

MONTHLY MONITORING REPORT

April 2017

Central Subway Project

San Francisco Municipal Transportation Agency (SFMTA)
San Francisco, CA

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PMOC Contract No.: DTFT6014D00010

Task Order No. 5

Project No.: FTA-13-0294

Work Order Number: 002

OPs Referenced: 01 and 25

CLIN 0002B

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Time on project: 2+ years

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 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. Phase 1 of the project constructed a 5.1-mile LRT line along the densely populated 3rd Street corridor. Revenue service commenced on the T Third Line in April 2007. 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 replace the entire LRV 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 March 2017, the project was 66.3% complete based on expenditures and there was one active construction contract: 1300 Stations and Systems/Trackwork. That contract was 53.4% complete based on incurred cost at the end of March 2017. Substantial completion was originally scheduled for February 2018, but the latest master program schedule update forecasts substantial completion on June 5, 2019, a delay of 481 days (27 days later than January's forecast).* The contractor has submitted revised schedule updates through February 2017, which are under review by SFMTA. *The March 2017 schedule update was not submitted pending SFMTA comments on the February 2017 submittal.* The master schedule information for the project is based on SFMTA's latest update of the construction schedule, which indicates a forecast Revenue Service Date (RSD) of *November 14, 2019. This is 323 days later than the required RSD of December 26, 2018 in the Full Funding Grant Agreement (FFGA).*

The Project Management Oversight Contractor (PMOC) notes that the forecast RSD moved 24 days later during March 2017, implying that only six days of planned work on the critical path was accomplished in the month. The RSD has moved 65 days later over the past three months.

In the opinion of the PMOC the ongoing month-by-month extension of the projected RSD is detrimental to effective management of the project. When project team members see that target completion dates are consistently extended, the motivation to work towards the target dates is lost. SFMTA and the contractor are encouraged to develop a mutually agreed, achievable schedule for completion of the remaining work, including any realistic schedule recovery strategies and appropriate schedule float to absorb future delays that will inevitably occur. The PMOC will convene a schedule workshop in July 2017 with the objective of

identifying a range of achievable dates for completion of construction and for the start of revenue service. An achievable substantial completion date for the 1300 Contract is likely several months later than the current forecast of November 2019.

SFMTA completed an update of the Rail Activation Plan (RAP) as part of its annual update of the Project Management Plan (PMP) and distributed the updated version of the report in April 2017. The RAP now provides substantial detail on the testing, commissioning, and start-up activities that will influence the RSD for the project. **The PMOC will review the RAP and updated PMP over the next two months.**

Table 1 - Core Accountability Items

Project Status: (as of March 31, 2017)		Original at FFGA:	Current Estimate:
Cost	Cost Estimate	\$1,578,300,000	\$1,578,300,000
Contingency	Unallocated Contingency	\$74,722,000	\$8,880,402 (no change from February)
	Total Contingency (Including Approved Contract Changes)	\$185,500,000	\$76,147,036 (\$356,000 more than in February)
Schedule	Revenue Service Date	12/26/2018	11/14/2019 (SFMTA forecast)
Total Project Percent Complete	Based on Expenditures	66.25%	
	Based on Earned Value	65.38%	
Major Issues	Status	Comments/Planned Action	
Schedule Contingency	Based on the latest program master schedule, there is negative schedule float of approximately eight months.	The minimum schedule contingency agreed to at this stage of the project is 6.0 months. <i>The project is more than 10 months behind schedule and it is likely that further delays will occur.</i>	
Cost Contingency	<i>The current Total Contingency is \$76.1 million. The Federal Transit Administration (FTA) recommends a minimum contingency level of \$60 million.</i>	Accumulating delays will likely lead to an increase in project soft costs that could consume some of the contingency but should not result in an overall cost overrun.	

<p>Technical Capacity and Capability</p>	<p><i>The Resident Engineer (RE) for the YBM work package has moved to the UMS work package. The YBM Assistant RE will take over the RE position for YBM. Two Office Engineers have been added. Additional staff recruitment is underway for claims and contract administration personnel.</i></p>	<p><i>The RE from YBM has demonstrated an ability to effectively manage the contractor and keep progress on that work package closer to schedule than the other packages. This experience should be helpful on the new assignment as UMS RE.</i></p>
<p>Date of Next Quarterly Meeting:</p>		<p><i>August 3, 2017</i></p>

Earned Value (EV): \$1,031,886,602, an increase of \$3.54 million from February. Earned value for the month of March was well below the earned value for February and was far below the planned increase in earned value of more than \$15 million. The earned value performance of the project is consistent with the reported schedule performance, confirming that the project is falling further behind schedule as time goes on.

Planned Value (PV): \$1,351,937,374, a planned increase of \$15.50 million from February.

Actual Cost (AC): \$1,045,653,327, an increase of \$9.61 million from February.

Cost Performance Index (CPI): 0.99. A value greater than 1 means that value of the work completed is more than the cost of the work (under budget) and less than 1 means that the value of the work is less than the cost of the work (over budget). ***The PMOC notes that the cost of work performed in both January and February was much higher than the increase in earned value. The PMOC is concerned that there may be a trend of earned value falling below incurred cost.***

Schedule Performance Index (SPI): 0.76. SPI greater than 1 is ahead of schedule and less than 1 is behind schedule. SFMTA has identified the minimum acceptable SPI to be 0.90.

Contingency

Cost Contingency

The total available contingency (approved contingency less approved contract changes) is \$76,147,036, which is above the minimum required contingency of \$60 million and increased by \$335,000 from February. A total of 64 contract modifications had been executed for the 1300 Contract with a total value of \$7.09 million as of May 3, 2017. No new contract modifications were executed in the month of April. **In the opinion of the PMOC, SFMTA’s cost forecasts should recognize the possibility of increased soft costs due to project delays. Despite the potential for higher soft costs, the available cost contingency appears to be sufficient to provide reasonable assurance of on-budget completion of the project. SFMTA and the contractor are encouraged to continue to identify additional schedule recovery strategies to**

reduce the potential for delay-related costs and to continue to work to resolve long-standing time impact claims.Schedule Contingency

All contingency in the schedule has been consumed, and there is more than 10 months of negative float. Further delays are likely because the contractor has not demonstrated that it can achieve the planned production rates for mining work for the CTS caverns. The PMOC will facilitate a schedule workshop in July 2017 with the objective of developing a range of dates for the probable actual construction completion and start of revenue service.

PMOC Observations, Opinions, and Concerns

The PMOC is concerned that construction progress on critical path work in March continued to be well below plan. The forecast completion date moved 24 days later, implying that actual progress was far less than the planned progress. The PMOC notes that the crossover cavern excavation is planned to start in May, rather than after the platform cavern completion. This could help to mitigate the impact of delays and help to prevent further slippage of the RSD.

The PMOC also notes that the cost of work performed in January and February was much higher than the increase in earned value. The PMOC is concerned that there appears to be a trend of costs exceeding the value of completed work.

In the opinion of the PMOC, the ongoing month-by-month extension of the projected RSD is detrimental to effective management of the project because the project team does not have achievable schedule targets to manage to. SFMTA and the contractor are encouraged to develop an achievable schedule for completion of the remaining work that reflects reasonable production rates for critical path work based on the actual production rates being achieved.

A schedule workshop is planned for July 2017 to evaluate potential time saving measures and assess the likely range for the RSD of the project. The production rate for the remaining mining work at CTS should be able to be determined at that time, allowing a more reliable forecast of the time required to complete construction.

The PMOC remains concerned that unresolved responsibility for the accumulated delays to date is hindering SFMTA and Tutor Perini Corporation (TPC) from working together to identify schedule mitigation measures. The PMOC notes that SFMTA and TPC may use the Dispute Review Board (DRB) process to attempt to reach resolution regarding the responsibility for delays, which is an appropriate use of the DRB.

The PMOC notes that there are several new large extra cost claims by the contractor in the past month that could represent significant cost exposure for the project. The total cost contingency less identified trends of 9.9% of the potential remaining spending remains sufficient to provide reasonable confidence of on-budget completion of the project. The available contingency is well above the recommended minimum of \$60 million. However, SFMTA should revise its cost forecasting process to recognize the likely increases in project management cost associated with delays to the project completion date.

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A. PROJECT STATUS

Full Funding Grant Agreement (FFGA)

The FFGA 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 and retrieval shaft. Final completion has been achieved, and financial close out should occur in 2017. SFMTA is still working to reach resolution on the amounts that are due to the stations contractor to cover extra costs related to non-conforming work by the tunnel contractor. The tunnel contractor also must repair leaks in the tunnel and some of the cross passages before the contract can be closed out. Coordination of access to the tunnel for the leak repair work with ongoing station construction has been challenging. Access for the tunnel contractor to make leak repairs has been approved by the stations contractor and the tunnel contractor is preparing a schedule for the work. *BART has accepted the removal of instruments related to the CSP tunnel and has issued a release of claims regarding the undercrossing of BART's tunnels at Market Street. BART needs to confirm by letter that it has received payment from the tunnel contractor for BART's costs related to the CSP tunneling work.*

It appears likely that this contract will close out with a final cost less than \$2 million over the original contract value, with change orders of less than 1% of the contract amount, which is very good cost control performance compared to typical infrastructure projects.

