

SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT
300 Lakeside Drive, P. O. Box 12688, Oakland, CA 94604-2688

NOTICE OF MEETING AND AGENDA
BOND OVERSIGHT COMMITTEE

Friday, December 21, 2018
9:30 a.m. – 11:00 a.m.

COMMITTEE MEMBERS: Marian Breitbart, Michael Day, Daren Gee, Christine D. Johnson, Michael McGill, John Post

A Meeting of the Bond Oversight Committee will be held on Friday, December 21, 2018, at 9:30 a.m. The Meeting will be held in Conference Room 2100, 300 Lakeside Drive, 21st Floor, Oakland, California.

AGENDA

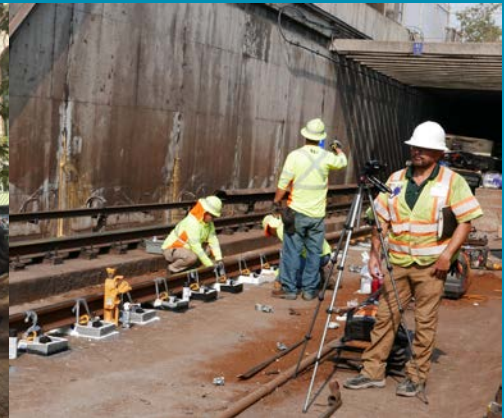
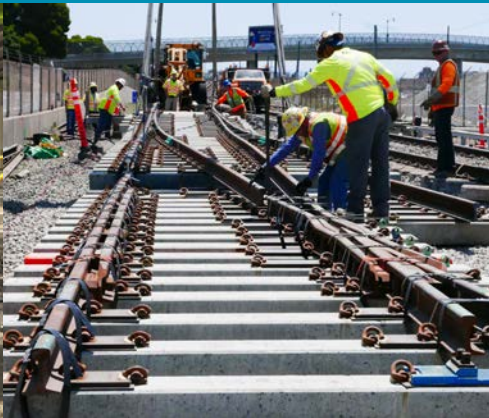
1. Call to Order
 - A. Roll Call
2. Introduction of Committee Members
3. Introduction of BART Staff
4. Selection of New Chairperson and Vice Chairperson (Action)
5. Meeting Minutes: June 1, 2018 & September 21, 2018 (For Discussion/Action)
6. Presentation: Measure RR Update (For Discussion)
7. Presentation: Earned Value Management (For Discussion)
8. Setting next meeting agenda scheduled for March 15, 2019 (For Discussion)
9. Public Comment

Please refrain from wearing scented products (perfume, cologne, after-shave, etc.) to this meeting, as there may be people in attendance susceptible to environmental illnesses.

BART provides service/accommodations upon request to persons with disabilities and individuals who are limited English proficient who wish to address Committee matters. A request must be made within one and five days in advance of Board/Committee meetings, depending on the service requested. Please contact the Office of the District Secretary at (510) 464-6083 for information.



BART Safety, Reliability, and Traffic Relief Program (Measure RR) Update



December 21, 2018



Agenda

- February 10, 2018 Board Workshop:
Program Update provided to Board
 - June 20, 2018 Board Meeting:
Bond Oversight Committee Annual Report provided to Board
 - December 6, 2018 Board Meeting:
Program Update provided to Board with Mid- & Long-Term Outlook
-

- Accomplishments to Date
- Program Update
 - Hiring
 - Small Business
 - Outreach
- Mid-Term & Long-Term Outlook



Major Accomplishments to Date

- \$132.5M expended. On target to surpass the \$300M 1st tranche work objective by June 2020.
- 82% of all RR expenditures have been spent on the Renew Track & Renew Power programs:
 - RENEW TRACK
 - 22/90 miles of rail replaced (14.5 miles replaced Jan 17-June '18)
 - 68/214 miles of rail reprofiled (Jan '17-June '18)
 - 1030 ft of new restraining rail installed (June '18)
 - RENEW POWER
 - 4/100 miles of cable installed – Downtown Oakland (Washington St to 19th St) installation in progress (Jan '17-June '18)
 - 4/43 rectifiers renewed systemwide (Jan '17-June '18)
 - Traction power substation replaced in Richmond Yard (June '18)



Major Accomplishments to Date (cont'd)

- Held 58 small business outreach events. 21% of RR expenditures on contracted work have gone to small businesses.
- Hired 206 positions out of the 309 FY18-19 headcount goal.
- Secured additional space on the 8th Floor, populated by RR staff.
- Secured Hayward warehouse to house RR inventory.
- Established the Bond Oversight Committee (BOC) and held five BOC meetings. The first BOC Annual Report was completed and presented to the Board in June 2018.

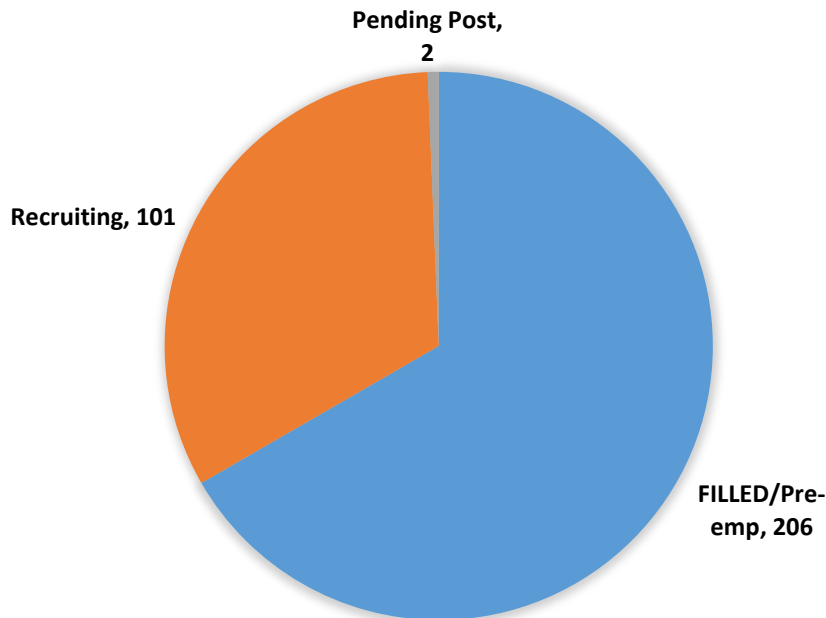


Program Update – Hiring

Bond Progress	# of Positions
FILLED/Pre-employment	206
Recruiting	101
Pending Post	2
	309

