional locations	All			X		
Update architectural basis of design	All			X		
Preliminary finish schedule for typical areas	Bldg			X		

Line Item & Header Description	Area (Bldg, AF, Port)	Concept Design 0- 20%	Schem. Design 20-30%	Design Dev. 30-60%	Const. Docs 60-90%	Const. Docs 90-100%
60% complete plan for open spaces and streetscape improvements and water management	All				X	
Review energy study, revise basis of design report	All				X	
Updated cost estimate, design schedule, and construction schedule, occupancy schedule, calculations - presentation	All				X	
Revised specifications, equipment	All				X	
Review and approval of architectural materials, review and approval of architectural material details, respond in writing to all comments from 30% phase, submit all documents to review	All				X	
Complete landscaping architecture including streetscape, curb-outs, parking layout	All				X	
Floor plans, reflected ceiling plans	All			X		
Room Names - Room Numbers	Bldg					X
Architectural design report	All					X
Basis of design report, cost estimates, specifications, schedules, all design calculations, presentations and reviews	All					X
Complete all specifications	All					X
Incorporation of 90% comments into 100% design	All					X
Production of a complete set of buildable, bidable drawings and specifications as necessary for all aspects of the construction of the project in accordance with laws and the requirements of the agreement	All					X
Documents issued for construction to be sealed by Architect of Subconsultants licensed as architects or engineers in Massachusetts	All					X
Substructure						
Foundation layout	Bldg	X				
Conceptual foundation sizes and rebar quantity per cubic yard	Bldg		X			
Preliminary foundation details	Bldg		X			
Preliminary slab on grade details	Bldg		X			
Basement plan and section if applicable	Bldg		X			
Basement wall preliminary detail if applicable	Bldg		X			
Preliminary drainage plan if applicable	Bldg		X			
Foundation plan	Bldg			X		
Superstructure						
Major sections through building to show relevant conditions	Bldg	X				
Structural Conceptual Design - schematic floor plans, development of alternatives	Bldg	X				
Structural Conceptual Reports - Existing conditions, wind loading	Bldg	X				
Building to grade relationship	Bldg		X			
Identify major building elements	Bldg		X			
Provide element sizes and quantities for concrete constructions (e.g. 24" square column 117 lbs. of rebar per CY)	Bldg		X			
Floor plans at each level	Bldg		X			
Development of alternatives, critical coordination clearances, outline specifications or materials list, column schedules	Bldg		X			
Floor to floor and floor to ceiling height	Bldg			X		
Provide element quantities (e.g. pounds per square foot for structural steel)	Bldg			X		
Structural floor plans	Bldg			X		
Bracing type, girders	Bldg			X		
Structural notes, critical coordination clearance, sections and details, column schedules and details	Bldg			X		
Correlation with architectural and mechanical features and specifications	Bldg				X	
Structural report, special condition, schedules	Bldg				X	
Structural floor plans at each level, sections and details, critical coordination clearances, schedules, schedule for reinforcing bar, structural notes, correlation with architectural and mechanical features, specifications	Bldg				X	
Structural reports	Bldg				X	
Exterior Closure						
Major elevations with extent of glazing and mullion spacing indicated	Bldg	X				
Identify major building materials used for exterior cladding	Bldg	X				
Identify preliminary architectural features impacting building exterior	Bldg	X				
Building envelope analysis	Bldg		X			
Floor lines, roof line and top of parapets indicated with dimensions	Bldg			X		

