# MONTHLY MONITORING REPORT
## *March 2018*

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

Draft Report Delivered to FTA on April 12, 2018
Final Report Delivered to FTA on April 20, 2018

*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: 3.5 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 expand the LRV fleet and includes options for replacement of the entire fleet. Average weekday boardings are projected to be 43,521 in 2030.

## Project Status

The project has been under construction since February 2010. *At the end of February 2018, the project was 75.3% complete based on expenditures.* The one active construction contract: 1300 Stations and Systems/Trackwork*, was 66.9% complete based on incurred cost.* Substantial completion of this contract was originally scheduled for February 10, 2018, but the latest master program schedule update forecasts substantial completion on June 12, 2019, a delay of 488 days. *SFMTA's most recent update of the program schedule continues to forecast the Revenue Service Date (RSD) on November 22, 2019. This is 331 days later than the required RSD of December 26, 2018 in the Full Funding Grant Agreement (FFGA) and unchanged from the previous forecast. However, construction at the CTS headhouse invert has been delayed due to design changes, and the next schedule update will likely show RSD to be later by up to three weeks.*

*Waterproofing installation is underway in the headhouse and the platform and crossover caverns at CTS. Placement of the invert slab in the headhouse is scheduled to be complete on April 20. Interior wall and floor construction; mechanical, electrical, and plumbing; escalator and elevator work; and final installation of surface utilities continues at YBM and UMS. Track has been laid from the tunnel portal to UMS, and surface street restoration work continues at a slow pace along the surface alignment on 4th Street. SFMTA is working with its Sustainable Streets Division to improve construction efficiency while limiting impacts to users of the transportation network.*

The CSP Program Director left the project on February 1, 2018 as previously announced. *SFMTA reported that interviews of candidates for the Program Director position have been scheduled. New Resident Engineers (RE) are now leading the CTS and UMS work packages for SFMTA.*

**Table 1 - Core Accountability Items**

| **Project Status:** *(as of February 28, 2018)* | | **Original at FFGA:** | **Current Estimate:** |
|---|---|---|---|
| **Cost** | Cost Estimate | $1,578,300,000 | $1,578,300,000 |
| **Contingency** | Unallocated Contingency | $74,722,000 | $9,005,903 |
| | Total Contingency (Including Approved Contract Changes) | $185,500,000 | $*73,938,444* |
| **Schedule** | Revenue Service Date | 12/26/2018 | *11/22/2019 (SFMTA forecast)* |
| **Total Project Percent Complete** | Based on Expenditures | *75.25%* | |
| | Based on Earned Value | *75.55%* | |
| **Major Issues** | **Status** | **Comments/Planned Action** | |
| Schedule Contingency | All schedule contingency has been consumed. | *PMOC review of SFMTA's updated schedule risk assessment is underway.* | |
| Cost Contingency | *Total Contingency is $73.94 million - 15.1% of the remaining work.* | The contingency appears adequate for the current level of project completion. | |
| Technical Capacity and Capability | The Program Director position is being filled on an acting basis. Recruitment underway for permanent replacement and Start-up and Testing Manager. | The PMOC will monitor the agency's progress in recruitment and hiring of needed staff. | |
| **Date of Next Quarterly Meeting:** | | *May 9, 2018* | |

Earned Value (EV): *$1,192,330,772, an increase of $13.94 million from January.*

Planned Value (PV): *$1,513,164,797, a planned increase of $31.07million from January.*

Actual Cost (AC): *$1,187,650,107, an increase of $9.23 million from January.*

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

Schedule Performance Index (SPI): *0.79,* indicating that the amount of work completed is significantly less than planned and the project is behind schedule.

## Contingency

*Cost Contingency*

The total available contingency (approved contingency less approved contract changes) as of April 4, 2018 was $73,938,444, which is above the minimum required contingency of $60 million.

*SFMTA's latest trend summary report estimates a total potential additional cost increase from claims, denied change order requests, and pending changes of $53.37 million, which is $20.57 million less than the available contingency.*

Schedule Contingency

All contingency in the schedule has been consumed, and there is about 11 months of negative float from the baseline schedule. *SFMTA has updated its assessment of schedule risks. The assessment now indicates a 90 percent probability that the RSD will be on or before December 11, 2019. There are significant schedule risks associated with the completion of the Automated Train Control System (ATCS). SFMTA is working with the supplier to obtain an updated, detailed schedule for installation and testing of the ATCS. The PMOC will review the remaining schedule risks once the updated ATCS schedule has been approved by SFMTA.*

## PMOC Observations, Opinions, and Concerns

A reevaluation of required cost and schedule contingencies should be undertaken following completion of excavation and the primary structural support systems at CTS, expected in April 2018.

*The PMOC notes that SFMTA's efforts to reach resolution of disputes with Tutor-Perini Corporation (TPC) regarding schedule delays have been unsuccessful thus far. The PMOC supports the concept of assigning a dedicated claims management team for the 1300 Contract which should allow the RE staff to focus on advancing ongoing construction to avoid further delays and the contract administration staff to execute routine contract changes more quickly.*

The PMOC recommends that SFMTA quickly resolve the ongoing contractual issues regarding the schedule for and management of the Automatic Train Control System (ATCS) to avoid schedule delays. *SFMTA is working with the ATCS contractor to identify scope items to include in a revised contract.* Once the contract actions are completed and an updated ATCS schedule is produced, the PMOC plans to conduct a comprehensive schedule review for the project.

The PMOC notes that work is being delayed by the protracted time taken for Sustainable Streets Division (SSD) review of traffic control plans *(TCP) and by strict limits on the scale of traffic disruptions that will be accepted in TCPs. In the opinion of the PMOC, SFMTA management should work with SSD and CSP management to assure that traffic control requirements appropriately balance the needs of the project and the traveling public. A partnering approach may be effective in addressing TCP issues.*

*The PMOC notes that the potential cost increases for the project in SFMTA's trend summary report remained relatively stable from March to April 2018.* The PMOC continues to note that the forecast for project management costs should be updated to account for higher costs due to the extended duration of the project. Overall cost contingency in the project budget continues to be sufficient to provide reasonable assurance of on-budget completion of the project.

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# A. PROJECT STATUS

## Full Funding Grant Agreement (FFGA)

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

## Design

Design is complete.

## Construction

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

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

***Contract 1252 Tunnel.*** This completed contract included the construction of 1.5 miles of twin tunnels excavated by tunnel boring machines and construction of the tunnel portal, retrieval shaft, and five cross-passages. Final completion has been achieved, and financial close out is underway. *San Francisco Municipal Transportation Agency (SFMTA) is preparing to issue two contract modifications addressing scope changes and resolution of cost impacts to the City.* The cost and schedule impacts to station construction of voids that formed around the tunnel liner during tunnel excavation in the Chinatown (CTS) Station area remain to be resolved. The tunnel contractor and tunnel designer have been tasked with preparing white papers identifying the possible causes of these voids. *The white paper from the tunnel designer has been issued and is under review by SFMTA. The white paper from the contractor continues to be overdue.* SFMTA is holding $850,000 in retainage on the 1252 Contract to cover additional costs that may be claimed by Tutor Perini Corporation (TPC)**.** The 1252 Contract will be closed out after the cost impacts to the 1300 Contract are resolved.

***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 February 2018, the construction of the Stations and Surface, Track, and Systems Contract was 66.94% complete based on cost and 67.65% complete based on the value of completed construction.*

The contractor and SFMTA have been establishing "Big Hairy Audacious Goals" (BHAGs) as a means of encouraging focus and collaboration between the contractor and agency project team members to maintain and enhance schedule performance. The BHAGs are established for critical path and other important activities in the schedule and are defined so as to be difficult to achieve. Thus far, few of the identified BHAGs have been achieved. See Table 5 on Page 15 for the current status of BHAGs. The following paragraphs describe ongoing work for each construction package.

Union Square/Market Street Station (UMS): *Installation of stair 1 and work on the vent shaft walls at the Union Square Garage entrance was scheduled to be complete on April 6. Encasement of permanent walers and struts is continuing in the station box. Scallop walls are being poured on either side of the station box. Completion of the scallop walls will allow track to be placed through the station.* Issues with the structural interfaces between the station walls and the headwalls placed by the tunnel contractor need to be addressed before the final wall sections can be completed. *At the south headwall, SFMTA provided direction to the contractor regarding the interface. At the north headwall, SFMTA and the contractor are in dispute regarding modifications that are needed to the permanent beam at the mezzanine level. SFMTA asserts that the necessary changes are due to non-conforming work by TPC, while TPC insists that SFMTA issue a Contract Modification (CMod) prior to work proceeding. Delays in completing the north headwall work are impacting the schedule for placement of track through UMS, which could in turn delay future systems work in the tunnels. Delays continued for work on the emergency exit stairs at O'Farrell Street, which is now scheduled for completion at the end of April. Final street and sidewalk finishing at the Ellis/Market/Stockton intersection was again delayed. Work remains to be completed on both corners of the Market Street intersection as well as the curb lane of Market Street. Final placement of utilities under Stockton Street between Ellis and O'Farrell is nearing completion, with connections of a new gas line by Pacific Gas and Electric Company (PG&E).*

Chinatown Station (CTS): *At CTS, waterproofing material is being placed in the crosscut, platform, and crossover caverns. Waterproofing protection and rebar are also being placed. The invert slab for the crossover cavern is scheduled to be placed in nine pours between March 28 and April 16. Pours for the invert slab of the south platform cavern will follow, starting on April 24. Meanwhile, the invert for the north platform cavern is scheduled to be complete by April 27. In the headhouse, placement of the invert slab was delayed by a decision to provide extra waterproofing components and by a revision to the design for reinforcing steel. The target date of March 31 for placement of the slab was not achieved, and completion is now forecast on April 20, three weeks later.* ***This delay to work on the program critical path is causing a day-for-day delay to the overall completion date for the program.***

Yerba Buena/Moscone Station (YBM): *Utility work continues to progress slowly at the intersection of 4th Street with Howard Street. Differing site conditions continue to cause delays to the placement of the 36-inch sewer force main at this location. At Howard Street, the 16-inch x 12-inch Auxiliary Water Supply System (AWSS) line is being backfilled. Placement of PG&E power boxes can now proceed, as the location of the penetrations of the slurry wall for the power conduits and coordination with the placement of the under-surface deck for the headhouse have been completed. Water leak repairs at the headhouse invert were reported to be going slowly, with only one crew working.* **The PMOC is concerned that, based on experience at the South Ferry Station in Manhattan, complete repair of the water leaks may be difficult to achieve.** ***Diligent inspection should occur for all critical waterproofing work to assure than the installation meets contract requirements.*** *Installation of electrical equipment will follow completion of the leak repairs. At the upper levels of the headhouse, interior walls and other features are being installed. Preparations are underway for placement of the under-surface deck of the headhouse, which is*

