



# Massport Capital Programs

Primavera Schedule Toolkit – CM@Risk Schedules

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## 1. Introduction

### 1.1. Disclaimer

It remains the Designer's responsibility to ensure that the schedule submittal meets the Authority's Contract and specification requirements. The Designer remains responsible for the overall proposed design, design schedule, and any/all applicable deliverables.

When the Construction Manager comes onboard, it becomes the CM's responsibility to ensure that the schedule submittal meets the Authority's Contract and specification requirements. The CM remains responsible for the project scope of work, the means and methods, and the planned sequence of work.

The Contract and specification control for instances where there are discrepancies between these documents and the toolkit. The Authority does not guarantee that the toolkit is free from errors or inconsistencies, and the presence of such errors or inconsistencies does not relieve the Designer from preparing schedule submittals in accordance with the Contract requirements. The Authority makes no representations or warranties of any kind, express or implied, about the accuracy, reliability, or completeness with respect to the toolkit or any of the information, services, or related content contained therein for any purpose.

The Authority assumes no liability or responsibility for any damages (whether incurred directly or indirectly) or loss of any kind that might arise from the use of, misuse of, or the inability to use the information contained in the toolkit. The Authority assumes no liability for improper or incorrect use of the toolkit.

The Authority reserves the right to update, remove, or amend any of the information contained in the toolkit as needed without prior notice. Refer to the Authority's website for updates to this toolkit.

### 1.2. Contract Requirements for Schedules and Submittals

The Authority's Schedule Toolkit is an extension of the Project Schedule Specification found in Div. I and Div. IIB and is intended to provide the Design and CM teams with support and guidance in meeting the requirements of the schedule specification. The toolkit is comprised of this document, The Massport Schedule Cost Loading Guidelines, a Primavera schedule .XML file and Primavera schedule layout PLF files.

The toolkit provides the following benefits: Provide a schedule backbone that support the software requirements, minimizes the administrative burden of adjusting the schedule platform to meet these requirements, provide standard reports, calendars, activity IDs and layouts that meet the Authority's requirements.

### 1.3. Roles and Responsibilities

This Schedule Toolkit contains guidelines for the Design, CTD, and Construction Schedules. The Designer and Construction Manager shall work collaboratively to develop and maintain an



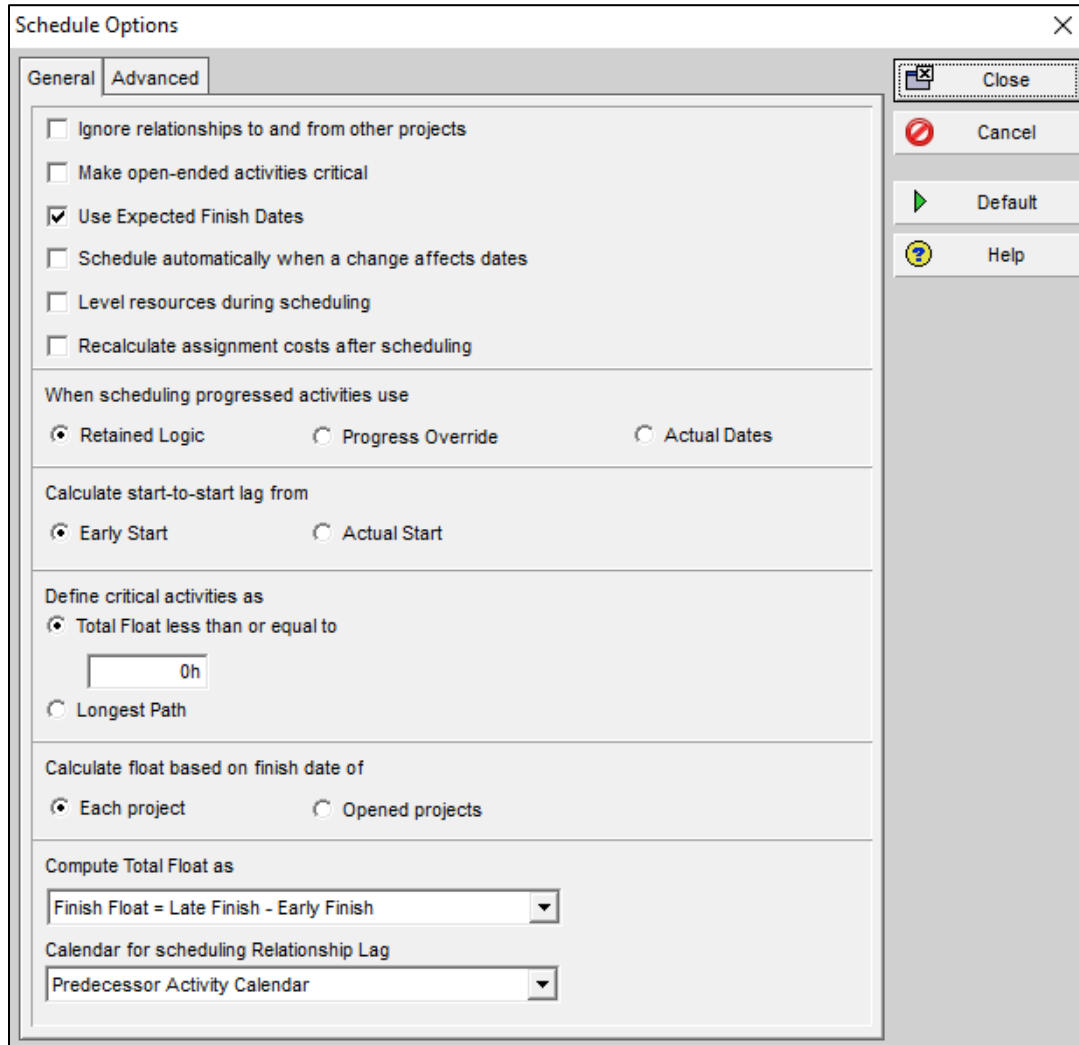
appropriate project schedule to Massport standard and approval. The Following table establishes the Roles and Responsibilities of each entity.

