

Cost Reduction Opportunities

5 February 2016

Presentation to
GLX working Group

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Arup



- A global, integrated, multidisciplinary firm of professionals
- 13,000 people in 90 offices around the globe
- Independent & employee owned
- Founded in 1946

Los Angeles: Crenshaw LRT Design Build

Scope and Methodology

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Scope and Methodology

- Identify core elements required for the Project's functionality
- Develop order-of-magnitude benchmarks as
 - High level means to identify atypical project costs and candidate areas for potential cost reductions
- Identify the significant cost-drivers of scope and schedule
- Identify significant elements of the Project that exceed core functionality and can be reduced without sacrificing fundamental project benefits
 - Estimate range of potential savings
 - Analyze consequential risk with Risk Assessment thread
- Review previous Value Engineering studies
 - Recommend capture of smaller concepts

Scope and Methodology

- Site tour, technical workshops, and meetings
 - MassDOT
 - MBTA
 - Owner's Representative (Hatch Mott Macdonald)
 - Program Manager / Construction Manager (HDR / Gilbane)
 - Construction Manager / General Contractor (White / Skanska / Kiewit)
 - Designers (HNTB / AECOM)
 - Independent Cost Estimator (Stanton)
- Review of project documentation

Benchmarking Overview

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Federal Transit Administration Cost Database

Purpose of Benchmarks

- The FTA database provides a good comparison among projects.
- The FTA database is populated with different types of light rail projects, and some are closer comparisons to the GLX project than are others.
- Comparing GLX against the FTA database provides a guide as to which cost categories fall outside the normal range and merit further attention.
- The FTA recommends using its data base to compare project costs and for modeling purposes
- The FTA database should not be relied upon to generate project cost estimates.

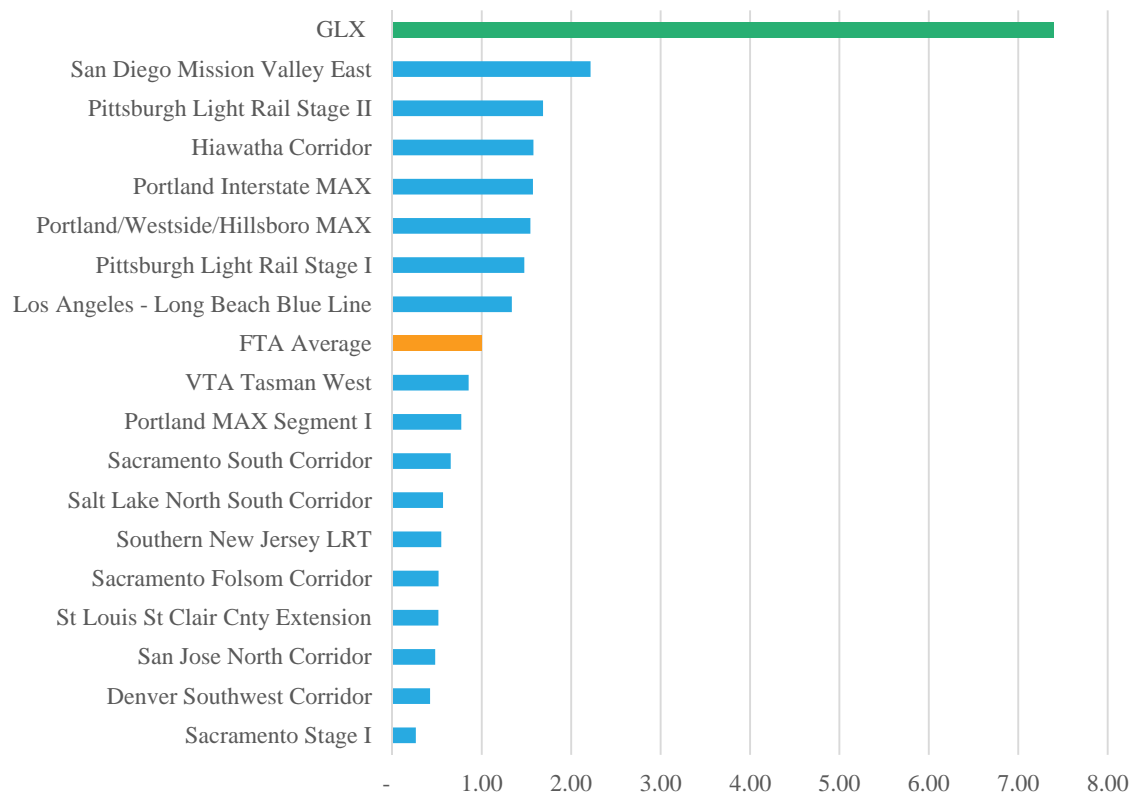
Federal Transit Administration Cost Database