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 March 2017, the construction of the Stations and Surface, Track, and Systems Contract was 53.41% complete based on cost and 53.57% complete based on the value of completed construction.*

Union Square/Market Street Station (UMS): The latest Big Hairy Audacious Goal (BHAG) for this work package is to complete excavation and placement of support of excavation for the station box by June 1, 2017. *This goal is 35 days earlier than the July 5, 2017 completion date for this work shown in the March 31, 2017 schedule update by San Francisco Municipal Transportation*

Agency (SFMTA). **The contractor continues to fall behind the progress needed to achieve this BHAG and it appears likely that the goal will not be achieved.** Excavation to the bottom of the station invert was underway in late March. The contractor reported that break-in to the tunnel started on April 13, as planned, and will continue through May.

Final utility placements continued at the triangle formed by Market Street, the westbound lane of Ellis Street, and the western end of the Ellis Street Annex. San Francisco Water Department (SFWD) and Pacific Gas & Electric (PG&E) coordination continued for the completion of water and gas lines in the area. Utility issues continue to delay the restoration of the street in this area. The contractor's April 28 4-week look-ahead schedule does not indicate a completion date due to the large number of remaining utility issues.

At the north concourse, a PG&E electrical vault and duct bank for the station permanent power were completed on April 28. All remaining utility work was due to be completed in early May. Subsurface work in the north concourse awaits completion of the soil nail walls for the fan room in the Union Square Garage work area.

In the Union Square Garage area, removal of contaminated soil associated with the unanticipated fuel tanks at the bottom of the excavation was completed. Soil nail walls for the fan room took longer than expected, with the last level now scheduled for completion May 15—about two weeks later than planned. Structural steel for the new station entrance in the garage area has been completed, and utilities and mechanical systems are being installed prior to placement of lightweight concrete for backfill.

Chinatown Station (CTS): Excavation of the bottom left and right side drifts and invert was underway in both the northbound and southbound directions in early April and was completed in the northbound direction on April 27. The southbound bottom side drifts and invert were scheduled to be complete by the end of May. Meanwhile, work on the top center drift started on May 1 for the southbound direction and was due to begin on May 22 for the northbound direction. The mining work has continued to take much longer than planned in the baseline schedule. The projected project completion date slipped 24 days in March due to slow production for this critical path work. The contractor is continuing to work two 12-hour shifts six days per week on the mining work at CTS in an attempt to mitigate the schedule impacts of the low production rate.

The current BHAG for completion of the mining for the platform cavern is June 15, 2017. **This date is 15 days earlier than the completion date shown in the latest SFMTA schedule update, implying that the BHAG is not likely to be achieved. The Project Management Oversight Contractor (PMOC) and SFMTA have agreed to schedule a schedule containment workshop in July, after the planned completion of the platform cavern. The actual production rates achieved for the platform cavern work will then be used to project the likely completion date for the crossover cavern, which is the last mining work on the project critical path.**

SFMTA and the contractor plan to advance the start of excavation for the crossover cavern to mitigate the impacts of schedule delays. That work is scheduled to begin after completion of the platform cavern in the baseline schedule. The most recent program master schedule indicates that the work could start July 25. The latest 4-week look-ahead schedule from the contractor indicates

*that break-in for the crossover cavern will start on May 22. **Depending on the production rate for the excavation of the crossover cavern, the early start of this work could recover several weeks of delay in the schedule.***

Yerba Buena/Moscone Station (YBM): The latest BHAG for YBM is to complete the station box invert slab on April 15 and the headhouse invert slab on April 30. *The 4-week look-ahead schedule dated May 8, 2017 indicates that the final invert pours for the station box and the headhouse will be completed on May 17, about two weeks later than the goal. **In the opinion of the PMOC, the slight delay in completion of the YBM BHAGs will not influence the overall project schedule.***

Remaining subsurface utility work along Clementina Street and subsequent restoration of that street is being coordinated with the planned opening of a new hotel on the northwest corner of Clementina and 4th Streets. The most recent projection for the opening date of the hotel was July 2017. Work to install a 36-inch sewer force main in 4th Street was underway and scheduled to continue into June. Final restoration of 4th Street will follow completion of this sewer work.

Finishing work continued on the mezzanine and concourse levels of the station. *Plaster work is scheduled to be completed in May, followed by the start of electrical rough-in work. Work on the installation of the emergency exit stairway that will exit on the Folsom Street sidewalk has been interrupted due to the discovery of an unknown underground storage tank and asbestos-containing pipe in the excavation. Removal of the tank and pipe is expected to be complete in mid-May, with excavation and installation of the stair structure to follow.*

Surface, Track, and Systems (STS): The latest BHAGs for this work package include:

- Complete all utility work and pavement restoration south of Bryant Street by May 31, 2017;
- Complete all utility work and pavement restoration through the Bryant Street/4th Street intersection to the portal by July 15, 2017.

Utility conflicts continue to impact the completion of the street improvements that will allow work on the trackway in the center of 4th Street to commence. SFMTA has been managing the conflicts, and the number of required utility relocations is declining. *Water line work by SFWD remains to be completed at the intersections of 4th Street with Townsend and Welsh streets. All of this work was expected to be completed in early April but now is extending into June. PG&E can complete relocations of gas lines at various locations along 4th Street after SFWD completes the water line work at Townsend Street. Completion of two large sewer mains between Welsh and Bryant streets is underway, but the work at Townsend Street cannot be completed until AT&T removes a duct bank in the 4th and Bryant intersection.*

SFMTA and the contractor continue to evaluate solutions to problems with the sidewalk surface where new sidewalk panels installed by the contractor interface with the existing sidewalk panels. *The center panel, adjacent to the panels installed by the contractor will be replaced along a short section of sidewalk between Brannan and Freelon streets.*

Preparations were underway for placement of the transition slab between the cut and cover tunnel and the bored tunnel originally scheduled for April 18 and now planned for May 16. The

contractor continues to complete the track invert slab in the UMS and YBM station areas in coordination with the completion of the station box invert slabs at these stations.

Despite the focused attention of the Central Subway Project's (CSP) senior management team on achievement of the short term BHAGs, these goals have not arrested the ongoing schedule slippage, and the projected Revenue Service Date (RSD) moved *24 days later in the latest reporting period*. As discussed in the Schedule section of this report, the trend of schedule slippage due to lower than planned production for the CTS Sequential Excavation Method (SEM) mining *continued in March with excavation productivity declining compared to February*. **Improved performance for the mining operation must be achieved immediately, and sustained and additional time savings must be identified for all four lines of work that are driving the current RSD in order to avoid further delays to the current forecast RSD of November 14, 2019. The PMOC notes that SFMTA and the contractor have revised the work sequence at CTS to advance the start of the crossover cavern. Depending on the productivity of the work at the crossover cavern, this change in work sequence could reduce the overall project schedule delay by several weeks.**

In the opinion of the PMOC, the ongoing month-by-month extension of the projected RSD is detrimental to effective management of the project because the project team does not have achievable schedule targets to manage to. SFMTA and the contractor are encouraged to develop a mutually agreed and achievable schedule for completion of the remaining work including any realistic schedule recovery strategies and appropriate schedule float to absorb future delays that will inevitably occur. Such a schedule should be developed as soon as possible. The PMOC will convene a schedule workshop in July 2017 with the objective of identifying a range of likely feasible construction completion dates and RSDs.

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

Bay Area Rapid Transit (BART)

BART has accepted the work for removal of CSP instrumentation in the BART tunnel and has issued releases of SFMTA for liability. BART needs to provide confirmation that it has received payment from the tunnel contractor for agency costs associated with the tunneling work, which will close out the SFMTA-BART coordination for the tunnel contract.

California Department of Transportation (Caltrans)

An Encroachment Permit is needed to install electrical and traffic signal equipment at the I-280 off ramp. SFMTA is working to obtain the permit for the work, which is not on the critical path.

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) Quarterly Progress Review Meetings (QPRMs). The FLSC has begun to address the certifiable items list for the Stations Contract. Rail crossing

permits from CPUC are required for the at-grade portion of the project alignment. CPUC has provided the permits but they will need to be extended as the permits call for the crossings to be in operation before the scheduled completion of the CSP project.

San Francisco Public Utilities Commission (SFPUC)

Coordination is ongoing for the installation of new water and sewer facilities along 4th Street.

San Francisco Department of Public Works (SFPDW)

No updates to report.

San Francisco Parks and Recreation Department

No updates to report.

Private Property Owners

All real estate acquisitions have been completed. 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. These claims are being handled by the contractors' builder's insurance policies, 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

Vehicle design and fabrication is underway by Siemens Corporation for four Light Rail Vehicles (LRVs) for the Central Subway, 20 LRVs for near-term fleet expansion, and 151 LRVs for fleet replacement. Options for up to 85 additional vehicles are available for fleet expansion. The vehicle design and assembly process is reported to be on schedule. *Three cars had been delivered to SFMTA as of the end of March and delivery of the fourth car was scheduled for April. Dynamic testing, including clearance tests on the existing Muni tracks is underway for the first car and static tests are being performed on the second car. Production of eight additional cars continues at the assembly plant.*

Real Estate

All project right-of-way has been acquired, and all commercial and residential relocations are complete. SFMTA processed a budget revision to shift \$5.26 million in contingency that had been carried for real estate into unallocated contingency.

