

# Green Line Extension Review Interim Project Management Team Final Report May 9, 2016



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# INTRODUCTION and CONTEXT



# Introduction

In December, the MassDOT Board and the MBTA Fiscal and Management Control Board established an Interim Project Management Team to perform a rapid assessment and redesign of the Green Line Extension project.

The Team, which includes both agency and consultant staff, was tasked with answering six questions:

- 1) What would a redesigned Green Line Extension project look like?
- 2) How much would the project cost to deliver, including monies already spent or committed?
- 3) What would the new project schedule look like, including FTA coordination and approval, procurement, and construction?
- 4) If the GLX project continues, how should the remaining design and construction work be procured and executed?
- 5) If the GLX project continues, how should it be managed, by both MBTA staff and consultants?
- 6) What revenue is available to pay for a revised GLX project?

# Conditions Established by the MassDOT Board and FMCB

In addition, the Boards unanimously approved a resolution laying out the conditions under which they would consider proceeding with the GLX project:

- 1) Value engineering and redesign would be undertaken to substantially reduce the cost of delivering the project while maintaining its core functionality.
- 2) A procurement strategy would be developed to ensure that a reliable cost estimate, viable cost reduction strategies, and appropriate risk allocation are incorporated into the GLX project going forward
- 3) New project management would be put into place within the MBTA and for needed outside professional services contracts.
- 4) Additional funding beyond that previously approved by the MassDOT Board would need to be obtained from other sources such as the Boston Region Metropolitan Planning Organization and the municipalities, land owners, and developers benefitting from the project (additional Commonwealth funding would be limited to requirements set forth for federal funding only).

# Characteristics of the GLX Project

- 1) 4.5 miles of new Green Line track in East Cambridge, Somerville, and Medford
- 2) Six new stations and a relocated Lechmere Station
- 3) Anticipated to bring regional economic benefits, including:
  - Faster travel times for workers and residents
  - Increased access to/from neighborhoods currently without rail transit
  - Increased economic activity from new development
- 4) Anticipated daily ridership of approximately 49,000 boardings and alightings by 2030
- 5) Projected to improve local and regional air quality
- 6) Substantial transit-oriented planning already done in the GLX project corridor





# QUESTIONS and DISCUSSION



# THE REDESIGNED GREEN LINE EXTENSION PROJECT

*What would a redesigned Green Line Extension project look like?*





# Redesigned GLX Project: Key Principles

- 1) The redesign should reduce the cost of GLX to as close as possible to the original Full Funding Grant Agreement (FFGA) program cost of \$1.992 billion.
- 2) The redesign should not violate the requirements of the FFGA or reduce the project's functionality and benefits.
- 3) The redesigned project should contain ONLY the most streamlined project elements that are still needed for core functionality and benefits.
- 4) The redesign should reduce not only costs, but also construction risks, complexities, uncertainties, and the construction timetable.
- 5) Because external parties are being asked to contribute funding, the redesign should only include elements that are essential to the operation of the GLX.

# The Redesigned GLX Project

## What is unchanged from the original GLX design?

- 1) Identical number of stations (seven) in the same locations, with all stations receiving Green Line service
- 2) Identical platform size and functionality
- 3) Conforms with the Environmental Assessment, Environmental Impact Report, and Full Funding Grant Agreement
- 4) Includes the purchase of 24 new Green Line cars
- 5) Includes a multiuse community path
- 6) Same level and frequency of Green Line service

*The Interim Project Management Team considered modifying the Union Square branch to be served either by Bus Rapid Transit or Commuter Rail, but ultimately decided the cost savings were insufficient to justify the change, which could jeopardize the FFGA funding*

# The Redesigned GLX Project

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## How is the redesign different from the original GLX design?

- 1) Greatly simplified stations and maintenance facility
- 2) Simplified viaducts and bridge designs
- 3) Modified power and signal systems
- 4) Modified accessibility design within the requirements of the Americans with Disabilities Act
- 5) Simplified community path
- 6) Improved construction conditions, which will improve productivity

# Station Functionality Comparison

Function	Previous Design							Redesign						
	Lechmere	Union Sq.	Washington	Gilman Sq.	Lowell St.	Ball Sq.	College Ave	Lechmere	Union Sq.	Washington	Gilman Sq.	Lowell St.	Ball Sq.	College Ave
<b>Elevators</b>	3	2	2	2	2	2	2	2	N	N	1	1	N	2
<b>Escalators</b>	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N
<b>Stairs</b>	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	N	Y
<b>Ramp</b>	N	N	N	Y	Y	N	Y	N	N	N	Y	N	N	N
<b>Fare vending</b>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<b>Fare arrays</b>	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N
<b>Canopies</b>	Y	Y	Y	Y	Y	Y	Y	Weather Shelters	Weather Shelters	Weather Shelters	Weather Shelters	Weather Shelters	Weather Shelters	Weather Shelters
<b>Platforms</b>	4-Car	3-Car	3-Car	3-Car	3-Car	3-Car	3-Car	4-Car	3-Car	3-Car	3-Car	3-Car	3-Car	3-Car