- The FTA provides a Capital Cost Database which includes 17 completed light rail projects.
- The FTA Standard Cost Categories (SCC) for construction costs are:
 - SCC 10 - Guideway and Track
 - SCC 20 - Stations
 - SCC 30 - Support Facilities
 - SCC 40 - Sitework
 - SCC 50 - Systems
- 2018 was selected as the base year for comparison against GLX as this is the approximate mid-point of construction.

GLX to FTA SCC 10-50: Capital Works

Comparative Cost / Mile FTA = 1.0

Comparative Cost / Mile SCC 10-50 with FTA Avg = 1.0



- The GLX project length of 4.7 miles is atypically short vs. the FTA average of 13.9 miles, meaning that the construction is unable to realize economies of scale
- GLX is within active rail corridors that traverse a constrained, dense urban environment
 - Relocation of 4.3 miles of commuter rail lines including associated systems
 - Restricted construction work hours to limit impacts to active commuter rail and abutting neighborhoods
 - Substantial site works within constrained cross-sections
- GLX stations are beyond core functionality vs. typical Light Rail Transit station
- GLX Vehicle Maintenance Facility is larger than what is needed to operate the GLX
- GLX systems include both Light Rail Transit and commuter rail

Value Engineering and Cost Reduction Opportunities

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Value Engineering and Cost Reduction Opportunities

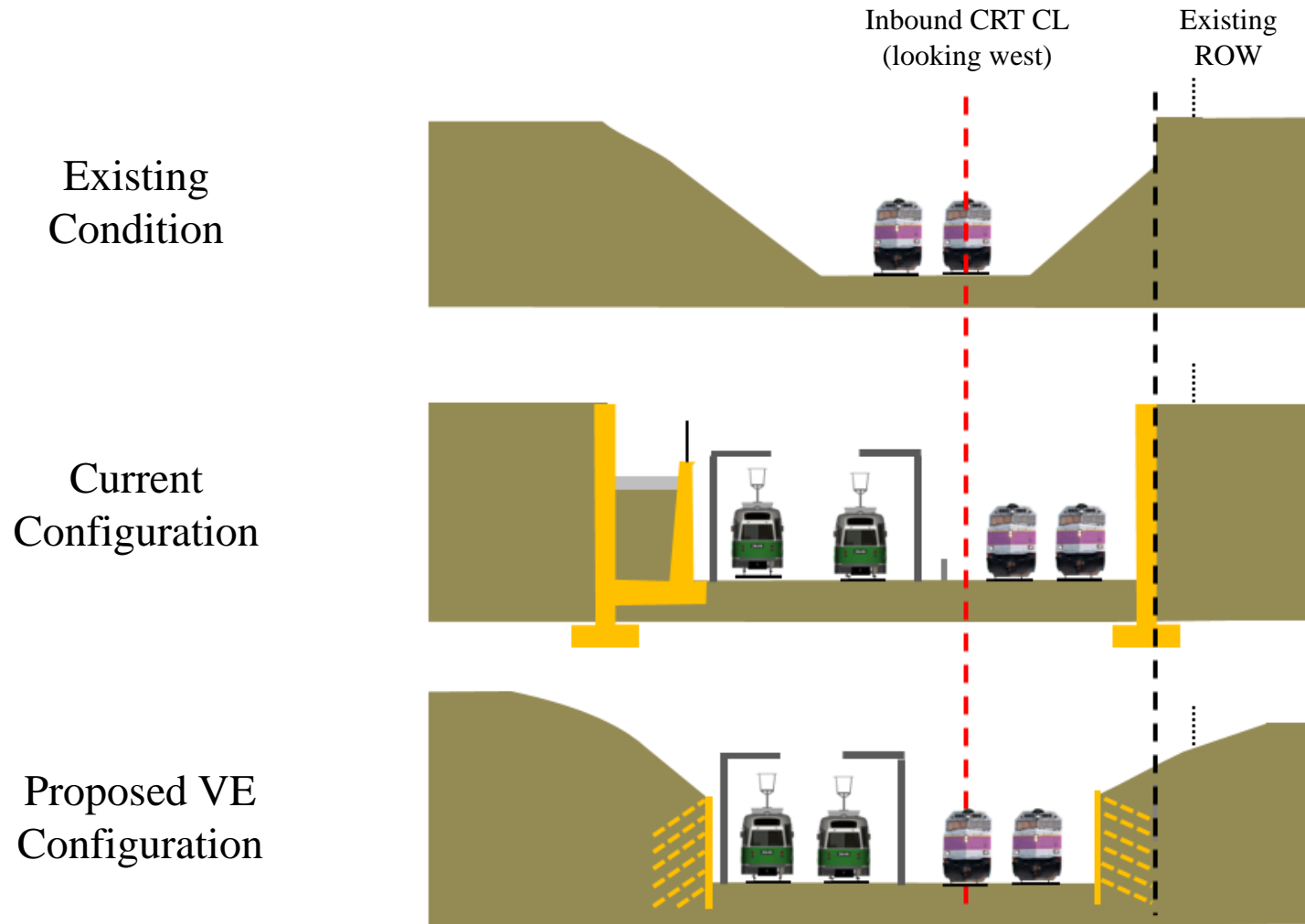
No.	Description	% of Project Construction Cost
1	New Lowell Line Cross-Section	~ 40%
2	Scaled Down Stations	~ 23%
3	Union Square Branch Alternatives	~ 15%
4	Viaduct Redesign	~ 12%
5	Downsized Vehicle Maintenance Facility	~ 11%
6	Schedule and Productivity Improvements	~ 8%