Line Item & Header Description	Area (Bldg, AF, Port)	Concept Design 0- 20%	Schem. Design 20-30%	Design Dev. 30-60%	Const. Docs 60-90%	Const. Docs 90-100%
Finished grades clearly shown	Bldg			X		
Exterior elevations and details	Bldg				X	
Roofing						
Roof material and insulation requirements	Bldg		X			
Preliminary drains and slope	Bldg		X			
For re-roof projects, indicate roof cores results	Bldg		X			
Preliminary roof details and down-drain locations	Bldg			X		
Roof Plan	Bldg			X		
Structural Roof Plan	Bldg			X		
Roof Plan	Bldg				X	
Interior Construction						
Space allocation and utilization plan	Bldg	X				
Identify preliminary architectural features impacting interior spaces	Bldg		X			
Provide a copy of facility standard wall details for use in basis of estimate	Bldg		X			
Interior partitions - delineated by fire rating	Bldg		X			
Door and window locations	Bldg				X	
Preliminary door and hardware details	Bldg				X	
Preliminary standard wall details	Bldg				X	
Interior elevations	Bldg				X	
Floor covering plan, enlarged plans, interior space allocation and utilization plan, interior elevations, signage location, building sections, construction details, installation plans, list of new and reused items	Bldg					X
Interior Finishes						
Identify preliminary wall finishes	Bldg			X		
Identify preliminary floor finishes	Bldg			X		
Identify preliminary ceiling finishes	Bldg			X		
Color and finish boards with physical samples	Bldg					X
Conveying Systems						
Automatic conveyances	Bldg		X			
Vertical transportation recommendations	Bldg		X			
Identify location of elevators	Bldg			X		
Identify location of escalators	Bldg			X		
Identify location of moving walk ways	Bldg			X		
Identify preliminary interior finish requirements	Bldg			X		
Provide draft specifications	Bldg			X		
Vertical transportation plans	Bldg			X		
Plumbing						
Identify utility connection points	Bldg	X				
Identify retail utility requirements	Bldg	X				
Locate existing plumbing equipment, verify locations of vertical shafts with architectural plans	Bldg	X				
Basis of the design report, radioactive waste	Bldg	X				
Plan Drawings	Bldg		X			
Coordination with structural for support of piping, development of outline specifications	Bldg		X			
Identify restroom locations and fixture counts	Bldg			X		
Provide as-built drawings if available	Bldg			X		
Plumbing system plan drawings, plot plan for outside of building underground distribution, riser diagrams	Bldg			X		
Identify drinking foundations & floor drains	Bldg				X	
Provide draft specifications	Bldg				X	
detailing, one line flow and control diagrams, schedules and design reports	Bldg				X	
Complete construction documents for Plumbing	Bldg					X
HVAC						
Identify equipment requirements (e.g. 300 TN chiller)	Bldg	X				

Line Item & Header Description	Area (Bldg, AF, Port)	Concept Design 0-20%	Schem. Design 20-30%	Design Dev. 30-60%	Const. Docs 60-90%	Const. Docs 90-100%
Locate existing mechanical HVAC equipment. Verify location mechanical rooms w/ architectural plan, identify connections to major utilities, steam, indicate existing intake and exhaust relationships	Bldg	X				
Basis of design report, outside air temperature, requirements for HVAC services, fume hood, HVAC system concepts, energy source	Bldg	X				
Identify amount of ductwork required (e.g. lb. per square foot)	Bldg		X			
Mechanical plan drawings, laboratory planning modules, development of outline specifications	Bldg		X			
Block load calculations for space cooling and heating	Bldg		X			
Provide preliminary single line diagrams	Bldg			X		
Identify control points and major elements of BMS	Bldg				X	
Provide as-built drawings if available	Bldg				X	
Provide draft specifications	Bldg				X	
Mechanical plan drawings and sections- 60%	Bldg				X	
Details of unique conditions, control diagrams with legend and operating description	Bldg				X	
Equipment schedules	Bldg				X	
Design report	Bldg				X	
Complete Construction Documents for HVAC	Bldg					X
Mechanical Design report	Bldg					X
Fire Protection Systems						
Locate existing fire equipment, lay out major components	Bldg	X				
Basis of design report, integrated fire alarm and security system	Bldg	X				
Fire protection egress plan	Bldg		X			
Plan drawings	Bldg		X			
Development of outline specifications	Bldg		X			
Fire protection narrative	Bldg		X			
Identify utility connection points	Bldg			X		
Provide as-built drawings if available	Bldg			X		
Provide draft specifications	Bldg			X		
Ceiling plan drawings	Bldg			X		
Fire protection design report	Bldg			X		
List manufacturers of equipment, sizes and capacities of major components	Bldg			X		
Identify size of fire mains and stand pipes	Bldg				X	
Identify sprinkler head to area ratio	Bldg				X	
Provide preliminary single line diagrams	Bldg				X	
Complete Construction Documents for Fire Protection	Bldg					X
Electric Power & Lighting						
Scaled electrical plans, tentative layouts of components where space is critical, ceiling plans, laboratory planning module, electrical site plan details, preliminary details for site electrical work	All		X			
Establishment of the final scope, overall building connected load requirements, agreement from each utility company or agency on design development drawings, development of outline specifications or materials list.	Bldg		X			
Provide preliminary single line diagrams	All			X		
Provide as-built drawings if available	All			X		
Floor plans, scaled ceiling plans for each space, plot plan with primary feeder location showing access to the project, one line riser diagram of electrical distribution, one line riser diagram of auxiliary power distribution	Bldg			X		
Provide preliminary lighting layout	All			X		
Provide draft specifications	All				X	
Electrical design report. Specifications	Bldg				X	
Floor plans, ceiling plans, plot plan, electrical distribution plan, riser diagrams, one line diagrams with size and fault currents	Bldg					X
Electrical design report and specification for construction	Bldg					X
Electrical Systems						
Identify any existing security systems	AF,Port	X				
Identify any security systems upgrades	AF,Port	X				
Provide preliminary single line diagrams	All	X				