Labor Relations and Policies

Appendix G of the Project Monthly Report details the Small Business Enterprise (SBE) goals and actual participation on each contract as of *March 31, 2017*. 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

The 1300 contractor had previously raised the possibility of Buy America compliance issues with cooling equipment for the three underground stations. In the case of the cooling equipment, the contract specifications for the Variable Refrigerant Flow (VRF) cooling units identify four manufacturers that are all foreign, and the contractor has not been able to identify a domestic supplier that can meet the specifications. SFMTA has indicated that it intends to seek a waiver of Buy America requirements for this equipment, citing examples from other FTA-funded projects where waivers were granted by FTA for similar equipment. SFMTA is assembling information in advance of scheduling a meeting with FTA to discuss the proposed waiver request.

B. PROJECT MANAGEMENT PLAN AND SUB-PLAN IMPLEMENTATION

Project Management Plan (PMP)

SFMTA delivered an update of the PMP in April 2017. The PMOC will review the revised PMP, focusing on the updated Rail Activation Plan (RAP) and the organizational reporting structure for the quality functions. The reporting relationships for the quality function have been revised due to the departure of SFMTA's Capital Programs and Construction Quality Manager.

Environmental Assessment/Mitigation Plan/Archaeological Plans

The PMOC received the Fourth Quarter 2016 Mitigation Monitoring Reporting Program (MMRP) update from SFMTA on February 17, 2017.

Real Estate Acquisition Management Plan (RAMP)

The RAMP Revision 5, dated September 26, 2013, was submitted to FTA on November 19, 2013. All required real estate for the project has been acquired 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

Several CSP project staff members continue to be focused on development of an as-built record of the construction for the 1300 Contract. This effort requires support from the field management staff for each of the work packages. The updates have been completed for all stations through January 2017.

SFMTA reported that the Resident Engineer (RE) from the YBM work package has been assigned as the RE for UMS. The Assistant Resident Engineer (ARE) for the YBM work package has been promoted to RE for that package. Recruitment for the UMS ARE position is underway. SFMTA also is recruiting for additional support in change order analysis and contract administration. Two new Office Engineers started work in April.

Several long-standing major change orders and time impact claims remain to be resolved, but SFMTA has initiated discussions with the contractor on some of the oldest issues, including the impacts of a PG&E power pole on demolition work at the CTS headhouse. *SFMTA reported that it is now meeting with the contractor on a weekly basis to address delay claims, including any additional compensation that may be due to the contractor, beginning with the work at CTS that preceded the start of excavation. SFMTA and TPC are planning to submit information regarding the time impact claims at CTS to the Dispute Review Board (DRB) in an attempt to reach resolution on these issues. **In the opinion of the PMOC, this is an appropriate use of the DRB.***

The PMOC notes that no new contract modifications were issued in April. The PMOC will continue to monitor the SFMTA's progress in clearing the backlog of pending change orders. A new action item for SFMTA to include metrics for the time needed to progress identified potential contract changes and contractor change order requests through the various stages of resolution was identified.

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) and Proposed Contract Changes (PCCs) 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 companion contract change management log includes items that have been determined to have merit and are progressing through negotiations toward a contract modification (CMod). SFMTA is working to improve the timeliness of processing determinations of merit as well as the progression of pending contract changes and completion of CMods by creating summary tables of the numbers of items that are in the various stages of processing. **In the opinion of the PMOC, the trend log tracking should include the amount of time that has passed from the initial identification of the trend, and a new action item has been identified for SFMTA's response.** The PMOC has observed some improvement in the progress of contract change processing reflecting the emphasis of the management team in reducing the backlog of contractor change requests. CSP senior managers review the status of pending changes with RE staff members for each work package every other week in an attempt to reduce this backlog and have set an objective of having fewer than 10 change requests that require merit determination. *No new modifications to the contract were executed between early April and early May 2017.*

The most recent versions of the Trend Log and Trend Summary documents are dated May 3, 2017. A total of 64 contract modifications had been executed for the 1300 Contract as of that date. The total value of executed CMods was \$7,085,814. Note that tables 2 and 3 reflect the project status as of the end of March 2017 and may show different values for approved contract changes.

Project Cost (as of March 31, 2017)

Cost estimate: \$1.5783 billion.

Total contingency: \$76.15 million (minimum contingency is \$60 million), an increase of \$356,000 from February.

Total net incurred costs: \$1,045,653,329, an increase of \$9.61 million from February (66.25% of the total project budget).

Current funding level: \$1,329,794,000 (84.3% of the total project budget).

Earned Value (EV): \$1,031,886,602, an increase of \$3.54 million from February.

Actual Cost (AC): \$1,045,653,327, an increase of \$9.61 million from February.

Cost Performance Index (CPI): 0.99.

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 indicates a cost underrun, and a value of less than 1 indicates 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. **The PMOC notes that the cost of work performed in January and February was much higher than the increase in earned value. The PMOC is concerned that a trend of costs exceeding earned value may have been established. The PMOC will continue to closely monitor costs in relation to earned value.**

Project Cost Trends

SFMTA tracks potential changes in project cost, calling these potential changes “trends.” Trends include all potential changes in the contract 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 50% of the contractor’s estimate of extra costs.

Table 2 summarizes the trends for the two construction contracts that have not attained financial close out. The remaining contingency, less identified trends, represents about 45% of the potential left to spend for Contract 1252. **After potential changes are accounted for, there is now only \$4.75 million in contingency remaining for Contract 1300. The resulting contingency of 1.2% of potential remaining spending after potential changes are accounted for is tight, but unallocated contingency and excess contingency for other elements of the program are likely sufficient to allow on-budget completion of the CSP. The combined allocated contingency for all construction work less identified trends is now \$7.36 million or 1.9% of the potential remaining work. In the opinion of the PMOC, the allocated contingency for the 1252 Contract is greater**

than the amount required to assure final close out of the contract within the budget. The allocated contingency for the 1300 Contract is more in line with the likely contract cost given the pending contract changes, but there is a significant likelihood that additional contingency will need to be allocated to this contract prior to completion, as SFMTA has identified an additional \$26.8 million in potential contract changes in its trend log.

Table 2 - Contract, Budget, and Trends for Active Construction Projects¹

	1252 – Tunnel	1300 Stations, STS
Original Contract	233,584,015	839,676,400
Approved Contingency	2,329,485	40,000,000
Extra Budget for Non-Project Costs	6,173,508	
Approved Budget	235,913,500	879,676,400
Approved Changes	1,494,770	7,085,813
Current Contract (1252 does not include non-project costs)	235,078,785	846,762,213
Remaining Contingency	834,715	32,914,187
Potential Changes (Trends)	170,654	28,161,472
Estimate at Completion	235,249,439	874,923,685
Contingency Less Trends	664,061	4,752,715
Spent to Date	233,793,900	469,808,434
Potential Left to Spend	1,455,539	405,115,251
Contingency Less Trends as % of Potential Cost to Complete	45.6%	1.2%

¹ As reported in the March 2017 Central Subway Project Monthly Progress Report – SFMTA (reformatted by the PMOC).

Table 3 shows the overall budget, trends, and contingency status for the entire Central Subway program. **The total contingency, including unallocated contingency and subtracting identified trends, represents 10.3% of the potential remaining spending, which, in the opinion of the PMOC, is sufficient to provide reasonable confidence in an on-budget completion of the project.**