FY18 SUMMARY

- FY18 Head-count goal was 162
- *By year-end 90% of those positions were hired/selected*



CURRENT PROGRESS

- FY18+19 Head-count goal is 309
- *Bond measure to date: 206 selected/hired*
- *On target to meet FY19 goal*



Program Update – Small Business

Program	Total RR Commitments	Total RR SB Commitment	SB Commitment %	# of SB Contracts	Total RR Payments on RR Contracts	RR Payments to SBs	SB Payment %
Renew Track	\$39,623,183	\$7,989,342	20%	46	\$14,208,951	\$1,790,084	13%
Renew Power	\$142,657,318	\$75,707,108	53%	129	\$25,889,206	\$8,645,236	33%
Repair Tunnels & Structures	\$59,857,935	\$7,786,683	13%	46	\$15,029,137	\$938,435	6%
Renew Mechanical	\$14,465,578	\$2,275,053	16%	24	\$797,115	\$420,259	53%
Replace Train Control/Increase Capacity	\$555,394	\$9,699	2%	1	\$0	\$0	---
Renew Stations	\$4,108,146	\$1,801,617	44%	11	\$2,200,621	\$495,845	23%
Expand Safe Access to Stations	\$3,925,268	\$1,376,440	35%	44	\$1,133,972	\$240,878	21%
Design/Engineer to Relieve Crowding	\$5,697,420	\$1,509,231	26%	13	\$1,592,336	\$342,395	22%
Total	\$270,890,243	\$98,455,174	36%	314	\$60,851,338	\$12,873,132	21%

Notes: All amounts are based on RR fund percent only. Amounts are updated to October 31, 2018. Includes formal contracts only; does not include informal purchases or work performed by BART's own forces. SB totals include DBEs, MSBEs, SBs, and LSBs. Sources: RR commitments are based on RR Requisitions report, Procurement Sealed Bids Report and PeopleSoft Work Plans application. RR% for each project is based on Financial Analysts' report, RR Funds / Total Project Budget. Payments based on PeopleSoft and VPT.



Program Update – Outreach

- 58 outreach events have been held throughout the Bay Area since inception (September 2017)
 - 38 events (2018); 20 events (2017)
 - Targeted advertisements for Small Businesses by industry and location
 - OCR staff has participated in 12 workshops, fairs, or events organized by other organizations or agencies
- Over 600 participants have attended outreach events representing a variety of business types
- Positive survey responses received from participants
 - 80% of surveys stated that participants are more likely to bid on BART work after attending the event






Program Update – Next Steps

- Additional roll-out of programs to assist small businesses
 - **Mentor-Protégé Program:** has its first participants with several additional contracts in the pipeline
 - **Small Business Supportive Services:** soon to provide comprehensive services to Small Businesses (five-year agreement)
- Upcoming events (in development)
 - **Building to Bid:** The purpose of this outreach event is to navigate Small Businesses through BART's bidding process to increase bid preparedness
 - **Power Pitch:** LGBTBE firms will receive technical assistance and have the opportunity to introduce their businesses and products to BART representatives





