PMOC REPORT

OP 34 – Project Schedule Review

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

July 2012 (FINAL)

PMOC Contract Number: DTFT60-09-D-00012
Task Order Number 4: Programmatic
Work Order Number 12: Honolulu Risk Refresh
Project No. DC-27-5181
OPs Referenced: OP 32D

Jacobs Engineering Group, Inc., 501 North Broadway, St. Louis, MO 63102
Tim Mantych, P.E., (314) 335-4454, tim.mantych@jacobs.com
Length of Time Assigned: Five Years (November 18, 2009 through November 17, 2014)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

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 the Project Schedule.

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)

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 – 97,500 (2019); 116,300 (2030).
- **Target Revenue Service Date (RSD):** March 2019

1.3 PMOC 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 34: Project Schedule Review.

1.4 Methodology

The PMOC followed the requirements outlined in the *FTA OP 34 Project Schedule Review*, dated May 2010, to assess and evaluate the grantee's project schedule. The schedule review evaluates the efficiency and effectiveness of the project sponsor's project implementation during any phase of the project life cycle. The schedule review validates the inclusivity of the Project scope and characterizes individual project elements within the current Project phase. It also validates the program management's readiness to enter and implement the next major program phase, the construction phase. The review of the Project schedule addresses seven subcategories:

- Schedule
- Technical Review
- Resource Loading
- Project Calendars
- Interfaces
- Project Critical Path
- Critical Areas of Concern

1.5 Summary of Findings

The PMOC has identified a number of recommendations and opportunities to strengthen the integrity of the grantee's Project Controls organization, procedures, plans, technical schedule input, and technical capacity and capability; many of which were included in previous schedule workshops, meetings, and previous OP 34A schedule reviews. The PMOC expects the grantee to holistically and conclusively incorporate these recommendations in future schedule updates.

1.6 Conclusion

It is the PMOC's professional opinion that the Master Project Schedule (MPS) is mechanically sound and meets the minimal technical requirements of fundamental soundness. This determination is based on conducting the technical schedule review using the OP 34 guidelines and requirements.

1.7 Recommendations

The PMOC recommends the following actions be taken prior to the FTA executing an FFGA:

Format

No recommendations necessary.

Structure, Quality & Detail

(1) The grantee should establish and implement an intelligent activity ID convention in the MPS and all contractor and consultant schedules.

(2) The grantee should improve the method in which the MPS and monthly reports are transmitted to the PMOC since document uploading and downloading issues were identified in early 2011.

Mechanical Correctness

(3) The grantee should further reduce the amount number of activity logic ties that contain an excessive amount of lag due to Start-Start (SS), Start-Finish (SF), and Finish-Finish (FF) relationship types. Most of this can be accomplished with the addition of more activity detail using Finish-Start (FS) relationship ties greatly improving the logic.

(4) The grantee must significantly improve and increase logic ties at major interface points between the stations, Guideway, MSF, core systems contract, and vehicle procurement.

(5) Similarly, the MPS requires more FFGA execution successor relationship ties to identify design and construction work that cannot begin without an FFGA or due to a lack of local funding if the FFGA is delayed.

Work Breakdown Structure (WBS)

No recommendations necessary.

Phasing and Sequencing, Critical Path, Material Tasks and efficient work sequence

(6) The grantee should perform more meaningful and comprehensive analysis of the MPS critical and near critical paths each month.

(7) The grantee should review the longest critical path and make appropriate revisions to better reflect current critical path activities, and FFGA related activities.

Cost/Resource Loading

(8) Ensure that resource and cost loading requirements are included in all construction contractor contractual requirements.

Schedule control, methods, tools and organization

(9) The grantee project controls department should be co-located with all GEC project control management support staff (not including the GEC Resident Engineer team field staff, once construction begins).

(10) The grantee should implement all schedule management procedures and guidelines as documented in the PMP and its respective project control companion documents.

(11) The grantee should define a standardized reporting format and distribution for all project scheduling parties.

(12) The grantee should standardize all scheduling software settings and incorporate the requirements in all construction contractual documents.

(13) The grantee must develop and submit monthly progress reports, budget and schedule updates on a consistent basis.

Schedule Sequencing, similar activities, labor and materials, sequencing of ROW activities, temporary construction and site logistics

(14) The MPS should contain more detail to address site access and logistics, and general planning and use of staging yards, including pre-cast concrete yards and related temporary construction physical constraints.

(15) The calendar library needs minor corrections to clean up naming conventions, representation of holidays, and standard five day work week activities must be assigned an appropriate 5 day per week calendar to better represent professional services and other 5 workday activities. All calendar types should also be changed from "Global" to "Project" to prevent other schedule users from unintentional intermingling with other global calendars in their P6 data base systems.

(16) Provide more justification for the construction activity durations in the basis of schedule and better explain the basis for patent (built-in) contingency for each activity.

2.0 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 the Project Schedule.

2.1 Project Sponsor

The City and County of Honolulu ("City") is the overarching FTA grantee. The City's Department of Transportation Services (DTS) and HART have executed a Memorandum of Understanding, which delineates each agency's roles and responsibilities so as not to jeopardize the City's standing as an FTA grantee. HART is responsible for the New Starts grants for the Project and may share responsibilities with DTS for grants using Section 5307 or other FTA funding sources.

2.2 Project Description

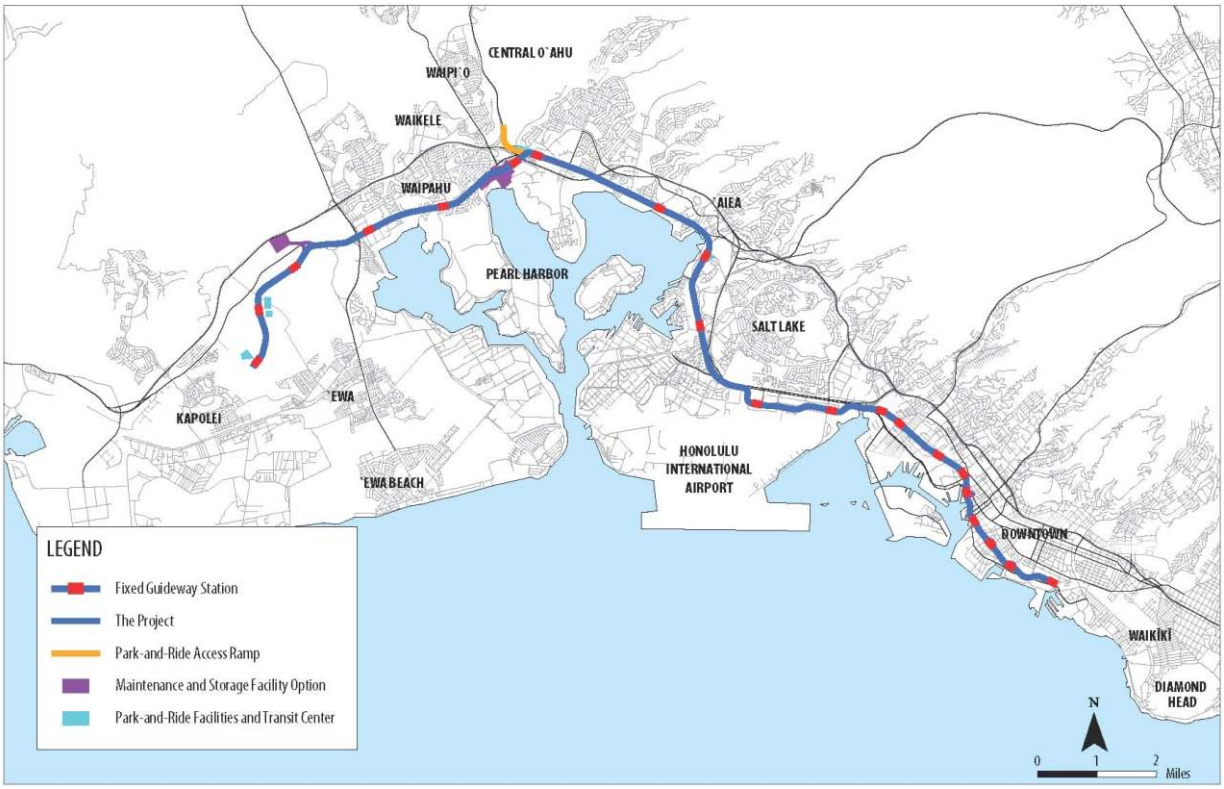
The proposed Project is a 20.5-mile light metro rail line in a grade-separated right-of-way that will provide high-capacity transit service on the island of Oahu from East Kapolei in the west to the Ala Moana Center in the east. The alignment is elevated except for a 0.6-mile at-grade portion adjacent to the Leeward Community College station. In addition to the guideway superstructure and trackwork, major physical elements of the Project include: 21 stations; one maintenance and storage facility; numerous right-of-way parcel acquisitions; and 80 light metro vehicles and associated core systems.

The Project is planned to be delivered in four design and construction 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)

In a recently-announced change, HART now plans to combine Segments III and IV into a single guideway construction contract.

Figure 1. Project as Identified in FEIS



East Kapolei is the western terminus of the Project. The alignment begins at North-South Road north of Kapolei Parkway. The alignment follows North-South Road in a northerly direction to Farrington Highway where it turns east following Farrington Highway and crosses Fort Weaver Road. The alignment is elevated along North-South Road and along Farrington Highway. The alignment continues in a north-easterly direction following Farrington Highway in an elevated structure. South of the H-l Freeway, the alignment descends to grade as it runs alongside the Maintenance & Storage Facility at the former Navy Drum Site. The alignment continues at-grade to Leeward Community College and then returns to an elevated configuration to cross over the H-l Freeway. North of the Freeway, the alignment turns eastward along Kamehameha Highway. Segment I includes seven stations: East Kapolei, University of Hawaii at West Oahu, Ho'opili, West Loch, Waipahu Transit Center, Leeward Community College and Pearl Highlands.

Segment II carries the alignment from Pearl Highlands to Aloha Stadium, running mostly above the median of Kamehameha Highway. At the highway interchange 'Ewa of the stadium, the alignment crosses over to the mauka side of Kamehameha Highway, in land adjacent to the roadway that is currently used for stadium parking. Segment II includes two stations: Pearl Ridge and Aloha Stadium. East of Aloha Stadium Station, the segment features a third track for temporary train layovers or storage.

The Airport Segment, or Segment III, takes the alignment from Aloha Stadium to Middle Street. This entirely elevated section of the route starts on the mauka side of Kamehameha Highway, then transitions to the median of that street. As the route proceeds in the Koko Head direction, it leaves Kamehameha Highway to run on the makai side of the elevated H-1 Freeway. At Honolulu International Airport, the alignment swings out over the median of the H-1, then down Aolele Street to a station site adjacent to the main airport terminal. The route then continues Koko Head on Aolele and, eventually, the parallel Ualena Street to Lagoon Drive. At that point, the alignment crosses a corner of Ke'ehi Lagoon Park and threads through another highway interchange to Kamehameha Highway again at Middle Street. Segment III includes four stations: Pearl Harbor, Airport, Lagoon Drive, and Middle Street.