Range of Potential Savings: 10% to 40% of Construction Cost

New Lowell Line Cross-section

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Lowell Line Cross-Section



Lowell Line Cross-Section Opportunities

- Reduce proposed cross-sectional width
- Eliminate utility corridor
 - Relocate AC power to catenary
 - Redesign emergency egress to more economical solutions
- Apply fewer and more economical retaining walls
 - Purchase sub-surface easements
- Associated reduction of quantities for:
 - Commuter Rail tracks
 - Bridges
 - Utilities/drainage
 - Systems
 - Site works

Lowell Line Cross-Section is ~ 40% of the Construction Cost

Scaled Down Stations

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Stations Opportunities

- Continue current VE trend toward core functionality
- Decouple access from adjacent bridges
- Vertical circulation
 - Pedestrian Bridge
 - Elevators each side
 - Two covered stairs
- Platform(s) with canopy
- Fare collection needs to be considered
- Defer head-house to joint development



Yawkey Station

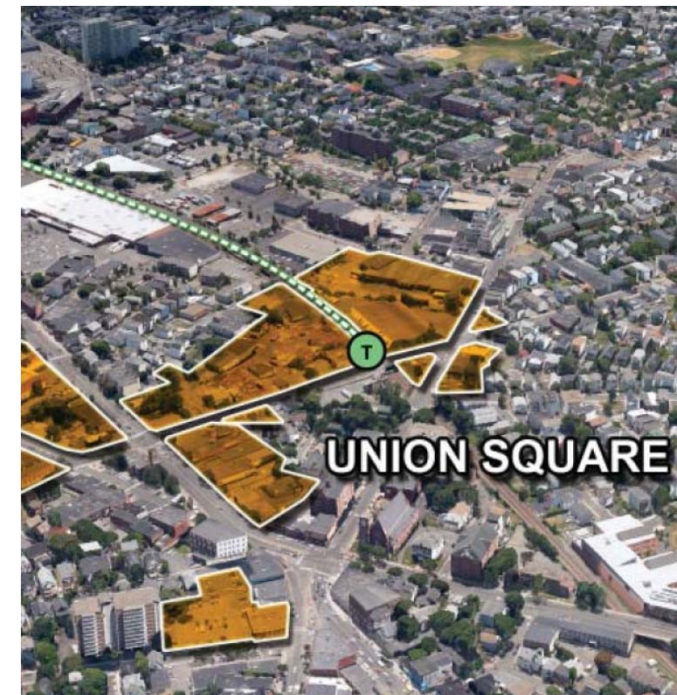
Stations are currently ~ 23% of Construction Cost

