US DOT Federal Transit Administration
TPM-20 Office of Capital Project Management
Project Management Oversight

**Oversight Procedure 40b – Risk and Contingency Review (Abbreviated Review)**

## 1.0 PURPOSE

The purpose of this Oversight Procedure (OP) is to describe the review procedures and reporting requirements that the Federal Transit Administration (FTA) expects from the Project Management Oversight Contractor (PMOC) as regards review of the Sponsor's plan for mitigating and managing project risks.

Further, this OP describes the procedure for a PMOC risk assessment, under an abbreviated review process. See Appendix D.

## 2.0 BACKGROUND

The reliability of the Sponsor's project scope, cost estimate, and schedule over the course of the project life is extremely important, not only for the success of the individual project, but also for the professional credibility of the transit industry including FTA. Professional risk management provides the basis for improving the reliability of project delivery.

## 3.0 OBJECTIVES

This review requires an evaluation of the reliability of the Sponsor's project scope, cost estimate, and schedule at a summary level, with special focus on the elements of uncertainty associated with the effectiveness and efficiency of the Sponsor's project implementation and within the context of the surrounding project conditions.

This OP requires the PMOC to synthesize available project information including the Sponsor's separate Risk and Contingency Management Plan; evaluate, explore, and analyze uncertainties and risks; establish that an appropriate qualitative and quantitative assessment of ranges of forecasted cost and schedule has been developed; describe and evaluate the analytical methods used; consider risk mitigation options and alternatives including use of cost and schedule contingencies; draw conclusions; and provide recommendations for adjustment to scope, cost, schedule, project delivery method, construction methodology, and project management and risk planning in order to respond to project risk.

Review of the Sponsor's capacity and capability and of the Sponsor's Project Management Plan and subplans will occur in an expedited manner by focusing on key elements that present the strongest risk to the project's goals. The scope, estimate, and schedule reviews are reviewed in an expedited fashion; a duration of approximately 1-2 months; the review will culminate in a workshop as follows and as discussed further in this OP:

A workshop will be conducted in which the Sponsor will present the major elements of the project's scope, cost, and schedule at a summary level. The workshop's goals are to provide the Sponsor and PMOC the opportunity to jointly confirm these project documents based on the PMOC's earlier

expedited review, and to also discover and document weaknesses and assumptions in the documents; such weaknesses and assumptions will either be corrected or noted on a Risk Register to be used as a basis for the PMOC's risk analysis. The PMOC will work jointly with the Sponsor to establish an appropriate agenda and schedule of attendees for the meeting. It is intended that the meeting duration be no more than 3 days, depending on the complexity of the project and the level of definition of the documents. Workshop duration beyond these limits shall be confirmed with the FTA.

FTA may direct the PMOC to conduct this review at various points in a project's life. This review is applicable to projects using any project delivery method: Design-Build-Build (DBB), Design-Build (DB), Construction Manager/General Contractor (CM/GC), etc.

The PMOC's review under this OP is a critical input to FTA's decision regarding project advancement and funding.

## 4.0 REFERENCES

The statutes, regulations, policies, guidance documents and circulars in OP 01 Administrative Conditions and Requirements apply.

## 5.0 REVIEW OF SPONSOR'S SUBMITTALS

In advance of performing the review, the PMOC shall obtain and study documents similar to those listed in Appendix B, as appropriate for the particular project phase and level of review, including the Sponsor's Project Management Plan (including especially the Risk and Contingency Management Plan) and supporting documents. Supporting documents shall include appropriate design, cost, and schedule information sufficient to establish the basis of the project. Many of these documents will have been obtained through the review of scope, schedule, cost, and Sponsor management capacity and capability in other OPs. The PMOC shall perform an initial review and notify the FTA of important discrepancies in the project information that would hinder the review; an example would be insufficient detail or a mismatch between drawings and cost estimate in which the drawings are current and the cost estimate is significantly older.

## 6.0 SCOPE OF WORK

### 6.1 Overview

The scope of this review includes evaluation and recommendations for amendment of the Sponsor's project risk identification and assessment, mitigation recommendations, and contingency assessment, as reflected in its Risk and Contingency Management Plan. The PMOC shall independently develop a risk analysis to provide a thorough analysis of the Sponsor's project.

This risk management review builds upon any review of scope, schedule, cost, and Sponsor management capacity and capability in other OPs that may have been previously performed.

#### 6.1.1 Sponsor interface

PMOC interface with the Sponsor during its risk review facilitates and expedites the process and provides the PMOC with the background necessary to efficiently evaluate risk and provide recommendations for revisions, if any, to the Sponsor's Project Management Plan. A typical structure for Sponsor interface meetings is presented in Appendix C.

### 6.1.2 Organizing the Risk Assessments by FTA Milestones

Depending on the project trends, detailed forecasted levels of project risk would be developed around points in time when level of project development typically indicates changes in project risk. The following reflect common and important FTA Milestones for such detailed reviews:

- Readiness to Enter into Engineering;
- Readiness for SSGA/FFGA;
- Ready to Bid Construction;
- Start of Construction;
- 20% construction;
- 50% construction;
- 75% construction; and
- 90% construction.

The FTA Milestones may be modified to reflect important milestones in the Sponsor's schedule, especially those points where significant changes in risk occur. If FTA Milestones and PMOC-added milestones are more than one year apart, the PMOC shall consider developing supplemental milestones.

## 6.2 Project Status Evaluation: PMOC's Efforts

A joint PMOC and Sponsor project status evaluation is a precursor to the detailed risk review. The completeness and accuracy of the risk review is highly dependent on the completeness and accuracy of the project status evaluation. The project status evaluation is performed in an abbreviated process, focusing on the most important drivers of the Sponsor's management capacity and capability, scope, cost, and schedule, especially as related to risk. The target is a review process of no more than 1-2 months. This evaluation shall culminate with include a workshop of typically a 2-5 day duration, during which the sponsor will present its scope, cost, and schedule documents, including whatever supporting documents are necessary to provide a full project understanding. It is the intent that this presentation will expedite the review through focus on those elements of the project that present large amounts of risk to the project's goals.

Prior to the workshop, the PMOC will additionally review key elements of the Sponsor's PMP (including especially the Risk and Contingency Management Plan and Staffing Plan) to also, in an expedited fashion, consider risks related to management capacity and capability, scope, cost and schedule. Other review elements may be included at the discretion of the FTA.

## 6.3 Identification and Categorization of Risks: Sponsor's Efforts

Risk identification plays a significant role in the overall risk management process. Sufficient efforts shall be made by the Sponsor to ensure that adequate resources and processes have been used to develop a thorough listing of risk events, appropriate to the current project phase. This "Risk Register" shall include at a minimum a description of the potential risk event; its qualitatively-evaluated potential consequences and likelihood of occurrence; its SCC category and risk category; the contract package in which it falls (where appropriate); a method for prioritizing among risks; and potential actions to mitigate the risk.

### 6.3.1 Example of risk register

An example of a simplified, partial, risk register is included in Appendix E.

## 6.4 Identification and Categorization of Risks: PMOC's Efforts

The PMOC shall participate in a joint PMOC and Sponsor workshop, the intent of which is to receive a presentation on the key elements of the Sponsor's scope, cost, schedule and other key documents required to provide a full description of the project. The Sponsor and PMOC will consider each project element and the cost estimate and schedule, noting assumptions and potential risks in each area, and will identify new risk events that may threaten the projects goals as well as evaluate risk events that exist on the Sponsor's current Risk Register.

### 6.4.1 Risk Events

**Risk Events** are individually identified contingent, or unplanned, events that may occur and which may create a plan variance and may be cause for special management scrutiny or action. Such events, or a combination of such events, do not represent all risk present on a project, and the identification or disposal of risk events may only become possible as the project proceeds through its various phases. Therefore, risk event identification will require frequent updates as a project progresses.

### 6.4.2 Risk Categories

Risk shall be characterized as belonging to any of the following categories, which are listed in chronological order; generally, risk is categorized as associated with the category during which the risk may be earliest and best mitigated. The categories are listed below, and are related to traditional sequential phases of project development. If a risk event is not disposed of during a particular phase, it may survive into the following phase. See Appendix F for application of the risk category to risk assessment principles for capital and non-capital construction project elements.

**Requirements Risk** relates to the establishment and variability of fundamental goals and conditions of a project to which the design or construction process must respond, as well as the activities of the Sponsor to actively identify these goals and conditions. Generally, requirements risk is associated with all project development activities from earliest concept through Project Development. A significant portion of Requirements Risk can be attributed to the potential influence of project stakeholders and third parties (such as regulatory agencies) if project goals and requirements are not fully defined.

**Design Risk** is associated with the performance and variability of design-related activities occurring after Project Development. Substantially complete design risk is indicated when no material design-related assumptions or likely variations are detected through the scope review; the estimate review indicates that 95% of all construction direct cost activities are shown on both design deliverables and cost estimate; and the schedule review indicates that no project level critical path element or procurement activity exceeds 45 calendar days (or other reasonable minimum) in duration.

**Market Risk** is related to the procurement of project management, administrative, right-of-way, design, or construction services; materials; and equipment and the variability associated therewith. This risk refers to both the effects of the open-market pricing of goods and services, as well as the effects of the Sponsor's contract packaging strategies.

**Construction Risk** includes both risks that are due to the inevitable variability of the project's environment—including such items as unusual weather, unexpected subsurface conditions, and

unexpected construction contractor failure—as well as performance risk that is manageable by the Sponsor and its consultants and contractors—for example uncertainty surrounding mobilization of a tunnel boring machine and its planned production rates. Capital construction risk may be subdivided into: Early-Range Construction Risk (composed generally of site activities such as Geotechnical or Utility activities, usually associated with up to 20% complete), Mid-Range Construction Risk (associated with coordination of contractors, etc., from 20% to 50%), and Late-Range Construction Risk (associated with 50% to substantial completion).

## 6.5 Risk Assessment: PMOC's Efforts

### 6.5.1 Project Cost Risk Overview

The PMOC shall use its professional judgment and objective cost data to sequentially summarize, adjust, and condition the Sponsor's estimate at the minor SCC level to empirically develop the basis for evaluation of cost risk. These parameters will then be used to assess the magnitude of project risk and guide the potential responses to manage the risk.

**Top-down Cost Risk Assessment** - The FTA has developed methodologies for evaluating cost-risk assessment using broad parameters derived from historic project information. These parameters are applied as risk-based ranges of potential cost at a summarized category level, and this process is referred to as a top-down cost risk assessment model. The FTA top-down cost risk assessment methods are project-level risk assessment tools that have been developed through implementation on many FTA transit projects. The features have become accepted as common starting points for creation of a project-specific cost risk assessments.

### 6.5.2 Pre-assessment Adjustments of the Sponsor Estimate

**Stripped Cost Estimate** - Based upon analyses performed in accordance with the OP associated with the review of the cost estimate, the PMOC shall ensure that Sponsor has identified all contingency funds embedded within its cost estimate. Such contingency funds may include both unallocated funds (usually applied as a percentage of summary costs) and allocated funds (usually applied as increases to individual estimate line items). Both patent (or exposed) contingency funds and latent (or hidden) contingency funds shall be identified; the identification of latent contingency funds will likely involve interviews with the Sponsor. Furthermore, particular attention shall be paid to contingent funds that may be embedded within estimates for inflation or escalation risk.

Once these contingency funds have been quantified, they shall be removed from the estimate to form a Stripped Cost Estimate.

**Adjusted Cost Estimate** - Utilizing scope, cost, schedule, contract packaging, etc. information developed through prior-performed analyses prescribed by Oversight Procedures and/or workshops with the Sponsor, the PMOC shall evaluate the Stripped Cost Estimate, suggesting changes to the various estimate line items to produce an Adjusted Cost Estimate. The amount of analysis shall be appropriate with the level of review required by the FTA. Care shall be taken to identify whether items so adjusted shall also become elements of the Risk Register. Any such adjustments and their rationale shall be fully documented. Note that the adjusted estimate, at a minimum, shall include one level of breakdown below the standard SCC Cost Elements [e.g.10.01, 10.02, etc.] The estimate shall be inflated to the year of expenditure (YOE), which becomes the basis for the ensuing risk assessment. Note that the inflation rate used for developing the Adjusted Cost Estimate shall be a rate that is a

reasonably-expected value without significant hidden contingency, in a similar manner that occurs with other estimate line items.

Subsequent analyses of risk depend upon accurate estimate adjustments. Where possible, and especially in the case of significant adjustments, the PMOC shall strive for consensus of the FTA, PMOC, and Sponsor in such adjustments before moving forward with the risk assessment.