Table 3 - Budget and Contingency Status for Central Subway Project

SFMTA Central Subway Project, Budget, Costs and EAC by SCC January 31, 2017		FFGA Budget	Budget Transfers	Current Budget = Committed	Change	Base Budget	Contingency	Expenditures to Date	Remaining Budget	Cost to Complete	Estimate at Completion	Budget Forecast Variance	
		\$	\$	\$	%	\$	\$	\$	\$	\$	\$	\$	
10	Guideway and Track Elements	315,926,081	(30,698,202)	285,227,879	-10%			220,985,849	77%	64,242,030			
10.02	Guideway: At Grade, Semi-exclusive	2,395,143	464,857	2,860,000	19%			382,500	13%	2,477,500			
10.06	Guideway: Underground cut and cover	74,407,195	(4,590,788)	69,816,407	-6%			61,978,677	89%	7,837,730			
10.07	Guideway: Underground tunnel	224,933,257	(23,592,511)	201,340,746	-10%			153,358,156	76%	47,982,590			
10.09	Track: Direct fixation	7,293,157	(532,068)	6,761,089	-7%			2,647,916	39%	4,113,173			
10.10	Track: Embedded	1,601,763	(1,601,763)	-	-100%			-	0%	-			
10.12	Track: Special	5,295,566	(845,929)	4,449,637	-16%			2,618,600	59%	1,831,037			
20	Stations, Stops, Terminals, Intermodal	432,698,735	154,938,209	587,636,944	36%			325,216,713	55%	262,420,231			
20.01	At-grade station	774,913	6,827,944	7,602,857	881%			1,422,988	19%	6,179,869			
20.02	Aerial station, stop, shelter, mall, terminal, platform		3,124,033	3,124,033	NA			-	0%	3,124,033			
20.03	Underground station	412,084,888	143,123,329	555,208,217	35%			319,907,877	58%	235,300,340			
20.07	Elevators, escalators	19,838,934	1,862,903	21,701,837	9%			3,885,848	18%	17,815,989			
40	Sitework and Special Conditions	232,551,627	(18,613,257)	213,938,370	-8%			194,583,261	91%	19,355,109			
40.01	Demolition, clearing, earthwork	8,887,028	3,468,587	12,355,615	39%			11,908,516	96%	447,099			
40.02	Site utilities, utility relocation	29,562,587	30,586,986	60,149,573	103%			62,544,421	104%	(2,394,848)			
40.03	Haz. Material, contam'd soli removal, ground water treatment	2,957,442	4,494,779	7,452,221	152%			4,601,585	62%	2,850,636			
40.04	Environmental mitigation	3,146,216	(2,023,317)	1,122,899	-64%			619,100	55%	503,799			
40.05	Site structures, including retaining walls, sound walls	2,894,074	(187,643)	2,706,431	-6%			2,706,431	100%	-			
40.06	Pedestrian and bike access and accommodation, landscaping	14,393,910	(4,602,915)	9,790,995	-32%			2,391,071	24%	7,399,924			
40.07	Automobile, van, bus accessways, including roads and parking lots	11,919,550	(5,340,451)	6,579,099	-45%			3,350,864	51%	3,228,235			
40.08	Temporary facilities and other construction indirect costs	158,790,820	(45,009,283)	113,781,537	-28%			106,461,273	94%	7,320,264			
50	Systems	108,429,774	(13,184,464)	95,245,310	-12%			23,361,105	25%	71,884,205			
50.01	Train control and signals	37,447,116	(9,415,693)	28,031,423	-25%			7,281,419	26%	20,750,004			
50.02	Traffic signals and crossing protection	3,013,232	9,549,297	12,562,529	317%			9,218,252	73%	3,344,277			
50.03	Traction power supply	20,379,634	1,085,439	21,465,073	5%			5,297,411	25%	16,167,662			
50.04	Traction power distribution	16,239,951	(3,798,838)	12,441,113	-23%			1,393,019	11%	11,048,094			
50.05	Communications	28,545,305	(16,514,719)	12,030,586	-58%			171,003	1%	11,859,583			
50.06	Fare collection system and equipment	2,804,536	3,295,464	6,100,000	118%			-	0%	6,100,000			
50.07	Central Control		2,614,586	2,614,586	NA			1	0%	2,614,585			
Subtotal (10 - 50)		1,089,606,217	92,442,286	1,182,048,503	8%	1,146,079,601	35,968,902	764,146,928	65%	417,901,575	410,264,800	1,174,411,728	7,636,775
60	ROW, Land, Existing Improvements	37,398,029	(5,151,708)	32,246,321	-14%	32,246,321	-	30,731,521	95%	1,514,800	1,514,800	32,246,321	-
60.01	Purchase or lease of real estate	33,798,029	(3,732,219)	30,065,810	-11%	30,065,810	-	28,322,091	94%	1,743,719	1,514,800	29,836,891	228,919
60.02	Relocation of existing households and businesses	3,600,000	(1,419,489)	2,180,511	-39%	2,180,511	-	2,409,430	110%	(228,919)	-	2,409,430	(228,919)
70	Vehicles	26,385,653	-	26,385,653	0%	13,309,000	13,076,653	2,147,782	8%	24,237,871	11,161,218	13,309,000	13,076,653
70.01	Light Rail Vehicles	26,385,653	-	26,385,653	0%	13,309,000	13,076,653	2,147,782	8%	24,237,871	11,161,218	13,309,000	13,076,653
80	Professional Services	361,568,360	(32,829,240)	328,739,120	-9%	310,518,041	18,221,079	248,627,097	76%	80,112,023	61,890,945	310,518,042	18,221,078
80.01	Preliminary Engineering	46,317,094	(114,420)	46,202,674	0%	46,202,674	-	46,202,675	100%	(1)	-	46,202,675	(1)
80.02	Final Design	86,053,240	(24,734,909)	61,318,331	-29%	61,318,331	-	61,199,308	100%	119,023	61,322,751	61,322,751	(4,420)
80.03	Project Management for Design and Construction	191,025,800	(88,107,411)	102,918,389	-46%	89,012,544	13,905,845	67,006,356	65%	35,912,033	27,099,017	94,105,373	8,813,016
80.04	Construction Administration and Management	15,495,521	78,558,172	94,053,693	507%	91,096,881	2,956,812	62,741,949	67%	31,311,744	23,212,103	85,954,052	8,099,641
80.05	Professional Liability and Other Non-Construction Insurance	6,800,000	-	6,800,000	0%	6,800,000	-	6,340,196	93%	459,804	78,370	6,418,566	381,434
80.06	Legal, Permits, Review Fees by Other Agencies	7,242,340	970,264	8,212,604	13%	8,212,604	-	4,304,907	52%	3,907,697	3,494,221	7,799,128	413,476
80.07	Surveys, Testing, Investigation, Inspection	234,036	699,064	933,100	299%	933,100	-	831,706	89%	101,394	1,858	833,564	99,536
80.08	Start up	8,400,329	(100,000)	8,300,329	-1%	6,941,907	1,358,422	-	0%	8,300,329	7,881,932	7,881,932	418,397
Subtotal (10 - 80)		1,514,958,258	54,461,339	1,569,419,597	4%	1,502,152,963	67,266,634	1,045,653,328	67%	523,766,269	484,831,763	1,530,485,091	38,934,506
90	Unallocated Contingency	63,341,742	(54,461,340)	8,880,402	-86%		8,880,402		0%	8,880,402			8,880,402
Total Project Costs (10 - 100)		1,578,300,000	(1)	1,578,299,999	0%		76,147,036	1,045,653,328	66%	532,646,671	484,831,763	1,530,485,091	47,814,908

SCC Breakdown of Forecast Construction Costs Not Available

²Data reported in the March 2017 Central Subway Project Monthly Progress Report – SFMTA (reformatted by the PMOC).

Change Order Control

SFMTA continues to estimate that additional CMods with a net increase in contract value of \$170,654 will be executed as part of contract close out for the 1252 Contract. Based on the expected final contract value, change orders for the base work are forecast to represent less than 1% of the original contract amount. This represents exceptionally good change order control compared to typical capital projects.

SFMTA is maintaining its management tools for tracking potential contract changes for the 1300 Contract. *The latest summary report is titled “CN1300 Trend Summary” and is dated May 3, 2017. This report shows that 64 contract modifications have been approved (no additional CMods since April 5) for a net increase in the contract value of \$7,085,814. CORs (generated by the contractor) that have been determined to have merit and PCCs (generated by SFMTA) have a combined expected value of \$26,773,136 in increased contract value, an increase of \$966,000 since April 5. An additional 562 items are being tracked in the Trend Log with a net value of \$26.63 million in possible contract value increases. Of these, 259 have been judged by SFMTA to be without merit, but are being carried at a reduced value in the trend to address potential future claims. A further 245 items have been voided and are carried at no cost. There are 40 items covered by certified claims and notices of potential claims by the contractor (\$13.3 million total exposure, \$5.2 million greater than last month), and 14 items are “open” or “new” and awaiting a determination of merit.*

The most recent version of the Trend Summary shows a total potential increase in contract cost of \$60,489,734 including the \$7.09 million in contract cost increases executed thus far. The total estimated cost impact of the identified trends increased by about \$6.23 million from April 5, 2017 to May 3, 2017. Much of the increase in potential cost exposure is due to a claim for extra costs by the subcontractor conducting the excavation of the platform cavern at CTS. That subcontractor claims that the 5-foot-wide Tunnel Boring Machine (TBM) segments are larger than anticipated. The PMOC will research this issue to determine if the cost claim may have merit. The following trend items with potential cost increases in excess of \$250,000 are identified in the Trend Log

1. TS and SL changes for STS - \$298,307
2. Change to grade 50 steel from specified grade 70 steel (due to availability issues) - \$572,884
3. Extra trucking costs for contaminated soil at CTS - \$2,274,225
4. Harder rock than anticipated for CTS slurry wall excavation - \$2,820,600
5. Delays to installation of tangent piles at UMS - \$1,082,380
6. UMS Garage underpinning requirements - \$732,157
7. 12-inch waterline at UMS, added scope - \$336,359
8. Utility conflicts with sewer line installation at UMS - \$744,465

