



BRG Look Back Study

November 30, 2015

General Focus

Review the GLX Project, determine what has happened, and provide an understanding of the current status.

BRG Look Back Study

- Fully Independent, No Prior GLX History, No Conflicts
- Document Review and Analysis
- Interviews and Site Visit
 - MassDOT/MBTA
 - HDR/Gilbane (PM/CM)
 - Hatch Mott MacDonald/Patrick Engineering (OR)
 - Stanton (ICE)
 - AECOM/HNTB (Designer)
 - WSK (CM/GC)
 - ARUP
 - Nossaman
 - FTA/PMOC
 - CIM & ACE/MA

Look Back Study Objectives:

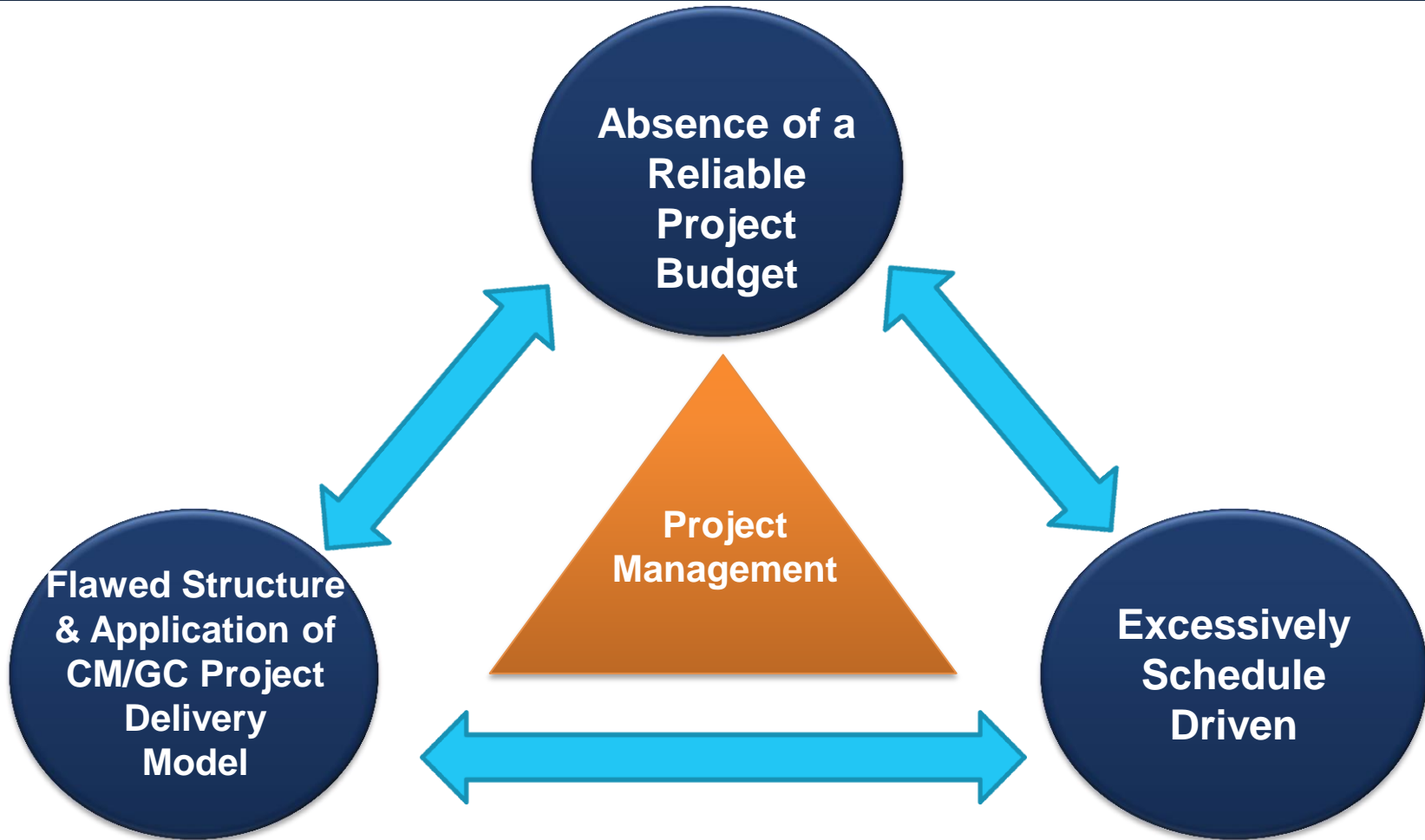
- Independent Assessment of Management Effectiveness & Clarity of Professional Services Providers and MassDOT/MBTA Staff, Including Staffing and Training Decisions
- Independent Assessment of the Determination to use the CM/GC Methodology
- Independent Analysis of Project Cost Estimating and Risk Analysis
- *Independent Analysis of Cost Drivers that Contributed to Project Budget Overruns*

