PMOC REPORT

OP 40 – Risk and Contingency Review

Honolulu Rail Transit Project
Honolulu Authority for Rapid Transportation (HART)
City and County of Honolulu
Honolulu, HI

September 2012 (FINAL)

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TABLE OF CONTENTS

TABLE OF CONTENTS ..... **i**
LIST OF TABLES ..... **i**
LIST OF FIGURES ..... **ii**
LIST OF APPENDICES ..... **ii**

1.0 EXECUTIVE SUMMARY **1**
1.1 Introduction 1
1.2 Project Description 1
1.3 Jacobs Scope of Work 2
1.4 OP 40: Risk and Contingency Refresh 2

2.0 OP 40: RISK AND CONTINGENCY REVIEW **5**
2.1 Purpose 5
2.2 Methodology 5
2.3 Risk Identification 6
2.4 Contract Packaging 6
2.5 Cost Risk Assessment 7
2.5.1 Methodology 7
2.5.2 SCC Adjustments 8
2.5.3 Baseline Beta Values 8
2.5.4 Beta Value Adjustments 11
2.5.5 Cost Risk Analysis 12
2.6 Schedule Risk Assessment 13
2.6.1 Methodology 13
2.6.2 Schedule Risk Analysis 15
2.7 Risk Mitigation 26
2.7.1 Primary Mitigation 26
2.7.2 Secondary Mitigation 27
2.7.3 Cost Contingency 28
2.7.4 Schedule Contingency 30
2.8 Conclusion 31
2.9 Recommendations 33

APPENDICES **34**

LIST OF TABLES

Table 1. PMOC Adjustments – Risk Profile 3 Portion Estimate $YOE 8
Table 2. Standard Beta Values for Risk Profile 1 9
Table 3. Standard Beta Values for Risk Profile 2 9
Table 4. Standard Beta Values for Risk Profile 3 9
Table 5. Beta Values Risk Refresh 10
Table 6. Risk Model Data 12
Table 7. CPS to APS Milestone Comparison 17

Table 8. IRM Milestone Probability of Achievement Date 21
Table 9. PMOC Recommended Secondary Mitigation 28
Table 10. PMOC Recommended Contingency 29
Table 11. Schedule Contingency Final Design through RSD 30

LIST OF FIGURES

Figure 1. Schedule Risk Assessment Process 15
Figure 2. Schedule Risk Assessment Steps and Schedule Types 15
Figure 3. Duration Distribution Type 18
Figure 4. Schedule Risk Register 19
Figure 5. Schedule Risk Scoring Chart 19
Figure 6. Project Completion Date Confidence Level 20
Figure 7. Activity ID F270 “FTA Approval of FFGA” 22
Figure 8. Activity ID 20 “20% Construction” 23
Figure 9. Activity ID 50 "50% Construction" 24
Figure 10. Activity ID 75 “75% Construction” 25
Figure 11. Activity ID 90 “90% Construction” 26
Figure 12. Buffer Float and RSD Analysis 31

LIST OF APPENDICES

Appendix A: Acronym List
Appendix B: Documents Reviewed

1.0 EXECUTIVE SUMMARY

1.1 Introduction

The Honolulu Authority for Rapid Transportation (HART) continues to advance development of its proposed Honolulu Rail Transit Project ("Project"), formerly known as the Honolulu High-Capacity Transit Corridor (HHCTC) Project, in accordance with the Federal Transit Administration (FTA) New Starts requirements. The Project is intended to provide improved mobility in the highly-congested east-west corridor along Oahu's south shore between Kapolei and the Ala Moana Center. The Project would provide faster, more reliable public transportation services than those currently operating in mixed-flow traffic.

FTA assigned Jacobs as a Project Management Oversight Contractor (PMOC) on September 24, 2009, for the purpose of monitoring the Project and providing FTA with "information and well-grounded professional opinions regarding the reliability of the project scope, cost, and schedule" of the Project. That effort continues with this update report, which represents the PMOC's assessment of Risk and Contingency Management. This report is based on information provided by the grantee as of June 2012.

1.2 Project Description

The Project is an approximately-20-mile-long elevated fixed guideway rail system along Oahu's south shore between East Kapolei and Ala Moana Center. The alignment is elevated, except for a 0.6-mile at-grade portion at the Leeward Community College station. The proposed investment includes 21 stations (20 aerial and 1 at-grade), 80 "light metro" rail transit vehicles, administrative/operations facilities, surface and structural parking, and maintenance facilities. The grantee plans to deliver the Project in four guideway segments:

- Segment I (West Oahu/Farrington Highway) – East Kapolei to Pearl Highlands (6 miles/7 stations)
- Segment II (Kamehameha Highway) – Pearl Highlands to Aloha Stadium (4 miles/2 stations)
- Segment III (Airport) – Aloha Stadium to Middle Street (5 miles/4 stations)
- Segment IV (City Center) – Middle Street to Ala Moana Center (4 miles/8 stations)

HART has combined Segments III and IV into a single guideway construction contract. The Contract Packaging Plan has been updated to reflect this change.

Additional Project information:

- **Additional Facilities:** Maintenance and Storage Facility (MSF) and parking facilities
- **Vehicles:** 80 vehicles, supplied by the Core Systems Contractor (CSC), which is also responsible for systems design and construction and operations. The CSC is a Design-Build-Operate-Maintain (DBOM) contract.
- **Ridership Forecast:** Weekday boardings – 99,800 (2019); 114,300 (2030).
- **Grantee's Target Revenue Service Date (RSD):** March 2019

1.3 Jacobs Scope of Work

Under this Work Order, Jacobs is to provide the following deliverables:

- OP 32A: Project Transit Capacity Review
- OP 32C: Project Scope Review
- OP 32D: Project Delivery Method Review
- OP 33: Capital Cost Estimate Review
- OP 34: Project Schedule Review
- OP 40: Risk and Contingency Review

This report is limited to OP 40: Risk and Contingency Review.

1.4 OP 40: Risk and Contingency Refresh

Methodology

The PMOC followed the requirements outlined in the *FTA OP 40 Risk and Contingency Review*, dated May, 2010, to complete a risk analysis of the Project. This review requires an evaluation of the reliability of the grantee's project scope, cost estimate, and schedule, with special focus on the elements of uncertainty associated with the effectiveness and efficiency of the grantee's project implementation and within the context of the surrounding project conditions.

Summary of Findings

(1) Risk Assessment:

- The PMOC has refreshed its earlier risk review and presented its preliminary results to the grantee in April 2012. Concern was expressed over the rate of project cost contingency usage.
- The grantee responded with revised plans, estimates, and schedules to address the contingency shortfall.
- The PMOC has prepared this risk refresh based upon the grantee's revisions.
- The PMOC separated the project into three distinct risk profiles to better model the effect of risk upon the project.
- The PMOC found that the grantee's risk identification effort, including its risk mitigation activities, generally conforms to its documented processes.
- The cost risk assessment found few exceptional cost risks. No Beta value changes impacting all SCCs were included as a result of the grantee's prior lack of contingency management since there is increased emphasis on cost and schedule controls included in the RCMP.

(2) Project Cost Estimate:

- The grantee's estimate is $4,949 million, which includes a stripped estimate of $4,305 million plus a contingency of $644 million.
- The PMOC recommended estimate is $4,978 million, which includes a

stripped estimate of $4,305 million, plus $15 million in cost adjustments for "Contractor Markups" as detailed in the OP 33 report, and plus a recommended contingency of $658 million.

- The recommended estimate represents the median value from the FTA risk assessment model, when adjusted for the specifics of this project. The historic trend indicates that 80% of similarly-scoped projects have fallen within the range of $4,497 million to $5,789 million.
- The grantee's estimate varies from the PMOC-recommended estimate by $29 million ($15 million in recommended adjustments and $14 million in recommended contingency).
- The difference between the grantee's project estimate of $4,949 million and the PMOC's recommended estimate of $4,978 million is 0.6%.
- It is observed that significant contingency reduction occurred since the recent prior risk review, to a point where contingency is below accepted control levels. The grantee has identified a total of $644 million in contingency. This is $222 million less than the amount of contingency of $866 million identified during the prior review to support the request to enter into Final Design.
- It is recognized that efforts have been made to recover contingency levels through cost reduction measures, value engineering, and revised project delivery strategies.
- The grantee's estimated finance charges for the project are $173 million.

(3) Risk and Contingency Management Plan (RCMP):

- Organizational structure identified in the RCMP has been adjusted to improve risk management throughout the project life.
- RCMP includes more refined plans for the grantee to monitor and mitigate high-risk rated items.
- RCMP demonstrates that risk identification, assessment, and mitigation continue as a part of the project management process.
- Some strengthening of the risk contingency tracking, custody, and reporting is indicated in the updated RCMP. A revised contingency draw-down curve has been included in the RCMP. This revised curve was required due to a significant use of contingency that violated earlier contingency draw-down controls.
- This strengthening includes plans for more frequent (monthly) reviews of the remaining cost and schedule contingencies to ensure they are within the control limits set by the cost and schedule contingency draw-down curves.
- This strengthening of the contingency tracking and control is welcomed. However, diligence and vigilance must be applied to this effort to avoid a high rate of contingency use that could ultimately leave the project unprotected.

(4) Secondary Mitigation Measures:

- RCMP includes several potential Secondary Mitigation options. However, there is a lack of detailed development of plans and cost

estimates for the items identified in the RCMP.

- The amount of secondary mitigation identified in the RCMP is assessed by the PMOC to be approximately $106 million.
- The PMOC recommended amount of secondary mitigation is $149 million.

(5) Project Schedule:

- The Grantee's target Revenue Service Date is March 2019.
- The PMOC recommends that the Revenue Service Date identified in the FFGA be no earlier than the first quarter of 2020.

Recommendations

(1) The grantee's total project estimate of $5,122 million, including $644 million in total contingency and $173 million in finance charges, is acceptable to support an FFGA.

(2) The Revenue Service Date identified in the FFGA should be January 31, 2020.

(3) Strong controls must be put in place immediately to avoid future rapid contingency reduction. The frequency and the levels of project management to which these statistics are reported should be improved and monitored monthly.

(4) Prior to execution of an FFGA, the grantee should develop more details for the Secondary Mitigation items and attempt to identify secondary mitigation measures that approach a total value of $149 million. Doing so will strengthen the ability to develop these items in the design documents and include them as deductive alternates in construction contracting proposals.

2.0 OP 40: RISK AND CONTINGENCY REVIEW

2.1 Purpose

Per FTA Oversight Procedure (OP) 40, PMOC has performed "an evaluation of the reliability of the grantee's project scope, cost estimate, and schedule, with special focus on the elements of uncertainty associated with the effectiveness and efficiency of the grantee's project implementation and within the context of the surrounding project conditions."[1] Through the process of risk and contingency review, the PMOC attempts to aid the grantee in its efforts to better define the project's risks and to provide avenues for recovery should those risks become reality.

The purpose of this report is to provide a refresh of recommendations for adjustments to scope, cost, schedule, and project delivery options and to consider risk identification and risk mitigation options and alternatives, particularly in regard to contingencies, in order to respond to established project risks. This report is produced as one of a series of reviews undertaken to establish the Project's Readiness for receipt of the Full Funding Grant Agreement. This report is based on information provided by the grantee as of June 2012.

2.2 Methodology

The purpose of this section is to describe the review and evaluation methodology utilized by the PMOC with regards to the grantee's identification of project risk and its plans for mitigating and managing these risks, including the use of schedule and cost contingencies.

The PMOC is required to synthesize available project information, explore and analyze uncertainties and risks, and provide a qualitative and quantitative assessment of ranges of forecasted cost and schedule. The PMOC reviewed risk mitigation options and alternatives, including use of cost and schedule contingencies.

The risk refresh requires an evaluation of the reliability of the grantee's project scope, cost estimate, and schedule, with specific focus on the elements of uncertainty normally associated with the implementation of the project. PMOC reviewed scope, cost, and schedule documents and presented these reviews in separate spot reports on each topic. The objective of this refresh is to assess changes in the project risks and uncertainties associated with project conditions and the effectiveness and efficiency of project implementation in identifying and mitigating risks in regard to scope, cost and schedule. This report provides a qualitative and quantitative assessment of the ranges of forecasted cost and schedule and project management planning in order to respond to project risk. The PMOC's refresh is understood to be a critical input to FTA's decision regarding project advancement and funding.

Since its 2011 Pre-FD risk review, the PMOC has performed regular monitoring visits to the grantee's project and has refreshed the PMOC's earlier risk assessment based upon an updated understanding of project risks and updated schedule and cost information provided by the grantee. In April 2012, the PMOC participated in a risk refresh workshop with HART, the

[1]OP 40 Risk and Contingency Review, Rev. 2, May 2010, pg. 1.

purpose of which was to discuss HART's progress in its risk management efforts, and to discuss PMOC's observations and reflections from PMOC's initial review of HART's updated scope, cost, schedule, and risk information. The April 2012 risk refresh meeting yielded discussions related to rapid use of cost contingency funds, and, as a result, HART responded with in-depth reviews and updates of its project plans and costs, including reconfiguration of project elements to replenish cost contingencies. These subsequent efforts resulted in revised schedules, estimates, and a revised Risk and Contingency Management Plan (RCMP) in June 2012. This risk refresh is based upon those revised plans, schedule, cost, and RCMP documents and other PMOC observations developed during the risk refresh effort.

For the purposes of its risk refresh, the PMOC considered the project in three separate elements, which are termed here as "risk profiles":

- ***Risk Profile 1*** is that work associated with the West Oahu/Farrington Highway design-build contract and for which significant construction has begun;
- ***Risk Profile 2*** is associated with elements for which a market-based price has been finalized through contracting or other efforts and for which design risk is minimized, including such elements as the Maintenance and Storage Facility, the Kamehameha Guideway, the Core Systems Contract, certain already-procured design contracts, as well as certain engineering consultant and relatively fixed inter-governmental agreement costs; and
- ***Risk Profile 3*** is associated with other project elements that are less fixed in terms of design progression and risk and for which the final market price remains unresolved, including such elements as the Stations Construction, Airport and City Center Guideways and Utilities Construction, final design for these elements, engineering consultant costs for these elements, and various inter-governmental contracts and agreements that show higher cost risks.

2.3 Risk Identification

The PMOC has reviewed HART's updated risk register and has found that HART has been reasonably diligent in its efforts to track and revise its risk register through internal project risk tracking processes. In its review of the project's scope, estimate, and schedule, the PMOC did not develop any recommendations for adjustment to HART's risk register, which is attached to its updated Risk and Contingency Management plan.