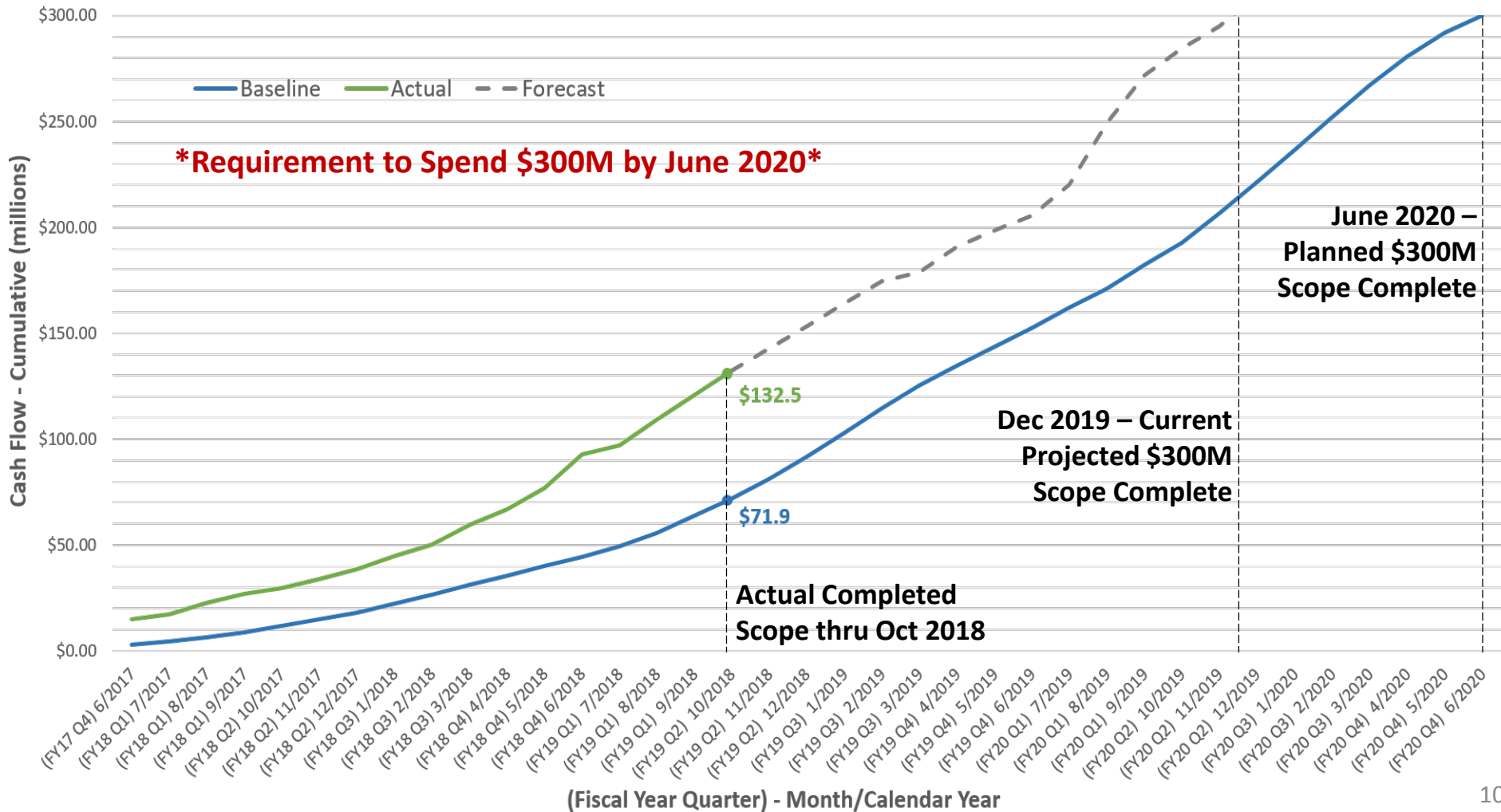
Investment Summary

Summary of Investments	\$ Millions	% of Total Bond	Benefits		
			 Safety	 Reliability	 Crowding + Traffic Relief
REPAIR AND REPLACE CRITICAL SAFETY INFRASTRUCTURE	\$3,165	90%	✓	✓	✓
Renew track	\$625	18%	✓	✓	
Renew power infrastructure	\$1,225	35%	✓	✓	
Repair tunnels and structures	\$570	16%	✓	✓	
Renew mechanical infrastructure	\$135	4%	✓	✓	
Renew stations	\$210	6%	✓	✓	✓
Replace train control and other major system infrastructure to increase peak period capacity	\$400	12%	✓	✓	✓
RELIEVE CROWDING, REDUCE TRAFFIC CONGESTION, AND EXPAND OPPORTUNITIES TO SAFELY ACCESS STATIONS	\$335	10%	✓	✓	✓
Design and engineer future projects to relieve crowding, increase system redundancy, and reduce traffic congestion	\$200	6%		✓	✓
Expand opportunities to safely access stations	\$135	4%	✓	✓	✓
TOTAL	\$3,500	100%			



Measure RR - Scope & Spending (SHORT-TERM) CUMULATIVE

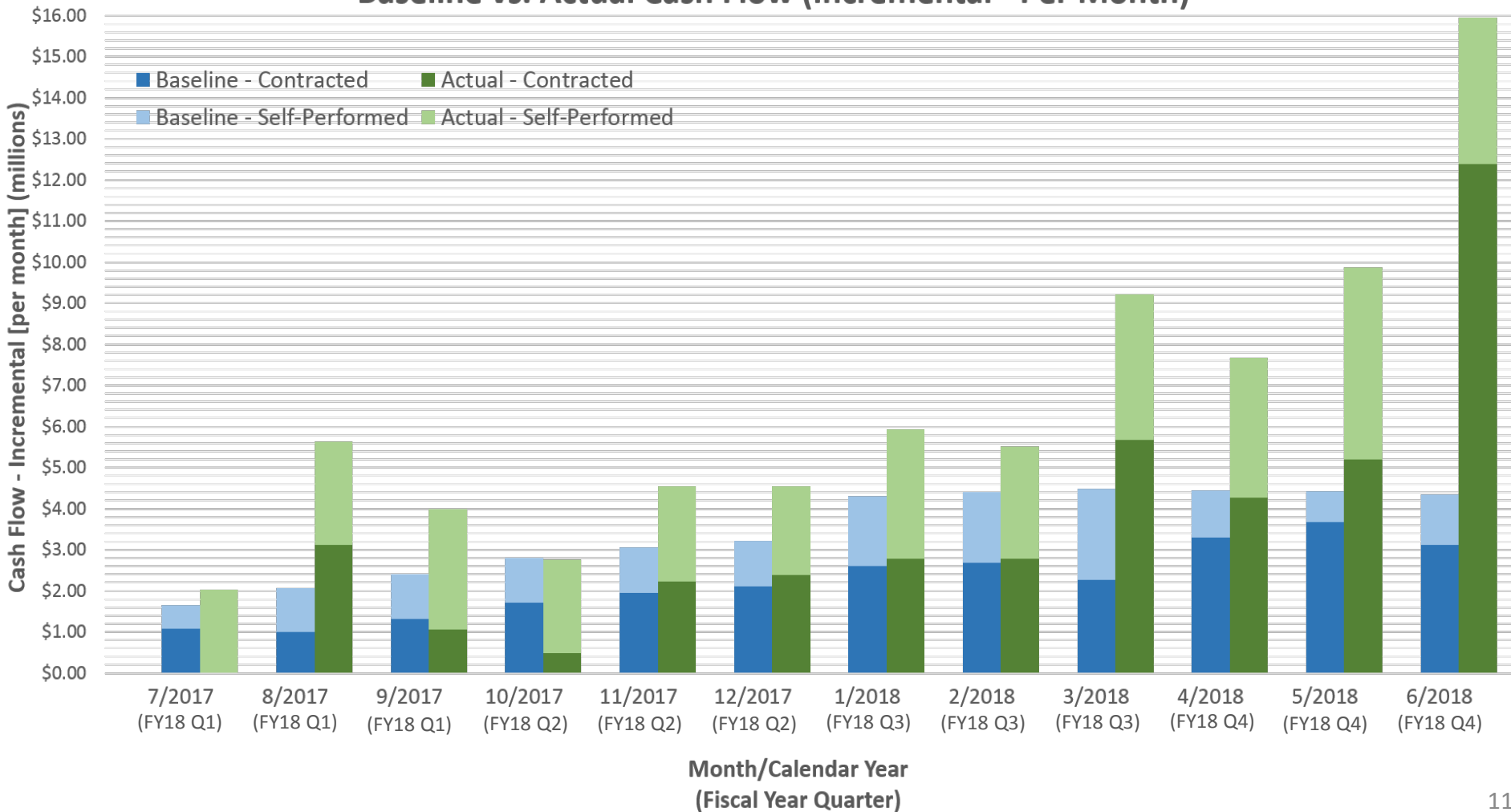
BART Measure RR Program - SHORT-TERM (3-Year Planned Work, thru June 2020)





