

# MONTHLY MONITORING REPORT

*August 2018*

## Central Subway Project

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

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*PMOC Contract No.: DTFT6014D00010*

*Task Order No. 5*

*Project No.: FTA-13-0294*

*Work Order Number: 002*

*OPs Referenced: 01 and 25*

*CLIN 0002B*

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Time on project: 4+ 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 beneath Stockton Street in downtown San Francisco. The CSP is Phase 2 of the San Francisco Municipal Transportation Agency's (SFMTA) T Third Light Rail Transit (LRT) Project. The CSP will extend the T Third Line from the 4th Street Caltrain Station to Chinatown, providing a direct rapid transit link from the Bayshore and Mission Bay areas to South of Market, Union Square, and downtown.

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

### Project Status

The project has been under construction since February 2010. *At the end of July 2018, the project was 78.1% complete based on expenditures.* The one active construction contract: 1300 Stations and Systems/Trackwork being executed by Tutor-Perini Corporation (TPC), *was 70.7% complete based on incurred cost.* Substantial completion of this contract was originally scheduled for February 10, 2018, but the latest master program schedule update forecasts substantial completion on July 26, 2019, a delay of 532 days. SFMTA's most recent update of the program schedule continues to forecast the Revenue Service Date (RSD) to occur on January 14, 2020. This is 384 days later than the required RSD of December 26, 2018 in the Full Funding Grant Agreement (FFGA) and unchanged from the previous month.

*SFMTA has not yet executed contract modifications for Automated Train Control System (ATCS) and radio system work to remove portions of the scope of work from the TPC contract. When the changes are executed, SFMTA will directly control contracts for the suppliers of these systems to mitigate potential delay claims from TPC and to afford better control of design and integration activities.*

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

**Table 1 - Core Accountability Items**

<b>Project Status:</b> <i>(as reported in SFMTA's July 2018 Monthly Progress Report)</i>		<b>Original at FFGA:</b>	<b>Current Estimate:</b>
<b>Cost</b>	Cost Estimate	\$1,578,300,000	\$1,578,300,000
<b>Contingency</b>	Unallocated Contingency	\$74,722,000	\$6,742,405
	Total Contingency (Including Approved Contract Changes)	\$185,500,000	\$71,175,324

<b>Schedule</b>	Revenue Service Date (RSD)	12/26/2018	1/14/2020 (SFMTA forecast)
<b>Total Project Percent Complete</b>	Based on Expenditures	78.08%	
	Based on Earned Value	78.70%	
<b>Major Issues</b>	<b>Status</b>	<b>Comments/Planned Action</b>	
Schedule Contingency	All schedule contingency has been consumed.	SFMTA to publish a revised RSD reflecting remaining schedule risks and the current status of construction prior to the next QPRM.	
Cost Contingency	Total Contingency is \$71.18 million – 16.5% of the value of remaining work.	The contingency appears adequate for the current level of project completion, although increasing contractor claims are a concern.	
Technical Capacity and Capability	Program Director and Start-up and Testing Manager positions open.	SFMTA recruitment is continuing. SFMTA to seek consultant support for start-up and testing.	
<b>Date of Next Quarterly Meeting:</b>		November 14, 2018	

Earned Value (EV): \$1,242,178,166, an increase of \$16.49 million from June.

Planned Value (PV): \$1,526,333,656, a planned increase of \$2.90 million from June.

Actual Cost (AC): \$1,232,288,344, an increase of \$7.49 million from June.

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

Schedule Performance Index (SPI): 0.81, indicating that the amount of work completed is significantly less than planned and the project is behind schedule.

## Contingency

### Cost Contingency

The total available contingency (approved contingency less approved contract changes) as of September 19, 2018 was \$67,455,883, which is above the minimum required contingency of \$25 million. (Note: these figures include contract modifications executed after publication of SFMTA's July Monthly Progress Report). SFMTA has issued contract modifications totaling \$3.71 million since July 31. SFMTA's latest trend summary report estimates a total potential additional cost increase from claims, denied change order requests, and pending changes of \$55.19 million, which is \$15.73 million less than estimated in August. SFMTA has reduced its estimate of cost exposure from claims to reflect duplicate claims covering the same issues. With the current estimate of cost exposure from claims, about \$12.27 million in excess contingency is available in the project budget. Additional unallocated contingency of \$1.4 million should be available as a result of the final close-out price for the Tunnel Contract.

### Schedule Contingency

All contingency in the schedule has been consumed, and there are about 13 months of negative float from the baseline schedule. The forecast RSD did not change in the past month. The Federal Transit Administration's (FTA) recommended schedule float at the current stage of project completion is four months. Applying this float to the current program schedule yields a PMOC-estimated RSD in May 2020.

### **PMOC Observations, Opinions, Recommendations and Concerns**

The Project Management Oversight Contractor (PMOC) continues to recommend that the estimate at completion for project management costs should be updated to account for higher costs due to the extended duration of the project. *The PMOC notes that contract changes totaling \$2,263,498 were executed for professional services supporting the project in July. These changes are necessary due to the extended duration of construction.*

The PMOC recommends that SFMTA quickly complete the contract actions regarding management of the ATCS and the radio system. Until the contract modifications to remove elements of the ATCS and radio system work from the 1300 Contract are complete, significant risks to the schedule are associated with these components of the project. Once the ATCS and radio contract actions are completed, the PMOC plans to conduct a comprehensive schedule review for the project.

The PMOC notes that the time required for SFMTA to make decisions regarding project issues needs improvement. Resolution of issues, such as approval of traffic control plans for construction at CTS and along 4<sup>th</sup> Street, are taking far too long. The PMOC continues to recommend that SFMTA quickly resolve the traffic control requirements for restoration of surface streets so that this work can proceed. With about one year remaining until the July 2019 forecast substantial completion of the TPC contract, decisions will need to be made rapidly and solutions implemented quickly to avoid further delays to the completion date for the project.

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

The PMOC encourages SFMTA to act quickly to fill the open positions for Program Director and Start-up and Testing Manager. Developing a plan for testing and commissioning is a critical item for confirming the time required to prepare the project for revenue service.

*The required RSD identified in the FFGA for the CSP is less than three months in the future. SFMTA must submit a request to extend the RSD prior to the required revenue service date in the grant. SFMTA should include sufficient float in its forecast of the actual RSD to accommodate remaining construction, testing and start-up risks. SFMTA's current schedule indicates RSD in January 2020 with no schedule float. FTA's recommended schedule float of four months yields a RSD forecast of May 2020. SFMTA's request for extension of the RSD must justify the revised RSD for which it is requesting approval by FTA.*

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## A. PROJECT STATUS

*The Project Management Oversight Consultant (PMOC) did not conduct on-site monitoring for the month of August 2018. This report was prepared using published information provided by the San Francisco Municipal Transportation Agency (SFMTA) and information obtained through a conference call on September 21, 2018.*

### **Full Funding Grant Agreement (FFGA)**

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

### **Design**

Design is complete.

### **Construction**

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

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

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

**Contract 1300 (Combination of UMS, CTS, YBM, and STS).** This contract includes the construction of three underground stations, one surface station, all surface works required for the installation of Light Rail Transit (LRT) between 4th and King streets and the tunnel portal, and all LRT track and systems components. *As of the end of July 2018, the construction of the Stations and Surface, Track, and Systems (STS) Contract was 70.68% complete based on cost and 72.87% 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 latest available information on the status of BHAGs. New BHAGs were defined at a partnering meeting between Tutor Perini Corporation (TPC) and SFMTA held on July 12, 2018.* The following paragraphs provide a brief summary of completed and ongoing work for each construction package.