# Vehicle Maintenance Facility Comparison

Function	Previous Design	Redesign
Vehicle Maintenance Facility building	94,000 square feet	55,000 square feet
Transportation building	8,200 square feet	1,200 square feet
Employee parking	175 deck plus surface spaces	143 surface spaces
Green Line Vehicle storage capacity	88	44
Wheel truing	Included	None
Sanding	Automatic System	Sanding by hand
Part storage	Automated storage and retrieval system	Manual rack storage
Facility tracks	4 through tracks, 2 heavy maintenance	4 through tracks
Car wash	Included	None
Cranes/hoists	Two 7.5 ton and one 5 ton	One 10 ton and one 7.5 ton
Maintenance of Way facility	2 tracks, offices, storage	None
Traction power substation	Included	None

# Bridges Comparison

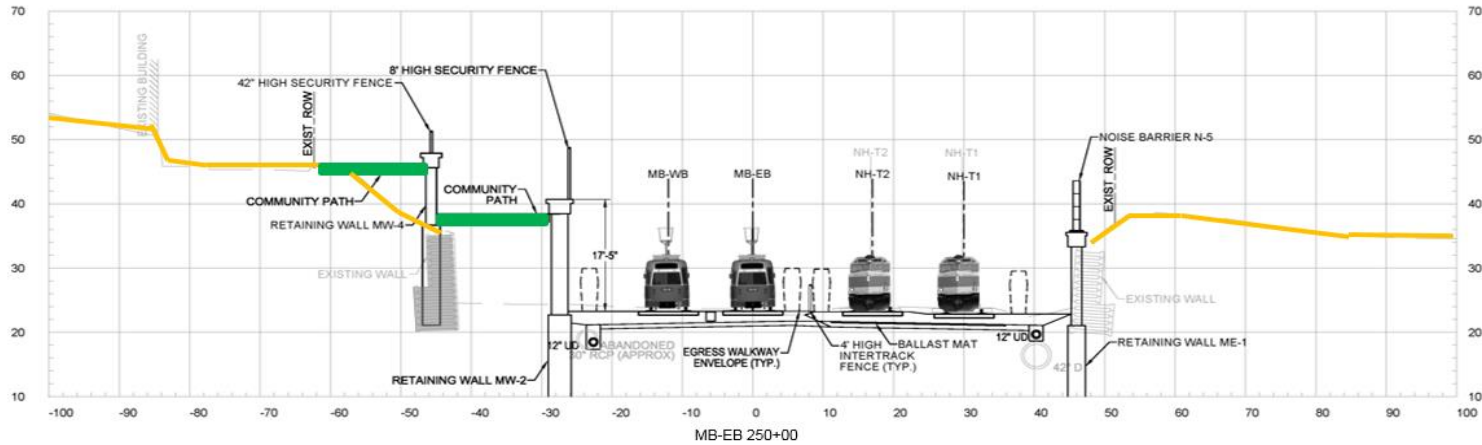
Bridge	Previous Design	Redesign
<b>Medford Street</b>	Full replacement	Keep existing Bridge WB GLX tunnel behind abutment
<b>School Street</b>	Full replacement	Keep existing Bridge WB GLX tunnel behind abutment
<b>Lowell Street</b>	Full replacement	Revise GLX alignment, remove south abutment earthwork, and avoid bridge reconstruction
<b>Broadway</b>	Full replacement of 2 lane bridge plus 1 parking lane, sidewalk, and 2 bike lanes. Partial closure during construction	Replace with 2 lane bridge, and 2 bike lanes. Parking lane and sidewalk removed. Full closure during construction
<b>College Ave</b>	Widen bridge structure to accommodate right-hand turning lane	Maintain right-hand-turn lane on existing bridge, remove sidewalk, and add new pedestrian bridge



