REVISED RECOVERY PLAN OF 2018

NOVEMBER 19, 2018, UPDATED MAY 10, 2019

HONOLULU AUTHORITY for RAPID TRANSPORTATION

5/14/2019

Andrew S. Robbins
HART Executive Director and
Chief Executive Officer

Date

Table of Contents

Executive Summary **1**
ES-1. Introduction 1
ES-2. Key Changes Since 2017 Recovery Plan 3
ES-3. Management Capacity and Capabilities 4
ES-4. Cost Reduction and Containment 5
ES-5. DBFOM Project Delivery 7
ES-6. Completion of the FFGA Scope 7
ES-7. Project Capital Funding and Finance 7
ES-8. Recovery Plan Summary 8
1 Key Changes Since September 2017 Recovery Plan **9**
1.1 Project Capital Cost Updated to Address FTA's Concerns 9
1.2 Project Schedule Updated to Address FTA's Concerns 9
1.3 All Non-Capital Investment Grant (Non-CIG) Capital Funds Committed and Secured for the Project 9
1.4 Design-Build-Finance / Operate-Maintain (DBFOM) Form of Public-Private Partnership (P3) to be Utilized for Project Completion and for Systemwide Operations and Maintenance (O&M) 10
1.5 Transition in Process to Transfer Responsibility for Rail Operations and Maintenance 10
1.6 Financial Capacity to Cover an Unexpected Cost Increase or Funding Shortfall in an Amount Equivalent to at least Ten Percent of the Project Cost 11
1.7 Financial Capacity to Cover Delays in Receipt of FTA CIG Funding 11
1.8 Summary of Key Assumptions in the Twenty-Year Financial Model 12
1.9 Summary of Sources and Uses of Funds 13
2 Project Background **15**
2.1 Purpose of the Recovery Plan 15
2.2 Project Description 16
2.3 Project History 17
2.4 Major Project Issues 20
2.5 DBFOM Analysis and Decision 23
2.5.1 P3 Objectives 24
2.5.2 P3 Project Scope 25
2.5.3 Preliminary Financing Structure for P3 28
3 Management Capacity and Capability **31**
3.1 Overview 31
3.2 Project Staffing and Personnel 31

3.2.1 HART Board of Directors 41
3.2.2 The City and County of Honolulu 41
3.2.3 Executive Director and CEO Search 42
3.2.4 Qualifications of Key Personnel 42
3.2.5 Qualifications of Key Personnel – DTS 49
3.2.6 Staffing Strategy and Approach 52
3.3 HART Process and Procedure Changes 52
3.3.1 Management of Current Contracts 52
3.3.2 Project Controls 57
3.3.3 Risk Management Program 61
3.3.4 Operations and Maintenance Transition Plan 66
3.3.5 Safety Oversight 71
3.3.6 Decision Milestone Matrix 71
4 Cost Reduction and Containment 73
4.1 Methodology and Approach 73
4.2 Project Delivery Efficiencies 73
4.3 Potential Cost Reduction through DBFOM 74
4.4 Value Engineering 75
4.5 Lessons Learned 75
4.6 Soft Costs 76
4.7 Peer Reviews 76
4.8 HECO Utility Relocation and Alternative Equipment 76
4.9 Interim Opening 78
4.9.1 Interim Opening Service Operation 79
4.9.2 Park and Ride Facility 80
4.10 Cost Containment and Cost Savings Evaluations 81
5 Fulfillment of FFGA Scope 89
5.1 Project Progress and Current Status 89
5.2 Major Contract Status 89
5.2.1 Contract Status for DBFOM P3 Elements 90
5.3 ROW Update 91
5.4 Strategic Actions to Facilitate Timely ROW Acquisitions 91
5.5 Summary of Actions to Completion 92
5.5.1 Major Contract Procurements and DBFOM 92
5.5.2 HECO Coordination 92
5.5.3 Casting Yard 93
5.6 Development of Acceptable Project Cost 93
5.6.1 Introduction 93
5.6.2 Cost Estimating Methodology 93

5.6.3 Adequacy of Contingency 94
5.6.4 Updated Cost Estimate 94
5.6.5 Range of Finance Costs 95
5.7 Development of Acceptable Project Schedule 95
5.7.1 Project Schedule for Non-DBFOM P3 elements 96
5.7.2 Project Schedule for DBFOM P3 Elements 96
5.8 Operations and Maintenance for Interim and Full Openings 97
5.9 Fare Collection 97
6 Project Finance 99
6.1 Summary 99
6.2 Outcome of State and City Funding Legislation 101
6.2.1 State Legislature and Governor of the State of Hawai'i 101
6.2.2 Honolulu City Council and Mayor of the City and County of Honolulu 102
6.3 Financial Plan 102
6.4 Funding Sources and Forecast Methodology 105
6.4.1 O'ahu GET Surcharge and State-wide TAT 105
6.4.2 GET Surcharge and TAT Forecast Methodology 106
6.4.3 Federal Funding 109
6.4.4 City Subsidy – HART Support 109
6.5 Project Capital Plan 111
6.5.1 Capital Cost 111
6.6 Capital Cost Financing 112
6.7 Risks, Uncertainties, and Mitigation Strategies 112
6.7.1 Capital Plan 113
6.7.2 Revenue and Funding Risks 114
7 Operating Plan 115
7.1 Introduction 115
7.2 Bus Operations and Planning for Rail Service 116
7.2.1 Interim Opening 1 – East Kapolei Station to Aloha Stadium Station 116
7.2.2 Interim Opening 2 – Eastward Extension from Aloha Stadium Station to Middle Street Station 118
7.2.3 Full Opening – East Kapolei Station to Ala Moana Center Station 120
7.3 Operating Plan 122
7.3.1 Introduction 122
7.3.2 Update Summary 122
7.3.3 Operating Cost Update 124
7.3.4 Operating Revenues 133
7.3.5 System-wide Operating Plan 139
7.3.6 City Contribution 140
7.3.7 Operating Cost Risks 142

7.3.8 Operating Revenue Risks 142
7.3.9 Potential Mitigation Strategies for the Operating Plans 143

8 Sensitivity Analysis for Capital Cost and Revenue 145

8.1 Sensitivity Analysis for 10% Cost Increase 145

8.2 Demonstrate Financial Capacity to Cover Delays in Receipt of FTA CIG Funding 145

9 Recovery Plan Summary 147

Figures

Figure 1-1 Obligated and Unobligated FTA Funding 12
Figure 1-2 Sources and Uses of Funds 13
Figure 2-1 HRTP System Overview 16
Figure 3-1 Organizational Chart and Key Departmental Updates – Senior Management 33
Figure 3-2 Organizational Chart and Key Departmental Updates – Project Director and Core Systems, Integration & P3 Project Delivery 34
Figure 3-3 Organizational Chart and Key Departmental Updates – Design and Construction 35
Figure 3-4 Organizational Chart and Key Departmental Updates – ROW, Planning, Environmental Compliance and Sustainable Mobility 36
Figure 3-5 Organizational Chart and Key Departmental Updates – Budget and Finance, and Administrative Services 37
Figure 3-6 Organizational Chart and Key Departmental Updates – Project Controls and Procurement, Contracts, and Construction Claims 38
Figure 3-7 Organizational Chart and Key Departmental Updates – System Safety & Security, Public Information, Government Relations, Quality Assurance, HART Board Support, Civil Rights, Legal Counsel 39
Figure 3-8 Field Office Risk Management Flowchart 62
Figure 3-9 Risk Manager and Project Controls Flowchart 63
Figure 3-10 Risk Management Reports and Committee Flowchart 64
Figure 3-11 Readiness and Activation Team Staff Organization Chart 67
Figure 3-12 Expected Number of Rail O&M Full-Time Positions in the City DTS and HART 68
Figure 3-13 Integration of Rail into Existing DTS Divisions 69
Figure 3-14 DTS Rail Operations and Maintenance Staffing Plan 70
Figure 4-1 HECO Clearance Relocations 77
Figure 4-2 HRTP Alignment Overview 79
Figure 4-3 Interim Opening Turnback Configuration 80
Figure 4-4 Interim Service Summary of Operations 80
Figure 4-5 Park and Ride Facilities 81
Figure 4-6 Project Cost Reduction Efforts 83
Figure 5-1 Project Progress and Status 90
Figure 5-2 Updated Cost Summary 94
Figure 6-1 Funding Summary 100

Figure 6-2 Baseline Financial Plan (DRAFT) ... 104
Figure 6-3 Baseline Financial Plan Summary ... 105
Figure 6-4 Revenue Council Estimated General Fund Tax Revenues ... 106
Figure 6-5 Revenue Council Growth Rates ... 107
Figure 6-6 GET Comparison, 1981-1991 vs. 1992-2017 ... 107
Figure 6-7 Project Forecasted Growth Rates ... 108
Figure 6-8 Statewide TAT Compounded Growth Rate ... 108
Figure 6-9 Obligated and Unobligated FTA CIG Funding ... 109
Figure 6-10 Estimated City Subsidy – HART Non-Capitalized Support and Additional Funds ... 110
Figure 6-11 Baseline Project Costs ... 111
Figure 6-12 Baseline Project Capital Costs ... 111
Figure 7-1 Original Financial Plan Figures, June 2012 ... 123
Figure 7-2 Original Financial Plan Rail Costs in FY2020, YOE Dollars (Millions) ... 124
Figure 7-3 Update of Rail O&M Costs, 2017 Dollars (Millions) ... 125
Figure 7-4 Honolulu Labor Index, August 2016 ... 126
Figure 7-5 Core Systems Materials Index Update ... 127
Figure 7-6 Power Consumption and Rate Variances ... 128
Figure 7-7 Rail Costs under Various Inflation Assumptions ... 130
Figure 7-8 Comparison of Cost Escalation Scenarios, FY2026-FY2036, YOE Dollars (Millions) ... 131
Figure 7-9 Core Systems Labor Index and Industrial Power Correlation ... 132
Figure 7-10 Growth Rates of Bus Costs per Revenue Service Hour ... 132
Figure 7-11 TheHandi-Van Annual Trips and Operating Costs ... 133
Figure 7-12 TheBus Fare Structure and History ... 134
Figure 7-13 Historical and Forecasted Linked Trips for TheBus and the Project, FY2004–FY2030, Millions of Trips ... 136
Figure 7-14 Original Financial Plan Fare Increases, FY2011–FY2030, YOE Dollars (Millions) ... 137
Figure 7-15 Average Fare Comparisons Original vs Updated Plan, YOE Dollars (Millions) ... 138
Figure 7-16 Ridership Sensitivity, YOE Dollars (Millions) ... 140
Figure 8-1 Obligated and Unobligated FTA CIG Funding ... 146

Appendices

Appendix A: **Project Maps**
- Exhibit A-1: Honolulu Rail Transit Project Alignment
- Exhibit A-2: Honolulu Rail Transit Project Progress & Status
- Exhibit A-3: HECO Clearance Relocation Projects

Appendix B: **Primary and Secondary Mitigation Measures, Value Engineering, and Cost Containment and Reduction Ideas, Implemented or Considered**
- Exhibit B-1: HART Primary and Secondary Mitigations, and Other Cost Reduction Proposals
- Exhibit B-2: Value Engineering Proposals, Implemented from Previous VE Studies and Under Consideration by HART
- Exhibit B-3: Lessons Learned

Appendix C: **Program Risks**
- Exhibit C-1: Risk Hit List for the Honolulu Rail Transit Project

Appendix D: **Ryder Levett Bucknall USA Quarterly Construction Cost Report, Fourth Quarter 2017**

Appendix E: **Andrew S. Robbins Curriculum Vitae**

Appendix F: **Basis of Cost Estimate**

Appendix G: **Basis of Schedule**

Appendix H: **Ridership Forecasts**
- Exhibit H-1: Comparison of HRTP Ridership Forecasts, Daily Rail System Boardings, 2030
- Exhibit H-2: East-bound Rail Boardings/Alightings, A.M. Peak Period (6 a.m.–9 a.m.), 2030
- Exhibit H-3: West-bound Rail System Boardings/Alightings, A.M. Peak Period (6 a.m.–9 a.m.), 2030

Appendix I: **HECO Relocations and Related Issues**
- Exhibit I-1: HECO Equipment and Relocation Costs
- Exhibit I-2: HECO Relocation Solutions by HRTP Section

Appendix J: **Operating Plan Methodology and Scenarios**
- Exhibit J-1: Operating Plan, Continued Original Plan Methodology
- Exhibit J-2: Operating Plan, Moderate Range Scenario
- Exhibit J-3: Operating Plan, High Cost Range Scenario
- Exhibit J-4: Operating Plan, Ridership Sensitivity, at Current Average Fare Rate

This page intentionally left blank.

Acronyms

AGS	Airport Section Guideway and Station Group
AHJV	Ansaldo Honolulu Joint Venture
AIS	Archaeological Inventory Survey
APTA	American Public Transportation Association
BLS	United States Bureau of Labor Statistics
BOE	Basis of Estimate
CAM	Critical Access Milestone
CAGR	Compounded Annual Growth Rate
CCGS	City Center Section Guideway and Station Group
CCUR	City Center Utilities Relocation Construction
CMS	Contract Management System
CPI-U	Consumer Price Index All Urban Consumers
CPP	Contract Packaging Plan
DB	Design-Build
DBB	Design-Bid-Build
DBFOM	Design-Build-Finance-Operate-Maintain
DBOM	Design-Bid-Operate-Maintain
DTS	City and County of Honolulu, Department of Transportation Services
EAC	Estimate at Completion
EIS	Environmental Impact Statement
FEIS	Final Environmental Impact Statement
FFGA	Full Funding Grant Agreement
FHSG	Farrington Highway Station Group
FRR	Farebox Recovery Ratio
FTA	Federal Transit Administration
FY	Fiscal Year
GAAP	Generally Acceptable Accounting Principles
GET	State of Hawai'i General Excise and Use Tax
GO	General Obligation
HART	Honolulu Authority for Rapid Transportation
HDOT	State of Hawai'i Department of Transportation
HECO	Hawaiian Electric Company, Inc.
HRTP	Honolulu Rail Transit Project

ICE	Independent Cost Estimate
IDIQ	Indefinite Delivery Indefinite Quantity
IVR	Interactive Voice Response
KHG	Kamehameha Highway Guideway
KHSG	Kamehameha Highway Station Group
kV	Kilovolt
LCC	Leeward Community College
LPA	Locally Preferred Alternative
MOS	Minimum Operable Segment
MPIS	Master Project Integrated Schedule
MSF	Maintenance and Storage Facility
MTA	Metropolitan Transportation Authority
NEPA	National Environmental Protection Act
NTP	Notice to Proceed
O&M	Operations and Maintenance
OahuMPO	O'ahu Metropolitan Planning Organization
OTS	O'ahu Transit Services, Inc.
P3	Public-Private Partnership
PHGTC	Pearl Highlands Parking Garage and Transit Center
PMOC	Project Management Oversight Contractor
PMP	Project Management Plan
R&O	Risks and Opportunities
RFP	Request for Proposals
ROC	Rail Operations Center
ROD	Record of Decision
ROW	Right-of-Way
RSD	Revenue Service Date
RVH	Revenue Vehicle Hour
SB4	Senate Bill 4
SCC	Standard Cost Category
SEIS	Supplemental Environmental Impact Statement
SUE	Subsurface Utility Engineering
TAT	Transient Accommodation Tax
TCE	Temporary Construction Easement
TCP	Traditional Cultural Property

TDFM	Travel Demand Forecasting Model
TECP	Tax-Exempt Commercial Paper
TOD	Transit-Oriented Development
TVM	Ticket Vending Machine
UH	University of Hawai'i
USDOT	United States Department of Transportation
WBS	Work Breakdown Structure
WMATA	Washington Metropolitan Area Transit Authority
WOSG	West O'ahu Station Group
WOFH	West O'ahu/Farrington Highway Guideway
YOE	Year of Expenditure

This page intentionally left blank.

Executive Summary

ES-1. Introduction

On December 19, 2012, the Federal Transit Administration (FTA) and the City and County of Honolulu (City) formalized a partnership by signing a Full Funding Grant Agreement (FFGA) for the Honolulu Rail Transit Project (HRTP or Project). The Honolulu Authority for Rapid Transportation (HART) is the semi-autonomous public transit authority responsible for the planning, construction, and expansion of the fixed guideway transit system Project. The HRTP is a 20.1-mile fixed guideway rail system with 21 stations extending from East Kapolei to Ala Moana Center. By 2030, nearly 70% of O'ahu's population and more than 80% of the island's jobs will be located along the 20.1-mile rail corridor, with stations at key commuter and visitor destinations such as the Honolulu International Airport, Joint Base Pearl Harbor-Hickam, downtown Honolulu and Ala Moana Center.

Consistent with FTA direction, the Project will be completed at a cost of under $8.299 billion excluding financing costs with a Revenue Service Date (RSD) for the full system no later than September 2026. HART's commitment to the residents of Honolulu is to complete the Project at a cost no greater than $8.165 billion and open for full revenue service by December 2025. The initial State of Hawai'i General Excise and Use Tax (GET) surcharge was intended to provide a 70% local share (30% federal share), which is one of the highest local share overmatches in the FTA New Starts Program. With the current cost of the Project at $8.165 billion and the FTA match at its original $1.55 billion, the local match is approximately 80% of the Project cost.

The Project has faced numerous challenges since its inception that have resulted in cost increases and schedule delays. Project planning and cost estimates were developed in the midst of a recession and were hampered by a number of events that were beyond the anticipation of the original parties. At the same time, well-intended decisions were made to award various Project construction contracts to take advantage of the construction market at the time and to stimulate local job creation prior to completing all third-party agreements, contractor interface requirements and, in some cases, applicable designs. These early contract awards experienced negative cost and schedule impacts that have contributed to the need for this Recovery Plan.

In addition, delays associated with Notice to Proceed (NTP), the Archaeological Inventory Study (AIS), and Traditional Cultural Properties (TCPs)—which suspended construction activities on the West O'ahu/Farrington Highway Guideway (WOFH), Kamehameha Highway Guideway (KHG), and Maintenance and Storage Facility (MSF) contracts—had a large impact on Project costs totaling $172 million, including escalation. Moreover, lawsuit delays pushed construction activities into the recovery years following the recession, which had a cascading impact on schedule and, in turn, had even further cost impacts on the Project. Finally, an equally harmful and even longer-term cost impact, also beyond the control of the

Project sponsor, is the fact that Honolulu was the most expensive city for construction in the United States for the years 2012 through 2017, according to the Rider Levett Bucknall National Construction Cost Index. While the execution of some early contracts in hindsight was unfortunate and resulted in substantial cost impacts, there were also many cost impacts that could not have been anticipated.

Despite these challenges, HART and the City are committed to construct and deliver the Project as described in the FFGA. This update to the Recovery Plan now includes a Financial Plan that is predicated on additional local revenues generated by Act 1 Relating to Government of the Twenty-Ninth Legislature, 2017, First Special Session (Act 1), enacted into law with the signature of Governor David Ige on September 5, 2017. HART confirms that it has the resources to complete the HRTP as described in the FFGA—20.1 miles with 21 stations. Subsequent to the State action, the City Council adopted Ordinance 17-48 in support of the funding language in the bill, and the Mayor signed the same on September 7, 2017. This Financial Plan also illustrates how the City subsidized $44 million toward the Project budget as a commitment toward the full City contribution to rail funding that became necessary by Act 1. The City has approved legislative measures confirming this commitment. HART received the $44 million on November 13, 2018.

This Recovery Plan further demonstrates that HART has diligently developed and established management structures, controls, and procedures that are as important to the completion of the Project as the committed funding. The Recovery Plan details HART's core competencies and the development and implementation of critical project management, risk management, and cost and schedule controls that are essential to the recovery of this Project. HART also continues to proactively evaluate additional opportunities to reduce Project cost.

As part of the cost control efforts, HART evaluated and ultimately selected an alternative delivery method for the City Center Guideway and Stations Segment (CCGS) and Pearl Highlands Parking Garage and Transit Center (PHGTC). The cancellation of the design-build contract for the final City Center segment of the Project due to a conflict of interest created by the merger of the design firm and a construction firm on the CCGS segment of the Project in 2017 provided HART an opportunity to explore alternative project delivery methods ahead of the re-procurement.

HART contracted with a financial advisory firm, Ernst and Young Infrastructure Advisors, to perform an independent feasibility assessment for the use of a Public-Private Partnership (P3) approach to the CCGS and PHGTC and to operate/maintain the Project on a long-term basis. A Commercial Viability Analysis was performed to evaluate several P3 delivery methods against HART goals for the construction of the remaining Project elements and operations of the full HRTP system. HART subsequently conducted comprehensive analysis and refinement to tailor an appropriate approach unique to the Project, understanding the existing partnership between HART and the City and County of Honolulu. The internal assessment concluded that utilizing a design-build-finance delivery method for the design

and construction of the remaining elements of the Project and a 30-year operating and maintenance agreement for both systems elements and non-systems facilities would provide the best approach for providing increased budget and schedule certainty going forward.

Based upon further refinement of the P3 approach developed by the HART team, the Board of Directors at its meeting on September 27, 2018 approved the utilization of a P3 delivery model to design, build, and finance the CCGS and PHGTC and operate and maintain the entire system with the City and County of Honolulu. Seeking P3 financing as a part of the Design-Build-Finance-Operate-Maintain (DBFOM) solicitation will potentially reduce public financing for the CCGS and PHGTC, as well as facilitate the beneficial transfer of schedule, cost and integration risk to an experienced and competent private sector concessionaire. DBFOM also addresses FTA concerns with the transition of O&M responsibilities between HART and the City and creates the opportunity for the long-term sustainability of the rail system throughout the useful life of the operating assets.

Cost and schedule controls will be increasingly important as the Project moves into Honolulu's dense urban core. The delay in the procurement of the CCGS contract enabled HART to advance the utilities design as Indefinite Delivery Indefinite Quantity (IDIQ) documents, thus minimizing the risks associated with utilities relocations and approvals. This, in turn, will reduce risk in the subsequent CCGS Contract. In May 2018, HART awarded the City Center Utilities Relocation Construction (CCUR) contract and work is currently underway.

ES-2. Key Changes Since 2017 Recovery Plan

The following are the key changes since the 2017 Recovery Plan. Additional detail on these changes is provided in Section 1.

- Project capital cost has been updated to address FTA's concerns.
- Project schedule has been updated to address FTA's concerns.
- All non-capital investment grant (Non-CIG) capital funds have been committed and secured for the Project.
- DBFOM form of P3 will be utilized for Project completion and for systemwide O&M.
- Transition is in process to transfer responsibility for rail O&M (oversight and administration) from HART to the City and County of Honolulu, Department of Transportation Services (DTS) under Charter Amendment 4.

ES-3. Management Capacity and Capabilities

HART is confident the Project will be completed successfully under the DBFOM delivery method, utilizing its experienced key personnel and core competencies. As detailed in Section 3.2, HART now has in place a core group of individuals who have the qualifications and experience to complete a major transportation project of this scope and complexity. A continuing challenge for the Project has been hiring and maintaining experienced rail transit and construction managers. Given the fact that this is Honolulu's first rail transit construction project, its remote location 2,400 miles from the U.S. mainland, and the fact that it is one of the most expensive cities in the United States in which to live, hiring and retaining experienced personnel has been a challenge. Section 3 outlines the steps HART has been taking to immediately address open senior management positions, and it describes longer-term efforts to mentor Hawai'i-based personnel toward the skills and experience needed to assume leadership roles.

On September 5, 2017, Andrew S. Robbins became HART's new Executive Director and CEO. Mr. Robbins brings more than 37 years of rail transit experience to the Project along with a specialized expertise with driverless public transit systems that operate elsewhere in the world. These skills and experience have been most helpful as HART commissions the first high-tech driverless train to be used on a city-wide transit system in the United States. Mr. Robbins has built upon the momentum established by HART Interim Executive Director and CEO Krishniah Murthy with respect to streamlined project delivery and efficient cost containment controls. Mr. Murthy headed the overall design and construction program at Los Angeles Metro for many years, bringing numerous rail projects successfully through the design, construction and commissioning process. He continues as a special advisor on the Project.

Other key enhancements include:

- HART has strengthened its Project Controls capability, including re-baselining the Project schedule and budget and developing a trend analysis for the early detection of cost overruns, schedule impacts and project risk. It has also implemented robust tools such as the Master Project Integrated Schedule (MPIS), which has resulted in increased communication and coordination.
- To strengthen its formal risk modeling program, HART established a Risk Management Committee in 2017. Monthly meetings ensure that the progress of the Project is closely monitored in relation to contingency usage and risk exposure.
- The HART Readiness and Activation Division, formally known as the Operations and Maintenance Division, is dedicated to containing costs and maintaining scheduled system openings by ensuring a seamless transition from capital construction and commissioning to passenger service. The Division meets regularly with DTS leadership regarding the transition of responsibility for O&M to the City, focusing on

organizational development and planning, systems operability and maintainability, and readiness and activation cost implications.

- HART has also expanded its Core Systems resources by bringing in an individual with 50+ years' experience with automated systems to help with the system testing and certifying.

ES-4. Cost Reduction and Containment

HART's overall efforts in cost reduction and cost containment are discussed in Section 4. This discussion supplements the Project Management Plan (PMP) and the Risk and Contingency Management Plan (RCMP) which were updated in response to comments from the Project Management Oversight Contractor (PMOC) in March 2018. The approved RCMP, and the associated Risk Management Procedure, continue to serve as the basis of HART's ongoing Risk Management program. Risk mitigations are actively pursued by the HART Project team members on a monthly basis, often with success in reducing risk exposure that translate into cost and schedule savings. Furthermore, risks are candidly addressed and included in the risk database, so that the overall cost exposure of the Project is objectively forecast. Risk Management Committee meetings are held generally every month, allowing senior managers at HART to address important risk topics such as Secondary Mitigations, new risks, top project risks, and identifying action items as needed for small teams to pursue mitigation of risks.

Consistent with the RCMP, HART has implemented cost reduction and containment measures, including:

- Exploring project delivery efficiencies by revising contract requirements and packaging strategies.
- Brainstorming mitigations to known risks.
- Implementing value-engineering principles to reduce cost without compromising functional requirements.
- Evaluating cost avoidance through an active lessons-learned program.
- Evaluating soft costs.
- Proactively evaluating the costs and benefits of an interim opening.
- Evaluating secondary mitigation opportunities if the cost proposals for the DBF components (CCGS and PHGTC) of the DBFOM project exceed the affordability limit for the Project.

Examples of cost reductions and containment, in addition to risk mitigations, are outlined below.

- HART and the Hawaiian Electric Company, Inc. (HECO) have collaborated to address a significant cost risk associated with the guideway structure impinging on safety clearance areas for HECO's electric transmission and distribution lines. By collaborating on solutions using a combination of alternate service vehicles, increased easements, and selective undergrounding of utility lines, HART will be able to save approximately $132 million.
- HART has identified significant cost savings resulting from the proactive management of active risks. These have been discussed with the PMOC and FTA. HART provided an evaluation showing contingency reductions for many of the items, and cost avoidance for the other items – meaning the cost avoidance is recognized but overall contingency is still held by Project Controls allowing the preserved contingency from the risk mitigations to be used should other issues arise in the future.
- In case the affordability limit is exceeded for the DBF portion of the project (for CCGS, PHGTC and associated Core Systems work within the DBF) HART will work with P3 Proponents to identify which value engineering, innovations, and/or secondary mitigations can and should be included and implemented in the Project scope that will keep the overall Project within budget. Within the P3 procurement, HART will be utilizing an Alternate Technical Concept (ATC) process whereby P3 proponents may propose, on a confidential basis, changes to the RFP and innovations that may be included in their proposals that seek to reduce the overall cost and increase the value to taxpayers in regard to building and operating the CCGS and PHGTC less expensively, but still fulfill the basic requirements and functionalities of the DBF and O&M portions of Project. Using these approaches, HART will have an early notification of issues during the procurement process regarding affordability of the CCGS and PHGTC components of the Project such that effective management decisions can be made on the deployment of ATC's and possible and available secondary mitigation measures.
- HART continues to evaluate cost reduction options that would not compromise the integrity of the overall system nor compromise the terms of the FFGA or environmental clearance. Many such concepts may arise as Alternative Technical Concepts (ATC's) that the DBFOM firms bidding for the P3 concession would be encouraged to propose. Such ideas may include simplification of the station canopy design or elimination of non-essential aesthetic elements.

The above efforts, along with the revised Risk Management and Project Controls structures and actions, are intended to contain cost and schedule growth associated with project risks.

ES-5. DBFOM Project Delivery

In partial response to the increased costs of the HRTP and the delays which the Project has experienced, over the last eight months HART studied various alternative approaches to project delivery, some of which involve significant risk transfer to potential private partners in sharing cost, schedule and financing risk for completing HRTP construction. These partnerships also transfer risk and responsibility to the private sector for operating and maintaining the system and providing asset maintenance and replacement under a long-term contractual arrangement.

The CCGS segment is the most complex portion of the civil works within the Project and can be a beneficial undertaking as a P3 owing primarily to the substantial interface risks in the design and construction of the guideway, stations, and core systems elements which can be effectively transferred from the public to the private sector. This is especially true in the case of advanced and proprietary technology which a public entity is often less able to operate and manage than an experienced private operator.

On September 27, 2018 the HART Board of Directors voted to change the project delivery approach to complete the remaining capital components of the HRTP and to operate and maintain the entire system under a specifically structured P3 based on a 30-year concession for DBFOM project delivery.

ES-6. Completion of the FFGA Scope

Using the project management techniques, risk analysis, cost containment, change in project delivery approach, and project controls described in this Recovery Plan, HART confirmed the updated Project cost of $8.165 billion and an updated RSD of December 2025. While HART believes that this cost estimate and schedule are realistic and achievable, HART has agreed to use FTA's recommended Project cost of $8.299 billion and recommended RSD of September 2026 resulting from the June 2018 Risk Refresh. HART is committed to completing the original FFGA scope in accordance with the FTA-recommended cost and schedule. HART acknowledges that the federal funding commitment for the Project is capped under the FFGA and that the additional funds needed to complete the FFGA scope must be provided from non-federal sources.

As described previously, actions by the State Legislature and the Governor, and local funding actions by the Honolulu City Council and the Mayor, have made the completion of the Project to Ala Moana Center—the original scope of the FFGA—achievable.

ES-7. Project Capital Funding and Finance

As discussed in Section 6, the Project capital cost and associated funding and financing for the Project have been revised to reflect the $8.299 billion total capital cost (exclusive of

financing costs). The financial plan includes $214 million in City funding, of which $44 million was received on November 13, 2018. Revenue sources also reflect the extension of the GET and the TAT to December 31, 2030.

ES-8. Recovery Plan Summary

This 2018 Recovery Plan documents the significant changes and accomplishments that have been made to assure that the Honolulu Rail Transit Project will be completed on budget and on time, and in accordance with the terms and conditions of the FFGA. As stated, HART has agreed to use FTA's recommended Project cost of $8.299 billion and recommended RSD of September 2026 resulting from the June 2018 Risk Refresh. However, HART is committed to the Project opening for passenger service prior to December 31, 2025 and completing the Project within the construction cost estimate total of $8.165 billion inclusive of contingency and exclusive of finance costs.

In addition to ongoing responsibilities and the actions stated in the Recovery Plan, HART's major upcoming milestones include completing construction of West Side stations, providing construction access to the Core Systems Contractor for installations on Functional Track, closing out the WOFH and KHG contracts with Kiewit (the HART Board approved the final change orders towards closing out these contracts on November 15, 2018), thereby reducing the size of the overall project and its associated risks, and relocating both the wet and dry utilities in the City Center segment, procuring the CCGS and PHGTC as a DBFOM form of P3 and completion of HECO coordination and utility relocation. The CCGS DBFOM contract is the last major contract to be procured and the critical path for the overall Project. Utility relocation is a significant part of the CCGS contract in Honolulu's urban core, and HART is proactively performing pre-construction Subsurface Utility Engineering and geotechnical work. This final major contract will benefit from lessons learned and value engineering as well as updates to Project Controls, particularly the robust MPIS and Risk Assessment.

This updated Recovery Plan lays out the local funding now available to meet the current cost estimate and complete the Project. It also details a carefully developed and internally tested analysis of the Project's management capacity and capability, which has resulted in a management structure oriented toward swift implementation of project controls designed to manage identified risks.

1 Key Changes Since September 2017 Recovery Plan

This Recovery Plan updates the September 2017 Recovery Plan submitted to the Federal Transit Administration (FTA) by the Honolulu Authority for Rapid Transportation (HART). The Plan provides detailed discussion about the Honolulu Rail Transit Project (HRTP or Project) and HART's enhanced project management capacity and project controls designed to manage identified risks and provide for completion of the Project on budget at $8.299 billion and on schedule by September 2026. Key changes from the prior plan resulting from these enhancements are summarized below.

1.1 Project Capital Cost Updated to Address FTA's Concerns

In response to issues raised in the Final Risk Refresh Report on the Honolulu Rail Transit Project transmitted by FTA on June 29, 2018 and in compliance with FTA direction in its letter of September 21, 2018, HART has updated the Project cost estimate to $8.299 billion (excluding finance costs). While this cost is $134 million greater than HART's cost estimate of $8.165 billion, HART has revised the Project cost estimate and identified the additional funding to meet the higher estimate. Although the Recovery Plan utilizes the cost estimate recommended by FTA, HART intends to meet its commitment to the citizens of Honolulu to complete the Project within the $8.165 billion cost estimate.

1.2 Project Schedule Updated to Address FTA's Concerns

In response to the issues raised in the Final Risk Refresh Report on the Project transmitted by FTA on June 29, 2018 and in compliance with FTA direction in its letter of September 21, 2018, HART has updated the Project schedule to reflect a Revenue Service Date (RSD) of September 2026 compared to HART's forecast of December 2025. Although the Recovery Plan utilizes the RSD recommended by FTA, HART intends to meet its commitment to the citizens of Honolulu to complete the Project with full system revenue service by December 2025.

1.3 All Non-Capital Investment Grant (Non-CIG) Capital Funds Committed and Secured for the Project

HART has identified all non-CIG funding as required by the 2018 Risk Refresh to meet the $8.299 billion capital cost of the Project. As requested by FTA in its letters of September 21, 2018 and October 25, 2018, the Mayor and City Council have released, and HART has received the $44 million identified in HART's current and previous financial plan of September 15, 2017.

1.4 Design-Build-Finance / Operate-Maintain (DBFOM) Form of Public-Private Partnership (P3) to be Utilized for Project Completion and for Systemwide Operations and Maintenance (O&M)

In partial response to the increased costs of the HRTP and the delays which the Project has experienced, over the last eight months HART studied various alternative approaches to project delivery, some of which involve significant risk transfer to potential private partners in sharing cost, schedule and financing risk for completing HRTP construction. These partnerships are intended to transfer risk and responsibility to the private sector for operating and maintaining the system and providing asset maintenance and replacement under a long-term contractual arrangement.

HART's Recovery Plan includes the modification of the project delivery structure from Design-Build (DB) to Design-Build-Finance-Operate-Maintain (DBFOM) for the Center City Guideway and Stations (CCGS) Segment and the Pearl Highlands Garage and Transit Center (PHGTC). On September 27, 2018, the HART Board of Directors voted to complete the remaining capital components of the HRTP and operate and maintain the entire system under a specifically structured P3 based on a 30-year concession for DBFOM project delivery.

1.5 Transition in Process to Transfer Responsibility for Rail Operations and Maintenance

The approval of the 2016 Charter Amendment 4 to the Revised Charter of the City and County of Honolulu 1973 (2000 edition), as amended, reassigned operations and maintenance responsibilities for the rail system from HART to the City and County of Honolulu, Department of Transportation Services (DTS).

HART and DTS are negotiating a Memorandum of Understanding (MOU) to clarify the responsibilities of the two organizations during the transitional phase when construction and O&M activities overlap. In addition, HART and DTS delivered a joint transition plan presentation to the HART Board of Directors on March 15, 2018. HART and DTS also presented on the subject to the Project Management Oversight Consultant (PMOC) in February and May of 2018. In August 2018, HART, the PMOC, and FTA representatives agreed to use the major milestones of the Rail Activation Plan (RAP) as the basis for the transition of O&M to DTS.

Additional detail concerning the transition plan is provided in Section 3.

1.6 Financial Capacity to Cover an Unexpected Cost Increase or Funding Shortfall in an Amount Equivalent to at least Ten Percent of the Project Cost

As discussed in Section 6, there are funding, cost and interest rate risks associated with the Project. Strategies available to HART to mitigate these downside risks include:

- Utilize the existing Tax-Exempt Commercial Paper (TECP) bond program for short-term financing needs.
- Reduce HART's expenses and Project costs.
- Absorb higher interest rates above the conservative interest rates used to estimate financing. The HART financial plan uses an average 4% rate for fixed-rate debt and 3% for variable-rate debt. The average rates used are approximately 1% higher than the current market rate. Thus, HART can absorb reasonable increases in a rising rate environment.

1.7 Financial Capacity to Cover Delays in Receipt of FTA CIG Funding

HART modified FTA grant award schedule for the remaining $744 million in the financial plan based on the schedule provided by FTA in a letter to HART dated March 29, 2019. The table below compares the estimated schedule for the remaining $744 million as compared to the initial $806 million. Using an average 4% interest on fixed rate debt, every $100 million delay increases debt service by $4 million annually. While HART believes the FTA's intent is to expedite the FFGA funding commitment upon acceptance of the Recovery Plan, HART should be able to absorb short-term delays.

Figure 1-1 Obligated and Unobligated FTA Funding

Fiscal Year Allocations	Obligated Amounts	Unobligated Amounts	Total
2008-2011	$119,990,000	---------	$119,990,000
2012	$200,000,000	---------	$200,000,000
2013	$236,277,358	---------	$236,277,358
2014	$250,000,000	---------	$250,000,000
2019	---------	---------	---------
2020	---------	$100,000,000	$100,000,000
2021	---------	$150,000,000	$150,000,000
2022	---------	$150,000,000	$150,000,000
2023	---------	$150,000,000	$150,000,000
2024	---------	$100,000,000	$100,000,000
2025	---------	$50,000,000	$50,000,000
2026	---------	$43,732,642	$43,732,642
Total	$806,267,358	$743,732,642	$1,550,000,000

1.8 Summary of Key Assumptions in the Twenty-Year Financial Model

The financial model was prepared using the following general assumptions. Detailed discussions are in Section 6.

- State of Hawai'i General Excise (GET) and Transient Accommodation (TAT) tax revenues are based on the State of Hawai'i Council on Revenues forecast.
- Project costs increased from $8.165 billion to $8.299 billion, an increase of $134 million or 1.64% to comply with the FTA's 2018 Risk Refresh Report.
- Average interest rates used for debt are 4% for fixed-rate debt and 3% for variable-rate debt and TECP.

1.9 Summary of Sources and Uses of Funds

The figure below summarizes the sources and uses of funds for the Project. As shown in the figure and discussed in Section 6, the total cost of the Project excluding financing costs is $8.299 billion. After payment of Project capital costs and financing costs (interest and fees) of $840 million, HART expects to have a $109 million cash balance at Project completion.

Figure 1-2 Sources and Uses of Funds

Source / Use	Amount (millions)	Total (millions)
Beginning FFGA Cash Balance		$298
Add Funding Source:		
GET	$5,990	
TAT	$1,182	
FTA CIG	$1,550	
City Subsidy	$ 214	
Other ($4 million from the American Recovery and Reinvestment Act, Interest Income and Rent)	$ 13	$8,950
Total Sources		**$9,248**
Less Project Uses		
Project Costs	($8,077)	
Unallocated Contingency	($222)	
Total Project Uses		**($8,299)**
Cash Available Before Financing		$949
Financing Costs (Interest and Fees)		($840)
Ending Cash Balance		**$109**

Note: Numbers may not match due to rounding.

This page intentionally left blank.

2 Project Background

2.1 Purpose of the Recovery Plan

The purpose of the Recovery Plan is to address key changes to the Project that have occurred since the prior plans were submitted in 2017.

The Recovery Plan submitted to the FTA on April 28, 2017 included two options for completion of the Project. The inclusion of the second option, or Plan B, was due to the uncertainties regarding a dedicated source of funding at that time.

On September 5, 2017, the Governor of the State of Hawai'i, David Y. Ige, signed into law Act 1, providing additional funding through December 2030 to the City and HART to complete the 20.1-mile and 21-station elevated rail transit system extending from East Kapolei in the west to the Ala Moana Center in the east. On September 15, 2017, HART submitted a revised Recovery Plan, without the Plan B option, reflecting the additional funding.

Subsequent to the September revised Recovery Plan, FTA required HART to further revise the Recovery Plan to reflect risk-adjusted changes in Project cost and schedule and to demonstrate the commitment of local funding from the City. In addition, on February 26-27 2018, the PMOC conducted a Risk Refresh Workshop to review detail of individual risks and provide recommendations regarding risk mitigation options and alternatives, including changes to scope, schedule, budget, and use of cost and schedule contingencies. On June 29, 2018, FTA transmitted a final Risk Refresh Report providing recommendations for adjustments to the Project scope, cost, schedule and project management activities to respond promptly to project risks. This 2018 Recovery Plan will demonstrate the following to the satisfaction of the FTA:

- HART has the management and technical capacity and capability to successfully complete the full scope of work of the Project defined in the Full Funding Grant Agreement (FFGA).
- HART has developed a realistic and achievable updated Capital Cost Estimate for the completion of the Project.
- HART has developed a realistic and logical updated Project Schedule that will assure the full Project can be opened to Revenue Service by the revised RSD of September 2026, and by December 2025 as committed to the citizens of Honolulu.
- As discussed in Section 6, HART has revised the dedicated sources to make up the difference between the original FFGA Project Cost and the updated Capital Cost Estimate through local financial resources that are stable, reliable, and committed to the Project.

This Recovery Plan provides documentation for each element outlined above and provides an updated report on the status of the Project. Additionally, this Recovery Plan includes an updated Financial Plan based on the State Legislative and subsequent City actions that have been taken.

2.2 Project Description

The HRTP is a 20.1-mile-long fixed guideway rail system featuring 21 stations that extends from East Kapolei on the west side of the island of O'ahu to Ala Moana Center on the east side via Honolulu International Airport. The alignment is elevated, except for a 0.6-mile at-grade portion at the Leeward Community College (LCC) station. The system will be operated and maintained at the 43-acre Rail Operations Center (ROC, formerly known as the Maintenance and Storage Facility [MSF]) near LCC. The system features fully automated, driverless trains; an integrated, electronic fare payment system; and passenger screen gates.

Figure 2-1 HRTP System Overview

2.3 Project History

The Project was preceded by decades of rail planning dating back to 1967, which has led to the current Locally Preferred Alternative (LPA) for the Project extending from East Kapolei to Ala Moana. Below is a chronology of key events in the Project's history:

- July 2005: The Hawai'i State Legislature authorized—and in August 2005 the Honolulu City Council approved—a 0.5% GET surcharge to provide non-federal local funding for a new rail transit system.
- August 2005: DTS initiated an Alternatives Analysis following the FTA Section 5309 New Starts Program (now known as the FTA Major Capital Investment Grant Program).
- January 2007: The City selected the LPA, steel-wheel on steel-rail, and began collecting the GET surcharge. The City then initiated work on the Project's Environmental Impact Statement (EIS) and preliminary engineering for the system.
- February 2007: The Honolulu City Council passed City Council Resolution 07-039 approving the selection of the Minimum Operating Segment (MOS) from East Kapolei to Ala Moana Center, via Salt Lake Boulevard. The MOS was subsequently amended to serve the Honolulu International Airport—deferring the Salt Lake portion of the alignment.
- November 2009: The City executed its first contract for the Project, a DB services contract with Kiewit Pacific Company for the WOFH segment.
- June 2010: The Final Environmental Impact Statement (FEIS) for the Project was approved by the FTA, with publication of the FEIS on June 25, 2010.
- November 2010: O'ahu voters approved a City Charter Amendment establishing HART, to create a semi-autonomous public transit authority responsible for the planning, construction, operation, maintenance, and expansion of the City's fixed guideway mass transit system.
- January 2011: A Section 106 Programmatic Agreement was signed. FTA issued its environmental Record of Decision (ROD) for the Project on January 18, 2011, providing pre-award authority for utility relocation and acquisition of rail vehicles.
- February 2011: The HART Real Estate Acquisition Management Plan was approved, providing pre-award authority for Right-of-Way (ROW) acquisition.
- December 19, 2012: The City and the FTA signed an FFGA for a Project consisting of 20.1 miles and 21 stations, a total estimated project cost of $5.12 billion with a committed federal share (subject to annual congressional appropriations) of $1.55 billion, and a full system RSD of January 31, 2020.

- August 2014: HART reveals the bids for the construction of nine Westside rail stations were opened and, due to changes in the construction marketplace, exceeded initial forecasts.
- July 2015-February 2016: The City and HART obtained reauthorization and approval of a five-year extension of the GET surcharge beyond December 31, 2022 to December 31, 2027 from the State Legislature, Governor of the State of Hawai'i, Honolulu City Council and Mayor of the City and County of Honolulu. This five-year extension was anticipated to yield $1.2 billion in additional local funds to the Project.
- June 2016: The FTA directed HART to submit a Recovery Plan by August 7, 2016, which demonstrates that HART is working to contain costs and minimize delays in schedule impact. In July 2016, FTA extended the deadline to submit the Recovery Plan to December 31, 2016.
- November 2016: A majority of O'ahu voters approved Charter Amendment 4, which allowed for DTS to handle future operations and maintenance of the rail system, as well as the bus and para-transit systems.
- December 2016: HART submits the Update of the Final Financial Plan for the FFGA to the FTA. The FTA grants an extension for HART to complete and submit its Recovery Plan to April 30, 2017.
- In April 2017, HART submitted a Recovery Plan to the FTA. This was subsequently revised in September 2017.
- August 24, 2017: HART cancelled the CCGS DB solicitation after analysis showed that cancellation would be in HART's best interest to do so. It had been over two years since the original CCGS Request for Proposals (RFP) was issued, and since then two of the three offerors had made significant changes to their Joint Ventures.
- September 2017: The Hawai'i State Legislature passed Senate Bill 4 (SB4), during a 2017 Special Session that is enacted into law as Act 1 by Governor David Ige. This extends the GET surcharge for three additional years, through December 31, 2030, and raises the TAT from 9.25% to 10.25% for 13 years, until December 31, 2030. These additional sources of funding are anticipated to generate an additional $2.509 billion and will provide the financial capacity needed to complete the Project as planned in the FFGA. However, Act 1 prohibits GET and TAT revenues allocated from the Mass Transit Special Fund to be used for HART's administrative, operating, marketing, or maintenance costs and operation and maintenance costs of a mass transit project.
- September 2017: HART conducted a dynamic clearance test for the train, in which Honolulu's first light rail train was towed on the guideway between HART's Rail Operations Center and the future home of the West Loch rail station.

- September 2017: The City Council votes to adopt the extension of the GET surcharge and TAT to December 31, 2030, which is signed into law by Mayor Kirk Caldwell.
- September 2017: The Revised Recovery Plan is submitted to the PMOC and FTA.
- February 2018: City Council reviews Bill 42, which would allow for greater flexibility in the sources of City monies to be used for the capital cost of the Honolulu Rail Transit Project, including associated HART administrative and operations costs.
- June 2018: In February 2018, the PMOC conducted a Risk Refresh Workshop to update its risk assessment of the Project. Based on outcomes of the reviews conducted, the PMOC recommended a revised Project budget of $8.299 (excluding finance costs) and a revised full RSD of September 2026.
- September 2018: In its September 21, 2018 letter, the FTA requested (1) a decision on the procurement method for the CCGS segment by made within 30 days or by October 21,2018; (2) the revised Recovery Plan with a financial plan sufficient to cover the total estimated Project cost be provided to the FTA no later than 60 days or by November 20, 2018; and (3) the City commit $44 million in City and County of Honolulu funding for fiscal years 2018 and 2019 to the Project, as outlined in the 2017 Recovery Plan within 60 days or by November 20, 2018.
- September 2018: HART explored alternative project delivery methods to complete the Project, particularly the P3 model. During its September 27, 2018 meeting, the HART Board of Directors approved moving forward on the development of a P3 to DBF the CCGS and PHGTC, and operate and maintain (O&M) the system with the City and County of Honolulu. Subsequently, HART released RFP Part 1 for the P3 contract.
- October 2018: In a letter to the FTA dated October 9, 2018, the Chair of the Honolulu City Council, Ernest Y. Martin, reiterated a commitment to conduct hearings to fully commit the necessary City funds identified in HART's 2017 Recovery Plan within the 60 days specified in the letter by taking action on Resolution 18-132 which authorizes the issuance and sale of GO bonds not to exceed $44 million. The $44 million was received on November 13, 2018.
- October 2018: The City Council unanimously approved the 2018 Draft Recovery Plan on October 30, 2018.
- November 2018: The 2018 Draft Recovery Plan was presented to the HART Board of Directors on November 1, 2018 and subsequently was approved on November 15, 2018.

2.4 Major Project Issues

The Project has been hampered by a number of events that were beyond the anticipation of the originating parties. These included issues related to the National Environmental Protection Act (NEPA) involving three federal cooperating agencies that arose very late in the EIS process as the Project was obtaining final signoffs from these agencies (which affected the alignment of the Project near the airport), historic preservation issues at the slated Pearl Harbor Station, and a Native Hawaiian Programmatic Agreement matter. Some early contracts also were awarded before final agreements had been reached with various third parties such as the University of Hawai'i (UH) and its associated campuses, the State of Hawai'i Department of Transportation (HDOT), Hawaiian Electric Company, Inc. (HECO) and other utilities, and other State and City agencies.

In awarding some early contracts, the Project did not sufficiently account for the necessary integration and interface activities between the major contractors or have a fully integrated Master Project Schedule. Additionally, the single most costly impact to the Project, which was beyond the control of the Project sponsor as further described below, was the cessation of all construction activities for 13 months because of Project litigation, which had a cascading effect on cost and schedule.

Below is a summary of key issues and their impacts to the Project:

Legal Challenges

- As a result of the Notice to Proceed (NTP), the Archaeological Inventory Study (AIS), and Traditional Cultural Properties (TCPs) delays, the Project incurred $172 million in delay costs on the two West Side guideway DB and the MSF DB contracts.
- The AIS delay was a 13-month delay that overlapped with the NTP delays on the West Side guideway and MSF DB packages.
- WOFH specifically incurred a total delay of 23.5 months and delay related costs in the amount to $107 million which includes construction escalation. (Note: This amount reflects only the WOFH, Kamehameha Highway Guideway (KHG), and MSF contract delay costs. It does not include associated costs [agency staff, rent, etc.] or legal costs that resulted from the delays.)
- In January 2011 a lawsuit was filed in state court that challenged the City's initiation of construction of the first section of the Project without completion of archaeological surveys and approval of the State Historic Preservation Division of all four project sections for the full 20.1 miles of the Project. The City's action was consistent with long-standing practice in the state for large construction projects, as well as being consistent with federal regulations.

- The initial ruling by the First Circuit Court of the State of Hawai'i was in favor of the City and the State defendants. This ruling was appealed to the Hawai'i Supreme Court in 2012, which reversed the First Circuit and, instead, ruled in favor of the plaintiff, resulting in a cessation of all construction activities for nearly 13 months pending the completion of archaeological surveys for the entire Project.
- A second lawsuit was initiated in Federal District Court in May 2011, by plaintiffs claiming that there had been inadequate consideration of alternatives in the EIS with regard to NEPA and cultural and historical sites. In November 2012, the court held that only three of the multiple claims by the plaintiffs required further analysis. However, the court also imposed an injunction on further work on the City Center segment of the Project and froze further acquisition of real property in downtown. The City initiated a Supplemental Environmental Impact Statement (SEIS) to address all three issues in December 2012, which was completed and released in June 2013. Upon review of the SEIS by the District Court, the court dismissed all of the claims of the plaintiffs.
- In September 2013, the State Historic Preservation Division (SHPD) approved the archeological survey reports for the Project, fulfilling the AIS reporting requirements and construction resumed in the first section of the Project. The court dismissed all of the claims of the plaintiffs and vacated its injunction.
- The plaintiffs then appealed the District Court decision to the Ninth Circuit Court of Appeals. In February 2014, the Ninth Circuit Court of Appeals upheld the lower court's decision; the injunction was lifted and, with the resolution of the state court lawsuit, the Project was allowed to resume construction.

Protests

- In March 2011, the City selected the contractor for the vehicle/core systems Design-Build-Operate-Maintain (DBOM) Contract, AHJV. Protests by the two unsuccessful contractors resulted in a nine-month delay in awarding the AHJV contract, which in turn resulted in a $8.7 million settlement of delay claims by AHJV.

Integration Issues

- As delays began to build as a result of these events, it became evident that the failure of the Project to sufficiently address the integration between the major contractors or have in place a fully integrated Master Project Schedule, as well as major assumptions for future contracts that would later prove to be incorrect, culminated in substantial negative consequences in the Project cost and schedule.

HECO Utility Coordination

- In March 2013, HECO stated that as a "rule of thumb" the minimum horizontal working clearances for their existing overhead lines were 50 feet for 138 kiloVolt

(kV) lines, 40 feet for 46kV lines, and 30 feet for 12kV lines. In 2015, HART and HECO officials began meeting as a task force to remedy the clearance issues. In 2018, the HART Board of Directors approved paying for 15 new specialized trucks to allow HECO crews safe access to work on the power lines along the westside of the Project, saving approximately $130 million in utility relocation costs.

Project Cost Increases

- The Project experienced extraordinary increases in the cost of construction following these delays, as documented in the Ryder Levett Bucknall Comparative Cost Index of major United States cities from 2009 through 2016 (Appendix D). During the period of mid-2009 to 2011, when cost estimating for the FFGA was being completed, United States cities—including Honolulu—went through a relatively flat period of escalation in construction costs. Beginning in 2012, construction costs escalated significantly, with Honolulu's construction costs escalating to the highest construction costs among major cities in the United States, maintaining that position for four years through the fourth quarter of 2016. In 2017, Honolulu was the only city among the 12 markets tracked to show a decline in construction costs, according to the Ryder Levett Bucknall Comparative Cost Index of major United States cities (fourth quarter). Despite this decline, Honolulu's comparative costs remained high, second only to New York City. As of Q2/2018, the Ryder Levett Bucknall Comparative Cost Index reported Honolulu's construction costs declining further, although still high, third only to New York City and San Francisco.

- In August 2014, the bids received for the construction of nine West Side rail stations exceeded budget estimates by more than 63%, or $100 million, signaling a major change in the construction market and resulting in the cancellation of the station solicitation.

- Following the West Side rail station contract cancellation, a Project Risk Update presentation was made to the HART Board of Directors in November 2014, in which HART determined that the Project Cost would be $550 million to $700 million over the FFGA budget. Further, HART was faced with a persistent funding deficit stemming from overestimating the revenue yield from the GET surcharge and from a funding gap to replace $210 million in FTA Section 5307 funds (these funds were included in the FFGA Financial Plan, but then were required to be withdrawn from the Project's Financial Plan to assure those funds for use by TheBus), resulting in a total estimated budget gap of $910 million.

- In June 2015, the City and HART obtained approval of a five-year extension of the GET surcharge from the State Legislature. This five-year extension was anticipated to yield $1.2 billion in additional local funds to the Project, which increases the local/federal match ratio of the Project to a 75% local / 25% federal match.

The Honolulu City Council adopted an ordinance to extend the GET surcharge for an additional five years to 2027 in January 2016.

- In January 2016, the City recommitted to the Project and announced its intention to seek an extension of the GET from the State Legislature and the City Council to cover the funding gap, consistent with the FFGA assurances imposed on the City in the event of a funding shortfall.
- In May 2016, HART received preliminary values for the Independent Cost Estimate (ICE) for the CCGS DB package that indicated an estimated cost $719 million higher than anticipated. With the projected funding shortfall for the Project, the procurement of the CCGS DB package was suspended, which shifted the entire schedule out to the end of 2024.

Recovery Plan

- In June 2016, the FTA directed HART to submit a Recovery Plan; in developing its Recovery Plan, and in particular in addressing overall project management and management capacity and capability issues, HART identified and made a good faith effort to act on the lessons learned in the prior stages of Project development.
- In April 2017, HART submitted a Recovery Plan to the FTA. This was subsequently revised in September 2017. This November 2018 Recovery Plan further revises the previously-submitted recovery plans in response to FTA's comments and direction.
- In September 2018, the HART Board approved changing the project delivery method for completing the Project, from DB to DBFOM. Subsequent to these actions, HART and the City issued a RFP to initiate the procurement process for selecting a P3 Developer.

2.5 DBFOM Analysis and Decision

A major component of the Recovery Plan is the modification of the project delivery structure from DB to DBFOM. On September 27, 2018, the HART Board of Directors voted to complete the remaining capital components of the HRTP and operate and maintain the entire system under a specifically structured P3 based on a 30-year concession for DBFOM project delivery.

In partial response to the increased costs of the HRTP and the delays which the project has experienced, over the last eight months HART studied various alternative approaches to project delivery, some of which involve significant risk transfer to potential private partners in sharing cost, schedule and financing risk for completing HRTP construction. These partnerships also transfer risk and responsibility to the private sector for operating and maintaining the system and providing asset maintenance and replacement under a long-term contractual arrangement. This approach has been undertaken by numerous major

transit projects internationally, and, more recently, in the United States. These include the Eagle P3 Project in Denver, a commuter rail line connecting the Denver Airport with Downtown Denver Union Station that recently opened to full revenue service; the Purple Line in Maryland, connecting the commuter suburbs of Bethesda, Silver Spring and College Park to the Washington DC Metro System, currently under construction; and most recently the automated, elevated rail system connecting Los Angeles International Airport with the LA Metro rail and bus systems. Each of these project delivery examples, as well as numerous similar transit programs around the world, have projected meaningful cost savings over conventional methods of project delivery, most notably with respect to long-term savings in the cost of system operations and maintenance.

Over the last 10-20 years, the infrastructure industry and financial markets have moved together to create new methods of delivering major projects in energy, water resources, aviation, and transportation. Generally referred to as P3s, such project delivery processes are based on methods by which a private developer consortium typically including engineers, constructors, equity investors, lenders, system operators and maintenance firms, accepts significant responsibilities for designing, building, financing, operating and maintaining a major infrastructure project. This is the origin of the term "DBFOM," which refers to the contractual transaction by which such responsibility and risk are transferred from the public sector to a private sector developer team. What P3s have in common, regardless of the discrete elements of a specific project, is that there is a strong contractually-driven focus by the developer on the "life-cycle" of a project – meaning that the public and private partners together assure that design and construction is directly associated with long-term facility maintenance, asset management, and customer-oriented system operation. In far too many cases of conventional project delivery, insufficient emphasis is placed on the "life-cycle" of the asset in favor of the more visible front-end construction. This leads to an erosion of nominal state-of-good-repair, ultimately more expensive to the public.

HART has engaged in reviewing more effective ways of completing the construction of the HRTP – particularly the CCGS work – while at the same time, in consultation with the City, incorporating the long-term requirements for cost-effective system O&M. The CCGS segment is the most complex portion of the civil works within the Project and can be a beneficial undertaking for a P3 owing primarily to the substantial interface risks in the design and construction of the guideway, stations, and systems elements which can be effectively transferred from the public to the private sector.

2.5.1 P3 Objectives

In assessing the potential benefits of completing all capital works and undertaking a long-term operating and maintenance concession, HART and the City established a series of objectives to be achieved by converting to a DBFOM project delivery structure. These objectives are:

- Provide HART and the City of Honolulu with a "life-cycle" approach that recognizes major infrastructure endeavors are long-term community assets and should be constructed, operated, and maintained accordingly.
- Optimize the management of risks faced in completing construction and operating and maintaining the system.
- Ensure a process incorporating budgetary discipline and substantially reduce the possibility of cost increases or change orders, other than those related to acts of nature or other unforeseen circumstances.
- Confirm adherence to schedule and provide substantial contractual requirements and associated financial penalties to the developer if delays are encountered.
- Encourage increased and robust competition from among US-based and international contractors with positive performance records in developing and operating major transit and infrastructure projects, many of whom are unlikely to propose for only a design-build program.
- Stipulate procedures for transferring risks and responsibilities of design, construction, finance, operations and maintenance to the developer, while assuring appropriate oversight by HART during construction and the City during operations – thereby eliminating significant requirements for increased staffing by HART and the City during the operational phase.
- Promote incorporation by the developer of technical innovation and best practices by optimizing the developer's opportunities to connect design and construction with long-term operations and maintenance, resulting in efficient, cost-effective, and high levels of measurable and verifiable systems operation.
- Integrate the mutual goals of HART and the City to build, operate and maintain one of the most significant infrastructure assets undertaken on behalf of the citizens and visitors to Hawai'i.

The P3 structure being undertaken by HART and the City is based on these objectives, primarily to assure that HART's commitment to complete the Project with currently committed capital funding sources (GET, TAT, FFGA) and the City's commitment to fund the operation and maintenance of the rail system can both be achieved.

2.5.2 P3 Project Scope

The decision to convert to DBFOM at this stage of a project is unique to this Project. As detailed in this Recovery Plan, the majority of the West Side guideway segments, from East Kapolei to Aloha Stadium, have been constructed and the Core Systems Contractor is currently installing systems components. The nine stations along the West Side alignment

are currently in construction. Construction of the Airport Guideway and Stations segment, which starts beyond Aloha Stadium and extends to Middle Street, has commenced and the design-build joint venture is making good progress. The Core Systems Contractor has substantially completed most of the systems design work for the entire alignment; is fabricating, delivering, and installing equipment and conducting tests along the West Side Guideway and Stations Segment and the MSF; manufacturing and delivering the entire 20-train fleet; developing training manuals, procedures, and plans and working on safety certification activities for the 2020 Interim Opening.

These portions of the project – completion of the AGS, finalization of the West Side contracts and related systems installation – will continue along their present course and not be included in the P3 Developer contract. Notwithstanding the developmental status of the HRTP, converting the CCGS and PHGTC portion of the Project at its current stage to a P3 and incorporating a long-term operations and maintenance component is likely to yield substantial benefits to both HART and the City.

Thus, the design, construction, and systems work for the unbuilt segments of the project will form the core civil construction element of the P3 Developer contract. It is anticipated that the CCGS construction will occur between 2020 and 2025, with RSD required no later than December 2025 as per the local commitment.

Under the P3 Project scope of work proposed in the Request for Proposals issued by HART and the City on September 28, 2018, the Project elements to be performed by the P3 Developer are:

- Design and construction of the City Center Guideway and Stations Segment:
  - The P3 Developer will be required to design and construct approximately 4.1 miles of elevated guideway and eight stations, including: Kalihi, Kapālama, Iwilei, Chinatown, Downtown, Civic Center, Kaka'ako and Ala Moana Center stations.
- Design and construction of the Pearl Highlands Parking Structure, Transit Center and Ramp.
  - The P3 Developer will be required to design and construct a 1,600-stall parking structure, a minimum 6-bay bus transit center, access ramps, other roadway improvements to integrate the HRTP with other modes of transportation and other infrastructure work including, but not limited to Waiawa Stream floodplain hydraulic mitigations.
- Selection and restoration of a casting yard site:
  - The P3 Developer, at its own cost and expense, will be required to secure its own casting yard site for the P3 Project.

- Installation of Core Systems infrastructure for the City Center Guideway and Stations Segment:
  - It is currently anticipated that the installation of all Core Systems equipment for the City Center Guideway and Stations Segment, including on-site testing, design and engineering, interface and coordination, system integration, system demonstration and safety certification for Full Opening will continue to be performed by the Core Systems Contractor. The contractual arrangements for such performance by the Core Systems Contractor of the Core Systems installation scope will be confirmed by the P3 Developer as to whether the Core Systems Contractor will continue to perform such Core Systems scope as a contractor to HART under the Owner Core Systems Contract or will instead perform such Core Systems scope as a subcontractor to the Developer under a P3 Core Systems Subcontract.
- O&M of fixed facilities and, under terms to be negotiated, Core Systems for the full alignment, including the operation and maintenance of the HART Infrastructure:
  - Subject to further detail with respect to the initial 10 years of revenue service commencing with the opening of Interim Operation, the P3 Developer will be responsible for the operation and maintenance of the Core Systems for the entire alignment of the HRTP from Interim Opening to the expiration of the term of the Project Agreement; and (b) the operation and maintenance of the Fixed Facilities for the entire alignment of the HRTP from Interim Opening to the expiration of the term of the Project Agreement. This will include training and supervising all personnel, and providing all necessary labor, equipment, facilities, materials and services.
  - It is currently anticipated that the operations and maintenance of all Core Systems for the HRTP for a ten (10) year period commencing on Interim Opening will continue to be performed by the Core Systems Contractor. The contractual arrangements for such performance will be confirmed during the procurement process, in particular, as to whether the Core Systems Contractor will perform the operation and maintenance of the Core Systems during such period as a contractor to HART under the Owner Core Systems Contract or will instead perform such Core Systems scope as a subcontractor to the P3 Developer under a P3 Core Systems Subcontract.
  - Upon expiration of the initial operations and maintenance phase undertaken by the Core Systems Contractor under either the Owner Core Systems Contract or the P3 Core Systems Subcontract expires, it is intended that the P3 Developer will retain the option of: (1) negotiating with the Core Systems Contractor to continue performing its operations and maintenance responsibilities for all or part of the remainder of the term of the Project Agreement; (2) subcontracting

with a third-party subcontractor; or (3) utilizing the P3 Developer's own resources to perform those operation and maintenance responsibilities, subject to the prior approval of the City being obtained in accordance with the terms of the Project Agreement.

2.5.3 Preliminary Financing Structure for P3

The P3 capital work, currently estimated in the range of $1.4 billion, will be funded through GET, TAT, FFGA, and City funds. The P3 Developer will be required to finance a portion of the construction through its own financial arrangements. Given the anticipated annual receipts from the GET and TAT, allocation and disbursement of the FTA grant proceeds over the period between 2020 and the GET/TAT sunset date of December 31, 2030, the developer will receive milestone payments for capital construction cost during the 2020-2025 construction period, and the balance between 2025-2030, post-construction. It is assumed that the P3 Developer will arrange "bridge financing" through its financial partners to cover its costs of construction between 2020 and 2025, and the remainder of the payments by HART after 2025 will be utilized by the developer to fully retire whatever principal and interest is owing based on the P3 Developer's internal capital structure. HART's analysis of projected capital source funding indicates that, subject to the affordability cap, sufficient funds will be available to cover P3 Developer milestone payments during the construction period and estimated principal and interest payments subsequent to substantial completion, which will be paid as capital availability payments (APCs) to the P3 Developer.

Since the CCGS work will be completed and the Project opened for full revenue service no later than HART's committed date of December 31, 2025, there would be a five year "tail" in which HART would be reimbursing the balance of the P3 Developer's cost subsequent to completing construction. This represents a substantial hedge against defects and/or non-performance of the civil works and facilities maintenance – a much stronger security, for example, than likely under a traditional design-build delivery approach. If determined to be necessary, additional security for civil work defects could be arranged, either through a surety approach, letter of credit, or parent company guarantee. In effect, HART will maintain a very strong inducement to cure any defects that may arise through retainage of the P3 Partner's capital availability payments.

The P3 Developer's scope will include maintenance and "warranty" of its CCGS and PHGTC construction. The P3 Developer would also be provided with all as-builts and engage in appropriate field inspection of the constructed works on the West Side/Airport (built by others) and would be required to include a negotiated level of responsibility for these facilities. Regardless of project delivery method, HART would likely retain certain risks related to the built facilities, including latent defects, force majeure events, etc.

A key objective for HART and the City is to ensure that the P3 Developer continues to perform in accordance with the availability and performance requirements throughout the

operations and maintenance phase of the P3 Project. The method proposed to assure performance may include the retention of long-term equity and/or the provision of long-term performance bonds or other arrangements proposed by the P3 Developer.

This page intentionally left blank.

3 Management Capacity and Capability

The purpose of this section is to describe HART's organizational structure, including key personnel, and to demonstrate its management and technical capabilities to successfully complete the Project within the proposed budget and schedule.

3.1 Overview

The HART Project Management Plan (PMP) describes the overall management approach for the HRTP and has been updated since Revision 6. The seventh revision focuses on management of the Project during construction and addresses changes to the HART organization. It also addresses the change in project delivery method for the CCGS segment from DB to a DBFOM delivery. It also includes comments and recommendations by the FTA's Project Management Oversight Contractor (PMOC) on project management and control procedures. HART will submit the PMP in November 2018.

All work shall also be performed in accordance with the HART established Quality Management Plan (QMP), which was revised to incorporate requirements of the revised PMP as described in the above paragraph. The revised QMP (Revision 4) will also be submitted in November 2018.

3.2 Project Staffing and Personnel

Figures 3-1 through 3-7 illustrate the HART organization charts (currently pending HART Board approval).

This page intentionally left blank.