This Adjusted Cost Estimate, appropriately stripped of contingencies, establishes a highly optimistic level of cost forecast for the various estimate line items, useful for assessing the range of risk for the line item.

### 6.5.3 Risk Profiles

Many large transit projects, especially those in latter stages of development, consist of multiple phases or contract packages that are delivered using differing project methods or that are staged with differing timing. For example, Phase I of a project may begin a year or more earlier than Phase II; alternatively, the corridor for a particular project may be delivered using design-build methods, while the stations may use design-bid-build delivery. These circumstances may create project portions that exhibit different risk profiles, characterized by widely varying risk ranges factors.

Where practical and reasonable for accurate assessment of project risk or application of contingencies, the project may be apportioned based on these different risk profiles; risk and mitigations, including contingencies assessed independently by project portion; and the portions subsequently combined using appropriate techniques into an overall project risk recommendation.

### 6.5.4 Cost Risk Assessment – Beta Range Model

The PMOC shall develop an independent top-down project cost risk assessment using the Beta Range Model method. The following generally describes its procedures; actual implementation of the Beta Range Model method shall be undertaken by those thoroughly familiar with the process and able to use judgment as necessary to fine-tune the process for specific project conditions.

#### 6.5.4.1 Standard Cost Category (SCC) Risk Assessment

**SCC Cost Element Ranges** - Utilizing the procedures outlined below, the PMOC shall establish likely ranges of cost for estimated line items, or elements, at the minor SCC level, spanning the range of lower bound to upper bound, to which a Beta probability distribution function will be applied, allowing the application of risk across the entire project. The Beta probability distribution function has been derived from historical FTA transit project outcomes, and may be adjusted from time-to-time. These ranges shall be established as follows:

- **Lower Bound SCC Cost Element Range Establishment** - The Adjusted Cost Estimate for each minor SCC is established as the lower bound value of the SCC element.
- **Upper SCC Cost Element Range Establishment** - The PMOC shall establish the upper bound minor SCC value through multiplying the Lower Bound value by a range factor (hereinafter referred to as the Beta Range Factor or BRF); i.e., Upper Bound = BRF*Lower Bound.

**Beta Range Factor Establishment** - The PMOC shall establish the Beta Range Factor (BRF) values through a process of initially utilizing the guidelines indicated below and in Appendix F, and then varying the developed Beta Factors based upon specific project situations (especially including those noted in the Risk Register), considering discussion with the Sponsor and FTA work order manager.

Beta Range Factors are sums of Risk Category factors; i.e., total risk for an SCC element is the sum of the individual Risk Category Factors for Requirements Risk, Design Risk, Market Risk, and Construction Risk, added to a base factor of 1.05. The base factor of 1.05 provides for a 5% end-of-project risk range allowance, which recognizes that risk generally remains, even at the end of construction.

Methods for establishing the BRFs are presented in Appendix F.

**SCC Cost Item Risk Curve Establishment** - The median, mean, and variance of the suggested range distribution for the SCC cost item are fully determined using the Lower Bound, the BRF, and the historically-derived Beta distribution. These calculations are modeled in the Beta Range Model Workbook.

**Project Delivery Method Influence** - Differing project delivery methods may generally affect the timing and scope of risk retained by the Sponsor but not necessarily the magnitude of risk nor the sequence of risk mitigation until contracting has occurred. Traditional project delivery methods (Design-Bid-Build) transfer or share much of the construction risk at the completion of design and market risk mitigation. Alternative project delivery methods such as Design-Build may transfer or share some components of requirements, design, market, and construction risk prior to the completion of design activities. The extent and effectiveness of risk transfers and risk retained by the Sponsor inherent in such alternative project delivery methods shall be considered when developing recommendations for BRF assignment.

#### 6.5.4.2 Project Level Cost Risk Assessment

Project-level risk is an aggregated amount of the risk associated with all of the SCC Category Cost Ranges. The Beta Range Model Workbook develops these calculations.

The Beta Range Model Workbook has been developed to illustrate the method's common features and to serve as a starting point for a particular project. This workbook is based on the summary organizational structure of the FTA Standard Cost Categories (SCC) 10 through 80 for the capital cost elements of a project; SCC category 90 (contingency) is specifically excluded as a duplicate measure of risk. Risk for SCC category 100 (finance charges) is not covered in the standard BRFs for categories 10 through 80; opinion of finance cost risk is provided separately through other FTA reviews. The Beta Range Model Workbook illustrates the formats and bases of calculations to properly execute the cost risk assessment described herein. The PMOC shall become fully familiar with the Beta Range Model Workbook prior to undertaking the work of this section. The PMOC shall adjust the FTA Beta Range Model Workbook as appropriate to meet specific project conditions.

The PMOC shall produce, using the Beta Range Model Workbook, a summary table that lists the Sponsor's estimated values, and the PMOC's recommended project cost elements with its assessment data—including the reportable range of variability determined in the risk assessment and its effect on the overall budget. The PMOC will then identify, in a narrative format, the key risk drivers through an analysis of those project elements with large cost risk impact.

The FTA may direct the PMOC to perform additional analyses as appropriate to provide further insight into the project-level risk assessment.

**Conditioned Estimate** - The PMOC shall evaluate contingency amounts identified for the project and shall comment on the sufficiency of the contingency, establishing a recommended contingency amount

for the project in accordance with this OP. A Conditioned Estimate may be developed by adding the recommended contingency to the Adjusted Estimate, which forms the PMOC's recommendation for the project budget. Note that contingency recommendations, regardless of method of analysis, are applied at the project level only, regardless of whether and how the Sponsor may allocate the contingency among the various project elements.

### 6.5.5 Project Schedule Risk Overview

The PMOC shall use its professional judgment and objective schedule data to evaluate the Sponsor's assessment of schedule risk, and to provide an independent assessment of schedule risk.

**Schedule Risk** is risk to the project schedule critical path directly delaying the project, or to any other significant activity, the delay of which may reduce schedule float, schedule contingency or threaten the project estimate. Note that schedule risk may also indicate cost risk.

#### 6.5.5.1 Pre-assessment Adjustments of the Sponsor Schedule

**Stripped Schedule** - Based upon analyses performed in accordance with the OP associated with the review of the Schedule and/or workshops with the Sponsor, the PMOC shall to render an opinion whether the Sponsor has exposed all contingency durations embedded therein; the level of analysis so undertaken shall conform to the level required by the FTA. Such contingency durations to be removed may include both unallocated (usually applied as a dummy activity at the end of the project or sub-network) and allocated (usually applied as increases to individual activity durations). Both patent (or exposed) contingency durations and latent (or hidden) contingency durations shall be identified; the identification of latent contingency durations will likely involve interviews with the Sponsor. Further, particular attention shall be paid to contingent durations that may be embedded as lag time hidden within the activity logic ties or artificially applied constraints.

Once identified, these contingency durations shall be quantified and removed from the schedule to form a Stripped Schedule.

**Adjusted Schedule** - Utilizing scope, cost, schedule, etc. information developed in prior-performed Operational Procedures or joint PMOC and Sponsor workshops, the PMOC shall appropriately provide suggested revisions to the Stripped Schedule, increasing or decreasing the various activity durations. When applied to the Stripped Schedule, the suggested changes will develop an Adjusted Schedule. Any such adjustments and their rationale shall be fully documented.

The Adjusted Schedule forms a highly optimistic schedule for the project.

Subsequent analyses of risk depend upon accurate schedule adjustments. Where possible, and especially in the case of significant adjustments, the PMOC shall strive for consensus of the FTA, PMOC, and Sponsor in such adjustments before moving forward with the schedule risk evaluation.

### 6.5.6 Schedule Risk Assessment

#### 6.5.6.1 Summary Schedule Development

To aid in efficient and effective attribution of risk, the PMOC shall review, or independently develop, a summary schedule based upon the Adjusted Schedule that will be used for modeling project schedule risk. The summary schedule shall be a mechanically-correct critical-path method schedule that adequately reflects the interrelationships among its activities so as to model the effect of a variation in any activity upon the other activities. The number of activities modeled shall be commensurate with

the Adjusted Schedule and level of detail available at the time of analysis; very large models are, however, generally difficult to assess and the principles underlying risk attribution may be difficult for all audiences to understand. Therefore, the PMOC shall review, or independently establish, a summary schedule for risk assessment purposes which, in its professional judgment, strikes a reasonable balance between transparency and level of detail required for sufficient risk assessment.

#### 6.5.6.2 Schedule Activity Risk Assessment

Duration ranges for the activities of the Summary Schedule shall be established through a process of evaluating the specific project attributes (especially including those noted in the Risk Register); the reasonableness of these duration ranges shall be determined considering discussion with the Sponsor and the FTA. The Adjusted Schedule durations shall be used to establish the optimistic estimate for the summarized activity durations. The PMOC shall determine that appropriate technical experts have been consulted to establish the most likely and pessimistic estimates for the activity duration, or other parameters required for the stochastic analysis. The choice of probability functions or other technical parameters used in the analysis shall be clearly documented. Methods used in the analysis shall be made clear to all parties, in order that each may review, comment upon, and ultimately embrace the results of the schedule risk assessment.

The schedule activity risk assessment shall utilize a commercially-available project scheduling system that is capable of critical path scheduling and stochastic modeling for probabilistically-described activity durations. This system will be used for capturing and reporting activity risk duration ranges, as well as reporting the resulting project-level schedule risk assessment.

#### 6.5.6.3 Project Level Schedule Risk Assessment

The likelihood of project completion within the timeframes estimated on Sponsor's master schedule shall be assessed using a commercially available scheduling software program capable of stochastic schedule risk modeling ("Monte Carlo" modeling). The schedule modeling shall successively and randomly develop alternate forecasted project completion dates, based upon the activity duration range input described above. Such modeling shall be undertaken by individuals fully capable of establishing modeling parameters and capable of interpreting the modeling results. This assessment shall include an evaluation of the predicted range of completion dates compared to the Sponsor's scheduled milestones; evaluation of assigned activity duration ranges, including statistical information such as range, median, mean, minimum and maximums; and identification of critical and near-critical paths and the relationship between those paths and identified risk events. The FTA may direct other similar analyses.

The Project Schedule Risk Assessment shall consider whether non-construction activities, such as vehicle procurement, may introduce a relationship that creates a critical path that in turn masks critical paths for construction activities; in such case, it may be prudent to temporarily remove the non-construction activities and perform a separate analysis on the thus-altered schedule.

Based upon its findings, the PMOC shall assess the sufficiency of the Sponsor's base sequencing and schedule to adequately reflect the modeled interim and final milestone completion dates. The PMOC shall provide recommendations for adjustment to the Sponsor's schedule and Project Management Plan to reduce the risk of not meeting the project's schedule goals.

**Conditioned Schedule** - The PMOC shall evaluate the contingency amounts identified for the project

and shall comment on the sufficiency of the contingency, establishing a recommended amount for the project in accordance with this OP. A Conditioned Schedule is developed when the recommended contingency is integrated with the Adjusted Schedule.

### 6.6 Risk Mitigation: Sponsor's Efforts

The PMOC shall review and make recommendations regarding Sponsor risk mitigation plans, as documented in its Risk and Contingency Management Plan—a part of the Project Management Plan. Areas of review and comment shall include the development and management of:

- Primary mitigation;
- Secondary mitigation; and
- Contingencies and contingency draw-down curves.

#### 6.6.1 Risk Mitigation Recommendations

The review and recommendations shall be organized appropriately by Mitigation Structure (defined below), SCC, and Risk Type. Each mitigation recommendation shall include an indication of the Mitigation Type(s) (defined below) that best describe the mitigation recommendation.

##### 6.6.1.1 Mitigation Structure

Mitigation structure refers to varying levels by which the Sponsor and its consultants and contractors may respond to the risk events identified through the review processes described above. This structure consists of three parts: Primary Mitigation, Secondary Mitigation, and Contingencies.

**Primary Mitigation** occurs throughout the various project phases and is the result of the planned actions of the Sponsor and its consultants and contractors as described in the Risk Management Plan portion of the Project Management Plan, as supplemented with the PMOC's recommendations resulting from this review. Such activities are scheduled at the earliest phase during which the mitigation activity may occur, and are expected to be completed on a timely basis to achieve the cost- and schedule-risk parameter targets at the end of that phase. Examples of mitigation might be completing design, or a geotechnical survey, etc.

**Secondary Mitigation** consists of pre-planned, potential scope or process changes that may be triggered when risk events occur that cause overuse of project contingencies. Example events that may incur secondary mitigation include construction bids that are significantly over the estimate, or unexpected geotechnical hazards that are encountered, etc., such that the change is likely to cause a significant over-budget condition. Such "triggered" mitigation enables the Sponsor to make cost reductions in a planned and orderly process and preserves contingencies for use later in the project. Secondary Mitigation is fundamentally different than value engineering, which is a formal, systematic, multi-disciplined process designed to optimize the value of each dollar spent.