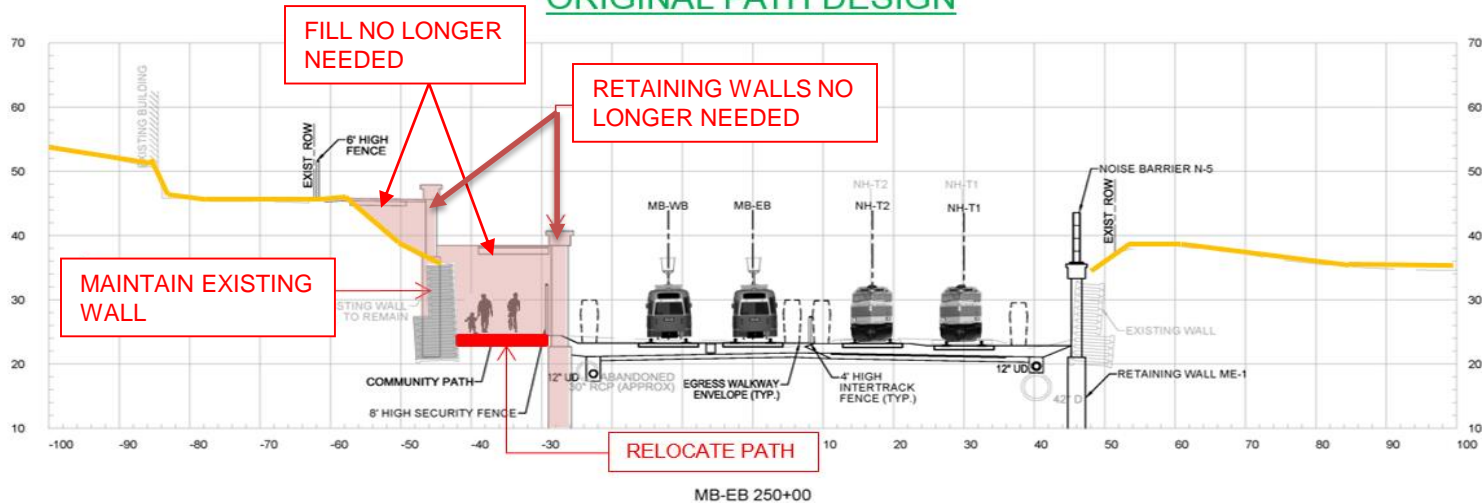
# Community Path Comparison

Function	Previous Design	Alternate Design
<b>Length of Path</b>	10,000 feet	7,000 feet
<b>Start/ finish</b>	Lowell Street to Water Street, Cambridge	Lowell Street to Washington Street, Somerville
<b>Width</b>	11-foot average, 8-foot minimum	11-foot average – 8 foot minimum
<b>Street Access Points</b>	Central Street Sycamore School Street Medford Street Walnut Street Chester Street (2) Washington Street West Boulevard	Central Street Sycamore Street School Street Chester Street (Possible) Washington Street

# Redesign Example: Retaining Walls/Community Path



ORIGINAL PATH DESIGN



ALTERNATIVE PATH DESIGN

# QUESTIONS and DISCUSSION



# THE NEW PROGRAM COST ESTIMATE

*How much would the project cost to deliver, including monies already spent or committed?*



# Building a New Program Cost Estimate

## How was the estimate prepared?

- 1) Started with the base framework prepared by an Independent Cost Estimator
- 2) Modified quantities to reflect the new simplified design
- 3) Built unit-price estimates and production-based adjustments
- 4) Estimated a completely new contractor indirect cost
- 5) Performed a statistical analysis of the estimate accuracy
- 6) Developed a cost estimate with a confidence level of 90% ('P90')
- 7) Incorporated completed costs, where appropriate, to update the program estimate
- 8) Assumed the use of the Design-Build competitive procurement method

# The New Program Cost Estimate

Line Item #	PROGRAM BUDGET COST CENTER DESCRIPTION	New Program Estimate IPMT	Sunk-Cost Included in Estimate
1	CONSTRUCTION ( <i>D-B Value</i> )	\$ 1,192,400,000	\$0
2	REAL ESTATE	\$ 112,500,000	\$93,000,000
3	VEHICLES	\$ 182,700,000	\$182,700,000
4	PROFESSIONAL SERVICES	\$ 414,900,000	\$221,000,000
5	UNALLOCATED CONTINGENCY	\$ 182,200,000	\$0
6	<i>CURRENT CM/GC CONSTRUCTION CONTRACTS</i>	\$ 203,900,000	\$203,900,000
7	<b>TOTAL</b> (with no Additional Funding Considerations)	<b>\$ 2,288,600,000</b>	<b>\$700,600,000</b>

Inc. Force Account

- 1) Total includes sunk costs; both allocated and unallocated contingencies; design costs; and escalation to the completion of the Program (as redesigned).
- 2) Does not include finance charges, which had been calculated at \$305 million in the FFGA.
- 3) For planning purposes, this estimate assumes that procurement begins in May 2016 and that construction begins in October 2017. Escalation costs beyond that are estimated at \$1.6 million/month.