Union Square Branch Alternatives

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Union Square Branch

- 3,600 Boardings Daily
 - Only 144 for Lechmere Station
- GLX Washington: ½ mile
- Commuter Rail Station with service to North Station
 - Eliminate Light Rail Transit tracks and associated works
 - Do not relocate commuter rail track
- Shuttle to/from Lechmere
 - Bus
 - Single track Light Rail Transit



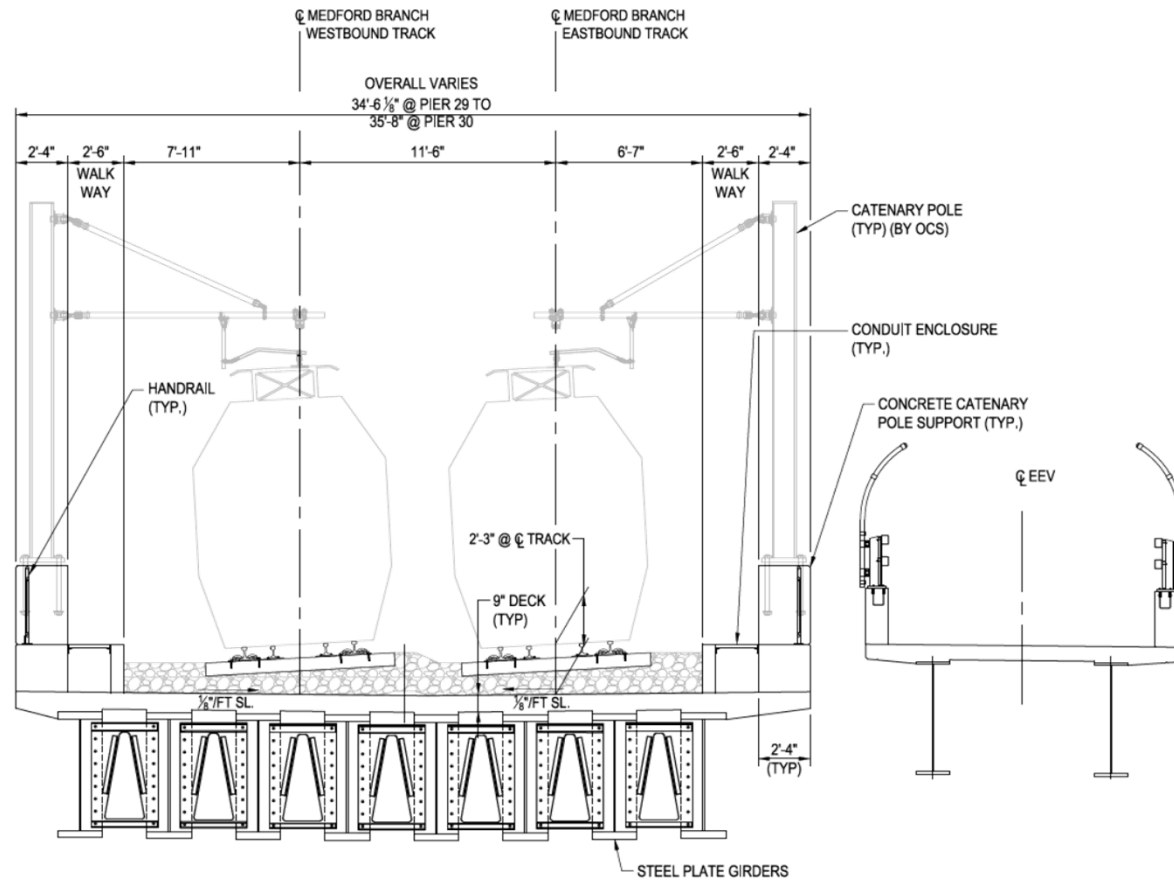
The Union Square Branch is currently ~ 15% of Construction Cost