Measure RR – Self-Perform vs. Contract INCREMENTAL (Monthly) thru FY18

BART Measure RR Program - FY18
Baseline vs. Actual Cash Flow (Incremental - Per Month)





Measure RR Cashflow (\$ Millions) – Mid-Term & Long-Term Outlook

Program	Forecast Expenditures			Expended (thru Oct 2018)	% Expended out of Total Bond Investment
	SHORT-TERM (thru June 2020)	MID-TERM (thru 2025)	LONG-TERM (thru End of Bond)		
Renew Track	\$190	\$400	\$625	\$60.2	10%
Renew Power Infrastructure	\$125	\$608	\$1,225	\$49.0	4%
Repair Tunnels & Structures	\$24	\$268	\$570	\$7.9	1%
Renew Mechanical	\$23	\$65	\$135	\$4.1	3%
Replace Train Control/Increase Capacity	\$20	\$286	\$400	\$2.4	1%
Renew Stations	\$21	\$148	\$210	\$2.6	1%
Expand Safe Access to Stations	\$15	\$86	\$135	\$2.6	2%
Design/Engineer to Relieve Crowding	\$22	\$69	\$200	\$3.7	2%
Total	\$440	\$1,930	\$3,500	\$132.5	4%



Renew Track

STATUS & MILESTONES

EXPENDED Thru 10/2018: \$60.2

FORECAST Thru 6/2020: \$190

FORECAST Thru 2025: \$400

FORECAST Thru End: \$625

STATUS – Renew Track

# Projects in Planning	# Projects in Design	# Projects in Bid/Award	# Projects in Construction	# Projects Completed	TOTAL # Projects
0	6	11	0	2	19

MILESTONES

SHORT-TERM Thru June 2020	MID-TERM Thru 2025	LONG-TERM Thru End of Bond
<ul style="list-style-type: none"> ✓ Design complete <ul style="list-style-type: none"> ✓ C35 interlock ✓ R65 interlock ✓ Construction complete <ul style="list-style-type: none"> ✓ M03 interlock ✓ Rail relay – 22 miles ✓ C55, Phase 1 ✓ Restraining rail replacement – M103 • Construction complete <ul style="list-style-type: none"> – C25, C55 & C35 interlocks – Oakland Yard project • Design complete <ul style="list-style-type: none"> – System joint elimination construction – A65/A75/A77 interlocks • Continue DF pad installation 	<ul style="list-style-type: none"> • Design complete <ul style="list-style-type: none"> – K-Line interlocks – Richmond Yard turn outs – Friction modification implementation • Construction complete <ul style="list-style-type: none"> – C25 interlock – A65/A75/A77 interlocks – Rail relay of 40 miles – R65 interlocks – DF pad installation – Restraining rail replacement – C101, C102 • Begin construction of system joint elimination 	<ul style="list-style-type: none"> • Construction complete <ul style="list-style-type: none"> – K-Line interlocks – System joint elimination – Richmond Yard turn outs • Begin implementation friction modification



Renew Power

STATUS & MILESTONES

EXPENDED Thru 10/2018: \$49.0

FORECAST Thru 6/2020: \$125

FORECAST Thru 2025: \$608

FORECAST Thru End: \$1,225

STATUS – Renew Power Infrastructure

# Projects in Planning	# Projects in Design	# Projects in Bid/Award	# Projects in Construction	# Projects Completed	TOTAL # Projects
1	15	2	6	1	25

MILESTONES

SHORT-TERM Thru June 2020	MID-TERM Thru 2025	LONG-TERM Thru End of Bond
<ul style="list-style-type: none"> ✓ Design complete – Station Fire Alarm Replacement – Phase 2 ✓ Construction in progress for 34.5 kV cable <ul style="list-style-type: none"> ✓ K-Line & M-Line ✓ Awarded <ul style="list-style-type: none"> ✓ M-Line 34.5 kV Cable Replacement ✓ San Leandro Traction Power Substation Replacement ✓ Tunnel Lighting M-Line ✓ Station Emergency Lighting Ph 2 to BOD 11/2018 ✓ Install complete traction power substation in Richmond Yard • Design complete 34.5 kV cable replacement <ul style="list-style-type: none"> – A, C & R-Lines – Willow Pass Road high voltage bulk supply transformer – Multi-functional protective relays and rectifiers – Cast coil transformers & differential protection schemes – Uninterruptible Power Supplies (UPS) – 24 Train Control Rooms • On going Installation <ul style="list-style-type: none"> – M-Line tunnel lighting • Begin installation <ul style="list-style-type: none"> – Station Fire Alarm Replacement – Phase 2 – Third rail replacement – A-Line – Transbay Tube (TBT) emergency generator 	<ul style="list-style-type: none"> • Installation complete <ul style="list-style-type: none"> – Station Emergency Lighting – Phase 2 – Tunnel lighting – TBT & Walnut Creek tunnel – TBT emergency generator – Station Fire Alarm Replacement – Ph 2 – Met G generator replacement – Cast coil transformer & differential protection – Traction power substations at Civic Center & Montgomery – Willow Pass Road high voltage bulk supply transformer replacement • Continued construction <ul style="list-style-type: none"> – 34.5 kV cable replacement – systemwide – Traction power substation replacement – systemwide 	<ul style="list-style-type: none"> • Construction complete <ul style="list-style-type: none"> – 34.5 kV cable replacement – systemwide – Traction power substation replacement – systemwide