# The Costs of Escalation Included in Construction

## Included in the Construction Estimate

- 1) Uses a 3.5% annual inflation rate, based on an analysis of current industry performance for horizontal construction
- 2) Uses an additional one-time 2.0% mark-up to reflect the local construction market
- 3) Escalation is estimated at \$1.6 million per month

# Construction Cost Comparison: Previous vs. Revised Estimates

## MAJOR COST REDUCTION INITIATIVES

Line Item #	<u>Construction</u> Cost Centers	Previous GLX Estimates	New Program Estimate ('90 percentile') IPMT	Variance COST AVOIDANCE (previous - new)
A	<b>Stations</b>	\$409,500,000	\$121,200,000	\$288,300,000
B	<b>Bridges</b>	\$86,200,000	\$51,300,000	\$34,900,000
F - G	<b>Retaining Walls and Community Path</b> (* New Community Path = \$20M +/-)	\$187,500,000	\$64,600,000 *	\$122,900,000
I	<b>Maintenance Facility (VMF)</b>	\$195,500,000	\$80,130,000	\$115,370,000
J	<b>All Other</b>	\$935,600,000	\$875,000,000	\$60,600,000
<b>TOTAL</b>		<b>\$1,814,300,000</b>	<b>\$1,192,230,000</b>	<b>\$622,070,000</b>

*These partial cost estimates are for relative cost comparisons between the previous project and the redesigned GLX only.*

*Previous GLX Estimates = generated from the Independent Cost Estimate for iGMP#4 and proportioned to iGMP#5 and other past estimates for the VMF and other components)*

All Other = track, power, signal, and all other required program infrastructure



# QUESTIONS and DISCUSSION



# POTENTIAL SCHEDULE

*What would the new project schedule look like, including reprocurement and construction?*



# Potential Schedule Summary

## A potential three-phase schedule:

### Phase 1: Federal Transit Administration Review

- Continue review of redesign concepts, cost estimate, and projected schedule in order to seek release of federal funding
- Risk workshop and contingency review
- Finance Plan update, including confirmed municipal financial commitments
- Review of agency technical capacity and program management proposal
- Anticipated duration: Unknown

### Phase 2: Organization Capacity Building and Procurement

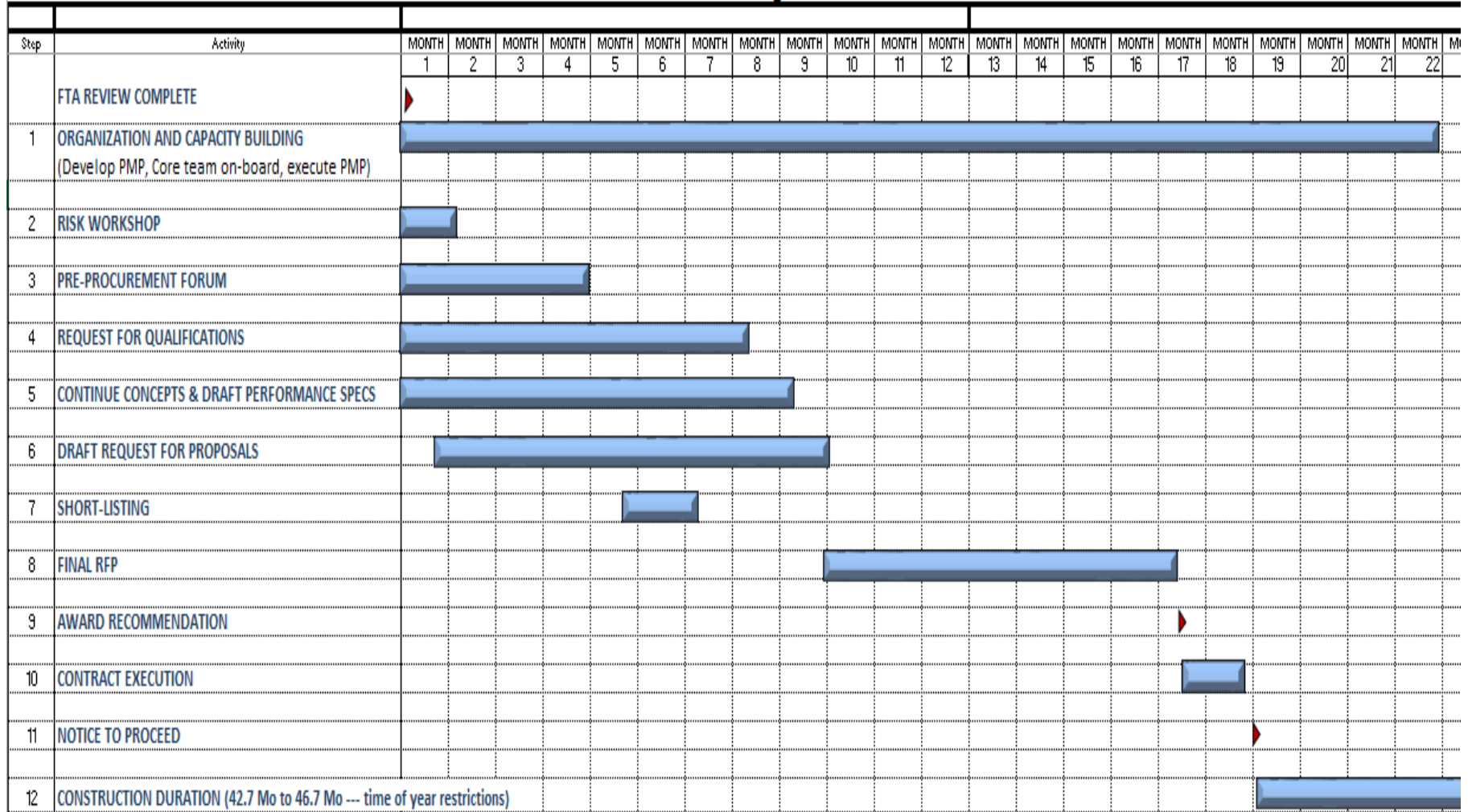
- Recruit Program Management Team
- Train and prepare staff
- Execute all procurement tasks
- Anticipated duration: 18 Months