Viaduct Redesign

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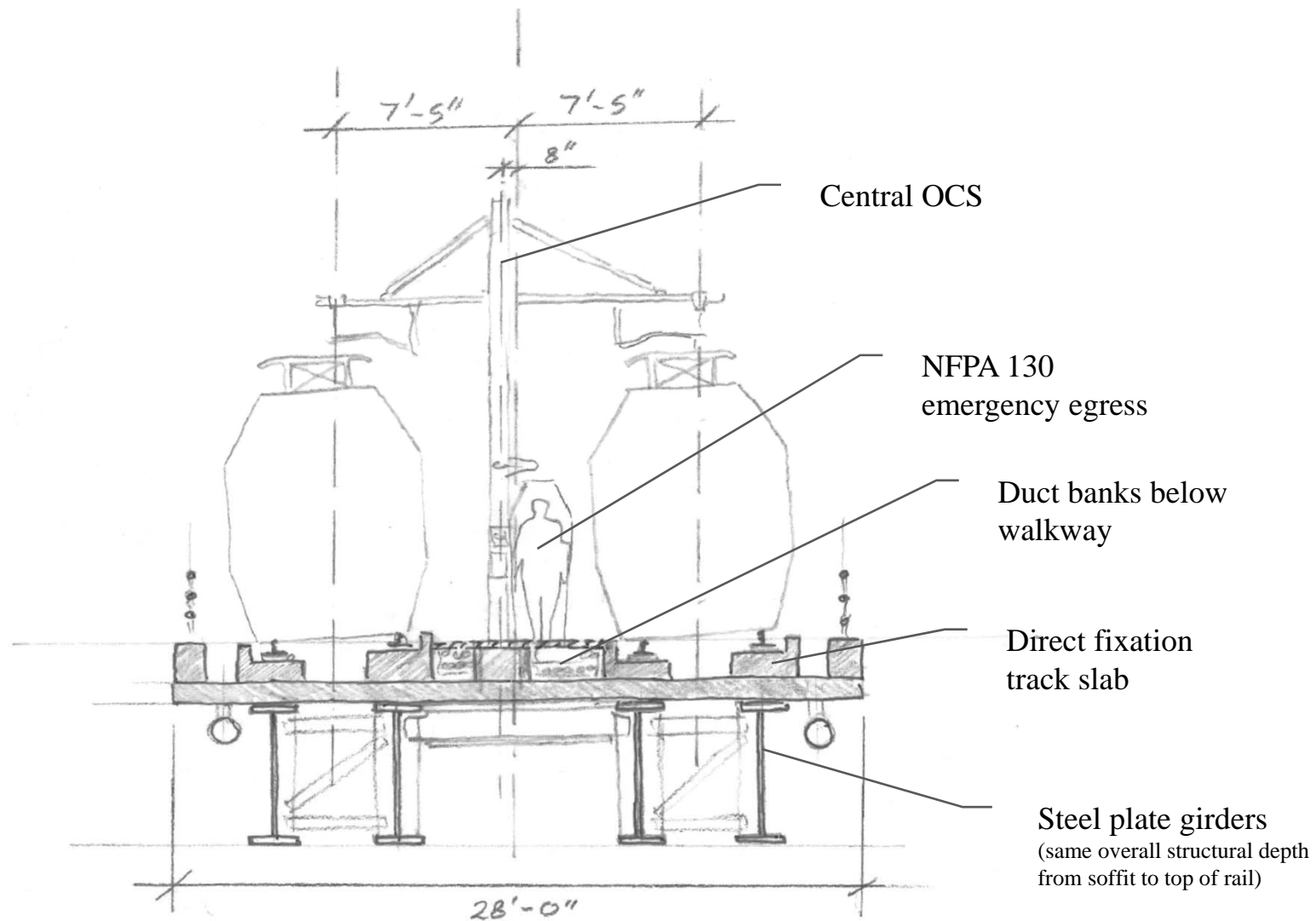
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Lechmere Viaduct – Current Cross-section