Renew Mechanical

STATUS & MILESTONES

EXPENDED Thru 10/2018: \$4.1

FORECAST Thru 6/2020: \$23

FORECAST Thru 2025: \$65

FORECAST Thru End: \$135

STATUS – Renew Mechanical

# Projects in Planning	# Projects in Design	# Projects in Bid/Award	# Projects in Construction	# Projects Completed	TOTAL # Projects
0	5	2	0	0	7

MILESTONES

SHORT-TERM Thru June 2020	MID-TERM Thru 2025	LONG-TERM Thru End of Bond
<ul style="list-style-type: none"> ✓ Awarded Coverboard Enhancement contract ✓ Procurement of Standpipe contract (L-Line tunnel) • Design complete <ul style="list-style-type: none"> – Fire hose cabinets, L-Line tunnel & yard fire services – Turntables & vacuum system – Backflow preventers, sewage pumps & rotoclones – LMA Liebert unit • Installation complete – Coverboard enhancement systemwide 	<ul style="list-style-type: none"> • Installation complete <ul style="list-style-type: none"> – Turntable replacement (OCY, ORY), vacuum system (OKS) & hydraulic truck lift cylinders (OHY, ORY) – Fire protection systemwide (yards, stations & L-Line tunnel) – HVAC & control tower replacement (OCY, ORY) – LMA Liebert unit • Continued installation – Storm water treatment systemwide 	<ul style="list-style-type: none"> • Installation complete <ul style="list-style-type: none"> – LMA computer room fire protection – Transbay Tube dampers overhaul • Continued installation – Storm water treatment systemwide



Tunnels & Structures

STATUS & MILESTONES

EXPENDED Thru 10/2018: \$7.9

FORECAST Thru 6/2020: \$24

FORECAST Thru 2025: \$268

FORECAST Thru End: \$570

STATUS – Repair Tunnels & Structures

# Projects in Planning	# Projects in Design	# Projects in Bid/Award	# Projects in Construction	# Projects Completed	TOTAL # Projects
8	8	1	4	0	21

MILESTONES

SHORT-TERM Thru June 2020	MID-TERM Thru 2025	LONG-TERM Thru End of Bond
<ul style="list-style-type: none"> ✓ Rehabilitation complete – Platform edge – MacArthur Station ✓ Design complete – Aerial fall protection A-Line • Advertise & award <ul style="list-style-type: none"> – Caldecott BART Tunnel (CBT) Creep Repair – Safety Barriers – systemwide – M-Line Water Intrusion (Phase1) – M-Line Aerial Fall Protection • On going Retrofit <ul style="list-style-type: none"> – Transbay Tube (TBT) internal seismic – invert tube segments 21-53 – TBT internal – electrical substations complete at pump stations #3 & #4 – Substation exterior walls - systemwide 	<ul style="list-style-type: none"> • Design complete <ul style="list-style-type: none"> – Aerial fall protection on C, R & L Lines – Renew catwalks on aerials (A-Line) – Rehab expansion joints (aerial structures) – Water intrusion through trackway & platform joints at stations on C & R-Lines – Slope stabilization – MW012 • Construction complete <ul style="list-style-type: none"> – CBT Creep Repair – Safety Barriers – M-Line Water Intrusion (Phase1) – M-Line Aerial Fall Protection – TBT internal retrofit – Slope stabilization – MW012 	<ul style="list-style-type: none"> • Construction complete <ul style="list-style-type: none"> – Aerial fall protection on C, R & L-Lines – Renew catwalks on aerials (A-Line) – Rehab expansion joints (aerial structures) – Water intrusion through trackway & platform joints at stations on C & R-Lines



Replace Train Control

STATUS & MILESTONES

EXPENDED Thru 10/2018: \$2.4

FORECAST Thru 6/2020: \$20

FORECAST Thru 2025: \$286

FORECAST Thru End: \$400

STATUS – Replace Train Control / Increase Capacity

# Projects in Planning	# Projects in Design	# Projects in Bid/Award	# Projects in Construction	# Projects Completed	TOTAL # Projects
0	0	1	0	0	1

MILESTONES

SHORT-TERM Thru June 2020	MID-TERM Thru 2025	LONG-TERM Thru End of Bond
<ul style="list-style-type: none"> ✓ Completed supplemental qualification of systems equipment installers ✓ Completed pre-proposal meetings ✓ Completed outreach to local, small & DBE businesses ✓ Prequalified Communication Based Train Control (CBTC) system providers & CBTC system equipment installers (9-mo delay due to protest & reopen installer contractor qualification) ✓ Received technical proposals • Identify competitive range & issue Best and Final Offer (BAFO) • Award to CBTC supplier • Issue enabling works contracts (new switch & station power supply) • Issue CM & DSDC Contracts • Update & prepare BART Integrated Computer System (ICS) for the new Automated Train Supervision (ATS) System • Mobilize co-located project team (BART, Consultant, CBTC System Supplier) 	<ul style="list-style-type: none"> • Develop new Automatic Train Supervision (ATS) system • Prove CBTC on the test track • Integrate new CBTC equipment on all vehicles • Install CBTC equipment on the revenue trackway • Train operators, controllers & maintainers on the new CBTC system and equipment • Begin migration and operation of the new CBTC system into revenue service 	<ul style="list-style-type: none"> • Complete migration through the Transbay Tube (TBT) and the Oakland Wye • Increase the frequency of service through the TBT • Complete the CBTC Contract



