

## Risk Mitigation Meeting Minutes #48

DATE: August 20, 2013

MEETING DATE: **August 13, 2013**

LOCATION: 821 Howard Street, 2<sup>nd</sup> Floor – Main Conference Room

TIME: 2:00pm

ATTENDEES: John Funghi, Albert Hoe, Eric Stassevitch, Alex Clifford, Vivian Chow, Beverly Ward, Roger Nguyen, Luis Zurinaga. Brad Lebovitz

COPIES TO: Attendees:, Richard Redmond, Mark Benson, Jane Wang, Mark Latch, Sanford Pong, Aileen Read, Chuck Morganson, James Sampson, David Kuehn  
File: M544.1.5.0820

REFERENCE Project No. M544.1, Contract No. 149 Task 1-4.01  
Program/Construction Management

SUBJECT: **Risk Management – Risk Mitigation Meeting  
Risk Mitigation Report No. 48**

### RECORD OF MEETING

ITEM #	DISCUSSION	ACTION BY DUE DATE
1 -	<p>Proposed revisions to Schedule Contingency Management currently under review by the FTA, requires additional supporting risk analysis to demonstrate the confidence in the proposed changes to the schedule contingency drawdown curve. The Program’s Risk profile changed in September 2012 due to changes in the Program’s contract delivery strategy. The Risk Manager is currently conducting an in house 2013 Risk Refresh to further analyze and document the impact of the new risk profile on the cost and schedule of the Program. One element of the Risk Refresh is the Schedule Assessment; to be discussed in detail at today’s meeting.</p> <p>The Risk Refresh contains a comprehensive review of all aspects of the Program, and the focus of today’s meeting is only on the Schedule Assessment and Risk Modeling performed on the current Program Master Schedule. The Risk Manager presented as a point of reference the schedule contingency drawdown curve developed and maintained since March 2009 and explained that the remaining agreed to FTA hold points are based on Program construction costs at 20%, 50%, 75% and 90% completion.</p> <p>The schedule assessment utilized the Schedule Risk Analysis outlined in FTA OP 40. The Risk Manager presented an overview of the process demonstrating thru graphical presentations the inputs required into the risk analysis program. The resulting output histogram and the monte carlo analysis were presented and discussed. The risk analysis indicated an 80%-95% confidence level in completing the Program on time utilizing just the standard default software</p>	



ITEM #	DISCUSSION	ACTION BY DUE DATE
	<p>settings for a first run analysis. The Program Master schedule utilized updated contract 1252 schedule and contract 1300 bid schedule critical path items, removing the buffer float, to create a summary level schedule.</p> <p>The Risk Manager provided further explanation of the process, stating the default settings of the risk analysis software are; minimum duration of (0.75), most likely duration of (1.00), and max duration of (1.25). Further refinement of the input is possible by closely examining the durations of key activities; adjustments on each level of the overall activity can then be made if the particular risks justify duration adjustments. One example of this refinement is the head house at YBM: Currently one schedule activity bar represents this work in the summary schedule. If the excavation activity portion of the head house construction contains substantial risk, then the risk analysis could break out the basic activities of the head house construction; setting for the excavation activity could be broken out and assigned specific probabilities such as minimum duration (1.00); most likely duration (1.15); and maximum duration (1.30).</p> <p>The Risk Manager requested the committee to evaluate the data as presented and provide comments regarding the assumptions made in the analysis. In particular, input on specific risks that would affect key activities and the respective probabilities utilized in the analysis.</p> <p>The Risk Committee recommended several different versions of the risk analysis be performed, adjusting schedule summary activities to current known risks and assigning probabilistic outcomes to activity durations commensurate with the risk.</p>	<p>PM/CM PCC 08/27/13</p>
2 -	The next Risk meeting will take place in two weeks <b>August 27, 2013</b> , to further analyze the results of expanding the duration.	

**ACTION ITEMS –**

ITEM #	MTG DATE	Task #	DESCRIPTION	BIC	DUE DATE	STATUS
1	12/13/12		<b>Risk 7</b> – Cost for significant settlement grout	J. Wang	09/12/13	Open
4	12/13/12		<b>Risk 72</b> – 4 <sup>th</sup> & King (SSWP)	S. Pong C. Morganson	09/12/13	Open
1	08/13/13		Expand/Confirm CN1300 Startup activities	PM/CM	08/27/13	Open
1	08/13/13		Examine additional schedule activities	PCC	08/27/13	Open
1	08/13/13		Schedule duration that are in the Master Schedule	PCC	08/27/13	Open

Meeting adjourned at 4:00pm

These meeting minutes have been prepared by B. Ward and reviewed by E. Stassevitch, and are the preparer's interpretation of discussions that took place. If the reader's interpretation differs, please contact the author in writing within four (4) days of receipt of these minutes.

Signed:  [initials of preparer & reviewer] Date:  [Date review completed.]

## Meeting Agenda

**Project No. M544.1, Contract No. CS-149**  
**Program/Construction Management**  
**Risk Mitigation Management Meeting No. 48**  
**August 13, 2013**  
**2:00pm – 4:00pm**  
Central Subway Project Office  
821 Howard St. 2<sup>nd</sup> Floor  
Main Conference Room

**Attendees:**

Mark Benson		Richard Redmond		Roger Nguyen	
Vivian Chow		Albert Hoe		Eric Stassevitch	
Alex Clifford		Mark Latch		Beverly Ward	
John Funghi		Brad Lebovitz		Luis Zurinaga	

**1. Risk Refresh 2013 – Schedule Contingency Assessment**

- **Overview of Risk Refresh Process**
- **Current Status of Project**
- **Schedule Contingency**

**2. Schedule Assessment**

- **Risk Analysis Input**
- **Summary Schedule Development**
- **Minimum; Most Likely; Maximum**
- **Current Risk Summary**

**3. Next Steps**



## Meeting Attendance Sheet

**Project No. M544.1, Contract No. CS-149**  
**Program/Construction Management**  
**Risk Management Meeting No. 48**  
**August 13, 2013**  
**2:00 p.m. – 4:00 p.m.**  
 Central Subway Project Office  
 821 Howard Street, 2<sup>nd</sup> Floor  
 Main Conference Room

*Deliver Meeting Attendance Sheet with original signatures/initials to Document Control.*

NAME	AFFILIATION	PHONE	E-MAIL (for minutes)	INITIALS
Mark Benson	CSP	415-701-5295	<a href="mailto:Mark.Benson@sfmta.com">Mark.Benson@sfmta.com</a>	
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Alex Clifford	CSP	415 701- 5275	<a href="mailto:Alex.clifford@sfmta.com">Alex.clifford@sfmta.com</a>	AC
John Funghi	SFMTA	415-701-4299	<a href="mailto:john.funghi@sfmta.com">john.funghi@sfmta.com</a>	JF
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Beverly Ward	CSP	415-701-5291	<a href="mailto:Beverly.ward@sfmta.com">Beverly.ward@sfmta.com</a>	BW
Luis Zurinaga	SFCTA	415-716-6956	<a href="mailto:luis@sfcta.org">luis@sfcta.org</a>	LZ
ROGER NGUYEN	SFMTA			RN