Union Square/Market Street Station (UMS): *Interior wall and floor construction is underway throughout the station. Street work at O'Farrell and Stockton is nearing completion, while all street construction work has been completed at the Stockton/Ellis/Market Street intersection.*

Chinatown Station (CTS): *Work to install vaults for electrical power supply continues to be delayed pending development of an acceptable plan for maintaining traffic and pedestrian movements at the surface. Construction in the headhouse has reached the concourse level, where preparations are underway to place the floor slab. The structure of the north platform cavern is complete and work continues on the south platform, crossover and crosscut caverns.*

Yerba Buena/Moscone Station (YBM): *Utility work is nearing completion at the intersections of 4th Street with Howard Street and Folsom Street. Water leak repairs at the station and headhouse invert level have been completed. Mechanical, Electrical, and Plumbing (M/E/P), interior walls, stairs, escalators, and elevators are being installed throughout the station.*

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

### Systems and Track

SFMTA is continuing the process of removing the contract for the Automated Train Control System (ATCS) from the 1300 Contract. *SFMTA reported that the contract modification to remove the ATCS scope from the 1300 Contract has not been executed. SFMTA is still waiting for a revised schedule from the ATCS supplier, Thales, which will be included in Thales' revised contract. **In the opinion of the PMOC, the available time for SFMTA commissioning work after ATCS completion in the current schedule may be inadequate. Until SFMTA completes the contract actions to remove ATCS work from the 1300 Contract and develops a realistic program schedule incorporating the ATCS work, establishing a reliable forecast of the project completion date will not be possible.***

SFMTA also plans to remove portions of the radio system scope of work, including design and integration activities, from the TPC contract. The supplier for system-wide radio upgrades, Harris, will be contracted to provide radio system design and integration. **The PMOC continues to recommend that SFMTA quickly resolve the ongoing contractual issues regarding the schedule for and management of the ATCS and radio system to avoid further schedule delays.**

Work on track has been suspending pending delivery of new track to replace the non-conforming track supplied by the contractor. SFMTA expects delivery of the track in mid-October. SFMTA has proposed to the contractor that the new track will be supplied at no cost to the contractor if the contractor reimburses SFMTA for the salvage value of the rail to be removed and removes the installed rail at no additional cost. The installed section of embedded track from Townsend Street to Brannan Street would not be removed. TPC has thus far not agreed to reimburse SFMTA for the salvage value of the originally-supplied rail. SFMTA would demand that TPC turn over the rail to SFMTA if payment for the salvage value of the rail is not forthcoming.

### Tunnel Work

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

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

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

No updates to report.

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

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

### ***CPUC***

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

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

No updates to report.

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

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

### **Real Estate**

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

### **Labor Relations and Policies**

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

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

The 1300 contractor had previously raised the possibility of Buy America compliance issues with cooling equipment for the three underground stations. 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. A review of the PMP by the PMOC has not been requested by FTA.

### **Environmental Assessment/Mitigation Plan/Archaeological Plans**

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

### **Real Estate Acquisition Management Plan (RAMP)**

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

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

See section F.

### **Safety and Security Management Plan (SSMP)**

See section H.

### **Risk and Contingency Management Plan (RCMP)**

See section I.

## **C. PROJECT MANAGEMENT CAPABILITY AND CAPACITY**

### **Agency Staff**

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

SFMTA's efforts to hire a Start-up and Testing Manager have been delayed while CSP and SFMTA operations management resolved differences of opinion regarding the required skills and experience for the position. SFMTA Operations has nominated a staff member to work on the start-up and testing process. The CSP management staff does not believe that the nominated staff have sufficient experience in systems testing and start-up activities. SFMTA intends to secure support services from a consultant to supplement the assigned Operations Division staff members. **The PMOC encourages SFMTA to obtain the required consulting support for testing and training as soon as possible. Completion of the plan for testing, commissioning, training, and start-up activities for the project is critical to maintaining the schedule.**

SFMTA reported that the Resident Engineer (RE) for the STS work package has resigned. Recruitment for a replacement is underway. SFMTA also reported that it has selected a Claims Manager, who will start work in October. A staff of three to four will be assigned to claims management and administration for the 1300 Contract. SFMTA also has hired an additional cost analyst to assist with execution of contract modifications.

## Contractor Staff

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

## D. PROJECT COST STATUS

### Project Cost Control Systems

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

*The most recent versions of the Trend Log and Trend Summary documents are dated September 19, 2018. The Trend Summary indicates that 89 contract modifications had been executed for the 1300 Contract. The total value of executed CMods was \$12,710,785 (\$3.71 million higher than in August). The NOPC Log, dated September 19, 2018, indicates that there are now 116 potential claims (one additional since August). The Claim Log shows that 98 of these potential claims have been certified and submitted by the contractor. The submitted claims total \$34.82 million in extra costs, which is significantly lower than in August. **Although the program cost exposure from contractor claims is significant, the available cost contingency appears adequate at the current stage of project completion.***

*Note that Tables 2 and 3 reflect the project status as of the end of August 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 July 31, 2018)

Cost estimate: \$1.5783 billion.

Total contingency: \$71.18 million (minimum contingency is \$25 million), \$2.26 million less than in June.

Actual Cost (AC): \$1,232,288,344, an increase of \$7.49 million from June (78.08% of the total project budget).

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

Earned Value (EV): \$1,242,178,166, an increase of \$4.11 million from June (78.70% 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. Note that Tables 2 and 3 do not reflect the final negotiated value of the 1252 Contract as presented at the August QPRM. **Based on the final contract value, it appears that about \$1.4 million in allocated contingency for the 1252 Contract will not be used and can be returned to the project budget as unallocated contingency.**

*In the July 2018 MPR, SFMTA estimates the total cost impact of potential changes to the 1300 Contract at \$20.10 million, compared with \$18.40 million in June, an increase of about \$1.70 million. After potential changes were accounted for, \$10.91 million in allocated contingency remained for Contract 1300 at the end of July. **The resulting contingency of 4.4% of potential remaining cost on the 1300 Contract after potential changes are accounted for is likely insufficient, and additional contingency will probably need to be allocated to this contract prior to completion. The available unallocated contingency and excess contingency for other elements of the program 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 16.5% of the potential remaining spending. **In the opinion of the PMOC, this contingency is sufficient to provide a high level of confidence in an on-budget completion of the project, although increasing claims from the contractor are a concern.***

**Table 2 - Contract, Budget, and Trends for Active Construction Projects<sup>1</sup>**

	<b>1252 – Tunnel</b>	<b>1300 Stations, STS</b>
<b>Original Contract</b>	233,584,015	839,676,400
<b>Approved Contingency</b>	2,329,485	40,000,000
<b>Extra Budget for Non-Project Costs</b>	6,173,508	
<b>Approved Budget</b>	235,913,500	879,676,400
<b>Approved Changes</b>	1,363,054	8,991,244
<b>Current Contract (1252 does not include non-project costs)</b>	234,947,069	848,667,644
<b>Remaining Contingency</b>	966,431	31,008,756
<b>Potential Changes (PCCs and merited CORs)</b>	20,000	20,100,290
<b>Estimate at Completion</b>	234,967,069	868,767,934
<b>Contingency Less Trends</b>	946,431	10,908,466
<b>Spent to Date</b>	233,589,322	621,714,065
<b>Potential Left to Spend</b>	1,377,747	247,053,869
<b>Contingency Less Trends as % of Potential Cost to Complete</b>	68.7%	4.4%

<sup>1</sup> As reported in the July 2018 Central Subway Project Monthly Progress Report – SFMTA (reformatted by the PMOC).

