Oversight Procedure 33 – Capital Cost Estimate Review

1.0 PURPOSE

This Oversight Procedure (OP) describes the review, analysis and recommended procedures and reporting requirements that the Federal Transit Administration (FTA) expects from the Project Management Oversight Contractor (PMOC) with regard to the:

- Soundness of the Sponsor's cost estimating methods and processes compared with proven professional quantity surveying and cost estimating practices;
- Congruence of the project cost estimate with the project scope and schedule, i.e. do these three elements fully reflect each other;
- Reliability of the estimate for procurements, contract bids, and contract closeout, i.e. will the project budget prove to be adequate at these milestone events.

2.0 BACKGROUND

Congress and FTA's good stewardship require that a Sponsor's cost estimates be reliable before entry into Engineering and Full Funding Grant Agreement (FFGA) or Small Starts Grant Agreement (SSGA), as well as other points in project development, when requested by FTA, a thorough evaluation of the scope, schedule and cost is performed to confirm the estimate's reliability.

3.0 OBJECTIVES

FTA's objective is to assess the consistency of cost estimating information, understand its characteristics, evaluate the methodologies, and confirm that the estimate adequately reflects the overall project scope, the estimated quantities shown on the design documents, the anticipated market conditions, the risk elements associated with the project, and the project schedule. This procedure is applicable to Design-Bid-Build, Design-Build and other delivery methods. A cost or cost range is established as a base from which future estimates are measured. Later, when contract packages are conceived, the PMOC will evaluate the estimates in the packages. This review may be performed prior to FFGA or SSGA and issuance of documents for bid, or during construction. The review results should help the Sponsor with decisions regarding the level of cost control measures, appropriateness and reasonableness of contingency provisions, and mitigations required; in addition, the results will assist FTA with decisions regarding project advancement and funding.

4.0 REFERENCES

The statutes, regulations, policies, guidance documents and circulars in OP 01 apply. The Sponsor's estimate should conform to industry standards as published by leading project management and control organizations. In addition, the schedule management and project controls will be subject to reviews as described in the following OPs:

- OP32C – Project Scope Review
- OP34 – Project Schedule Review
- OP40a/b/c – Risk and Contingency Review

5.0 SPONSOR SUBMITTALS

The PMOC shall obtain and study the Sponsor's current cost information:

- Summary of O&M Cost Assumptions/Productivities;
- Capital cost estimate in original and SCC format;
- Capital cost estimate backup data (take-offs, cut sheets, work breakdown structure, calculations, and recapitulation) for the purpose of traceability or mapping.
- Capital cost estimating methodology memo (refer to Appendix B);
- Assumptions used for all escalation and contingency (allocated, unallocated, and hidden or latent) provisions.
- Before and After Study Documentation.

In addition, the PMOC shall obtain and study the project environmental documents, project drawings, specifications, narratives, design criteria reports, project schedule, information on land acquisitions and relocations, and procurement of vehicles, material, and equipment.

6.0 SCOPE OF WORK

This Review may be performed during project planning, design or construction. The work order may specify the extent of the review, add re-assessments or specialized analyses. Under the MAP-21 process, PMOC cost reviews will occur as directed by the FTA work order manager but, most likely at the following stages:

Review during Project Development (PD)
Preparation of a comprehensive capital cost estimate in native and SCC format should occur during PD. The PMOC should review the cost estimate and also review the Sponsor's cost estimate staffing, capabilities and processes. OP51, Appendix B, Section 6 provides criteria for evaluating the completeness, level of detail and reasonableness of the project cost estimate at Entry into Engineering.

Entry into Engineering: Preparation of an appropriate cost estimate developed using acceptable methodology, with all elements identified in SCC second level format, including costs for third party, utility and critical ROW agreements. Depending on the initial risk level of the project and/or Sponsor, the PMOC would conduct either a review workshop or a more intensive full cost estimate review (in conjunction with full scope and schedule reviews). The FTA reserves the discretion to conduct risk assessments prior to Entry into Engineering. As a result, additional cost estimating analysis may need to be performed to support processes required under OP40a/b/c.

Reviews during Engineering: Upon Entry into Engineering, the PMOC updates the cost estimate review and conducts a risk assessment which could range from a Sponsor-led expedited review, FTA-led expedited review or FTA-led full review. This review could be used to award Letter of No Prejudice (LONP), Letter of Intent (LOI) or Early Systems Work Agreement (ESWA) or commitment of Federal share.

Review for FFGA/SSGA

: Prior to the final request for FFGA/SSGA, the FTA will perform a readiness review, potentially request the PMOC to refresh its Cost review (along with schedule and risk). FFGA/SSGA, required for construction, can occur at any time after the Project Engineering phase. As such, the PMOC review for FFGA/SSGA will need to be commensurate with the Sponsor's documents available at the time and require the PMOC team performing the update to evaluate the suitability of the project documents to the Sponsor's project execution and contracting strategy, whether design-bid-build, design-build or other FTA acceptable process.

Reviews during Construction: During construction, the FTA may require the PMOC to monitor the Sponsor's compliance with the cost and estimating elements of the PMP and its subplans, monitor for risks to budget, including contingency levels, and monitor the appropriate cost and estimating capacity and capability of the Sponsor's organization.

The PMOC shall assess and evaluate the Sponsor's estimate and its plan for cost control. Consider the adequacy of the Sponsor's project control staff, systems and software for the size and complexity of the project. Validate the usefulness of the estimate as a project management tool, consider the level of definition of the estimate and elements within the schedule for appropriateness to the project phase; identify cost uncertainties, and issues with the project estimate mechanical soundness, and fundamental and reasonable soundness.

The PMOC shall review the Sponsor's cost control including internal procedures and estimate reviews. Consider the timing and adequacy of such reviews to determine if the schedule is sufficiently developed, properly maintained, and consistent with the progress of the project. Review the Sponsor's processes and procedures for developing, monitoring and changing the estimate, including approvals if a significant change in the Revenue Service Date is required. The PMOC should additionally determine if the Sponsor has a formalized Configuration Management process that controls baseline budget and any re-baselining controls for cost revisions.

The PMOC shall provide recommendations to improve the development and implementation of cost management and proactively help the Sponsor solve cost problems. In a report, the PMOC shall document its findings, professional opinions and recommendations.