**Contingencies** are set-aside estimated amounts (monetary set-asides for cost and time set-asides for schedule) that are included within the overall cost or schedule targets for the project. The amounts are to be used to overcome increases in cost or schedule that are due to potential risks, and for which no other mitigation measure is available. These contingency amounts may be associated with a particular activity or category of cost, or may be set aside in a general fund. In most cases, the amount of risk a project experiences reduces as the project progresses toward completion; similarly, it is expected that

the amount of contingencies required for a project also decreases over time; however, at no time shall the contingency be totally consumed until all project risk is removed—usually only at project completion or beyond.

#### 6.6.1.2 Mitigation Types

The PMOC shall indicate whether the four Mitigation Types— Risk Avoidance, Risk Transfer, Risk Reduction, or Risk Acceptance—have been sufficiently considered in the Sponsor's list of proposed mitigation measures.

**Risk Avoidance** is available when a project element that is associated with certain potential risk events may be alternatively delivered through a less-risky process or design, or may be eliminated altogether.

**Risk Transfer** occurs when the mitigation and the consequences resulting from a risk event become the responsibility of a party other than the Sponsor; this may include a partial transfer (or risk sharing). Risk transfer measures involve sharing or transference to a third party such as a contractor, consultant, or other governmental organization in the form of contract requirements, warranties, or insurance policies etc. The recommendation may also be to reallocate scope in such a manner as to transfer risks to parties that are better suited to mitigate risk.

**Risk Reduction** is a planned action that will either reduce the consequence or the likelihood of a risk event. The root cause of the risk event, how the root cause or its consequences will be reduced by implementing the mitigation action, and who within the Sponsor organization or project team will carry out the mitigation shall be included.

**Risk Acceptance** results from the recognition that further reduction of a particular risk would only come at the expense of the project's fundamental goals, such as unacceptable service loss or cost increase, etc. Risk acceptance may also be a preferred method to deal with those risks that are of a high level of impact yet low level of probability and that mitigating them would put undue financial burden on the project. Risk Acceptance often involves the potential consumption of project cost or schedule contingencies, project schedule float, or an increase in either project estimate or schedule.

In its review, the PMOC shall recognize that there is a point in the implementation of the Sponsor's project ("break point") where non-contingency mitigation becomes increasingly difficult to effect and beyond which Risk Acceptance through the use of project contingency funds is the only effective means to treat project risk. This "break point" between risk reduction and risk acceptance typically occurs at the point where all construction has been procured, whether through Design-Bid-Build or Design-Build delivery methods. Prior to this "break point," secondary mitigation may be additionally available to preserve a minimum contingency balance that provides sufficient funds for the completion of the project.

### 6.6.2 Primary Risk Mitigation Recommendations

The PMOC shall review the Sponsor's Primary Risk Mitigation process and mitigation activities, and comment on the sufficiency of the list of prioritized cost and schedule risk mitigation measures within the Sponsor's Risk and Contingency Management Plan (RCMP), including scope, deliverables, outcomes, and recommended completion dates. These measures shall include those management activities directly related to performance by the Sponsor as well as its consultants. This list will serve as a means to provide recommendations and to monitor the reduction of project cost risk. The RCMP shall indicate progress-reporting intervals for tracking the performance of mitigation actions. All

material assumptions shall be identified along with their rationales. The mitigation plans shall develop priorities such that mitigation activities associated with high-risk project work elements are to be executed as early as possible to reduce the potential for loss.

Mitigation measures shall include actions related to partial risk transference, especially those risks transferred through construction contracting, ensuring that risk remaining with the Sponsor is fully recognized and an effective risk response plan has been developed. The Sponsor's project delivery methods and contracting plans, including its proposed terms and conditions, shall offer a comprehensive approach to ensuring that all costs due to risk transference are reflected in the project estimate.

Schedule risk mitigation recommendations shall specifically treat both critical path and non-critical path activities. One role of schedule mitigation is to protect the critical path from non-critical path activities becoming critical themselves through two main objectives. The primary objective of schedule risk mitigation is keeping a necessary amount of path float between the project critical paths and all of the intersecting (or potentially intersecting) paths, i.e. to "buffer" the critical paths and thus preserve their stability. The secondary objective of schedule risk management is to keep significant risk (such as technical construction process risk) off of the project critical path, or minimize their schedule variance if critical path activities are involved. The general principle is that activities with high schedule risk shall start and complete as soon as feasible.

### 6.6.3 Project Cost Contingency

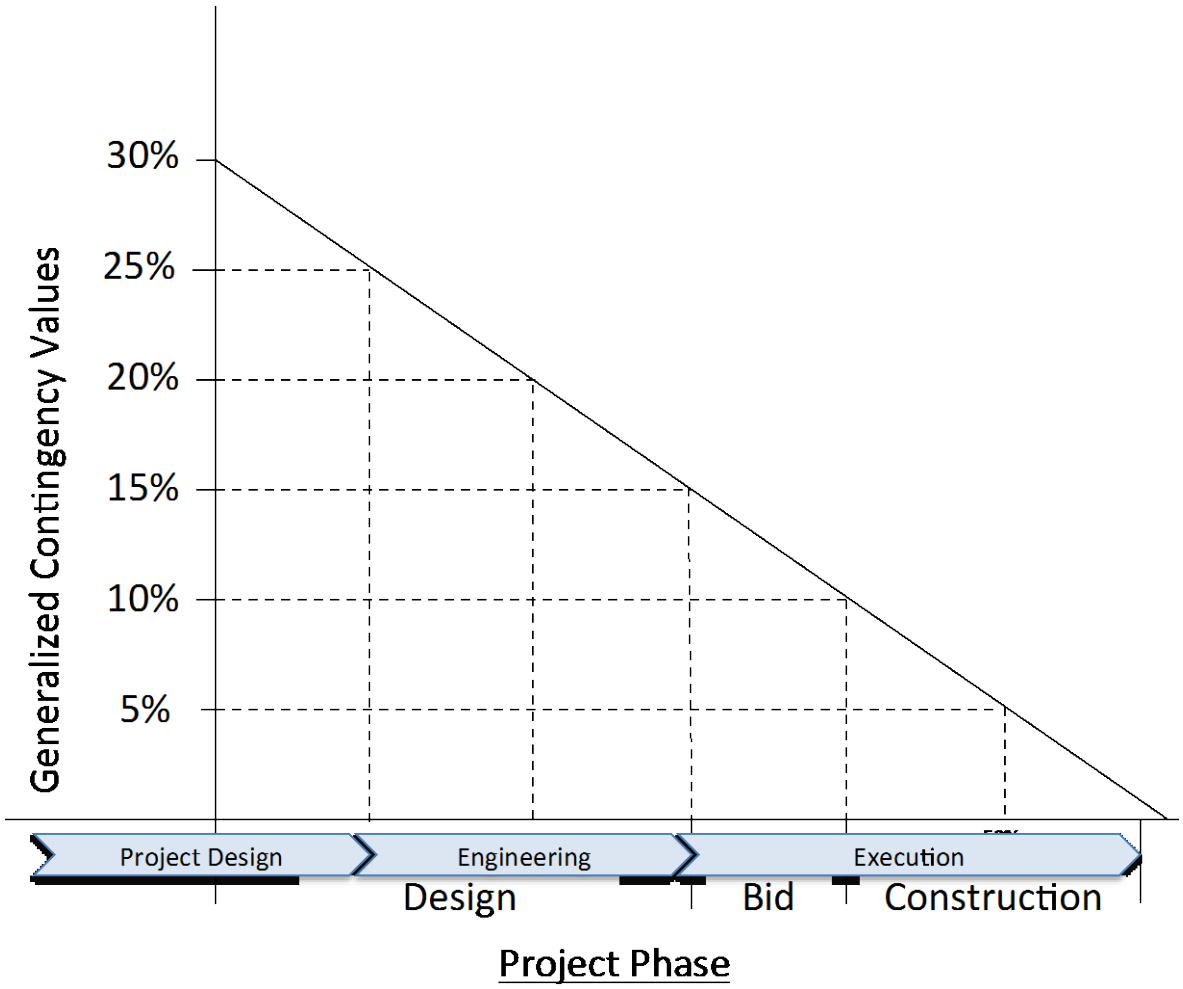
The PMOC shall fully identify, describe, and analyze the adequacy of the Sponsor's cost contingencies. This analysis shall be developed in consideration of four models: 1) the generalized contingency level recommendations (described below); 2) a Cost Contingency Draw-down curve (described below); 3) a Sponsor-provided risk assessment model (if undertaken); and 4) a PMOC-developed risk assessment model. The PMOC shall use its professional judgment to evaluate the contingency requirements estimated by these four approaches, and shall establish an overall recommended minimum contingency level, as described below.

#### 6.6.3.1 Generalized Contingency Levels

The FTA has determined, from historic project information, that the following minimum levels of contingency (the aggregate of allocated and unallocated cost contingency) are generally prudent:

- At Entry into Engineering, 25%
- At Readiness to Bid Construction, 15%.
- At Start of Construction, 10%.
- At 50% physically complete for construction, 5%.

The above contingency estimates may be interpolated at points of completion between the above milestones (see figure below).




The generalized contingency levels reflect historic risk undertaken through a design-bid-build delivery method. Where alternate delivery methods, especially design-build (DB), are used and where the DB contract has been bid and the bid price incorporated into the Adjusted Estimate, then Sponsor risk associated with design and procurement (Design and Market Risk Categories) will likely have been significantly transferred to the design-builder. An analysis of the actual contracting document is necessary to determine the extent of the risk transference and the resulting extent of reduced contingency requirements in this circumstance.

### 6.6.4 Cost Contingency Draw-down Curve

The PMOC shall review and make recommendations regarding adjustments to the Sponsor's Cost Contingency Draw-down Curve, and shall use its professional judgment to consider the currently-recommended contingency as well as a Forward Pass analysis (and Backward Pass analysis as appropriate) in development of its recommendations. The Cost Contingency Draw-down Curve shall indicate recommended minimum contingency levels by phase that most reasonably reflects the specific project conditions. These minimum levels shall be indicated for each of the FTA milestones, including additional milestones as identified by the Sponsor and PMOC for points of time at which significant changes in risk may occur. These milestones and minimum contingency amounts define a cost contingency drawdown curve, indicating a minimum level of contingency that must remain in the

project budget at any given point in time. This draw-down curve is used to protect from inappropriately early draw down of contingency funds.

#### 6.6.4.1 Forward Pass Cost Contingency Analysis

The Cost Contingency Draw-down Curve is evaluated in consideration of a "forward pass" set of minimum recommended cost contingency values for each of the Project Milestones beyond that under current review and for additional points of significant changes of project risk, utilizing the Generalized Contingency Levels above.

Where the Sponsor or PMOC has identified additional milestone points, the PMOC shall use its judgment to establish forward-pass contingency recommendations, based on interpolated Generalized Contingency recommendations above.

In the case of multiple project phases that are staged at differing levels of development, or significant portions that exhibit differing risk profiles. A project contingency curve may be constructed as the addition of several contingency curves reflecting each significant project portion.

#### 6.6.4.2 Backward Pass Cost Contingency Analysis

Projects, or portions of projects, may face extraordinary levels of risk during specific project points in time. In such case, the PMOC may establish a Cost Contingency Draw-down Curve in consideration of a "backward pass" set of recommended cost contingency values that represent the minimum amount of total cost contingency expected to be necessary at Project Milestones, which may be used to adjust forward pass contingency/milestone recommendations. The Backward Pass method considers estimates of minimum total cost contingencies based upon an assessment of the project status and project risk at the milestone under consideration. Items of high risk, especially those identified with the Mitigation Type of "Risk Acceptance", shall be specifically reviewed when performing the backward pass analysis.

This process begins by considering the final stages of the project (say 95% complete) and determining how large of a contingency fund shall remain in the project budget to solve potential risk-laden events. This amount—often established through the judgment of project experts—becomes the minimum amount of contingency that shall be maintained at that point. The next step is to consider another point in time when the project is less complete (say at 75% completion) and to similarly determine the size of contingency fund that shall remain available until the next milestone. This process is completed—moving stage by stage toward the beginning of the project—until the current phase is reached.