Look Back Study Findings:

What have we learned?

- No silver bullets
- Multiple problems
- Inter-connected
- Longstanding

GLX Project Story



Excessively Schedule Driven

Look Back Study Findings:

Schedule-Driven Project



- Schedule - The Driving Force Behind Selection of CM/GC Delivery Method
 - GLX Project is a Legal Requirement Under State Implementation Plan with Mandated Deadlines
 - Schedule Minimization (Overlap of Design and Construction)
 - Federal Funding Considerations Related to Schedule Minimization
 - Flexibility to Address Project Uncertainties

Look Back Study Findings:

Schedule-Driven Project



- Schedule Pressure Impacted the Ability to Successfully Implement CM/GC
- Schedule Pressure to Develop and Complete the Full Funding Grant Agreement by the End of CY 2014

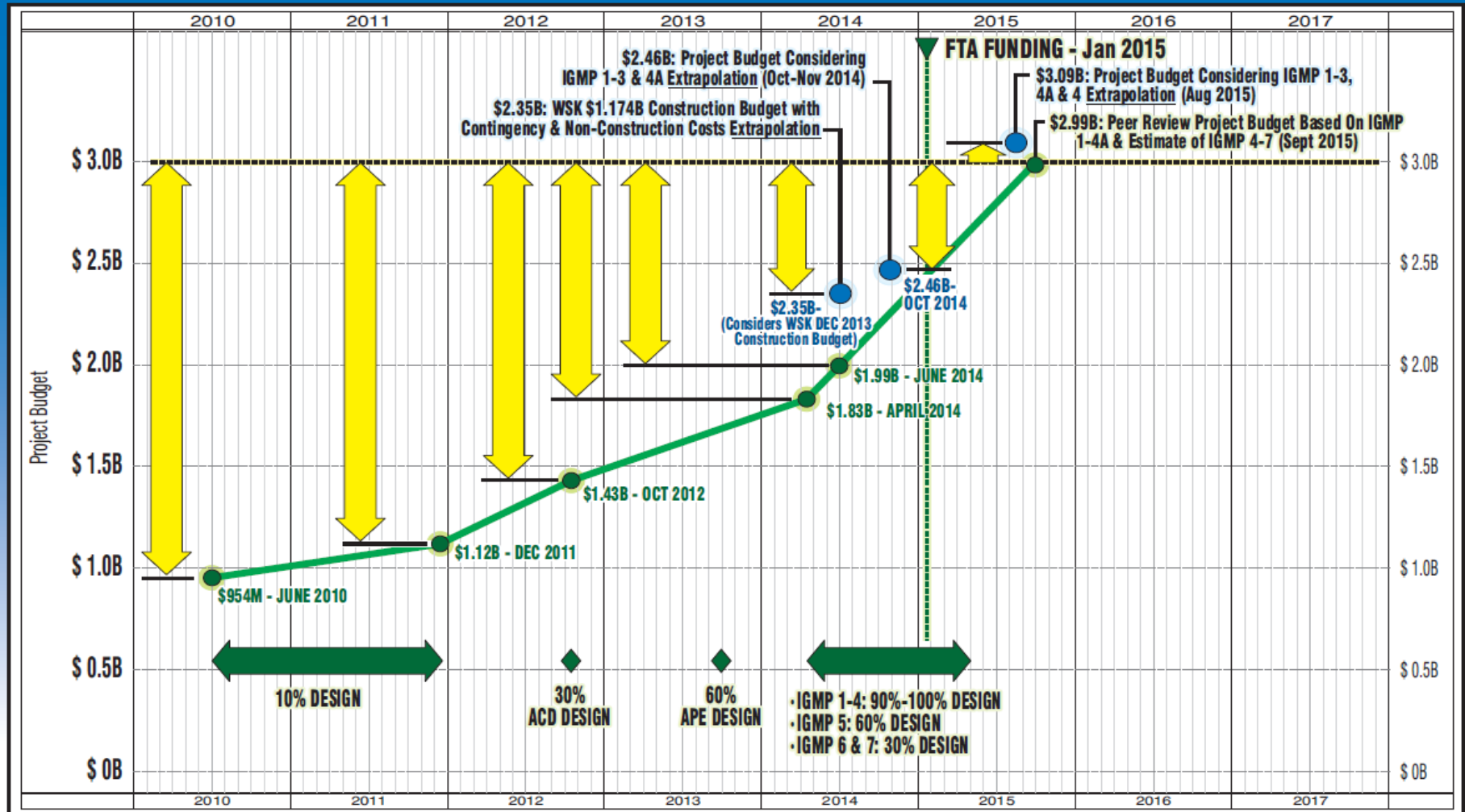
Absence of a Reliable Project Budget

BRG Look Back Study

Analysis of Cost Estimating and Risk Analysis



PROJECT BUDGET CHRONOLOGY AND ANALYSIS



PRELIMINARY
PRIVILEGED & CONFIDENTIAL

GREEN LINE EXTENSION PROJECT
Cambridge, Somerville & Medford, Massachusetts



Look Back Study Findings:

Analysis of Cost Estimating and Risk Analysis



