

MONTHLY MONITORING REPORT
October 2018

Central Subway Project
San Francisco Municipal Transportation Agency (SFMTA)
San Francisco, CA

FINAL

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EXECUTIVE SUMMARY

Project Description

The Central Subway Project (CSP) involves construction of a 1.7-mile extension of Muni's T Third Line along 4th Street and beneath Stockton Street in downtown San Francisco. The CSP is Phase 2 of the San Francisco Municipal Transportation Agency's (SFMTA) T Third Light Rail Transit (LRT) Project. The CSP will extend the T Third Line from the 4th Street Caltrain Station to Chinatown, providing a direct rapid transit link from the Bayshore and Mission Bay areas to South of Market, Union Square, and downtown.

Four new stations are being constructed as part of the project—an at-grade station at 4th and Brannan streets and three underground stations at Yerba Buena/Moscone Center (YBM), Union Square/Market Street (UMS), and Chinatown (CTS). Four light rail vehicles (LRVs) are included in the budget for the CSP as part of a larger procurement that will expand the LRV fleet and includes options for replacement of the entire fleet. Average weekday boardings are projected to be 43,521 in 2030.

Project Status

The project has been under construction since February 2010. *At the end of September 2018, the project was 79.8% complete based on expenditures.* The one active construction contract: 1300 Stations and Systems/Trackwork being executed by Tutor Perini Corporation (TPC), *was 75.0% complete based on incurred cost.* Substantial completion of this contract was originally scheduled for February 10, 2018, but the latest master program schedule update forecasts substantial completion on July 30, 2019, a delay of 536 days. SFMTA's most recent update of the program schedule continues to forecast the Revenue Service Date (RSD) to occur on January 14, 2020. This is 384 days later than the required RSD of December 26, 2018 in the Full Funding Grant Agreement (FFGA) and unchanged from the previous month.

SFMTA has completed language for a contract modification (CMod) for Automated Train Control System (ATCS) to remove portions of the scope of work from the TPC contract, but the CMod has not been executed pending review by the Capital Programs and Construction Contract Administration group. SFMTA will directly control contracts for the suppliers of ATCS to mitigate potential delay claims from TPC and to afford better control of design and integration activities. SFMTA is working on a similar CMod to remove portions of the scope of work for radio systems from the TPC contract.

Restoration of the street surface at three intersections on 4th Street remains on hold pending resolution of the traffic control requirements and schedule for the work.

Table 1 - Core Accountability Items

Project Status: <i>(as reported in SFMTA's September 2018 Monthly Progress Report)</i>		Original at FFGA:	Current Estimate:
Cost	Cost Estimate	\$1,578,300,000	\$1,578,300,000
Contingency	Unallocated Contingency	\$74,722,000	\$6,742,405

	Total Contingency (Including Approved Contract Changes)	\$185,500,000	\$67,455,883
Schedule	Revenue Service Date (RSD)	12/26/2018	1/14/2020 (SFMTA forecast)
Total Project Percent Complete	Based on Expenditures	79.8%	
	Based on Earned Value	80.0%	
Major Issues	Status	Comments/Planned Action	
Schedule Contingency	All schedule contingency has been consumed.	SFMTA to publish a revised RSD reflecting remaining schedule risks and the current status of construction prior to the next Quarterly Progress Review Meeting (QPRM).	
Cost Contingency	Total Contingency is \$67.46 million – 16.6% of the value of remaining work.	The contingency appears adequate for the current level of project completion, although increasing contractor claims are a concern.	
Technical Capacity and Capability	Program Director and Start-up and Testing Manager positions open.	SFMTA recruitment is continuing. SFMTA to seek consultant support for start-up and testing.	
Date of Next Quarterly Meeting:		November 28, 2018	

Earned Value (EV): \$1,263,947,948, an increase of \$8.46 million from August.

Planned Value (PV): \$1,532,262,710 a planned increase of \$2.92 million from August.

Actual Cost (AC): \$1,258,818,958, an increase of \$8.51 million from August.

Cost Performance Index (CPI): 1.00, indicating that the value of completed work is consistent with the incurred cost.

Schedule Performance Index (SPI): 0.82, indicating that the amount of work completed is significantly less than planned and the project is behind schedule.

Contingency

Cost Contingency

The total available contingency (approved contingency less approved contract changes) as of September 30, 2018 was \$67,455,883, which is above the minimum required contingency of \$25 million. SFMTA's latest trend summary report estimates a total potential additional cost increase from claims, denied change order requests, and pending changes of \$67.04 million, which is substantially higher than estimated in October. With the current estimate of cost exposure from claims, about \$1.22 million in excess contingency is available in the project budget. Additional unallocated contingency of \$1.4 million should be available as a result of the final close-out price for the Tunnel Contract.

Schedule Contingency

All contingency in the schedule has been consumed, and there are about 13 months of negative float from the baseline schedule. The forecast RSD did not change in the past month. The Federal Transit Administration's (FTA) recommended schedule float at the current stage of project completion is four months. Applying this float to the current program schedule would yield a Project Management Oversight Contractor (PMOC)-estimated RSD in May 2020. *SFMTA continues to work on an updated schedule risk assessment that will be used to establish a proposed revised required RSD for the project. SFMTA is expected to issue a draft letter requesting a shift in the grant-required RSD prior to the next Quarterly Project Review Meeting (QPRM).*

PMOC Observations, Opinions, Recommendations and Concerns

The PMOC is concerned about the large increase in claims in the past month. Claims and pending/potential contract changes now have a total value nearly equal to the remaining contingency in the project budget. SFMTA should focus on the resolution of outstanding claims in order to improve confidence in the adequacy of the available contingency.

The PMOC continues to be concerned that the time required for SFMTA to make decisions regarding project issues and to execute contract changes needs improvement. Resolution of issues, such as approval of traffic control plans for construction at CTS and along 4th Street, are taking far too long. Also, the execution of planned contract changes for ATCS have taken far too long.

The PMOC continues to recommend that SFMTA quickly complete the contract actions regarding management of the ATCS and the radio system. Until the contract modifications to remove elements of the ATCS and radio system work from the 1300 Contract are complete, significant risks to the schedule are associated with these components of the project.

The PMOC recommends that SFMTA complete its review of its Quality Assurance (QA) procedures and process to determine how non-conforming rail was accepted and installed for a significant portion of the alignment before the issue was identified. The PMOC also recommends that SFMTA assess its design control procedures to identify how to avoid inconsistent requirements for specified materials in different portions of the specification.

The recruitment process for a new Program Director is continuing. *SFMTA's Director of Transit has retired. The CSP management is working with the acting head to identify staff to support start-up and testing.* SFMTA intends to acquire testing and start-up management support from its program management consultant, but the staff has not been assigned. Meanwhile, SFMTA added a full-time claims manager to expedite the claim resolution process.

The required RSD identified in the FFGA for the CSP is about one month in the future. SFMTA's current schedule indicates RSD in January 2020 with no schedule float. SFMTA must submit a request to extend the RSD prior to the required revenue service date in the grant. SFMTA should include sufficient float in its forecast of the actual RSD to accommodate remaining construction, testing, and start-up risks. *SFMTA plans to issue a letter requesting extension of the grant-required RSD. The PMOC conducted a comprehensive schedule review for the project on November 7, 2018, in support of FTA's consideration of SFMTA's pending request to extend the RSD.*

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A. PROJECT STATUS

Full Funding Grant Agreement (FFGA)

The FFGA for the Central Subway Project (CSP) was signed on October 11, 2012.

Design

Design is complete.

Construction

Contract 1250 (UR #1). This completed contract relocated utilities within the footprint of the proposed Yerba Buena/Moscone Center (YBM) Station.

Contract 1251 (UR #2). This completed contract included the relocation of utility lines within the footprint of the proposed Union Square/Market Street (UMS) Station and temporarily rerouted existing trolley coach lines around the construction zone.

Contract 1252 Tunnel. This completed contract included the construction of 1.5 miles of twin tunnels excavated by tunnel boring machines and construction of the tunnel portal, retrieval shaft, and five cross-passages. Final completion has been achieved, and final contract close out is now underway. San Francisco Municipal Transportation Agency (SFMTA) presented the final cost data for the contract at the August Quarterly Progress Review Meeting (QPRM). Not including costs of extra work paid from non-project sources, the final cost of the Central Subway tunneling work is \$233,511,253, compared to the most current estimate at completion of \$234,967,069. When SFMTA reconciles the final contract cost with the program budget, about \$1.4 million in additional unallocated contingency should be available as a result of the final cost of the tunneling work being well below the current allocated budget for the work. The final cost of the tunnel work was not reflected in SFMTA's *September 2018* monthly progress report and is not reflected in cost tables presented in this report. Final close-out of the contract is awaiting receipt of information from the contractor on how the payments received have been distributed to subcontractors.

Contract 1300 (Combination of UMS, CTS, YBM, and STS). This contract includes the construction of three underground stations, one surface station, all surface works required for the installation of Light Rail Transit (LRT) between 4th and King streets and the tunnel portal, and all LRT track and systems components. *As of the end of September 2018, the construction of the Stations and Surface, Track, and Systems (STS) Contract was 72.76% complete based on cost and 73.31% complete based on the value of completed construction.*

The contractor and SFMTA have been establishing "Big Hairy Audacious Goals" (BHAGs) as a means of encouraging focus and collaboration between the contractor and agency project team members to maintain and enhance schedule performance. Thus far, few of the identified BHAGs have been achieved.

The forecast date for completion of construction for each work package is shown for the September 2018 and August 2018 schedule updates in Table 2.

Table 2 - Forecast Construction Completion Dates for CSP Work Packages

<i>Work Package</i>	<i>September 2018 Forecast Construction Completion Date</i>	<i>August 2018 Forecast Completion Date</i>
1253 – Union Square/Market Street Station	7/30/2019	7/29/2019
1254 – Chinatown Station	1/1/2020	12/31/2019
1255 – Yerba Buena/Moscone Station	7/30/2019	7/29/2019
1256 – Surface Track and Systems	10/17/2019	10/16/2019

Source: SFMTA Monthly Progress Reports for *August and September 2018*

Union Square/Market Street Station (UMS): *Interior wall, floor, and stairway construction is underway throughout the station. Street work at O’Farrell and Stockton is nearing completion, while all street construction work has been completed at the Stockton/Ellis/Market Street intersection. The traffic signal controller and related conduits at the Ellis/Market Street intersection still remains to be completed. Tutor Perini Corporation (TPC) completed the closing of one of the remaining openings in Stockton Street between O’Farrell and Geary streets during October.*

Chinatown Station (CTS): *Work to install vaults for electrical power supply continues to be delayed pending resolution of the traffic control requirements for the work. Central Subway management is of the opinion that closing the western crosswalk of Washington Street is preferable to shifting traffic lanes and eliminating loading zones on the opposite side of the street in order to shift the walkway to the east. SFMTA Sustainable Streets Division thus far has not approved closure of the walkway. **This is one of several critical decisions that need to be reached to move construction forward.** Construction in the headhouse continues at the concourse level, where concrete placements for the floor slab are completed for the second pour. The third concrete pour is on hold pending modification of the reinforcement. The structure of the north platform and crossover caverns is complete, and work continues on the south platform and crosscut caverns. Work to complete the north egress tunnel and shaft is underway, with completion targeted prior to Chinese New Year.*

Yerba Buena/Moscone Station (YBM): *Utility work is nearing completion at the intersections of 4th Street with Howard Street and Folsom Street. Mechanical, Electrical, and Plumbing (M/E/P), interior walls, stairs, escalators, and elevators are being installed throughout the station. Placement of the surface-level deck was completed during October, and Clementina Street was opened for public use. Water leaks continue to be an issue, with repair work ongoing. A report related to mitigation of water leaks is under review. Installation of special electrical coatings in the traction power room is being delayed by excess moisture levels from water leaks. **SFMTA will need to determine how to manage ongoing water intrusion into the YBM structure to avoid further delays to construction of the station.***

Surface, Track, and Systems (STS): *Very little work is ongoing on the surface section of the alignment on 4th Street due to continuing issues with unresolved requirements for traffic control for street restoration. SFMTA is still awaiting an Encroachment Permit from the California Department of Transportation (Caltrans) for work at the Interstate 80 off-ramp at Bryant Street.*

Systems and Track

SFMTA still has not executed the contract modification for the separation of the Automated Train Control System (ATCS) from the 1300 Contract. Contract language has been prepared and is under review. SFMTA received a revised schedule from the ATCS supplier, Thales, which will be included in Thales' revised contract.