# **RISK REFRESH 2013**

## **I. PROJECT BACKGROUND**

- A. PROJECT OVERVIEW**
- B. HISTORY OF PRIOR WORKSHOPS #1, #2, #3, AND #4  
Refresh May 2011**

## **II. METHODOLOGY AND SCOPE OF REVIEW**

- A. GENERAL**
- B. FTA GUIDANCE and REGULATIONS**
- C. PROJECT REVIEWERS**
- D. GRANTEE SUBMITTALS AND INFORMATION FOR REVIEW**

## **III. SUMMARY OF PROJECT STATUS**

- A. TECHNICAL CAPACITY AND CAPABILITY REVIEW**
- B. SCOPE REVIEW**
- C. CAPITAL COST ESTIMATE REVIEW**
- D. SCHEDULE REVIEW**

## **IV. CONTRACT PACKAGING REVIEW**

- A. REVIEW AND ANALYSIS OF CONTRACT PACKAGE STRATEGY**
- B. REVIEW AND ANALYSIS OF RISK ALLOCATION AND ASSESSMENT**

## **V. RISK IDENTIFICATION-RISK REGISTER**

- A. DEVELOPMENT OF RISK REGISTER**
- B. REVIEW AND ANALYSIS OF RISK IDENTIFICATION-RISK REGISTER**

## **VI. RISK ASSESSMENT**

- A. COST RISK ANALYSIS**
- B. STANDARD COST CATEGORY ADJUSTMENTS**

# RISK REFRESH 2013

C. PROJECT COST RISK ASSESSMENT

**D. SCHEDULE ASSESSMENT AND RISK MODELING**

VII. RISK MITIGATION

A. PRIMARY MITIGATION

B. SECONDARY MITIGATION

C. CONTINGENCY

VIII. CONCLUSIONS

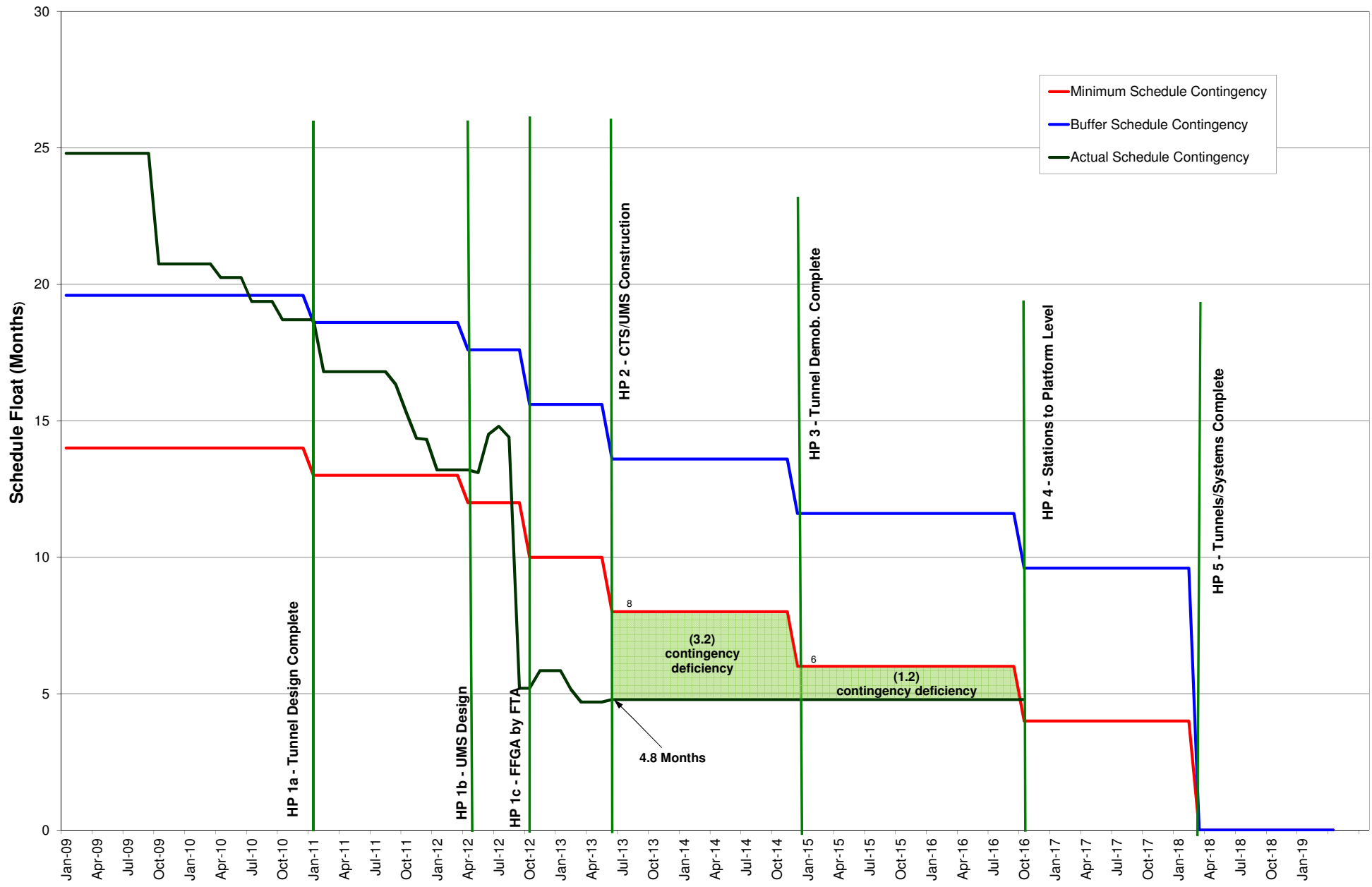
A. SUMMARY OF FINDINGS

B. RECOMMENDATIONS/PMOC OPINIONS

DRAFT

# CENTRAL SUBWAY PROJECT Schedule Contingency Drawdown

June 2013

























**CENTRAL SUBWAY  
RISK SUMMARY**

Risk #	Risk Description	Risk Owner	Risk Category	Risk Rating	Status	Contract
99	Breakdown in relationships between SFMTA and Contractors during construction results in increased claims and delays to the overall construction schedule.	MB	C	8	7/27/12 FDS 1940	GEN
F	Underground obstructions Stations (UMS)	JW	C	8	8/12/15 UMS 1320	UMS
F	Underground obstructions stations (CTS)	QC	C	8	10/9/17 CTS1500	CTS
F	Underground obstructions Stations (MOS)	QC	C	8	4/28/15 MOS1150	MOS
70	Change in traffic control requirements after bid.	RR	C	8	5/22/17 STS1020	GEN
83	Cost of vehicles may be more than estimated due to sole source and small order	LA	R	8	11/17/17 STS 1500	GEN
203	Headwalls interface delay 1300 Contractor (SSTS)	MB	C	8		SSTS
208	Additional cost if we change direction going to the Pagoda	RR/MB	C	8		TUN
46	Public complaints result in unanticipated restrictions on construction at CTS. (schedule and estimate for underground work assumes 6 day work week and 2 shifts per day)	MB/BC	C	6	10/9/17 CTS1500	CTS
52	Unacceptable settlement and impact on major utilities at CTS. (OLD SEWERS AND OTHERS WITHIN 20FT SPACE BETWEEN TOP OF CAVERN AND STREET LEVEL)	RR	C	6	4/22/16 N-CTS9730	CTS
204	AT&T Vault - New Sewer Work south of Bryant	RR/MB	C	6		SSTS
B	Storage and testing of excavated soils from tunnel limits advance rate of tunneling.	SW	C	6	2/5/14 TUN1124	TUN
34	Loss of business results in unanticipated restrictions on construction at UMS.	RR	C	5	9/7/16 UMS1430	UMS
72	Interface new Signaling and Train Control system to existing at Fourth and King	SP	C	5	3/4/16 STS1045	STS
104	CPUC approval at Grade Crossing for G0164d takes longer to negotiate / obtain than schedule allows	SP	R	5	7/27/12 FDS 1940	STS
E	Underground obstructions tunnel and retrieval shaft	SW	C	5	2/5/14 TUN1124	TUN
T	Delay on station emergency ventilation approval	JW	R	5	7/27/12 FDS 1940	GEN
16	TBM loss and / or damaged in Transit	MB	C	5	5/20/13 TUN1095	TUN
67	Archeological/Cultural findings during construction increases schedule and/or cost. (UMS)...LESS THAN 1%	MB	C	5	8/12/15 UMS1320	UMS
68	Archeological/Cultural findings during construction increases schedule and/or cost. (CHINA TOWN) ...AROUND 10%	MB	C	5	10/9/17 CTS1500	CTS
7	Potential for excessive settlement of BART tunnels - SIGNIFICANT COMPENSATION GROUT REQUIRED OVER ESTIMATE ALLOWANCES	SW	C	4	8/28/13 TUN1120	TUN
111	Major Earthquake stops work	AW	C	4	12/30/20 MS 0010	GEN
112	Major safety event halts work	MB	C	4	12/30/20 MS 0010	GEN
116	TBM procurement, delivery and assembly takes longer than assumed in schedule.	MB	C	4	5/20/13 TUN1095	TUN
196	The process of acquiring station licenses: acquisition/condemnation could significantly delay schedule and cost more than that presently planned.	RR	C	4		GEN
210	Mission Bay Loop Grant – Needs to be built to allow for train turnarounds (June 2013)	LA	C	4	06/13 TUN	GEN
212	UMS Inclined piles – 8" clearance between piles and tunnel results in damage or safety issues within the tunnel	RR	C	4		TUN
213	Micro Piles exist within tunnel path at UMS	RR	C	4		TUN
38	'Tiebacks in Stockton Street misallocated (in path of walls and would have to be dug out within 20ft of surface level)'	MB	C	3	5/6/14 UMS1170	UMS
48	Incomplete drawdown of groundwater. (inside of box and inside of caverns)	QC	C	3	5/1/16 CTS1140	CTS
50	CTS station contractor delayed by tunnel contractor since station platform construction cannot start until tunnels have been finished.	MB	C	3	12/16/13 TUN1122	CTS
66	Archeological/Cultural findings during construction increases schedule and/or cost.(Moscone) AROUND 10%	QC	C	3	4/28/15 TUN1150	MOS