*the primary structural roof. Finishing and Mechanical, Electrical, and Plumbing (M/E/P) work also continues in the station box at all three levels. Elevators 1 and 2 are being installed, with completion scheduled April 20. The contractor reported that changes to the tactile warning strips along the platform edge will cause extra work for forming of the platform terrazzo. The reasons for changes to the warning strips were not disclosed.*

Surface, Track, and Systems (STS): *Very little work is ongoing on the surface section of the alignment on 4th Street. The electrical subcontractor is preparing to pull Muni power cables through conduits along the alignment. Placement of the track slab at 4th and Brannan can proceed once two communications ductbanks and two conduits are relocated by the private utility owners of these facilities. Other street restoration work is on hold pending resolution of SFMTA Sustainable Streets restriction of all street restoration work to weekends only. The contractor is claiming extra costs due to inefficiencies, and SFMTA is seeking a relaxation of the Sustainable Streets Division (SSD) requirements. The possibility of conducting the work over a relatively short, but major traffic shutdown is currently under discussion.* ***In the opinion of the PMOC, SFMTA management should work with SSD and CSP management to assure that traffic control requirements appropriately balance the needs of the project and the traveling public. A partnering approach may be effective in addressing TCP issues.***

*SFMTA has not completed structural design calculations for the planned attachment of Overhead Contact System (OCS) insulating material on the underside of the Interstate 80 (I-80) bridge at 4th and Bryant streets. The calculations are a requirement for the Caltrans Encroachment Permit that is necessary to complete the work across the I-80 off ramp at Bryant Street. SFMTA has initiated the process of removing the contract for the Automatic Train Control System (ATCS) from the 1300 Contract. SFMTA is identifying the scope of work elements to be removed from the 1300 Contract and the necessary additions to the ATCS contract. SFMTA also is working to modify the definition of substantial completion for the 1300 Contract to remove requirements related to the ATCS software and testing. SFMTA expects to receive a detailed schedule of ATCS activities with logic ties to other program work in the coming weeks.* ***In the opinion of the PMOC, until SFMTA has the ATCS schedule, establishing a reliable forecast of the project completion date will not be possible. The PMOC continues to recommend that SFMTA quickly resolve the ongoing contractual issues regarding the schedule for and management of the ATCS to avoid schedule delays.***

*In the tunnel section of the project, track in both tunnels has been installed to UMS. Installation of track through UMS and on to CTS is awaiting completion of the platform-level station walls. Meanwhile, the walkways along the track are being installed in both tunnels working from the portal to the north.*

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

### *Bay Area Rapid Transit (BART)*

SFMTA has received comments on the shop drawings for installation of escalators and elevators at the Ellis Street annex after the contractor paid the required BART permit fees. Work in this area can now proceed.

### *California Department of Transportation (Caltrans)*

SFMTA needs an Encroachment Permit to install electrical and traffic signal equipment at the I-280 off ramp. Permit issuance is pending TCP and design approval.

### *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 (QPRM), including the February 7 QPRM. The FLSC is working to approve items on the certifiable items list for the Stations Contract. SFMTA has expressed concern that CPUC may have insufficient staff to witness the required safety tests for CSP, which could further delay the Revenue Service Date (RSD). The PMOC recommends that this potential risk be monitored in the risk register and mitigation strategies be developed.

### *San Francisco Public Utilities Commission (SFPUC)*

No updates to report.

### *San Francisco Department of Public Works (SFDPW)*

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

### *San Francisco Parks and Recreation Department*

No updates to report.

### *Private Property Owners*

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

### Status of Vehicle Design, Procurement, Testing, and Integration

Vehicle design and fabrication is underway by Siemens Corporation for 4 Light Rail Vehicles (LRVs) for the Central Subway, 24 LRVs for near-term fleet expansion (4 for service to the new Warriors Arena), and 151 LRVs for fleet replacement. Options for up to 85 additional vehicles are available for fleet expansion. Production and delivery of the vehicles continues on or ahead of schedule. SFMTA has identified which of the new cars will be assigned as being funded by the CSP and will provide information on the date they are placed into revenue services for ongoing tracking of these assets in which the federal government has a financial interest.

### Real Estate

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

### Labor Relations and Policies

Appendix G of the Project Monthly Report details the Small Business Enterprise (SBE) goals and actual participation on each contract as of December 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 applied for a waiver of Buy America requirements for this equipment, which is under review by FTA.

## B. PROJECT MANAGEMENT PLAN AND SUB-PLAN IMPLEMENTATION

### Project Management Plan (PMP)

*SFMTA delivered an update of the PMP in April 2018. The PMOC will be conducting a limited review of the PMP in the coming weeks.*

### Environmental Assessment/Mitigation Plan/Archaeological Plans

*The PMOC received the Third Quarter 2017 Mitigation Monitoring Reporting Program (MMRP) update from SFMTA on January 31, 2018. The PMOC will conduct a limited review of this document in the coming weeks.*

### Real Estate Acquisition Management Plan (RAMP)

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

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

See section F.

### Safety and Security Management Plan (SSMP)

See section H.

### Risk and Contingency Management Plan (RCMP)

See section I.

## C. PROJECT MANAGEMENT CAPABILITY AND CAPACITY

### Agency Staff

The CSP Program Director, John Funghi, left the project effective February 1, 2018. SFMTA announced that Albert Hoe, the Deputy Program Director has been appointed as the Acting Program Director. Mr. Funghi plans to be available for approximately 8 hours per week to assist with the resolution of outstanding contract issues with TPC. He also has been attending Dispute Review Board (DRB) hearings and key meetings addressing contractual issues between SFMTA and TPC. *SFMTA reported that interviews of candidates for the Program Director position have been scheduled.*

New Resident Engineers (RE) have been assigned to the CTS, UMS, and YBM work packages. The new REs demonstrated good control of recent work package status meetings attended by the PMOC. SFMTA's efforts to hire a Start-up and Testing Manager were delayed while the team reached out to the SFMTA operations department for input on the position description. CSP and SFMTA operations management will jointly review applicants and agree on the decision on who to hire for this key project role. **The PMOC supports engaging SFMTA operations management in the hiring process for the Start-up and Testing Manager, who will be responsible for assuring that operating needs are addressed in the testing, commissioning, training, and start-up activities of the project.**

**The PMOC has been reporting for several months that the REs have been challenged to address the high volume of open contractor change requests requiring merit determination, completion of negotiations for merited changes, and completion of the necessary paperwork to execute changes that have been negotiated.** *As of February 28, only three new contract modifications with a net value of $238,000 had been issued since September 2017.* SFMTA reported that both the agency and contractor had been focusing on preparations for DRB hearings and had been unable to address other more routine contract issues. **This is further evidence that both the contractor and SFMTA have insufficient staff resources to address the large number of contract issues affecting the project. The PMOC supports the concept of assigning dedicated contract change management resources to the 1300 Contract.** The CSP organization chart now shows full-time CMod support staff members for each of the four work packages.

SFMTA reported that it is continuing recruitment efforts for other open management positions. SFMTA further reported that execution of agreed contract changes has been hampered by

difficulties associated with the City of San Francisco's change to a new financial accounting system. Budgets for CSP project components are not accurately reflected in the new system, causing difficulties in implementing contract changes. The PMOC will continue to monitor the SFMTA's progress in clearing the backlog of pending change orders.

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

*The most recent versions of the Trend Log and Trend Summary documents are dated April 4, 2018. The Trend Summary indicates that 78 contract modifications had been executed for the 1300 Contract. The total value of executed CMods was $8,359,906 (no change since February). The NOPC Log, dated April 4, 2018,* indicates that there are now *86 potential claims (six additional since February).* The Claim Log shows that 65 of these potential claims have been certified and submitted by the contractor and two have been resolved and will be addressed through contract modifications. The submitted claims total $30.25 million in extra costs, which is $270,000 higher than in February.

*Note that Tables 2 and 3 reflect the project status as of the end of February 2018 as reported in SFMTA's latest Monthly Progress Report (MPR)*, and show substantially different values for potential contract changes because of the differing data dates and because pending contract changes in Tables 2 and 3 include only SFMTA-initiated PCCs and contractor CORs that have been determined to have merit. Claims and denied CORs are not included in the cost forecast in Tables 2 and 3.

### Project Cost (*as of February 28, 2018*)

Cost estimate: $1.5783 billion.

Total contingency: $73.94 million (minimum contingency is $60 million), $238,000 less than January.

Actual Cost (AC): *$1,187,650,107, an increase of $9.23 million from January (75.25% of the total project budget)*.

Current funding level: $1,479,780,000 (93.6% of the total project budget).

Earned Value (EV): *$1,192,330,772, an increase of $13.94 million from January (75.55% of project value earned).*

Cost Performance Index (CPI): *1.00.*

CPI is a measure of cost efficiency on a project. It is the ratio of EV to AC. A CPI equal to or greater than 1.0 indicates a cost underrun, and a value of less than 1.0 indicates a trend towards a cost overrun. A value of 0.9 or greater is considered acceptable, considering the margin of error in estimating the value of completed work.

## Project Cost Trends

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

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 *54%* of the potential left to spend for Contract 1252. SFMTA's latest forecast for close out of Contract 1252 indicates that additional credits will be extended by the contractor leading to a reduction in final contract value**. It appears likely that additional contingency from Contract 1252 will be available for reallocation to unallocated contingency.**

*In the February MPR, SFMTA estimates the total cost impact of potential changes to the 1300 Contract at $22.56 million, compared with $24.65 million in January*, *a decrease of about $2.1 million. After potential changes were accounted for, $9.08 million in allocated contingency remained for Contract 1300 at the end of January.* **The resulting contingency of 3.2% of potential remaining spending on the 1300 Contract after potential changes are accounted for is likely insufficient, and additional contingency will probably need to be allocated to this contract prior to completion. The available unallocated contingency and excess contingency for other elements of the program are very likely sufficient to allow on-budget completion of the CSP**.

Table 3 shows the overall budget, trends, and contingency status for the entire Central Subway program. *The Budget Forecast Variance, which reflects the total remaining contingency after the cost of trends is accounted for, is 15.1% of the potential remaining spending.* In the opinion of the PMOC, this contingency should be sufficient to provide a high level of confidence in an on-budget completion of the project.

## Table 2 - Contract, Budget, and Trends for Active Construction Projects[1]

| | 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 | *8,359,906* |
| **Current Contract (1252 does not include non-project costs)** | 235,078,785 | *848,036,306* |
| **Remaining Contingency** | 834,715 | *31,640,094* |
| **Potential Changes (PCCs and merited CORs)** | 20,000 | *22,564,939* |
| **Estimate at Completion** | 235,098,785 | *870,601,245* |
| **Contingency Less Trends** | 814,715 | *9,075,155* |
| **Spent to Date** | 233,589,322 | *588,892,734* |
| **Potential Left to Spend** | 1,509,463 | *281,708,511* |
| **Contingency Less Trends as % of Potential Cost to Complete** | 54.0% | *3.2%* |

[1] *As reported in the February 2018* Central Subway Project Monthly Progress Report – SFMTA (reformatted by the PMOC).