9. Changes in construction sequence for UMS Garage - \$500,000
10. UMS art glass installation requirements - \$382,978
11. Obstructions to jet grout placement at UMS - \$2,062,420
12. Change in track switch machine manufacturer at STS - \$391,909
13. Additional monitoring instruments at CTS - \$429,777
14. Extra work to prepare existing tunnel - \$431,423
15. Additional traffic control requirements at 4th and King - \$675,001
16. Incomplete interface design at STS - \$300,001
17. Additional traffic control requirements for STS work package - \$1,032,302
18. Cost of changes to the design of CTS to accommodate the plaza requested by the community - \$4,618,428
19. Change in vent for emergency generator at all stations - \$500,001
20. Missing conduit between manholes at UMS - \$250,001
21. Contractor-claimed change in contract requirements for pre-loading permanent struts at UMS - \$1,853,352
22. *Soil nail and shotcrete wall changes in Union Square Garage - \$1,187,172 (up from \$896,524)*
23. Contractor claim that wayside signals are extra - \$1,512,373
24. Change in drain piping details at UMS - \$332,252
25. Temporary drainage at Union Square Garage ramps - \$292,754
26. Change in automatic train control system for reverse running - \$400,001
27. Design changes for UMS vertical drainage slots - \$866,709
28. Costs associated with differing site conditions for Level 3 Duct Bank - \$2,400,001
29. *Claim for extra costs and time due to extremely hard ground claimed by TPC during the coring for the SEM mining work - \$750,000 (new)*
30. Escalator raceways at UMS - \$492,065
31. *Change in design for BART entrance elevator at UMS - \$400,000 (new)*
32. *Extra costs for SEM excavation at CTS due to tunnel segments being 5 feet wide - \$3,750,000 (new)*
33. Time impacts due to power pole conflict during demolition at CTS - \$3,516,164
34. Time impacts from extended submittal reviews and substitution request procedures - \$3,021,262

35. Claimed delays to SEM work at the platform invert due to compensation grout exclusion zone requirements in the contract specifications - \$800,000 (new)

The PMOC notes that there are several new large extra cost claims by the contractor in the past month that could represent significant cost exposure for the project.

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)

Funding and Expenditures

Federal, state, and local project funding and expenditures are shown in Table 4 with unchanged funding levels from the previous reporting period.

Table 4 - Project Funding

Source	Committed (\$1,000)	Awarded (\$1,000)
<u>Federal</u>		
New Starts	942,200	769,196
Congestion Mitigation	41,025	41,025
<i>Federal Subtotal</i>	983,225	660,221
<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>		
Prop. K Sales Tax	123,975	123,975
<i>Local Subtotal</i>	123,975	123,975
Project Total:	1,578,300	1,179,794

E. PROJECT SCHEDULE STATUS

SFMTA prepared a master program schedule update in April representing progress on the project through March 2017. The contractor has submitted revised schedule updates through February 2017, which are under review by SFMTA. The March 2017 schedule update was not submitted pending SFMTA comments on the February 2017 submittal. The schedule updates are being completed and re-submitted in accordance with the verbal opinion issued by the project DRB that TPC should implement SFMTA's comments in finalizing its schedule updates and that TPC should document any disputes with the comments in the schedule narrative. Presuming that the latest TPC schedule updates are compliant with the contract and the DRB direction, ongoing schedule updates

are expected to be available at the time of the contractor's pay requests. SFMTA should not have to create its own schedule updates going forward if the contractor's updates are acceptable.

In the opinion of the PMOC, using the DRB was an effective means of achieving agreement between SFMTA and the contractor regarding schedule updates. The parties should continue to use the partnering process and the DRB as resources for resolving project issues. Resolution of the issues regarding contractor schedule updates is an important achievement that provides a firm basis for realistic and reliable project schedule evaluation. An agreed project schedule from the contractor will be critical to the evaluation and agreement on schedule recovery strategies.

The PMOC remains concerned that unresolved responsibility for the accumulated delays to date is hindering SFMTA and TPC from working together to identify schedule mitigation measures. SFMTA has initiated discussions with TPC regarding long-standing delay claims and has provided a formal proposal regarding the time allowance for one of the oldest claims (delayed removal of a power pole at CTS). SFMTA and TPC are now holding weekly meetings to resolve the outstanding schedule delay issues. **In the opinion of the PMOC, SFMTA should finalize the time impact allowances on the remaining contractor delay claims as soon as possible so that SFMTA and the contractor can focus on the current schedule issues. SFMTA and the contractor should make appropriate use of the partnering and DRB processes to facilitate resolution of any disputes regarding allowable time impacts.** *SFMTA reported that it intends to take the issue regarding the delays associated with a PG&E power pole at CTS to the DRB in the coming months.*

The PMOC facilitated a schedule workshop with SFMTA project management and project controls staff on November 18 and 19, 2015. As a result of the workshop, an initial proposed action plan for developing the necessary tools from the current TPC schedule includes the following steps:

1. SFMTA makes adjustments to schedule logic in TPC schedule.
2. SFMTA evaluates the resulting schedule and finalizes the recommended logic changes.
3. SFMTA reviews the resulting schedule tool with TPC.
4. SFMTA and TPC agree on refinements.
5. Final schedule refinements made by TPC or SFMTA, and revised schedule accepted for ongoing use.
6. Routine schedule updates continue with the revised schedule. SFMTA continues to make its own updates based on four-week look-ahead schedules and actual progress as a check on TPC schedules. Monthly meetings held to resolve any differences.
7. SFMTA (and TPC) evaluate changes to work sequence, options for acceleration, and other strategies for schedule recovery. Mutually agreed recovery strategies implemented in revised schedule.

If TPC and SFMTA cannot agree on the schedule refinements (step 4), SFMTA develops its own schedule forecasting tool in parallel with TPC and continues to work with TPC to accept the revisions through monthly schedule reconciliation meetings. As of the March 2017 SFMTA Progress Report for CSP, SFMTA had completed items 1 through 6, and the contractor had submitted revised schedule updates in conformance with the agreements reached through the DRB process. These schedule updates were under review by SFMTA at the publication date for this report.

The March master program schedule update indicates that the projected RSD slipped 24 days during the month. The critical path for the construction work continues to flow through the construction of CTS, but analysis by the PMOC indicates that there are a total of four lines of work that are influencing the RSD for the project. The projected RSD forecast is now November 14, 2019, more than ten months later than planned. There is negative float on the project critical path, and further delays to the RSD are virtually certain based on the progress of work on the critical path.

The contractor has been working two 12-hour shifts and six days per week at CTS in an attempt to reduce the impacts of lower than planned production rates for the ongoing SEM mining work for the platform cavern. *The planned work productivity for the month of March was not achieved, causing the further slip in the projected RSD. The latest 4-week look-ahead schedule for CTS shows that the contractor plans to begin mining work on the crossover cavern in May. This is two months ahead of the most recent forecast for the start of this work, which was to follow the completion of the platform cavern. Depending on the rate of advancement for the crossover cavern excavation, this planned change in work sequence could mitigate several weeks of delay on the project critical path.*

Table 5 shows the latest BHAGs and the status for each work package in the 1300 Contract.

Table 5 - Interim BHAGs for CTS Construction Progress

Milestone	Target Date	Actual Date	Status
Complete platform cavern excavation	June 15, 2017		<i>Latest 4-week look-ahead schedule indicates that this milestone will be missed. Latest 4-week look-ahead schedule shows this work starting on May 22.</i>
Start crossover cavern excavation	May 15, 2017		
Complete station box excavation	June 1, 2017		<i>Master schedule indicates July 1 completion. BHAG missed, completion date not shown on schedule. On track</i>
Complete utilities at Ellis	April 15, 2017		
Complete utilities at Geary	June 30, 2017		
Complete utilities at O'Farrell	July 31, 2017		

Milestone	Target Date	Actual Date	Status
Complete invert slab for station box at YBM	April 15, 2017		Latest 4-week look-ahead schedule shows May 16 completion.
Complete invert slab for headhouse	April 30, 2017		Latest 4-week look-ahead schedule shows May 17 completion.
Complete all utility work along 4th Street	May 31, 2017 south of Bryant July 15, 2017 through 4th and Bryant intersection		BHAGs will be missed.

The PMOC convened a second schedule workshop for the project on June 22 and 23, 2016. The PMOC's analysis of the schedule indicates that four lines of work are driving the RSD:

- CTS work leading to tunnel electrical power and Advanced Train Control System (ATCS) testing;
- STS work (Radiax, Train Control and Software) leading to ATCS testing;
- CTS work leading to building start-up and testing; and
- UMS work leading to building start-up and testing.

Improvements must be made in the overall durations of each of these lines of work in order to move the RSD earlier than the current projection, presuming that the ongoing schedule slippage at CTS can be arrested. The workshop identified several strategies for improving the schedule for each line of work. These strategies are now under review by SFMTA. Additionally, the SFMTA scheduling team and the PMOC's scheduling experts reviewed the schedule benefits of the current schedule performance milestones. Due to the fact that multiple lines of work are driving the RSD, the impact of achieving the milestones would be limited. **Combined with the fact the many of the milestones have not been achieved, the PMOC's conclusion is that the practice of setting short term schedule performance targets has not been effective in achieving schedule recovery.**

In the opinion of the PMOC, although setting and working toward the short term milestones may be encouraging cooperation and collaboration between TPC and SFMTA in advancing the current work, this practice has not, and most likely will not, result in overall time savings or any improvement in the RSD for the project. A more comprehensive view of the lines of work that are driving the RSD must be taken by SFMTA and efforts must be made to improve the work sequence and advance elements of the testing and commissioning activities near the end of the project in order to improve the RSD. SFMTA should engage its Transit Division in planning the testing and commissioning work as soon as possible, since Transit Division staff will have key roles in these activities.