SFMTA also is preparing a contract modification for the separation of the radio system scope of work, including design and integration activities, from the TPC contract. The supplier for system-wide radio upgrades, Harris, will be contracted to provide radio system design and integration.

Work on track had been suspending pending delivery of new track to replace the non-conforming track supplied by the contractor. The track was delivered at the end of October and is stored on 4th Street. Installation of the replacement track will begin in November. SFMTA retained ownership of the non-conforming rail and is working with project representatives for the Sacramento Streetcar project to potentially transfer ownership of the rail for use on that project.

Tunnel Work

The electrical subcontractor continues to progress the installation of conduits and Overhead Contact System (OCS) support equipment in the tunnels.

Third Party Agreements Including Utilities, Railroads, Other Agencies, Etc.

Bay Area Rapid Transit (BART)

No updates to report.

California Department of Transportation (Caltrans)

SFMTA needs an Encroachment Permit to install electrical and traffic signal equipment at the I-80 off-ramp, which terminates at the intersection of 4th and Bryant streets. SFMTA Sustainable Streets Division (SSD) is planning other improvements to the intersection that would be implemented after completion of the Central Subway Project. Caltrans is insisting that the Encroachment Permit include all planned improvements, while SFMTA is requesting that the later work by SSD be covered by a separate permit. SFMTA and Caltrans have been unable to resolve the issue and it has been escalated to the SFMTA Director of Transportation.

CPUC

The California Public Utilities Commission (CPUC) is participating in the various safety meetings, including the Safety and Security Certification Review Committee (SSCRC) and Fire and Life Safety Committee (FLSC) meetings. Representatives of the CPUC also regularly attend the SFMTA/Federal Transit Administration (FTA) QPRMs, although they were not present at the May 9, 2018 or August 8, 2018 meetings. The FLSC is working to approve items on the certifiable items list for the Stations Contract. SFMTA has expressed concern that CPUC may have insufficient staff to witness the required safety tests for CSP, which could further delay the Revenue Service Date (RSD). This potential risk is being monitored in the risk register, and mitigation strategies have been identified.

San Francisco Public Utilities Commission (SFPUC)

No updates to report.

San Francisco Department of Public Works (SFPDW)

SFPDW inspects completed street and sidewalk facilities that the contractor has proposed to release to the City. SFPDW develops punch lists of required repairs that must be completed by the contractor prior to acceptance of the streets and sidewalks.

San Francisco Parks and Recreation Department

No updates to report.

Private Property Owners

All real estate acquisitions are complete. There will be a need to extend the duration of some of the licenses for compensation grouting. A number of private property owners and businesses have issued claims for damage associated with the project construction. The builder's insurance policies maintained by the contractor cover the costs associated with these claims, and the contractor has demonstrated improved responsiveness to damage claims that are associated with ongoing construction work.

Status of Vehicle Design, Procurement, Testing, and Integration

The four Light Rail Vehicles (LRVs) for the Central Subway have been delivered and accepted by SFMTA. An additional 24 LRVs for near-term fleet expansion (4 for service to the new Warriors Arena), and 151 LRVs for fleet replacement are in various stages of production and delivery. SFMTA has identified which of the new cars are considered to be funded by the CSP and will provide information on the date they are placed into revenue services for ongoing tracking of these assets in which the federal government has a financial interest.

Real Estate

SFMTA has acquired all project right-of-way, and all commercial and residential relocations are complete.

Labor Relations and Policies

Appendix E of the Project Monthly Report details the Small Business Enterprise (SBE) goals and actual participation on each contract as of *September 2018*. SFMTA contract goals range from 6% to 30% on each of the contracts. The majority of the contracts have met these goals to date.

Compliance with Applicable Statutes, Regulations, Guidance, and FTA Agreements

No updates to report.

B. PROJECT MANAGEMENT PLAN AND SUB-PLAN IMPLEMENTATION

Project Management Plan (PMP)

SFMTA delivered an update of the PMP in April 2018. A review of the PMP by the PMOC was not requested by FTA.

Environmental Assessment/Mitigation Plan/Archaeological Plans

The PMOC received the First Quarter 2018 Mitigation Monitoring Reporting Program (MMRP) update from SFMTA on July 10, 2018. The PMOC's review of the report indicates that SFMTA continues to meet its commitments for monitoring and mitigation of project impacts.

Real Estate Acquisition Management Plan (RAMP)

SFMTA submitted RAMP Revision 5, dated September 26, 2013, to FTA on November 19, 2013. SFMTA has acquired all required real estate for the project in accordance with the RAMP.

Quality Assurance/Quality Control (QA/QC) Program Plan

See section F.

Safety and Security Management Plan (SSMP)

See section H.

Risk and Contingency Management Plan (RCMP)

See section I.

C. PROJECT MANAGEMENT CAPABILITY AND CAPACITY

Agency Staff

The CSP Program Director, John Funghi, left the project effective February 1, 2018. Albert Hoe, the Deputy Program Director was appointed as the Acting Program Director. Recruiting for this key project staff position is continuing. SFMTA reported that hiring staff from outside the San Francisco Bay Area is challenging due to cost of living issues. **The PMOC will continue to monitor agency efforts to fill the Program Director position.**

*The director of SFMTA Operations has retired and an acting Director has been assigned. The CSP management staff is working with the Acting Transit Director to identify staff resources to work on the start-up and testing process. SFMTA also intends to secure support services from a consultant to supplement the assigned Operations Division staff. As of November 2018, these services had not started. **The PMOC encourages SFMTA to obtain the required consulting support for testing and training as soon as possible. Completion of the plan for testing, commissioning, training, and start-up activities for the project is critical to maintaining the schedule.***

SFMTA reported that the Resident Engineer (RE) for the STS work package has resigned. Recruitment for a replacement is underway. SFMTA also reported that a new Claims Manager

started work in October. A staff of three to four will be assigned to claims management and administration for the 1300 Contract. *SFMTA also has hired additional cost analysts to assist with execution of contract modifications and with documentation of costs that are to be reimbursed by third parties.*

Contractor Staff

There were no changes in the contractor's management staff.

D. PROJECT COST STATUS

Project Cost Control Systems

SFMTA continued to maintain the Trend Log and logs of Change Order Requests (CORs), Proposed Contract Changes (PCC), Notice of Potential Claims (NOPC), and Certified Claims for Contract 1300 using CM13. The Trend Log includes all potential changes in contract value, including items that, in the opinion of the CSP staff, are not merited and new items for which merit has not been determined. The contract change management log includes CORs that have been determined to have merit as well as agency-initiated PCCs that are progressing through negotiations toward a Contract Modification (CMod). The NOPC Log and the Claim Log include CORs rejected by SFMTA for which the contractor expects to submit or has submitted a claim.

*The most recent versions of the Trend Log and Trend Summary documents are dated November 7, 2018. The Trend Summary indicates that 90 contract modifications had been executed for the 1300 Contract. The total value of executed CMods was \$14,007,049 (\$1.30 million increase from October). The NOPC Log, dated October 3, 2018, indicates that there are now 120 potential claims (two additional since October). The Claim Log shows that 103 of these potential claims have been certified and submitted by the contractor. The submitted claims total \$49.86 million in extra costs, which is \$14.04 million higher than in October. **The PMOC is concerned about the large increase in claims in the past month. Claims and pending/potential contract changes now have a total value nearly equal to the remaining contingency in the project budget.***

Project Cost (as of September 2018)

Cost estimate: \$1.5783 billion.

Total contingency: \$67.46 million (minimum contingency is \$25 million), No change since August 2018.

Actual Cost (AC): \$1,258,818,958, an increase of \$8.51 million from August (79.8% of the total project budget).

Current funding level: \$1,517,025,000 (96.1% of the total project budget).

Earned Value (EV): \$1,263,947,948, an increase of \$8.46 million from August (80.08% of project value earned).

Cost Performance Index (CPI): 1.00.

CPI is a measure of cost efficiency on a project. It is the ratio of EV to AC. A CPI equal to or greater than 1.0 indicates a cost underrun, and a value of less than 1.0 indicates a trend towards a

cost overrun. A value of 0.9 or greater is considered acceptable, considering the margin of error in estimating the value of completed work.

Project Cost Trends

SFMTA tracks potential changes in project cost, calling these potential changes “trends.” Trends include all potential changes in a contract’s value. As the status of an identified trend changes, it may become a contract modification, it may become an item that is paid on a force account basis, or it may be denied/closed with no impact to the project cost. Extra cost items identified by the 1300 contractor that CSP management concludes have no merit are carried in the total trend amount at a lower value than the contractor’s estimate of extra costs, with the value reflecting SFMTA’s assessment of the likelihood that the change would ultimately be approved through the contract dispute resolution process.

*In the September 2018 Monthly Progress Report (MPR), SFMTA estimates the total cost impact of potential changes to the 1300 Contract at \$22.00 million, compared with \$20.60 million in August, an increase of about \$1.4 million. After potential changes were accounted for, \$5.29 million in allocated contingency remained for Contract 1300 at the end of September. **The resulting contingency of 2.3% of potential remaining cost on the 1300 Contract after potential changes are accounted for is likely insufficient, and additional contingency will probably need to be allocated to this contract prior to completion. The available unallocated contingency and excess contingency for other elements of the program will be sufficient to allow on-budget completion of the CSP if SFMTA’s estimate of pending changes is accurate. However, numerous claims from TPC may consume the available contingency if not settled for less than the claimed amounts.***

Table 3 shows the overall budget, trends, and contingency status for the entire Central Subway program. *The Budget Forecast Variance, which reflects the total remaining contingency after the cost of trends is accounted for, is 16.6% of the potential remaining spending. **In the opinion of the PMOC, this contingency is sufficient to provide a reasonable confidence in an on-budget completion of the project, although increasing claims from the contractor are a concern.*** Note that the values in Table 3 reflect the project status as of the end of September 2018 as reported in SFMTA’s latest MPR, and show somewhat different values for potential contract changes because of the differing data dates and because pending contract changes in Table 3 include only SFMTA-initiated PCCs and contractor CORs that have been determined to have merit. Claims and denied CORs are not included in the cost forecast in Table 3.

Change Order Control

SFMTA is maintaining its management tools for tracking potential contract changes for the 1300 Contract. *The latest CN1300 Trend Summary is dated November 7, 2018. This report shows that 90 contract modifications have been approved for a net increase in the contract value of \$14,007,049, which is up \$1.3 million from October. CORs (generated by the contractor) that have been determined to have merit and PCCs (generated by SFMTA) have a combined potential net cost impact of \$13.17 million in increased contract value, about \$1.77 million less than in October. This estimate includes expected reimbursements by third parties for work completed for their*

benefit. SFMTA expects to settle the outstanding CORs for less than the overall cost currently claimed by the contractor.

An additional 932 items are being tracked in the Trend Log. Of these, SFMTA judged 444 items to be without merit and denied them. Many of these denied trend items are included in contractor claims. A further 370 items have been voided and are carried at no cost. There are 107 items covered by certified claims and NOPCs by the contractor (\$45.39 million total exposure), and 12 items are “open” or new and awaiting a determination of merit.