## Table 3 - Budget and Contingency Status for Central Subway Project

| SFMTA Central Subway Project, Budget, Costs and EAC by SCC January 31, 2018 | | 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%** | | | **267,661,861** | 94% | **17,566,018** | | | |
| 10.02 | Guideway: At Grade, Semi-exclusive | 2,395,143 | 464,857 | 2,860,000 | 19% | | | 1,925,000 | 67% | 935,000 | | | |
| 10.06 | Guideway: Underground cut and cover | 74,407,195 | (4,590,788) | 69,816,407 | -6% | | | 63,654,512 | 91% | 6,161,895 | | | |
| 10.07 | Guideway: Underground tunnel | 224,933,257 | (23,592,511) | 201,340,746 | -10% | | | 192,685,433 | 96% | 8,655,313 | | | |
| 10.09 | Track: Direct fixation | 7,293,157 | (532,068) | 6,761,089 | -7% | | | 5,797,916 | 86% | 963,173 | | | |
| 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% | | | 3,599,000 | 81% | 850,637 | | | |
| **20** | **Stations, Stops, Terminals, Intermodal** | **432,698,735** | **153,715,820** | **586,414,555** | **36%** | | | **384,286,124** | 66% | **202,128,431** | | | |
| 20.01 | At-grade station | 774,913 | 6,827,944 | 7,602,857 | 881% | | | 1,858,052 | 24% | 5,744,805 | | | |
| 20.02 | Aerial station, stop, shelter, mall, terminal, platform | | 2,653,209 | 2,653,209 | NA | | | - | 0% | 2,653,209 | | | |
| 20.03 | Underground station | 412,084,888 | 142,371,764 | 554,456,652 | 35% | | | 375,270,111 | 68% | 179,186,541 | | | |
| 20.07 | Elevators, escalators | 19,838,934 | 1,862,903 | 21,701,837 | 9% | | | 7,157,961 | 33% | 14,543,876 | | | |
| **40** | **Sitework and Special Conditions** | **232,551,627** | **(17,612,885)** | **214,938,742** | **-8%** | | | **203,180,597** | **95%** | **11,758,145** | | | |
| 40.01 | Demolition, clearing, earthwork | 8,887,028 | 3,468,587 | 12,355,615 | 39% | | | 12,078,515 | 98% | 277,100 | | | |
| 40.02 | Site utilities, utility relocation | 29,562,587 | 31,505,451 | 61,068,038 | 107% | | | 67,055,649 | 110% | (5,987,611) | | | |
| 40.03 | Haz. Material, contam'd soli removal, ground water treatment | 2,957,442 | 4,576,686 | 7,534,128 | 155% | | | 5,509,570 | 73% | 2,024,558 | | | |
| 40.04 | Environmental mitigation | 3,146,216 | (2,023,317) | 1,122,899 | -64% | | | 565,590 | 50% | 557,309 | | | |
| 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% | | | 3,135,333 | 32% | 6,655,66 | | | |
| 40.07 | Automobile, van, bus accessways, including roads and parking lots | 11,919,550 | (5,340,451) | 6,579,099 | -45% | | | 4,957,283 | 75% | 1,62 | | | |
| 40.08 | Temporary facilities and other construction indirect costs | 158,790,820 | (45,009,283) | 113,781,537 | -28% | | | 107,172,226 | 94% | 6,609 | | | |
| **50** | **Systems** | **108,429,774** | **(13,087,948)** | **95,341,826** | **-12%** | | | **30,894,358** | **32%** | **64,447,46** | | | |
| 50.01 | Train control and signals | 37,447,116 | (9,319,177) | 28,127,939 | -25% | | | 7,502,459 | 27% | 20,625,480 | | | |
| 50.02 | Traffic signals and crossing protection | 3,013,232 | 9,549,297 | 12,562,529 | 317% | | | 11,093,412 | 88% | 1,469,117 | | | |
| 50.03 | Traction power supply | 20,379,634 | 1,085,439 | 21,465,073 | 5% | | | 9,791,727 | 46% | 11,673,346 | | | |
| 50.04 | Traction power distribution | 16,239,951 | (3,798,838) | 12,441,113 | -23% | | | 1,695,354 | 14% | 10,745,759 | | | |
| 50.05 | Communications | 28,545,305 | (16,514,719) | 12,030,586 | -58% | | | 658,553 | 5% | 11,372,033 | | | |
| 50.06 | Fare collection system and equipment | 2,804,536 | 3,295,464 | 6,100,000 | 118% | | | 152,852 | 3% | 5,947,148 | | | |
| 50.07 | Central Control | | 2,614,586 | 2,614,586 | NA | | | 1 | 0% | 2,614,585 | | | |
| **Subtotal (10 - 50)** | | **1,089,606,217** | **92,316,785** | **1,181,923,002** | **8%** | **1,148,288,193** | **33,634,809** | **886,022,940** | **75%** | **295,900,062** | **284,850,193** | **1,170,873,133** | **11,049,869** |
| **60** | **ROW, Land, Existing Improvements** | **37,398,029** | **(5,151,708)** | **32,246,321** | **-14%** | **32,246,321** | **-** | **30,732,020** | **95%** | **1,514,301** | **1,514,301** | **32,246,321** | **-** |
| 60.01 | Purchase or lease of real estate | 33,798,029 | (3,732,219) | 30,065,810 | -11% | 30,065,810 | - | 28,322,590 | 94% | 1,743,220 | 1,514,301 | 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** | **10,598,347** | **40%** | **15,787,306** | **2,710,653** | **13,309,000** | **13,076,653** |
| 70.01 | Light Rail Vehicles | 26,385,653 | - | 26,385,653 | 0% | 13,309,000 | 13,076,653 | 10,598,347 | 40% | 15,787,306 | 2,710,653 | 13,309,000 | 13,076,653 |
| **80** | **Professional Services** | **361,568,360** | **(32,829,239)** | **328,739,121** | **-9%** | **310,518,042** | **18,221,079** | **260,296,802** | **79%** | **68,442,319** | **50,221,240** | **310,518,042** | **18,221,079** |
| 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 | | 61,318,331 | - |
| 80.03 | Project Management for Design and Construction | 191,025,800 | (88,107,410) | 102,918,390 | -46% | 89,012,545 | 13,905,845 | 69,793,632 | 68% | 33,124,758 | 24,313,978 | 94,107,610 | 8,810,780 |
| 80.04 | Construction Administration and Management | 15,495,521 | 78,558,172 | 94,053,693 | 507% | 91,096,881 | 2,956,812 | 71,405,448 | 76% | 22,648,245 | 14,596,367 | 86,001,815 | 8,051,878 |
| 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 | 78,823 | 6,419,019 | 380,981 |
| 80.06 | Legal, Permits, Review Fees by Other Agencies | 7,242,340 | 970,264 | 8,212,604 | 13% | 8,212,604 | - | 4,497,714 | 55% | 3,714,890 | 3,254,766 | 7,752,480 | 460,124 |
| 80.07 | Surveys, Testing, Investigation, Inspection | 234,036 | 699,064 | 933,100 | 299% | 933,100 | - | 857,829 | 92% | 75,271 | 22,993 | 880,822 | 52,278 |
| 80.08 | Start up | 8,400,329 | (100,000) | 8,300,329 | -1% | 6,941,907 | 1,358,422 | - | 0% | 8,300,329 | 7,835,290 | 7,835,290 | 465,039 |
| **Subtotal (10 - 80)** | | **1,514,958,258** | **54,335,839** | **1,569,294,097** | **4%** | **1,504,361,556** | **64,932,541** | **1,187,650,109** | **76%** | **381,643,988** | **339,296,387** | **1,526,946,496** | **42,347,601** |
| 90 | Unallocated Contingency | 63,341,742 | (54,335,839) | 9,005,903 | -86% | | 9,005,903 | | 0% | 9,005,903 | | | 9,005,903 |
| **Total Project Costs (10 - 100)** | | **1,578,300,000** | **-** | **1,578,300,000** | **0%** | | **73,938,444** | **1,187,650,109** | **75%** | **390,649,891** | **339,296,387** | **1,526,946,496** | **51,353,504** |

SCC Breakdown of Forecast Construction Costs Not Available

[2]Data reported in the *February 2018* Central Subway Project Monthly Progress Report – SFMTA (reformatted by the PMOC).

## Change Order Control

SFMTA continues to estimate that CMods with a net increase in contract value of only $20,000 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 infrastructure projects.**

SFMTA is maintaining its management tools for tracking potential contract changes for the 1300 Contract. *The latest CN1300 Trend Summary is dated April 4, 2018. This report shows that 78 contract modifications have been approved for a net increase in the contract value of $8,359,906, which is unchanged from March 7. CORs (generated by the contractor) that have been determined to have merit and PCCs (generated by SFMTA) have a combined potential cost impact of $19.83 million in increased contract value, slightly higher than on March 7, 2018. SFMTA expects to settle the outstanding CORs for less than the overall cost currently claimed by the contractor.* SFMTA also expects to receive $6.00 million in non-project funds to cover the cost of these pending contract changes. *The expected net impact of the CORs and PCCs on the potential project cost is $13.83 million.*

*An additional 778 items are being tracked in the Trend Log. Of these, SFMTA judged 385 items to be without merit and denied them. A further 309 items have been voided and are carried at no cost. There are 84 items covered by certified claims and NOPCs by the contractor ($31.51 million total exposure),* and 15 items are "open" or "new" and awaiting a determination of merit.