The PMOC shall:

1. Evaluate the Sponsor's development and implementation of the following cost management components:
    a. Project Control Organizational Structure – Includes the Sponsor's staff combined with the potential blending of other consultant project controls staff for all project phases
    b. Project control systems, tools and software used
    c. Review of project control plans, procedures, and cost management contractual requirements
2. Conduct a Technical Estimate Review
    a. Mechanical Soundness check
    b. Fundamental and Reasonable Soundness check
3. Readiness to conduct OP 40 Schedule Risk Analysis check – (If applicable)

The PMOC shall provide a written comparison of the proposed estimate with similar project(s) and analyze the differences. To the extent possible, early in the project early stages, the PMOC shall use the cost data base for comparisons purposes. The PMOC should then draw conclusions and provide recommendations based on this comparison, if applicable.

6.1 Review of Sponsor's Estimate Review Process

The Sponsor should have a review process for its own cost estimate and be continually monitoring and updating its estimate using said process. The PMOC should review the Sponsor's approach to this task for adequacy and timing. Checks may be in the form of peer reviews and/or independent cost estimates or internal reviews that ensure the estimate provided to the PMOC for FTA's review is, at a minimum, internally consistent, coordinated, and reflects current assumptions and project status.

6.2 Review of Sponsor's Cost Estimate

The PMOC should perform any or all of the following after discussing the selection with FTA staff:

- A full project level cost characterization;
- A limited cost element review;
- Development of a cost estimate baseline;
- Specialized quantitative cost modeling or assessments, surveillance reporting or trends analysis;
- Reevaluation of project cost information on a periodic or event driven basis;
- Coordination of the cost estimate with the project scope and schedule;
- Coordination of the cost estimate with any known risk elements worthy of forecast adjustments;
- Presentation to the Sponsor of findings, analysis, recommendations, and opinions;
- Participation in a workshop with the Sponsor to discuss the project.

6.2.1 Proposed Approach to Reviewing the Estimate – A Sampling Plan

After briefly evaluating the Sponsor's submittals associated with their current Cost Estimate (and discussing with them), the PMOC shall propose to FTA an approach to reviewing the Sponsor's cost estimate that, regardless of the level of development of the estimate, will provide FTA will reliable findings and recommendations. The PMOC's proposed approach should be commensurate with the level of development of the Sponsor's Cost Estimate, which typically becomes more detailed as design progresses. In addition, depending on the Sponsor's chosen Project Delivery method(s), the PMOC may need to structure the proposed approach for the reviewing the Sponsor's Cost Estimate to be appropriate for the planned Delivery method(s) (i.e. Design-Build, Construction Manager-General Contractor (GM-GC), or other hybrid approaches might necessitate different and refined techniques for evaluating the Sponsor's Cost Estimate). Further, the Sponsor's cost estimating techniques and methodologies are often different based on the size of the project (from an overall projected cost standpoint), complexities, number of anticipated contract packages, and other factors. As such, in proposing an appropriate and reasonable approach to reviewing the Sponsor's Cost Estimate, the PMOC should consciously consider the stage of project development, the methodology and degree of development of the Sponsor's Cost Estimate, and the size, complexities, and circumstances surrounding the project being evaluated. The proposal should include a description of the level of sampling of the estimate line items, and, if possible, examples of a sampling approach taken from a

previous project(s). The plan shall also identify the sources of comparable data to be reviewed including third parties, market indices, other projects or databases, schedule options, etc.

6.2.2 Review of Sponsor's Cost Estimating Capabilities

When applicable, as part of Checklist, Section 3, Project Sponsor Organization, found in OP-51, the PMOC should request from the Sponsor the names, resumes, and job descriptions of its Cost Estimating representatives, along with any organizational or project-specific policies or procedures that the Cost Estimating representatives are tasked with following. Although this test is also covered in the OP-21, Sponsor Project Management Capacity and Capability Review, the importance of having a sufficient number of qualified Cost Estimators in support of a major capital project cannot be emphasized enough. As such, the PMOC should review the Sponsor's capabilities in this regard as part of its overall evaluation of the Sponsor's Cost Estimate.

In addition, when applicable, the PMOC shall reference the Checklist Section 2.0 Project Management Plan, found in OP-51 to confirm that the Sponsor's Project Management Plan incorporates the practices and procedures needed to manage the cost estimates and cost control processes.

6.3 Basic Review

6.3.1 Review for Traceability, Integration, Coordination, Consistency

The PMOC should check that the Cost Estimate is:

- Mechanically correct and complete; free of any material inaccuracies or incomplete data
- Consistent with relevant, identifiable industry or engineering practices
- Consistent and reasonable approach taken and format used by the Sponsor's cost estimators
- Consistent and reasonable methods of calculation/application of multipliers for escalation, inflation, general conditions, contingencies, cost of money, and taxes.
- Consistent with the project scope described in NEPA document, Record of Decision, and design documents
- Organized into SCC cost accounts categories
- Consistent with the current project schedule

6.3.2 Characterize the Level of Estimating

The PMOC should:

- Characterize the estimating methodologies used:
  - Parametric (Statistical) -- A cost estimating methodology using statistical relationships (see Appendix C). Commonly referred to as "Top Down" estimating.
  - Analogous (Comparison) -- An estimate of costs based on historical data of a similar (analog) item.
  - Bottom-Up (Detailed Engineering) -- This involves using a detailed Work Breakdown Structure (WBS) and pricing out each work package making up the project.
  - Extrapolation (Earned Value) -- Estimates which are based on actual project costs
- For the estimated elements, characterize the nature of the support for the costs estimated, i.e. how these were derived so that the basis of estimate is documented in terms how the scope was captured, how it was priced and what assumptions were considered in the cost
  - Level 1: Characterize the line quantities and nature of the estimate as being:

        - the product of unit cost and quantity (Unit costs are defined when the estimate separately identifies direct and indirect cost components)
        - a cost estimating relationship (CER); (Unit pricing is classified as CER)
        - a lump sum (sometimes referred to as an "allowance" or "plug number")
    - Level 2: Subdivide Level 1 as follows:
        - quantities indicated in both the design documents and the cost estimate
        - quantities indicated only in the cost estimate
        - quantities indicated only in the design documents
    - Level 3: Subdivide Level 2 into the following subcategories:
        - Cost to Cost CERs
        - Non-Cost to Cost CERs
        - Cost or Non-Cost to Non-CERs
    - Level 4: Subdivide Level 3 as follows:
        - Project direct costs
        - Escalation of materials and labor
        - Total project allowances
        - Project indirect costs
        - Construction contractor profit
        - Total inflation costs (nationwide/regional change in costs over time)
        - Total project contingency (allocated, unallocated, hidden or latent) (coordinate work under this section with work performed separately under OP-40 for risk and contingency)

The PMOC shall provide its professional opinion regarding the over/understatement in the Sponsor's cost estimate and shall support its opinion with its own spreadsheets and calculations. The PMOC shall assess the integration and traceability of the estimate with the defined scope and schedule of the project for purposes of identifying a "baseline" or initial project estimate. The PMOC shall assess the escalation factors used for material, labor and other costs, as well as the inflation of costs from the Base Year to the Year of Expenditure (YOE) cost, the soundness of the economic forecasts and factors used, and the appropriateness and reasonableness of contingency levels, noting the use of inconsistent and questionable rates or costing techniques within the estimate.

6.4 Specific Reviews

6.4.1 Review of Parametric Project Cost Estimate (Refer to Appendix C for Description)

The PMOC shall characterize the Sponsor's parametric estimate of project cost to determine that it:

- Identifies the key input drivers (i.e. independent variables) and explains their relative impact on the estimate;
- Adequately provides and supports the data and inputs used in calibration;
- Demonstrates that the model utilizes historical costs that are calibrated to current conditions within a reasonable degree of accuracy;
- Explains any adjustments to the model or to the key inputs, and provides adequate rationale for such adjustments;

- Demonstrates that the calibrated model produces reliable estimates in comparison to some other benchmark (e.g., actuals, comparative estimates).

6.4.2 Review of Definitive Project Cost Estimate (Refer to Appendix D for Checklist)

Review and characterize the Sponsor's cost estimate using the checklist from Appendix D. Determine that the estimate reflects a thorough and reasonable incorporation of all cost elements consistent with the project scope, schedule, known and unknown risk elements, and correlates with current construction contractor pricing and work quantities. Assess and evaluate construction contract package elements and the impact of the terms in the General and Supplementary Conditions of the Contract, and Division 1 provisions, on the anticipated bid price. Describe and characterize the Sponsor's construction contract package information as follows:

- Identification of restrictive schedule or mobilization requirements that would materially affect bid prices;
- Identification of construction contract elements or contract language that would reasonably serve as a basis for reduced competition, increased pricing (due to passed-on risks), and ambiguous or incomplete terms leading to additional compensation, which is not part of a scheduled payment item;
- Geotechnical data;
- Provision for third party, real estate, utility relocations and support issues.
- Evaluative and pricing approach to changed conditions;
- Unit pricing and allowed variability in unit pricing (including maximum limits of variance);
- Provision for an adequate amount for the construction contractor's general conditions;
- Requirements for specific services such as QA/QC or scheduling, appropriately allocated to each contract and evident in bidding documents.

The PMOC shall develop an independent detailed cost estimate of the construction contractor's general conditions for the systems work and for the three largest construction contracts, and shall compare and contrast and make recommendations of change to the Sponsor's estimate.

6.4.3 Comparison between Sponsor's Project Cost Estimate and FTA Database

The FTA maintains a Capital Cost Database on the FTA's website that can be found at the following link: http://www.fta.dot.gov/12305_11951.html.

The Database presents a summary of "as-built" costs for federally-funded, Light and Heavy Rail projects. The projects' costs are tracked in FTA's Standard Cost Categories, (SCCs) which have been validated by the project sponsors. While the Database should not be used exclusively or predominantly as the PMOC's Cost Estimating review tool, it should be consulted with as it allows for a comparison to historical projects, having generally similar characteristics. It provides a tool for assessing and evaluating the Sponsor's project estimate, specifically identifying variances in unit costs and quantities from database averages, while promoting analysis of variances. The PMOC should continually consult the Database with each Cost Estimate review as the Database will be further

developed, with new projects being added periodically, along with an annual update of the inflationary factors.

6.4.4 During Engineering, Pre-Bid, Post-Bid: Market Conditions Review

During project implementation, the Sponsor will receive bids or offers that may have a significant impact on the project budget. The PMOC shall analyze project information Pre-Bid:

- Identify, organize, characterize, and analyze substantial construction contracts, signaling, and equipment procurements;
- Describe and evaluate the Sponsor's contract packaging strategy, its relationship to the project cost estimate, and the rationale (political, economic, engineering, etc.) for the contract packaging strategy;
- Characterize and evaluate the Sponsor's proposed plan and processes for solicitations;
- Characterize and evaluate the material elements of the project risk assessments as available, emphasizing scope, cost and schedule reviews as highlighted in internal risk registers, and the Sponsor's Risk and Contingency Management Plan (RCMP). Correlate these elements with the contract packaging strategy analysis, bid/bidder information, market conditions information, specialty equipment requirements, etc.

Address the following Post-Bid:

- Correlate and analyze bids or proposal amounts against the estimated values for each bid or proposal by element. Assess the impact of each deviation on the overall estimate, risk assessments, cost risk-cost ranges and risk mitigations;
- Characterize and evaluate the Sponsor's bid process (plan sets distributed, pre-bid conference attendance, bid question activity, exit conferences, telephone interviews, analytical products, bid tabulations);
- Characterize estimate reconciliation exercises performed between the Sponsor and the contractor (i.e. post bid negotiations, inclusions and exclusions);
- Where significant variances between bid received and estimates are discovered:
  - Trace variances on bid tabulation elements back to the cost estimate and risk register;
  - Sample unit cost and quantity information to evaluate the reliability of estimate compared with bid pricing; obtain independent market data and adjust as necessary to compare to pricing and estimate. Sample scope elements from the contract documents to support conclusions;
  - Survey the market to ascertain reasons for no bids, price drivers, retained risks, etc.;
  - Develop an estimated allocation between unit cost and quantity variance;
  - Organize causal factors into groups such as market factors, general conditions, risk transfers, etc.;
  - Evaluate contract award against design scope to assess whether the contract includes all of the planned scope as originally estimated (sometimes designs are adjusted after the

estimate is prepared and large portions of work are not included in the solicitation package leading up to contract award).