*The potential exposure of the project to additional costs from the denied items, NOPCs, claims, and open items is \$53.87 million, which, when added to the \$13.17 million in increased project costs from merited contract changes, yields a possible exposure of the project to additional costs for the 1300 Contract of \$67.04 million. This compares to the remaining contingency for the project of \$66.16 million, after accounting for the latest contract modifications. An additional \$1.4 million in contingency should be available from the 1252 Contract based on the final contract value. **In the opinion of the PMOC, the rapid increase in claims by TPC calls into question the adequacy of the program contingency. Unless the claims are settled for less than the claimed amount, there is a risk that the program budget could be exceeded.***

The Trend Log shows the following trend items with potential cost increases in excess of \$250,000:

1. # 24 - Change to grade 50 steel from specified grade 70 steel (due to availability issues) - \$572,884
2. # 36 - Extra trucking costs for contaminated soil at CTS - \$2,274,225
3. # 39 - Harder rock than anticipated for CTS slurry wall excavation - \$2,290,471
4. # 61 - Delays to installation of tangent piles at UMS - \$627,081, *decreased from \$750,000*
5. # 160 - Conflicting duct bank at UMS - \$581,837
6. # 176 - UMS Garage underpinning requirements - \$732,157
7. # 192 - 12-inch waterline at UMS, added scope - \$336,236
8. # 193 - *Sewer line conflict at UMS - \$449,000 (new)*
9. # 239 - Changes in construction sequence for UMS Garage - \$500,000
10. # 246 - UMS art glass installation requirements - \$270,001, *decreased from \$690,017*
11. # 272 - Obstructions to jet grout placement at UMS - \$2,060,001
12. # 341 - Change in track switch machine manufacturer at STS - \$347,670
13. # 399 - Additional monitoring instruments at CTS - \$429,777
14. # 466 - Extra work to prepare existing tunnel - \$399,000
15. # 498 - Additional traffic control requirements at 4th and King - \$500,001
16. # 524 - Changed requirements for pre-loading of UMS concourse level struts - \$1,319,593
17. # 526 - Incomplete interface design at STS - \$300,001
18. # 528 - Additional traffic control requirements for STS work package - \$1,032,302
19. # 537 - Cost of changes to the design of CTS to accommodate the plaza requested by the community - \$2,759,569, *decreased from \$4,500,001 (paid from non-project funds)*
20. # 543 - Change in construction sequence at CTS - \$250,001
21. # 546 - Additional 12-inch water line work at YBM - \$254,106
22. # 580 - Missing conduit between manholes at UMS - \$250,001
23. # 592 - *Extra excavation costs for rock at CTS - \$1,808,202 (new)*
24. # 636 - Changes in emergency vent design (all stations) - \$500,001
25. # 644 - Contractor-claimed change in contract requirements for pre-loading permanent struts at UMS - \$1,853,352
26. # 657 - Elevator/escalator monitor at UMS - \$1,001,907

27. # 658 - Fire department monitor panel for UMS elevators - \$355,287
28. # 677 - Fire department monitor panel for CTS elevators - \$376,899
29. # 695 - Change in scope for slip-lining of 78-inch sewer on 4th Street - \$800,016
30. # 715 - Soil nail and shotcrete wall changes in Union Square Garage - \$1,365,378
31. # 728 - Add fire alarm horn and strobe at vehicle ramp in Union Square Garage - \$288,976
32. # 840 - Change in drain piping details at UMS - \$332,252
33. # 892 - Temporary drainage to re-direct water off new ramps at UMS - \$261,851
34. # 968 - Design changes for UMS vertical drainage slots - \$603,910
35. # 1022 - Claim for extra costs and time due to extremely hard ground claimed by TPC during the coring for the Sequential Excavation Method (SEM) mining work - \$862,720
36. # 1032 - Escalator raceways at UMS - \$296,946, *decreased from \$492,065*
37. # 1099 - Extra costs for SEM excavation at CTS due to tunnel segments being 5 feet long - \$4,404,329
38. # 1117 - Extra costs due to concrete obstruction at CTS south platform cavern - \$451,686
39. # 1152 - Extra costs for tying wall reinforcing into invert slab at UMS - \$359,905
40. # 1175 - Time impacts due to power pole conflict during demolition at CTS - \$520,000
41. # 1217 - Claimed delays to SEM work at the platform invert due to compensation grout exclusion zone requirements in the contract specifications - \$900,889
42. # 1268 - Revised reinforcing steel for headhouse invert at CTS - \$1,147,356, *decreased from \$1,241,941*
43. # 1299 - Claimed extra costs for a schedule delay to the train control subcontract - \$2,000,001
44. # 1311 - Claimed extra costs for delays to the CTS south platform center drift excavation due to restrictions caused by compensation grouting - \$675,952
45. # 1344 - *Acceleration costs - \$1,398,816 (new)*
46. # 1373 - Extra costs for jet grouting complications at Macy's basement at UMS - \$585,521
47. # 1378 - General claimed extra costs for SEM work at CTS - \$5,457,322
48. # 1390 - Extra costs to haul excavation spoils to Ox Mountain disposal site - \$1,500,000
49. # 1406 - General claim at YBM - \$604,697
50. # 1424 - Extra work due to changes in form-savers and couplers at roof to wall connection at YBM - \$250,001

51. # 1479 - Large volume of water inflow at end of probe - \$300,000
52. # 1485 - Conflict between YBM headhouse column reinforcing steel and temporary struts - \$498,187
53. #1557 – Changes to escalators 1 and 2 at YBM - \$1,000,000
54. # 1571 - Increase in allowance for Dispute Review Board (DRB) costs - \$1,296,364, increased from \$250,000
55. # 1606 - Claim of defective specifications at YBM - \$2,500,001
56. # 1669 - Extra quantity of compensation grouting material all stations - \$775,000, decreased from \$857,500
57. # 1670 - Differing site conditions at CTS - \$9,092,979, increased from \$1,000,001
58. # 1689 - Costs to provide hardened rail - \$800,001
59. # 1711 -Extra costs for claimed change in connection requirements for communication cables at YBM - \$301,719
60. # 1749 - Change in routing of data conduit at UMS - \$333,520
61. #1785 - Extra costs for design changes at UMS - \$500,001
62. # 1849 – External cable for ATCS - \$365,000 (new)

The PMOC notes that there were four new trends with costs in excess of \$250,000 in the current month and a major increase in the cost exposure from one of the trends.

In addition to these large potential cost increases, the Trend Log includes the following major cost savings:

1. Deletion of compensation grouting bid items at YBM - (\$1,833,869)
2. Deletion of the Air Replenishment System (ARS) - (\$4,689,000)
3. Replace specified Closed Circuit Television (CCTV) equipment with alternate for all stations - (\$1,600,000)

Funding

Federal, state, and local project funding and expenditures are shown in Table 4. The awarded funding now represents 96.1% of the project budget.

Table 4 - Project Funding

Source	Committed (\$1,000)	Awarded (\$1,000)
<u>Federal</u>		
New Starts	942,200	942,200
Congestion Mitigation	41,025	41,025
<i>Federal Subtotal</i>	983,225	983,225
<u>State</u>		
TCRP	14,000	14,000
State RIP	88,000	12,498
Prop. 1B / PTMISEA	307,792	307,792
Prop. 1A / HSR	61,308	61,308
<i>State Subtotal</i>	471,100	395,598
<u>Local</u>		
MTA	0	475
Prop. K Sales Tax	123,975	137,727
<i>Local Subtotal</i>	123,975	138,202
Project Total:	1,578,300	1,517,025

E. PROJECT SCHEDULE STATUS

SFMTA prepared an update of the master program schedule in October representing progress on the project through September 30, 2018. SFMTA continues to reject schedule updates from the contractor. SFMTA has directed the contractor to make corrections to the schedule logic, but the contractor has not complied with this direction. As a result, the schedule forecasts for the project are based on SFMTA's version of the schedule. SFMTA also developed an ATCS schedule, including testing activities in June. This schedule has not been integrated into the overall program schedule.

As of the end of September 2018, the project was 384 days late, based on the projected RSD of January 14, 2020. The substantial completion date for the 1300 Contract is now forecast on July 30, 2019, which is 536 days later than the original date (February 9, 2018). The latest schedule update indicates no change to the projected RSD from the previous schedule.

TPC has issued claims and NOPCs for various issues leading to delays to construction. SFMTA has issued CMods that allow 18 additional days of construction. SFMTA has also issued CMod 87 that allows an additional 82 days of construction, with 67 of those days including extended contractor overhead. The 100 days of additional construction duration included in the executed CMods yields a revised substantial completion date for the 1300 Contract of May 20, 2018. The additional time from May 20, 2018 to the forecast substantial completion date of July 30, 2019 is the subject of disputes and claims, which are being addressed through a DRB.

Thus far, resolution on the claims has not been reached. The contractor is pushing for a "global settlement" that awards it significant additional time and associated extended overhead costs. SFMTA is considering the contractor's latest offer of a global settlement, which includes a firm commitment to complete the project on an agreed date.

The schedule for installation and testing of the ATCS is the subject of major delay claims, and it is uncertain how delays to the ATCS work could impact the project critical path. SFMTA received an updated schedule from the train control supplier and added other activities to produce a preliminary ATCS schedule. *This schedule indicates that the ATCS work can be completed in April 2019, leaving about four months for ATCS testing and about five months for SFMTA commissioning work prior to the January 14, 2020 forecast for RSD.*

The critical path for the construction work still flows through the CTS headhouse concrete work, electrical activities, STS start-up and testing, commissioning, and pre-revenue activities. Work at UMS is close to the critical path so that any delays at UMS or time-savings at CTS may cause a change in the critical path.

SFMTA and TPC have been establishing BHAGs as a way to focus the project team's attention on advancing project work and to encourage teamwork among SFMTA and TPC staff to removing barriers to completion of the work. **In the opinion of the PMOC, the BHAGs continue to be missed and are of questionable value in mitigating delays.**

The PMOC and SFMTA convened a schedule workshop on July 26 and 27, 2017 with the objective of agreeing on an approach to establishing a reliable forecast of the project RSD. The PMOC issued a report documenting the results of the workshop and identifying action items relative to the schedule. SFMTA and the PMOC reviewed the status of the action items on October 17, 2017. The remaining open action items include:

1. Review and confirm schedule for procurement of ATCS hardware, software, and testing. SFMTA is implementing contract actions that will give it more direct control over the ATCS work. SFMTA received a detailed schedule for ATCS work from Thales. This schedule is being revised and then needs to be finalized once the Thales contract actions are complete, and the detailed ATCS schedule needs to be integrated into the program schedule.
2. Conduct a risk assessment to identify a reasonable range for the RSD recognizing the schedule risks. The PMOC met with SFMTA to review the current status of the risk analysis. SFMTA completed refinements to the analysis and provided results of the work in April. SFMTA delivered a report on the schedule risk analysis to FTA on June 20, 2018. SFMTA is in the process of updating its risk assessment and plans to make a formal request to extend the RSD in the grant prior to December 2018. *The PMOC conducted a schedule workshop and risk review in November as part of its review of SFMTA's proposed extended RSD.*

In the opinion of the PMOC, until the contract modifications to remove the ATCS and radio system work from the 1300 Contract are complete, significant risks to the schedule are associated with the ATCS work. Until these risks are retired or better defined, it will be difficult to establish a reliable RSD.

Project Schedule Data (as of September 30, 2018)

Earned Value (EV): \$1,263,947,948, an increase of \$8.46 million from August.

Planned Value (PV): \$1,532,262,710, a planned increase of \$2.92 million from August.

Going forward, the planned earned value for each month should be substantially lower because the baseline schedule projected Substantial Completion in February 2018. Actual earned value each month should generally exceed the planned earned value for the month for the remainder of the project.

Schedule Performance Index (SPI): 0.82. SPI is a measure of schedule efficiency on a project. It is the ratio of earned value to planned value. An SPI equal to or greater than 1.0 indicates more work was completed than planned and a value of less than 1.0 indicates less work was completed than planned. A value of equal to or greater than 0.9 reflects satisfactory performance, considering the margin of error in estimating both earned value and planned value. The current value of 0.82 indicates that the project is significantly behind schedule.

Table 5 shows the status of the schedule milestones established for the project.

Table 5 - Schedule Milestones

(P = Planned Date, A = Actual Date, F = Forecast Date)	
Preliminary Engineering (PE):	Authorized in July 2002 (A)
Record of Decision:	Issued November 26, 2008 (A)
Final Design (FD):	Authorized in January 2010 (A)
FFGA Request:	Submitted September 2011 (A)
FFGA Executed:	October 11, 2012 (A)
Ground Breaking: (Utility Relocation Contract)	February 9, 2010 (A)
Tunnel excavation complete (hole through):	June 2, 2014 (SB); June 11, 2014 (NB) (A)
Cross passages complete:	December 20, 2014 (P); April 15, 2015 (A)
Tunneling substantial completion:	April 15, 2015 (A)
Station construction Notice to Proceed (NTP):	June 17, 2013 (A)
Station construction substantial completion:	February 24, 2018 (P); July 30, 2019 (F)
RSD:	December 26, 2018 (P); January 14, 2020 (F)

Schedule Contingency Management criteria were developed from the FTA Risk Assessment prior to entry into Final Design (FD). Minimum schedule contingency levels at various project milestones or “Hold Points” were agreed to with SFMTA at Risk Workshop #4, held in 2009. The FTA recommended schedule contingency for the current stage of the project is 4.0 months. The current schedule reflects about 13 months of negative buffer float. Applying the recommended schedule float to SFMTA’s current RSD forecast yields a RSD estimate of May 2020.