Line Item & Header Description	Area (Bldg, AF, Port)	Concept Design 0-20%	Schem. Design 20-30%	Design Dev. 30-60%	Const. Docs 60-90%	Const. Docs 90-100%
Locate existing connections, layout major components for existing and proposed systems, indicate general space requirements, verify locations of electrical rooms with architectural plans, verify locations of vertical shafts with architectural plans	Bldg	X				
Basis of design report, calculations of existing size and available capacity	Bldg	X				
Basic security and special systems concepts and reports	Bldg		X			
Provide conduit, wire, equipment sizes	All			X		
Plan specifications to include one line diagrams and specifications	Bldg			X		
Provide draft specifications	All				X	
Special Systems drawings, plans, details and specifications	Bldg				X	
Equipment						
Provide preliminary equipment schedule including size and capacity	All	X				
Identify any fuel storage systems impacted by new work	AF,Port	X				
If fuel storage upgrades are included in scope, provide details	AF,Port			X		
Plan indicating major extent of materials and any special conditions or equipment	All			X		
Floor plan for equipment locations	Bldg			X		
Furnishings						
Provide preliminary furnishing plan	Bldg				X	
Special Construction						
Identify any special construction items (Provide allowance value if appropriate)	All			X		
Building / Site Demo						
Demo Plan identifying materials to be removed including sections and details of existing items	All	X				
Demolition requirements	All	X				
Provide hazardous material survey	All	X				
Sitework						
Site plan of the project showing location of all buildings, roads, parking and landscape elements	All	X				
Soils report and foundation design recommendations	All	X				
Clear delineation of the project limit lines	All	X				
Preliminary spot elevations and site contours	All	X				
Provisions for trash disposal and removal by truck dock - Haul route	All	X				
If needed environmental impact study	All	X				
Site disturbance permit (erosion control) for more than 1 acre	All	X				
Off-site borrow and spoils permit (federally funded)	AF,Port	X				
Preliminary location of batch plant if possible	AF,Port	X				
Provide existing fencing plan if applicable	AF,Port	X				
Proposed fencing plan if applicable	AF,Port	X				
Site drainage, storm water removal or detention noted	All		X			
Identify number of parking spaces and code/zoning requirements	Bldg		X			
Vicinity plan, proposed site plan, vehicular access routes, erosion control measures, documentation of alternative investigations.	All		X			
Establishment of final scope	All		X			
Development of outline specification and material list, transportation layout for site	All		X			
Site plan showing all striping, indication of phasing, planting plan	All			X		
Site construction document design report, site safety plan, develop specification and material list, transportation layout	All			X		
Site Improvements						
Site layout	Bldg,AF	X				
Provide as-built drawings if available	Bldg,AF	X				
Provide a copy of facility standard details for use in basis of estimate	Bldg,AF	X				
Complete sanitary construction documents	Bldg,AF					X
Site Civil/Mechanical/Electrical Utilities						