### Phase 3: Construction

- Anticipated duration: 43 months (with a range to 47 months), depending on the start of construction and work hours arrangements

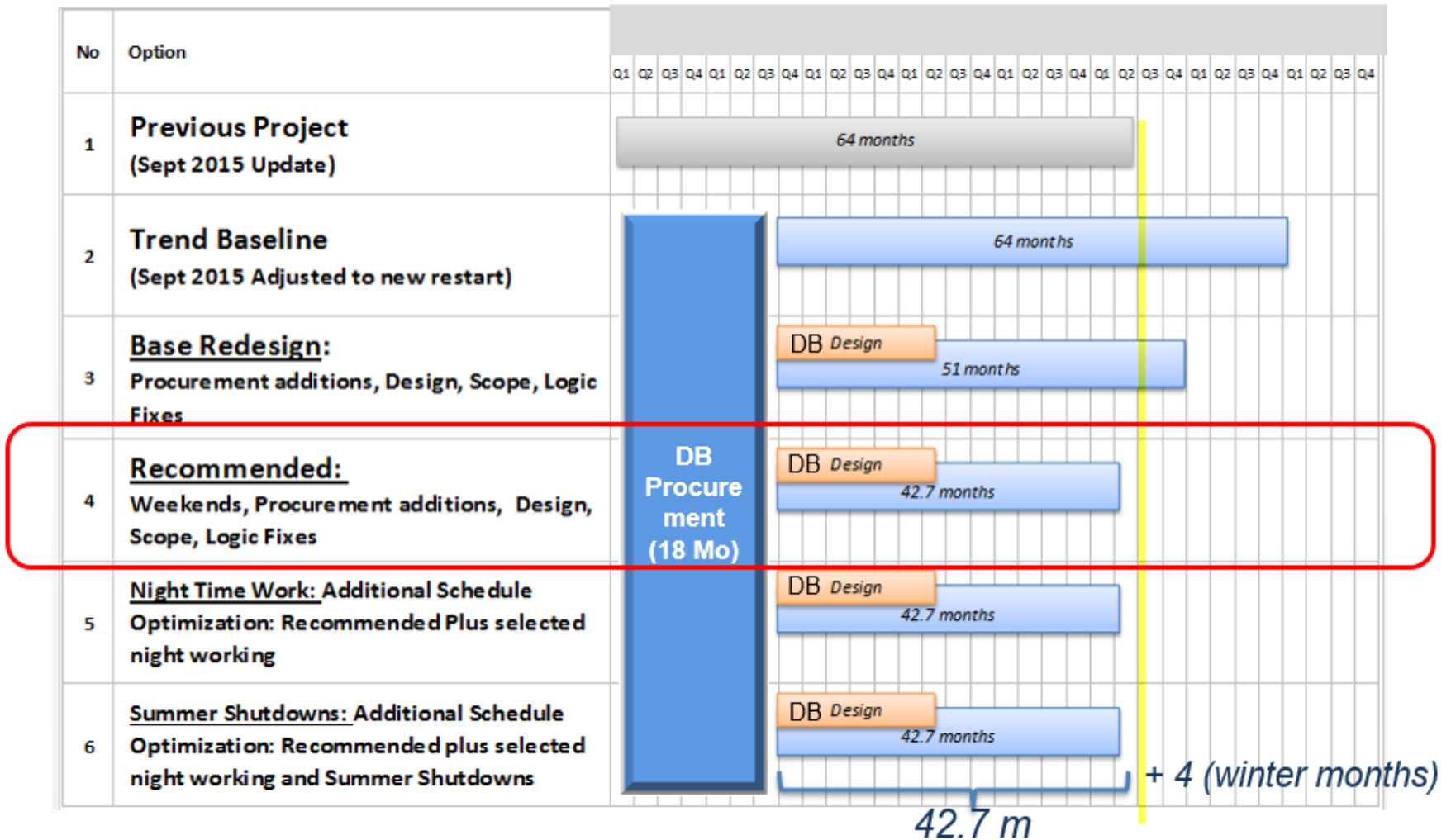
# Potential Procurement Schedule

Potential Green Line Extension Design-Build Procurement Schedule





# Potential Construction Schedule



# QUESTIONS and DISCUSSION



## COMPETITIVE PROCUREMENT RECOMMENDATION

*If GLX continues, how should the remaining design and construction work be procured and executed?*



# Procurement Recommendation: Design-Build Delivery Method

If the GLX project continues, the Interim Project Management Team recommends:

- Use the Design-Build project delivery method
- Put the project out to bid in one comprehensive contract package
- Use the guidelines laid out in the new and approved Design-Build manual
- Use a specific not-to-exceed price

## Considerations

- While the MBTA has experience with the Design-Build method, it has never used it on a project of this size or complexity.
- Lessons learned on MassDOT bridge and roadway projects and on the MBTA Greenbush project can be beneficial
- Technical capacity within the MBTA to manage a Design-Build procurement of this size remains a concern
- MBTA staff would need training and would need to be augmented with new expertise

# Procurement Recommendation: Design-Build Delivery Method

## How can the risks be reduced?

- 1) The use of Alternative Technical Concepts, confidential One-on-One Concept Meetings, and other innovations during the bidding process would encourage creativity and competition among the bidders, to the benefit of the MBTA.