**Table 3 - Budget and Contingency Status for Central Subway Project<sup>2</sup>**

SFMTA Central Subway Project, Budget, Costs and EAC by SCC July 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
		\$	\$	\$	%	\$	\$	\$	%	\$	\$	\$	\$
<b>10</b>	<b>Guideway and Track Elements</b>	<b>315,926,081</b>	<b>(30,698,202)</b>	<b>285,227,879</b>	<b>-10%</b>			<b>268,766,497</b>	<b>94%</b>	<b>16,461,382</b>			
10.02	Guideway: At Grade, Semi-exclusive	2,395,143	464,857	2,860,000	19%			1,937,500	68%	922,500			
10.06	Guideway: Underground cut and cover	74,407,195	(4,590,788)	69,816,407	-6%			63,663,292	91%	6,153,115			
10.07	Guideway: Underground tunnel	224,933,257	(23,592,511)	201,340,746	-10%			193,768,789	96%	7,571,957			
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			
<b>20</b>	<b>Stations, Stops, Terminals, Intermodal</b>	<b>432,698,735</b>	<b>153,084,482</b>	<b>585,783,217</b>	<b>35%</b>			<b>408,887,162</b>	<b>70%</b>	<b>176,896,055</b>			
20.01	At-grade station	774,913	6,827,944	7,602,857	881%			3,153,932	41%	4,448,925			
20.02	Aerial station, stop, shelter, mall, terminal, platform		2,299,081	2,299,081	NA			-	0%	2,299,081			
20.03	Underground station	412,084,888	142,094,554	554,179,442	34%			396,992,080	72%	157,187,362			
20.07	Elevators, escalators	19,838,934	1,862,903	21,701,837	9%			8,741,150	40%	12,960,687			
<b>40</b>	<b>Sitework and Special Conditions</b>	<b>232,551,627</b>	<b>(17,223,974)</b>	<b>215,327,653</b>	<b>-7%</b>			<b>206,917,137</b>	<b>96%</b>	<b>8,410,516</b>			
40.01	Demolition, clearing, earthwork	8,887,028	3,495,857	12,382,885	39%			12,105,785	98%	277,100			
40.02	Site utilities, utility relocation	29,562,587	31,865,195	61,427,782	108%			68,513,788	112%	(7,086,006)			
40.03	Haz. Material, contam'd soli removal, ground water treatment	2,957,442	4,576,686	7,534,128	155%			5,798,644	77%	1,735,484			
40.04	Environmental mitigation	3,146,216	(2,023,317)	1,122,899	-64%			606,590	54%	516,309			
40.05	Site structures, including retaining walls, sound walls	2,894,074	(185,746)	2,708,328	-6%			2,708,328	100%	-			
40.06	Pedestrian and bike access and accommodation, landscaping	14,393,910	(4,602,915)	9,790,995	-32%			3,467,232	35%	6,323,763			
40.07	Automobile, van, bus accessways, including roads and parking lots	11,919,550	(5,340,451)	6,579,099	-45%			5,113,532	78%	1,465,567			
40.08	Temporary facilities and other construction indirect costs	158,790,820	(45,009,283)	113,781,537	-28%			108,603,238	95%	5,178,299			
<b>50</b>	<b>Systems</b>	<b>108,429,774</b>	<b>(12,845,521)</b>	<b>95,584,253</b>	<b>-12%</b>			<b>35,104,562</b>	<b>37%</b>	<b>60,479,691</b>			
50.01	Train control and signals	37,447,116	(9,319,177)	28,127,939	-25%			7,619,133	27%	20,508,806			
50.02	Traffic signals and crossing protection	3,013,232	9,791,724	12,804,956	325%			11,489,577	90%	1,315,379			
50.03	Traction power supply	20,379,634	1,085,439	21,465,073	5%			11,958,675	56%	9,506,398			
50.04	Traction power distribution	16,239,951	(3,798,838)	12,441,113	-23%			1,882,994	15%	10,558,119			
50.05	Communications	28,545,305	(16,514,719)	12,030,586	-58%			1,911,330	16%	10,119,256			
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			90,001	3%	2,524,585			
<b>Subtotal (10 - 50)</b>		<b>1,089,606,217</b>	<b>92,316,785</b>	<b>1,181,923,002</b>	<b>8%</b>	<b>1,148,787,815</b>	<b>33,135,187</b>	<b>919,675,358</b>	<b>78%</b>	<b>262,247,644</b>	<b>249,232,748</b>	<b>1,168,908,106</b>	<b>13,014,896</b>
<b>60</b>	<b>ROW, Land, Existing Improvements</b>	<b>37,398,029</b>	<b>(5,151,708)</b>	<b>32,246,321</b>	<b>-14%</b>	<b>32,246,321</b>	<b>-</b>	<b>30,648,969</b>	<b>95%</b>	<b>1,597,352</b>	<b>1,597,352</b>	<b>32,246,321</b>	<b>-</b>
60.01	Purchase or lease of real estate	33,798,029	(3,732,219)	30,065,810	-11%	30,065,810	-	28,239,539	94%	1,826,271	1,597,352	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)
<b>70</b>	<b>Vehicles</b>	<b>26,385,653</b>	<b>-</b>	<b>26,385,653</b>	<b>0%</b>	<b>13,309,000</b>	<b>13,076,653</b>	<b>11,929,247</b>	<b>45%</b>	<b>14,456,406</b>	<b>1,379,753</b>	<b>13,309,000</b>	<b>13,076,653</b>
70.01	Light Rail Vehicles	26,385,653	-	26,385,653	0%	13,309,000	13,076,653	11,929,247	45%	14,456,406	1,379,753	13,309,000	13,076,653
<b>80</b>	<b>Professional Services</b>	<b>361,568,360</b>	<b>(30,565,741)</b>	<b>331,002,619</b>	<b>-8%</b>	<b>312,781,540</b>	<b>18,221,079</b>	<b>270,034,772</b>	<b>82%</b>	<b>60,967,847</b>	<b>40,483,270</b>	<b>310,518,042</b>	<b>20,484,577</b>
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	-	61,184,158	100%	134,173	-	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	72,270,568	70%	30,647,822	20,767,894	93,038,462	9,879,928
80.04	Construction Administration and Management	15,495,521	80,821,670	96,317,191	522%	93,360,379	2,956,812	78,224,025	81%	18,093,166	8,846,938	87,070,963	9,246,228
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	-	4,955,321	60%	3,257,283	2,797,159	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
<b>Subtotal (10 - 80)</b>		<b>1,514,958,258</b>	<b>56,599,337</b>	<b>1,571,557,595</b>	<b>4%</b>	<b>1,507,124,676</b>	<b>64,432,919</b>	<b>1,232,288,346</b>	<b>78%</b>	<b>339,269,249</b>	<b>292,693,123</b>	<b>1,524,981,469</b>	<b>46,576,126</b>
90	Unallocated Contingency	63,341,742	(56,599,337)	6,742,405	-89%		6,742,405		0%	6,742,405			6,742,405
<b>Total Project Costs (10 - 100)</b>		<b>1,578,300,000</b>	<b>-</b>	<b>1,578,300,000</b>	<b>0%</b>		<b>71,175,324</b>	<b>1,232,288,346</b>	<b>78%</b>	<b>346,011,654</b>	<b>292,693,123</b>	<b>1,524,981,469</b>	<b>53,318,531</b>

SCC Breakdown of Forecast Construction Costs Not Available

<sup>2</sup> Data reported in the July 2018 Central Subway Project Monthly Progress Report – SFMTA (reformatted by the PMOC).

## Change Order Control

SFMTA is maintaining its management tools for tracking potential contract changes for the 1300 Contract. *The latest CNI300 Trend Summary is dated September 19, 2018.* This report shows that 89 contract modifications have been approved for a net increase in the contract value of \$12,710,685, which is about \$3 million higher than August. *CORs (generated by the contractor) that have been determined to have merit and PCCs (generated by SFMTA) have a combined potential cost impact of \$18.59 million in increased contract value, about \$600,000 higher than in August.* SFMTA expects to settle the outstanding CORs for less than the overall cost currently claimed by the contractor. SFMTA also expects to receive \$4.5 million in non-project funds to cover the cost of some of these pending contract changes. *The expected net impact of the CORs and PCCs on the project cost is an increase of \$14.09 million.*

*An additional 907 items are being tracked in the Trend Log. Of these, SFMTA judged 440 items to be without merit and denied them. Many of these denied trend items are included in contractor claims. A further 347 items have been voided and are carried at no cost. There are 105 items covered by certified claims and NOPCs by the contractor (\$31.89 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 \$41.09 million, which, when added to the \$14.09 million in increased project costs from merited contract changes, yields a possible exposure of the project to additional costs for the 1300 Contract of \$55.18 million. This compares to the remaining contingency for the project of \$67.46 million, after accounting for the latest contract modifications. An additional \$1.4 million in contingency should be available from the 1252 Contract based on the final contract value. **In the opinion of the PMOC, the available cost contingency for the CSP remains sufficient to address potential cost increases, although the cost exposure from contractor claims is a concern.***