Critical Path Summary (Baseline Schedule)

CTS Install Guidewalls, Slurry Walls, and Install Surface Deck (complete)

CTS Excavate Headhouse and Bracing (complete)

CTS SEM and Install Supports (underway)

CTS Headhouse Structural Concrete/Remove Bracing

CTS Install M/E/P Equipment
CTS Start-up and Testing
CTS P-1254R Commissioning of Station
Safety and Security Certification/Pre-Revenue Activities
RSD on December 26, 2018 (currently forecast January 14, 2020)

Three Month Look-ahead

The following activities are planned over the next three months:

1300 Contract

UMS

- Complete paving of Stockton Street from Ellis Street to Geary Street
- Coordinate with the business improvement district for implementation of Winter Walk
- Continue exterior finishing work at the plaza level of the Union Square Garage and the north entrance
- Construct finished walls and floors in the station box
- Complete the structural interface between the tunnels and the station box
- Install M/E/P throughout the station
- Install stairs throughout the station
- Install the escalators in the south concourse

CTS

- Completion of concourse-level, *intermediate*, and *mezzanine level slabs* in the headhouse
- Complete placement of final linings in the crossover and platform caverns
- Continue bottom-up construction of the headhouse interior walls and floors
- Complete invert, waterproofing installation, and staircase for north emergency egress.
- Install station power vaults

YBM

- Install mechanical and electrical equipment throughout station
- Continue construction of stairs within the station box and emergency egress stairs
- Continue finishes work throughout the station
- Complete utility work at 4th and Howard Street and 4th and Folsom Street intersections above the station box and complete street restoration work
- Install escalators and elevators

STS

- Complete OCS pole installation
- Resolve requirements for traffic control and construction staging for completion of street restoration work along 4th Street south of I-80
- Obtain Encroachment Permit from Caltrans for construction in the I-80 ramp/Bryant Street area
- Complete street reconstruction, installation of trolley coach OCS, and traction power equipment at the 4th and Bryant intersection
- Complete reconstruction of 4th Street at the Brannan Street intersection
- Plan for construction of the trackway and installation of track along 4th Street
- *Install track to CTS, including replacement of non-conforming rail*
- Construct tunnel walkways
- Continue construction of surface level station at Brannan Street
- De-assign ATCS subcontract work from the 1300 Contract and finalize detailed schedule for ATCS completion
- De-assign Radio System subcontract work from the 1300 Contract
- Continue installation of electrical conduits in tunnels
- Continue pulling traction power cables along 4th Street

The PMOC expects to attend the following meetings:

- Weekly Management (November 26, 2018; January 7 and February 4, 2019)
- Weekly Contract 1300 Construction Progress Meetings (January 8/9 and February 5/6, 2019)
- CSP PMOC Status Meetings (January 8 and February 5, 2019)
- CSP Risk Management Meeting (January 8 and February 5, 2019)
- FTA/QPRM (November 28, 2018)

F. QUALITY ASSURANCE AND QUALITY CONTROL

QA/QC Plan Implementation

SFMTA's Quality Assurance Manager (QAM) retired from the project in May 2018. A replacement started working on the project in early July.

The 1300 contractor's staff includes a Contractor's Quality Manager (CQM), who reports to the Contractor's Management at an organization level superior to the contractor's Project Manager. The CQM is provided by a subcontractor. The reporting structure is to provide the CQM with

direct access to the contractor's Principal Officers. A Contractor Non-conformance Report (CNCR) Log for identifying, correcting, documenting, and controlling non-conformances is maintained by the contractor and reviewed at weekly status meetings for each work package. Subsequent work may not progress for work that is the subject of a Corrective Action Request (CAR) until conditions averse to quality are corrected. In the event that the contractor does not issue a CNCR, SFMTA may issue a Non-conformance Notice (NCN) where non-conforming work is identified by SFMTA's quality assurance staff.

The quality concerns for the 1300 Stations Contract identified in the SFMTA June monthly report included issues identified in the previous month. A key activity for SFMTA is to determine the causes for acceptance of non-conforming rail during the submittal review process and at delivery of the rail to the project site.

The PMOC continues to recommend that SFMTA complete its review of its QA procedures and process to determine how the non-conforming rail was accepted and installed for a significant portion of the alignment before the issue was identified. The PMOC also recommends that SFMTA assess its design control procedures to identify how to avoid conflicting requirements for specified materials in different portions of the specification.

The previous QAM was conducting a surveillance of quality control related to the water leaks that have appeared in the YBM station. The status of that surveillance has not been reported. **The PMOC recommends that the new QAM follow up on the status of this audit.**

As of October 31, 2018, TPC's Quality Manager had filed 402 CNCRs (three new since September 30). Eight new items were under review, 14 other items had responses identified but not yet approved, the proposed responses to 21 items were disapproved, and 34 items had approved responses that were not yet implemented. In addition, 282 items were closed (four more than in September) and 43 items had been voided.

G. AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE

There are no ADA issues for the project at this time.

H. SAFETY AND SECURITY

Safety and Security Management Plan

An updated SSMP Revision 2, dated February 2, 2014, was submitted to FTA on May 2, 2014. The SSMP outlines the plans needed prior to revenue operations. These plans include the Rail Activation Plan (RAP), the System Integration Test Plan, the Safety and Security Certification Plan (SSCP), and the Pre-Revenue Operations and Start-up Plan. SFMTA has completed the SSCP, which is being used to guide safety certification activities. The initial draft of the RAP was completed with the latest update of the PMP. The System Integration Test Plan and the Pre-Revenue Operations and Start-up Plan are expected to be provided after SFMTA hires the Start-up and Testing Manager for the program.

Fire and Life Safety/Safety and Security Issues

The Construction Specification Conformance Checklists have been completed and approved for all construction packages. In September 2013, the CPUC staff began attending monthly as-built meetings to review the completed items. All items related to the tunnel construction have been certified and accepted by SFMTA's safety staff. The certification work was started to address the station construction items in 2016. As of August 6, 2018, 264 of the 1660 items on the Safety and Security Conformance Checklist were approved and 31 items required follow-up responses from the SFMTA construction team. Twelve items were under review by the committee. The San Francisco Fire Department (SFFD) regularly attends the now combined FLSC and SSCRC meetings.

Construction Safety

There were no recordable incidents on the project in the month of September. The performance metrics relating to accidents per working hour remain well below the OSHA goals for similar construction. The current incident statistics for the project are shown in Table 6.

Table 6 - Construction Safety Data

<i>Through September 2018</i>	No. of Incidents	Incident Rate ¹	Goal
1300 Contract			
OSHA Recordable Accidents	13	0.83	<3.4
Job Transfer/Restricted Duty Incidents	0	0	NA
Lost Time Incidents	3	0.19	<1.6
Total Incidents	16	1.02	NA
Hours Worked	3,150,285		

¹OSHA incident rate = incidents x 200,000/hours worked.

I. PROJECT RISK, RISK MANAGEMENT, AND RISK MITIGATION

SFMTA conducts monthly meetings to review the status of identified risks, monitor the implementation of mitigation measures, identify new risks, and evaluate the probability and potential impacts of existing and newly identified risks. The current major risks to the project address the potential for further delays to the construction of the stations, which cannot be mitigated or recovered, resulting in further delays to the RSD. At the Risk Mitigation meeting on October 2, 2018 these and other major remaining project risks were evaluated. The outcome of the risk meeting is documented in Appendix D.

The PMOC noted the following significant items of discussion at the October meeting:

- Risk 99 – Breakdown in relationships between SFMTA and contractors during construction results in increased claims and delays to the overall construction schedule – rating has been increased, resulting in this being the top ranked risk. Along with risk 240 – Unresolved Assignment of Schedule Delay Responsibility leading to higher costs for the program – the effects of this risk are occurring now. *SFMTA has started to conduct its detailed review of the causes of and responsibilities for delays in an effort to establish a*

negotiating position for a global resolution of the outstanding delay claims. Risk 99 and 240 remain the top threats to the program.

- *Risk 205 – Prolonged time to execute CMods creates additional cost and causes conflict between REs and the contractor. TPC is now refusing to progress work that includes changes to the contract documents without an executed CMod, which may delay future work. SFMTA noted that its standard procedures for contract modifications lead to delays in execution of all changes.*
- *The meeting proceeded with routine updates to previously identified risks. Risks associated with underground mining at CTS are nearing retirement, pending completion of the final lining of the platform and cross-cut caverns.*
- *CSP’s new quality manager noted that there has been an increase in NCNs, which are issued when the contractor fails to issue a CNCR.*
- *The impact of water leaks at YBM remains a high-ranked risk. High moisture and humidity levels at YBM are delaying the placement of dielectric coatings in the main electrical room at YBM. Humidity levels higher than specified are also being detected at UMS. A report on the causes of the leaks by an expert panel is complete. **The PMOC notes that implementation of mitigation measures to either stop or manage the incoming water and provide dry conditions in the electrical rooms is critical to maintaining progress of construction at YBM.***
- *Initial ratings were developed for a new risk that had been identified at previous risk mitigation meetings:*
 - *Systems test integration between components – rated high for probability and cost impact and medium for schedule impact, resulting in a rating of 8.*

The PMOC encourages SFMTA to continue to identify new risks associated with the coordination of design and installation of upcoming building finishes and M/E/P and systems work, as the major risks associated with civil work and related differing site conditions are being retired.

SFMTA has been applying updated schedule risks to a Monte Carlo analysis of the program schedule in order to establish a range of likely construction completion dates and revenue service dates. *SFMTA provided an updated report on the schedule risk assessment to the PMOC as part of the schedule workshop conducted in November. SFMTA plans to finalize its risk assessment and issue a draft letter requesting an extension to the RSD prior to the November 28 QPRM. The letter will be finalized, reflecting any comments by FTA prior to the currently required RSD in December 2018.*

J. ACTION ITEMS AND RECOMMENDATIONS

Table 7 on the following page shows the current action items for SFMTA. Table 8 provides a summary of the currently active PMOC recommendations. Closed recommendations are removed from the table one month after closure.

Table 7 - SFMTA Action Items for Central Subway Project

Category	NO.	ACTION	DATE OPENED	DUE DATE	DATE CLOSED	COMMENTS
C	178	Recognize impact of schedule delays to project management costs	11/14/2017	2/1/2018	TBD	SFMTA has started the process to update its forecast for project management costs.
S	179	Issue letter to FTA with proposed revision to the RSD	9/20/2018	11/28/2018	<i>TBD</i>	Issue prior to required completion date in December 2018. <i>A schedule and risk workshop was conducted in November as part of the PMOC's review of SFMTA's proposed revised RSD.</i>

(Note: All closed items are removed a month after being closed. Changes to open items since last update are indicated in *italics*.)

Category Key: C – Cost
 FMP – Fleet Management Plan
 IRP – Independent Review Panel
 PMP – Project Management Plan

QA – Quality Assurance
 RA – Risk
 RE – Real Estate

S – Schedule
 SC – Scope
 SS – Safety

T – Tech. Cap. & Cap.
 CH – Change Mgmt.

Table 8 - Active PMOC Recommendations

Number	Date Identified	Recommendation
1	12/27/2017	SFMTA and the contractor should continue to use the DRB process as a tool to resolve contract disputes. <i>DRB reviews are continuing – CLOSED.</i>
2	12/27/2017	Required cost and schedule contingencies should be reevaluated when CTS excavation and placement of the invert slab of the headhouse is complete. Headhouse invert slab was completed in June 2018. SFMTA is reevaluating its schedule risk assessment given the delayed completion of this critical path work.
3	12/27/2017	The CSP Management Team should assess the impacts that schedule acceleration may be having on the quality program for the project and make any necessary adjustments needed to assure that quality is not compromised.
4	12/27/2017	The status of BHAGs should be discussed at each work package status meeting in order to improve the effectiveness of the goals in advancing critical project work. The PMOC noted that BHAGs were discussed at each of the four work package status meetings. CLOSED.
5	12/27/2017	The trend log tracking should include the amount of time that has passed from the initial identification of the trend.
6	1/10/2018	SFMTA should immediately prepare and implement a plan for filling key positions, including the Program Director and Resident Engineer openings. The PMOC will monitor the agency's progress in recruitment and hiring of needed staff. RE positions were filled, but the STS RE recently resigned. Program Manager and Start-up and Testing Manager remain open.
7	1/10/2018	SFMTA should evaluate the current and future staffing levels and expertise required to address outstanding contract issues while effectively managing ongoing construction and preparing for systems testing and start-up activities. The PMOC supports the concept of assigning a dedicated claims management team, which has been partially implemented. SFMTA has added several contract and claims management staff – CLOSED.