SFMTA agreed to several action items that will lead to an updated schedule and projection of likely RSD outcomes (see Table 8). The PMOC notes that SFMTA *has completed* an update of

the RAP including a more detailed schedule of testing, commissioning, and start-up activities as part of the 2017 update of the PMP.

The potential for schedule recovery can be evaluated with more confidence after the completion of the SEM work for the platform cavern and after mining work for the crossover cavern has been underway for a few weeks. Information on the likely progress rate for the crossover cavern excavation can be used to project a completion date for the SEM work at CTS, which is on the project critical path. Based on the BHAG for the platform cavern completion and the expected start date for the crossover cavern, the PMOC expects to hold another schedule recovery workshop in July 2017.

Project Schedule Data

Earned Value (EV): \$1,031,886,602, an increase of \$3.54 million from February.

Planned Value (PV): \$1,351,937,374, a planned increase of \$15.50 million from February.

Schedule Performance Index (SPI): 0.76. SPI greater than 1 is ahead of schedule and less than 1 is behind schedule. SFMTA has identified the minimum acceptable SPI to be 0.90; the current SPI indicates unacceptable schedule performance. *The SPI declined from 0.77 in the previous reporting period.*

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 indicates more work was completed than planned and a value of less than 1 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 0.76 indicates that the project is significantly behind schedule.

Table 6 shows the status of the schedule milestones established for the project.

Table 6 - 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)

(P = Planned Date, A = Actual Date, F = Forecast Date)	
Station construction substantial completion:	February 24, 2018 (P); <i>June 4, 2019</i> (F)
RSD:	December 26, 2018 (P); <i>November 14, 2019</i> (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 on February 24 through 27, 2009. The FTA recommended schedule contingency for the current stage of the project is 6.0 months. As noted above, the current schedule reflects *more than 10 months* of negative buffer float.

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 Mechanical, Electrical, and Plumbing (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 *November 14, 2019*)

Three Month Look-ahead

The following activities are planned over the next three months:

1300 Contract

UMS

Complete utility placement, backfill, and paving of Ellis Street
 Install guardrails and prepare the new vehicle ramps at Union Square Garage for use by the public

Complete structural steel for the north entrance

Continue excavation and placement of struts and walers in the station box

Expose *and remove* the tunnel liner in the station box

Complete construction of access shaft at O’Farrell Street

Complete the invert in the Ellis Street Annex area

CTS

Complete excavation of the station platform caverns

Start excavation of the crossover cavern

Start structural work in the north egress shaft

Provide compensation grouting as needed

YBM

Complete invert slabs for the station box and headhouse

Continue interior wall construction and M/E/P rough-in at the mezzanine and concourse levels

Start interior wall construction and M/E/P rough-in at the platform level and in the headhouse

Complete utilities in 4th Street above the station box and restore street pavement

STS

Sewer installation and repair

Waterline installation

Alternative Water Supply System (AWSS) installation

Muni ductbank installation

Continue street restoration and final paving

Start installation of tunnel lighting

Installation of overhead contact system support poles

Placement of tunnel walkways

Complete installation of track in the portal area

Continue installation of track invert slab in the station areas

The PMOC expects to attend the following meetings:

- Weekly Management (*June 5, July 10, and July 31*)
- Weekly Contract 1300 Construction Progress Meetings (*first Tuesday and Wednesday of June, July, and August*)
- Weekly Configuration Management Board (CMB) (*June 7, July 12, and August 2*)
- Monthly CSP Risk Management Meetings (*June 8, July 13 and August 3*)
- CSP month-end meetings on *June 6, July 13, and August 1*)
- FTA/QPRM scheduled for *August 3, 2016*

F. QUALITY ASSURANCE AND QUALITY CONTROL

QA/QC Plan Implementation

Contractor QC, as detailed in the Contract Technical Specification, is the means by which the contractor ensures that construction complies with the requirements of the contract. The contractor conducts at least three phases of control (Preparatory Phase, Initial Phase, and Follow-up Phase) to ensure that all work is carried out per the contract.

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 adverse 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.

Construction crew attention to quality has been consistent, with the occurrence of critical non-conforming work being infrequent. The quality concerns for the 1300 Stations Contract identified in the SFMTA *March* monthly report were *largely* unchanged from the previous month and included:

- As is typical to similar projects, work performed prior to receipt of approval status of required submittals/RFIs with/without knowledge of QC remains a potential area of concern.
- TPC's Record Document (as-built) development, including CNCRs and a timely record of work performed that is different than what is required by the latest approved Conformed Design Drawings needs improvement. Quality Assurance Surveillance QAS076 was conducted, posted to CM13, and provided to TPC for their action. The Quality Assurance Surveillance followed findings from a Quality Assurance Audit provided to TPC for corrective action in January of 2016. *The audit identified some lack of conformance to the requirements of the Record Document Specification Section 01 78 39.*
- *Revisions of and adherence to the required process for identifying, documenting, and implementing requirements for support of excavation as the SEM work progresses at CTS. Daily meetings are held to review the planned work for the upcoming shifts to assure that the proper excavation support and sequencing are implemented. SFMTA reports that TPC is meeting these requirements in a "most acceptable manner."*
- TPC has been reluctant to include documentation of the contractor's Quality Control process acceptance of completed work at UMS in monthly pay applications, resulting in extra effort being expended by the SFMTA RE staff to confirm that only acceptable work is included in the invoices.

As of April 3, 2017, 290 CNCRs had been filed by TPC's Quality Manager (7 more than in early February), 9 new items were under review, 33 other items had responses identified but not yet approved, the proposed responses to 10 items were disapproved, and 23 items had approved responses that were not yet implemented. In addition, 178 items were closed and 37 items had been voided. None of the open or disapproved items is delaying progress of the work.

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 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 with the next PMP update.

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 will begin to address the station construction items in 2016. The San Francisco Fire Department (SFFD) regularly attends the now combined FLSC and SSCRC meetings. The SFFD will continue to coordinate with the Stations Construction Project to identify issues of importance during construction.

Construction Safety

The 1300 Contract is maintaining an excellent safety record, with a total of six recordable and four lost time incidents since the project start. *No recordable incidents occurred in the month of March 2017.* The performance metrics relating to accidents per working hour are well below the OSHA goals for similar construction. The current accident records for the 1300 Contract are shown in Table 7.

Table 7 - Construction Safety Data

<i>Through March 2017</i>	No. of Incidents	Incident Rate ¹	Goal
1300 Contract			
OSHA Recordable Accidents	6	0.58	<3.4
Job Transfer/Restricted Duty Incidents	0	0	NA
Lost Time Incidents	1	0.10	<1.6

<i>Through March 2017</i>	No. of Incidents	Incident Rate ¹	Goal
Total Incidents	7	0.68	NA
Hours Worked	2,068,856		

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

I. PROJECT RISK, RISK MANAGEMENT, AND RISK MITIGATION

RCMP Revision 3 was received by the PMOC on April 30, 2013. The outgoing PMOC provided its final Spot Report to FTA on July 19, 2013. SFMTA submitted a CSP “Contingency Management – Schedule 2012 Update” on May 22, 2013. SFMTA provided a further update of the schedule risk assessment in June 2015 that recommended a reduction of the minimum schedule contingency after demobilization of the tunnel work to 4.0 months. The updated risk assessment was conducted on the approved baseline schedule for the 1300 Contract without updates to reflect the then current status of the construction work and the accumulated construction delays.

The Contract 1300 baseline schedule was adopted in early December 2014. Schedule updates completed by the contractor have been rejected by SFMTA due to logic errors and have not been incorporated into the master program schedule. SFMTA has prepared its own revision of the construction schedule and is using updates to that schedule to maintain the master program schedule. SFMTA is continuing to refine the record of as-built construction activity incorporated in the master schedule. The schedule risk assessment update is now expected from the CSP after the schedule tool in P6 is further enhanced and a recovery schedule is produced. The risk assessment would be conducted to determine a range of likely actual RSDs based on the updated schedule, possible recovery of accumulated delays, and remaining schedule risks. The timing of the risk assessment will be determined in the coming months.