The City Center Segment, Segment IV, is also entirely-elevated as it carries the alignment from Middle Street to the Ala Moana Center. Segment IV features guideway structures above Dillingham Boulevard, Nimitz Highway, Halekauwila Street, Queen Street, and Kona Street. Above Kona Street at the Ala Moana Center Station, the segment includes tail tracks beyond the station to provide operational flexibility and storage. The segment includes eight stations: Kalihi, Kapalama, Iwilei, Chinatown, Downtown, Civic Center, Kaka'ako, and Ala Moana.

The Project also includes one Maintenance & Storage Facility (MSF), two park and ride lots, one park and ride structure and two bus transit centers. The rail vehicles will be fully-automatic and driverless.

The anticipated weekday boardings for the line are as follows:

- 97,500 (in 2019)
- 116,300 (in 2030)

2.3 Project Status

A Locally Preferred Alternative (LPA) was adopted in July 2008. The grantee was provided approval to begin Preliminary Engineering (PE) on October 16, 2009. The Final Environmental Impact Statement (FEIS) was published on June 25, 2010, and a Record of Decision (ROD) was issued on January 18, 2011. FTA granted approval to enter Final Design on December 29, 2011. The grantee is preparing an application for a Full Funding Grant Agreement in accordance with the FTA New Starts requirements.

2.4 Project Budget

The grantee's Base Cost Estimate (BCE), dated June 2012, is $5.122 billion in Year-of-Expenditure (YOE) dollars, including $644 million in allocated and unallocated contingency and $173 million financing costs.

2.5 Project Schedule

Table 1 presents the grantee's target dates for key milestones of this New Starts Project as identified in its Master Project Schedule.

Table 1. Target Milestone Dates

Milestone Description	Grantee Target Date
FTA Award Full Funding Grant Agreement	07-Oct-12
WOFH/KH Revenue Service	29-Jun-16
Airport/City Center Revenue Service (RSD)	12-Mar-19

Note: MPS Data Date of March 30, 2012

2.6 Project Management Oversight Contractor (PMOC)

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 34: Project Schedule Review.

2.7 Evaluation Team

The following table presents the PMOC Evaluation Team and the respective roles associated with the assessment of the Project.

Table 2. PMOC Evaluation Team

Name	Location	Phone	Email Address	Role
Jacobs				
Tim Mantych	St. Louis, MO	314-335-4454	tim.mantych@jacobs.com	Program Manager
Bill Tsiforas	Las Vegas, NV	702-676-1568	William.tsiforas@jacobs.com	Task Order Manager
Keith Konradi	St. Louis, MO	314-335-4464	Keith.konradi@jacobs.com	Rail Engineering
Bob Niemietz	St. Louis, MO	314-335-4484	Robert.niemietz@jacobs.com	Structural Engineering
Ahmad Hasan	St. Louis, MO	314.335.4103	Ahmad.hasan@jacobs.com	Geotechnical Engineering
Allan Zreet	Dallas, TX	214-424-8511	Allan.zreet@jacobs.com	Architect
Charles Neathery	Dallas, TX	214-424-7519	Charles.neathery@jacobs.com	Construction Management, Project Controls, Schedule Risk Assessment
Tim Morris	Dallas, TX	214-424-7506	Tim.morris@jacobs.com	Cost Estimating
Brian Carpenter	Dallas, TX	214-424-8530	brian.carpenter@jacobs.com	Cost Estimating, Scheduling
Steve Rogers	Dallas, TX	214-424-7522	Steve.rogers@jacobs.com	Cost Estimating
Albert Amos	Austin, TX	512-314-3122	Alber.amos@jacobs.com	Economics
David Nelson	Boston, MA	617-242-9222	David.nelson@jacobs.com	Operations, Transit Capacity
Tracey Lober	St. Louis, MO	314-335-4219	Tracey.lober@jacobs.com	QA/QC
Joe Leindecker	St. Louis, MO	314-335-4077	Joe.leindecker@jacobs.com	Planning
Virginkar and Associates, Inc.				
Arun Virginkar	Brea, CA	714-993-1000	virginkar.arun@va-inc.com	Vehicle Engineer, Buy America
Hal Edris	Spring Grove, PA	717-225-9630	edris.hal@va-inc.com	Systems Integration Manager
Triunity Engineering Management Inc.				
Jonnie Thomas	Denver, CO	303-953-0320	jonnie.thomas@triunityeng.com	Systems (Communications)
Interactive Elements Inc.				
Dennis Newman	New York, NY	212-490-9090	anoldsaw@aol.com	Safety
Dorothy Schulz	New York, NY	212-490-9090	dms10024@aol.com	Security
LS Gallegos				
JR Casner	Centennial, CO	303-790-8474	hcasner@lsgallegos.com	Construction Management, QA/QC
OR Colan & Associates				
Bob Merryman	St. Louis, MO	636-949-2125	rmerryman@orcolan.com	Real Estate
Kowalenko Consulting Group Inc.				
Emma Kowalenko	Chicago, IL	312-853-0500	ekowalenko@kowalenkogroup.com	Planning/Environmental
Independent Contractor				
David Sillars	Corvallis, OR	541-737-8058	dsillars@sillars.com	Risk Manager

2.8 Documents Reviewed

Appendix B provides a listing of the project-related documents that were utilized during development of this PMOC Report.

3.0 OP 34: PROJECT SCHEDULE REVIEW

3.1 Methodology

The PMOC followed the requirements outlined in the FTA *"Project Management Oversight Operating Procedure (OP) 34: Project Schedule Review"*, dated May 2010 to assess and evaluate the grantee's project schedule. The PMOC Schedule Review report format is consistent with the OP 34 and addresses all of the subcategories included under the categories listed below:

- Technical Review
  - Format
  - Structure, quality, and detail
  - Mechanical soundness
  - WBS
  - Phasing and sequencing
  - Hierarchy
  - Cost and resource loading
  - Schedule Contingency
  - Constraints
  - Schedule Control
- Project Activities and Constraints
  - Sequencing
  - Resource Loading
  - Schedule Elements

The Schedule Review categories holistically characterize each element in the project/program schedule, from schedule development and performance measurement, through post project archive record documentation. The Schedule Review will evaluate the efficiency and effectiveness of the project sponsor's project implementation during any phase of the project life cycle.

The Schedule Review validates the inclusivity of the Project scope and characterizes individual project elements within the current Project phase. It also validates the program management's readiness to enter and implement the next major program phase, Application for Full Funding Grant Agreement (FFGA). The report findings result in a compilation of tabular and graphical reports and conclude with a list of PMOC findings and recommendations for grantee action.

The PMOC used the following meeting notes, files, reports and documents to support the Schedule Review:

Table 3. Schedule Submittal Package History

Document Name	Transmitted to PMOC	Status (PMOC Comments)
First Schedule Submittal Package		
MPS Mar 26,2010.xer	1.13.11	Requires Revision.
MPS Mar 26,2010.pdf	1.13.11	
ROW Schedule Mar 26,2010.xer	1.13.11	Requires Revision.
ROW Schedule Mar 26,2010.pdf	1.13.11	
Basis of Schedule Report A_01-18-11.pdf	1.18.11	Basis of Schedule (first submission to PMOC).
Second Schedule Submittal Package		
HHCTPMPS11.xer	1.11.11	Requires Revision.
HHCTPROW111.xer	1.11.11	Requires Revision.
HHCTPROW111.pdf	1.11.11	
Master Program Schedule to PMO_01-07-11.pdf	1.13.11	
Master ROW Schedule to PMO_01-07-11.pdf	1.13.11	
Third Schedule Submittal Package		
HHCTPMPS.xer	2.23.11	Requires Revision.
HHCTPMPMOC.pdf	2.23.11	
MPS – DEC31.pdf	2.23.11	
Basis of Schedule Report A_01-18-11.pdf	2.23.11	Submitted second time by grantee
Basis of Schedule HHCTP.PDF	2.23.11	
MSF Basis of Schedule HHCTP.pdf	2.24.11	Supplemental to MPS Basis of Schedule
Fourth Schedule Submittal Package		
MPSPMOCA.xer	2.24.11	Requires Revision.
Fifth Schedule Submittal Package		
MPS31.xer	3.1.11	Requires Revision.
Sixth Schedule Submittal Package		
HHCTPROW.xer	3.9.11	Requires Revision.
ROW-BG-30911-PMOC.xer	3.9.11	Requires Revision.
HHCTPROWPMO.pdf	3.9.11	
Basis of Schedule HHCTP.PDF	3.9.11	
RTDS Master Project Schedules 3-9-11.pdf	3.9.11	Resubmitted on 3.13.11 also.
Seventh Schedule Submittal Package		
PMOCA.xer	3.15.11	Needs further revision but the PMOC agreed to use for this OP34. Does not contain an integrated ROW schedule.
IPS with CPP data 12811.xer	3.24.11	Integrated Project Schedule, first submission, requested by PMOC in January 2011. Used to support the OP34.
Eighth Schedule Submittal Package		
MPSHHCTCP 2011_6.xer	7.2.11	Incomplete, contains fatal flaws such as no discernible critical path, -420 negative float, errors and warnings, no ROW Schedule, no Permit Schedule, and no Procurement Schedule. First schedule submitted since May 11, 2001 on-site PMOC Schedule Workshop.
RTD PMOC by Major Milestones.plf	7.2.11	Report File Layout – was incorrect.

Document Name	Transmitted to PMOC	Status (PMOC Comments)
Basis of Master Project Schedule_Rev 2_063011_FINAL.pdf	7.2.11	Basis of Schedule, Revision 2 – acceptable with comments to be incorporated in next revision.
BOS_Early& Late _Rev 2_063011.xlsx	7.2.11	Graphic inserted in BOS
Network of Schedules Rev 2 063011.xlsx	7.2.11	Graphic inserted in BOS
WBS 2010-07-30-AA.xls	7.2.11	Graphic inserted in BOS
Ninth Schedule Submittal Package		
HHCTCPMPS2011_6rev2.xer	7.9.11	MPS
HHCTCPROW2011_6rev1.xer	7.9.11	ROW Schedule
HHCTCPMPS2011_6rev2 – Critical Path – Airport.pdf	7.9.11	
HHCTCPMPS2011_6rev2 – Critical Path – City Center.pdf	7.9.11	
HHCTCPMPS2011_6rev2 – Critical Path – WOFH-KH.pdf	7.9.11	
HHCTCPMPS2011_6rev2 – Critical Path – Longest Path.pdf	7.9.11	
HHCTCPMPS2011_6rev2.pdf	7.9.11	
HHCTCPROW2011_6rev1.pdf	7.9.11	
MPS - PMOC.plf	7.9.11	Report Layout File
ROW - PMOC.plf	7.9.11	Report Layout File
SCHEDLOG MPS 7-09-11.TXT	7.9.11	Schedule File Log
Tenth Schedule Submittal (Supplemental MPS Revision)		
HHCTCPROWandMPS_6 b.xer	7.11.11	MPS with incorporated ROW Schedule
Schedule Updates		
MPS HHCTCP 2011_8	1.5.12	August 2011
MPS HHCTCP 2011_9	1.5.12	September 2011
MPS HHCTCP 2011_10	1.5.12	October 2011
MPS HHCTCP 2011_11	1.5.12	November 2011
Not Submitted		December 2011
Not Submitted		January 2012
Not Submitted		February 2012
OP34 + OP40 MPS (FFGA Application)		
MPS HRTP 2012_1 FFGA Baseline Submittal.xer	3.15.12	Used for OP34
MPS HRTP 2012_1.txt	3.15.12	
MPS HRTP FFGA Baseline PMOC Layout.plf	3.15.12	
MPS HRTP FFGA Submittal Cover.doc	3.15.12	
HART_Basis of Schedule Report Rev 2 (March 16 2012) Final Draft.pdf	3.15.12	
OP34 + OP40 MPS (FFGA Application)	Revision to consolidate Airport + City Center guideway	
HRTP Baseline Progress Schedule REV.04.xer	6.13.12	Used for OP34
HART FFGA BASELINE PMOC Review.plf	6.13.12	
Basis of Schedule 062012.pdf (Rev 3.0)	6.20.12	

During the PMOC review to support the grantee's entrance into the final design phase in 2011, the grantee re-submitted the MPS numerous times before the PMOC was able to determine the MPS met the minimal FTA guidelines and requirements.