Number	Date Identified	Recommendation
8	1/10/2018	SFMTA should now focus on updating the risks and mitigation strategies to reflect the transition of the work from excavation and major structural supports to M/E/P and systems installation and testing. A specific risk of delays due to contractual issues with the ATCS system would appear to be a concern.
9	2/23/2018	The PMOC recommends that SFMTA quickly resolve the ongoing contractual issues regarding the schedule for and management of the ATCS to avoid schedule delays. Execution of amendments is still pending.
10	2/23/2018	The PMOC recommends SFMTA immediately resolve differences of opinion regarding skills required for the Start-up and Testing Manager and fill this position. SFMTA plans to obtain consulting support for the testing and start-up work while assigning two operations staff to the project. The assignments have yet to be implemented.
11	3/11/2018	SFMTA management should work with SSD and CSP management to assure that traffic control requirements appropriately balance the needs of the project and the traveling public. A partnering approach may be effective in addressing Traffic Control Plan (TCP) issues. The requirements for traffic control for street restoration at the remaining intersections along 4th Street were to be agreed at a meeting on July 13. However the plan is still not in place and the target date of September 1, 2018 was missed.
12	4/12/2018	The PMOC recommends that the risk assessment and schedule forecast be updated once the contract amendment to separate ATCS work from the 1300 Contract is executed. Significant schedule risk is associated with the unknown schedule for ATCS work and this risk can be better evaluated once the Thales contract has been modified.
13	5/17/2018	The PMOC recommends that SFMTA quickly determine what course of action to take in response to the installation of standard, rather than hardened, rail for the project's trackwork. Replacement rail should be procured as soon as possible to minimize delays to the project. Rail was delivered in October 2018. CLOSED.

Number	Date Identified	Recommendation
<i>14</i>	<i>6/21/2018</i>	The PMOC recommends that SFMTA complete its review of its QA procedures and process to determine how the non-conforming rail was accepted and installed for a significant portion of the alignment before the issue was identified. The PMOC also recommends that SFMTA assess its design control procedures to identify how to avoid conflicting requirements for specified materials in different portions of the specification.
<i>15</i>	<i>7/18/2018</i>	SFMTA is encouraged to work with the designer to expedite solutions to design issues identified by the contractor to avoid delays to the program critical path.
<i>16</i>	<i>7/18/2018</i>	The PMOC recommends that the new QAM follow up on the status of the quality audit for waterproofing installation at YBM.
<i>17</i>	<i>8/6/2018</i>	The PMOC recommends that SFMTA take immediate action to prevent further occurrences of contractor or subcontractor crews performing work without proper QC oversight.

APPENDIX A. LIST OF ACRONYMS

AC	Actual Cost
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ARS	Air Replenishment System
ATCS	Automated Train Control System
BART	Bay Area Rapid Transit
BCE	Baseline Cost Estimate
BHAG	Big Hairy Audacious Goal
BRT	Bus Rapid Transit
Caltrans	California Department of Transportation
CAR	Corrective Action Request
CCTV	Closed Circuit Television
CFR	Code of Federal Regulations
CLIN	Contract Line Item Number
CM/GC	Construction Manager/General Contractor
CMod	Contract Modification
CNCR	Contractor Non-Conformance Report
COR	Change Order Request
CPI	Cost Performance Index
CPUC	California Public Utilities Commission
CQM	Contractor's Quality Manager
CSP	Central Subway Project
CTS	Chinatown Station
DF	Designated Function
DRB	Dispute Review Board
EV	Earned Value
FD	Final Design
FEIR	Final Environmental Impact Report
FEIS	Final Environmental Impact Statement
FFGA	Full Funding Grant Agreement
FLSC	Fire and Life Safety Committee
FMP	Fleet Management Plan
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IRP	Independent Review Panel
LONP	Letter of No Prejudice
LRT	Light Rail Transit
LRV	Light Rail Vehicle
M/E/P	Mechanical, Electrical, and Plumbing

MMRP	Mitigation Monitoring Reporting Program
MOU	Memorandum of Understanding
MPR	Monthly Progress Report
MPS	Master Project Schedule
Muni	Common Public Reference to SFMTA
NCN	Non-conformance Notice
NCR	Non-conformance Report
NEPA	National Environmental Policy Act
NOPC	Notice of Potential Claim
NTP	Notice to Proceed
O&M	Operations & Maintenance
OCS	Overhead Contact System
OHA	Operational Hazard Analysis
OP	Oversight Procedure
PCC	Proposed Contract Change
PE	Preliminary Engineering
PHA	Preliminary Hazard Analysis
PMOC	Project Management Oversight Contractor
PMP	Project Management Plan
PTMISEA	Public Transportation Modernization, Improvement, and Service Enhancement Account
PV	Planned Value
QA/QC	Quality Assurance/Quality Control
QAM	Quality Assurance Manager
QPRM	Quarterly Progress Review Meeting
QTR	Quarter
RAMP	Real Estate Acquisition Management Plan
RAP	Rail Activation Plan
RCMP	Risk and Contingency Management Plan
RE	Resident Engineer
ROD	Record of Decision
RSD	Revenue Service Date
SBE	Small Business Enterprise
SCIL	Safety Certifiable Item List
SCP	Safety Certification Plan
SEIS	Supplemental Environmental Impact Statement
SEM	Sequential Excavation Method
SEPP	Security and Emergency Preparedness Plan
SFDPW	San Francisco Department of Public Works
SFFD	San Francisco Fire Department

SFMTA	San Francisco Municipal Transportation Agency
SFPUC	San Francisco Public Utilities Commission
SIT	Systems Integration Test
SOP	Standard Operating Procedure
SPI	Schedule Performance Index
SSCP	Safety and Security Certification Plan
SSCRC	Safety and Security Certification Review Committee
SSCVR	Safety and Security Certification Verification Report
SSD	Sustainable Streets Division
SSMP	Safety and Security Management Plan
SSO	State Safety Oversight
SSP	System Security Plan
SSPP	System Safety Program Plan
STS	Surface, Track, and Systems
TBD	To Be Determined
TBM	Tunnel Boring Machine
TCP	Traffic Control Plan
TPC	Tutor Perini Corporation
TSA	Transportation Security Administration
TVA	Threat and Vulnerability Analysis
U.S.C.	United States Code
UMS	Union Square/Market Street Station
YBM	Yerba Buena/Moscone Center Station
YOE	Year of Expenditure

APPENDIX B. SAFETY AND SECURITY CHECKLIST

Central Subway Project Overview			
Project mode (Rail, Bus, BRT, Multimode)	Light Rail Transit		
Project phase (Preliminary Engineering, Design, Construction, or Start-up)	Construction		
Project Delivery Method (Design/Build, Design/Build/Operate/Maintain, CM/GC, etc.)	Design-Bid-Build		
Project Plans	<i>Version</i>	<i>Review by FTA/FRA</i>	Status
Safety and Security Management Plan	2014	2011	Revision 1 Update submitted to FTA 02/25/2011. Not submitted to FRA. Revision 2 submitted to FTA on May 2, 2014.
Safety and Security Certification Plan (SSCP)	2011		SSCP was revised 10/2011. Revision 1 was developed in November 2011. Not submitted to FRA.
System Safety Program Plan (SSPP)	2009	2009	SSPP dated 03/13/2009 submitted to FTA 07/31/2009. Not submitted to FRA.
System Security Plan (SSP) or Security and Emergency Preparedness Plan (SEPP)	2009		Not submitted to FTA. Not submitted to FRA.
Construction Safety and Security Plan	2012		Health and Safety. Construction Safety Standards Revision 3, June 27, 2012.
Safety and Security Authority	<i>Y/N</i>		Notes/Status
Is the grantee subject to 49 CFR Part 659 state safety oversight requirements?	Y		
Has the state designated an oversight agency as per Part 659.9?	Y		California Public Utilities Commission (CPUC) Consumer Protection & Safety Division 505 Van Ness Avenue San Francisco, CA 94102 (415) 703-1017 phone (415) 703-1758 fax Point of contact: Arun Mehta

Central Subway Project Overview			
Project mode (Rail, Bus, BRT, Multimode)	Light Rail Transit		
Project phase (Preliminary Engineering, Design, Construction, or Start-up)	Construction		
Project Delivery Method (Design/Build, Design/Build/Operate/Maintain, CM/GC, etc.)	Design-Bid-Build		
Project Plans	<i>Version</i>	<i>Review by FTA/FRA</i>	Status
Has the oversight agency reviewed and approved the grantee's SSPP as per Part 659.17?	Y		SFMTA currently operates its LRT system in compliance with an SSPP approved by the CPUC. These plans will be revised, as required, to incorporate the addition of the CSP during the late construction and early testing phase and submitted to the CPUC for approval prior to the planned start of revenue operations.
Has the oversight agency reviewed and approved the grantee's Security Plan or SEPP as per Part 659.21?	Y		See above.
Did the oversight agency participate in the last Quarterly Program Review Meeting?	N		
Has the grantee submitted its safety certification plan (SCP) to the oversight agency?	Y		SFMTA submitted the SSCP to CPUC staff for review and Commission approval during the preliminary engineering phase. The plan was approved in March 2009. The SSCP revised in November 2011 was submitted to the CPUC and was approved. CPUC attends monthly certification review meetings conducted by SFMTA.
Has the grantee implemented security directives issues by the Department Homeland Security, Transportation Security Administration?	N/A		Currently, there are no TSA directives or programs applicable to the project. If any arise during the course of the project, the activities to comply will be developed and shown on a revision of the project safety and security activities schedule.

Central Subway Project Overview			
Project mode (Rail, Bus, BRT, Multimode)	Light Rail Transit		
Project phase (Preliminary Engineering, Design, Construction, or Start-up)	Construction		
Project Delivery Method (Design/Build, Design/Build/Operate/Maintain, CM/GC, etc.)	Design-Bid-Build		
Project Plans	<i>Version</i>	<i>Review by FTA/FRA</i>	Status
SSMP Monitoring			
Is the SSMP project-specific, clearly demonstrating the scope of safety and security activities for this project?	Y	The PMOC reviewed the CSP SSMP and provided a spot report to FTA in May 2011. FTA approved the CSP SSMP on May 16, 2011. A follow-up Adherence Audit was conducted September 14-16, 2011. The audit found that CSP is conducting its activities in accordance with the SSMP.	
Grantee reviews the SSMP and related project plans to determine if updates are necessary?	Y	SSMP Revision 2 was submitted to FTA on May 2, 2014.	
Does the grantee implement a process through which the Designated Function (DF) for Safety and DF for Security are integrated into the overall project management team? Please specify.	Y	Safety and security are under the direction of the SFMTA Safety and Security Manager and supplemented by Project Management/Construction Management consultant staff, including a Safety and Security Certification professional who has been dedicated to supervise project Safety and Security Certification.	
Does the grantee maintain a regularly scheduled report on the status of safety and security activities?	Y	Safety and security certification status and activities are reported in the weekly construction progress meetings and the CSP Monthly Progress Report.	
Has the grantee established staffing requirements, procedures, and authority for safety and security activities throughout all project phases?	Y		
Does the grantee update the safety and security responsibility matrix/organizational chart as necessary?	Y	The PMOC found the revised matrix in the SSMP, Rev. 1, 02/08/11, to be compliant.	
Has the grantee allocated sufficient resources to oversee or carry out safety and security activities?	Y		

Central Subway Project Overview			
Project mode (Rail, Bus, BRT, Multimode)	Light Rail Transit		
Project phase (Preliminary Engineering, Design, Construction, or Start-up)	Construction		
Project Delivery Method (Design/Build, Design/Build/Operate/Maintain, CM/GC, etc.)	Design-Bid-Build		
Project Plans	<i>Version</i>	<i>Review by FTA/FRA</i>	Status
Has the grantee developed hazard and vulnerability analysis techniques, including specific types of analysis to be performed during different project phases?	Y		CSP has prepared a Preliminary Hazard Analysis Report, Rev. 0, April 23, 2009. Corrective actions and analysis for different project phases have been identified in the report.
Does the grantee implement regularly scheduled meetings to track to resolution any identified hazards and/or vulnerabilities?	Y		
Does the grantee monitor the progress of safety and security activities throughout all project phases? Please describe briefly.	Y		Safety and Security is an ongoing agenda item for the current construction contract (1300) work package status meetings. The status of safety and security certifications is reviewed at weekly project management meetings.
Does the grantee ensure the conduct of preliminary hazard and vulnerability analyses? Please specify analyses conducted.	Y		
Has the grantee ensured the development of safety design criteria?	Y		Design is complete and construction is underway.
Has the grantee ensured the development of security design criteria?	Y		Design is complete and construction is underway.
Has the grantee ensured conformance with safety and security requirements in design?	Y		Certification checklists have been developed. Certification is achieved through monthly meetings. Design is complete and construction is underway.