2.4 Contract Packaging

The grantee is utilizing both traditional (Design/Bid/Build or DBB) and alternative (Design/Build or DB and Design/Build/Operate/Maintain or DBOM) project delivery methods for the various contracts. The West Oahu/Farrington Highway (WOFH) Segment DB Contract, Kamehameha Highway Segment DB Contract, the Maintenance and Storage Facility (MSF) DB Contract, and the Core Systems Contract (CSC) DBOM have all been selected and contracted. The remaining work (Airport and City Center and the stations) is anticipated to be procured utilizing a traditional DBB method. To achieve expected market efficiencies and in hope of reducing cost, elements of this work have been consolidated into larger packages than earlier planned.

2.5 Cost Risk Assessment

This section includes the PMOC refresh of the cost risk of the project, based on the PMOC's review of HART's capital cost estimate, details of which are included in the OP 33 – Capital Cost Estimate Review Report. This section also describes the BRF (Beta Range Factor) assignments for the SCC Risk Assessment utilized in the FTA Risk and Contingency Review Workbook. Finally, the cost risk evaluation is described and the results are reported.

2.5.1 Methodology

Cost risk evaluation is a combination of the PMOC's professional judgment and objective cost data to summarize and make adjustments to the grantee's cost estimate. This is in addition to a rational and empirical application of a risk model analysis used to simulate the magnitude of project risk and establish the potential responses to manage the risk. In the context of the project risk evaluation, quantitative risk assessment is utilized in the analysis of risk exposure and the corresponding management of uncertainty. The PMOC utilized the following steps for the cost risk analysis of the project:

(1) The PMOC conducted a cost review of the estimates of the project budget. The results of the PMOC review include an adjusted cost estimate that, in the PMOC's opinion, represents a more likely base cost of the project costs. For the project, the grantee costs are largely based on detailed and parametric estimating procedures, utilizing industry standards and pricing recently received on contracts for this project.

(2) A Stripped Cost Estimate was then developed from the adjusted cost estimate. The PMOC removed contingency funds embedded in the adjusted estimate, including both contingencies allocated by SCC and general unallocated contingencies. The PMOC interviewed the grantee's estimating staff to determine the extent to which latent (hidden) contingencies existed within the estimate, and found no latent contingency to review. The resulting Adjusted Cost Estimate with was reported in YOE dollars.

(3) A likely range of costs was then established, utilizing the FTA Risk and Contingency Review Workbook. The Adjusted Cost Estimate for each SCC Cost Element was then established as the lower bound value of the SCC Element Cost Range. The upper bound of the SCC Cost Element range is established through multiplying the lower bound value by a Beta Range Factor (BRF); i.e., upper bound = BRF*lower bound.

(4) For the Project, the Adjusted Estimate was divided between Risk Profiles 1, 2, and 3, as earlier described.

(5) BRF values were established by the PMOC through a process that initially utilized the guidelines indicated in OP 40 and then the Beta Factors were adjusted based upon specific project situations and identified risks. An example is that, for the project, the design and market factors for the DB and DBOM work warranted much lower beta factors than other cost categories, since design and market prices are largely established. With previously developed information from the risk registers, an assessment of appropriate beta factors for the risk worksheet was made. This assessment occurred independently for each Risk Profile.

(6) Once the Beta values were assigned to each portion of work, the resulting Risk Profiles were combined to develop an overall project risk assessment, including establishment of a target budget and recommended contingencies. These results provided a basis for evaluation of the grantee's budget and contingencies.

2.5.2 SCC Adjustments

The PMOC used its professional judgment as well as evaluation of objective data to develop its assessment of the Project costs and to develop the indicated adjustments. The following indicates adjustments made to the HART estimate; as noted, an adjustment was made to only the Risk Profile 3 portion (the "DBB" portion and unawarded). See Table 1 for a summary of PMOC adjusted project costs by major SCC. The Adjusted Estimate represents the stripped project cost in $YOE.

Table 1. PMOC Adjustments – Risk Profile 3 Portion Estimate $YOE

Standard SCC codes		YOE Dollars				
		From SCC workbook	Calculate YOE adjusted estimate			
SCC	Category	Estimate total	Allocated contingency	SCC stripped estimate	YOE PMOC Adjustments	Adjusted estimate
SCC 10	Guideway	736,555	122,759	613,795	0	613,795
SCC 20	Stations, Stops, Terminals, Intermodals	506,166	84,361	421,805	9,505	431,310
SCC 30	Support Facilities: Yards, Shops and Admin Bldgs	0	0	0	0	0
SCC 40	Sitework and Special Conditions	520,876	86,626	434,249	5,738	439,987
SCC 50	Systems	18,192	3,032	15,160	0	15,160
SCC 60	ROW, Land and existing improvements	218,508	24,103	194,406	0	194,406
SCC 70	Vehicles	0	0	0	0	0
SCC 80	Professional services and Agency costs	338,807	42,458	296,349	0	296,349
	SCC 10-80 total	2,339,103	363,339	1,975,764	15,243	1,991,008

The PMOC recommended an adjustment to the base cost estimate in the amount of $15.24 million to account for insufficient contractor markup that was identified in several construction contracts. Detail of this adjustment is discussed in the OP 33 – Capital Cost Estimate Review report.

Note that no latent contingency adjustments were made from any portion of the grantee estimate. Detail regarding the nature of the PMOC adjustments is discussed in OP 33 – Project Cost Estimate Review.

2.5.3 Baseline Beta Values

For each risk profile, the standard Beta values selected for use in this risk assessment are shown by major SCC category in the tables below. These standard values are developed from FTA standards, adjusted in consideration of stage of project and project delivery method. For example, in this project the Design Betas for the Design-Build portions are lower than for the Design-Bid-Build portions, since the design-builder assumes much of the risk for non-owner generated design changes.

Table 2. Standard Beta Values for Risk Profile 1

SCC	R	D	M	C	Total Beta
SCC 10 - 50	0.00	0.00	0.00	0.35	1.35
SCC 60	Not applicable				
SCC 70	Not applicable				
SCC 80.01	0.00	0.00	0.00	0.05	1.05
SCC 80.02	0.00	0.00	0.00	0.05	1.05
SCC 80.03-08	Not applicable				
R = Requirements Risk	D = Design Risk		M = Market Risk		
C = Construction Risk	Total Beta = 1 + (R + D + M + C)				

Table 3. Standard Beta Values for Risk Profile 2

SCC	R	D	M	C	Total Beta
SCC 10 - 50	0.00	0.00	0.00	0.50	1.50
SCC 60	0.00	0.25	0.40	0.30	1.95
SCC 70	0.00	0.05	0.10	0.30	1.45
SCC 80.01	0.00	0.00	0.00	0.05	1.05
SCC 80.02	0.00	0.00	0.00	0.15	1.15
SCC 80.03	0.00	0.15	0.05	0.25	1.45
SCC 80.04	0.00	0.20	0.15	0.40	1.75
SCC 80.05	0.00	0.00	0.00	0.20	1.20
SCC 80.06	0.00	0.10	0.00	0.20	1.30
SCC 80.07	0.00	0.10	0.10	0.35	1.55
SCC 80.08	0.00	0.40	0.25	0.65	2.30
R = Requirements Risk	D = Design Risk		M = Market Risk		
C = Construction Risk	Total Beta = 1 + (R + D + M + C)				

Table 4. Standard Beta Values for Risk Profile 3

SCC	R	D	M	C	Total Beta
SCC 10&30-50	0.00	0.25	0.25	0.50	2.00
SCC 20	0.15	0.60	0.25	0.50	2.50
SCC 60	0.00	0.40	0.80	0.30	2.50
SCC 70	Not applicable				
SCC 80.01	Not applicable				
SCC 80.02	0.00	0.30	0.30	0.40	2.00
SCC 80.03	0.00	0.40	0.25	0.30	1.95
SCC 80.04	0.00	0.30	0.50	0.40	2.20
SCC 80.05	0.00	0.15	0.10	0.20	1.45
SCC 80.06	0.00	0.30	0.25	0.75	2.30
SCC 80.07	0.00	0.20	0.25	0.55	2.00
SCC 80.08	0.00	0.60	0.25	0.65	2.50
R = Requirements Risk	D = Design Risk		M = Market Risk		
C = Construction Risk	Total Beta = 1 + (R + D + M + C)				

Beta values for the project were developed based on a refreshed view of the Scope, Cost, and Schedule risks identified in the project, informed by regular PMOC site visits and project

reviews. The Beta values were refreshed from previous Beta assignments by the PMOC team and used for the refreshed final cost risk assessment. Note that the Beta value adjustments occurred independently for each Risk Profile as applicable. These Beta values were assigned as outlined in FTA guidance OP 40, and generally fall within ranges expected for this character of project. Beta values were applied at the second level SCC structure.

Table 5. Beta Values Risk Refresh

SCC	Description	Risk Profile 1	Risk Profile 2	Risk Profile 3
10	**Guideway& Track Elements (Route Miles)**			
10.04	Guideway: Aerial structure	1.35	1.50	2.00
10.08	Guideway: Retained cut or fill	1.35	-	-
10.09	Track: Direct fixation	1.35	1.50	2.00
10.11	Track: Ballasted	1.35	-	-
10.12	Track: Special (switches, turnouts)	-	-	2.00
20	**Stations, Stops, Terminals, Intermodals**			
20.01	At-grade station, stop, shelter, mall, terminal, platform	-	-	2.35
20.02	Aerial station, stop, shelter, mall, terminal, platform	-	-	2.35
20.06	Automobile parking multi-story structure	-	-	2.50
20.07	Elevators, escalators	-	-	2.35
30	**Support Facilities: Yards, Shops, Admin. Bldgs.**			
30.02	Light Maintenance Facility	-	1.50	-
30.03	Heavy Maintenance Facility	-	1.50	-
30.04	Storage or Maintenance of Way Building	-	1.50	-
30.05	Yard and Yard Track	-	1.50	-
40	**Sitework& Special Conditions**			
40.01	Demolition, Clearing, Earthwork	1.35	1.50	2.00
40.02	Site Utilities, Utility Relocation	1.35	1.50	2.00
40.03	Haz. mat'l, contam'd soil removal/mitigation, ground water treatments	-	1.50	2.00
40.04	Environmental mitigation, e.g. wetlands, historic/archeological, parks	1.35	1.50	2.00
40.05	Site structures including retaining walls, sound walls	1.35	1.50	2.00
40.06	Pedestrian / bike access and accommodation, landscaping	1.35	1.50	2.00
40.07	Automobile, bus, van accessways including roads, parking lots	1.35	1.50	2.00
40.08	Temporary Facilities and other indirect costs during construction	1.35	1.50	-
50	**Systems**			
50.01	Train control and signals	-	1.55	-
50.02	Traffic signals and crossing protection	-	1.55	1.55
50.03	Traction power supply: substations	-	1.55	-
50.04	Traction power distribution: catenary and third rail	-	1.55	1.55
50.05	Communications	-	1.55	-
50.06	Fare collection system and equipment	-	1.55	-
50.07	Central Control	-	1.55	-
60	**ROW, Land, Existing Improvements**			
60.01	Purchase or lease of real estate	-	-	2.50
60.02	Relocation of existing households and businesses	-	1.95	2.50
70	**Vehicles**			
70.01	Light Rail	-	1.45	-
70.06	Non-revenue vehicles	-	1.45	-
70.07	Spare parts	-	1.45	-
80	**Professional Services**			
80.01	Preliminary Engineering	1.05	1.05	-

SCC	Description	Risk Profile 1	Risk Profile 2	Risk Profile 3
80.02	Final Design	1.05	1.15	2.00
80.03	Project Management for Design and Construction	-	1.45	1.95
80.04	Construction Administration & Management	-	1.75	2.20
80.05	Professional Liability and other Non-Construction Insurance	-	1.20	1.45
80.06	Legal; Permits; Review Fees by other agencies, cities, etc.	-	1.30	2.30
80.07	Surveys, Testing, Investigation, Inspection	-	1.55	2.00
80.08	Start up	-	2.30	2.50

2.5.4 Beta Value Adjustments

The detailed results of the scope, cost, and schedule reviews are presented elsewhere; significant issues noted in those reviews are reflected in the risk assessment model by means of adjustments to the risk Beta factors (β) applied to each SCC sub-category. These adjustments result in forecasts of ranges of cost for the project; this review has focused on the *Entry to Final Design* phase. Standard FTA Beta values incorporate an expectation of common risks that occur across transit projects; Beta adjustments below reflect those increases or decreases in risk that, in the PMOC's opinion, differ from risks occurring within standard Beta values.

The following sections present detail regarding the basis for adjustments, reflected previously in Table 1, beyond standard OP 40 Beta value suggestions. The purpose of this listing is to provide information regarding Beta values of note.

SCC Wide Beta Value Changes

- No broad changes to Beta values are applied to the risk modeling at the stage of this refresh. However, this decision is based upon a concerted effort by the grantee to best improve its management of contingency tracking, custody, and control.

SCC-Specific Beta Value Changes

The following issues determined the final resulting Beta values for the SCC sub-categories, which is the Beta value that reflects risk across all four categories of *Requirements*, *Design*, *Market*, and *Construction* risk, including the general Beta value increases previously noted in the section above. Noted below are only those conditions where exceptional changes to the standard Betas were noted. "Normal" risks associated with similar construction are accounted for in the base risk model.

SCC-20 – Stations, Stops (Risk Profile 3)

- Requirements Risk
  - 20.01, 20.02, & 20.04 (β) = 2.35, decrease D to 0.45. Station designs have been revised substantially for cost efficiency reasons, leaving stations at a more preliminary design level than previously evaluated compared to other project elements. The standard Beta values reflect that revised design stage. However, the previous design effort discovered and resolved many issues that will be applied to the new design. Therefore, the standard Design Beta value is reduced accordingly.

2.5.5 Cost Risk Analysis

This section presents the PMOC's analysis of the model-based Project Cost Risk Assessment based on the FTA Risk and Contingency Review Workbook (version 3.x), utilizing the project adjusted BRFs. This workbook is based on the summary organizational structure of the FTA SCC 10 through 80 for the capital cost elements of a project; SCC 90 (contingency) is specifically excluded as a duplicate measure of risk. Risk for SCC 100 (finance charges) is not covered in the standard FTA risk range factors. Project-level risk is an aggregated amount of the risk associated with all of the SCC Ranges.