102	Late finish of early contract delays later contracts and extends PM / CM and incurs additional costs	AW	C	3	12/30/20 MS 0010	GEN
115	Jet grouted station end walls are installed by Tunnel contractor. Station Contractor assumes risk of possibly leakage problems due to insufficiently quality of end walls.	SW	C	3	5/26/15 UMS1295	TUN
205	Prolong period of CMod's creates additional cost/causes bad blood between Resident Engineer and Contractor	ES/ RR	C	3		GEN
214	Micro Piles at UMS interfere with Tube-a-manchette installation (60' deep micropiles)	MB	C	3		TUN
J	Macy's entrance conflict with new piles	JW	C	3	1/23/14 UMS1060	UMS
PR37	Temporary construction power and ability to provide permanent power feed - PGE ability to provide power requirements to the program together with their other commitment	QC	C	3	5/3/18 STS1080	GEN
Q	As-built drawings and UMS construction drawings do not contain enough information to produce shop drawings without significant surveying effort delaying construction north	JW	C	3	3/24/12 UMS1280	UMS
V	Incorporation of revised Planning Zoning/ development criteria for Moscone Station TOD impact MOS and CTS construction contract.	RE	D	3	12/13/16 N-CTS1225	GEN

Design
Required
Market

**CENTRAL SUBWAY  
RISK SUMMARY**

Risk #	Risk Description	Risk Owner	Risk Category	Risk Rating	Status	Contract
15	Major TBM machine failure	SW	C	2	2/5/14 TUN1124	TUN
33	Damage to utilities at UMS causes delay to construction and/or consequential cost. (very close to walls adjacent to relocated utility trenches)	JW	C	2	7/19/16 UMS1410	UMS
89	3rd Party reviews of Design documents delays completion of Final Design.	JW	D	2	5/23/12 FDS 1930	GEN
95	Contractor default during construction impacts schedule. (key sub-contractor)	AW	C	2	11/17/17 STS 1500	GEN
100	Procurement of long lead items delays work. (fans, rails and special track work, TPSS, Escalators, elevators, TBM)	JW	C	2	11/17/17 STS 1500	GEN
106	Risk of Labor dispute delaying the work.	RR	C	2	11/17/17 STS 1500	GEN
211	Differing site conditions encountered during ground freezing of Cross Passage 5 results in increased costs.	RR	C	2		TUN
215	DPW Excavation permit reviews delay contract works	AC	C	2		GEN
PR1	Actual TBM production rate may be slower than forecasted.	MB	C	2	2/5/14 TUN1124	TUN
PR78	Delays or complication by other SFMTA projects delays CSP: radio, fare collection, C3/TMC	MB	C	2	7/27/12 FDS 1940	STS
27	Loss of business results in unanticipated restrictions on construction at MOS.	BN	C	2	4/28/15 MOS1150	MOS
28	Incomplete cutoff of groundwater at UMS	JW	C	2	8/12/15 UMS1320	UMS
65	Archeological/Cultural findings during construction increases schedule and/or cost. (Portal) AROUND 10%	SW	C	2	10/24/12 TUN1080	TUN
103	Difficulty in getting required permits.	AC	C	2	12/18/12 FDS 1275	GEN
105	Electrical service delays startup and testing.	RR	C	2	11/17/17 STS 1500	GEN
216	Olivet building potential construction impact	MB	C	2		TUN
2a	42"/48" sewer line relocated as part Utility 1 package is damaged by subsequent construction of the launch box.	SW	C	2	10/24/12 TUN1080	TUN
PR80	ROW costs higher than anticipated.	AW	M	2	7/1/12 FDS 1240	GEN
5	Possibility that lowest level of tie-backs extending out from Moscone Center could be within the tunnel alignment.	SW	C	1	7/2/13 TUN1118	TUN
8	Flowing groundwater in vicinity of UMS Station could make adequate annulus grouting difficult.	SW	C	1	8/28/13 TUN1120	TUN
32	Delay in advanced utility relocation delays ground treatment and start of construction. (Uty 2)	JW	R	1	7/31/12 N-ATT00100	UMS
35	Ground support structure causes groundwater table to rise which results in leakage into adjacent structures. ( new structure might create a dam that results into leaks into new	JW	C	1	9/7/16 UMS1430	UMS
37	Damage to adjacent buildings at UMS due to surface construction activities.	JW	C	1	9/7/16 UMS1430	UMS
71	Power supply interruptions to TBM's (no dual power feed currently planned)	RR	C	1	2/5/14 TUN1124	TUN
202	Cargo Preference (Ship America) must solicit U.S.- flag carriers. Civilian Agencies Cargo = at least 50% (governed by Cargo Preference Act of 1954	RR	C	1		SSTS
1	Additional night shift work required at portal launch box due to bus storage facility relocation delay	SW	C	1	3/20/15 TUN1160	TUN
U	Proximity at junction of head house boundary wall and school yard may result in relocation of school yard during wall construction	MB	C	1	8/16/13 CTS1010	CTS
13	Damage / settlement 3x 5' to old brick sewer running parallel to tunnel alignment	MF	C	1	12/16/13 TUN1121	TUN
21	Incomplete cutoff of groundwater at MOS	QC	C	1	4/28/15 MOS1150	MOS
22	Public complaints result in unanticipated restrictions on construction at MOS.	JW	C	1	9/16/16 MOS1230	MOS
36	Damage to buildings or utilities as a result of heave from jet grouting at UMS.	JW	C	1	4/14/15 UMS1310	UMS
79	Delay in obtaining tunnel easements (3 #) (goes to condemnation) - Costs of ROW may cost more than expected	AC	R	1	9/7/2012	TUN
PR83	Coordination with prime contractor could result in schedule impacts to others.	RE	C	1	0	GEN