Figure 3-1 Organizational Chart and Key Departmental Updates – Senior Management

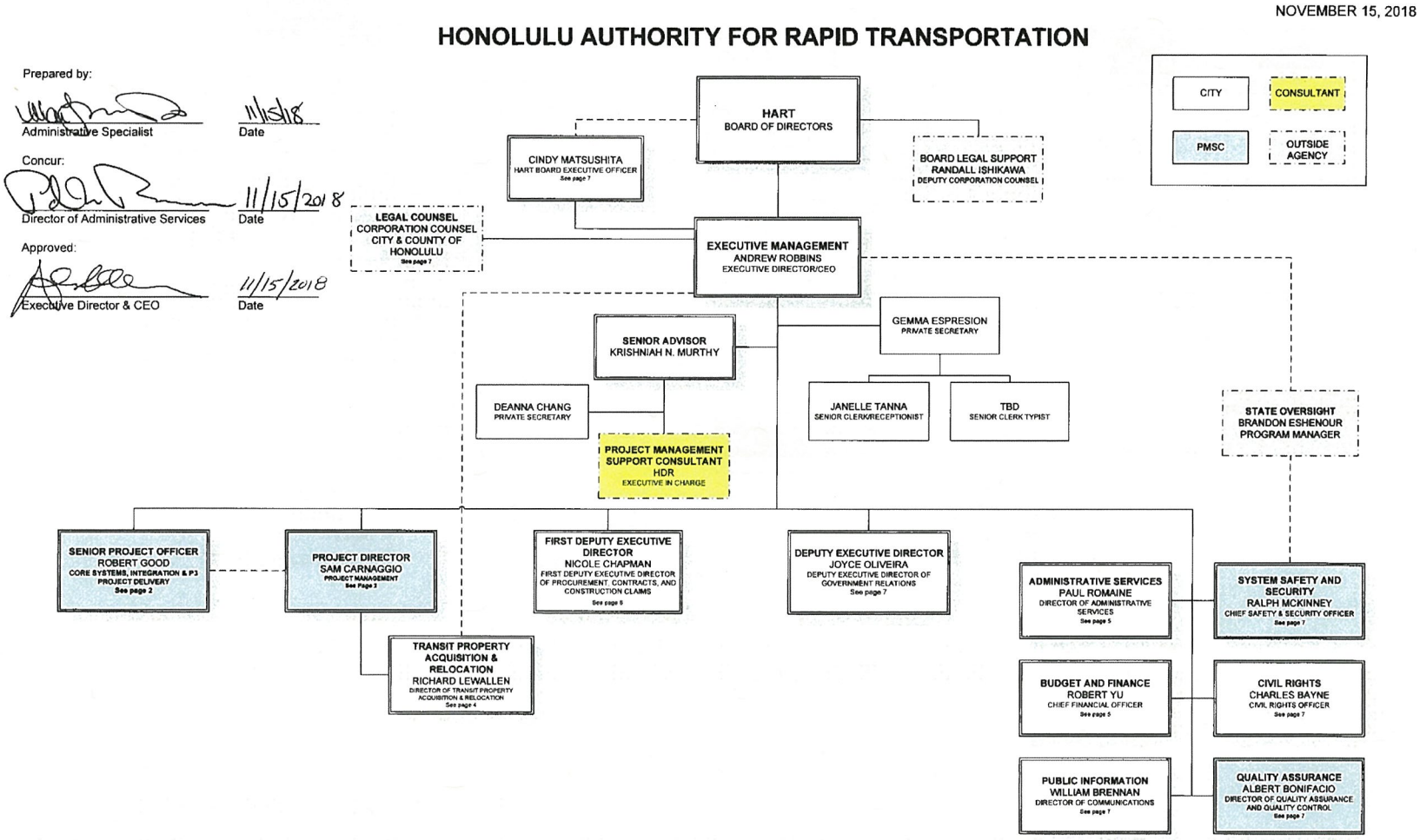


Figure 3-2 Organizational Chart and Key Departmental Updates – Project Director and Core Systems, Integration & P3 Project Delivery

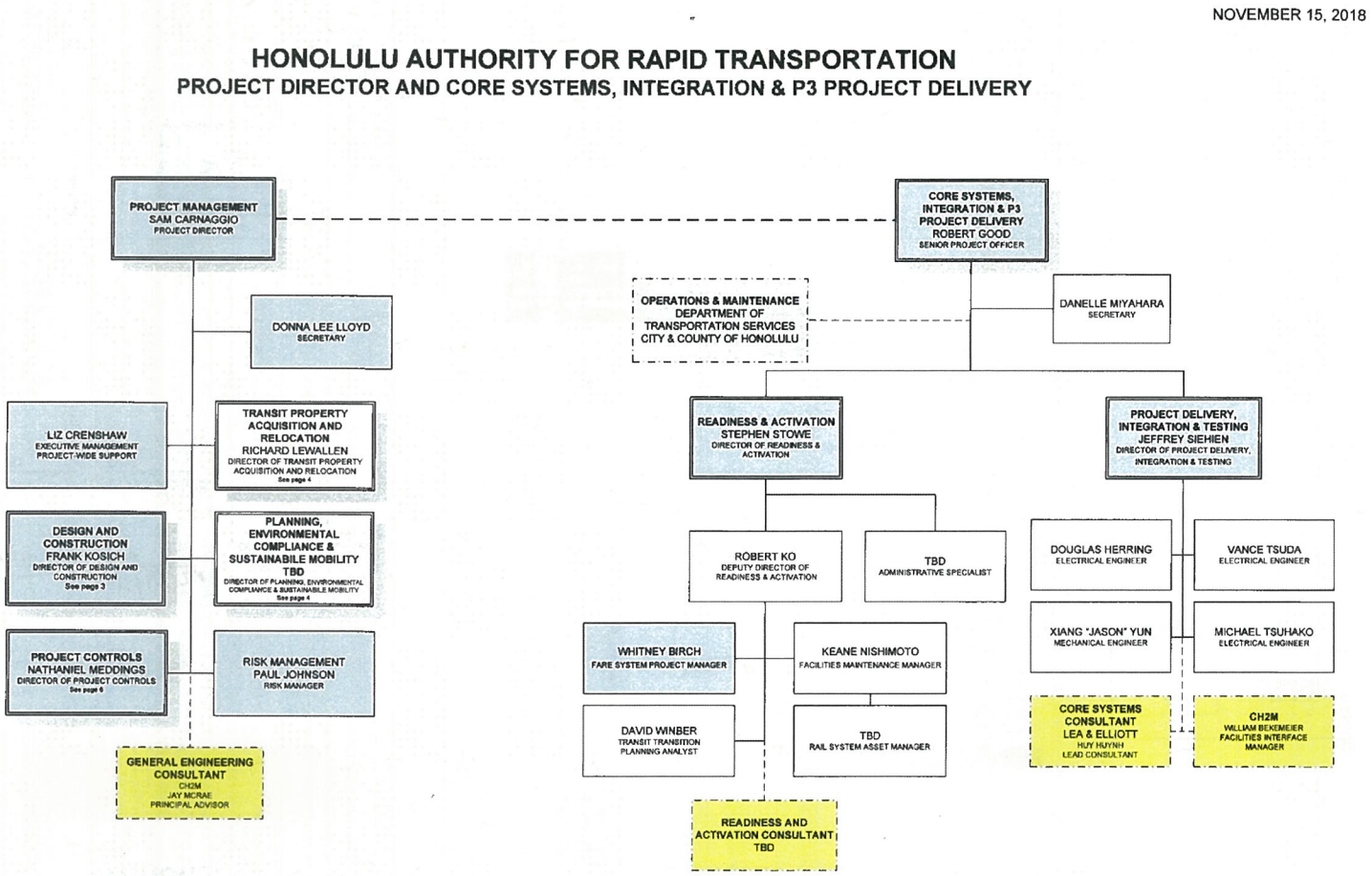


Figure 3-3 Organizational Chart and Key Departmental Updates – Design and Construction

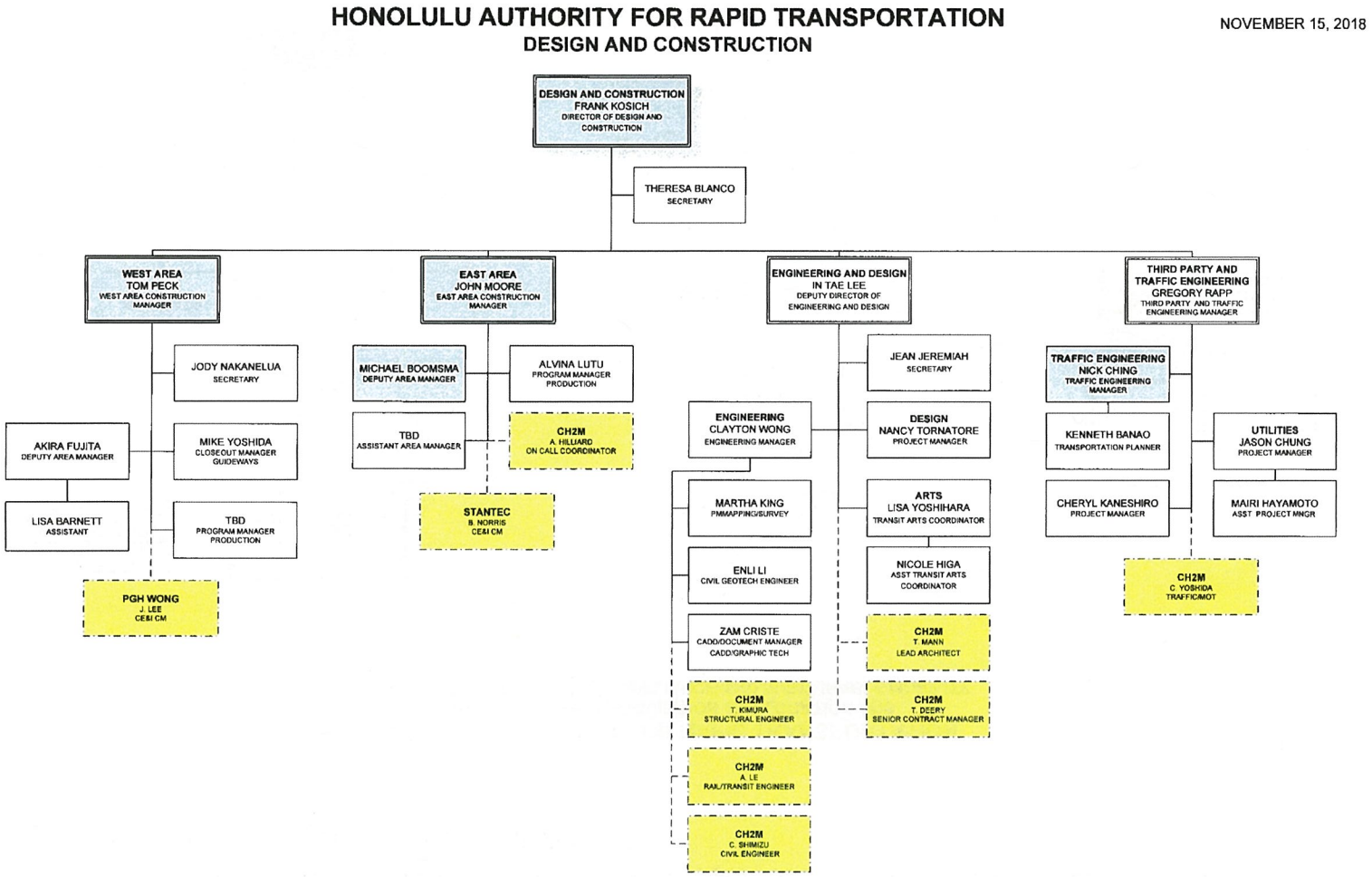


Figure 3-4 Organizational Chart and Key Departmental Updates – ROW, Planning, Environmental Compliance and Sustainable Mobility

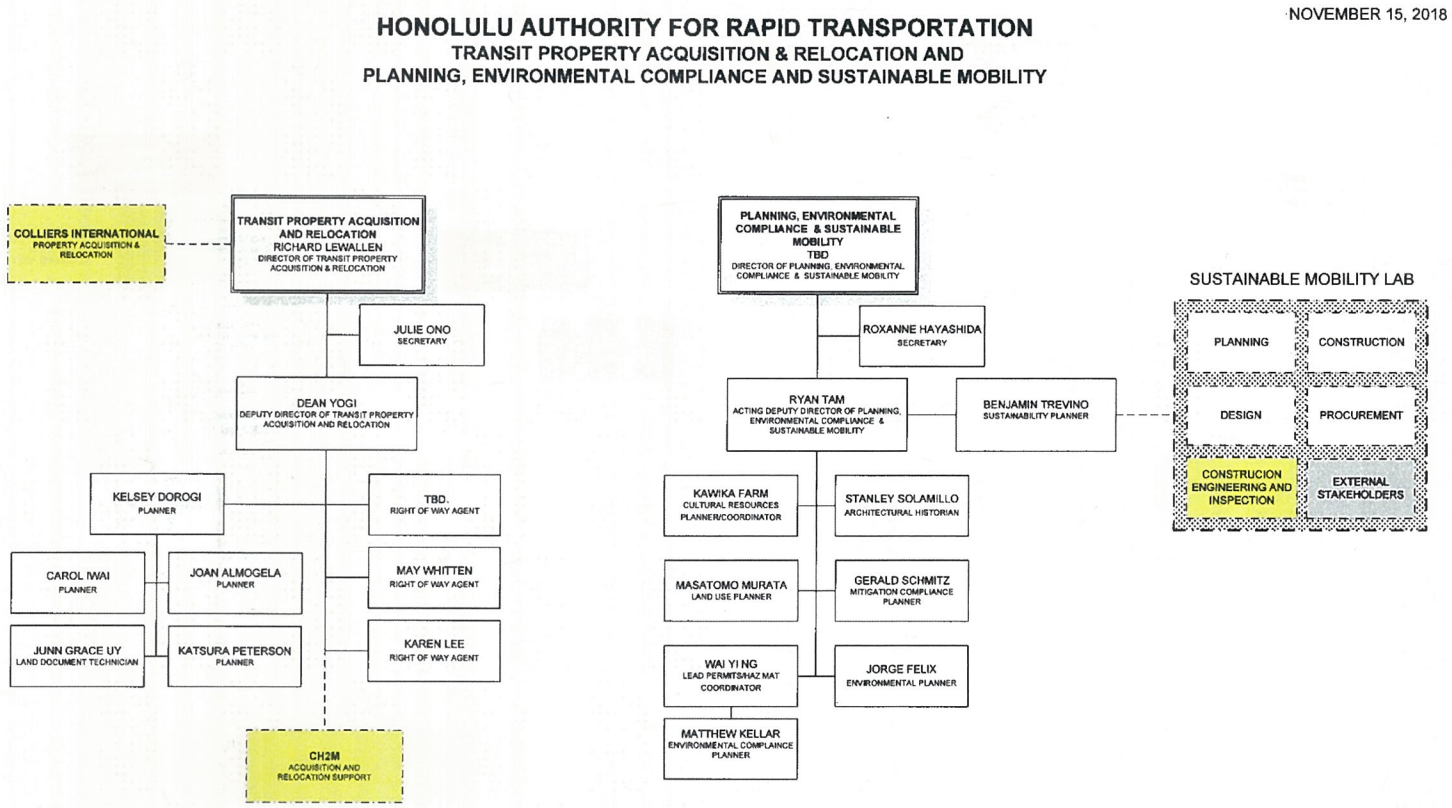


Figure 3-5 Organizational Chart and Key Departmental Updates – Budget and Finance, and Administrative Services

NOVEMBER 15, 2018

HONOLULU AUTHORITY FOR RAPID TRANSPORTATION
BUDGET AND FINANCE, AND ADMINISTRATIVE SERVICES

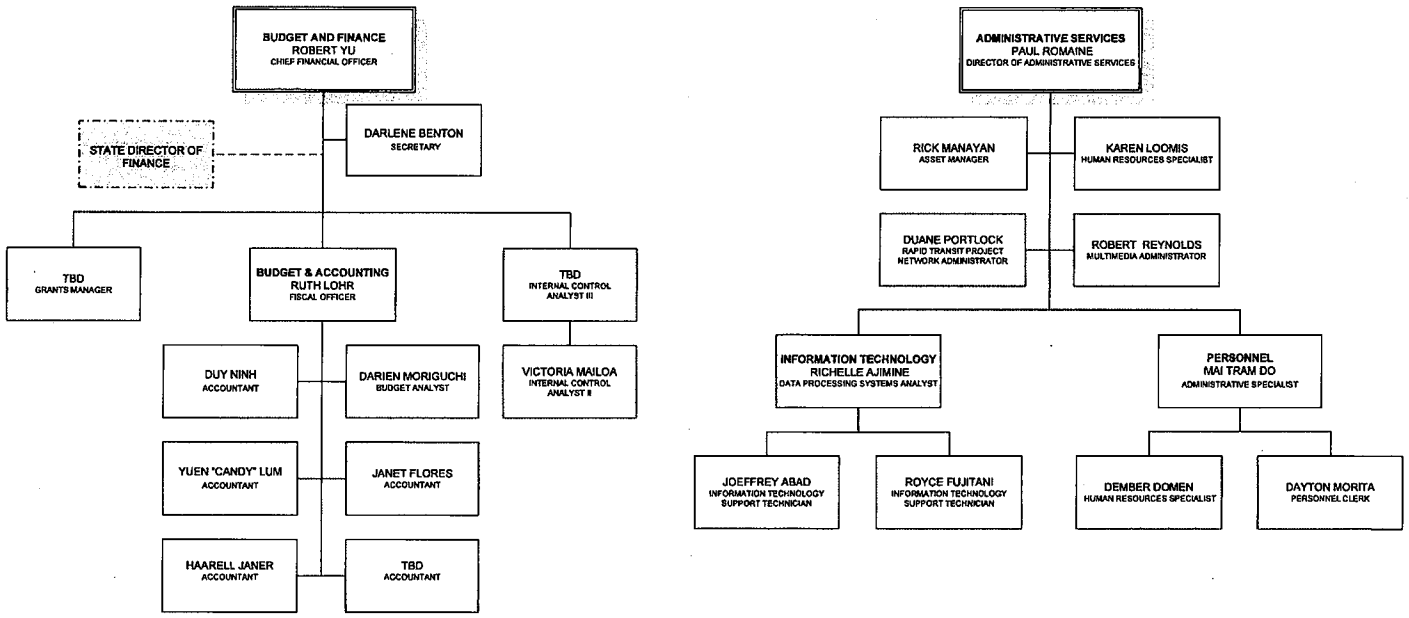


Figure 3-6 Organizational Chart and Key Departmental Updates – Project Controls and Procurement, Contracts, and Construction Claims

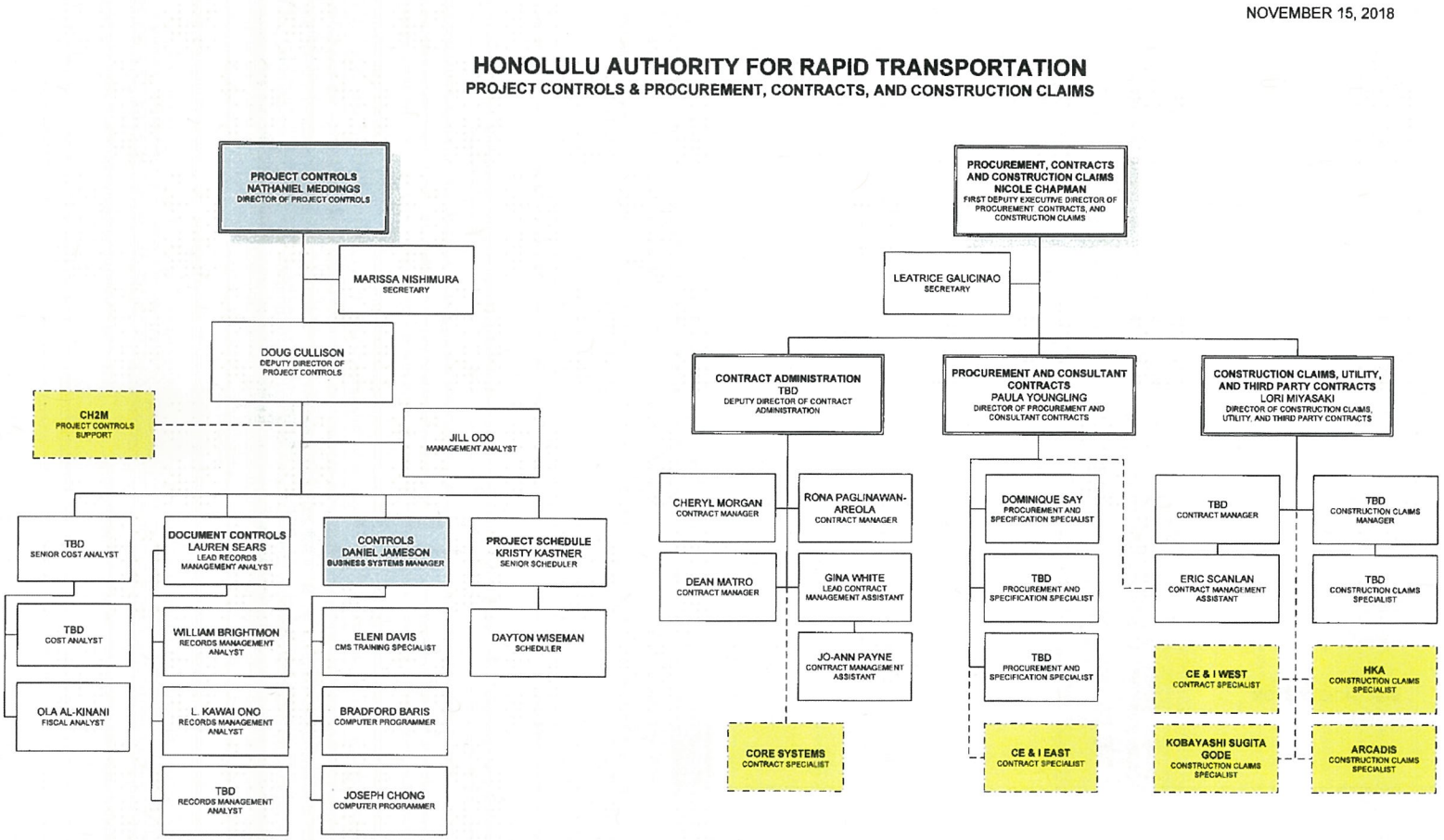
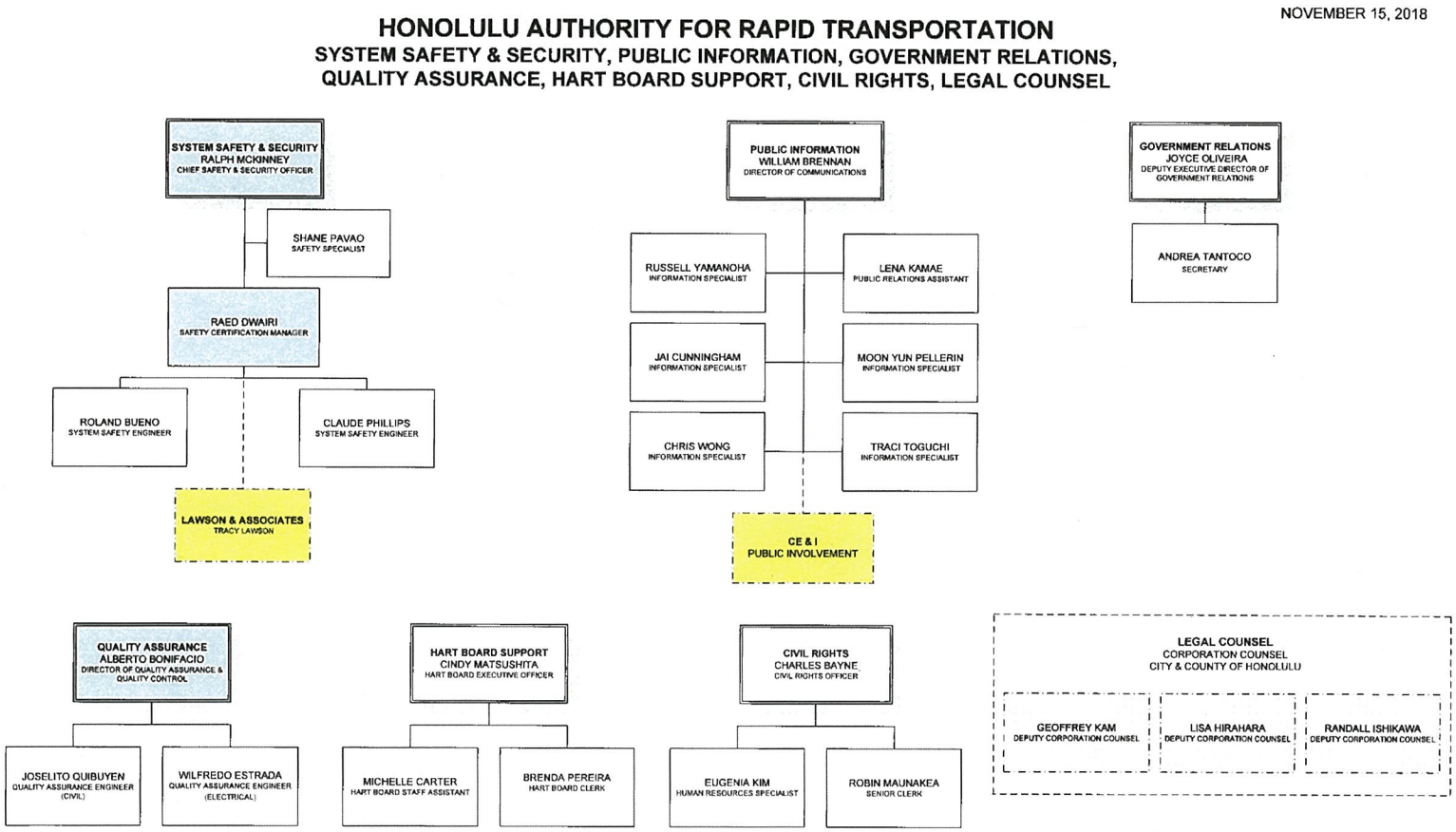


Figure 3-7 Organizational Chart and Key Departmental Updates – System Safety & Security, Public Information, Government Relations, Quality Assurance, HART Board Support, Civil Rights, Legal Counsel



This page intentionally left blank.

3.2.1 HART Board of Directors

By City Charter, HART is governed by a 10-member Board. The voting membership comprises the director of HDOT, the Director of DTS and six volunteers from the community: three appointed by the Mayor, three by the City Council. The voting members appoint the ninth voting member to the Board. The Director of the City Department of Planning and Permitting is a non-voting ex officio member. Act 1 (First Special Session, 2017) additionally provided for four non-voting members: two members appointed by the Senate President, and two members appointed by the Speaker of the House. A proposed Charter amendment to add Act 1's four non-voting members to the HART Board, among other things, failed at the general election on November 6, 2018.

The Board is the policy-making body of the authority and appoints and evaluates the HART Executive Director and CEO. The Board adopts HART's annual operating and capital budgets, adopts a six-year capital program, adopts rules and regulations, and carries out other duties as authorized by law. The Board's powers are primarily stated in the City Charter Section 17-104.

In November 2016, voters approved a Charter amendment clarifying the responsibility of the HART Board of Directors to establish policies and regulations regarding the development of the rail system, the internal management and organization of HART, and the allocation of decision-making authority between the Board and the agency's Executive Director and staff. In the exercise of its authority, the Board is approved this Recovery Plan on November 15, 2018. In addition, the 2016 Charter amendment additionally provides for the establishment of a rate commission and placed the operations and maintenance responsibilities for bus, paratransit, and rail with the DTS.

The current composition of the HART Board of Directors is particularly well-suited to address the current needs of the HRTP. Members contribute their substantial knowledge and experience in varied disciplines, including government, policy, engineering, construction management, financing, labor relations, law, public planning, and transportation. Board members provide a significant level of policy guidance and support in furtherance of the Project's goals; most recently, members have devoted a substantial amount of time in advancing the P3 delivery method, the Recovery Plan for the FTA, and the revision of its rules pursuant to the 2016 Charter amendment 4.

3.2.2 The City and County of Honolulu

As the grantee of the FFGA, the City and County of Honolulu is a critical partner in the Project. With the enactment of Charter Amendment 4, responsibility for the operations and maintenance of rail was transferred from HART to the City through DTS. Coordination efforts are currently underway to ensure a smooth transition from the development of operations and maintenance processes, policies and procedures by HART to the

management and performance of operations and maintenance functions by DTS. DTS, which had already been responsible for bus, paratransit, bicycle and pedestrian ways, is now responsible for a unified multi-modal transportation system.

Charter Amendment 4 also created a Rate Commission, which is responsible for the annual review and recommendation for fares, rates, and tariffs for bus, paratransit, and rail to the Mayor and the Honolulu City Council.

3.2.3 Executive Director and CEO Search

It has been one year now since Andrew S. Robbins, P.E., took the helm at HART on September 5, 2017, as HART's new permanent Executive Director and CEO. Mr. Robbins has extensive experience in project management and engineering, systems engineering, construction and installation, operations and maintenance, business development, as well as substantial firsthand knowledge of driverless transit systems. Mr. Robbins obtained Board approval to keep the Interim Executive Director and CEO Krishniah N. Murthy on the Project as the Senior Advisor to Mr. Robbins. Their experience in the rail industry is complementary and together they provide the very capable senior leadership team required for a project of this magnitude and complexity. See Appendix E for Mr. Robbins' curriculum vitae.

3.2.4 Qualifications of Key Personnel

HART understands the critical nature of consistency as it relates to project management and the success of the Project. This understanding has led HART to establish the following core group of individuals who have extensive experience in transit, construction, engineering, and management and who possess the values required to complete a project of this size:

- **Andrew Robbins, Executive Director and CEO:** Mr. Robbins is a licensed professional engineer in the U.S. with a career spanning more than 37 years. Mr. Robbins has been involved in numerous transit systems located domestically and internationally, at airports and within urban areas, having worked as a Field Engineer, Project Engineer, Project Manager and Business Development Executive. Mr. Robbins has a specialty in driverless transit systems with hands-on experience in project management, project engineering, systems engineering, construction and installation, operations and maintenance and business development. Mr. Robbins has most recently led efforts in project development, bidding and contract negotiations for many transit projects in the United States including in Denver, Las Vegas, San Francisco, and Los Angeles.

- **Krishniah N. Murthy, Senior Advisor:** Mr. Murthy has over 45 years of professional experience in rail transit programs. In his last assignment before his retirement, Mr. Murthy was the Executive Director of Transit Project Delivery for the Los Angeles County Metropolitan Transportation Authority (Los Angeles Metro) from 2007 to

2014. At the end of his tenure, the program had approximately $9 billion of projects in various stages from concept to construction. Prior to his Los Angeles Metro engagement, Mr. Murthy had 35 years of transit project design and construction experience working on various U.S. and international projects including Atlanta, Dallas-Fort Worth, Phoenix, San Diego, Los Angeles, New Delhi, and London.

- **C. S. Carnaggio, Project Director:** Mr. Carnaggio has 35 years of experience in design and construction in the transportation industry, with the last 18 years of his career being exclusively in transit. He brings a unique combination of experience at both federal and regional transit agencies, having served for four years at FTA as the Director of Engineering and 14 years delivering capital projects for regional transit agencies such as WMATA and MTA in Baltimore. Having delivered major projects very similar to the HRTP, Mr. Carnaggio's leadership experience and transit knowledge provides HART with the assurance that sound delivery decisions are made.

- **Robert J. Good, Senior Project Officer, Core Systems, Integration & P3 Project Delivery:** Mr. Good has over 51 years of project experience in automated rail and transit-oriented projects. Mr. Good is an electrical engineer by trade but for the past 30 years, has worked in project management of Transit Systems. Before coming to HART, Mr. Good was the Head of Systems Project Management North America, and managed all Systems and Automated Projects for Bombardier North America. In his last position, he controlled and managed over $3 billion dollars' worth of projects for Bombardier which included automated/light rail transit systems projects. Mr. Good has worked on various projects during his career, such as London Undergrounds SSL lines, Gautrain in South Africa, Edmonton Alberta project, and various automated people mover airport projects. One of the major projects that Mr. Good has worked on was the P-3 Gautrain Project in Johannesburg, South Africa, an 80-kilometer medium speed metro with two lines - one from Pretoria to Johannesburg, and the second line from Sandton to Tambo Airport.

- **Nicole Chapman, First Deputy Executive Director of Procurement, Contracts, and Construction Claims:** Ms. Chapman has been with HART for five years and has over 20 years' experience in procurement and contracts, including serving as procurement and contracts legal counsel for the City and County of Honolulu and the City and County of San Francisco. Prior to working in the government sector, she worked for a defense litigation law firm and served as in-house counsel in the Bay Area and Hong Kong. Ms. Chapman's local knowledge relating to construction contract procurement and interpretation of agreement language adds to HART's ability to manage contracts.

- **Joyce Oliveira, Deputy Executive Director of Government Relations:** Ms. Oliveira has been with HART for 8 years and has been continuously employed by the State of Hawai'i and the City and County of Honolulu for over 27 years, all of which have

been in the development of policies involving local legislative and regulatory initiatives, and the communication of these initiatives to legislators and government officials. In her various State and City positions, Ms. Oliveira represented at internal and external meetings and at hearings with the City Council, State legislative staff and public and private sector organizations. During her tenure in State government services, Ms. Oliveira worked for House Vice-Speaker Emilo Alcon, Lieutenant Governor Benjamin Cayetano and House Representative Donna Mercado Kim. Ms. Oliveira rejoined Councilmember Kim on her staff at the Honolulu City Council, and continued to work for her successor, Councilmember Romy Cachola and eventually transitioned to work at the city administrative level for former Honolulu Mayor Mufi Hannemann. Prior to her government services, Ms. Oliveira worked as a legal assistant with the law firms of Ashford & Wriston and Bays, Deaver, Hiatt, Kawachika & Lezak in Honolulu.

- **Robert Yu, Chief Financial Officer:** Mr. Yu has over 25 years of experience in the public transportation industry. Prior to joining HART in March 2017, he served as Senior Vice President and Deputy General Manager for O'ahu Transit Services, Inc. (OTS), the operator and manager of Honolulu's TheBus and TheHandi-van system, from 2009 to 2017 and Vice President of Finance and Administration from 1992 to 2009. Before his career in public transportation, Mr. Yu held various financial and audit positions at Chevron USA and Grant Thornton CPAs in San Francisco and Hawaiian Electric Industries in Honolulu. He is a Certified Public Accountant.

- **Frank Kosich, Director of Design and Construction:** Mr. Kosich has over 37 years of project and program management experience and has managed major projects in the United States and abroad both in the private sector and as a Commander and District Engineer with the U.S. Army Corps of Engineers. His most recent assignment, prior to joining to the HART Project, was with Metropolitan Transit Authority Capital Construction, as Senior Resident Engineer for the Second Avenue Subway Core Systems contract in New York City. His oversight and relevant experience matches well with the current ongoing design and construction.

- **Stephen Stowe, Director of Readiness and Activation:** Mr. Stowe brings with him over 40 years of experience in the rail transit and guided transportation system industry. Most recently, he was the President at Transit Leadership Solutions LLC in Ocala, Florida where he provided independent consulting services to clients. Mr. Stowe has experience in Operations and Maintenance, Project Management and Project Start Up on multiple high-profile transit projects all over the world including the United Kingdom, Hong Kong, Newark, Las Vegas, and Pittsburgh. Prior to forming his consulting company in 2015 he was General Manager of O&M for Bombardier Systems Group responsible for O&M of all their airport and urban driverless systems throughout the USA.

- **Ralph McKinney, Chief Safety and Security Officer:** Mr. McKinney has over 20 years of experience in transit system safety, transit safety and security certification, transit operations, public safety, and security. Mr. McKinney's experience includes serving as the Chief Safety and Security Officer at the Chicago Transit Authority and as Safety Administrator at the Utah Transit Authority. He has worked on multiple federally-funded major capital transit projects which include: heavy rail modernization, light rail extensions and a streetcar New Start. He is a technical expert on programs, regulations, and compliance with FTA, FRA, TSA, USDOT SSO and APTA policies and standards. Mr. McKinney currently holds the highly recognized designations of Certified Safety Executive (WSO-CSE) through the World Safety Organization, Transit Safety and Security Professional (TSSP) through the Transit Safety & Security Division of the Transportation Safety Institute, US Department of Transportation, and Certified Safety Professional (CSP) through the Board of Certified Safety Professionals.

- **Raed Dwairi, Safety Certification Manager:** Mr. Dwairi has 20 years of professional safety & security experience in the rail transit industry. His experience includes working for the State Safety Oversight Agency in California and managing the triennial safety & security review program. He has worked on multiple federally-funded major capital transit projects which include new vehicle procurements. He has specific experience in Automated People Mover (APM) Systems having served as a the State of California's designated representative to the Sacramento County Department of Airports from the early planning stages of their APM system in 2008, through testing, commissioning, certification in 2011, and oversight of the APM System's Operations & Maintenance from 2011-2017. Mr. Dwairi is a Certified Safety Specialist (CSS-Rail), from the Transit Safety & Security Division of the Transportation Safety Institute, US Department of Transportation.

- **Jeffrey Siehien, Director of Project Delivery, Integration and Testing:** Mr. Siehien has 25 years of experience in engineering and program development for major transit systems. His expertise is in developing new technology systems and upgrading existing systems. Additionally, Mr. Siehien brings a full understanding of design impacts on ridership, operations and maintenance. His previous experience working for NYC Transit included training and mentoring engineers in operations and maintenance throughout the design, construction, and testing lifecycle of the system. He also developed training protocols as part of his responsibilities to make sure personnel was qualified to operate and maintain the system.

- **Tom Peck, West Area Construction Manager:** Mr. Peck is a licensed engineer with over 35 years of successful leadership in a broad range of multi-level management positions including international experience in engineering, contracting, construction, and program/project management. His experience includes the $4.2 billion Second Ave Subway project in New York City and the $35 billion Roads

and Drainage Program in Qatar. He held multiple positions in the US Army Corps of Engineers including holding a Federal contracting warrant.

- **John Moore, East Area Construction Manager:** Mr. Moore has over 46 years of experience in management, design, and construction of major public and private works projects, including transit. As a licensed contractor in Florida, he was the qualifier for Stone and Webster and later for URS. Mr. Moore was also recognized by the courts in Dade County Florida as an expert witness in Construction. For the past six years with HART, he has had various responsibilities, including being the Deputy Resident Engineer for the KHG contract; leading the completion of the AIS trenching; being the lead in resolving the delay and escalation claims received from Kiewit for the MSF, WOFH, and KHG contracts; being the Project Manager for the On-Call Contractor and the Elevator and Escalator contracts; and is currently the Interim Construction Manager for the Airport and City Center portions of the system, including the remaining twelve stations.

- **Gregory Rapp, Third Party and Traffic Engineering Manager:** Mr. Rapp is licensed Architect, a member of the American Institute of Architects (AIA), and Leadership in Energy and Environmental Design certified (LEED AP) who brings relevant knowledge and experience. In his over 30 years of design, construction and construction management experience in Hawai'i, Asia and the US Mainland he has been involved in numerous large scale commercial projects. He has also been working directly with Third Party Stakeholders in Hawai'i during the 20 years he has been working on projects in Hawai'i and understands the stakeholders' needs and policies and is able to navigate them to aid a project's success.

- **In Tae Lee, Deputy Director of Engineering and Design:** Mr. Lee is a licensed professional Civil Engineer and a professional Structural Engineer with 30 plus years of experience in managing, designing, and inspecting structural projects for transportation facilities. Mr. Lee has been with the Project since April of 2010. His primary responsibility is project management and the design of transportation structures. Mr. Lee has extensive experience in the area of pre-stressed concrete, post-tensioned concrete, reinforced concrete, and timber and steel structures. In addition, he has been responsible for providing structural expertise during the construction of transportation structures of various types and configurations. At HART he is responsible for management, planning and oversight of engineering which includes design-bid-build final design contracts, interface, architectural, structural, geotechnical, traffic, roadway and other general civil disciplines.

- **Paul Johnson, Risk Manager:** Mr. Johnson has 37 years of experience in facilities project management and construction, including leading cost containment/cost reduction sessions on many projects and programs including rail transit, highways, and water systems. He is a Certified Value Specialist (CVS) through SAVE International, and as an experienced facilitator is working with HART teams on risk

identification and mitigation such as utility interface. Mr. Johnson recently completed a 2-year assignment as Director of Logistics on the World Cup Programme in Qatar. The assignment involved close coordination with Qatar Rail for development of the country's rail transit stations and the tunneled guideway. Mr. Johnson's experience as an owner's representative and construction manager includes numerous forms of project delivery such as Design-Build, Design-Bid-Build, and Prime Contracting, all of which have applications on the remaining contracts in the HART project.

- **Albert Bonifacio, Director of Quality Assurance and Quality Control:** Mr. Bonifacio has over 50 years of management and engineering experience in the fields of licensing, site characterization, land access/acquisition, environmental, architecture, structural/civil design, building services (M&E), transportation including Rolling Stock, equipment and product manufacturing, construction, quality assurance/quality control (QA/QC), property market evaluation, estimates, system safety and security certification and project control. Experience in supervising and managing multi-million US dollar ($500M+) contracts with private and government customers and subcontractors from planning phase, preliminary engineering, final design, construction, testing and start-up, commissioning, safety certification, operation and maintenance. He is a licensed Professional Engineer, Certified Quality Auditor by the American Society of Quality, and a Certified Lead Auditor, ANSI/ASME N45.2.23 (Nuclear Power Plants). Mr. Bonifacio has been managing the HART Quality Management System including Quality Control for HART since February of 2010.

- **William Brennan, Director of Communications:** Mr. Brennan has a Bachelor's Degree in Journalism and over 40 years of experience in the communications industry. His unique experience in both public and private sectors includes television and radio anchor/reporter, television Executive News Producer, Communications Director, Press Secretary, and Informational Specialist. His local government experience includes Chief Public Information Officer at the State of Hawai'i Department of Commerce & Consumer Affairs, Communications Director at the City & County of Honolulu, and as an Informational Specialist at HART before being assigned to the Director of Communications Position.

- **Paul Romaine, Director of Administrative Services:** Mr. Romaine has over 39 years of professional experience in in private, federal and local government leadership and management positions. He started his career as a Metallurgical Engineer in the railroad industry leading research projects on alloy development and manufacturing processes for frog switches, railroad wheels and railroad brake shoes. He has also held leadership positions in airport management, quality assurance, aviation operations, aircraft maintenance, and aviation safety. He has been working for the City & County of Honolulu for the last 16 years including 6 years as the

Administrative Services Officer for DTS and 10 years as the Director of Administrative Services for HART (since agency inception).

- **Richard Lewallen, Director of Transit Property Acquisition and Relocation:** Mr. Lewallen has over 30 years of professional experience as an attorney after earning his Juris Doctor degree. Specifically, Mr. Lewallen's experience includes general managerial experience, directly overseeing both staff and contracted consultants; government real property acquisition and relocation experience consistent with the Uniform Relocation Assistance and Real Property Acquisition Act (URA), and; eminent domain law, and litigation management. Mr. Lewallen has a deep working knowledge specific to HART and its property acquisition and relocation practices, staffing, consultants, appraisers, surveyors, and attorneys as he has represented HART in many of its active eminent domain proceedings. Mr. Lewallen possess all necessary experience related to eminent domain law, processes, and procedures, including Hawai'i State law and its nexuses to federal law. Additionally, Mr. Lewallen's deep experience practicing law in Honolulu provides him intimate knowledge specific to the Hawai'i legal system, practicing attorneys, judges, and idiosyncratic court procedures.

- **Dr. Ryan Tam, Acting Deputy Director of Planning, Environmental Compliance & Sustainable Mobility:** Dr. Tam has a PhD in Urban and Regional Planning from Massachusetts Institute of Technology, a Master of Science Degree in Transportation from Massachusetts Institute of Technology, a Master of Urban Planning from Harvard University and a Bachelor of Science in Urban and Regional Studies from Cornell University. Over the last 9-1/2 years at HART and DTS, Dr. Tam has led a range of transportation and environmental planning efforts, including project permitting, environmental compliance, multimodal integration, travel demand forecasting, and project development. Dr. Tam also serves as HART's representative on the O'ahu Metropolitan Planning Organization Technical Advisory Committee. Prior to the Honolulu Rail Transit Project, Dr. Tam worked as a consultant for DTS to implement hub-and-spoke bus routes as well as planning for a proposed Bus Rapid Transit system.

- **Charles Bayne, Civil Rights Officer:** Mr. Bayne has over 43 years professional experience in operations, human resource management, customer service and business management in both private and public sectors. Mr. Bayne has been with HART for almost 8 years serving as Civil Rights Officer, DBE Liaison Officer, Labor Standards Officer (LSO), Equal Employment Opportunity Officer (EEO), Title VI Specialist, Language Access Coordinator and Americans with Disabilities Act (ADA) Compliance Officer. Mr. Bayne has lived in Hawai'i for 25 years and his acquired local knowledge contributes to the successful administration of assigned programs.

- **Nathaniel Meddings, Director of Project Controls:** Mr. Meddings is a Certified Construction Manager (CCM) specializing in project management, project controls,

and risk management. His background includes earned value reporting and analysis, change control facilitation, funding analysis, contingency management, constructability reviews and the development and monthly updating of master program schedule(s) including analysis of associated time impact analysis that may impact the Program. His recent experience as Project Controls Lead with Arizona's South Mountain Freeway P3 Project and City of Tucson Modern Streetcar Project will allow him to quickly acclimate to his new role at HART.

3.2.5 Qualifications of Key Personnel – DTS

DTS will assume responsibility for operation and maintenance of the rail system as it begins revenue service. As DTS already oversees operation and maintenance of the City's existing public transit services (TheBus and TheHandi-Van), DTS administration and staff understand the specific requirements and needs of such a complex system. Key individuals with many years of relevant experience have been identified to lead and support DTS as it takes on this new responsibility. These include:

- **Wes Frysztacki, Director of Transportation Services:** Mr. Frysztacki has more than 40 years' experience in transportation, and has advised hundreds of government entities throughout the U.S. He planned and developed many multi-billion-dollar highway and rail projects. Over the past twenty years Mr. Frysztacki has been active in Hawai'i advising on all forms of ground transportation. Previously, Mr. Frysztacki was the Director of Transportation and Regional Planning for the Puget Sound Council of Governments in Seattle, Washington. He was involved in every facet of regional planning for the Seattle-Tacoma-Everett metropolitan area. He orchestrated the formulation of strategic actions supported by a series of critical approvals, funding mechanisms and construction projects. These projects resulted in dozens of rail and bus facilities in operation in the Puget Sound region today.

- **Jon Nouchi, Deputy Director of Transportation Services:** Mr. Nouchi is a graduate of 'Iolani School and the University of Southern California's Price School of Public Policy where he received a degree in Urban and Regional Planning with focused studies in Transportation and Land Use. Mr. Nouchi was previously the Deputy Director of Planning at the HART and the Director of Planning and Service Development for O'ahu Transit Services, Inc. His current role at the City is focused on implementing sustainable transportation infrastructure through innovative technologies while improving mobility island-wide for O'ahu residents.

- **Eileen Mark, Public Transit Operations Division Chief:** Ms. Mark, as chief of the City and County of Honolulu Public Transit Operations Division, is responsible for oversight of the City's public transit system, including both TheBus and TheHandi-Van. Ms. Mark previously served as chief of the Paratransit Operations Branch. Prior to joining DTS, Ms. Mark oversaw the administration of environmental and land use

permits as chief of the Land Use Approvals Branch of the Department of Planning and Permitting.

- **Chris Clark, Acting Transportation Planning Division Chief:** Mr. Clark has fifteen years of transportation planning experience in the public sector with state, regional, and local governments. He is a member of the American Institute of Certified Planners and the Institute of Transportation Engineers. His experience includes managing and developing various staff and consultant driven long-range plans, congestion management processes, and corridor studies; along with creating work programs compliant with 23 CFR 450. Mr. Clark was the project manager for the O'ahu Regional Transportation Plan 2040 (ORTP) which includes more than $17 billion in fiscally constrained and $11 billion in illustrative improvements.

- **Mark Kikuchi, Traffic Engineering Division Chief:** Mark Kikuchi is the chief of the Traffic Engineering Division, which is responsible for the safe and efficient operation of all City Streets as it relates to motor vehicles, bicycles and pedestrians. Mr. Kikuchi previously served as chief of the Traffic Safety and Alternate Modes Branch where he was responsible for the Traffic Divisions local and Federal CIP program. He also had oversight over the Pedestrian and Bicycle Safety and Education Programs. Prior to joining DTS, Mr. Kikuchi was a CIP projects manager for the HDOT-Airports Division and as a Soils/Geotechnical Engineer in private practice.

DTS has contracted with Jacobs Engineering to provide specialized O&M support. The Jacobs team includes individuals with many years of relevant expertise that will be helpful to DTS as it takes on new responsibilities. These experts include:

- **Andrew Lane**: Mr. Lane has 20 years of transit systems experience, including testing and commissioning, rolling stock and wayside maintenance delivery at locations in USA, Canada and Asia. His expertise includes rolling stock testing and commissioning, maintenance and systems trouble shooting on a variety of vehicle platforms including: light and medium metros, electric multiple units, advanced rapid transit, monorails, and airport people movers. His expertise includes vehicle maintenance and optimization, maintenance program planning, maintenance information systems, engineering investigations of underperforming systems, downtime and accident investigation, life cycle costs/ total cost of ownership review for improved asset management, and design for maintenance reviews.

- **Jeff Herold:** Mr. Herold, with more than 35 years' experience, is currently acting as TransLink's Program Manager for Major Initiatives on Vancouver's Canada Line. He is a Senior Commercial Advisor on the Canada Line Fleet Expansion project including managing the procurement of 24 new vehicles and negotiating a major Concession Agreement amendment to require the Concessionaire to act as Owner's Representative for the analyses, design, selection, inspection, testing and acceptance of the vehicles (project value approximately $90M). He is also a Senior

Commercial Advisor on the Canada Line OMC, System and Station Upgrade Project including negotiating a major Concession Agreement amendment to require the Concessionaire to expand the stations, OMC and Systems necessary to accommodate 24 new vehicles and be able to run those vehicles at a service level approximately 50% higher than current levels (project value approximately $35M).

- **Mark Garrity:** Mr. Garrity has 30 years' experience in transportation. He served as Deputy Director of Transportation Services for the City of Honolulu from 2013-2017, where he led several initiatives including integration of the City's bus system with the future rail system, developing the new multimodal electronic fare collection system, and a capital program focused on improving walking, bicycling and bus connections to rail transit stations. As Transportation and Land Use Planning Manager for the Honolulu Rail Transit Project from 2007-2012, he was responsible for completion of technical analysis supporting the Environmental Impact Study and official submittals to the Federal Transit Administration related to station-area land use, transit-oriented development, station access, urban design and sustainability.

- **David Solow:** Mr. Solow brings 39 years of experience in starting, building, and leading complex rail transportation operations and as a former Metrolink CEO, David is an accomplished project manager and consensus builder who creates strategies for rail agencies by pulling together diverse groups, stakeholders, and interests. He has worked with the U.S. Federal Railroad Administration (FRA) in evaluating projects and service development plans and works to obtain agreements between the FRA and host railroads and state grantees. David has assisted the FRA in developing high speed rail and intercity passenger rail programs, developing program guidance and network integration planning oversight for service such as the California High Speed Rail Program.

- **Janice Li:** Ms. Li has 27 years of professional experience focused on planning, engineering, implementation, and management of transportation projects including automated, heavy, commuter, and light rail transit and bus system. Her expertise is in the management, operation and maintenance of transportation systems as well as strategic planning, performance/process improvement, simulation, system integration, asset management, and project delivery. Her recent projects included technical and project management oversight of contractor performance on various P3, DBOM and Design-Build programs.

- **Steve Hall:** Mr. Hall brings 43 years of experience in rail transit operations and maintenance including substantial experience planning and guiding the start-up of new automated rapid transit systems. He has planned and directed all aspects of operations and maintenance for the successful startup of the Vancouver SkyTrain and the JFK AirTrain fully automated rapid transit systems. He analyzed all aspects of operations and maintenance delivery for rail transit systems including life cycle

costing, and prepared numerous operations and maintenance estimates and proposals for new rapid transit projects with a focus on cost-effectiveness.

3.2.6 Staffing Strategy and Approach

HART continues to actively recruit through national recruiting websites, its own project website, job fairs, industry periodicals at the national level, local media, and through outreach to local agencies and engineering firms. HART has successfully recruited highly qualified individuals to fill the Chief Executive Officer/Executive Director, Senior Advisor, Chief Financial Officer, Deputy Director of Procurement, Director of Design and Construction, Director of Readiness and Activation, Senior Project Officer Core Systems, Integration & P3 Project Delivery, West Area Construction Manager, Director of Project Controls, and the Risk Manager positions. The passage of SB4 and Act 1 has provided HART an opportunity to look at the Project delivery as a whole, including revenue operations. This opportunity will be wed to an evaluation of the organization structure as a whole, including evaluation of needed core competencies. Staffing levels and management competencies required for cost-effective delivery of the Project will be the guiding factor.

HART's hiring and retention issues are not specific to rail construction personnel but have occurred across all disciplines and in all divisions of HART, including the administrative and financial offices which do not require any form of rail or construction experience. HART is also committed to retaining institutional knowledge and improving employee retention by providing career progression opportunities, preparation individuals for leadership roles, and providing fair compensation for City staff. HART has taken the necessary steps to create an employee-friendly working environment and a corporate policy of positive communication, maintaining a safe environment, and supporting staff needs.

3.3 HART Process and Procedure Changes

The following section describes changes to HART's processes and procedures which have been implemented to control costs, maintain schedule, and provide credibility in reporting moving forward.

3.3.1 Management of Current Contracts

3.3.1.1 Overview

Currently, to date HART has approximately 128 third-party contracts in place for the Honolulu Rail Transit Project, procured in compliance with the Hawai'i Public Procurement Code and federal requirements, in particular, FTA C. 4220.1F. Each contract was procured under the principles and requirements of competitive procurement through Request for Bids, Request for Proposals, or Request for Qualifications under the Brooks Act. HART has in place a Procurement Manual that provides detailed information to guide staff on the

procurement requirements including the selection of contracting method, evaluation of proposals, and elements of negotiations (in a Brooks Act requests for qualifications); it provides citations of the Procurement Code, which is key to accurate and correct compliance of the procurement requirements.

Once a contract is awarded and changes become necessary, it is imperative that a rigorous and systematic process is in place that justifies each change, and the cost of each change as fair and reasonable. The following paragraph describes the change procedures in place currently at HART.

3.3.1.2 Contract Change Procedures

HART's current Contract Change Procedures is to establish a change management process that includes review of change requests with appropriate checks and balances. The Procedures require documentation justifying the request for change at each phase of the process, from finding of merit, to negotiations, and finally to a signed change order. Examples of required documentation include an independent cost estimate, cost proposal from the contractor, and a cost analysis.

The Contract Change Procedures also define the responsibilities and provide guidance to staff members on the steps taken to administer a change order.

In March 2017, HART established the Change Control Committee (CCC) to review and recommend a finding of merit for all change orders. Prior to the CCC, review and approval was limited only to design and construction division only. HART's new leadership at the time identified a need to bring more checks and balance to the change process as well as discipline, oversight, and proper documentation for change orders. The CCC, therefore, was created to comprise not just design and construction, but heads of Procurement and Contracts Division, Design & Construction, and Project Controls. This way, each change order is reviewed for contracts compliance (procurement and contracts), interface with core systems and other construction contracts and sound technical construction (design and construction), and cost and schedule (project controls). The new procedures continue to recognize design and construction as the key division responsible for providing the factual basis of the change order, a critically important component to any request for change and potential construction claims.

The CCC reviews requests for changes for both construction and professional services contracts. The purpose and goal of the Change Control Committee is to bring added discipline to change approvals, to ensure that proper documentation is prepared that demonstrate merit and justification for the change order, and finally, whether the change may, unknown to the field project team, impact other construction projects, or cost or schedule of other contracts.

The CCC, established and administered under Procurement and Contracts, sets into process an established weekly meeting with requirements for timely submission by the field project

team of the requests for finding of merit. The field project team, who has the day-to-day experience of the contract is the first to make a determination on the merit. If the project team does not believe there is merit, the notice of denial is sent to the contractor immediately by the field project team. The CCC does not review or question the denial of merit by the field project team. The CCC, however, reviews all change requests the field project team has deemed to have merit.

Prior to each weekly CCC meeting, the field project team submits in writing the request for finding of merit and the basis the team deems it to have merit. At these Committee meetings, the field project team addresses and responds to the questions asked by the members of the CCC relating to contract compliance, justification, interface, cost and schedule.

If the Change Control Committee agrees with the finding of merit, it triggers the follow-on steps of the change procedures as set forth in the Contract Change Procedures, including the development of an independent cost estimate, scope clarification, review of the contractor's cost proposal, cost analysis, and drafting of the negotiations strategy memo.

The Contract Change Procedures will continue to be examined and regularly updated or improved as issues arise in the course of the Project.

3.3.1.3 Contract Administration

In early 2017, Contract Administration, which was its own Division, came under the umbrella of the Procurement and Contracts Division. HART realized that it was logical to have a division manage a contract from "cradle to grave," from procurement to contract administration, construction claims to closeout.

For all change requests, HART Contract Administration works with the field change team, resident engineer or project manager to provide guidance, enforce contract compliance, and ensure the change procedures are followed. It is HART Contract Administration's responsibility not only for ensure contract compliance, but that all change requests are processed properly and efficiently.

HART Contract Administration also administers its contracts, such as updating insurance certificates as a part of updating its contract files, provides weekly, monthly, quarterly and annual reports on contracts and change orders; the requesters include the ED-CEO, DED, the Mayor, City Council, Board, PMOC, and various branches of the State of Hawai'i. HART Contract Administration and reviews all professional services invoices for contract cost compliance and directs the invoices per the routing process to the contract project manager for the project manager's review and approval of services provided. (For construction projects the project manager, supported by cost engineers, schedule specialists, contract managers, and change and claims specialists, is the key personnel to review invoices submitted by the contractor to review for compliance with the contract; that services were satisfactorily performed in accordance with the terms or specifications of the contract.)

HART Contract Administration ensures that the contract file for each contract includes all required documentation including task orders (if applicable), independent cost estimates, contractors cost proposal, cost or price analysis and all required approvals. Since mid-2014, HART's Procurement and Contracts has been the designated repository of the "official" Contract File," which includes a uniform table of contents for all contracts from inception of procurement to closeout of the contract. While the Procurement binders include the procurement history, the rationale, the selection of contract methodology, the independent cost estimate, solicitation documents, and all approvals and required documents relating to the solicitation, the contract administration folder includes the required post-award documents, including the executed contract and notice to proceed, performance and payment bonds, change order documents relating to the change order process (see Section 3.3.1.2 above), formal correspondence, and change orders resulting from "settlement" of claims, and closeout documents.

3.3.1.4 Construction Claims

Contractual remedies are provided in the contract itself and are in accordance with the Hawai'i Public Procurement Code. They are also provided in the Procurement Manual and the Contract Change Procedures. In 2016, a Construction Claims division was created under Procurement and Contracts. The Construction Claims division assists the field project team to recognize issues that may lead to potential claims; advises on management of these issues to avoid claims or actions that may increase HART's liability; and assists and supports the field team in alternative dispute resolutions.

HART's goal is to provide ample opportunities for amicable resolution, to the extent possible, recognizing that an amicable resolution is preferable to litigation; this said, HART balances this goal with its firm belief and practice that all resolution must be within a "fair and reasonable" target.

The opportunities available to HART and the contractor for resolution of a dispute are as follows: If a contractor request for change is rejected by the field project team or the CCC, the contractor may request a decision from the Officer-in-Charge (OIC). In those cases that the OIC determines there is no merit, the parties may enter into an alternative dispute resolution, including mediation. Under Hawai'i Administrative Rules, alternative dispute resolution cannot be binding, but it provides another opportunity for the parties to present their cases. At each new phase of the parties' attempt at an amicable resolution, new facts may emerge that may lead to an agreement on the dispute. If a resolution cannot be reached by way of an alternative dispute process, the contractor may appeal the issue to the Chief Procurement Officer/Contracting Officer (CO) for a final determination. Since the CO's decision is the "final" decision under Hawai'i Revised Statutes, which triggers the contractor's right to file a lawsuit in circuit court, the CO reviews the arguments of both sides rigorously prior to issuing the CO's decision. HART deems the appeal to the CO as a "claim" for purposes of notifying to the FTA of claims.

3.3.1.5 Improvements to Contractor Interface

HART has worked to improve coordination between contractors to ensure the plans, specifications and work in place of one coincide with the work of another. Below are issues that took considerable time and effort to coordinate and resolve through HART's interface processes:

- Peripheral Device locations (PA speakers, CCTV, fire alarms, etc.)
- Number, sizes and types of conduit (including cable segregation requirements)
- SCADA cabling and coordination requirements
- Conduit configurations in canopy supports
- Location and configuration of Communications Interface Cabinets (CIC) and associated conduit
- Access control for door entry (card readers; electric locks, strikes and hinges)
- Coordination of base plates and mounting studs installation with Passenger Screen Gates
- Fare Gates and ticket vending machines locations and configuration
- Provisions in station layout and infrastructure for future elevators
- Coordination and interface with third parties to discern requirements, procedures, and resolve issues associated with design and construction
- Coordination of Train Control Room (TCCR) layouts (cable tray, FM200, HVAC, lighting) between contractors
- Attaining station conduit shop drawings from FFCs
- Attaining redline drawings of FFC installations
- Coordination of Construction Access Milestones provided to AHJV, the Core Systems Contractor, from the Fixed Facilities (FF) contractors
- Coordination of outstanding punch list completion by the FF Contractor for delivery to HART and then to the Core Systems Contractor

HART's leadership is currently closely monitoring and facilitating interface and coordination between the FF Contractors and the Core Systems Contractor to ensure that critical issues are resolved and that the FF Contractor provides construction access to the Core Systems Contractor in a timely manner. This is to avoid delay to planned revenue opening service dates and claim costs due to schedule slippage.

3.3.2 Project Controls

3.3.2.1 Project Controls Overview

The Project Controls organization is primarily responsible for managing cost and schedule outcomes of the Project. Project Controls has 27 team members divided into the following functional groups:

- Cost Estimating
- Cost Management
- Schedule Management
- Document Controls
- Business Systems
- Project Reporting

Project Controls made significant changes in staffing to improve division performance since 2017. This includes updating the number of staff in the Cost Management group from 1 to 4 team members, separating Business Systems and Document Controls into 2 groups, and filling multiple vacancies within the division. Project controls is heavily augmented by support from the General Engineering Consultant.

Project Controls updated the Contract Management System (CMS) from Oracle CM 13 to CM 14, which has stabilized some system performance issues identified in previous performance assessments. However, Oracle stopped developing the product in 2015 and HART is not able to update JAVA or Internet Explorer to the latest versions due to compatibility issues. Project Controls is evaluating various options to replace Oracle CM altogether.

Meanwhile, Project Controls is committed to simplifying and implementing business processes more efficiently, centralizing the focus of information on analysis, reporting, and communication.

3.3.2.2 Trends

The Project has undergone major scope revisions and approved changes yielding significant cost and schedule impacts. In dealing with this and potential cost escalations, Project Controls performs rigorous and continuous predictive analysis in key areas of where costs can be reduced or schedule delays can be mitigated. The August 24, 2017, cancellation of the CCGS procurement gave HART the opportunity to explore options to optimize cost and schedule. Project Controls analyzed these in the months between September 2017 and April 2018 with incremental updates provided in December 2017 and May 2018. As of the writing of this November 2018 Recovery Plan, the City Center Utility Relocation contract has

been awarded and the HART Board of Directors has authorized the release of an RFP for a P3 contract to complete the remaining construction contracts and system installation (as discussed in other sections).

The current budget and schedule will undergo a re-baseline once this Recovery Plan is adopted. Once established, forecasting cost and schedule variances to the re-baseline will be documented through a new trend report process. The trend analysis will allow for and document early detection of potential cost overruns, schedule slippages, and project risks associated with individual contracts or interface elements of the Project. Project Controls monitors the approved Project budget and documents potential variances throughout the life of the Project. Project Controls is also tracking any changes to the original Project scope of work which result in an increase to the Project's approved budget, as they can only be submitted for approval by the Board after a committed funding source has been established.

3.3.2.3 Cost Contingency

The cost contingency will be managed as a reserve fund by HART management. Contingency is allocated at the Contract Packaging Plan (CPP) level to address any unforeseen costs or risks related to design development, construction, and other Project conditions. Contingency is allocated based on inputs from HART's Risk Manager, and reduced or accounted for, as design, construction, and procurement progress, uncertainty and the potential for risk events are quantified in the Risk Model. A contingency drawdown curve will be established and managed via the Trend Process to ensure appropriate levels of contingency are managed and reported.

3.3.2.4 Master Project Integrated Schedule (MPIS)

The Project Master Integrated Schedule is the chief program management tool that ties information for all elements of the Project together and provides the necessary assistance in the planning and management of a complex execution plan for the Project. It is developed with a supporting basis and assumption report and is comprised of a hierarchy of program tasks and benchmark interim milestones, through both an Interim and System-wide RSD.

Over the past year (since September 2017), Project Controls has continued enhancing the MPIS by keeping the focus on using the schedule as the central point of communication in analyzing progress and reporting metrics to both the field level and executive management level. The status of previously identified critical areas of deficiency that were preventing the MPIS from being able to be used as a tool to meet this focus is below:

- There was a lack of consistency in the use of activity coding, calendars, and Work Breakdown Structure (WBS) coding. Standard calendars and WBS are utilized throughout the MPIS. Activity coding currently supports all internal and external reports.

- The schedule updating procedures needed to be revised. Complete.
- There was a lack of owner-specific and third-party interface information in the MPIS (such as inclusion of Regulatory Agency approvals, inspections, certifications, and other utility activities—such as utility relocation and HECO power and activation activities). Though improved since September 2017, this work continues.
- There was a disconnect of inter-project logic ties of Major Milestones and Critical Access Milestones (CAMs) to schedule activities. Complete and monthly review continues to ensure this doesn't reoccur.
- There was an unclear Critical Path at a Program Level. Complete.
- Total Float values were inconsistent and excessive, requiring a review of logic ties (as they may be missing successor tie[s]). Complete and monthly review continues to ensure this doesn't reoccur.
- Constraints, specifically hard constraints, were being used throughout the MPIS to hold a date in the system. This presented an issue, in that it would override the sequencing logic used for forecasting and accurate reporting of any potential forecasted delays. Use of constraints are minimized and are reviewed/reported to PMOC each month.
- Integration of testing activities from the feeder schedule was missing in MPIS. Activities are updated monthly.
- Safety and Security activities are not updated or accurate in the MPIS. Activities updated monthly.
- There was a lack of detail for upcoming planned work (information for the East Side segment shown at a planning level). The MPIS is a summary level schedule updated based on the contract level detailed schedules.
- There was a lack of standardized schedule reports and look-aheads of the MPIS information. Standard schedule reports are prepared and provided in the Monthly Internal Schedule Review.

In the past (prior to early 2017), the construction portion of the MPIS schedule was updated by uploading the contractor's progressed schedule directly into the MPIS. This was recognized as a concern that was quickly rectified. Presently, monthly updates are prepared by the Project Controls Scheduling team utilizing contractor's progress schedules, Three-week look-ahead schedules, inspector daily reports, and weekly CAM date review meetings.

Project Controls has instituted, and continues to conduct, a quality check each month on the use of constraints, high total float values, and orphaned activities. Many of the adjustments incorporated into the MPIS over the past 12-14 months are the biggest

contributing factors to establishing an integrated schedule. It is important to note that additional work is necessary with respect to the continued detailing of the East Side segment of work, which is expected to be an ongoing work in progress.

In addition, Project Controls recognized a general deficiency in how it was interfacing with the Project's internal groups. Project Controls has initiated a stronger communication and coordination effort with the HART Division Directors that has resulted in an enhancement of the detail and integrity of the schedule information, specifically for interface, turnover of activities and milestones, levels of detail information within the schedule, and accurate logic ties. A majority of logic detail has been incorporated in the MPIS leading up to the Interim RSD and for the complete system-wide RSD. Testing, certification, and Safety & Security information is at a summary level in the MPIS, but additional details from these sections are available in contractor schedules and are routinely reviewed/evaluated in order to reflect appropriate relationships and durations in the MPIS.

The improvement of Project Controls' processes has led to the development of a new internal Monthly Schedule Report, with sections feeding into the published Monthly Project Status Report, as appropriate. The internal report shows more detailed layout options; a Critical Path and Analysis section; a Look-ahead Schedule; a Major Milestone and Critical Access Milestone Schedule and Analysis section; Third-Party Turnover and Interfaces section; a ROW section; a Core Systems, Testing, and Analysis section; and an Area of Concern section—to identify present and potential issues.

Project Controls' goal is to enforce the MPIS and make system reports available as a centralized tool for communication and presentation of current Project status and critical activities; analysis of any variances; identification of issues or concerns, mitigations, or recommendations; and workaround plans.

3.3.2.5 Schedule Contingency

Schedule contingency is carried as an activity in the MPIS: one for Interim Opening, December 31, 2020 and another for Full Revenue Opening, September 1, 2026. The amount of contingency for Full Revenue Opening is currently the difference between an earlier, best-case opening date and September 1, 2026. HART's Risk Model quantifies the required contingency to cover total impact to the Critical Path for each item of risk based on input from the Risk Manager. HART will manage and update all risks that may affect completion of the Project within the approved schedule on a monthly basis and re-run the network model on a quarterly basis. Project Controls also continues to report progress towards meeting HARTs commitment to the Hawai'i State Legislature to complete the Project by December 31, 2025.

3.3.3 Risk Management Program

HART's overall efforts in Risk Management, including cost reduction and cost containment, are specifically addressed in the Risk and Contingency Management Plan (RCMP). The RCMP was originally drafted in 2011. The RCMP was extensively redrafted in 2017 to reflect current processes, and it was updated again in 2018 to respond to PMOC comments. The finalized RCMP was approved and signed by HART managers in March 2018. The approved RCMP, and the associated Risk Management Procedure (also approved in March 2018) continues to serve as the basis of HART's ongoing Risk Management program.

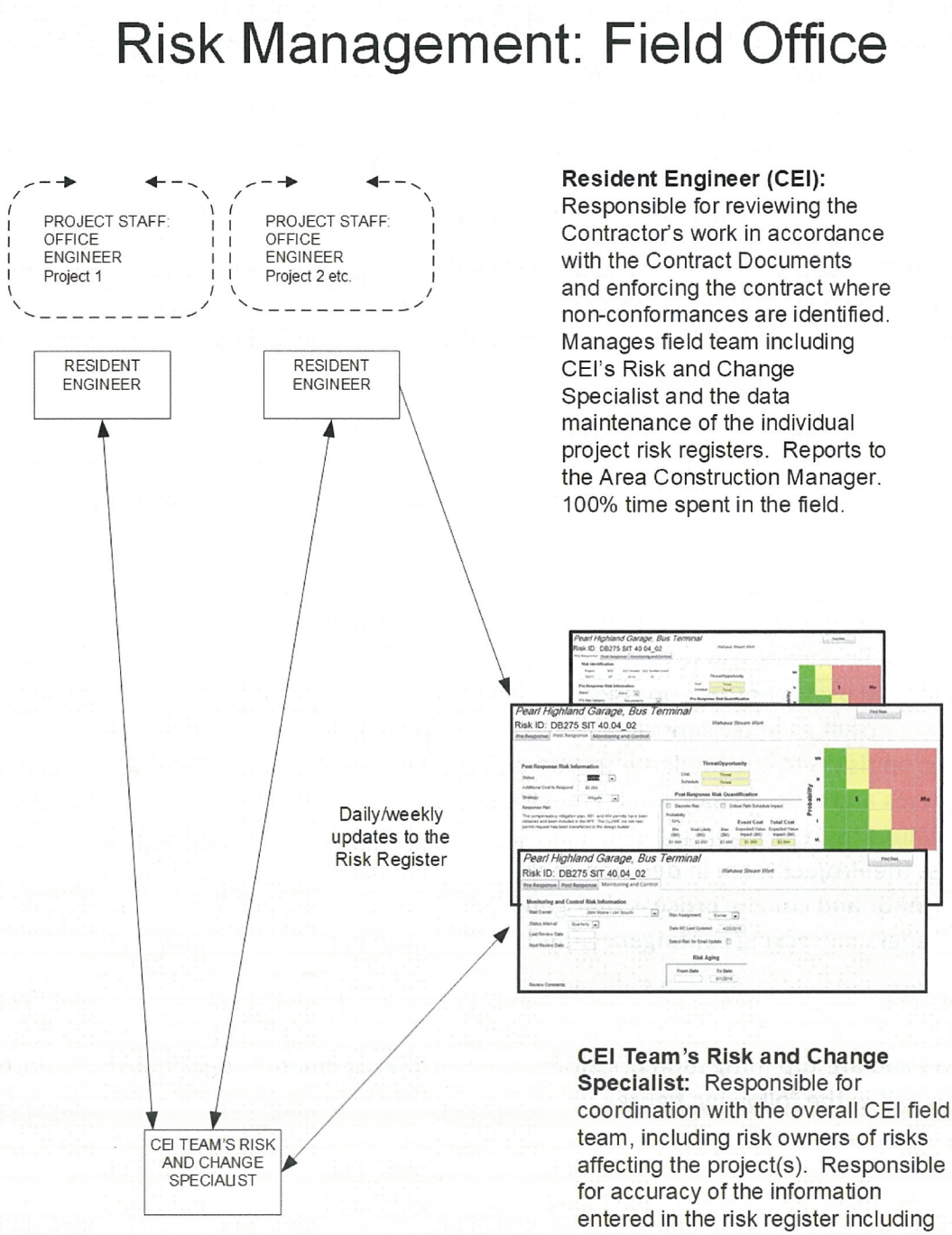
Risk mitigations are actively pursued by the HART Project team members on a monthly basis, often with success in reducing risk exposure translating into cost and schedule savings. Furthermore, risks are candidly addressed and included in the risk database, so that the overall cost exposure of the Project is objectively forecast.

Risk Management Committee meetings are held generally every month, allowing senior managers at HART to address important risk topics such as Secondary Mitigations, new risks, top Project risks, and identifying action items as needed for small teams to pursue mitigation of risks.

The HART Risk Management Program helps to establish confidence in the HRTP cost and schedule projections. The Risk Program includes the identification, categorization, and assessment of risks and opportunities (R&O) related to each individual contract. A network risk model uses a bottom-up risk assessment to define cost and schedule R&O impacts for each contract to other contracts, and to the Project as a whole. In 2016 HART increased its focus on risk with the implementation of formal risk modeling efforts that include rigorous analyses and cross-departmental meetings to determine mitigation strategies. This effort continues to the current time in 2018. Quantifying the cost and schedule R&O impacts will assist the Project team in decision-making and risk management. HART has also developed a monitor and control process that generates reports to assist the Risk Manager and Project Managers in tracking contingency funds.

The difficulties experienced in the West Side DB contracts, including contract language and requirements as described below, are identified as risks and/or lessons learned for AGS and CCGS and are top mitigation priorities. The Risk Management Program process flowchart is depicted in the following figures.