Using the Beta values in Table 5, a simulation project risk model was developed, as presented later in this report. Table 6 presents the corresponding numeric data results from the risk model.

Table 6. Risk Model Data

YOE Grantee values	Overall
Grantee total estimate (SCC 10-90)	4,948,635
Grantee exposed contingency	643,561
Grantee stripped estimate (SCC 10-80)	4,305,074
YOE PMOC values	
Latent contingency	0
Inflation Adjustment	0
Adjustments	15,243
Adjusted estimate	4,320,318
Model recommendations	
Recommended estimate	4,978,259
Contingency recommendation	657,941
Contingency %	15%
Secondary mitigation target	5,196,807
Secondary mitigation recommended amount	218,548
Secondary mitigation %	5%

Further analysis of these amounts is provided in other sections below.

Findings Regarding Cost Risk Analysis

(1) The PMOC has refreshed its earlier risk review and presented its preliminary results to the grantee in April 2012. Concern was expressed over the rapid reduction of project cost contingency.

(2) The grantee responded with revised plans, estimates, and schedules to address the contingency shortfall.

(3) The PMOC has prepared this risk refresh based upon the grantee's revisions.

(4) The PMOC separated the project into three distinct risk profiles to better model the effect of risk upon the project.

(5) The PMOC found that the grantee's risk identification effort, including its risk mitigation activities, generally conforms to its documented processes.

(6) The cost risk assessment found few exceptional cost risks. No Beta value changes impacting all SCCs were included as a result of the grantee's prior lack of contingency management since there is increased emphasis on cost and schedule controls included in the RCMP.

Recommendations

(1) The grantee's total project estimate of $5,122 million, including $644 million in total contingency and $173 million in finance charges, is acceptable to support an FFGA.

2.6 Schedule Risk Assessment

2.6.1 Methodology

It should be noted that the Schedule Risk Assessment is based on the Master Project Schedule with a Data Date of March 30, 2012. As noted in the following discussion, the PMOC conditioned the MPS for use in the risk assessment.

This review focuses on the elements of ***schedule*** uncertainty associated with the effectiveness and efficiency of the grantee's project implementation, the project scope, and surrounding project conditions.

The OP 40 schedule analysis output data are generated from Oracle's "*Pertmaster Risk Analysis*" software program used by the PMOC. The PMOC risk analysis process conforms to the software user manual and intent of the OP 40 as described below:

There are two kinds of project risk:

- ***Uncertainty risks*** are inherent variability that makes it impossible to predict exactly how long an activity will take. For instance, you can estimate how long it will take within a range of uncertainty, but you can never predict exactly how long.
- ***Risk events*** are events separate from an activity that can disrupt or otherwise impact the activity.

Pertmaster handles risk events by using a Risk Register to enter potential risk events and estimates of the probability and impact of the risks on activity duration, costs, and project quality. Once uncertainty and risk event impact estimates have been entered for all tasks within a project, Pertmaster performs a high number of project simulations using "Monte Carlo" or "Latin Hypercube" sampling of the estimates to select random task duration and cost values for every run-through of the simulation. These simulations generate a range of outcomes that can be used to predict project duration and costs with statistical confidence.

The Critical Path Method (CPM) is the traditional means for determining a project finish date. However, because CPM only determines a single date and does not consider potential risks, results are not always comprehensively reliable. Risk Analysis uses risk inputs to determine a range of project finish dates with more confidence and reliability. The Pertmaster risk analysis is based on the risk management process outlines in Chapter 11 of the Project Management

Institute's "*A Guide to the Project Management Body of Knowledge*" and consists of the components shown below. The process is not strictly linear; there may be considerable repetition of certain steps before moving on.

Schedule Review

The purpose of the Schedule Review "Characterization" is to check the grantee project schedule, referred to as the Current Probable Schedule (CPS) for logic errors, open-ended tasks, negative lags, start-to-finish links, and other potential problems that could compromise the risk analysis. This step ensures the integrity of the schedule and improves the chances for a meaningful analysis. If mechanical or fundamental revisions are necessary based upon the schedule characterization, the risk management team makes the necessary adjustments and creates a revised schedule file, called the Adjusted Project Schedule (APS).

Pre-Analysis Check

A rudimentary analysis of the schedule is performed to identify activities that drive project duration and costs. These activities merit the closest attention during subsequent detailed risk analysis.

Build a Risk Model

Estimates for duration, cost, and resource uncertainty for each project task are identified by a specific team of experts relying on industry statistics and experience. The estimate uncertainty duration ranges are incorporated into a copy of the project schedule called the Estimate Uncertainty Model (EUM).

The team then brainstorms a list of potential risk events, evaluates the risk events as to how likely it is that they may occur and the potential impact such occurrences may have. The list of risk events is then entered into a risk register and each risk event is assigned a probability and impact, resulting in a risk degree factor, which is scored by the risk modeling software. At this point, a copy of the EUM is made, to which Pertmaster then applies the uncertainty and maps the risk events to the appropriate tasks to build a risk model, called an Impacted Risk Model (IRM).

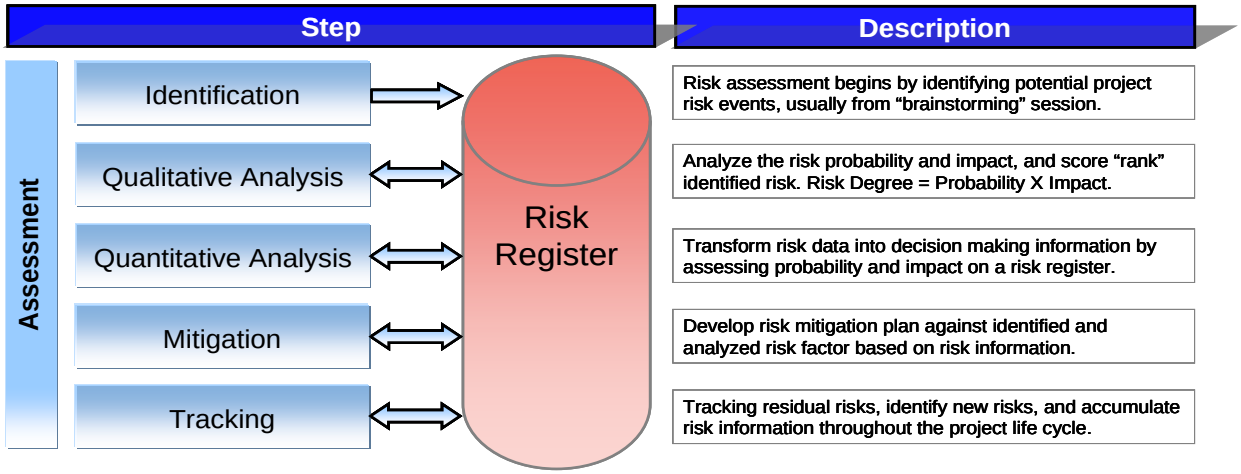
Analyze and Review

A "Monte Carlo" or "Latin Hypercube" sampling analysis is run on the IRM. The risk analysis output can be viewed and evaluated in a wide variety of reports. The review options allow the risk management team to focus of areas of the schedule that pose the greatest risk to the overall program. This helps with the creation of an efficient and cost-effective risk mitigation plan.

Mitigate and Report

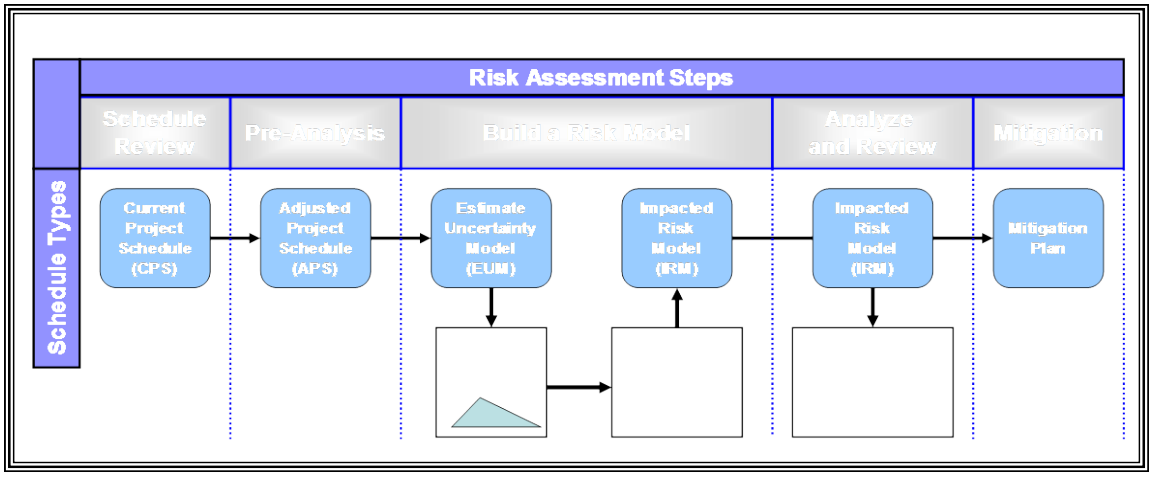
Based on the preliminary analysis, the risk management team reviews and evaluates alternative scenarios with varying reductions to duration, resource and cost uncertainty. Ultimately, the most cost-effective risk mitigation strategy is chosen and formalized into a risk mitigation plan.

Figure 1. Schedule Risk Assessment Process



The figure below describes the various schedules that are created once the PMOC commences the OP 34 review of the grantee's project schedule, called the CPS. The final product is the Impacted Risk Model (IRM), which the PMOC uses for the risk analysis in Pertmaster.

Figure 2. Schedule Risk Assessment Steps and Schedule Types



2.6.2 Schedule Risk Analysis

Project Schedule Review

The PMOC used the grantee's project schedule file *"HRTP Baseline Progress Schedule REV.04.xer"* (CPS) to conduct the Schedule Review. The PMOC concentrated its efforts on ensuring that a detailed, mechanical and fundamentally sound schedule was used for both the risk assessment and the contingency analysis. The grantee and the PMOC collaboratively worked through initial master program schedule development to ensure adequate detail and logic to support the PMOC risk analysis.

The PMOC made a backup copy of the CPS electronic file and made several logic adjustments to

account for poor or missing logic ties and increased some activity detail to better represent the network logic in order to produce a more realistic risk analysis model. The PMOC used the "adjusted" project schedule, herein referred to as the "Adjusted Project Schedule" (APS), to provide more realistic risk assessment and contingency analysis output. The APS is considered most optimistic, as it is stripped of all latent and patent time contingency.

The HART Basis of Schedule stated that all activities in the MPS contained a 12% contingency. The PMOC has repeatedly recommended that HART should not apply a standard contingency amount across all activities or across varying complexities of work across the project alignment. In addition, it is the PMOC's professional opinion that, of activities containing an original duration less than 8 days, a substantial number do not contain a true 12% contingency.

Most activities in the MPS utilize a 7-day per week calendar that does not contain non-work periods for weekends or holidays. The PMOC has continually recommended HART use multiple calendars to more accurately represent and distinguish non-work periods. The PMOC removed (stripped) 10% contingency from the Airport and City Center construction activities, and some of the same section alignment final design activities. The PMOC believes many of the original and remaining durations are optimistic and do not contain 12% contingency as expressed by the HART GEC and project control staff. This is especially the case when considering that the Basis of Schedule does not comprehensively explain how all activities durations were calculated and does not provide supporting documentation explaining the 12% "built-in" contingency. Lastly, the FTA Roadmap and FTA and PMOC review periods contain short timeframe durations in an effort to achieve an FFGA by the fall of 2012. These activities certainly do not contain contingency and are optimistic based on documented historical data related to FFGA Application and FTA review. The risk analysis adjusts the activity duration distribution ranges in order to establish a reliable and supportable risk analysis calculation, primarily for determining the project completion date.

The PMOC inserted activity milestone (points) which represent 20, 50, 75, and 90% construction completion. The project revenue service date (RSD) was used as the 100% completion point. The PMOC created the following logic ties for each milestone activity:

- 20% construction completion milestone after completion of the Core Systems Contract Final Design Approval
- 50% construction completion milestone after completion of the MSF and completion of the Kamehameha Guideway section
- 75% construction completion milestone after completion of the Airport Guideway and Airport Stations Group construction and after the first vehicle delivery package
- 90% construction completion after the construction completion of the Kaka'ako Station and the City Center Guideway completion

A summary of the PMOC adjustments are listed below:

1. Deleted (stripped) activities BUFF-1, BUFF-2, and BUFF-3 which represented time contingency
2. Changed remaining duration to "at completion duration" for the following activity ID's:
    a. PA-0910
    b. FFGA-002

c. FD140-2170
d. MM900-2050
e. MM910-169oh
f. DBB275-0270R
g. UTIL 500H
h. P-SCAP0072

3. Deleted "steps" that were built-into the following activities:
    a. PA-0570
    b. PA-0220

4. FFGA execution contained an excess of 800 days float, which is not realistic; so the PMOC added successor activities:
    a. Airport guideway design
    b. Airport station design
    c. City Center Guideway utility design
    d. Kaka'ako Stations Design

Once all of the above adjustments were made to the APS, the PMOC generated a schedule run report (F9 Report). The APS completion date and interim milestone data are provided in the table below:

Table 7. CPS to APS Milestone Comparison

Activity Description	CPS - Finish Dates	APS - Finish Dates
FFGA Award	07-Oct-12	07-Oct-12
20% Construction	N/A	13-Jan-14
50% Construction	N/A	03-Jan-16
75% Construction	N/A	04-Mar-17
90% Construction	N/A	29-Apr-18
RSD	12-Mar-19	08-Nov-18
N/A = CPS does not contain construction milestone hold-points. These are intended for the risk assessment and contingency management.		

Pre-Analysis Check

The PMOC performed a pre-analysis check by applying a quick risk distribution range across all schedule activities and reviewing the confidence level range, duration sensitivity, and criticality index. Preliminary notes and observations were made for specific schedule drivers. Note the pre-analysis check is performed as a pre-impacted risk analysis, meaning that the schedule does not have risk events incorporated at this point of the risk analysis process.