Risk Register

PROJECT RISK REGISTER		Risk Profile					Severity Score					Legend		RISK RATING = PROBABILITY X (COST IMPACT + SCHEDULE IMPACT)	
Central Subway Project San Francisco		Likelihood Score	1	2	3	4	5	Probability	Low (1)	Medium (2)	High (3)	Very High (4)	Significant (5)	2	
REV : 23		5						< 10%	< 10%	< 10% - 50%	> 50%	< 75% - 90%	> 90%	< 3 Low	
DATE ISSUED: 07/09/13		4						< \$250K	< \$250K	< \$250K - \$1M	< \$1M - \$3M	< \$3M - \$10M	> \$10M	3 - 9 Medium	
		3						< 1 Month	< 1 - 3 Months	< 1 - 3 Months	< 3 - 6 Months	< 6 - 12 Months	> 12 Months	> 10 High	
		2													
		1													
Final Risk ID	Risk Description	Mitigation Description	Risk Category	Probability %	Cost Impact	Schedule Impact	Calc Impact	Calc %	Risk Rating	Score	Status	Must Complete by Date			
Underground Tunnel															
1	Additional night shift work required at portal launch box due to bus storage facility relocation delay	Work with TJPA to coordinate construction schedules and GGB to coordinate Traffic Routing.	C	2	1	-	1	35%	1	2	No longer considered a risk. GGB not scheduled to be utilizing site until 2014	3/20/15 TUN1160			
2a	42"/48" sewer line relocated as part Utility 1 package is damaged by subsequent construction of the launch box.	1. Make follow-on contractor responsible for repairs to any existing utility lines. 2. Properly as built actual location as part of Utility 1 package and provide to Contract 3 Contractor	C	1	1	2	2	10%	2	3	Sewer Installation complete, awaiting as built drawing. Sewer installed according to contract drawings. Contract 1252 provisions for protection of existing utilities puts all cost and schedule risk on Contractor.	10/24/12 TUN1080			
5	Possibility that lowest level of tie-backs extending out from Moscone Center could be within the tunnel alignment.	1. Lower tunnel alignment 5' below the lowest expected tieback. 2. Include obstruction clause and allowance in contract documents.	C	1	1	1	1	10%	1	2	Contract Documents issued for bid, contain location of tiebacks from as built drawings, do not intersect tunnel alignment.	7/2/13 TUN1118			
7	Potential for excessive settlement of BART tunnels - SIGNIFICANT COMPENSATION GROUT REQUIRED OVER ESTIMATE ALLOWANCES	1. Early and extensive co-ordination with BART. 2. Survey BART tunnels to determine exact locations. 3. Checking effect of maximum expected settlement on tunnels. 4. Require EPBM TBM, Contractor to demonstrate effective control of ground settlements and correction of settlements by compensation grouting, and pre-installation of compensation grout piping under BART tunnels prior to tunneling reaching Market St. Require repair/adjustment plan. 5. Develop contingency plan to provide bus bridge, if needed. 6. Require non-stop weekend excavation beneath BART tunnels. 7. Monitor movement of BART tunnels in real-time. 8. Repair/adjust as needed. 9. Include probable cost in estimate.	C	2	2	2	2	35%	4	8	Risk is considered active, with mitigation measures fully developed with the exception of Bus Bridge. Adjusted cost impact lower resulting in Risk rating increasing to 2 but still remains a low risk.	8/28/13 TUN1120			
8	Flowing groundwater in vicinity of UMS Station could make adequate annulus grouting difficult.	1. Use appropriate additives such as accelerators in primary annulus backfill grouting, if needed. 2. Use secondary grouting as needed.	C	1	1	1	1	10%	1	2	Plans issued for bid contain mitigation measures	8/28/13 TUN1120			
E	Underground obstructions tunnel and retrieval shaft	Include differing site conditions in GPs as well as DRB to adjudicate conflicts and minimize costs	C	2	2	3	3	35%	5	10	Mitigation measures have been implemented. Maintain adequate contingency throughout tunnel construction	2/5/14 TUN1124			
PR1	Actual TBM production rate may be slower than forecasted.	Assign significant liquidated damages for not meeting specific schedule dates.	C	1	1	3	2	10%	2	4	Considered Risk inherent in the work and reflected in the Current Cost Estimate. Risk will be reflected in Contractor's Bid. LDs included in contract.	2/5/14 TUN1124			
13	Damage / settlement 3x 5' to old brick sewer running parallel to tunnel alignment	Slip Line 3'x5' brick sewer before TBM reaches CTS.	C	1	1	-	1	10%	1	1	Tunnel profile has been lowered 25 ft. and plans developed for replacement of at risk utilities in advance of tunnel drive.	12/16/13 TUN1121			
15	Major TBM machine failure	Closely monitor condition and maintenance of the machines.	C	1	2	2	2	10%	2	4	Contractor has indicated that they plan to use a newly manufactured TBM for this project.	2/5/14 TUN1124			
16	TBM loss and / or damaged in Transit	Provide provisions for insurance for TBM in transit to jobsite	C	1	5	4	5	10%	5	9	Costs covered by Contractor's insurance.	5/20/13 TUN1095			
115	Jet grouted station end walls are installed by Tunnel contractor. Station Contractor assumes risk of possibly leakage problems due to insufficiently qualify of end walls.	1. In the 1252 contract, have tunnel contractor set aside a pre-determined amount of money in escrow that can be used to repair any leaks encountered by the station contractors after the in the jet grout end walls are excavated. 2. Alternatively, place an allowance in the station contracts for end wall leakage repair.	C	3	1	1	1	50%	3	6	Project configuration changes include headwall designs with multiple levels of redundancy. Warranty provisions added to contact language.	5/26/15 UMS1295			
116	TBM procurement, delivery and assembly takes longer than assumed in schedule.	Accommodate delay to TBM procurement and delivery, on the order of 2 or 3 months, with current float shown on the construction schedule.	C	2	2	2	2	35%	4	8	Mitigation measures are being implemented	5/20/13 TUN1095			