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

1. # 24 - Change to grade 50 steel from specified grade 70 steel (due to availability issues) - \$572,884
2. # 36 - Extra trucking costs for contaminated soil at CTS - \$2,274,225
3. # 39 - Harder rock than anticipated for CTS slurry wall excavation - \$2,290,471, increased from \$1,880,379
4. # 61 - Delays to installation of tangent piles at UMS - \$750,000, reduced from \$1,557,001
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 - \$399,000
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. # 546 - Additional 12-inch water line work at YBM - \$254,106
21. # 580 - Missing conduit between manholes at UMS - \$250,001
22. # 636 - Changes in emergency vent design (all stations) - \$500,001
23. # 644 - Contractor-claimed change in contract requirements for pre-loading permanent struts at UMS - \$1,853,352
24. # 657 - Elevator/escalator monitor at UMS - \$1,001,907
25. # 658 - Fire department monitor panel for UMS elevators - \$355,287
26. # 677 - Fire department monitor panel for CTS elevators - \$376,899
27. # 695 - Change in scope for slip-lining of 78-inch sewer on 4th Street - \$800,016
28. # 715 - Soil nail and shotcrete wall changes in Union Square Garage - \$1,365,378
29. # 728 - *Add fire alarm horn and strobe at vehicle ramp in Union Square Garage - \$288,976 (new)*
30. # 840 - Change in drain piping details at UMS - \$332,252
31. # 892 - Temporary drainage to re-direct water off new ramps at UMS - \$261,851
32. # 942 - Change in ATCS for reverse running - \$400,000
33. # 968 - Design changes for UMS vertical drainage slots - \$603,910
34. # 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
35. # 1032 - Escalator raceways at UMS - \$492,065

36. # 1099 - Extra costs for SEM excavation at CTS due to tunnel segments being 5 feet long - \$4,404,329
37. # 1117 - Extra costs due to concrete obstruction at CTS south platform cavern - \$451,686, *decreased from 583,623*
38. # 1152 – *Extra costs for tying wall rear into invert slab at UMS - \$359,905 (new)*
39. # 1175 - Time impacts due to power pole conflict during demolition at CTS - \$520,000, *reduced from \$3,516,164 due to execution of CMod*
40. # 1217 - Claimed delays to SEM work at the platform invert due to compensation grout exclusion zone requirements in the contract specifications - \$900,889
41. # 1268 - Revised reinforcing steel for headhouse invert at CTS - \$1,241,941
42. # 1299 - Claimed extra costs for a schedule delay to the train control subcontract - \$2,000,001
43. # 1311- Claimed extra costs for delays to the CTS south platform center drift excavation due to restrictions caused by compensation grouting - \$675,952
44. # 1352 - Acceleration costs for station box at UMS - \$300,001
45. # 1373 - Extra costs for jet grouting complications at Macy’s basement at UMS - \$585,521
46. # 1378 - General claimed extra costs for SEM work at CTS - \$5,457,322
47. # 1390 - Extra costs to haul excavation spoils to Ox Mountain disposal site - \$1,500,000 - new
48. # 1406 - General claim at YBM - \$604,697
49. # 1424 - Extra work due to changes in form-savers and couplers at roof to wall connection at YBM - \$250,001
50. # 1479 - Large volume of water inflow at end of probe - \$300,000
51. # 1485 - Conflict between YBM headhouse column reinforcing steel and temporary struts - \$498,187
52. #1567 – *Changes to escalators 1 and 2 at YBM - \$720,743 (new)*
53. # 1571 - Increase in allowance for Dispute Review Board (DRB) costs - \$250,000
54. # 1606 - Claim of defective specifications at YBM - \$2,500,001, *reduced from \$7,509,028*
55. # 1669 - Extra quantity of compensation grouting material all stations - \$857,500
56. # 1670 - Differing site conditions at CTS - \$1,000,001
57. # 1689 - Costs to provide hardened rail - \$800,001, *reduced from \$3,147,867*

58. # 1711 – Extra costs for claimed change in connection requirements for communication cables at YBM - \$301,719

59. #1785 - \$600,001 - extra costs for design changes at UMS (new)

**The PMOC notes that there was one new trend with costs in excess of \$250,000 in the current month, and a significant reduction in the value of several trends.**

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

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

## Funding

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

**Table 4 - Project Funding**

Source	Committed (\$1,000)	Awarded (\$1,000)
<b><u>Federal</u></b>		
New Starts	942,200	919,182
Congestion Mitigation	41,025	41,025
<i>Federal Subtotal</i>	983,225	960,207
<b><u>State</u></b>		
TCRP	14,000	14,000
State RIP	88,000	12,498
Prop. 1B / PTMISEA	307,792	307,792
Prop. 1A / HSR	61,308	61,308
<i>State Subtotal</i>	471,100	395,598
<b><u>Local</u></b>		
MTA	0	475
Prop. K Sales Tax	123,975	137,727
<i>Local Subtotal</i>	123,975	138,202
<b>Project Total:</b>	<b>1,578,300</b>	<b>1,494,007</b>

## E. PROJECT SCHEDULE STATUS

SFMTA prepared an update of the master program schedule in August representing progress on the project through July 31, 2018. SFMTA continues to reject schedule updates from the contractor. SFMTA has directed the contractor to make corrections to the schedule logic, but the contractor has not complied with this direction. As a result, the schedule forecasts for the project are based on SFMTA's version of the schedule. SFMTA also developed an ATCS schedule,

including testing activities in June. This schedule has not been integrated into the overall program schedule.

As of the end of July 2018, the project was 384 days late, based on the projected RSD of January 14, 2020. The substantial completion date for the 1300 Contract is now forecast on July 26, 2019, which is 532 days later than the original date (February 9, 2018). The latest schedule update indicates no change to the projected RSD from the previous schedule.

TPC has issued claims and NOPCs for various issues leading to delays to construction. SFMTA has issued CMods that allow 18 additional days of construction. SFMTA reported in August that it was preparing to issue CMod 87 that will allow an additional 82 days of construction, with 67 of those days including extended contractor overhead. The 100 days of additional construction duration included in the executed and pending CMods yields a revised substantial completion date for the 1300 Contract of May 20, 2018. The additional time from May 20, 2018 to the forecast substantial completion date of July 26, 2019 is the subject of disputes and claims, which are being addressed through a DRB.

Thus far, resolution on the claims has not been reached. The contractor is pushing for a “global settlement” that awards it significant additional time and associated extended overhead costs. SFMTA is insisting that the various claims be considered individually, with any merited time extensions and costs being included in contract modifications. **The PMOC supports the approach of considering each claim on its individual merits.**

The schedule for installation and testing of the ATCS is the subject of major delay claims, and it is uncertain how delays to the ATCS work could impact the project critical path. SFMTA received an updated schedule from the train control supplier and added other activities to produce a preliminary ATCS schedule. This schedule indicates that the ATCS work can be completed in October 2019, leaving about two months for SFMTA commissioning work prior to the January 14 forecast for RSD. **This does not appear to be sufficient time to prepare for revenue operations after ATCS completion.**

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

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

Table 5 shows the latest BHAGs and the status for each work package in the 1300 Contract. New BHAGs were identified at a SFMTA/TPC partnering session on July 12, 2018 and presented at the August QPRM. Information on the status of these BHAGs was not available at the publication date for this report.