Figure 3-8 Field Office Risk Management Flowchart



Resident Engineer (CEI): Responsible for reviewing the Contractor's work in accordance with the Contract Documents and enforcing the contract where non-conformances are identified. Manages field team including CEI's Risk and Change Specialist and the data maintenance of the individual project risk registers. Reports to the Area Construction Manager. 100% time spent in the field.

CEI Team's Risk and Change Specialist: Responsible for coordination with the overall CEI field team, including risk owners of risks affecting the project(s). Responsible for accuracy of the information entered in the risk register including identifying new risks. Reports to the Project Engineer. Coordinates with HART's Director of Risk Management (Risk Manager). 100% of time spent in the field.

Figure 3-9 Risk Manager and Project Controls Flowchart

Risk Management and Monthly Reports

Director of Risk Management (Risk Manager): Responsible for leading the program's Risk Management process. Master keeper of the Program Risk Register. Ensures the validity of data provided by the CEI field staff. Provides monthly reports to the Risk Management Committee. Provides quarterly modeling from Risk Refresh workshops with CEI teams, including Cost and Schedule Probability curves. Informs Project Controls of Risk forecasts for Project Controls to plot trend lines against the program Cost and Schedule contingency drawdown curves. 10-15% time spent in the field.

CEI TEAM'S RISK AND CHANGE SPECIALIST

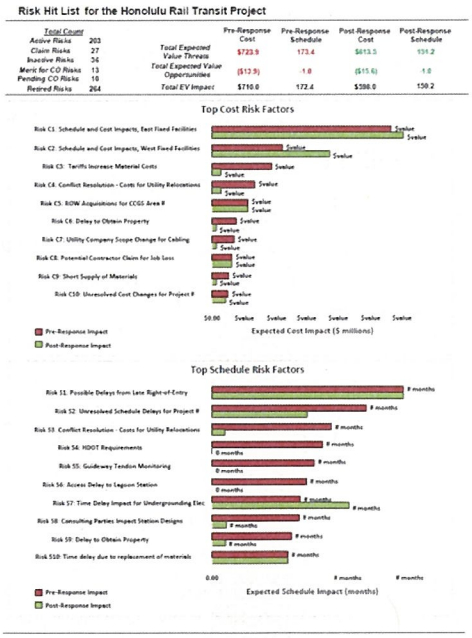
Monthly exports of project Risk Registers

Validation of Changes/Import into Master Program Risk Register

RISK MANAGER

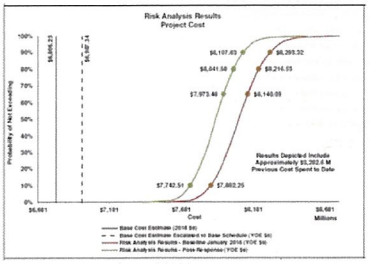
Monthly Reporting

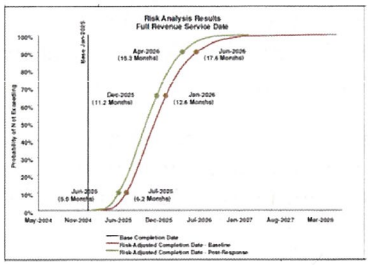
Risk Hit List Reports:



- Risk Hit List Reports (top cost and schedule risks for overall Project)
- Risk Hit List Reports for Individual Projects
- Risk Expected Value Report
- Month-to-Month Risk Changes Report

Quarterly Modeling





Risk Management Reports: Risk Management Reports are provided to HART Executive Management, Project Controls, and the PMOC on a monthly basis. Quarterly Risk Refresh workshops are held to review all risks and mitigation efforts in further detail and to produce updated Cost and Schedule Probability curves.

Figure 3-10 Risk Management Reports and Committee Flowchart

Risk Management Committee

PROJECT DIRECTOR (CHAIR)

DIRECTOR OF DESIGN AND CONSTRUCTION

DIRECTOR OF PROJECT CONTROLS

DIRECTOR OF PROCUREMENT, CONTRACTS AND CONSTRUCTION CLAIMS

AREA CONSTRUCTION MANAGERS (EAST AND WEST SEGMENTS)

DIRECTOR OF CORE SYSTEMS

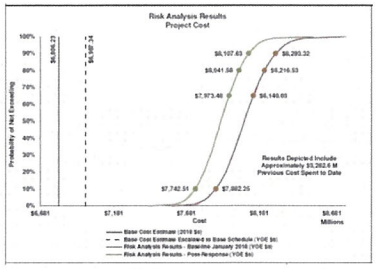
FINANCE MANAGER

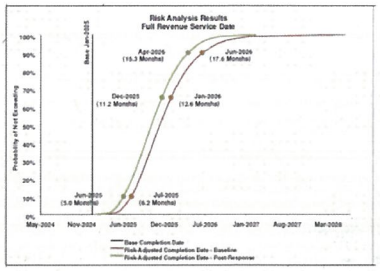
RISK MANAGER

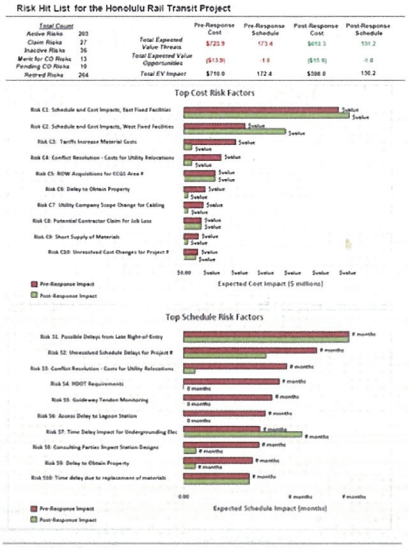
(Note: The CEO and CEO Advisor, and other staff as needed are invited to the Risk Management Committee meetings)

RISK MANAGEMENTMENT COMMI TTEE

Risk Management Committee: The Risk Management Committee is chaired by the Project Director, with assistance from the Risk Manager. The Committee consists of the positions shown above. The Committee generally meets monthly to review the top risks and mitigation efforts on the HART Project, as well as the updated Cost and Schedule Probability Curves. The Director of Project Controls participates and reports on the overall Project budget and remaining contingency. The reports provided by the Risk Manager provide the Committee with insight from the field of what challenges the teams are facing in terms of risks, what mitigation strategies are being employed. Discussions at the meetings result in action items including new mitigation efforts that need to be undertaken by HART staff.







Risk Modeling and Reporting: Detailed Risk Modeling occurs on a quarterly basis, based on thorough reviews with all project teams. This effort results in updated cost and schedule probability curves using Monte Carlo evaluation software. Although the curves are produced monthly, the budgets are evaluated quarterly against project controls information to ensure as much alignment in project values as possible.

On a monthly basis, a summary of top risks by project and program are produced by the Risk Manager along with cost and schedule tornado (Risk Hit List) diagrams, monthly risk comparison reports, and the Risk Expected Value Report. These reports inform HART management on the health of each project as well as the overall the program, related to exposure to cost and schedule risks.

The Project is currently monitoring 253 active risks and has closed or retired 300 risks since June 2016. The following is a list of the top three known cost risks, which account for $289 million, or 48% of the total risk profile:

- Re-baselining the Core Systems Schedule for the overall West and East Segments to meet a Final Overall Baseline Schedule, extending the RSD from January 2022 to December 2025.
- Re-baselining the Core Systems Schedule to meet a Final Baseline Schedule, establishing the Interim RSD for the West Segment as December 2020.
- Resolving ROW acquisitions necessary for Rail, with an affected Developer in Kaka'ako.

The top schedule risk is the delay of the Core Systems schedule by 77 months (from mid-2019 to completion of CCGS in 2025). Core Systems is delayed as a result of delayed completion of the West Side and East Side projects.

Further schedule risks are less significant and are concurrent with (not additive to) the Core Systems schedule delay, such as:

- Misidentified or unidentified utilities which might occur in remaining West Side efforts or East Side contracts (a delay of 2 months).
- HDOT or DTS requirements for conformance with their standards (a delay of 6 months).

A more comprehensive listing of the cost and schedule risk factors is included in Appendix C. This excerpt from the Top Risk Summary Report shows how each risk factor includes a detailed description, a pre-response estimate, a post-response estimate, and the individual risk owners. It also shows the overall risk and potential recommended mitigation for the respective risks on the Project.

HART has developed a Risk and Contingency Management plan and is committed to enacting cost containment and value engineering measures as a primary tool to maintain the Project's capital cost within the established budget.

If needed, HART also has a number of strategies to mitigate these downside risks, including:

- Utilizing its existing TECP program for short-term financing needs.
- Reduce HART's expenses and Project costs.
- Absorb higher interest rates above the conservative interest rates used to estimate financing. The HART financial plan uses an average 4% rate for fixed-rate debt and 3% for variable-rate debt. The average rates used are approximately 1% higher than

the current market rate. Thus, HART can absorb reasonable increases in a rising rate environment.

In the process of preparing this Recovery Plan, HART determined that certain legal risks regarding ROW acquisitions and relocations had never been fully captured in extant risk assessment models. Many of these risks relate to the wide range of possible jury verdicts with regard to property valuations in eminent domain trials. However, given the sometimes unpredictable and uncontrollable results of jury verdicts in eminent domain trials, HART believes it most prudent to disclose the potential for risk in excess of budgeted amounts in the updated financial plan. HART continues to assess its total risks for the entire Project, inclusive of ROW risks, involving monthly discussions with the ROW Manager and other property advisors in order to stay abreast of the probabilities and ranges of cost impacts associated with ROW and easement acquisitions, and obtaining Construction Rights of Entry to allow the Project to proceed.

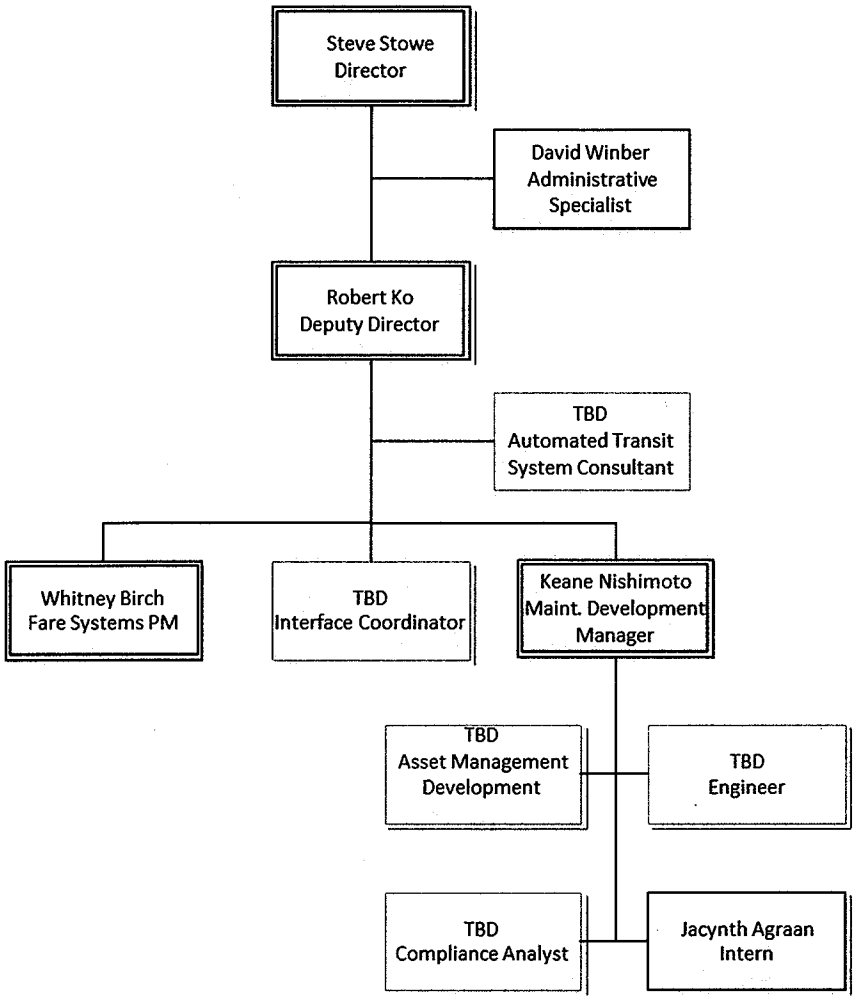
3.3.4 Operations and Maintenance Transition Plan

The approval of the 2016 Charter Amendment 4 to the Revised Charter of the City and County of Honolulu 1973 (2000 edition), as amended, reassigned operations and maintenance responsibilities for the rail system from HART to the City DTS. HART's responsibilities will continue to include planning, design, development, and construction of the Project, while DTS is responsible for operations and maintenance of the system. Furthermore, the decision in September 2018 to pursue a P3 concession that will include the remaining capital projects and 30 years of O&M will impact on how the City prepares to take over this responsibility. The City expects the change to a P3 for O&M will offer an opportunity for long-term reliability, improved performance, higher quality of service, and greater assurance of asset replacement.

HART and DTS are preparing an MOU to clarify the roles and responsibilities of the two organizations during the transitional phase when construction and O&M activities overlap. HART and DTS are also jointly developing rail O&M policies and procedures that will be adopted by DTS; for example, more than 550 documents need to be prepared in advance of revenue service. Staff are currently meeting to discuss how the P3 procurement approach will change responsibilities for each agency.

HART and DTS delivered a joint transition plan presentation to the HART Board of Directors on March 15, 2018. HART and DTS also presented on the subject to the Project Management Oversight (PMO) in February and May of 2018. In August 2018, HART, the PMO, and FTA representatives agreed to use the major milestones of the Rail Activation Plan (RAP) as the basis for the transition of O&M to DTS. The RAP has currently been reassigned to Mr. Bob Good, Senior Project Officer of Core Systems, Integration & P3 Project Delivery and under the preparation and review of Mr. Steve Stowe, Director of Readiness and Activation.

Figure 3-11 Readiness and Activation Team Staff Organization Chart



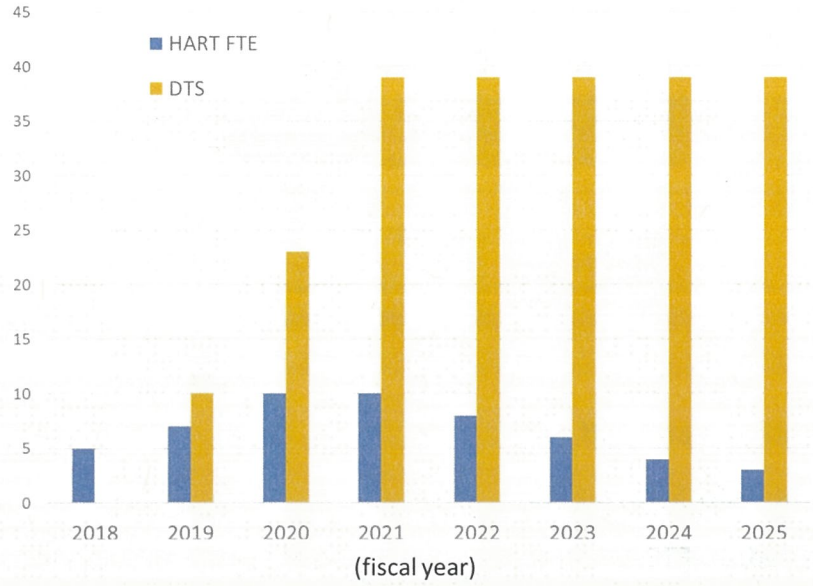
Readiness and Activation Team Staff

- Current HART Staff: 5 FTEs
- Projected: 10 FTE
- Identifying automated transit system consultant

HART has supported the transition by advising DTS of critical milestones, providing a matrix of O&M responsibilities, creating a formal document sharing process, establishing recurring meetings between the agencies, providing a list of prioritized HART meetings, providing HART O&M planning and policy recommendations, and responding to DTS requests in a timely manner. HART has established a System Start-up series of meetings to actively engage DTS and all O&M stakeholders.

The City's goal is to develop rail O&M oversight capability within DTS and other departments as appropriate, while recognizing that the recent switch to a P3 delivery method including 30 years of O&M will impact DTS's scope and level of responsibility. While HART has been responsible for contract management and mobilization planning, DTS will increase participation as new staff are approved by the City Administration and the City Council. DTS received approval for 10 new positions in FY19, and is now creating supporting position descriptions (PD). DTS will request more positions in future fiscal years, as appropriate.

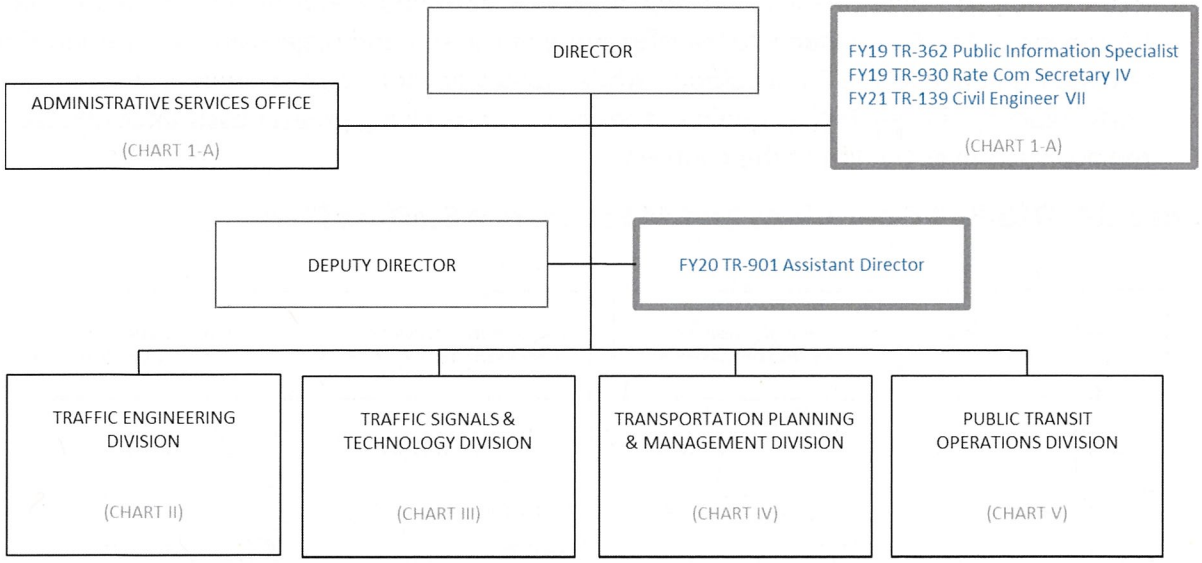
Figure 3-12 Expected Number of Rail O&M Full-Time Positions in the City DTS and HART



The emphasis is on filling civil service positions with limited use of Personal Services Contracts (PSC). The strategy will be to integrate rail into existing DTS Divisions and train existing staff, who are already performing rail related functions such as National Transit Database, grants management, multi-modal coordination, and parking. DTS has hired experienced rail consultants to assist with the transition of O&M responsibilities within the current DTS structure as shown in Figure 3-13. The City expects the change to a P3 for O&M could potentially change the number of civil service positions needed, but more investigation will be needed to make that determination.

In addition to DTS, other City departments that may also be affected by the City taking over responsibility for oversight of O&M are identifying needs and preparing requests for new positions. For example, Police (HPD), Facility Maintenance (DFM), Human Resources (DHR), Fiscal Services (BFS), Information Technology (DIT), Customer Services (CSD), Design and Construction (DDC), and others are all considering how their staffing needs will change with rail, and specifically under a P3 concession. The next key steps for DTS are to: 1) fully use HART institutional knowledge and capability, 2) transition existing City staff and consultants into mobilization group, 3) add senior DTS staff as appropriate, and 4) actively represent DTS interest in rail activation and construction.

Figure 3-13 Integration of Rail into Existing DTS Divisions



3.3.4.1 HART Rail O&M Preparation

The knowledge transfer process from HART to DTS has started. HART has developed a draft MOU to implement RCH 2016 Charter Amendment 4. HART is sharing Project and O&M development documents with DTS through the HART Contract Management System (CMS) and HART Sharepoint system. HART staff developed a draft document sharing and review procedure, and is working with the Department of Information Technology to verify that DTS has access to the HART systems. HART initiated monthly executive meetings and weekly working level meetings with DTS.

3.3.4.2 DTS Rail O&M Preparation

DTS staff are attending HART BOD, and PMOC meetings. DTS worked with HART to execute an office space MOU allowing the colocation of the mobilization group. DTS has started preparing an O&M Transition Plan and made a special request for added staff positions. DTS has been identifying future rail O&M functions and risks, taking into account the recent change to a P3 approach. DTS and HART are drafting rail O&M related position descriptions.

The current budget includes funding for new positions that are now in the hiring process and DTS has hired a consultant to assist with the transition of O&M responsibility from HART to DTS.

3.3.4.3 The 2018-2019 HART-DTS Rail O&M Staffing Strategy and Status

The City's goal is to develop rail O&M capability within DTS and other departments as appropriate, given the recent change to a P3 procurement strategy. DTS requested 10 new positions in FY 19 and is now creating supporting position descriptions (PD). DTS will request more positions in future fiscal years. The emphasis is on filling civil service positions with limited use of Personal Services Contracts (PSC). The strategy will be to integrate rail into existing DTS Divisions with the new positions identified in Figure 3-14. By switching to a P3 approach, the City expects to transfer some of the risk and responsibility for operation and maintenance to the P3 developer, while increasing long-term reliability, improving performance, offering higher quality of service, and receiving greater assurance of asset replacement over the life of the contract.

Figure 3-14 DTS Rail Operations and Maintenance Staffing Plan

3.3.5 Safety Oversight

The HART Chief Safety and Security Officer leads the HART System Safety and Security Division (HART S&S) and is responsible for managing all Project safety and security activities and ensuring all Project safety and security requirements are met. The Safety and Security Management Plan and the Safety and Security Certification Plan have been updated and are current. The implementation and monitoring of these safety plans reflect HART's commitment to ensuring the safety and security readiness of the system for public use throughout all phases of the project life cycle. HART S&S provides monthly updates to the FTA PMOC on the status of safety and security certification, a brief summary on important safety and security issues, and activities that may impact the Project schedule and budget. HART S&S will continue to effectively and efficiently manage its resources in support of HART's ultimate goal of delivering a safe and reliable public transportation system to the citizens and visitors of the Honolulu area.

As mandated by Title 49 of the United States Code of Federal Regulations (CFR) Section 633 and Title 29 CFR Sections 1910 and 1926, HART is responsible for ensuring its employees are provided with a safe work environment. HART also conducts construction safety and security oversight activities to ensure Project Contractors are meeting their responsiblities for providing their employees, subcontractors, and visitors with a safe and healthy work environment. The federal Occupational Safety and Health Administration measures a safe work environment by calculating the total incident rate for categorized work activities. HART's current total incident rate is three times lower than the State of Hawai'i average of 11 and tracking parallel to the national average of 3.5. This low incident rate allows HART to take advantage of premium savings in the Owner-controlled Insurance Program versus the cost of a traditional insurance plan, and by sustaining respectable loss ratios through payment of fewer and average lower claim amounts, resulting in a positive impact of the Project schedule and budget.

As Safety Certification is critical to the success of the Project, the HART S&S works closely with HDOT, who approves the HRTP's entry into passenger service, and all the Project teams to track and verify all safety-related requirements. Regular meetings are held with HDOT to keep them informed of all safety activities in progress. The HART S&S will, upon completion, deliver a fully certified system to DTS to begin Revenue Service Operations.

3.3.6 Decision Milestone Matrix

HART has updated and is maintaining a Decision Milestone Matrix that will help to outline and prioritize the necessary decisions to move the Project forward. The Decision Milestone Matrix lists items of concern that could pose cost and schedule risk to the Project. It identifies the owner for each item, lists the deadlines for decisions on the items, assess potential impacts and mitigation actions to resolve the items. Combined with the Risk Management program, the Decision Milestone Matrix will become a powerful tool in

making appropriate project decisions and ensuring that critical issues remain at an elevated level to be reviewed by HART Executive Management for timely and effective decisions. The matrix itself is owned by the Risk Manager, who now meets with appropriate managers to determine the critical issues that will be in need of decisions and meets with the Project Director generally on a monthly basis for a review of the matrix. The matrix has recently (in 2018) been presented to Executive Management and to the PMOC at the PMOC Monthly Progress Meetings.

4 Cost Reduction and Containment

4.1 Methodology and Approach

HART continues to apply the knowledge gained from having prepared, awarded, and managed numerous multi-million, multi-year alternative delivery transit contracts to date, to ongoing and future work necessary to complete the overall HART Project. This effort will become increasingly important as the Project moves into Honolulu's dense urban core. HART's commitment to explore project delivery efficiencies, and all practical cost containment and cost reduction measures through value-engineering and lessons learned, are further described below.

4.2 Project Delivery Efficiencies

HART has consistently sought to apply project delivery efficiencies to design and construction contracts to improve overall Project cost and schedule performance. Some of the areas analyzed by the Project teams include the following:

- Developing a contract packaging strategy to lower costs by increasing competition. One example is the separation of the City Center Utilities procurement from the overall City Center Guideway and Stations Procurement, allowing a 2-year head start on the complex utilities relocation work, which allows more cost effective local management of the utility relocation work, minimizes risk to the competing guideway and stations contractors (now with a DBFOM delivery mechanism) which should result in more competitive pricing for the City Center Guideway and Stations work.
- Moving towards P3 (DBFOM) procurement and re-packaging where appropriate to contain or lower costs.
- Rewriting the RFP for CCGS and Pearl Highlands to be more performance-based and less prescriptive.
- Revising contract language, in collaboration with various construction and procurement stakeholders, to provide clear direction and minimize disputes.
- Removing non-essential design and construction elements to reduce cost.
- Performing pre-construction Subsurface Utility Engineering (SUE) and geotechnical investigations.
- Reviewing various Project financing options.
- Implementing a Maintenance of Traffic strategy that allows for expedited issuance of Road Use Permits.

- Utilizing precast and offsite fabrication to reduce cost and schedule.
- Utilizing partnering to resolve construction issues in the field.
- Utilizing a Dispute Review Board to minimize or avoid potential impacts and prolonged litigation.

4.3 Potential Cost Reduction through DBFOM

HART's extensive analysis indicates that completing the capital elements of the Project and utilizing a 30-year operations and maintenance concession would likely result in a number of benefits regarding project cost and schedule. The benefits that will result from employing the DBFOM delivery approach are the result of both assuring improved budget and schedule certainty through a P3 concession and through implementation of specific cost reduction and schedule acceleration measures. The key elements of the DBFOM approach that can result in project cost reduction are highlighted below:

- Procuring a large-scale P3 contract incorporating both a major capital construction program and a long-term O&M concession will likely result in increased competition from world-class consortia incorporating design, construction, finance, operations and maintenance components. This increased competition is anticipated to result in more aggressive and competitive pricing for both capital cost and annualized O&M costs, as demonstrated by many similar procurements around the world. Honolulu has had a difficult history of procuring complex projects, whether through Design-Bid-Build (DBB) or DB delivery methods, owing to the dearth of world-class companies resident to the Island, combined with the cost to mainland or overseas-based companies of mobilization/demobilization. The P3 procurement has "bundled" the construction and O&M components of the Project and will likely result in a significantly-sized P3 development/concession contract. The magnitude of this procurement has already attracted significant interest from a number of global consortia who have expressed interest – a much more positive result than would be expected by procuring separate design-build contracts for the CCGS Contract and the PHGTC and negotiating annual O&M contracts with an operating entity.
- Utilizing a DBFOM delivery approach will reduce or eliminate much of the "interface risk" and inherent cost and inefficiency that results from HART serving as the intermediary between civil construction and systems installation. Placing single-point responsibility for coordinating and integrating the myriad activities involved in a complex transit program has been demonstrated to save both cost and time. Given the Project's history in delivering the western segments of the guideway and systems, implementing a P3 concession in which an experienced private consortium assumes responsibility for integration risk is viewed as an important opportunity to

save cost through better coordination and scheduling. For example, by eliminating the need for requesting shared access or waiting for complete turnover of site access, the DBFOM developer can create an earlier entry for the installation of electrical wiring and wayside equipment to create a smoother flow of installation work for a shorter completion schedule. This will then let the system testing to begin earlier and once again reduce the schedule, thus reducing cost.

- In addition to savings on manpower and scheduling, the improved coordination of work will allow sub-system testing to occur earlier, and early identification of issues will again help reduce the overall schedule. Furthermore, having one lead contractor (DBFOM) coordinating the work will reduce the amount of supervision, safety oversight and rework.
- Another cost reduction opportunity will result from design of the stations and transit center in a more coordinated manner, since the P3 developer has control of the entire design of the system. The developer can shift design teams to the most critical areas so that the design becomes far more efficient, allowing each construction contractor to adjust schedules to suit the work requirements. This again generates potential Project cost reductions. Furthermore, the P3 developer can move crews to other portions of the civil works that need to be completed in a more efficient manner, again reducing schedule and cost.

There are many other areas where moving to a DBFOM delivery will reduce cost, both in the civil works as well as during the operations and maintenance phase. Overall, placing the coordination, completion and interface risk in the hands of an experienced private sector consortium is anticipated to support the primary goal of HART and the City: To deliver a world-class transit project within the currently projected budget and to open the Project for service by the currently projected RSD.

4.4 Value Engineering

The Risk Manager is compiling and updating all value-engineering suggestions from either formal or informal value-engineering studies and all lessons learned from the Project. Refer to Appendix B for cost savings implemented and considered through value engineering.

4.5 Lessons Learned

HART has been identifying lessons learned information from the west teams, to identify any new cost-avoidance opportunities by being mindful of these topics and addressing them appropriately within the new contracts on the eastern section of the Project. One workshop was held on May 11, 2017, with a focus on ROW, Core Systems interface, utilities, schedule incentives, and how important lessons learned are covered in RFPs. Refer to Appendix B for the current list of lessons learned.

4.6 Soft Costs

HART has undertaken a review of its consultants to address its soft costs and non-direct construction costs, as suggested by the PMOC. HART is taking steps to evaluate consultant scope, performance, qualifications, and technical competencies. HART will also need to systematically evaluate soft costs in all program areas. Upon completion of the soft cost evaluations, HART will bring recommendations to the Executive Director and CEO and the HART Board of Directors for adoption.

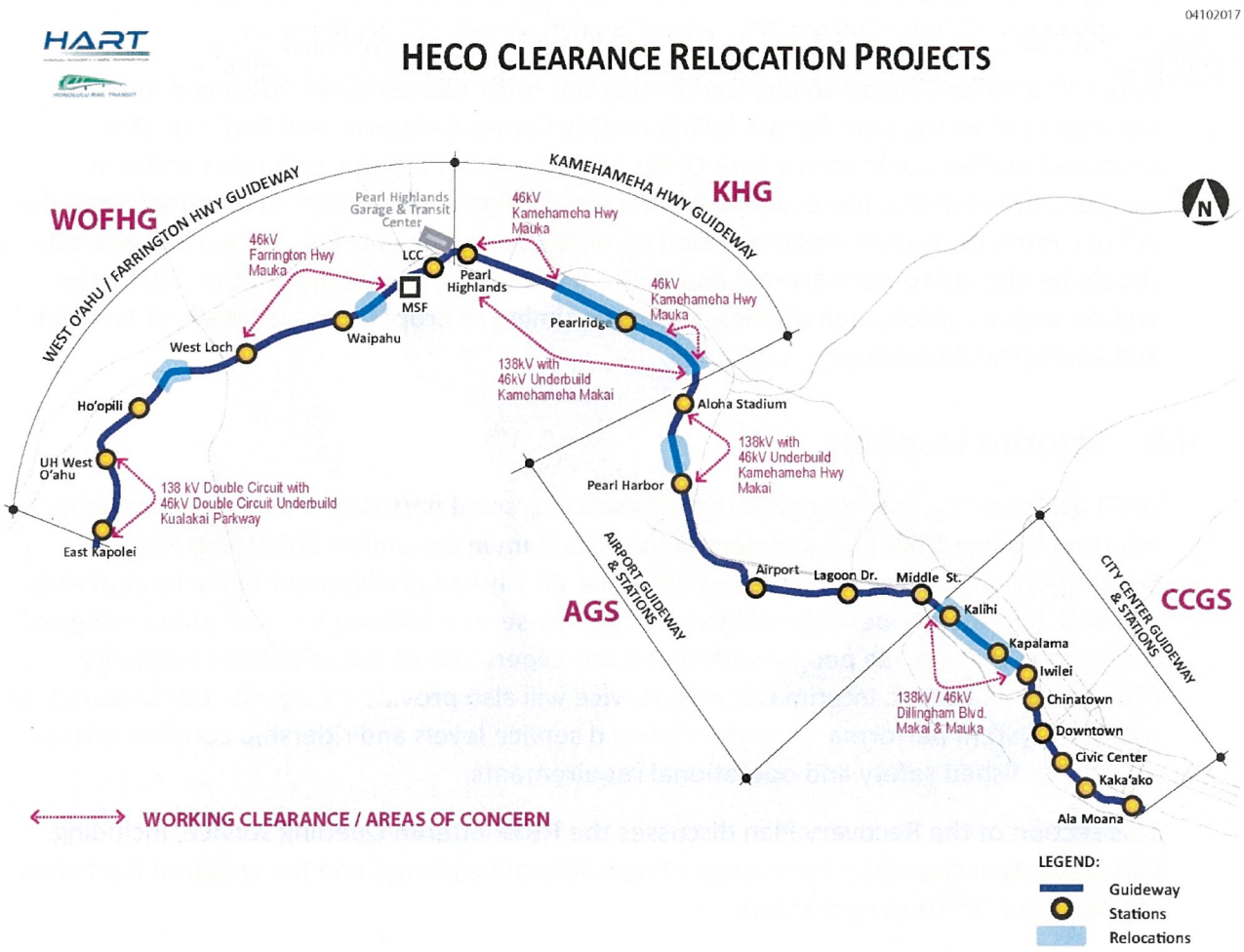
4.7 Peer Reviews

HART has proactively held industry and peer reviews to strengthen the organization by receiving constructive and unbiased feedback from industry leaders. In 2014, HART had the Utah Transit Authority perform a review which generated a number of recommendations for the organization. In 2016, HART reached out to APTA whose review was completed in 2017 and provided insight with regards to technical management capacity and capability, contract administration and change order process and claims management. HART implemented many of the recommendations and continues to seek input from a variety of industry sources, such as, the General Contractors Association of Hawai'i and the FTA's PMOC.

4.8 HECO Utility Relocation and Alternative Equipment

The current system alignment has major impacts on multiple utilities, and HECO in particular has had the most influence on the Project cost and schedule. HECO's self-established clearance requirements conflicted with the construction and operation of the HART system. HART and HECO collaborated to identify alternative equipment (vehicles to address working clearance concerns between HART's rail guideway and HECO's high-voltage 138kV transmission, 46kV sub-transmission, and 12kV distribution power lines and associated steel or wood poles. The necessary horizontal working clearances that HECO requires are 50 feet for 138kV power lines, 40 feet for 46kV power lines, and 30 feet for 12kV power lines. Refer to Figure 4-1 below for a map showing the areas of concern.

Figure 4-1 HECO Clearance Relocations



HART has agreed to underground portions of HECO's utility lines, provide HECO funds to purchase the new alternative vehicles, and provide storage space for these vehicles. Because HECO has granted variances to their original clearance requirements in certain areas, the Project can avoid costly overhead and underground utility relocations and save an estimated $132 million. The clearance solutions vary for each section of HART's alignment and are detailed in Appendix I.

The AGS and CCGS corridors both have significant HECO utilities that need to be relocated underground. HART is utilizing Task Order based contracts to relocate HECO utilities in order to provide a clear path for the AGS and CCGS contractors to build the guideway. The AGS and CCGS contractors will provide the necessary infrastructure for the HECO utility relocations. AGS will use a combination of alternate service vehicles, increased Navy easements, and redesigned (re-framed) pole arms to avoid undergrounding the nine-pole 138kV system fronting Joint Base Pearl Harbor-Hickam. The AGS re-framing work is on-going with an expected completion in November 2018. The CCGS design team is in the review

process with HECO to underground all of its utility lines along the CCGS ROW which includes Dillingham Boulevard and the Kakaako corridor. HECO's facilities relocation and coordination with the Project DB contractors remain a high-risk item.

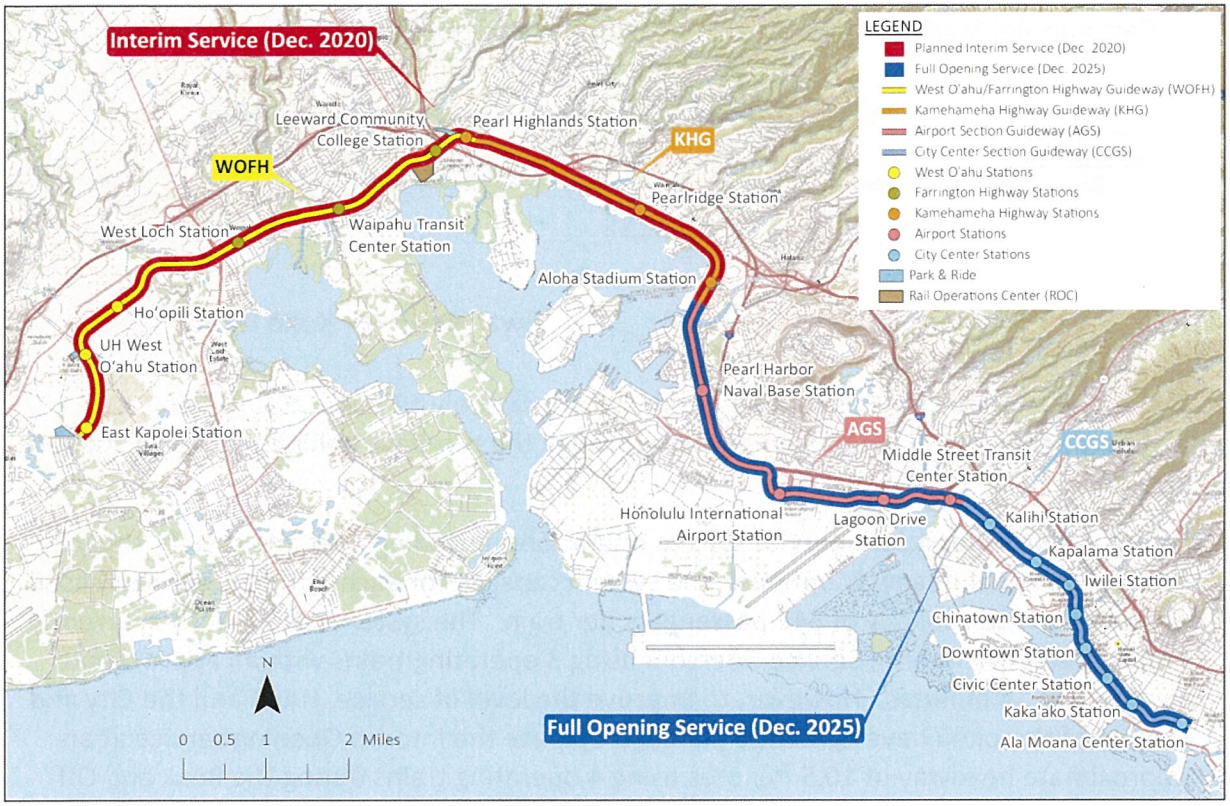
Within the utility-congested City Center section, HART has issued an advanced utilities contract to clear the path for the follow-on City Center Guideway and Stations. This advanced utilities contract is a Task Order based contract utilizing unit rates and is in progress. This method has expedited the start of utility construction. In addition, since the utility contractor is compensated based on units of work performed, the parties interests should be aligned to work around and assist in mitigating known risks in the City Center section such as unforeseen utilities, uncertain timing of property access, and inadvertent archaeological discoveries.

4.9 Interim Opening

HART and the City, together with their stakeholders and partners, are now preparing for an Interim Opening from East Kapolei to Aloha Stadium in December 2020. The Interim Opening will include approximately half of the 20.1 mile full alignment and a total of nine stations. Successful operation of Interim Opening service will enhance the public image of the system and provide people with first-hand experience of the speed and reliability offered by rail transit. Interim Opening service will also provide an excellent opportunity to evaluate system performance under reduced service levels and ridership conditions based upon established safety and operational requirements.

This section of the Recovery Plan discusses the HRTP Interim Opening service, including various system capacities for a range of operational headways and the required fleet sizes for Peak and Off-Peak operations.

Figure 4-2 HRTP Alignment Overview

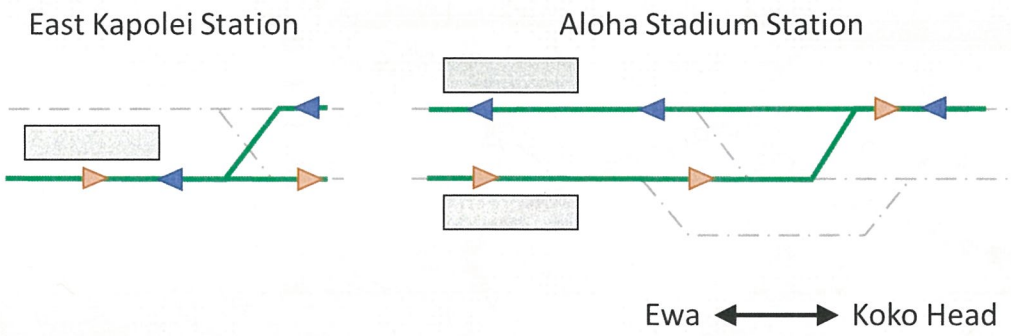


4.9.1 Interim Opening Service Operation

For Interim Opening service, the system will operate in a fully automated pinched loop configuration using the crossovers located near the East Kapolei and Aloha Stadium stations. The crossovers located near the Aloha Stadium are intermediate crossovers that are used to direct trains to move from one mainline track to another. During Full Operational service, the intermediate crossovers may also be used to reverse trains during certain circumstances, such as a train failure or during transitions between peak/off-peak headways and during special stadium event operations or unusual operating circumstances.

The turnback configurations at the Aloha Stadium and East Kapolei stations are shown in Figure 4-3 below.

Figure 4-3 Interim Opening Turnback Configuration



The round trip time for this configuration is approximately 42 minutes, including an estimated time of 1.5 minutes to operate through the turnback behind the Aloha Stadium station.

Figure 4-4 provides a summary of system operations, including fleet and system capacity, for four different headway options. The system capacity for each option is derived based on comfort load capacity of 642 passengers per train. The system can meet the currently anticipated peak Interim Service ridership using 3 operating trains with an approximate headway at 14 minutes. However, to improve the level of service, HART and the City and County of Honolulu have agreed to plan and operate the Interim Opening service at an approximate headway of 10.5 minutes using 4 operating trains during the Peak and Off-Peak periods.

Figure 4-4 Interim Service Summary of Operations

Headway (minutes)	System Capacity (pphpd)	No. of Operating Trains	Spares (15% of Operating Trains)	Total #'s of Trains
5.2	7,345	8	2	10
10.5	3,670	4	1	5
14.0	2,750	3	1	4
15.0	2,565	3	1	4

4.9.2 Park and Ride Facility

Park-and-ride lots will be constructed at stations to provide commuters flexibility to drive to a selected station and park to use the system. Figure 4-5 shows the Park-and-Ride Facilities being planned for Interim and Full Service, the spaces being planned at each location, and the planned availability dates.

Figure 4-5 Park and Ride Facilities

Location	Number of Space for Interim Service	Available Date (Interim Service)	Number of Space (Full Build)
East Kapolei	*	*	900
UH West	300	7/2019	1,000
Ho'opili	300	**	300
Pearl Highlands	NA	NA	1,600
Aloha Stadium	590	12/2019	590

* HART is working on an agreement with UH on appropriation of land
** Currently, HART is working with D.R. Horton on completion date.

To improve ridership and better serve transit riders, HART and the City will work on a bus/rail interface plan for the Interim Service period. This plan will address the integration of bus service as a feeder system to the planned train operation, including passenger transfer policies and schedules. HART and the City are planning to work with AHJV to ensure that they properly plan their O&M manpower and schedules to properly support Interim Service.

HART is working on operational readiness and safety certification in accordance with HART's Rail Activation Plan. HART is closely working with DTS leadership to plan for Interim Opening service since DTS will be responsible for the system's operations and maintenance under City Charter Amendment #4.

The City may consider implementing another Interim Opening service extending from East Kapolei to Middle Street stations after completion of the AGS portion of the system. This service is beneficial because the Middle Street station is a major bus interchange, which will provide better transfer service to passengers. Also, HART will be able to put the AGS' stations and guideway into service after completion without having these facilities idle for several years prior to Full Opening. The City will work on details related to the development plan for this Interim Opening service in the future.

4.10 Cost Containment and Cost Savings Evaluations

HART has conducted several internal workshops in 2017 and 2018 with a focus of brainstorming and evaluating any potential cost-saving measures that can be implemented on the Project. A summary of recent significant cost saving opportunities for the Project are outlined in Figure 4-6. A complete list of cost reduction and cost containment items is provided in Appendix B.

This page intentionally left blank.

Figure 4-6 Project Cost Reduction Efforts

Item	Type	Description of Savings	Estimated Savings	Status
1	**Risk Reduction**	Separate procurement for City Center Utilities Relocations (CCUR) and Roadway Work, from the pending CCGS procurement. **Key Advantages:** • Allows HART to manage the difficult utilities relocation work using smaller local contractors familiar with Honolulu utilities, on a task order basis, • Reduces the potential for large claims due to delays when encountering unanticipated conditions. Utilities contractors can shift crews to other work until specific conflicts are resolved. • Allows a 2-year head start on the utilities relocation work ahead of CCGS work which reduces risk to CCGS contractors and should result in more competitive bids with the utilities risk removed.	$300 Million	Implemented. CCUR Contract awarded in 2017 and is underway.
2	**Risk Reduction**	Detailed list of reduction to several dozen Active Risks on HART's Risk Register, from January 2018 to April 2018. The savings shown is the net change of all risk additions minus reductions. Specifics of most of these risk changes are confidential, are documented in HART's Risk Management System, and have been discussed in detail with PMOC and FTA. The risk reductions do not specifically correlate to contingency reductions. Contingency is still held for other unforeseen conditions on the Project; but if the contingency is not used, it will be turned back to the Project as a savings. **Example of Significant Risk Reduction that has been discussed publicly with the HART Board:**	$177 Million	Risks are reviewed and adjusted monthly

Item	Type	Description of Savings	Estimated Savings	Status
		Purchase of specialty lift vehicles for HECO that allow some of the high voltage power lines in the western segment to remain overhead near the guideway, versus having to place those lines underground: Saving of $50 Million (included in the $177 Million shown above.)		
3	**Risk Reduction**	Closeout of the two West Side guideway contracts (WOFH and KHG). The projects are substantially complete but not yet fully closed out. Resolution of all outstanding issues in a final closeout agreement is anticipated to result in a savings to HART. Any risks now held in the Risk Management System that can be retired can then be returned to project contingency as a cost savings.	Confidential	Closeout discussions are actively underway with the contractor, with a goal of full closeout by the end of 2018.
4	**Risk Reduction**	Resolution of a claim by the Core Systems Contractor due to delays in completion of elements of the work by other contracts being managed by HART which has delayed the Core Systems Contractor, including several years of delay to the stations and the pending CCGS work, resulting in the new RSD of December 2025. Resolution of this claim, and keeping the Core Systems Contractor as part of the DBFOM work, will be beneficial to HART, the value of which is confidential. Any risks now held in the Risk Management System that can be retired can then be returned to project contingency as a cost savings.	Confidential	Claim resolution discussions are actively underway with the Core Systems Contractor, with a goal resolving the claim by the end of 2018.
5	**Secondary Mitigation**	HART will make it clear to the P3 firms that the affordability limits for the work cannot be exceeded. The P3 firms will be allowed to propose innovative cost saving, value engineering and secondary mitigations they would implement in order to keep the Project within HART's budget. HART would opt for any innovative value engineering reductions prior to implementation of any necessary secondary mitigation alternatives in order to keep the work within budget.	TBD	HART will work with the P3 firms to consider any necessary Secondary Mitigations to keep the work within HART's affordability limits.

Item	Type	Description of Savings	Estimated Savings	Status
6	**Risk Reduction**	Implementation of a P3 (DBFOM) Procurement strategy for CCGS and PHGTC. From the June 2018 Risk Assessment on this topic, and the subsequent White Paper on P3 dated July 13, 2018, the savings on the HART Project by switching to P3 from DB are outlined as follows: • Initial Capital Cost Savings for CCGS and PHGTC: $50 Million • Future Operations and Maintenance Cost Savings to the City of Honolulu over 30 years: $310 Million (YOE) • Sum of Initial and Future Cost Savings for CCGS, PHGTC, and future O&M: $360 Million	$360 Million total ($50M Capital, plus $310M future O&M)	P3 (DBFOM) procurement approach was approved by HART Board in September 2018, which allowed Procurement Part 1 to commence. City concurrence will still be needed parallel to the procurement process.
7	**ATC's**	Cost saving measures to the CCGS and PHGTC projects were developed by HART staff. Many of these items are not under HART's direct control for design, but could be considered as Alternative Technical Concepts (ATC's) from competing P3 (DBFOM) companies. A list of possible cost saving ideas that could be ATC's are included in more detail in Appendix B, and are summarized as follows: • Item 6: Simplify Station Canopies for 8 Stations in CCGS: $12M • Item 7: Preserve the current precast yard for use by CCGS versus acquiring a new yard nearby: $20M • Increase developer participation for the two Park & Ride lots at UH West O'ahu, and Ho'opili: $8M • Item 10: Eliminate the following non-essential items from CCGS: a) Acrylic sound barriers. Replace with the normal concrete barriers along the guideway.	$50M	These and other ATC's can be considered as initiated by P3 competitors

Item	Type	Description of Savings	Estimated Savings	Status
		b) Additional aesthetically treated columns between the stations. c) Guideway up-lighting between the stations Total Savings: $7M • Item 13: Pursue a permit to drill in the harbor to support the Makai side of Chinatown Station. Simplifies the structure, which is currently designed as a cantilever: $3M		
8	**Secondary Mitigations**	Refer to Appendix B. These ideas pertain to modifications to the PHGTC design, station designs, and park & ride lots. The ideas are not favored by HART and are not recommended. They would compromise FFGA and environmental commitments. The PHGTC is an integral part of the Project. The station reduction ideas would have a significant functional impact to the program.	See Appendix B for estimated savings	These ideas are not recommended for the reasons noted in Appendix B
9	**Cost Saving Ideas Studied and Rejected**	Refer to Appendix B for a list of cost saving ideas that were discussed HART staff and then failed for the reasons noted. HART's efforts are to identify any and all cost-saving opportunities, but also to be realistic in our evaluation of overall viability. Ideas 2, 3, 4, 9, 11, 15, 16, F1, F2, F3, F4, and F5 were brainstormed, evaluated, and failed for the reasons noted.	See Appendix B for estimated savings	These ideas were failed for further consideration for the reasons noted in Appendix B
10	**Value Engineering**	Refer to Appendix B for a list of Value Engineering (VE) ideas identified as having been implemented from a comprehensive VE study held in 2011. See Items (a) through (g), totaling approximately $107.4 Million in savings.	$107.4 Million	These ideas were credited as having been implemented from the 2011 VE study.
11	**Value Engineering**	Refer to Appendix B for a list of VE ideas identified in various years from 2010 to 2016, and credited as having been implemented in the Project. These ideas (h) through (bb) total approximately $335 Million.	$335 Million	These ideas were credited as having been implemented in the projects.

Item	Type	Description of Savings	Estimated Savings	Status
12	**Value Engineering**	Several additional VE ideas (a) through (g) at the end of Appendix B are currently under review.	Savings under review	Review is ongoing
13	**Lessons Learned**	Refer to Appendix B for a list of Lessons Learned from the West contracts being applied as appropriate to the East contracts. The savings are not specifically estimated, but any "cost avoidance" opportunities are under active consideration by HART so that issues of concern are not repeated on ongoing or future contracts.	Not calculated	Lessons Learned reviews are ongoing

This page intentionally left blank.

5 Fulfillment of FFGA Scope

5.1 Project Progress and Current Status

Based on the Risk Refresh analysis, the System is scheduled to open for passenger service by September 2026, with a total cost of $8.299 billion. The total cost includes contingency but does not include financing, which is discussed in detail in Chapter 6. The Master Project Schedule shows 600 days of schedule contingency.

The Project is currently 45% complete based on the weighted value progress of the individual construction and design contracts as of August 31, 2018, which includes completion of the ROC and 10.75 miles of elevated guideway constructed from the East Kapolei Station site to just past the Aloha Stadium Station site. The Project team is working to transition to an earned value calculation based on construction progress and not based on weighted expenditure calculation of the individual design and construction contracts.

5.2 Major Contract Status

Major contracts that have been awarded and their percentage completion are as follows: West O'ahu /Farrington Highway Guideway (99.9%); Kamehameha Highway Guideway (99.9%); Maintenance and Storage Facility (100.0%); West O'ahu Stations Group (65.4%); Farrington Highway Stations Group (77.5%); Kamehameha Highway Stations Group (46.6%); Core Systems (56.0%); and Airport Section Guideway and Stations Group (31.3%). HART currently has over $4.8 billion either completed or under contract, which includes 15.9 of the 20.1 miles of guideway and 13 of the 21 stations.

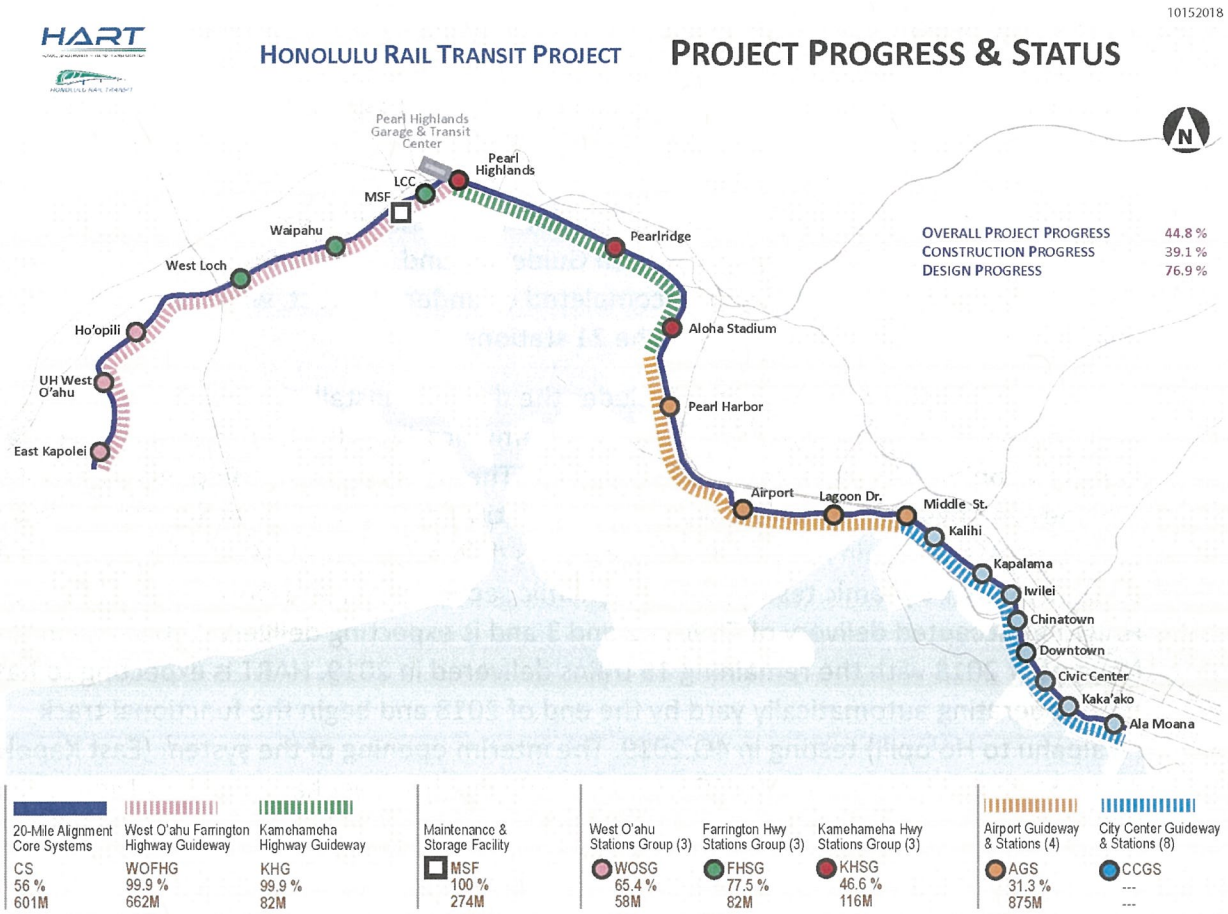
The Core Systems Contractor scope includes the delivery, installation and testing of Vehicles, Signaling, Traction Electrification, Communications, Passenger Screen Gates, and a fully functioning ROC (formerly known as MSF). The contractor has completed most of the base design development and is well into completion of manufacturing and factory testing of all subsystems. Train #1 (four-car consist) was delivered to the ROC in March 2016 and is currently under dynamic testing on the dynamic section (Waipahu to West Loch). Currently, HART has accepted delivery of Trains #2 and 3 and is expecting delivery of Train #4 in November 2018 with the remaining 16 trains delivered in 2019. HART is expecting to have trains operating automatically yard by the end of 2018 and begin the functional track (Waipahu to Ho'opili) testing in 4Q 2019. The interim opening of the system (East Kapolei to Aloha Stadium) is slated for the 4Q 2020 and full opening (East Kapolei to Ala Moana) in 2026.

5.2.1 Contract Status for DBFOM P3 Elements

HART is in the process of securing specialized services in support of the P3. A RFP for Legal Advisory Services was released on April 26, 2018, and an advisor selected on August 3, 2018. A RFP for Financial Advisory Services was released on July 11, 2018, and an advisor will be selected in or around November, 2018.

A HART-City and County of Honolulu joint procurement RFP Part 1 for the DBFOM remaining portions of the Honolulu Rail Transit Project that includes the CCGS and the PHGTC was released on September 28, 2018. Following the establishment of a shortlist of RFP Part 1 qualified proposers, the RFP Part 2 will be issued in or around early 2nd Quarter of 2019, with award of a contract in or around December 2019. The procurement schedule tracks the overall Project schedule to meet full revenue service by December 30, 2025.

Figure 5-1 Project Progress and Status



5.3 ROW Update

Currently the Project has identified 219 parcel acquisitions that are required for the Project and 114 total relocations of displacees. The 219 parcels do not include other parcels which are needed for Temporary Construction Easements (TCE) and/or utility easements. For the Project, HART ROW Branch has obtained construction access for 163 of the required parcels and completed 107 of the required relocations. HART continues to make progress in obtaining the required access and completing necessary relocations with the majority of the work concentrated in the CCGS segment. Construction access is being negotiated for the remaining 55 parcels within CCGS. In addition, access is being finalized for one parcel within KHGS. Six remaining relocations in the CCGS and one in the Airport Section require additional work.

Across all segments of the Project, HART's ROW scope of work has expanded considerably since its original conception in the FFGA. In addition to the parcels mentioned above, HART has identified 123 TCEs and/or utility takings, spread over 72 parcels. The HECO utility relocation and related easements are particularly complicated and often involve multiple parties with competing interests. HART continues to diligently pursue these entitlements.

Past experience has shown that exhausting the possibility of a negotiated resolution before commencing eminent domain proceedings has unnecessarily and unproductively delayed property acquisitions. Accordingly, Project staff have been instructed to pursue negotiation and condemnation proceedings concurrently, so that acquisitions can be resolved as efficiently as possible, whether through a negotiated agreement or adjudication.

5.4 Strategic Actions to Facilitate Timely ROW Acquisitions

HART recognizes there are significant challenges to be addressed to ensure that the Project can be delivered as planned. The following actions are being implemented to improve our ability to deliver the ROW properties in the timeliest manner possible.

- Fill vacant positions and increase staffing to meet increased acquisition needs
- Use all available information to act at the earliest possible time and maximize economies of scale where appropriate
- Place priority on obtaining access for construction of temporary utility work. This is advanced via bi-weekly meeting with the construction team and other branches
- Engage legal representation for complex/difficult acquisitions early
- Prioritizing pursuit of property based on construction timetables
- Aggressive monitoring of acquisition and relocation activity progress. This includes regular meeting with ROW and its eminent domain legal teams to monitor and advance these cases in a timely fashion

- HART management has increased its role in advancing some intra-governmental agreements for ROW.

5.5 Summary of Actions to Completion

5.5.1 Major Contract Procurements and DBFOM

The CCGS DB and the PHGT DB contract procurements are the last major contracts yet to be awarded. The CCGS contract is the critical path for the overall Project and is the last of the major contracts to be procured. Utility relocation is a significant risk to the construction of the remaining 4.16 miles of the alignment in what HART refers to as "City Center" and eight stations. The City Center is in Honolulu's urban core and will involve construction in the most congested part of the alignment. To mitigate the utilities relocation risk, HART solicited and awarded on May 31, 2018 a $400 million Indefinite Delivery Indefinite Quantity (IDIQ) contract to advance the utility relocation work in City Center.

To complete the design and construction of the CCGS and the 1600-stall PHGTC, HART in conjunction with the City has elected to utilize a DBFOM delivery method, which HART believes will provide greater cost and schedule certainty. To this end, HART and the City and County of Honolulu jointly issued a RFP Part 1 for the DBFOM of the CCGS and the PHGTC on September 28, 2018. Following the establishment of a shortlist of RFP Part 1 qualified proposers, the RFP Part 2 will be issued in or around early 2nd Quarter of 2019. The procurement schedule tracks a schedule to meet full revenue service by December 30, 2025. The award of the DBFOM contract is anticipated to be in or around December 2019.

5.5.2 HECO Coordination

HECO indicated a need in the 2020 timeframe for a new dedicated 46kV substation to feed the ROC due to requirements in HECO Rule 13 for line extensions and substations. HECO submitted a PUC application for the construction of the Ka'aahi Substation on March 8, 2018. HECO intends to design and construct the Substation and line extension. The Substation will be located near the ROC and the LCC Passenger Station on UH land. HECO's service proposal for the Ka'aahi Substation was executed by HART and HECO on July 19, 2018.

HECO has also informed HART that HECO will not perform utility relocation construction services for the electrical facilities within the Airport and City Center sections, including the Dillingham Relocation Utilities section. HECO had previously performed electrical utility relocation construction work for the western half of the Project at HART's request to help reduce and manage cost. However, HECO has indicated that it will not be self-performing any construction work for the remaining AGS and CCGS contracts. According to HECO, this is a result of its resources having become stressed, which would affect its core mission. However, HECO will continue to perform the electrical design. HART procured the utility

relocations construction services under various task-order based contracts to mitigate cost and schedule. HART continues to explore alternative and available options to ensure that the current 2026 schedule is not affected.

5.5.3 Casting Yard

On April 19, 2017, the FTA provided conditional approval of HART's acquisition via license agreement of the precast concrete manufacturing yard, identified as Lot 31 of Kapolei Business Park West, Phase I. HART finalized compliance with the FTA conditional approval on April 20, 2017.

HART has executed the agreement to assume the current license and has secured a new license for the casting yard through November 2022. HART has executed both the short and long term sublicense agreements for the casting yard with the AGS DB contractor, Shimmick/Traylor/Granite JV.

5.6 Development of Acceptable Project Cost

5.6.1 Introduction

One of the most critical components of the HART Recovery Plan is the development of a realistic cost estimate for the completion of the full Project scope as set forth in the FFGA, referred to herein as the Estimate at Completion (EAC). In developing the EAC, HART has embraced FTA guidelines and procedures relating to risk assessment, cost mitigation, and estimates of capital cost, as well as cost estimating methodologies well accepted in the construction industry.

In particular, in developing the EAC, HART conducted a process for the identification and categorization of risks (illustrated in Appendix C) and developed the Primary and Secondary Mitigations (described in Appendix B). The Basis of Estimate (BOE) in Appendix F describes in detail the capital cost estimate methodology and assumptions used to develop the Project EAC.

5.6.2 Cost Estimating Methodology

For awarded construction contracts, the actual values of the contracts were used in developing the EAC. This includes the WOFH, KHG, AGS, and MSF DB contracts; the West O'ahu Station Group (WOSG), Farrington Highway Station Group (FHSG), and KHSG DBB contracts; and the Core Systems Contractor DBOM contract. All bid values were adjusted and sorted by the appropriate Standard Cost Category (SCC) for these estimates. An ICE and Validation Estimate were completed for the CCGS procurement.

Additional data sources used for factoring the EAC included staffing projections; change orders in negotiations with contractors; merit changes under evaluation; known risks with

potential cost or schedule impacts; and contingency to account for unknown site conditions, unresolved design or scope issues, market fluctuations, regulatory requirements, and schedule impacts.

5.6.3 Adequacy of Contingency

One of the lessons learned by HART from the earlier stages of the Project is the critical importance of sufficient project contingency to address changing market conditions, the cost impact of schedule delays, and other project risk factors. The FTA places great importance on assuring that the Project sponsor maintains adequate contingency levels for various stages of project development, as described in the FTA's Oversight Procedure 40c, Risk and Contingency Review, 11-12. Combining the FTA's guidance with the Risk Management Program described in Section 3 of this Recovery Plan, the total contingency is $986 million (12% of EAC).

5.6.4 Updated Cost Estimate

Based on the Risk Refresh analysis, the current Capital Cost Estimate without financing costs is $8.299 billion, which includes $986 million of allocated and unallocated contingency, all in Year of Expenditure (YOE) dollars. HART and the City are assessing the use of affordability cap(s) to mitigate the risk of cost overruns; this may be included in the P3 RFP, which will be used for evaluating P3 proposals during procurement.

A summary of the estimated costs for the Project is provided in Figure 5-2.

Figure 5-2 Updated Cost Summary

Contract Summary Status		(thousands)	Total Estimate at Completion (thousands)
Active Construction (includes allocated contingency)		$4,080,445	$4,080,445
Unawarded Construction (includes allocated contingency)	1. Non-P3 Elements 2. P3 DBFOM Elements	$99,200 $1,332,259	$1,431,459
Staff and Consultants (includes allocated contingency)		$1,937,488	$1,937,488
Completed Contracts		$627,870	$627,870
Unallocated Contingency		$221,738	$221,738
Total Capital Project (excludes finance costs)		**$8,299,000**	**$8,299,000**

HART's procedures include periodic updates to the cost estimates for all work, relying in part on the data from previously bid work, to help estimate the cost of remaining work.

Furthermore, the Risk Management System provides quarterly updates to all Project risks in order to model the necessary levels of allocated contingency for each contract. This result, supplemented with the level of unallocated contingency shown above, provides HART with a reasonable degree of confidence that the Project will be delivered within the EAC shown in Figure 5-2 above. At the time of each quarterly update, if the EAC varies from the value shown above, then HART has the opportunity to either utilize a portion of the unallocated contingency, or to implement aggressive cost containment/cost reduction proposals being monitored by the Risk Manager with input from the Project teams in order to keep the Project on budget.

5.6.5 Range of Finance Costs

The Project financing costs will be determined by the ultimate funding solution. Financing costs will vary based on when additional funding is received, the total amount of debt required, interest rates, and bond maturity. The Project financing is detailed in Section 6.

5.7 Development of Acceptable Project Schedule

While HART does not agree with the need to revise the RSD to September 1, 2026, we will reflect this as the RSD for the Recovery Plan and the Revised Financial Plan. The basis of this disagreement has to do with the PMOC calculated Adjusted Project Schedule upon which the contingency analysis was based. PMOC removed all contingency and made several adjustments to the Project Schedule submitted by HART, but missed one 600 day lag at the end of completing the Programmatic Agreement activities. Removal of this lag prior to running the contingency analysis changes the Adjusted Project Schedule RSD from May 2, 2025 to September 25, 2024; a difference of seven months. While it is probably not a one-for-one relationship, the PMOC calculated RSD, based on a need for 487 days of contingency would change from September 1, 2026 to January 25, 2026.

HART will continue to evaluate and manage the Project with the intent of accomplishing RSD by December 31, 2025 because that is the commitment made to the constituents of Hawai'i in September 2017 with the passing of the extended GET and TAT. However, HART will also recognize FTA's requirement to report on the Risk Refresh required RSD of September 1, 2026.

HART's success in achieving the updated RSD will depend in large part on the continued use of the MPIS as a forecasting tool rather than a status reporting tool. While this is a recent change in how the MPIS has been used, management attention will be needed in order to maintain this focus across the organization. Project Controls has reached out to the various HART Division Directors for information to populate the MPIS and how their activities relate to procurement, design, and/or construction. Diligent updating of this information is crucial to the success of the MPIS being a useful tool for managing the overall Project activities in

order to best manage the Project as a whole rather than localized optimization of each contract.

5.7.1 Project Schedule for Non-DBFOM P3 elements

The MPIS includes activities from HART Division Directors for procurement, environmental actions, and safety and security as well as design, construction, and core systems contracts. There are major milestones among the construction and systems contracts that provide significant points of interface, referred to as CAMs, that define access and cross-contract exchange of design, construction, and operational information. These CAMs are coordinated weekly by a team consisting of HART, systems contractor and facility contractor in order to allow planning of both contractors' efforts. CAM changes/updates are reported in monthly schedule updates and reviewed by HART management.

During schedule development consideration was given to the constructability of utility relocations, foundations, columns, and guideway erection based on performance metrics, as well as the physical characteristics of the existing built environment. Construction sequences were developed based on a reasonable and prudent approach to construction assuming a balance and flow of crews, crew sizes, and equipment and directional headings to optimize the schedule. The selected contractor(s) may come up with equal or better schemes based on their preferred means and methods and existing operational experience as well as the availability of equipment and labor.

5.7.2 Project Schedule for DBFOM P3 Elements

Upon the decision to utilize a P3 to complete the remaining contracts, Project Controls reviewed the schedule and evaluated areas for schedule improvement based on the concept that coordination of activities between the facility construction and the systems installation would be smoother and more efficient. The construction work included in this venture includes the CCGS, the core systems installation in the City Center segment, and the PHGTC.

Areas of assumed schedule improvement include a shortened period of time from completion of the final station to full opening and improved coordination of facility and systems installation efforts. Examples of these areas include TCCR construction/systems installation and platform completion/systems installation.

Project Controls expects to receive monthly schedule updates from the P3 contractor in order to monitor progress and to provide continued reports to both management and the FTA.

5.8 Operations and Maintenance for Interim and Full Openings

With the passage of Charter Amendment 4 in the 2016 election, DTS is responsible for O&M of the rail system. The Project's Rail Activation Team includes representatives from HART and DTS, and is responsible for developing a safe, secure, convenient, reliable, and clean service to the general public for the 20.1-mile rail system from East Kapolei Station to Ala Moana Center Station. The team is currently developing the policies, procedures, and staffing requirements to successfully operate and maintain the HRTP system as described above in Section 3.

Under DTS leadership, the P3 Developer will be ready to operate and maintain the system from East Kapolei Station to Aloha Stadium Station for an interim opening in December 2020. The Project must meet the same rigorous operational readiness standards and safety requirements for the interim opening as for any level of passenger service, and many of the major start-up costs will still apply to an interim passenger service. The FTA will also require a Transit Asset Management Plan and State of Good Repair reporting for revenue service.

At Full Opening, the system will operate daily from 4 a.m. to midnight and arrive approximately every five minutes during peak travel hours, while less service will be provided during the interim opening period. Headways and operating strategies will reflect forecasted passenger demand, and schedules will be coordinated with the City bus system and service will be modified to accommodate special events.

5.9 Fare Collection

Ticket vending machines were originally envisioned for the rail system with fare enforcement officers verifying payment. This scope was removed from the rail operations portion of the contract and a specific fare system design build operate maintain contract was awarded to Init, Innovations in Transportation Inc. in April 2016. This contract is for a multi-modal (bus, paratransit and rail), account-based, smart card fare payment system branded as the HOLO card system. The design portion of the Project was completed in 2017 and the Pilot for the bus and back office portions of the system, including a primary and secondary data center, customer website, institutional website, interactive voice response (IVR), retail sales application and devices and City Sales offices is scheduled to begin in late 2018 running through 2019. System Acceptance for this portion is scheduled to be finalized by the start of the City's FY2020.