Risk Register

PROJECT RISK REGISTER		Risk Profile					Severity Score					Legend		RISK RATING = PROBABILITY X (COST IMPACT + SCHEDULE IMPACT)		
Central Subway Project San Francisco		Likelihood Score	1	2	3	4	5	Low (1)	Medium (2)	High (3)	Very High (4)	Significant (5)	<3 Low	3 - 9 Medium	>10 High	SCORE = PROBABILITY X (COST IMPACT + SCHEDULE IMPACT)
REV : 23		5						< 10%	< 10% - 50%	> 50%	< 75% - 90%	> 90%				
DATE ISSUED: 07/09/13		4						< \$250K	< \$250K - \$1M	> \$1M - \$3M	< \$3M - \$10M	> \$10M				
		3						< 1 Month	< 1 - 3 Months	< 3 - 6 Months	< 6 - 12 Months	> 12 Months				
		2														
		1														
Final Risk ID	Risk Description	Mitigation Description	Risk Category	Probability %	Cost Impact	Schedule Impact	Calc Impact	Calc %	Risk Rating	Score	Status	Must Complete by Date				
B	Storage and testing of excavated soils from tunnel limits advance rate of tunneling.	1. Provide adequate storage and handling facility to accommodate testing activity. 2. Work with SAR to develop acceptance criteria, to minimize or eliminate testing requirements. 3. Require the contractor to provide a detailed workplan for testing, sorting and stockpile prior to hauling.	C	2	3	3	3	35%	6	9	Contractor is attempting to obtain the use of additional Caltrans parcel between Fourth & Fifth and Harrison & Bryant to help facilitate this work and provide additional storage area. .	2/5/14 TUN1124				
MOS Station																
21	Incomplete cutoff of groundwater at MOS	1. Require additional grouting to limit leakage to permissible level. 2. Include probable grouting work in cost & schedule estimates.	C	1	1	-	1	10%	1	1	Mitigation measure to be made part of the contract documents	4/28/15 MOS1150				
22	Public complaints result in unanticipated restrictions on construction at MOS.	1. Public outreach. 2. Maintain regular and open communications so Public knows construction plans and progress at all times. 3. Require Contractor to assist Public Outreach efforts, maintain access to businesses and assist with deliveries and pick-ups, control noise and vibration, continuously cleanup site, and provide pedestrian and vehicle traffic and protection plans, informational signage, ADA ramps and minimum sidewalk widths. 4. Work with MOED to increase cleanup of the area and assist pedestrians across streets, as needed. 5. Monitor and enforce noise, vibration, ADA, traffic, and cleanup requirements. 6. Quickly process and resolve damage and accident claims from the Public. 7. Assumed this work in cost & schedule estimates.	C	1	1	-	1	10%	1	1	Implementation of mitigation measures part of Communication/Outreach plan and certain aspects to be included in the contract documents.	9/16/16 MOS1230				
F	Underground obstructions Stations (MOS)	1. Provide adequate allowance for differing site conditions to address unknown underground obstructions. 2. Show field verified obstructions discovered during previous contracts on contract drawings. 3. Make as-built drawings of structures adjacent to the work available to the contractor as reference drawings.	C	4	2	2	2	80%	8	16	Mitigation measures have been implemented.	4/28/15 MOS1150				
27	Loss of business results in unanticipated restrictions on construction at MOS.	1. Public outreach. 2. Maintain regular and open communications so Merchants know construction plans and progress at all times. 3. Require Contractor to coordinate with merchants, maintain access to businesses and assist with deliveries and pick-ups, continuously cleanup site, and provide pedestrian and vehicle traffic and protection plans, informational signage, and minimum sidewalk widths. 4. Require barriers to protect pedestrians and shield them from noise and dirt from construction. 5. Work with MOEWD to increase cleanup of the area and assist pedestrians across streets. 6. Include this work in cost & schedule estimates.	C	1	2	1	2	10%	2	3	Mitigation measures to be implemented and to the extent possible requirements will be written into contract documents to minimize disruptions to businesses.	4/28/15 MOS1150				
F	Underground obstructions Stations (UMS)	1. Provide adequate allowance for differing site conditions to address unknown underground obstructions. 2. Show field verified obstructions discovered during previous contracts on contract drawings. 3. Make as-built drawings of structures adjacent to the work available to the contractor as reference drawings.	C	4	2	2	2	80%	8	16	Mitigation measures have been implemented.	8/12/15 UMS 1320				
28	Incomplete cutoff of groundwater at UMS	1. If needed, perform grouting to mitigate the intrusion of groundwater. 2. Include in cost & schedule estimates.	C	1	2	1	2	10%	2	3	Mitigation measures in the form of consolidation grouting to be included in contract documents	8/12/15 UMS1320				