- *A Reliable Project Budget is Defined as being within +10% and -5% of what it would Cost to Design and Construct the Project*

Look Back Study Findings:

Analysis of Cost Estimating and Risk Analysis



- *A Reliable Project Budget was Achievable as Early as October 2012 when the Project's Design was 30% Complete*

Look Back Study Findings:

Analysis of Cost Estimating and Risk Analysis



- *A Reliable Project Budget has not been Produced to Date*

Flawed Structure & Application of CM/GC Project Delivery Model

What is CM/GC Procurement?

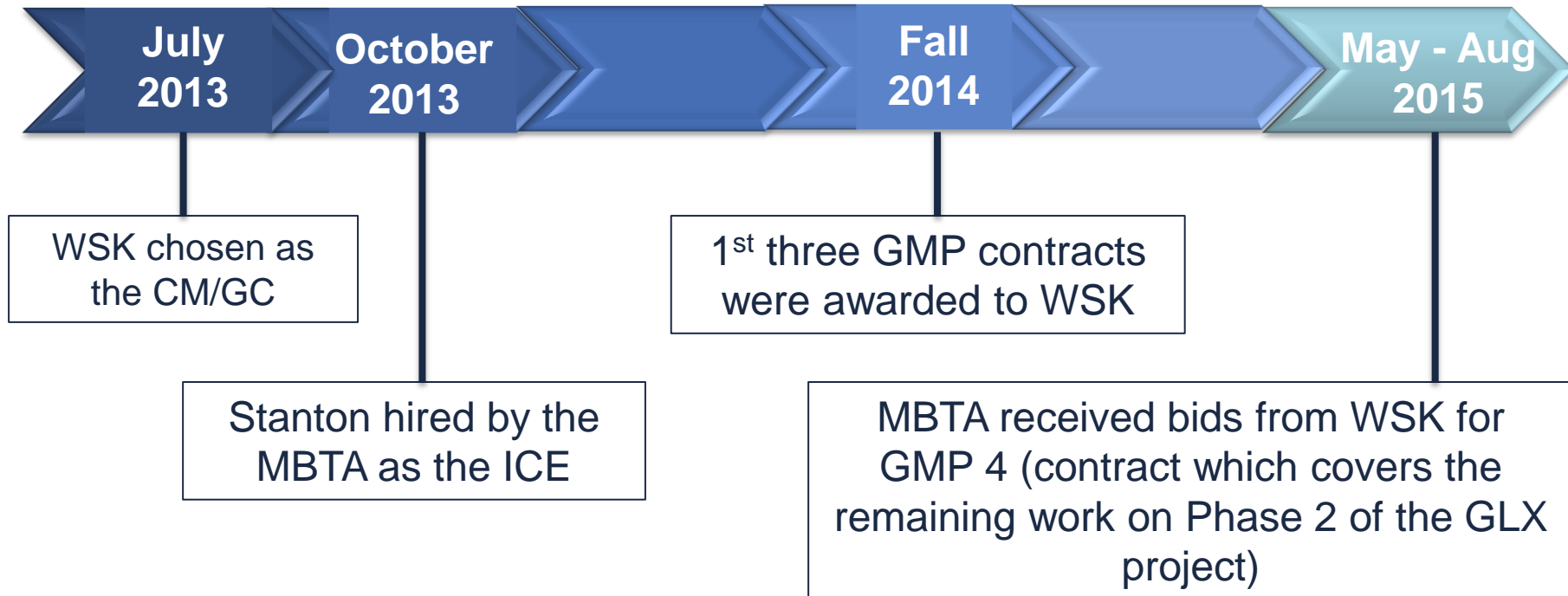
- Phases 2 through 4 of the project use a contract delivery method called Construction Manager/General Contractor (CM/GC). In this procurement method
 - A CM/GC contractor is procured through a qualifications- and fee-based selection process
 - A design team is procured under a separate contract
 - The MBTA, CM/GC and design team work together to develop designs which the CM/GC prices at a “Guaranteed Maximum Price” (GMP)
- The use of CM/GC on the GLX Project was approved as a pilot program by legislation signed on June 19, 2012
- The MBTA Board of Directors approved use of this approach on July 11, 2012