The following considerations shall be made in development of the backward pass contingency values:

- At the Revenue Operations Date (ROD), the demand for total cost contingency has been reduced to a minimum requirement for scope changes or clarifications and schedule delays or changes. The establishment of required contingency at this point shall carefully consider conditions such as the Sponsor's experience and experience on other similar transit projects to identify an amount sufficient to close out punch list work, additional work orders, etc. The working target for this point is generally 1-3% total contingency, including 0-1% for schedule delay costs and the remainder for other costs;
- At the point that the project construction procurement is "substantially complete" (90-100% bid for either Design-Bid-Build or 90-100% subcontracted for alternative project delivery methods), the

project is exposed to cost changes in the range of 10% of project costs, which includes 4-6% to reflect schedule delays that at this point can average 20% of the construction phase duration; and

- For any potential delay duration greater than 9 months, the contingency amounts shall assume 3 months each of demobilization and remobilization with a variable standby period in between.
- Consideration shall be made to appropriately reflect contingency needs under design-build contracts, where the cost of the contracted design-build portion is accurately reflected in the Adjusted Estimate. In this circumstance, Sponsor contingency needs for Design and Market risks may be significantly reduced, and Sponsor contingency needs for Construction risks may also be significantly reduced, though to a lesser extent. A thorough analysis of the design-build contract is necessary to establish these amounts.

### 6.6.5 Secondary Cost Risk Mitigation Recommendations

The PMOC shall review the credibility and applicability of the Sponsor's schedule of Secondary Risk Mitigation items, and comment on whether such Secondary Mitigation results in sufficient protection for the project. Such evaluation shall consider levels of risk reflected within the risk register, as well as any risk analyses available for the project. The schedule of Secondary Mitigation shall include the targeted magnitude of the cost and/or time savings expected and the latest time at which a Secondary Mitigation item may be triggered effectively, as well as a description of the scope, deliverables, and outcomes of the item. The PMOC will also review and comment on scheduled progress-reporting intervals for Sponsor's tracking of the utilization and management of such mitigation capacities, as well as any integration with the Sponsor's overall program schedule. All important assumptions shall be identified along with their rationales.

Estimation of all Secondary Mitigation items shall be at a level commensurate with the current level of estimating used for the project as a whole. Further, the cost and/or schedule adjustments proposed shall include an analysis of the adjustment for any scope reductions as well as any adjustment for redesign of the project area affected due to such scope reduction, with any associated soft costs.

The Secondary Mitigation Recommended Amount in the Beta Range Model is calculated as the Secondary Mitigation Target minus the Conditioned Estimate. This target is developed using the Beta Range Model Workbook; if the project budget includes contingency above the modeled Conditioned Estimate, such contingency amount above the Conditioned Estimate may be considered as fulfilling a portion of the Secondary Mitigation recommended amount. With approval from the FTA, the PMOC may modify this amount based upon overlapping Sponsor milestones, actual progress beyond a given phase, or other project-specific factors.

Where Secondary Mitigation is insufficient to protect the project at the level prescribed in the Beta Range Model Workbook, or as otherwise adjusted by the FTA, the PMOC shall recommend sufficient additional contingency to reach the level of protection that would otherwise be available through Secondary Mitigation. In general, Secondary Mitigation should be sufficient to bring the project to the 65% confidence level as indicated in the Beta Range Model Workbook, or such other level as may be directed by the FTA...

As a project progresses toward completion, it may be increasingly difficult to develop Secondary Mitigation measures, especially if project construction is already contracted. Early identification of Secondary Mitigation measures helps to preserve its availability in later stages of the project. The PMOC shall consider the current design efficiency, the stage of the project, and the impact that

developing Secondary Mitigation measures will have on the FFGA/SSGA's scope, transit capacity, or level of service.

In the case of design-build contracting, Secondary Mitigation elements may be preserved by contractually causing the design-builder to provide Secondary Mitigation design options in its work, subject to Sponsor's option.

### 6.6.6 Project Schedule Contingency Review

The PMOC shall fully identify, describe, and analyze the adequacy of the Sponsor's schedule contingencies. The PMOC shall make recommendations as to what minimum amounts of schedule contingency are recommended for inclusion in the Sponsor's Project Management Plan and supporting schedules.

#### 6.6.6.1 Schedule Contingency Analysis and Recommendation

The PMOC shall evaluate the schedule contingency available within the Sponsor's schedule, and provide recommendations as appropriate. Such recommendation shall be made in consideration of the following:

- The project shall follow the general guideline that sufficient schedule contingency is available at any major review milestone to absorb a project schedule delay equivalent to 25% of the remaining duration through the Revenue Service Date proposed for the project, calculated by adding the schedule contingency to the Adjusted Schedule;

- Any available schedule risk assessment histogram indicates a confidence level of at least 65% of reaching the proposed Revenue Service Date (RSD); and

- The general assessment of risk is not in conflict with the risk contingency requirements established in development of the Schedule Contingency Draw-down Curve, below;

- Based on inflation factors, professional opinion and other factors, the PMOC should ensure that the cost estimate is appropriately increased to account for any additional schedule contingencies.

#### 6.6.6.2 Schedule Contingency Draw-down Curve

The Sponsor shall develop a forecasted amount of minimum total schedule contingency to be available for the project at the current and each future major milestone; the PMOC shall review this analysis and comment and make recommendations about its sufficiency. Premature use of significant amounts of schedule contingency reduces the ability of the project to withstand schedule change. These minimum levels shall be indicated for each of the FTA milestones, including additional milestones as identified by the Sponsor and PMOC for points of time at which significant changes in risk may occur. These milestones and minimum schedule contingency amounts define a schedule contingency drawdown curve indicating a minimum level of contingency that must remain in the project schedule at any given point in time. This draw-down curve is used to protect from inappropriately early draw down of schedule contingency durations.

The Schedule Contingency Draw-down curve shall be evaluated by sequentially "stepping back" through various completion milestones for the project and estimating the minimum amount of schedule

contingency required to complete the project on schedule from that point forward, in consideration of risks identified in this OP. The PMOC shall evaluate this draw-down curve and comment on its appropriate allocation of risk over time, including recommendations for adjustment as appropriate.

### 6.7 Sponsor's Risk and Contingency Management Plan (RCMP)

The PMOC shall ensure that the Sponsor's RCMP considers all aspects of potential risk, including management capacity and capability, project performance, cost and schedule risk. A recommended structure for the Risk and Contingency Management Plan is included in Appendix G.

Upon FTA approval, the PMOC shall make available to the Sponsor the assessments and recommendations developed in this OP for inclusion in the Sponsor's Risk and Contingency Management Plan (RCMP), a section of the Project Management Plan. The PMOC shall work collaboratively with the Sponsor, as the Sponsor prepares and/or revises the Risk and Contingency Management Plan (RCMP) section of its Project Management Plan to reflect the recommendations and considerations provided by the PMOC.

### 6.8 PMOC's Monitoring of Sponsor's Risk and Contingency Management Plan

Post-assessment monitoring by the PMOC is intended to assess the Sponsor's performance in risk management and ensure that the Sponsor's project implementation achieves its risk management objectives and targets. The PMOC shall use the Sponsor's Risk and Contingency Management Plan (RCMP), which has been collaboratively amended with the PMOC's recommendations, as its guide for post-risk review monitoring.

Monitoring shall consist of evaluation and reporting of:

- The Sponsor's prosecution of the Primary Mitigation action items, including the effectiveness of the action to mitigate the potential risk event and the timeliness of the completion of the action item;
- The occurrence of risk events on the project, whether or not previously identified, and their estimated effect on the project's cost and schedule goals;
- The use of cost and/or schedule contingencies and whether such use threatens minimum levels of contingency required for future phases;
- Successful implementation of other major initiatives noted in the RCMP; and
- The effectiveness of the Sponsor's organization to fully manage its Risk and Contingency Management Plan.

## 7.0 REPORT, PRESENTATION, RECONCILIATION

The PMOC shall provide the FTA with a written report of its findings, analysis, recommendations, professional opinions, and a description of the review activities undertaken. After FTA approval, the PMOC shall 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-1 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 of FTA-templates when provided. The PMOC may add other software as required but documentation and report data shall be made available to FTA.

The PMOC shall prepare a written report in the format discussed in Appendix H and attach the sponsor's most current SCC estimate, schedule, and other related documents. Embed references to, or exhibits from, Sponsor's estimate, schedule or other documents to explain the analysis, findings, and recommendations.

Integrate and summarize available information and data for the project, providing professional opinion, analysis, information, data and descriptive text in an accessible and understandable format. Opinions shall be supported by data tables prepared in a professional manner

## APPENDIX A

## Acceptable Quality Level

| | DESIRED OUTCOME | PERFORMANCE REQUIREMENT | CHECK LIST | PERFORMANCE MEASURE | ACCEPTABLE QUALITY LEVEL | MONITORING METHOD |
|---|---|---|---|---|---|---|
| 1 | PMOC shall support FTA's programmatic decisions through review and analysis of Sponsor's risk management process<br>PMOC shall review, analyze and recommend to FTA regarding Project Contingency and Contract Packaging. | **R1a.** The PMOC shall develop and document a process for review, analysis and reporting to FTA of Sponsor's risk assessment and risk management practices. | | **M1a.** Evidence of a documented process. | **Q1a.** Process exists and has been followed. | **MM1a.** Periodic review by FTA or its agent. |
| | | **R1b.** The PMOC shall use its process to analyze and advise FTA on Cost, Schedule and Contract Packaging and other project risk issues. | | **M1b.** Documented assessment of overall Project Contingencies and Contractual Risk Allocations. | **Q1b.** Review must be made and the PMOC provides internal verification that the process as documented was followed. | **MM1b.** Periodic review by FTA or its agent. |
| | | **R1c. The PMOC shall develop and document a process for review and analysis of Sponsor's Project Contingencies, Contractual Risk Allocations and Contract Packaging.** | | **M1c. Evidence of a documented process.** | **Q1c. Process exists and has been followed.** | **MM1c. Periodic review by FTA or its agent.** |
| | | **R1d. The PMOC shall use its process to analyze the adequacy, effectiveness and efficiency of Sponsor's Project Contingencies and Sponsor's management and risk management practices prior to each milestone, as directed by FTA.** | | **M1d. Documented assessment of overall Project Contingencies, Contractual Risk Allocations and management practices.** | **Q1d. Review must be made and the PMOC provides internal verification that the process as documented was followed.** | **MM1d. Periodic review by FTA or its agent.** |
| 2 | The PMOC shall utilize its experience and professionalism in monitoring Sponsor risk management systems to produce required deliverables based on comprehensive systems analysis strategically repeated as the project advances.<br>The PMOC shall review, identify, characterize and analyze project contingency | **R2a. PMOC Oversight Plan.** The PMOC shall develop and submit a plan for providing surveillance of the Sponsor's performance in risk management defining how services and products will be accomplished in a manner meeting FTA requirements. | | **M2a.** Documented evidence of a risk management surveillance plan, supported by professional opinion. | **Q2a.** Professional opinion of risk management objectives and targets, other supporting documentation or submittals and recommendations for course of action. | **MM2a.** Periodic review by FTA or its agent. |
| | | **R2b. Cost Risk.** The PMOC shall identify, assess and evaluate the uncertainties in Sponsor's cost estimates in terms of project's social, political, legal, financial and physical environment and make recommendations regarding identified risks. | | **M2b.** Documented evidence of review of Sponsor's cost estimates, supported by professional opinion. | **Q2b.** Professional opinion and recommendations regarding identified items of likely risk. | **MM2b.** Periodic review by FTA or its agent. |