- That the Sponsor has established a plan to utilize bid results to adjust future packages for similar unsolicited work (if necessary).

6.4.5 During Construction -- Assessment of Sponsor's Cost Estimate

Characterize the Sponsor's estimate of the project cost-to-complete the project. Describe the level to which it:

- Is integrated with and makes adequate use of the Sponsor's previously developed supporting documentation for the estimate;
- Reflects current project schedule, including the Contractor's Critical Path (CPM) scheduling plan;
- Reflects the Sponsor's change order experience on the project;
- Evaluates and incorporates project progress and trends to date; and
- Reflects reasonable provisions for testing, commissioning, start-up, and revenue service.

6.4.6 During Construction -- Assessment of Sponsor's Cost Estimate – Contingency and Risk

1. Cost Contingency

Per the requirements of the *Project Cost Contingency* section of OP40b, perform a review of the project cost contingency to ensure that appropriate amounts are included commensurate with the stage of project development. Prepare a cost draw-down curve per the *Cost Contingency Draw-Down Curve* section of OP 40b including both forward pass and backward analysis analyses. Also, refer to the requirements of OP40b, Appendix G Risk and Contingency Management Plan Structure, Cost Contingency Management Plan to ensure that the estimate itself is fully coordinated with the Sponsor's plan.

2. Readiness to perform OP 40 a, b or c Risk Analysis

During the project the FTA may direct the PMOC to conduct/refresh an OP 40 Risk Assessment. The risk assessment includes a cost and schedule risk analysis as described in OP40a, OP40b and OP40c. In order to perform a cost risk analysis the project estimate must first be reviewed or characterized (OP 33) and adjustments must be made if so determined by the PMOC. Most importantly, similar to the project schedule, the project estimate must be completely stripped of all contingencies (patent and latent).

1. Once all contingencies have been identified and documented during the Technical Review, all contingencies must be removed from the project estimate.
2. Once all constraints are identified and documented during the Technical Review, all constraint must be removed from the project estimate.

7.0 REPORT, PRESENTATION, RECONCILIATION

Refer to Appendices E and F below for information on the Body of the Report.

The PMOC shall provide FTA with a written report of its findings, analysis, recommendations, professional opinions, and a description of the review activities undertaken. After FTA review and approval, the PMOC should share the report with the Sponsor. In the event that differences of opinion exist between the PMOC and the Sponsor regarding the PMOC's findings, the FTA may direct the PMOC to reconcile with the Sponsor and provide FTA with a report addendum covering the agreed modifications by the Sponsor and PMOC.

The report formatting requirements of OP 01 apply. When necessary, the PMOC shall perform data analysis and develop data models that meet FTA requirements using Microsoft Office products such as Excel and Word and use FTA-templates when provided. The PMOC may add other software as necessary, but all supporting documentation and report data must be made available to FTA.

APPENDIX A

Acceptable Quality Level

	DESIRED OUTCOME	PERFORMANCE REQUIREMENT	CHECK LIST	ACCEPTABLE QUALITY LEVEL	PERFORMANCE MEASURE	MONITORING METHOD
1	The PMOC shall validate the usefulness of Sponsor's cost estimates as project management tools.	**R1a.** The PMOC shall develop and document a process for review, analysis and validation of Sponsor's project cost estimates.		**Q1a.** PMOC provides documentation of the process.	**M1a.** Review of the process documentation.	**MM1a.** Periodic review by FTA or its agent.
		R1b. The PMOC shall use its process and project management judgment to validate the usefulness of Sponsor's cost estimates as project management tools		**Q1b.** Assessment must be made and the PMOC provides internal verification that the process as documented has been followed.	**M1b.** Documented assessment of the Sponsor's cost estimates as project management tools.	**MM1b.** Periodic review by FTA or its agent and the PMOC's internal verification.
2	The PMOC shall assure FTA's access to increasingly reliable cost estimates throughout the life of the project and as directed by FTA.	**R2a.**The PMOC shall provide FTA with its opinion as to the soundness of Sponsor's estimating methods and processes compared with proven professional quantity surveying and cost estimating practices for projects of this scale.		**Q2a.** Professional opinion of the soundness of Sponsor's cost estimating processes.	**M2a.** PMOC's review and opinion as to the soundness of cost estimating methods and processes demonstrates the application of sound management and engineering practices and professional experience.	**MM2a.** Periodic review by FTA or its agent.
		R2b. The PMOC shall provide FTA with its opinion as to the congruence of the project cost estimate with the project scope and schedule. In addition, the PMOC will evaluate whether the cost estimate includes sufficient and reasonable provisions for known and unknown risk elements.		**Q2b.** Professional opinion of the congruence of Sponsor's cost estimates with the project scope, schedule, and risk elements.	**M2b.** PMOC's review and opinion as to the congruence of project cost estimates with the project scope, schedule, and risks is based on sound management and engineering practices and professional experience.	**MM2b.** Periodic review by FTA or its agent.
		R2c. The PMOC shall provide FTA with its opinion as to the reasonableness and appropriateness of core assumptions embedded in the Cost Estimate by the Sponsor, included provisions for escalation and contingencies.		**Q2c.** Professional opinion of the reasonableness and appropriateness of all core assumptions in the Cost Estimate, which particular emphasis on escalation and contingency provisions.	**M2c.** PMOC's review and opinion on soundness and reasonableness of Sponsor core assumptions for its Cost Estimates.	**MM2c.** Periodic review by FTA or its agent.
		R2d. The PMOC shall provide FTA with its opinion as to the reliability of the cost estimates for procurements, contract bids and contract closeout as seen in light of the project budget.		**Q2d.** Professional opinion of the reliability of Sponsor's cost estimates for procurements, contract bids and contract closeout.	**M2d.** PMOC's review and opinion as to the reliability of cost estimates for procurements, contract bids and closeout demonstrates sound management and engineering practices and professional experience.	**MM2d.** Periodic review by FTA or its agent.
		R2e. The PMOC shall provide FTA with its opinion as to the adequacy and timing of Sponsor's plan for evaluating, monitoring, and updating its Project cost estimate to ensure that the estimate provided to PMOC is internally coordinated and consistent.		**Q2e.** Professional opinion of the adequacy of Sponsor's internal cost estimate evaluation, monitoring, and updating plan.	**M2e.** PMOC's review and opinion as to Sponsor's plan for internal evaluation, monitoring, and updating of its cost estimate demonstrates the application of sound management and engineering practices and professional experience.	**MM2e.** Periodic review by FTA or its agent.