- 2) The use of a two-part best-value selection process would allow the MBTA the flexibility to select a winning bidder based on a combination of both qualifications, innovative proposals, and price.
- 3) Performance criteria would allow bidders to work with less-than-complete designs to develop bid packages that both meet the needs of the MBTA and benefit from innovation and creativity.
- 4) Thorough training and mentoring of MBTA staff in the use of Design-Build as a procurement technique for complex projects, complemented by the addition of new staff (both MBTA and consultant) with appropriate experience and skills.

# QUESTIONS and DISCUSSION



# MANAGING THE GREEN LINE EXTENSION PROJECT

*If GLX continues, how should it be managed, by both MBTA staff and consultants?*





# Managing the GLX Project

## Why did the previous GLX management struggle with project delivery?

Both the December 'look-back' report prepared by the Berkeley Research Group and ASCENT found that:

- 1) MBTA staff assigned to the GLX project were too few in number to deal with the complexity of the project and with the dozens of consultants
- 2) Too much autonomy and authority was ceded to consultants who took full advantage by charging too much and delivering too little
- 3) Project controls were inadequate to provide early warning of nascent problems
- 4) MBTA culture valued process over outcomes, stifling initiative, handicapping decision-making, and diffusing accountability
- 5) External deadlines drove project management to prioritize speed over other management aspects

# Managing the GLX Project

## How should the GLX project be managed effectively?

The MBTA hired management consultant ASCENT to analyze past problems and recommend a new management structure for a redesigned GLX.