*The potential exposure of the project to additional costs from the denied items, NOPCs, claims, and open items is $39.54 million, which, when added to the $13.83 million in increased project costs from merited contract changes, yields a possible exposure of the project to additional costs for the 1300 Contract of $53.37 million.* This compares to the remaining contingency for the project of $73.94 million. **In the opinion of the PMOC, the available cost contingency for the CSP remains sufficient to address potential cost increases.**

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

1. # 24 - Change to grade 50 steel from specified grade 70 steel (due to availability issues) - $572,884
2. # 36 - Extra trucking costs for contaminated soil at CTS - $2,274,225
3. # 39 - Harder rock than anticipated for CTS slurry wall excavation - $1,880,379
4. # 61 - Delays to installation of tangent piles at UMS - $1,082,380
5. # 160 - Conflicting duct bank at UMS - $581,837
6. # 176 - UMS Garage underpinning requirements - $732,157
7. # 192 - 12-inch waterline at UMS, added scope - $336,236
8. # 239 - Changes in construction sequence for UMS Garage - $500,000

9. # 246 - UMS art glass installation requirements - $690,017
10. # 272 - Obstructions to jet grout placement at UMS - $2,060,001
11. # 341 - Change in track switch machine manufacturer at STS - $347,670
12. # 399 - Additional monitoring instruments at CTS - $429,777
13. # 466 - Extra work to prepare existing tunnel - $431,423
14. # 498 - Additional traffic control requirements at 4th and King - $500,001
15. # 524 - Changed requirements for pre-loading of UMS concourse level struts - $1,319,593
16. # 526 - Incomplete interface design at STS - $300,001
17. # 528 - Additional traffic control requirements for STS work package - $1,032,302
18. # 537 - Cost of changes to the design of CTS to accommodate the plaza requested by the community - $4,500,001 (paid from non-project funds)
19. # 543 - Change in construction sequence at CTS - $250,001
20. # 580 - Missing conduit between manholes at UMS - $250,001
21. # 636 - Changes in emergency vent design (all stations) - $500,001
22. # 644 - Contractor-claimed change in contract requirements for pre-loading permanent struts at UMS - $1,853,352
23. # 695 - Change in scope for slip-lining of 78-inch sewer on 4th Street - $800,016
24. # 715 - Soil nail and shotcrete wall changes in Union Square Garage - $1,365,378
25. # 840 - Change in drain piping details at UMS - $332,252
26. # 942 - Change in ATCS for reverse running - $400,000
27. # 968 - Design changes for UMS vertical drainage slots - $603,910
28. # 1022 - Claim for extra costs and time due to extremely hard ground claimed by TPC during the coring for the Sequential Excavation Method (SEM) mining work - $862,720
29. # 1032 - Escalator raceways at UMS - $492,065
30. # 1099 - Extra costs for SEM excavation at CTS due to tunnel segments being 5 feet long - $4,404,329
31. # 1117 - Extra costs due to concrete obstruction at CTS south platform cavern - $583,623
32. # 1175 - Time impacts due to power pole conflict during demolition at CTS - $3,516,164
33. # 1211 - Time impacts from extended submittal reviews and substitution request procedures - $3,021,262
34. # 1217 - Claimed delays to SEM work at the platform invert due to compensation grout exclusion zone requirements in the contract specifications - $900,889

35. # 1276 - Estimated extra costs of proposed scope increase to provide sidewalk bulb-outs at 4th and Bryant and 4th and Harrison - $1,500,000 (paid from non-project funds)
36. # 1299 - Claimed extra costs for a schedule delay to the train control subcontract - $2,000,001
37. # 1311- Claimed extra costs for delays to the CTS south platform center drift excavation due to restrictions caused by compensation grouting - $675,952
38. # 1373 - Extra costs for jet grouting complications at Macy's basement at UMS - $500,001
39. # 1378 - General claimed extra costs for SEM work at CTS - $5,457,322
40. # 1424 - Extra work due to changes in form-savers and couplers at roof to wall connection at YBM - $250,001
41. # 1479 - Large volume of water inflow at end of probe - $300,000
42. # 1571 - Increase in allowance for DRB costs - $250,000

**The PMOC notes that there were no new trends with costs in excess of $250,000 in the current month.**

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

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

## Funding

Federal, state, and local project funding and expenditures are shown in Table 4. The awarded funding now represents 93.8% of the project budget.

**Table 4 - Project Funding**

| Source | Committed ($1,000) | Awarded ($1,000) |
|---|---|---|
| **Federal** | | |
| New Starts | 942,200 | 919,182 |
| Congestion Mitigation | 41,025 | 41,025 |
| *Federal Subtotal* | 983,225 | 960,207 |
| **State** | | |
| 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 |
| *State Subtotal* | 471,100 | 395,598 |
| **Local** | | |
| Prop. K Sales Tax | 123,975 | 123,975 |
| *Local Subtotal* | 123,975 | 123,975 |
| **Project Total:** | **1,578,300** | **1,479,780** |

## E. PROJECT SCHEDULE STATUS

*SFMTA prepared an update of the master program schedule in March representing progress on the project through February 2018.* SFMTA continues to reject schedule updates from the contractor. SFMTA has directed the contractor to make corrections to the schedule logic, but the contractor has not complied with this direction. As a result, the schedule forecasts for the project are based on SFMTA's version of the schedule.

As of the end of February 2018, the project was 331 days late, based on the projected RSD of November 22, 2019. The projected substantial completion date for the 1300 Contract is now forecast on June 12, 2019, which is 488 days later than the original date (February 9, 2018). The latest schedule update indicates no change in the projected substantial completion date or the forecast RSD. An established schedule BHAG to complete the CTS headhouse invert slab by March 31 was missed and will likely be three or more weeks late. ***A similar delay in the forecast RSD can be anticipated in SFMTA's next monthly progress report.*** *The delay was caused by the addition of waterproofing features at CTS to provide additional protection from water leaks and changes to the design of reinforcing steel in the CTS headhouse invert slab. The modified waterproofing system was motivated by the leaks experienced at YBM.*

Major delay claims and NOPCs by TPC for CTS and the other work packages are pending resolution. SFMTA and TPC have been addressing the claims through the DRB process and executive level meetings. The schedule for installation and testing of the ATCS is the subject of major delay claims, and it is uncertain how delays to the ATCS work could impact the project critical path. SFMTA has requested an updated schedule from the train control supplier, which has not been received. Contractual issues with TPC are causing difficulty in coordination and management of the ATCS work. SFMTA informed TPC of its intent to de-assign the ATCS work from the 1300 Contract. *SFMTA has been working with the ATCS contractor, Thales, to identify scope items to be added to Thales' work as part of the de-assignment. SFMTA also is identifying*

*changes in the definition of substantial completion for the 1300 Contract to recognize that there will be no responsibilities relative to ATCS software and testing after the de-assignment is implemented. SFMTA also reported that it expects to receive a detailed schedule for ATCS work from Thales in the coming weeks and a definition of what work in the stations and tunnels needs to be completed in order for Thales to begin testing its systems.* **The PMOC encourages SFMTA to quickly resolve the ongoing contractual issues regarding the schedule for and management of the ATCS to avoid schedule delays.**

DRB hearings have been conducted to address several major delay claims by the contractor. DRB opinions have been issued for some of the claims, and SFMTA is issuing CMods that extend the contract substantial completion date by 84 days, with extended contract overhead allowed for a portion of the days, consistent with the DRB findings with regard to schedule. *TPC is disputing the DRB findings and may file claims for additional compensation above the amounts suggested by the DRB.*

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

SFMTA and TPC have been establishing BHAGs as a way to focus the project team's attention on advancing project work and to encourage teamwork among SFMTA and TPC staff to removing barriers to completion of the work.

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

**Table 5 - Interim BHAGs for Construction Progress**

| Milestone | Target Date | Actual Date | *Status* |
|---|---|---|---|
| **CTS** | | | |
| *Complete headhouse invert* | *3/31/2018* | *TBD* | *Completion forecast in late April* |
| *Complete cavern final lining* | *9/1/2018* | *TBD* | *Waterproofing started on all cavern areas* |
| *Complete all concrete* | *12/31/2018* | *TBD* | |
| **UMS** | | | |
| *Complete roadway restoration:* | | | |
| • *Geary/Stockton* | *2/14/2018* | *2/28/2018* | *Complete* |
| • *O'Farrell/Stockton* | *3/15/2018* | *TBD* | *Running late – April likely* |
| • *Ellis/Market* | *3/1/2018* | *TBD* | *Running late – date uncertain* |
| *Closure of roof openings:* | | | |
| • *1A* | *5/1/2018* | *2/2018* | *Completed Early* |
| • *3B* | *8/11/2018* | *TBD* | *Utilities need to be completed* |
| *Stockton Street open to traffic from O'Farrell to Ellis* | *5/1/18* | *TBD* | *Area now to be used for construction staging. Date uncertain* |
| **YBM** | | | |
| *All station finishes complete* | *9/21/2018* | *TBD* | *Need interim milestones to track progress* |

| Milestone | Target Date | Actual Date | *Status* |
|---|---|---|---|
| **STS** | | | |
| *Complete track installation and street work on 4th Street* | *3/31/2018* | *TBD* | *Will not be met. No work underway* |
| *Surface signal design complete* | *2/20/2018* | *TBD* | |
| *Track to CTS* | *6/1/2018* | *TBD* | *Delayed by structural work at UMS* |
| *Tunnel walkway to UMS* | *4/1/2018* | *TBD* | *Late. Completion expected in April* |

TBD: To Be Determined

**In the opinion of the PMOC, the current BHAGs are meaningful milestones representing key elements of work for each package. Some of the BHAGs are far in the future and interim milestones will need to be set to assess progress toward achievement. To improve the effectiveness of the BHAGs in driving schedule performance, the PMOC recommends that the status of BHAGs be discussed at each work package status.**

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

1. Review and confirm schedule for procurement of ATCS hardware, software, and testing. The ATCS supplier is preparing an update of its schedule, which is pending. SFMTA is implementing contract actions that will give it more direct control over the ATCS work.
2. Conduct a risk assessment to identify a reasonable range for the RSD recognizing the schedule risks. *The PMOC met with SFMTA to review the current status of the risk analysis. SFMTA completed refinements to the analysis and provided results of the work in April. SFMTA has concluded that it will continue to forecast RSD in December 2019. The PMOC plans to assess SFMTA's schedule risk analysis after the updated schedule for ATCS work is delivered.*
3. If SFMTA intends to pursue a Revenue Service Demonstration, prepare a plan that identifies the work that must be complete in order to start such a demonstration. Identify a range of dates by which the required work is likely to be complete. SFMTA does intend to pursue a Revenue Service Demonstration and is identifying what work will need to be complete, including staff training, to implement such a demonstration. SFMTA has initiated discussion with Muni operations on the requirements for the potential demonstration.