Risk Register

PROJECT RISK REGISTER												Risk Profile		Severity Score		Legend		RISK RATING = PROBABILITY X (COST IMPACT + SCHEDULE IMPACT)						
Central Subway Project San Francisco												Likelihood Score	1	2	3	4	5	Low (1)	Medium (2)	High (3)	Very High (4)	Significant (5)	<3 Low	2
REV : 23												5						< 10%	< 10% - 50%	> 50%	< 75% - 90%	> 90%	3 - 9 Medium	
DATE ISSUED: 07/09/13												4						< \$250K	< \$250K - \$1M	< \$1M - \$3M	< \$3M - \$10M	> \$10M	>10 High	
												3						< 1 Month	< 1 - 3 Months	< 3 - 6 Months	< 6 - 12 Months	> 12 Months		
												2												
												1												
Final Risk ID	Risk Description	Mitigation Description	Risk Category	Probability %	Cost Impact	Schedule Impact	Calc Impact	Calc %	Risk Rating	Score	Status	Must Complete by Date												
32	Delay in advanced utility relocation delays ground treatment and start of construction. (Uty 2)	1. Intensive coordination with and commitment from utility owners. 2. Early completion incentive for utility relocation contract. 3. Enforce franchise agreements.	R	1	1	1	1	10%	1	2	Advance utility relocation contract (1251) is underway with a projected completion date in advance of advertising UMS construction contract, reducing this risk of cost and schedule impacts	7/31/12 N-ATT00100												
33	Damage to utilities at UMS causes delay to construction and/or consequential cost. (very close to walls adjacent to relocated utility trenches)	1. Intensive utility coordination and investigation. 2. Relocate utilities out of the way of construction wherever possible. 3. Show utilities on reference plans. 4. Have utility contact information and procedure on plans. 5. Have contingency repair/restoration plans. 6. Include probable impacts to schedule & cost in estimates.	C	2	1	1	1	35%	2	4	Although mitigation measure have been fully implemented, Increased probability due to proximity of new pile design to existing relocated utilities.	7/19/16 UMS1410												
34	Loss of business results in unanticipated restrictions on construction at UMS.	1. Public outreach. 2. Work closely with Merchant's Association. 3. Maintain regular and open communications so Merchants know construction plans and progress at all times. 4. Advertise that Stockton Street Merchants are Open for Business. 5. Require Contractor to coordinate with merchants, maintain access to businesses and assist with deliveries and pick-ups, continuously cleanup site, and provide pedestrian and vehicle traffic and protection plans, informational signage, and minimum sidewalk widths. 6. Require barriers to protect pedestrians and shield them from noise and dirt from construction. 7. Work with the Union Square BID or MOED to increase cleanup of the area and assist pedestrians across streets. 8. Include this work in cost & schedule estimates.	C	2	3	2	3	35%	5	10	Mitigation measures to be implemented and to the extent possible requirements will be written into contract documents to minimize disruptions to businesses.	9/7/16 UMS1430												
35	Ground support structure causes groundwater table to rise which results in leakage into adjacent structures.( new structure might create a dam that results into leaks into new and existing structures)	1. Perform detailed hydrogeologic modeling and analysis. 2. Monitor groundwater table at multiple locations and passive measures as necessary to mitigate. 3. Reference the Tech memo in contract documents. 4. Include probable costs in estimate.	C	1	2	-	1	10%	1	2	Mitigation measures incorporated in design based on updated Hydrogeologic analysis and report	9/7/16 UMS1430												
36	Damage to buildings or utilities as a result of heave from jet grouting at UMS.	Utilize tangent piles combined with surface jet grouting.	C	1	1	-	1	10%	1	1	Mitigation measures implemented in contract documents to reduce risk	4/14/15 UMS1310												
37	Damage to adjacent buildings at UMS due to surface construction activities.	1. Require protective barriers. 2. Have an emergency and rapid response customer focused task force to fix damaged facilities. 3. Quickly repair and reimburse resulting costs. 4. Include probable cost in estimate.	C	1	2	-	1	10%	1	2	Mitigation measures implemented in contract documents to reduce risk	9/7/16 UMS1430												
38	Tiebacks in Stockton Street misallocated (in path of walls and would have to be dug out within 20ft of surface level)	1. Direct contractor to dig out the tiebacks on the plans. 2. Include allowance and differing site conditions clause in contract. 3. Include this work in the cost and schedule estimates.	C	2	2	1	2	35%	3	6	Mitigation measures fully implemented, Advance utility relocation contract (1251) confirmed location of tiebacks. Risk rating has been reduced due to a lowering of the probability of event occurring	5/6/14 UMS1170												

Risk Register

PROJECT RISK REGISTER		Risk Profile					Severity Score					Legend		RISK RATING = PROBABILITY X (COST IMPACT + SCHEDULE IMPACT)		
Central Subway Project San Francisco		Likelihood Score	1	2	3	4	5	Low (1)	Medium (2)	High (3)	Very High (4)	Significant (5)	<3 Low	3-9 Medium	>10 High	2
REV : 23		5						< 10%	< 10% - 50%	> 50%	< 75% - 90%	> 90%				
DATE ISSUED: 07/09/13		4						< \$250K	< \$250K - \$1M	> \$1M - \$3M	< \$3M - \$10M	> \$10M				
		3						< 1 Month	< 1 - 3 Months	< 3 - 6 Months	< 6 - 12 Months	> 12 Months				
		2														
		1														
Final Risk ID	Risk Description	Mitigation Description	Risk Category	Probability %	Cost Impact	Schedule Impact	Calc Impact	Calc %	Risk Rating	Score	Status	Must Complete by Date				
J	Macy's entrance conflict with new piles	1. Show known obstructions shown on as-built drawings on contract drawings. 2. Make as-built drawings available to contractor as reference drawings. 3. Have contractor field verify obstruction shown on as-built drawings and contract drawings	C	3	1	1	1	50%	3	6	Known obstructions are shown on the ES drawings. Allowance for differing site conditions added to UMS Station contract.	1/23/14 UMS1060				
Q	As-built drawings and UMS construction drawings do not contain enough information to produce shop drawings without significant surveying effort delaying construction north entrance.	1. Investigate if electronic files of design can be given to the contractor. 2. Clearly define shop drawing criteria in the technical specifications. 3. Make as-built drawings available as reference drawings to the contractor	C	3	1	1	1	50%	3	6	Specifications require contractor to survey USG in order to develop shop drawings for structural steel.	3/24/12 UMS1280				
CTS Station																
46	Public complaints result in unanticipated restrictions on construction at CTS. (schedule and estimate for underground work assumes 6 day work week and 2 shifts per day)	1. Public outreach. 2. Maintain regular and open communications so Public knows construction plans and progress at all times. 3. Require Contractor to assist Public Outreach efforts, maintain access to businesses and assist with deliveries and pick-ups, control noise and vibration, continuously cleanup site, and provide pedestrian and vehicle traffic and protection plans, informational signage, ADA ramps and minimum sidewalk widths. 4. Require barriers to protect pedestrians and shield them from noise and dirt from construction. 5. Work with MOED to increase cleanup of the area and assist pedestrians across streets, as needed. 6. Monitor and enforce noise, vibration, ADA, traffic, and cleanup requirements. 7. Quickly process and resolve damage and accident claims from the Public. 8. Include this work in cost & schedule estimates.	C	2	5	1	3	35%	6	12	Implementation of mitigation measures part of Communication/Outreach plan and certain aspects to be included in the contract documents.	10/9/17 CTS1500				
48	Incomplete drawdown of groundwater. (inside of box and inside of caverns)	1. Require additional grouting to limit leakage to permissible level. 2. Include probable grouting work in cost & schedule estimates. 3. Include allowance for dewatering within cavern during construction.	C	2	2	1	2	35%	3	6	Mitigation measures have been included in contract documents	5/1/16 CTS1140				
50	CTS station contractor delayed by tunnel contractor since station platform construction cannot start until tunnels have been finished.	1. Include provisions in CTS contract identifying the potential waiting period for tunnel contractor. 2. Actively monitor progress towards schedule milestones	C	2	1	2	2	35%	3	6	Constraints on CTS contractor added to specification "Work Sequence and Constraints"	12/16/13 TUN1122				
52	Unacceptable settlement and impact on major utilities at CTS. (OLD SEWERS AND OTHERS WITHIN 20FT SPACE BETWEEN TOP OF CAVERN AND STREET LEVEL)	1. Evaluate effect of potential settlement on utilities. 2. Slip-line sewer by TBM contractor. 3. Reinforce other utilities as needed, monitored during construction, and repair / replace, as needed. 4. Have contingency repair/restoration plan. 5. Utility contact information and procedure will be on plans. 6. Develop an allowance for utility repair. 7. Include probable cost in estimate.	C	3	3	1	2	50%	6	12	Project configuration change, lowered station 25 ft. reducing the probability of this risk. Risk rating lowered.	4/22/16 N-CTS9730				
F	Underground obstructions stations (CTS)	1. Provide adequate allowance for differing site conditions to address unknown underground obstructions. 2. Make as-built drawings of structures adjacent to the work available to the contractor as reference drawings	C	4	2	2	2	80%	8	16	Mitigation measures have been implemented.	10/9/17 CTS1500				
U	Proximity at junction of head house boundary wall and school yard may result in relocation of school yard during wall construction		C	1	1	1	1	10%	1	2	Project configuration changed to eliminate encroachment. Risk converted to Construction risk from Risk 55.	8/16/13 CTS1010				
General																
Demolition, Clearing , Earthwork																
Site Utilities, Utility relocations																