| | DESIRED OUTCOME | PERFORMANCE REQUIREMENT | CHECK LIST | PERFORMANCE MEASURE | ACCEPTABLE QUALITY LEVEL | MONITORING METHOD |
|---|---|---|---|---|---|---|
| | availability, status and forecasts for critical project milestones and assure Sponsor's use of sound project management strategies. | **R2c. Schedule Risk.** The PMOC shall identify, assess and evaluate Sponsor's project schedule uncertainties in terms of social, political, legal, financial and physical environment and make recommendations regarding identified risks. | | **M2c.** Documented evidence of review of Sponsor's project schedule, supported by professional opinion. | **Q2c.** Professional opinion and recommendations regarding identified items of likely risk. | **MM2c.** Periodic review by FTA or its agent. |
| | | **R2d. Non-Cost and Non-Schedule Risk.** The PMOC shall, as directed by FTA, identify, assess and evaluate all non-cost and non-schedule related uncertainties and risks found in Sponsor's project, including risks associated with Sponsor's project delivery methods and strategies for packaging the contracts for construction, and make appropriate recommendations. | | **M2d.** Documented evidence of review and evaluation of Sponsor's non-cost and non-schedule related uncertainties, supported by professional opinion**.** | **Q2d.** Professional opinion and recommendations regarding identified items of likely risk. | **MM2d.** Periodic review by FTA or its agent. |
| | | **R2e. Risk Mitigation.** The PMOC shall review Sponsor's risk register and risk mitigation plan. If required by the FTA, the PMOC shall independently identify and characterize project risks, develop a and prepare a report showing its recommendations, including those for needed changes to Sponsor's PMP. | | **M2e.** Documented evidence of review and assessment of risk together with recommend changes to PMP and preparation of risk mitigation plan, supported by professional opinion. | **Q2e.** Professional opinion and recommended changes to PMP together with risk mitigation plan. | **MM2e.** Periodic review by FTA or its agent. |
| | | **R2f. The PMOC shall identify, describe and analyze the adequacy of Sponsor's cost contingencies, make necessary recommendations and, through parameters developed using the "forward pass" and "backward pass" approaches, create the overall minimum contingency curve.** | | **M2f. Documented evidence of a thorough review, analysis and description of Sponsor's Cost Contingencies, supported by professional opinion.** | **Q2f. Professional opinion of Cost Contingencies.** | **MM2f. Periodic review by FTA or its agent.** |
| | | **R2g. The PMOC shall develop a "Forward Pass" cost contingency analysis using historically-developed parameters and a "Backward Pass" cost contingency analysis using project specific data. This data shall be reconciled and a Cost Contingency Curve and graphics developed.** | | **M2g. Documented evidence of forward and backward pass cost contingency analysis, and creation of cost contingency curve, supported by professional opinion.** | **Q2g. Professional opinion and review of all cost contingency analyses and creation of Cost Contingency Curve with graphics.** | **MM2g. Periodic review by FTA or its agent.** |
| | | **R2h. The PMOC shall identify, describe and analyze the adequacy of Sponsor's schedule contingencies making recommendations for minimum amounts of schedule contingency and supporting schedules.** | | **M2h. Documented evidence and review of Sponsor's Project Schedule Contingencies, supported by a professional opinion.** | **Q2h. Professional opinion and evaluation of Sponsor's Schedule Contingencies.** | **MM2h. Periodic review by FTA or its agent.** |

| | DESIRED OUTCOME | PERFORMANCE REQUIREMENT | CHECK LIST | PERFORMANCE MEASURE | ACCEPTABLE QUALITY LEVEL | MONITORING METHOD |
|---|---|---|---|---|---|---|
| | | **R2i. The PMOC shall "step back" at various milestones and estimate the minimum amount of schedule contingency required to complete the project on schedule. This data shall be used to develop a Schedule Contingency Curve.** | | **M2i. Documented evidence of schedule contingency analysis and creation of schedule contingency curve, supported by a professional opinion.** | **Q2i. Professional opinion and review of all schedule contingency analyses and creation of Schedule Contingency Curve with graphics.** | **MM2i. Periodic review by FTA or its agent.** |
| | | **R2j. The PMOC shall identify, describe and analyze Sponsor's individual contract packages and a) Contract Packaging Strategy: characterize and report on the sufficiency of design and construction contract packaging strategies; b) Contractual risk Allocation: discover and report proposed or actual allocation of risk between Sponsor and third parties; and c) Contractual Risk Allocation Assessment: evaluate proposed contractual allocations of risk and comment on potential cost-to-benefit balance and effectiveness of assignments.** | | **M2j. Documented evidence, review and assessment of Sponsor's Contract Packaging Strategy and Contractual Risk Allocations and supporting documents, supported by professional opinion.** | **Q2j. Professional opinion and Contract Packaging Review.** | **MM2j. Periodic review by FTA or its agent.** |
| 3 | The PMOC shall document its findings, professional opinions, and recommendations in a report to the FTA for its Risk, Cost and Schedule Contingency, and Contractual Risk Allocation Reviews. PMOC shall further attach SCC estimate, schedule and other related documents with Primary Deliverables and Sub deliverables. | **R3.** The PMOC shall present its findings, conclusions, analysis and recommendations to FTA and reconcile those recommendations with the Sponsor to the extent possible when so directed by FTA. | | **M3.** PMOC's findings conclusions, recommendations, and presentation. | **Q3.** 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 Sponsor to the extent possible. | **MM3.** Periodic review by FTA or its agent. |

## APPENDIX B

## Sponsor's Submittals

In advance of performing the review, the PMOC shall obtain and study the following, as appropriate for the particular project phase and level of review required. Many of these documents will have been obtained through the review of scope, schedule, cost, and Sponsor management capacity and capability in other OPs. The PMOC shall perform an initial review and notify the FTA of important discrepancies in the project information that would hinder the review; an example would be insufficient detail or a mismatch between drawings and cost estimate in which the drawings are current and the cost estimate is significantly older.

Coordinate these submittals with those required for the OPs related to *Readiness to Enter Engineering* and *Readiness for SSGA/FFGA.*

**Programmatic**

Project Development Final Report
Final environmental documents and NEPA determination

**Scope / Project Definition**

Basis of Design and Design Criteria
Project Plans, Drawings, and Specifications
Master Permitting Plan and Schedule
Geotechnical Baseline Report
Vehicle design documentation
Transit Capacity and Operating Plan

**Project Management Plan and sub-plans**

Program Management Plan (if applicable)
Basis for the Project
Environmental Assessment/Mitigation Plan
Project Controls (Document, Scope, Cost, Schedule, Dispute)
Risk Assessment, Risk and Contingency Management Plan
Project Delivery and Procurement
Sponsor Management Capacity and Capability
Real Estate Management Plan
** Other subplans if necessary to evaluate and expose significant areas of risk

**Schedule**

Project schedule in original and SCC format; schedule narrative describing critical path, expected durations, and logic

**Cost Estimate**

Capital cost estimate in original and SCC format
Capital cost estimating methodology memo

**FTA Agreements**

Entry to Engineering Checklist (if applicable)
SSGA/FFGA Checklist (if applicable)
Record of Decision
Full Funding Grant Agreement and Attachments if available

## APPENDIX C

## Sponsor Risk Interface

Interface with the Sponsor during the risk review facilitates the process and provides the PMOC with project background information necessary to identify new risk events or amendments to the existing Sponsor Risk Register. Subsequently, the PMOC develops a risk analysis and risk review recommendations for incorporation into the Sponsor's Project Management Plan. It is the purpose of this level of review to develop this information in an abbreviated manner by focusing on significant TCC, schedule, scope, and cost risk drivers, through a primary workshop with the sponsor of no more than 3 days in duration with a subsequent risk assessment immediately following the workshop or as soon a reasonable; auxiliary meetings for follow-up of specific issues discovered in the workshop may be necessary.

Prior to the workshop, the PMOC team shall be provided a tour of the alignment, including station and support facility locations

A suggested structure for the joint PMOC and Sponsor meeting is as follows; the PMOC shall assess the level of project completion and familiarity of the Sponsor with the risk review process to determine whether adjustment to the following structure is appropriate:

Kickoff meeting:

- Introduce PMOC team and Sponsor team;
- Sponsor presents the project to PMOC team:
    - Agency organization, including project team and plan for staffing;
    - Description of work and reviews over the previous year;
    - Discussion of schedule, cost estimate, Sponsor's RCMP and risk register;
- Review of the project by discipline, organized by SCC;
    - Review the status of Sponsor's risks listed on its Risk Register, and discuss and record any additional risks discovered during the workshop, including qualitative characterization of likelihood and magnitude of cost and/or schedule impact for the identified risks;
- Summarize findings, conclusions, recommendations, questions, and enter into discussions with the Sponsor's project team to resolve open questions;
- Discuss actions required to facilitate the PMOC risk analysis; and
- Inform the Sponsor of next steps in the risk review process.

Risk Workshop: This workshop shall occur after PMOC team has reviewed the risk listing, has developed its cost and schedule risk assessments, and has developed recommendations regarding Sponsor's target budget, contingency and risk mitigation.

- Introduce PMOC team and Sponsor team;
- Describe the process used to review and establish quantitative risk recommendations;
- Summarize the key findings of the review and recommendations;
- Provide recommendations regarding risk mitigation options and alternatives including possible changes to scope, budget, schedule, project delivery method, construction methodology, and/or use of cost and schedule contingencies;
- Review detail of individual risks, as appropriate, regarding the method of quantification of risk and which risks strongly influence overall project risk;

- Review specific recommended mitigation measures and solicit completion dates; and
- Discuss action items and next steps in the risk management and FTA review process.

## APPENDIX D

## Risk and Contingency Review Levels

The following generally depicts large differences among the three OP40 products (OP40 a, b, or c). Refer to details within each OP40 product to establish technical requirements for each element to be performed. The FTA will initially recommend the level of risk and contingency review to apply to any project, and the FTA may change the level of review at any time during a project as project conditions warrant.

| | | FTA will determine initial level of review required based on assumed project conditions; level of review may be changed should actual project conditions warrant, at FTA discretion. | | |
|---|---|---|---|---|
| | **Activity** | **OP40a Sponsor-led** | **OP40b Abbreviated** | **OP40c Full** |
| A | Review of management capacity & capability, scope, cost, schedule (and others as directed) | Sponsor presents organization, scope, schedule and estimate; PMOC reviews and comments | Perform 1-2 month abbreviated TCC, scope, cost, schedule review, etc. Includes 2-3 day workshop | Perform full TCC, scope, cost, schedule review, etc. Generally 2-3 month process. |
| B | Review sponsor risk identification | PMOC participates with Sponsor Risk Register Workshop and comments | Review, comment on, and provide amendments to sponsor's risk register | |
| C | Review sponsor assessment (if required or provided) | Participate and comment on Sponsor's assessment | Review and comment on sponsor's assessment process; contrast against PMOC risk assessment | |
| D | Develop or refresh PMOC Beta range assessment and develop or refresh schedule risk model | PMOC participates in Sponsor's assessment process. No PMOC risk modeling required | Provide concurrently with TCC, scope, cost, schedule workshop where possible | Usually requires a separately scheduled risk workshop |
| E | Review sponsor risk response plans (primary and secondary mitigation) | Sponsor presents mitigation management; PMOC reviews and provides comment | Review, comment on, and provide amendments to Sponsor's primary and secondary mitigation plans | |
| F | Review sponsor contingency and contingency management | Sponsor presents contingency planning; PMOC reviews and provides comment | Provide modeled contingency recommendations; compare to sponsor's contingency. Review and comment on Sponsor's contingency management planning | |
| G | Review sponsor RCMP | Sponsor presents its RCMP; PMOC reviews and provides comment | Review and comment on sponsor's PMP; focus on risk organization and levels of contingency authority | |

# APPENDIX E

## Example Risk Register

The following is provided as an example only of a risk register used for risk identification; the intention is to convey the basic content for a robust risk register. Other more detailed formats have been found useful in practice, depending on professional experience and project-specific requirements.

The Risk Register developer is encouraged to obtain the most recent examples before determining Risk Register format.