APPENDIX A

Acceptable Quality Level

	DESIRED OUTCOME	PERFORMANCE REQUIREMENT	CHECK LIST	ACCEPTABLE QUALITY LEVEL	PERFORMANCE MEASURE	MONITORING METHOD
3	The PMOC shall provide FTA with assessments of the consistency of Sponsor's cost estimating process.	**R3.** The PMOC shall provide FTA with its analysis and opinion as to the consistency of and correlation between estimated quantities and quantities contained in design or contract documents as reflected in Sponsor's cost estimates and the degree to which the cost estimates reflect the scope and schedule contained in design or contract documents.		**Q3.** Professional opinion of the consistency, thoroughness, and correlation to the current design scope and schedule is included in the Sponsor's cost estimates.	**M3.** PMOC's review and opinions as to the consistency and correlation of cost estimate quantities with design and contract quantities and the degree to which cost estimates reflect the design and contract scope and schedule reflect the application of sound management and engineering practices and professional experience.	**MM3.** Periodic review by FTA or its agent.
4	The PMOC shall provide FTA with a written report of its findings, analysis, recommendations and professional opinions.	**R4.** The PMOC shall present its findings, analysis, recommendations and professional opinions to FTA in a written report and, when so directed by FTA, seek to reconcile its findings with Sponsor to the extent possible. A supplemental report shall be filed describing the results of reconciliation attempts.		**Q4.** Reports and presentations are professional, clear, concise, and well written. The findings and conclusions have been reconciled with other PMOC reports and have been reconciled with the Sponsor to the extent possible.	**M4.** Review of the PMOC's presentation of findings, analysis, recommendations and professional opinions by the FTA.	**MM4.** Periodic review by FTA or its agent.

APPENDIX B

Sponsor's Memo Regarding Cost Estimating Methods

The PMOC shall review the Sponsor's memo or report regarding its cost estimating methodologies and approach. The memo should be developed by the Sponsor as part of its alternatives analysis work and updated with each subsequent estimating effort. The memo or report outline should be as follows:

1) Introduction to the project;

2) Estimating Methodology – Describe the general approach to defining and quantifying the project capital cost estimate;

3) Sources of Cost Data – Define the nature and sources for cost data used in the preparation of the estimate;

4) Cost Estimating Assumptions:
   a) Allocated Contingency
   b) Unallocated Contingency
   c) Latent (or hidden) Contingency
   d) Estimating Procedures – If multiple parties are estimating parts of the project, this memo should help to ensure reasonableness and consistency of approach
      i) Parametric Approach (see Appendix C)
      ii) Top Down Approach (using peer data, historical database information, etc.; typically used by Sponsors prior to Engineering or for Design-Build contracts)
      iii) Bottom Up Approach (using built-up quantities and units for labor, material, equipment, and all supporting services or acquisition costs and based upon more defined and educated provisions as developed during the design process; typically used by Sponsors during and at the conclusion of final design for Design-Bid-Build contracts)
      iv) Facilities (Guideway, Stations, Support Facilities) Costing Procedures for typical vs. non-typical components
      v) Organization and Management of Cost Data (by segment elements; project-wide elements)

5) Estimate Limitations – Describe perceived or known risks, as well as unknowns that could lead to changes in the estimate due to changes in project scope and design standards, schedule, incorrect unit cost or quantity assumptions, and unforeseen problems in implementation;

6) Tracking Costs – Describe how capital expenditures in the SCC format will be tracked through design, construction, revenue service, etc. (e.g. provision in Division 1 contract terms and conditions requiring contractor/consultant to submit SCC update with monthly pay application). FTA requires that costs be tracked in the SCC format through construction, into revenue service and through two years post-revenue service to document contract closeout and to establish the "after" point for the Before and After Study.

APPENDIX C

Parametric Estimating

The term “Parametric”, as applied to estimating, denotes determination of the position of the estimate for a new project within the limitations of cost parameters developed by cost experience on similar previous projects. The Department Of Defense (DOD) and International Society of Parametric Analysts (ISPA) defines “parametric estimating” as a technique that “...develops estimates based upon the examination and validation of the relationships which exist between a project's technical, programmatic, and cost characteristics, and the resources consumed during its development, manufacture, maintenance, and/or modification.”

ISPA goes on to note that practitioners use a number of parametric techniques to estimate costs, including cost estimating relationships (CERs) and parametric models. ISPA defines a CER as a mathematical expression, which describes how the values of, or changes in, a “dependent” cost variable are partially determined, or “driven,” by the values of, or changes in, one or more “independent” variables. In practice, CERS are usually derived using a single, independent cost variable. Since a parametric estimating method relies on the value of one or more input variables, or parameters, to estimate the value of another variable, a CER is actually a type of parametric estimating technique.

ISPA defines a cost CER as one in which cost is the dependent variable. In a “cost-to-cost” CER the independent variables are also costs. The cost of one element is used to estimate, or predict, that of another.

In a non-cost-to-cost relationship, the CER uses a characteristic of an item to predict its cost. Examples are CERs that estimate the quantity of revenue vehicles as a function of guideway mileage (independent variable), or the design engineering costs from the number of engineering drawings (independent variable) involved.

APPENDIX D

Definitive Project Cost Estimate Review Checklist

The components of the cost estimate are to be reviewed against these criteria. Structure the review to incorporate as much of this terminology and these concepts as is practical and consistent with Sponsor's project design or construction plan.

Review of Sponsor's cost estimate shall indicate whether:

- Estimate was developed by those with substantial experience in the type of construction under consideration;
- Sufficient judgment was applied to forecast design development, especially during early design stages;
- Evidence exists indicating sufficient collaboration with design team, especially in the application of value engineering;
- Work Breakdown Structure has been formatted to conform to the FTA Standard Cost Categories (SCC).