The PMOC used this schedule to complete the OP 34 review to support the grantee's request to enter Final Design. Subsequently, HART was granted entry into Final Design with specified conditions. The conditions primarily addressed HART's responsibility to demonstrate consistent

and accurate monthly progress reporting of scope, schedule and cost. The category titled "Schedule Updates" in the Table above illustrates a historical record of HART's monthly progress reporting and transmittal of reports to the FTA PMOC. The record shows inconsistency developing and submitting standard monthly progress reporting. The PMOC received four (4) months of monthly schedule updates on the same day, January 5, 2012.

Each month since August 2011, the PMOC made documented requests to receive the monthly progress report, monthly schedule update, and monthly Estimate to Complete (ETC) cost projections. HART project controls staff stated several times their efforts were diverted to FFGA and risk assessment document preparation instead of producing FTA required monthly reporting. It is the PMOC's professional opinion that HART project control and senior management staff failed to demonstrate a sufficient level of technical capacity and capability during this phase.

Since January 2012, the PMOC has more aggressively conducted over-the-shoulder reviews while visiting HART project controls staff each month. As a result, the PMOC has observed slow but continual improvement with HART project control deliverables, most notably the MPS, Basis of Schedule, and implementation of project control procedures. These issues and concerns were discussed with the HART project control and senior management staff, including the new Project Executive Director in April 2012.

HART submitted a revised Master Project Schedule to the PMOC June 13, 2012. The MPS was revised to include the following major topics:

1. Combine the Airport and City Center Guideway construction contract
2. Eliminate the second opening, Airport Segment
3. Combine the opening of Airport with the City Center Segment

To date, no significant progress has been realized.

3.2 Technical Review

The following section includes review topics as listed in the OP 34 *"Technical Review"* subcategories. Each review topic includes a description explaining the relevant information included in the schedule and Basis of Schedule. Graphics are included when necessary to support the PMOC's explanation and determination.

3.2.1 Schedule Format

Is the schedule format consistent with relevant, identifiable industry or engineering practices? Does it use software appropriate for the size and complexity of the project?

The MPS format, WBS, hierarchy, data libraries, and reporting file layouts and standards are consistent with industry standard of care and are well documented in contract specification requirements for the consultants and contractors working on the Project.

The grantee is using Oracle's Primavera Project Manager (P6) scheduling software and is requiring all scheduling parties involved on the Project to use the same software. This software

is more than acceptable and is considered a world class project management tool. The HART project control staff have established and refined project control procedures and have well documented schedule breakdown structure and assumptions recorded in the Basis of Schedule.

PMOC Determination
Grantee has satisfied the requirement.

PMOC Recommendations
No significant recommendations.

3.2.2 Characterize Structure, Quality and Detail

(1) Schedule Breakdown Structure (SBS)

The Schedule Breakdown Structure (SBS) describes the taxonomy of the various schedule "types" which comprise the Master Project Schedule. The basis of schedule explains the relationship between schedule types and how the information is integrated between schedules and schedule users including the construction contractors, vendors, and sub-consultants. The MPS is a summary schedule of all work packages in the Project. When a contract award is issued for a design or construction contract, the contracted party is responsible for developing and updating a schedule for their work. Each schedule, referred to as a Contract Project Schedule (CPS). The General Engineering Consultant (GEC) is responsible for reviewing and approving each CPS. Approved CPS schedules are then forwarded to the HART project control staff or incorporation into the MPS. The MPS contains only select milestones and summary activities from the CPS schedules.

The standardized set of milestones that serve as the integration point between the multiple CPS schedules are listed below:

- Pay Milestones
- Interface/Coordination Milestones
- Access Milestones

The GEC provides these milestones to each contractor (scheduling party) in a standardized template. After the GEC reviews each CPS for conformance and acceptance, HART assembles and summarizes the information into the MPS. The MPS includes various reports formatted for varying reporting audiences. In the past, the ROW schedule, Permit schedule and 3rd party utility schedules were developed and maintained separately but are now incorporated into the MPS and can easily be organized and sorted by topic.

(2) Quality

During the 2011 schedule review and risk analysis to support entry into the final design phase, the PMOC noted several inconsistencies with schedule development, progress update maintenance process, use of activity ID naming conventions, and procedures for document transmittal to the PMOC. The PMOC noted an apparent failure in addressing and implementing previous PMOC recommendations.

Since the July 2011 risk analysis, the PMOC has observed a slight improvement with project control and schedule quality although the PMOC has not consistently received monthly progress reports since that time. The grantee has incorporated several PMOC recommendations to improve quality and standardization across all project schedules and reports.

(3) Detail

The MPS is presented in a logical manner through the use of an intuitive WBS and descriptive activity tasks and milestones. The schedule detail and activity count has substantially increased since the PMOC's initial Schedule Review in the fall of 2008 and it more in line with the detail and logic density expected of a Project's scope, magnitude, and complexity. While grantee improvements and revisions are ongoing, the grantee did, nevertheless, provide sufficient information and detail to support the PMOC's schedule review.

PMOC Determination

Grantee has satisfied the requirement. Schedule structure, quality, and detail meet the minimal FTA requirements and guidelines.

PMOC Recommendations

(1) The grantee should establish and implement an intelligent activity ID convention in the MPS and all contractor and consultant schedules.
(2) The grantee should improve the method in which the MPS and monthly reports are transmitted to the PMOC since document uploading and downloading issues were identified in 2011.

3.2.3 Mechanical Correctness

Is the schedule mechanically correct and complete, free of material inaccuracies or incomplete information?

The fundamental element that supports the integrity of a schedule is the internal schedule calendar structure, default settings and calculations utilized with the scheduling software. Before a manager can interpret the schedule information generated from schedule reports, a check must be performed to ensure that the information in the schedule is fundamentally correct and contains logical activity relationship connections. A fundamental soundness check must be performed after every schedule update to ensure the information and logic contained in the schedule is correct and properly represents actual work performed. Once the fundamental check is performed, the schedule can be updated and generated reports can be interpreted with confidence.

The Schedule File Log generated by the scheduling software indicates valuable technical information that must be reviewed every time the schedule is revised or progress-updated. This procedure is a critical quality control method that must be performed.

The Schedule File Log includes data categories for:

- Schedule / Leveling Settings
- Statistics
- Errors and Warning
- Result
- Exceptions

The technical data contained in the Schedule File log generated by the HART schedule is summarized in the table below.

Table 4. Technical Data Summary

Schedule Log Categories with Data	MPS		
Statistics		**Errors and Warnings**	
# of Projects	1	# without Predecessors	1
# of Activities	3681	# without Successors	1
# of Activities Not Started	2725	Out-of-sequence Activities	0
# in Progress	144	# with Actual Dates > Data Date	0
# Completed	812	Milestone Activities with invalid Relationships	0
# of Relationships	5895	**Scheduling/Leveling Results**	
# of Constraints	0	# of Projects Leveled	1
Settings		# of Activities Leveled	3681
Scheduling	Yes	Data date	30-Mar-12
Leveling	No	Latest calculated early finish	10-Apr-19
Ignore relationships to / from other projects	No		
Make open-ended activities critical	No	Critical Activities	50
Use expected finish dates	Yes	Activities with unsatisfied constraints	0
When scheduling progressed activities	Retain Logic	Activities with unsatisfied constraints	0
Calculate start-to-start lag from	Early Finish	Activities with external dates	0
Define critical activities as	Longest Path		
Compute total float as	Finish Float		
Calendar for scheduling relationship lag	Predecessor		

The most common scheduling mistakes are usually indicated in the Errors and Warnings and Exceptions categories. During schedule development and updating, it is common to accidentally omit relationship connections or inaccurately enter progress update information; this report is the best method to prove and correct such mistakes.

(1) Open-ended Activities

Typically, open-ended activities should only include the first start activity and the last finish activity, although it is acceptable to also include milestone activities, usually finish milestones, open ended without a successor. Generally, open-ended activities are caused by an oversight wherein an activity is missing a predecessor or successor. This usually occurs during schedule development and when activity relationships are revised during routine progress updating. Caution should be used during schedule progress updating because a minor oversight can create an unintentional open-ended activity. It only takes one incorrect logic connection, or open-ended activity, to severely undermine the integrity of a schedule. Routine quality control procedures include the review of open-ended activities to ensure that they are properly used and connected to appropriate relationship chains.

The MPS contains two (2) open-ended activities, the project start and finish activities.

Table 5. Open-Ended Activity Count

Open Ended Type	Amount
Predecessor	1
Successor	1
Total	**2**

(2) Out-of-Sequence Progressing

Out-of-sequence progressing is an important indicator because it indicates errors, omissions and other potential problems that can distort milestone dates and general progress information, thus affecting the schedule as a whole. Proper activity progress updating and review will prevent out-of-sequence progressing problems. In addition, keeping the amount of open-ended activities to a minimum is conducive to "good housekeeping" practices and overall a more manageable task during schedule updating. For this reason, many schedule specifications require that only the start and end activities can be open-ended.

The Schedule File Log did not indicate any out-of-sequence progressing.

(3) Activities with Actual Dates > Data Date

When activities are progressed, the early start date is changed to an "Actual Start" date indicated by the letter "A" next to the date. During progress updating, a common mistake is progressing activities beyond the Data Date. Other common mistakes include entering a percent complete in an activity without entering an Actual Start date.

The Schedule File Log did not indicate any errors.

(4) Milestone Activities with invalid relationships

This refers to certain types of milestones containing invalid predecessor or successor relationships. There are no issues identified at this time.

(5) Settings – Critical Path

The critical path can easily be distorted by excessive use of constraint dates, out-of-sequence progressing, open-ended activities, and other improper progress update procedures. A common oversight is the misinterpretation of a schedule's true critical path. Sometimes a schedule calculation caused by the excessive or improper use of constraint dates may adversely affect the critical path software calculation. Consistent monitoring of the critical path during progress updates and variance reporting is crucial and reconciled by evaluating the Schedule File Log.

The grantee has demonstrated the correct use of critical path calculations as it has provided reports distinguishing critical path based on TF and longest path.

(6) Constraint Dates

The Schedule File Log indicates that constraint dates are not used in the MPS which conforms to previous PMOC recommendations.