Central Subway Project Overview			
Project mode (Rail, Bus, BRT, Multimode)	Light Rail Transit		
Project phase (Preliminary Engineering, Design, Construction, or Start-up)	Construction		
Project Delivery Method (Design/Build, Design/Build/Operate/Maintain, CM/GC, etc.)	Design-Bid-Build		
Project Plans	<i>Version</i>	<i>Review by FTA/FRA</i>	Status
Has the grantee verified conformance with safety and security requirements in equipment and materials procurement?	Y		Safety and Security Conformance checklists have been prepared for each of the construction contracts. All certifiable elements of the Tunnel work have been certified and accepted by SFMTA Safety. Certification reviews are underway for the stations contract.
Has the grantee verified construction specification conformance?	Y		This is on-going as construction progresses and verified through the Safety and Security Certification process
Has the grantee identified safety and security critical tests to be performed prior to passenger operations?	N		Currently being developed.
Has the grantee verified conformance with safety and security requirements during testing, inspection, and start-up phases?	N		<i>Project is in construction, with RSD about 16 months in the future.</i>
Does the grantee evaluate change orders, design waivers, or test variances for potential hazards and/or vulnerabilities?	Y		
Has the grantee ensured the performance of safety and security analyses for proposed work-arounds?	N/A		Currently no work-arounds have been identified.

Central Subway Project Overview		
Project mode (Rail, Bus, BRT, Multimode)	Light Rail Transit	
Project phase (Preliminary Engineering, Design, Construction, or Start-up)	Construction	
Project Delivery Method (Design/Build, Design/Build/Operate/Maintain, CM/GC, etc.)	Design-Bid-Build	
Project Plans	<i>Version</i>	<i>Review by FTA/FRA</i> Status
Has the grantee demonstrated through meetings or other methods, the integration of safety and security in the following: <input type="checkbox"/> Activation Plan and Procedures <input type="checkbox"/> Integrated Test Plan and Procedures <input type="checkbox"/> Operations and Maintenance Plan <input type="checkbox"/> Emergency Operations Plan	In Process	Second draft of Rail Activation Plan has been completed. An Integration Matrix has been implemented for all disciplines including safety and security concerns. Grantee intends to hire a Start-up and Testing Manager who will develop the plans and procedures. This hire is becoming a critical activity.
Has the grantee issued final safety and security certification?	N	Project is in the construction phase.
Has the grantee issued the final safety and security verification report?	N	Project is in the construction phase.
Construction Safety		
Does the grantee have a documented/implemented Contractor Safety Program with which it expects contractors to comply?	Y	Health and Safety Construction Safety Standards Revision 3, June 27, 2012.
Does the grantee's contractor(s) have a documented companywide safety and security program plan?	Y	
Does the grantee's contractor(s) have a site-specific safety and security program plan?	Y	The remaining active contractor has a plan. Contract documents require that the contractor follows an Environmental Health and Safety Program, specific to the contract work.
Provide the grantee's OSHA statistics compared to the national average for the same type of work?	Y	Provided in the Central Subway Monthly Progress Report. Statistics remain favorable compared to national averages and project safety goals.

Central Subway Project Overview		
Project mode (Rail, Bus, BRT, Multimode)	Light Rail Transit	
Project phase (Preliminary Engineering, Design, Construction, or Start-up)	Construction	
Project Delivery Method (Design/Build, Design/Build/Operate/Maintain, CM/GC, etc.)	Design-Bid-Build	
Project Plans	<i>Version</i>	<i>Review by FTA/FRA</i> Status
If the comparison is not favorable, what actions are being taken by the grantee to improve its safety record?	N/A	Statistics are favorable. No action needed.
Does the grantee conduct site audits of the contractor's performance versus required safety/security procedures?	Y	Safety walks are routinely conducted at each construction site.
Federal Railroad Administration		
If shared track: has grantee submitted its waiver request application to FRA? (Please identify specific regulations for which waivers are being requested.)	N/A	No shared track. No waivers are anticipated.
If shared corridor: has grantee specified specific measures to address shared corridor safety concerns?	N/A	
Is the CHA underway?	N/A	
Other FRA required Hazard Analysis – Fencing, etc.?	N/A	
Does the project have Quiet Zones?	N	
Does FRA attend the Quarterly Review Meetings?	N	

N/A = Not applicable.

APPENDIX C. PROJECT MAP AND OVERVIEW

CENTRAL SUBWAY PROJECT: Project Overview and Map

Date:	<i>November 16, 2018</i>
Project Name:	Central Subway Project (CSP) New Starts Light Rail Transit
Grantee:	San Francisco Municipal Transportation Agency (SFMTA)
FTA Regional contact:	Mr. Bernardo Bustamante
FTA Headquarters contact:	Mr. Andre Anderson

Scope

Description:	The CSP will extend the Third Street Light Rail line from the Caltrain station at Fourth and King streets to Chinatown. It was incorporated in the FEIS/FEIR on the Third Street Light Rail project published in December 1998, but FTA did not include the CSP in the Record of Decision (ROD) issued in March 1999. A ROD for the CSP, however, was issued by FTA on November 26, 2008, and the U.S. Department of Transportation and FTA determined that the requirements of the National Environmental Policy Act (NEPA) of 1969 were satisfied for the CSP. The environmental record for the CSP is included in the Final Supplemental Environmental Impact Statement (SEIS), Volume II, dated July 11, 2008 and the Final SEIS, Volume I, dated September 23, 2008. These documents present the detailed statement required by NEPA and U.S.C. 5324 (b). SFMTA requested authority to enter Preliminary Engineering (PE) in March 2002 and submitted a Project Management Plan (PMP) in June 2002. FTA approved entry into PE in July 2002. Approval to enter Final Design (FD) was granted by FTA on January 7, 2010. The Full Funding Grant Agreement (FFGA) was signed on October 11, 2012.
Guideway:	The length of the CSP will be 1.7 miles of double-tracked line.
Stations:	The CSP includes three subway stations and one surface station.
Additional Facilities:	The CSP does not include any ancillary facilities.
Vehicles:	The CSP Service Plan dated October 2009 clarified that four vehicles will be required. Vehicle manufacturing is underway and SFMTA has identified the four vehicles that will be considered to have been partially funded with CSP grant funds.
Ridership:	43,521 Average Weekday Boardings are projected in 2030.

Schedule

07/02	Approval Entry to PE	2016	Estimated Rev Ops at Entry to PE
01/10	Approval Entry to FD	2018	Estimated Rev Ops at Entry to FD
10/11/12	FFGA	2018	Estimated Rev Ops at FFGA
01/14/2020	Revenue Operations Date at date of this report		

79.6% *Percent Complete Based on Progress (September 2018 data)*

Cost

\$764 million	Total Project Cost (\$YOE) at Approval Entry to PE
\$1,578 million	Total Project Cost (\$YOE) at Approval Entry to FD
\$1,578 million	Total Project Cost (\$YOE) at FFGA signed
\$TBD million	Total Project Cost (\$YOE) at Revenue Operations
\$1,578 million	Total Project Cost (\$YOE) at date of this report including \$0.00 in Finance Charges
<i>\$1,258.8 million</i>	Amount of Expenditures at date of this report from Total Project Budget of \$1,578 million
<i>80.0%</i>	Percent Complete based on Expenditures at date of this report
\$6.72 million	Unallocated Contingency remaining
<i>\$67.46 million</i>	Total Project Contingency (allocated and unallocated contingency as reported by CSP)
\$25 million	Minimum Total Project Contingency revised on September 5, 2012 PMOC review of Contingency Management Plan

	AT HOLD POINTS	QTR	Minimum Contingency Levels	Revised Levels
1A	Hold Point 1a – Tunnels 100% designed February 2011 (Actual)	1Q11	280	280
1B	Hold Point 1b – CTS 100% designed June 2012 (Actual)	4Q11	250	240
1C	Hold Point 1c – 40% Bid (Tunnel and CTS)	2Q12	225	200
1D	Hold Point 1d – FFGA Award October 2012 (Actual)	3Q12	-	180
2	Hold Point 2 – Commence CTS / UMS construction (Actual June 17, 2013)	2Q13	160	160
3	Hold Point 3 – Demobilize Tunnels (Actual April 15, 2015)	2Q15	140	140
4	Hold Point 4 – Stations to platform levels (CTS / YBM) November 2016	2Q18	60	60
5	Hold Point 5 – Complete CTS / Tunnels systems inst. April 2018	2Q19	25	25
RSD	PMOC / FTA RSD	4Q19		
CURRENT TOTAL CONTINGENCY \$67.46 Million				



APPENDIX D. TOP PROJECT RISKS

Top risks were discussed at the November 2018 risk meeting as noted below

Top Risks Discussed at Most Recent Meeting:

Risk 99 – Breakdown in relationships between SFMTA and contractors during construction results in increased claims and delays to the overall construction schedule. This risk is being realized, with TPC issuing more than 100 claims to date. This risk is now rated as the highest threat to the project. SFMTA and the contractor are using the DRB process to address disputes, but thus far, the DRB recommendations have not resulted in agreement between SFMTA and the contractor. *SFMTA is initiating an analysis of the responsibilities for delays to support negotiation of a global settlement for delays.*

Risk 240 – Unresolved assignment of responsibility for schedule delays may lead to increased costs for the program. This risk continues to be a concern. TPC continues to push for a global settlement of the outstanding claims. If accepted, the proposed settlement would have significant cost impacts.

Risk 255 – Water leaks at YBM. Water leaks continue at YBM despite ongoing repair activities. Most of the leaks are at the interface between the station box and the headhouse. Thus far, the schedule impacts of the leaks have been minor, but SFMTA expects to be liable for the costs of the repairs. SFMTA has spent \$500,000 to \$800,000 on leak mitigation work. *SFMTA has received findings of a third party evaluation of the reasons for the leaks and is starting work to mitigate the impacts of the leaks.* The findings of the leak evaluation indicate that the design did not provide a complete “bathtub” that would keep groundwater out of the structure.

Risk 251 – Activities required to complete the project scope are not identified in the schedule, resulting in the time required to complete the project being longer than currently forecast. The ATCS contractor provided a detailed schedule for its work, which did not result in additional time beyond what was included in the simplified schedule. This risk will continue to be monitored. SFMTA noted that TPC’s schedule updates include new activities not included in the baseline schedule that cause the completion date to be pushed later. The contract does not allow such addition of activities to the schedule without agreement of SFMTA. SFMTA’s schedule updates are capturing differences between the activities in the baseline schedule and the work actually being completed.

Risk 234 and 52 – Unacceptable settlement occurs due to SEM mining at CTS, causing damage to buildings or utilities. All SEM mining work is complete, and placement of the final linings for the CTS platform and crossover caverns is underway. These risks can be retired when sufficient time has passed to allow the surrounding ground to respond to the excavation. Thus far, compensation grouting has been effective in returning the adjacent buildings to elevations that are within the established tolerances. SFMTA will monitor the behavior of the ground over and near the excavation and will retire this risk when the final linings of the cavern structures are complete.

Risk 253 – Insufficient resources are available to complete the work as planned. Thus far, crew shortages have not been experienced. However, there are concerns about the adequacy of the electrical subcontractor’s resources. As M/E/P work ramps up at UMS and CTS, resources for the work may become a concern.