Viaducts are currently ~ 12% of Construction Cost

Lechmere Viaduct – Revised Cross-section



Viaducts Opportunities

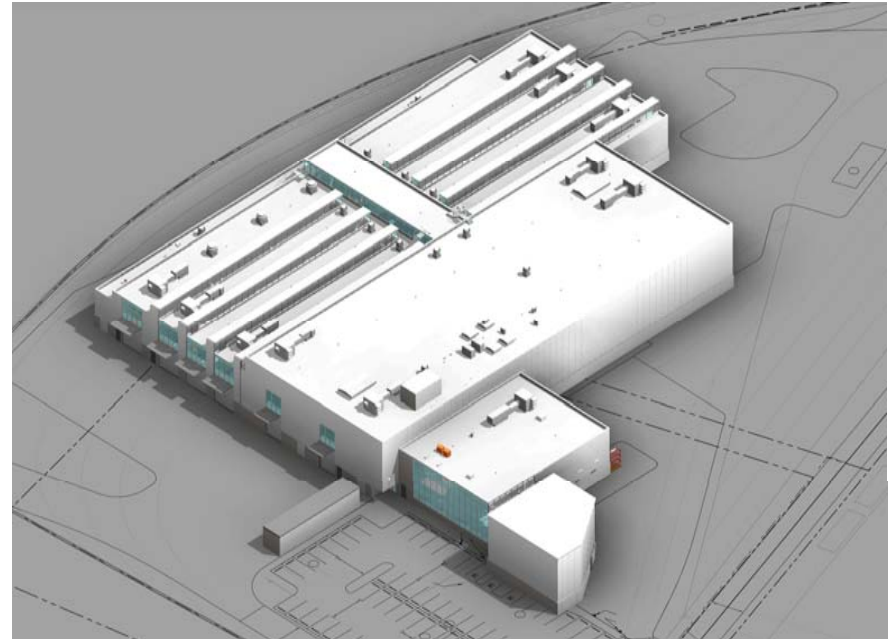
- Reduce the number of viaducts:
 - Replace Emergency Egress viaduct with more economical solutions, i.e. areas of safe refuge, stairwells
 - Replace viaduct to Vehicle Maintenance Facility with at-grade tracks (already developed by GLX Project Team)
- Reduce the weight of the viaducts:
 - Replace ballast with direct fixation
 - Switch to center pole Overhead Contact System
 - Replace structural steel tubs at Lechmere Station

Downsized Vehicle Maintenance Facility

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Vehicle Maintenance Facility

- 80 Green Line car stabling
- Transportation building + above ground parking deck
- Green Line Vehicle Maintenance Facility
 - Heavy and light maintenance of Green Line cars
 - Maintenance of Way equipment storage
- Traction Power Substation



Note: source graphics GLX Project Team

VMF is currently ~ 11% of Construction Cost

Vehicle Maintenance Facility Opportunities

- Reduce the number of vehicles that are stabled:
 - 80 Green Line vehicles as currently sized
 - Can reduce to 24 to 44 vehicles
 - 20 Green Line vehicles currently stabled at Lechmere Station
 - 24 vehicles purchased for Green Line Extension
 - 34 vehicles needed to start Green Line Extension's daily operations
- Track and systems
 - Reduce the extent of track and systems commensurate with the reduced number of vehicles stabled

Vehicle Maintenance Facility Opportunities (Continued)

- Transportation Building
 - Eliminate above ground parking deck (already developed by GLX Project Team)
 - Use modular buildings
- Vehicle Maintenance Facility
 - Defer heavy maintenance
 - Defer Maintenance of Way storage
 - Use Light Maintenance Shed

Schedule and Productivity Improvements

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Opportunities for Increased Productivity

- Working off-peak hours (nights and weekends)
- Single tracking
- Weekend service interruptions
- Strategic short-term service interruptions
 - Lowell Line trains a la Democratic National Convention
 - Fitchburg Line trains operated to Porter Square Station with transfer to Red Line
- Coordinate service interruptions with MBTA's planned projects:
 - Positive Train Control
- Incorporating Value Engineering and Cost Reduction Concepts

Schedule and productivity inefficiencies add ~ 6 to 18 months

Additional Costs

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Additional Costs Associated with Potential Cost Reduction Opportunities

- Incompatible construction work in progress
- Escalation of construction costs due to delays
- Re-design
- Additional Right-of-Way acquisitions
- Temporary bus service

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