**The PMOC supports SFMTA's planned approach to identifying a range for the RSD for the project.**

## Project Schedule Data

Earned Value (EV): *$1,192,330,772, an increase of $13.94 million from January.*

Planned Value (PV): *$1,513,164,797, a planned increase of $31.07 million from January.*

*The PMOC notes that the planned earned value curve had an unusually high planned value for February that was likely associated with the planned acceptance of a major systems element of the program. Going forward the planned earned value for each month should be substantially lower because the baseline schedule projected Substantial Completion in February 2018. Actual earned value each month should generally exceed the planned earned value for the month for the remainder of the project.*

Schedule Performance Index (SPI): *0.79*. SPI is a measure of schedule efficiency on a project. It is the ratio of earned value to planned value. An SPI equal to or greater than 1.0 indicates more work was completed than planned and a value of less than 1.0 indicates less work was completed than planned. A value of equal to or greater than 0.9 reflects satisfactory performance, considering the margin of error in estimating both earned value and planned value. The current value of *0.79* 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:<br>(Utility Relocation Contract) | February 9, 2010 (A) |
| Tunnel excavation complete (hole through): | June 2, 2014 (SB); June 11, 2014 (NB) (A) |
| Cross passages complete: | December 20, 2014 (P); April 15, 2015 (A) |
| Tunneling substantial completion: | April 15, 2015 (A) |
| Station construction Notice to Proceed (NTP): | June 17, 2013 (A) |
| Station construction substantial completion: | February 24, 2018 (P); June 12, 2019 (F) |
| RSD: | December 26, 2018 (P); November 22, 2019 (F) |

Schedule Contingency Management criteria were developed from the FTA Risk Assessment prior to entry into Final Design (FD). Minimum schedule contingency levels at various project milestones or "Hold Points" were agreed to with SFMTA at Risk Workshop #4, held in 2009. The FTA recommended schedule contingency for the current stage of the project is 6.0 months. As noted above, the current schedule reflects about 11 months of negative buffer float. *Once the placement of the invert slab at the CTS headhouse is complete, the recommended minimum schedule contingency will decline to four months.*

## Critical Path Summary *(Baseline Schedule)*

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

CTS SEM and Install Supports (underway)
CTS Headhouse Structural Concrete/Remove Bracing
CTS Install M/E/P Equipment
CTS Start-up and Testing
CTS P-1254R Commissioning of Station
Safety and Security Certification/Pre-Revenue Activities
RSD on December 26, 2018 (currently forecast *November 22, 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 Stockton Street between O'Farrell Street and Ellis Street*
- *Complete street and sidewalk paving and traffic signal work at the Ellis/Stockton/Market Street intersection*
- Complete emergency exit stairs at O'Farrell Street
- *Complete street and sidewalk restoration at the Stockton Street/O'Farrell Street intersection*
- Continue exterior finishing work at the plaza level of the Union Square Garage and the north entrance
- Continue below-grade construction in the north concourse fan plant
- Continue encasement of permanent walers and placement of interior walls in the main station box
- Install elevator in the BART annex
- Continue construction of interior walls in the south concourse

*CTS*

- *Completion of waterproofing in the station and crossover caverns and the headhouse*
- Start placement of final linings in the crossover and platform caverns
- Place the headhouse invert slab
- *Start bottom-up construction of the headhouse interior walls and floors*
- Continue construction of final lining for emergency exit at north end of station

*YBM*

- *Repair groundwater leaks in the headhouse at the invert level*
- Install mechanical and electrical equipment at the invert level of the headhouse
- Remove temporary struts and shoring at the mezzanine level of the headhouse
- Install shoring and complete placement of the headhouse undersurface deck
- Continue construction of stairs within the station box and emergency egress stairs
- Continue M/E/P rough-in and interior work on the mezzanine and concourse levels
- Continue finishes work at the platform level
- Continue utility work at 4th and Howard Street and 4th and Folsom Street intersections above the station box
- Install escalators and elevators

*STS*

- *Prepare a comprehensive plan for traffic control and construction staging for completion of street restoration work along 4th Street south of I-80.*
- *Coordinate completion of private utility work along 4th Street*
- *Obtain Encroachment Permit from Caltrans for construction in the I-80 ramp/Bryant Street area*
- *Plan for construction of the trackway and installation of track along 4th Street*
- Install track from YBM through UMS and on toward CTS
- Construct tunnel walkways
- Continue construction of surface level station at Brannan Street
- *De-assign ATCS subcontract work from the 1300 Contract and prepare detailed schedule for ATCS completion*
- *Conduct field inspection of 4th and King switch control equipment to determine design requirements for advancing final switch and signal installation*

The PMOC expects to attend the following meetings:

- *Weekly Management (May 7, June 11, and July 9, 2018)*
- *Weekly Contract 1300 Construction Progress Meetings (May 8/9, June 12/13, and July 10/11, 2018)*
- *Weekly Configuration Management Board (CMB) (May 9, June 13, and July 11, 2018)*
- *CSP PMOC Status Meetings (May 8, June 5, and July 10, 2018)*
- *CSP Risk Management Meeting (May 8, June 5, and July 10, 2018)*

- *FTA/QPRM (August 2, 2018)*

# F. QUALITY ASSURANCE AND QUALITY CONTROL

## QA/QC Plan Implementation

The 1300 contractor's staff includes a Contractor's Quality Manager (CQM), who reports to the Contractor's Management at an organization level superior to the contractor's Project Manager. The CQM is provided by a subcontractor. The reporting structure is to provide the CQM with direct access to the contractor's Principal Officers. A Contractor Non-conformance Report (CNCR) Log for identifying, correcting, documenting, and controlling non-conformances is maintained by the contractor and reviewed at weekly status meetings for each work package. Subsequent work may not progress for work that is the subject of a Corrective Action Request (CAR) until conditions averse to quality are corrected. In the event that the contractor does not issue a CNCR, SFMTA may issue a Non-conformance Notice (NCN) where non-conforming work is identified by SFMTA's quality assurance staff.

The quality concerns for the 1300 Stations Contract identified in the SFMTA January monthly report included issues identified in the previous month including:

- As is typical to similar projects, work performed prior to receipt of approval status of required submittals/Requests for Information (RFI) remains a potential area of concern.
- Also as is typical, timely identification and response to construction problems such as too little concrete cover for reinforcing steel due to close proximity of adjacent objects remains a challenge.
- Schedule compression demands are disrupting RE and design staff priorities. *Quality has not been affected to date, but the concern remains.*

*The SFMTA Quality Assurance Manager (QAM) continues to conduct surveillance of quality control related to the water leaks that have appeared in the YBM station. The surveillance has not yet identified any evidence that non-conforming work is responsible for the leaks.* At the same time, the designer insists that the design is sufficient to prevent ground water intrusion. As a result of the leaks at YBM, SFMTA questioned the designer about how the waterproofing at CTS could be enhanced. The designer responded that although the CTS design is sufficient, a system of pre-installed grout injection pipes would enhance the ability to repair any leaks that might arise while minimizing delays to follow-on work. SFMTA is considering whether to adopt the design refinement. **The PMOC continues to recommend that the CSP management team assess the impact that schedule acceleration may be having on the quality program and make necessary adjustments to assure the effectiveness of the quality program.**

*As of March 29, 2018, TPC's Quality Manager had filed 354 CNCRs (eight new since the last report). Ten new items were under review, nine other items had responses identified but not yet approved, the proposed responses to 13 items were disapproved, and 27 items had approved responses that were not yet implemented. In addition, 257 items were closed (one more than on February 28) and 38 items had been voided.*

## G. AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE

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

## H. SAFETY AND SECURITY

### Safety and Security Management Plan

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

### Fire and Life Safety/Safety and Security Issues

The Construction Specification Conformance Checklists have been completed and approved for all construction packages. In September 2013, the CPUC staff began attending monthly as-built meetings to review the completed items. All items related to the tunnel construction have been certified and accepted by SFMTA's safety staff. The certification work was started to address the station construction items in 2016. *As of April 2, 2018, 231 of the 1660 items on the Safety and Security Conformance Checklist were approved and 19 items required follow-up responses from the SFMTA construction team.* 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. *There was one lost-time incident in the month of February 2018 involving the construction elevator. TPC had a safety stand-down immediately after the incident to review safety procedures for elevator operation.* 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**

| *Through February 2018* | No. of Incidents | Incident Rate[1] | Goal |
|---|---|---|---|
| **1300 Contract** | | | |
| OSHA Recordable Accidents | 6 | *0.45* | <3.4 |
| Job Transfer/Restricted Duty Incidents | 0 | 0 | NA |
| Lost Time Incidents | *2* | *0.15* | <1.6 |
| Total Incidents | *8* | *0.59* | NA |
| Hours Worked | *2,691,818* | | |

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

# I. PROJECT RISK, RISK MANAGEMENT, AND RISK MITIGATION

SFMTA conducts monthly meetings to review the status of identified risks, monitor the implementation of mitigation measures, identify new risks, and evaluate the probability and potential impacts of existing and newly identified risks. The current major risks to the project address the potential for further delays to the construction of the stations, which cannot be mitigated or recovered, resulting in further delays to the RSD. *At the Risk Mitigation meeting on April 3, 2018, these and other major remaining project risks were evaluated. The outcome of the risk meeting is documented in Appendix D.*

The PMOC noted the following significant items of discussion:

- *Risk 248 – production rate for mining work at CTS being less than planned was retired, as the mining work has been completed.*
- *Risk 234 – damage to adjacent buildings from mining work at CTS due to settlement is being monitored and likely can be retired soon. No significant settlement has been detected. Risk 52, which addresses possible damage to utilities above the CTS caverns also should be retired soon. At some point SFPUC should provide a release to SFMTA documenting the lack of damage to its facilities.*
- *Risk 249 – Inability to re-sequence activities that are currently shown as finish to start is being considered for downgrading (by reducing the probability of occurrence), as TPC has been advancing work activities to save time. It appears that there will continue to be opportunities to advance work compared to the sequence shown in the baseline schedule.*
- *Risk 205 – Delays and higher costs due to poor relationships between TPC and SFMTA due to slow/delayed contract modifications was discussed. SFMTA is focusing on clearing trend items where negotiations are complete and where work has been documented with extra work tags. About half of the outstanding 700 trends are in these categories. Where negotiations are complete and agreement has not been reached, SFMTA will issue unilateral CMods. SFMTA has issued about seven such modifications, but TPC has not provided the required forms that document how much of the work is by subcontractors. Until those forms are received, SFMTA cannot issue payment.*
- *Risks 229 and 230 – Delays to system acceptance testing and commissioning can be better defined once SFMTA receives a detailed and coordinated schedule for the train control work (expected in the coming weeks). SFMTA will be updating the RAP when the new Start-up and Testing Manager is hired.*
- *Risk 36 – Damage to adjacent buildings due to grouting operations at UMS is a candidate for retirement.*
- *The risk of delays and extra costs due to water leakage at YBM and CTS was discussed. It was noted that this risk was realized at YBM and the impacts are occurring. Crews are working to mitigate the leaks. The cost of the repairs may be borne by the project. At CTS, mitigation measures to reduce this risk are being implemented. The mitigation*

*measures have resulted in delays of two to three weeks and costs that are yet to be determined.*

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

SFMTA has been applying updated schedule risks to a Monte Carlo analysis of the program schedule in order to establish a range of likely construction completion dates and revenue service dates. *Has updated the Monte Carlo analysis to reflect recent progress of construction at CTS, including delays to the placement of the invert slab for the headhouse. The updated analysis indicates that there is a 65 percent probability that the RSD will be on or before November 14, 2019, which is about two weeks later than the previous forecast. There is a 90 percent probability that the RSD will be on or before December 12, 2019. SFMTA's latest monthly progress report forecasts RSD on November 22, 2019, which has a 60 percent probability of being achieved. SFMTA plans to continue monitoring of the schedule progress.* ***The PMOC recommends that the risk assessment and schedule forecast be updated once the detailed schedule for completion of ATCS installation and testing has been delivered by Thales. Significant schedule risk is associated with the unknown schedule for ATCS work and this risk can be better evaluated once a detailed schedule is available.***

**In the opinion of the PMOC, SFMTA is taking an appropriate approach to identifying and quantifying the potential impacts of the remaining schedule risks to the project. The outcome of the SFMTA risk assessment is expected to be a range of likely RSDs for the project.**

## J. ACTION ITEMS AND RECOMMENDATIONS

Table 8 on the following page shows the current action items for SFMTA. Table 9 provides a summary of the currently active PMOC recommendations.