The most recent Risk Mitigation Meeting attended by the PMOC was the May 4, 2017 Risk Mitigation Meeting for the CSP, which included a review of the status of the top risks ranked “6” or above and several other risks that had not been updated recently. The PMOC noted the following significant items of discussion:

- The risk of damage to structures in the CTS construction area due to settlement and subsequent failure of utilities remains. SFWD still has not yet installed gate valves on the two major water mains that traverse the construction zone. *The work was further delayed when SFWD quoted an unreasonably high price for installation of the valves.* These valves are intended to facilitate quick shut-off of water in the event that one of the water lines fails, thereby preventing collateral damage due to water intrusion. Once the valves have been installed, this risk can be re-evaluated and likely reduced.
- The risk of prolonged negotiations regarding contract change requests leading to poor relations between SFMTA and TPC resulting in delays and higher costs being addressed through partnering and scheduling negotiating sessions for contract modifications twice per week. *It was noted that contract modifications are still taking a long time, with much of the delay due to slow responses by the contractor for cost estimates.*

- *Two risks related to delays in testing, commissioning, and system start-up have been partially mitigated through preparation of a more detailed RAP and accompanying schedule of testing and start up activities. SFMTA issued the updated RAP in April. Muni operations is now reviewing and is expected to provide comments on the RAP. The schedule for testing needs additional logic ties to construction work completion. At present, no testing work is shown to start before May 2019. Testing work can likely start sooner at YBM, as that station construction will be completed earlier than the other two stations.*
- *The risk of being unable to recover schedule delays has occurred. All parties agree that the planned RSD of December 2018 will not be achieved. Mitigation strategies will now focus on establishing an achievable completion date for construction and RSD and then aggressively managing to achieve the revised dates. The revised RSD (expressed as a range of dates) will be identified through the PMOC-facilitated schedule workshop now expected to be conducted in July.*
- *The risk of SEM excavation leading to settlement and damage to adjacent buildings has been experienced, with some movement of the Mandarin Tower recorded by monitoring devices. The movement has not exceeded the allowable thresholds and compensation grouting has been underway to arrest the settlement. Monitoring will continue and the contractor will retain resources to continue compensation grouting as required.*
- *The risk of the CSP quality program being ineffective in processing non-confirming work, thereby causing schedule delay remains, but non-confirming work has not impacted the progress of work so far.*
- *Unresolved responsibility for schedule delays that leads to increased project cost remains a risk. Executive partnering sessions and the DRB are being used to resolve disputes regarding schedule delays.*
- *The risk that delays in receiving electrical service from PG&E cause delays in the start-up and testing program remains very low.*
- *The risk that the headwalls for the stations, installed by the tunnel contractor, leak and lead to added costs for the station construction remains very low.*
- *The risk of delays due to coordination with the construction of the hotel at 4th and Clementina streets remains low. The remaining major work to complete in Clementina is installation of the electrical supply box by PG&E, which will need to follow utility work for the hotel.*
- *The risk of design changes not being captured in as-built record drawings remains low. The CSP quality program is monitoring the preparation of as-built drawings and the contractor is doing a good job of preparing drawings as the work proceeds.*
- *The risk that delayed receipt of funding allocations results in delays to construction is low, since the latest federal budget includes the planned payment for CSP.*

- *The risk that delays on other projects will cause delays to CSP remains low.*

In the opinion of the PMOC, the risk mitigation meeting continues to be an effective forum for identifying threats to the success of the CSP and for developing mitigation measures to reduce the threats. The project team continues to engage in meaningful discussions during the risk mitigation meetings that help focus attention on the most important issues that could affect project cost, quality, and the completion schedule.

A list of the top risks discussed at the April 2017 Risk Mitigation Meeting is included in Appendix D.

J. ACTION ITEMS

Table 8 on the following page shows the current action items for SFMTA.

Table 8 - SFMTA Action Items for Central Subway Project

Category	NO.	ACTION	DATE OPENED	DUE DATE	DATE CLOSED	COMMENTS
S	165	Develop recovery schedule	12/10/15	8/20/17		Schedule workshop planned for <i>July 2017</i> . Recovery schedule to follow within 30 days.
S, RA	166	Update schedule risks based on recovery schedule	12/10/15	9/20/17		Assume that schedule risks are updated 30 days after completion of recovery schedule.
S	169	Review and address logic errors and acceleration strategies in the schedule	6/23/16	6/1/17	Ongoing evaluation	<i>TPC has delivered revised schedule updates through February 2017, which are under review by SFMTA. If accepted, this item can be closed.</i>
S	171	Provide a range of dates for the Revenue Start Date	6/23/16	9/20/17		The updated RSD should be identified based on the schedule risks identified in item 166.
S	173	Integrate testing and commissioning tasks into master program schedule	12/6/2016	5/15/2017	5/5/2017	<i>Updated RAP with detailed schedule was delivered in April 2017. CLOSED</i>
CH	174	Revise contract change tracking process to include the amount of time that has passed since the trend was originally identified.	3/24/17	TBD		Revised action to measure the time needed to resolve contract changes.

Category	NO.	ACTION	DATE OPENED	DUE DATE	DATE CLOSED	COMMENTS
<i>CH, S</i>	<i>175</i>	SFMTA to implement a process to resolve time impact allowances on the remaining contractor delay claims as soon as possible so that SFMTA and the contractor can focus on the current schedule issues.	3/24/17	<i>TBD</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.

APPENDIX A. LIST OF ACRONYMS

AC	Actual Cost
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ARE	Assistant Resident Engineer
ARS	Air Replenishment System
ATCS	Advanced Train Control System
AWSS	Alternative Water Supply 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
CFR	Code of Federal Regulations
CLIN	Contract Line Item Number
CMB	Configuration Management Board
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
MPS	Master Project Schedule
Muni	Common Public Reference to SFMTA
NCN	Non-conformance Notice
NCR	Non-conformance Report
NEPA	National Environmental Policy Act
NTP	Notice to Proceed
O&M	Operations & Maintenance
OHA	Operational Hazard Analysis
OP	Oversight Procedure
PCC	Proposed Contract Changes
PE	Preliminary Engineering
PG&E	Pacific Gas & Electric Co.
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
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
RFI	Request for Information
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
SFWD	San Francisco Water Department
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
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
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
VRF	Variable Refrigerant Flow
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?	Y		
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.
Has the grantee implemented security directives issued 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.
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.

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
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		
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.

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
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 on the current construction contract (1300).
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 are developed and certified through monthly meetings. Design is complete and construction is underway.
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. <i>Certification reviews are underway for the stations contract.</i>
Has the grantee verified construction specification conformance?	Y		This is on-going as construction progresses.
Has the grantee identified safety and security critical tests to be performed prior to passenger operations?	N		Currently being developed.

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 during testing, inspection, and start-up phases?	N	Project is in construction, with RSD more than 2.5 years in the future.
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.
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	<i>In Process</i>	<i>Second draft of Rail Activation Plan has been completed. An Integration Matrix has been implemented for all disciplines including safety and security concerns.</i>
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.

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
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.
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 is 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	

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
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>May 19, 2017</i>
Project Name:	Central Subway Project (CSP) New Starts Light Rail Transit
Grantee:	San Francisco Municipal Transportation Agency (SFMTA)
FTA Regional contact:	Mr. Jeffrey S. Davis
FTA Headquarters contact:	Ms. Kim Nguyen

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.
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
11/14/2019			Revenue Operations Date at date of this report

65.4% *Percent Complete Based on Progress (March 2017 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>\$1,045.7 million</i>	Amount of Expenditures at date of this report from Total Project Budget of \$1,578 million
66.3%	Percent Complete based on Expenditures at date of this report
\$8.88 million	Unallocated Contingency remaining
<i>\$76.15 million</i>	Total Project Contingency (allocated and unallocated contingency as reported by CSP)
\$60 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	4Q16	60	60
5	Hold Point 5 – Complete CTS / Tunnels systems inst. April 2018	2Q18	25	25
RSD	PMOC / FTA RSD	4Q19		
CURRENT TOTAL CONTINGENCY \$76.15 Million				



APPENDIX D. TOP PROJECT RISKS

The Project Risk Register was updated in 2016. Top risks *and selected risks that had not been reviewed in several months* were discussed at the April 2017 meeting as noted below.

Top Risks Discussed in the Previous Month:

#52 – The risk of settlement of older utilities above the CTS cross-cut cavern and platform cavern excavations. The ground above and near the excavation is extensively instrumented, and daily meetings are being held to review the recorded data from the instruments. Gate valves have yet to be installed on the water lines above the excavation. These will allow immediate shut-off of water in the event of a failure in one of the lines or ground settlement that could damage the lines and cause a leak. *SFMTA is negotiating the cost of these valves with SFWD.*

#205 – The risk that the prolonged process for approval and execution of CMods results in bad blood between SFMTA and the contractor. CMods are now being processed more quickly and the backlog of unresolved changes is being reduced. SFMTA continues to try and streamline the CMod process. The parties are meeting twice weekly to advance negotiations.

#229 – Risk that acceptance testing takes longer than planned, resulting in delays to the Revenue Service Date (RSD). A more detailed schedule for testing is included in the updated Rail Activation Plan (RAP). *Some testing may be advanced at YBM, as that station will be completed earlier than the other subway stations.*

#230 – Insufficient time for Muni operations involvement in commissioning results in delays and an impact to the RSD. Muni operations and management are reviewing the RAP. CSP staff to confirm that commissioning schedule is sufficient and that Muni can provide required staff.