Entity	Design Schedule	CTD Schedule	Construction Schedule
Massport	Review & Approve	Review & Approve	Review & Approve
Design Team	Develop	Develop	Review
CM	N/A	N/A	Develop

## 2. Primavera P6

### 2.1. Settings

The template has been developed using the following schedule settings, which can be found under “tools/schedule/options”. The schedule shall adhere to these settings.



The screenshot shows the 'Schedule Options' dialog box with the 'Advanced' tab selected. The settings are as follows:

- ☐ Ignore relationships to and from other projects
- ☐ Make open-ended activities critical
- ☒ Use Expected Finish Dates
- ☐ Schedule automatically when a change affects dates
- ☐ Level resources during scheduling
- ☐ Recalculate assignment costs after scheduling
- When scheduling progressed activities use:
  - ☒ Retained Logic
  - ☐ Progress Override
  - ☐ Actual Dates
- Calculate start-to-start lag from:
  - ☒ Early Start
  - ☐ Actual Start
- Define critical activities as:
  - ☒ Total Float less than or equal to
  - ☐ Longest Path
- Calculate float based on finish date of:
  - ☒ Each project
  - ☐ Opened projects
- Compute Total Float as:
  -
- Calendar for scheduling Relationship Lag:
  -

Buttons on the right: Close, Cancel, Default, Help.

Figure 1: P6 Schedule Settings

### 2.2. Calendars

Primavera uses activity calendar assignments to model the allowable work periods. The Authority has developed several standard calendars to represent the work periods normally encountered on Authority projects. These calendars were developed in accordance with the standard specifications and many of the common work restrictions.

The following standard Calendar has been created:



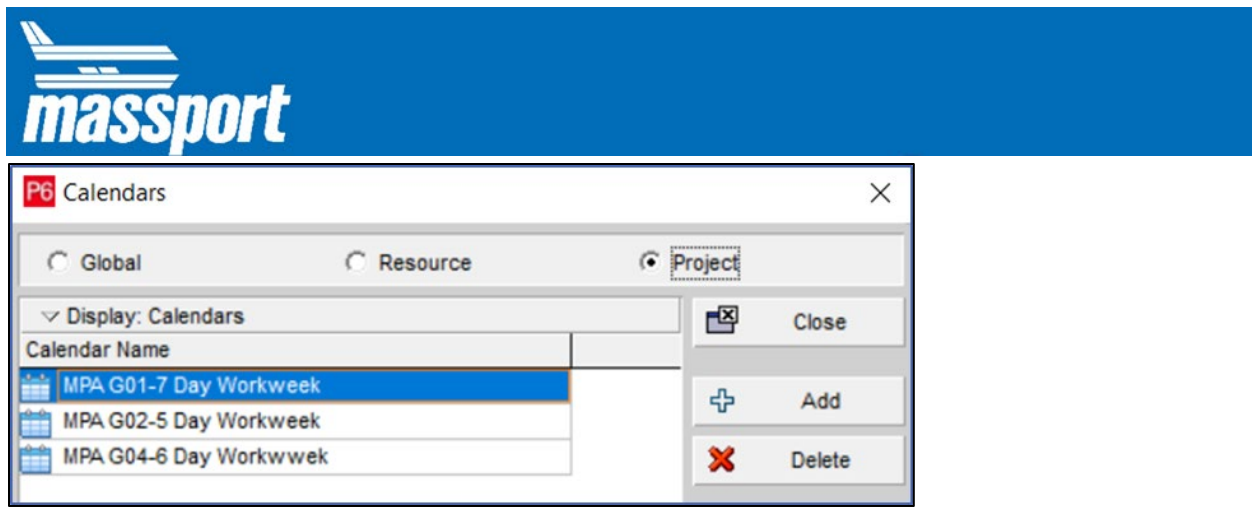


Figure 2: P6 Template Calendars

A request for the use of any additional calendars prior to their use should be submitted to Massport and approved by Massport Project Manager and Project Controls.