**Table 8 - SFMTA Action Items for Central Subway Project**

| Category | NO. | ACTION | DATE OPENED | DUE DATE | DATE CLOSED | COMMENTS |
|---|---|---|---|---|---|---|
| **S** | **171** | Provide a range of dates for the Revenue Start Date | 6/23/16 | *6/1/2018* | *TBD* | *SFMTA should update the Monte Carlo analysis when the ATCS schedule is received from Thales.* |
| **S** | **177** | Develop plan, confirm feasibility of "Revenue Service Demonstration" | 7/27/17 | TBD | TBD | SFMTA is identifying requirements for the demonstration. |
| ***C*** | ***178*** | Recognize impact of schedule delays to project management costs | 11/14/17 | *2/1/2018* | TBD | SFMTA has started the process to update its forecast for project management costs. |

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

Category Key:
C – Cost
FMP – Fleet Management Plan
IRP – Independent Review Panel
PMP –Project Management Plan
QA – Quality Assurance
RA – Risk
RE – Real Estate
S – Schedule
SC – Scope
SS – Safety
T – Tech. Cap. & Cap.
CH – Change Mgmt.

**Table 9 – Active PMOC Recommendations**

| Number | Date Identified | Recommendation |
|---|---|---|
| 1 | 12/27/2017 | SFMTA and the contractor should continue to use the DRB process as a tool to resolve contract disputes. |
| 2 | 12/27/2017 | Required cost and schedule contingencies should be reevaluated when CTS excavation *and placement of the invert slab of the headhouse is complete.* |
| 3 | 12/27/2017 | SFMTA should further define the requirements for a possible "Revenue Service Demonstration," which could involve opening a portion of the line early. The definition of requirements will help to confirm the feasibility and timing of the proposed demonstration. |
| 4 | 12/27/2017 | The CSP Management Team should assess the impacts that schedule acceleration may be having on the quality program for the project and make any necessary adjustments needed to assure that quality is not compromised. |
| 5 | 12/27/2017 | The status of BHAGs should be discussed at each work package status meeting in order to improve the effectiveness of the goals in advancing critical project work. |
| 6 | 12/27/2017 | The trend log tracking should include the amount of time that has passed from the initial identification of the trend. |
| *7* | *1/10/2018* | SFMTA should immediately prepare and implement a plan for filling key positions, including the Program Director and Resident Engineer openings. The PMOC will monitor the agency's progress in recruitment and hiring of needed staff. RE positions filled. |
| *8* | *1/10/2018* | The baseline schedule for the Monte Carlo risk assessment should be updated to include any time-saving measures that have been implemented, thereby adjusting the baseline RSD date. *CLOSED* |
| *9* | *1/10/2018* | SFMTA should evaluate the current and future staffing levels and expertise required to address outstanding contract issues while effectively managing ongoing construction and preparing for systems testing and start-up activities. The PMOC supports the concept of assigning a dedicated claims management team, which has been partially implemented. |
| *10* | *1/10/2018* | SFMTA should work with the City to address problems in contract management associated with the switch to a new financial management system. Some contract modifications have been executed. |

| Number | Date Identified | Recommendation |
|---|---|---|
| 11 | 1/10/2018 | SFMTA should now focus on updating the risks and mitigation strategies to reflect the transition of the work from excavation and major structural supports to M/E/P and systems installation and testing. A specific risk of delays due to contractual issues with the ATCS system would appear to be a concern. |
| 12 | 2/23/2018 | The PMOC recommends that SFMTA quickly resolve the ongoing contractual issues regarding the schedule for and management of the ATCS to avoid schedule delays. SFMTA has been unable to obtain submittals for the ATCS design and equipment procurement, making it impossible to confirm the completion status of the work. |
| 13 | 2/23/2018 | The PMOC supports engaging SFMTA operations management in the hiring process for the Start-up and Testing Manager, who will be responsible for assuring that operating needs are addressed in the testing, commissioning, training, and start-up activities of the project. |
| 14 | 2/23/2018 | The PMOC recommends that the potential risk of CPUC having insufficient staff to witness required tests be monitored in the risk register and mitigation strategies be developed. |
| 15 | 3/11/2018 | *SFMTA management should work with SSD and CSP management to assure that traffic control requirements appropriately balance the needs of the project and the traveling public. A partnering approach may be effective in addressing TCP issues.* |
| *16* | *4/12/2018* | *The PMOC recommends that the risk assessment and schedule forecast be updated once the detailed schedule for completion of ATCS installation and testing has been delivered by Thales. Significant schedule risk is associated with the unknown schedule for ATCS work and this risk can be better evaluated once a detailed schedule is available.* |

# APPENDIX A. LIST OF ACRONYMS

| | |
|---|---|
| AC | Actual Cost |
| ADA | Americans with Disabilities Act |
| APTA | American Public Transportation Association |
| ARS | Air Replenishment System |
| ATCS | Automatic Train Control System |
| BART | Bay Area Rapid Transit |
| BCE | Baseline Cost Estimate |
| BHAG | Big Hairy Audacious Goal |
| BRT | Bus Rapid Transit |
| Caltrans | California Department of Transportation |
| CAR | Corrective Action Request |
| CCTV | Closed Circuit Television |
| CFR | Code of Federal Regulations |
| CLIN | Contract Line Item Number |
| CM/GC | Construction Manager/General Contractor |
| 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 |
| MPR | Monthly Progress Report |
| MPS | Master Project Schedule |
| Muni | Common Public Reference to SFMTA |
| NCN | Non-conformance Notice |
| NCR | Non-conformance Report |
| NEPA | National Environmental Policy Act |
| NOPC | Notice of Potential Claim |
| NTP | Notice to Proceed |
| O&M | Operations & Maintenance |
| OCS | Overhead Contact System |
| OHA | Operational Hazard Analysis |
| OP | Oversight Procedure |
| PCC | Proposed Contract Changes |
| PE | Preliminary Engineering |
| PG&E | Pacific Gas and Electric Company |
| PHA | Preliminary Hazard Analysis |
| PMOC | Project Management Oversight Contractor |
| PMP | Project Management Plan |
| PTMISEA | Public Transportation Modernization, Improvement, and Service Enhancement Account |
| PV | Planned Value |
| QA/QC | Quality Assurance/Quality Control |
| QAM | Quality Assurance Manager |
| QPRM | Quarterly Progress Review Meeting |
| QTR | Quarter |
| RAMP | Real Estate Acquisition Management Plan |
| RAP | Rail Activation Plan |
| RCMP | Risk and Contingency Management Plan |
| RE | Resident Engineer |
| 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 |
| SIT | Systems Integration Test |
| SOP | Standard Operating Procedure |
| SPI | Schedule Performance Index |
| SSCP | Safety and Security Certification Plan |
| SSCRC | Safety and Security Certification Review Committee |
| SSCVR | Safety and Security Certification Verification Report |
| SSD | Sustainable Streets Division |
| SSMP | Safety and Security Management Plan |
| SSO | State Safety Oversight |
| SSP | System Security Plan |
| SSPP | System Safety Program Plan |
| STS | Surface, Track, and Systems |
| TBD | To Be Determined |
| TBM | Tunnel Boring Machine |
| TCP | Traffic Control Plan |
| TPC | Tutor Perini Corporation |
| TSA | Transportation Security Administration |
| TVA | Threat and Vulnerability Analysis |
| U.S.C. | United States Code |
| UMS | Union Square/Market Street Station |
| 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** | *Version* | *Review by FTA/FRA* | **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.<br>Not submitted to FRA. |
| System Security Plan (SSP) or Security and Emergency Preparedness Plan (SEPP) | **2009** | | Not submitted to FTA.<br>Not submitted to FRA. |
| Construction Safety and Security Plan | **2012** | | Health and Safety.<br>Construction Safety Standards Revision 3, June 27, 2012. |
| **Safety and Security Authority** | *Y/N* | | **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)<br>Consumer Protection & Safety Division<br>505 Van Ness Avenue<br>San Francisco, CA 94102<br>(415) 703-1017 phone<br>(415) 703-1758 fax<br>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** | *Version* | *Review by FTA/FRA* | **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. CPUC attends monthly certification review meetings conducted by SFMTA. |
| Has the grantee implemented security directives issues by the Department Homeland Security, Transportation Security Administration? | N/A | | Currently, there are no TSA directives or programs applicable to the project. If any arise during the course of the project, the activities to comply will be developed and shown on a revision of the project safety and security activities schedule. |

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

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

| **Central Subway Project Overview** | | | |
|---|---|---|---|
| Project mode (Rail, Bus, BRT, Multimode) | Light Rail Transit | | |
| Project phase (Preliminary Engineering, Design, Construction, or Start-up) | Construction | | |
| Project Delivery Method (Design/Build, Design/Build/ Operate/Maintain, CM/GC, etc.) | Design-Bid-Build | | |
| **Project Plans** | *Version* | *Review by FTA/FRA* | **Status** |
| Has the grantee verified conformance with safety and security requirements in equipment and materials procurement? | Y | | Safety and Security Conformance checklists have been prepared for each of the construction contracts. All certifiable elements of the Tunnel work have been certified and accepted by SFMTA Safety. Certification reviews are underway for the stations contract. |
| Has the grantee verified construction specification conformance? | Y | | This is on-going as construction progresses and verified through the Safety and Security Certification process |
| Has the grantee identified safety and security critical tests to be performed prior to passenger operations? | N | | Currently being developed. |
| Has the grantee verified conformance with safety and security requirements during testing, inspection, and start-up phases? | N | | Project is in construction, with RSD about 2 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. |

| **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** | *Version* | *Review by FTA/FRA* | **Status** |
| Has the grantee demonstrated through meetings or other methods, the integration of safety and security in the following:<br>- Activation Plan and Procedures<br>- Integrated Test Plan and Procedures<br>- Operations and Maintenance Plan<br>- Emergency Operations Plan | In Process | | Second draft of Rail Activation Plan has been completed. An Integration Matrix has been implemented for all disciplines including safety and security concerns. |
| 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<br>Construction Safety Standards Revision 3, June 27, 2012. |
| Does the grantee's contractor(s) have a documented companywide safety and security program plan? | Y | | |
| Does the grantee's contractor(s) have a site-specific safety and security program plan? | Y | | The remaining active contractor has a plan. Contract documents require that the contractor follows an Environmental Health and Safety Program, specific to the contract work. |
| Provide the grantee's OSHA statistics compared to the national average for the same type of work? | Y | | Provided in the Central Subway Monthly Progress Report. |

| **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** | *Version* | *Review by FTA/FRA* | **Status** |
| If the comparison is not favorable, what actions are being taken by the grantee to improve its safety record? | N/A | | Statistics are favorable. No action needed. |
| Does the grantee conduct site audits of the contractor's performance versus required safety/security procedures? | Y | | Safety walks are routinely conducted at each construction site. |
| **Federal Railroad Administration** | | | |
| If shared track: has grantee submitted its waiver request application to FRA? (Please identify specific regulations for which waivers are being requested.) | N/A | | No shared track.<br>No waivers are anticipated. |
| If shared corridor: has grantee specified specific measures to address shared corridor safety concerns? | N/A | | |
| Is the CHA underway? | N/A | | |
| Other FRA required Hazard Analysis – Fencing, etc.? | N/A | | |
| Does the project have Quiet Zones? | N | | |
| Does FRA attend the Quarterly Review Meetings? | N | | |

N/A = Not applicable.