**RISK REGISTER**

Grantee:
Project:
Date:

1-Requirements
2-Design
3-Market
4-Construction

| Rating | Low (1) | Med (2) | High (3) | Very High (4) | Significant (5) |
|---|---|---|---|---|---|
| Probability | <10% | 10><50% | >50% | 75%><90% | >90% |
| Cost | <$250K | $250K><$1M | $1M><$3M | $3M><$10M | >$10M |
| Schedule | <1 Mths | 1><3 Mths | 3><6 Mths | 6><12 Mths | >12 Mths |
| Rankinig | <=3 | 3.1-9.49 | | >=9.5 | |

| | | | | | Risk Ranking | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Probability | Cost | Schedule | Risk Rating | |
| SCC | ID | Risk Cat. | Risk Description | Outcome | [P] | [C] | [S] | (P) X (C+S)/2 | Mitigation Action |
| 10.01 | 3 | 1-Requirements | Third parties may influence the alignment in an untimely manner. | Delay and cost. | 2 | 1 | 0 | 1 | Obtain municipal consent buy-in at 30% design. |
| 10.01 | 5 | 1-Requirements | Delays may occur in reconfiguring Railroad connection project. | If Railroad connection is not completed in time, entire Agency project could be subject to indefinite delay. | 3 | 2 | 5 | 10.5 | Agency undertake design |
| 10.01 | 6 | 1-Requirements | The drawings indicate that there are freight tracks close to the LRT guideway. Is clearance an issue at any of these locations? Is there the possibilty of crash walls or something similar required? | Could cause additional costs and studies involved with providing greater physical separation between light rail and freight rail lines. | 3 | 4 | 0 | 6 | Evaluate whether the current estimate reflects this scope for crash walls. May be an estimate reduction |
| 20.01 | 43 | 1-Requirements | As all stations have center island platforms at grade, if a decision, for safety or operations reasons, is made to avoid pedestrian grade crossings, all stations will need tunnels or bridges along with multiple vertical circulation elements to replace them. | Much greater cost per station. | 1 | 5 | 0 | 2.5 | History indicates a very low probability |
| 20.01 | 153 | 2-Design | Potential elevated pedestrian connection between park-and-ride and LRT station (814) | | 3 | 3 | 0 | 4.5 | |
| 30.02 | 55 | 1-Requirements | Failure to identify economical, environmental-suitable, and practical location for maintenance facility could cause excessive project costs. | Much higher costs, both for real estate acquisition and construction cost and for O&M costs when the project goes into operation. | 1 | 3 | 0 | 1.5 | Is currently under choice selection, among final 4 sites. Re-evaluate costs when a site is chosen. |
| 40.01 | 61 | 1-Requirements | Balance of earthwork is unknown at this time, although it would appear that there may be more fill than cut. Lack of economical embankment material could be a problem. | Higher cost if material is hard to find. | 4 | 4 | 3 | 14 | Evauate as an estimate adjustment. Figure out more during design. |
| 40.02 | 62 | 1-Requirements | Since a number of the "tunnels" are only shallow cut & cover grade separations under existing streets (where the utilities are usually buried), there are likely to be utility issues to be dealt with. | Costly relocations of utilities. Short construction season may require expedited advance utiliy relocation packages to avoid delaying project. | 2 | 3 | 0 | 3 | Perform utility location studies during early PE |
| 60.01 | 139 | 1-Requirements | Potential impact to loading dock access of existing commercial building (124) | | 5 | 4 | 0 | 10 | Evaluate for estimate adjustment |

## APPENDIX F

## Beta Range Factor Guidelines

The following guidelines apply for cumulative Beta Range Factors (BRFs). Note that 1) the following BRF amounts are the sum of the individual risk category factors; 2) failure to remove a category of risk at a given phase indicates that some amount of that risk survives to the next phase—for example, Design Risk may exist during the construction phase if a design decision has been delayed; and 3) the cumulative factors here represent a range of observed risk across many transit projects and therefore increases to the suggested BRFs shall only occur where exceptional risks are involved, beyond what would be expected by a "normal" project. The PMOC shall appropriately suggest BRFs, depending upon the complexity of and risk inherent in the element under analysis.

**SCC10 through 50:**

- A BRF above 2.50 implies uncertainty associated with the completion of the project development process; after completion of project development, some level of Requirements Risk remains;
- A BRF between 2.50 and 2.25 implies reduction of remaining Requirements Risk, and increasing mitigation of Design Risk as design proceeds to Entry to Engineering During Engineering, remaining design risk is virtually removed, yielding a BRF at completion of Engineering of 1.75;
- A BRF between 1.75 and 1.50 recognizes the existence and reduction of Market Risk (bid risks; uncertainties associated with reliable information on market conditions, short of a project specific firm price, etc.);
- A BRF between 1.50 and 1.35 generally recognizes uncertainties related to construction associated with geotechnical/utility, other underground, or other construction activities occurring during the first 20% of construction "Early Construction").
- A BRF of 1.25 indicates reduction of risk to the level of 50% of construction;
- A BRF between 1.25 and 1.05 indicates uncertainty associated with late construction activities, including activities through start-up and substantial completion.
- A BRF of 1.05 implies that no unresolved risk events are identified for this item and only unknown risk events remains.

**SCC10 through 40:**

- Where exceptional geotechnical conditions exist, especially deep excavations and/or tunneling, the PMOC shall provide a separate analysis and explanation of the BRFs that apply to the corresponding estimate elements. Such BRFs may significantly exceed standard BRFs.

The standard BRFs are presented in Table 1 and Figure 1 in this appendix. Note that at any given point in a project, BRFs for the SCC elements may be comprised of cumulative factors of risk from any or all of the categories shown.

**Table 1 – SCC 10-50 Beta Range Factors by Risk Category**

| Risk Category | Risk Category Factor |
|---|---|
| Requirements Risk | Min. 0.15 |
| Design Risk in Project Development | 0.10 |
| Design Risk in Engineering | 0.50 |
| Market Risk | 0.25 |
| Construction Risk | 0.45 |
| Post Construction | 0.05 |

| Construction Risk Sub-Factor | |
|---|---|
| Early Construction | 0.25 |
| Mid Construction | 0.15 |
| Late Construction | 0.05 |

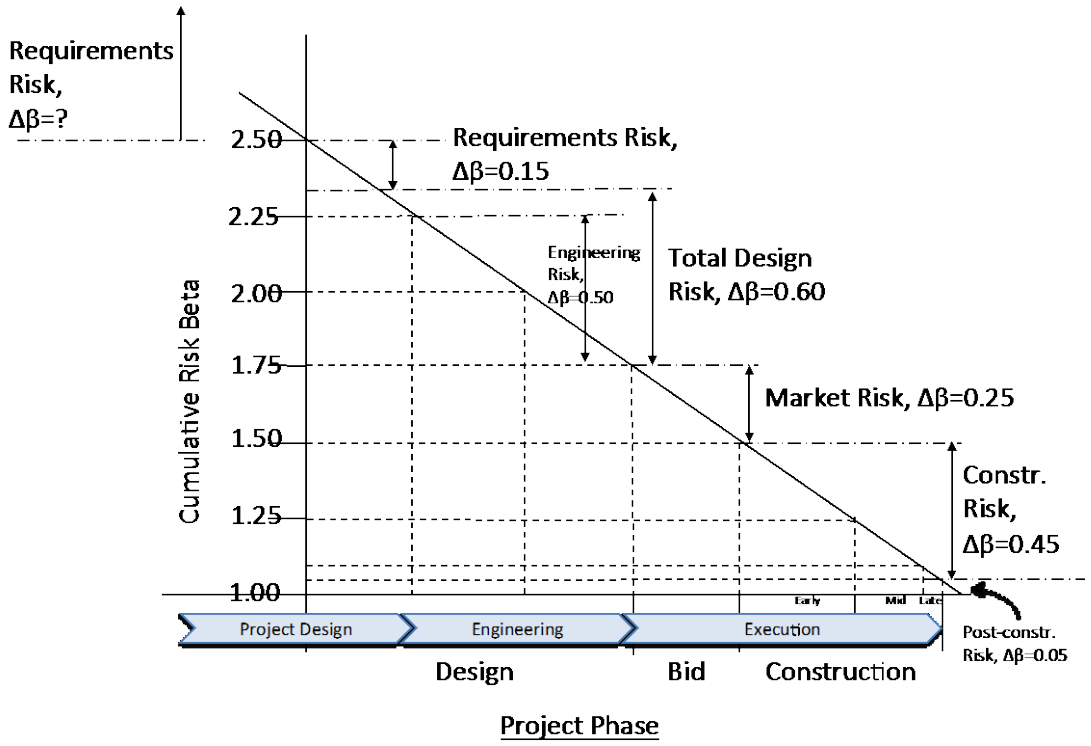



**Figure 1 – SCC 10-50 Beta Risk Factors by Level of Development**

**SCC60 through 80:**

SCCs 60 through 80 represent project elements that are not traditional construction elements. As such, the risk categories shall be interpreted as follows:

- Requirements risk is similar to that defined above, wherein it is related to uncertainty of environmental conditions, uncertainty of third party requirements or regulations, or uncertainty of project goals;
- Design risk is related to the sufficiency and potential error of development of plans for execution of the element. For example, for SCC80, this may relate to the development of staffing plans for project management staffing;
- Market risk is similar to that defined above. It is related to the potential variance in price for acquisition of the property, equipment, or staffing necessary to complete the element; and
- Construction risk relates to the actual act of completing the element itself, including any variances that result from conditions only evident at the time of acquisition of property or equipment, or at the time of execution of management or technical activities, such as design or construction management.

**SCC60:**

- Risk for Right-of-Way tends to survive later in time and suffer higher risk than for those items in SCC 10 through 50 due to large uncertainties and delayed resolution of ROW acquisition; therefore cumulative BRFs are generally estimated larger than that of SCCs 10 through 50 until ROW acquisition is substantially complete. See Figure 2.

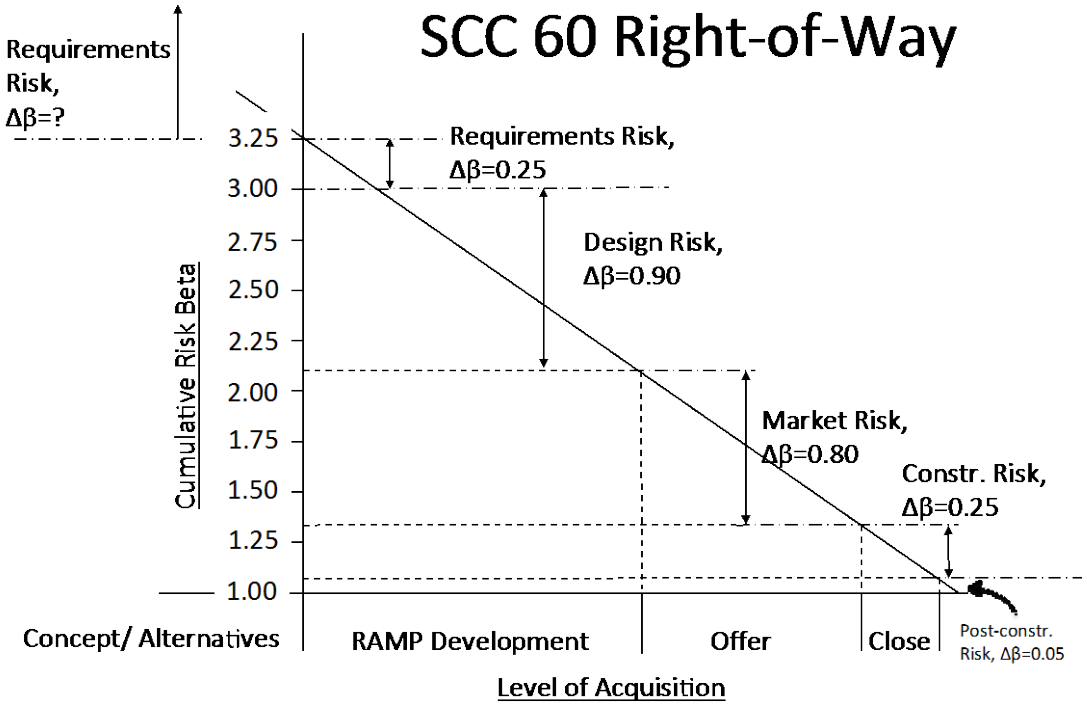



**Figure 2 - SCC 60 Beta Range Factors by Level of Development**

**SCC70:**

- Risk for vehicles tends to be removed more quickly in time than for those items in SCC 10 through 50 due to reduced design uncertainties and early vehicle purchasing; therefore cumulative BRFs are generally less than that of SCCs 10 through 50 during early phases of the project. See Figure 3.

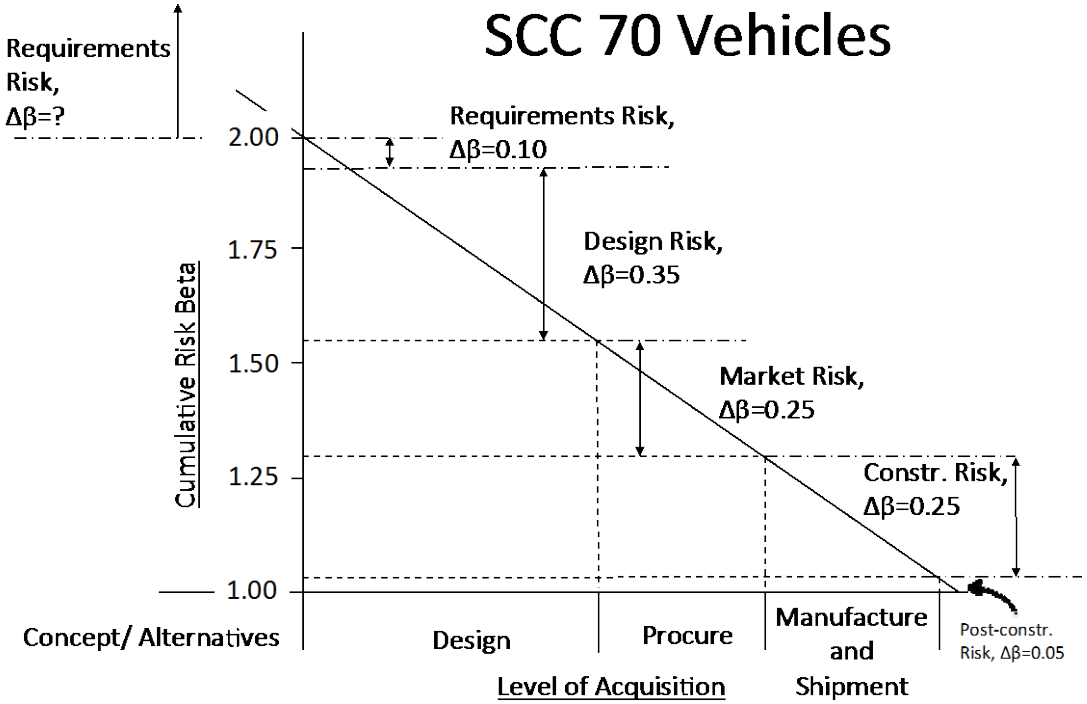



**Figure 3 - SCC 70 Beta Range Factors by Level of Development**

**SCC80:**

- Risk for each minor SCC for professional services is highly dependent upon the phase in which it is performed. For professional services, the cumulative BRFs shall be mostly drawn down at the point at which the category of services has been largely completed. BRFs for other services (i.e., insurance, etc.) in this category shall be estimated in consideration of the commensurate risk factors. See Figure 4 for standard BRF values for professional services.