What is CM/GC Procurement?

- Another key piece of the CM/GC methodology is the Independent Cost Estimator (ICE). The ICE provides cost estimating services on individual GLX construction packages, which are used for comparison with the bids received from the CM/GC team on those packages
- Potential advantages of the CM/GC model are that it overlaps design and construction, thereby shortening overall program delivery time and providing a single point of responsibility
- A potential disadvantage of the CM/GC model is that CM/GC faces no competition

GLX Procurement Timeline

- The work associated with Phases 2-4 of the GLX Project was broken down into a series of guaranteed maximum price (GMP) contracts with the CM/GC



- Is CM/GC a Reasonable Delivery Model?
 - Yes
- Was CM/GC the Right Model for the GLX Project?
 - Insufficient Information to Judge
- Was CM/GC Developed and Administered Effectively for GLX Project?
 - No
- Should the MBTA use CM/GC in the future?
 - Only with Open Book Cost Accounting and Current Best Practices

Look Back Study Findings:

Assess the Determination to Use CM/GC



- *Justifications for Using CM/GC*
 - Schedule - The Driving Force Behind Selection
 - Other Justifications - Not Realized Then or Not Important Now
 - Design Refinement with WSK Preconstruction Involvement
 - Cost Certainty with Construction Guaranteed Maximum Pricing
 - MBTA Maintained Control of the Design
 - Single Point of Responsibility for Construction

- *Flaws in the Structure and Application of the CM/GC Model*
 - Flawed CM/GC Proposal Evaluation – Fee-Based Criteria
 - Failure to Use Open Book Cost Accounting – No Visibility into Construction Costs Incurred and Contractually - Specified 4.25% Fee Markup
 - Disconnect Between the ICE IGMP Estimating and HDR/Gilbane's IGMP Budgets
 - WSK was Allowed to Qualify its IGMP Proposals – Effectively Shifting Project Risk back to the MBTA Negating Intended Cost Certainty Considered in the CM/GC Model

- *Flaws in the Structure and Application of the CM/GC Model*
 - Excessive IGMP Negotiations Between HDR/Gilbane, the ICE, the MBTA and WSK - Occurred over Several Months and Allowed WSK to Secure Highest Price for its Work While Remaining within 110% of the ICE Estimate
 - Insufficient CM/GC Training for HDR/Gilbane and the MBTA
 - BRG Recommends that CM/GC Model not be Considered for Future Projects unless Open Book Cost Accounting can be used and the Project Team Receives Further CM/GC Training