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

<b>Milestone</b>	<b>Target Date</b>	<b>Actual Date</b>	<b>Status</b>
<b>CTS</b> Complete cavern final lining	10/1/2018	TBD	Delayed from 9/1/2018
Complete all concrete	12/31/2018	TBD	
<b>UMS</b> Complete roadway restoration:			
• O'Farrell/Stockton	10/1/2018	TBD	Delayed from 6/1/2018
• Ellis to O'Farrell	11/1/2018	TBD	Delayed from 6/1/2018
Closure of roof openings:			
• 1A	10/1/2018	TBD	Delayed from 5/15/2018
• 3B	9/1/2018	TBD	Delayed from 8/1/2018
<b>YBM</b> All station finishes complete	9/21/2018	TBD	Delayed from 6/1/2018
Water leak repairs completed	10/1/2018	TBD	
<i>Skylight installed at headhouse</i>	12/31/2018	TBD	
<b>STS</b> <i>Decision on intersection work plan</i>	9/1/2018	TBD	Delayed from 5/1/2018
<i>All surface work complete</i>	1/1/2019	TBD	
<i>Surface signal design complete</i>	11/1/2018	TBD	Replacement track needed
<i>Trackwork installed to CTS</i>	10/31/2018	TBD	

TBD = To Be Determined

**In the opinion of the PMOC, the BHAGs continue to be missed and are of questionable value in mitigating delays.**

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

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

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

### Project Schedule Data (as of July 31, 2018)

Earned Value (EV): \$1,242,178,166, an increase of \$16.49 million from June.

Planned Value (PV): \$1,526,333,656, a planned increase of \$2.90 million from June.

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): 0.81. 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 0.80 indicates that the project is significantly behind schedule.

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

**Table 6 - Schedule Milestones**

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

Schedule Contingency Management criteria were developed from the FTA Risk Assessment prior to entry into Final Design (FD). Minimum schedule contingency levels at various project milestones or “Hold Points” were agreed to with SFMTA at Risk Workshop #4, held in 2009. The FTA recommended schedule contingency for the current stage of the project is 4.0 months. The

current schedule reflects about 13 months of negative buffer float. Applying the recommended schedule float to SFMTA's current RSD forecast yields a RSD estimate of May 2020.

### **Critical Path Summary (*Baseline Schedule*)**

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

CTS Excavate Headhouse and Bracing (complete)

CTS SEM and Install Supports (underway)

CTS Headhouse Structural Concrete/Remove Bracing

CTS Install M/E/P Equipment

CTS Start-up and Testing

CTS P-1254R Commissioning of Station

Safety and Security Certification/Pre-Revenue Activities

RSD on December 26, 2018 (currently forecast January 14, 2019)

### **Three Month Look-ahead**

The following activities are planned over the next three months:

#### ***1300 Contract***

##### *UMS*

- Complete utility placement, backfill, and paving at the Stockton Street intersections with O'Farrell Street
- Close the access openings in Stockton Street
- Continue exterior finishing work at the plaza level of the Union Square Garage and the north entrance
- Construct finished walls and floors in the station box
- Complete the structural interface between the tunnels and the station box
- Install M/E/P throughout the station
- Install stairs throughout the station
- Install the escalators in the south concourse

##### *CTS*

- Completion of concourse-level slab in the headhouse
- Complete placement of final linings in the crosscut, crossover, and platform caverns
- Continue bottom-up construction of the headhouse interior walls and floors
- *Complete invert, waterproofing installation and staircase for north emergency egress.*

*YBM*

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

*STS*

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

The PMOC expects to attend the following meetings:

- Weekly Management (October 1, November 12, and December 10, 2018)
- Weekly Contract 1300 Construction Progress Meetings (October 2/3, November 13/14, and December 11/12, 2018)
- Weekly Configuration Management Board (CMB) (October 3, November 14, and December 13, 2018)

- CSP PMOC Status Meetings (October 2, November 13, and December 11, 2018)
- CSP Risk Management Meeting (To Be Determined (TBD))
- FTA/QPRM (November 14, 2018)

## F. QUALITY ASSURANCE AND QUALITY CONTROL

### QA/QC Plan Implementation

SFMTA's QAM retired from the project in May 2018. A replacement started working on the project in early July.

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

The quality concerns for the 1300 Stations Contract identified in the SFMTA June monthly report included issues identified in the previous month. A key activity for SFMTA is to determine the causes for acceptance of non-conforming rail during the submittal review process and at delivery of the rail to the project site. The RE for the STS work package noted at a weekly management meeting that subcontractors had been performing work without proper work plans and without required QC oversight from the contractor's QC team. **In the opinion of the PMOC, this is a serious breach of contract requirements for which SFMTA should take immediate action to prevent further occurrences.**

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

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

*As of August 31, 2018, TPC's Quality Manager had filed 386 CNCRs (8 new since July 31). Five new items were under review, 16 other items had responses identified but not yet approved, the proposed responses to 19 items were disapproved, and 30 items had approved responses that were not yet implemented. In addition, 275 items were closed (three more than in July) and 41 items had been voided.*

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

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

## H. SAFETY AND SECURITY

### Safety and Security Management Plan

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

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

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

### Construction Safety

SFMTA reported that TPC had achieved improved construction safety performance by reinforcing the extensive use of site safety inspections, safety training, and rapid responses to worker safety observations. The performance metrics relating to accidents per working hour remain well below the OSHA goals for similar construction. The current incident statistics for the project are shown in Table 7.

**Table 7 - Construction Safety Data**

<i>Through May 2018</i>	No. of Incidents	Incident Rate <sup>1</sup>	Goal
<b>1300 Contract</b>			
OSHA Recordable Accidents	13	0.90	<3.4
Job Transfer/Restricted Duty Incidents	0	0	NA
Lost Time Incidents	3	0.21	<1.6
Total Incidents	16	1.11	NA
Hours Worked	2,882,120		

<sup>1</sup>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 July 10, 2018, these and other major remaining project risks were evaluated. The outcome of the risk meeting is documented in Appendix D. *The PMOC did not attend the Risk Mitigation Meeting September.*

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

- The PMOC noted that a new risk “YBM Water Leaks” has been added to the register and that this risk is the second highest rated risk after “Unresolved Assignment of Schedule Delay Responsibility may lead to increased program cost.” The PMOC notes that it may be appropriate to add a risk for potential water leaks at CTS, since the basic design of the headhouse is similar to that for YBM. SFMTA noted the actions it is taking to repair water leaks and to determine the underlying causes for the leaks. A consultant is conducting an independent evaluation of the design to assess whether inadequate waterproofing in the design could be responsible for the leaks. At present, the leaks are not holding up progress for installation of equipment at YBM.
- SFMTA noted that it is working to execute unilateral CMods to reflect the findings of the DRB regarding claims filed by TPC. In approximate terms, SFMTA is likely to agree with changes that will increase the TPC contract value by about \$20 million, while TPC is seeking more than \$50 million in increased direct costs and extended construction overhead. In the opinion of the PMOC, the final contract cost will most likely be the subject of mediation and/or litigation.
- As part of the review of risk 251 (risk that all work is not identified in the current construction schedule, resulting in delays), SFMTA noted that a detailed schedule of activities for the ATCS has been developed, and this detailed schedule did not result in the need for more time to complete the ATCS work.
- SFMTA noted that it continues to work to hire a Start-up and Testing Manager for the project. Muni Operations has identified two of its staff to work on start-up activities. The CSP Acting Program Director does not believe that these staff members have sufficient experience in start-up work. SFMTA is working to secure consultant support for the start-up work. In the opinion of the PMOC, the combination of experienced consultant support and current Muni Operations staff may represent a cost-effective approach to meeting the temporary requirement for testing and start-up expertise and the long-term need for ongoing operation of the service.
- The PMOC noted that recent issues with inadequate coordination of architectural features (either in design or in construction or both) have not been captured as potential future

risks. **In the opinion of the PMOC, SFMTA should be using the issues at YBM with coordination of architectural features as an opportunity for lessons learned that can be applied to the other two underground stations.** The issues at YBM include coordination between finish ceiling support systems and smoke control features and problems with the finished floor elevations.

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

SFMTA has been applying updated schedule risks to a Monte Carlo analysis of the program schedule in order to establish a range of likely construction completion dates and revenue service dates. SFMTA provided an updated report on the schedule risk assessment to FTA on June 20. However, the PMOC determined that the schedule risk analysis did not reflect the recent delays to critical path work and requested that SFMTA update the analysis. SFMTA is currently reviewing and updating the projection for RSD based on the current status of the project. **The PMOC recommends that the risk assessment and schedule forecast be further updated once the contract actions to separate the ATCS work from the 1300 Contract are complete. Significant schedule risk is associated with the schedule for ATCS work, and this risk can be better evaluated once the contract modifications are executed.**

**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. Closed recommendations are removed from the table one month after closure.