Risk 238 – Quality program is ineffective in processing non-conformance items causing schedule impacts. The SFMTA QAM conducted a review of potential causes of water leaks at YBM and concluded that there is no evidence of a failure in the QA/QC process. There is a concern that TPC is refusing to issue CNCRs when non-conforming work is identified. This or a similar risk was realized when it was discovered that non-conforming rail for the project had been approved through the submittal process, delivered to the project, and installed over portions of the alignment. SFMTA’s new QAM has started an effort to reduce the time for CNCRs to be issued, dispositioned, approved, and closed. *The QAM also noted that there has been an increase in issuance of NCNs, which raises a concern about the effectiveness of the contractor’s quality program.*

Risk 205 – Prolonged time to execute contract modifications may lead to poor relations between the REs and the contractor. This risk continues to be a concern. A few additional CMods, including some large cost increases, have been issued over the past two months. SFMTA continues to focus on speeding up the process of evaluating the justification for CMods and completing the negotiation process on price and time impacts with TPC. Additional staff has been assigned to processing CMods, and the agency is reviewing its procedures for modifying all contracts to identify opportunities to streamline the process. *However, internal SFMTA procedures continue to extend the time required to execute CMods.*

Risk 229 and 230 – Risk that contractor and SFMTA systems testing and commissioning will take longer than currently planned. SFMTA has delivered to the PMOC a more detailed schedule for ATCS, which includes the contractor’s system tests. SFMTA still needs to complete a more detailed commissioning schedule that includes identification of required testing and the responsibilities for witnessing and approving the tests. SFMTA is working to bring on a Testing and Commissioning Manager to lead this effort and is coordinating with Muni’s Operations department on the job description and hiring process, which has taken much longer than planned. SFMTA also plans to obtain consultant support for the testing and commissioning process in addition to the services of staff assigned from SFMTA Operations. The Start-up and Testing staff members have not started work on the project.

Risk 254 – CPUC has insufficient staff to witness required testing. This risk of delays due to insufficient CPUC staffing continues to be a concern. SFMTA has identified having CPUC audit tests conducted by others as a possible mitigation measure. SFMTA is working with CPUC to advance the certification process that must be completed in advance of testing.

The PMOC recommends that SFMTA focus on updating the risks and mitigation strategies to reflect the transition of the work from excavation and major structural supports to M/E/P and systems installation and testing. A specific risk of delays due to contractual issues with the ATCS system would also appear to be a concern.

APPENDIX E. ROADMAP TO REVENUE OPERATIONS

Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT				
Description	Estimated Start Date	Estimated Completion Date	Actual Completion Date	Notes
<i>Testing</i>				
Finalize/update Systems Integration Test (SIT) Plan	TBD	05/15/2019	TBD	Project is in construction, with RSD about 1.5 years in the future. <i>This item is becoming critical.</i>
Prepare Schedule for Testing (update)	06/01/2018	10/01/2018	11/07/2018	Initial testing, commissioning, and start-up schedule has been completed. An updated Rail Activation Plan with more detailed testing plans and schedules will be prepared once the Start-up and Testing Manager is onboard. <i>This item is becoming critical.</i>
Finalize Test Procedures	TBD	05/15/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Conduct System Integrated Testing with trains, including procedures and reports	08/13/2019	12/15/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Complete Testing Reports	12/01/2019	12/15/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
<i>Operating Plan, Rules, and Training</i>				
Finalize Operating Plan	03/15/2019	03/29/2019	TBD	Project is in construction, with RSD about 1.5 years in the future. SFMTA's latest two-year operating budget includes start-up of CSP.
Finalize/revise SOPs, manuals, and rulebook as applicable	03/27/2019	06/09/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Operations Manuals	05/11/2019	06/09/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Staffing and Operations Plan	3/	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.

Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT				
Description	Estimated Start Date	Estimated Completion Date	Actual Completion Date	Notes
Training of O&M personnel	10/23/2019	10/29/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Emergency response plan, training, and drills	10/23/2019	10/29/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
<i>Vehicle Maintenance Plan, Equipment, Facilities, and Training</i>				
Rail Fleet Management Plan	5/1/2018	8/3/2018	8/3/2018	-
Maintenance Schedules and Procedures	NA	NA	NA	The LRV fleet is being replaced and expanded through a separate project. The four vehicles required for CSP have been delivered. Maintenance related items are being provided by the supplier.
Spare Parts Requirements	NA	NA	NA	The LRV fleet is being replaced and expanded through a separate project. The four vehicles required for CSP have been delivered. Maintenance related items are being provided by the supplier.
Maintenance Manuals	NA	NA	NA	The LRV fleet is being replaced and expanded through a separate project. The four vehicles required for CSP have been delivered. Maintenance related items are being provided by the supplier.
Maintenance Training	NA	NA	NA	The LRV fleet is being replaced and expanded through a separate project. The four vehicles required for CSP have been delivered. Maintenance related items are being provided by the supplier..
<i>Facility and Right-of-way Maintenance Plan, Equipment, Facilities, and Training</i>				
Maintenance Schedules and Procedures	06/10/2019	06/29/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Spare Parts Requirements	05/01/2019	07/30/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.

Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT				
Description	Estimated Start Date	Estimated Completion Date	Actual Completion Date	Notes
Maintenance Manuals	10/22/2019	11/05/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Maintenance Training	11/06/2019	11/15/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Pre-Revenue Operations				
Finalize and/or update RAP and/or Pre-Revenue Operations Plan	04/02/2015	03/01/2019	TBD	The second draft with additional detail and a schedule for testing and pre-revenue activities was submitted with the 2017 update of the PMP. An updated plan will be prepared when a Start-up and Testing Manager is hired. <i>This item is becoming critical.</i>
Implement Rail Activation Committee	01/01/2019	12/25/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Develop/revise SSPP & Security Plan (approved by State Safety Oversight (SSO))	<i>Ongoing</i>	10/31/2015	10/31/2015	CPUC triennial review conducted in October 2015 concluded that SFMTA “has a comprehensive System Safety Program Plan (SSPP) and has made significant progress in executing that plan.”
FTA Office of Safety & Security Readiness Review	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
PMOC OP-54 Readiness for Revenue Operations Review Report, Phase I	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Conduct Operational Hazard Analysis (OHA) and resolve other hazards/vulnerabilities	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.

Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT				
Description	Estimated Start Date	Estimated Completion Date	Actual Completion Date	Notes
Pre-Revenue Operations	11/16/2019	12/25/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Public Outreach				
Develop Safety Outreach Plan	01/07/2019	02/15/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Provide Community Outreach	03/22/2019	12/10/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Grand Opening Plan	11/08/2018	09/15/2019	TBD	Project is in construction, with RSD about 1.5 years in the future.
Construction Close Out				
Close Out of Non-Conformance Reports	Ongoing	12/25/2019	TBD	NCRs are tracked and closed prior to follow-on work. Final closure of NCRs expected as of final completion date of 1300 Contract.
Punch List Complete	07/26/2019	12/25/2019	TBD	Punch list completion expected at final completion of 1300 Contract.
Certificates of Occupancy/Substantial Completion	06/01/2019	07/28/2019	TBD	
Safety, Security, and Fire-life Safety Certifications				
Update/Finalize SSMP			02/18/2014	Revision 2 completed.
Finalize and/or update Safety Certifiable Item List (SCIL) and SSCP			10/10/2008	Revision 0.
Implement Safety and Security Certification Committee			08/01/2010	Committee meets monthly to review certifiable items.
Implement Fire Life Safety Committee			08/01/2010	

Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT				
Description	Estimated Start Date	Estimated Completion Date	Actual Completion Date	Notes
Preliminary Hazard Analysis (PHA)				Need dates.
Threat and Vulnerability Analysis (TVA)				Need dates.
Design Criteria Reflecting Safety and Security Requirements	NA	NA	NA	Design is complete and construction is underway.
Review status of quality non-conformances	Ongoing	12/26/2019	TBD	
Close Out of non-safety critical items	Ongoing	Ongoing	TBD	
Close Out of safety critical items	Ongoing	Ongoing	TBD	
Complete Safety & Security Certification Verification Report (SSCVR)	TBD	10/26/2019		60 days before RSD - Check against latest regulations.
Document Workarounds/Open Items List	07/29/2019	12/25/2019	TBD	
Verify emergency drills, tabletops, training, etc. are completed	11/25/2019	12/25/2019	TBD	
SSO final certification/ signature	11/13/2019	12/24/2019		21 days before RSD - Check against latest regulations.
Revenue Service				

Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT				
Description	Estimated Start Date	Estimated Completion Date	Actual Completion Date	Notes
Target Revenue Service Date	-	12/25/2019		Current forecast RSD.
FFGA Revenue Service Date	-	12/26/2018		

APPENDIX F. LESSONS LEARNED

LL#	Date	Phase	Category	Subject	Lesson Learned
1	09-30-10	FD	Management	Consultant Contracts	The project must have a full understanding of the agency and other approving governmental authorities to avoid delay of contract approval and consequential delay of the Master Project Schedule (MPS).
2	09-30-10	FD	Cost	Staffing Plan	The project staffing plan needs to be formulated during PE and updated at least quarterly during FD to manage Standard Cost Category 80 costs and monitor design production.
3	09-30-10	FD	Scope	Letter of No Prejudice (LONP)	A defined scope of grantee and PMOC responsibilities needs to be provided for content and acceptability of LONP requests.
4	09-30-10	FD	Management	SSMP	FD consultants should be trained, shortly after mobilization, in the format and their responsibility regarding the System Safety Consultant.
5	10-30-10	FD	Cost	Baseline Cost Estimate (BCE) Update	The BCE should be updated with current costs as soon as they are known by the project to allow mitigation of cost contingency usage.
6	02-21-12	FD	Management	Program Controls	Program Controls system/software selected for use for the duration of the project should be in place and functional prior to approval to enter FD. Doing so will avoid a transition during FD that could create a lag in timely reporting of cost and schedule status.
7	02-21-12	FD	Management	Risk Mitigation	Oversight Procedure (OP) 40 needs to be revised to establish minimum requirements for secondary mitigation at different phases of the project, similar to those for cost and schedule contingency. The PMOC recommends 5% of project cost at Entry into FD and 3% at execution of an FFGA.
8	02-21-12	FD	Scope	Third Party Agreements	All third party agreements need to be identified as soon as possible, but no later than 65% design completion. This includes leases, both temporary and permanent; MOUs; and licenses, specifically for preconstruction property surveys and settlement monitoring instruments (especially important for underground construction). These third party agreements need to be secured no

LL#	Date	Phase	Category	Subject	Lesson Learned
					later than the advertisement date of the construction that they affect. Third party agreements need to be tracked by the project continuously, reported monthly, and updated in a third party agreement matrix submitted quarterly to FTA.
9	02-21-12	FD	Cost	Cost Estimating Procedures	During the preliminary design phase, the project should establish the cost estimating procedures, format, and software to be used by all estimating entities for the entire duration of the project.
10	02-21-12	FD	Cost	Allocated Cost Contingency	In the BCE submitted to FTA for Entry into FD, the project should identify percentages of allocated cost contingency contained in the BCE that are apportioned for design risk, market risk, and construction risk.
11	02-28-12	FD	QA	Design Management Action Log	Design Management should develop a matrix as a tracking tool to document, track, and close out known elements that are missing from design submission packages.
12	08-15-12	FD	Environmental Mitigations	MMRP	Numerous mitigations identified in the MMRP are to be handled by incorporating specific design details and/or statements in the contract drawings and technical specifications. The grantee should note on the MMRP the relevant drawings and/or technical specifications.
13	08-31-12	FD	Management	Risk Contingency Levels and Hold Points	It became apparent, during the monitoring of the cost contingency drawdown curve for the project that the contingency levels and hold points no longer represented the current stage of project development and risk reduction/contingency usage related to project development. The project advanced through 100% project design; however, the project did not receive credit for the cost contingency usage established by the risk model. The PMOC recognized this deficiency and participated with the grantee in developing a cost contingency drawdown that reflects current project development and reduced risk.