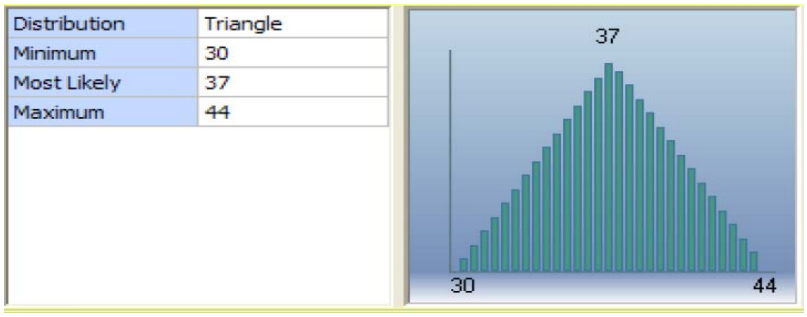
Build a Risk Model "Impacted Risk Plan"

(1) Estimate Uncertainty Model (EUM)

Before running the risk analysis, the PMOC assigned three durations to each activity in the schedule. The three durations for each activity represent best case "minimum", most likely, and

worst case "maximum". The PMOC reviewed the activity Original Durations (OD) in the CPS and made an objective determination of the adequacy of each OD. The PMOC used most of the schedule OD durations as the most-likely durations and, in some cases, the PMOC determined that certain activity ODs were overly optimistic. Most of the "maximum" durations the PMOC assigned are 30-35% greater than their ODs, depending on the work task, project phase and task location. Also, some final design and FFGA related activities containing a one-day duration were assigned a worst case duration of 3 days, or 300% of the original duration. The best case durations were calculated as 95% of the OD, or "- 5%". This value is low because the EUM is already based on a stripped and "best case" schedule. The value ranges (differences in activity durations) reflect levels of uncertainty. Based on the three durations, a triangular distribution was assigned to each activity.

Figure 3. Duration Distribution Type



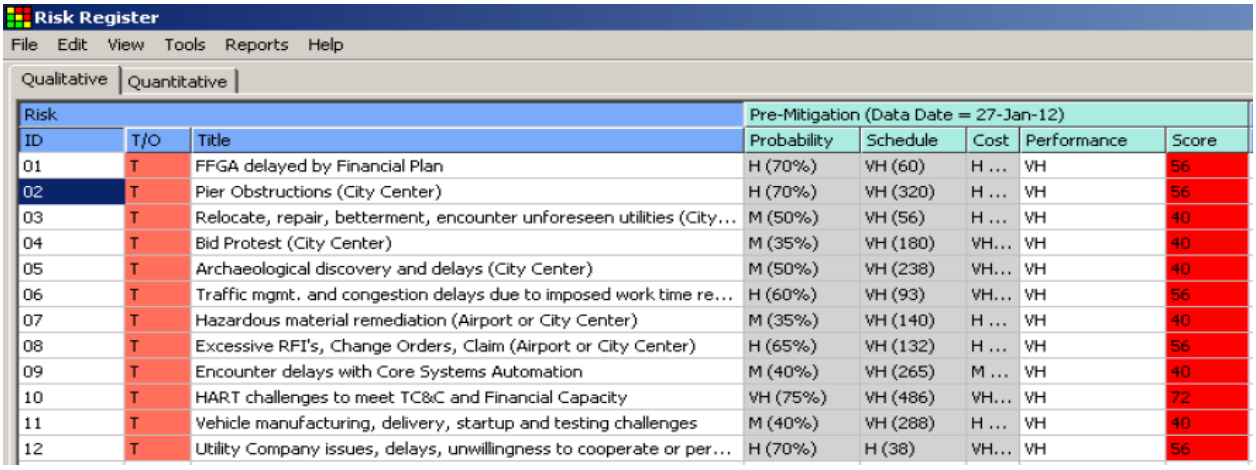
Once the estimate uncertainty process step is complete, the EUM is used to develop the Impacted Risk Model (IRM).

(2) Impacted Risk Model (IRM)

The PMOC conducted a review and evaluation of all risks in the HART Project risk register and the PMOC risk register in order to decide which risk events should be used for the schedule risk analysis (Pertmaster). Once the risks were culled and prioritized, the PMOC assigned the risks events into the longest critical path and into the respective project alignment sections, WOFH/ Kamehameha, Airport and City Center, and the MSF.

Twelve risk events (ID numbers) are used in the risk register to build the risk plan. Many of the risk events are tied to the Airport and City Center section alignment since they are located near downtown and inherently contain more uncertainty than the more westerly, non-critical alignment sections that do not do adversely affect the risk analysis. The Pertmaster risk register used to generate the IRM is included in the figure below:

Figure 4. Schedule Risk Register



Risk Register

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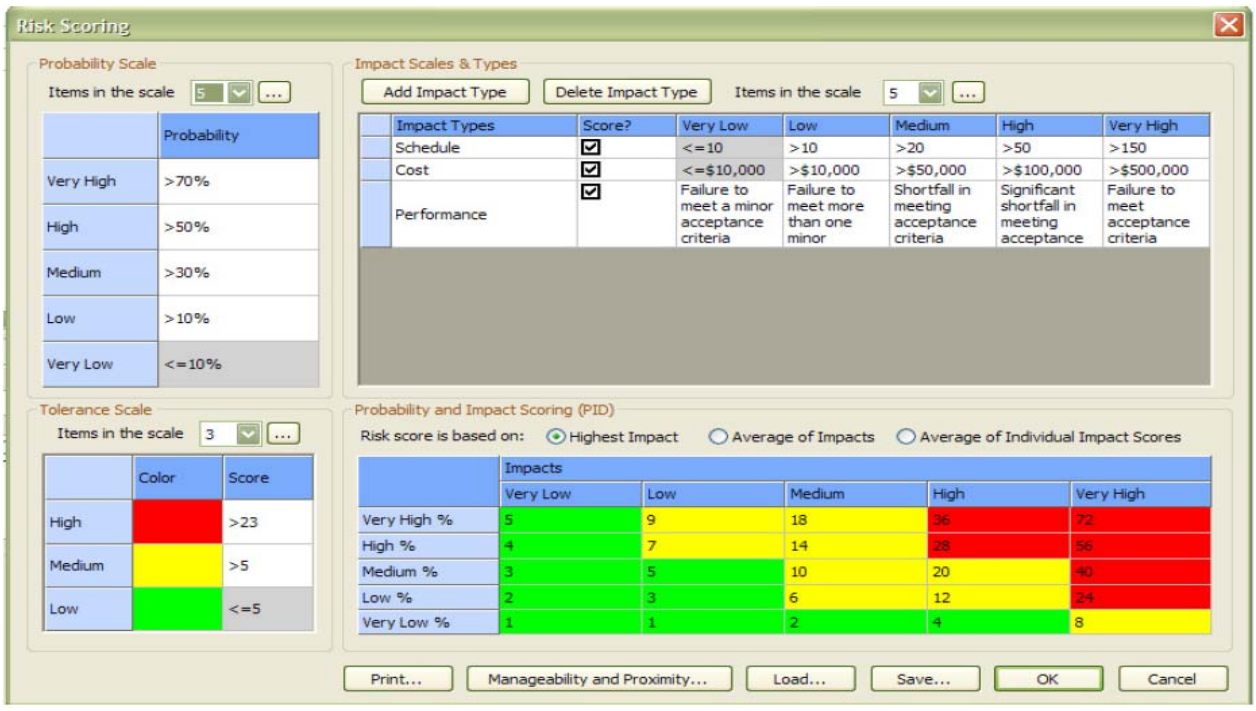
Qualitative | Quantitative

Risk			Pre-Mitigation (Data Date = 27-Jan-12)				
ID	T/O	Title	Probability	Schedule	Cost	Performance	Score
01	T	FFGA delayed by Financial Plan	H (70%)	VH (60)	H ...	VH	56
02	T	Pier Obstructions (City Center)	H (70%)	VH (320)	H ...	VH	56
03	T	Relocate, repair, betterment, encounter unforeseen utilities (City...	M (50%)	VH (56)	H ...	VH	40
04	T	Bid Protest (City Center)	M (35%)	VH (180)	VH...	VH	40
05	T	Archaeological discovery and delays (City Center)	M (50%)	VH (238)	VH...	VH	40
06	T	Traffic mgmt. and congestion delays due to imposed work time re...	H (60%)	VH (93)	VH...	VH	56
07	T	Hazardous material remediation (Airport or City Center)	M (35%)	VH (140)	H ...	VH	40
08	T	Excessive RFI's, Change Orders, Claim (Airport or City Center)	H (65%)	VH (132)	H ...	VH	56
09	T	Encounter delays with Core Systems Automation	M (40%)	VH (265)	M ...	VH	40
10	T	HART challenges to meet TC&C and Financial Capacity	VH (75%)	VH (486)	VH...	VH	72
11	T	Vehicle manufacturing, delivery, startup and testing challenges	M (40%)	VH (288)	H ...	VH	40
12	T	Utility Company issues, delays, unwillingness to cooperate or per...	H (70%)	H (38)	VH...	VH	56

Each risk event was scored based on a risk degree factor. The risk degree factor is calculated by the risk event probability and impact factors. The probability and impact factors for each risk event are objectively determined by the PMOC risk management team. The risk register scoring system prioritizes each risk event by the risk degree factor, see figure below.

Figure 5. Schedule Risk Scoring Chart



Risk Scoring

Probability Scale

Items in the scale 5 ...

	Probability
Very High	>70%
High	>50%
Medium	>30%
Low	>10%
Very Low	<=10%

Impact Scales & Types

Add Impact Type | Delete Impact Type | Items in the scale 5 ...

Impact Types	Score?	Very Low	Low	Medium	High	Very High
Schedule	☑	<=10	>10	>20	>50	>150
Cost	☑	<=$10,000	>$10,000	>$50,000	>$100,000	>$500,000
Performance	☑	Failure to meet a minor acceptance criteria	Failure to meet more than one minor	Shortfall in meeting acceptance criteria	Significant shortfall in meeting acceptance	Failure to meet acceptance criteria

Tolerance Scale

Items in the scale 3 ...

	Color	Score
High		>23
Medium		>5
Low		<=5

Probability and Impact Scoring (PID)

Risk score is based on: ◉ Highest Impact ○ Average of Impacts ○ Average of Individual Impact Scores

	Impacts				
	Very Low	Low	Medium	High	Very High
Very High %	5	9	18	36	72
High %	4	7	14	28	56
Medium %	3	5	10	20	40
Low %	2	3	6	12	24
Very Low %	1	1	2	4	8

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Once the risk events and their risk degree factors are determined, they are incorporated into a copy of the PMOC EUM, resulting in a plan file called the Impacted Risk Model (IRM). The IRM is used to produce all of the schedule analysis "output" reports.

Analyze and Review

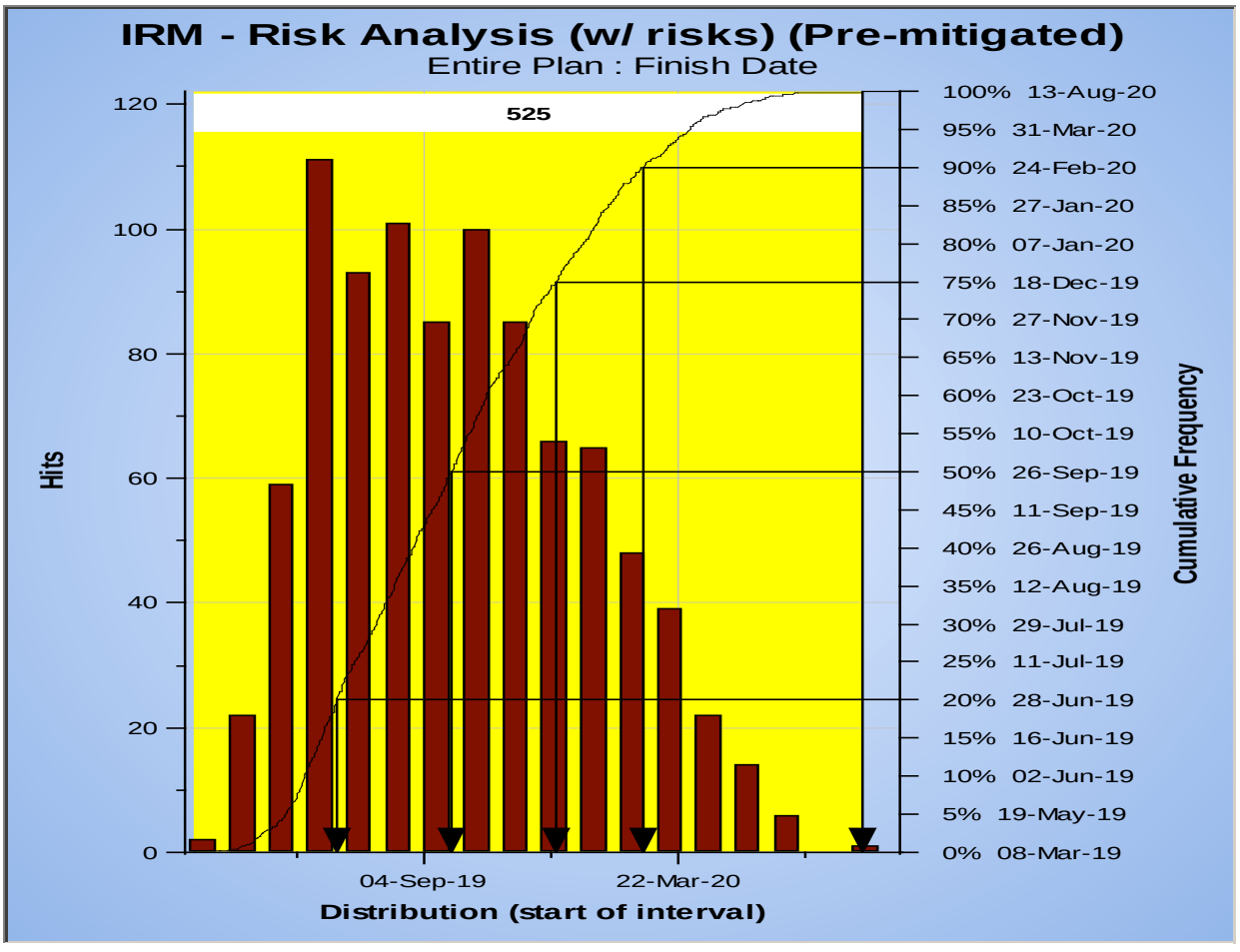
(1) Summary Results

Using the estimate uncertainty and risk events incorporated into the IRM, histogram and tornado graphs are generated to evaluate the distribution ranges and sensitivity factors stemming from the top key schedule drivers. The tornado graphs illustrate three representations of key risk drivers, which are:

- Duration Sensitivity – Size of the risk impact,
- Criticality Index – Frequency of the impact,
- Duration Cruciality – Size and frequency of the impact on the overall project.