HART will continue to be responsible for the manufacture, testing, and installation of the Ticket Vending Machines (TVM) and faregates at each of the 21 stations. Under the operations portion of the contract, Init will also provide two years of maintenance on the Interim Rail equipment with job shadowing by city employees so they can take over the maintenance portion of the work. Init will remain responsible for day to day operations.

This page intentionally left blank.

6 Project Finance

This section discusses the funding sources; capital costs; and risks, uncertainties, and mitigation strategies associated with the 20.1-mile and 21-station elevated rail transit system extending from East Kapolei in the west to the Ala Moana Center in the east. As this is an update to the Plan submitted on September 15, 2017, comparisons will be made whenever possible.

This section is organized in the following manner:

- Summary
- Outcome of State and City Funding Legislation
- Financial Plan
- Funding Sources and Forecast Methodology
- Project Capital Plan
- Risks, Uncertainties, and Mitigation Strategies

6.1 Summary

As discussed in the September 15, 2017 Plan, on September 5, 2017, the Governor of the State of Hawai'i, David Y. Ige, signed into law Senate Bill 4, 2017 Special Session (SB4), which became Act 1, 2017 Special Session (Act 1), providing additional funding sources to the City and HART to complete a 20.1-mile and 21-station elevated rail transit system extending from East Kapolei in the west to the Ala Moana Center in the east, known as the Honolulu Rail Transit Project (Project). Act 1 authorized an extension of the 0.5% State of Hawai'i General Excise and Use Tax (GET) surcharge for 3 years from December 31, 2027, to December 31, 2030. Furthermore, Act 1 increased the state-wide Transient Accommodation Tax (TAT) by 1.0%, and dedicated the revenues from that increase to the capital costs of the Project.

Act 1 requires the City Council to adopt an ordinance effectuating the 3-year extension of the GET surcharge prior to January 1, 2018. No City Council action is required to effectuate the TAT increase or its disbursement toward the costs of the Project. On September 6, 2017, the City Council adopted Bill 45 (2017), CD1, to extend the GET surcharge to December 31, 2030, and the mayor signed Ordinance 17-48 into law on September 7, 2017.

The salient funding features of Act 1 are summarized as follows:

- Authorizes the City to extend the current 0.5% GET surcharge for 3 years from December 31, 2027, to December 31, 2030.

- Reduces the State's share of the gross proceeds of the 0.5% GET surcharge from 10% to 1% effective September 5, 2017.
- Established a 1% state-wide TAT increase (from 9.25% to 10.25%) beginning January 1, 2018, to December 31, 2030.
- Provides that revenues derived from the GET surcharge on O'ahu and the 1% TAT increase are to be used for HART's capital expenditures, excluding HART's operating, administrative, marketing, and maintenance costs.

In the September 15, 2017 Plan, Act 1 was projected to yield up to $2.509 billion of additional revenue. HART revised projections going forward beginning July 1, 2018 based on actual collections for the fiscal year ended June 30, 2018 and growth revisions made by the State of Hawai'i Council on Revenues (Revenue Council) in their May 2018 meeting.

Our revised projections yielded an additional $188 million in revenues to $2.697 billion from the September 5, 2017 Plan. Figure 6-1 below illustrates the updated additional revenues expected from Act 1. Assumptions used to derive this amount are discussed later in this Section.

Figure 6-1 Funding Summary

Source	Prior Funding Projections (millions)	Act 1 (millions)	Dollar Amount of Change (millions)	Percent of Change
Actual GET Collections from September 2009 to June 2017	$1,600	$1,600	$0	0%
Projected GET from July 2017 to December 2027	$2,875	$3,252	$377	13.11%
Projected GET from January 2028 to December 2030	$0	$1,138	$1,138	100%
State-wide TAT from January 2018 to December 2030	$0	$1,182	$1,182	100%
Total	**$4,475**	**$7,172**	**$2,697**	**60.27%**

In addition to providing additional funding for the Project, Act 1 includes a number of State oversight provisions:

- Beginning on January 1, 2018, all of the GET surcharge and TAT increase revenues will be deposited into a State special fund known as the Mass Transit Special Fund.
- The State's Comptroller must certify HART invoices as an acceptable use of funds pursuant to Act 1 before the State Director of Budget and Finance will release any GET and TAT in the Mass Transit Special Fund to the City.

- The State's Office of the Auditor will conduct and complete an audit of HART by January 2019. Furthermore, the auditor is required to perform an annual review beginning immediately and ending on December 2031.
- The President of the State Senate and the House Speaker are to each appoint two non-voting members to the HART Board of Directors.

6.2 Outcome of State and City Funding Legislation

6.2.1 State Legislature and Governor of the State of Hawai'i

As indicated above, following State legislative action in a special session, Governor Ige signed SB4 into law on September 5, 2017, which became Act 1.

Act 1 provides for revenue sources to fund the construction of the Project. More specifically, the act:

- Authorizes the City, which previously adopted an ordinance to establish a 0.5% surcharge on the state GET, to extend the surcharge for three additional years, from December 31, 2027, to December 31, 2030.
- Decreases from 10% to 1% the GET surcharge gross proceeds retained by the State effective September 5, 2017.
- Increases the TAT state-wide by 1%, from 9.25% to 10.25%, beginning January 1, 2018, through December 31, 2030, for the Project.
- Establishes the Mass Transit Special Fund and specifies that the revenues from the GET surcharge and TAT increase be deposited into this special fund for the capital costs of the Project.
- Requires the State Comptroller to verify and certify invoices submitted for the Project.
- Allows the State Director of Finance to disburse moneys from the Mass Transit Special Fund to the City's Director of Budget and Fiscal Services on a monthly basis upon the State Comptroller's certification of HART's invoices.
- Provides that, after September 5, 2017, GET and TAT revenues allocated from the Mass Transit Special Fund cannot be used for the following:
  - Operation or maintenance costs of a mass transit project.
  - HART's administrative, operating, marketing, or maintenance costs.
- Provides that, if a court makes a monetary award to a County due to the State's violation of any state law or constitutional provision relating to the State's deduction

and withholding of county surcharge on state tax revenues, then an amount equal to the monetary award shall be deducted and withheld from the tax revenues deposited into the Mass Transit Special Fund and shall be credited as a general fund realization of the State.

- Requires the State Auditor to conduct and complete an audit before January 2019 and to conduct annual reviews of HART.
- Provides for the Senate President and the House Speaker to each appoint two non-voting, ex-officio members to the Board of Directors of HART.

6.2.2 Honolulu City Council and Mayor of the City and County of Honolulu

Following final passage of Bill 45 (2017), CD1, Relating to the Transportation Surcharge, by the City Council, Honolulu Mayor Kirk Caldwell signed into law Ordinance No. 17-48. Ordinance 17-48 extends the county surcharge for 3 years from 2027 to 2030. Additionally, Ordinance 17-48 codifies the prohibitions on the use of the GET surcharge funds established in Act 1 described above.

6.3 Financial Plan

The "Baseline" financial plan presented in Figure 6-2 was prepared using the following assumptions:

- GET and TAT revenue projections are based on:

  1.) Actual GET collections from July 1, 2016 to June 30, 2018 (two years running average), and the Revenue Council's forecast from their May 2018 meeting.

  2.) TAT revenue projections from January 1, 2018 are based on the state-wide collections and Revenue Council's forecast from their May 2018 meeting. Actual HART TAT collections were not used as a base (variable) because of insufficient data. As noted in Section 6.2, the effective date of the 1% TAT was January 2018, thus, only two (2) months of actual HART TAT collection data was available. Assumptions used are discussed under the Funding Sources and Forecast Methodology section (Section 6.4) below.

- Annual non-capitalized support expenditures of HART are funded by the City. Allocations of capitalized expenditures (allowable reimbursement from GET and TAT revenues under ACT 1 and non-capitalized expenditures follow generally acceptable accounting principles (GAAP).
- Additional $134 million in project costs identified in the FTA 2018 Risk Refresh. Total project costs at $8.299 billion, exclusive of finance charges, with full Revenue Service Date (RSD) on September 2026.

- A combination of GO bonds and short-term borrowing in the form of Tax-Exempt Commercial Paper (TECP) will be used to partially finance the Project. Projected interest rates used for GO bonds are 4% for fixed rate and 3% for variable rate bonds and TECP.
- Capital expenditures projections are based on contract schedules and milestones.
- Public Private Partnership (P3) and non-Public Private Partnership funding sources and expenditures are combined at this time, pending completion of the P3 procurement process. The P3 delivery method, structured as a Design-Build-Finance-Operate-Maintain (DBFOM) includes Design-Build-Finance (DBF) of the Center City Guideway Section (CCGS) and the Pearl Highlands Parking Garage and Transit Center (PHGTC). This includes the transfer of the Core System's Design-Build (DB) portion of work beyond Middle Street under the P3.

Figure 6-2 and 6-3 below summarize HART's baseline financial plan.

Figure 6-2 Baseline Financial Plan (DRAFT)

City and County of Honolulu / HART
Consolidated Financial Plan, P3 and Non-P3
November 20, 2018, REVISION Date May 10, 2019

($ in millions)	Fiscal Years																
	Total	Actual to 2017	Actual 2018	Est. 2019	Est 2020	Est. 2021	Est. 2022	Est. 2023	Est. 2024	Est. 2025	Est. 2026	Est. 2027	Est. 2028	Est. 2029	Est. 2030	Est. 2031	Est. 2032
Beginning Cash Balance	$298	$298	$23	$161	$25	$25	$27	$22	$69	$13	$10	$26	$49	$133	$125	$113	$195
Project Funding Sources:																	
G.E.T. Surcharge	$5,990	$1,546	$261	$272	$277	$288	$298	$308	$318	$328	$338	$349	$360	$371	$382	$295	$0
TAT Revenues	1,182	-	9	63	71	75	80	84	88	93	98	101	106	111	116	89	-
Federal Grant	1,550	785	21	-	100	150	150	150	100	50	44	-	-	-	-	-	-
City Subsidy	214	-	-	44	25	26	21	17	12	10	10	10	10	10	10	10	-
All Other	13	7	6	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Revenue	$8,951	$2,339	$297	$379	$473	$539	$548	$559	$518	$481	$489	$460	$475	$492	$508	$393	$0
Debt Proceeds																	
TECP (net) Max $350 m	$1,860	$130	$120	$227	$321	$301	$246	$240	$275	$0	-	-	-	-	-	-	-
Variable Bonds	350	-	350	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fixed Rate Bonds Net of Issuance Costs	2,501	-	-	250	617	544	330	100	100	560	-	-	-	-	-	-	-
Total Debt Proceeds	$4,709	$130	$467	$477	$938	$845	$576	$340	$375	$560	$0	$0	$0	$0	$0	$0	$0
Additional Funds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Project Sources	$13,659	$2,469	$764	$856	$1,411	$1,384	$1,124	$899	$893	$1,041	$489	$460	$475	$492	$508	$393	$0
Project Uses:																	
Construction	$6,360	$1,847	$419	$708	$802	$825	$575	$393	$425	$361	$4	-	-	-	-	-	-
Design	$249	$168	13	13	34	10	7	3	1	0	-	-	-	-	-	-	-
ROW / Utilities	$626	$195	13	130	117	74	45	40	12	0	0	0	-	-	-	-	-
Program-Wide	$437	$264	23	24	25	25	25	22	17	(1)	13	-	-	-	-	-	-
HART, COR & Other Uses	$283	$116	23	24	28	29	22	18	11	7	5	-	-	-	-	-	-
Planning	$123	$101	1	2	9	5	3	2	0	-	-	0	-	-	-	-	-
Project Costs	$8,077	$2,691	$492	$899	$1,015	$968	$677	$477	$467	$367	$23	$0	$0	$0	$0	$0	$0
Unallocated Contingency	222	-	-	-	-	-	-	11	22	21	102	67	-	-	-	-	-
Total Project Costs	$8,299	$2,691	$492	$899	$1,015	$968	$677	$488	$489	$388	$125	$67	$0	$0	$0	$0	$0
Debt Service:																	
Principal:																	
Variable Principal	$350	$0	$0	$0	$0	$0	$42	$50	$50	$50	$50	$50	$50	$8	$0	$0	$0
Fixed Principal	2,511	-	-	-	-	-	-	21	82	154	213	244	276	441	488	507	85
TECP Retirement	1,860	50	100	50	300	300	300	248	237	275	-	-	-	-	-	-	-
Subtotal Principal	$4,721	$50	$100	$50	$300	$300	$342	$319	$369	$479	$263	$294	$326	$449	$488	$507	$85
Interest:																	
Variable Interest	$73	$0	$4	$10	$11	$11	$10	$9	$7	$6	$4	$3	$1	$0	$0	$0	$0
Fixed Interest	723	-	-	15	37	55	65	69	79	87	82	74	64	50	32	13	2
TECP Interest	33	2	0	2	4	5	5	6	6	2	-	-	-	-	-	-	-
Subtotal Interest	$829	$2	$4	$27	$51	$70	$80	$84	$92	$94	$86	$76	$65	$50	$32	$13	$2
Total Debt Service	$5,550	$52	$104	$77	$351	$370	$422	$403	$461	$573	$349	$370	$391	$500	$520	$520	$87
City Debt Reserve:																	
Deposit to City Debt Reserve	$259	$0	$30	$16	$44	$45	$31	$11	$0	$82	$0	$0	$0	$0	$0	$0	$0
Release City Debt Reserve	(259)	-	-	-	-	-	-	(50)	-	-	-	-	-	-	-	(209)	-
City Debt Reserve	($0)	$0	$30	$16	$44	$45	$31	($39)	$0	$82	$0	$0	$0	$0	$0	($209)	$0
Total Project Uses	$13,848	$2,743	$626	$992	$1,411	$1,383	$1,130	$851	$950	$1,043	$473	$437	$391	$500	$520	$311	$87
Net Current Change	($189)	($275)	$138	($136)	$0	$1	($5)	$48	($57)	($2)	$16	$23	$84	($8)	($12)	$82	($87)
Ending Cash Balance	$109	$23	$161	$25	$25	$27	$22	$69	$13	$10	$26	$49	$133	$125	$113	$195	$108

Note: Numbers may not match due to rounding.

Figure 6-3 Baseline Financial Plan Summary

Sources and Uses	Funding (millions)
SOURCES	
Beginning Cash Balance	$298
GET	$5,990
TAT	$1,182
Federal Grant	$1,550
City Subsidy	$214
All Other ($4 million from the American Recovery and Reinvestment Act; the rest from interest income and rent)	$13
Total Funding Sources	*$9,248*
USES	
Capital Expenditures exclusive of Financing	$8,299
Financing Costs (Interest and Fees)	$840
Total Capital Expenditures including Financing Costs	*$9,139*
Ending Cash Balance	**$109**

Note: Numbers may not match due to rounding.

6.4 Funding Sources and Forecast Methodology

6.4.1 O'ahu GET Surcharge and State-wide TAT

The local funding sources for the Project are as follow:

- A dedicated 0.5% GET surcharge, with the City and HART receiving 99% of the gross GET proceeds effective September 5, 2017. The 99% is an increase from the 90% of gross proceeds from July 1, 2007, to September 4, 2017.
- A dedicated 1.0% of the State-wide TAT, with the City and HART receiving 100% of the gross proceeds beginning January 1, 2018.

Both the GET and TAT expire on December 31, 2030. Both funding sources are deposited into the Mass Transit Special Fund quarterly subject to the oversight provisions described in the Sections 6.1 and 6.2.1 above. However, the State's Director of Budget and Finance has the discretion to disburse these funds monthly, subject to the availability of funds in the Mass Transit Special Fund.

As shown in Figure 6-1 in the Summary section above, these funding sources are expected to bring in $7.172 billion to the Project through December 31, 2030, with approximately $2.697 billion in additional funding generated from the provisions of Act 1.

6.4.2 GET Surcharge and TAT Forecast Methodology

6.4.2.1 Current Method

The growth rates used for this financial plan are forward looking (up to 7 years) and based on the State Revenue Council's latest forecast of state general fund tax revenue and growth as detailed by the State Department of Taxation (May 2018, see Figure 6-4). The Revenue Council is a constitutionally mandated body consisting of seven members appointed by the Governor, the Senate President, and the House Speaker. Its revenue estimates are used by the Governor and the State Legislature to prepare bi-annual budgets and appropriations. Deviations from the Revenue Council's estimates must be justified. The Revenue Council meets four times each year to review, establish, and/or revise state tax revenue estimates. Figure 6-4 shows the Revenue Council's Estimates of General Fund Tax Revenues forecast as detailed by the State Department of Taxation. Figure 6-5 below summarizes the growth rates through year 2030.

The revenue forecast is evaluated at the beginning of each fiscal year.

HART used the Revenue Council's growth rate for 2024 to estimate the growth rates from 2025 to 2030. The Revenue Council's forward-looking GET surcharge and TAT growth rates are consistent with the compounded growth rate as discussed below.

Figure 6-4 Revenue Council Estimated General Fund Tax Revenues

ESTIMATES OF GENERAL FUND TAX REVENUE FROM THE MEETING OF MAY 24, 2018: FY 2018 TO FY 2024

Line item projections generated by Tax Research & Planning Office to be consistent with the Council's forecast for the total General Fund tax revenues

(in thousands of dollars)

	BASE		ESTIMATED						
TYPE OF TAX	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
General Excise and Use Tax	$3,206,154	$3,239,225	$3,432,376	$3,562,313	$3,694,580	$3,827,718	$3,961,532	$4,104,492	$4,230,178
Individual Income Tax	2,116,392	2,192,341	2,392,412	2,537,392	2,647,358	2,767,577	2,898,729	3,033,765	3,175,379
Corporate Income Tax	93,036	76,761	85,397	105,421	107,292	109,333	112,127	114,396	116,987
Public Service Company Tax	152,760	122,159	126,170	130,472	134,802	139,155	143,599	148,184	152,916
Tax on Insurance Premiums	153,173	164,688	174,013	178,624	183,326	188,383	193,679	199,356	214,347
Cigarette and Tobacco Tax	83,685	82,792	83,276	85,420	87,954	90,566	93,300	96,127	99,049
Liquor Tax	50,590	51,167	52,125	52,856	53,428	53,944	54,423	54,870	55,324
Tax on Banks and Other Financial Corps.	12,691	9,174	8,346	6,018	4,413	3,277	2,583	1,981	15,343
Inheritance and Estate Tax	49,613	18,968	19,313	19,678	20,040	20,399	20,760	21,128	21,502
Conveyance Tax	26,415	49,737	56,030	60,330	64,720	69,380	74,236	79,386	83,947
Miscellaneous Taxes*	16,067	15,845	16,273	16,277	16,274	16,270	16,266	16,260	16,254
Transient Accommodations Tax	233,781	292,357	330,495	360,236	385,451	409,622	432,215	453,642	475,304
GENERAL FUND TOTAL	$6,194,356	$6,315,215	$6,776,226	$7,115,037	$7,399,638	$7,695,624	$8,003,449	$8,323,587	$8,656,530
GROWTH RATE	8.0%	2.0%	7.3%	5.0%	4.0%	4.0%	4.0%	4.0%	4.0%

* The figures on this line include penalty and interest charges, fees and license charges from various taxes, and allocations to the General Fund from the environmental response, energy and food security tax.

Figure 6-5 Revenue Council Growth Rates

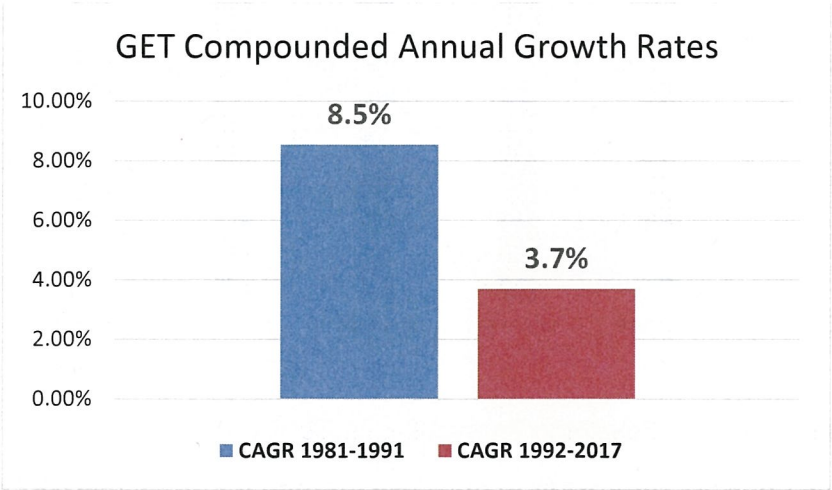
Fiscal Year	GET Surcharge	TAT
2018		
2019	3.79%	9.00%
2020	3.71%	7.00%
2021	3.60%	6.27%
2022	3.50%	5.52%
2023	3.61%	4.96%
2024 – 2030	3.06%	4.78%

6.4.2.2 Prior Method – GET Surcharge

The June 2012 Financial Plan assumed that GET growth would be consistent with the long-term GET Compounded Annual Growth Rate (CAGR) of 5.04% from Fiscal Year (FY) 1981 to FY2010.

Generally, the advantage of utilizing a long-term historical growth average to forecast revenues is that it spans several business cycles, thereby normalizing extreme high- and low-growth years. However, the period used in the 2012 Financial Plan included sustained high inflationary years in the 1980s and early 1990s. Figure 6-6 below highlights the change in the CAGR from 1981–1991 compared to 1992–2017. The CAGR experienced since 1992 (3.7%) is less than half the growth rate experienced over the preceding 10-year period (8.5%).

Figure 6-6 GET Comparison, 1981-1991 vs. 1992-2017



Given the wide variance in the CAGR, the 5.04% growth rate assumed at the time of the 2012 Financial Plan has been changed a number of times since then, to lower numbers reflecting actual growth rates of the GET surcharge collections, as shown in Figure 6-7 below.

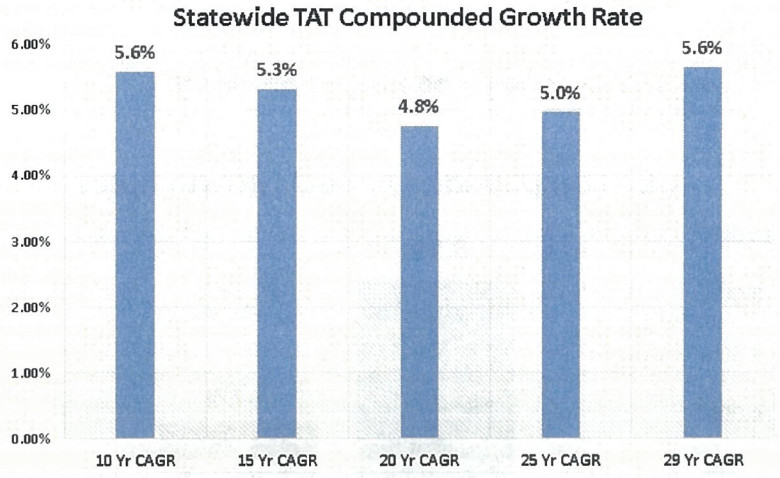
Figure 6-7 Project Forecasted Growth Rates

Month and Year	Growth Rate Forecast
July 1, 2012	5.04%
March 31, 2015	4.75%
September 30, 2015	4.00%
March 1, 2016	4.30%

6.4.2.3 Transient Accommodation Tax

The projected TAT growth rate is based on the most recent Revenue Council's State General Fund Tax Revenue forecast (May 2018, see Figure 6-4). The Revenue Council's growth rates are consistent with the historical CAGR when adjusted for increases in the TAT tax rate. As shown in Figure 6-8 below, the CAGR has been relatively consistent over various time intervals. The CAGR based on the Revenue Council's forecast is 5.4%.

Figure 6-8 Statewide TAT Compounded Growth Rate



6.4.2.4 Conclusion on Revenues Forecast Methodology

The Revenue Council's forecast is an objective method for projecting GET surcharge and TAT revenues, embodied in the State Constitution. The Revenue Council's forecast provides for timely updates to changes in the economy and is consistent compared to the GET and TAT CAGR since 1990 as well as variances in more recent CAGR periods.

6.4.3 Federal Funding

The City received a total of $806 million of the $1.55 billion New Starts funding from the FTA through July 2017. The remaining $744 million is awaiting FTA award. The financial plan uses an average 4% rate for fixed-rate debt. Consequently, the amount awarded and period of the award will have an incremental effect on finance charges. No additional FTA grant funding is considered in the financial plan. Figure 6-9 summarizes obligated and unobligated FTA funding.

Figure 6-9 Obligated and Unobligated FTA CIG Funding

Fiscal Year Allocations	Obligated Amounts	Unobligated Amounts	Total
2008-2011	$119,990,000	---------	$119,990,000
2012	$200,000,000	---------	$200,000,000
2013	$236,277,358	---------	$236,277,358
2014	$250,000,000	---------	$250,000,000
2019	---------	---------	---------
2020	---------	$100,000,000	$100,000,000
2021	---------	$150,000,000	$150,000,000
2022	---------	$150,000,000	$150,000,000
2023	---------	$150,000,000	$150,000,000
2024	---------	$100,000,000	$100,000,000
2025	---------	$50,000,000	$50,000,000
2026	---------	$43,732,642	$43,732,642
Total	$806,267,358	$743,732,642	$1,550,000,000

6.4.4 City Subsidy – HART Support

As discussed in the Summary section, Act 1 revenues derived from State tax revenues (GET and TAT) are to be used for capital expenditures and prohibits the use of these revenues for HART annual administrative and operating expenditures. This updated Financial Plan assumes that the non-capitalized portion of these restricted expenditures are not paid from GET or TAT revenues. Beginning July 1, 2018, HART revised its Capitalization Policy on capital and non-capital administrative and operating expenditures. As a result, approximately 70% of administrative and operating expenditures are deemed capital expenditures. This policy revision is consistent with GAAP. Figure 6-10 shows HART's annual amounts of City subsidy.

Based upon HART's Capitalization Policy, the estimated amount of City funds required for administrative and operating expenses are shown in Figure 6-10 below. As stated above, Act 1 revenues derived from State tax revenues (GET and TAT) are to be used for capital expenditures. However, it does not prohibit the use of tax revenues for HART non-capital administrative expenditures prior to its enactment on September 5, 2017. A total of $39 million of tax revenues was available prior to Act 1 and will be exhausted by 2021.

In addition, the City recognizes that additional funds, beyond the amounts projected as non-capitalized HART administration costs, may be required to complete the Project. The actual additional funds that the City needs to contribute depends on future GET and TAT revenue collections. Figure 6-10 below shows the amount of additional funds. The amount of City subsidy may require annual City Council appropriation through the annual Executive Operating and Capital Budget, by fiscal year. As a result, this updated Financial Plan requires City Council approval. HART obtained City Council approval of this Recovery Plan along with the updated Financial Plan by Council's adoption of Resolution 18-239, CD1, FD1 and a Memorandum of Agreement (MOA) between the City and HART by Council's adoption of Resolution 18-237 on October 30, 2018.

The City has advanced the amount of $44 million to HART to satisfy the City's funding commitment.

Figure 6-10 Estimated City Subsidy – HART Non-Capitalized Support and Additional Funds (differences in table due to rounding)

Fiscal Year	HART Non-Capitalized Support Funds (millions)	Additional Funds (millions)	Total (millions)
2019	$0	$44	$44
2020	$0	$25	$25
2021	$0	$26	$26
2022	$6	$15	$21
2023	$5	$12	$17
2024	$3	$9	$12
2025	$2	$8	$10
2026	$2	$8	$10
2027	$0	$10	$10
2028	$0	$10	$10
2029	$0	$10	$10
2030	$0	$10	$10
2031	$0	$10	$10
Total	**$18**	**$196**	**$214**

6.5 Project Capital Plan

The Baseline Project costs are shown below in Figure 6-11.

Figure 6-11 Baseline Project Costs

Description	Amount (millions)
Capital Cost	$8,299
Financing and Issuance Costs	$840
Total	**$9,139**

6.5.1 Capital Cost

The Baseline Project costs below include executed contracts totaling approximately $4.837 billion (58.28% of total project cost below) with approximately $3.278 billion paid to date. On Thursday, September 27, 2018, the HART Board of Directors approved a P3 delivery method to procure the CCGS and PHGTC, the remaining two major construction contracts. It is structured as a DBFOM and includes DBF of the CCGS and the PHGTC. This includes the transfer of the Core System's DB portion of work beyond Middle Street to be under the P3.

The Baseline Project capital costs shown in Figure 6-12 include both P3 and non-P3 capital costs at this time, pending completion of the P3 procurement process.

Figure 6-12 Baseline Project Capital Costs

Cost Summary	Estimate at Completion (thousandths)
Construction (SCC 10 to SCC 50)	$5,416,746
ROW (SCC 60)	$361,625
Vehicles (SCC 70)	$211,390
Professional Services (SCC 80)	$2,087,501
Unallocated Contingency	$221,738
Total Capital Project Costs (excludes finance costs)	**$8,299,000**

6.6 Capital Cost Financing

The financing plan for the Project was developed to (1) preserve the City's financial condition, (2) minimize finance charges, and (3) repay debt service solely from Project revenues commensurate with the expiration of the GET and TAT.

In the years in which capital expenditures are greater than the funding available, a combination of GO bonds (to be repaid by Project revenues and other funding sources) and short-term borrowing (up to a 270-day revolving basis) in the form of TECP will be used. HART and the City entered into a Memorandum of Understanding on May 7, 2015, which was amended and restated on July 26, 2017 (as amended and restated, the "MOU"), The MOU provides, among other things, that HART is required to deposit into the City's general fund a debt reserve equal to the lesser of 10% of the par value of the outstanding bond amount or 50% of the maximum annual debt service on all outstanding bonds. This financial plan anticipates the release of the debt reserve to partially fund debt service in 2023 and 2031. On September 6, 2017, the City successfully sold $350 million of variable rate GO bonds to partially meet HART's FY2018 cash needs. The City has begun the process to issue GO bonds to meet HART's FY2019 cash needs.

The financial plan assumes interest rates of 4.00% for fixed rate GO bonds and 3.00% for variable rate GO bonds. The rates used are based on the City's current AA+ rating. The interest rate used on TECP is at 3.00%. The variable rate bonds sold on September 6, 2017, described above, carry an initial variable interest rate of Securities Industry and Financial Markets Association (SIFMA) plus 30 to 32 basis points (approximately 1.1%) adjusted weekly.

Issuance costs of debt are estimated at 0.40% of gross GO bond proceeds and the TECP line of credit.

The City's financing requirements are presented in Figure 6-2, under Debt Financing Summary. In summary, GO bond proceeds amount to $2.851billion, with TECP revolving borrowings at $1.860 billion (maximum limit of $350 million outstanding). All debts will be repaid by FY2032.

6.7 Risks, Uncertainties, and Mitigation Strategies

The sections above focus on discussions surrounding the baseline financial plan and assumptions. This following discussion emphasizes the risks and uncertainties, including mitigation strategies, on key assumptions.

6.7.1 Capital Plan

6.7.1.1 Project Costs

This section discusses potential risks associated with the CCGS, utility installation and relocations, and ROW acquisition and relocations.

- **CCGS:** As discussed above, the HART Board of Directors approved a DBFOM P3 delivery method to procure the CCGS and PHGTC with the objective of reducing costs and shortening the Project schedule.
- **Utilities:** Utility installations/relocations represent another significant cost component as the Project moves into the more congested City Center segment. The Project has major impacts on multiple utilities, with electrical infrastructure owned by HECO having the greatest impact on cost and schedule. Utility relocations along Dillingham Boulevard are on the critical path and will require in-depth utility design work to provide for the needs of the system and address HECO electrical clearance issues.

  To mitigate the risk, HART awarded the CCUR contract in April 2018 and work begun shortly after. It is an advanced utility relocation effort accomplished by a unit rate contract with scope executed on the contract as design is completed. The sequencing of work will be driven by when final designs are coordinated with Third-Parties and through task orders released to the CCUR contractor. This advance utility relocation strategy minimizes cost and schedule risks assigned to this Project. It also de-risk the CCGS under the P3 delivery model.
- **ROW:** HART acknowledges that the Honolulu real estate market is robust, which increases HART's financial and legal risks regarding ROW acquisitions and relocations. These risks have not yet been fully captured in existing risk assessment models. Many of these risks relate to the wide range of possible jury verdicts with regard to property valuations in eminent domain trials. However, given the sometimes unpredictable and uncontrollable results of jury verdicts in eminent domain trials, HART believes it most prudent to disclose the potential for risk in excess of budgeted amounts in the updated financial plan.

  HART has completed a full re-assessment of its total allocated and unallocated risks for the entire Project, inclusive of ROW risks, and is confident that its current contingency budget is adequate to cover remaining risks on the Project.

In summary, HART has a robust risk management program and is committed to enacting cost containment measures as a primary tool to maintain the Project's capital cost and schedule within the established budget.

If needed, HART also has a number of strategies to mitigate these downside risks, including:

- Utilize the existing TECP bond program for short-term financing needs.
- Reduce HART's expenses and Project costs.
- Absorb higher interest rates above the conservative interest rates used to estimate financing. The HART financial plan uses an average 4% rate for fixed-rate debt and 3% for variable-rate debt. The average rates used are approximately 1% higher than the current market rate. Thus, HART can absorb reasonable increases in a rising rate environment.

6.7.1.2 Interest Rates and Municipal Market

There are inherent risks associated with interest rates and access to Municipal Market with capital projects requiring financing. Interest rate volatility as a result of monetary policies, geopolitical events, economic activities, etc., can impact Project cost. In a rising rate environment, additional revenues are used to pay financing costs. As a result, borrowings will increase to replace the revenue reserved to pay for capital expenditures.

To mitigate interest rate risk, the financial plan uses an average 4% rate for fixed-rate debt and 3% for variable-rate debt. The average rates used are approximately 1% higher than the current market rate.

6.7.2 Revenue and Funding Risks

6.7.2.1 GET Surcharge and TAT Revenues

The baseline financial plan utilizes the most current forecast by the State Revenue Council. However, actual collections may come in lower than the forecasts depending on
(1) a number of underlying economic factors outside of the Project's control, and
(2) the Department of Taxation's GET tax surcharge processing fluctuations. Temporary revenue instability can be covered by TECP. Prolonged downturns in actual revenue collections may require long-term solutions as described above.

6.7.2.2 Federal Grant Revenues

The updated baseline financial plan assumes authorization by the FTA to drawdown on the remaining $743 million commencing in February 2019. Should the authorization occur later than February 2019, additional debt may need to be issued to balance Project costs. Future debt requirements would be reduced once the authorization is granted and drawdowns resume. As an example, an authorization and disbursement of $100 million by February 2019 would result in up to $4 million in annual interest savings.

7 Operating Plan

This Operating Plan section discusses the integration strategies for bus and rail operations and service during the interim revenue service and full revenue service. Currently, one interim service opening with nine stations is scheduled for December 2020, a second interim opening would add service to another four stations including the airport in 2023, and full revenue service with all 21 stations is scheduled to begin in 2026. HART is striving to complete the Project by December 2025 and the City will be ready to provide fully integrated bus service when the rail system opens.

This chapter is organized in the following manner:

- Introduction
- Bus Operations and Planning for Rail Service
- Operating Plan

7.1 Introduction

DTS, in collaboration with HART, is actively working on fully integrated multimodal transportation plans in preparation for both interim and full revenue service.

Charter Amendment 4 revised the City Charter to transfer operations and maintenance responsibility for rail from HART to DTS to leverage operations efficiencies within the multimodal rail, bus, and paratransit system under the leadership of a single entity. Furthermore, Charter Amendment 4 established a Rate Commission to annually review bus, paratransit, and rail fares. Operations and leadership teams from DTS and HART have convened regular meetings to establish a road map and paths to integration, transfer, and establishment of an efficient operations and maintenance structure for the Project. The coordination will result in a detailed organizational chart which will clearly delineate roles, responsibilities, and fiscal impacts for future funding of positions, some which may transfer from HART to DTS at appropriate times pending rail segment completion and opening.

The interim operations milestones pertaining to bus and paratransit including initial interim opening between the East Kapolei and Aloha Stadium Stations, the potential extension of the interim segment to Middle Street Station, and full revenue service of the complete 20.1-mile, 21-station alignment is detailed in the narrative below.

7.2 Bus Operations and Planning for Rail Service

This section details the planning and implementation strategies to fully integrate bus (TheBus) and paratransit (TheHandi-Van) with rail as constructed segments are opened and become operational.

Any proposed changes to existing service will involve a public review process.

7.2.1 Interim Opening 1 – East Kapolei Station to Aloha Stadium Station

The planned interim opening of revenue service in December 2020 between East Kapolei and Aloha Stadium Stations (a total of nine stations) represents approximately half of the 20.1-mile full rail alignment. It is a short-term opportunity to improve mobility within West and Central O'ahu; however, since it does not yet enter the urban Honolulu boundary, planned service changes for the bus will be limited to reconfigurations of existing local services and neighborhood circulators to incorporate the nine rail stations. Regional express routes and trunk routes providing service between West and Central O'ahu will mostly remain intact until approaching full revenue service when rail enters urban Honolulu.

Successful operation of this segment will enhance the public image and the value of rail transit to the island economy and may boost support for the east (UH Mānoa) and west (West Kapolei) extensions of the rail alignment as envisioned in the EIS.

7.2.1.1 East Kapolei Station

Current hub-and-spoke bus networks in Ewa and Kapolei will be realigned to provide service to this station as well as the neighboring UH West O'ahu Station. A 900-parking-space park-and-ride facility is planned as part of the station site.

Existing trunk, regional rapid service, and peak-hour expresses will continue to operate. Community circulator routes will connect this station to the neighborhoods of Makakilo, Villages of Kapolei, Kapolei Hawaiian Homesteads, Kalaeloa, Ewa Villages, Ewa Gentry, Ocean Pointe, Hoakalei, and Ewa Beach.

Moderate service increases are planned for realignment of the current route network and increases in spans of service. DTS, in coordination with HART, is currently planning and designing rail station access pedestrian crossing infrastructure to connect this station to public properties across the major highway-speed state roadway.

7.2.1.2 UH West O'ahu Station

Current hub-and-spoke bus networks in Kapolei will be realigned to provide service to this station as well as the neighboring East Kapolei Station. A 1,000-parking-space park-and-ride lot is planned as part of the station site.

Existing trunk, regional rapid service, and peak-hour expresses will continue to operate. Community circulator routes will connect this station to the neighborhoods of Makakilo, Villages of Kapolei, Kapolei Hawaiian Homesteads, Kalaeloa, and Ho'opili.

Moderate service increases are planned for realignment of the current route network and increases in spans of service.

7.2.1.3 Ho'opili Station

Ho'opili Station will be constructed before its surrounding Transit-Oriented Development (TOD) principled neighborhood, which is expected to develop concurrently around the station through 2030. A planned temporary park-and-ride will offer commuters the option to use rail as an alternative to using the parallel H-1 Freeway.

No additional service is planned for the interim opening, although existing trunk routes will be able to accommodate the new neighborhood until more density is imminent.

7.2.1.4 West Loch Station

Current hub-and-spoke bus networks in Waipahu already support this station location. Existing trunk, regional rapid service, and peak-hour expresses will continue to operate. Existing community circulator routes will connect this station to the neighborhoods of Royal Kunia, Village Park, and West Loch Estates.

Moderate service increases are planned for increased frequency on existing routes and increases in spans of service.

7.2.1.5 Waipahu Transit Center Station

Current hub-and-spoke bus networks in Waipahu already support this station location via an existing major transit center and transfer point. Existing trunk, regional rapid service, and peak-hour expresses will continue to operate. Existing community circulator routes will connect this station to the neighborhoods of Royal Kunia, Village Park, Robinson Heights, Waipahu, Waikele, Seaview, Crestview, and Waipio. New service will extend to the new Koa Ridge neighborhood.

Moderate service increases are planned for extended service, increased frequency on existing routes, and increases in spans of service.

7.2.1.6 Leeward Community College Station

A single existing community circulator will connect this station to the Pearl City and Pearl City Peninsula neighborhoods.

No increases in service or service span are planned for this phase.

7.2.1.7 Pearl Highlands Station

Existing trunk and regional rapid services will continue to operate and serve this station. A 1,600-parking-space garage with dedicated regional freeway interfaces and a major bus transit center is planned as part of the station site but will not be available for interim opening.

No increases in bus service are planned for this station for this phase. DTS, in coordination with HART, is currently planning and designing rail station access pedestrian crossing infrastructure to connect this station to public and private properties across the adjacent major State-owned Kamehameha Highway.

7.2.1.8 Pearlridge Station

Existing trunk and regional rapid services will continue to operate and serve this station. An adjacent bus transit center will be constructed to serve this station. Current peak-hour community circulator routes will be realigned and service spans extended.

Moderate service increases are planned for extended service, increased frequency on existing routes, and noted increases in spans of service.

7.2.1.9 Aloha Stadium Station

Existing trunk and regional rapid services will continue to operate and serve this station. A 600-parking-space park-and-ride lot and a major bus transit center will be constructed as part of this site. Current peak-hour community circulator routes will be realigned and service spans extended to support this station.

Since this station currently serves as the interim east-end terminus of the rail alignment as construction commences eastward to the final planned terminus at Ala Moana Center Station, major service increases are planned for extended service, increased frequency on existing routes, and noted increases in spans of service. These services will include new frequent peak-hour expresses and all-day regional rapid services between Aloha Stadium Station and major commuter destinations including Downtown Honolulu, UH Mānoa, Waikiki, and East Honolulu. These new services will operate until further rail extensions are opened for operations, at which time they will cease and be restructured and reallocated.

7.2.2 Interim Opening 2 – Eastward Extension from Aloha Stadium Station to Middle Street Station

A potential second interim opening in 2023 would extend the initial interim segment approximately 5 miles and four stations beyond the Aloha Stadium Station to the Middle Street Station via the Honolulu International Airport. This is the rail operational alignment's first entry into the urban core of Honolulu and provides the additional benefit of interfacing directly with the Honolulu International Airport. At this point, however, the operating

alignment would still not reach the highest density of riders in urban Honolulu near the Downtown Station and the planned terminus at Ala Moana Center Station. Connecting bus networks will be adjusted accordingly during this phase but will not reach final major changes until the full operational line is completed.

7.2.2.1 Pearl Harbor Station

Existing trunk and regional rapid services will continue to operate and serve this station. This station lacks space for an adjacent transit center to facilitate bus transfers to the nearby Pearl Harbor Naval Shipyard and the Joint Base Pearl Harbor-Hickam. Transfers to bus will occur at the neighboring Aloha Stadium Station.

No increases in service are planned for this station except for related frequency and span of service costs incurred at neighboring stations that are serviced by the same trunk and regional rapid services.

7.2.2.2 Airport Station

Existing trunk services will continue to operate and serve this station. A small-scale transit center is integrated into the design of this station site. Some trunk routes servicing the airport will be restructured into community circulator routes with extended service spans to connect this station to the Makalapa, Āliamanu, Salt Lake, and Moanalua neighborhoods.

Moderate service increases are planned for restructured and extended service, increased frequency on existing routes, and increases in spans of service.

7.2.2.3 Lagoon Drive Station

No current existing services operate in the area of Lagoon Drive Station; however, new services are planned to connect community circulators to the station with a collaborative planning effort between DTS, HART, and HDOT to plan, design, and construct a bus turnaround loop for new routes serving the Lagoon Drive Station. These circulators will connect the Lagoon Drive station to the Airport Industrial Area as well as the Salt Lake, Moanalua, Mapunapuna, and Kalihi neighborhoods.

During the proposed interim extension to Middle Street, former new frequent peak-hour expresses and all-day regional rapid services operating between Aloha Stadium Station and major commuter destinations including Downtown Honolulu, UH Mānoa, Waikiki, and East Honolulu will be discontinued at Aloha Stadium Station and implemented at Lagoon Drive station for convenient access to the H-1 Freeway. Major increases are planned for new services, increased frequency on existing routes, and increases in spans of service. Although this is not the penultimate stop in the interim extension, it is the most practical location to transfer to and efficiently route connecting rail-access services. These services will operate until the final opening of full rail operations to Ala Moana Center Station, at which time they will cease and be restructured and reallocated.

7.2.2.4 Middle Street Station

Middle Street Station will connect directly to the Kalihi Transit Center, the largest bus transit center in urban Honolulu. Major trunk and regional rapid services will continue to operate and serve this station, with high-frequency routings and a large number of originating and ending trips. Community circulators will be implemented to connect with Kalihi Uka, Kalihi Waena, and Kalihi Kai neighborhoods. Restructured service to and from Windward O'ahu will interface with rail at the Middle Street Station.

Major service increases are required for bus routes at this station as well as to increase capacity and frequency on existing urban Honolulu corridor trunk routes to anticipate and afford capacity with the overlay of the high-capacity rail operations connecting to the existing bus network.

7.2.3 Full Opening – East Kapolei Station to Ala Moana Center Station

The full opening of rail to service the entire planned 20.1-mile, 21-station corridor represents the largest-scale implementation and revision of connecting bus and paratransit operations. Peak-hour express routes except those serving Windward and East regions can be scaled back and converted to high-frequency peak-hour services which interface to the rail alignment. This potential savings in bus operating expenses can be applied to creating better connections at all stations, emphasizing *mauka-to-makai* (inland to ocean) bus route alignments that connect at rail stations. All neighborhood community circulator connections in previously-detailed station-based plans will be revised and adjusted according to new projected demand for services. The following section summarizes potential bus service changes for the new stations coming online.

7.2.3.1 Kalihi Station

New trunk, regional rapid, and community circulator services connecting to Kalihi Uka and Kalihi Kai will be implemented to serve this station. Moderate service increases are planned for all new routes and increases in spans of service.

7.2.3.2 Kapālama Station

New trunk, regional rapid, and community circulator services connecting to Kamehameha Heights, Alewa Heights, and Kalihi Kai will be implemented to serve this station. Moderate service increases are planned for all new routes and increases in spans of service.

7.2.3.3 Iwilei Station

New trunk, regional rapid, and community circulator services connecting to Liliha and Nuuanu will be implemented to serve this station. Moderate service increases are planned for all new routes and increases in spans of service.

7.2.3.4 Chinatown Station

Existing and new trunk and regional rapid services will be continued and implemented to serve this station. Moderate service increases are planned for all new routes and increases in spans of service. DTS and HART are collaboratively planning major pedestrian access infrastructure to improve rail and transit access to the station.

7.2.3.5 Downtown Station

Existing and new trunk and regional rapid services will be continued and implemented to serve this station. Moderate service increases are planned for all new routes and increases in spans of service. This station does not have adequate space for an adjacent bus transit center. Major transit connections will be made at the neighboring Civic Center Station.

7.2.3.6 Civic Center Station

Services from Windward O'ahu will terminate at the Civic Center Station in Kaka'ako. New trunk services will be implemented to serve this station. Community circulator services connecting this station to Pacific Heights, Pauoa, Papakōlea, and Makiki will also be implemented. Additionally, rapid bus services to connect this station to Ala Moana, Waikiki, UH Mānoa, and East Honolulu will be installed.

Major service increases are planned for all new routes and increases in spans of service. DTS is planning a transit mall and on-street transit center for this station, as well as related dedicated pedestrian and cycle track infrastructure.

7.2.3.7 Kaka'ako Station

Community circulator services connecting this station to Makiki will be implemented. Moderate service increases are planned for all new routes and increases in spans of service.

7.2.3.8 Ala Moana Center Station

Major existing trunk routes will see service frequency and span increases. Additionally, rapid bus services to connect this station to Waikiki, UH Mānoa, and East Honolulu will be implemented with community circulators connecting this station to Makiki, Mānoa, and Mō'ili'ili. Major service increases are planned for all new routes and increases in existing frequencies and spans of service. DTS is planning two bus transit centers adjacent to the station to facilitate anticipated high rates of transfers and pedestrian walk-up passengers. A major bus rapid transit project is planned to connect the terminus of the rail alignment to the high population- and job-density destination of Waikiki.

7.3 Operating Plan

As stated in the prior sections, the detailed planning for the integrated transportation system has begun and will continue to be refined. Ultimately, any proposed changes to existing bus service will involve a public review process. The Operating Plan will be continuously updated to reflect these refinements.

The original Operating Plan (June 2012) was updated in December 2016. The updates include the impacts of the change in interim and full RSDs; actual cost escalation rates to date; updated ridership projections; and other operating changes (such as fare gates instead of fare enforcement).

As with the original Financial Plan (June 2012), the updated Financial Plan reflects the current transit policies applied to the future integrated transit system. The current City policy of setting fare revenue recovery rate is 27% to 33% of operating costs. The current fare rate categories remain constant in the updated Financial Plan. By holding these factors constant, this updated Operating Plan projection will serve as a base comparison for changes to fare policies, fare differentials, and service levels.

7.3.1 Introduction

This is an update to the Operating Plan portion of the original City's Final Financial Plan for FFGA, June 2012. This updated Financial Plan is based on the 20.1-mile route with full revenue service starting in December 2025, with interim service anticipated to begin in December 2020 to Aloha Stadium.

The Project will be fully integrated with TheBus operations, which will be reconfigured to add feeder bus service to provide increased frequency and more transfer opportunities between bus and rail. The new rail and modified bus service will provide additional travel options, increase service frequencies, expand the hours of operation, minimize wait times, reduce total travel times, improve service reliability, and enhance comfort and convenience for passengers.

7.3.2 Update Summary

7.3.2.1 Original Financial Plan

The following figure summarizes the financial elements in the original Financial Plan that was released in June 2012. The figure compares FY2011 actual with the first full year of operations in FY2020 in inflated YOE dollars.

Figure 7-1 Original Financial Plan Figures, June 2012

		FY 2011 Actual	Original FY 2020	Change	% Change
Bus Cost	YOE million $'s	$173	$263	$90	52%
Handi-Van Cost	YOE million $'s	$34	$59	$25	73%
Rail Cost	YOE million $'s	$0	$113	$113	-
Combined Total	YOE million $'s	$207	$435	$228	110%
Bus Service Hours	millions	1.38	1.58	0.20	14%
Fare Revenue	YOE million $'s	$54	$110	$56	104%
Average Fare	YOE $'s	$0.93	$1.30	$0.37	40%
Subsidy	YOE million $'s	$133	$307	$174	131%

7.3.2.2 Updated Operating Costs

Projecting rail operating costs is a two-step process. The first step is to update the operating plan in today's current dollars incorporating all known changes (for example, four-car trains, fare gates, and power consumption estimates). After capturing current real changes, the second step is to convert current year cost figures into YOE dollars by selecting an inflationary factor.

Updated rail costs in current-year dollars are as projected in the original Financial Plan (June 2012). However, projection estimates in certain cost categories vary considerably from the original projections.

These current year cost estimates are then converted to YOE dollars. The original Financial Plan applied various escalation factors to each cost category (for example, core systems, power costs, and station maintenance). This update provides a range of cost escalation scenarios and details their impacts.

Bus costs have been as anticipated in the original Financial Plan. The historical annual increase in bus costs per revenue service hour in the original Operating Plan was 3.9%. The actual cost per revenue hour over the last 10 years is 3.1% reflecting the recent lower fuel prices. The updated Financial Plan estimates bus costs per revenue service hours to increase at approximately the same level as the original Financial Plan's historical cost. Handi-Van has experienced the cost increases as projected in the original Operating Plan.

7.3.2.3 Updated Ridership

Ridership is projected using a travel demand model with inputs from customer survey data. A more robust regional planning model is currently being utilized to forecast ridership in conjunction with a fare modeling study, which was provided on September 19, 2018, to the City and County of Honolulu's Rate Commission now responsible for making recommendations for fares inclusive of rail. Approximately 258,000 daily linked trips were estimated in the first full year of a combined bus and rail system. The forecast grew to 280,000 linked trips per day after ten years for the bus and rail combined system. The

updated forecast estimates approximately 279,000 linked trips in the first full year and 313,000 in the tenth year.

With respect to actual boarding to date, actual boarding and the original Financial Plan forecast began to diverge in FY2013. There are a number of factors that may have contributed to this situation, but service hour reductions and the decreasing price of fuel beginning in May 2014 are likely contributors. The updated ridership forecast commences at the current ridership results from FY2016.

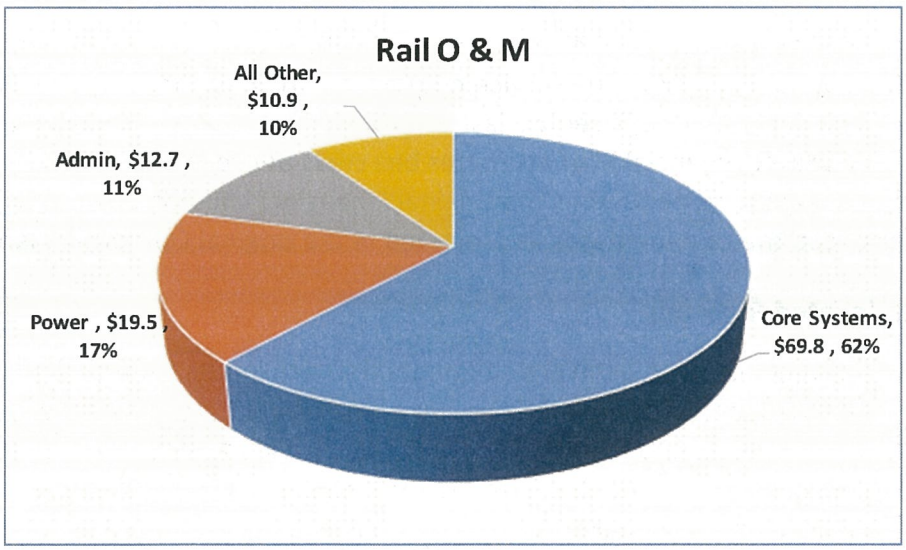
Fare rate increases are comparable to Consumer Price Index All Urban Consumers (CPI-U) increases utilizing the original Financial Plan factors. Similar to the cost scenarios, this Financial Plan also details the impact of lower ridership figures and its impact on fare rates and subsidy levels.

7.3.3 Operating Cost Update

7.3.3.1 Rail O&M Costs

The assumptions incorporated in the original Financial Plan were mostly conceptual, as final designs were not developed by the plan's release in June 2012. This update of rail O&M costs is based on information obtained and project developments between June 2012 and November 2016. These updated figures will be continually reviewed as designs are finalized, operation and maintenance contracts are secured, and organizational structure develops. The following figure reflects the operating costs in the original Operating Plan. Core Systems Contract and power represent nearly 80% of all operating costs.

Figure 7-2 Original Financial Plan Rail Costs in FY2020, YOE Dollars (Millions)



The following figure compares the updated cost estimates to the original financing cost estimate for FY2016. In other words, if the rail systems were opened today, what would the

cost be using the contractual cost of the AHJV contract, current electrical rates, power consumption estimates, etc. The figure reveals that total rail costs in current dollars are approximately as projected in the original Financial Plan. However, deviations exist within the various cost categories. These deviations are explained in the following sections.

Figure 7-3 Update of Rail O&M Costs, 2017 Dollars (Millions)

	FFGA First Full Year of Operations, June 2012						Updated FY2017	
	In Constant $'s mil.	FFGA Inflation Factor	Inflated to Cost in FY2017	Inflated to Cost in FY2020	Inflated to Cost in FR2026		Updated Amount in Current $'s	Change from FFGA FY2017
Core Systems Labor	$ 25.5	1.2%	$ 27.1	$ 27.9	$ 29.9		$ 36.1	$ 9.1
Core Systems Materials	$ 20.2	3.6%	$ 24.1	$ 27.3	$ 34.0		$ 20.5	$ (3.6)
Core Systems Admin	$ 13.1	1.2%	$ 13.9	$ 14.5	$ 15.6		$ 13.9	$ -
Subtotal Core Systems	*$ 58.2*		*$ 65.1*	*$ 69.8*	*$ 79.5*		*$ 70.6*	*$ 5.5*
Admin	$ 10.4	2.5%	$ 11.8	$ 12.7	$ 14.7		$ 7.0	$ (4.8)
Power Costs	$ 18.3	0.8%	$ 19.1	$ 19.5	$ 21.8		$ 16.5	$ (2.5)
Guideway Maintenance	$ 1.9	2.5%	$ 2.2	$ 2.4	$ 2.7		$ 2.65	$ 0.4
Security Patrols	$ 0.7	2.5%	$ 0.8	$ 0.8	$ 1.0		$ 2.00	$ 1.2
Fare Enforcement	$ 1.8	2.5%	$ 2.0	$ 2.2	$ 2.6		$ -	$ (2.0)
Fare Collection	$ 2.4	2.5%	$ 2.8	$ 3.0	$ 3.4		$ 3.33	$ 0.6
Station Maintenance	$ 2.1	2.5%	$ 2.3	$ 2.5	$ 2.9		$ 2.83	$ 0.5
Water	$ 0.01	2.5%	$ 0.01	$ 0.01	$ 0.02		$ 0.03	$ 0.0
Subtotal	*$ 37.7*		*$ 41.0*	*$ 43.1*	*$ 49.2*		*$ 34.3*	*$ (6.6)*
Total Projected O&M	**$ 96.5**		**$ 106.0**	**$ 112.8**	**$ 128.7**		**$ 104.9**	**$ (1.1)**

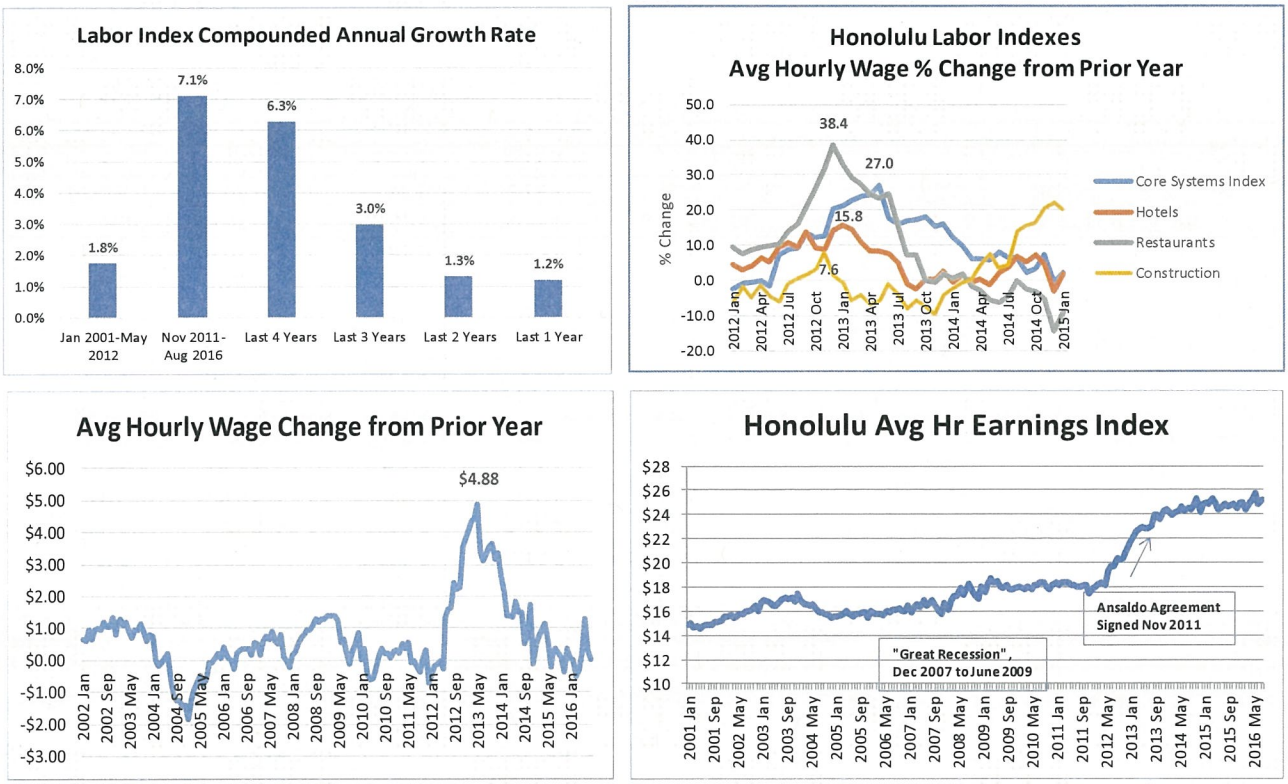
7.3.3.1.1 *Core Systems Contract*

The Core Systems Contract was signed with AHJV to operate and maintain the rail system. The O&M costs for the Project were developed using prices from the Core Systems Contract awarded in 2011. The Core Systems Contract has formulas to convert the bid award's 2011 dollars to YOE dollars. The formulas are based on indices published by the United States Bureau of Labor Statistics (BLS) for labor costs and material costs. The contract's labor index is based on the Honolulu Average Hourly Earnings of Production Employees in the Trade, Transportation, and Utilities Sector. The materials index is a composite of two national Producer Price indexes for Line-Haul and Rapid Transit Cars.

For the original Financial Plan, 11 years of historical data from the BLS were used to escalate the O&M costs that are included in the Core Systems Contract. The greatest deviation from the original Financial Plan is the Core Systems labor escalation factor. The Core Systems Contract was signed in November 2011. The following figure shows the labor index spiked in early calendar year 2012, reflecting the pent-up pressure after the "Great Recession." Average hourly wages grew $4.88 per hour (27%) from the previous year in May 2013. Similar spikes in the average hourly rate increase were experienced in other major sectors of the Honolulu economy such as the restaurant, hotel, and construction sectors. Contractually the labor CAGR peaked at an annualized rate of 17% in early 2013. The CAGR

for this labor index from the execution of the contract in November 2011 through August 2016 has since dropped to approximately 7%. This labor index has averaged only 1.3% growth per year over the last two years. Despite the falling growth rate, if the rail systems started now, the escalation would add approximately $9 million to operating costs.

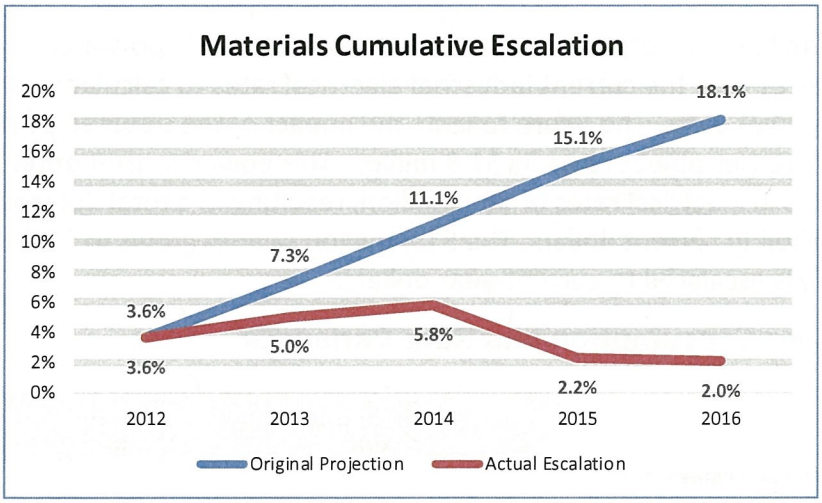
Figure 7-4 Honolulu Labor Index, August 2016



Unlike the labor index, the materials composite index is much lower than the original Operating Plan projections. The materials index was expected to grow at 3.6% annually. The following figure highlights the actual change in the materials composite index is well below

the original projection through August 2016. This actual index change represents a $3.6 million savings from the original plan.

Figure 7-5 Core Systems Materials Index Update



7.3.3.1.2 *City Cost Responsibilities*

Rail operations and maintenance will be the responsibility of the City, based on the passage of Charter Amendment 4 in the 2016 elections. These costs include the following: power costs, guideway structure inspections and maintenance, security patrols, fare revenue collection and equipment servicing, fare inspection and enforcement, station maintenance (including escalators and elevators), and costs associated with the staffing of administrative and management personnel, including overhead, for the organization. The City and HART are now planning to operate and maintain the system using a specifically structured P3 based on a 30-year concession for DBFOM project delivery. This approach could provide more certainty over future O&M cost, while reducing risk.

7.3.3.1.3 *HART and City Administration*

The original Financial Plan assumed that the HART organization would include 86 full-time equivalent positions in the first full year of operations. The cost estimates in the original plan assumed a stand-alone organization with a full complement of staffing, including support position such as human resources, accounting, and information technology. There was no consolidation of services with the City or the bus operator. With the recent Charter organizational changes, the plan has been updated based on new organizational structures and resource needs. The City has hired a consultant team to assist with the transition of O&M responsibilities.

7.3.3.1.4 *Power Costs*

The largest operating cost besides the Core Systems Contract is electrical power. The original Operating Plan based its power consumption and demand projection from

estimates in the Core Systems Contractor's proposal. The power price projection was based on then-current industrial rates and escalated rates gradually over the projection period. These original estimates have been reviewed and updated relative to current track alignment and four car train operations.

The following figure incorporates the most recently available power consumption and demand figures with the current industrial electrical rates to calculate the current dollar impact for power costs. The figure reflects the impact of the updated power consumption total that increases power costs by $1.8 million. This power consumption increase is offset by a decrease in electrical rates of $3.1 million, resulting in a total decrease in power costs to $16.5 million in current dollars. The $1.8 million savings grows to $2.5 million when the original plan is escalated to current-year dollars.

Figure 7-6 Power Consumption and Rate Variances

	Original Plan	Update 2016	Change	% Change
Power Rate Comparison:				
Usage per kwh	$0.22	$0.157	$ (0.06)	-29%
Traction Demand per kw	$18.86	$24.34	$ 5.48	29%
Station Demand per kw	$11.11	$24.34	$ 13.23	119%
Volume Comparison:				
Energy Consumption kwh	69,470,784	77,137,606	7,666,822	11%
Demand kw	10,920	11,355	435	4%
Cost Update:				
Annual Power Cost	$18,303,028	$16,545,748	($1,757,281)	-10%
Cost Variance:				
Change in Rates		($3,112,227)		
Change In Volume		$1,777,130		
Mix Variance		($422,184)		
Total Variance		($1,757,281)		

7.3.3.1.5 *Fare Collection and Enforcement*

Ticket vending machines were originally envisioned for the rail system with fare enforcement officers verifying payment. This scope was removed from the rail operations portion of the contract and a specific fare system design build operate maintain contract was awarded to Init, Innovations in Transportation Inc. in April 2016. This contract is for a multi-modal (bus, paratransit and rail), account-based, smart card fare payment system branded as the HOLO card system. The design portion of the Project was completed in 2017 and the Pilot for the bus and back office portions of the system, including a primary and secondary data center, customer website, institutional website, IVR, retail sales application and devices and City Sales offices is scheduled to begin in late 2018 running through 2019. System Acceptance for this portion is scheduled to be finalized by the start of the City's FY2020.

HART will continue to be responsible for the manufacture, testing, and installation of the TVM and faregates at each of the 21 stations. Under the operations portion of the contract, Init will also provide two years of maintenance on the Interim Rail equipment with job shadowing by city employees so they can take over the maintenance portion of the work. Init will remain responsible for day to day operations.

7.3.3.1.6 *Guideway and Station Maintenance*

The Core Systems Contractor is responsible for all maintenance associated with operating the rail system, including all track and equipment on the guideway. The City will be responsible to inspect and maintain the guideway structure, station structures, and station elevators and escalators. The cost estimate includes resources to cover mandated guideway inspection, graffiti removal, and elevator/escalator repair, and includes reserves to accumulate for major station and guideway repair. The updated figures increase both guideway and station maintenance by approximately $0.5 million each for a combined total of approximately $4 million per year.

7.3.3.1.7 *Security*

The rail system will have over 1,650 security cameras, emergency and information call points, sophisticated security software, as well as security staffing. The original security plan included an eight-position staff as well as fare enforcement officers. The increase of $1.2 million in the cost of security reflects the need to increase staffing to offset the reduction in prior plan's fare enforcement officers.

7.3.3.1.8 *Cost Adjustments Related to Inflationary Growth Rates*

Once the operating costs are determined in current dollars, these cost estimates must be converted to future YOE dollars. The following figure provides escalated costs under a variety of inflation assumptions. The chart demonstrates that the future first year operating costs could vary from approximately $127 million to $144 million depending on escalation assumptions.

Figure 7-7 Rail Costs under Various Inflation Assumptions

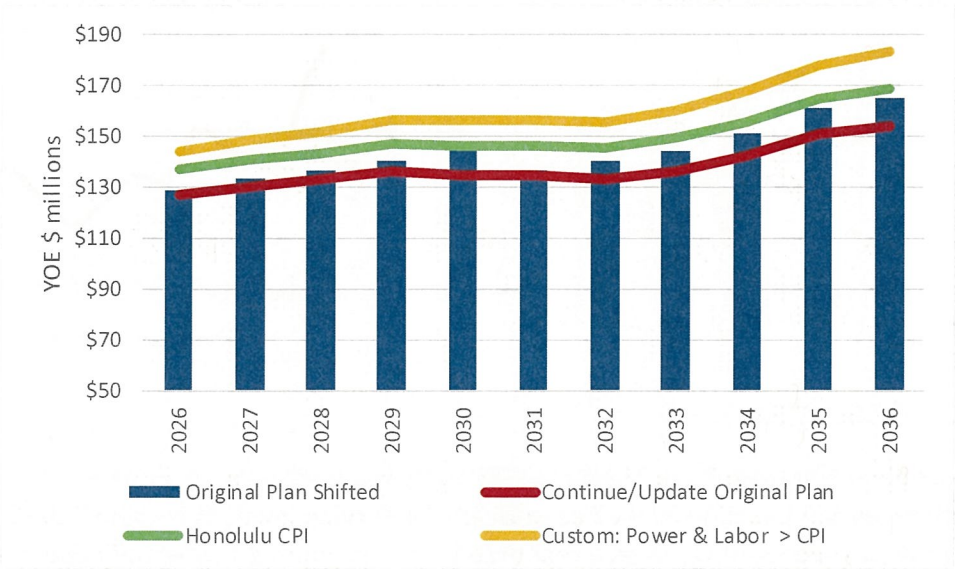
	Inflation Factor Scenarios						
Cost Category	Continue FFGA Escalation Factor to FY2026	Change from FFGA FY2026		Honolulu CPI to FY2026	Change from FFGA FY2026		Custom Inflation	Change from FFGA FY2026
Core Systems Labor	$ 40.5	$ 10.5		$ 46.7	$ 16.7		$ 51.5	$ 21.5
Core Systems Materials	$ 30.0	$ (4.0)		$ 27.2	$ (6.8)		$ 27.4	$ (6.6)
Core Systems Admin	$ 14.9	$ (0.7)		$ 18.8	$ 3.2		$ 19.1	$ 3.5
Subtotal	*$ 85.3*	*$ 5.8*		*$ 92.6*	*$ 13.1*		*$ 98.0*	*$ 18.5*
Administration	$8.7	$ (6.0)		$ 8.8	$ (5.9)		$ 8.8	$ (5.9)
Power Costs	$ 19.1	$ (2.7)		$ 21.5	$ (0.4)		$ 23.6	$ 1.8
Guideway Maintenance	$ 3.3	$ 0.6		$ 3.3	$ 0.6		$ 3.3	$ 0.6
Security Patrols	$ 2.6	$ 1.6		$ 2.5	$ 1.6		$ 2.5	$ 1.6
Fare Enforcement	$ -	$ (2.6)		$ -	$ (2.6)		$ -	$ (2.6)
Fare Collection	$ 4.3	$ 0.8		$ 4.2	$ 0.8		$ 4.2	$ 0.8
Station Maintenance	$ 3.5	$ 0.6		$ 3.6	$ 0.6		$ 3.6	$ 0.6
Water	$ 0.0	$ 0.0		$ 0.0	$ 0.0		$ 0.0	$ 0.0
Subtotal	*$ 41.5*	*$ (7.6)*		*$ 43.9*	*$ (5.2)*		*$ 46.1*	*$ (3.0)*
Total Projected O&M	**$ 126.9**	**$ (1.8)**		**$ 136.6**	**$ 7.9**		**$ 144.1**	**$ 15.5**

7.3.3.1.9 *Continuing Original Plan Methodology*

This projection scenario applies the original operating plan inflation factors to current dollar cost estimates. Under this scenario, the labor index for Core Systems would continue to fall back to historical trend lines, and power costs inflation would remain low. Core Systems material inflation would reverse its current low to-date escalation and grow at its original Financial Plan annual rate of 3.6%.