The PMOC shall further consider the following category-specific items:

- SCC category 10-50: Fixed Construction (guideways, stations, support facilities, site work, systems)
  - Construction Materials
    - Quantities have been calculated with appropriate conservatism to accommodate development to a more advanced stage of design if appropriate
    - Allowances for material quantities have been included for commodities which cannot be fully quantified at the present level of design
    - Unit Prices have been developed using the best available local market information
    - Project sales tax exemption status has been established if appropriate and incorporated in material cost projections
    - Quotes have been obtained for specialty and price-sensitive materials
    - Material cost projections reflect reasonable allowances/provisions for market volatility
  - Construction labor
    - Local wage rates, fringe benefits, and work rules are incorporated and are consistent with federal labor laws (e.g. Davis-Bacon Act)
    - Local payroll taxes and insurance rates are incorporated
    - Holiday / show-up / vacation pay is incorporated
    - Crew productivity is appropriate and conservative for the task under evaluation
    - Availability and variability of utility and railroad outages and "track time" have been incorporated in a conservative manner in determining the crew productivities for impacted work
  - Construction equipment
    - Local equipment rental rates and current fuel costs are incorporated

        - Consideration has been given to procuring certain pieces of equipment via a cost/benefit analysis that supports purchasing, rather than leasing
        - Quotes have been obtained for specialty equipment (TBM's, etc.), an appropriate evaluation of market conditions has been incorporated, and currency adjustments as applicable have been made.
    - Escalation for Construction Materials, Labor and Equipment
        - Confirm that reasonable escalation rates have been applied to estimates of material, labor and equipment costs to anticipate prices at the time of project bid. Cost escalation can result from increased global or local demand (example is China's construction boom results in high demand for copper, steel, cement), or reduced supply (example is the reduced labor pool in neighboring states when construction workers flocked to New Orleans after Hurricane Katrina).
    - Special considerations
        - Utility and Railroad labor, equipment, and overhead rates have been verified and incorporated in third party or "force account" work pricing, as well as local utility/RR work and safety rules
        - Special consideration has been given to support operations and facilities for tunneling operations, facilities to support operations in contaminated/hazardous materials, etc.
    - Construction Indirect Costs, Multipliers for Risk etc.
        - Contractor indirect and overhead costs are advanced beyond a percent of the associated construction direct costs and should be analyzed based on field and home office indirect costs such as contract duration, appropriate levels of staffing (including project managers, engineers, safety engineers, schedulers, superintendents, QA/QC engineers, craft general foreman, labor stewards / nonproductive labor, warehousing, project trucking, survey layout, purchasing, timekeeping, etc.), mobilization / demobilization costs, equipment standby / idle time costs, reviewer office / lab / tool facilities, safety equipment, QA/QC testing equipment, temporary utilities (sanitary / power / light / heat), jobsite and public security measures, etc.
        - Appropriate provisions have been included for payment and performance bonds and special insurance requirements (RR protective, pollution liability, etc.).
        - Other construction insurance provisions and/or project-wide coverage (Owner Controlled Insurance Policy) has been included based on quotes from appropriate carriers.
        - Contractor profit / risk costs have been incorporated that reflect the expected level of competition by contract package (higher profit margin where few competitors will bid) and the sharing or assumption of risks by the contracting community as a result of the contract terms and conditions, project scope, and schedule.
- Cat. 60 - Real Estate
    - Provisions for professional services (contracted and in-house legal, appraisal, real estate and relocation consultants) and conservative provisions for property acquisitions, easements, and associated costs for the real estate and relocations have been included. Check that easements, acquisitions, inspections, takings, etc. have been appraised or estimated by qualified professionals familiar with local real estate markets and practices. For projects that involve acquisition of railroad property or property rights, verify that the estimate has been performed by a specialist familiar with these unique transactions. Include reasonable provisions for any market volatility and taxes. The real estate estimate

should also contain an additional allowance above each estimated Fair Market Value (FMV) to reflect settlements and court awards which should be considered inevitable. This allowance should be based on historical data regarding complete acquisition costs on similar projects in the recent past. The cost estimate for real estate should include all of the relevant cost elements identified in OP 23, Appendix C.

- Cat. 70 - Vehicles
  - Costs for professional services (both contracted and in-house) for vehicle design and procurement as well as construction of prototypes and vehicles themselves. Review estimates for current purchase prices for similar vehicles or quoted prices from manufacturers; costs for spare parts and project requirements for non-revenue support vehicles are included. Also, consideration should be given to current market conditions and production schedules due to the relative shortage of vehicle suppliers.
- Cat. 80 - Professional Services
  - Costs both contracted and in-house for all professional, technical and management services related to the design and construction of fixed infrastructure (Cats. 10 - 50) during the engineering, construction, testing, and start-up phases of the project. This includes environmental work; surveying; geotechnical investigations; design; engineering and architectural services; materials and soils testing during construction; specialty services such as safety or security analyses; value engineering, risk assessment, cost estimating, scheduling, Before and After studies, ridership modeling and analyses, auditing, legal services, administration and management, etc. by agency staff or outside consultants. Provisions for professional liability insurance and other non-construction insurance should be included on 80.05.
  - Refer to Sponsor's contracts for services.
  - Confirm that cost estimates are based on realistic levels of staffing for the duration of the project through close-out of construction contracts.
  - Confirm that the Sponsor has developed a staffing plan that properly contemplates the cost of attrition, staffing interruptions, and replacement of key personnel.
  - Confirm that costs for permitting, agency review fees, legal fees, etc. have been included.
- Cat. 90 - Unallocated Contingency
  - Confirm that adequate contingency has been added to the total project cost based on the perceived project risk and the stage of design/construction development.
- Cat. 100 – Finance Charges
  - Confirm that finance charges are included if necessary. Ensure that the Sponsor and FTA's Financial Management Oversight Consultant review the reasonableness of the amount of finance charges.
- Allocated Contingency
  - Confirm that adequate contingency has been allocated to each of the SCC categories based on the perceived risk inherent to each and the stage of project development.
- Inflation
  - Confirm that adequate and reasonable inflation rates have been applied to Base Year project costs to anticipate costs at procurement or bid (through the use of cash flow analysis). The Year of Expenditure costs should be developed thoughtfully. Reference indices that may be useful are the ENR Building Cost Index and Construction Cost Index, some with regional cost databases.