The PMOC generated confidence level histograms and duration cruciality tornado diagrams. The IRM schedule was recalculated over 900 times to the point of convergence, selecting random durations for each task, to estimate the project completion date within a confidence range. This analysis yields the results shown in the figure below.

Figure 6. Project Completion Date Confidence Level



The IRM distribution range for project completion ranges from the 0% to 100% confidence levels span a 525-day period. The probability percentage points for the IRM are:

- 20% Confidence level completion date: 28-Jun-19
- 50% Confidence level completion date: 26-Sep-19
- 75% Confidence level completion date: 18-Dec-19
- 90% Confidence level completion date : 24-Feb-20
- 100% Confidence level completion date: 13-Aug-20

The risk event results are produced by running a schedule analysis using the IRM which contains qualitative risk events within the software risk register. The true indication of how sensitive each risk event ultimately becomes is not realized until the analysis is performed. For example, a risk event with a very high score does not necessarily mean that it will be highly sensitive to the schedule, as it may only affect non-critical activities containing total float. The schedule drivers that contain the most impact potential contain a high risk degree and are on the longest critical path or near critical path.

(2) Analysis of Interim Milestones

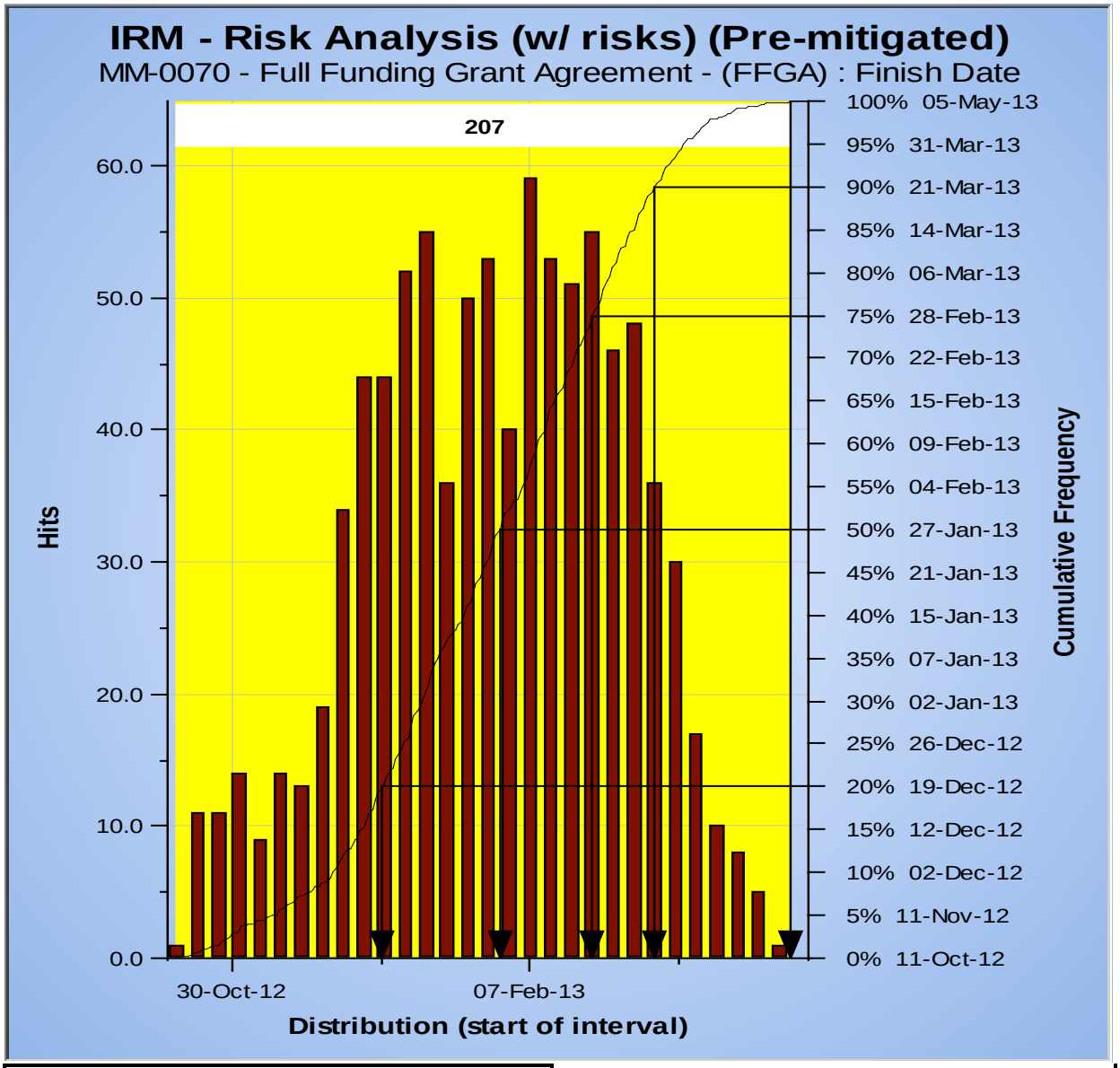
In addition to the calculation of the RSD, to assess the schedule mitigation capacity of the project, a schedule distribution was calculated for each of the schedule milestones. The table below summarizes the confidence level amounts for each of the Project milestones used in the schedule risk assessment.

Table 8. IRM Milestone Probability of Achievement Date

Project Milestone	Activity ID	IRM Milestone Dates – Percentile Rank				
		20th	50th	75th	90th	Maximum
20% Construction	20	22-Feb-14	18-Mar-14	07-Apr-14	25-Apr-14	15-Jun-14
FFGA Award	F270	19-Dec-12	27-Jan-13	28-Feb-13	22-Mar-13	05- May-13
50% Construction	50	01-Apr-16	08-May-16	12-Jun-16	09-Jul-16	04-Oct-16
75% Construction	75	06-Jul-17	18-Aug-18	12-Oct-18	28-Nov-18	28-Feb-18
90% Construction	90	02-Nov-18	12-Dec-18	15-Jan-19	14-Feb-19	04-May-19
Open to City Center 3	9999	28-Jun-19	26-Sep-19	18-Dec-19	24-Feb-20	13-Aug-20

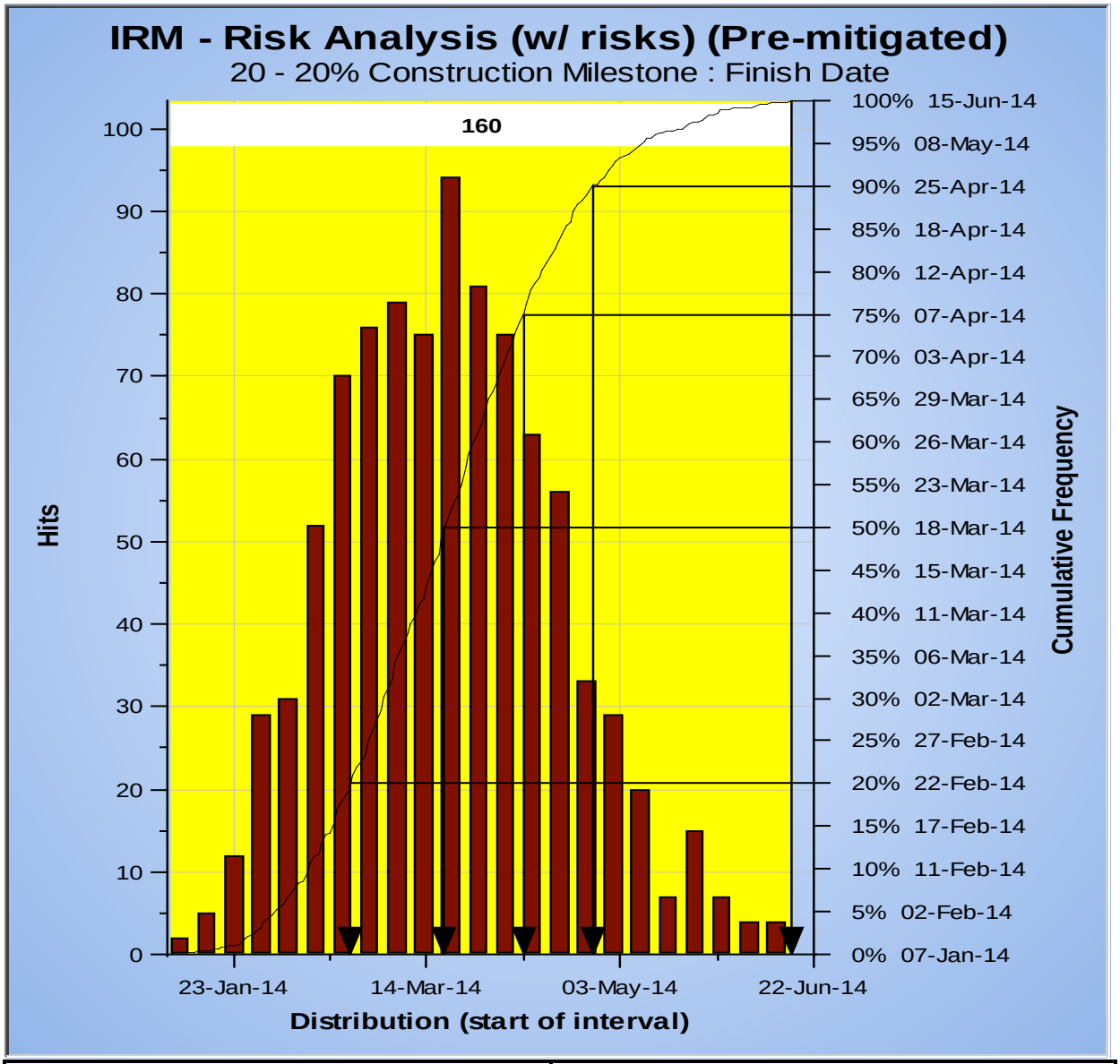
The data illustrates the Project milestone IRM confidence level distribution as summarized in the table above.

Figure 7. Activity ID F270 “FTA Approval of FFGA”



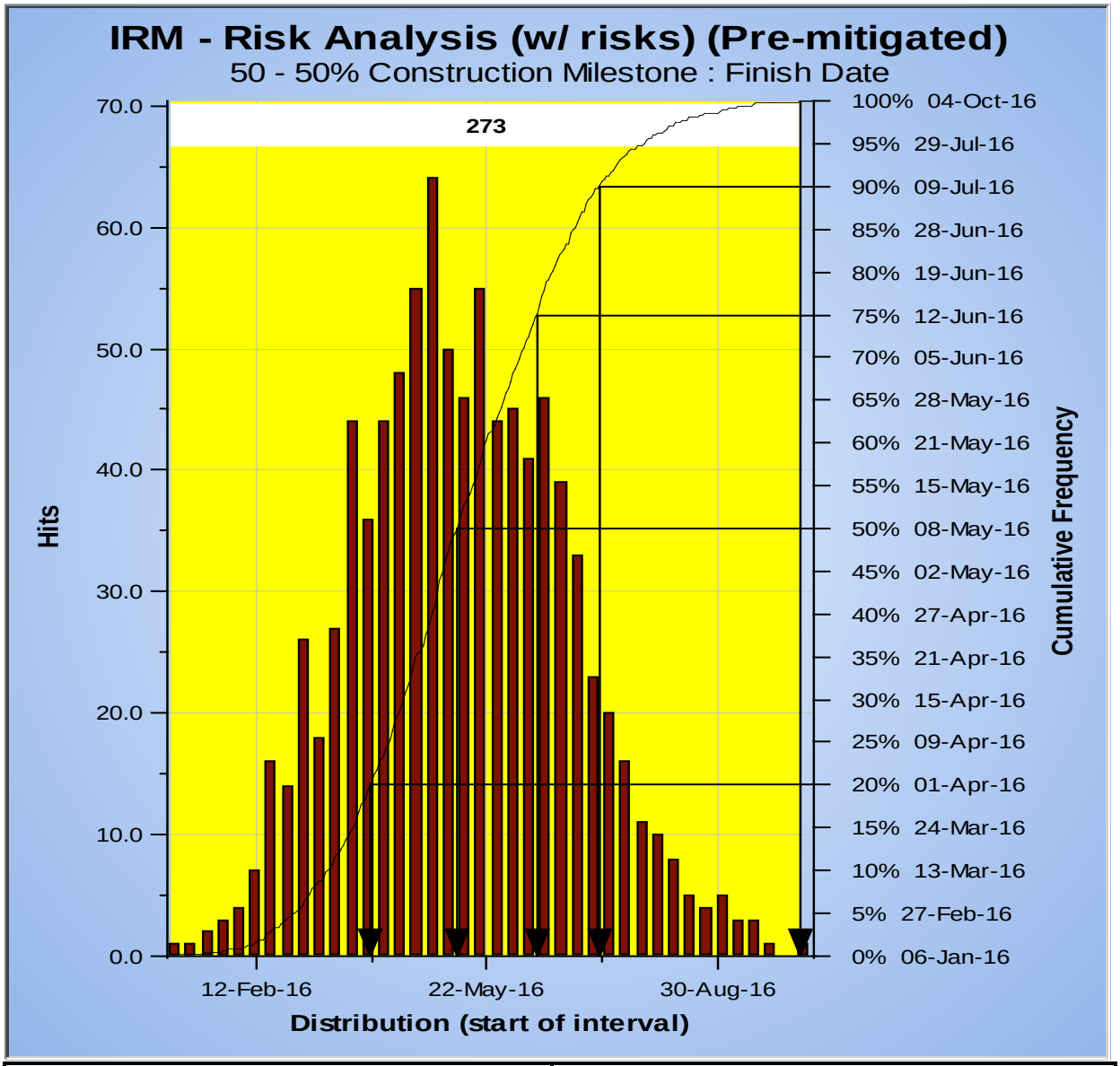
Earliest Date	11-Oct-12	Range of Uncertainty
Latest Date	05-May-13	207 Calendar Days
Most Likely (50 Percentile)	27-Jan-13	

Figure 8. Activity ID 20 "20% Construction"