In this scenario, total rail O&M cost would total approximately $127 million in the first full year of operations. This scenario would result in a cost savings of $1.8 million per year over the original Financial Plan cost projection inflated to the December 2025 starting date committed to the public.

Figure 7-8 Comparison of Cost Escalation Scenarios, FY2026-FY2036, YOE Dollars (Millions)



7.3.3.1.10 *Moderate Range Scenario*

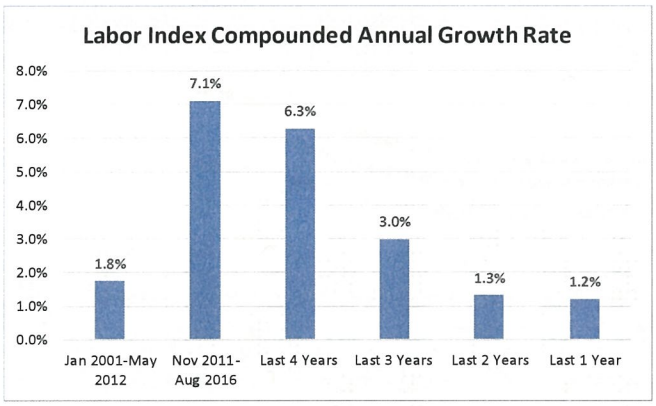
Although the Honolulu Labor Index growth rate has decreased from its post-recession spike and electric rates to date have actually decreased from 2012, this scenario increases current-dollar projections by the Honolulu CPI-U, providing another cost perspective. This scenario uses the State Department of Business, Economic Development and Tourism's (DBEDT) most recent Honolulu CPI-U forecast (November 15, 2016) through 2019, and then steps up CPI-U from 2.6% to 2.8% annually.

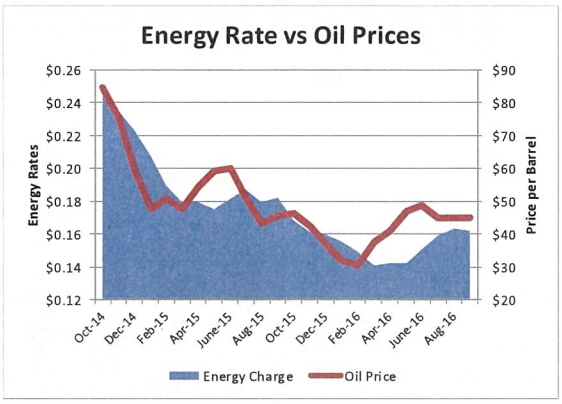
In this scenario, total rail O&M cost would total $136.6 million in the first full year of operations. This scenario would result in a cost increase of $7.9 million (6%) per year over the original Financial Plan cost projection inflated to the December 2025 starting date.

7.3.3.1.11 *High Cost Range Scenario*

The Core Systems labor and power costs represent approximately 50% of the current update for rail costs. To date, these costs have exhibited the most volatility. A more conservative forecasting approach would be to assume higher escalation factors than under the original Financial Plan methodology. Increasing these two cost categories approximately 1.4 times CPI-U results in total rail cost increasing to $144 million (11%) in the first full year of operations.

Figure 7-9 Core Systems Labor Index and Industrial Power Correlation



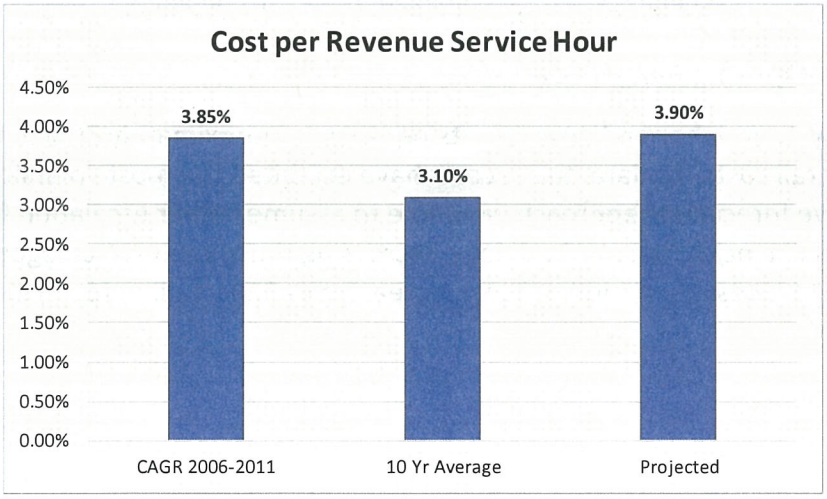


7.3.3.2 TheBus O&M Costs

In the original Financial Plan, TheBus O&M costs were developed using existing bus operations as the baseline as well as anticipated service levels through FY2030. TheBus O&M costing methodology uses a resource build-up approach that fully allocates O&M costs based on level-of-service variables. Each unit cost is broken down by object class which allows for applying different inflation rates to each object class. The overall composite cost based on revenue service hours was a 3.2% annual cost increase.

The following figure compares the inflationary growth factors cited in the original Financial Plan from 2006–2011 (3.9%), the updated 10 year average (3.1%), and the average used in the updated projection (3.9%). The updated projection uses a more conservative estimate given that the most recent years have realized savings from a sharp decrease in fuel costs. The total cost per revenue service hour for bus operations is currently approximately $130.

Figure 7-10 Growth Rates of Bus Costs per Revenue Service Hour

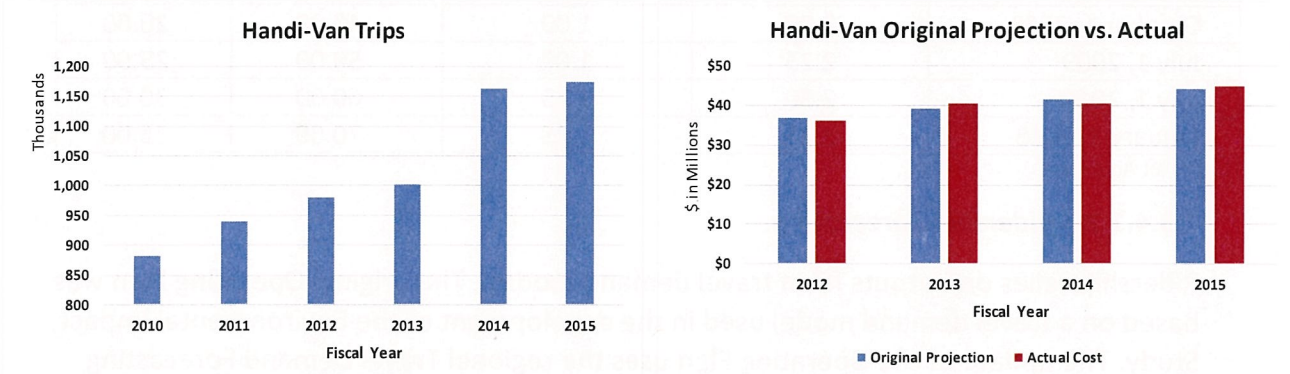


7.3.3.3 TheHandi-Van O&M Costs

TheHandi-Van is a paratransit service operating in tandem with TheBus and has been in operation since 1999. In FY2011, TheHandi-Van serviced more than 940,000 trips with an associated total O&M cost of approximately $34 million. The projected O&M costs for TheHandi-Van are based on the FY2011 cost per rider, equal to $36.32, applied to the projected ridership, and adjusted for inflation.

The original Operating Plan assumed that TheHandi-Van ridership would increase at an average annual rate of 1.8% from FY2011 to FY2030. The overall TheHandi-Van total cost was projected to increase between 5% to 6% per year given the increase in ridership and inflation. FY2015 actual results and the original Financial Plan estimate were $44.8 million and $44.1 million respectively. The updated Financial Plan continues the assumptions in the original Financial Plan for TheHandi-Van.

Figure 7-11 TheHandi-Van Annual Trips and Operating Costs



7.3.3.4 Other O&M Costs

The Financial Plan also includes operating costs associated with other transit service programs. The projection increases over time from approximately $1 million in FY2017, up to $8 million per year in FY2036.

7.3.4 Operating Revenues

7.3.4.1 Passenger Fares

7.3.4.1.1 *Fare Policy*

A City resolution stipulates that the farebox recovery ratio (FRR) for TheBus be maintained between 27% and 33%, which demonstrates a commitment of the City to keep operating costs and revenues growing at a comparable rate on average. This Financial Plan assumes the current fare structure for TheBus will be maintained for both TheBus and the Project, with free transfers assumed between both modes.

The figure below details the history of City fare increases. The City last raised fares in January 2018.

Figure 7-12 TheBus Fare Structure and History

Effective Date	One-way Cash Fare		Monthly Pass	
	Adult	Youth	Adult	Youth
March 1, 1971	0.25	0.15	N/A	N/A
March 2, 1971	0.25	0.10	N/A	N/A
June 9, 1972	0.25, 0.50	0.10, 0.25	N/A	N/A
March 15, 1974	0.25	0.10	N/A	N/A
November 1, 1979	0.50	0.25	15.00	7.50
June 18, 1984	0.60	0.25	15.00	7.50
October 1, 1993	0.85	0.25	20.00	7.50
July 1, 1995	1.00	0.50	25.00	12.50
July 1, 2001	1.50	0.75	27.00	13.50
July 1, 2003	1.75	0.75	30.00	13.50
October 1, 2003	2.00	1.00	40.00	20.00
July 1, 2009	2.25	1.00	50.00	25.00
July 1, 2010	2.50	1.25	60.00	30.00
January 1, 2018	2.75	1.25	70.00	35.00

N/A = Not Applicable

7.3.4.1.2 *Ridership Forecasting*

Ridership relies on outputs from travel demand models. The original Operating Plan was based on a travel demand model used in the development of the Environmental Impact Study. The update of the Operating Plan uses the regional Travel Demand Forecasting Model (TDFM) of the O'ahu Metropolitan Planning Organization (OahuMPO). This regional TDFM uses land use and population data to estimate transit system usage at different horizon years.

The TDFM estimates future island-wide vehicular traffic flows and transit ridership based on land use, employment, population characteristics, and an underlying transportation network. The OahuMPO uses the TDFM during long-range planning efforts to assess and compare the performance of different transportation projects relative to a baseline scenario.

The TDFM is a tour-based micro-simulation model system that uses the TransCAD 6.0 software package. The model uses a synthetic population and land use forecasts to simulate and track the travel patterns of each individual or household in future years. The tour-based model simulates individual daily travel patterns as a series of linked trips or tours which begin or end at home or work. Trips are simulated as one of seven different tour purposes, such as work, school, or non-mandatory trips. The tour-based framework allows consistency across trip mode choice decisions. Someone who takes a bus to work, for example, would not be able to use a car for a trip during lunch because he or she would not have a car

available to make the trip. The simulation results are then aggregated and assigned to a transportation network (highway or transit service). Simulation results are also supplemented by forecasts of tourists, airport passengers, and commercial vehicle traffic.

Major inputs into the OahuMPO TDFM include long-range socioeconomic forecasts prepared by the City Department of Planning and Permitting in 2015 for the O'ahu Regional Transportation Plan. Long-range population, housing, and employment forecasts for 2040 were linearly interpolated to develop intermediate forecasts for 2020 and 2030. A monte carlo simulation was used to fit a synthetic population to these targets. Overall, the land use inputs included approximately 3.4% fewer residents in 2030 than previous projections, or a total of 1.1 million people.

Other model inputs include data from the 2010 United States Census, as well as travel behavior surveys of 4,000 households and 950 visitors conducted in 2012. An onboard survey of 26,300 bus riders in 2012–2013 was also incorporated into the model. These surveys were used to calibrate the travel mode choice components of the model—that is, how the model predicts that the synthetic travelers will chose to ride transit or drive an automobile.

Another major input into the TDFM is the underlying roadway and transit projects that are assumed to be in place at the time of the forecast year. This fare modeling study includes the committed short-range highway and transit projects included in the 2040 O'ahu Regional Transportation Plans that was adopted in April 2016. Proposed mid- and long-range highway projects through 2029 and 2040, respectively, are not included in the fare model study due to their implementation horizons.

The TDFM also includes an underlying bus route network in order to simulate how travelers will use the transit system. Although DTS is developing the bus service plans that will be implemented when the rail system opens, this fare study uses two scenarios for analytical purposes.

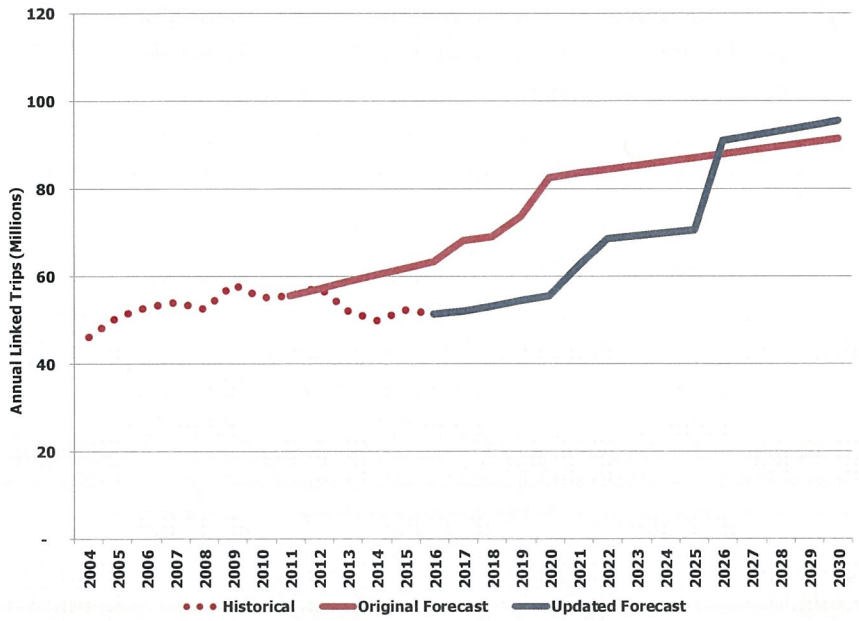
The full-opening forecast assumes the comprehensive long-term restructuring of the bus network that was described in the Project's FEIS. This conceptual long-term bus network includes the addition of new high-frequency community circulators, truncation of regional and peak-period express routes, and a modest expansion in the bus fleet. Overall, the 2030 bus network included a roughly 20% increase in bus service hours over 2011 levels and an increase in the peak bus fleet of 474 vehicles (approximately a 10% increase).

In FY2011, TheBus reported boardings corresponded to approximately 55.5 million linked trips (taking transfers into account). The original Operating Plan estimated ridership from the original travel demand model. Approximately 258,000 daily linked trips were estimated in the first full year of a bus and rail combined system in 2020. The forecast grew to 280,000 linked trips per day in 2030 for the bus and rail combined system. Figure 7-8 displays the original Financial Plan with the updated forecasted linked trips. The updated forecast

estimates approximately 279,000 linked trips in the first full year and 313,000 in the tenth year.

The figure also shows a gap has developed between 2012 and 2016. Beginning in 2013, the observed boarding and forecast began to diverge. There are a number of factors that may have contributed to this situation, but service hour reductions and the decreasing price of fuel beginning in May 2014 are likely contributors. The updated ridership forecast commences at the current ridership results from FY2016.

Figure 7-13 Historical and Forecasted Linked Trips for TheBus and the Project, FY2004–FY2030, Millions of Trips

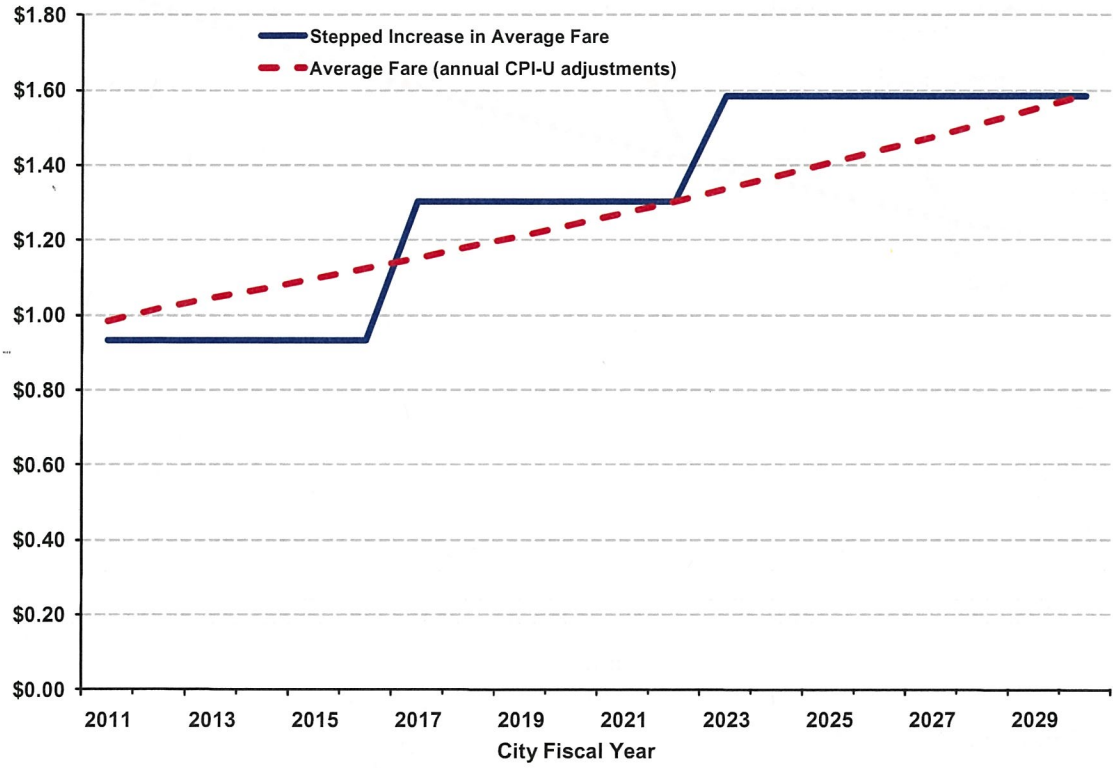


7.3.4.1.3 *Fares*

The following figure illustrates the assumed future fare increases from the original Financial Plan. This figure compares the stepped-up fare changes that are used as the basis for the fare revenue forecast, as compared to an annual increasing average fare. The original

Financial Plan growth in average fare is assumed as a "step function" with increases of approximately $0.37 in FY2017 and $0.28 in FY2023.

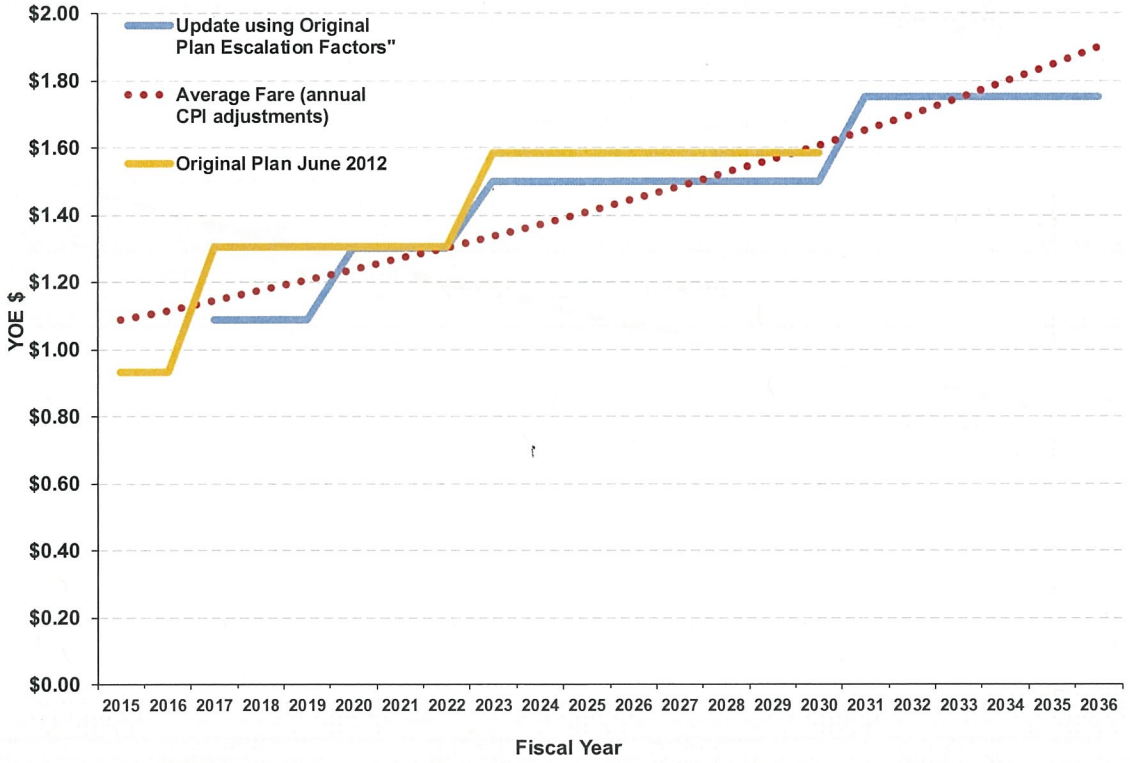
Figure 7-14 Original Financial Plan Fare Increases, FY2011–FY2030, YOE Dollars (Millions)



7.3.4.1.4 *Continuing the Original Plan Revenue and Cost Assumptions*

The following figure updates the original fare projection consistent with current City policies and fare products. The figure illustrates the impact of the shift in date of the full RSD. This figure assumes the updated rates based on cost escalation factors in the original Financial Plan as well as revenue factors developed in the FEIS. Under this scenario, rates increase $0.20 to $1.30 in FY2020; to $1.50 in FY2023; and $1.75 in FY2031.

Figure 7-15 Average Fare Comparisons Original vs Updated Plan, YOE Dollars (Millions)



7.3.4.2 Federal Funds

The City currently receives Federal funds through FTA's Section 5307 Urbanized Area Formula Program. As mentioned in the system-wide capital plan chapter of this Financial Plan, the majority of Section 5307 funds are applied first to ongoing capital needs with any surplus being used for preventive maintenance.

Beyond the Project construction period, the Financial Plan assumes that Section 5307 funds will be distributed first to fund the Project Capital Asset Replacement Program and ongoing system-wide capital expenditures; any remaining balance will then be used to fund preventive maintenance. The updated Financial Plan also includes a projected $1 million to $2 million annually for other federal grant programs.

7.3.5 System-wide Operating Plan

7.3.5.1 Original Financial Plan Methodology

As previously discussed, this projection scenario applies the original Financial Plan escalation factors to convert current dollar cost estimates to YOE dollars and utilizes the same fare revenue factors. In this scenario, total rail O&M cost would total approximately $127 million in the first full year of operations. This scenario would result in a cost savings of $1.8 million per year over the original Financial Plan cost projection inflated to the December 2025 starting date. Average fare rates would increase with CPI-U. The original Financial Plan had average fares rising from $0.93 per trip to $1.58 in the ten-year period ending in FY2030. In the updated Financial Plan, average fares would rise $0.17 to $1.75 over the ten-year period ending FY2036.

Exhibit J-1, *Operating Plan, Continued Original Plan Methodology*, in Appendix J provides the revenue, cost, and subsidy level through FY2036.

7.3.5.2 Moderate Range Scenario

Under this scenario, rail inflationary costs grow with projected increases in CPI-U. This scenario would increase total rail O&M costs by approximately $8 million (6%) in the first full year of operations over the original Financial Plan's FY2026 projection. The original Financial Plan had average fares rising from $0.93 per trip to $1.58 in the ten-year period ending in FY2030. In this scenario, average fares would rise $0.24 to $1.82 over the ten-year period ending FY2036.

Exhibit J-2, *Operating Plan, Moderate Range Scenario*, provides the revenue, cost, and subsidy level through FY2036.

7.3.5.3 High Cost Range Scenario

Under this scenario, rail inflationary costs grow from 3.6% to 3.8% annually for the most volatile cost categories to date: Core System labor and power costs. Growth in these cost categories would increase total rail O&M costs by approximately $15 million (11%) in the first full year of operations. The original Financial Plan had average fares rising from $0.93 per trip to $1.58 in the ten-year period ending in FY2030. In this scenario, average fares would rise $0.27 to $1.85 over the ten-year period ending FY2036.

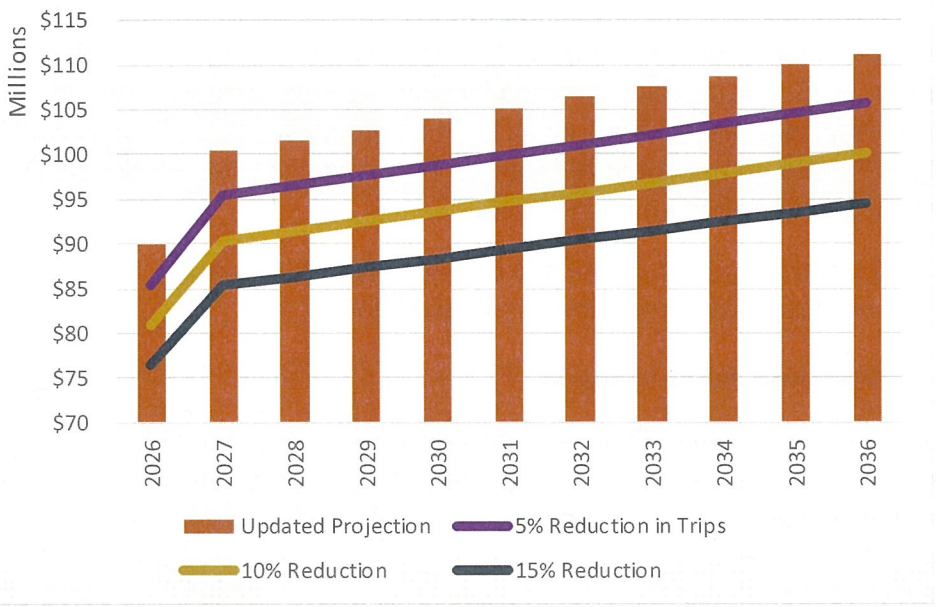
Exhibit J-3, *Operating Plan, High Cost Range Scenario*, provides the revenue, cost, and subsidy level through FY2036.

7.3.5.4 Slower Revenue Growth Scenario

Currently, there is not an automated system to capture ridership statistics. The bus and rail system will be equipped with an integrated automated fare collection system that will provide further insight into customer travel habits. Currently, surveys are preformed

periodically to determine customer travel habits. Given the reliance on survey data, potential changing customer travel habits, and other economic factors, this update models the impact of a more conservative revenue model. The figure below highlights the impact of a 5%, 10%, and 15% reduction in ridership.

Figure 7-16 Ridership Sensitivity, YOE Dollars (Millions)



The lower fare revenue in FY2026 reflects the full 20.1-mile rail system starting in 2026, midway through the fiscal year.

HART has contracted with CH2M Hill to undertake more detailed fare structure implementation options, including estimated ridership and fare revenue impacts. The core objective of this study is to evaluate alternative fare structure/fare policy options, including estimation of ridership and fare revenue impacts. This fare model will be used to estimate the ridership and fare revenue impacts of alternative fare structures, including changes to fare products, fare rates and transfer policies.

Exhibit J-4, *Operating Plan, Ridership Sensitivity, at Current Average Fare Rate*, provides the revenue, cost, and subsidy level through FY2036.

7.3.6 City Contribution

The City's contribution to transit O&M expenses is funded using local revenues from the General and Highway Funds. The General Fund comprises most of its revenues from the following taxes:

- Real Property Tax: Tax on real property based on assessed value; rates vary with property class.

- State Transient Accommodations Tax: 7.3% tax on a dwelling that is occupied for less than 180 consecutive days. The City has historically received a portion of these revenues.
- Public Service Company Tax: The City receives 1.9% of all public service companies' gross income.

The Highway Fund comprises most of its revenues from the following taxes:

- Fuel Tax: A 16.5 cent per gallon tax on all fuel sold or used within the City's jurisdiction.
- Vehicle Weight Tax: A tax on the net weight of all passenger and non-commercial vehicles (5 cents per pound), and motor vehicles and non-passenger-carrying vehicles (5.5 cents per pound).
- Public Utility Franchise Tax: A 2.5% tax on all electric power and gas companies' gross sales receipts.

During the period from FY1994 to FY2011, revenues from these sources totaled $14 billion, of which approximately $1.5 billion (11%) went to transit. The percentage in FY2015 totaled approximately 13%. The original Financial Plan percentage in the first full year of operations totaled approximately 19%. The updated Financial Plan, assuming no change in fare policies, fare products, and service levels, would increase to approximately 21% in the first operating year.

The Financial Plan forecasts the growth in these City Funds at an aggregate level and the resulting share that will be needed for transit operations. This forecast applies the aforementioned CPI-U inflation forecast in Honolulu as well as a real rate of growth equal to 1.3%, which is equal to the real growth experienced between FY1996 and FY2011.

Increases in other transit revenue sources, such as advertising, concession contracts, and development opportunities, could reduce the amounts required to be transferred from the City's General and Highway Funds.

Although the actual funding of the operating costs will involve further in depth review and extensive public discussion, additional offsets such as fare differentials, fare equity, cost effective routing, potential TOD related increases to tax revenues, and other revenues could provide additional resources for the Project.

7.3.7 Operating Cost Risks

7.3.7.1 Core Systems Contract

As described earlier, approximately 80% of the Project's O&M cost will be covered by the Core Systems DBOM contract, including pass-through utility costs. The O&M agreement includes pricing for labor, materials, management and administration necessary to support the O&M of the Project. As such, the risks and uncertainties around unit prices and service plan are strongly mitigated by the presence of this contract for up to ten years.

7.3.7.2 Cost Escalation – Labor, Health Care and Energy Prices

Escalation rates were applied to each Project O&M cost category from the Core Systems Contract and each object class for TheBus and TheHandi-Van O&M costs. This level of disaggregation allowed for consideration of differences in the growth outlook for various cost items, such as labor, health care or fuel prices, which may expected to increase faster than general inflation. Inflationary risks and uncertainties do remain, however, as the global and local supply/demand balance evolves. This is the case, for example, with energy costs in Honolulu, which are highly driven by oil prices and therefore are subject to its volatility.

7.3.7.3 Other Transportation Costs – TheBus and Handi-Van

The risks and uncertainties outlined above could lead to a higher level of O&M subsidy required to operate and maintain the City's public transportation system, that is, TheBus and TheHandi-Van. In the base scenarios, TheBus and TheHandi-Van are projected to grow at higher than general inflation. The updated Financial Plan projects TheBus operating subsidy (as measured by TheBus O&M cost minus TheBus fare revenues) per Revenue Vehicle Hour (RVH) to grow at a higher rate (3.8%) than the original plan (3.2%).

TheHandi-Van service levels are driven directly by ridership growth. The annual growth rate in TheHandi-Van ridership continues to be driven by the projected growth in population above 65 years old assuming 70% of the growth. TheHandi-Van's costs are projected to grow between 5% to 6% per year.

7.3.8 Operating Revenue Risks

Fare revenues are based on current demand forecasts for ridership and a continuation of current fare levels in real terms, which could both change due to a number of short-term and long-term factors such as the following:

- The state of the economy
- The local job market
- Population growth

- Traffic congestion on roads and main highways
- Fuel prices
- Land use and development plans

While the existing travel demand forecast has made some assumptions with regard to each of these variables, there are uncertainties surrounding the timing and extent of each.

The operating revenues included in the Financial Plan assume periodic fare increases that would maintain a FRR for TheBus and rail between 27% and 33%, in accordance with the City's current policy. However, the FRR would not be met if fares are not increased as shown in the Financial Plan.

The fare revenue forecast has not taken into account any temporary ridership decreases that could result from the fare increases based on previous experience demonstrating the relative inelasticity of the City's transit demand with respect to fares. Furthermore, the fare increases have been sized to increase the average fare at approximately the same rate as general price inflation, but on a less frequent basis. Accordingly, the fare increases should have a minimal effect on ridership. However, any reduction in ridership as a result of the fare increases could lead to a lower FRR.

7.3.9 Potential Mitigation Strategies for the Operating Plans

7.3.9.1 Advertising and Other Non-fare Operating Revenues

Expanding the advertising program could generate significantly more than the approximately $100,000 received by the City for bus advertisements. With the introduction of rail service, not only will there be an ability to advertise within each railcar, but the stations will also present potential advertising locations for local businesses. Based on 2011 National Transit Database data, Honolulu receives approximately $0.001 per boarding in advertising revenues, while similar larger-sized systems receive advertising revenues that are 10 to 100 times greater, after adjusting for ridership. Other miscellaneous operating revenue opportunities include the lease of ROW for telecommunications or the naming of stations. These funds could offset the City's contribution to O&M costs.

7.3.9.2 Parking Revenues

Demand for park-and-ride stations is strong in Honolulu, and charging even a nominal amount for daily parking could generate a significant amount of revenue. Collected parking funds could be used for capital and/or operating expenses, as parking surcharges could be used to offset the construction costs of the parking garages, or revenues could be used to offset operating costs of the garages including garage attendants and security personnel.

7.3.9.3 Improvement in Service Efficiencies in TheBus, TheHandi-Van, and Rail Operations

The addition of the Project to the existing transit network will likely result in some overlap of service between bus and rail. While some bus service and route modifications are planned as the Project is implemented, there is a possibility to further reduce redundancies in the bus service as rail ridership grows. This would have an impact on ongoing bus fleet replacement cycles, which can lead to reduction in both capital and O&M costs.

Productivity on TheHandi-Van system, as measured by the number of unlinked trips per RVH, decreased every year between FY2006 and FY2010 at a CAGR of -1.9%. However, the paratransit system experienced its first productivity gain in six years in FY2011, with riders per RVH increasing by 3.3%. The Base Case Financial Plan does not include any productivity gains beyond the one already captured in the FY2011 estimates. However, should the trend in productivity gains continue, growth in TheHandi-Van O&M cost could be further contained to mitigate a greater increase in ridership.

8 Sensitivity Analysis for Capital Cost and Revenue

8.1 Sensitivity Analysis for 10% Cost Increase

As discussed in Chapter 6, there are funding, cost and interest rate risks associated with the Project. Strategies available to HART to mitigate these downside risks include:

- Utilize the existing TECP bond program for short-term financing needs.
- Reduce HART's expenses and Project costs.
- Absorb higher interest rates above the conservative interest rates used to estimate financing. The HART financial plan uses an average 4% rate for fixed-rate debt and 3% for variable-rate debt. The average rates used are approximately 1% higher than the current market rate. Thus, HART can absorb reasonable increase in a rising rate environment.

8.2 Demonstrate Financial Capacity to Cover Delays in Receipt of FTA CIG Funding

HART has assumed a conservative FTA grant award schedule for the remaining $744 million in the financial plan, with annual receipt of FTA funds capped at $100 million. The figure below compares the estimated schedule for the remaining $744 million as compared to the initial $806 million. Using our average 4% interest on fixed rate debt, every $100 million delay increases debt service by $4 million annually. While we believe the FTA's interest is not to delay funding after the Recovery Plan is received, HART should be able to absorb short-term delays.

Figure 8-1 Obligated and Unobligated FTA CIG Funding

Fiscal Year Allocations	Obligated Amounts	Unobligated Amounts	Total
2008-2011	$119,990,000	---------	$119,990,000
2012	$200,000,000	---------	$200,000,000
2013	$236,277,358	---------	$236,277,358
2014	$250,000,000	---------	$250,000,000
2019	---------	$100,000,000	$100,000,000
2020	---------	$100,000,000	$100,000,000
2021	---------	$100,000,000	$100,000,000
2022	---------	$100,000,000	$100,000,000
2023	---------	$100,000,000	$100,000,000
2024	---------	$100,000,000	$100,000,000
2025	---------	$143,732,642	$143,732,642
Total	$806,267,358	$743,732,642	$1,550,000,000

9 Recovery Plan Summary

This 2018 Recovery Plan documents the significant changes and accomplishments that have been made to assure that the Project will be completed on budget and on time. While HART has agreed to use FTA's updated Project Cost of $8.299 billion and updated RSD of September 2026 resulting from the June 2018 Risk Refresh. HART is committed to the Project opening for passenger service on December 31, 2025 and completing the Project within a construction cost estimate total of $8.165 billion inclusive of contingency, excluding finance costs.

In addition to ongoing responsibilities and the actions stated in the Recovery Plan, HART's major upcoming milestones include completing construction of West Side stations, providing construction access to the Core Systems Contractor for installations on Functional Track, closing out the WOFH and KHG contracts with Kiewit, thereby reducing the size of the overall project and its associated risks, and relocating the both the wet and dry utilities in the City Center segment, procuring the CCGS and PHGTC as a DBFOM form of P3 and completion of HECO coordination and utility relocation. The CCGS DBFOM contract is the last major contract to be procured and the critical path for the overall Project. Utility relocation is a significant part of the CCGS contract in Honolulu's urban core, and HART is proactively performing pre-construction Subsurface Utility Engineering and geotechnical work. This final major contract will benefit from lessons learned and value engineering as well as updates to Project Controls, particularly the robust MPIS and Risk Assessment.

This updated Recovery Plan lays out the local funding now available to meet the current cost estimate and complete the Project, not including financing costs. It also details a carefully developed and internally tested analysis of the Project's management capacity and capability, which has resulted in a management structure oriented toward swift implementation of project controls designed to manage identified risks.

APPENDIX A

Project Maps

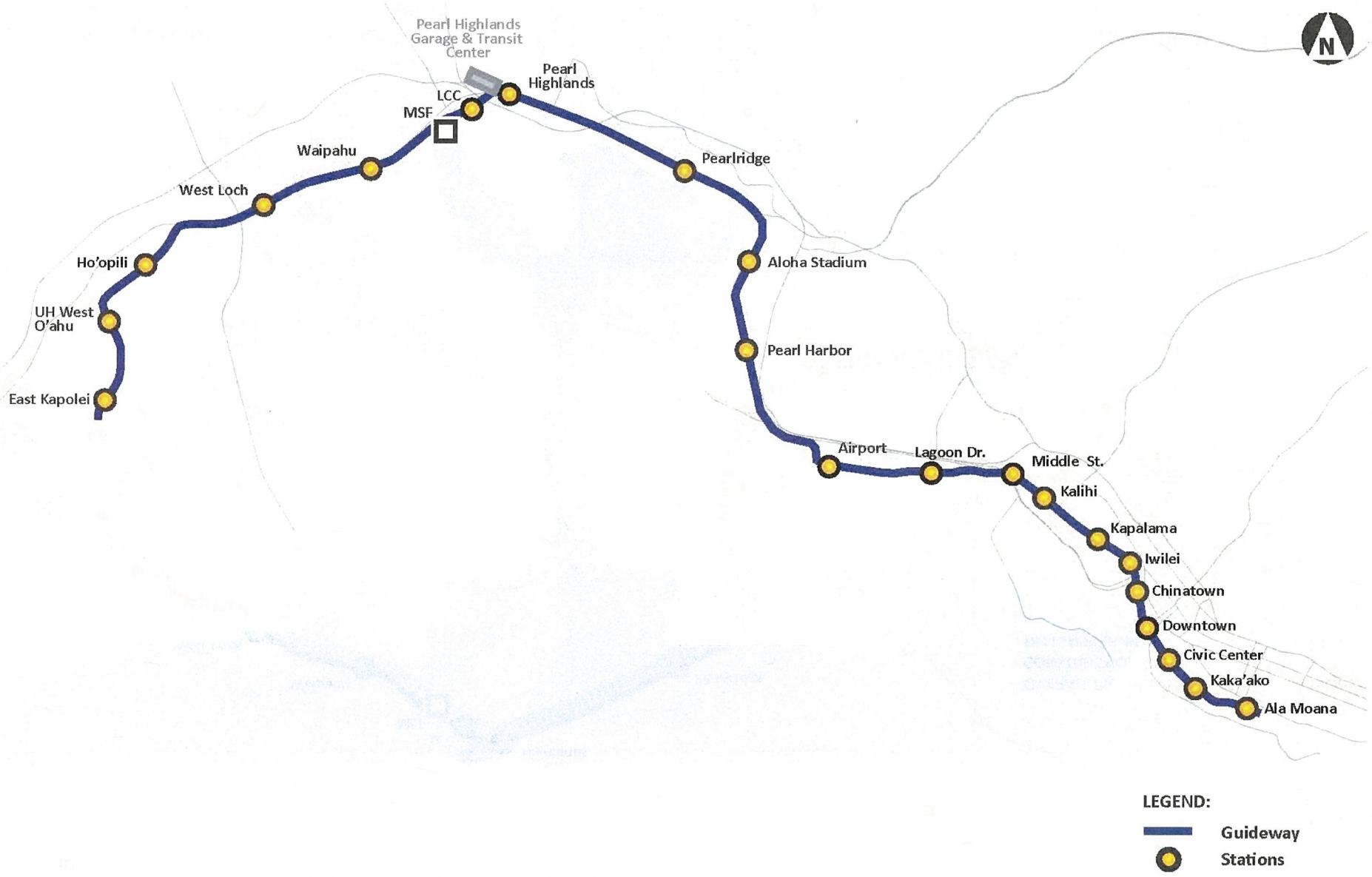
10152018

HART

HONOLULU RAIL TRANSIT

20 MILE ALIGNMENT 21 STATIONS

HONOLULU RAIL TRANSIT PROJECT



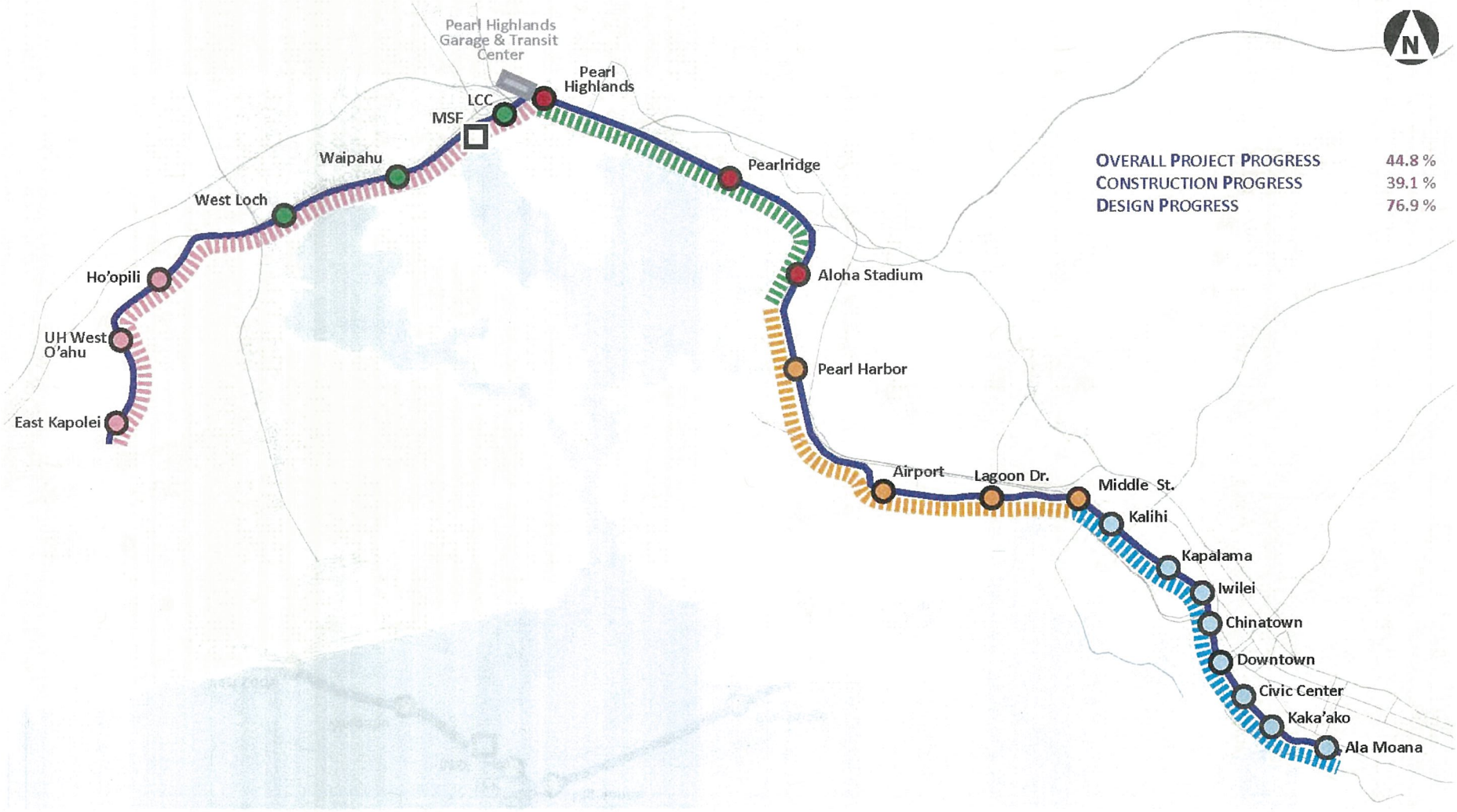
10152018

HART

HONOLULU RAIL TRANSIT

HONOLULU RAIL TRANSIT PROJECT

PROJECT PROGRESS & STATUS



OVERALL PROJECT PROGRESS	44.8 %
CONSTRUCTION PROGRESS	39.1 %
DESIGN PROGRESS	76.9 %

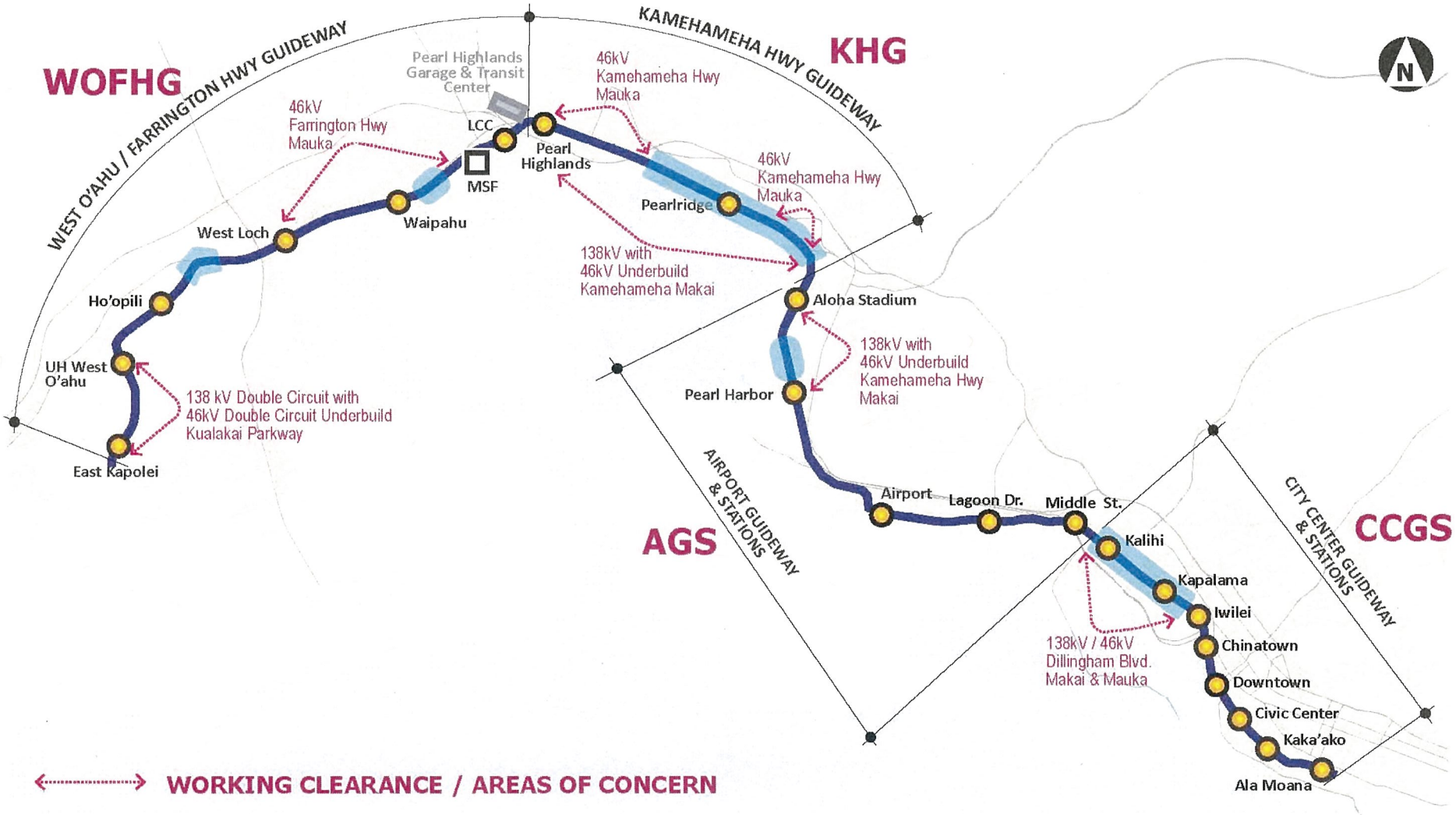
20-Mile Alignment Core Systems	West O'ahu Farrington Highway Guideway	Kamehameha Highway Guideway	Maintenance & Storage Facility	West O'ahu Stations Group (3)	Farrington Hwy Stations Group (3)	Kamehameha Hwy Stations Group (3)	Airport Guideway & Stations (4)	City Center Guideway & Stations (8)
CS	WOFHG	KHG	MSF	WOSG	FHSG	KHSG	AGS	CCGS
56 %	99.9 %	99.9 %	100 %	65.4 %	77.5 %	46.6 %	31.3 %	---
601M	662M	82M	274M	58M	82M	116M	875M	---

10152018

HART

HONOLULU RAIL TRANSIT

HECO CLEARANCE RELOCATION PROJECTS



APPENDIX B

Primary and Secondary Mitigation Measures, Value Engineering, and Cost Containment and Reduction Ideas, Implemented or Considered

Appendix B: Primary and Secondary Mitigation Measures, Value Engineering, and Cost Containment and Reduction Ideas, Implemented or Considered

B-1: HART Primary and Secondary Mitigations, and other Cost Reduction Proposals

Document Updated August 8, 2018

No.	Title	Cost Reduction Potential, and Target Date for Decision	Review Team Comments	Recommend to HART Mgt. for Further Development
	Secondary Mitigation (Cost Reduction) Proposals			
	Secondary mitigation consists of pre-planned potential scope or process changes that may be triggered when risk events occur that cause overruns that cannot be resolved by available project contingency. Triggered mitigation would enable the grantee to make cost reductions in a planned and orderly process and preserve contingencies for use later in the process. Secondary mitigations should be developed in the design documents and included as alternate bid items in the remaining procurements to assure that the final phase of the HART project remains within budget while holding sufficient contingency to resolve unexpected but necessary costs through project completion.			
	Secondary Mitigations Not Recommended			
1.f	Defer Pearl Highlands Garage and Transit Center.	$315.0M savings **Cost Estimating Assumptions:** See ROM dated 02/09/2017 **Target Date for Decision:** 2019-2020	Environmental: Would require a Post-ROD review and potentially other documentation. Operations: Negative effect on ridership. Schedule: Could pursue environmental approval in next 3 years, and build in 2022-25. General: Politically sensitive topic. FFGA: Would require an FFGA change.	This is an available secondary mitigation opportunity however it is not recommended as PHGTC is an essential part of the Project necessary for accommodating ridership from the central and northern parts of Oahu. However, in the event that the affordability limit for the project is exceeded, HART will be open to cost saving proposals (ATC's) from the P3's pertaining to the overall scope of CCGS and PHGTC, whether the reductions be value engineering proposals or secondary mitigations.
	Primary Cost-Saving Measures Recommended for Inclusion as ATC's in CCGS Procurement (Note: These are primary cost-saving alternatives, not Secondary Mitigations)			
6	Defer station canopies or simplify them for 8 eastern stations in CCGS.	$1.5M savings per station, x 8 stations = $12.0M savings **Cost Estimating Assumptions:** Change to Fritted Glass In lieu of Canvass Sails. Canvass sail canopy's cost roughly $3,000,000. Priced up Fritted Glass canopies for the Downtown station. Estimating received a verbal phone quote from Kula Glass at $149.52/sf so the all in cost for fritted glass canopies sitting on structural steel framing is $1,500,000. A savings of roughly $1,500,000 per station. Confirm ROM estimates. **Target Date for Decision:** July 2018	Environmental: Could be an acceptable idea within EIS commitments. Could require public meetings and input. Operations: Future impact if sensitive equipment is exposed to more rain. Schedule: This could be a DB priced alternative in CCGS procurement. General: Affects Core Systems equipment and electrical installations. Exposes PSGs to more rain. Consider public and political sensitivity if no cover or an aesthetically compromised cover is provided. HART Design: Needs to have direction in July 2018 in order to describe any changes in the DB procurement documents by Sept. 2018	Yes – exact designs to be determined by P3 proponents and to be proposed under the P3 Procurement process. Advantage would also include the possibility of including PV panels on station roofs. HART costs in terms of CE&I and interface risks avoided.
7	Preserve the current precast yard for use by CCGS versus acquiring a new yard nearby.	$20M from CCGS estimate line items (verify with ROM or ICE). Cost of efforts and improvements that would not need to be replicated: environmental approvals, clearing and grubbing, site grading and prep, suitable internal roads, trailers, utility connections, entrances	Environmental: Could be simplified because would not have to environmentally clear and develop another property for this industrial use. No post-ROD required or amendment of the APE. Operations: May mitigate a risk to Final RSD.	Yes.

No.	Title	Cost Reduction Potential, and Target Date for Decision	Review Team Comments	Recommend to HART Mgt. for Further Development
		(including signal), and batch plant. Confirm ROM estimates by Ben Kamph. **Target Date for Decision:** July 2018, but not later than December 2018 for RFP Part 2.	Schedule: Current schedule assumptions indicate less than one year of overlap between AGS and CCGS use of space. Continue to monitor both schedules and the viability of this potential future opportunity. General: HART is now paying a lease option on the new site until it is required for casting yard setup.	
8	Increase developer participation for the two Park & Ride lots at UH West Oahu, and Ho'opili.	Assume 15% savings of current budget of $50.4 million; Potential savings of $7.6 Million. ROM is pending.	Environmental: Depending on the type of development, could require a supplemental EIS. Operations: No impact. Schedule: No impact. General: There was a verbal commitment from developer to provide a small P&R (ask In-Tae).	Yes, explore with DL&R.
10	Eliminate the following non-essential items from CCGS: 1) Acrylic sound barriers. Replace with the normal concrete barriers along the guideway. 2) Additional aesthetically treated columns between the stations. 3) Guideway up-lighting between the stations.	Assume $7M savings. Need ROM update. Guideway01 ROM for this idea (Guideway01 proposal) was $13.45M but team suggested that is too high. **Target Date for Decision:** July 2018	Environmental: These are not EIS commitments, so they could be omitted if not affordable. Mitigating the noise with a sound barrier (or other method) is required, but not the type of barrier. Operations: Small savings to future O&M. Schedule: RSD not affected. General: Consider political and community sensitivities. Some of these elements are already stated as Priced Options in the draft CCGS RFP.	Yes.
13	Pursue a permit to drill in the harbor to support the Makai side of Chinatown Station. Simplifies the structure, which is currently designed as a cantilever.	Possibly $3M savings for simplified structure ROM is pending **Target Date for Decision:** Dec. 2018	Environmental: Need to pursue a permit for work in the harbor. A Post-Rod would be required. Operations: Aesthetic enhancement due to reduced structure of cantilever. Less steel structure to routinely paint. Schedule: Permit could be pursued parallel to DB's work, to not delay CCGS procurement. HART Design: Design team is exploring feasibility of this idea with other agencies. If feasible, it will be noted in RFP Part 2. General: DB would have to price both options in case permit is not granted.	Yes.
	Other Secondary Mitigations Not Recommended for Reasons Noted			

Appendix B: Primary and Secondary Mitigation Measures, Value Engineering, and Cost Containment and Reduction Ideas, Implemented or Considered

No.	Title	Cost Reduction Potential, and Target Date for Decision	Review Team Comments	Recommend to HART Mgt. for Further Development
1	***Pearl Highlands Garage and Transit Center (PHGTC) Ideas:***		Environmental: On all of these Pearl Highland options, the final design will have to meet no-rise requirements (to determine if the project will increase flood heights) without affecting no-rise condition for WOFH and Pearl Highland Station contracts.	
1.a	Build 3 lower levels of the PHG with sufficient structure for future vertical expansion. Defer the upper 5 levels of the garage.	$35.0M savings **Cost Estimating Assumptions:** First floor parking level is $83,100,000. Upper levels cost $7,428,571/floor. **Target Date for Decision:** July 2018 if bundled with CCGS P3	Environmental: Possible new USACE 404 Permit needed, but we have time to pursue. Post-ROD review would be needed. HART may need to identify another way to meet or address the parking commitments made. Operations: Current Rideshare systems and the advent of Autonomous Vehicles (AV's) could reduce future demand for parking. Schedule: Could pursue permit in next 3 years, and build in 2022-25. General: Opportunity for significant savings, and avoids over-building in case Rideshares and AV's become more mainstream, to get people to/from the station. FFGA: FFGA change needed to "omit" upper floors rather than "defer." HART Design:	Not recommended due to the result of having DB or P3 firms having to absorb the time and cost to prepare two designs for PHG. Complicates the procurement.
1.b	Eliminate the upper levels of the PHG and replace the equivalent parking project with surface parking somewhere else. New locations have yet to be determined.	$7.3M savings **Cost Estimating Assumptions:** At 259 stalls per floor, and $7.428M/floor = $28k per parking stall, less $14k per at-grade stall = $14,000 deduct per stall. Assume 518 stalls deduct. **Target Date for Decision:** July 2018 if bundled with CCGS P3	Environmental: No impact to current USACE Permit if garage foundation footprint stays the same. Environmental clearance (Post-ROD or Supplemental EIS) will be needed for the surface parking to be located elsewhere. Operations: Public can board at different stations closer to Park & Ride lots. Schedule: Could pursue more surface parking from 2018 to 2021, in time to build by 2025. General: Opportunity for significant savings, and avoids over-building in case Rideshares and AV's become more mainstream, to get people to/from the station. FFGA: FFGA change may be needed.	Not recommended due to the result of having DB or P3 firms having to absorb the time and cost to prepare two designs for PHG. Complicates the procurement.
1.c	Combine the Transit Center (TC) and Garage into one structure to reduce	$24.4M savings	Environmental: Possible new USACE 404 Permit	Not recommended due to the result of having DB or P3 firms having to absorb

No.	Title	Cost Reduction Potential, and Target Date for Decision	Review Team Comments	Recommend to HART Mgt. for Further Development
	the footprint, with TC on level 2 or 3. Allow joint development on surplus property such as an extension of the planned adjacent Waiawa Development (from the development arm of the trust that owns Kamehameha School).	**Cost Estimating Assumptions:** Will need to add another floor to make up for parking loss and build a pedestrian bridge from parking garage to the station. Parking garage will need to remain in the current location because of the way the rail line curves to enter the station. See attached ROM. **Target Date for Decision:** July 2018 if bundled with CCGS P3	needed, but we have time to pursue. Will need to identify another way to meet or address parking commitments made. Regarding Joint Development: Would need evaluation into divesting federal interests and compliance with HRS 343. Supplemental EIS may be needed to incorporate joint development. Operations: Enhanced operations because parking much closer to transit. See site plan. However, the guideway would need to run through the parking structure, affecting ramping and circulation, which is not ideal. Schedule: Could pursue permit in next 3 years, and build in 2022-25. General: Could simplify the H2 ramp into the garage. Need to evaluate if there is sufficient floor space for the TC. If lower floor area must increase, this offsets the savings.	the time and cost to prepare two designs for PHGTC. Complicates the procurement.
1.d	Revise the structure of the PHGTC for a lower cost structure.	Possibly $20M savings. ROM pending. PHGTC is a good candidate for a VE study, with emphasis on the structural support system which is costly due to elevated structure within a flood plain. **Target Date for Decision:** July 2018 if bundled with CCGS P3	Environmental: Possible new USACE 404 Permit needed, but we have time to pursue. If new ROW is required, this needs to be included in the upcoming RAMP revision. Operations: Not affected. Schedule: Could pursue permit in next 3 years, and build in 2022-25. General: Need a structural evaluation of the feasibility of this idea.	Not recommended due to the result of having DB or P3 firms having to absorb the time and cost to prepare two designs for PHG. Complicates the procurement.
1.e	Change the PHG design to shrink the footprint of the garage and provide fewer spaces.	$13.5M savings **Cost Estimating Assumptions:** A 10% reduction is $13.5M. A 20% reduction would be $27.0M. **Target Date for Decision:** July 2018 if bundled with CCGS P3	Same comments as in part (a) above.	Not recommended due to the result of having DB or P3 firms having to absorb the time and cost to prepare two designs for PHG. Complicates the procurement.
5	Defer a station entrance (1 of 2) at each of the following downtown stations: Kalihi, Downtown, and Ala Moana. This pertains only to the deferral of the Fare Gate Entry Module.	$4.5M savings ($1.5M x 3) if only the fare gate entry modules are reduced at 3 stations. $13.5M savings ($4.5M each x 3) if the whole station entrances are removed at 3 stations. July 2018 for scoping	Environmental: Post-ROD evaluation and Environmental Justice analysis may be needed. Operations: Future inconvenience to ridership by having to cross street at grade to access other side of station. Schedule: Could have DB price the alternative. Build the FGEM if affordable.	Not recommended due to compromise to station access by public, inconsistency with other western stations, political and public sensitivity to compromised stations.

Appendix B: Primary and Secondary Mitigation Measures, Value Engineering, and Cost Containment and Reduction Ideas, Implemented or Considered

No.	Title	Cost Reduction Potential, and Target Date for Decision	Review Team Comments	Recommend to HART Mgt. for Further Development
			General: Consider public and political sensitivity.	
12	Reduce size of surface parking lot at UH W Oahu from 1000 spaces to something smaller, and pursue joint development.	$1.4M savings At $14,000 per stall, assume 100 stalls **Target Date for Decision:** July 2018 if bundled with CCGS P3. Dec. 2018 if not part of CCGS P3.	Environmental: Need input from Planning. Will need to identify another way to meet or address the parking commitments made. Regarding Joint Development: Would need evaluation into divesting federal interests and compliance with HRS 343. Supplemental EIS may be needed to incorporate joint development. Operations: Introduction of AVs, and current Rideshare could reduce future demand for parking. Schedule: Time to pursue without impacting RSD. General: Need concurrence and participation from UH. FFGA: FFGA change may be needed.	Not recommended due to minor savings and compromise to environmental commitments.
14	Omit or defer Chinatown Station.	$27.0M **Cost Estimating Assumptions:** See ROM from 2017 **Target Date for Decision:** July 2018	Environmental: Would require at least a Post-ROD review. Operations: Affects ridership. Schedule: Could obtain pricing from the DB while pursuing the Environmental approvals. HART Design: Would need direction to describe in procurement document which needs to be drafted by Sept. 2018. Would need to describe partial infrastructure still in place such as TPSS. General: Highly politically sensitive topic. FFGA: Would require an FFGA change.	Not recommended due to interruption of service downtown, and City concerns. If the station is added back in later it would be at a much higher cost.
	Ideas Discussed and Failed			
2	Defer the purchase of one or more trains	$3 million per train; or $9 million for 3 trains **Cost Estimating Assumptions:** The net cost deduction should be $3M for a complete 4 car train. Assume 3 EACH **Target Date for Decision:** May 2018	Environmental: Would not require new EIS or ROD. Operations: Plan is for 20 trains. Reduction affects the spare ratio to just over one train every 5 min at Full RSD. Schedule: Interim and Final RSDs not affected. General: Significant contractual concern to omit from ongoing CSC. Could breach the service agreement. Additional trains could be purchased later.	Rejected during discussion with Bob Good and PMOC on 10MAY2018. HART is under contract. Credit for omitting a train would be minimal at this point in the process.

Appendix B: Primary and Secondary Mitigation Measures, Value Engineering, and Cost Containment and Reduction Ideas, Implemented or Considered

No.	Title	Cost Reduction Potential, and Target Date for Decision	Review Team Comments	Recommend to HART Mgt. for Further Development
3	Change to a Communications Based Train Control (CBTC) system.	Possibly $20 million savings in initial capital cost, and annual O&M of $0.5 million. See Risk Analysis. Can sell surplus property. **Target Date for Decision:** July 2018	Environmental: No new documents required. Improves functionality because it shortens the headways. Operations: Improvement. Schedule: Make part of CCGS procurement. General: Affects East and West with switch to CBTC.	No. Idea has been studied by Core Systems team and failed due to AHJV's investment in and support for a block system, versus CBTC.
4	Consider participation of stores or developers to pay the cost of downtown stations such as Ala Moana, Kaka'ako, and Civic Center. Concept has been done in other cities.	Significant savings; approx. $20M/station x 3 stations = $60 M total. Need ROM to confirm. **Target Date for Decision:** July 2018	Environmental: Supplemental EIS may be needed to incorporate joint development. Operations: Enhancement. Schedule: Would likely defer procurement of CCGS while developer participation agreements are reached. General: Significant savings potential if we can attract partners to build or pay for the stations in conjunction with their revenue producing additions. Consider creating a Community Facilities District (CFD) around the stations. As part of the development entitlements for high density housing, require a contribution to the CFD for the construction of the station in lieu of the reduction of parking requirements. Timing may be long due to revised zoning ordinance among other development review considerations.	Not feasible. Proposal discussed with Sam Carnaggio, 04JUN2018
9	Omit the dedication plaques at stations.	Small savings, possibly $0.1M. ROM is pending. **Target Date for Decision:** March 2020, so that if installed then in time for Interim RSD.	Environmental: No new documents needed. Operations: No impact. Schedule: No impact. General: Consider political and community sensitivities on this proposal.	Remove this idea from consideration due to its small cost saving potential and because plaques are warranted. Remove from list per discussion with Project Director and PMOC in June 2018.
11	Quickly close-out western contracts and return values held in risk back to project contingency.	Confidential savings. Assume place-holder of $10M but actual estimate lower or higher is not disclosed. **Target Date for Decision:** December 2018	Environmental: No negative impact. Operations: No negative impact. Schedule: No negative impact. General: Encourages competition for CCGS work.	N/A as Secondary Mitigation.
15	Allow DB to propose Alternative Technical Concepts (ATC's) to reduce cost on the CCGS project. (This is already allowed in the CCGS procurement documents.)	Need ROM. Assume a reasonable % reduction in forecast acceptable alternatives. CCGS: Assume a savings from ATC's of 1% of $1,017.6M = $10.2M savings	Environmental: ATC's must respect the environmental, programmatic agreement, and FFGA commitments. Operations: TBD.	This is not a Secondary Mitigation.

Appendix B: Primary and Secondary Mitigation Measures, Value Engineering, and Cost Containment and Reduction Ideas, Implemented or Considered

No.	Title	Cost Reduction Potential, and Target Date for Decision	Review Team Comments	Recommend to HART Mgt. for Further Development
		Target Date for Decision: Completed already	Schedule: Respects current CCGS procurement schedule. General: Allows DB innovation. Note: This is already captured as an opportunity in the CCGS Risk Register.	
16	Allow DB to propose Alternative Technical Concepts (ATC's) to reduce cost on the PHGTC project.	Assume a savings from ATC's of 1% of $314.7M = $3.1M savings **Target Date for Decision:** July 2018 if bundled with P3	Similar comments to Proposal 15 above.	This is not a Secondary Mitigation.
F1	Shift the guideway from the centerline of Dillingham to a side of the road to avoid significant utility relocations	Had HART known of the HECO offset requirement, this idea would have been proposed in the initial EIS for significant savings in utility relocations of over $50 Million.	Environmental: Post-ROD evaluation needed to assess impacts due to right-of-way and Historic properties. Potential for Supplemental EIS. Operations: Would delay Final Revenue of Service due to further environmental study and design time. Schedule: Compromises RSD beyond 2025. General: The advantage is utility cost savings through reduced relocations. This idea was previously ruled out. Increases R/W acquisition.	No
F2	Omit up-lighting at the City Center Stations illuminating the underside of canopies.	Had been an item in a previous VE study.	This lighting is necessary for passenger security and access. Omitting this lighting would be a compromise to public safety.	
F3	Structure procurement for CCGS to take on the contractor doing the precast for AGS, for efficiency.	Not calculated.	Fail idea due to numerous disadvantages: warranty issues, potential risks and claims, procurement issues.	
F4	Have developers pay for parking garages. This was done in South Africa, where the developers took on the operations, and paid for the garages.	Not calculated.	HART did a P3 study for PHG TC. Was found to not be viable. Schedule: Would defer procurement of CCGS. Environmental: Probably no effect, but it depends on what developers propose. Cost savings: Could be significant if we could attract developers to build these garages.	
F5	Shift Ala Moana Station to Pensacola St.	Anticipated to be a cost increase as a result of schedule impact and increased project duration, escalation and soft costs.	Previously failed due to R/W impacts. Would require a Post-ROD evaluation and potentially supplemental environmental documentation.	

B-2: Value Engineering Proposals, Implemented from Previous VE Studies and Under Consideration by HART

HART implemented a formal Value Engineering (VE) Study in 2011 on the overall rail transit corridor. The VE study was facilitated by Value Management Strategies (VMS). The significant implemented ideas from this VE study, with approximate cost savings for each item, are listed below.

a) Load test more shafts and increase resistance factor. Savings: $25 Million.
b) Use tip grouting for drilled shafts. Savings: $5 Million.
c) Perform sequential testing with O-cells for friction. Savings: $18 Million.
d) Minimize the use of permanent casing for drilled shafts. Savings: $47 Million.
e) Optimize lateral resistance of drilled shafts. Savings: $10 Million.
f) Shift guideway alignment makai at Middle Street Station. Savings: $1.3Million.
g) Relax coincident vertical and horizontal geometric design criterion and lower profile. Savings: $1.1 Million.

Additional Value Engineering efforts by HART include:

h) 2016: Primary and secondary mitigation lists submitted to FTA (26 Primary mitigations, and 52 Secondary mitigations, and 6 Funding ideas) have been considered. Eleven of these ideas have been implemented or partially implemented representing approximately $25 million in savings to the project.
i) 2016: Alternative Technical Concepts (ATC's) on AGS. (These ATC's are proprietary to the bidders but have resulted in approximately $25 million in savings to the project.)
j) 2012: Station modular design. This has saved approximately 10% of the station costs for modularity, equating to $20 million in savings.
k) 2011: ATCs on KHG. (These ATC's are proprietary to the bidders but have resulted in approximately $20 million in savings to the project.)
l) Pre-2011 station VE study for efficiencies in station layout and concept design.
m) 2010: ATCs on WOFH (These ATC's are proprietary to the bidders but have resulted in approximately $20 million in savings to the project.)
n) Structures optimization study, one for superstructure, one for substructure (PB for HART in the 2007-2008 timeframe). Resulted in the implementation of drilled shafts and segmental box. This value planning effort was to implement the guideway work the most economically.
o) The modular station design. The Guideway VMS study. Ala Moana station shift. ATC's on WOFH, KHG, AGS. Ranged $20 to $30M in savings per project.
p) 2016: Split out advanced Dillingham Temporary Utilities (DTU) packages to reduce CCGS schedule, overhead, and risk pricing. Implemented savings: $40 Million.
q) 2016: Allowed AGS contractor to use drilled shaft load test data from WOFH and KHG. Implemented savings: $20 Million.
r) 2016: Relaxed mass concrete specification to reduce cooling requirements. Implemented savings: $10 Million.

s) 2015: Split 9-pack of West Side Station Group (WSSG) stations into three 3-packages including WOSG, FSHG, KHSG. Implemented savings: $46 Million
t) 2013: Eliminated method shafts on Kamehameha Highway Guideway (KHG) Implemented savings: $2 Million
u) 2012: Eliminated guideway lighting. Implemented savings for full guideway: $12 million.
v) Value Engineering Change Proposal (VECP) for piles at Waipahu Station. Implemented savings: $3 Million.
w) Eliminating bioretention where possible. Implemented savings is under review.
x) Deferring certain elevators for future installation. Implemented savings: $20 Million.
y) Change of the canopy design. Implemented savings: $10 million.
z) Minimize the need for station personnel. Future cost-savings in personnel (not calculated)
aa) HART's directive drawings require all final designers to specify stainless steel balustrades. The change to galvanized steel was included in the 12/19/2014 FHSG bid documents. Implemented Savings: $1.4 Million.
bb) Kapalama station originally had Fare Gate Entry Modules (FGEM) on both sides of Dillingham Blvd. The Makai side FGEM has already been deleted, but could be provided under a future Transit Oriented Development (TOD) agreement. Implemented Savings: $1 Million.