Risk Register

PROJECT RISK REGISTER		Risk Profile					Severity Score					Legend		RISK RATING = PROBABILITY X (COST IMPACT + SCHEDULE IMPACT)	
Central Subway Project San Francisco		Likelihood Score	1	2	3	4	5	Probability	Low (1)	Medium (2)	High (3)	Very High (4)	Significant (5)	<3 Low	2
REV : 23		5	Yellow	Orange	Red	Red	Red	< 10%	< 10%	< 10% - 50%	> 50%	< 75% - 90%	> 90%	3 - 9 Medium	
DATE ISSUED: 07/09/13		4	Green	Yellow	Orange	Red	Red	< \$250K	< \$250K	< \$250K - \$1M	> \$1M - \$3M	< \$3M - \$10M	> \$10M	>10 High	
		3	Green	Green	Yellow	Orange	Red	< 1 Month	< 1 Month	< 1 - 3 Months	> 3 - 6 Months	< 6 - 12 Months	> 12 Months		
		2	Green	Green	Green	Yellow	Orange								
		1	Green	Green	Green	Green	Yellow								
		1	Green	Green	Green	Green	Yellow								
Final Risk ID	Risk Description	Mitigation Description	Risk Category	Probability %	Cost Impact	Schedule Impact	Calc Impact	Calc %	Risk Rating	Score	Status	Must Complete by Date			
Hazmat, Contaminated Material															
Environmental Mitigations															
65	Archeological/Cultural findings during construction increases schedule and/or cost. (Portal) AROUND 10%	1. Provide on-call Archeologist. 2. Provide allowance and procedure in contract for Archeological/Cultural discoveries.	C	1	2	1	2	10%	2	3	Additional boring taken in vicinity of portal indicated no evidence of Archeological/Cultural resources.	10/24/12 TUN1080			
66	Archeological/Cultural findings during construction increases schedule and/or cost.(Moscone) AROUND 10%	1. Provide on-call Archeologist. 2. Provide allowance and procedure in contract for Archeological/Cultural discoveries.	C	3	1	1	1	50%	3	6	Mitigated - Current exposure only to those amount above those currently identified	4/28/15 TUN1150			
67	Archeological/Cultural findings during construction increases schedule and/or cost. (UMS)...LESS THAN 1%	1. Provide on-call Archeologist. 2. Provide allowance and procedure in contract for Archeological/Cultural discoveries.	C	3	1	2	2	50%	5	9	Mitigation measures to be implemented in contract documents	8/12/15 UMS1320			
68	Archeological/Cultural findings during construction increases schedule and/or cost. (CHINA TOWN) ...AROUND 10%	1. Provide on-call Archeologist. 2. Provide allowance and procedure in contract for Archeological/Cultural discoveries.	C	3	1	2	2	50%	5	9	Mitigation measures to be implemented in contract documents	10/9/17 CTS1500			
Auto/bus/van access ways, roads															
70	Change in traffic control requirements after bid.	1. Provide unit bid items to reimburse contractor for traffic management costs outside their control. 2. Include allowance in construction contracts for PCOs.	C	3	4	1	3	50%	8	15	Mitigation measures implemented.	5/22/17 STS1020			
71	Power supply interruptions to TBM's (no dual power feed currently planned)	Obtain TBM power directly from PG&E substation.	C	1	2	-	1	10%	1	2		2/5/14 TUN1124			
Train Control and Signals															
72	Interface new Signaling and Train Control system to existing at Fourth and King	Connect new system in parallel with existing system until the new system has been tested and safety certified for operation.	C	2	2	3	3	35%	5	10	Awaiting approval of contract plans by Muni Operations.	3/4/16 STS1045			
PR78	Delays or complication by other SFMTA projects delays CSP: radio, fare collection, C3/TMC	1. Monitor other projects' developments. 2. Develop contingency plans as needed to avoid 1256 delay of revenue service.	C	2	1	1	1	35%	2	4		7/27/12 FDS 1940			
Traffic signals & Crossing Protn.															
Purchase or lease of Real Estate															
79	Delay in obtaining tunnel easements (3 #) (goes to condemnation) - Costs of ROW may cost more than expected	1. Engage Owners in negotiations as soon as possible. 2. PM/CM to provide real estate specialists to facilitate.	R	1	1	-	1	10%	1	1	Right of possession obtained on all three parcels. Cost agreement reached with 1455 Stockton & 801 Market.	9/7/2012			
PR80	ROW costs higher than anticipated.	Provide adequate contingency for potential higher costs	M	1	3	-	2	10%	2	3	Similar to Risk 81.	7/1/12 FDS 1240			
Reloc. of Household or Business															
Vehicles															
83	Cost of vehicles may be more than estimated due to sole source and small order	Time the procurement of the vehicles to be part of the procurement of the existing Breda LRVs.	R	3	4	1	3	50%	8	15	CSP vehicles to be included in overall SFMTA vehicle procurement contract.	11/17/17 STS 1500			
Preliminary Engineering															
4															
89	3rd Party reviews of Design documents delays completion of Final Design.	Provide assistance to 3rd Parties to facilitate their reviews and obtain concurrent partial approval for underground work.	D	1	2	2	2	10%	2	4	3rd Party coordination meeting ongoing.	5/23/12 FDS 1930			
Project Management for Design and Construction															
95	Contractor default during construction impacts schedule. (key sub-contractor)	Assist Bonding company in transition and to maintain schedule.	C	1	2	2	2	10%	2	4		11/17/17 STS 1500			
99	Breakdown in relationships between SFMTA and Contractors during construction results in increased claims and delays to the overall construction schedule.	1. Executive partnering and alternate dispute resolution. 2. Provide incentives in construction contracts in addition to penalties	C	2	5	3	4	35%	8	16	Mitigation measures being implemented	7/27/12 FDS 1940			