#232 – *Unable to recover accumulated delays, resulting in late RSD. This risk has occurred and the RSD is very likely to be delayed. This also remains the top risk, as further delays are likely.* Mitigation measures underway were discussed. *A schedule containment workshop will be held in July 2017.*

#234 – This risk that the contractor's proposed alternative Sequential Excavation Method (SEM) excavation method would cause subsidence will continue to be monitored until all SEM operations are completed. Closely related to risk #52. Settlement that is occurring is within the expected range *and compensation grouting is being done to arrest the settlement.*

#238 – This risk is that the Quality Program may be ineffective in processing the nonconformance issues causing schedule impacts. The process of tracking and processing the Non-conformance Reports (NCRs) through improved tracking logs is continuing. The CNCR log is being updated as appropriate. CNCRs are being identified timely and processed appropriately. The rating of this risk has been reduced.

#240 – This risk that unresolved assignment of schedule delay responsibility may lead to increased cost continues. SFMTA and the contractor are working on schedule updates and on

resolution of the causes for schedule delays that have occurred. Efforts continue to focus on how to reduce the accumulated delays. This risk is closely related to #232.

#105 – Risk that delayed availability of station and traction power from PG&E will delay RSD. This risk is low, as SFMTA has made payments to PG&E for the power supplies and installation of the PG&E facilities required for power distribution is underway.

#115 – Risk that the station headwalls leak water, resulting in extra costs for the station contractor. This risk is low, but cannot be retired until all three subway stations have been fully excavated.

#244 – Risk of delays due to coordination of construction with work at 254 4th Street. Coordination is ongoing and the risk of delays is low. Major coordination remaining is for utilities in Clementina Street.

#246 – Risk that design changes are not captured in the as-built record drawings for the project. TPC is doing a good job of preparing as-built drawings as the construction is proceeding. CSP's QA program includes reviews to assure that all changes are captured in the drawings.

#247 – Risk that delayed receipt of FY 2017/2018 federal funding allocation results in construction delays. This risk is low as the latest federal budget includes the planned payments for CSP.

#PR 78 – Risk that delays to other projects cause delays to the CSP RSD. The risk is low, as the current schedules for the other projects indicate that they will be completed well ahead of the start of testing and commissioning for CSP.

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
Testing				
Finalize/update Systems Integration Test (SIT) Plan	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Prepare Schedule for Testing	1/1/2017	TBD	TBD	Initial testing, commissioning, and start-up schedule has been completed.
Finalize Test Procedures	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Conduct System Integrated Testing with trains, including procedures and reports	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Complete Testing Reports	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Operating Plan, Rules, and Training				
Finalize Operating Plan	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Finalize/revise SOPs, manuals, and rulebook as applicable	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Operations Manuals	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Staffing and Operations Plan	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Training of O&M personnel	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Emergency response plan, training, and drills	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Vehicle Maintenance Plan, Equipment, Facilities, and Training				
Rail Fleet Management Plan	TBD	TBD	TBD	

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 Schedules and Procedures	TBD	TBD	TBD	The LRV fleet is being replaced and expanded through a separate project. The CSP requires an expansion of the fleet of four vehicles.
Spare Parts Requirements	TBD	TBD	TBD	The LRV fleet is being replaced and expanded through a separate project. The CSP requires an expansion of the fleet of four vehicles.
Maintenance Manuals	TBD	TBD	TBD	The LRV fleet is being replaced and expanded through a separate project. The CSP requires an expansion of the fleet of four vehicles.
Maintenance Training	TBD	TBD	TBD	The LRV fleet is being replaced and expanded through a separate project. The CSP requires an expansion of the fleet of four vehicles.
Facility and Right-of-way Maintenance Plan, Equipment, Facilities, and Training				
Maintenance Schedules and Procedures	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Spare Parts Requirements	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Maintenance Manuals	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Maintenance Training	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Pre-Revenue Operations				
Finalize and/or update RAP and/or Pre-Revenue Operations Plan	4/2/2015	TBD	TBD	<i>The second draft with additional detail and a schedule for testing and pre-revenue activities has been submitted with the 2017 update of the PMP.</i>
Implement Rail Activation Committee	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Shadow operations	NA	NA	NA	<i>Project will be operated by the established MUNI operations division.</i>

Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT				
Description	Estimated Start Date	Estimated Completion Date	Actual Completion Date	Notes
Develop/revise SSPP & Security Plan (approved by SSO)	<i>Ongoing</i>	<i>10/31/2015</i>	<i>10/31/2015</i>	<i>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.”</i>
FTA Office of Safety & Security Readiness Review	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
PMOC OP-54 Readiness for Revenue Operations Review Report, Phase I	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Conduct Operational Hazard Analysis (OHA) and resolve other hazards/vulnerabilities	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Pre-Revenue Operations	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Public Outreach				
Develop Safety Outreach Plan	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Provide Community Outreach	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Grand Opening Plan	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Construction Close Out				
Close Out of Non-Conformance Reports	Ongoing	<i>09/02/2019</i>	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	12/17/2018	<i>09/02/2019</i>	TBD	Punch list completion expected at final completion of 1300 Contract.
Certificates of Occupancy/Substantial Completion	TBD	<i>06/05/2019</i>	TBD	

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>Safety, Security, and Fire-life Safety Certifications</i>				
Update/Finalize SSMP			2/18/2014	Revision 2 completed.
Finalize and/or update SCIL and SSCP			10/10/2008	Revision 0.
Implement Safety and Security Certification Committee			8/1/2010	Committee meets monthly to review certifiable items.
Implement Fire Life Safety Committee			8/1/2010	
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	09/06/2019	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	09/15/2019		60 days before RSD - Check against latest regulations.
Document Workarounds/Open Items List	TBD	TBD	TBD	
Verify emergency drills, tabletops, training, etc. are completed	TBD	TBD	TBD	
State Safety Oversight (SSO) final certification/signature	TBD	10/24/2019		21 days before RSD - Check against latest regulations.
<i>Third Party and Agency Agreements</i>				
Third Party/Agency Agreements Necessary for Revenue Service	TBD	TBD	TBD	Project is in construction, with RSD 2+ years in the future.
Third Party/Agency Approvals Necessary for Revenue Service	TBD	TBD	TBD	Project is in construction, with RSD 2+ 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
<i>Revenue Service</i>				
Target Revenue Service Date	-	11/14/2019		Current forecast RSD. Recovery schedule to be prepared.
FFGA Revenue Service Date	-	12/23/2018		

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.

LL#	Date	Phase	Category	Subject	Lesson Learned
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 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.

LL#	Date	Phase	Category	Subject	Lesson Learned
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.
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	1-30-14	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	6-30-14	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.

LL#	Date	Phase	Category	Subject	Lesson Learned
17	4-10-15	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. When the safety and structural integrity of a construction site depends on maintain soil conditions with the use of mechanical systems, the site should be continuously staffed or monitoring devices at the site should be continuously monitored from a remote location to assure that the expected soil conditions are maintained.
18	4-10-15	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. The quick action to involve the appropriate parties resulted in satisfactory handling of the artifacts with minimal delays to the construction schedule.

LL#	Date	Phase	Category	Subject	Lesson Learned
19	5-11-15	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. In the future, the latest design information, including submittals and related designer notes, will be used to inspect reinforcing steel prior to concrete placement.
20	9-28-15	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 applications and 4-week look-ahead schedules from the contractor. Lesson learned – 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.

LL#	Date	Phase	Category	Subject	Lesson Learned
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 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. As a result of the pre-planning and assembly of the complex trackwork, the final assembly was completed without the need for field adjustments and in less time than planned. This was an effective approach to mitigate the risks associated with the installation of complex custom track components in an operating transit line.
22	3-1-17	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 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.

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 March 2017.

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
	Current 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	\$3,962,031
	Current Contract Value	\$20,794,581
	Expended to Date	\$20,794,581
	% Expended	100%
	SBE Participation	87%
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.	
Cost:	Original Contract Value	\$233.58 million
	Approved Change Orders	\$8.26 million
	Current Contract Value	\$241.84 million
	Expended to Date	\$234.88 million; \$6.2 million is paid from non-project funds
	% Expended	97.1%
	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	\$7.05 million
	Current Contract Value	\$846.72 million
	Expended to Date	\$472.93 million
	% Expended	55.9%
	SBE Participation	1804%
Schedule:	NTP issued June 17, 2013. Substantial Completion planned February 10, 2018 and <i>forecast June 2019</i> .	
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	\$7,937,601
	% Expended	100.0%
	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	\$34,228,038
	Approved Change Orders	\$1,626,722
	Current Contract Value	\$35,854,760
	Expended to Date	\$35,207,277
	% Expended	98.2%
	SBE Participation	36.7%
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	\$16,822,238
	Approved Change Orders	\$312,814
	Current Contract Value	\$17,232,252
	Expended to Date	\$14,163,416
	% Expended	81.9%
	SBE Participation	26.7%
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	\$58,536,776
	% Expended	68.8%
	SBE Participation	39.7%
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	\$9,669,141
	% Expended	56.5%
	SBE Participation	29.0%
Schedule:		
Issues or Concerns:		