(7) Activity Relationship Ties

Many construction phase activity logic ties contain an excessive amount of lag due to Start-Start (SS), Start-Finish (SF), and Finish-Finish (FF) relationship types. These relationship types are used due to the lack of construction activity detail. These types of relationship ties use excessive lags to offset other activities connected with the construction activity.

The grantee incorporated more detail and structure within the construction activities in response to PMOC recommendations from the last schedule review and risk analysis although the PMOC had to make additional interface logic adjustments in order to adjust the schedule in order to conduct the schedule risk analysis.

PMOC Determination

The grantee has satisfied the requirement. The MPS mechanical soundness meets the minimal FTA requirements and guidelines although the PMOC has identified several recommendations to further improve the MPS mechanical and fundamental soundness.

PMOC Recommendations

(1) The grantee should further reduce the amount of activity logic ties that contain an excessive amount of lag due to Start-Start (SS), Start-Finish (SF), and Finish-Finish (FF) relationship types. Most of this can be accomplished with the addition of more activity detail using Finish-Start (FS) relationship ties, greatly improving the logic.
(2) The grantee must significantly improve and increase logic ties at major interface points between the stations, Guideway, MSF, core systems contract, and vehicle procurement.

(3) Similarly, the MPS requires more FFGA execution relationship ties to identify design and construction work that cannot begin without an FFGA or due to a lack of local funding if the FFGA is delayed.

3.2.4 Work Breakdown Structure (WBS)

The Work Breakdown Structure (WBS) is a sorting and organization of project-specific information (budget, cost and schedule) usually determined by the owner. A WBS is defined by activity code or WBS fields in the scheduling software. A typical master schedule that is comprised of multiple subprojects must contain a standardized WBS or activity code structure. Many times WBS or activity code fields are established by the owner and supplied to the schedule users, especially if multiple consultants or contractors are sharing the same program wide WBS. Summary activity grouping such as "hammocking" is frequently used for upwards Level-1 reporting and provides an easy way to sort large groupings of activities in schedules containing hundreds or thousands of activities.

The primary function of the WBS is to clearly identify and illustrate the decomposition of major areas of work for the Project. It also distinguishes work packages, contract packages, and project components. Such areas of work include but are not limited to:

- Environmental Mitigation
- Right of Way Acquisition and Relocation
- Utility Relocations
- Planning / PE / Final Design / Construction / Startup & Testing / Closeout
- Individual Contract or Project Packaging
- Geographical Areas or Areas by Responsibility
- Procurement for Professional Services
- Material and Equipment Procurement

The data below the summary levels generally provide adequate detail to differentiate between major project segment and contracting areas. The MPS can be sorted by project phase (PE / Design / Construction / Startup & Testing), Project Segment, or by Project Contract, as identified in the Contract Packaging Plan. While the schedule's detail activities represent "task based" work by description and duration, the MPS does not contain resources and therefore does not provide quantification of necessary manpower and equipment resources needed to perform the activity task.

The MPS activity detail is sufficient to determine the type of work that is being performed and is traceable to the Project Contract Packaging Plan. The MPS can be organized, sorted and summarized by project phase, alignment section, FTA/PMOC work efforts, work package and contract package. The MPS WBS is flexible and robust enough to generate project executive summary level 1 and 2 reporting or detailed level 3 contract specific reporting.

PMOC Determination

Grantee has satisfied the requirement. The MPS WBS meets the minimal FTA requirements and guidelines.

PMOC Recommendations
No significant recommendations.

3.2.5 Phasing and Sequencing

(a) Does the schedule contain activities that adequately define the entire scope of the work performed?

The scope inclusivity is transparent between translations of the Contract Packaging Plan to the MPS WBS. The WBS allows report flexibility to organize and sort the schedule by project phase, project alignment section, or work package.

PMOC Determination
Grantee has satisfied the requirement. The MPS phasing and sequencing meets the minimal FTA requirements and guidelines.

PMOC Recommendations
No significant recommendations.

(b) Is the schedule sufficiently developed to determine the validity, stability and reasonableness of the project critical path? Are the near critical paths easily identifiable and reasonable in terms of their logic and proximity to the project critical path?

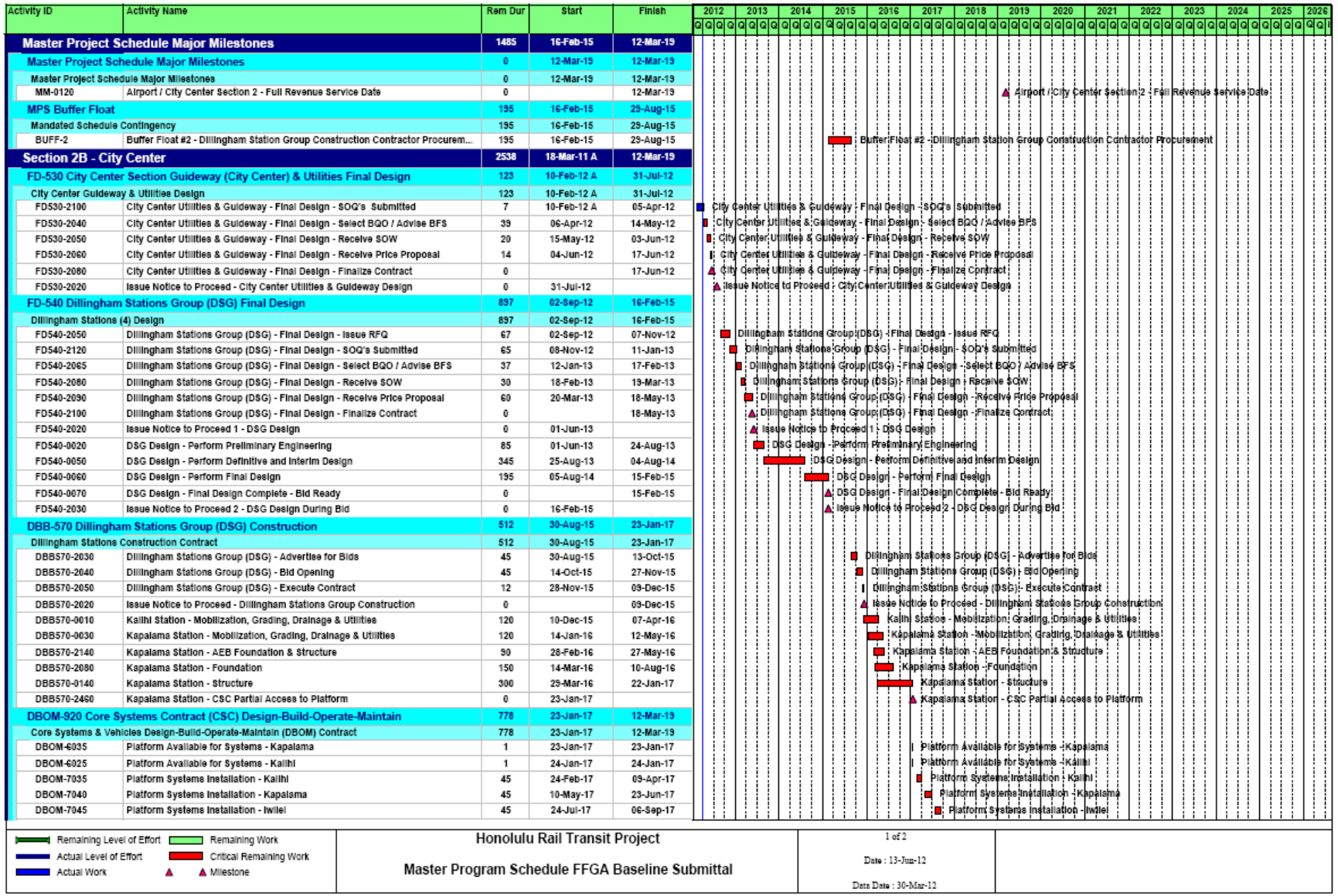
Once a schedule is determined to be fundamentally and mechanically sound, the critical path can be reviewed and evaluated for schedule reasonableness. The critical path analysis determines the existence of a discernible critical path, the activities on the critical path, and whether the schedule milestones and completion dates are realistic and achievable.

The critical path can easily be distorted by the excessive use of constraint dates, out-of-sequence progressing, open-ended activities, and other improper progress update procedures. A common oversight is the misinterpretation of a schedule's true critical path. Sometimes a schedule calculation caused by the excessive or improper use of constraint dates may adversely impact the software's critical path calculation. Consistent monitoring of the critical path during progress updates and variance reporting is crucial and can be reconciled by evaluating the Schedule File Log.

(1) Critical Path

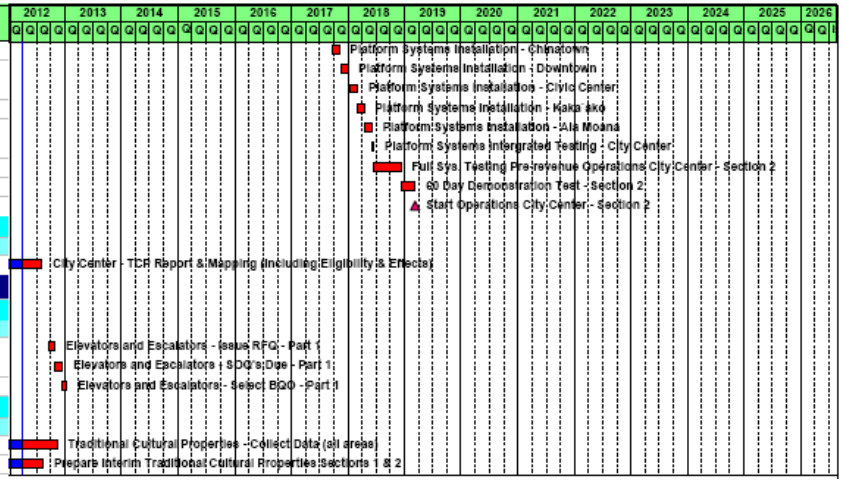
P6 utilizes a critical path calculation method by identifying critical activities either by identifying critical activities according to their total float or by using the software setting "Longest Path." The "Longest Path" calculation is the truest indication of a project's critical path because it discriminates between near-critical activities and the most critical activities. The PMOC generated a critical path "longest path" bar chart report as presented in the figure below.