### ASCENT proposed four recommendations:

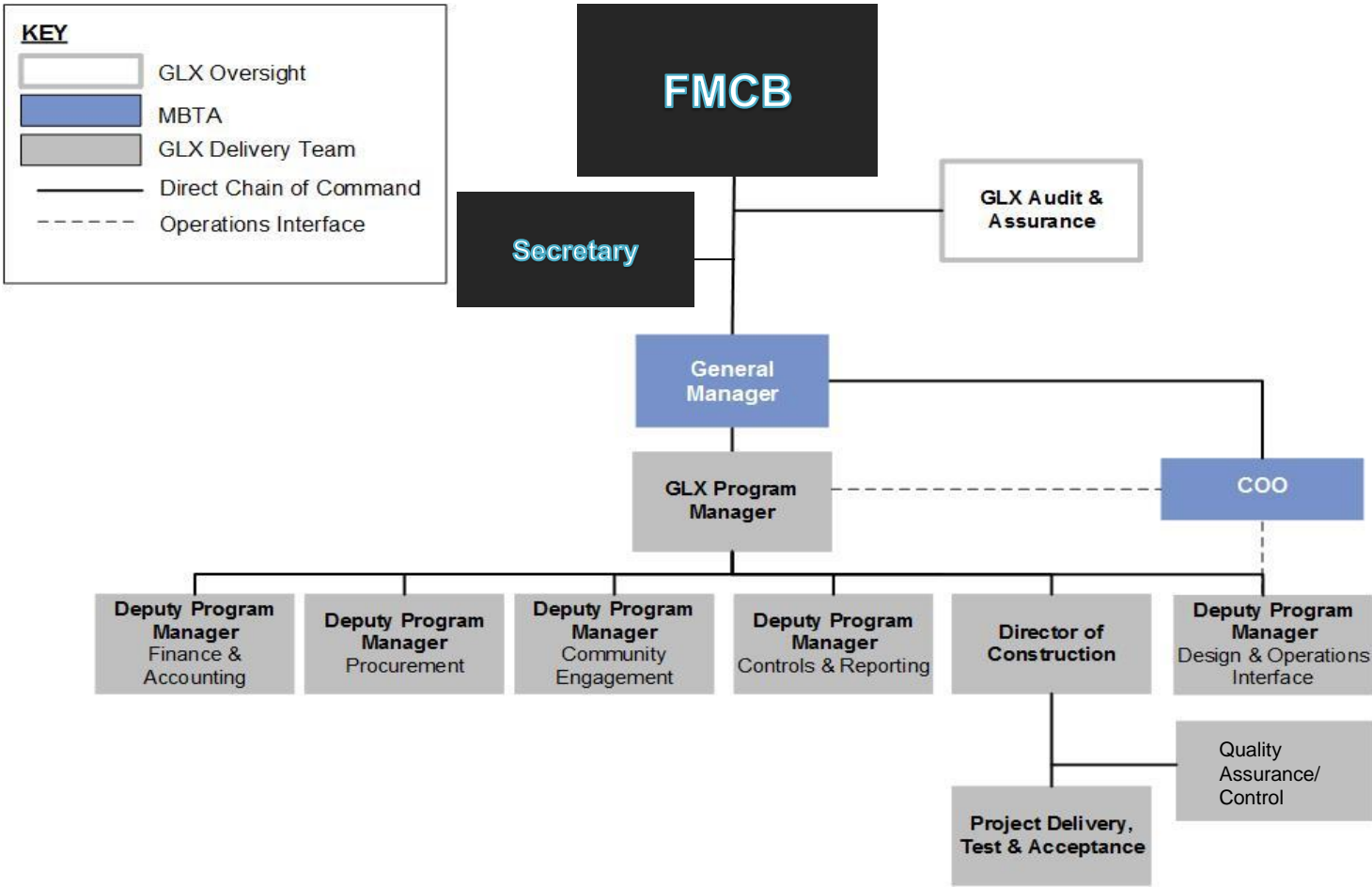
- 1) Use a structured program management approach
- 2) Provide autonomy and oversight to and expect accountability from a new GLX program management team
- 3) Create a 'core of competence' among GLX program management team staff and leadership that can help to transform the overall construction functions within the MBTA
- 4) Establish a strong sense of ownership and accountability among project staff and leadership

# Managing the GLX Project

## Characteristics of the Proposed Program Management Approach, as described by ASCENT:

- 1) A leadership team comprised of a Program Manager, a Director Construction, and five Deputy Program Managers
- 2) 40-50 staff members, including MassDOT/MBTA staff and consultant staff
- 3) Processes, policies, and procedures developed specifically for the GLX project
- 4) Autonomy from day-to-day MBTA business
- 5) Clear, timely, and accurate reporting at the program, project, and construction levels
- 6) A self-aware culture committed to accountability, transparency, and process improvement

# Managing GLX – Proposed Structure



# Managing the GLX Project

## How could this go wrong? What are the ongoing management risks?

The ASCENT team has cautioned that the MBTA must be realistic about the difficulties of implementing a Program Management Team model for the GLX project:

- MassDOT/MBTA leadership would have to guard against the almost inevitable organizational response: “We’ll do enough to appease those who care, but not so much that it affects those who don’t or seriously threatens the status quo.”
- Investing in the right talent and leadership for the Program Management Team would cause dislocations and anxiety within the MBTA, and possibly public criticism, but would have to be done.
- Even with a Program Management Team approach, a megaproject of the scope and complexity of GLX will consume resources and agency attention. Without proper safeguards, GLX could become a major distraction from the MBTA focus on reinvestment in its core system.