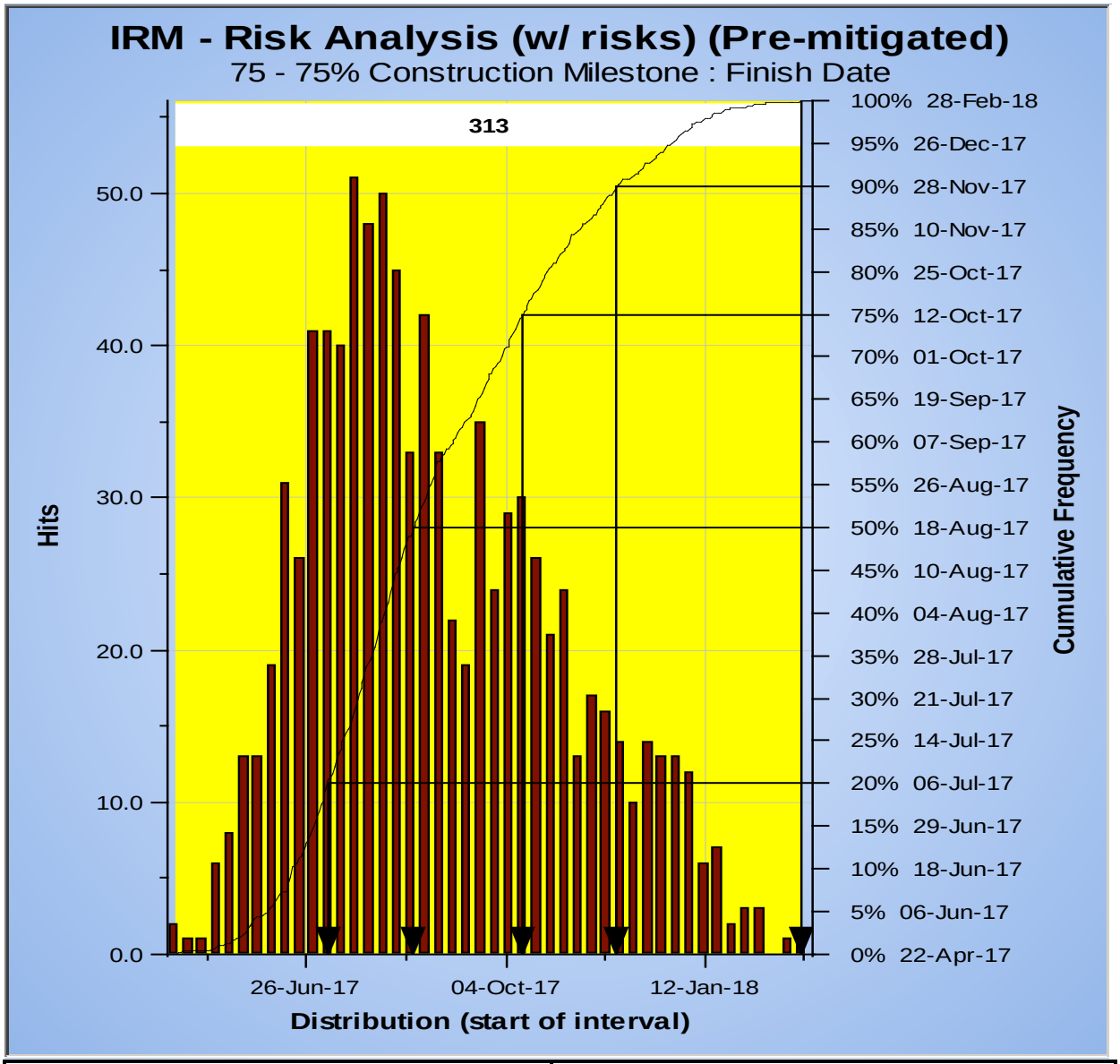
Earliest Date	07-Jan-14	Range of Uncertainty
Latest Date	15-Jun-14	160 Calendar Days
Most Likely (50 Percentile)	18-Mar-14	

Figure 9. Activity ID 50 "50% Construction"



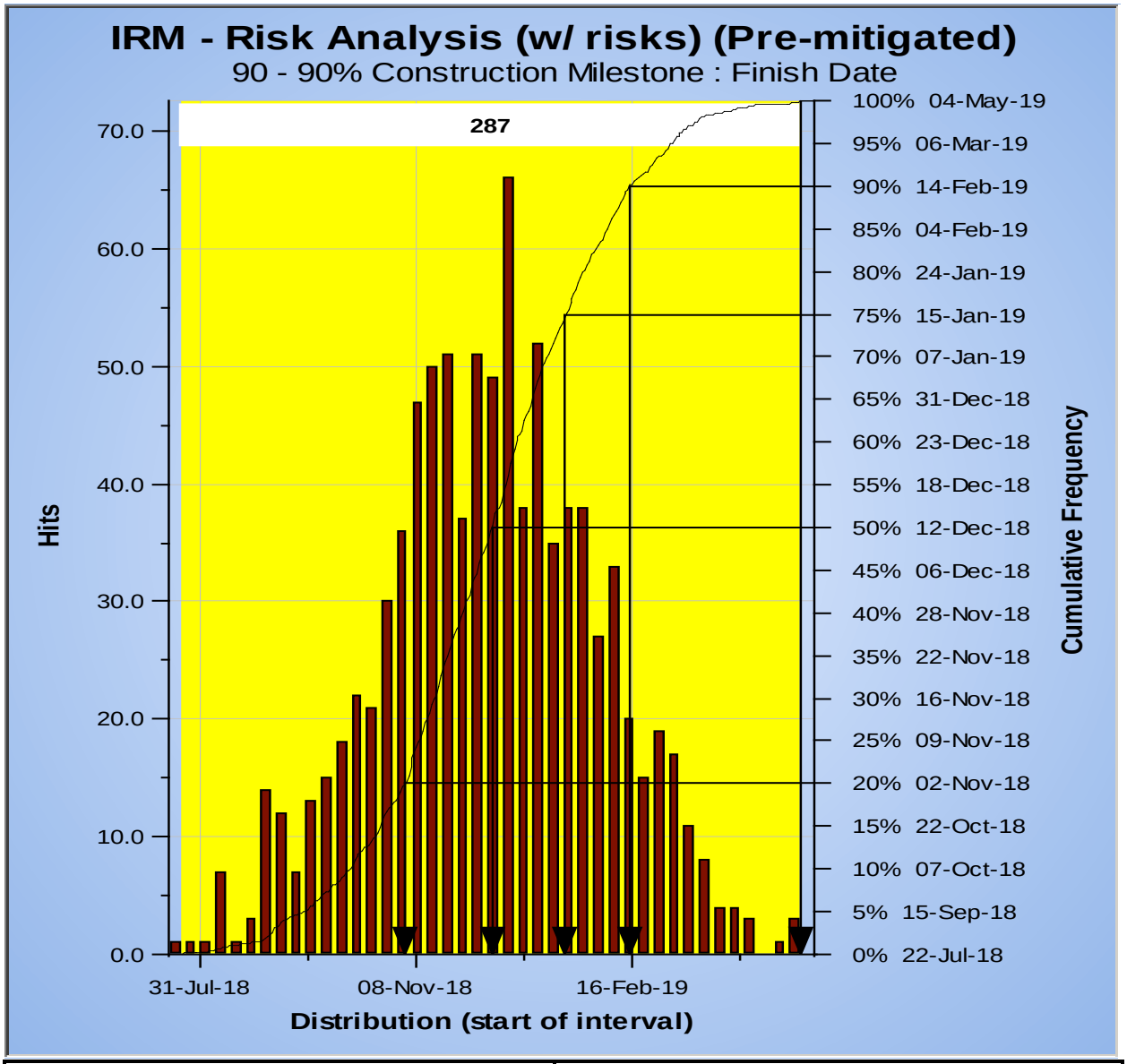
Earliest Date	06-Jan-16	Range of Uncertainty
Latest Date	04-Oct-16	273 Calendar Days
Most Likely (50 Percentile)	08-May-16	

Figure 10. Activity ID 75 "75% Construction"



Earliest Date	22-Apr-17	Range of Uncertainty
Latest Date	28-Feb-18	313 Calendar Days
Most Likely (50 Percentile)	18-Aug-17	

Figure 11. Activity ID 90 "90% Construction"



Earliest Date	22-Jul-18	Range of Uncertainty
Latest Date	04-May-19	287 Calendar Days
Most Likely (50 Percentile)	12-Dev-18	

2.7 Risk Mitigation

2.7.1 Primary Mitigation

Grantee has provided a risk register with its identification of project risks. That list contains information related to action plans for mitigation of the identified risks. Development of a formal Risk and Contingency Management Plan (RCMP) as an integral part of the grantee's Project Management Plan is expected, including establishment within the grantee's organization of authority to ensure that the RCMP is well-managed. An acceptable RCMP was submitted on

September 27, 2011; an updated version dated June 29, 2012 has been provided to the PMOC. Primary mitigation is comprised of the management actions defined within the RCMP that will occur to reduce or eliminate current or future identified risks.

Findings regarding the updated RCMP

(1) Organizational structure identified in the RCMP has been adjusted to improve risk management throughout the project life.
(2) RCMP includes more refined plans for the grantee to monitor and mitigate high-risk rated items.
(3) RCMP demonstrates that risk identification, assessment, and mitigation continue as a part of the project management process.
(4) Some strengthening of the risk contingency tracking, custody, and reporting is indicated in the updated RCMP. A revised contingency draw-down curve has been included in the RCMP. This revised curve was required due to a significant use of contingency that violated earlier contingency draw-down controls.
(5) This strengthening includes plans for more frequent (monthly) reviews of the remaining cost and schedule contingencies to ensure they are within the control limits set by the cost and schedule contingency draw-down curves.
(6) This strengthening of the contingency tracking and control is welcomed. However, diligence and vigilance must continue to be applied to this effort to avoid a rapid contingency usage that could ultimately leave the project unprotected.

2.7.2 Secondary Mitigation

Secondary mitigation consists of pre-planned potential scope or process changes that may be triggered when risk events occur that cause overruns that cannot be resolved by available project contingency. Example events that may incur secondary mitigation include right of way costs 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 and reduction of contingency for future work. Such "triggered" mitigation would enable the grantee to make cost reductions in a planned and orderly process and preserve contingencies for use later in the project. It is noted that Secondary Mitigation is not to be confused with a value engineering exercise. Value engineering is a formal, systematic, multi-disciplined process designed to optimize the value of each dollar spent.

Table 9 utilizes model information to estimate required amounts of secondary contingency. The overall secondary mitigation recommendation of $219 million took into consideration all three Risk Profile portions of the project:

- Risk Profile 1 and 2 include $70 million in Secondary Mitigation and represent portions of the project that have already been contracted for construction.
- Risk Profile 3 includes $149 million in Secondary Mitigation and represents pre-contracted conditions.

It is well-recognized that secondary mitigation is difficult to cost-effectively obtain where portions of the project are already contracted for construction (Risk Profiles 1 and 2). However,

Risk profile 3 consists of pre-contracted conditions, and therefore, development of secondary mitigation for this portion of the work is more available. The PMOC-recommended amount of secondary mitigation is based on Risk Profile 3 only, or $149 million.

In its most current RCMP, the grantee provides a list of potential Secondary Mitigation items whose total value varies from an estimated $68 million to $181 million. The nature of these estimates implies that the degree of estimate to develop these values is rather subjective and therefore caution should be applied to relying on the upper end of the value range. Utilizing a common 1/3 offset from the lower end of the range, a planning value of $106 million may be more realistic, and is used in the following discussion of adequacy of Secondary Mitigation. However, the lack of detailed design or estimating for the Secondary Mitigation items precludes strong reliance on the grantee-provided Secondary Mitigation.

Table 9. PMOC Recommended Secondary Mitigation

YOE Grantee values	Overall	Part 1	Part 2	Part 3
Grantee total estimate (SCC 10-90)	4,948,635	574,853	1,932,807	2,440,975
Grantee exposed contingency	642,285	32,504	144,570	465,210
Grantee stripped estimate (SCC 10-80)	4,306,350	542,349	1,788,237	1,975,764
YOE PMOC values				
Latent contingency	0	0	0	0
Inflation Adjustment	0	0	0	0
Adjustments	15,243	0	0	15,243
Adjusted estimate	4,321,594	542,349	1,788,237	1,991,008
Model recommendations				
Recommended estimate	4,979,691	577,244	1,962,184	2,440,263
Contingency recommendation	658,097	34,895	173,948	449,255
Contingency %	15%	6%	10%	23%
Secondary mitigation target	5,198,290	588,835	2,019,964	2,589,491
Secondary mitigation recommended amount	218,599	11,591	57,780	149,228
Secondary mitigation %	5%	2%	3%	7%

Findings

(1) RCMP includes several potential Secondary Mitigation options. However, there is a lack of detailed development of plans and cost estimates for the items identified in the RCMP.

(2) The amount of secondary mitigation identified in the RCMP is assessed by the PMOC to be approximately $106 million.

(3) The PMOC recommended amount of secondary mitigation is $149 million.

Recommendations Regarding Secondary Mitigation

(1) Prior to execution of an FFGA, the grantee should develop more details for the Secondary Mitigation items and attempt to identify secondary mitigation measures that approach a total value of $149 million. Failure to do so will preclude the ability to develop these items in the design documents and include them as deductive alternates in construction contracting proposals.

2.7.3 Cost Contingency

The PMOC identified YOE $644 million in allocated and unallocated contingency, and found no additional latent contingency. This amount is reflected in Table 10.

Table 10. PMOC Recommended Contingency

YOE Grantee values	Overall	Part 1	Part 2	Part 3
Grantee total estimate (SCC 10-90)	4,948,635	574,853	1,932,807	2,440,975
Grantee exposed contingency	642,285	32,504	144,570	465,210
Grantee stripped estimate (SCC 10-80)	4,306,350	542,349	1,788,237	1,975,764
YOE PMOC values				
Latent contingency	0	0	0	0
Inflation Adjustment	0	0	0	0
Adjustments	15,243	0	0	15,243
Adjusted estimate	4,321,594	542,349	1,788,237	1,991,008
Model recommendations				
Recommended estimate	4,979,691	577,244	1,962,184	2,440,263
Contingency recommendation	658,097	34,895	173,948	449,255
Contingency %	15%	6%	10%	23%
Secondary mitigation target	5,198,290	588,835	2,019,964	2,589,491
Secondary mitigation recommended amount	218,599	11,591	57,780	149,228
Secondary mitigation %	5%	2%	3%	7%

The PMOC prepared a risk assessment by Risk Profile as previously described. At this refresh, the PMOC recommends an approximate 6% contingency for the Risk Profile 1 portion of the work, approximately 10% for the Risk Profile 2 portion, and approximately23% contingency for the Risk Profile 3 portion of the work, equating to an overall contingency recommendation of $658 million (or ~15%), indicating a $14 million shortage of contingency.