Figure 2. Longest Path



Activity ID	Activity Name	Rem Dur	Start	Finish
Master Project Schedule Major Milestones		**1485**	**16-Feb-15**	**12-Mar-19**
Master Project Schedule Major Milestones		0	12-Mar-19	12-Mar-19
Master Project Schedule Major Milestones		0	12-Mar-19	12-Mar-19
MM-0120	Airport / City Center Section 2 - Full Revenue Service Date	0		12-Mar-19
MPS Buffer Float		195	16-Feb-15	29-Aug-15
Mandated Schedule Contingency		195	16-Feb-15	29-Aug-15
BUFF-2	Buffer Float #2 - Dillingham Station Group Construction Contractor Procurem...	195	16-Feb-15	29-Aug-15
Section 2B - City Center		**2538**	**18-Mar-11 A**	**12-Mar-19**
FD-530 City Center Section Guideway (City Center) & Utilities Final Design		123	10-Feb-12 A	31-Jul-12
City Center Guideway & Utilities Design		123	10-Feb-12 A	31-Jul-12
FD530-2100	City Center Utilities & Guideway - Final Design - SOQ's Submitted	7	10-Feb-12 A	05-Apr-12
FD530-2040	City Center Utilities & Guideway - Final Design - Select BQO / Advise BFS	39	06-Apr-12	14-May-12
FD530-2050	City Center Utilities & Guideway - Final Design - Receive SOW	20	15-May-12	03-Jun-12
FD530-2060	City Center Utilities & Guideway - Final Design - Receive Price Proposal	14	04-Jun-12	17-Jun-12
FD530-2080	City Center Utilities & Guideway - Final Design - Finalize Contract	0		17-Jun-12
FD530-2020	Issue Notice to Proceed - City Center Utilities & Guideway Design	0	31-Jul-12	
FD-540 Dillingham Stations Group (DSG) Final Design		897	02-Sep-12	16-Feb-15
Dillingham Stations (4) Design		897	02-Sep-12	16-Feb-15
FD540-2050	Dillingham Stations Group (DSG) - Final Design - Issue RFQ	67	02-Sep-12	07-Nov-12
FD540-2120	Dillingham Stations Group (DSG) - Final Design - SOQ's Submitted	65	08-Nov-12	11-Jan-13
FD540-2065	Dillingham Stations Group (DSG) - Final Design - Select BQO / Advise BFS	37	12-Jan-13	17-Feb-13
FD540-2080	Dillingham Stations Group (DSG) - Final Design - Receive SOW	30	18-Feb-13	19-Mar-13
FD540-2090	Dillingham Stations Group (DSG) - Final Design - Receive Price Proposal	60	20-Mar-13	18-May-13
FD540-2100	Dillingham Stations Group (DSG) - Final Design - Finalize Contract	0		18-May-13
FD540-2020	Issue Notice to Proceed 1 - DSG Design	0	01-Jun-13	
FD540-0020	DSG Design - Perform Preliminary Engineering	85	01-Jun-13	24-Aug-13
FD540-0050	DSG Design - Perform Definitive and Interim Design	345	25-Aug-13	04-Aug-14
FD540-0060	DSG Design - Perform Final Design	195	05-Aug-14	15-Feb-15
FD540-0070	DSG Design - Final Design Complete - Bid Ready	0		15-Feb-15
FD540-2030	Issue Notice to Proceed 2 - DSG Design During Bid	0	16-Feb-15	
DBB-570 Dillingham Stations Group (DSG) Construction		512	30-Aug-15	23-Jan-17
Dillingham Stations Construction Contract		512	30-Aug-15	23-Jan-17
DBB570-2030	Dillingham Stations Group (DSG) - Advertise for Bids	45	30-Aug-15	13-Oct-15
DBB570-2040	Dillingham Stations Group (DSG) - Bid Opening	45	14-Oct-15	27-Nov-15
DBB570-2050	Dillingham Stations Group (DSG) - Execute Contract	12	28-Nov-15	09-Dec-15
DBB570-2020	Issue Notice to Proceed - Dillingham Stations Group Construction	0		09-Dec-15
DBB570-0010	Kalihi Station - Mobilization, Grading, Drainage & Utilities	120	10-Dec-15	07-Apr-16
DBB570-0030	Kapalama Station - Mobilization, Grading, Drainage & Utilities	120	14-Jan-16	12-May-16
DBB570-2140	Kapalama Station - AEB Foundation & Structure	90	28-Feb-16	27-May-16
DBB570-2080	Kapalama Station - Foundation	150	14-Mar-16	10-Aug-16
DBB570-0140	Kapalama Station - Structure	300	29-Mar-16	22-Jan-17
DBB570-2460	Kapalama Station - CSC Partial Access to Platform	0	23-Jan-17	
DBOM-920 Core Systems Contract (CSC) Design-Build-Operate-Maintain		778	23-Jan-17	12-Mar-19
Core Systems & Vehicles Design-Build-Operate-Maintain (DBOM) Contract		778	23-Jan-17	12-Mar-19
DBOM-6035	Platform Available for Systems - Kapalama	1	23-Jan-17	23-Jan-17
DBOM-6025	Platform Available for Systems - Kalihi	1	24-Jan-17	24-Jan-17
DBOM-7035	Platform Systems Installation - Kalihi	45	24-Feb-17	09-Apr-17
DBOM-7040	Platform Systems Installation - Kapalama	45	10-May-17	23-Jun-17
DBOM-7045	Platform Systems Installation - Iwilei	45	24-Jul-17	06-Sep-17

Activity ID	Activity Name	Rem Dur	Start	Finish
DBOM-7050	Platform Systems Installation - Chinatown	45	21-Sep-17	04-Nov-17
DBOM-7055	Platform Systems Installation - Downtown	45	19-Nov-17	02-Jan-18
DBOM-7060	Platform Systems Installation - Civic Center	45	17-Jan-18	02-Mar-18
DBOM-7065	Platform Systems Installation - Kaka`ako	45	03-Mar-18	16-Apr-18
DBOM-7070	Platform Systems Installation - Ala Moana	45	17-Apr-18	31-May-18
DBOM-7090	Platform Systems Intergrated Testing - City Center	14	01-Jun-18	14-Jun-18
DBOM-8260	Full Sys. Testing Pre-revenue Operations City Center - Section 2	180	15-Jun-18	11-Dec-18
DBOM-8265	60 Day Demonetration Test - Section 2	90	12-Dec-18	11-Mar-19
DBOM-8270	Start Operations City Center - Section 2	0	12-Mar-19	
Programmatic Agreement		125	18-Mar-11 A	01-Aug-12
Programmatic Agreement		125	18-Mar-11 A	01-Aug-12
PA-0465	City Center - TCP Report & Mapping (Including Eligibility & Effects)	125	18-Mar-11 A	01-Aug-12
General, Professional Services		230	18-Mar-11 A	13-Jan-13
MI-930 Elevators and Escalators		120	16-Sep-12	13-Jan-13
Elevators & Escalators P/I/T/C		120	16-Sep-12	13-Jan-13
MI930-0030	Elevators and Escalators - Issue RFQ - Part 1	45	16-Sep-12	30-Oct-12
MI930-0070	Elevators and Escalators - SOQ's Due - Part 1	45	31-Oct-12	14-Dec-12
MI930-0095	Elevators and Escalators - Select BQO - Part 1	30	15-Dec-12	13-Jan-13
Programmatic Agreement		225	18-Mar-11 A	09-Nov-12
Programmatic Agreement		225	18-Mar-11 A	09-Nov-12
PA-0310	Traditional Cultural Properties - Collect Data (all areas)	225	18-Mar-11 A	09-Nov-12
PA-0420	Prepare Interim Traditional Cultural Properties Sections 1 & 2	136	01-Aug-11 A	13-Aug-12



The critical path currently extends from the City Center section final design procurement and Dillingham station design procurement, Kalihi station site work, Kapalama construction then through core systems contract "platform systems installation" across the Airport and City Center segments ending with full project startup and testing.

Some of the activities on the longest critical path are questionable and should be reviewed in more detail by HART. The elevators and escalators are on the longest path because of the one activity bar with an excessive duration and Programmatic Agreement activities also exist on the longest critical path.

More importantly the HART should review network logic related to the current FFGA Application effort and other potential LONP requests since, the Airport and City Center segment contract obligations cannot proceed without federal funding.

(2) Near Critical Paths

Near critical paths are the chains of activities that contain the least amount of total float other than the longest critical path. It is possible for these activity chains to overtake the critical path activities if the critical path activities are progressed and completed more rapidly than those of the near critical paths. Management should always focus on the critical path but not lose sight of the near critical paths as they could eventually become more critical towards the end of the project than the critical path. The result is referred to as merge bias, an effect of excessive logic density and total float proximity of near critical paths. This typically occurs when schedule compression pushes an excessive number of activity chains against the project completion milestone, thereby exceeding resource availability and causing project delay.

The grantee staff primarily concentrates on near critical paths when reviewing and evaluating the contract package schedules for each design-build contractor. The MPS has continued to change and evolve during the final design phase and the grantee has not performed extensive near critical path analysis or reporting.

The PMOC does recommend the grantee spend more time performing analysis and corrective action decision making. They have not performed these tasks primarily because they have not consistently developed progress reporting data in order to perform such analysis.

PMOC Determination

The grantee has satisfied the requirement. The MPS critical path is discernible and meets the minimal FTA requirements and guidelines.

PMOC Recommendations

(1) The grantee should perform more meaningful and comprehensive analysis of the MPS critical and near critical paths each month.
(2) The grantee should review the longest critical path and make appropriate revisions to better reflect current critical path activities, and FFGA application activities.

(c) Are the schedule assumptions for project phase durations reasonable?

The grantee provided a Basis of Schedule at the request of the PMOC in order to support the general schedule assumptions. The BOS explains all schedule assumptions for the schedule structure, WBS and activity codes, calendars, crew sizing and resource limitations, hours per day, shifts per day, labor, material and equipment resource constraints, and production, inefficiency, and contingency factors which support the calculation of activity durations.

The project alignment is separated into four geographic sections. The first three separate the corridor alignment and the fourth represents the maintenance storage facility located above section 1 north of Pearl Harbor. Construction of the 21-mile corridor will advance in an easterly direction beginning with section 1 and terminating at section 3 Ala Moana Center. Initially HART planned to incrementally open the system by alignment segment then later combined the opening of the WOFH and Kamehameha Highway section. In June 2012, HART decided to combine the guideway construction and opening of the Airport and City Center Segments resulting in a total of two Project alignment openings.

<u>Opening #1 – (16-June-2016)</u>

- Section 1 – West Oahu / Farrington Highway(7 stations)&Kamehameha Highway (2 stations)
- Section 4 – Maintenance Storage Facility (MSF)

<u>Opening #2 – (12-Mar-2019)</u>

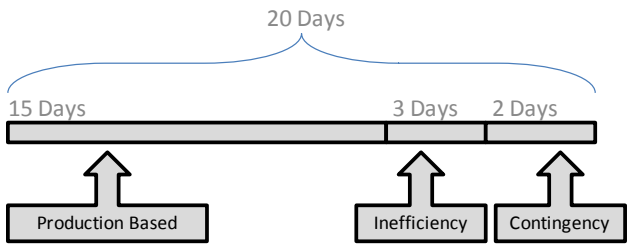
- Section 2 – Airport (4 stations)
- Section 3 – City Center (8 stations)

The PMOC risk assessment and the application for FFGA will focus only on the 2019 project completion milestone, not the interim opening #1. The BOS describes the assumptions used to develop the activity durations. The PMOC recommended that the grantee calculate each activity duration based on three categories:

- Production
- Inefficiency
- Contingency

For example, if an activity contains an original duration of twenty (20) days, then the BOS would list the breakdown of how the duration was derived.

Figure 3. Activity Duration Breakdown



The PMOC has carefully reviewed the assumptions for each activity duration as part of the Schedule Review and also in preparation for the risk assessment, which requires the independent assignment of risk uncertainty durations for each activity; e.g., Best Case, Most Likely, and Worst Case durations.

The Project's remaining phases include completion of final design, construction, and startup and testing. The final design phase is somewhat unconventional to FTA funded transit projects, as it contains a mixture of design-build, design-bid-build, and design-build operate-maintain contract delivery methods. Primarily for this reason, the PMOC is treating the final design phase as the construction phase, since a significant amount of construction will be executed concurrently with definitive design activities specific to the design-bid-build contracts.