CM/GC

Item	Best Practice	GLX Experience
Pricing	<ul style="list-style-type: none">• Pricing & contract provisions and administration should be consistent• Qualifications & assumptions made regarding means & methods should be included in the contract	<ul style="list-style-type: none">• Manual & contract contemplate GMP, but lump sum used• CM/GC qualifications were included in the IGMP Agreements• Unclear whether assumptions were included that would protect the MBTA
Budgeting	<ul style="list-style-type: none">• Establish strict budgeting protocols	<ul style="list-style-type: none">• No reliable budgeting process adopted
Cost Accounting	<ul style="list-style-type: none">• If a GMP contract, open book cost accounting should be used	<ul style="list-style-type: none">• Not adopted

CM/GC

Item	Best Practice	GLX Experience
Cost Estimating	<ul style="list-style-type: none"> • Open book • Cost reconciliations at 60%, 90%, & 100% design • No pre-defined ranges of acceptability 	<ul style="list-style-type: none"> • Open book cost estimation not adopted • Cost reconciliations did not consistently occur at set design stages • 110% range of acceptability defined in the Manual & the contract
Multipliers and Other Mark-ups	<ul style="list-style-type: none"> • Clearly identify cost items included in multipliers and other mark-ups • Cap mark-ups 	<ul style="list-style-type: none"> • Multiplier is limited to profit & HOH • Indirect costs are not capped
Subcontracting	<ul style="list-style-type: none"> • CM/GC is required to follow owner's bidding practices 	<ul style="list-style-type: none"> • CM/GC was required to obtain three bids • Three bids not always obtained

CM/GC

Item	Best Practice	GLX Experience
Preconstruction Services	<ul style="list-style-type: none">• Should be a highly collaborative & open process• End goal of identifying high-risk items & mitigations	<ul style="list-style-type: none">• Unclear how collaborative the relationships really were
Value Engineering	<ul style="list-style-type: none">• Be open to VE suggestions• Incentivize parties to suggest VE solutions	<ul style="list-style-type: none">• Many VE solutions were rejected
Design Management	<ul style="list-style-type: none">• Design should be managed in order to minimize scope creep and budget busts	<ul style="list-style-type: none">• No “design to budget” requirements

CM/GC

Item	Best Practice	GLX Experience
Minimize Construction Packages	<ul style="list-style-type: none">• Minimum number of construction packages• An early works package may be used	<ul style="list-style-type: none">• 7 IGMP packages
General Provisions	<ul style="list-style-type: none">• Based on design-bid-build contract documents• Appropriate risk shifts based on risk items & mitigations identified during preconstruction services	<ul style="list-style-type: none">• Unclear whether risk items and mitigations were identified• Some risks were shifted back to the MBTA inappropriately

Management Clarity and Effectiveness

- **MBTA Staffing Model**

- 4 FTEs from MBTA to Manage PM/CM, CM/GC, Designer and ICE
- HDR/Gilbane Used as Additional MBTA Staff
 - QA/Audits
 - New Starts
 - Final Design Management
 - CM/GC Pre-Construction and Construction Oversight
- Integration of HDR/Gilbane with MBTA Staff
- Co-Location and Shared Understanding
- Flexibility with Staffing Levels

- Long Term Consequences
 - Missed Opportunity for Institutional Knowledge at MBTA
 - Increased Professional Service Costs on Projects
 - Reduced Staffing Decision Flexibility
 - Inability to Facilitate Greater Internal Focus on Progress, Performance and Risk

- Review the Emphasis of Schedule on Decision-Making
- Develop Staff's Core Competencies through Training
- Create Stronger Accountability for Project Cost Certainty
- Build Resilience Through Robust Mitigation Strategies

Appendix – BRG Background

- BRG: Global Consulting Firm – 878 Professionals
- Programmatic and Project-Specific Project Risk Management Consulting Services
- Claims Analysis and Expert Witness Testimony Experience
- Including Professionals with Extensive Cost Analysis and Infrastructure Construction Expertise

Terry L. Yeager

- Civil Engineer/MBA
- Over 20 Year's Experience as a Heavy and Highway Contractor Including Mega Projects, Design Build Projects and PPP Projects
- Over 12 Year's Experience as a Dispute Resolution and Project Risk Management Consultant
- Claims Analyst with Significant Expert Witness Testimony Experience

Terry Rodgers

- Finance/Ph.D. Management
- Over 30 Year's Consulting with Public & Private Organizations and State & Federal Agencies
- Construction Industry Experience with Cost Analyses & Claims, Compliance Reviews, Management Oversight and Operational & Strategic Management Services