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. Headhouse invert slab was completed in June 2018. SFMTA is reevaluating its schedule risk assessment given the delayed completion of this critical path work.
3	12/27/2017	The CSP Management Team should assess the impacts that schedule acceleration may be having on the quality program for the project and make any necessary adjustments needed to assure that quality is not compromised.
4	12/27/2017	The status of BHAGs should be discussed at each work package status meeting in order to improve the effectiveness of the goals in advancing critical project work. The PMOC noted that BHAGs were discussed at each of the four work package status meetings. <b>CLOSED</b>
5	12/27/2017	The trend log tracking should include the amount of time that has passed from the initial identification of the trend.
6	1/10/2018	SFMTA should immediately prepare and implement a plan for filling key positions, including the Program Director and Resident Engineer openings. The PMOC will monitor the agency's progress in recruitment and hiring of needed staff. RE positions filled. Program Manager and Start-up and Testing Manager remain open.
7	1/10/2018	SFMTA should evaluate the current and future staffing levels and expertise required to address outstanding contract issues while effectively managing ongoing construction and preparing for systems testing and start-up activities. The PMOC supports the concept of assigning a dedicated claims management team, which has been partially implemented. <i>SFMTA has added several contract and claims management staff –</i> <b>CLOSED.</b>
8	1/10/2018	SFMTA should now focus on updating the risks and mitigation strategies to reflect the transition of the work from excavation and major structural supports to M/E/P and systems installation and testing. A specific risk of delays due to contractual issues with the ATCS system would appear to be a concern.

Number	Date Identified	Recommendation
9	2/23/2018	The PMOC recommends that SFMTA quickly resolve the ongoing contractual issues regarding the schedule for and management of the ATCS to avoid schedule delays. Execution of amendments is still pending.
10	2/23/2018	The PMOC recommends SFMTA immediately resolve differences of opinion regarding skills required for the Start-up and Testing Manager and fill this position. SFMTA plans to obtain consulting support for the testing and start-up work while assigning two operations staff to the project. The assignments have yet to be implemented.
11	3/11/2018	SFMTA management should work with SSD and CSP management to assure that traffic control requirements appropriately balance the needs of the project and the traveling public. A partnering approach may be effective in addressing TCP issues. <i>The requirements for traffic control for street restoration at the remaining intersections along 4th Street were to be agreed at a meeting on July 13. However the plan is still not in place and the target date of September 1, 2018 was missed.</i>
12	4/12/2018	The PMOC recommends that the risk assessment and schedule forecast be updated once the contract amendment to separate ATCS work from the 1300 Contract is executed. Significant schedule risk is associated with the unknown schedule for ATCS work and this risk can be better evaluated once the Thales contract has been modified.
13	5/17/2018	The PMOC recommends that SFMTA quickly determine what course of action to take in response to the installation of standard, rather than hardened, rail for the project's trackwork. Replacement rail should be procured as soon as possible to minimize delays to the project. <i>Rail was ordered and is due for delivery in October 2018. <b>CLOSED</b></i>
14	6/21/2018	The PMOC recommends that SFMTA complete its review of its QA procedures and process to determine how the non-conforming rail was accepted and installed for a significant portion of the alignment before the issue was identified. The PMOC also recommends that SFMTA assess its design control procedures to identify how to avoid conflicting requirements for specified materials in different portions of the specification.
15	7/18/2018	SFMTA is encouraged to work with the designer to expedite solutions to design issues identified by the contractor to avoid delays to the program critical path.

<b>Number</b>	<b>Date Identified</b>	<b>Recommendation</b>
<i>16</i>	7/18/2018	The PMOC recommends that the new QAM follow up on the status of the quality audit for waterproofing installation at YBM.
<i>17</i>	8/6/2018	The PMOC recommends that SFMTA take immediate action to prevent further occurrences of contractor or subcontractor crews performing work without proper QC oversight.

**APPENDIX A. LIST OF ACRONYMS**

AC	Actual Cost
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ARS	Air Replenishment System
ATCS	Automated Train Control System
BART	Bay Area Rapid Transit
BCE	Baseline Cost Estimate
BHAG	Big Hairy Audacious Goal
BRT	Bus Rapid Transit
Caltrans	California Department of Transportation
CAR	Corrective Action Request
CCTV	Closed Circuit Television
CFR	Code of Federal Regulations
CLIN	Contract Line Item Number
CM/GC	Construction Manager/General Contractor
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

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

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

**APPENDIX B. SAFETY AND SECURITY CHECKLIST**

<b>Central Subway Project Overview</b>			
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		
<b>Project Plans</b>	<i>Version</i>	<i>Review by FTA/FRA</i>	<b>Status</b>
Safety and Security Management Plan	<b>2014</b>	<b>2011</b>	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)	<b>2011</b>		SSCP was revised 10/2011. Revision 1 was developed in November 2011. Not submitted to FRA.
System Safety Program Plan (SSPP)	<b>2009</b>	<b>2009</b>	SSPP dated 03/13/2009 submitted to FTA 07/31/2009. Not submitted to FRA.
System Security Plan (SSP) or Security and Emergency Preparedness Plan (SEPP)	<b>2009</b>		Not submitted to FTA. Not submitted to FRA.
Construction Safety and Security Plan	<b>2012</b>		Health and Safety. Construction Safety Standards Revision 3, June 27, 2012.
<b>Safety and Security Authority</b>	<i>Y/N</i>		<b>Notes/Status</b>
Is the grantee subject to 49 CFR Part 659 state safety oversight requirements?	Y		
Has the state designated an oversight agency as per Part 659.9?	Y		California Public Utilities Commission (CPUC) Consumer Protection & Safety Division 505 Van Ness Avenue San Francisco, CA 94102 (415) 703-1017 phone (415) 703-1758 fax Point of contact: Arun Mehta

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

<b>Central Subway Project Overview</b>			
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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		
<b>Project Plans</b>	<i>Version</i>	<i>Review by FTA/FRA</i>	<b>Status</b>
<b>SSMP Monitoring</b>			
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		

<b>Central Subway Project Overview</b>			
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		
<b>Project Plans</b>	<i>Version</i>	<i>Review by FTA/FRA</i>	<b>Status</b>
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.

<b>Central Subway Project Overview</b>			
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Project Delivery Method (Design/Build, Design/Build/Operate/Maintain, CM/GC, etc.)	Design-Bid-Build		
<b>Project Plans</b>	<i>Version</i>	<i>Review by FTA/FRA</i>	<b>Status</b>
Has the grantee verified conformance with safety and security requirements in equipment and materials procurement?	Y		Safety and Security Conformance checklists have been prepared for each of the construction contracts. All certifiable elements of the Tunnel work have been certified and accepted by SFMTA Safety. Certification reviews are underway for the stations contract.
Has the grantee verified construction specification conformance?	Y		This is on-going as construction progresses and verified through the Safety and Security Certification process
Has the grantee identified safety and security critical tests to be performed prior to passenger operations?	N		Currently being developed.
Has the grantee verified conformance with safety and security requirements during testing, inspection, and start-up phases?	N		<i>Project is in construction, with RSD about 17 months in the future.</i>
Does the grantee evaluate change orders, design waivers, or test variances for potential hazards and/or vulnerabilities?	Y		
Has the grantee ensured the performance of safety and security analyses for proposed work-arounds?	N/A		Currently no work-arounds have been identified.

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

<b>Central Subway Project Overview</b>		
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	
<b>Project Plans</b>	<i>Version</i>	<i>Review by FTA/FRA</i> <b>Status</b>
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.
<b>Federal Railroad Administration</b>		
If shared track: has grantee submitted its waiver request application to FRA? (Please identify specific regulations for which waivers are being requested.)	N/A	No shared track. No waivers are anticipated.
If shared corridor: has grantee specified specific measures to address shared corridor safety concerns?	N/A	
Is the CHA underway?	N/A	
Other FRA required Hazard Analysis – Fencing, etc.?	N/A	
Does the project have Quiet Zones?	N	
Does FRA attend the Quarterly Review Meetings?	N	

N/A = Not applicable.