Renew Stations

STATUS & MILESTONES

EXPENDED Thru 10/2018: \$2.6

FORECAST Thru 6/2020: \$21

FORECAST Thru 2025: \$148

FORECAST Thru End: \$210

STATUS – Renew Stations

# Projects in Planning	# Projects in Design	# Projects in Bid/Award	# Projects in Construction	# Projects Completed	TOTAL # Projects
0	0	2	1	0	3

MILESTONES

SHORT-TERM Thru June 2020	MID-TERM Thru 2025	LONG-TERM Thru End of Bond
<ul style="list-style-type: none"> ✓ Advertised <ul style="list-style-type: none"> ✓ Escalator contract ✓ 19th St Station Modernization • Award & begin construction <ul style="list-style-type: none"> – Escalator contract – 19th St Station Modernization • Construction complete – El Cerrito del Norte Modernization • Prepare Station Modernization conceptual plan at 2 stations 	<ul style="list-style-type: none"> • Continued construction – Escalator contract • Construction complete – 19th St Station Modernization 	<ul style="list-style-type: none"> • Construction complete – Escalator contract



Station Access STATUS & MILESTONES

EXPENDED Thru 10/2018: \$2.6

FORECAST Thru 6/2020: \$15

FORECAST Thru 2025: \$86

FORECAST Thru End: \$135

STATUS – Expand Safe Access to Stations

# Projects in Planning	# Projects in Design	# Projects in Bid/Award	# Projects in Construction	# Projects Completed	TOTAL # Projects
4	13	0	5	0	22

MILESTONES

SHORT-TERM Thru June 2020	MID-TERM Thru 2025	LONG-TERM Thru End of Bond
<ul style="list-style-type: none"> ✓ Advancing design <ul style="list-style-type: none"> ✓ Active access at multiple stations ✓ Bicycle stair channels at 7 stations ✓ Accessibility Improvement Projects (AIP) Phase 1&2 ✓ Ongoing construction – Active access projects at 2 stations ✓ Planning/design secure bike parking 5 stations & modernize 2 bike stations ✓ Initiated hearing loop installation of agent booths at 3 stations & Customer Service Center at Lake Merritt ✓ Initiated platform edge tile replacement at 6 stations • Construction complete <ul style="list-style-type: none"> – El Cerrito del Norte – MacArthur – Elevator lobby LED lights -10 stations – Station Public Address (PA) system improvements pilot • Begin construction <ul style="list-style-type: none"> – Regional trail connections • Implement/modernize secure bike parking and bike stair channels at multiple stations • Advance Safe Routes to BART program • Intermodal / Passenger drop off design • Complete hearing loop installation at agent booths • Strategic parking expansion 	<ul style="list-style-type: none"> • Design complete – AIP Phases 4 and 5 • Construction complete <ul style="list-style-type: none"> – Regional trail connections – AIP Phases 1 and 2 • Design & construction complete – AIP Phase 3 • Continued construction – Active access projects/secure bike parking • Implement <ul style="list-style-type: none"> – Wayfinding and real time arrival information – Safe Routes to BART projects – Dynamic intermodal/drop-off redesign – Strategic parking expansion 	<ul style="list-style-type: none"> • Construction complete <ul style="list-style-type: none"> – Active access projects/secure bike parking – AIP Phases 4 and 5 – AIP fare gate audio modifications – Complete station PA system improvements Phase 3 • Design & construction complete – AIP Phase 6 • Implement <ul style="list-style-type: none"> – Wayfinding and real time arrival information – Safe Routes to BART projects – Dynamic intermodal/drop-off redesign



Relieve Crowding

STATUS & MILESTONES

EXPENDED Thru 10/2018: \$3.7

FORECAST Thru 6/2020: \$22

FORECAST Thru 2025: \$69

FORECAST Thru End: \$200

STATUS – Design / Engineer to Relieve Crowding

# Projects in Planning	# Projects in Design	# Projects in Bid/Award	# Projects in Construction	# Projects Completed	TOTAL # Projects
3	3	2	0	0	8

MILESTONES

SHORT-TERM Thru June 2020	MID-TERM Thru 2025	LONG-TERM Thru End of Bond
<ul style="list-style-type: none"> ✓ Advertised <ul style="list-style-type: none"> ✓ Civic Center Platform Stairs ✓ New Transbay Rail Crossing – Strategic Advising and Program Management ✓ Advancing design <ul style="list-style-type: none"> ✓ Embarcadero Station Platform Elevator ✓ Platform Screen Door Pilot program ✓ HMC Phase 2 ✓ Core Capacity Project PM - completed environmental & submitted all materials for FTA entry to engineering • Award – New Transbay Rail Crossing – Strategic Advising and Program Management • Award & begin construction <ul style="list-style-type: none"> – Civic Center Stair Platform • Advertise & award <ul style="list-style-type: none"> – Embarcadero Station Platform Elevator – Platform Screen Door Pilot at 12th St Station • Complete HMC Phase 2 - Trackwork procurement 	<ul style="list-style-type: none"> • Construction complete <ul style="list-style-type: none"> – Embarcadero Station Platform Elevator – Platform Screen Door Pilot at 12th St Station – HMC Phase 2 • New Transbay Rail Crossing – Advertise, award & begin work on Planning/ Environmental contract • Platform Screen Door Pilot program –Prioritize future locations based upon Pilot outcomes • Core Capacity project – Project implementation 	<ul style="list-style-type: none"> • New Transbay Rail Crossing <ul style="list-style-type: none"> – TBD based upon funding and results of prior work • Platform Screen Door Pilot program – based upon funding/pilot results: Install at downtown stations & other locations TBD • Core Capacity project – Project completion