The most uncertainty lies within the current phase, which requires a significant number of FTA requirements and PMOC reviews for FFGA application activity. The grantee's primary challenge is related to achieving a sound post-risk-assessment financial plan review while maintaining adequate technical capacity and capability.

The PMOC has recommended the grantee continually ask the FTA Region staff for input and validation of all FTA review and approval activities included in the MPS. The grantee and the FTA/PMOC are currently using a "Roadmap" document to track activities and durations, and progress information specific to the FFGA application process.

Though a dynamic process, the grantee has produced documentation that better describes activity duration justification and schedule assumptions within the Basis of Schedule. The PMOC does however recommend the grantee improve the MPS calendar library and utilization of multiple calendars to distinguish activities performed during business weekdays, night work, and weekends; all of which will better support the aggressive activity durations contained within the MPS.

PMOC Determination

The grantee has satisfied the requirement. The MPS phase durations and basis of durations meet the minimal FTA requirements and guidelines.

PMOC Recommendations

No significant recommendations. Calendar utilization recommendations are included in a separate report section.

(d) Are project schedule structure and sequencing logical and reasonable?

The schedule structure is addressed in Section 3.2.2.

Regarding the schedule sequencing, the MPS contains all of the contracts, organized and sorted as described in the Contract Packaging Plan. The design and construction sequence along the corridor starting at the west and proceeding easterly is portrayed well in the schedule. The MPS contains a logical sequence of activities that marginally represent the interface between the

individual contracts and segments at a summary level. The PMOC has identified the need to insert more logic ties that better interface major project components.

PMOC Determination
The grantee has satisfied the requirement. The MPS structure and sequencing meets the minimal FTA requirements and guidelines.

PMOC Recommendations
No significant recommendations.

(e) Is sequencing, through the use of predecessors and successors, identified for all material tasks? Is the work sequenced efficiently?

The grantee improved activity detail and representation of material tasks in response to the PMOC schedule review to support entry into final design. The activity relationship logic (predecessors and successors) and lags were determined to be fundamentally and mechanically sound, as addressed in the Technical Review Item (4) above. A significant portion of the alignment is elevated guideway and the grantee concentrated sequencing and contract packaging plan based on the continuous and repetitive sequencing of guideway construction (piers, columns, guideway precast concrete segment casting and placement, stations platforms, trackwork and systems). The work sequence is based on the optimization of gantry cranes for precast concrete placement. Additionally, the grantee and GEC have placed an emphasis on construction contractor staging and precast yard availability to support the optimization of guideway construction. The construction is adequately sequenced in accordance to the budget cost estimate constraints.

PMOC Determination
Grantee has satisfied the requirement. The MPS sequencing of material tasks meets the minimal FTA requirements and guidelines.

PMOC Recommendations
No significant recommendations.

(f) Is the use of constraints identifiable, justified and reasonable?

The utilization of constraint dates is addressed in the Technical Review Item 3, above, to support the PMOC mechanical and fundamental soundness review. While constraint dates can be successfully managed when used properly, a schedule risk analysis cannot be performed with the use of constraint dates. The PMOC has consistently recommended that the grantee should avoid using constraint dates and prohibit its sub-consultants and contractors from using them. The latest MPS has significantly improved since the utilization of constraint dates has greatly reduced.

(g) Are work areas identified in construction and properly sequenced from the appropriate predecessor activities?

The PMOC response is included in Item (e) above.

3.2.6 Schedule Hierarchy

(a) Is the top-level summary included to facilitate understanding of phases or groups of activities?

(b) Is the schedule detail beneath the "hammock" or summary level task based?

These items are addressed in Section 3.2.4.

3.2.7 Cost/Resource Loading

Cost and resource loading includes the planned utilization of material, labor and equipment resources required to perform the work. The resource library may contain material, labor, and/or equipment resources as a basis for determining and quantifying activity original durations and remaining durations as work is performed, measured and progressed in the schedule, typically interfaced with earned value management. When resources are assigned to an activity, the quantity to complete and units per time period of the driving resources determine the activity's duration. In addition the activity resources can be "leveled", "smoothed", "squeezed" or "crunched" as analysis and management decisions are evaluated for remaining work to be performed.

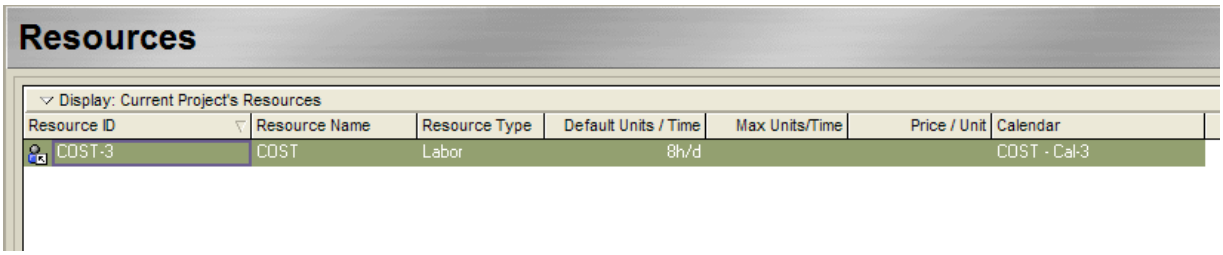
The resource library also may contain budget and cost information. Designers and construction contractors generate and submit the cost-loaded information with monthly progress updates to support their monthly payment requests. An adequately-resourced schedule combined with earned value management (backward looking) and trending analysis (forward looking) are prudent schedule control methods, especially during the project schedule update process, regardless of the project phase.

The MPS resource library contains one resource named "COST." This resource is used to populate cost amounts in some summary level activities. The project costs correctly total the cost amount indicated in the Project Contract Packaging Plan and can be tracked by contract or summarized by project segment.

The MPS resource library also contains one material resource named "COST" (Figure 4). This resource is defined as $1/unit and its parameters are set to calculate costs from assigned units; however, total costs appear to be assigned to each activity without utilizing the software's calculation feature. In addition, actual costs appear to be manually entered in lieu of automatic calculation based on activity percent complete.

No other resources are used in the MPS.

Figure 4. Resource Library



The PMOC has determined that the MPS does not contain a true resource library and, therefore, is not resource loaded. The PMOC recommends that the grantee require resource loading for all construction project schedules and include this requirement within the contractual documents, specifications and General Conditions. The resource assignments will greatly assist with activity duration calculations, claim avoidance, and mitigation reviews for construction contracts. Resource loading is not preferred, cannot be effectively used in summary schedules such as the MPS, and is best used for more detailed construction schedules such as the CPS schedules.

PMOC Determination

The grantee and PMOC agreed to postpone comprehensive cost loading effort until the PMOC schedule review and risk analysis was complete in order to most effectively and efficiently perform the exhaustive cost loading exercise. The exercise to completely cost load the MPS will not affect the PMOC's risk analysis specific to determining a proposed FFGA RSD date for the project.

PMOC Recommendations

(1) Ensure that resource and cost loading requirements are included in all construction contractor contractual requirements.

3.2.8 Schedule Contingency

Discuss thoroughly the exposed and hidden (patent and latent) contingency in the schedule, including amounts and how it is expressed in the schedule.

(a) Is the schedule sufficiently developed to determine the validity, stability and reasonableness of the project critical path? Are the near critical paths easily identifiable and reasonable in terms of their logic and proximity to the project critical path?

(1) Contingency

The grantee's basis schedule narrative states that the MPS activities include 12% contingency and that the contract durations are based on the "most probable duration," although, the grantee did not provide sufficient documentation justifying the 12% contingency factor.

The MPS contains one calendar that is based on calendar days (7 days per week) and includes holidays. The sole use of one 7 day per week calendar precludes the allowance of non-work periods that could be considered contingency reserves. For example, if the grantee used a 5 day per week calendar for construction activity, Saturdays could be considered a reserve day (contingency).

The PMOC evaluated the grantee's basis of schedule and their claim of incorporating 12 percent contingency in all schedule activities. Because the basis of schedule does not include activity duration substantiation for all work elements in the MPS, the PMOC elected to strip only a portion of contingency from the construction activities.

(2) Critical Path

The critical path and near critical paths are discussed under Item (b) in Section 3.2.5.

PMOC Determination
Grantee has satisfied the requirement. The MPS incorporation of contingency as documented in the Basis of Schedule meets the minimal FTA requirements and guidelines.

PMOC Recommendations
No significant recommendations.

(b) Is the use of constraints identifiable and reasonable?

The use of constraint dates is not relevant to schedule contingency unless manipulated with purpose to undermine the project schedule float. The utilization of constraint dates is addressed in the Section 3.2.3 and Item (f) in Section 3.2.5.

3.2.9 Schedule Control Methods and Tools

The PMOC conducted a detailed review and evaluation of the grantee's project management control system to determine whether the grantee was efficient and effective in implementing the project. The PMOC also evaluated the grantee's project control system and organization as part of its Technical Capacity and Capability Review and Technical Schedule Review to support the grantee's request to enter the Final Design and construction phases. Parts of these reviews included an evaluation of the tools, procedures, organization, and roles and responsibilities of the project control positions. The following topics address each of these items.

(1) Tools

The grantee is using Oracle's Primavera Project Manager scheduling software as mentioned in Item 1, above. It is also using Contract Manager, formerly Primavera Expedition, as its document management system. The grantee's computer hardware, server, supporting software packages, and interfaces with the grantee's existing repositories that support the project controls and project management reporting are adequate for the Project. The grantee intends to intertwine the Project Controls and Document Management systems with its existing system after the project is completed.

The most powerful schedule management tool is the scheduling software being used. This tool, like all tools, must be used properly. The schedule software contains calculation settings that apply to cost and resource loading, critical path, predecessor and successor logic connectivity, percent complete, cost and resource utilization, and actual work performed. Many, if not all of these settings are crucial for progress update and critical path calculation. CPM schedule specifications and related contractual requirements seldom address or completely specify which scheduling software setting conditions are required for a given project or program. This oversight may lead to intentional manipulation of software settings to favor the end user.

Special attention is needed to ensure that schedule calculations accurately generate and avoid distorting schedule forward and backward pass CPM data. The scheduling software calculation settings should be monitored to ensure that they are consistently used and not randomly changed or manipulated, especially on large programs that require multiple design and or construction schedules. The grantee should make sure all software settings are standardized and consistently used by all scheduling parties on the Project. The contractual documents should clearly state which settings should be used.

The following table describes the standard default settings used within the MPS schedule software. The contract requirements do not stipulate which scheduling software settings are to be used, although the PMOC recommends that all scheduling parties consistently use the default settings as "marked" in the table below.

Table 6. Software Settings

Description	Settings		
Logic Calculation	Retained ☒	Progress Override ☐	
Start-to-Start Lag from:	Actual Start ☐	Early Start ☒	
Schedule Durations:	Contiguous ☒	Interruptible ☐	
Show Open ends as:	Critical ☐	Non-critical ☒	
Calculate total float as:	Most Critical ☐	Start float ☐	Finish float ☒
Interproject relationships:	With update ☐	Without update ☐	Ignore ☒
AutoCost Rules: % Complete link to RD	Yes ☒	No ☐	

The PMOC reviewed the schedule and observed that all settings are in compliance with industry standards of care. The grantee does not address software settings in the Project Schedule specifications or General Conditions, although the PMOC has recommended that it do so.