Recently Implemented Cost Reduction Ideas

a) Early utilities package for CCGS: Savings: $40Million in reduced overhead cost, plus significant risk and cost-avoidance estimated at $300 Million. The savings is due to working with smaller local utilities contractors on a task order basis versus a much larger design-builder with greater higher overhead costs who would claim significantly higher damages in case of utility delays affecting guideway and stations.

Value Engineering Ideas under Consideration by HART

a) Moving the terminus of Ala Moana by 200 feet. This alignment change will help with future project extensions to UH Manoa and saves money: $6 Million.
b) Reducing cost of ROW acquisition by using property slices versus full takes. HART has only had full takes of 15 properties. There have been hundreds of partial takes which have maintained the businesses in place.
c) Utilizing several properties by leasing to others until such time as HART must take it for construction purposes. DL Horton, UH, DLR.
d) Bringing value to adjacent property for reduced cost of land.
e) Concessions and advertising at stations. Looking at power, utility connections, and space requirements to accommodate in the future.
f) The Pearl Highlands Station Parking Garage provides 40% of the total number of spaces required by the project as indicated in the FEIS. Defer until a funding sources has been identified. Provide temporary parking at other location, such as adjacent to the UHWO Station, the Hoopili Station, or elsewhere. Cost saving potential: $215 Million.

g) At the Downtown Station, the Makai fare gate entry module (FGEM) could be deleted, but vertical circulation would still be required on Makai side to access the Makai platform. Bathroom on Makai side would be eliminated. Bathroom on the Mauka side would be expanded. Cost Saving Potential: $1.5 Million.

B-3: Lessons Learned

Program Lessons Learned are being compiled by the Director of Risk Management and will be checked on all new projects moving forward with appropriate persons or teams in an effort to avoid the problem from recurring.

No.	Title	Description
1	Award contracts for the Project only after all Federal documents, such as the EIS, the ROD and the FFGA have been executed.	The City and County of Honolulu is the recipient of the Federal grant and managed the initial aspects of the Project. The City awarded contracts to the contractors as follows: November 11, 2009 — Award to Kiewit for WOFH for $482,924,000 June 14, 2010 — Original Environmental Impact Statement January 18, 2011 — Original Record of Decision June 30, 2011 — Award to Kiewit, KHG for $372,150,000 June 30, 2011 — Award to KKJV, MSF $195,258,000 July 1, 2011 — Creation of the Honolulu Authority for Rapid Transportation (HART) November 28, 2011 — Award to Ansaldo, Core Systems for $1,397,387,093 December 19, 2012 — Full Funding Grant Agreement May 28, 2013 — Supplemental Draft Environmental Impact Statement September 30, 2013 — Supplemental Final Environmental Impact Statement September 30, 2013 — Amended Record of Decision The timing of the award of these contracts contributed to the filing of lawsuits which caused significant delays and costs.
2	Avoid committing funds in the financial plan that would impact the local community and existing transit operations.	The FFGA Financial Plan included a total of $210 million of 5307 Formula Funds to fund the Rail Transit Project over a six year period. 5307 Formula Funds can be used for a variety of purposes such as: planning, engineering, design; capital investment in bus and bus related activities, such as bus replacement and overhaul; capital investments in new and existing fixed guideway systems; and preventive maintenance. Although, this figure represented only 4% of the total project funding, it caused concern with the transit rider community. The bus and Handi-Van riders were concerned that the use of 5307 Formula Funds for the rail project over a six year period could result in program reductions in the existing services. Affects on community support for the project from this situation need to be considered.
3	Avoid awarding contracts until Third Party Agreements with State, City and other entities, such as universities, have been executed.	A clear understanding, documented for the record, of each parties' expectations and commitments, is essential to progressing the work forward with minimal impacts.
4	Avoid awarding contracts until agreements have been executed with the local utilities	A clear understanding, documented for the record, of each parties' expectations and commitments, is essential to progressing the work forward with minimal impacts.
5	Avoid awarding contracts until the majority of Real Estate and Right-of-Way have been acquired.	Securing all of the required properties, including temporary construction easements, along the corridor is essential to smoothly progressing the work. While the HRTP has kept out in front of most ROW needs, there have been instances where the lack of property has either caused higher bid pricing due to uncertainty, or directly affected the ongoing work from a schedule and cost impact standpoint.
6	Align contract packaging in such a way as to ensure contractor coordination and to minimize potential impact to other contracts by the lack of performance by a single contractor.	The fact that the interface processes and procedures were not fully established prior to the first contracts being let in 2009/2010, created disparities in the requirements with later contracts, making implementation more difficult. Provisions for the identification and resolution of interface issues during construction for the Design-Bid-Build contracts should have been established earlier during the overall project. Finally, requiring the contractors to create a tabulation of interface points at the beginning of their contracts, in concert with their interfacing partners, is conducive to smoother implementation of interface processes. This is as opposed to initiating interface communications on an ad hoc basis as issues arise.
7	Develop contracts of a size and nature to ensure participation and	Along with the robust market conditions, a more thorough initial assessment of the contracting capabilities and capacities in Hawaii's remote setting may have altered the initial contract packaging plan to accommodate local contractors and subcontractors. Other concurrent private work (commercial and high-rise residential) has stressed the capacities of most Hawaii-based construction companies, driving higher costs on less familiar

No.	Title	Description
	competition by the local contracting community	work (HRTP) for an unknown owner (HART). Given the choice of current opportunities, most local firms favored their bread-and-butter, repetitive floor plate work rather than venturing into new territory – or – they priced their work accordingly (higher) on the HRTP.
8	Recognize Current and Future Market Conditions	Unfortunately, the delays in the initiation of the Project and interruptions caused by lawsuits occurred at a time of extraordinarily significant increase in market cost, causing labor, material, and equipment costs to soar during the subsequent several years. While some accommodation for escalation was provided in the 2012 Full Funding Grant Agreement (FFGA) at approximately 3% per year, one could not have forecast that escalation in Hawaii would experience quadruple that expectation in 2014 and 2015, projecting the same for 2016 (12% annually), then somewhat tapering back. There is a fine balance in assessing this escalation rate projection during the execution of an FFGA, trying to keep initial cost projections down while including some conservatism in case significant cost increases occur. Given the history of this program, along with other recent major capital programs in the US, it does appear that the best lesson is to be more conservative in initial FFGA cost estimates and escalation projections.
9	Focus on detailed contract scope refinement	Coupled with the assessment of the local contracting capabilities, keeping the right scope in the right package could have been improved upon, given what is known now from contractor feedback and the complexity of interfacing several separate contracts. For example, the long-span platform box girders included with the station entry building contracts would have been more appropriately included in the large bridge structure guideway contracts. Similarly, the low voltage electrical scope (public address, fire alarm, security, etc.) being performed by the Core Systems Contractor, and the furnishing and installation of the elevators and escalators let as a separate contract, would be more effectively performed by subcontractors working for the station general contractors. Some of these lessons have been implemented in the development of the east guideway contracts as Design-Build contracts containing both the guideway and stations. The low voltage and elevator/escalator complexity remains however, to be handled as an ongoing interface resolution issue.
10	Become more aware of contractual risk management	Placing all, or nearly all, of the risk on a contractor or consultant will inevitably drive initial project costs higher. Conversely, preparing contract terms and conditions where the owner takes the majority of risk can result in significant claims and subsequent cost overruns as well. HART's contracts, general conditions, special provisions, and other terms of agreement have continued to evolve over the past several years to try and strike a balance between overly onerous or too lenient terms. After the over-budget west side station package results, contractor feedback solicited in late 2014 resulted in a major re-write of the general conditions and special provisions and the initial results from the new west side station procurements have been favorable.
11	Begin Traffic Planning and Management before contracts are awarded	The trade-off between mobility of commuters and accessibility to property is extreme due to localized travel behavior and past practices of contractor responsibilities for MOT. Historically, HDOT and other agencies impacting traffic have provided broad guidelines to the contractor and that has been adequate. The same principles have been applied to HART's project. However, in other locations where projects of this duration and complexity have had such a major impact, there has been much more extensive traffic planning and impact analysis. HART acknowledges their need to partner more closely with the City and with property owners to work through these issues in concert with the contractors. This is getting much more scrutiny than previously as the project migrates from West to East applying real time what is learned on almost a daily basis. Another aspect of this is the need to be more pre-active in the business impact mitigation at an earlier stage of the project. There is a need to anticipate the impact, provide outreach to the businesses before the impact and together develop mitigations to assist them.
12	Ensure that Technical Capacity and Capability is acquired early and is redundant	Globally, the quantity of qualified transit professionals is in short supply as the demand for transportation choices and more sustainable solutions is increasing faster than Universities and direct experience can maintain. The HRTP is a major undertaking that will take many years to complete. Staffing up with the correct technical skills at market prices within the City's salary structure is a challenge. Mobilizing the requisite transit expertise from outside the state of Hawaii and combining with local professional skills with enough people to cover the volume of work to be performed is the key. The problems of relocating to Hawaii are not new. The cost of living and sacrifices to personal family situations are a barrier of entry let alone acceptance and integration into the community which is based on long standing extended family social structures. Attrition rates are higher than most comparable projects and the impact of these factors on schedule, budget and quality is difficult to quantify. Succession planning and incorporating more local staff while transferring technologies, tools and best practices is essential for HART's long term success.
13	Temporary Construction Easement (TCE).	As a HART management decision, it was decided to transfer the responsibility of obtaining and managing all TCE's to the DB's. Consider a list of HART owned properties in the RFP. Have contractor price the risk in their bid. This will leave HART with more important R/W acquisition tasks for full or partial takes, but not with means and methods that the contractor needs to determine resulting in TCE's. Resolved for City Center if it is DB, but if it is DBB, then HART may coordinate some TCE's because our design is not constructible within the existing R/W without the benefit of TCE's.
14	Not all parcels acquired prior to NTP for earlier CCGS. Anticipated availability dates included in RFP. Led to delay claims in other projects.	Identify and prioritize parcels and put into a schedule to define anticipated times. Once dates map out, include in RFP +X days (current strategy). Evaluate risk with FTA approval. August 2017 update: Lesson learned is going to a unit rate type contract for utility work.
15	Unidentified easements or ROW parcels.	If the change is triggered by change of design then responsibility of DB per RFP, provided it's constructible. Constructability review of utility and roadway design. August 2017: Risk response strategy is to perform a constructability review of the utilities and roadway design to make sure sufficient property is available for construction use.

Appendix B: Primary and Secondary Mitigation Measures, Value Engineering, and Cost Containment and Reduction Ideas, Implemented or Considered

No.	Title	Description
16	Quality of stamped plans (utility and roadway).	SUE data provided to AECOM for their design. Constructability reviews including independent third parties such as HECO, HDOT, HTI, AT&T, Hawaii Gas. August 2017update: SUE data is being completed and will be provided to AECOM from August 2017 through November 2017. This information will strengthen the utility system design for CCGS.
17	SP-7.3.2 on misidentified/unidentified utilities. 365 days for investigating unknown utilities.	Cap or share the risk via deductibles. Include list of properties that have not been investigated. August 2017 update: HART takes responsibility for any misidentified/unidentified utilities in year 1 of the contract. After that the risk is transferred to the DB. If it changes to DBB then HART owns this risk.
18	HECO Work	Analysis of whether third party or DB contractor. August 2017 update: We have a choice of one or two contractors for conduits and cables. This is a mitigation to help move the process along and satisfy technical requirements. HECO's preference is that HART coordinate the work for MOT, public outreach, trenching, conduit placement, pulling conductors, terminations, testing, etc.
19	Utility Agreements	Owners obtaining all agreements (current plan). Include agreements in RFP. August 2017 update: Lesson learned is to obtain the utility reimbursement agreements as soon as possible prior to bringing the contractor on board.
20	Service Connections	DB contractor complete design infrastructure with HECO. Clearly define work between On-Call and DB, try not to have activities sandwiched. Consider scoping DB for service connections and demolition. August 2017 update: This is a pending risk. Contractor will build a ductbank or series of poles. On-call will pull the cables (On Call 4 is standing HECO). The DBB (or DB) utility contractor will create service reconnections to existing buildings. For City Center we can have all work for utility relocations performed by a unit price contractor rather than splitting the work out to several contractors or to a DB.
21	Defined early access to pull guideway cable.	Liquidated Damages for CAM dates. August 2017 update: Construction Access Milestone (CAM). Most contracts to date have had CAM dates for interface between contractors. We have the dates but not financial penalties associated with not meeting the dates. Lesson learned is to have financial penalties associated with CAM's.
22	Train Control and Communication Room (TCCR) – connection to guideway. Room readiness.	a) Evaluate A+B in quality equation: This is associated with CAM dates, concerning allowing the contractor flexibility in sequencing their work, with contractors defining CAM dates, then scored by HART, such as staggering the completion of stations to allow Core Systems to sequence their work from station to station. b) Provide table of CAM dates. See item a. Blank would go to contractor to fill in, in the procurement documents. c) Equipment infrastructure installed. Core systems must do this. This has been the plan. d) Define temporary power requirements for any turnover to CSC. e) Incentives (quality, safety, early access, etc.). Incentives have not been used in earlier contracts. Under discussion for CCGS.
23	System site access – connectivity to guideway. Passenger screen gates installed.	Evaluate A+B in quality equation; Provide table of CAM dates. Equipment infrastructure installed. Define temporary power requirements for any turnover to CSC. Incentives (quality, safety, early access, etc.) See item 22 above.
24	Dillingham full road closures.	August 2017 update: The schedule options for CCGS assume major lane closures along Dillingham. The more lanes that can close at a given time, the faster the construction can occur.
25	Mitigating delay.	A+B with LD and/or incentive. August 2017 update: Working on incentivizing the contractor for performance versus allowing the contractor to exploit the risk.
26	Extended overhead cost included in contract.	Remove language from RFP. August 2017 update: In WOSG, FHSG, KHSG, and AGS: HART had bidders propose a competitive unit rate for each day of delay. The lesson learned is don't do this. Preferred to negotiated delay costs versus having them defined in the contract or on the bid form. ASU is an example of a defined unit rate for delay that the contractor may be using beyond the original intent. If this approach is used we must be careful to clarify the context of its application.
27	Interim milestone Dillingham corridor utilities/roadway.	Consider no excuses incentive. August 2017 update: No excuses incentive was intended to prevent or deter the DB from exploiting inconsistencies on stamped plans. We wanted to incentivize the DB for completing the work regardless of the unforeseen conditions. It is being used successfully on other transit projects including Florida DOT and Caltrans. It has been refined.
28	Progress payments on true earned value.	August 2017 update: Discussions have resulted in reporting work progress on actual construction completion versus including front-end soft costs such as mobilization which tends to overstate the actual construction percent complete. However, changing the way that progress payments are made continues to be a topic for study as a lesson learned.
29	Modification of RFP documents to account for DBB portion.	Considerable revisions to current RFP Include bid item for minor changes Utilize FA process. August 2017 update: need to define the DBB work conducted for the DB's information.
30	Delivery Schedule.	Project team and project controls evaluation of delivery schedule Define a granular schedule for risk modeling

Appendix B: Primary and Secondary Mitigation Measures, Value Engineering, and Cost Containment and Reduction Ideas, Implemented or Considered

No.	Title	Description
		Reallocate risk to granular schedule. August 2017 update: Associating risks with activities in the schedule so we understand what is concurrent and what is sequential.
31	Incorporate lessons learned from CE&I staff of West Side.	Site tour of Pearl Ridge, Peal Highlands, and Aloha Stadium station construction projects with C&I team on 24AUG2017 included discussions about lessons learned. Risk Manager to set up a Lessons Learned session with those staff to obtain their input and share with East Side team.

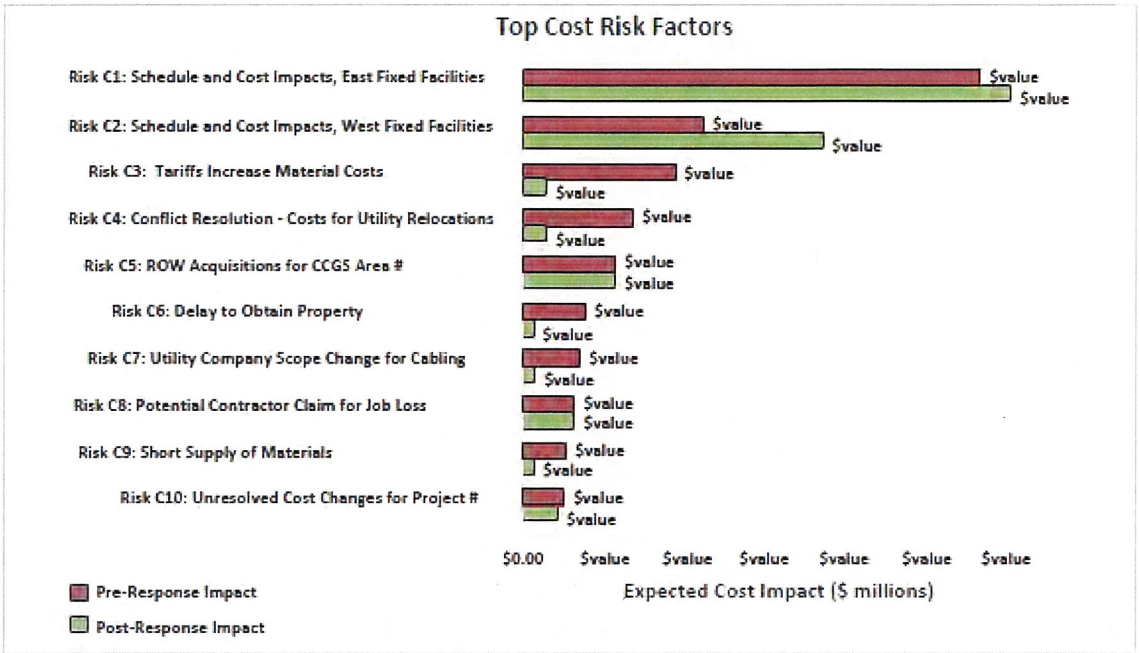
APPENDIX C

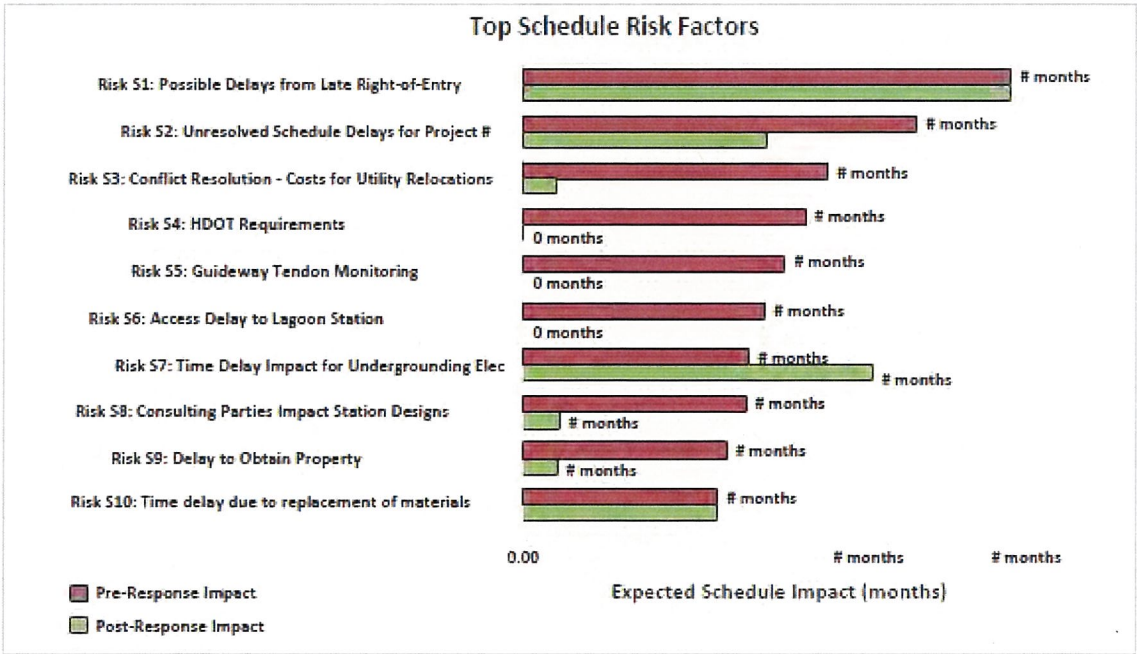
Program Risks

Risk Hit List for the Honolulu Rail Transit Project

Total Count	
Active Risks	203
Claim Risks	27
Inactive Risks	36
Merit for CO Risks	13
Pending CO Risks	10
Retired Risks	264

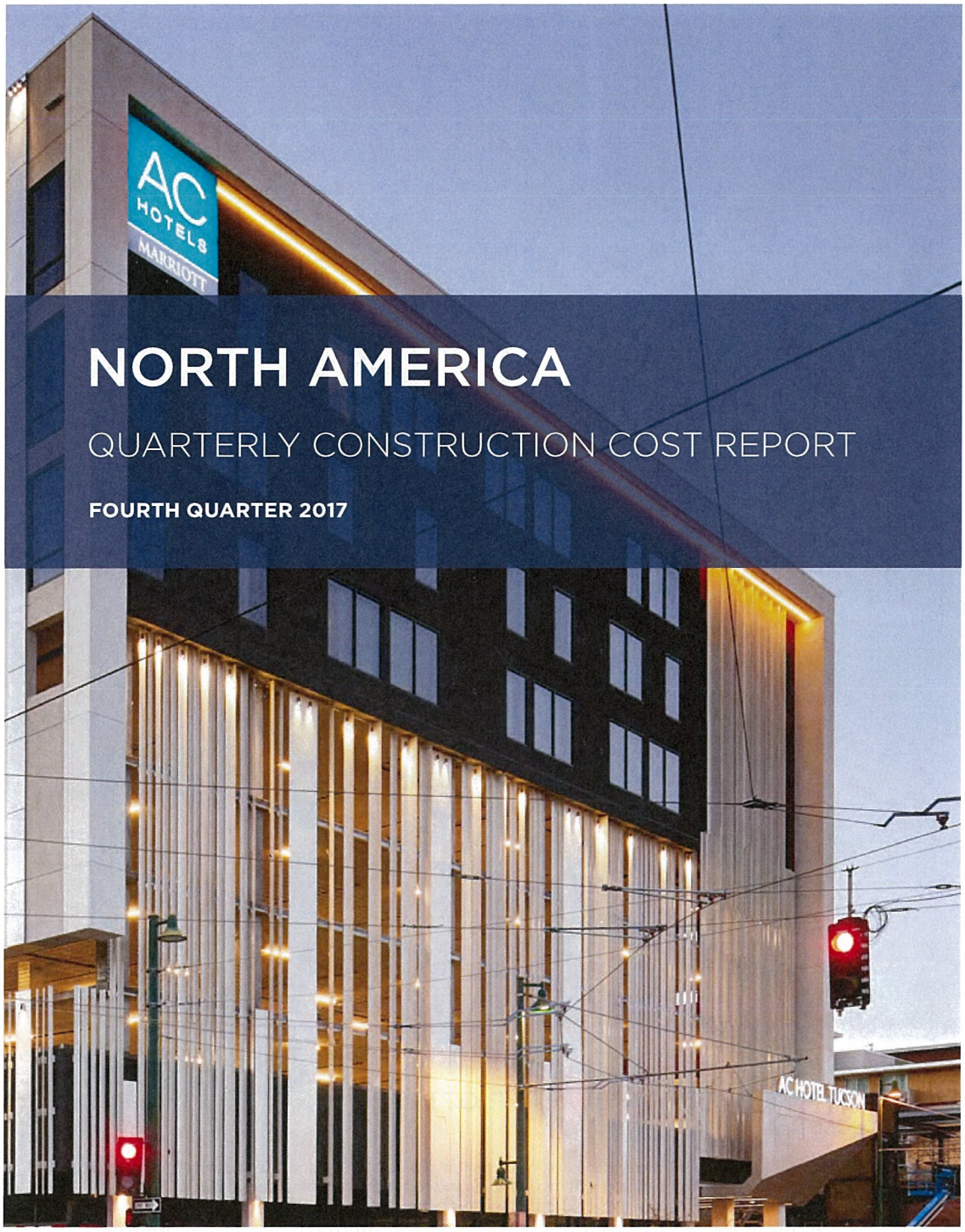
	Pre-Response Cost	Pre-Response Schedule	Post-Response Cost	Post-Response Schedule
Total Expected Value Threats	$723.9	173.4	$613.5	151.2
Total Expected Value Opportunities	($13.9)	-1.0	($15.6)	-1.0
Total EV Impact	$710.0	172.4	$598.0	150.2





APPENDIX D

Ryder Levett Bucknall USA Quarterly Construction Cost Report, Fourth Quarter 2017



NORTH AMERICA

QUARTERLY CONSTRUCTION COST REPORT

FOURTH QUARTER 2017

RLB Rider Levett Bucknall

ON THE COVER

AC HOTEL TUCSON BY MARRIOTT
TUCSON, AZ

The AC Hotel Tucson by Marriott is the first hotel built in Downtown Tucson, AZ in over 40 years. The project includes an 8-story building with hotel lobby and new commercial space on the 1st floor, a 200-space parking garage on floors 2-5, and a 136-room boutique hotel on floors 6-8.

RLB provided Project Management and Cost Management services. This urban site posed a number design and construction challenges in which RLB worked with the Owner and Design-Build Team to resolve proactively. With AC being a new Marriott brand, RLB has helped streamline the incorporation of the brand's design requirements, and has exercised expertise in project controls to hold Owner expectations regarding schedule and budget.

NORTH AMERICA

As we welcome 2018, we're pleased to bring you the latest edition of the Rider Levett Bucknall Quarterly Construction Cost Report.

Largely based on the rapid completion of projects and the continued availability of favorable-term financing which fuels development, the industry outlook through the end of this year remains positive. But there are a few hurdles, particularly on the horizon, on which we are keeping a watchful eye.

The serious and widespread damage inflicted by the 2017 hurricanes in Texas and the Caribbean, along with the record-setting wildfires throughout California (and, subsequently, the mudslides just north of Los Angeles) exacerbated the still-tight labor market in the United States.

An underlying factor is compounding the shortage. If the construction labor force is generally unable to afford living in the places where their services are most in demand, employers will eventually increase wages to attract workers—but at this point in time, this has not yet been fully realized.

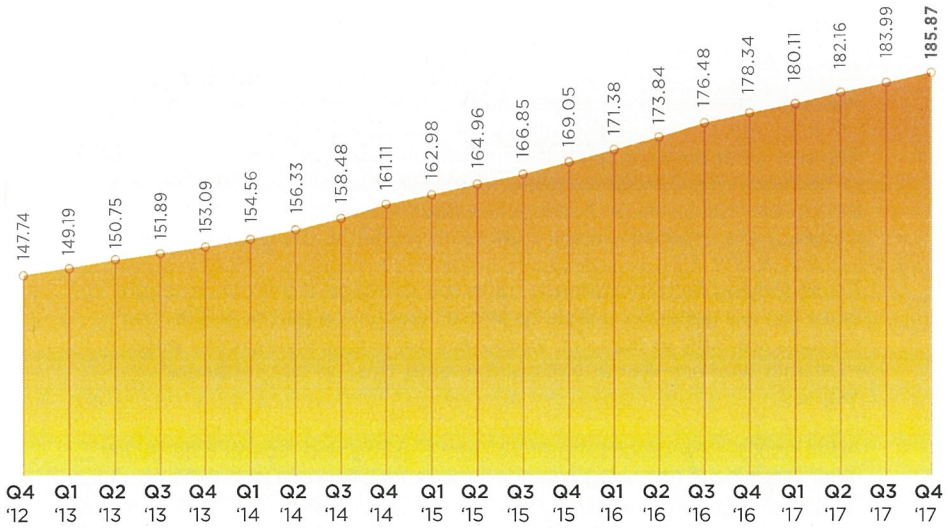
Additionally, slow processing of insurance claims and federal emergency relief funds have not only prolonged the recovery process, but, as on-the-ground conditions deteriorate over time, the costs of undertaking repairs creep upward. Coupled with steep and expected increases in the price of construction-materials staples such as gypsum board, lumber and plywood, and PVC products, the rebuilding looks to be drawn out and costly.

Surveys show that long-term industry confidence is slipping, for reasons that are largely rooted in Washington D.C. The long-promised infrastructure initiative seems to have slipped off the federal agenda, and may be headed to the individual states to implement. Legislation on immigration and resident aliens, while not yet law, threatens to destabilize and/or reduce the construction workforce at a time when the need for labor is peaking.

Julian Anderson FRICS
President, North America
Chairman of the Global Board

USA REPORT

NATIONAL CONSTRUCTION COST INDEX



Welcome to the fourth quarter 2017 issue of the Rider Levett Bucknall Quarterly Cost Report! This issue contains data current to October 1, 2017.

$1,241.5 Billion

According to the U.S. Department of Commerce, construction-put-in-place during October 2017 was estimated at a seasonally adjusted annual rate of $1,241.5 billion, which is

1.4% above

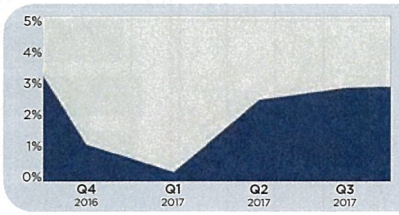
the revised September estimate of $1,224.6 billion, and

2.9% above

above the October 2016 estimate of $1,206.6 billion.

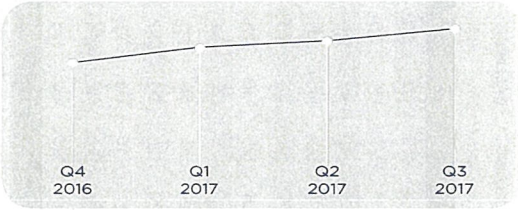
The National Construction Cost Index shows the changing cost of construction between October 2012 and October 2017, relative to a base of 100 in April 2001. Index recalibrated as of April 2011.

KEY UNITED STATES STATISTICS

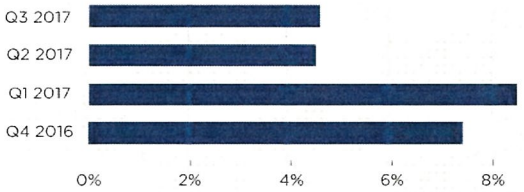


Gross Domestic Product* (GDP)
GDP recovers from a dip in Q1, and was sitting at 3.3% during Q3.

Consumer Price Index (CPI)
CPI experiences a nominal but steady increase. Inflation has grown 2.2% from this time last year.

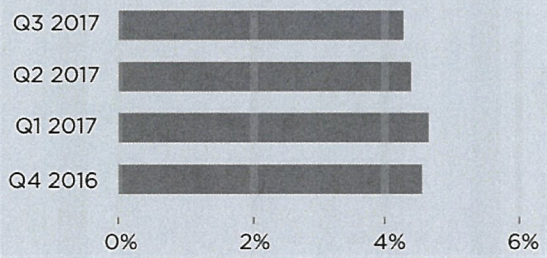


Architectural Billings Index (ABI)
ABI experiences its first dip since this time last year. It is yet to be determined if this dip is in response to impacts from recent hurricanes or from other factors.



Construction Unemployment
Construction unemployment evens out after a drop during the second quarter, currently at 4.7%.

National Unemployment
National unemployment experiences nominal variance from this time last year.



GDP represented in percent change from the preceding quarter, seasonally adjusted at annual rates. CPI quarterly figures represent the monthly value at the end of the quarter. Inflation rates represent the total price of inflation from the previous quarter, based on the change in the Consumer Price Index. ABI is derived from a monthly American Institute of Architects survey of architectural firms of their work on the boards, reported at the end of the period. Construction Put-in-Place figures represent total value of construction dollars in billions spent at a seasonally adjusted annual rate taken at the end of each quarter. General Unemployment rates are based on the total population 16 years and older. Construction Unemployment rates represent only the percent of experienced private wage and salary workers in the construction industry 16 years and older. Unemployment rates are seasonally adjusted, reported at the end of the period.
* Adjustments made to GDP based on amended changes from the Bureau of Economic Analysis.
Sources: U.S. Bureau of Labor Statistics, Bureau of Economic Analysis, American Institute of Architects.

USA REPORT

INDICATIVE CONSTRUCTION COSTS

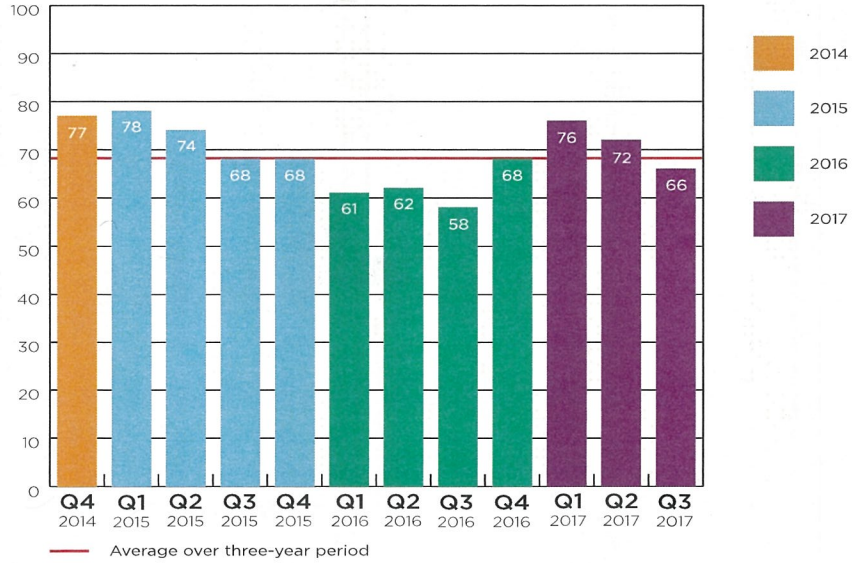
The data in the chart below represents estimates of current building costs in each respective market. Costs may vary as a consequence of factors such as site conditions, climatic conditions, standards of specification, market conditions, etc. Values of U.S. locations represent hard construction costs based on U.S. dollars per square foot of gross floor area, while values of Canadian locations represent hard construction costs based on Canadian dollars per square foot.

	OFFICES				RETAIL SHOPPING				HOTELS				HOSPITAL		INDUSTRIAL		PARKING				RESIDENTIAL				EDUCATION					
	PRIME		SECONDARY		CENTER		STRIP		5 STAR		3 STAR		GENERAL		WAREHOUSE		GROUND		BASEMENT		MULTI-FAMILY		SINGLE-FAMILY		ELEMENTARY		HIGH SCHOOL		UNIVERSITY	
LOCATION	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
USA																														
Boston	300	475	200	300	175	275	125	200	375	550	250	375	400	650	100	175	75	125	90	150	175	300	250	350	280	380	290	405	330	480
Chicago	280	450	175	280	185	280	135	220	390	650	270	390	360	700	110	185	80	125	120	155	160	340	220	420	250	380	300	400	350	600
Denver	165	255	120	185	90	145	75	140	215	325	155	190	380	470	90	150	50	75	90	120	90	200	90	410	250	300	260	315	305	415
Honolulu	285	525	245	400	210	490	175	430	515	740	325	545	475	755	145	225	100	145	140	265	195	440	280	755	340	475	405	605	440	715
Las Vegas	140	295	105	190	115	480	65	145	350	500	150	300	285	455	50	100	50	85	60	150	70	405	90	350	180	315	200	455	235	455
Los Angeles	225	340	165	250	150	330	120	185	355	520	255	330	475	705	110	175	105	125	130	175	185	295	190	335	340	450	360	485	390	555
New York	375	575	300	400	275	425	175	300	400	600	300	400	475	700	115	200	95	175	125	200	200	375	275	400	295	405	305	455	330	480
Phoenix	160	275	120	175	120	200	80	140	300	500	150	250	350	500	55	100	45	70	60	110	90	185	100	400	170	250	220	340	300	420
Portland	180	250	130	180	140	240	120	180	230	330	150	190	380	525	90	150	85	105	110	150	150	240	125	280	270	335	285	350	310	440
San Francisco	210	325	190	300	225	350	225	325	400	600	350	500	450	650	140	190	110	145	175	215	320	430	200	400	340	450	315	400	250	375
Seattle	205	250	150	205	135	305	110	155	245	340	225	240	390	540	100	125	95	120	140	165	165	260	170	300	275	320	325	480	315	475
Washington	275	425	200	300	150	275	125	175	350	525	250	350	400	650	90	150	70	125	80	125	175	300	250	350	280	355	280	380	330	480
CANADA																														
Calgary	235	295	190	285	220	310	110	160	300	450	190	245	550	720	85	145	75	90	75	120	140	215	125	315	185	260	220	310	300	450
Toronto	195	260	174	250	200	250	105	160	300	355	195	260	500	645	115	150	70	90	70	90	130	205	190	330	175	195	200	230	200	295

CONSTRUCTION INDUSTRY CONFIDENCE INDEX

The North American construction market continues to recover from the crash in 2009; and is now the third-longest market recovery period in U.S. history. ENR's Construction Industry Confidence Index (CICI), launched in 2009, is a survey of different types of firms (Design Professionals, General Contractors and Subcontractors) and represents their overall view of the current and future construction market. The index is 66 in the third quarter of 2017, reflecting a drop of six points since the previous quarter. Despite the drop, industry confidence remains high, as an index above 50 reflects sentiment for market growth.

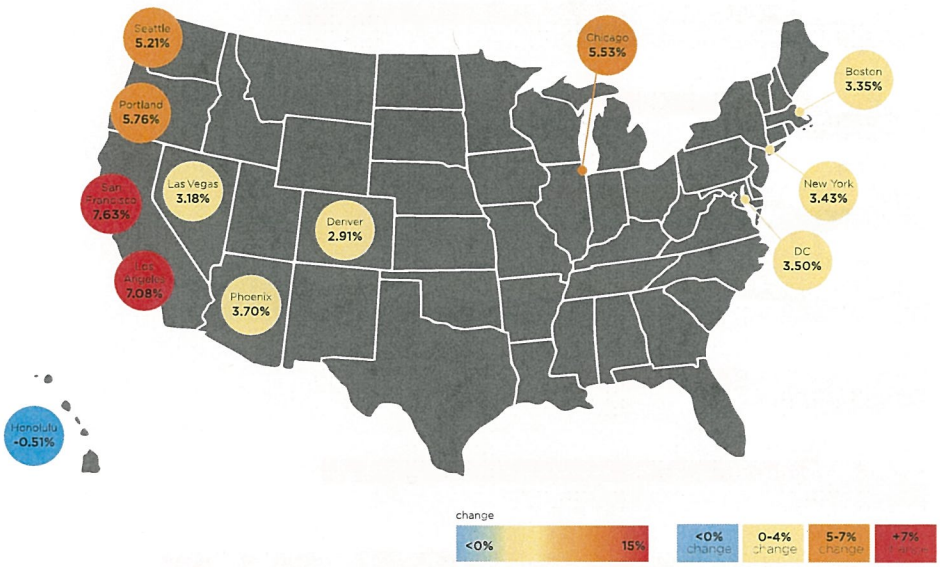
While it is expected that construction will continue to prosper through the end of 2018, long-term market concerns are what have led to a downturn in industry confidence.



Source: 2017 3Q Engineering News Record Confidence Survey

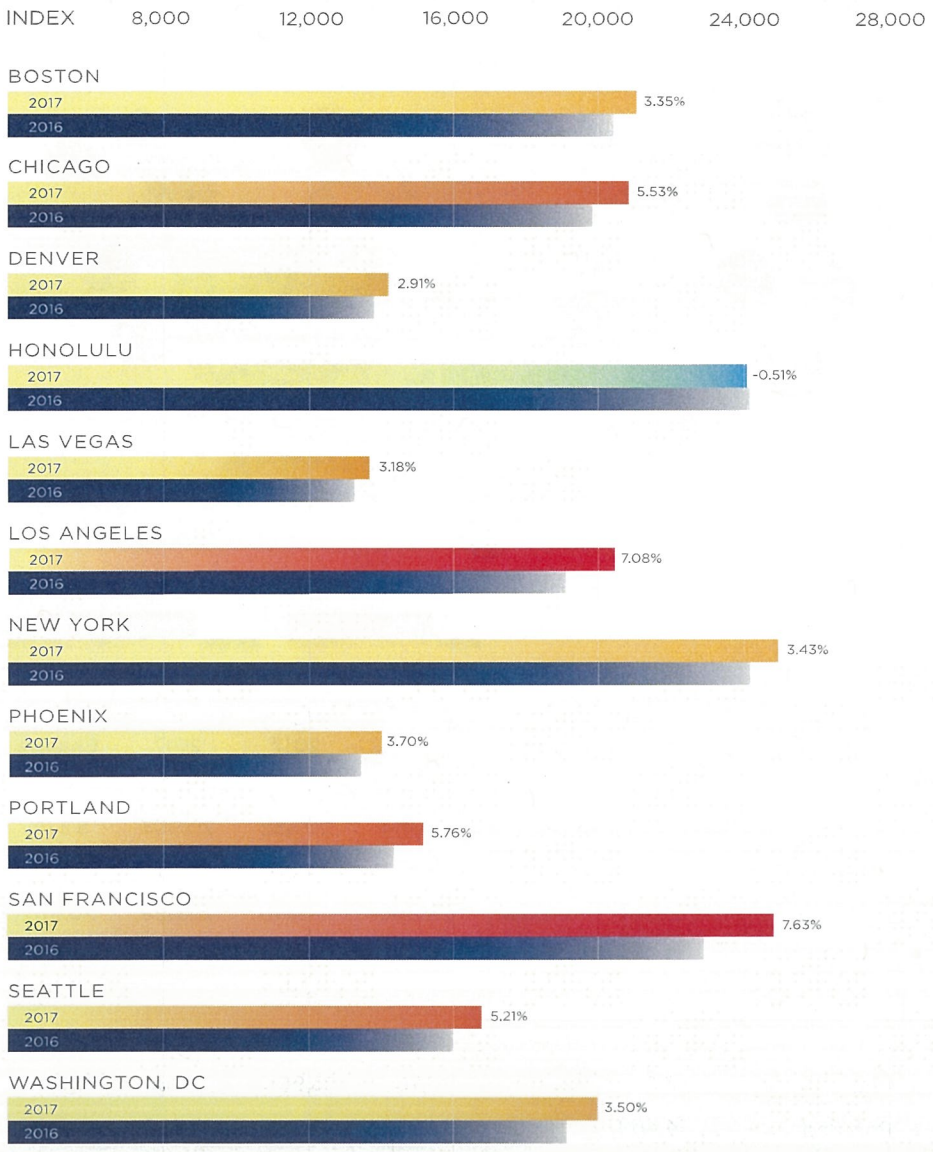
USA REPORT

COMPARATIVE COST INDEX



City	October 2016	January 2017	April 2017	July 2017	October 2017	Annual % Change
Boston	20,489	20,671	20,835	20,989	21,176	3.35%
Chicago	19,809	20,103	20,414	20,652	20,905	5.53%
Denver	13,932	13,987	14,097	14,187	14,337	2.91%
Honolulu	24,181	24,082	24,060	24,050	24,058	-0.51%
Las Vegas	13,342	13,435	13,510	13,614	13,766	3.18%
Los Angeles	19,225	19,401	19,997	20,326	20,586	7.08%
New York	24,101	24,303	24,499	24,698	24,927	3.43%
Phoenix	13,578	13,659	13,785	13,900	14,080	3.70%
Portland	14,469	14,638	14,830	15,044	15,302	5.76%
San Francisco	23,005	23,677	24,039	24,546	24,760	7.63%
Seattle	15,972	16,190	16,419	16,654	16,804	5.21%
Washington, DC	19,376	19,586	19,774	19,884	20,054	3.50%

Comparative Cost Map and Bar Graph Indicate percentage change between October 2016 and October 2017.



Each quarter we look at the comparative cost of construction in 12 US cities, indexing them to show how costs are changing in each city in particular, and against the costs in the other 11 locations. You will be able to find this information in the graph titled *Comparative Cost Index (above)* and in the *Cost and Change Summary (right)*.

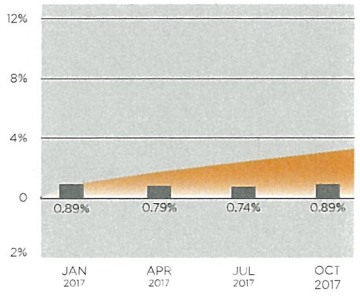
Our Comparative Cost Index tracks the 'true' bid cost of construction, which includes, in addition to costs of labor and materials, general contractor and sub-contractor overhead costs and fees (profit). The index also includes applicable sales/use taxes that 'standard' construction contracts attract. In a 'boom,' construction costs typically increase more rapidly than the net cost of labor and materials. This happens as the overhead levels and profit margins are increased in response to the increasing demand. Similarly, in a 'bust', construction cost increases are dampened (or may even be reversed) due to reductions in overheads and profit margins.

USA REPORT

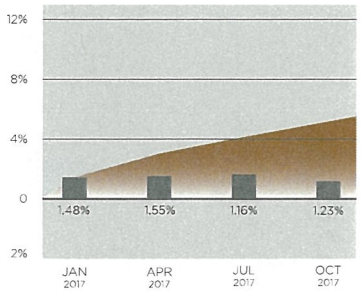
The following escalation charts track changes in the cost of construction each quarter in many of the cities where RLB offices are located. Each chart illustrates the percentage change per period and the cumulative percentage change throughout the charted timeline.

Percentage change per quarter — Cumulative percentage change for the period shown

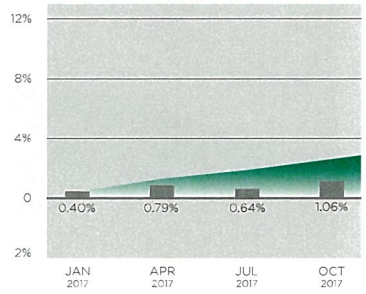
COST INDEX Boston



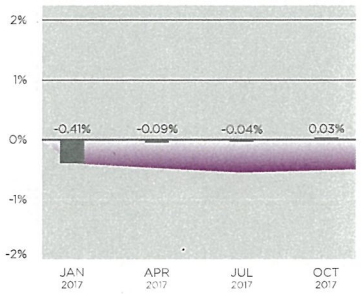
COST INDEX Chicago



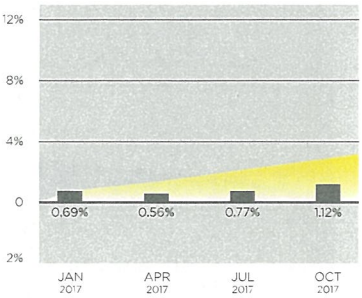
COST INDEX Denver



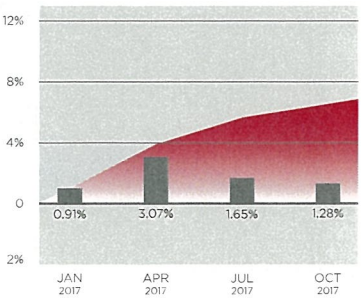
COST INDEX Honolulu



COST INDEX Las Vegas

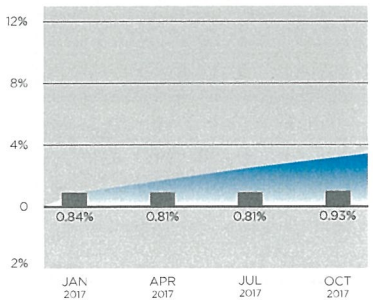


COST INDEX Los Angeles

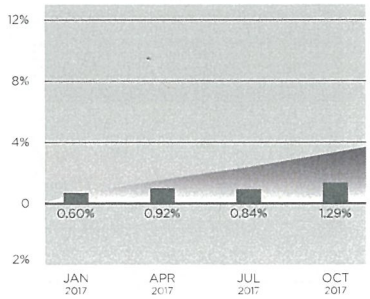


Our research suggests that between July 1, 2017 and October 1, 2017 the national average increase in construction cost was approximately 1.0%. Several locations saw increases over 1%, including Chicago, Denver, Las Vegas, Los Angeles, Phoenix, and Portland. However, Boston, Honolulu, New York, San Francisco, Seattle, and Washington DC all experienced increases less than 1%.

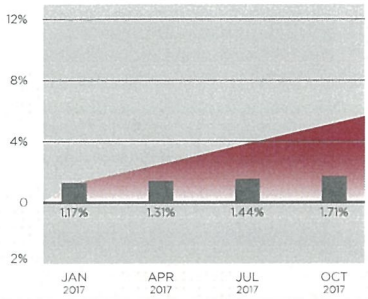
COST INDEX New York



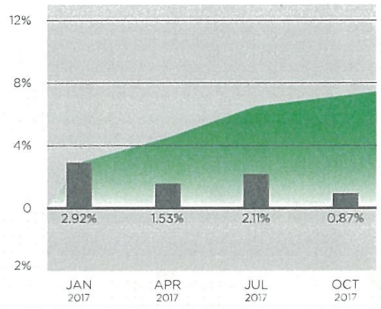
COST INDEX Phoenix



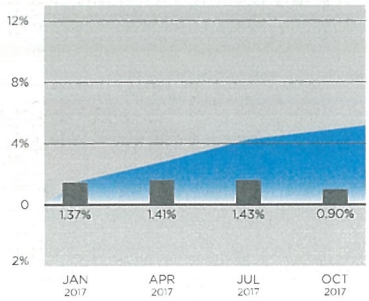
COST INDEX Portland



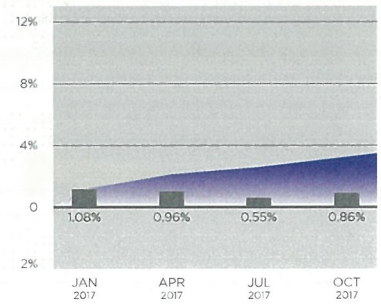
COST INDEX San Francisco



COST INDEX Seattle

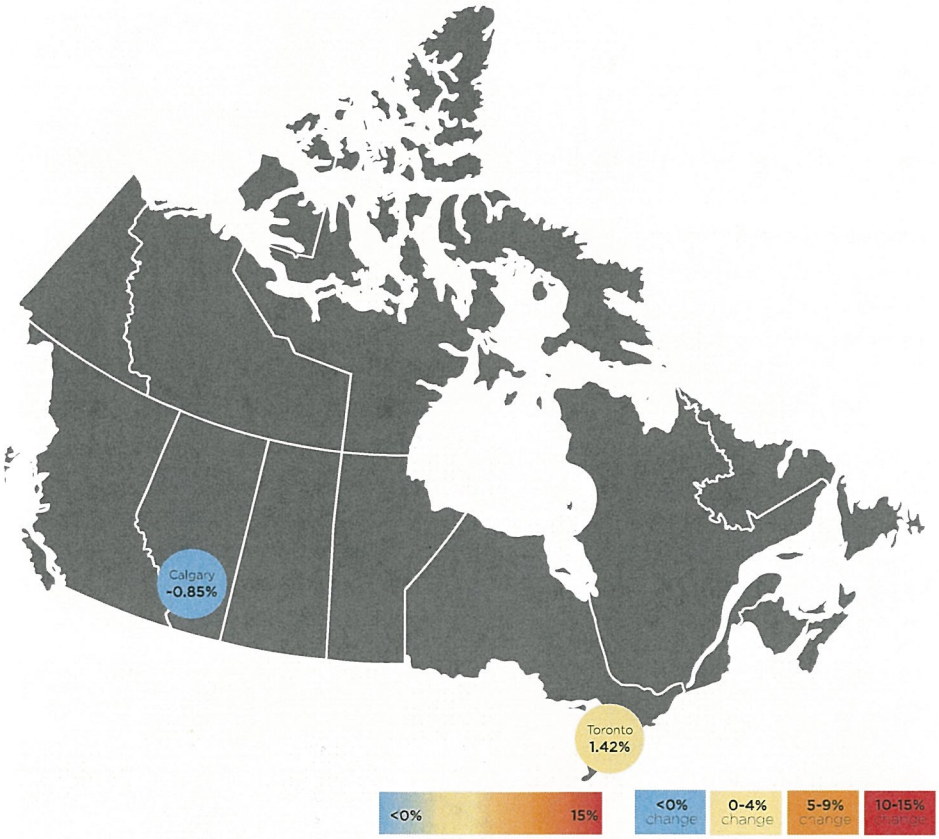


COST INDEX Washington DC



CANADA REPORT

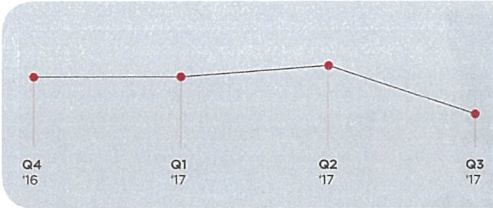
COMPARATIVE COST INDEX



City	October 2016	January 2017	April 2017	July 2017	October 2017	Annual % Change
• Calgary	18,435	18,190	18,089	18,080	18,279	-0.85%
• Toronto	18,690	18,800	18,664	18,569	18,956	1.42%

Nationally, construction activities gained some momentum as the value of building permits rose 3.5% in the first month of Q4 2017 (October). Main contributor to this rise relate to higher construction intentions for building component in Quebec and Ontario, as well as factories and plants in Alberta. Seasonally adjusted year-to-date value of permits increased 1% for the same period in 2016. Commercial and industrial building component push the non-residential sector higher in Ontario municipalities and Quebec. Other active sectors include multi-family dwellings in Quebec with 78% of permit value coming from the census metropolitan area (CMA) of Montreal. During October 2017, multiple high-value permits for apartment condominiums in Montreal CMA accounted for Quebec's provincial increase..

KEY CANADIAN STATISTICS

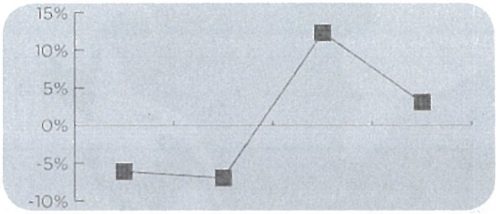


Gross Domestic Product

Experiencing a 0.42% change from last quarter, GDP shows minimal fluctuation, indicating a nominal 3.32% variance from this time last year.

Consumer Price Index

Canada's Consumer Price Index grows steadily every quarter, with a variance of 1.47% from this time last year.

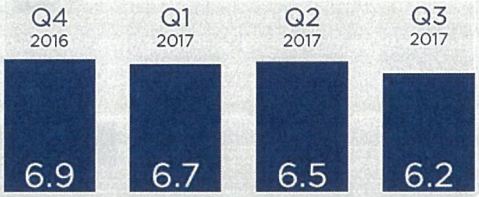


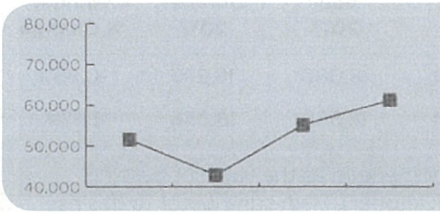
Value of Building Permits

The seasonally adjusted value of building permits continues to fluctuate quarter-to-quarter. Permits have increased 1% from the same period in 2016.

Unemployment

Canada's unemployment continues to decrease steady, down 0.8% from this time last year.



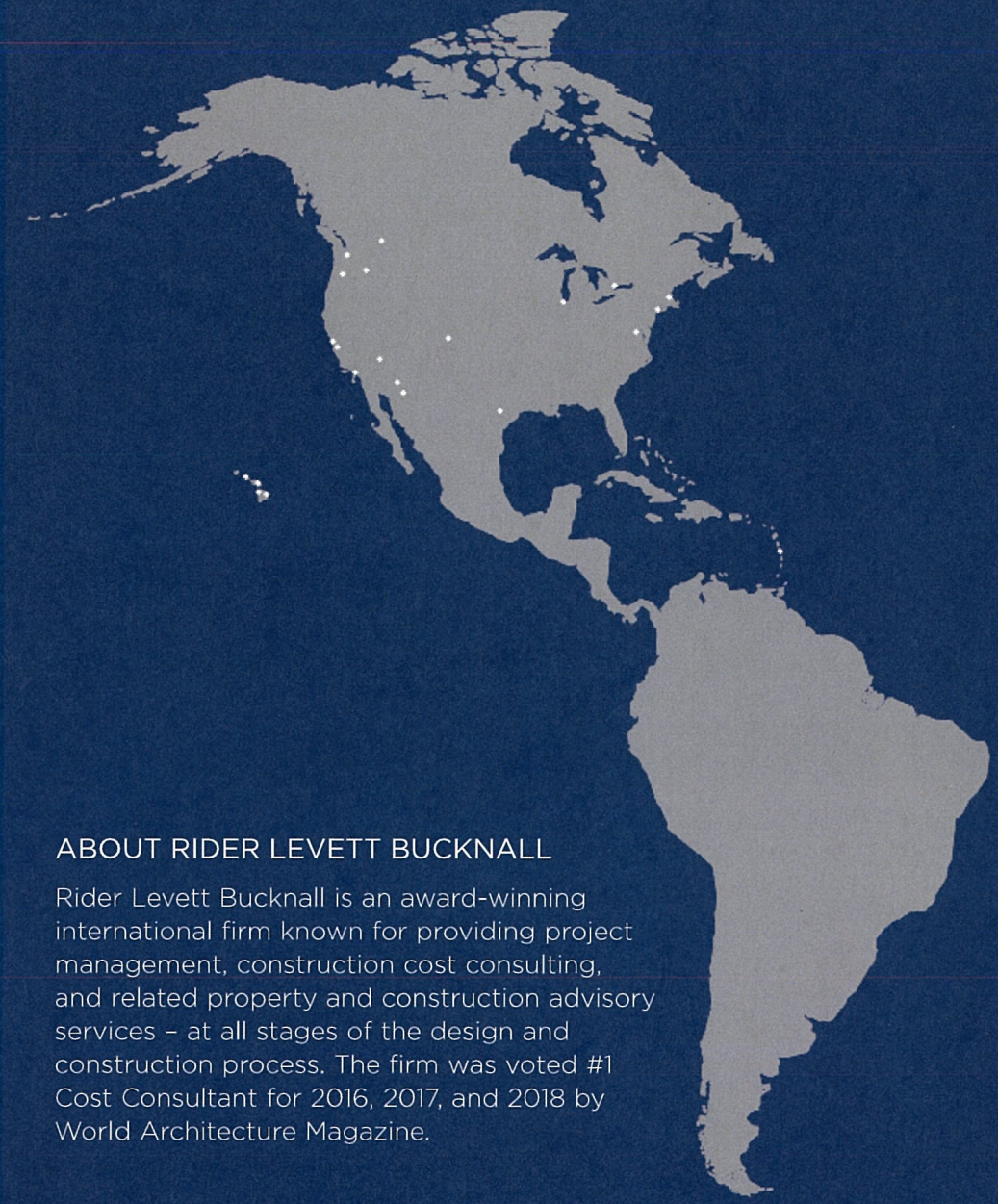


Housing Starts

Housing Starts are up 42% from Q1 2017; 11.43% higher than this time last year.

GDP represented in percent change from the preceding quarter, seasonally adjusted at annual rates. CPI quarterly figures represent the monthly value at the end of the quarter. Inflation rates represent the total price of inflation from the previous quarter, based on the change in the Consumer Price Index. General Unemployment rates are based on the total population 16 years and older. Construction Unemployment rates represent only the percent of experienced private wage and salary workers in the construction industry 15 years and older. Unemployment rates are seasonally adjusted, reported at the end of the period.

Sources: Statistics Canada



ABOUT RIDER LEVETT BUCKNALL

Rider Levett Bucknall is an award-winning international firm known for providing project management, construction cost consulting, and related property and construction advisory services – at all stages of the design and construction process. The firm was voted #1 Cost Consultant for 2016, 2017, and 2018 by World Architecture Magazine.

While the information in this publication is believed to be correct, no responsibility is accepted for its accuracy. Persons desiring to utilize any information appearing in this publication should verify its applicability to their specific circumstances.

This issue was compiled by Taryn Harbert with contributions from Evans Pomegas, Grant Owen, Edd Hamzanlui, Paul Brussow, Maelyn Uyehara, Cassie Idehara, Simon James, Philip Mathur, Scott Macpherson, Graham Roy, Daniel Junge, George Bergeron, Peter Knowles, Catherine Stoupas, Joe Pendlebury, Edward Traore, and Robin Kankerwal.

© December 2017 by Rider Levett Bucknall Ltd.

If you have questions or for more information, please contact us.

AUSTIN
Phone: +1 512 704 3026
E-mail: ward.simpson@us.rlb.com
Contact: Ward Simpson

BOSTON
Phone: +1 617 737 9339
E-mail: BOS@us.rlb.com
Contact: Grant Owen

CALGARY
Phone: +1 403 571 0505
E-mail: YYC@ca.rlb.com
Contact: Edward Traore

CHICAGO
Phone: +1 312 819 4250
E-mail: chris.harris@us.rlb.com
Contact: Chris Harris

DENVER
Phone: +1 720 904 1480
E-mail: DEN@us.rlb.com
Contact: Peter Knowles

HILO
Phone: +1 808 934 7953
E-mail: ITO@us.rlb.com
Contact: Kevin Mitchell

HONOLULU
Phone: +1 808 521 2641
E-mail: HNL@us.rlb.com
Contact: Paul Brussow
Maelyn Uyehara
Erin Kirihara

LAS VEGAS
Phone: +1 702 227 8818
E-mail: LAS@us.rlb.com
Contact: Simon James

LOS ANGELES
Phone: +1 213 689 1103
E-mail: LAX@us.rlb.com
Contact: Philip Mathur
Brian Lowder

MAUI
Phone: +1 808 875 1945
E-mail: OGG@us.rlb.com
Contact: Kevin Mitchell

NEW YORK
Phone: +1 212 952 1300
E-mail: EWR@us.rlb.com
Contact: Grant Owen

PHOENIX
Phone: +1 602 443 4848
E-mail: PHX@us.rlb.com
Contact: Julian Anderson
Scott Macpherson
John Jozwick

PORTLAND
Phone: +1 503 226 2730
E-mail: PDX@us.rlb.com
Contact: Graham Roy

SAN FRANCISCO
Phone: +1 415 362 2613
E-mail: SFO@us.rlb.com
Contact: Catherine Stoupas

SAN JOSE
Phone: +1 650 943 2317
E-mail: joel.brown@us.rlb.com
Contact: Joel Brown

SEATTLE
Phone: +1 206 223 2055
E-mail: emile.leroux@us.rlb.com
Contact: Emile Le Roux

ST. LUCIA
Phone: +1 758 452 2125
E-mail: mark.williamson@lc.rlb.com
Contact: Mark Williamson

TORONTO
Phone: +1 905 827 8218
E-mail: YYZ@us.rlb.com
Contact: Joe Pendlebury

TUCSON
Phone: +1 520 777 7581
E-mail: TUS@us.rlb.com
Contact: Joel Brown

WAIKOLOA
Phone: +1 808 883 3379
E-mail: KOA@us.rlb.com
Contact: Kevin Mitchell

WASHINGTON, DC
Phone: +1 202 457 1450
E-mail: DCA@us.rlb.com
Contact: Grant Owen

rlb.com
AC HOTEL TUCSON

APPENDIX E

Andrew S. Robbins Curriculum Vitae

Andrew S. Robbins, P.E.

Education:

Master of Science in Industrial Engineering
Engineering Management Program (Management of Large Engineering & Construction Projects)
University of Pittsburgh
Pittsburgh, PA USA

Bachelor of Science in Electrical Engineering
Minor in Urban Studies (Urban Planning & Transportation Economics)
Lehigh University
Bethlehem, PA USA

Professional Registrations:

Registered Professional Engineer, State of Hawaii PE-8125
Professional Engineer, Commonwealth of Pennsylvania

Personal attributes:

Dedicated; innovative; leads, strives for excellence

Professional Summary:

Seasoned Rail Transit Executive with substantial international experience in urban rail, rail equipment & infrastructure, airport transit, construction and engineering. Extensive experience in customer relations, contracts, public-private partnerships & project finance, project management, engineering, operations & maintenance, professional speaking, bids and proposals, and technical and commercial negotiations. Strategic thinker in the area of public works, cities and urban issues with a focus on transportation.

Expert in driverless transit systems including sales & business development, project management, project engineering, systems engineering, systems integration and operations & maintenance. Extensive experience in Design-Build-Operate-Maintain and Public-Private Partnerships (P3) project development.

Summary of Work Experience:

Honolulu Authority for Rapid Transportation
City & County of Honolulu, Honolulu, HI USA

Executive Director & CEO – September 2017 to present

Chief Executive of an Authority responsible for the development of a large and complex major infrastructure project stretching across the island of Oahu. Recruit, train, retain, motivate and manage a direct staff of 130 and a number of consultants involving more than 120 procurements. Develop and optimize procurements and project delivery methodologies. Work closely with project partners including the Authority's Board of Directors, the City and County of Honolulu, the State of Hawaii, The Federal Transit Administration and numerous other agencies, utilities, and private sector stakeholders. Develop solutions to complex technical and financial issues. Effectively communicate the status of the project and other details with media, stakeholders and the public. Work closely with the City to prepare for and make the transition to operations and maintenance.

Bombardier Transportation, San Francisco, CA USA

Senior Director - Head of Sales & Business Development, Automated Systems – Americas, 2015- 2017

Responsible for a team of Sales and Business Development Directors and Managers located in Canada, Brazil and USA. Leadership, management, direct sales and business development responsibility for all systems projects throughout the Americas. Providing training, sales forecasting and reporting.

Major Projects and Achievements: 1) Developed, negotiated and executed contracts valued over US$150 million, for an automated people mover system in San Francisco and an automated rail transit system in Vancouver, B.C. 2) Leading sales teams in Canada, USA and Latin America in identifying high-priority projects to fulfill the company's commercial plan for the Americas region. 3) Sales & Business Development lead in regard to a new Public-Private Partnership project in Los Angeles which will be executed under a 30-35 year concession agreement and at a value of approximately US$2.5B billion.

Bombardier Transportation, Hong Kong & China

Head of Sales & Business Development – North Asia Region, 2013- Present

Responsible for a team of Sales and Business Development Directors and Managers located in China, Hong Kong and Taiwan. Management, direct sales and business development responsibility for all systems projects in China, Hong Kong. Korea and Taiwan. Providing leadership to Bid Teams, Technical Support team in Beijing and managing Spare Parts and After-Market Sales Teams. Providing training, sales forecasting and reporting.

Major Projects and Achievements: 1) Negotiation and formation of a new China joint venture for execution, manufacturing and delivery of Automated People Mover (APM) and Monorail projects in China. China JV established in 2014. 2) Provided overall team leadership in regard to the first new urban automated line in Shanghai valued at over US$300 million. Selected by both the Chinese and Western joint venture partners to lead all technical negotiations for the bidding consortium resulting in award of contract in 2015 for Shanghai's first ever driverless transit system.

Director, Sales & Business Development – Asia-Pacific, 2012-2013

Major Project: Provided sales leadership and negotiated contract for new rail transit vehicles in Singapore.

Bombardier Transportation, San Francisco, CA

Head of Systems Sales & Business Development – Americas Region, 2008-2012

Located in San Francisco, responsible for a team of Sales and Business Development Directors and Managers located in Canada, Mexico and USA. Management and direct sales and business development responsibility for all systems projects in the Americas.

Projects included bids for US$400 million BART/Oakland APM (low bidder), US$1.2B (Core Systems) Honolulu Rapid Transit (low bidder), US$5B XpressWest high speed rail P3 project, Las Vegas Monorail Extensions, Vancouver Metro vehicles, various APM and O&M contracts. Managed resources performing business development activities in Latin America and bidding and securing the US$1.2B 25 km Sao Paulo Monorail project (a fully driverless, high-capacity urban rail transit system using monorail technology.)

Director, Project Development & Sales - Transit Systems– January 2003 to 2008

Located in San Francisco, responsible for project development, sales and proposal leadership in the automated people mover segment, for projects located in Western North America and Asia-Pacific. Responsibilities included teaming, negotiations, technical and commercial proposal development for large design-build-operate-maintain projects.

Major accomplishments included the formation and management of a construction, engineering, finance and rail system supplier consortium to propose and bid on the Vancouver Canada Line project, an early Public-Private Partnership (P3) procurement involving finance-design-build-operate-maintain of a 30 km driverless urban rail system in Vancouver, B.C.

Other major accomplishments included the development, proposal, bid and negotiation of a contract for the Guangzhou, China Urban Automated Transit System (the first urban driverless system in China). Efforts included forming the project structure and project organization, and launching the project execution team resulting in the successful completion and operation of this system.

Director, Private Rail Projects – Americas & Asia-Pacific, August 2001 – December 2002

Located in Oakland, CA, responsible for screening, structuring and management of projects in the emerging market for Public-Private Partnership solutions for rail transit development. This included identifying teaming, workscope and commercial terms and conditions, and establishing project development efforts, including leadership in the development of proposals. Negotiated two contracts for driverless transit systems located at the McCarran Las Vegas International Airport.

DaimlerChrysler Rail System (known as "Adtranz"), Pittsburgh, PA

Vice President, Business Development, April 1994 – July 2001

Responsible for screening and structuring design-build-operate-maintain projects, developing strategies and business plans, developing proposals and negotiating contracts. Project experience included the automated transit system projects and contracts secured at the London Heathrow, Rome, Kuala Lumpur, Orlando, Houston and San Francisco International airports. Led the development and tendering activities on behalf of an international consortium bidding to the Singapore Land Transport Authority for the US$205M Bukit Panjang, Singapore automated light rapid transit system which entered service in November, 1999.

Program Manager, Programs and Contracts Department, December, 1991 - March, 1994

Program Manager on-site in Honolulu, Hawaii, US$300M E&M portion of a US$1.1B turnkey contract for a new urban rapid transit system. Responsibilities included coordinating all operating system preliminary engineering, operations & maintenance planning, meetings and negotiations with City and County of Honolulu, design reviews, budgeting, scheduling and public relations efforts. The project progressed through completion of preliminary engineering.

Previous positions at Adtranz and Westinghouse Electric Corporation/Transportation Division, in engineering, engineering management, and operations & maintenance.