APPENDIX E

Body of Report (refer to OP 01 for more information on report requirements)

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1) Executive Summary
   a) The PMOC shall provide an executive summary in three pages or less that includes the following:
      i) Synthesis of findings as related to the cost estimate;
      ii) Characterization of significant uncertainties in terms of likelihood (probable, remote, improbable) and their consequence (catastrophic, critical, serious, moderate, marginal);
      iii) Professional opinion regarding the reliability of the cost estimate;
      iv) Statement of potential range of cost (lower, upper, and most likely);
      v) To reduce important uncertainties, recommendations for additional work of any kind including but not limited to investigation, planning or design work by the Sponsor or other party with a schedule for the performance of the work (recommend performance either before or after FTA's decision regarding project advancement or funding.)
2) Introduction
   a) Indicate date of estimate received in original and SCC format
   b) Indicate the level of design completion represented by the cost estimate
3) Methodology – Describe the PMOC's approach to:
   a) Sampling; provide rationale for approach (e.g. higher sample rate for higher cost items, etc.); overall sampling rate of __ percent;
   b) Checking costs against scope and schedule;
   c) Identifying allowances;
   d) Identifying patent (exposed) and latent (hidden) contingencies;
   e) Evaluating provisions for escalation and inflation;
   f) Evaluating provisions for risk elements;
   g) Accepting Sponsor cost and other information with/without adjustment;
4) PMOC team review of the various cost and other documents provided by the sponsor following this outline:
   a) Description of the structure, quality, level of detail of the project information (including Sponsor and third party information);
      i) describe the contract packages and the estimating approach/consistency for each;
      ii) describe the manner of tying the estimate line items to the FTA Standard Cost Categories (SCC) line items;
   b) Characterization or Stratification of Cost Items

i) Characterize estimate data into one of three cost item categories or classifications -- Lump Sum, Unit Cost or Cost Estimate Relationship. Organize Sponsor costs in the format shown in Appendix F;

ii) Select sample totals based on individual sampling rates for each category;

iii) Identify cost items for detailed review based on random selection of individual cost items;

iv) Allowances - Evaluate use of allowances for reliability with respect to the scale of the work covered and known project risks.

c) Mechanical Check of Estimate

i) Mathematically sum all lump-sum prices, unit price and quantity calculations, and cost estimating relationships to confirm the sponsor's total cost estimate;

ii) Perform a mathematical check of all sampled unit price or quantity calculations;

iii) Mathematically check the cross-walk and cost sums from the contract packages to the FTA Standard Cost Categories;

iv) Mathematically check all escalation and inflation provisions through a cash flow analysis.

d) Comparison to Industry Standards

i) Review sampled unit prices and quantities for conformance to industry standards, regional variations or other unique characteristics;

ii) Check sampled unit costs of similar items used in differing conditions to ensure local conditions and difficulty factors were considered in the individual estimated units;

iii) Check sampled quantities to confirm basis of calculations are consistent with design documents and core assumptions.

e) Correspondence with Scope Review

i) Cross check sampled quantity estimates with the project scope contained in the design documents to determine degree of correlation between the design deliverables and the project cost estimate down to the 2nd level WBS;

ii) Perform general "Overview" of total estimate to give it a "sanity check" and ensure that all major components appear, conscious of any risk assessments that have occurred;

iii) Review sample quantities for reasonableness and to be representative of industry standards and the design scope of work with respect to major components.

f) Evaluation of Contract Package Elements

i) Assess certain contract package elements as to requirements and associated reviewer payments, characterizing elements as:

(1) Contract requirements for specific services such as QA/QC and scheduling that would be material elements in the development of bids;

(2) Elements of contract language that would reasonably serve as a basis for additional compensation not part of a scheduled payment item;

(3) Restrictive schedule or mobilization requirements that would be material pricing elements in developing a bid;

(4) Geotechnical data and pricing approach to changed conditions;

(5) Unit pricing and allowed variability in unit pricing;

(6) Risk elements that will be absorbed by the contractor.

g) Costs associated with General and Supplementary Conditions of the Construction Contract; Division 1 Provisions:

i) By contract package, evaluate the Sponsor's proposed language and the allocation of scope, schedule and cost risk described therein;

ii) For comparison with the Sponsor's estimates, the PMOC is to develop independent cost estimates for General /Supplementary Conditions/ Division 1 for the three largest construction contracts and the systems work;

h) Contingencies – Present and evaluate cost contingency elements in the Sponsor's cost estimate – patent (exposed) and latent (hidden costs that are functionally equivalent to contingency but not identified). Are the contingency amounts appropriate for the level of risk and stage of design/construction development?

i) Escalation and Inflation Review

i) Building up from the second SCC level, evaluate uniformity of application of escalation and inflation factors. Review and evaluate the application of the escalation factors to costs for materials, labor and equipment. Review and evaluate the application of inflation rates to the Base Year dollar costs to arrive at Year of Expenditure dollars. Consider the adequacy and reasonableness of the rates, the soundness of the economic forecasts, and whether the Sponsor has performed any sensitivity analysis to supports its projections;

ii) Compare escalation and inflation factors used by sponsor to Producer Price Index data from the Bureau of Labor and Statistics (http://www.bls.gov) and other sources such as ENR, AGC, Means, Richardson, etc. to ensure adequate escalation and inflation cost is included to carry the project to the mid-point of construction (the assumed time when contract unit awards will be complete).