Next Steps

- Under Development:
 - Planning of second tranche – Fine-tune scope, schedule, and budget for mid-term project activities
 - Standardized RR Program Reporting
 - Earned Value Management



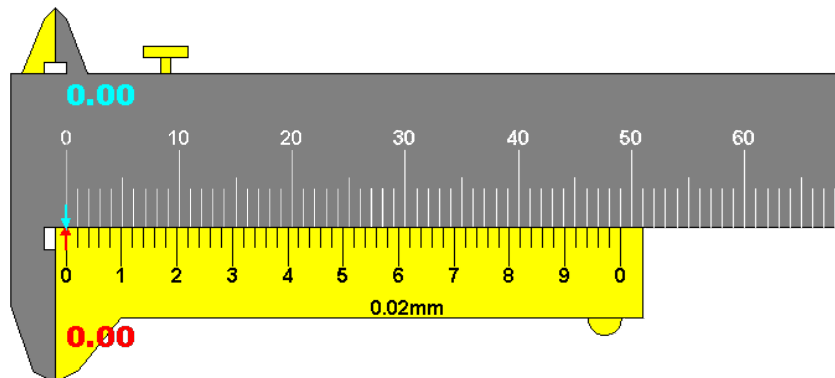
Earned Value Management RR Program

December, 2018

Earned Value Management



- ✓ **Method to objectively assess a project's progress**
 - Defined in the beginning = **Baseline**
 - Define the value of each piece of work = **Schedule of values (SOV)**
 - Define when work is expected to be progressed = **Planned Value (PV)**
 - Measure the progress at a given time = **% Complete**
 - Calculate the value of the work completed = **Earned Value (EV)**



Schedule of Values



A Schedule of Values is proportioning budget across work elements to validate % complete.

Each project can have its own schedule of values depending on verifiable pieces of the work:

Example 1

Project ID	Project Name/ID	Total Project Budget
15TC004	Water Intrusion in Train Control Room:	\$7,059,154
	FINAL DESIGN (WF0345A0700)	\$1,932,294
	35% Design (20%) (Includes Assessment)	\$386,459
	65% Design (30%)	\$579,688
	95% Design (35%)	\$676,303
	100% Design (10%)	\$193,229
	IFB Submittal (5%)	\$96,615
	CONTRACT PROCUREMENT / GENERAL SUPPORT	\$390,048
	CONSTRUCTION / INSTALLATION / CLOSEOUT	\$4,736,812
	CONTINGENCY	\$1,764,788
	TOTAL PROJECT W/ CONTINGENCY	\$8,823,942

Example 2

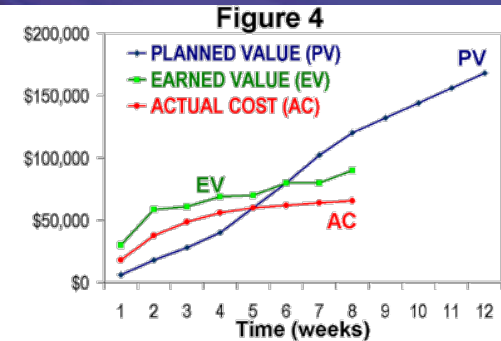
Project ID	Project Name/ID	Total Project Budget
15CQ011	A65/A75 Interlocking (Replacement)	\$18,600,000
	FINAL DESIGN (WF0103A0700)	\$500,000
	65% - 95%	\$350,000
	IFB Submittal	\$150,000
	CONSTRUCTION / INSTALLATION / CLOSEOUT	\$18,100,000
	BUS BRIDGE A65	\$1,000,000
	BUS BRIDGE A75	\$1,000,000
	TRAIN CONTROL SUPPORT	\$50,000
	CONSTRUCTION	\$16,050,000

How is EV Calculated and Used



The Earned Value (EV) is equal to the Physical % Complete multiplied by the budget for the current work element.

- If Design is 30% complete and the budget for design is \$900,000 then the $EV = \$900,000 \times .3$ or \$270,000



Cost Performance Indicator (CPI) compares the Earned Value (EV) with the Actual Cost (AC)

- Less than 1 indicates actual \$ spent is more than the value of the work completed. If the actual cost to perform 30% design is \$400,000 the $\$270,000 / \$400,000 = 0.675$

Schedule Performance Indicator (SPI) compares the Earned Value (EV) with the Planned Value (PV)

- Less than 1 indicates the value of the work completed is less than what was expected at this time in the project.

When to take Action and What Action



Earned Value is a snapshot in time.

Project is less than 25% spent:

- Drastic differences in CPI and SPI - $<.5$ or > 1.5 – may indicate a fault in the baseline set up and planning.

Project after 25% spent:

- CPI/SPI should hover around 1.0. $<.8$ or > 1.2 should elicit further scrutiny

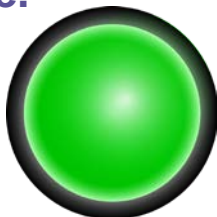
Project between 25% and 90%,

- Trends over multiple periods should be evaluated for minimal fluctuation in CPI/SPI.

Project Milestones:

- Baselines (and Forecasts) should be reevaluated at significant milestones such as between planning and design, at 90% Design, once bids are received.

For a true indication of the health of a project, Earned Value must be combined with an Estimate to Complete.



Project X Example



Project X = \$12M (\$12 M is the budget = Planned Value)

Design = \$2.4M

Construction = \$9.6M

50% Complete

When Design is 50% complete, **the Earned Value (EV) = \$1.2M** or 50% of \$2.4M.