LL#	Date	Phase	Category	Subject	Lesson Learned
14	06-30-13	Const.	Management	Change Order Process	Perform an audit of the project's procedures related to Change Orders and processing. The project should train staff and inform contractor of their obligations in the process.
15	01-30-14	Const.	Management	Independent Review Panel (IRP) Decision-makers	At the request of SFMTA, the American Public Transportation Association (APTA) formed a panel of geotechnical and tunnel experts to perform a peer review of the BART Undercrossing. Prior to crossing under the BART tunnels, the Independent Review Panel (IRP), contractor, SFMTA, and BART representatives convened at predetermined tunnel boring machine (TBM) locations to discuss the TBM progress and determine whether the tunneling should proceed. It is critical that decision makers from each organization attend these meetings. It was noted that BART Senior Management did not attend and instead deferred decisions to lower level staff.
16	06-30-14	Const.	Bid documents	Pre-Classification for Soil and Groundwater Disposal	Soils and groundwater generated from construction activities should be pre-classified with appropriate sampling and testing required by potential disposal facilities. Coordinate with the disposal facilities to get materials accepted.
17	04-10-15	Const.	Quality Control/Safety	Monitoring of Soil Conditions during Underground Construction	There was a breach of the excavation of frozen ground during construction of a cross passage between the twin bored tunnels followed by water and soil flowing into the tunnels, resulting in subsidence of the ground above and damage to underground utilities. Apparently the flow of materials into the tunnels went on for quite some time before the problem was detected and actions could be taken to arrest the flow. The construction site was not staffed when the breach started and there was no external warning system in place to notify the contractor or the agency of the condition. Lesson: When the safety and structural integrity of a construction site depends on maintaining soil conditions with the use of mechanical systems, the site should be continuously staffed or monitoring

LL#	Date	Phase	Category	Subject	Lesson Learned
					devices at the site should be continuously monitored from a remote location to assure that the expected soil conditions are maintained.
18	04-10-15	Const.	Environmental	Archeological Data Recovery Protocols	Sensitive archeological materials were uncovered during the excavation of the roof area at YBM. The Program Manager took immediate action to notify the appropriate state officials and implemented protocols for protection of the materials. The most likely descendent of the remains was quickly identified and a representative was engaged and brought to the site to supervise the ongoing excavation. Lesson: Pre-planning and quick action to involve the appropriate parties resulted in satisfactory handling of the artifacts with minimal delays to the construction schedule.
19	05-11-15	Const.	Quality Control	Use of Latest Design Information for Field Inspection	After two roof pours were completed, it was discovered that required reinforcing steel was missing. Changes to the arrangement of the reinforcing steels were made as part of the submittal review and response process. Notes from the designer were included on the approved shop drawings but not in the contract design drawings. Field inspectors were using only the design drawings to confirm the proper installation of reinforcing steel prior to concrete placement. Lesson: A process should be established to assure that the latest design information, including submittals and related designer notes, is available in the field and used to inspect reinforcing steel prior to concrete placement.
20	09-28-15	Const.	Schedule	Maintenance of Updated Construction Schedule and Master Program Schedule	SFMTA was unable to obtain an acceptable baseline schedule from the station construction contractor for over a year. Then, SFMTA could not obtain acceptable updated status schedules from the contractor for another 8 months. As a result, the construction status and completion date could not be accurately determined for the first 20 months of the contract. This made schedule control impossible. SFMTA finally created its own schedule updates for the first 12 months of the construction contract using the pay

LL#	Date	Phase	Category	Subject	Lesson Learned
					applications and 4-week look-ahead schedules from the contractor. Lesson: Owners should aggressively assert the need for accurate schedule updates from contractors and should withhold payment if such updates are included in the contract terms or specifications and are not forthcoming. If schedule updates are not received within the first few months of the project, the owner should create its own updates for the purpose of progress monitoring and schedule control.
21	11-30-15	Const.	Construction Planning	Installation of Special Trackwork in Operating Systems	SFMTA needed to install special trackwork to provide the connection to the new alignment for the Central Subway portion the T Third LRT line. The original plan was to install the special trackwork at the intersection in eight extended weekend shutdowns. Working with the contractor, the plan was revised to accomplish the necessary trackwork installations in two shutdowns. After considering the outcome of the first shutdown, where a portion of the special trackwork did not fit properly and needed adjustment during the shutdown, SFMTA decided to pre-assemble the second, more complex, special trackwork assembly at an off-site facility. The assembly was completed and the resulting track was surveyed to confirm the geometry and to assure that the assembly would fit into the existing field conditions. While conducting the assembly and disassembly of the track components, the contractor identified an approach that would reduce the time required to reassemble the trackwork in the field. Lesson: Effective pre-planning and mock-up assembly of complex trackwork, may allow the final assembly to be completed without the need for field adjustments and in less time than planned. This approach can mitigate the risks associated with the installation of complex custom track components in an operating transit line.
22	03-01-17	Const.	Legal/Claims	Preparation for Mediation	A contractor for advance utility relocation issued a multi-million-dollar claim for extra costs due to delays and unforeseen conditions. SFMTA

LL#	Date	Phase	Category	Subject	Lesson Learned
					<p>believed the claim had no justification. After several years, the claim was referred for mediation prior to going to trial. The contractor made a very compelling presentation regarding the extra costs. However, due to careful preparation by SFMTA management, the agency was able to provide specific and detailed rebuttals to the contractor’s major arguments. The mediation resulted in a settlement for less than 15% of the original claim amount. SFMTA chose to accept the settlement amount, recognizing that the costs to pursue the claim in court would likely exceed the settlement value. Lesson: Careful record keeping and preparation for dispute resolution can limit agency exposure to costs related to claims.</p>
23	01-10-18	Design and Procurement	Claims	Quality Control of As-built Data for Procurement	<p>The Central Subway had three major construction phases: Utility Relocation, Tunneling, and Stations/Track/Systems. Inaccurate as-built information from earlier construction phases has led to claims for differing site conditions during the construction of Stations/Track/Systems phase. For example, during the final design phase for the tunnel work, SFMTA agreed to a proposed change to tunnel segments defined in the preliminary engineering phase. The length of tunnel segments was changed from 4 feet to 5 feet except in areas with tight curves. The approved change in segment length was not captured in the final design documents for the stations contract, even though the change in tunnel design was made prior to completion of the station contract documents. When the stations contractor encountered 5-foot-long segments while mining for the platform and crossover caverns at the Chinatown Station, he issued a change order request to account for extra costs due to the need to change the excavation approach to handle the longer tunnel segments. The current claimed extra cost is \$4.4 million. Lesson: Procedures should be established to ensure that approved design changes during construction of early phases of complex projects are accurately reflected in contract</p>

LL#	Date	Phase	Category	Subject	Lesson Learned
					documents for follow-on construction phases. PMOC oversight should confirm that procedures are in place to capture changes in design during construction and to assure that changes are reflected in follow-on construction contract procurement documents.
24	06-18-18	Design, Construction	Quality Management	QC of Contract Specifications and Material Acceptance	<p>The Rail Procurement section of the specification called for hardened rail throughout the project. The Trackwork section of the specification allowed standard rail under all but special conditions. The contractor procured standard rail despite SFMTA’s intent to use hardened rail. The standard rail was accepted on delivery and was installed over a significant portion of the alignment before the issue was identified. A dispute has arisen, with SFMTA referring to the Rail spec and directing replacement of all rail, and the contractor referring to the Trackwork spec and asserting that the rail meets contract requirements. Lesson: Design control and quality management procedures are needed to eliminate duplication in the contract specifications and assure that any duplicative requirements are consistent across sections of the specification. Quality control and assurance procedures need to be improved to assure that non-conforming materials are not accepted on delivery.</p>

APPENDIX G. CONTRACT STATUS

The following sections provide the status of ongoing contracts associated with the CSP. Note that the DBE participation percentages are updated by SFMTA on a quarterly basis. The current values are through *September 30, 2018*.

Contract No.	1250	
Contract Description:	UR #1 (YBM)	
Status:	Completed June 2011.	
Cost:	Original Contract Value	\$9,273,939
	Approved Change Orders	\$2,694,211
	Final Contract Value	\$11,968,150
	Expended to Date	\$11,968,150
	% Expended	100%
	SBE Participation	97%
Schedule:	NTP issued January 2010. Substantial completion in June 2011.	
Issues or Concerns:		
Contract No.	1251	
Contract Description:	UR #2 (UMS)	
Status:	Work is complete.	
Cost:	Original Contract Value	\$16,832,550
	Approved Change Orders	\$3,836,531
	Final Contract Value	\$20,699,081
	Expended to Date	\$20,794,581
	% Expended	100%
	SBE Participation	87.4%
Schedule:	NTP issued January 2011. Substantial completion in August 2012.	
Issues or Concerns:	Final total cost claim by contractor has been settled.	
Contract No.	1252	
Contract Description:	Tunnels	
Status:	Final completion achieved. Financial close out underway. <i>Final contract cost to be lower than reported here.</i>	
Cost:	Original Contract Value	\$233.58 million
	Approved Change Orders	\$7.83 million
	Current Contract Value	\$241.41 million
	Expended to Date	\$233.59 million; \$6.2 million is paid from non-project funds
	% Expended	96.8%
	SBE Participation	5.8%
Schedule:	Final completion achieved May 15, 2015.	
Issues or Concerns:	None.	

Contract No.	1277	
Contract Description:	Pagoda Palace Demolition	
Status:	Construction is complete; contract is in close out.	
Cost:	Original Contract Value	\$498,995
	Approved Change Orders	\$149,981
	Current Contract Value	\$648,976
	Expended to Date	\$648,976
	% Expended	100%
	SBE Participation	100%
Schedule:		
Issues or Concerns:	None.	

Contract No.	1300	
Contract Description:	Three subway stations (YBM, UMS, and CTS) and STS	
Status:	Mass excavation complete at one station and well underway at two other stations.	
Cost:	Original Contract Value	\$839.68 million
	Approved Change Orders	\$12.71 million
	Current Contract Value	\$852.38 million
	Expended to Date	\$643.14 million
	% Expended	75.5%
	SBE Participation	22.9%
Schedule:	NTP issued June 17, 2013. Substantial Completion planned February 2018 and forecast July 2019.	
Issues or Concerns:	The work on this contract is behind schedule.	

Contract No.	CS-155-1	
Contract Description:	Design Package 1 for Contracts 1250, 1251, and 1252. PB/Telemon	
Status:	Design is complete. Construction support is nearly complete for Contract 1252.	
Cost:	Original Contract Value	\$5,795,000 (includes exercised options)
	Approved Change Orders	\$2,145,159
	Current Contract Value	\$7,940,159
	Expended to Date	\$7,904,713
	% Expended	99.6%
	SBE Participation	30.2%
Schedule:		
Issues or Concerns:		

Contract No.	CS-155-2	
Contract Description:	Design Package 2 for UMS, CTS, and YBM. CSDG prime	
Status:	Designs are complete for all of the station contracts. Construction support of Contract 1300 is underway.	
Cost:	Original Contract Value	\$39,949,948
	Approved Change Orders	\$7,950,658
	Current Contract Value	\$47,900,606
	Expended to Date	\$42,196,304
	% Expended	88.1%
	SBE Participation	31.6%
Schedule:		
Issues or Concerns:		

Contract No.	CS-155-3	
Contract Description:	Design Package 3 for STS. HNTB-B&C Prime	
Status:	Design is complete. Construction support of Contract 1300 is underway.	
Cost:	Original Contract Value	\$16,864,250
	Approved Change Orders	\$1,637,474
	Current Contract Value	\$18,501,724
	Expended to Date	\$15,275,838
	% Expended	82.6%
	SBE Participation	25.9%
Schedule:		
Issues or Concerns:		

Contract No.	CS-149	
Contract Description:	Central Subway Partnership (Project Manager/Construction Manager)	
Status:	On-going.	
Cost:	Original Contract Value	\$85,139,092
	Approved Change Orders	\$0
	Current Contract Value	\$85,139,092
	Expended to Date	\$72,666,838
	% Expended	85.4%
	SBE Participation	32.4%
Schedule:		
Issues or Concerns:		

Contract No.	CS 156	
Contract Description:	Project Controls Consultant	
Status:	On-going.	
Cost:	Base Contract Value	\$17,112,873
	Approved Change Orders	\$0
	Current Contract Value	\$17,112,873
	Expended to Date	\$10,081,808
	% Expended	58.9%
	SBE Participation	30.0%
Schedule:		
Issues or Concerns:		