(2) Control Methods and Procedures

Schedule Control begins with the establishment of "standardized" project control, contractual requirements, and conformance procedures. *Requirements* refer to the contract terms and conditions, specifications, procedures, and guidelines associated with the individual contracts for the vendors, contractors, and consultants on the project. *Conformance* refers to the assurance that all parties abide by the contractual specifications and requirements. *Standardization* refers to the approach of requiring all scheduling parties to use the same input and output forms so that all reporting information is consistent. The requirements and standards are typically set by the owner during the PE and Final Design phases, when the project management control systems are defined and tailored for the program. Report standardization is crucial for upwards and downwards reporting. The data input and output must be standardized, organized, and sorted in a consistent and thorough manner so that it can be summarized and tailored for the appropriate reporting audiences.

Schedule contractual conformance by all parties is not only a necessity, but paramount to the ongoing avoidance and mitigation of contract modifications, change orders, and claims. Contractual conformance commitment by all parties amplified from the top down is essential for a project's successful planning and timely execution.

The PMOC reviewed all of the project control procedures submitted by the grantee. The grantee's Project Scheduling Procedure "4.PC-04, Revision 0" best addresses the individual Contract Project Schedules (CPS) and how that information is reviewed and approved, analyzed, and incorporated into the MPS.

(3) Organizational Breakdown Structure (OBS), Roles and Responsibilities

The OBS is included in the latest version of the PMP. The PMOC reviewed the OBS and interviewed key management staff to support the Technical Capacity and Capability Review. The PMOC also provided review comments on the PMP and Project Control procedure document during the schedule review process in a concurrent effort to support the grantee's preparation for an FFGA.

PMOC Determination

Grantee has satisfied the requirement. The MPS schedule methods and controls meet the minimal FTA requirements and guidelines.

PMOC Recommendations

(1) The grantee project controls department should be co-located with all GEC project control management support staff (not including the GEC Resident Engineer team field staff, once construction begins).

(2) The grantee should implement all schedule management procedures and guidelines as documented in the PMP and its respective project control companion documents.
(3) The grantee should define a standardized reporting format and distribution for all Project Scheduling parties.
(4) The grantee should standardize all scheduling software settings and incorporate the requirements in all construction contractual documents.

3.3 Project Activities and Constraints

The following section includes a continuation of Schedule Review subcategories as listed in OP 34.

3.3.1 Schedule Sequencing

(a) Does the schedule follow an expected work sequence?
(b) That occur concurrently identified and reasonably sequenced in the schedule to assure similar work activities can be accomplished with available labor and materials?

The MPS, the Basis of Schedule, and the project Contract Packaging Plan address the proposed design and construction packaging strategy. The MPS WBS also separately identifies construction activity by project segment, which illustrates the sequencing among construction segment procurement and installation. A majority of the alignment is on an overhead guideway structure requiring very repetitive construction installation of piers, columns, bent caps, precast units, deck work and track work.

Construction contractor crewing requirements are based on the optimization of precast concrete crane erection systems for construction of the aerial guideway structure. The sequencing will generally proceed in an easterly direction starting at the Farrington/West Oahu segment. The Project consists of two operational dates related to the incremental construction and operational turnover of the project segments.

The schedule WBS is organized and clearly segregated by the Project sections. Optimization of aerial guideway structure crane equipment and coordination with the Core Systems Contract seems intuitive and is a reasonable work sequence approach.

This category predominately focuses on the construction phase and the optimization of equipment and labor forces for similar and consecutively executed work elements. The aerial guideway structure provides, by far, the best opportunity to optimize economies of scale and related efficiencies with crew sizing. The basis of schedule includes logical assumptions for crew sizing and optimization related to pier, bent, and aerial structure installation, much of which is based on production factors supplied by the construction contractor. Construction detail is represented in the grantee's MPS is more detailed than previous schedules. The MPS is not resource-loaded, so resource "smoothing", "squeezing," "crunching," and related concurrency analysis cannot be conducted and evaluated.

PMOC Determination
The grantee has satisfied the requirement. The MPS sequencing meets the minimal FTA requirements and guidelines.

PMOC Recommendations
No significant recommendations.

(c) Does phasing due to planned right-of-way acquisition provide sufficient time for efficient use of resources?

The grantee incorporated the ROW Schedule into the MPS after PMOC consultation on July 11, 2011. The MPS has improved now that real estate acquisition activities contain better interface logic ties with existing contracts and future work packages in concert with the contract packaging plan and project sections. In addition, they have greatly increased the amount of activity detail for temporary and permanent easements, and real estate acquisition of partial and full takes. The real estate acquisition is organized and sorted by project section and work package. The work package resembles the contract packaging plan for work under contract by delivery method.

Recently real estate acquisition has not been on the project critical path as the grantee has successfully and duly progressed work activity in the western corridor areas where the current construction contracts are underway. The ROW schedule activities also include time contingency allowances for the condemnation process, if and when it needs to be pursued.

PMOC Determination
Grantee has satisfied the requirement. The MPS real estate acquisition planning meets the minimal FTA requirements and guidelines.

PMOC Recommendations
No significant recommendations.

(d) Are the durations and logic reasonable for temporary construction and physical construction constraints, such as transportation or site access restrictions?

The logistics of site access, transportation, material/equipment handling and storage are commonly referred to as site management. The most relevant site management elements on the project are related to traffic control, contractor material and equipment staging, and location of precast concrete casting/ storage yards.

The MPS was developed with some consideration of physical construction constraints, such as construction of the aerial guideway structure and the relocation, adjustment, and installation of utilities in the narrow street limits of the alignment. The MPS contains a minimal amount of detail representing site management and access, traffic control, material storage and handling, pre-cast concrete yard, working adjacent to waterways, and operational adjacencies to third party businesses. The PMOC recommends the grantee focus more attention on these topics and

consider increasing activity detail and interface logic ties in order to best manage and predict "constraining elements" that inherently impact construction staging and material handling.

PMOC Determination

Grantee has satisfied the requirement. The MPS schedule activities and logic meet the minimal FTA requirements and guidelines.

PMOC Recommendations

(1) The MPS should contain more detail to address site access and logistics, and general planning and use of staging yards, including pre-cast concrete yards and related temporary construction physical constraints.

(e) Are project calendars appropriately defined and utilized, including allowances for seasonal weather variances?

Calendars are used for a multitude of reasons, one of which is for varying weather conditions. The scheduling software calendar library dictates the number of work periods and non-work periods, usually measured in units of hours or days. The calendar(s) also can be used to incorporate non-work periods such as holidays, weather days, or other seasonal restriction periods such as the installation of temperature-sensitive materials. The utilization of multiple calendars is practical and necessary during schedule development and should be monitored and reviewed frequently to track historical information.

The schedule contains thee (3) base calendars as listed in the table below:

Table 7. Calendars

Calendar Name	Global / Project	No. of Activities	Days / Week	Hrs / Day	Description
7 Day Workweek	G	3504	7	8	Non-work periods; none,
Standard 5 Day Workweek w/ Basic Holidays	G	13	5	8	Non-work periods; weekends, holidays. Missing Holidays for year 2014 and beyond.
7 Day	G	164	7	8	Non-work periods; none

The MPS global structure was reviewed to verify the calendar utilization. The "7 Day Workweek" and the "7 Day" calendars are similar as the both do not include any non-work periods. HART should delete one and use the other for consistency. Furthermore, they should change the calendars from "Global" to "Project".

The calendar library does not contain anticipated inclement weather days. These periods of non-work performance can be addressed in many ways, such as by increasing activity durations or accounting for them in separate calendars. The grantee did state that it incorporated latent contingency into the activity original durations, but not the calendars, to account for inclement weather. The grantee also stated that Hawaii, in general, does not encounter a significant amount of severe weather or undergo significant seasonal conditions that would negatively impact construction work activity.

The PMOC has frequently recommended that the grantee use multiple calendars in the MPS, though the grantee has chosen not to do so. The PMOC believes that the grantee's reluctance to incorporate other calendars, such as a 5 day per week (work week) calendar, produces inaccurate schedule information and introduces unwarranted and misleading (weekend) schedule dates that can be misinterpreted by the reporting audiences. The absence of multiple calendars is not a fatal flaw although is an industry standard best management practice.

PMOC Determination

Grantee has satisfied the requirement although minor corrections are necessary.

PMOC Recommendations

(1) The calendar library needs minor corrections to clean up naming conventions, representation of holidays, and standard five day work week activities must be assigned an appropriate 5 day per week calendar to better represent professional services and other 5 workday activities. All calendar types should also be changed from "Global" to "Project" to prevent other schedule users from unintentional intermingling with other global calendars in their P6 data base systems.

(f) Have labor and material availability been factored into construction durations?

The MPS does not contain enough detail at the construction task level to adequately represent labor and major availability. Furthermore, the BOS does not adequately address labor and material availability specific to the MPS. The BOS refers to the construction contractor requirements to account for this topic in its Contract Project Schedules.

Labor availability should be evaluated for all life cycle phases of the Project, not just for construction. This has been identified and discussed during the PMOC's Technical Capacity and Capability Review and review of the grantee's staffing plan. The PMOC has identified labor availability (recruiting, hiring, and retention) as a significant problem that has adversely affected the grantee's technical capacity and budget. The grantee has admitted that it is using more outside consultants and contract employees than it originally planned to use, and it has incurred more expenses than originally planned because of the hiring and retention challenges.

Labor and material availability has been factored into the project budget cost estimate, although they are not very traceable or evident through review of the MPS or Basis of Schedule. The BOS does, however, moderately address construction durations, mostly based on production factors supplied by the WOFH construction contractor proposal, which is included as an attachment to the BOS. The PMOC has recommended that the grantee include additional information in the BOS to clarify and better explain its assumptions used for all activity durations, construction and non-construction. While the most recent BOS version better explains activity duration assumptions, the PMOC recommends the grantee provide more justification for the construction activity durations as a means to historically record their assumptions as the project progresses.

PMOC Determination
Grantee has satisfied the requirement. The MPS construction durations meet the minimal FTA requirements and guidelines.

PMOC Recommendations
(1) Provide more justification for the construction activity durations in the basis of schedule and better explain the basis for patent (built-in) contingency for each activity.

3.3.2 Schedule Resource Loading

(a) Do quantities and costs as defined in the cost estimate match the resources/costs assigned to activities in the schedule?

Cost and resource loading are two different topics that must be addressed separately, especially for each project phase other than construction. The PMOC addressed resource and cost loading in Section 3.2.7.

The MPS does not contain resource loading but it is cost-loaded. The BOS addresses activity task durations, inefficiency factors, and contingency amounts. The PMOC acknowledges that it is not necessary to resource load the MPS, that the MPS is too summary in nature, and that management of resource loaded schedules is best implemented by requiring the construction contractors to resource load each CPS.

PMOC Determination
Grantee has satisfied the requirement. The MPS construction durations meet the minimal FTA requirements and guidelines.

PMOC Recommendations
No significant recommendations.