APPENDIX F

Basis of Cost Estimate

HONOLULU RAIL TRANSIT PROJECT
East Kapolei to Ala Moana Center
Basis of Estimate

October 2018

Table of Contents

Executive Summary **4**

1 Estimating Overview **6**

2 Estimating Methodologies **8**

Estimating Format 8
Estimating Software 8
Quantity Takeoff/Reconciliation 8
Estimate Development 8
Cost-Based Method 9
Historical Bid Price Method 9
Design Allowance 9
Escalation 10
Estimate Review 10

3 Sources of Data **11**

4 Indirect Costs **12**

5 Estimate Assumptions **13**

6 FTA Standard Cost Categories **14**

FTA SCCs 14
SCC 10 Guideway and Track Elements 14
SCC 20 Stations, Stops, Terminals, Intermodal 14
SCC 30 Support Facilities: Yards, Shops, and Administration Buildings 14
SCC 40 Sitework and Special Conditions 14
SCC 50 Systems 14
SCC 60 ROW, Land, Existing Improvements 14
SCC 70 Vehicles 14
SCC 80 Professional Services 14
SCC 90: Contingency 14
SCC 100: Finance Charges 15

7 Statement of Probable Cost **16**

Appendices

Appendix A: Alignment Details **17**

Appendix B: Cost Estimate Comparison by Standard Cost Category **18**

Appendix C: Cost Estimate Worksheet by Standard Cost Category **19**

Appendix D: Base Cost Estimate (BCE) by Source of Funding **20**

Appendix E: Repackaging of City Center Guideway & Stations **21**

Acronyms and Abbreviations

AGS	Airport Guideway and Stations
BCE	Base Cost Estimate
BOE	Basis of Estimate
CCGS	City Center Guideway and Stations
CCUR	City Center Utilities Relocation
CE&I	Construction Engineering and Inspection
D/B	Design/Build
D/B/B	Design/Bid/Build
DBOM	Design-Build-Operate-Maintain
FEIS	Final Environmental Impact Statement
FFGA	Full Funding Grant Agreement
FHSG	Farrington Highway Station Group
FTA	Federal Transit Administration
HART	Honolulu Authority for Rapid Transportation
HCSS	Heavy Construction Systems Specialists'
HDOT	Hawai'i Department of Transportation
HGEA	Hawaii Government Employees Association
HRTP	Honolulu Rail Transit Project
IDIQ	Indefinite Delivery Indefinite Quantity
KHG	Kamehameha Highway Guideway
KHSG	Kamehameha Highway Station Group
MOS	Minimum Operable Segment
MOT	Maintenance of Traffic
NTP	Notice-to-Proceed
OP	Oversight Procedure
P3	Public-Private Partnership
PHGT	Pearl Highlands Garage & Transit Center
PMOC	Project Management Oversight Contractors
RFP	Request for Proposals
ROC	Rail Operations Center
ROM	Rough Order of Magnitude
ROW	Right-of-Way
RSD	Revenue Service Date
SCC	Standard Cost Category
SUE	Subsurface Utility Engineering
WBS	Work Breakdown Structure
WOFH	West O'ahu/Farrington Highway
WOSG	West O'ahu Station Group
YOE	Year of Expenditure

Executive Summary

This Basis of Estimate (BOE) is an update of the Capital Cost Estimate Basis and Assumptions methodology report included in the September 2017 Recovery Plan. The revised Capital Cost Estimate for the Honolulu Rail Transit Project (HRTP or the Project) will supplement the Full Funding Grant Agreement (FFGA) dated December 19, 2012.

The Project consists of twenty (20) miles of elevated fixed guideway rail system extending from East Kapolei at the west terminus to Ala Moana Center at the east terminus via Pearl Harbor, the Honolulu International Airport, and downtown Honolulu. The Project includes twenty-one (21) stations, out of which twenty (20) are aerial and one (1) at-grade station, a Rail Operations Center (ROC), and 80 driverless vehicles.

The Honolulu Authority for Rapid Transportation (HART) Recovery Plan cost estimate is organized in the United States (U.S.) Department of Transportation Federal Transit Administration (FTA) Standard Cost Category (SCC) format. It includes the following components: guideway, track elements, stations, support facilities, sitework, special conditions, systems, right-of-way (ROW), land improvements, vehicles, and professional services.

Approximately 70% of the Project's SCC 10-50 construction contracts have been bid and awarded. The major contracts awarded have been a mixture of design-build and traditional design-bid-build. This includes the Rail Operations Center (ROC, formerly known as Maintenance and Storage Facility), two (2) guideway contracts, three (3) main station contracts, one (1) combined large guideway and station Airport section contract, and systems and vehicles contracts. The remaining balance of the key construction City Center section contracts are task order-based indefinite delivery/indefinite quantity and design-build contracts. All primary final design contracts have been awarded to date.

In August 2017, the City Center Guideway and Stations (CCGS) solicitation was canceled due to various developments which made it prudent to re-solicit the contract. To mitigate schedule delays and reduce unforeseen risk, alternate delivery methods were considered resulting in the revised Contract Packaging Plan for one (1) advanced utilities contract with unit-rate pricing for roadway and utilities and one (1) contract for the guideway and stations. Although the HART Board of Directors approved the Public-Private Partnership (P3) for CCGS & PHGT, the basis of estimate assumes design-build will be procured as planned because of time constraints in submitting this recovery plan 60 days after P3 approval was received. Please see Appendix E for methodology and approach. To help relieve cash flow and schedule compression, the Pearl Highlands Garage & Transit Center (PHGT) procurement has been deferred and is scheduled for solicitation in calendar year 3Q 2020. The P3 Developer will have flexibility to work on PHGT earlier if it is advantageous to HART.

The cost estimate as of October 2018, including change orders, known risks and total contingency, is estimated at $8.299 billion (see Table 1-1 below). The cost estimate inclusive of finance charges eligible for federal participation brings the total to $8.934 billion. All costs are in Year of Expenditure (YOE) dollars. Actual costs applied for the awarded contracts have escalation built in and remains as bid pricing. Costs for the future contracts have been escalated from the base year dollars to the mid-point of construction, compounded annually with assumed project timeline. Excluded from this report is the basis of determining forecasted finance charges. The methodology of financial modeling can be reviewed in Chapter 6 of the Recovery Plan dated October 2018.

The current cost estimate is $8.934 billion which includes $840 million of total allocated and unallocated contingency and $635 million in financing costs, all in YOE dollars. Table 1-1 below summarizes the cost estimate by FTA SCC:

Table 1-1 Current Estimate by SCC Summary

Standard Cost Category Major	
Applicable Line Items Only	YOE ($ in Million) Current Estimate
SCC 10 GUIDEWAY AND TRACK ELEMENTS	**$1,608**
SCC 20 STATIONS, STOPS, TERMINALS, INTERMODAL	**832**
SCC 30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	**101**
SCC 40 SITEWORK & SPECIAL CONDITIONS	**2,544**
SCC 50 SYSTEMS	**332**
SCC 60 ROW, LAND, EXISTING IMPROVEMENTS	**362**
SCC 70 VEHICLES	**211**
SCC 80 PROFESSIONAL SERVICES	**2,088**
SCC 90 UNALLOCATED CONTINGENCY	**221**
Subtotal (10-90)	**$8,299**
SCC 100 FINANCE CHARGES	**635**
Total Project Cost (10-100)	**$8,934**

1 Estimating Overview

The basis of this estimate incorporates multiple contract delivery methods, including design-build, design-bid-build, design-build-operate-maintain and various procurement contracts. A custom tailored approach was used in this estimate as select contracts have been awarded or are in award negotiation in addition to future contracts. This estimate includes executed change orders/amendments, known pending changes and exposures, allocated and unallocated contingency, and escalation factors provided in the FTA SCC.

Four (4) design-build contracts – ROC, West O'ahu/Farrington Highway (WOFH), Kamehameha Highway Guideway (KHG), and Airport Guideway & Stations (AGS) – are included with their awarded costs. Three (3) main design-bid-build contracts – West O'ahu Station Group (WOSG), Farrington Highway Station Group (FHSG), and Kamehameha Highway Station Group (KHSG) – are also included with the awarded costs. The design-build-operate-maintain (DBOM) Core Systems including vehicles, and procurement of Fare Collection and Elevator & Escalators awarded costs were also applied. One (1) Indefinite Delivery Indefinite Quantity (IDIQ) contract - City Center Utilities Relocation (CCUR) is included with its awarded cost. The awarded costs for all final design contracts were also used.

All of the awarded contracts have escalation built in and remains as bid pricing. The adjusted contract values inclusive of change orders were applied as lump sum line items with designated SCC. Please see Appendix C for a detailed breakdown.

The remaining P3 contract combines two (2) of the remaining primary future contracts with their own summary level specific basis and assumptions noted below. The detailed basis of estimates and backup data were provided to FTA for evaluation separately, due to data sensitivity. The list below is a summary of HART assumptions during estimating, however, the P3 developer will have the flexibility to plan when work actually starts.

1) CCGS consists of the remaining 4.16 miles of elevated guideway and eight (8) stations for the City Center Section. It is anticipated to be awarded in 4Q 2019 with assumed duration of approximately fifty-two (52) months. The design of the guideway is currently at 90% design level and stations at 30% stage. There is an independent estimate prepared by the Construction Engineering and Inspection (CE&I) consultants and an estimate validation that has been prepared at the current design stage using cost-based estimating methodology.

2) PHGT consists of the Pearl Highlands 8-story Parking Garage, the H2R1 Ramp, and the Bus Transit Center adjacent to Pearl Highlands Station. It is anticipated to be awarded in 4Q 2021 with assumed duration of approximately thirty-two (32) months. This contract, currently at the 30% design level. The cost estimate has been prepared at the current design stage using cost-based and historical data-based estimating methodology.

The estimate was developed using multiple database-driven software: HeavyBid Estimating & Bidding for civil construction, and Timberline for vertical elements. Assemblies were developed for some of the major components such as the guideway superstructure and foundations. These assemblies enable the generation of quantities based on specific design criteria and the development of standardized data.

Labor rate tables were developed using the 2017 State of Hawai'i Davis-Bacon wages with fringes, and prevailing wage rates for various labor crafts. Material costs are in 3Q 2017 dollars and based on local vendor quotations in addition to industry standard publications. Equipment costs are based on blue book values and internal estimating databases.

The estimate was developed according to a Work Breakdown Structure (WBS) based on the FTA's SCC for New Starts Projects. The categories range from SCC 10 to SCC 100.

The estimate is also based on the Contract Packaging Plan, Rev. 6.0 update issued October 2018. Operations & maintenance costs are excluded from the estimate.

2 Estimating Methodologies

Estimating methodologies are not static and must be flexible to adjust to the needs of the Project's stage in the development process. The development process is described by the overall level of engineering design associated with the major development stages defined for the Project:

Development Stage	Engineering Design Completion				
ROM					
Preliminary Design					
30% Design Level					
60% Design Level					
90% Design Level					
100% Design Level					
	0%	15%	30%	60%	90% 100%

Each development stage is represented by a range of engineering design completion and is influenced by ongoing updates associated with revisions to design plans. Due to the variability, the appropriate estimating methods or procedures at a given milestone will be based on the actual levels of project engineering and scope definition present at that time. The goal of using established estimating methodologies is to assure that the cost estimate is prepared in a consistent and uniform manner, organized and standardized in methods, and formatted in order to facilitate estimate review and reporting.

Estimating Format
A consistent format is developed for the reporting, estimating, and managing of the project's cost estimate. The estimate was developed according to a WBS based on the U.S. Department of Transportation FTA's SCC.

Estimating Software
Commercially available database software systems are used depending on the type of work elements. For example, Heavy Construction Systems Specialists' (HCSS) HeavyBid Estimating & Bidding Software is used for heavy civil construction work elements. Timberline is used for vertical elements like buildings and specialties. In order to provide uniformity between work elements and sections of the alignment, and to provide a consistent platform for reporting and analysis requirements, the cost data are exported to Microsoft Excel. This will help facilitate reviews, edits and reporting. It will also allow for increased flexibility for adjustments.

Quantity Takeoff/Reconciliation
Quantity take-offs are prepared either by direct measurement and calculation of construction elements using design drawings, sketches, or electronically calculated from CADD files. Detailed quantity take-offs will be completed and reconciled utilizing the standard WBS.

Quantity take-offs are by specific area (station by station, bridge by bridge, segment by segment, drawing by drawing, etc.) for ease of comparison. Maintenance of Traffic (MOT) dependent items including earthwork, temporary pavement, temporary striping, temporary barrier, etc. shall be taken off by both segment by segment and phase by phase in a reviewable trail manner.

Estimate Development
Estimate development is the development of unit costs for each construction activities. The development of individual or composite estimated unit costs is accomplished through the use of cost-based methods by using labor, equipment and material rates, and/or by historical bid price unit costs that are expressed in current year dollars. These methods are used either individually or in combination.

Cost-Based Method

The cost-based method is typically used to develop costs for complex construction elements including, but not limited to, earthwork, paving and bases, bridges, cast-in-place retaining walls, retained earth systems, drainage and traffic control. This method allows for unit costs to be developed based on current local construction and market conditions and to apply changes which may affect productivity or the cost of labor, equipment or materials. The following steps are required in order to develop a unit price using this method:

- Analyze the proposed construction conditions
- Estimate production rates
- Compile a list of materials
- Obtain materials prices using local available sources
- Determine labor and equipment rates
- Calculate direct unit price using the above factors
- Add allowances for contractor overhead and profit

Markup allowance on labor	15%
Markup allowance on equipment	15%
Markup allowance on material	15%
Markup allowance on subcontract or composite unit cost	10%

The following sources were used to obtain basic cost data that is input into the database estimating program in order to develop any needed construction unit prices:

- Labor Rates – Davis-Bacon wage determination
- Equipment Rates – Equipment Watch Rental Blue Book
- Material Prices - Material and supply prices for locally available material are obtained from local supplier quotes, if possible. Secondary sources of material cost data may be taken from RSMeans or other published resources.

Historical Bid Price Method

Historical bid prices are typically used to develop costs for common subcontractor construction elements, including, but not limited to: electrical, signing, striping, landscaping and irrigation, and drilled shafts. When using this method, the time of bid and conditions of the historical project used for pricing is taken into account and factors are applied as needed:

- Adjust bid prices where the bid date is older than twelve (12) months from the current date by using an appropriate escalation factor.
- Adjust bid prices to reflect conditions of the project, such as type of terrain, geographical location, soil, traffic and other related factors.

The source for historical bid prices is previously awarded contracts and Hawai'i Department of Transportation (HDOT) bid results. Historical unit prices that are used for the Project will be verified for appropriateness and documented as to their source as well as any adjustments for site conditions and escalation.

Design Allowance

Design Allowance (or design contingency), in the statistical sense, is the estimated percentage by which a calculated value may differ from its true or final value and is typically included in an estimate as an allowance for the level of engineering design completion or to address imperfections in the estimating methods used at the various project development stages. Design Allowance is typically added to the

direct cost by the use of percentage multipliers. This allowance typically falls in a range of 10% to 25%. Design Allowance is generally greatest for the early stage of project development and decreases with advancement in the level of engineering design and pricing detail. The percentage selected for a given project is generally based on level of definition of the scope of work involved and is substantiated by professional judgment and experience relative to level of uncertainty and historical cost variability typically seen for work within a particular cost category.

Escalation

Estimates are current year dollars escalated to YOE. The assumed CCGS anticipated Notice-to-Proceed (NTP) is October 2019 with planned completion in December 2023 (52 months). Escalation is calculated at 3% per year to the contract's midpoint of construction, compounded annually. The CCUR contract is currently anticipating a June 2018 NTP with planned completion in January 2022 (47 months). Escalation is based on 2.5% for two years. The PHGT is anticipating a 32 months contract duration with an NTP of calendar year 4Q 2021. Escalation of 3% per year, compounded annually, is based on the 4Q 2017 cost estimate update. Indirect contracts were modified to reflect time-driven changes.

Estimate Review

Following preparation of the cost estimate, a detailed quality assurance and control process occurs. This task will assemble the cost estimating team to perform a review of the scope, productions, indirect staff, overhead & profit, assumptions and basis used to prepare the cost estimate. This process will provide a thorough vetting of the cost estimates.

3 Sources of Data

The unit costs included in the estimate were derived from multiple sources, including the following:

- State of Hawai'i prevailing wages (2017, wage rate schedule Bulletin No. 489)
- Bureau of Labor Statistics
- Local vendor quotes for various materials
- Industry standards as published by leading project management and control organizations
- Historical information (cost databases, bid tabulations from the Project and RSMeans)

The data was compiled, compared and adjusted to reflect local rates, conditions, and specific project needs.

The cost estimates for awarded contracts were comprised of original base value, executed changes or amendments, pending changes, potential changes and claims exposure. Actual costs applied for the awarded contracts have escalation built in and remains as bid pricing. The forecast estimate is prepared and analyzed monthly and is supported by other source information such as the Change Management Log maintained by the CE&I project teams.

Cost estimates for the future contracts have been escalated from the base year dollars to the mid-point of construction, compounded annually with assumed project timeline. All values were then sorted by SCC.

Professional Services and Other Contracts: Staffing plan estimates are based on anticipated staff level of effort and projected substantial completion dates for each contract package, as appropriate. Staffing plan estimates are developed using local industry professional service rates multiplied by the current timeline associated with each contract package. Per diem, taxes, and reasonable overhead rates are also applied. The detailed staffing plans were provided to FTA for evaluation separately with sensitive vendor information, such as hourly rates, redacted. Due to HART's duty to safeguard this data, staffing plans are not widely disseminated and reporting is aggregated at the SCC level.

CE&I staffing plans were projected with the major underlying construction contract substantial completion dates in the Master Project Summary Schedule as the driver for level of effort. Additional contingency required was based on the FTA's Oversight Procedure (OP) 40 generalized contingency model and how far the underlying construction contract was in the contract lifecycle (see Table 1-2 below).

Table 1-2 Major Construction Contract as Driver of CE&I Contingency

Major Construction Contract	Construction Planned Duration (months)	Contract Lifecycle Status	Generalized Contingency Value (%)	Generalized Contingency Value (months)
West O'ahu Station	42	Construction > 50% complete	5%	3
Farrington Highway Station	42	Construction > 50% complete	5%	3
Kamehameha Highway Station	36	Construction < 50% complete	10%	4
Airport Guideway & Stations	54	Construction < 50% complete	10%	6
City Center Guideway & Stations	51	Design > 50% complete	20%	11

For professional services contracts, escalation is generally calculated at 3% per year. However, for HART and seconded staff, escalation is 2.5% based on contractual language and historic trends in Hawaii Government Employees Association (HGEA) bargaining unit agreements. Staffing plans for project-wide professional services agreements generally include contingency funding to cover at least twelve (12) months of additional work through December 2025.

The ROW estimate is based on a bottom-up analysis of remaining parcels to be acquired and relocated. The acquisition cost estimate is supported by an independent property appraisal for each individual parcel. Other allowances are included in the estimate that cannot be publicly disclosed due to the sensitivity of on-going negotiations. The detailed ROW estimate was submitted to FTA for evaluation separately. All public reporting for ROW activities is aggregated at the SCC level.

5 Estimate Assumptions

The following is a list of key assumptions/qualifications:

- Labor rates are current Davis-Bacon Wages with fringes, and prevailing wage rates for the State of Hawai'i.
- Buy America requirements apply.
- Costs for future contracts are based on a competitive bid environment, with a minimum of three proposers/bidders anticipated.
- There are sufficient experienced contractors available to perform the future work in the Honolulu construction marketplace.
- Risks for market conditions were included in the risk model to account for unique escalation for materials and labor.
- Risk model includes all known risks and individual risk probabilities correctly assigned.
- Allocated contingency is sufficient to cover all known risks.
- Professional services will not materially differ from contract staffing plans.
- Contract execution does not materially deviate from Contract Packaging Plan Rev 6.0.
- All costs are in YOE dollars.
- The anticipated RSD is September 2026.

6 FTA Standard Cost Categories

FTA SCCs
As required by the FTA, HART uses the FTA's SCCs to summarize the individual contract packages into a comprehensive Total Project estimate. A description of the major cost components includes the following:

SCC 10 Guideway and Track Elements
The scope of the guideway and track elements has not changed significantly from the FFGA cost estimate. The major change for the guideway is the separation of the Airport and City Center contracts into two (2) design-build contracts. Contracts have been awarded for the first sixteen (16) miles of guideway and the plan is to award the final four (4) miles in late 2019 as part of the P3 package. Construction is more than 95% complete on the first eleven (11) miles of guideway.

SCC 20 Stations, Stops, Terminals, Intermodal
The scope of the station related elements has not changed significantly from the FFGA cost estimate. The major change for stations is combining the stations into the guideway design-build contract packages for the Airport and City Center sections. Contracts have been awarded for the first thirteen (13) stations and the plan is to award the final eight (8) stations in late 2019 as part of the P3 package.

SCC 30 Support Facilities: Yards, Shops, and Administration Buildings
This element remains the same as in the FFGA cost estimate and the ROC contract is substantially complete.

SCC 40 Sitework and Special Conditions
This section includes civil, utility, and landscape/hardscape elements. The utilities have been repackaged for the Airport and City Center to be stand-alone contracts. The City Center utility contract also includes a section of Dillingham roadway widening improvements to facilitate constructability. Please refer to the Contract Packaging Plan and Appendix E for additional information.

SCC 50 Systems
This element remains the same as in the FFGA cost estimate.

SCC 60 ROW, Land, Existing Improvements
The ROW estimate is based on a bottom-up analysis of remaining parcels to be acquired and relocated. Section 4 above provides a detailed explanation of our forecasting methodology and key assumptions.

SCC 70 Vehicles
The number of vehicles and scope remains the same as in the FFGA cost estimate.

SCC 80 Professional Services
Soft costs were developed based on a staffing approach. HART, in cooperation with its major stakeholders, developed a staffing matrix for all major categories of soft costs. Section 4 above provides a detailed explanation of the forecasting methodology and key assumptions.

SCC 90: Contingency
A contingency budget was developed for the Project to address risks for increased costs that typically arise during the construction phase and, as such, are anticipated but unknown. Contingency is not intended to fund additional Scope of Work elements not indicated in the Final Environmental Impact Statement (FEIS).

SCC 100: Finance Charges

This SCC code is reserved for finance charges that will be incurred due to borrowing required to complete the Minimum Operable Segment (MOS). Estimated finance costs, and the method by which it was derived, is detailed in the revised Financial Plan and reflected in Chapter 6 of the Recovery Plan completed in October 2018.

HART has no control over the cost of labor and materials, the prime contractor's or any subcontractor's method of determining prices, or the competitive bidding or market conditions. This opinion of probable cost of construction is made on the basis of experience, qualifications, and best judgment of a cost consultant familiar with the construction industry. Professional cost consultants have prepared this estimate in accordance with generally accepted industry principles and practices, and are available to discuss its contents with any interested party.

DISCLAIMER NOTICE
This document is disseminated under the sponsorship of the United States Department of Transportation, FTA, in the interest of information exchange. The United States Government assumes no liability for the contents or use thereof.

The United States Government does not endorse products or manufacturers. Any trade or manufacturers' names appear herein solely because they are considered essential to the contents of the report.

NO RELIANCE BY THIRD PARTIES
This report and all subsidiary reports are prepared solely for the FTA, and should not be relied upon by any party, except the FTA, its Project Management Oversight Contractors (PMOC), and the HART Board of Directors, in accordance with the purpose as described in the next section.

REPORT FORMAT AND FOCUS
This document is submitted in compliance with the terms of FTA Contract No. DTFT60-09-D-00012, Task Order No. 2. Its purpose is to provide information and data to assist the FTA as it continually monitors HART's technical capability and capacity to execute a project efficiently and effectively, and hence, whether HART continues to be ready to receive federal funds for further project development.

This document covers the project and quality management activities on the Honolulu Rail Transit Project managed by HART as the project sponsor and partially financed by the FTA under the FFGA. Concurrent non-project activities and other items not covered by the FFGA may not be included.

INFORMATION REGARDING FORWARD-LOOKING STATEMENTS
This document includes forward-looking information. The words "believe", "anticipate", "expect", "intend", "aim", "plan", "predict", "continue", "assume", "positioned", "may", "will", "should", "shall", "risk" and any other similar expressions that are predictions of or indicate future events and future trends identifies forward-looking information. Forward-looking information includes all matters that are not historical facts. Readers should not place undue reliance on forward-looking information because it involves known and unknown risks, uncertainties and other factors that are in many cases beyond HART's control. By its nature, forward-looking information involves risks and uncertainties because it relates to events and depends on circumstances that may or may not occur in the future. Forward-looking information is not a guarantee of future performance, and HART's actual results of operations, financial condition, and the development of the industry in which it operates may differ materially from those made in or suggested by forward-looking information contained in this document. The cautionary statements set forth above should be considered in connection with any subsequent forward-looking information that HART, or persons acting on its behalf, may issue. Factors that may cause HART's actual results to differ materially from those expressed or implied by the forward-looking statements in this document include but are not limited to the risks described in HART's annual report. For projects funded through the FTA's New Starts program, the FTA and its PMOC use a risk-based assessment process to review and validate a project sponsor's budget and schedule. Any results of an FTA or PMOC risk-based assessment represent a "snapshot in time" for a particular project under the conditions known at that same point in time. The status of any assessment may be altered at any time by new information, changes in circumstances, or further developments in the project. Furthermore, any forward-looking statements contained in this document are made as of the date of this report, and HART does not undertake any obligation to update publicly or to revise any of the included forward-looking statements, whether as a result of new information, future events or otherwise, except as expressly required by law.

Alignment	Length (Miles)	Length (LF)*	Stationing	Stations
West O'ahu/Farrington Highway (D/B–Guideway) (D/B/B–Stations)	6.87	36,233.59"	Sta.392+00.00 to Sta.754+33.59	**6 Stations:** 1. East Kapolei 2. UH West O'ahu 3. Ho'opili 4. West Loch 5. Waipahu Transit Center 6. Leeward Community College
Kamehameha Highway (D/B–Guideway) (D/B/B–Stations) (P3–Parking Garage)	3.88	20,505.14"	Sta.770+00 to 975+05.14	**3 Stations:** 7. Pearl Highlands 8. Pearlridge 9. Aloha Stadium
Airport Section (D/B–Guideway & Stations)	5.15	28,600.00"	Sta.989+00 to Sta.1275+00	**4 Stations:** 10. Pearl Harbor Naval Base 11. Honolulu International Airport 12. Lagoon Drive 13. Middle Street Transit Center
City Center Section (IDIQ–Utilities & Roadway) (P3–Guideway & Stations)	4.16	22,000.00"	Sta.1275+00 to Sta.1495+00	**8 Stations:** 14. Kalihi 15. Kapalama 16. Iwilei 17. Chinatown 18. Downtown 19. Civic Center 20. Kaka'ako 21. Ala Moana Center

*Stationing on drawings, not actual calculations.

D/B = Design/Build
D/B/B = Design/Bid/Build
IDIQ = Indefinite Delivery/Indefinite Quantity

Appendix B: Cost Estimate Comparison by Standard Cost Category

Current Cost Estimate Comparison from FFGA		
Applicable Line Items Only	**FFGA Original**	**YOE (x 000s) Current Estimate**
10 GUIDEWAY & TRACK ELEMENTS (20.09)	**1,275,329**	**1,608,482**
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0	0
10.04 Guideway: Aerial structure	1,175,328	1,457,856
10.05 Guideway: Built-up fill	0	0
10.08 Guideway: Retained cut or fill	8,077	0
10.09 Track: Direct fixation	86,332	150,626
10.11 Track: Ballasted	3,551	0
10.12 Track: Special (switches, turnouts)	2,041	0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (21)	**506,166**	**831,702**
20.01 At-grade station, stop, shelter, mall, terminal, platform	7,334	13,462
20.02 Aerial station, stop, shelter, mall, terminal, platform	353,476	602,715
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0
20.06 Automobile parking multi-story structure	79,691	148,242
20.07 Elevators, escalators	65,665	67,283
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	**99,425**	**100,807**
30.01 Administration Building: Office, sales, storage, revenue counting	0	0
30.02 Light Maintenance Facility	8,161	3,057
30.03 Heavy Maintenance Facility	40,907	64,480
30.04 Storage or Maintenance of Way Building	8,382	8,619
30.05 Yard and Yard Track	41,975	24,651
40 SITEWORK & SPECIAL CONDITIONS	**1,103,867**	**2,543,737**
40.01 Demolition, Clearing, Earthwork	34,696	34,484
40.02 Site Utilities, Utility Relocation	350,695	882,120
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water	7,229	34,345
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks	30,842	5,519
40.05 Site structures including retaining walls, sound walls	8,638	28,649
40.06 Pedestrian / bike access and accommodation, landscaping	48,263	15,244
40.07 Automobile, bus, van accessways including roads, parking lots	212,536	293,818
40.08 Temporary Facilities and other indirect costs during construction	410,969	1,249,558
50 SYSTEMS	**247,461**	**332,018**
50.01 Train control and signals	91,493	164,834
50.02 Traffic signals and crossing protection	12,524	3,771
50.03 Traction power supply: substations	32,874	32,397
50.04 Traction power distribution: catenary and third rail	36,426	37,121
50.05 Communications	59,889	67,391
50.06 Fare collection system and equipment	10,222	22,694
50.07 Central Control	4,033	3,810
Construction Subtotal (10-50)	**3,232,248**	**5,416,746**
60 ROW, LAND, EXISTING IMPROVEMENTS	**222,188**	**361,625**
60.01 Purchase or lease of real estate	201,659	272,900
60.02 Relocation of existing households and businesses	20,529	88,725
70 VEHICLES (80)	**208,501**	**211,390**
70.01 Light Rail	186,061	190,384
70.05 Other	0	129
70.06 Non-revenue vehicles	16,011	14,371
70.07 Spare parts	6,429	6,506
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	**1,183,826**	**2,087,501**
80.01 Preliminary Engineering	95,120	54,754
80.02 Final Design	257,935	615,663
80.03 Project Management for Design and Construction	385,826	698,410
80.04 Construction Administration & Management	218,156	306,860
80.05 Professional Liability and other Non-Construction Insurance	52,138	103,340
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.	76,135	103,697
80.07 Surveys, Testing, Investigation, Inspection	24,955	141,964
80.08 Start up	73,561	62,813
Subtotal (10-80)	**4,846,764**	**8,077,262**
90 UNALLOCATED CONTINGENCY	**101,871**	**221,738**
Subtotal (10-90)	**4,948,635**	**8,299,000**
100 FINANCE CHARGES	**173,058**	**635,000**
Total Project Cost (10-100)	**5,121,693**	**8,934,000**

Appendix C: Cost Estimate Worksheet by Standard Cost Category

MAIN WORKSHEET-BUILD ALTERNATIVE

City and County of Honolulu — Today's Date: Oct 2018

Honolulu Rail Transit Project, East Kapolei to Ala Moana Center — Yr of Base Year $: HART FY 2018

Full Funding Grant Agreement (2018 Recovery Plan Baseline) — Yr of Revenue Ops: HART FY 2026

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**20.05**	1,354,268	203,838	**1,558,106**	**$ 77,711**	**30%**	**18%**	**1,608,482**
10.01 Guideway: At-grade exclusive right-of-way		0	0	0				0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)		0	0	0				0
10.03 Guideway: At-grade in mixed traffic		0	0	0				0
10.04 Guideway: Aerial structure	19.45	1,217,209	195,638	1,412,848	$ 72,640			1,457,856
10.05 Guideway: Built-up fill		0	0	0				0
10.06 Guideway: Underground cut & cover		0	0	0				0
10.07 Guideway: Underground tunnel		0	0	0				0
10.08 Guideway: Retained cut or fill	0.60	0	0	0	$ -			0
10.09 Track: Direct fixation		137,059	8,200	145,259				150,626
10.10 Track: Embedded		0	0	0				0
10.11 Track: Ballasted		0	0	0				0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**21**	684,115	82,773	**766,888**	**$ 36,518**	**15%**	**9%**	**831,702**
20.01 At-grade station, stop, shelter, mall, terminal, platform	1	13,462	0	13,462	$ 13,462			13,462
20.02 Aerial station, stop, shelter, mall, terminal, platform	20	511,803	61,854	573,656	$ 28,683			602,715
20.03 Underground station, stop, shelter, mall, terminal, platform		0	0	0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.		0	0	0				0
20.05 Joint development		0	0	0				0
20.06 Automobile parking multi-story structure		93,231	19,255	112,486				148,242
20.07 Elevators, escalators		65,619	1,664	67,283				67,283
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS		100,807	0	**100,807**	**$ 5,028**	**2%**	**1%**	**100,807**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		3,057	0	3,057				3,057
30.03 Heavy Maintenance Facility		64,480	0	64,480				64,480
30.04 Storage or Maintenance of Way Building		8,619	0	8,619				8,619
30.05 Yard and Yard Track		24,651	0	24,651				24,651
40 SITEWORK & SPECIAL CONDITIONS		2,273,175	241,658	**2,514,833**	**$ 125,428**	**48%**	**29%**	**2,543,737**
40.01 Demolition, Clearing, Earthwork		33,004	1,038	34,042				34,484
40.02 Site Utilities, Utility Relocation		783,072	95,528	878,600				882,120
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		33,830	515	34,345				34,345
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		5,519	0	5,519				5,519
40.05 Site structures including retaining walls, sound walls		24,950	2,595	27,545				28,649
40.06 Pedestrian / bike access and accommodation, landscaping		14,744	500	15,244				15,244
40.07 Automobile, bus, van accessways including roads, parking lots		238,398	23,420	261,818				293,818
40.08 Temporary Facilities and other indirect costs during construction		1,139,657	118,062	1,257,719				1,249,558
50 SYSTEMS		315,097	10,166	**325,263**	**$ 16,223**	**6%**	**4%**	**332,018**
50.01 Train control and signals		156,191	2,063	158,255				164,834
50.02 Traffic signals and crossing protection		3,172	599	3,771				3,771
50.03 Traction power supply: substations		32,397	0	32,397				32,397
50.04 Traction power distribution: catenary and third rail		37,121	0	37,121				37,121
50.05 Communications		67,391	0	67,391				67,391
50.06 Fare collection system and equipment		15,015	7,503	22,519				22,694
50.07 Central Control		3,810	0	3,810				3,810
Construction Subtotal (10-50)		4,727,462	538,435	**5,265,897**	**$ 262,638**	**100%**	**62%**	**5,416,746**
60 ROW, LAND, EXISTING IMPROVEMENTS		254,836	106,790	**361,625**	**$ 18,036**		**4%**	**361,625**
60.01 Purchase or lease of real estate		171,400	101,500	272,900				272,900
60.02 Relocation of existing households and businesses		83,436	5,290	88,725				88,725
70 VEHICLES (number)	**80**	211,390	0	**211,390**	**$ 2,642**		**2%**	**211,390**
70.01 Light Rail	80	190,384	0	190,384	$ 2,380			190,384
70.02 Heavy Rail		0	0	0				0
70.03 Commuter Rail		0	0	0				0
70.04 Bus		0	0	0				0
70.05 Other		129	0	129				129
70.06 Non-revenue vehicles		14,371	0	14,371				14,371
70.07 Spare parts		6,506	0	6,506				6,506
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)		1,938,536	90,197	**2,028,733**	**$ 101,184**	**39%**	**24%**	**2,087,501**
80.01 Preliminary Engineering		54,754	0	54,754				54,754
80.02 Final Design		555,982	29,770	585,753				615,663
80.03 Project Management for Design and Construction		653,816	26,467	680,283				698,410
80.04 Construction Administration & Management		270,215	25,914	296,129				306,860
80.05 Professional Liability and other Non-Construction Insurance		99,340	4,000	103,340				103,340
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		99,929	3,768	103,697				103,697
80.07 Surveys, Testing, Investigation, Inspection		141,687	277	141,964				141,964
80.08 Start up		62,813	0	62,813				62,813
Subtotal (10 - 80)		7,132,224	735,421	**7,867,645**	**$ 392,401**		**92%**	**8,077,262**
90 UNALLOCATED CONTINGENCY				**79,210**			**3%**	**221,738**
Subtotal (10 - 90)				**7,946,855**	**$ 396,352**		**93%**	**8,299,000**
100 FINANCE CHARGES				**583,707**			**7%**	**635,000**
Total Project Cost (10 - 100)				**8,530,562**	**$ 425,464**		**100%**	**8,934,000**

Appendix D: Base Cost Estimate (BCE) by Source of Funding

SCC BCE by Source of Federal Funding ($ X000s)	Total Project Cost (YOE $)		Federal 5309 New Starts	Federal Other (ARRA)	Local
10 GUIDEWAY & TRACK ELEMENTS (20.09 route miles)	$1,608,482		$289,527	$0	$1;318,955
20 STATIONS, STOPS, TERMINALS, INTERMODAL (21)	831,702		149,706	0	681,996
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	100,807		18,145	0	82,662
40 SITEWORK & SPECIAL CONDITIONS	2,543,737		457,873	0	2,085,864
50 SYSTEMS	332,018		59,763	0	272,255
60 ROW, LAND, EXISTING IMPROVEMENTS	361,625		65,093	0	296,532
70 VEHICLES (80)	211,390		38,050	0	173,340
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	2,087,501		375,750	4,000	1,707,751
90 UNALLOCATED CONTINGENCY	221,738		39,913	0	181,825
100 FINANCE CHARGES	635,000		56,180	0	578,820
Total Project Cost (10 - 100)	**$8,934,000**		**$1,550,000**	**$4,000**	**$7,380,000**

Sources of Federal Funding ($ X000s) and Matching Share Ratios	Costs Attributed to Source of Funds		Federal/ Local Matching Ratio within Source	All Federal Funds	Local Funds
Federal 5309 New Starts	8,930,000		18/82	1,550,000	7,380,000
Federal Other (Section 5307)	0		NA	0	0
Federal Other (ARRA)	4,000		100/0	4,000	0
Total	**$8,934,000**		**$1,554,000**		**$7,380,000**
Overall Federal Share of Project				18%	
New Starts Share of Project				18%	

Appendix E: Repackaging of City Center Guideway & Stations

The CCGS contract package is the fourth and final segment for the Project. The history, current status and circumstances surrounding the repackaging of the CCGS design-build procurement from 2013 to date, and the programmatic advantages used to arrive at this current approach are described below:

History
In 2013, the City Center Section scope was combined as the Airport and City Center Guideway DBB contract; a single contract to include utility relocations, roadway and guideway from Aloha Stadium to Ala Moana Station. Stations on the "East" were to be constructed under a separate contract at that time.

By 2015, the City Center Section had advanced a CCGS design-build project to include utility relocations, roadway, guideway, and stations from Middle Street to Ala Moana Station.

In 2017, several cumulative factors evoked reconsideration of the contract packaging plan for the City Center Section, namely: funding delays led to a one-year procurement suspension to the CCGS design-build Request for Proposals (RFP); recent improvements in existing underground utility information impacted the schedule of signed and sealed underground utility drawings; and AECOM, the lead design team for the CCGS, acquired a key company on one of the RFP teams, creating a conflicted offeror.

On August 24, 2017, the CCGS design-build RFP was cancelled, enabling consideration for alternative contract packaging approaches.

In September 2018, the HART Board of Directors approved moving forward with P3 strategy for CCGS & PHGT contact packages.

Advantages to Current Packaging Plan
Multiple factors resulted in the selection of an alternate delivery approach. The most significant of those factors were:

(1) Mitigation of Unidentified Utilities: A Subsurface Utility Engineering (SUE) contract was issued in early 2017, and the results of this investigation can now be used in the development of a more confident underground utility design.

(2) Mitigation of Lagging Design Approvals: An IDIQ CCUR procurement would allow HART to procure a construction contractor prior to completion of the design and 3rd Party Reviews. By comparison, a lump-sum design-bid-build procurement would likely be postponed until completion of the design to minimize change orders.

(3) Increased Field of Offerors for CCUR: By separating the CCUR package from CCGS, the Roadway and Utility scope could potentially become accessible to more contractors. Additional offerors for this package could then increase the level of competition and ultimately reduce the cost of this work.

(4) Mitigation of Late ROW Availability: An IDIQ CCUR contract would allow HART flexibility to direct the work as individual ROW parcels become available, while avoiding claims associated with late ROW availability, as could be expected on a lump sum contract.

(5) Mitigation of Underground Changes in Conditions: Unit-rate pricing was thought to align the parties' interests in the likely event of encountering unforeseen utilities. As compared to a lump-sum design-bid-build project, wherein the contractor may leave the site, submit a notice of impact, and wait for design direction from the owner; a unit-rate contractor would be more likely

to work with the owner and engineer to resolve issues and resume construction as quickly as possible.

(6) Strategically Issuing CCUR Task Orders: Task Orders for CCUR can be strategically issued in order to relocate larger risk utilities sooner. This will not only allow the CCGS contractor to be more efficient in their construction sequencing of the foundations and guideway construction, but also minimizes the risk of delays to CCGS should unforeseen conditions be encountered.

APPENDIX G

Basis of Schedule

HONOLULU RAIL TRANSIT PROJECT
East Kapolei to Ala Moana Center
Basis of Schedule

November 2018

Table of Contents

1 Introduction 6

2 Project Goals 8

3 Project Calendars 9

4 FTA Milestones 10

5 Schedule Control and Reporting 12

6 Network of Schedules 14

6.1 Master Project Schedule 14

6.2 Guideway Segments 14

6.3 West-side Stations 15

6.4 East-side Guideway and Stations 16

6.5 City Center Utilities Relocation 17

6.6 Rail Operations Center (ROC) (Previously the MSF) 18

6.7 Core Systems Contractor (CSC) 18

6.8 Other Project-wide Contracts 20

6.9 Pearl Highlands Garage and Transit Center (PHGT) 20

7 Contract Status 21

8 Production Rate Assumptions 22

9 Schedule Contingency 23

10 Assumptions (CCGS) 24

11 Critical Path 27

11.1 Near Critical 27

12 Price Allocation 29

13 Activity Coding 30

14 Constraints and Interfaces 31

14.1 Constraints 31

14.2 Interface Table 31

15 Measurement of Scope Accomplishment 32

16 Schedule of Milestones and Schedule of Values 33

17 Cash Flow Forecast 34

18 Monthly Pay Request 35

19 Professional Services Availability 36

20 Construction Labor, Material, and Equipment Availability 37

21 ROW Acquisition, Easements, and Permits 38

Appendices

Appendix A **Work Breakdown Structure (Levels 1-3) 39**
Exhibit A-1 Work Breakdown Structure, Level 1 (Global Activity Code WBS1) 39
Exhibit A-2 Work Breakdown Structure, Level 2 (Global Activity Code WBS2) 39
Exhibit A-3 Work Breakdown Structure, Level 3 (Global Activity Code WBS3) 39
Exhibit A-4 Work Breakdown Structure, Level 4 (Global Activity Code WBS4) 39
Exhibit A-5 Work Breakdown Structure, Level 4 (Global Activity Code WBS5) 41
Appendix B **Interface Table with Contract Access Milestone Dates 44**
Appendix C **Summary Schedule 47**

AGS	Airport Guideway and Stations
ALM	Ala Moana Station
AS	Aloha Stadium Station
BCS	Balanced Cantilevered Spans
BFS	City and County of Honolulu, Department of Budget and Fiscal Services
BOS	Basis of Schedule
CAM	Construction Access Milestone
CTN	China Town Station
CCGS	City Center Guideway and Stations
CCUR	City Center Utilities Relocation
CVC	Civic Center Station
CEI	Construction Engineering and Inspection
CFCG	Configuration Control Group
CPM	Critical Path Methodology
CSC	Core Systems Contractor
DB	Design-Build
DBB	Design-Bid-Build
DBOM	Design-Build-Operate-Maintain
DFIM	Design-Furnish-Install-Maintain
DNT	Downtown Station
E&E	Elevators and Escalators
EV	Earned Value
FEIS	Final Environmental Impact Statement
FHSG	Farrington Highway Station Group
FTA	Federal Transit Administration
GET	General Excise Tax
HART	Honolulu Authority for Rapid Transportation
HRTP	Honolulu Rail Transit Project
IO	Interim Opening
IWL	Iwilei Station
KLH	Kalihi Station
KAK	Kaka'ako Station
KHG	Kamehameha Highway Guideway
KHSG	Kamehameha Highway Station Group
KLM	Kapālama Station
kV	Kilovolt
LCC	Leeward Community College
MOT	Maintenance of Traffic
MPIS	Master Project Integrated Schedule
MPS	Master Project Schedule
MSF	Maintenance and Storage Facility
NTP	Notice to Proceed
P-3	Public-Private Partnership
PC	Project Controls
PHGT	Pearl Highlands Garage, Transit Center and Ramp H2R1

PH	Pearl Highlands Station
PR	Pearl Ridge Station
ROC	Rail Operations Center
ROW	Right-of-Way
RSD	Revenue Service Date
SCC	Standard Cost Category
SOM	Schedule of Milestones
SOV	Schedule of Values
SPI	Schedule Performance Index
SV	Schedule Variance
TPSS	Traction Power Substation
UHWO	University of Hawai'i–West O'ahu
WBS	Work Breakdown Structure
WOFH	West O'ahu/Farrington Highway Guideway
WOSG	West O'ahu Stations Group

1 Introduction

This Basis of Schedule (BOS) is intended to describe the methodology and assumptions used to develop and provide updates to the Master Project Integrated Schedule (MPIS). This document was previously updated on June 17, 2012, with a supplemental document provided in November 2015 (*Basis of Schedule Update*, dated November 05, 2015), and again in April 2017 for the April Recovery Plan. Subsequent to resolution of project funding issues in the fourth quarter of 2017 and the intention to advance the schedule of award of the City Center Guideway and Station (CCGS) contract, HART management decided to re-package the City Center guideway, stations, and utility relocation work into two packages, i.e. City Center Utilities Relocation (CCUR) followed by either a Design-Build (DB) or public-private partnership (P-3) for the City Center Guideway and Stations work. The November 2018 update is prepared for an update to the Recovery Plan following the decision to solicit for a P-3.

The Honolulu Rail Transit Project (HRTP or the Project) consists of a 20.1-mile fixed rail system on elevated guideway structure from East Kapolei to Ala Moana Center, 20 elevated stations, 1 at-grade station, a Rail Operations Center (ROC, formerly known as the Maintenance and Storage Facility [MSF]) and service yard, parking facilities, intermodal facilities, utilities, roadway improvements, all system work, right-of-way (ROW) acquisition, relocations, 80 driverless rail vehicles, and complete professional services, including design, construction management, and owner costs.

The Project is approximately 44.8% complete as of August 2018, which includes completion of the ROC and 10.75 miles of elevated guideway constructed from the East Kapolei Station site to just past the Aloha Stadium Station site. It should be noted that the reported percentages complete are based on the current Estimate at Completion (EAC) and assumed Revenue Service Date (RSD) of December 2025, not the PMOC Risk Refresh recommended RSD of September 2026.

With the award of the Airport Guideway and Stations (AGS) Design-Build contract and the City Center Utility Relocation (CCUR) contract the Honolulu Authority for Rapid Transportation (HART) currently has over $4.96 billion either completed or under contract, which includes 15.9 of the 20.1 miles of guideway and 13 of the 21 stations. The two most significant contract packages yet to be awarded are the CCGS DB and the Pearl Highlands Garage, Transit Center and Ramp H2R1 (PHGT) Design-Build. Both of these contracts are part of the P-3 solicitation released on September 28, 2018.

The upcoming contract packages will require a Baseline Schedule that will utilize the Critical Path Methodology (CPM) to depict the necessary detail of activities, durations, interim milestones, and logic necessary to achieve the contract-defined milestone requirements. In addition, interdependency logic ties by way of Contract Access Milestones (CAMs) will be included in order to define crucial access and cross-contract exchange of design, construction, and operational status information. HART will monitor this activity through the P-3 monthly progress schedules.

The MPIS will be cost-loaded, to enable cost disbursement charts and trending histograms to be created from current actual costs (Work in Progress). A Schedule of Milestones (SOM) will enable the MPIS to also be structured with earned value measurement gauges with assigned

payment amounts upon accomplishment; Schedule Performance Index (SPI) indicators can then be charted and monitored at both the contract level and at the overall MPIS level. Each monthly update of the individual contracts' baseline CPM schedules will be summarized into the overall MPIS and will include CAM interfaces, coordination with third-party entities, and contract milestones. Each monthly update is reviewed and compared against the approved baseline, with any variances noted and reported with recommended corrective actions.

2 Project Goals

The Project has the following goals:

- Improve mobility within the corridor
- Improve travel reliability within the corridor
- Improve access to planned development in support of the City and County of Honolulu (City) policy to develop a Second Urban Center
- Improve transportation equity within the corridor

3 Project Calendars

The standard global Project calendar used for work days is 5 days per week, 8 hours per day, with 10 holidays, as indicated below.

The following ten holidays are incorporated as non-work periods in the global calendar.

Table 3-1 Global Project Calendar Holidays

Holiday	Time of Event
New Year's Day	1st work day in January
Martin Luther King, Jr., Day	3rd Monday in January
President's Day	3rd Monday in February
Memorial Day	Last Monday in May
King Kamehameha Day	11th day in June
Independence Day	4th day in July
Labor Day	1st Monday in September
Thanksgiving	4th Thursday in November
Day after Thanksgiving	4th Friday in November
Christmas	25th day in December

The global Project calendar to be used for contractor and subcontractor procurement activities for calendar days is 7 days per week, 8 hours per day (without holidays).

4 FTA Milestones

The following table details dates upon which the Project has achieved or is projected to achieve certain FTA milestones:

Table 4-1 Project FTA Milestones

Milestone	Date
Approval to Enter Preliminary Engineering	October 16, 2009 (Actual)
Final Environmental Impact Statement (FEIS) Record of Decision Issued	January 18, 2011 (Actual)
Approval to Enter Final Engineering	December 29, 2011 (Actual)
Full Funding Grant Agreement	December 19, 2012 (Actual)
FTA Recovery Plan A Submittal	April 28, 2017 (Actual)
Current FFGA Revenue Service Date	January 31, 2020 (Baseline)
December 2017 Recovery Plan – RSD	December 31, 2025 (Goal)
November 2018 Updated Recovery Plan - RSD	September 1, 2026

The following are awarded construction contracts with Substantial Completion dates:

Table 4-2 Awarded Construction Contract Substantial Completion Dates

Construction Contract	Substantial Completion Date
West O'ahu/Farrington Highway Guideway (WOFH) Design-Build (DB)	March 3, 2017*
Kamehameha Highway Guideway (KHG) DB	September 30, 2017*
Maintenance and Storage Facility (MSF) DB	July 2, 2016 (Actual)
West O'ahu Stations Group (WOSG) Design-Bid-Build (DBB)	March 12, 2019*
Farrington Highway Station Group (FHSG) DBB	January 16, 2019*
Kamehameha Highway Station Group (KHSG) DBB	May 17, 2019*
Airport Guideway and Station (AGS) DB	May 3, 2021
Core Systems Contractor (CSC) Design-Build-Operate-Maintain (DBOM)	March 15, 2019*
City Center Utilities Relocation	February 2022
Fare Collection System Design-Furnish-Install-Maintain (DFIM)	January 14, 2029
Elevators and Escalators (E&E) DFIM	May 1, 2019*

*Change Orders are expected, or are in process, that may amend the Substantial Completion date.

During the last four years, and since the April 2017 BOS was completed, there was a change in the expected contracting methodology and re-packaging of several construction contracts. This resulted in a P-3 contract solicitation that would include Design-Build construction of CCGS and PHGT, as well as the completion of the Core Systems installation in the City Center segment.

Passenger Service has been planned to support a uniform startup process and is broken into two passenger service opening dates:

- December 2020 for the nine west-side stations and guideway through Aloha Stadium Station, to be completed and opened as an Interim Opening Service date.

- December 2025 for the balance of the system including all 21 stations remains HART's target date due to the commitment made to the Honolulu public when the GET and TAT were extended. However, for FTA reporting purposes, September 1, 2026 is the required RSD.

5 Schedule Control and Reporting

The assumption of the original June 2012 BOS was to have a Master Project Schedule (MPS) consisting of summarized dates from a series of project-wide network activities (ROW, Utilities by Utility Companies, Environmental Permits, etc., as well as unawarded construction or DB projects). These summarized dates and activities were to be updated on a monthly basis by HART personnel utilizing the final design and construction contract milestone dates. Over time, this translated into HART Project Controls staff updating the MPS schedules based on progress schedules from the construction contractors. The HART personnel, starting with the WOFH contract, were not able to receive timely progress schedules from the contractors, resulting in HART's inability to keep the MPS current.

This process was revised in February/March 2017. The Master Project Integrated Schedule (MPIS) is not a single schedule file, rather it is the product of a Master Project Schedule (MPS) and several contract schedule files utilizing external logic ties to integrate 19 schedules. The MPIS feeder schedules are Control Level Schedules with summary activities or Level of Effort activities (that reflect a group of activities from the contractors' schedule) and include the contract milestones for the contract. The P6 schedule files are listed below:

MPIS

- Master Project Schedule – In general, this file contains activities that do not belong to any of the other contract files listed below including: Design contracts, Archeological Studies, lawsuit delays, utility work (not tracked in a contract file), funding delays, Interim Opening milestone, Revenue Service Date milestone, project contingency, contract project activities prior to the project baseline schedule (i.e., Pearl Highlands Garage and Transit), Consultant contracts, Level of Effort summary activities, etc.
- Right-of-Way (ROW) – Right-of-Way activities for the identified property needs for the project.
- Maintenance and Storage Facility (ROC)
- West O'ahu/Farrington Highway Guideway (WOFH)
- Kamehameha Highway Guideway (KHG)
- West O'ahu Station Group (WOSG)
- Farrington Highway Station Group (FHSG)
- Kamehameha Highway Station Group (KHSG)
- Airport Guideway and Stations (AGS)
- H2 Highway off-ramp to Pearl Highlands Station (H2R2)
- Safety and Security
- Core Systems Contract-West (CSC1)
- Core Systems Contract East (CSC2)
- UH West O'ahu Temporary Park and Ride (UHWT)
- Elevators and Escalators (E&E)
- City Center Utilities Relocation DBB (CCUR)
- Kamehameha Highway Civil work
- Kamehameha Highway 138 kV Relocation
- City Center Guideway and Stations DB or P-3 (CCGS)

The contractors' CPM monthly progress schedules will be used by the HART Project Controls (PC) staff to update monthly the Control Level Schedules that feed into the MPIS. If contractors do not provide timely progress schedules (as was routine through 2016), the HART PC staff will update the Control Level Schedule based on field staff daily reports, weekly reports, monthly reports, 4 weeks look ahead schedules, and discussions with the Construction Engineering and Inspection (CEI) field staff and/or CEI schedulers.

Included in the Contractor's Baseline CPM Schedule updates are the CAM dates that are used to monitor and control "cross-contract" interfaces. These CAM dates will be utilized in the Control Level Schedules to update contractor reported milestones and activities related to other contracts (using external logic ties) that may potentially affect progress not detailed in the contractor schedules, or include information of pending contract awards.

The primary guideline of the MPIS is that the information at a summary level contained within the MPIS is available and may be appropriate for public knowledge. The MPIS will be updated by the HART Project Controls team on a monthly basis.

The contractors' progress schedules are to be cost loaded according to the Schedule of Milestones (SOM) or Schedule of Values (SOV) as appropriate. With the SOM/SOV included in the Baseline Schedule, the detailed schedules will also provide a cash flow projection (Planned Value or Budgeted Cost of Work Scheduled) and actual scope accomplishment (Earned Value or Budgeted Cost of Work Performed), allowing for an evaluation of schedule performance.

6 Network of Schedules

6.1 Master Project Schedule

The Master Project Schedule (MPS) is a feeder schedule to the MPIS that includes the following:

- Environmental Actions
- Professional Services contracts (that is, Final Design, General Engineering Consultant, and CEI)
- Summary Levels of Effort for presentation purposes
- Procurement activities
- On-Call Contractor durations
- Airport Guideway and Stations construction planning activities, prior to accepted Contractor Baseline Schedule (Removed since last update)
- Agreements/Memoranda of Understanding
- Major milestone dates such as Interim Opening and Revenue Service Date

The purpose of the MPS has been to act as the backbone of the MPIS. The construction contracts and the Core Systems Contract started out as a set of summary activities embedded in the MPS. As the Project specifics were developed, the activities were expanded and eventually became a separate feeder schedule with external logic ties to the other schedule files of the MPIS. There is only one construction schedules remaining in the MPS at the time of this writing: PHGT. As the baseline schedule for PHGS is submitted and eventually accepted by HART, the PHGT activities in the MPS schedule will be deleted and replaced with a summarized schedule developed from the contractor's schedule, and external logic ties will be made in order to integrate it with the other related contracts. The same will occur upon award of other remaining construction projects.

6.2 Guideway Segments

Each guideway section contains utility relocations, cast-in-place drilled shaft foundations, cast-in-place columns, pre-cast structural guideway bridge segments, trackwork, and roadway/site restoration work. The 20.1-mile corridor is broken down into the following segments:

- WOFH: 6.87 miles
- KHG: 3.88 miles
- AGS: 5.15 miles
- CCGS: 4.16 miles

Table 6-1 Guideway Segment Elements Breakdown

Segment	Foundation Shafts (Piers)	Columns	Pre-cast Segments	Aerial Stations	At-Grade Stations
West O'ahu/ Farrington Highway	309 completed	283 completed	3,209 – completed 84 – Balanced Cantilevered Spans (BCS) completed	5	1
Kamehameha Highway	186 completed	169 completed	2,029 – completed 43 – BCS completed	3	0
Airport	93 complete of 225	56 complete of 232	727 complete of 2,703	4	0
City Center	195	176	1,892 segments (172 spans)	8	0
Project Totals	**915**	**860**	**9,833**	**20**	**1**

Foundation shafts and columns that are not yet designed as part of a DB contract are based on typical 125-foot spacing. Pre-cast segments are based on normal 11-foot lengths. Some foundations have multiple piers (drilled shafts) supporting a single column, thus the difference in quantities.

In 2017, HECO informed HART that HECO will not perform utility relocation construction services for the electrical facilities within the Airport and City Center sections. Therefore, the AGS and future contracts will include this electrical distribution work in the Airport and City Center alignment.

6.3 West-side Stations

The station groups on the WOFH and KHG segments, from East Kapolei to Aloha Stadium, are currently under construction as separate DBB contracts as indicated below. CAM dates are established within each of the three station contracts that correlate to milestone start activities in the CSC and E&E contracts. The contractor's projected dates for completion of the CAMs are monitored in the MPIS along with the CSC need dates. Disconnects are monitored and managers are involved with identifying mitigating strategies.

The FHSG consists of West Loch Station, Waipahu Transit Center Station, and Leeward Community College (LCC) Station. LCC Station is the only at-grade station in the corridor, with the other facilities built alongside and over/under the WOFH guideway segment.

The WOSG consists of Ho'opili Station, University of Hawai'i–West O'ahu (UHWO) Station, and East Kapolei Station. All stations are built alongside and over/under the WOFH guideway segment.

The KHSG consists of Pearl Highlands Station, Pearlridge Station, and Aloha Stadium Station. Pearl Highlands Station is built alongside and over WOFH. Aloha Stadium Station and Pearlridge Station are built alongside and over/under the KHG segment.

6.4 East-side Guideway and Stations

The AGS DB contract is underway and consists of 211 spans of guideway and four stations, namely Pearl Harbor Naval Base Station, Honolulu International Airport Station, Lagoon Drive Station, and Middle Street Transit Center Station.

With the AGS contract now awarded, the primary focus for the schedule development is on finalizing an acceptable baseline schedule for AGS and on the planning factors for theremaining CCGS segment. Once an acceptable baseline schedule is finalized, the MPIS summary schedule will be modified to appropriately report the AGS status and its impact on CAMs for the CSC.

The CCGS guideway segments are broken down into the following work areas for HART scheduling purposes only and are likely to be modified by the selected P-3 contractor.

- Area 1A: Track Stationing 1275 to Stationing 1295, (Span 636 to Span 655), which includes Kalihi Station.
- Area 1B: Track Stationing 1295 to Stationing 1333, (Span 656 to Span 680).
- Area 1C: Track Stationing 1333 to Stationing 1356, (Span 681 to Span 697), which includes Kapālama Station.
- Area 2: Track Stationing 1356 to Stationing 1374, (Span 698 to Span 711), which includes Iwilei Station.
- Area 3: Track Stationing 1374 to Stationing 1407, (Span 712 to Span 739), which includes Chinatown Station and Downtown Station.
- Area 4: Track Stationing 1407 to Stationing 1445, (Span 740 to Span 767), which includes Civic Center Station.
- Area 5: Track Stationing 1445 to Stationing 1471, (Span 768 to Span 788), which includes Kaka'ako Station.
- Area 6: Track Stationing 1471 to Stationing 1493, (Span 789 to Span 807), which includes Systems Site #23 and Ala Moana Center Station.

The CCGS guideway segment begins along Kamehameha Highway/Dillingham Boulevard, just east of the Middle Street Transit Center Station, and ends on Kona Street at Kona Iki Street, adjacent to Ala Moana Center. The eight stations within this segment consist of Kalihi Station, Kapālama Station, Iwilei Station, Chinatown Station, Downtown Station, Civic Center Station, Kaka'ako Station, and Ala Moana Center Station.

The planned start of the CCGS construction portion of the P-3 is based on:

- A Notice to Proceed (NTP) allowing station design completion early enough to start station construction as soon as utilities relocation are completed.
- An expected NTP allowing construction to start within two months after the Kaka'ako (Areas 2-6) utilities have been relocated. This will allow the contractor to have full access to 2.6 miles of the full alignment and includes six stations. Access to the Dillingham portion of the CCGS alignment will be provided when the Dillingham utilities relocation has been completed.

6.5 City Center Utilities Relocation

City Center Utilities Relocation is an advanced utility relocation effort being conducted to remove the utilities in the way of planned drilled shafts, prepare for road widening, and remove overhead utility obstructions. Contracts to be utilized for this effort include On-Call III, On-Call IV, and City Center Utilities Relocation contract (unit rate contractr) with the goal of relocating existing wet (water, sewer, etc.) and dry utilities (electrical, communications, telephone, cable, etc.) prior to the P-3 contractors access to the guideway alignment.

The utilities relocation scope of work includes:

- Relocate water, storm drain, and sewer;
- Install underground electrical and communications ductbanks from which the aboveground dry utilities will be installed;
- Install underground ductbanks (both open trench and microtunnel) for 138 kV;
- Install permanent HECO work; specifically all electrical cable/installs in City Center area;
- Provide temporary roadway surface;
- Kapālama Bridge Widening;
- Permanent HECO work; specifically electrical cables, pulling, and connections of 46 kV and lower distribution lines on AGS;

The plan to complete the design for utility relocation is being revamped due to difficulties in getting approvable drawings from the City and County Planning Department. Drawing sets for specific task orders are now being developed in order to gain timely review/approval from the Planning Department. As of October 16, 2018 the revised schedule is not known, but pressure is being exerted on HART and the designer staff to prepare the drawings, gain approval, and complete construction by August 2021 in the Dillingham area and October 2020 in the Kaka'ako area.

The CCUR work was awarded as a unit rate construction contract with scope executed on the contract as design is complete. The interim roadway widening is expected to start first and include the storm drainage infrastructure. Utility relocation work will focus on the Kaka'ako and Dillingham wet utilities as the design is completed. The dry utility relocation work in the Kaka'ako area will likely start next with the Dillingham dry utility relocation starting last. The actual sequencing will be driven by when the final designs are coordinated with Third-Parties. The sequencing will be decided by HART through the task orders released to the CCUR contractor.

6.6 Rail Operations Center (ROC) (Previously the MSF)

Construction of the ROC reached Substantial Completion on July 2, 2016. The CSC is now in control of the ROC facilities. Installation of facility equipment and rail yard track power and communications is ongoing.

6.7 Core Systems Contractor (CSC)

The CSC schedule is currently presented as two separate feeder schedules. The schedule portraying the western segment (Segment 1), leading to the Interim Opening at Aloha Stadium Station, summarizes the CSC schedule into a manner against which HART can properly track and forecast the impact of other contracts. The schedule portraying the eastern segment (Segment 2), leading to the Revenue Service Date, is more conceptual but still provides the necessary activities, durations, and milestones in order to portray the CSC time required to complete the systems work upon the completion of the construction. The CSC Segment 2 schedule will be expanded upon in 2019 in order to provide a higher level of detail for tracking impacts to specific systems work leading to the RSD.

The CSC has partial/shared access to the guideway and stations during fixed facility construction to install cable and equipment prior to Substantial Completion of a fixed facility. CSC then has full access to complete the systems installation and to perform integrated testing and pre-operations demonstrations that lead to the passenger opening. In general, each guideway and station contract has been scheduled such that the CSC will have a period of 4 to 6 months for installation prior to Substantial Completion of the fixed facility. The partial/shared access will require coordination and site control by the associated fixed facility contractor. Following Substantial Completion of the fixed facilities, the CSC has up to 9 months to complete installation, testing, and commissioning activities with full site control.

CSC access needs and criteria:

- Partial/shared access at-grade or on-deck of the guideway:
    - Guideway site remains under the control of the guideway contractor.
    - Specified civil interface points are complete and validated.
    - The Traction Power Substation (TPSS) sites have been prepared by the civil contractor and are free and clear and available for the installation of the TPSS equipment.
    - A reasonable section of at-grade system-wide duct bank is available to allow the commencement of CSC cable pulling activities.
    - On-deck access is available into the viaduct for installation of main cable ways.
    - On-deck access is available to a reasonable length of installed track to allow commencement of wayside equipment installation.

- Full access work-site control at-grade or on-deck of the guideway:
    - The site is handed over from the guideway contractor to the CSC.
    - All civil activities are complete to enable the electrical and mechanical systems to be powered and tested.
    - At-grade, all system-wide duct banks are installed.
    - On-deck, all track and third-rail equipment is fully installed.
- Shared access to equipment rooms in stations:
    - Equipment rooms within a station are complete including the first coat of paint.
    - The rooms and adjacent areas are clean and free of dust.
    - Doors are mounted and lockable.
    - Hanging ceilings and raised floors (if applicable) have not necessarily been installed, but all mounting positions are marked.
    - Temporary power and lighting is available.
    - All specified civil interface points are complete and validated.
- Balance of partial/shared access in stations:
    - Access is provided to passenger circulation and platform areas for installation of the balance of electrical and mechanical systems.
    - All areas are clean and free of dust or dust-producing activities.
    - Hanging ceilings have not necessarily been installed, but mounting brackets or locations are marked.
    - All specified civil interface points are complete and validated.
    - For fare vending machine installation (by the separate Fare Collection System Contractor), passenger concourse areas must have final floor finishing complete.
- Full access work-site control in stations:
    - Work site control is handed over from the station contractor to the CSC.

- With the exception of minor finishing activities, all civil and facility works are complete including station auxiliary equipment such as fire control and air conditioning, enabling all electrical and mechanical work to be completed and tested.

- The station is clean and free of dust.

- Subject to the CSC processes, the station is able to be powered and functionally tested.

6.8 Other Project-wide Contracts

The E&E Contract has been established wherein each station will be designed to standard dimensions and envelopes so that the E&E Contractor can furnish, install, test, and maintain the elevators and escalators in concert with the CSC and fixed facility operations. The E&E Contractor will work closely with each station design-builder or the P-3 contractor to interface and integrate associated supporting systems installation.

The Fare Collection System contract is a DFIM contract that also interacts with the City's The Bus system. This contractor is coordinating with each station design-builder or the P-3 contractor to ensure the installed infrastructure meets their needs. The Fare Collection System contractor will install fare gates after completion of the stations, approximately 6 months prior to the respective opening date.

6.9 Pearl Highlands Garage and Transit Center (PHGT)

The PHGT is planned to be a part of the P-3 developers contract. Construction is planned to be started after completion of the KHSG contract. The PHGT provides for a multi-level parking garage as well as a Bus Transit Station. The timing of this contact is currently planned to reduce a peak of construction activity mid-2021 from over $70M per month to less than $60M/month.

7 Contract Status

The status of each HRTP contract and its impact on the Interim Opening Date and the Revenue Service Date is shown below.

Table 7-1 Contract Status and Impact

Contract	Impacts	Status
WOFH	Interim Opening	Nearing Substantial Completion
KHG	Interim Opening	Nearing Substantial Completion
WOSG	Interim Opening	Early Construction – Not on Critical Path
FHSG	Interim Opening	Early Construction – Not on Critical Path
KHSG	Interim Opening	Early Construction – **Critical Path to Interim Opening**
MSF	Interim Opening	Substantially Completed
AGS	Revenue Service	Early Design pot-holing and Maintenance of Traffic (MOT), started drilled shafts within one year of project NTP – Not on Critical Path
CCUR	CCGS	Portions are under design. Some dry utility task orders are awarded and expected to start mid-October 2018. – Portions are near **Critical Path**
CCGS	Revenue Service	Design-Build as part of the P-3. RFP Part 1 released Sept 28, 2018. NTP planned for 30 December 2019 – **Critical Path**
PHGT	Revenue Service	Design-Build as part of the P-3. Not on Critical Path
CSC	Both	**Critical Path** upon KHSG completion for Interim Opening **Critical Path** upon CCGS completion for Revenue Service

Table 8-1 Production Rate Assumptions

Type of Work	Production Rate (per crew)
Foundations (drilled shafts 7 to 10 feet in diameter) to maximum depth of 220 feet	City Center Guideway & Stations 7-8 days per shaft (drilling, cleaning, inspection, install rebar cage, monitoring ducts, place concrete, and complete transition zone). All shafts are expected to be wet type, and certain shafts may require permanent casings.
Columns (20 to 50 feet in length)	6 days per column (install rebar, install formwork, place concrete, and remove formwork for standard piers and L-type piers)
Precast Segment Structure (each truss for supporting 11 segments per span)	4.6 days per span (launch, initial set, epoxy, align, post-tension, and grout)
Utilities Relocation	
Water Line (Trenching and Installation)	14 linear feet per day
Sewer Line (Trenching and Installation)	11 linear feet per day
Storm Drain (Trenching and Installation)	21 linear feet per day
Duct Bank, 18 inches wide x 4 feet deep	19 linear feet per day
Duct Bank, 24 inches wide x 5 feet deep	14 linear feet per day
Duct Bank, 36 inches wide x 5 feet deep	8 linear feet per day

The September 2017 BOS included increases to the expected productivity rates of utility installation. Reasoning in support of the increased productivity installation rates are provided below:

- Expected increase in the level of effort by the contractor based on a unit rate type of contract. By issuing a contract strictly focused on utility relocation, the contractors are expected to be motivated to install work rather than to find delays.
- Increased level of HART contract management focused on proactive resolution of issues
- Approximately 26% of the electrical/communications ductbanks are expected to be run in parallel. Parallel ductbanks are expected to allow a productivity increase of 26% due to increasing the efficiency of excavations, installations, and backfill efforts.

Given the critical path described in Section 11, the current schedule contains 356 calendar days of project contingency leading to a projected Revenue Service Date of 31 Dec 2025. Project contingency is tracked as a separate activity at the end of the Project. Project contingency increases to 600 calendar days with the implementation of September 1, 2026 as the new RSD.

10 Assumptions (CCGS)

The following assumptions have been considered in the Project schedule regarding CCGS:

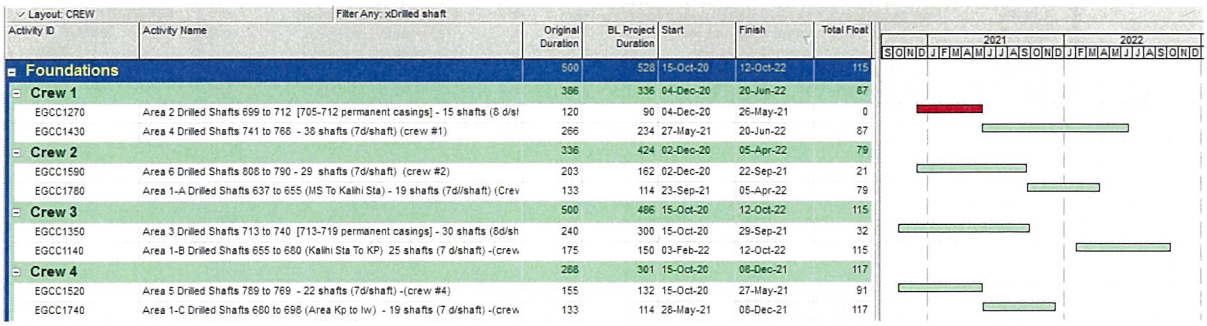
- NTP provided provided to P-3 Contractor on December 30, 2019
- CCUR – assumes an overall duration of approximately 47 months; this considers constraints to 138kV undergrounding activities.
- CCGS – assumes an overall duration of approximately 50 months; overlaps the Advanced Utilities Relocation contract by 26 months. Substantial Completion is expected in February 2024.
- Assumed durations for both scopes are based on evaluated productivity rates, and consider areas of the alignment where utilities can be completed in advance of shaft/column work, therefore overlapping contracts, but staggering work areas.
- **Implementation of utility relocation design packages based on task orders rather than types of utilities will not significantly delay construction work. However, this will be monitored.**
- Easements are assumed to be in place for all City Center High-Value ROW activities, inclusive of Howard Hughes Corp.
- Revenue Service Date (RSD) assumes Core Systems finalizes all full-alignment systems integration, testing, and pre-revenue commissioning no later than 9-months after DB Contract Substantial Completion.
- RSD includes 12-months of Project Contingency.
- The 138kV work on Dillingham Boulevard can be performed concurrently with dry utility work and prior to start of construction in the Dillingham corridor. The scheduling and coordination of the 138kV relocation requires additional analysis and schedule planning.
- The drilled shaft productivity rate used is 7 days per drilled shaft (drilling, installing rebar cage, placing concrete, and complete transition zone) and 8 days for depths greater than 120 feet or requiring permanent casings. Typical dimensions are 7 to 8 feet in diameter or up to 10 feet depending on the areas, type of pier, ground conditions with depths that range from 40 to 220 feet. A particular area in Area 3, over Nuuanu Stream in the Chinatown area, has a lower productivity of 8 days per drilled shaft to accommodate for the deeper shafts and the difficulty of wet drilling in and near the stream. The area over Nuuanu Stream requires a trestle to be built prior to drilling the shafts. The productivity is based on historical data from the KHG and WOFH Contracts as well as data drawn from AGS proposals and modified based on information received from a Draft Geotechnical Baseline Report.