Line Item & Header Description	Area (Bldg, AF, Port)	Concept Design 0- 20%	Schem. Design 20-30%	Design Dev. 30-60%	Const. Docs 60-90%	Const. Docs 90-100%
Proposed utilities noted	All		X			
Existing utilities noted	All		X			
Utilities statement companies, agencies, individual contracts	All		X			
Provide utility relocations	AF,Port			X		
Provide existing profiles	All			X		
Provide new profiles	All			X		
Utility plot plan.				X		
Existing utilities and their connections				X		
Airfield Electrical						
Identify electrical upgrades	AF	X				
Provide as-built drawings if available	AF	X				
Provide existing runway / taxiway lighting plan	AF	X				
Provide existing runway / taxiway signage plan	AF	X				
Provide existing single line diagrams	AF		X			
Provide proposed runway / taxiway lighting plan	AF		X			
Provide proposed runway / taxiway signage plan	AF		X			
Provide preliminary single line diagrams	AF			X		
Provide conduit, wire, equipment sizes	AF			X		
Airfield Construction						
Provide airfield plan	AF	X				
Provide as-built drawings if available	AF	X				
Provide a copy of facility standard details for use in basis of estimate	AF	X				
Provide safety - barricade plan	AF	X				
Provide phasing plan	AF		X			
Provide existing profiles	AF		X			
Provide proposed profiles	AF		X			
Provide existing striping / pavement marking plan	AF		X			
Provide proposed striping / pavement marking plan	AF		X			
Dock / Pier Construction						
Identify location, type, and depth of piles to be installed	Port	X				
Identify location, type, and depth of piles to be removed	Port		X			
Provide proposed details for pile-caps to be used	Port			X		
Identify any anchorage structures to be installed	Port			X		
Site Improvements - Roadways						
Site roadway layout	Port	X				
Provide as-built drawings of existing roadways if available	Port	X				
Provide a copy of facility standard details for use in basis of estimate	Port	X				
Provide roadway sections and details	Port		X			
Provide pavement marking plan	Port		X			
Provide layout and details for roadway barriers	Port		X			
Provide layout and preliminary details for retaining walls	Port		X			
Provide roadway phasing plan	Port		X			
Site Improvements - Track Work						
Provide track layout	Port	X				
Provide as-built drawings of existing track work adjacent to proposed new track work	Port	X				
Provide details for any cross-overs, spurs, turn-outs identify types and classification	Port			X		
Identify type of rail, rail-bies, and ballast	Port			X		
Provide typical rail section	Port			X		
Provide typical section at roadway crossings	Port			X		
Provide preliminary signalization plan	Port				X	
Provide single line diagram for train controls including conduit size, wire type and quantity	Port				X	

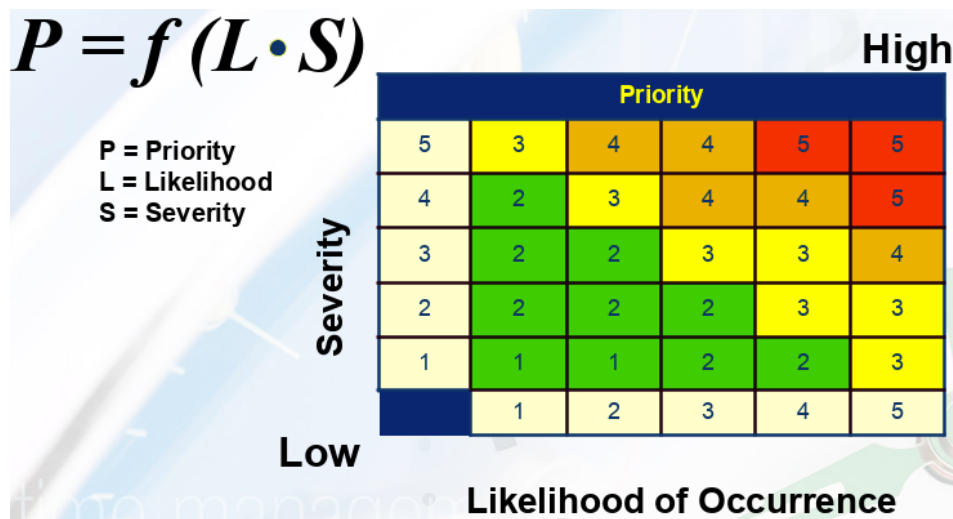
Appendix B – Sample Risk Register

Project Controls administers the Risk Analysis exercise during various phases of the project. The Risk Register is updated on a monthly basis unless otherwise deemed necessary by Project Controls.