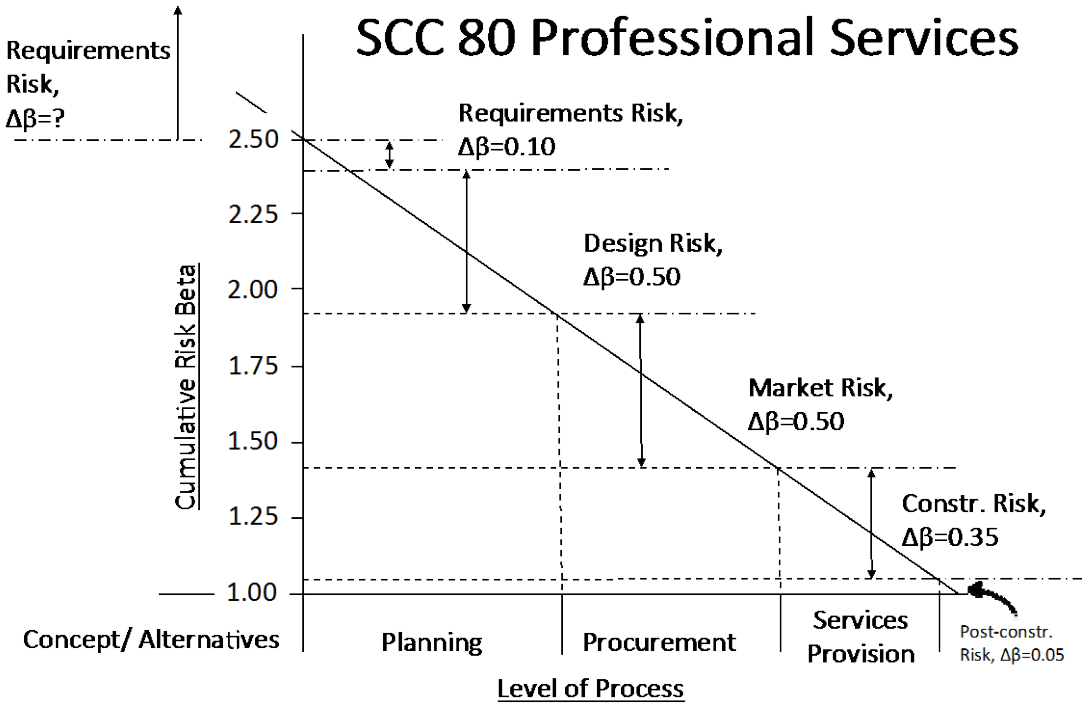



**Figure 4 - SCC 80 Beta Range Factors by Level of Development**

## APPENDIX G

## Risk and Contingency Management Plan (RCMP) Structure

**Note:** the following narrative for potential structure of the RCMP contains elements or details that may not be appropriate for all phases of the project. For example, early in the Engineering phase, some details may be undeveloped and only broad characterization of project elements or risk management plans may be available. The PMOC's review of the Sponsor's RCMP shall appropriately consider the phase of the project development, and the PMOC shall adjust its review accordingly.

The Risk and Contingency Management Plan (RCMP) is a subplan of the Sponsor's Project Management Plan (PMP); its successful implementation depends upon a fully updated and effective PMP. It is the purpose of the RCMP to highlight specific areas of management focus as identified through the risk evaluation process, which shall be implemented along with Sponsor's normal project operations as described elsewhere within the PMP. Further, the RCMP provides a means for monitoring Sponsor's progress as it moves the project forward to its next phase. These areas of management focus may include actions to strengthen management capacity and capability, project performance, cost and schedule analyses, mitigations of identified project risks, and others.

Information contained within the RCMP shall complement and not be in conflict with information contained elsewhere within the PMP or in other FTA guidance documents. Such areas of concordance shall include, for example, the project estimate and schedule, FTA's completion criteria for the various phases such as Entry to Engineering and SSGA/FFGA, master checklists for being considered ready to proceed into the next phase, as well as associated FTA PMOC work products used to review the various technical elements of the project, etc.

Successful implementation of the RCMP is important to the goals of both the Sponsor and the FTA, and monitoring of the RCMP implementation will be undertaken by both the Sponsor and the FTA (through the PMOC). It is important, therefore, that the FTA, PMOC, and Sponsor work collaboratively and develop agreement on the substance of the RCMP.

A potential structure for the RCMP follows:

### Overview

This section shall indicate that the RCMP is a subplan of the over-arching PMP, including an indication of the latest version of the PMP upon which the RCMP is based. If the RCMP depends specifically on other sections of the PMP, those sections shall be noted, including an indication of their latest versions.

A brief description of the important, actionable findings of the RCMP shall be included in the overview. If further actions are required to finalize the current draft of the RCMP, those shall also be indicated along with expected completion dates.

A brief summarization of topics covered within the RCMP shall be included, including such topics as:

Primary Mitigation, organized by significant project activities, such as:

- Management Capacity and Capability
- Project Scoping and Design;
- Delivery Methods and Contracting;
- Construction Process;

- Project Tracking, including:
    - Cost Estimating, Financing and Financial Management; and
    - Project Schedule Management.

Insurance:

- Professional services, construction phase, wrap-up, or other specialized insurances purchased for reduction of risk exposure.

Contingency Management:

- Cost Contingency Management Plan; and
- Schedule Contingency Management Plan.

Secondary Mitigation:

- Establishment of Secondary Mitigation actions and cost targets which may trigger the implementation of Secondary Mitigation.

Risk Management:

- Risk management and mitigation monitoring, change identification, and management controls.

**Goals and Objectives**

The major goals of the RCMP shall be stated, including establishment of measures to complete the project within budget and on schedule, implementation of project cost and time contingency procedures, risk mitigation, and development of available risk mitigation capacity. The role that the RCMP plays in advancing the Sponsor into the next stage of FTA approval shall be noted.

Broad goals expected to be accomplished prior to the next stage of RCMP revision (including revisions required at FTA milestones) shall be noted. For example, for a project in the Engineering (ENG) phase, such goals may include (similar, phase-appropriate goals would apply to other project phases):

- Adherence to environmental requirements, such as the National Environmental Policy Act ("NEPA") requirements;
- Mitigation of design risks where possible during the ENG phase, or appropriate transfer of such risks to a design-build entity if applicable;
- Mitigation of other identified risk events;
- Reasoned analysis and assessment of likely market risks to be encountered;
- Cost and schedule risk mitigation capacity developed and implemented as needed, including targets to be achieved during the ENG Phase and forecasted cost and schedule risk management mitigation capacity for subsequent phases;
- Uncertainty in cost estimates and forecasts and project schedules, including tracking mechanisms to identify trends in known costs and risk reduction; and
- Maintenance of minimum cost contingency and schedule contingency targets.

Generally, detailed description of these or other broad goals is required to achieve measurable project evaluations; those descriptions and their metrics shall be outlined in separate plans or in an appendix to the RCMP.

The RCMP shall note that the Sponsor and its local and state partners understand that the plan was developed in concurrence with the FTA, that implementation of the RCMP is an important consideration

in further FTA approvals, and that the RCMP describes processes and requirements that must be adhered to, in addition to current FTA grant contracts and related FTA Circulars, regulations and guidance.

Risk Review Process:

The section shall include a description of procedures used for development of the Risk and Contingency Management Plan, including procedures for development of risk identification, risk assessment, risk response recommendations, risk protection measures (including Secondary Mitigation and minimum contingencies) and risk management and control.

[Note: In the following sections, the Sponsor shall provide an outline of its strategic, performance-based project management activities to identify, assess and respond to the project risks. It is the intent of the following to view risk management as a process of continual risk reduction; i.e., while the mitigation of any specific identified risk is an important activity, the identification, addition and mitigation of newly-discovered risks forms a process that provides both the Sponsor and the FTA (through its PMOC) with the means and methods to best ensure satisfactory outcomes for the project. The goal of the RCMP is to provide a plan to take the Sponsor through the upcoming phase, and prepare it for possible entry into the next phase, with:

- Cost estimates and forecasts and project schedules continuing to be developed as planned;
- Reasoned analysis and assessment of likely upcoming risks, including risks associated with Sponsor's management capacity;
- Mitigation of risks at the earliest possible time;
- Completion of all mitigation actions scheduled for the upcoming phase;
- Cost and schedule risk mitigation capacity developed, implemented as needed, and targets achieved; and
- Minimum cost and schedule contingency targets continuing to be achieved.]

**Insurance**

This section shall include a summarized discussion of current or future major insurances provided to the project to respond to identified risk, including especially unusual, highly likely, or high exposure risk identified through the risk review process. Such insurances may include professional services, builder's risk, wrap-up, or other specialized insurances purchased for reduction of risk exposure. Detailed insurance information shall be included as an appendix to the RCMP or reflected elsewhere in the PMP.

**Primary Mitigation**

The primary mitigation section shall include the process used to develop the Risk Register, which outlines risks and mitigations that require Sponsor managerial, administrative, and technical action. The section shall be organized as follows; each area below shall include a brief summary of key risks and action items as of the date of the latest RCMP update.

A detailed listing of all identified risks and proposed mitigations shall be included as a separate report, or attached as an appendix, as further indicated below; this separate report shall be updated at the frequency noted in the RCMP.

Management Capacity:

The RCMP shall summarize key management capacity risks identified in the Risk register. A plan shall be indicated for additional resource commitments, additional requirements for methods and resources, and

improved management strategies to address the findings of risk. Management strategies shall include specific plans or products, project control, responsibilities, authorities, and measures of performance.

Detailed risk issues related to Management Capacity shall be specifically cited in an appendix, and shall be noted as *Management Capacity Risks and Mitigations*. This list shall include proposed mitigation activities, responsibility for action and targeted date for completion.

Project Scoping and Design:

Requirements: A summary of key requirements risks and proposed mitigations shall be discussed in the body of the report to provide a succinct overview of the outstanding risk mitigation work to be accomplished. In addition, all outstanding project requirements risks, including undefined project goals, third party requirements, and environmental considerations shall be listed in an appendix, indicated as *Requirements Risks and Mitigations*. Such activities shall also include risk associated with all compliance of NEPA activities consistent with the NEPA Final Determination; and public and governmental reviews and critiques;.

Design: A summary of important design risks and proposed mitigations shall be discussed in the body of the report to provide a succinct overview of the outstanding design risk mitigation work to be accomplished. In addition, all design activities indicated in the risk review as potential risk events, including activities associated with unproven project technologies, unresolved alternate design approaches, late design, and others shall be listed in an appendix, indicated as *Design Risks and Mitigations*. As appropriate, statements of sub consultant responsibilities for risk mitigation shall be included.

Where value engineering efforts have been or will be undertaken, a summarized discussion of the effect on project risk shall be discussed, including plans for closure of the value engineering process. Detailed value engineering items shall be referenced elsewhere in the PMP, or included in an appendix if otherwise unavailable.