5) Appendices

a) PMOC Evaluation Team Member and qualifications

b) Other appendices as required

APPENDIX F

Exhibit F-1: Project Cost Estimate Classification *DRAFT*

Estimate Classification	Quantity	UM	*n*	Unit Pricing	*n*	CER	*n*	Lump Sum / Allowance	Σ_n	Total	Percent *n*	Percent $
Percent Of Total			88.7%	43.0%	1.4%	22.4%	10.0%	34.6%				
10 GUIDEWAY & TRACK ELEMENTS (route miles)	9.40	RM	258	$ 73,570,533	4	$ 38,348,813	29	$ 59,196,427	291	$171,115,773		
Drawings / Specifications			257	$ 63,214,438	3	$ 32,950,675			260	$ 96,165,113	89.3%	56.2%
Schedule (Includes Escalation)			1	$ 10,356,094	1	$ 5,398,138	1	$ 8,332,735	3	$ 24,086,968	1.0%	14.1%
Design Report				$ -		$ -	28	$ 50,863,692	28	$ 50,863,692	9.6%	29.7%
GCs				$ -				$ -	-	$ -	0.0%	0.0%
Percent Of Total			54.3%	28.1%	11.4%	18.0%	34.3%	53.8%				
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	11.00	EA	19	$ 7,299,565	4	$ 4,683,534	12	$ 13,967,320	35	$ 25,950,418		
Drawings / Specifications			18	$ 6,272,000	3	$ 4,024,229			21	$ 10,296,229	60.0%	39.7%
Schedule (Includes Escalation)			1	$ 1,027,565	1	$ 659,304.4	1	$ 1,966,190	3	$ 3,653,059	8.6%	14.1%
Design Report				$ -		$ -	11	$ 12,001,130	11	$ 12,001,130	31.4%	46.2%
GCs				$ -				$ -	-	$ -	0.0%	0.0%
Percent Of Total			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%				
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	9.40	RM	-	$ -	-	$ -	-	$ -	-	$ -		
Drawings / Specifications						$ -			-	$ -	$ -	$ -
Schedule (Includes Escalation)				$ -		$ -		$ -	-	$ -	$ -	$ -
Design Report				$ -		$ -		$ -	-	$ -	$ -	$ -
GCs				$ -				$ -	-	$ -	$ -	$ -
Percent Of Total			48.3%	42.1%	32.8%	47.9%	18.9%	10.0%				
40 SITEWORK & SPECIAL CONDITIONS	9.40	RM	115	$ 34,909,305	78	$ 39,674,285	45	$ 8,243,518	238	$ 82,827,108		
Drawings / Specifications			114	$ 29,995,357	77	$ 34,089,602	44	$ 7,083,134	235	$ 71,168,093	98.7%	85.9%
Schedule (Includes Escalation)			1	$ 4,913,948	1	$ 5,584,682	1	$ 1,160,385	3	$ 11,659,015	1.3%	14.1%
Design Report				$ -					-	$ -	0.0%	0.0%
GCs				$ -					-	$ -	0.0%	0.0%
Percent Of Total			9.8%	9.8%	7.8%	23.2%	82.4%	67.0%				
50 SYSTEMS	9.40	RM	5	$ 2,459,937	4	$ 5,847,541	42	$ 16,888,973	51	$ 25,196,451		
Drawings / Specifications			4	$ 2,113,650	-	$ -	-	$ -	4	$ 2,113,650	7.8%	8.4%
Schedule (Includes Escalation)			1	$ 346,287	1	$ 823,163	1	$ 2,377,473	3	$ 3,546,923	5.9%	14.1%
Design Report				$ -	3	$ 5,024,379	41	$ 14,511,500	44	$ 19,535,879	86.3%	77.5%

GCs				$ -		$ -		$ -	-	$ -	0.0%	0.0%
Percent Of Total			0.0%	0.0%	50.0%	9.1%	50.0%	90.9%				
60 ROW, LAND, EXISTING IMPROVEMENTS	9.40	RM	-	$ -	2	$ 2,107,818	2	$ 21,078,182	4	$ 23,186,000		
Drawings / Specifications				$ -		$ -		$ -	-	$ -	0.0%	0.0%
Schedule (Includes Escalation)				$ -	1	$ 107,818	1	$ 1,078,182	2	$ 1,186,000	50.0%	5.1%
Design Report				$ -	1	$ 2,000,000	1	$ 20,000,000	2	$ 22,000,000	50.0%	94.9%
GCs				$ -		$ -		$ -	-	$ -	0.0%	0.0%
Percent Of Total			0.0%	0.0%	50.0%	9.1%	50.0%	90.9%				
70 VEHICLES (number)	30.00	A	-	$ -	2	$ 1,475,182	2	$ 14,751,818	4	$ 16,227,000		
Drawings / Specifications				$ -		$ -		$ -	-	$ -	0.0%	0.0%
Schedule (Includes Escalation)				$ -	1	$ 224,182	1	$ 2,241,818	2	$ 2,466,000	50.0%	15.2%
Design Report			-	$ -	1	$ 1,251,000	1	$ 12,510,000	2	$ 13,761,000	50.0%	84.8%
GCs				$ -		$ -		$ -	-	$ -	0.0%	0.0%
Percent Of Total			0.0%	0.0%	80.0%	89.3%	20.0%	10.7%				
80 PROFESSIONAL SERVICES	9.40	RM	-	$ -	8	$ 72,996,814	2	$ 8,779,666	10	$ 81,776,479		
Drawings / Specifications				$ -		$ -			-	$ -	0.0%	0.0%
Schedule (Includes Escalation)				$ -	1	$ 6,482,377	1	$ 779,666	2	$ 7,262,043	20.0%	8.9%
Design Report			-	$ -	7	$ 66,514,437	1	$ 8,000,000	8	$ 74,514,437	80.0%	91.1%
GCs				$ -		$ -			-	$ -	0.0%	0.0%
90 UNALLOCATED CONTINGENCY			-	$ -	2	$ 21,342,960	-	$ -	2	$ 21,342,960		
Drawings / Specifications									-	$ -	0.0%	0.0%
Schedule (Includes Escalation)					1	$ 2,721,995			1	$ 2,721,995	50.0%	12.8%
Design Report					1	$ 18,620,965			1	$ 18,620,965	50.0%	87.2%
GCs									-	$ -	0.0%	0.0%
100 FINANCE CHARGES			-	$ -	-	$ -	-	$ -	-	$ -		
Drawings / Specifications									-	$ -		
Schedule (Includes Escalation)									-	$ -		
Design Report									-	$ -		
GCs									-	$ -		
Percent Of Total			62.5%	26.4%	16.4%	41.7%	21.1%	31.9%				
Grand Totals	9.40	RM	397	$118,239,340	104	$186,476,946	134	$142,905,904	635	$447,622,189		