## APPENDIX C. PROJECT MAP AND OVERVIEW

### CENTRAL SUBWAY PROJECT: Project Overview and Map

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<b>Date:</b>	<i>August 20, 2018</i>
Project Name:	Central Subway Project (CSP) New Starts Light Rail Transit
Grantee:	San Francisco Municipal Transportation Agency (SFMTA)
FTA Regional contact:	Mr. Bernardo Bustamante
FTA Headquarters contact:	Mr. Andre Anderson

#### Scope

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

**Schedule**

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

78.7% *Percent Complete Based on Progress (July 2018 data)*

**Cost**

\$764 million	Total Project Cost (\$YOE) at Approval Entry to PE
\$1,578 million	Total Project Cost (\$YOE) at Approval Entry to FD
\$1,578 million	Total Project Cost (\$YOE) at FFGA signed
\$TBD million	Total Project Cost (\$YOE) at Revenue Operations
\$1,578 million	Total Project Cost (\$YOE) at date of this report including \$0.00 in Finance Charges
<i>\$1,232.3 million</i>	Amount of Expenditures at date of this report from Total Project Budget of \$1,578 million
78.1%	Percent Complete based on Expenditures at date of this report
<i>\$6.72 million</i>	Unallocated Contingency remaining
<i>\$71.18 million</i>	Total Project Contingency (allocated and unallocated contingency as reported by CSP)
\$25 million	Minimum Total Project Contingency revised on September 5, 2012 PMOC review of Contingency Management Plan

	<b>AT HOLD POINTS</b>	<b>QTR</b>	<b>Minimum Contingency Levels</b>	<b>Revised Levels</b>
<b>1A</b>	Hold Point 1a – Tunnels 100% designed February 2011 (Actual)	1Q11	280	280
<b>1B</b>	Hold Point 1b – CTS 100% designed June 2012 (Actual)	4Q11	250	240
<b>1C</b>	Hold Point 1c – 40% Bid (Tunnel and CTS)	2Q12	225	200
<b>1D</b>	Hold Point 1d – FFGA Award October 2012 (Actual)	3Q12	-	180
<b>2</b>	Hold Point 2 – Commence CTS / UMS construction (Actual June 17, 2013)	2Q13	160	160
<b>3</b>	Hold Point 3 – Demobilize Tunnels (Actual April 15, 2015)	2Q15	140	140
<b>4</b>	Hold Point 4 – Stations to platform levels (CTS / YBM) November 2016	2Q18	60	60
<b>5</b>	Hold Point 5 – Complete CTS / Tunnels systems inst. April 2018	2Q19	25	25
<b>RSD</b>	PMOC / FTA RSD	4Q19		
<b>CURRENT TOTAL CONTINGENCY \$71.18 Million</b>				



## APPENDIX D. TOP PROJECT RISKS

Top risks were discussed at the July 2018 risk meeting as noted below. *The PMOC has noted attended a risk update meeting since July 2018.*

### Top Risks Discussed at Most Recent Meeting:

**Risk 240** – Unresolved assignment of responsibility for schedule delays may lead to increased costs for the program. This risk continues to be a concern. TPC has issued numerous claims, which are being addressed through the DRB. TPC has been unwilling to accept some of the DRB conclusions.

**Risk 255 (new)** – Water leaks at YBM. Water leaks continue at YBM despite ongoing repair activities. Most of the leaks are at the interface between the station box and the headhouse. Thus far, the schedule impacts of the leaks have been minor, but SFMTA expects to be liable for the costs of the repairs. SFMTA has initiated a third party evaluation of the reasons for the leaks and is also studying alternative methods of mitigating the impacts of the leaks. At CTS the waterproofing system was 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.

**Risk 251** – Activities required to complete the project scope are not identified in the schedule, resulting in the time required to complete the project being longer than currently forecast. The ATCS contractor provided a detailed schedule for its work, which did not result in additional time beyond what was included in the simplified schedule. This risk will continue to be monitored. . SFMTA's schedule updates are capturing differences between the activities in the baseline schedule and the work actually being completed.

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

**Risk 253** – Insufficient resources are available to complete the work as planned. 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. There is a concern that TPC is refusing to issue CNCRs when non-conforming work is identified. This or a similar risk was realized when it was discovered that non-conforming rail for the project had been approved through the submittal process, delivered to the project, and installed over portions of the alignment. SFMTA has directed TPC to replace the rail and has started the process to independently order

replacement rail directly from a supplier. The overall schedule impact of the rail issue is unknown at this time.

**Risk 205** – Prolonged time to execute contract modifications may lead to poor relations between the REs and the contractor. This risk continues to be a concern. A few additional CMods have been issued over the past two months. SFMTA continues to focus on speeding up the process of evaluating the justification for CMods and completing the negotiation process on price and time impacts with TPC.

**Risk 229 and 230** – Risk that contractor and SFMTA systems testing and commissioning will take longer than currently planned. SFMTA has delivered to the PMOC a more detailed schedule for ATCS, which includes the contractor's system tests. SFMTA still needs to complete a more detailed commissioning schedule that includes identification of required testing and the responsibilities for witnessing and approving the tests. SFMTA is working to bring on a Testing and Commissioning Manager to lead this effort and is coordinating with Muni's operations department on the job description and hiring process, which has taken much longer than planned. SFMTA is now considering obtaining consultant support for the testing and commissioning process in addition to the services of staff assigned from SFMTA Operations.

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

**Risk 95** – Contractor (or key subcontractor) default during construction impacts the schedule. Defaults have occurred but have yet to impact the program schedule. Conquest is currently a concern due to the potential financial impacts of the procurement and installation of non-conforming rail for the project. Smaller subcontractors' default also may be a risk, but a larger concern is the lack of overall capacity due to the high volume of construction work underway in the San Francisco market.

**Risk 99** – Breakdown in relationships between SFMTA and contractors during construction results in increased claims and delays to the overall construction schedule. This risk is being realized, with TPC issuing 86 claims to date.

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

**APPENDIX E. ROADMAP TO REVENUE OPERATIONS**

<b>Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT</b>				
<b>Description</b>	<b>Estimated Start Date</b>	<b>Estimated Completion Date</b>	<b>Actual Completion Date</b>	<b>Notes</b>
<b>Testing</b>				
Finalize/update Systems Integration Test (SIT) Plan	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future. <i>This item is becoming critical.</i>
Prepare Schedule for Testing (update)	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. <i>This item is becoming critical.</i>
Finalize Test Procedures	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Conduct System Integrated Testing with trains, including procedures and reports	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Complete Testing Reports	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
<b>Operating Plan, Rules, and Training</b>				
Finalize Operating Plan	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future. SFMTA’s latest two-year operating budget includes start-up of CSP.
Finalize/revise SOPs, manuals, and rulebook as applicable	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Operations Manuals	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Staffing and Operations Plan	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Training of O&M personnel	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Emergency response plan, training, and drills	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.

<b>Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT</b>				
<b>Description</b>	<b>Estimated Start Date</b>	<b>Estimated Completion Date</b>	<b>Actual Completion Date</b>	<b>Notes</b>
<b><i>Vehicle Maintenance Plan, Equipment, Facilities, and Training</i></b>				
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..
<b><i>Facility and Right-of-way Maintenance Plan, Equipment, Facilities, and Training</i></b>				
Maintenance Schedules and Procedures	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Spare Parts Requirements	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Maintenance Manuals	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Maintenance Training	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.