Risk Register

PROJECT RISK REGISTER												Risk Profile		Severity Score		Low (1)		Medium (2)		High (3)		Very High (4)		Significant (5)		Legend			
Central Subway Project San Francisco												Likelihood Score		1		2		3		4		5		Probability		RISK RATING = PROBABILITY X (COST IMPACT + SCHEDULE IMPACT)			
REV : 23												5		4		3		2		1		Probability		< 10%		< 3 Low			
DATE ISSUED: 07/09/13												3		2		1		1		1		1		Cost Impact		< \$250K		3 - 9 Medium	
												2		1		1		1		1		1		Schedule Impact		< 1 Month		> 10 High	
												1		1		1		1		1		1		Score		SCORE = PROBABILITY X (COST IMPACT + SCHEDULE IMPACT)			
Final Risk ID	Risk Description	Mitigation Description	Risk Category	Probability %	Cost Impact	Schedule Impact	Calc Impact	Calc %	Risk Rating	Score	Status	Must Complete by Date																	
100	Procurement of long lead items delays work. (fans, rails and special track work, TPSS, Escalators, elevators, TBM)	1. Include schedule milestones for procurement of and substantial payment for stored long lead items in contract to encourage early procurement. 2. Monitor procurement of critical items.	C	1	2	2	2	10%	2	4	Not considered a project risk.	11/17/17 STS 1500																	
102	Late finish of early contract delays later contracts and extends PM / CM and incurs additional costs	1. Actively manage contracts and include incentive provisions for early completion in critical contracts. 2. Add buffer float to critical path to actively manage schedule contingency	C	2	1	2	2	35%	3	6	LONP 1 & 2 initiated to reduce this risk. See Risk 86. The mitigation of risks associated with early contracts will address this risk. Risk rating reduced due to mitigation measures implemented	12/30/20 MS 0010																	
T	Delay on station emergency ventilation approval	1. Work with SFFD to develop a plan acceptable to each party. 2. Incorporate SFFD requirements into construction documents.	R	2	5	-	3	35%	5	10	SFFD agreed to the proposed plan by SFMTA	7/27/12 FDS 1940																	
V	Incorporation of revised Planning Zoning/ development criteria for Moscone Station TOD impact MOS and CTS construction contract.	1. Participate and provide input of CSP constraints to SFMTA Real Estate during process of initial task to define best use. 2. Integrate work with SFMTA Real Estate into CSP.	D	2	1	2	2	35%	3	6		12/13/16 N-CTS1225																	
PR37	Temporary construction power and ability to provide permanent power feed - PGE ability to provide power requirements to the program together with their other commitment	1. Identify temporary power requirements for station construction. 2. Investigate the timing of the permanent feed.	C	2	1	2	2	35%	3	6	Cost for First and Redundant electrical services need to be included in Cost Estimate.	5/3/18 STS1080																	
Insurance, permits etc.																													
103	Difficulty in getting required permits.	1. Coordinate with permit officials and request permits as early as possible. 2. Obtain assistance obtaining permits from PM/CM & FD Consultants.	C	1	2	1	2	10%	2	3		12/18/12 FDS 1275																	
104	CPUC approval at Grade Crossing for G0164d takes longer to negotiate / obtain than schedule allows	1. Obtain Grade Crossing approvals at final CPUC inspection at the completion of construction. 2. Coordinate closely with CPUC until approval is received.	R	2	3	2	3	35%	5	10	Providing preview of 90% submittal to CPUC and will resolve comments/issues from PE before finalizing design documents	7/27/12 FDS 1940																	
105	Electrical service delays startup and testing.	1. Submit applications for new service as early as possible. 2. Coordinate closely with PG&E to ensure timely delivery of electrical service.	C	1	2	1	2	10%	2	3	Applications for new service have been submitted to PG&E.	11/17/17 STS 1500																	
106	Risk of Labor dispute delaying the work.	Enforce designated gate for employees of the contract in dispute so that the rest of the work is not delayed.	C	2	1	1	1	35%	2	4		11/17/17 STS 1500																	
Unallocated Contingency																													
111	Major Earthquake stops work	Include Force Majeure clause in contracts.	C	1	5	3	4	10%	4	8	Force Majeure clause included in contracts.	12/30/20 MS 0010																	
112	Major safety event halts work	1. Require contractor Safety plan to address this risk. 2. CM inspections to ensure that safety plan and procedures are implemented.	C	1	5	3	4	10%	4	8	Health and Safety provisions included in contracts. CS Program provides full-time Safety Manager.	12/30/20 MS 0010																	
196	The process of acquiring station licenses: acquisition/condemnation could significantly delay schedule and cost more than that presently planned.	1. Continue to negotiate with building owners 2. Required Notices and Appraisals to be completed 3. Commence condemnation process with City Attorneys	C	1	1	1	1	0%	4	-																			
202	Cargo Preference (Ship America) must solicit U.S.- flag carriers. Civilian Agencies Cargo = at least 50% (governed by Cargo Preference Act of 1954	1. Require Ship America compliance agreement first tier contractors and subcontractors	C	1	1	1	1	10%	1	2																			
203	Headwalls interface delay 1300 Contractor (SSTS)	1. Meet and develop recovery schedule 2. Review possible Adjustment to 1300 interface	C	3	3	2	3	50%	8	15																			

Risk Register

PROJECT RISK REGISTER Central Subway Project San Francisco REV : 23 DATE ISSUED: 07/09/13		Risk Profile					Risk Category	Probability	Low (1)	Medium (2)	High (3)	Very High (4)	Significant (5)	Legend	RISK RATING = PROBABILITY X (COST IMPACT + SCHEDULE IMPACT) 2	SCORE = PROBABILITY X (COST IMPACT + SCHEDULE IMPACT)
		Likelihood Score	1	2	3	4										
204	AT&T Vault - New Sewer Work south of Bryant	1. Continue negotiations/coordination with utility owners. 2. Schedule analysis to confirm coordination	C	2	2	4	3	35%	6	12						
205	Prolong period of CMod's creates additional cost/causes bad blood between Resident Engineer and Contractor	1. CMod Task Force - 5 Areas of Improvement 2. Implement 3. Delegation of Authority	C	3	1	1	1	50%	3	6						
208	Additional cost if we change direction going to the Pagoda	1. Develop Scope with designers currently under contract 2. Agree to alignment and details of new shaft location 3. Issue PCC to Contractor 4. Initial site works and borings if necessary 5. Obtain appropriate permits	C	3	3	2	3	50%	8	15						
210	Mission Bay Loop Grant – Needs to be built to allow for train turnarounds (June 2013)	1. Identify timeline for grant funding	C	4	1	1	1	80%	4	8						
211	Differing site conditions encountered during ground freezing of Cross Passage 5 results in increased costs.		C	1	2	2	2	10%	2	4						
212	UMS Inclined piles – 8" clearance between piles and tunnel results in damage or safety issues within the tunnel	1. Establish 1252 and 1300 contract requirements to construct within acceptable tolerances 2. Workshop to be held with BIH to discuss	C	1	5	3	4	10%	4	8						
213	Micro Piles exist within tunnel path at UMS	1. Re-profile and realign tunnel to clear micropiles	C	2	3	1	2	35%	4	8						
214	Micro Piles at UMS interfere with Tube-a-manchette installation (60' deep micropiles)	1. Provide micro-pile as-built information to contractor 2. Realign tube-a-manchettes clear of micro-piles	C	3	1	1	1	50%	3	6						
215	DPW Excavation permit reviews delay contract works	1. Obtain a blanket excavation permits from DPW covering the area of work for 1253, 1254, 1255, 1256	C	2	1	1	1	35%	2	4						
216	Olivet building potential construction impact	1. Reach out to building owner and keep him abreast of CS construction activities.	C	1	1	2	2	10%	2	3						
217	Delays or complications construction by others – SF Dept. Of Technology, 3rd party utilities	1. Early engagement and coordination for agreements and plan development to avoid construction delays.	C	2	1	1	1	35%	2	4	DTIS MOU has been signed.					