# APPENDIX C. PROJECT MAP AND OVERVIEW

## CENTRAL SUBWAY PROJECT: Project Overview and Map

| | |
|---|---|
| **Date:** | *April 6, 2018* |
| 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: | Mr. Andre Anderson |

**Scope**

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

**Schedule**

| | | | |
|---|---|---|---|
| 07/02 | Approval Entry to PE | 2016 | Estimated Rev Ops at Entry to PE |
| 01/10 | Approval Entry to FD | 2018 | Estimated Rev Ops at Entry to FD |
| 10/11/12 | FFGA | 2018 | Estimated Rev Ops at FFGA |
| 11/22/2019 | | | Revenue Operations Date at date of this report |

*75.6%* *Percent Complete Based on Progress* (*February 2018 data*)

**Cost**

| | |
|---|---|
| $764 million | Total Project Cost ($YOE) at Approval Entry to PE |
| $1,578 million | Total Project Cost ($YOE) at Approval Entry to FD |
| $1,578 million | Total Project Cost ($YOE) at FFGA signed |
| $TBD million | Total Project Cost ($YOE) at Revenue Operations |
| $1,578 million | Total Project Cost ($YOE) at date of this report including $0.00 in Finance Charges |
| *$1,187.7 million* | Amount of Expenditures at date of this report from Total Project Budget of $1,578 million |
| *75.3%* | Percent Complete based on Expenditures at date of this report |
| $9.00 million | Unallocated Contingency remaining |
| *$73.94* million | 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 | *2Q18* | 60 | 60 |
| **5** | Hold Point 5 – Complete CTS / Tunnels systems inst. April 2018 | *2Q19* | 25 | 25 |
| **RSD** | PMOC / FTA RSD | 4Q19 | | |
| **CURRENT TOTAL CONTINGENCY *$73.94 Million*** | | | | |


central T subway
Lombard St.
COIT TOWER
Columbus Ave.
Washington Square Park
Union St.
TUNNEL ONLY - NO SERVICE
Broadway
Broadway Tunnel
The Embarcadero
Washington St.
Ferry Building
T CHINATOWN
Stockton St.
Kearny St.
Montgomery St.
Battery St.
EMBARCADERO
California St.
Leavenworth St.
Bush St.
FOLSOM
FUTURE TRANSBAY TERMINAL
Post St.
MONTGOMERY
UNION SQUARE/ MARKET STREET
J K L M N T
Market St.
1st St.
N
Mission St.
2nd St.
POWELL
Howard St.
Folsom St.
Harrison St.
BRANNAN
Golden Gate St.
4th St.
I-80
YERBA BUENA/ MOSCONE
5th St.
3rd St.
2ND ST. AND KING
CIVIC CENTER
7th St.
6th St.
4TH ST. AND BRANNAN
King St.
AT&T BALLPARK
4TH AND KING/BERRY N T
Bryant St.
Brannan St.
Townsend St.
Caltrain
MISSION ROCK
UCSF
UCSF MISSION BAY
LEGEND
T Third Phase 2
T Third Phase 1
Muni Metro
Caltrain
BART

# APPENDIX D. TOP PROJECT RISKS

Top risks were discussed at the March risk meeting as noted below.

**Top Risks Discussed in the Previous Month:**

***Risk 248*** *–This risk was retired.*

***Risk 240*** – Unresolved assignment of responsibility for schedule delays may lead to increased costs for the program. This risk continues to be a concern. The DRB process is being used to help resolve issues regarding responsibilities for delays. SFMTA is issuing CMods to extend the substantial completion date consistent with the DRB findings. TPC has not accepted the DRB findings. *SFMTA noted that TPC is adding activities to the schedule that were not included in the baseline, in violation of the contract requirements.*

***Risk 251*** – Activities required to complete the project scope are not identified in the schedule, resulting in the time required to complete the project being longer than currently forecast. Thus far, although TPC has been identifying additional activities in its schedule updates, none of the added activities have resulted in further delays to the forecast completion date. SFMTA's schedule updates are capturing differences between the activities in the baseline schedule and the work actually being completed.

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

***Risk 249*** – Unable to re-sequence work that is currently shown as finish to start, resulting in an inability to recover from delays. Thus far, TPC has been able to offset recent delays by starting critical work early. This has prevented further schedule slippage and has allowed a portion of the accumulated delay to be recovered. SFMTA's schedule updates are capturing resequencing of work activities as they are implemented. *It was suggested that the probability of occurrence for the risk be reduced, since re-sequencing of work has been possible to date.*

***Risk 253*** – Insufficient resources are available to complete the work as planned. There is a concern that the primary electrical subcontractor may not have sufficient manpower to complete the scheduled work. No mitigations for this potential shortfall in staff resources have been identified. Thus far, crew shortages have not been experienced.

***Risk 238*** – Quality program is ineffective in processing non-conformance items causing schedule impacts. The SFMTA QAM conducted a review of potential causes of water leaks at YBM and concluded that there is no evidence of a failure in the QA/QC process. However, SFMTA is considering potential enhancements to the waterproofing design at CTS, given the experience at YBM.

***Risk 205*** – Prolonged time to execute contract modifications may lead to poor relations between the REs and the contractor. This risk continues to be a concern. A few CMods have been issued recently. *SFMTA noted that TPC has seven CMods approved by SFMTA for which it has failed to provide the necessary documentation for subcontractor payment amounts. SFMTA cannot issue payments until this documentation is submitted.*

***Risk 229 and 230*** – Risk that contractor and SFMTA systems testing and commissioning will take longer than currently planned. SFMTA is preparing a more detailed testing and commissioning plan, to include identification of required testing and the responsibilities for witnessing and approving the tests. This will be part of the updated RAP to be included in the updated PMP. SFMTA is working to bring on a testing and commissioning manager to lead this effort and is coordinating with Muni's operations department on the job description and hiring process. *SFMTA also noted that Muni will assign a staff member from the operations department to coordinate testing and start-up activities for the program. This position is in additional to the program's Stat-up and Testing Manager position.*

***Risk 254 –*** CPUC has insufficient staff to witness required testing. This new risk of delays due to insufficient CPUC staffing was rated moderate. SFMTA will identify mitigation measures. *SFMTA is working with CPUC to advance the certification process that must be completed in advance of testing.*

*Risk 36 – Damage to adjacent buildings due to grouting operations at UMS. This risk is a candidate for retirement since grouting operations are complete.*

*Risk 255 – Risk of water leaks causing delays to follow-on construction and added costs. Water leaks have appeared at the YBM headhouse and are being repaired. Cost and schedule impacts are accruing. At CTS the waterproofing system is being modified to provide additional ability to respond in the event that leaks occur. The modifications have delayed work on the critical path and will have cost impacts as well.*

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

# APPENDIX E. ROADMAP TO REVENUE OPERATIONS

| **Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT** | | | | |
|---|---|---|---|---|
| **Description** | **Estimated Start Date** | **Estimated Completion Date** | **Actual Completion Date** | **Notes** |
| ***Testing*** | | | | |
| Finalize/update Systems Integration Test (SIT) Plan | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| *Prepare Schedule for Testing (update)* | *6/1/2018* | *10/1/2018* | *TBD* | Initial testing, commissioning, and start-up schedule has been completed. *An updated Rail Activation Plan with more detailed testing plans and schedules will be prepared once the Start-up and Testing Manager is onboard.* |
| Finalize Test Procedures | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Conduct System Integrated Testing with trains, including procedures and reports | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Complete Testing Reports | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| ***Operating Plan, Rules, and Training*** | | | | |
| Finalize Operating Plan | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Finalize/revise SOPs, manuals, and rulebook as applicable | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Operations Manuals | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Staffing and Operations Plan | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Training of O&M personnel | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Emergency response plan, training, and drills | TBD | TBD | TBD | Project is in construction, with RSD *about 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** |
| ***Vehicle Maintenance Plan, Equipment, Facilities, and Training*** | | | | |
| Rail Fleet Management Plan | 5/1/2018 | 8/3/2018 | 8/3/2018 | |
| Maintenance Schedules and Procedures | NA | NA | NA | The LRV fleet is being replaced and expanded through a separate project. The four vehicles required for CSP have been delivered. Maintenance related items are being provided by the supplier. |
| Spare Parts Requirements | NA | NA | NA | The LRV fleet is being replaced and expanded through a separate project. The four vehicles required for CSP have been delivered. Maintenance related items are being provided by the supplier. |
| Maintenance Manuals | NA | NA | NA | The LRV fleet is being replaced and expanded through a separate project. The four vehicles required for CSP have been delivered. Maintenance related items are being provided by the supplier. |
| Maintenance Training | NA | NA | NA | The LRV fleet is being replaced and expanded through a separate project. The four vehicles required for CSP have been delivered. Maintenance related items are being provided by the supplier.. |
| **Facility and Right-of-way Maintenance Plan, Equipment, Facilities, and Training** | | | | |
| Maintenance Schedules and Procedures | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Spare Parts Requirements | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Maintenance Manuals | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Maintenance Training | TBD | TBD | TBD | Project is in construction, with RSD *about 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** |
| **Pre-Revenue Operations** | | | | |
| Finalize and/or update RAP and/or Pre-Revenue Operations Plan | 4/2/2015 | 4/2017 | 4/27/2017 | The second draft with additional detail and a schedule for testing and pre-revenue activities was submitted with the 2017 update of the PMP. |
| Implement Rail Activation Committee | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Shadow operations | NA | NA | NA | Project will be operated by the established MUNI operations division. |
| Develop/revise SSPP & Security Plan (approved by State Safety Oversight (SSO)) | *Ongoing* | 10/31/2015 | 10/31/2015 | CPUC triennial review conducted in October 2015 concluded that SFMTA "has a comprehensive System Safety Program Plan (SSPP) and has made significant progress in executing that plan." |
| FTA Office of Safety & Security Readiness Review | TBD | TBD | TBD | Project is in construction, with RSD *about 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 *about 2* years in the future. |
| Conduct Operational Hazard Analysis (OHA) and resolve other hazards/ vulnerabilities | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Pre-Revenue Operations | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| **Public Outreach** | | | | |
| Develop Safety Outreach Plan | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Provide Community Outreach | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Grand Opening Plan | TBD | TBD | TBD | Project is in construction, with RSD *about 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** |
| ***Construction Close Out*** | | | | |
| Close Out of Non-Conformance Reports | Ongoing | 09/24/2019 | TBD | NCRs are tracked and closed prior to follow-on work. Final closure of NCRs expected as of final completion date of 1300 Contract. |
| Punch List Complete | 12/17/2018 | 09/24/2019 | TBD | Punch list completion expected at final completion of 1300 Contract. |
| Certificates of Occupancy/Substantial Completion | TBD | 06/26/2019 | TBD | |
| ***Safety, Security, and Fire-life Safety Certifications*** | | | | |
| Update/Finalize SSMP | | | 2/18/2014 | Revision 2 completed. |
| Finalize and/or update Safety Certifiable Item List (SCIL) and SSCP | | | 10/10/2008 | Revision 0. |
| Implement Safety and Security Certification Committee | | | 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 | 09/24/2019 | TBD | |
| Close Out of non-safety critical items | Ongoing | Ongoing | TBD | |
| Close Out of safety critical items | Ongoing | Ongoing | TBD | |
| Complete Safety & Security Certification Verification Report (SSCVR) | TBD | 10/11/2019 | | 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 | |