Findings Regarding Cost Contingency

(1) The grantee's estimate is $4,949 million, which includes a stripped estimate of $4,305 million plus a contingency of $644 million.

(2) The PMOC recommended estimate is $4,978 million, which includes a stripped estimate of $4,305 million, plus $15 million in cost adjustments for "Contractor Markups" as detailed in the OP 33 report, and plus a recommended contingency of $658 million.

(3) The recommended estimate represents the median value from the FTA risk assessment model, when adjusted for the specifics of this project. The historic trend indicates that 80% of similarly-scoped projects have fallen within the range of $4,497 million to $5,789 million.

(4) The grantee's estimate falls short of the PMOC-recommended estimate by $29 million ($15 million in recommended adjustments and $14 million in recommended contingency).

(5) The difference between the grantee's project estimate of $4,949 million and the PMOC's recommended estimate of $4,978 million is 0.6%.

(6) It is observed that significant contingency reduction occurred since the recent prior risk review, to a point where contingency is below accepted control levels. The grantee has identified a total of $644 million in contingency. This is $222 million less than the amount of contingency of $866 million identified during the prior review to support the request to enter into Final Design.

(7) It is recognized that efforts have been made to recover contingency levels through cost reduction measures, value engineering, and revised project delivery strategies.

(8) The grantee's estimated finance charges for the project are $173 million.

Recommendations

(1) The grantee's total project estimate of $5,122 million, including $644 million in total contingency and $173 million in finance charges, is acceptable to support an FFGA.

(2) Strong controls must be put in place immediately to avoid future rapid contingency reduction. The frequency and the levels of project management to which these statistics are reported should be improved and monitored monthly.

2.7.4 Schedule Contingency

Adjusted Project Schedule (APS)

The APS was used for both the schedule risk assessment and the Contingency Analysis Review. The APS is a backup copy of the grantee's Master Project Schedule (MPS) with adjustments made to logic, calendars and incorporation of additional activities to better reflect a logical critical path and alleviate excessive float in certain other logic paths. The APS is also stripped of all patent and latent contingency. Because the APS is pre-analysis, not containing estimate uncertainty or risk events, it is considered most optimistic, as it is stripped of all latent and patent time contingency.

Contingency Analysis

The objective of the contingency analysis, pursuant to OP 40, is to estimate the minimum amount of schedule contingency required to complete the project on schedule. The FTA guidance states that the contingency recommendations shall be developed using the following assumptions:

- At the Revenue Service Date, schedule contingency requirements have been reduced to a minimum requirement or possibly eliminated
- At the point of 100% complete with bid, the project should have sufficient schedule contingency available to absorb a schedule delay equivalent to 20% of the duration from Entry into Final Design through Revenue Operations.

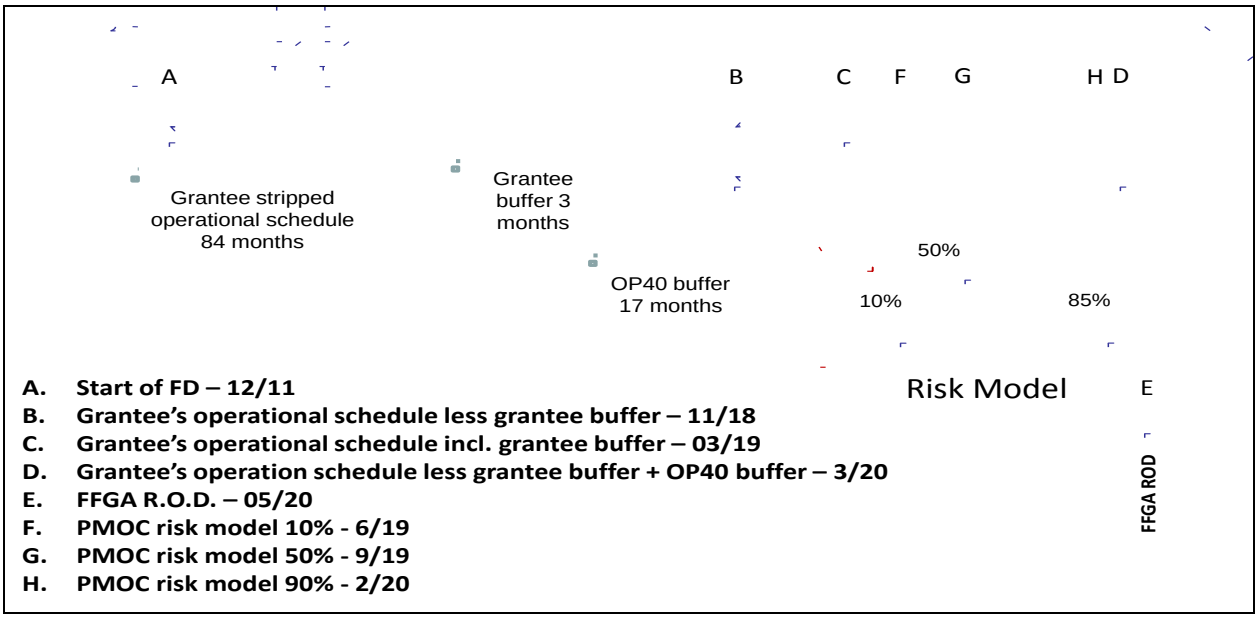
The APS indicates an 83.6-month duration from the start of the APS Final Design through RSD. According to the OP40, the project should contain the equivalent of 20% of this duration as contingency. The result is a contingency buffer total of 16.6 months. The result of adding 16.6 months contingency to the APS RSD (08-Nov-18) is shown in the table below. The OP 40 buffer float calculation results in an RSD of March 25, 2020.

Table 11. Schedule Contingency Final Design through RSD

Entry to Final Design	APS RSD	Duration			20% Float Duration			APS RSD 20% Float added to RSD	CPS RSD Date	Additional Float Required (Variance)		
		Dys	Mth	Yrs	Day	Mth	Yrs			Dys	Mth	Yrs
29-Dec-11	08-Nov-18	2,515	83.6	6.9	503	16.6	1.4	**25-Mar-20**	12-Mar-20	378	12.6	1.04

The figure below illustrates the same information relative to the PMOC Schedule Risk Analysis IRM dates plotted for the 10, 50 and 90th percentiles represented by letters F, G and H, respectively. The OP40 calculation for buffer float and the PMOC IRM 95th percentile both reflect a Project Completion Date of Mar 2020.

Figure 12. Buffer Float and RSD Analysis



Findings

(1) The Grantee's target Revenue Service Date is March 2019.

(2) The schedule risk analyses indicate that the Revenue Service Date be no earlier than the first quarter of 2020.

Recommendations

(3) The Revenue Service Date identified in the FFGA should be January 31, 2020.

2.8 Conclusion

(1) Cost Risk Assessment:

- The PMOC has refreshed its earlier risk review and presented its preliminary results to the grantee in April 2012. Concern was expressed over the rate of project cost contingency usage.
- The grantee responded with revised plans, estimates, and schedules to address the contingency shortfall.
- The PMOC has prepared this risk refresh based upon the grantee's revisions.
- The PMOC separated the project into three distinct risk profiles to better model the effect of risk upon the project.
- The PMOC found that the grantee's risk identification effort, including its risk mitigation activities, generally conforms to its documented processes.

- The cost risk assessment found few exceptional cost risks. No Beta value changes impacting all SCCs were included as a result of the grantee's prior lack of contingency management since there is increased emphasis on cost and schedule controls included in the RCMP.

(2) Project Cost Estimate:

- The grantee's estimate is $4,949 million, which includes a stripped estimate of $4,305 million plus a contingency of $644 million.
- The PMOC recommended estimate is $4,978 million, which includes a stripped estimate of $4,305 million, plus $15 million in cost adjustments for "Contractor Markups" as detailed in the OP 33 report, and plus a recommended contingency of $658 million.
- The recommended estimate represents the median value from the FTA risk assessment model, when adjusted for the specifics of this project. The historic trend indicates that 80% of similarly-scoped projects have fallen within the range of $4,497 million to $5,789 million.
- The grantee's estimate varies from the PMOC-recommended estimate by $29 million ($15 million in recommended adjustments and $14 million in recommended contingency).
- The difference between the grantee's project estimate of $4,949 million and the PMOC's recommended estimate of $4,978 million is 0.6%.
- It is observed that significant contingency reduction occurred since the recent prior risk review, to a point where contingency is below accepted control levels. The grantee has identified a total of $644 million in contingency. This is $222 million less than the amount of contingency of $866 million identified during the prior review to support the request to enter into Final Design.
- It is recognized that efforts have been made to recover contingency levels through cost reduction measures, value engineering, and revised project delivery strategies.
- The grantee's estimated finance charges for the project are $173 million.

(3) Risk and Contingency Management Plan (RCMP):

- Organizational structure identified in the RCMP has been adjusted to improve risk management throughout the project life.
- RCMP includes more refined plans for the grantee to monitor and mitigate high-risk rated items.
- RCMP demonstrates that risk identification, assessment, and mitigation continue as a part of the project management process.
- Some strengthening of the risk contingency tracking, custody, and reporting is indicated in the updated RCMP. A revised contingency draw-down curve has been included in the RCMP. This revised curve was required due to a significant use of contingency that violated earlier contingency draw-down controls.
- This strengthening includes plans for more frequent (monthly) reviews of the remaining cost and schedule contingencies to ensure they are within the control limits set by the cost and schedule contingency draw-down curves.
- This strengthening of the contingency tracking and control is welcomed.

However, diligence and vigilance must be applied to this effort to avoid a high rate of contingency use that could ultimately leave the project unprotected.

(4) Secondary Mitigation Measures:

- RCMP includes several potential Secondary Mitigation options. However, there is a lack of detailed development of plans and cost estimates for the items identified in the RCMP.
- The amount of secondary mitigation identified in the RCMP is assessed by the PMOC to be approximately $106 million.
- The PMOC recommended amount of secondary mitigation is $149 million.

(5) Project Schedule:

- The Grantee's target Revenue Service Date is March 2019.
- The PMOC recommends that the Revenue Service Date identified in the FFGA be no earlier than the first quarter of 2020.

2.9 Recommendations

(1) The grantee's total project estimate of $5,122 million, including $644 million in total contingency and $173 million in finance charges, is acceptable to support an FFGA.

(2) The Revenue Service Date identified in the FFGA should be January 31, 2020.

(3) Strong controls must be put in place immediately to avoid future rapid contingency reduction. The frequency and the levels of project management to which these statistics are reported should be improved and monitored monthly.

(4) Prior to execution of an FFGA, the grantee should develop more details for the Secondary Mitigation items and attempt to identify secondary mitigation measures that approach a total value of $149 million. Doing so will strengthen the ability to develop these items in the design documents and include them as deductive alternates in construction contracting proposals.

APPENDICES

Appendix A: List of Acronyms

A	▪	Ampere
AA	▪	Alternatives Analysis
AACE	▪	Association for the Advancement of Cost Engineering
AC	▪	Alternating Current
ACT ID	▪	Activity Identification
ADA	▪	Americans with Disabilities Act
AHJV	▪	Ansaldo Honolulu Joint Venture
ANSI	▪	American National Standards Institute
APB	▪	Absolute Permissive Block
APS	▪	Adjusted Project Schedule
APTA	▪	American Public Transportation Association
ASCE	▪	American Society of Civil Engineers
ASHRAE	▪	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	▪	American Society of Mechanical Engineers
ASTM	▪	ASTM International, nee, American Society for Testing and Materials
ATC	▪	Alternative Technical Concept
ATC	▪	Automatic Train Control
ATO	▪	Automatic Train Operation
BAFO	▪	Best and Final Offers
BCE	▪	Base Cost Estimate
BEA	▪	Bureau of Economic Analysis
BFMP	▪	Bus Fleet Management Plan
BLS	▪	Bureau of Labor Statistics
BOS	▪	Basis of Schedule
BRF	▪	Beta Risk Factor
BRIC	▪	Brazil, Russia, India and China
CBTC	▪	Communications-Based Train Control
CC	▪	Community College
CE&I	▪	Construction Engineering and Inspection
CER	▪	Cost Estimating Relationship
CIH	▪	Central Instrument Hut
CIL	▪	Central Instrument Location
CIR	▪	Central Instrument Room
CMP	▪	Configuration Management Plan
CMS	▪	Document Management System
COTS	▪	Commercial off-the-Shelf
CPI	▪	Consumer Price Index
CPM	▪	Critical Path Method
CPP	▪	Contract Packaging Plan
CPS	▪	Construction Project Schedule
CPS	▪	Current Probable Schedule
CSC	▪	Core Systems Contract
DB	▪	Design-Build
DBB	▪	Design-Bid-Build
DBEDT	▪	Hawaii Department of Business Economic Development and Tourism
DBOM	▪	Design-Build-Operate-Maintain
DC	▪	Direct Current
DEIS	▪	Draft Environmental Impact Statement
DHHL	▪	Department of Hawaiian Homelands
DOT	▪	United States Department of Transportation
DTS	▪	Department of Transportation Services

ECP	▪	Environmental Condition of Property
EDC	▪	Engineering Design Consultant
EIS	▪	Environmental Impact Statement
ENR	▪	Engineering News Record
ERTMS	▪	European Rail Traffic Management System
EUM	▪	Estimate Uncertainty Model
FAA	▪	Federal Aviation Administration
FAQ	▪	Frequently Asked Questions
FD	▪	Final Design
FEIS	▪	Final Environmental Impact Statement
FF	▪	Finish-Finish
FFGA	▪	Full Funding Grant Agreement
FMOC	▪	Financial Management Oversight Consultant
FS	▪	Finish-Start
ft	▪	Foot
FTA	▪	Federal Transit Administration
FY	▪	Fiscal Year
GBS	▪	Gap Breaker Station
GDP	▪	Gross Domestic Product
GEC	▪	General Engineering Consultant
GET	▪	General Excise Tax
GPRM	▪	Great Pacific Rocky Mountain
HART	▪	Honolulu Authority for Rapid Transportation
HDOT	▪	Hawaii Department of Transportation
HECO	▪	Hawaiian Electric Company
HHCTC	▪	Honolulu High Capacity Transit Corridor
HHCTCP	▪	Honolulu High Capacity Transit Corridor Project
HNL	▪	Honolulu International Airport
HVAC	▪	Heating, Ventilating, and Air Conditioning
ICD	▪	Interface Control Document
IEEE	▪	Institute of Electrical and Electronics Engineers
IPS	▪	Integrated Project Schedule
IRM	▪	Impacted Risk Model
KH (or KHG)	▪	Kamehameha Highway (or Kamehameha Highway Guideway)
kW	▪	Kilowatt
LCD	▪	Liquid Crystal Diode
LONP	▪	Letter of No Prejudice
LPA	▪	Locally Preferred Alternative
LV	▪	Low Voltage
M&I	▪	Manufacture and Install
MDBCF	▪	Mean Distance between Component Failure
MFPR	▪	Multifunction Protective Relay
MIL	▪	Military Specification
MOS	▪	Minimum Operating Segment
MOT	▪	Maintenance of Traffic
mph	▪	Miles Per Hour
mphps	▪	Miles Per Hour Per Second
MPS	▪	Master Project Schedule
MS	▪	Microsoft
MSF	▪	Maintenance and Storage Facility
MSS	▪	Master Summary Schedule
MTTR	▪	Mean Time to Repair
MVA	▪	Mega Volt Ampere
MW	▪	Megawatt
NBER	▪	National Bureau of Economic Research
NEMA	▪	National Electrical Manufacturers Association

