



## Green Line Extension Project – Project Schedule – Overview Summary

Over the past several months, the Green Line Extension Team has developed an updated project schedule for the Green Line Extension project. This schedule is actually based on two different schedule-development methodologies: (1) a traditional Critical Path Method (CPM) process, which produces a schedule with a specific estimated completion date and (2) a risk-based or risk-adjusted process, which generates a range of probable outcomes.

While a risk-adjusted schedule is built from a traditional CPM schedule, the two methods are actually quite different:

- A CPM schedule generates a baseline scenario which inevitably lengthens if scope uncertainty and risk events cannot be effectively mitigated.
- A risk-adjusted schedule sets target dates that account for uncertainty and identifies major risk drivers within a project schedule. Used properly, a risk-adjusted schedule can allow for the continuous implementation of risk management plans in order to avoid or mitigate the impact of identified problems.

### How Do I Read These Schedules?

Schedules are a presentation of the activities or steps needed to complete a project, with focus on:

- Length of time expected to complete each activity
- Sequence of activities to be completed

Within the schedule, each activity is described in the left hand column, along with when it is expected to start and finish. If there is an “A” next to the start or finish date, this means it is an actual date (e.g. it has already started or finished), not a projected date in the future.

In addition to showing the activity steps in table format (on the left side), the schedule also presents the activities in a series of horizontal bars (on the right side) that are arrayed by start, end, and length of time to complete. Many of the activities must be completed in a prescribed sequence – i.e. Commuter Rail tracks can only be moved after bridges have been widened and the northeast retaining wall is built.

The colored bars represent the following:

- Bars in **blue** show that activities that are in progress.
- Bars in **green** represent future work.
- Bars in **red** are critical activities.

Critical activities are those in which the sequence (or “path”) of steps is expected to take the longest to complete and which, if delayed, extend the completion date of the project. The faster you can complete that sequence of activities, the sooner your project completes. This underscores the importance of thoroughly understanding the critical elements of a project and the sequence within which they must be completed.

### **Current Green Line Extension Baseline CPM Schedule**

The current baseline CPM schedule for the Green Line Extension project indicates that it will take approximately 55 months for a Design/Build contractor to finish the project design, execute the construction, and test all of the elements of the Extension. The schedule assumes the procurement of the Design/Build team will happen on a roughly parallel path to that of the property acquisition, but does not officially award the Design/Build contract until after the major property acquisition and relocation processes are complete. This schedule also includes detailed and complex construction sequencing around the inter-related tasks of utility relocation, bridge construction, and drainage and retaining walls construction – all in the context of an active Commuter Rail corridor. The effective sequencing of each of these activities has to be done to create the future corridor for the Green Line Extension.

The schedule recognizes the limited work hours and other issues required to sequence construction activity around active railroad service. It also includes a period for testing and start-up of the Extension.

The baseline CPM schedule, which assumes no particular risks and that the project is able to proceed smoothly, estimates a completion date of July 2018.

### **What is a Risk-Adjusted Schedule?**

Risk-adjusted scheduling is intended to account for project uncertainties and to identify risk events that threaten the ability to execute work in accordance with a plan. Risk-based scheduling is designed to overcome the inherent optimism of a traditional CPM schedule. It identifies risks while a project schedule is being developed, determines the likelihood that a particular problem may occur, and defines necessary corrective actions.

Risk-adjusted scheduling builds upon traditional CPM scheduling methods and starts with a traditional CPM schedule as a foundation. The CPM schedule is coupled with identified risks,

and all of the information is then entered into a computer model that simulates the schedule, taking into account assigned risks and uncertainty ranges. The computer model runs thousands of variations of the schedule and computes a range of completion dates with an assigned probability for each. These metrics provide insight into potential problems that might affect the schedule and ranks the items that may have the largest impacts.

The Green Line Extension project is an immensely complicated project with thousands of design and construction activities and numerous potential risks. The power of a risk-based schedule is the power to identify risks early, be aware of their potential effect on cost and schedule, and develop strategies to mitigate them before they happen and/or to assign them to the party that can best manage them.

### **What are the Top Risks<sup>1</sup> in the Schedule for the Green Line Extension Project?**

- Coordination with over 40 different utility companies
- Maintenance of active railroad operations throughout construction
- Multiple relocations of Commuter Rail tracks may be required to construct utilities and retaining walls in the corridor
- Completion of major property acquisitions and relocations
- Completion of the process to compete for federal New Starts funding
- Completion of third-party agreements with the three corridor municipalities, railroad operators, utility companies, and multiple private land-owners along the corridor, including the time required for those entities to complete their required activities.

### **Current Green Line Extension Project Risk-Adjusted Schedule**

A risk-adjusted schedule will change over time as the project is further designed and strategies to assign, reduce, or eliminate identified risks are put into place. During the spring of 2011, the Green Line Extension Team held a Risk Workshop to analyze the risks embedded in the conceptual design for the project. The Team identified multiple risks that, if not mitigated, could negatively influence the project cost and schedule. In this early phase, the schedule model showed the potential for anywhere from a two-month slip to a 24-month slip, based on the identified risks.

Using the baseline schedule of July 2018, the risk-adjusted outcome ranges are:

- 10% Probability of Not Exceeding - September 2018
- 50% Probability of Not Exceeding - June 2019
- 90% Probability of Not Exceeding - July 2020

### **What Does This Mean for the Green Line Extension Project?**

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<sup>1</sup> Currently identified

MassDOT and the MBTA remain completely committed to the completion of the Green Line Extension project as expeditiously as possible. The Green Line Extension team is aggressively advancing the design and developing risk-mitigation strategies to allow the project to be completed as close to the baseline of July 2018 as possible.