The template schedule has been updated to include Massachusetts holidays through 2021. Holiday references: <http://www.sec.state.ma.us/cis/cishol/holidx.htm>

Holiday	2021	2022
New Year's Day	Jan. 1, Fri.	Jan. 1, Sat.
Martin Luther King Jr. Day	Jan. 18, Mon.	Jan. 17, Mon.
Patriots' Day	Apr. 19, Mon.	Apr. 18, Mon.
Memorial Day	May 31, Mon.	May 30, Mon.
Independent Day	Jul. 4, Sun.	Jul. 4, Mon.
Labor Day	Sep. 6, Mon.	Sep. 5, Mon.
Columbus Day	Oct. 11, Mon.	Oct. 10, Mon.
Veterans' Day	Nov. 11, Thu.	Nov. 11, Fri.
Thanksgiving Day	Nov. 25, Thu.	Nov. 24, Thu.
Christmas Day	Dec. 25, Sat.	Dec. 25, Sun.

Figure 3: MA Holidays Through 2022

### 2.3. Reporting Milestones

For each schedule type, specific requested Reporting Milestone will need to be created and linked to the appropriate activities. These Reporting Milestones have specific Activity IDs that must be used in each schedule for Massport reporting purposes. These Reporting Milestones are used solely for Massport Reporting purposes, and they do not serve as "Contractual Milestones" unless they are applicable within the contract. For a listing of the minimum milestone requirements please refer to the Reporting Milestones section of the appropriate schedule type in this toolkit.

## 2.4. Timely Submittals

A monthly update schedule should be submitted to Massport within 10 days of the beginning of each month. The schedule update should have a data date of the first (1<sup>st</sup>) of each month with progress up to the data date.

Schedule submissions should be made in PMWeb via the Schedule Module with the following attachments:

- The .XML file Schedule
- PDF Schedule Narrative
- PDF of required Layouts (refer to Schedule Layouts 2.5) *(each PDF should be submitted separately)*

Once submitted in PMWeb, schedules will be routed through a predefined workflow for Massport review and approval.

## 2.5. Schedule Layouts

The Authority requires that each schedule submission be accompanied by the following standardized schedule reports. Each report should be created (PDF format) and submitted as required in the schedule specification. The Authority has created several Primavera Layouts file (PLF) for use of the Designer to meet the requirements of the specifications. These layouts should be downloaded (PLF). The following layouts have been created:

- All Activities (General Schedule Layout)
- Critical Path/Longest Path Layout
- Look ahead Layout
- Recent Progress Layout (with Variance to previous update)
- Baseline Variance Layout

To import layout files, follow the steps listed below:

- Import each Layout separately (Navigate to View/Layouts/Open/Import)
- Once imported, select the layout you wish to use (Navigate to View/Layouts/Open)

The Authority requires the following information to be included within all schedule reports, unless otherwise noted.

- **Schedule Information - Columns View:**
  - Current Schedule: Activity ID, Name, Start, Finish, Total Float,
  - Baseline Schedule: Baseline Start, Baseline Finish, Baseline Total Float, Variance of Baseline Finish
  - Start and Finish dates should be the Primavera fields labeled “Start” and “Finish”.
- **Schedule Information - Bars View:**
  - Bars presented, colors, target information, calendar formatting, etc.
- Appropriate grouping and sorting
- Appropriate data filtering
- Administrative Report Information:
  - Header and footer information, Report titles, Page break locations, page numbers, etc.



### 3. Design Schedules

#### 3.1. Purpose of a Design Schedule

The Authority's Schedule Toolkit is an extension of the Project Schedule Specification and is intended to provide Designers with support and guidance in meeting the requirements of the schedule specification. The toolkit is comprised of this document, a Primavera schedule .XML file and Primavera schedule layout PLF files.

The objective is to use the design schedule information for planning, controlling and reporting Design/Engineering Activities. This narrative provides step-by step instructions for creating the design schedule, which will be used to estimate and manage the duration of the design portion of the project

The intent to use a design schedule is to:

- To help the Authority adjust to changes during design.
- Can be used to prepare proactive recovery /acceleration plans during changes/delays during design phase.
- Develop a tracking and reporting process that helps the Authority monitor schedule status and to initiate corrective action (if required).
- Produce reports to help the Authority's management team to evaluate the capital program.
- Improve logistics.
- Provides a schedule backbone that supports the software requirements
- Minimizes the administrative burden of adjusting the schedule platform to meet these requirements
- Provide standard reports, calendars, activity IDs and layouts that meet the Authority's requirements.