NEPA	▪	National Environmental Policy Act
NFPA	▪	National Fire Protection Association
NGD	▪	Negative Grounding Device
NTP	▪	Notice to Proceed
O&M	▪	Operations and Maintenance
OBS	▪	Organizational Breakdown Structure
OCC	▪	Operations Control Center
OCIP	▪	Owner Controlled Insurance Program
OCS	▪	Overhead Contact System
OD	▪	Original Duration
OD	▪	Original Duration
OP	▪	Oversight Procedure
PA	▪	Programmatic Agreement
PB	▪	Parsons Brinckerhoff
PE	▪	Preliminary Engineering
PHF	▪	Peak Hour Factor
PLA	▪	Project Labor Agreement
PLC	▪	Programmable Logic Controller
PMBOK	▪	Project Management Institute's Body of Knowledge
PMC	▪	Project Management Support Consultant
PMO	▪	Project Management Oversight
PMOC	▪	Project Management Oversight Contractor
PMP	▪	Project Management Plan
PPI	▪	Producer Price Index
QA/QC	▪	Quality Assurance/Quality Control
QMP	▪	Quality Management Plan
RA	▪	Risk Assessment
RAM	▪	Responsibility Assignment Matrix
RAMP	▪	Real Estate Acquisition and Management Plan
RBC CBTC	▪	Radio Block-Centered Communications-Based Train Control
RCMP	▪	Risk and Contingency Management Plan
RFMP	▪	Rail Fleet Management Plan
RFP	▪	Request for Proposals
rms	▪	Root Mean Squared
ROD	▪	Record of Decision
ROW	▪	Right-of-Way
RSD	▪	Revenue Service Date
RTD	▪	Rapid Transit Division
SBS	▪	Schedule Breakdown Structure
SCC	▪	Standard Cost Category
SF	▪	Start-Finish
SOA	▪	State Oversight Agency
SS	▪	Start-Start
SSCP	▪	Safety and Security Certification Plan
SSMP		Safety and Security Management Plan
TC	▪	Train Control
TC&C	▪	Technical Capacity and Capability
TCCR	▪	Train Control and Communications Room
TCRP	▪	Transit Cooperative Research Program
TES	▪	Train Electrification System
TPM	▪	Office of Program Management
TPSS	▪	Traction Power Substation
TRB	▪	Transportation Research Board
TRU	▪	Transformer-Rectifier Unit
TVM	▪	Ticket Vending Machine
UH	▪	University of Hawaii

UHERO	▪	University of Hawaii Economic Research Organization
UL	▪	Underwriters Laboratories
UPS	▪	Uninterruptible Power Supply
US	▪	United States of America
USB	▪	Universal Service Bus
USDOT	▪	United States Department of Transportation
USN	▪	United States Navy
V	▪	Volt
UITP	▪	International Association of Public Transport and
UTO	▪	Unattended Train Operation
VDC	▪	Volts, Direct Current
VE	▪	Value Engineering
VTA	▪	Verification, Test, and Acceptance
WBS	▪	Work Breakdown Structure
WOFH	▪	West Oahu/Farrington Highway
YOE	▪	Year of Expenditure

Note: The above list includes all acronyms identified in the various OP deliverables.

Appendix B: Documents Reviewed

Document	Rev. No.	Date
Management Plans/Administrative		
Final Environmental Impact Statement (FEIS)	-	25-Jun-10
Programmatic Agreement (PA)	-	18-Jan-11
Record of Decision (ROD)	-	18-Jan-11
Project Management Plan (PMP)	5.0	29-Jun-12
Quality Management Plan (QMP)	1	05-Feb-12
Real Estate Acquisition and Management Plan (RAMP)	5	31-Jan-12
Bus Fleet Management Plan (BFMP)	3	Mar-12
Rail Fleet Management Plan (RFMP)	0.1	Mar-12
Safety and Security Management Plan (SSMP)	3A	28-Feb-12
Safety and Security Certification Plan (SSCP)	2A	01-Mar-12
Configuration Management Plan	0.2	07-eb-12
Staffing and Succession Plan	5	25-May-12
Operating Plan	0.2	29-Jun-12
Force Account Plan	0.3	05-Jan-12
Mitigation Monitoring Program	0	15-Mar-12
Interface Management Plan	0.1	17-Jan-12
Risk Contingency Management Plan	0	29-Jun-12
Contract Packaging Plan	3	30-Mar-12
Claims Avoidance Plan	0.1	24-Jan-12
Construction Management Plan (CMP)	0.1	03-Feb-12
Contract Resident Engineer Manuals (DB & DBOM)	0.1	Feb-12
Contract Resident Engineer Manual (DBB)	A	15-Feb-12
1.PP-01 – Procedures Index	0	15-Mar-12
1.PP-02 – Procedure Development Process	0.1	12-Mar-12
1.PP-03 – Standard Terms, definitions, and Acronyms	0.1	12-Mar-12
1.PP-04– Baseline Documents Revision and Control	0.1	12-Mar-12
1.PP-05 – Identification of Badge Policy	0.1	15-Mar-12
2.PA-01 – Security Sensitive Information (SSI)	0.1	12-Mar-12
2.PA-02 – Procurement Control	0.1	12-Mar-12
2.PA-03 – Email Management	0.1	12-Mar-12
2.PA- 04- Project Wide Document Control	0.1	12-Mar-12
2.PA-05 – Project Library	0.1	12-Mar-12
2.PA-06 – Community Relations and Media Contacts	0.1	12-Mar-12
2.PA-07 – RTD Training Procedure	0.1	12-Mar-12
2.PA-08 – Policy for Safeguarding Protected Information	0.1	12-Mar-12
2.PA-09 – Permit Procedures	0	15-May-12
3.PM-01 – Contract Management System	1.1	14-Mar-12
3.PM-04 – Public Information Communication	0.1	15-Mar-12
3.PM-05 Meeting/Minutes	2.1	12-Mar-12
4.PC-02 – Project Management Control	0.1	15-Mar-12
4.PC-03 – Project Progress Reports	0.1	15-Mar-12
4.PC-04 – Program Scheduling	0.1	15-Mar-12
4.PC-05 – Project Accounting	0.1	12-Mar-12
4.PC-06 – Cost Estimating	0.1	12-Mar-12
4.PC-07 – Cost Control	0.1	12-Mar-12
4.PC-08 – Risk Management	0.1	12-Mar-12
4.PC-09 – Contingency Management	1	15-Mar-12
5.CA-01 – Contract Administration	0.1	15-Mar-12
5.CA-02 – Contract Change Management	0.1	14-Mar-12

Document	Rev. No.	Date
5.CA-03 – Contractor Progress Payments	0.1	13-Mar-12
5.CA-04 – Contractor Progress Reports	0.1	13-Mar-12
5.CA-05 – Contract Change Orders	0.1	13-Mar-12
5.CA-06 – Contract Closeout	0.1	13-Mar-12
5.CA-07 – Claims and Disputes Resolution	0.2	14-Mar-12
5.CA-08 – CACO and Contract Amendment Procedure	0	14-Mar-12
6.CM-01 – Submittal Procedure	1.1	14-Mar-12
6.CM-02 – RFI Procedure	2.1	14-Mar-12
6.CM-03 – RFC Procedure	0.2	14-Mar-12
6.CM-05 – Interface Management and Coordination Procedure	0.1	12-Mar-12
7.GA-01 – Board – Staff Interaction	0	17-July-11
7.GA-04 – Petty Cash Fund	0	17-July-11
7.GA-06 - Travel	0	17-July-11
7.GA-07 – Preparation of Board Materials	0	20-July-11
Technical		
Design Criteria		
Chapter 1 – General		15-Mar-12
Chapter 2 – Operations		15-Mar-12
Chapter 3 – Environmental Considerations		15-Mar-12
Chapter 4 – Track Alignment and Vehicle Clearances		14-Feb-12
Chapter 5 – Trackwork		15-Mar-12
Chapter 6 – Civil		15-Mar-12
Chapter 7 – Traffic		15-Mar-12
Chapter 8 – Utilities		15-Mar-12
Chapter 9 – Structural		15-Mar-12
Chapter 10 – Architecture		10-Feb-12
Chapter 11 – Landscape Architecture		15-Mar-12
Chapter 12 – Passenger Vehicles		10-Feb-12
Chapter 13 – Traction Electrification		15-Mar-12
Chapter 14 – Train Control		15-Mar-12
Chapter 15 – Communications and Control		15-Mar-12
Chapter 16 – Fare Vending		15-Mar-12
Chapter 17 – Corrosion Control		15-Mar-12
Chapter 18 – Maintenance & Storage Facilities (MSF)		14-Feb-12
Chapter 19 – Facilities Mechanical		15-Mar-12
Chapter 20 – Facilities Electrical		15-Mar-12
Chapter 21 – Fire and Intrusion Alarm Systems		15-Mar-12
Chapter 22 – Elevators and Escalators		15-Mar-12
Chapter 23 – Fire/Life Safety		15-Mar-12
Chapter 24 – Systems Assurance		10-Feb-12
Chapter 25 – System Safety and Security		15-Mar-12
Chapter 26 – Sustainability		14-Feb-12
HART Directive Drawings		3-Nov-10
HRTP Standard Specifications		15-Feb-12
West Oahu/Farrington Station Highway Final Design Drawings		Various
Geotechnical Data Report (WOFH)		27-Mar-09
Supplement to Geotechnical Data Report (WOFH)		15-May-09
Geotechnical Baseline Report (WOFH)	2.0	Aug-09
Kamehameha Highway Interim Design, Advanced Interim Design, and Final Design Drawings		Various
Kamehameha Highway Segment Geotechnical Baseline Report	1.1	07-May-10
Kamehameha Highway Geotechnical Data Report		16-Feb-10

Document	Rev. No.	Date
Kamehameha Highway Geotechnical Data Report Addendum		7-May-10
Airport Preliminary Engineering Drawings, Volumes 1-3		1-Oct-10
Airport Geotechnical Data Report		8-Feb-10
Airport Fixed-Guideway Foundation Technical Memorandum		6-Feb-10
City Center Preliminary Engineering Drawings, Volumes 1-4		6-Oct-10
City Center Geotechnical Data Report		26-Feb-10
City Center Fixed-Guideway Foundation Technical Memorandum		26-Feb-10
East Kapolei Station Updated Design Plans		9-Mar-12
UH West Oahu Station Updated Design Plans		9-Mar-12
Hoopili Station Updated Design Plans		9-Mar-12
West Loch Station In-Progress Submission		29-Feb-12
Waipahu Transit Center Station In-Progress Submission		29-Feb-12
Leeward Community College Station In-Progress Submission		29-Feb-12
Pearl Highlands Station Updated Design Plans		9-Mar-12
Pearlridge Station Updated Design Plans		9-Mar-12
Aloha Stadium Station Updated Design Plans		9-Mar-12
Airport Station Group Updated Design Plans		9-Mar-12
Dillingham Station Group Undated Design Plans		9-Mar-12
Kaka'ako Station Group Updated Design Plans		9-Mar-12
Ala Moana Station Updated Design Plans		9-Mar-12
Guideway Superstructure Study – Summary Report		22-May-08
Structures Workshop Summary Report		7-10-Jan-08
Systems Workshop Presentation		22-Aug-08
Transportation Technical Report		1-Aug-08
Construction Workshop Frequently Asked Questions (FAQ)		12-Jun-08
Construction Workshop Presentation		12-Jun-08
Environment Condition of Property, NAVFAC (Navy Drum Site)		Mar-09
Final Evaluation of Project Delivery Options		2-Nov-06
Fixed Guideway Fleet Sizing Report		Jun-09
Value Engineering – Stations Report		Sep-10
Value Enhancement Summary Report		Sep-10
Contracts		
West Oahu/Farrington Highway Design-Build – RFP, Addenda, Proposal and Contract Documents		Various
Kamehameha Highway Design-Build – RFP, Addenda, Proposal and Contract Documents		Various
Maintenance and Storage Facility Design-Build – RFP, Addenda, Proposal and Contract Documents		Various
Core Systems DBOM – RFP, Addenda, Proposal and Contract Documents		Various
General Conditions of Design-Build Contracts, Honolulu		Feb-09
Financial/Cost		
FFGA Capital Cost Estimate Basis and Assumptions		9-May-12
FFGA Main Worksheet – Build Alternative		14-May-12
FFGA Cash Flows Worksheet		14-May-12
FFGA HRTP SCC Cost Workbook		14-May-12
HART Capital Cost by Contract by SCC Workbook		20-Mar-12
Price Proposals (post bid) Kiewit WOFH		11-Nov-09
Price Proposals (post bid) Kiewit MSF		16-Mar-11
Price Proposals (post bid) Kiewit Kamehameha		16-Mar-11
Price Proposals (post bid) Ansaldo Core Systems		16-Mar-11
General Excise and Use Tax in Hawaii		16-Feb-06
Schedule		

Document	Rev. No.	Date
HRTP Baseline Progress Schedule REV.04.xer		13-Jun-12
HART FFGA BASELINE PMOC Review.plf		13-Jun-12
Basis of Schedule 062012.pdf (Rev 3.0)	3.0	20-Jun-12

Note: The above list includes all key documents reviewed by the PMOC for preparation of the various OP deliverables.