<b>Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT</b>				
<b>Description</b>	<b>Estimated Start Date</b>	<b>Estimated Completion Date</b>	<b>Actual Completion Date</b>	<b>Notes</b>
<b>Pre-Revenue Operations</b>				
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. An updated plan will be prepared when a Start-up and Testing Manager is hired. <i>This item is becoming critical.</i>
Implement Rail Activation Committee	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 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))	<i>Ongoing</i>	10/31/2015	10/31/2015	CPUC triennial review conducted in October 2015 concluded that SFMTA “has a comprehensive System Safety Program Plan (SSPP) and has made significant progress in executing that plan.”
FTA Office of Safety & Security Readiness Review	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
PMOC OP-54 Readiness for Revenue Operations Review Report, Phase I	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Conduct Operational Hazard Analysis (OHA) and resolve other hazards/vulnerabilities	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Pre-Revenue Operations	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
<b>Public Outreach</b>				
Develop Safety Outreach Plan	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Provide Community Outreach	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.
Grand Opening Plan	TBD	TBD	TBD	Project is in construction, with RSD about 1.5 years in the future.

<b>Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT</b>				
<b>Description</b>	<b>Estimated Start Date</b>	<b>Estimated Completion Date</b>	<b>Actual Completion Date</b>	<b>Notes</b>
<b><i>Construction Close Out</i></b>				
Close Out of Non-Conformance Reports	Ongoing	12/29/2019	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	7/26/2019	12/29/2019	TBD	Punch list completion expected at final completion of 1300 Contract.
Certificates of Occupancy/Substantial Completion	TBD	07/26/2019	TBD	
<b><i>Safety, Security, and Fire-life Safety Certifications</i></b>				
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	12/29/2019	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	11/15/2019		60 days before RSD - Check against latest regulations.
Document Workarounds/Open Items List	TBD	TBD	TBD	
Verify emergency drills, tabletops, training, etc. are completed	TBD	TBD	TBD	

<b>Roadmap to Revenue Operations - Central Subway Project, San Francisco Municipal Transportation Agency – DRAFT</b>				
<b>Description</b>	<b>Estimated Start Date</b>	<b>Estimated Completion Date</b>	<b>Actual Completion Date</b>	<b>Notes</b>
SSO final certification/signature	TBD	12/24/2019		21 days before RSD - Check against latest regulations.
<b><i>Third Party and Agency Agreements</i></b>				
Third Party/Agency Agreements Necessary for Revenue Service	TBD	TBD	TBD	Project is in construction, with RSD <i>about 1.5</i> years in the future.
Third Party/Agency Approvals Necessary for Revenue Service	TBD	TBD	TBD	Project is in construction, with RSD <i>about 1.5</i> years in the future.
<b><i>Revenue Service</i></b>				
Target Revenue Service Date	-	01/14/2019		Current forecast RSD.
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

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

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

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

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

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

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

### APPENDIX G. CONTRACT STATUS

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

<b>Contract No.</b>	<b>1250</b>	
<b>Contract Description:</b>	<b>UR #1 (YBM)</b>	
<b>Status:</b>	Completed June 2011.	
<b>Cost:</b>	Original Contract Value	\$9,273,939
	Approved Change Orders	\$2,694,211
	Final Contract Value	\$11,968,150
	Expended to Date	\$11,968,150
	% Expended	100%
	SBE Participation	97%
<b>Schedule:</b>	NTP issued January 2010. Substantial completion in June 2011.	
<b>Issues or Concerns:</b>		

<b>Contract No.</b>	<b>1251</b>	
<b>Contract Description:</b>	<b>UR #2 (UMS)</b>	
<b>Status:</b>	Work is complete.	
<b>Cost:</b>	Original Contract Value	\$16,832,550
	Approved Change Orders	\$3,836,531
	Final Contract Value	\$20,699,081
	Expended to Date	\$20,794,581
	% Expended	100%
	SBE Participation	87.4%
<b>Schedule:</b>	NTP issued January 2011. Substantial completion in August 2012.	
<b>Issues or Concerns:</b>	Final total cost claim by contractor has been settled.	

<b>Contract No.</b>	<b>1252</b>	
<b>Contract Description:</b>	<b>Tunnels</b>	
<b>Status:</b>	Final completion achieved. Financial close out underway. <i>Final contract cost to be lower than reported here.</i>	
<b>Cost:</b>	Original Contract Value	\$233.58 million
	Approved Change Orders	\$7.83 million
	Current Contract Value	\$241.41 million
	Expended to Date	\$233.59 million; \$6.2 million is paid from non-project funds
	% Expended	96.8%
	SBE Participation	5.8%
<b>Schedule:</b>	Final completion achieved May 15, 2015.	
<b>Issues or Concerns:</b>	None.	

<b>Contract No.</b>	<b>1277</b>	
<b>Contract Description:</b>	<b>Pagoda Palace Demolition</b>	
<b>Status:</b>	Construction is complete; contract is in close out.	
<b>Cost:</b>	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%
<b>Schedule:</b>		
<b>Issues or Concerns:</b>	None.	

<b>Contract No.</b>	<b>1300</b>	
<b>Contract Description:</b>	<b>Three subway stations (YBM, UMS, and CTS) and STS</b>	
<b>Status:</b>	Mass excavation complete at one station and well underway at two other stations.	
<b>Cost:</b>	Original Contract Value	\$839.68 million
	Approved Change Orders	\$8.99 million
	Current Contract Value	\$848.67 million
	Expended to Date	\$620.09 million
	% Expended	73.1%
	SBE Participation	21.3%
<b>Schedule:</b>	NTP issued June 17, 2013. Substantial Completion planned February 2018 and forecast July 2019.	
<b>Issues or Concerns:</b>	The work on this contract is behind schedule.	

<b>Contract No.</b>	<b>CS-155-1</b>	
<b>Contract Description:</b>	<b>Design Package 1 for Contracts 1250, 1251, and 1252. PB/Telemon</b>	
<b>Status:</b>	Design is complete. Construction support is nearly complete for Contract 1252.	
<b>Cost:</b>	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%
<b>Schedule:</b>		
<b>Issues or Concerns:</b>		

<b>Contract No.</b>	<b>CS-155-2</b>	
<b>Contract Description:</b>	<b>Design Package 2 for UMS, CTS, and YBM. CSDG prime</b>	
<b>Status:</b>	Designs are complete for all of the station contracts. Construction support of Contract 1300 is underway.	
<b>Cost:</b>	Original Contract Value	\$39,949,948
	Approved Change Orders	\$7,950,658
	Current Contract Value	\$47,900,606
	Expended to Date	\$41,490,486
	% Expended	86.6%
	SBE Participation	31.6%
<b>Schedule:</b>		
<b>Issues or Concerns:</b>		

<b>Contract No.</b>	<b>CS-155-3</b>	
<b>Contract Description:</b>	<b>Design Package 3 for STS. HNTB-B&amp;C Prime</b>	
<b>Status:</b>	Design is complete. Construction support of Contract 1300 is underway.	
<b>Cost:</b>	Original Contract Value	\$16,864,250
	Approved Change Orders	\$1,637,474
	Current Contract Value	\$18,501,724
	Expended to Date	\$15,140,016
	% Expended	81.8%
	SBE Participation	25.8%
<b>Schedule:</b>		
<b>Issues or Concerns:</b>		

<b>Contract No.</b>	<b>CS-149</b>	
<b>Contract Description:</b>	<b>Central Subway Partnership (Project Manager/Construction Manager)</b>	
<b>Status:</b>	On-going.	
<b>Cost:</b>	Original Contract Value	\$85,139,092
	Approved Change Orders	\$0
	Current Contract Value	\$85,139,092
	Expended to Date	\$67,013,727
	% Expended	78.7%
	SBE Participation	32.4%
<b>Schedule:</b>		
<b>Issues or Concerns:</b>		

<b>Contract No.</b>	<b>CS 156</b>	
<b>Contract Description:</b>	<b>Project Controls Consultant</b>	
<b>Status:</b>	On-going.	
<b>Cost:</b>	Base Contract Value	\$17,112,873
	Approved Change Orders	\$0
	Current Contract Value	\$17,112,873
	Expended to Date	\$9,996,954
	% Expended	58.4%
	SBE Participation	30.0%
<b>Schedule:</b>		
<b>Issues or Concerns:</b>		