Delivery Methods and Contracting:

The purpose of this section is to illustrate the Sponsor's plans for efficient risk allocation through choice of delivery method and through contractual risk allocation; such risks so considered shall include common design, market, and construction risks as well as those risks identified in the risk review. All contracts shall be considered, including design, vendor, and construction contracts. The Sponsor shall discuss the following:

- Strategies for contractual risk allocation or risk sharing through explicit contract language, ordinary custom/commercial/trade practices, or statutory authority such as the Uniform Commercial Code. The risk allocation plan shall include allocations of future and prior contracted work, shall complement other PMP sub-plans, such as the Contract Package Plan and future individual contracts, the Real Estate Acquisition Management Plan ("RAMP"), and all NEPA-related documentation;
- The effect of the chosen strategy on market pricing for the various contracts;
- Assessment of the contracted party's capacity to efficiently mitigate its allocated project risk exposure, including market risk, such that the risk allocation represents the best value for the project; and
- Actions to implement the strategy.

Detail for the proposed allocation strategy shall be referenced elsewhere in the PMP or shall be included

in an appendix. Individual risks identified in the risk review shall be indicated as *Delivery Methods and Contracting Risks and Mitigations*.

Construction Process:

The purpose of this section is to demonstrate the Sponsor's plans for effective management of risk during the construction process. This section shall include a summarized discussion of the key construction phase risks identified in the risk review and plans to mitigate and respond to those risks. Especial attention shall be placed on those risks that have not been wholly transferred to a contracted party. In addition, all outstanding project construction risks identified in the risk review shall be listed in an appendix, indicated as *Construction Risks and Mitigations*.

Project Tracking:

The purpose of this section is to discuss those activities that will be put in place to ensure that adequate tracking and forecasting of cost and schedule outcomes are available to measure potential increased cost or time due to project risk. Such increases may require actions, such as use of contingencies or may trigger the implementation of Secondary Mitigation. This section shall complement and may reference other related sections of the PMP. Where the risk review has identified risks associated with project cost and time tracking, a detailed listing of all identified risks and proposed mitigations shall be included in an appendix, indicated as *Project Tracking Risks and Mitigations*. The section shall be organized as follows; each area below shall include a brief summary of key risks and action items:

Cost Estimating and Forecasting: discussion shall include the process used for development and management of project cost and project cost uncertainty, including the effect of schedule risk uncertainty on the cost risk results. Included within the discussion shall be establishment of reliable estimates for the maximum dollar amount of the FTA financial contribution needed to implement or complete the project.

The following efforts for reduction of cost uncertainty shall be indicated or referenced elsewhere in the PMP:

- Continuous administrative and management efforts for increased detailed development of the cost estimate;
- Internal quality control to ensure adequate technical provision of all estimating and forecasting work;
- Methods for adjustment of cost schedules in reaction to realized schedule risks.

Detailed cost and cost risk information shall be referenced as available elsewhere in the PMP or made available in an appendix to the RCMP.

Project Schedule Management: discussion shall include the process used for development and management of project schedule forecasts and project schedule uncertainty, including any effect of cost risk uncertainty on the schedule risk results. Such external requirements as NEPA compliant related work and community involvement shall be considered in the discussion of risk-related schedule management.

Plans to maintain schedule tracking shall be discussed, including both design and construction schedules, to detect schedule deviation through techniques such as earned value. Such plans shall indicate responsibility and frequency of reporting (usually monthly). Where appropriate, the RCMP shall indicate efforts made to ensure that consultants and contractors comply with similar measures. Such tracking is important for the establishment of risk response actions, such as potential use of schedule contingency; this discussion shall rely upon and complement schedule control discussions contained within the scheduling section of the PMP.

### Contingency Management

The purpose of this section is to discuss the Sponsor's plans for establishment and management of cost and schedule contingency protections. The section shall be organized as follows:

Cost Contingency Management Plan:

- Results of cost contingency recommendations developed, including minimum contingency hold points by milestone and reflected in a minimum cost contingency draw-down curve;
- Sponsor plans to reach substantial conformance with the contingency recommendations on a timely basis;
- Procedures in place to implement and maintain throughout the project, a Cost Contingency Management Plan as an identifiable element in the RCMP, including authorities and procedures for distribution, transfer and use of all cost contingency in conformance with the requirements of this plan and sufficient documentation as each transfer occurs. This Cost Contingency Management Plan shall also describe the manner in which the Sponsor will forecast and trend the project contingency; and
- Sponsor plans to recover in those cases where cost estimate forecasts indicate contingency levels have fallen below the minimum planned contingency hold points, including as necessary implementation of a formal Recovery Plan or adjustment of the expected project final cost with FTA approval.

Schedule Contingency Management Plan:

- Results of schedule contingency recommendations developed, including minimum contingency hold points by milestone and reflected in a minimum schedule contingency draw-down curve;
- Sponsor plans to reach substantial conformance with the contingency recommendations on a timely basis;
- Procedures in place to implement and maintain a Schedule Contingency Management Plan as an identifiable element in the RCMP, including authorities and procedures for distribution, transfer and use of all schedule contingency in conformance with the requirements of this plan and sufficient documentation as each transfer occurs. This Schedule Contingency Management Plan shall also describe the manner in which the Sponsor will forecast and trend the project contingency; and
- Sponsor plans to recover in those cases where schedule estimate forecasts indicate contingency levels below the minimum planned contingency hold points, including as necessary a formal Recovery Plan or adjustment of the expected completion date for the project or appropriate milestones.

### Secondary Mitigation

The purpose of this section is to discuss the Sponsor's plans for establishment and management of Secondary Mitigation protections. The section shall discuss the following:

- Results of Secondary Mitigation recommendations developed and the process for reviewing and developing future items;
- A summary discussion of such Secondary Mitigation, including a brief description of a prioritized list of identified Secondary Mitigation items and the timing necessary for their implementation, especially including dates beyond which the items may no longer be effective;
- A discussion of those points of project completion at which Secondary Mitigation at which the items are no longer available to be triggered for implementation; and
- Procedures in place to track such trigger points and to implement available Secondary Mitigation, including authority responsibility for such actions.

If the project has progressed to a stage at which no available Secondary Mitigation has been identified, this condition shall be discussed in the report.

### Risk Management and Risk Mitigation

The Sponsor shall describe its plans to implement, administer and maintain throughout the project, a Risk and Contingency Management plan for:

- Assessing (identifying and analyzing) project cost and schedule risk;
- Developing risk-handling options inclusive of primary risk mitigation;
- Developing a secondary mitigation plan to handle risk events or "triggered" mitigation activities;
- Monitoring risks to determine how risks have been handled or changed; and
- Documenting and reporting to the FTA the risk management program.

The risk management description shall include such considerations as:

- Design control processes to detect potential consultant failure, such as scope, schedule, and budget "earned value" metrics;
- Clearly established Sponsor, consultant, and contractor responsibilities for risk management;
- Plans for amendment of the risk register during the course of the work, to both succinctly catalogue additional significant issues that arise, as well as to identify closure of issues as they become resolved to the satisfaction of the Sponsor and the FTA; and
- Plans and timing for systematically updating the RCMP.

## APPENDIX H

## Risk Report Format

Reporting shall occur immediately after conclusion of the risk workshops; timely reporting will facilitate Sponsor's early adoption of the recommended risk mitigation measures into its Project Management Plan.

In the conduct of this report, the PMOC shall use its professional judgment to identify and categorize, assess and evaluate the uncertainties in the Sponsor's project information, considering the project's administrative, management, political, legal, financial and physical conditions. The PMOC will document and report its professional opinions and its recommendations for responding to identified risk, including recommendations for mitigations including contingencies. Unless otherwise directed, the report will be sectioned as follows:

## Title Page

Include disclaimer, below.

> **Disclaimer Insert***:* This Project Management Oversight Contractor (PMOC) report and all supporting reports and back up materials contain the findings, conclusions, professional opinions and recommendations stemming from a risk-informed evaluation and assessment, prepared solely for the Federal Transit Administration (FTA). This report shall not be relied upon by any party, except FTA or the project Sponsor, in accordance with the purposes of the evaluation and assessment as described below. For projects funded through FTA's Major Capital Investment (New Starts) program, FTA and its PMOCs use a risk-informed process to review and reflect upon a Sponsor's scope, schedule, and cost, and to analyze the Sponsor's project development and management. This process is iterative in nature. The results represent a "snapshot in time" for a particular project under the conditions known at that point. The evaluation or assessment and related results may subsequently change due to new information, changes in circumstances, additional project development, specific measures a Sponsor may take to mitigate risks, Sponsor's selection of strategies for project execution, etc.

## Table of Contents

## List of Figures and Tables

## Executive Summary

The PMOC shall provide an executive summary in three pages or less that includes the following:

1) Purpose
2) Project Description
3) Results and Recommendations - PMOC's professional opinion regarding:
   - Contract packaging review and assessment
   - A table that provides the following elements, if a separate PMOC risk assessment has been performed:
     i) 10th, 40th. 50th, 65th, 80th, and 90th percentile projections
     ii) Total Contingency (per model)
     iii) Secondary Mitigation Required
     iv) Secondary Mitigation Available
   - Project schedule and schedule contingency, including statement of separate PMOC findings where a PMOC assessment has been performed; and

- Top Risks, mitigations, and recommended actions.

## Project Background

Project descriptions and data shall be consistent with the Monitoring report guidance, current monitoring report and the most recent FTA New Start profile. Notwithstanding the foregoing, FTA may direct the contractor to use an identifiable draft version of these materials. Ridership shall include peak hour ridership data. Sub-sectioning shall also include Guideway Components, Project Delivery Method, proposed Contract Packaging Strategy and, as applicable, Master Planning for the Corridor.

## Summary of Project Status from other OPs

Summary-level information from: Sponsor Management Capacity and Capability, Project Scope, Project Estimate, and Project Schedule reviews if performed. Include specifically elements from prior reviews that are particularly important to developing understanding of the issues presented later in this report.

## Risk Identification

Provide a summary of the process used for identification of risks, and provide a narrative discussion of key risk events (categorized by SCC), including their potential impact on the project. Characterize the remaining elements of the Risk Register, which is to be attached as an appendix.

## Risk Assessment

For projects with prior risk reviews, include comparisons of the currently-assessed project risk to the prior-assessed project risks and comment on the changes indicated.

### PMOC Cost Risk Assessment

Where the cost risk review is based on an independent PMOC risk assessment, describe the methodology used to deliver the risk assessment products. Further, present any cost estimate adjustments and selection of cost range factors; especially discuss any factors that vary from standard recommendations. Provide a summary of key risks that influence PMOC's characterization of level of project risk by SCC. The PMOC shall present detailed data and analysis in a separate appendix as necessary in order to maintain readability of the report.

### PMOC Schedule Risk Modeling

Where the schedule risk review is based on an independent PMOC risk assessment, describe the methodology used to deliver the risk assessment products. This section shall present the findings resulting from the schedule risk modeling, including development of the summary schedule activities, ranges for activity durations in the summary schedule, and characterization of specific risks that influence important schedule activities; characterization of the results of the schedule risk modeling, including confidence levels for achieving the Sponsor's Revenue Service Date target; the PMOC's professional opinion regarding the most likely schedule for Revenue Service Date; and PMOC's recommended actions.

### Risk Mitigation

The purpose of this section is to present the PMOC's review and recommendation for any adjustment of risk mitigation efforts by the Sponsor. The PMOC's narrative shall allow FTA management and the Sponsor to maintain focus upon these risk mitigation efforts as the means to maintain the baseline cost estimate and avoid potential cost escalation from these potential project risks.

The report shall include separate subsections for Primary Mitigation, Secondary Mitigation and Contingency Recommendations.

**Primary Mitigation:** Specific mitigation recommendations shall be presented, including appropriate timeframes for completion of the mitigation activity, especially focused on those mitigations considered necessary for successful approval at the next FTA milestone. Where a PMOC assessment has been performed, link the mitigation activity to the risk register and/or the assignment of exceptional risk factors. Such mitigation recommendations shall be segregated by SCC and Risk Category.

For projects with prior risk reviews, include discussions (as appropriate for project phase) of Sponsor's historic mitigation efforts by Risk Category.

**Secondary Mitigation:** Provide recommendations for adjustments to amounts of Secondary Mitigation capacity developed by the Sponsor. Where the risk review has provided such, include suggested additional areas for potential Secondary Mitigation.

**Contingency:** Provide a narrative indicating minimum recommended levels of both cost and schedule contingency, including a summary of the basis for development of the recommended minimums. Further, provide graphical or tabular representations of the Sponsor's contingency draw-down curves, including review comments and PMOC's recommendations for adjustment, if any.

## Monitoring Plan Basis

Indicate a plan for testing the implementation and effectiveness of Sponsor mitigation measures on the project.

## Conclusion

### Appendices

As required, include the following or other additional information:

**Risk Register**

**Sponsor Data Characterization**

Provide a descriptive listing of documents used in this analysis, including a narrative characterization of their completeness and sufficiency as appropriate for the project phase during which this review was conducted.