Table 10-1 CCGS Drilled Shaft Productivity

				Productivity Rates	
Area	Shaft Qty	Qty (LF)	Working Days	LF/day	Days/ Shaft
Area 1-A Drilled Shafts 637 to 655 (MS To Kalihi Sta)	19	2145	133	16.1	7
Area 1-B Drilled Shafts 655 to 680 (Kalihi Sta To KP)	25	2502	175	14.3	7
Area 1-C Drilled Shafts 680 to 698 (Area Kp to Iw)	19	2268	133	17.1	7
Area 2 Drilled Shafts 699 to 712 [705-712 permanent casings]	15	1250	120	10.4	8
Area 3 Drilled Shafts 713 to 740 [713-719 permanent casings]	30	1818	240	7.6	8
Area 4 Drilled Shafts 741 to 768	38	2161	266	8.1	7
Area 5 Drilled Shafts 789 to 769	22	1781	154	11.6	7
Area 6 Drilled Shafts 808 to 790	29	3021	203	14.9	7
Average (LF/WD and Days/shaft)				**12.5**	**7.25**

- Four sets of drilled shaft/piling rigs (four work crews) are used to construct the drilled shafts. The sequence of each crew is shown below:

Figure 10-2 CCGS Drilled Shaft/Piling Rig Sequence of Work



Activity ID	Activity Name	Original Duration	BL Project Duration	Start	Finish	Total Float
Foundations		500	528	15-Oct-20	12-Oct-22	115
Crew 1		386	336	04-Dec-20	20-Jun-22	87
EGCC1270	Area 2 Drilled Shafts 699 to 712 [705-712 permanent casings] - 15 shafts (8 d/sl	120	90	04-Dec-20	26-May-21	0
EGCC1430	Area 4 Drilled Shafts 741 to 768 - 38 shafts (7d/shaft) (crew #1)	266	234	27-May-21	20-Jun-22	87
Crew 2		336	424	02-Dec-20	05-Apr-22	79
EGCC1590	Area 6 Drilled Shafts 808 to 790 - 29 shafts (7d/shaft) (crew #2)	203	162	02-Dec-20	22-Sep-21	21
EGCC1780	Area 1-A Drilled Shafts 637 to 655 (MS To Kalihi Sta) - 19 shafts (7d//shaft) (Crev	133	114	23-Sep-21	05-Apr-22	79
Crew 3		500	486	15-Oct-20	12-Oct-22	115
EGCC1350	Area 3 Drilled Shafts 713 to 740 [713-719 permanent casings] - 30 shafts (8d/sh	240	300	15-Oct-20	29-Sep-21	32
EGCC1140	Area 1-B Drilled Shafts 655 to 680 (Kalihi Sta To KP) 25 shafts (7 d/shaft) -(crew	175	150	03-Feb-22	12-Oct-22	115
Crew 4		288	301	15-Oct-20	08-Dec-21	117
EGCC1520	Area 5 Drilled Shafts 789 to 769 - 22 shafts (7d/shaft) -(crew #4)	155	132	15-Oct-20	27-May-21	91
EGCC1740	Area 1-C Drilled Shafts 680 to 698 (Area Kp to Iw) - 19 shafts (7 d/shaft) -(crew	133	114	28-May-21	08-Dec-21	117

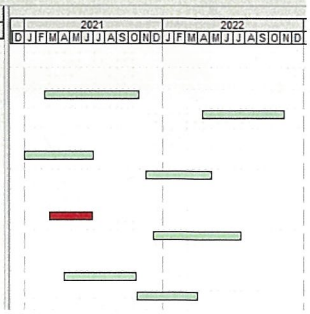
- The cast-in-place column/pier productivity rate used is 6 days per column. This is also consistent with the durations on WOFH and KHG, adjusting for specific columns where issues were experienced.

- Four sets of formworks (four work crews) are used to construct the columns/piers. The sequence of each crew is shown below:

Figure 10-3 CCGS Pier Formwork Sequence of Work

Layout: CREW | Filter Any: xcolumns

Activity ID	Activity Name	Original Duration	BL Project Duration	Start	Finish	Total Float
Columns		471	616	30-Dec-20	11-Nov-22	115
Crew 1		436	456	22-Feb-21	11-Nov-22	115
EGCC1750	Area 3 Columns 713 to 740 (crew #1)	176	176	22-Feb-21	29-Oct-21	32
EGCC1790	Area 1-B Columns 656 to 680 (Kalihi To KP) (crew #1)	150	150	12-Apr-22	11-Nov-22	115
Crew 2		339	296	30-Dec-20	05-May-22	79
EGCC1530	Area 5 Columns 789 to 769 (crew #2)	126	126	30-Dec-20	30-Jun-21	91
EGCC1150	Area 1-A Columns 637 to 655 (MS To Kalihi) (crew #2)	116	116	17-Nov-21	05-May-22	79
Crew 3		346	324	08-Mar-21	21-Jul-22	87
EGCC1280	Area 2 Columns 699 to 712 (crew #3)	80	78	08-Mar-21	29-Jun-21	0
EGCC1440	Area 4 Columns 741 to 768 (crew #3)	156	156	07-Dec-21	21-Jul-22	87
Crew 4		240	439	16-Apr-21	31-Mar-22	62
EGCC1600	Area 6 Columns 808 to 790 (crew #4)	132	132	16-Apr-21	22-Oct-21	21
EGCC1760	Area 1-C Columns 680 to 698 (KP To IW) (crew #4)	108	108	25-Oct-21	31-Mar-22	62

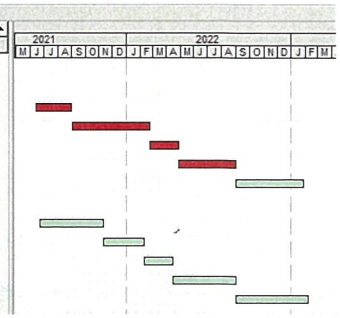


- Two sets of guideway segment erection trusses (two work crews) are used to construct the guideway bridge segments. The sequence of each crew is shown below:

Figure 10-4 CCGS Guideway Segment Erection Truss Sequence of Work

Layout: CREW | Filter Any: xSegments

Activity ID	Activity Name	Original Duration	BL Project Duration	Start	Finish	Total Float
Guideway		415	536	14-Jun-21	07-Feb-23	102
Crew 1		407	536	14-Jun-21	26-Jan-23	110
EGCC1290	Area 2 Segment Erection 698 to 711 (crew#1) (14 Spans on Falsework, or Truss	56	56	14-Jun-21	31-Aug-21	0
EGCC1370	Area 3 Segment Erection 712 to 739 (crew#1) (Truss)	118	118	01-Sep-21	22-Feb-22	0
EGCC1375	Segment Erection Crew 1 Mobilization & Demobilization	45	0	23-Feb-22	26-Apr-22	0
EGCC1160	Area 1-C Segment Erection 680 to 697 (crew#1) (Truss)	88	88	27-Apr-22	31-Aug-22	0
EGCC1800	Area 1-B Segment Erection 655 to 680 (crew#1) (Truss)	100	100	01-Sep-22	26-Jan-23	110
Crew 2		409	437	22-Jun-21	07-Feb-23	42
EGCC1540	Area 5 Segment Erection 788 to 768 (crew#2) (21 Spans on Falsework, or Truss	100	100	22-Jun-21	10-Nov-21	42
EGCC1610	Area 6 Segment Erection 789 to 798 (9 spans) (crew#2)	60	120	11-Nov-21	09-Feb-22	42
EGCC1615	Segment Erection Crew 2 Mobilization & Demobilization	45	0	10-Feb-22	14-Apr-22	42
EGCC1770	Area 1-A Segment Erection 636 to 655 (crew#2) (Truss)	96	96	15-Apr-22	31-Aug-22	42
EGCC1450	Area 4 Segment Erection 740 to 767 (crew#2) (Truss)	108	108	01-Sep-22	07-Feb-23	42



11 Critical Path

The MPIS is prepared, updated, and managed in order to provide a CPM, which allows HART to manage the longest sequence of activities that must be completed on time for the Project to complete on or by the due date. It identifies critical (versus non-critical) activities that, if one is delayed for a day, the entire Project will be delayed for a day unless a successor Critical Path activity is completed a day earlier. The Critical Path may potentially change each month the MPIS is updated. At the time of this writing, the Critical Path shows the following:

- Though not currently on the critical path, the City Center Utility Relocation work is critical to Dillingham Blvd being ready for the guideway construction. Several utility relocation activities need to be completed in each area of the City Center alignment in order to allow start of the construction work. Areas 2-6 are planned to be completed first and allow the construction contractor to start construction while the Area 1 utility relocations are being completed.
- Release of the P-3 RFP Part 1 on September 28, 2018 is the start of the critical path. Following an NTP to the successful P-3 team on December 30, 2019, the critical path continues with initiation of design activities.
- Guideway foundation design and the test shaft activities are next in order to initiate the Area 2 drilled shaft work. This is followed by column erection and segment erection in Area 2.
- Area 3 segment erection, demobilization/mobilization, and completion of segment erection in Area 1C is next.
- The CCGS station driving the Critical Path depends upon the sequencing of the guideway construction, which is ultimately decided by the selected CCGS Contractor. The last station to provide partial access to the guideway to CSC will fall on the Critical Path toward the end of the CCGS construction contract. Given the sequencing described above, the Kapālama Station is on the critical path following completion of station design.
- The completion of Core Systems installation, final testing, and performance of the demonstration test is tied to access to the TCCR at Kapalama Station. This logic provides the CSC 19 months from gaining access to the TCCR at Kapalama Station to complete its work, test, certify, and start Revenue Service.
- There is currently 600 days of float (contingency) included as a separate schedule activity leading to Revenue Service on September 1, 2026.

The duration of the CCGS P-3 Contract is expected to be approximately 51 months. The CCGS Critical Path (longest path) is found to run through two distinct, yet concurrent logic paths.

11.1 Near Critical

The near critical path activities have only 21 calendar days of float. This path includes utility relocation in Areas 5 and 6 prior to the Area 6 drilled shafts and columns. Following the column construction at Ala Moana station (Area 6), there are four straddle bent structures that need to be constructed in order for the station platform construction to start. Following completion of the platform and installation of the canopy, CSC can complete the systems installation and

component testing. At this point the critical path goes back to the final CSC activities of Full System Testing City Center and Pre-Revenue Service Operations testing.

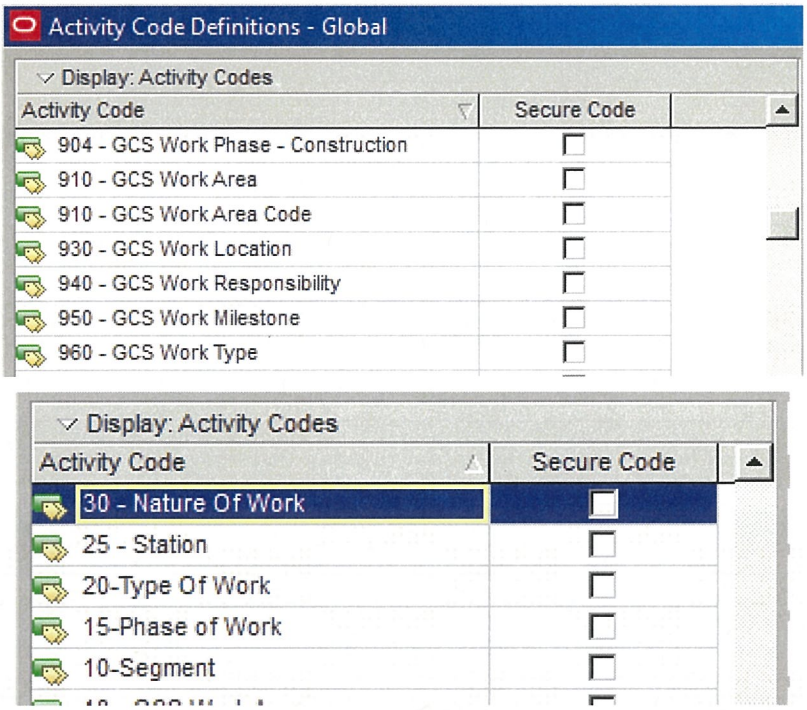
12 Price Allocation

Each contract baseline schedule will be cost loaded and contain cost (price) allocation to activities and/or milestones according to bid/proposal items. These allocations come from the SOM/SOV Pay Items and provide a cash flow based on scope accomplishment and the payment disbursement planned and actual as the contract progresses. The monthly plan versus actual accomplishment will provide a progress indicator that tracks and reports Earned Value (EV), SPI, as well as the Schedule Variance (SV) and financial percent complete.

13 Activity Coding

There are several Global Activity Codes used in the MPIS. Over the last several years there has been a lack of control over the number and use of Global Activity Codes and there are many codes with overlapping uses. An on-going review to determine the most useful codes and reduce the Global Activity Codes available to the HART users continues. An example of a few of the Global Activity Codes are as follow:

Figure 13-1 Global Activity Codes



Global Activity Codes are also being used for the project WBS. The WBS currently assigned to the 20,000+ activities in the MPIS will remain as they are currently assigned. However, under the new WBS HART will utilize a set of five Activity Codes; WBS1, WBS2, WBS3, WBS4, and WBS5. The WBS matches up with the Program, Project, Section, Element, Standard Cost Category (SCC), and CPP specifics of the overall HART program. The Activity Codes being utilized as the new WBS are listed in Appendix A.

There are three types of milestones used on the contract and MPIS schedules: Pay Milestones, Interface/Coordination Milestones, and Contract Access Milestones. These have unique codes that enable filtering and reporting as well as summarizing to the MPIS level from the contract level.

14 Constraints and Interfaces

Minimum constraints are used in the MPIS to enable the longest path or Critical Path to be tracked. Constraints are classified as hard constraints or soft constraints. Any constraints other than the start, Interim Opening, and RSD will contain a justification for use.

14.1 Constraints

Each contract contains a list of HART-furnished dates for facility access, environmental permits, materials, and interface milestones (work by others). In addition, a contract may have other site constraints that would be identified with dates (ROW/easements and/or utility relocations by others) or work conditions (for example, the corridor's MOT requirements). It is expected that each contract will contain logic, milestones, and activities that reflect these constraints and interfaces and will be summarized with plans, updates, and progress to the MPIS monthly. Any interface or impact to other contracts identified at the contract level will be immediately reported through the HART Project Controls Manager to the Director of Design and Construction for disposition. The impacting contract status will provide corrective action and/or recommendations for consideration.

Core Systems installation access is planned to occur at each station's equipment room approximately 4 months prior to that station's Substantial Completion. Access to the Guideway, is first at-grade on the completed System Site slabs and then to the duct banks and on deck approximately 6 months prior to Guideway Substantial Completion. At Substantial Completion, full access (and site control) is transferred over to the CSC to complete installation and make ready for Integrated Testing and Demonstration prior to passenger service. This requires that each operating section be Substantially Complete at least 9 months prior to passenger service (Guideway, Stations, and ROC).

14.2 Interface Table

An Interface Table has been generated which lists milestones that are provided ("pitched") by the contractor to others and those received ("caught") by the contractor from others to perform its work. The Interface Manager has the responsibility to conduct meetings to address these interactions of the contractors and maintain/circulate the Interface Table and accompanying status documentation. The contractor-assigned coordinators must participate in these meetings and may identify other key interfaces that could affect schedule performance, which will be monitored by the Interface Manager. Should a contract interface impact progress or productivity or threaten the attainment of key MPIS milestones, the interface is reported with recommended actions to the Director of Design and Construction.

Please see Appendix B for the Interface Table with CAM dates.

15 Measurement of Scope Accomplishment

The following are typical metrics used to measure progress of scope items:

- Number of design deliverables submitted or approved
- Schedule of Value or Schedule of Milestone items completed
- Linear feet of utilities relocated or installed
- Linear feet of roadworks completed
- Number of drilled shafts/foundations completed
- Number of columns completed
- Number of precast segments casted
- Number of precast segments erected, post-tensioned, and grouted
- Quantity of earthworks excavated or backfilled
- Square feet of slab erected

16 Schedule of Milestones and Schedule of Values

The SOM consists of a number of Pay Items that detail the contract's Schedule of Prices (Price Items) into manageable and verifiable scope items. For example, a Guideway contractor may break their foundations into work areas, and each associated foundation has a SOM Pay Item. When that Pay Item is accomplished and verified by HART staff, payment is made on the agreed-upon portion of the firm price assigned to that item. Pay Items must summarize to and cannot exceed the contract's Price Item and their contract value (lump sum). With payment on completed (accomplished) scope items, the contractors have the freedom to identify discrete elements for payment as long as their accomplishment can be verified by HART. Another example may be the Quality Management Plan (QMP) being broken down into (1) QMP outline, (2) QMP draft, and (3) QMP final, where each has an allocated payment value when submitted.

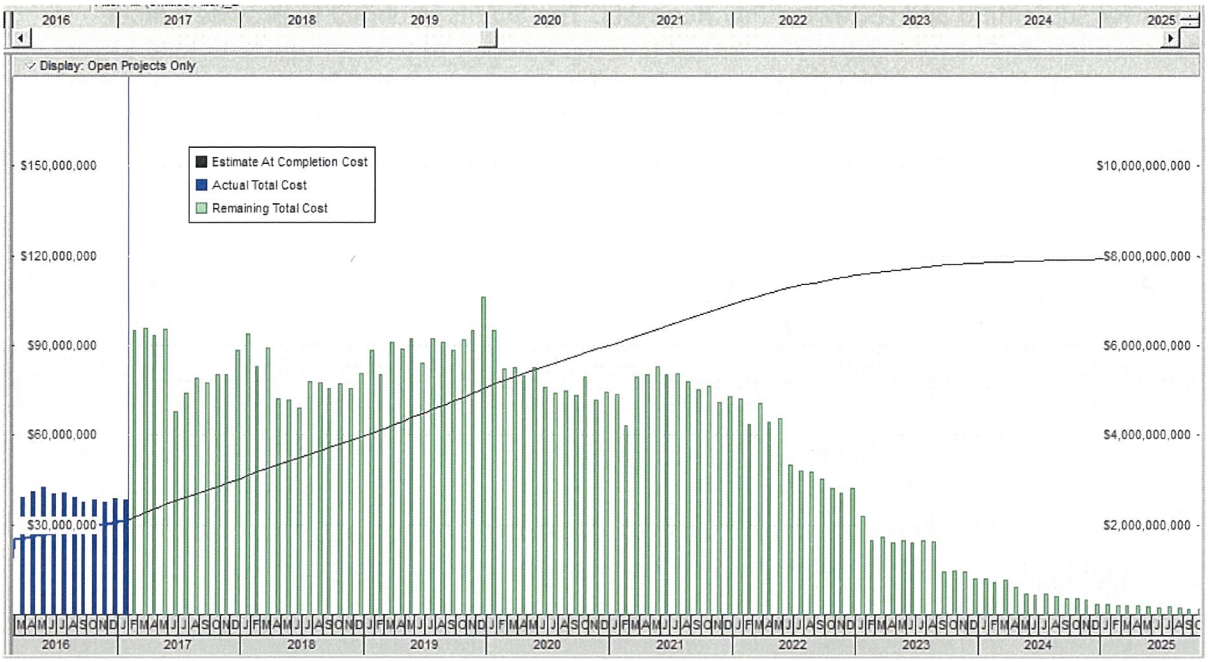
The SOV is a list furnished by contractors outlining the breakdown of the contract sum by schedule activity. It allocates values for the various parts of the work and is also used as the basis for submitting and reviewing Pay Requests. The SOV is intended to provide linkage between the contractor's baseline schedule and the planned payment request details. Once approved by HART, the SOV serves as the basis for contractor pay requests/invoices, subject to review and confirmation that the amount of work associated with the requested Pay Item values has been satisfactorily performed.

The target completion date is December 2025 and the required completion date is September 1, 2026. The EAC Cost Curve and Remaining Early Cost Histograms will be plotted and used as a baseline for comparison against monthly achievement (Earned Value). The Cash Flow Forecast will be reported in the HART Monthly Progress Report.

For each contract package, the EAC cost curve and Remaining Early Cost Histograms (as of the approved recovery plan date, currently September 2017) will be used to measure the monthly progress.

An example EAC cost curve and Remaining Early Cost Histogram is shown below:

Figure 17-1 EAC Cost Curve and Remaining Early Cost Histogram Example



18 Monthly Pay Request

Each month, contractors submit a Pay Request based on the last Friday of the month, which includes the following: the updated SOV or SOM with items accomplished during that period, planned for next period, and supported by the progressed schedule update; and identification of variances or changes to planned activities (if any). The HART staff reviews and confirms the contractors' Pay Requests, by verifying the reported monthly accomplishments based on field daily reports, weekly reports, monthly progress reports, the Primavera P6 progress schedule, and progress measurements recorded by the CEI team, and recommends payment by the City Department of Budget and Fiscal Services (BFS). Contract schedules are updated and summarized to the MPIS as well as variances analyzed with corrective actions. Any variances that impact the MPIS or the Project Budget are immediately identified with recommended corrective actions.

19 Professional Services Availability

This BOS assumes that the required professional services are adequately available for existing design and project management activities, upcoming DB contracts, and other such services.

20 Construction Labor, Material, and Equipment Availability

This BOS assumes that an adequate pool of construction labor, material, and equipment is readily available in the Hawai'i marketplace to effectively support the requirements of the upcoming large DB contracts without competing or placing stress on other ongoing work.

21 ROW Acquisition, Easements, and Permits

The HRTP has identified parcels that require acquisition and/or easements to deliver the MPIS as developed for this update. The HART ROW team has developed a detailed sub-schedule that is part of the MPIS's feeder schedules. ROW activities that have potential to impact construction activities are monitored monthly and tracked using the Right-of-Way Corridor Acquisition Status Report. Environmental permits are provided by HART to contractors, while the contractors are tasked with securing construction permits. Environmental compliance is monitored by HART.

Appendix A Work Breakdown Structure (Levels 1-3)

Exhibit A-1 Work Breakdown Structure, Level 1 (Global Activity Code WBS1)

Level 1 Code	Project	WBS Level
HRPT	Honolulu Rail Transit Project	WBS Level 1

Exhibit A-2 Work Breakdown Structure, Level 2 (Global Activity Code WBS2)

Level 2 Code	Section	WBS Level
PW	Project Wide	WBS Level 2
IO	Interim Opening	WBS Level 2
1	West Oahu / Farrington Highway Segment #1	WBS Level 2
2	Kamehameha Highway Segment #2	WBS Level 2
MF	Maintenance and Storage Facility (MSF)	WBS Level 2
3	Airport Segment #3	WBS Level 2
4	City Center Segment #4	WBS Level 2
RS	Revenue Service Date	WBS Level 2

Exhibit A-3 Work Breakdown Structure, Level 3 (Global Activity Code WBS3)

Level 3 Code	Element	WBS Level
C	C - Construction	WBS Level 3
F	F- Finance Charges	WBS Level 3
P	P- Professional Services	WBS Level 3
R	R- Right of Way	WBS Level 3
S	S- Sitework & Special Conditions	WBS Level 3
U	U- Unallocated Contingency	WBS Level 3
V	V- System & Vehicles	WBS Level 3
Z	Z- Project Revenue	WBS Level 3

Exhibit A-4 Work Breakdown Structure, Level 4 (Global Activity Code WBS4)

Level 4 Code	Standard Cost Category (SCC)	WBS Level
10	Guideway & Track	WBS Level 4
10.01	At-grade exclusive ROW	WBS Level 4
10.04	Aerial Structure	WBS Level 4
10.09	Direct Fixation	WBS Level 4
10.11	Ballasted	WBS Level 4
10.12	Special (switches, turnouts)	WBS Level 4
20	Stations	WBS Level 4
20.01	At-grade Station, stop, shelter, term, platform	WBS Level 4

Level 4 Code	Standard Cost Category (SCC)	WBS Level
20.02	Aerial station, shelter, mall, term, platform	WBS Level 4
20.04	Other station, landing, term, intermodal	WBS Level 4
20.06	Automobile parking multi-story structure	WBS Level 4
20.07	Elevators, Escalators	WBS Level 4
30	Support Facilities	WBS Level 4
30.01	Admin Building: Office, Sales, Storage, Revenue Counting	WBS Level 4
30.02	Light Maintenance Facility	WBS Level 4
30.03	Heavy Maintenance Facility	WBS Level 4
30.04	Storage or Maintenance of Way Building	WBS Level 4
30.05	Yard and Yard Track	WBS Level 4
40	Sitework & Special Conditions	WBS Level 4
40.01	Demolition, Cleaning, Earthwork	WBS Level 4
40.02	Site Utilities, Utility Relocation	WBS Level 4
40.03	Haz. mat'l, contam'd soil removal/mitigation, ground water treatments	WBS Level 4
40.04	Environmental mitigation, e.g. wetlands, historic/archeologic, parks	WBS Level 4
40.05	Site structures including retaining walls, Sound walls	WBS Level 4
40.06	Pedestrian/Bike access and accommodation, landscaping	WBS Level 4
40.07	Automobile, bus, van accessways including roads, parking lots	WBS Level 4
40.08	Temporary Facilities and other indirect cost during construction	WBS Level 4
50	System	WBS Level 4
50.01	Train control and signals	WBS Level 4
50.03	Traction power supply: substations	WBS Level 4
50.04	Traction power distribution: catenary and third rail	WBS Level 4
50.05	Communications	WBS Level 4
50.06	Fare collection system and equipment	WBS Level 4
60	ROW, Land, Existing Improvements	WBS Level 4
60.01	Purchase of lease of real estate	WBS Level 4
60.02	Relocation of existing households and businesses	WBS Level 4
70	Vehicles	WBS Level 4
80	Professional Service	WBS Level 4
80.01	Preliminary Engineering	WBS Level 4
80.02	Final Design	WBS Level 4
80.03	Project Management for Design and Construction	WBS Level 4
80.04	Construction Administration & Management	WBS Level 4
80.06	Legal, Permits, Review Fees by other agencies, cities, etc.	WBS Level 4
80.07	Surveys, Testing, Investigation, Inspection	WBS Level 4
80.08	Start up	WBS Level 4
90	Unallocated Contingency	WBS Level 4

Level 4 Code	Standard Cost Category (SCC)	WBS Level
95	Project Revenue	WBS Level 4
100	Finance Charges	WBS Level 4

Exhibit A-5 Work Breakdown Structure, Level 4 (Global Activity Code WBS5)

Level 5 Code	Contract Packaging Plan (CPP)	WBS Level
ART	Art-in-Transit Program	WBS Level 5
CCH-100	City and County of Honolulu	WBS Level 5
CCH-101	Department of Budget and Fiscal Services	WBS Level 5
CCH-102	Department of Design and Construction, Land Division	WBS Level 5
CCH-107	Corporation Counsel	WBS Level 5
CCH-108	Board of Water Supply	WBS Level 5
DB-120	West O'ahu/Farrington Highway Guideway	WBS Level 5
DB-200	Maintenance and Storage Facility	WBS Level 5
DB-275	Pearl Highlands Garage, Transit Center and Ramp H2R1	WBS Level 5
DB-320	Kamehameha Highway Guideway	WBS Level 5
DB-450	Airport Guideway and Stations	WBS Level 5
DB-550	City Center Guideway and Stations	WBS Level 5
DBB-171	West O'ahu Station Group Construction	WBS Level 5
DBB-271	Farrington Highway Station Group Construction	WBS Level 5
DBB-371	Kamehameha Highway Station Group Construction	WBS Level 5
DBB-385	Ramp H2R2	WBS Level 5
DBB-505	Airport Section Utilities Construction Relocation	WBS Level 5
DBB-511	City Center Utilities Relocation	WBS Level 5
DBB-525	Airport Section Guideway Seven Pier Construction	WBS Level 5
DBB-600	UHWO Permanent Park-and-Ride and East Entry Building Construction	WBS Level 5
DBB-602	UHWO Station Temporary Park-and-Ride and Campus Road B	WBS Level 5
DBB-701	Kamehameha Highway Civil Work Construction	WBS Level 5
DBOM-920	Core Systems Contract	WBS Level 5
FD-140	West O'ahu Station Group FD	WBS Level 5
FD-240	Farrington Highway Station Group FD	WBS Level 5
FD-340	Kamehameha Highway Station Group FD	WBS Level 5
FD-430	Airport Section Guideway and Utilities FD	WBS Level 5
FD-440	Airport Station Group FD	WBS Level 5
FD-530	City Center Guideway and Utilities FD	WBS Level 5

Level 5 Code	Contract Packaging Plan (CPP)	WBS Level
FD-550	Dillingham and Kaka'ako Station Group FD	WBS Level 5
FD-600	UHWO Permanent Park-and-Ride and East Entry Building FD	WBS Level 5
FD-700	KHG 138kV Utilities Relocation FD	WBS Level 5
FD-701	Kamehameha Highway Civil Work FD	WBS Level 5
HART-200	Honolulu Authority for Rapid Transportation (HART) - Labor	WBS Level 5
HART-201	Honolulu Authority for Rapid Transportation (HART) - Expenses and ODCs	WBS Level 5
HART-202	Precast Yard Agreement	WBS Level 5
MI-900	Fare Collection System	WBS Level 5
MI-930	Elevators and Escalators	WBS Level 5
MI-940	Core Systems Backup Generators	WBS Level 5
MI-950	Volt Ampere Reactive Equipment	WBS Level 5
MM-290	Construction Engineering and Inspection West Side	WBS Level 5
MM-595	Construction Engineering and Inspection East Side	WBS Level 5
MM-596	Construction Engineering and Inspection East Side II	WBS Level 5
MM-901	Program Management Support Consultant II	WBS Level 5
MM-902	Program Management Contractor Consultant	WBS Level 5
MM-905	General Engineering Consultant	WBS Level 5
MM-910	General Engineering Consultant II	WBS Level 5
MM-913	General Engineering Consultant III	WBS Level 5
MM-915	HDOT Traffic Management Coordination Consultant	WBS Level 5
MM-920	HDOT Design Coordination Consultant - WOFH	WBS Level 5
MM-921	HDOT Design Coordination Consultant - KHG	WBS Level 5
MM-922	HDOT Design Coordination Consultant - Airport & City Center Guideway and Stations	WBS Level 5
MM-925	HDOT Labor Master Agreement - WOFH	WBS Level 5
MM-930	HDOT State Safety Oversight Agency (SOA) Consultant	WBS Level 5
MM-935	Real Estate Consultant	WBS Level 5
MM-936	Real Estate Consultant II	WBS Level 5
MM-937	Real Estate Mapping and Surveying	WBS Level 5
MM-940	Kakoo Consultant	WBS Level 5
MM-941	Kakoo Consultant II	WBS Level 5
MM-945	On-Call Construction Contractor	WBS Level 5
MM-946	On-Call Hazardous Materials	WBS Level 5
MM-947	On Call Construction Contractor II	WBS Level 5
MM-948	On-Call Construction Contractor III	WBS Level 5

Level 5 Code	Contract Packaging Plan (CPP)	WBS Level
MM-949	On Call Construction Contractor Contract IV	WBS Level 5
MM-950	Owner-Controlled Insurance Program Consultant	WBS Level 5
MM-951	Owner-Controlled Insurance Program Brokerage Services	WBS Level 5
MM-953	Owner-Controlled Insurance Program Contract II	WBS Level 5
MM-960	Archaeological and Cultural Monitoring	WBS Level 5
MM-962	Core Systems Support	WBS Level 5
MM-964	Safety and Security Support	WBS Level 5
MM-970	Fare Collection System Technical Support Contract	WBS Level 5
MM-975	LEED Commissioning Services for the Maintenance and Storage Facility	WBS Level 5
MM-980	Construction Claims and Litigation Services	WBS Level 5
MM-981	Complex Real Property Negotiations and Litigation Support	WBS Level 5
MM-982	On-Call Appraisers	WBS Level 5
MM-983	Outside Counsel for Land Court Petition Services Contract	WBS Level 5
MM-985	On Call Appraisers II	WBS Level 5
MM-986	Legal Counsel for Real Estate	WBS Level 5
MM-990	Engineering Design and Design Review Services Contractor	WBS Level 5
PA-101	Programmatic Agreement - Humanities	WBS Level 5
PA-102	Programmatic Agreement - Historic Architecture Design Services Consultant	WBS Level 5
PA-103	Programmatic Agreement HPC Park Improvements	WBS Level 5
ROW	Real Estate / Right of Way Acquisition	WBS Level 5
UTIL	New Utilities or Relocation by Private Utility Owners	WBS Level 5

Appendix B Interface Table with Contract Access Milestone Dates

Activity ID	Activity Name	Date
Kalihi Station		
ST14KL1480	CSC Access at AUX Equip Bldg / TCCR-3A at KLH	17-May-22
ST14KLEE10	E&E Contractor Partial Access to Install Elev/Escalators	28-Nov-22
ST14KL1740	CSC Partial Access Balance of Station Structure-3B at KLH	12-Jan-23
ST14KL1840	CSC Partial Platform Access for CSC Install-3E at KLH	15-Mar-23
ST14KL1950	Kalihi Station - CSC FULL ACCESS IN STA-3H)	15-Jun-23
Kapālama Station		
ST15KP1480	CSC Access at AUX Equip Bldg / TCCR-3A at KLM	20-Oct-21
ST15KPEE10	E&E Contractor Partial Access to Install Elev/Escalators	15-May-23
ST15KP1840	CSC Partial Platform Access for CSC Install-3E at KLM	12-Jul-23
ST15KP1740	CSC Partial Access Balance of Station Structure-3B at KLM	23-Aug-23
ST15KP1950	Kapālama Station - CSC FULL ACCESS IN STA-3H	9-Jan-24
Iwilei Station		
ST16IW1480	CSC Access at AUX Equip Bldg / TCCR-8A at IWL	3-Aug-21
ST16IW1740	CSC Partial Access Balance of Station Structure-8B at IWL	16-Dec-21
ST16IW1840	CSC Partial Platform Access for CSC Install-8E at IWL	7-Mar-22
ST16IW1EE10	E&E Contractor Partial Access to Install Elev/Escalators	3-Jun-22
ST16IW1950	Iwilei Station - CSC FULL ACCESS IN STA-8H	14-Sep-22
Chinatown Station		
ST17CH1480	CSC Access at AUX Equip Bldg / TCCR-3A at CTN	13-Apr-22
ST17CHEE10	E&E Contractor Partial Access to Install Elev/Escalators	28-Jun-22
ST17CH1740	CSC Partial Access Balance of Station Structure-3B at CTN	26-Jul-22
ST17CH1840	CSC Partial Platform Access for CSC Install-3E at CTN	29-Nov-22
ST17CH1950	Chinatown Station - CSC FULL ACCESS IN STA-3H	29-Dec-22
Downtown Station		
ST18DW1480	CSC Access at AUX Equip Bldg / TCCR-3A at DNT	18-Nov-22
ST18DW1840	CSC Partial Platform Access for CSC Install-3E at DNT	29-Nov-22
ST18DWEE10	E&E Contractor Partial Access to Install Elev/Escalators	10-Jan-23
ST18DW1740	CSC Partial Access Balance of Station Structure-3B at DNT	3-Mar-23
ST18DW1950	Downtown Station - CSC Full Access in Sta-3H	23-Jun-23
Civic Center Station		
ST19CV1480	CSC Access at AUX Equip Bldg / TCCR-3A at CVC	9-May-22
ST19CVEE10	E&E Contractor Partial Access to Install Elev/Escalators	15-Dec-22
ST19CV1740	CSC Partial Access Balance of Station Structure-3B at CVC	8-Feb-23
ST19CV1950	Civic Center Station- CSC Full Access in Sta-3H	21-Aug-23

Activity ID	Activity Name	Date
ST19CV1840	CSC Partial Platform Access for CSC Install-3E at CVC	21-Aug-23
Kaka'ako Station		
ST20KK1480	CSC Access at AUX Equip Bldg / TCCR-8A at KAK	7-Jun-21
ST20KK1740	CSC Partial Access Balance of Station Structure-8B at Kaka'ako	1-Oct-21
ST20KKEE10	E&E Contractor Partial Access to Install Elev/Escalators	13-Jun-22
ST20KK1840	CSC Partial Platform Access for CSC Install-8E at Kaka'ako	5-Jul-22
ST20KK1950	Kaka'ako Station - CSC Full Access in Sta-8H	7-Dec-22
Ala Moana Station		
ST21AM1480	CSC Access at AUX Equip Bldg / TCCR-6A at ALM	10-Nov-22
ST21AM1740	CSC Partial Access Balance of Station Structure-6B at ALM	13-Jan-23
ST21AMEE10	E&E Contractor Partial Access to Install Elev/Escalators	17-Jan-23
ST21AM1840	CSC Partial Platform Access for CSC Install-6E at ALM	21-Feb-23
ST21AM1950	Ala Moana - CSC Full Access in Sta-6H	28-Sep-23

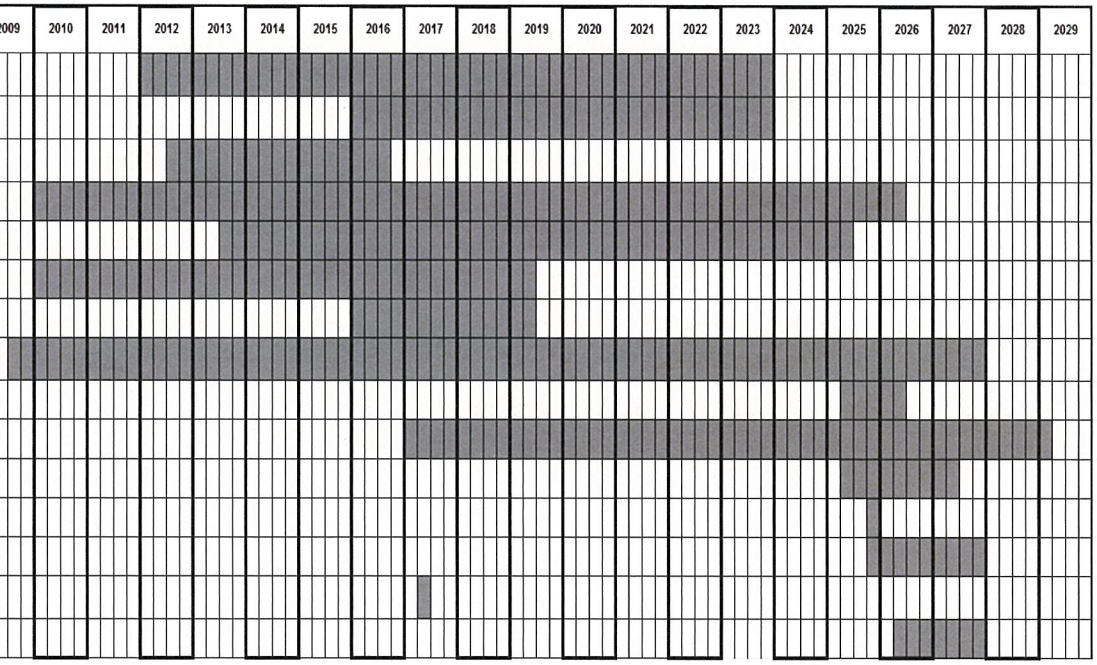
West Segment Station Groups

Activity ID	Activity Name	Date
KHSG		
X010001a-PH	1a (KHSG -> CSC) Access to TCCR & UPS (11/29/17) - PH	18-May-18
X010001b-PH	1b (KHSG -> CSC) Access to Balance of Building & Structure (2/15/18) - PH	8-Jun-18
X010001d-PH	1d (KHSG -> E&E) Access to Install E&E (5/18/18) - PH	1-Oct-18
X010001e-PH	1e (KHSG -> CSC) Access to Station Platform (4/17/18) - PH	25-Oct-18
X010002a-PR	2a (KHSG -> CSC) Access to TCCR & UPS (2/15/18) - PR	17-Jul-18
X010002b-PR	2b (KHSG -> CSC) Access to Balance of Building & Structure (5/18/18) - PR	7-Dec-18
X010002d-PR	2d (KHSG -> E&E) Access to Install E&E (8/17/18) - PR	12-Dec-18
X010002e-PR	2e (KHSG -> CSC) Access to Station Platform (6/18/18) - PR	30-Nov-18
X010003a-AS	3a (KHSG -> CSC) Access to TCCR & UPS (5/18/18) - AS	3-Dec-18
X010003b-AS	3b (KHSG-> CSC) Access to Balance of Building & Structure (7/18/18) - AS	31-Jan-19
X010003c-AS	3c (KHG -> KHSG) Access to Guideway Platform Deck Construction (12/18/17) - AS	18-Dec-17
X010003d-AS	3d (KHSG -> E&E) Access to Install E&E (10/18/18) - AS	11-Mar-19
X010003e-AS	3e (KHSG -> CSC) Access to Station Platform (8/17/18) - AS	11-Apr-19
FHSG		
WTC-01	Auxiliary Equipment Building / TCCR, Partial Access for Systems Installation	24-Nov-17
LCC-01	Auxiliary Equipment Building / TCCR, Partial Access for Systems Installation	14-Apr-18
WLO-01	Auxiliary Equipment Building / TCCR, Partial Access for WLO Systems Installation	24-Nov-17
WLO-02	Balance of Building and Structures, Partial Access for Systems Instal	26-Jan-18
WTC-02	Balance of Building and Structures, Partial Access for Systems Instal	2-May-18

Activity ID	Activity Name	Date
LCC-02	Balance of Building and Structures, Partial Access for Systems Instal	10-Apr-18
WLO-08	CSC provided Full Access @ Station Construction Completion	18-Sep-18
WTC-08	CSC provided Full Access @ Station Construction Completion	27-Dec-18
LCC-08	CSC provided Full Access @ Station Construction Completion	5-Dec-18
WLO-04	Elevator & Escalators Installation, Partial Access for E&E	24-Nov-17
WTC-04	Elevator & Escalators Installation, Partial Access for E&E	30-Mar-18
LCC-04	Elevator & Escalators Installation, Partial Access for E&E	17-Mar-18
WLO-05	Station Platform, Partial Access Systems Installation	20-Jan-18
WTC-05	Station Platform, Partial Access Systems Installation	28-Dec-17
LCC-05	Station Platform, Partial Access Systems Installation	24-Apr-18
WOSG		
X010000E05	ID Number 1a: EKP-TCCR and UPS rooms, Partial Access for Systems Installation (1/6/17)	7-Feb-18
X010000E07	ID Number 1b: EKP-Balance of Building and Structures, Partial Access for System Installation (3/8/17)	10-Apr-18
X010000E21	ID Number 1d: EKP-Elevator & Escalators Installation, Partial Access for E&E (7/7/17)	2-Aug-18
X010000E11	ID Number 1d: EKP-Elevator (#1) and Escalators Installation, Partial Access for E&E (7/7/17)	2-Aug-18
X010000E13	ID Number 1e: EKP-Station Platform, Partial Access for Systems Installation (4/8/17)	24-Jan-18
X010000E19	ID Number 1h: EKP-CSC provided Full Access at Station Construction Completion (1/5/18)	23-Mar-19
X010000W05	ID Number 2b: UHWO-Balance of Building and Structures, Partial Access for Systems Installation (1/6/17)	3-Mar-18
X010000W23	ID Number 2d: UHWO-Elevator & Escalator Installation, Partial Access for E&E (4/8/17)	12-Dec-17
X010000W09	ID Number 2d: UHWO-Elevator (#1) & Escalators Installation Partial Access for E&E (4/8/17)	11-Jan-18
X010000W21	ID Number 2d: UHWO-Elevator (#3) & Escalators Installation, Partial Access for E&E (4/8/17)	25-Apr-18
X010000W19	ID Number 2d: UHWO-Elevator (#5) & Escalators Installation, Partial Access for E&E (4/8/17)	25-Apr-18
X010000W11	ID Number 2e: UHWO-Station Platform, Partial Access for Systems Installation (12/7/16)	30-Mar-18
X010000W17	ID Number 2h: UHWO-CSC provided Full Access at Station Construction Completion (11/5/17)	9-Mar-19
X010000H05	ID Number 3b: HOP-Balance of Building and Structures, Partial Access for Systems Installation (8/6/16)	20-Dec-17
X010000H21	ID Number 3d: HOP-Elevator (#1) & Escalators Installation, Partial Access for E&E (12/7/16)	12-Apr-18
X010000H19	ID Number 3d: HOP-Elevator (#2) & Escalators Installation, Partial Access for E&E (12/7/16)	20-Mar-18
X010000H11	ID Number 3e: HOP-Station Platform, Partial Access for Systems Installation (9/6/16)	6-Dec-17
X010000H17	ID Number 3h: HOP-CSC provided Full Access @ Station Construction Completion (6/5/17)	13-Nov-18

Appendix C Summary Schedule

Schedule	Start Date	End Date
10 GUIDEWAY & TRACK ELEMENTS (20.05 route miles)	Mar-12	Nov-23
20 STATIONS, STOPS, TERMINALS, INTERMODAL (21)	Jan-16	Dec-23
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	Jul-12	Jul-16
40 SITEWORK & SPECIAL CONDITIONS	Jan-10	May-26
50 SYSTEMS	Sep-13	May-25
60 ROW, LAND, EXISTING IMPROVEMENTS	Mar-10	May-19
70 VEHICLES (80)	Feb-16	Jun-19
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	Sep-09	Dec-27
90 UNALLOCATED CONTINGENCY	Jun-25	May-26
100 FINANCE CHARGES	Jan-17	Jan-29
Revenue Ops / Closeout of Project	Jun-25	Jun-27
Revenue Service Date	Dec-25	Dec-25
Before and After Study: Two years post Rev Ops	May-26	May-28
Fulfillment of the New Starts funding commitment	Jun-17	Jun-17
Completion of Project Closeout	Jun-26	Dec-27



APPENDIX H

Ridership Forecasts

Appendix H: Ridership Forecasts

H-1 Four-Car Trains

Project ridership forecasts were updated in 2013 when HART switched the operating plans from a mixed fleet operation to fixed, four-car trainsets running at slightly longer headways. At that time, the travel demand forecasting model parameters were also updated to better differentiate rail from traditional bus services. These new model parameters accounted for factors such as reliability, passenger amenities, increased seating, and schedule-free services.[1] At the time of the FFGA, analysts estimated that 114,400 daily passengers would use the rail transit system in 2030.[2]

Using the four-car methodology, approximately 119,600 daily passengers were expected to use the system, or an increase of approximately 5% relative to the FFGA forecast. Overall, these forecasts remained consistent with the range of ridership estimates included in the technical studies that were part of the FEIS.

H-2 Regional Model Update

In 2016, HART began using the latest Oahu MPO travel demand forecasting model. This new tour-based model uses the TransCAD 6.1 software platform and is faster and more robust than the previous MINUTP model. The geographic information systems-based model incorporates updates to long-range population and land use forecasts from the City and County of Honolulu Department of Planning and Permitting, as well as travel behavior data from 2012 surveys of households, visitors, and transit riders. The new model also updates the committed short-range highway and transit projects included in the regional transportation plan which are likely to be completed by 2030. The new model retains the supporting bus network described in the Project's FEIS, although ferry routes and associated feeder buses (eliminated in 2009) were removed from the model.

A comparison of the FFGA, Four-Car Model, and Updated Project Model (Oahu MPO) ridership forecasts by means of station access are shown in Exhibit H-1. The new model forecasts approximately 121,600 rail passengers per day in 2030. This is approximately 2% higher than the four-car model forecast and 6% higher than the FFGA forecast. The new forecasts predict that approximately 55% of rail passengers (67,300 passengers) will walk to a station—an increase from 28% in the previous forecasts. The share of rail passengers connecting from a feeder bus decreases from 60% in the previous forecast down to 36% (44,100 daily passengers). Formal park-and-ride demand decreases from approximately 7% of all rail trips down to approximately 5% of all trips.

---

[1] The new model parameters are called non-included attributes.

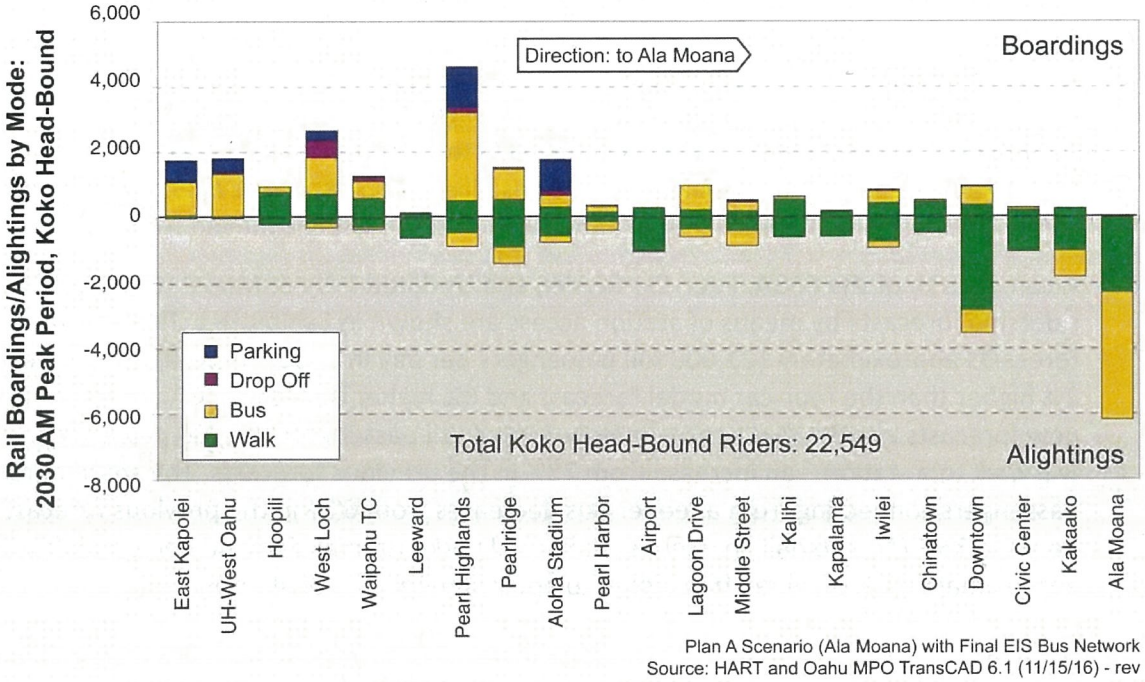
[2] Based on an end-to-end running time of 44.3 minutes, a peak headway of 2.4 minutes, and an off-peak headway of 4.7 minutes.

Exhibit H-2 shows the boarding and alighting patterns for the 22,600 east-bound rail passengers during the A.M. Peak Period (6 a.m. to 9 a.m.) by station mode of access. Approximately 66% of the east-bound passengers board the rail system west of the Aloha Stadium Station. In addition, approximately 40% of the alightings occurs at stations east of Downtown Honolulu (about 9,000 alightings). Exhibit H-3 shows the 8,900 west-bound boardings and alightings. Approximately half of the west-bound boardings occur east of the Downtown Station (4,400 boardings).

Exhibit H-1 Comparison of HRTP Ridership Forecasts, Daily Rail System Boardings, 2030

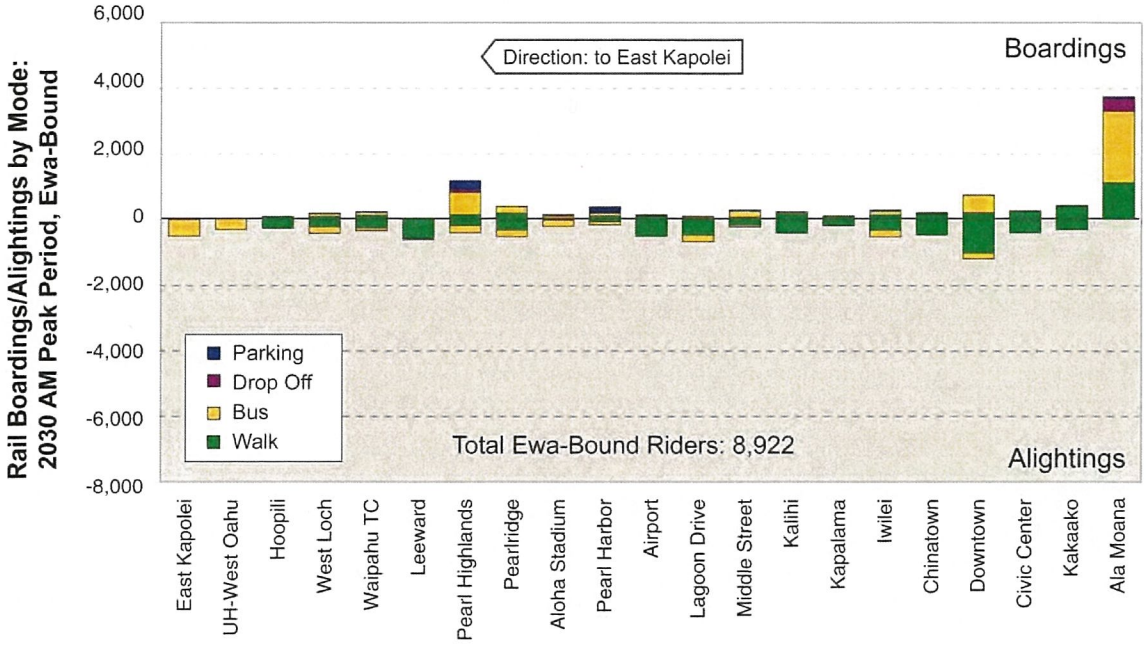
Forecast (Date)	Means of Station Access				
	Walk/ Bike	Bus	Drop Off	Parking	Total
FFGA Forecast (2/2012)	28,850	61,370	9,240	14,890	114,350
Four-Car Model (8/2013)	33,420	71,320	5,580	9,270	119,590
Updated Model (1/2017)	67,320	44,090	3,300	6,910	121,620

Exhibit H-2 East-bound Rail Boardings/Alightings, A.M. Peak Period (6 a.m.–9 a.m.), 2030



Plan A Scenario (Ala Moana) with Final EIS Bus Network
Source: HART and Oahu MPO TransCAD 6.1 (11/15/16) - rev

Exhibit H-3 West-bound Rail System Boardings/Alightings, A.M. Peak Period (6 a.m.–9 a.m.), 2030



Plan A Scenario (Ala Moana) with Final EIS Bus Network
Source: HART and Oahu MPO TransCAD 6.1 (11/15/16) - rev

APPENDIX I

HECO Relocations and Related Issues

Appendix I: HECO Relocations and Related Issues

I-1 138kV, 46kV, and 12kV Overhead Power Line Working Clearance Resolution

HART and HECO have come to an agreement to resolve HECO's concerns regarding adequate working clearances between HART's rail guideway and HECO's high-voltage 138kV transmission, 46kV sub-transmission, and 12kV distribution power lines and the associated steel or wood poles. In order for HECO's work crews to perform future maintenance, repairs, or pole replacements (utilizing their existing fleet of bucket truck vehicles), HECO has required horizontal working clearances of 50 feet for 138kV power lines, 40 feet for 46kV power lines, and 30 feet for 12kV power lines. In relation to the Project, this is the horizontal distance between HECO's overhead conductors and the HRTP's edge of guideway. HART was able to work with HECO to research and identify alternate equipment (vehicles) which would allow HECO's work to be performed in less horizontal space than originally required. With the use of these alternate vehicles, HECO has granted variances to their clearance requirements in certain areas that will enable existing poles to remain overhead and not be relocated as originally contemplated.

HART assembled a Task Force to review and analyze mitigation options to the clearance issue, which explored both relocation and non-relocation alternatives. Some non-relocation alternatives that were discussed with HECO included "re-framing" poles, maintaining poles from alternate access areas, and using alternate vehicles. Re-framing is an adjustment of how the power line conductor attaches to the structural steel pole by eliminating (or shortening) the existing pole arms and relocating the insulator and conductor closer to the pole, resulting in additional clearance to the HRTP guideway. With re-framing, additional analysis of the adjacent poles were required to ensure any angle changes in the power lines can be supported by the adjacent existing structural poles. The review of alternate access areas included performing a pole-by-pole analysis of the HECO alignment to confirm if any frontage roads (such as Moloalo Street) or private property could be used to access poles, rather than the public right-of-way. Allowing HECO to work from the guideway was also reviewed and discussed, but this didn't provide adequate solutions to allow for HECO to perform its work. Alternate vehicles were another explored alternative and have become the primary solution to resolve the HECO clearance concerns. HECO successfully tested two new bucket trucks that can perform the 46kV work and two additional high-reach bucket trucks that can perform the 138kV work within less than their required horizontal working clearance.

Alternatives for relocation of HECO facilities were also analyzed to mitigate cost and schedule. Traditional overhead and underground relocations were considered, with the cost-effective overhead relocations being the preferred solution. Relocating HECO's lines and attaching them to the rail guideway was another option considered; however, this option posed access and maintenance challenges for both agencies and was not pursued.

For the WOFH and KHG sections of the Project, HECO successfully tested two new bucket trucks (the Altec AN67-E100 and Altec TA45-L55, which are not currently in their fleet) that can perform the 46kV and 12kV maintenance work with less than their required working clearance. This will mitigate the need to relocate almost 90% of the 46kV poles/lines that do not meet the required working clearances. For the 138kV lines along WOFH and KHG, HECO and HART traveled to Colorado to review the operational capabilities of the Phoenix and Skybird bucket trucks. The Phoenix has an upward reach of 180 feet, a side reach of 79 feet, and a platform carrying capacity of 2,000 pounds. The Skybird has an upward reach of 210 feet, a side reach of 102 feet, and a platform carrying capacity of 1,300 pounds. HECO has also found alternate cranes which will allow for less than the required working clearance. HECO has determined the extent of their power lines that can be addressed through the use of this new equipment and has granted variances on a case-by-case basis where possible. Variances include the 138kV lines along Kualakai Parkway and along Kamehameha Highway (west of HECO's Waiau Power Plant). HART is working to finalize the design for the additional necessary 46kV relocations along the WOFH section and procured a designer to finalize the additional necessary 138kV relocations along the KHG section (east of HECO's Waiau Power Plant). For the Airport section of the Project, a HECO-HART combined solution of the use of alternate vehicles (identified on the west side), increased Navy easements, and redesigned (re-framed) pole arms will alleviate undergrounding the nine-pole 138kV system fronting Joint Base Pearl Harbor-Hickam. This solution will not require underground relocations of this 138kV system. For the City Center section of the Project, HART and HECO have agreed to underground the two existing overhead 138kV lines along Dillingham Boulevard. HECO's 46kV and 12kV lines were already considered for relocation in the CCGS procurement, and HART's designers are progressing to a preliminary engineering 138kV design with feedback from HECO.

HECO has provided a report for the 138kV alternate equipment and a separate report which covers the 46kV and 12kV alternate equipment. HART is required to purchase these alternate vehicles for HECO's future use, which will allow variances to HECO's clearance requirements and thus avoid costly line relocations (underground or overhead). As presented to HART's Board of Directors, the total underground relocation estimate for the 138kV and 46kV lines along the WOFH and KHG sections is estimated to be $200 million. With the alternate vehicles, a potential savings of $132 million is possible.

The equipment option costs are presented in the following exhibit, which includes relocation costs for WOFH and KHG (for those portions for which alternate equipment would not work and thus have to be relocated):

Exhibit I-1: HECO Equipment and Relocation Costs

Equipment/Relocation Option	Cost
Altec Vehicle Cost for 46kV	$ 7,170,225
Skybird and Phoenix Cost for 138kV	13,192,600
46kV and 12kV Relocation (WOFH)	5,700,000
138kV Underground Relocation (KHG)	32,000,000
46kV Overhead on Shorter Poles (KHG)	10,000,000
Total Cost with Vehicle Purchase	**$68,062,825**

For the Airport section, the 138kV underground relocation was included as a priced option, and HECO provided a letter allowing for the nine existing 138kV poles to remain in place by being re-framed to provide more horizontal working space. For the City Center section, the 138kV relocations are included in the Advanced Utilities Relocation contract base scope. The overall solution for the Project consists of a variety of alternative solutions for each section of the alignment to either allow for a variance from the standard requirements or to perform the necessary relocations to allow for acceptable working clearances, as outlined below and as shown in Exhibit I-2:

Exhibit I-2: HECO Relocation Solutions by HRTP Section

HRTP Section	Relocation Solutions
WOFH	138kV – No relocations with use of Alternate Vehicles. 46kV – No relocations with use of Alternate Vehicles except in two areas that will require overhead-to-overhead relocations.
KHG	138kV – No relocations for certain poles with use of Alternate Vehicles; relocation of overhead line to underground where variances were not granted. 46kV – Where 46kV lines are "under-built" to 138kV lines, replacement 46kV poles are required and allow for demolition of 138kV poles.
Airport	138kV – Re-frame poles (shorten conductor arms); no relocations with use of Alternate Vehicles. 46kV – No relocations with use of Alternate Vehicles.
City Center	138kV – Relocation of overhead lines to underground is included in the Advanced Utilities contract scope. 46kV – Relocation of overhead lines to underground is included in the Advanced Utilities contract scope.

I-3 Davis-Bacon Requirements

HECO has a collective bargaining agreement with different wage scales. The agreement also allows payment to its labor forces bi-weekly, which does not satisfy Federal Davis-Bacon Act requirements. Based on State of Hawaii Department of Labor and Industrial Relations correspondence, HECO began paying their employees weekly. HECO did submit a rate conformance request that was denied by the United States Department of Labor (USDOL). HECO is now coordinating with the USDoL to confirm the applicable rates.

APPENDIX J

Operating Plan Methodology and Scenarios

Exhibit J-1: Operating Plan, Continue Original Plan Methodology

City Fiscal Year	Units	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Operating Revenues																					
Fare Revenues (Bus)	YOE $M	55	58	59	72	80	86	100	101	102	84	93	94	95	96	112	113	114	115	116	117
Fare Revenues (Rail)	YOE $M	-	-	-	-	3	3	4	4	4	40	45	46	47	47	56	57	58	59	60	61
Fare Revenues (Handi-Van)	YOE $M	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Total Fare Revenues	**YOE $M**	**57**	**60**	**62**	**74**	**85**	**91**	**106**	**107**	**108**	**126**	**141**	**143**	**144**	**146**	**172**	**174**	**176**	**178**	**180**	**182**
Federal Operating Assistance																					
Total Federal Operating Assistance	**YOE $M**	**23**	**10**	**10**	**11**	**10**	**10**	**6**	**10**	**-**	**9**	**6**	**-**	**-**	**5**	**1**	**1**	**4**	**5**	**5**	**-**
Local Operating Assistance																					
Transfer from Project	YOE $M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
City Operating Subsidy	YOE $M	176	197	207	207	248	287	307	330	366	389	420	448	472	486	488	508	532	562	597	632
Total Local Operating Assistance	**YOE $M**	**176**	**197**	**207**	**207**	**248**	**287**	**307**	**330**	**366**	**389**	**420**	**448**	**472**	**486**	**488**	**508**	**532**	**562**	**597**	**632**
Total Operating Revenues	**YOE $M**	**256**	**268**	**279**	**292**	**343**	**389**	**419**	**447**	**475**	**524**	**567**	**591**	**616**	**638**	**661**	**683**	**712**	**745**	**781**	**814**
Operations and Maintenance (O&M) Costs																					
TheBus O&M Costs	YOE $M	204	212	220	229	238	247	257	268	291	309	342	358	374	391	409	428	448	469	490	513
Rail O&M Costs	YOE $M	-	-	-	-	39	71	87	100	101	127	130	133	136	134	135	133	136	142	151	154
TheHandi-Van O&M Costs	YOE $M	52	55	58	61	65	68	72	76	80	85	89	94	99	104	109	114	120	126	132	138
Other O&M Costs	YOE $M	1	1	1	2	2	2	3	3	3	3	5	6	7	8	8	8	8	8	8	8
Total O&M Costs	**YOE $M**	**256**	**268**	**279**	**292**	**343**	**389**	**419**	**447**	**475**	**524**	**567**	**591**	**616**	**638**	**661**	**683**	**712**	**745**	**781**	**814**
Farebox Recovery Ratio (Bus and Rail)		**27%**	**27%**	**27%**	**32%**	**30%**	**28%**	**30%**	**28%**	**27%**	**28%**	**29%**	**28%**	**28%**	**27%**	**31%**	**30%**	**30%**	**29%**	**28%**	**27%**

Exhibit J-2: Operating Plan, Moderate Range Scenario

City Fiscal Year	Units	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Operating Revenues																					
Fare Revenues (Bus & Rail)	YOE $M	55	58	59	72	83	89	104	105	106	124	138	140	141	143	154	156	173	175	177	186
Fare Revenues (Handi-Van)	YOE $M	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Total Fare Revenues	**YOE $M**	**57**	**60**	**62**	**74**	**85**	**91**	**106**	**107**	**108**	**126**	**141**	**143**	**144**	**146**	**157**	**159**	**176**	**178**	**180**	**189**
Federal Operating Assistance																					
Total Federal Assistance	**YOE $M**	**23**	**10**	**10**	**11**	**10**	**10**	**6**	**10**	**-**	**9**	**6**	**-**	**-**	**5**	**1**	**1**	**4**	**5**	**5**	**-**
Local Operating Assistance																					
Transfer from Project	YOE $M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
City Operating Subsidy	YOE $M	176	197	207	207	248	287	307	330	366	398	431	458	483	498	514	535	545	575	611	640
Total Local Assistance	**YOE $M**	**176**	**197**	**207**	**207**	**248**	**287**	**307**	**330**	**366**	**398**	**431**	**458**	**483**	**498**	**514**	**535**	**545**	**575**	**611**	**640**
Total Operating Revenue:	**YOE $M**	**256**	**268**	**279**	**292**	**343**	**389**	**419**	**447**	**475**	**534**	**577**	**601**	**627**	**650**	**673**	**696**	**725**	**758**	**795**	**829**
Operations and Maintenance (O&M) Costs																					
TheBus O&M Costs	YOE $M	204	212	220	229	238	247	257	268	291	309	342	358	374	391	409	428	448	469	490	513
Rail O&M Costs	YOE $M	-	-	-	-	39	71	87	100	101	137	141	143	147	146	146	145	149	156	165	169
TheHandi-Van O&M Costs	YOE $M	52	55	58	61	65	68	72	76	80	85	89	94	99	104	109	114	120	126	132	138
Other O&M Costs	YOE $M	1	1	1	2	2	2	3	3	3	3	5	6	7	8	8	8	8	8	8	8
Total O&M Costs	**YOE $M**	**256**	**268**	**279**	**292**	**343**	**389**	**419**	**447**	**475**	**534**	**577**	**601**	**627**	**650**	**673**	**696**	**725**	**758**	**795**	**829**
Farebox Recovery (Bus and Rail)		**27%**	**27%**	**27%**	**32%**	**30%**	**28%**	**30%**	**28%**	**27%**	**28%**	**29%**	**28%**	**27%**	**27%**	**28%**	**27%**	**29%**	**28%**	**27%**	**27%**

Exhibit J-3: Operating Plan, High Cost Range Scenario

City Fiscal Year	Units	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Operating Revenues																					
Fare Revenues (Bus & Rail)	YOE $M	55	58	59	72	83	89	104	105	106	124	138	140	156	157	159	161	183	185	187	189
Fare Revenues (Handi-Van)	YOE $M	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Total Fare Revenues	**YOE $M**	**57**	**60**	**62**	**74**	**85**	**91**	**106**	**107**	**108**	**126**	**141**	**143**	**158**	**160**	**162**	**164**	**186**	**188**	**190**	**192**
Federal Operating Assistance																					
Total Federal Assistance	**YOE $M**	**23**	**10**	**10**	**11**	**10**	**10**	**6**	**10**	**-**	**9**	**6**	**-**	**-**	**5**	**1**	**1**	**4**	**5**	**5**	**-**
Local Operating Assistance																					
Transfer from Project	YOE $M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
City Operating Subsidy	YOE $M	176	197	207	207	248	287	307	330	366	406	439	467	478	494	519	541	546	577	614	651
Total Local Assistance	**YOE $M**	**176**	**197**	**207**	**207**	**248**	**287**	**307**	**330**	**366**	**406**	**439**	**467**	**478**	**494**	**519**	**541**	**546**	**577**	**614**	**651**
Total Operating Revenue:	**YOE $M**	**256**	**268**	**279**	**292**	**343**	**389**	**419**	**447**	**475**	**541**	**585**	**609**	**636**	**659**	**683**	**706**	**736**	**770**	**809**	**843**
Operations and Maintenance (O&M) Costs																					
TheBus O&M Costs	YOE $M	204	212	220	229	238	247	257	268	291	309	342	358	374	391	409	428	448	469	490	513
Rail O&M Costs	YOE $M	-	-	-	-	39	71	87	100	101	144	149	151	156	156	156	156	160	168	178	183
TheHandi-Van O&M Costs	YOE $M	52	55	58	61	65	68	72	76	80	85	89	94	99	104	109	114	120	126	132	138
Other O&M Costs	YOE $M	1	1	1	2	2	2	3	3	3	3	5	6	7	8	8	8	8	8	8	8
Total O&M Costs	**YOE $M**	**256**	**268**	**279**	**292**	**343**	**389**	**419**	**447**	**475**	**541**	**585**	**609**	**636**	**659**	**683**	**706**	**736**	**770**	**809**	**843**
Farebox Recovery (Bus and Rail)		**27%**	**27%**	**27%**	**32%**	**30%**	**28%**	**30%**	**28%**	**27%**	**27%**	**28%**	**27%**	**29%**	**29%**	**28%**	**28%**	**30%**	**29%**	**28%**	**27%**

Exhibit J-4: Operating Plan, Ridership Sensitivity, at Current Average Fare Rate

	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Constant $'s											
No Reduction	$89,855,800	$100,325,001	$101,534,448	$102,743,895	$103,953,342	$105,162,789	$106,372,236	$107,581,683	$108,791,130	$110,000,577	$111,210,024
Total Revenue @ 95%	$85,363,010	$95,308,751	$96,457,725	$97,606,700	$98,755,675	$99,904,649	$101,053,624	$102,202,599	$103,351,574	$104,500,548	$105,649,523
Change from 100%	($4,492,790)	($5,016,250)	($5,076,722)	($5,137,195)	($5,197,667)	($5,258,139)	($5,318,612)	($5,379,084)	($5,439,557)	($5,500,029)	($5,560,501)
Total Revenue @ 90%	$80,870,220	$90,292,501	$91,381,003	$92,469,505	$93,558,008	$94,646,510	$95,735,012	$96,823,515	$97,912,017	$99,000,519	$100,089,022
Change from 100%	($8,985,580)	($10,032,500)	($10,153,445)	($10,274,389)	($10,395,334)	($10,516,279)	($10,637,224)	($10,758,168)	($10,879,113)	($11,000,058)	($11,121,002)
Total Revenue @ 85%	$76,377,430	$85,276,251	$86,304,281	$87,332,311	$88,360,341	$89,388,371	$90,416,401	$91,444,431	$92,472,461	$93,500,491	$94,528,521
Change from 100%	($13,478,370)	($15,048,750)	($15,230,167)	($15,411,584)	($15,593,001)	($15,774,418)	($15,955,835)	($16,137,252)	($16,318,670)	($16,500,087)	($16,681,504)