# QUESTIONS and DISCUSSION



# SOURCES and USES OF FUNDING

*What revenue is available to pay for a revised GLX project?*





# Sources and Uses - The Funding Gap

- 1) The cost estimate for the redesigned project is \$2.29 billion
  - Inclusive of sunk costs and the cost for new vehicles
  - Exclusive of finance charges (\$305 million in the Full Funding Grant Agreement)
  
- 2) The available revenue for the project is \$1.992 billion
  - \$996 million in federal New Starts funding (e.g. the Full Funding Grant Agreement)
  - \$996 million in Commonwealth funds
  
- 3) The funding gap is approximately \$300 million

# Additional Revenue Needed

## What outside revenue is available if the GLX project proceeds?

- 1) To close the almost \$300 million funding gap, MassDOT is seeking additional funding from the Boston Region Metropolitan Planning Organization, the GLX corridor municipalities, and major corridor landowners and developers
- 2) On May 5th, the Boston Region Metropolitan Planning Organization voted unanimously to release for public review an amendment to its Transportation Improvement Program (TIP) reallocating \$152 million in federal highway funds controlled by the MPO from GLX2 to the existing project
- 3) The City of Somerville has submitted to MassDOT a Letter of Intent with a financial commitment to the GLX project of \$50 million
- 4) The City of Cambridge has submitted to MassDOT a Letter of Intent with a financial commitment to the GLX project of \$25 million, half of which will be paid by DivcoWest (developer of the Northpoint area)
- 5) A funding gap of approximately \$73 million remains.



# QUESTIONS and DISCUSSION



# RISKS and RISK MANAGEMENT



# Risks and Risk Management

## Risk Still Exists, But Can be Identified

- 1) Despite substantial efforts to reduce or remove complexity and uncertainty from the design and delivery of the Green Line Extension project, the project still carries measurable risk that must be considered as part of the future overall GLX contingency assessment
- 2) Many of these aspects have been considered in the development of the new unallocated contingency budget. They must nevertheless be carefully monitored and managed if the project is to move forward and remain within the cost range estimated in this document
- 3) Should the GLX project continue, a Risk Workshop would be performed early on, most likely with the participation of the Federal Transit Administration. This Workshop would confirm the cost range estimated here, and would also identify additional risks that could alter the estimated costs

# Risks and Risk Management

**The following risks – among others – could change the estimated cost, schedule, and scope.**

- 1) Many variables influence the accuracy of the new GLX estimate.
- 2) Market conditions were considered in development of the bid estimate and contingency, but are still a concern, especially in the Boston construction market.
- 3) Escalation in the cost of commodities beyond market conditions.
- 4) Design regression is a factor for some components of the revised GLX project, such as the stations and the maintenance facility.
- 5) Restricted limitations-of-operations such as potential work hours, if not implemented, would affect the contractor's efficiencies and could increase costs.
- 6) Inability to commit to the scope and to specific performance thresholds ('making them stick') after bidding; this applies to all stakeholders (operations, cities, new project team, MBTA/MassDOT leadership, others).

**The Interim Project Management Team has identified many other risks. These and other risks would be further analyzed in a Risk Workshop, should the project go forward.**

# Risks and Risk Management

**The following tools and actions – among others – could help to manage risk:**

- 1) Significantly reduced scope and schedule
- 2) Competitive bids
- 3) Reprourement provides the Boards with a critical decision 'gate' (utilizing the 'not to exceed price')
- 4) Best-practices and lessons-learned for Design-Build procurements, including innovative exchanges
- 5) Improved confidence related to existing conditions
- 6) Owner's Representative initial review of previous risk register demonstrates an overall significant reduction in risk



# QUESTIONS and DISCUSSION



# NEXT STEPS

*Coordination with the Federal Transit Administration*



# Coordination with the Federal Transit Administration

- 1) If the GLX project is to move forward, the next step would be to enter into detailed discussions with FTA to seek approval of the redesign, the new cost estimate, the identified risks and risk mitigation strategies, and the overall process for releasing the New Starts funding (e.g. the Full Funding Grant Agreement).
  - Regular and ongoing communication with FTA has occurred throughout the redesign process.
  - MassDOT/MBTA sent a detailed letter describing the redesign to FTA for initial review and comment. FTA has committed to working with MassDOT/MBTA on all necessary validation reviews.
- 2) FTA would conduct a full cost, scope, schedule, and risk analysis before approving the project to move forward.
- 3) FTA would also analyze MBTA technical capacity to manage the project and the proposed Program Management approach.

# QUESTIONS and DISCUSSION