For the Cost Performance Index (CPI):

If the Actual Cost (AC) is less than \$1.2M (EV) the project is currently under spending.

If AC is greater than \$1.2M (EV), the project is over spending.

For the Schedule Performance Index (SPI): If the amount the team expected to spend to get to 50% (Planned Value (PV)) is less than \$1.2M (EV) the project is currently on, or ahead of schedule; and if the PV is greater than \$1.2M (EV), the project is potentially behind schedule.

$$\text{CPI} = \text{EV} / \text{AC}$$

> 1 is under spending, < 1 is over spending

$$\text{SPI} = \text{EV} / \text{PV}$$

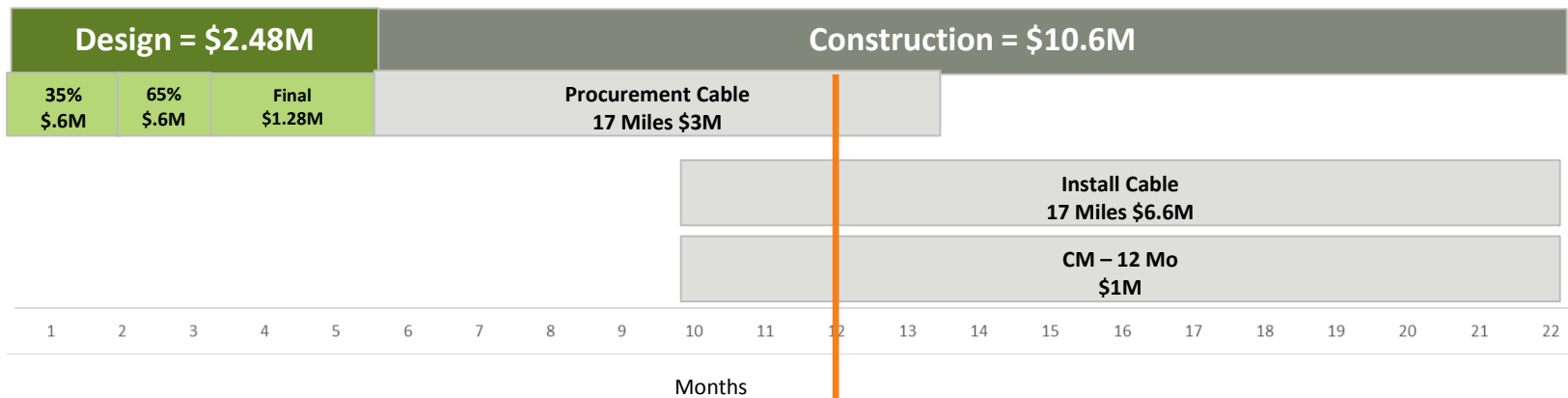
> 1 is ahead of schedule, < 1 is behind schedule

- For this example, Earned Value is measured on two work products only - Design and Construction
- More work products (ie design packages, procurement) to measure against equal a more accurate Earned Value Analysis
- More work products to measure against equal a more complicated and time consuming analysis
- The key is to find the balance of work products
- How work completed is measured (% complete) can be different for each project or work product ie Design can be measured by 35%, 60% etc, while procurement and/or construction of track can be measured by miles or quantity

Project X Example 2



Project X = \$13.08M (\$13.08 M is the budget = Planned Value)



Date of Earned Value Analysis

Work Product	Budget	Planned value at Month 12	Unit of Measure	Total Units	Units complete	% Complete	Earned Value	Actual Cost	CPI	SPI	Comments:
Design	\$ 2.48	\$ 2.48	% of Design	100%	100%	100.00%	\$ 2.48	\$ 2.60	0.95	1.00	Design is complete - ran over slightly but expect to make up with procurement cost savings
Procurement	\$ 3.00	\$ 2.65	Mile	17	15	88.24%	\$ 2.65	\$ 2.60	1.02	1.00	Procurement of Cable cost savings due to economy of scale - 15 Miles procured
Install Cable	\$ 6.60	\$ 1.10	Mile	17	2	11.76%	\$ 0.78	\$ 0.80	0.97	0.71	Expected to install 1.5 mi per month for a total of 3 mi but only 2 miles installed
Construction Management	\$ 1.00	\$ 0.17	Months	12	2	16.67%	\$ 0.17	\$ 0.15	1.11	1.00	
Project Total:	\$ 13.08	\$ 6.40				46.41%	\$ 6.07	\$ 6.15	0.99	0.95	

Program Rollup



RR Program Rollup Earned Value Management

	Total Budget	Physical % Complete	Expended to Date:	Planned Value	Earned Vlaue	CPI	SPI
RR Program Totals	\$ 2,554,400,000.00	4.7%	\$ 110,864,369.57	\$ 123,448,744.86	\$ 119,495,705.55	1.08	0.97

	Total Budget	Physical % complete	Expended to Date:	Planned Value	Earned Value	CPI	SPI
Renew Track	\$ 625,000,000	8.2%	\$ 52,106,957	\$ 47,404,929	\$ 51,449,407	0.99	1.09
Renew Power and Infrastructure	\$ 1,225,000,000	4.4%	\$ 46,580,039	\$ 55,534,132	\$ 53,960,835	1.16	0.97
Repair Tunnels & Structures	\$ 570,000,000	1.6%	\$ 9,055,282	\$ 14,327,306	\$ 9,176,813	1.01	0.64
Renew Mechanical	\$ 134,400,000	3.7%	\$ 3,122,092	\$ 6,182,378	\$ 4,908,650	1.57	0.79

Rollup Calculation:

- Each project calculates EV by % complete * Project Budget
- Earned values are added together within a program to calculate an overall Program EV
- Program EV divided by Program Budget creates Program % complete