Project No. / Name L1548 - Terminal C Canopy
 Project Budget \$50,000,000
 Weighted Contingency Required 5.34%
 Implied Project Contingency Required \$2,670,500.00

Category	Risk	Weighted Priority	Simulation Contribution Measure	Extra Attention
External	Int Blue Schedule / Operational Requirements	0.00	\$3,300	
	Labor Strikes	0.00	\$3,300	
	Environmental / Soil Conditions / Abatement	0.00	\$3,300	
	Traffic - Trucks / Buses	0.00	\$3,300	
	Existing Conditions	0.00	\$3,300	
	Weather / Winter Conditions	0.00	\$3,300	
	Building Inspector; Plumbing and Electrical Inspectors	0.00	\$3,300	
	Natural Disasters	0.00	\$3,300	
	MPA Board - Architectural Features	0.00	\$3,300	
	Vertical Transportation Inspector Availability	0.00	\$3,300	
	Homeland Security	0.00	\$3,300	
	IOC / New Tower Scope	0.00	\$3,300	
	FAA / MEPA Approvals	0.00	\$3,300	
EXTERNAL TOTAL			\$40,300	
Management	Advertising	0.00	\$3,300	
	MPA Procurement	0.00	\$3,300	
	Financial / Estimation	0.00	\$3,300	
	Contracts / Subcontracts Execution	0.00	\$3,300	
	Insurance / Bonding - Subcontractor Default	0.00	\$3,300	
	Gate Reconfiguration Project (Per A) Schedule	0.00	\$3,300	
	Fire Department	0.00	\$3,300	
	People Mover Scope	0.00	\$3,300	
	Terminal C Roadways Projects - Logistics and Staging	0.00	\$3,300	
	Terminal B to C Connector - Logistics and Staging	0.00	\$3,300	
	LEED Certification	0.00	\$3,300	
	MANAGEMENT TOTAL			\$39,900
Operational	Project Schedule	0.00	\$3,300	
	Out of Sequence Packages Impacting Schedule	0.00	\$3,300	
	Resiliency Standards	0.00	\$3,300	
	Quality / Rework	0.00	\$3,300	
	Infrastructure Requirements for Phasing	0.00	\$3,300	
	Police Detail / Fire Detail / Escort Availability	0.00	\$3,300	
	Contractability	0.00	\$3,300	
	Material Delivery / Site Logistics / Staging	0.00	\$3,300	
	MPA Infection	0.00	\$3,300	
	Scope Changes by MPA - Non-Project Area	0.00	\$3,300	
	Scope Changes by MPA - Project Area	0.00	\$3,300	
	MPA Requirements (BMA, Learns, Monthly Reports, PM/Asst, M/WBE)	0.00	\$3,300	
	Change Management Process / Timeliness	0.00	\$3,300	
	Procurement Process	0.00	\$3,300	
	Gender Staffing	0.00	\$3,300	
	CM Staffing	0.00	\$3,300	
	Stakeholder review of Design (Facilities)	0.00	\$3,300	
Design Deliverables / Incomplete Packages	0.00	\$3,300		
Work Plans	0.00	\$3,300		
OPERATIONAL TOTAL			\$40,300	

Risk Priority is a function Likelihood and Severity (as indicated below). Refer to the Risk Analysis Guidelines for an outline of the Risk Analysis process.



Appendix C – Sample Estimate Quality Controls Plan
Coming soon

Appendix D – Sample Target Cost Estimate and Continuous Estimating Effort
 Sample of Target Cost Estimate