3.3.3 Schedule Elements

(b) Does the schedule reflect project scope that is described in the approved environmental document?

The scope inclusivity is very transparent with the translation of the Contract Packaging Plan into the schedule WBS. All project components, facilities, and amenities are accounted for in the MPS and are easily identifiable through organization and sorting filters. The grantee verified that the project scope and the three incremental openings described in the environmental documents remain as depicted in the MPS.

PMOC Determination
Grantee has satisfied the requirement. The MPS scope elements match the environmental document scope of work and meet the minimal FTA requirements and guidelines.

PMOC Recommendations
No significant recommendations.

(c) Does the schedule include adequate time and appropriate sequencing for:

(1) Reviews

The MPS contains a sufficient number of activities that represent review periods for the FTA/PMOC for planning, environmental, Final Design, and FFGA application tasks. The design and construction phase also includes review periods for permitting, real estate acquisition, and Final Design review.

(2) Agreements

The MPS contains a sufficient number of activities that represent agreement tasks including interagency and third party agreements. The FTA and PMOC have suggested that the activity durations for various department agreements should be carefully evaluated, as the varying department resources may be too limited and constrained to meet the project's peak demands.

(3) Funding time frames and milestones

The MPS contains activity fragments that represent the final design phase, and FFGA Application.

(4) Material and Equipment Procurement

The MPS contains a minimal amount of activities that represent material and equipment procurement mainly because the MPS is a summary schedule. More detailed schedules such as the construction contractor schedules more appropriately contain level of detail describing procurement of equipment and material.

(5) Professional and Engineering Service Agreement Procurement

The MPS contains a sufficient number of activities that represent the procurement of professional services for planning, consultant services, general engineering consultant, Final Design, and program and construction management.

(6) Delivery methods

The MPS contains a sufficient number of activities that represent the procurement of professional services for both design-build and design-bid-build project delivery methods.

(7) Construction processes and durations and contingency buffer

The grantee has provided assumptions used to determine activity durations and built-in contingency for major Project components. While the PMOC has identified opportunities to strengthen the detail and assumptions in the BOS, it has nevertheless determined that the information provided is acceptable and meets the general intent of the OP 34 guidelines.

PMOC Determination
Grantee has satisfied the requirement. The MPS meets the minimal FTA requirements and guidelines as described within this review topic.

PMOC Recommendations
No significant recommendations.

3.4 Conclusion

It is the PMOC's professional opinion that the Master Project Schedule is mechanically sound and meets the minimal technical requirements of fundamental soundness. This determination is based on conducting the technical schedule review using the OP 34 guidelines and requirements.

The PMOC has identified a significant number of recommendations and opportunities to strengthen the integrity of the grantee's Project Controls organization, procedures, plans, technical schedule input, and technical capacity and capability. The PMOC expects the grantee to holistically and conclusively incorporate the recommendations as listed below:

3.5 Recommendations

Recommendations
The PMOC recommends the following actions be taken prior to the FTA executing an FFGA:

Format

No recommendations necessary.

Structure, Quality & Detail

(1) The grantee should establish and implement an intelligent activity ID convention in the MPS and all contractor and consultant schedules.
(2) The grantee should improve the method in which the MPS and monthly reports are transmitted to the PMOC since document uploading and downloading issues were identified in early 2011.

Mechanical Correctness

(3) The grantee should further reduce the amount number of activity logic ties that contain an excessive amount of lag due to Start-Start (SS), Start-Finish (SF), and Finish-Finish (FF) relationship types. Most of this can be accomplished with the addition of more activity detail using Finish-Start (FS) relationship ties greatly improving the logic.
(4) The grantee must significantly improve and increase logic ties at major interface points between the stations, Guideway, MSF, core systems contract, and vehicle procurement.
(5) Similarly, the MPS requires more FFGA execution successor relationship ties to identify design and construction work that cannot begin without an FFGA or due to a lack of local funding if the FFGA is delayed.

Work Breakdown Structure (WBS)

No recommendations necessary.

Phasing and Sequencing, Critical Path, Material Tasks and efficient work sequence

(6) The grantee should perform more meaningful and comprehensive analysis of the MPS critical and near critical paths each month.

(7) The grantee should review the longest critical path and make appropriate revisions to better reflect current critical path activities, and FFGA related activities.

Cost/Resource Loading

(8) Ensure that resource and cost loading requirements are included in all construction contractor contractual requirements.

Schedule control, methods, tools and organization

(9) The grantee project controls department should be co-located with all GEC project control management support staff (not including the GEC Resident Engineer team field staff, once construction begins).

(10) The grantee should implement all schedule management procedures and guidelines as documented in the PMP and its respective project control companion documents.

(11) The grantee should define a standardized reporting format and distribution for all project scheduling parties.

(12) The grantee should standardize all scheduling software settings and incorporate the requirements in all construction contractual documents.

(13) The grantee must develop and submit monthly progress reports, budget and schedule updates on a consistent basis.

Schedule Sequencing, similar activities, labor and materials, sequencing of ROW activities, temporary construction and site logistics

(14) The MPS should contain more detail to address site access and logistics, and general planning and use of staging yards, including pre-cast concrete yards and related temporary construction physical constraints.

(15) The calendar library needs minor corrections to clean up naming conventions, representation of holidays, and standard five day work week activities must be assigned an appropriate 5 day per week calendar to better represent professional services and other 5 workday activities. All calendar types should also be changed from "Global" to "Project" to prevent other schedule users from unintentional intermingling with other global calendars in their P6 data base systems.

(16) Provide more justification for the construction activity durations in the basis of schedule and better explain the basis for patent (built-in) contingency for each activity.

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)	4.1	Feb-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	4	09-Feb-12
Operating Plan	0.1	Mar-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	Pending	Pending
Contract Packaging Plan	2	19-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
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

Document Name	Transmitted to PMOC	Status (PMOC Comments)
First Schedule Submittal Package		
MPS Mar 26,2010.xer	1.13.11	Requires Revision.
MPS Mar 26,2010.pdf	1.13.11	
ROW Schedule Mar 26,2010.xer	1.13.11	Requires Revision.
ROW Schedule Mar 26,2010.pdf	1.13.11	
Basis of Schedule Report A_01-18-11.pdf	1.18.11	Basis of Schedule (first submission to PMOC).
Second Schedule Submittal Package		
HHCTPMPS11.xer	1.11.11	Requires Revision.
HHCTPROW111.xer	1.11.11	Requires Revision.
HHCTPROW111.pdf	1.11.11	
Master Program Schedule to PMO_01-07-11.pdf	1.13.11	
Master ROW Schedule to PMO_01-07-11.pdf	1.13.11	
Third Schedule Submittal Package		
HHCTPMPS.xer	2.23.11	Requires Revision.
HHCTPMPMOC.pdf	2.23.11	
MPS – DEC31.pdf	2.23.11	
Basis of Schedule Report A_01-18-11.pdf	2.23.11	Submitted second time by grantee
Basis of Schedule HHCTP.PDF	2.23.11	
MSF Basis of Schedule HHCTP.pdf	2.24.11	Supplemental to MPS Basis of Schedule
Fourth Schedule Submittal Package		
MPSPMOCA.xer	2.24.11	Requires Revision.
Fifth Schedule Submittal Package		
MPS31.xer	3.1.11	Requires Revision.
Sixth Schedule Submittal Package		
HHCTPROW.xer	3.9.11	Requires Revision.
ROW-BG-30911-PMOC.xer	3.9.11	Requires Revision.
HHCTPROWPMO.pdf	3.9.11	
Basis of Schedule HHCTP.PDF	3.9.11	
RTDS Master Project Schedules 3-9-11.pdf	3.9.11	Resubmitted on 3.13.11 also.
Seventh Schedule Submittal Package		
PMOCA.xer	3.15.11	Needs further revision but the PMOC agreed to use for this OP34. Does not contain an integrated ROW schedule.
IPS with CPP data 12811.xer	3.24.11	Integrated Project Schedule, first submission, requested by PMOC in January 2011. Used to support the OP34.
Eighth Schedule Submittal Package		
MPSHHCTCP 2011_6.xer	7.2.11	Incomplete, contains fatal flaws such as no discernible critical path, -420 negative float, errors and warnings, no ROW Schedule, no Permit Schedule, and no Procurement Schedule. First schedule submitted since May 11, 2001 on-site PMOC Schedule Workshop.
RTD PMOC by Major Milestones.plf	7.2.11	Report File Layout – was incorrect.

Document Name	Transmitted to PMOC	Status (PMOC Comments)
Basis of Master Project Schedule_Rev 2_063011_FINAL.pdf	7.2.11	Basis of Schedule, Revision 2 – acceptable with comments to be incorporated in next revision.
BOS_Early& Late _Rev 2_063011.xlsx	7.2.11	Graphic inserted in BOS
Network of Schedules Rev 2 063011.xlsx	7.2.11	Graphic inserted in BOS
WBS 2010-07-30-AA.xls	7.2.11	Graphic inserted in BOS
Ninth Schedule Submittal Package		
HHCTCPMPS2011_6rev2.xer	7.9.11	MPS
HHCTCPROW2011_6rev1.xer	7.9.11	ROW Schedule
HHCTCPMPS2011_6rev2 – Critical Path – Airport.pdf	7.9.11	
HHCTCPMPS2011_6rev2 – Critical Path – City Center.pdf	7.9.11	
HHCTCPMPS2011_6rev2 – Critical Path – WOFH-KH.pdf	7.9.11	
HHCTCPMPS2011_6rev2 – Critical Path – Longest Path.pdf	7.9.11	
HHCTCPMPS2011_6rev2.pdf	7.9.11	
HHCTCPROW2011_6rev1.pdf	7.9.11	
MPS - PMOC.plf	7.9.11	Report Layout File
ROW - PMOC.plf	7.9.11	Report Layout File
SCHEDLOG MPS 7-09-11.TXT	7.9.11	Schedule File Log
Tenth Schedule Submittal (Supplemental MPS Revision)		
HHCTCPROWandMPS_6 b.xer	7.11.11	MPS with incorporated ROW Schedule
Schedule Updates		
MPS HHCTCP 2011_8	1.5.12	August 2011
MPS HHCTCP 2011_9	1.5.12	September 2011
MPS HHCTCP 2011_10	1.5.12	October 2011
MPS HHCTCP 2011_11	1.5.12	November 2011
Not Submitted		December 2011
Not Submitted		January 2012
Not Submitted		February 2012
OP34 + OP40 MPS (FFGA Application)		
MPS HRTP 2012_1 FFGA Baseline Submittal.xer	3.15.12	Used for OP34
MPS HRTP 2012_1.txt	3.15.12	
MPS HRTP FFGA Baseline PMOC Layout.plf	3.15.12	
MPS HRTP FFGA Submittal Cover.doc	3.15.12	
HART_Basis of Schedule Report Rev 2 (March 16 2012) Final Draft.pdf	3.15.12	
OP34 + OP40 MPS (FFGA Application)	Revision to consolidate Airport + City Center guideway	
HRTP Baseline Progress Schedule REV.04.xer	6.13.12	Used for OP34
HART FFGA BASELINE PMOC Review.plf	6.13.12	
Basis of Schedule 062012.pdf (Rev 3.0)	6.20.12	