| **Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT** | | | | |
|---|---|---|---|---|
| **Description** | **Estimated Start Date** | **Estimated Completion Date** | **Actual Completion Date** | **Notes** |
| SSO final certification/signature | TBD | 11/19/2019 | | 21 days before RSD - Check against latest regulations. |
| ***Third Party and Agency Agreements*** | | | | |
| Third Party/Agency Agreements Necessary for Revenue Service | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| Third Party/Agency Approvals Necessary for Revenue Service | TBD | TBD | TBD | Project is in construction, with RSD *about 2* years in the future. |
| ***Revenue Service*** | | | | |
| Target Revenue Service Date | - | 12/10/2019 | | 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. |
| 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 |

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

| LL# | Date | Phase | Category | Subject | Lesson Learned |
|---|---|---|---|---|---|
| 15 | 01-30-14 | Const. | Management | Independent Review Panel (IRP) Decision-makers | At the request of SFMTA, the American Public Transportation Association (APTA) formed a panel of geotechnical and tunnel experts to perform a peer review of the BART Undercrossing. Prior to crossing under the BART tunnels, the Independent Review Panel (IRP), contractor, SFMTA, and BART representatives convened at predetermined tunnel boring machine (TBM) locations to discuss the TBM progress and determine whether the tunneling should proceed. It is critical that decision makers from each organization attend these meetings. It was noted that BART Senior Management did not attend and instead deferred decisions to lower level staff. |
| 16 | 06-30-14 | Const. | Bid documents | Pre-Classification for Soil and Groundwater Disposal | Soils and groundwater generated from construction activities should be pre-classified with appropriate sampling and testing required by potential disposal facilities. Coordinate with the disposal facilities to get materials accepted. |
| 17 | 04-10-15 | Const. | Quality Control/Safety | Monitoring of Soil Conditions during Underground Construction | There was a breach of the excavation of frozen ground during construction of a cross passage between the twin bored tunnels followed by water and soil flowing into the tunnels, resulting in subsidence of the ground above and damage to underground utilities. Apparently the flow of materials into the tunnels went on for quite some time before the problem was detected and actions could be taken to arrest the flow. The construction site was not staffed when the breach started and there was no external warning system in place to notify the contractor or the agency of the condition. Lesson: When the safety and structural integrity of a construction site depends on maintaining soil conditions with the use of mechanical systems, the site should be continuously staffed or monitoring devices at the site should be continuously monitored from a remote location to assure that the expected soil conditions are maintained. |
| 18 | 04-10-15 | Const. | Environmental | Archeological Data Recovery Protocols | Sensitive archeological materials were uncovered during the excavation of the roof area at YBM. The Program Manager took immediate action to notify the appropriate state officials and implemented protocols for protection of |

| LL# | Date | Phase | Category | Subject | Lesson Learned |
|---|---|---|---|---|---|
| | | | | | the materials. The most likely descendent of the remains was quickly identified and a representative was engaged and brought to the site to supervise the ongoing excavation. Lesson: Pre-planning and quick action to involve the appropriate parties resulted in satisfactory handling of the artifacts with minimal delays to the construction schedule. |
| 19 | 05-11-15 | Const. | Quality Control | Use of Latest Design Information for Field Inspection | After two roof pours were completed, it was discovered that required reinforcing steel was missing. Changes to the arrangement of the reinforcing steels were made as part of the submittal review and response process. Notes from the designer were included on the approved shop drawings but not in the contract design drawings. Field inspectors were using only the design drawings to confirm the proper installation of reinforcing steel prior to concrete placement. Lesson: A process should be established to assure that the latest design information, including submittals and related designer notes, is available in the field and used to inspect reinforcing steel prior to concrete placement. |
| 20 | 09-28-15 | Const. | Schedule | Maintenance of Updated Construction Schedule and Master Program Schedule | SFMTA was unable to obtain an acceptable baseline schedule from the station construction contractor for over a year. Then, SFMTA could not obtain acceptable updated status schedules from the contractor for another 8 months. As a result, the construction status and completion date could not be accurately determined for the first 20 months of the contract. This made schedule control impossible. SFMTA finally created its own schedule updates for the first 12 months of the construction contract using the pay applications and 4-week look-ahead schedules from the contractor. Lesson: Owners should aggressively assert the need for accurate schedule updates from contractors and should withhold payment if such updates are included in the contract terms or specifications and are not forthcoming. If schedule updates are not received within the first few months of the project, the owner should create its own updates for the purpose of progress monitoring and schedule control. |

| 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 the Central Subway portion the T Third LRT line. The original plan was to install the special trackwork at the intersection in eight extended weekend shutdowns. Working with the contractor, the plan was revised to accomplish the necessary trackwork installations in two shutdowns. After considering the outcome of the first shutdown, where a portion of the special trackwork did not fit properly and needed adjustment during the shutdown, SFMTA decided to pre-assemble the second, more complex, special trackwork assembly at an off-site facility. The assembly was completed and the resulting track was surveyed to confirm the geometry and to assure that the assembly would fit into the existing field conditions. While conducting the assembly and disassembly of the track components, the contractor identified an approach that would reduce the time required to reassemble the trackwork in the field. Lesson: Effective pre-planning and mock-up assembly of complex trackwork, may allow the final assembly to be completed without the need for field adjustments and in less time than planned. This approach can mitigate the risks associated with the installation of complex custom track components in an operating transit line. |
| 22 | 03-01-17 | Const. | Legal/Claims | Preparation for Mediation | A contractor for advance utility relocation issued a multi-million-dollar claim for extra costs due to delays and unforeseen conditions. SFMTA believed the claim had no justification. After several years, the claim was referred for mediation prior to going to trial. The contractor made a very compelling presentation regarding the extra costs. However, due to careful preparation by SFMTA management, the agency was able to provide specific and detailed rebuttals to the contractor's major arguments. The mediation resulted in a settlement for less than 15% of the original claim amount. SFMTA chose to accept the settlement amount, recognizing that the costs to pursue the claim in court would likely exceed the settlement value. Lesson: Careful record keeping and |

| LL# | Date | Phase | Category | Subject | Lesson Learned |
|---|---|---|---|---|---|
| | | | | | preparation for dispute resolution can limit agency exposure to costs related to claims. |
| 23 | 01-10-18 | Design and Procure-ment | Claims | Quality Control of As-built Data for Procurement | The Central Subway had three major construction phases: Utility Relocation, Tunneling, and Stations/Track/Systems. Inaccurate as-built information from earlier construction phases has led to claims for differing site conditions during the construction of Stations/Track/Systems phase. For example, during the final design phase for the tunnel work, SFMTA agreed to a proposed change to tunnel segments defined in the preliminary engineering phase. The length of tunnel segments was changed from 4 feet to 5 feet except in areas with tight curves. The approved change in segment length was not captured in the final design documents for the stations contract, even though the change in tunnel design was made prior to completion of the station contract documents. When the stations contractor encountered 5-foot-long segments while mining for the platform and crossover caverns at the Chinatown Station, he issued a change order request to account for extra costs due to the need to change the excavation approach to handle the longer tunnel segments. The current claimed extra cost is $4.4 million. Lesson: Procedures should be established to ensure that approved design changes during construction of early phases of complex projects are accurately reflected in contract documents for follow-on construction phases. PMOC oversight should confirm that procedures are in place to capture changes in design during construction and to assure that changes are reflected in follow-on construction contract procurement documents. |

# 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 December 31, 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 | $233.59 million; $6.2 million is paid from non-project funds |
| | % Expended | 96.6% |
| | 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 | $8.12 million |
| | Current Contract Value | $847.80 million |
| | Expended to Date | $572.08 million |
| | % Expended | 67.5% |
| | SBE Participation | 21.3% |
| **Schedule:** | NTP issued June 17, 2013. Substantial Completion planned February 2018 and forecast June 2019. | |
| **Issues or Concerns:** | The work on this contract is behind schedule. | |

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

| **Contract No.** | **CS-155-2** | |
|---|---|---|
| **Contract Description:** | **Design Package 2 for UMS, CTS, and YBM. CSDG prime** | |
| **Status:** | Designs are complete for all of the station contracts. Construction support of Contract 1300 is underway. | |
| **Cost:** | Original Contract Value | $*39,949,948* |
| | Approved Change Orders | $1,626,722 |
| | Current Contract Value | $41,576,670 |
| | Expended to Date | $40,248,246 |
| | % Expended | 96.8% |
| | SBE Participation | 31.6% |
| **Schedule:** | | |
| **Issues or Concerns:** | | |

| **Contract No.** | **CS-155-3** | |
|---|---|---|
| **Contract Description:** | **Design Package 3 for STS. HNTB-B&C Prime** | |
| **Status:** | Design is complete. Construction support of Contract 1300 is underway. | |
| **Cost:** | Original Contract Value | $16,864,250 |
| | Approved Change Orders | $368,002 |
| | Current Contract Value | $17,232,252 |
| | Expended to Date | $14,739,986 |
| | % Expended | 85.5% |
| | SBE Participation | 26.2% |
| **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 | $65,684,199 |
| | % Expended | 77.1% |
| | SBE Participation | 32.6% |
| **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 | $9,874,151 |
| | % Expended | 57.7% |
| | SBE Participation | 29.3% |
| **Schedule:** | | |
| **Issues or Concerns:** | | |