Level 2 Group Elements	Set Based Estimate / Design	Current Estimate / Design
A10 Foundations	\$100,000	\$150,000
A20 Basement Construction	\$200,000	\$150,000
B10 Superstructure	\$500,000	\$400,000
B20 Exterior Enclosure	\$200,000	\$300,000
B30 Roofing	\$100,000	\$100,000
C10 Interior Construction	\$100,000	\$100,000
C20 Stairs	\$20,000	\$20,000
C30 Interior Finishes	\$50,000	\$50,000
D10 Conveying	\$0	\$0
D20 Plumbing	\$50,000	\$50,000
D30 HVAC	\$50,000	\$50,000
D40 Fire Protection	\$15,000	\$15,000
D50 Electrical	\$50,000	\$50,000
E10 Equipment	\$0	\$0
E20 Furnishings	\$10,000	\$10,000
F10 Special Construction	\$0	\$0
F20 Selective Building Demolition	\$0	\$0
G10 Site Preparation	\$0	\$0
G20 Site Improvements	\$0	\$0
G30 Civil and Mechanical Utilities	\$0	\$0
G40 Electrical Utilities	\$0	\$0
G90 Other Site Construction	\$0	\$0

Sample of Continuous Estimating Effort

ESTIMATE OF COSTS					
ITEM DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
LOAD BEARING ELEMENTS					
1 AL-CONC Precast Pile (per attached trade update sheet)	1	ls	\$5,101,134.00	\$5,101,134	
DAMP-PROOFING/WATERPROOFING					
4 FORM COATING AT EXTERIOR WALLS	4,190	SF	\$10.00	\$41,900	
5 Misc. waterproofing requirements trade curing required	1	allow	\$10,000.00	\$10,000	
FOUNDATION CONCRETE					
4 AL-CONC Foundation Concrete (per attached trade update sheet)	1	ls	\$1,404,756.00	\$1,404,756	
ABOVE GRADE CONCRETE					
11 TOP Above Grade Concrete (O Proposal)	1	ls	\$976,680.00	\$976,680	
12 HOE- Allowance for rebar, topping areas and piers not shown	1	allow	\$78,680.00	\$78,680	
14 PRECAST CONCRETE DESIGN ASSIST SCOPE (WEST GARAGE)	1	ls	\$17,112,000.00	\$17,112,000	Proposed Design Assist Award (per attached trade update sheet)
PRECAST SEAL/SCALANT					
18 Precast Double Tees (Sealer)	507	sq ft	\$6.43	\$325,105	
19 Precast Double Tees (Sealer)	507	sq ft	\$1.22	\$587,812	
STRUCTURAL STEEL					
22 Corros - Wind Storage Steel Package (O Proposal)	1	ls	\$1,167,000.00	\$1,167,000	
23 Corrosation with Misc. Metal Package at L1-L10 stairs	1	allow	\$28,000.00	\$28,000	
FIREPROOFING					
26 Misc. Fireproofing at Communication Staff Structure	23,000	sq ft	\$4.00	\$92,000	
MISC. METAL					
29 New stairs and rails at existing west garage elevator cores (L-1)	2	rights	\$35,000.00	\$70,000	
30 New stairs and rails at existing west garage elevator cores (L2-10)	16	rights	\$22,000.00	\$352,000	
31 Storage at new stairs	16	rights	\$4,000.00	\$64,000	
32 Component change at Communication Staff Lobby	800	sq ft	\$140.00	\$112,000	
33 Castoffs at exterior piers	295	sf	\$280.00	\$81,280	
34 Coating at exterior piers	525	sf	\$125.00	\$64,875	
35 Misc. Metal Work at generator pad	1	allow	\$7,500.00	\$7,500	
36 Allowance - Misc. Metal Pipe Guards	150	sq	\$200.00	\$30,000	
37 Allowance - Misc Metal Scope Not Shown on Documents	1	allow	\$25,000.00	\$25,000	
				\$ 27,567,892	
TARGET ALIGNMENT					
1 ADD EXISTING ASBESTOS REMOVAL (2 @ 140K)			\$11,000	\$	90,000
2 ADD EXISTING ASBESTOS REMOVAL (2 @ 130K)			\$	\$	26,000
3 ADD L1 RAILS TO EXISTING EXTERIOR PIERS (8 RAILINGS @ \$1,500/RAILING)			\$	\$	12,000
4 ADD VEHICULAR BARRIERS (255 LF @ \$50/LF)			\$	\$	12,250
5 TRAIL2 Reduce Vehicular Barriers to 252 LF Total			\$	\$	(126,750)
				\$10,000	\$ 88,500
ESTIMATE OF COSTS - TARGET ALIGNMENT				\$ 27,564,102	