The Designer is requested to submit a Design Schedule to track the project's design phase effort. The schedule should track work as outlined in the Work Order and be submitted at the same time with the Work Order. This schedule will represent the Designer's Baseline Schedule. Please refer to **Section 3.7** for an Example

#### 3.2. Design Reporting Milestones

The Contract requires the following Reporting Milestones to be included with all schedule submissions. All reporting milestones should be assigned the 7-day calendar with no holidays provided. These Reporting Milestones are used solely to for Massport Reporting purposes, and they do not serve as "Contractual Milestones" unless they are applicable with the contract

As noted in the schedule specification, the activity ID and activity name must match what has been provided in the specification (as listed below). In addition, the activity ID and activity name must not change through the design phase.

The Designer should inform Massport if the some of these Reporting Milestone are not applicable to their project or require utilizing different milestone.

MPA Design Milestones	
Activity ID	Activity Name
MPA2000	Design Selection and NTP
MPA2100	Finish Schematic Design (30%)
MPA2200	Finish Design Development (60%)
MPA2300	Finish Final Design Documents (90%)
MPA2400	Finish Construction Documents (100%)
MPA5000	Construction NTP

**Design Selection and NTP:** This is the date the designer was brought onboard in the project and was given the NTP. This a Start Milestone with no predecessor.

**Finish Construction Documents (100%):** This is a Finish Milestone that has no successor, it represents the completion of the design phase of the project.

**Construction NTP:** This is the expected Construction NTP date from the designer. This will be a placeholder Start Milestone with no successor or predecessor.

### 3.3. Schedule WBS

Each schedule submission must adhere to the WBS provided below. This WBS is included in the schedule toolkit .XML file. The WBS structure shown below is the primary means for schedule organization and grouping. Additional WBS detail may be added and utilized at the Designer's discretion and will require the Authority's and Project Manager's Approval.

WBS	
Projects	Activities
WBS	
Layout: None	
WBS Code	WBS Name
MPA Design - CM@R Temp.	MPA Design Schedule Template - CM@RiskProjects (v1.0)
MPA Design - CM@R Temp..Start-Up	MPA Project Start-Up
MPA Design - CM@R Temp..Design Milestones	Design Milestones
MPA Design - CM@R Temp..Design Milestones.1	Work Order Summary Line Items
MPA Design - CM@R Temp..Design Milestones.1.1	Work Order #1
MPA Design - CM@R Temp..Design Milestones.1.2	Work Order #2
MPA Design - CM@R Temp..Design Milestones.MPA2000	Design Selection and NTP
MPA Design - CM@R Temp..Design Milestones.MPA2100	Schematic Design (30%)
MPA Design - CM@R Temp..Design Milestones.MPA2200	Design Developmet (60%)
MPA Design - CM@R Temp..Design Milestones.MPA2400	Design Documents (90%)
MPA Design - CM@R Temp..Design Milestones.MPA2500	Complete Construction Documents (100%)
MPA Design - CM@R Temp..Const	Construction

Figure 4: Design Schedule WBS Example

### 3.3.1. Summary Activities

The Designer should have the Summary Level Task listed in the Work Order as summary level tasks in the P6 schedule. Following is how to have these Summary Level Activities set-up:

- Duration of the Summary Level Activities should match the durations in the Work Order
- Summary Level Activities should be cost loaded and the costs should be derived from the level of effort derived from the Work Order
- Schedule activities durations should be no shorter than one week (1 week)
- Lower level activities should roll up to the Summary Level activities
- The Summary Level Activities should roll up to the milestones outlined here in the toolkit.

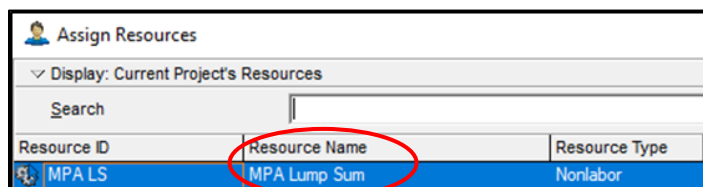
### 3.3.2. Activities Settings

The WBS will serve as the primary method for schedule organization and grouping. However, activity codes may be added and utilized at the vendor's discretion. The Designer must ensure that Activity Codes are maintained at the Project Level. Global activity codes will not be accepted

## 3.4. Cost Loading Requirements


The Authority requires that each schedule submission include cost loading. The following process is required for all schedule submissions:

- Each schedule submission will reflect the total project cost. The entire Work Order Value (plus approved amendments) must be loaded into the schedule.
  - Only Level of Effort Activities (LOE) should be cost loaded in the schedule, and the costs should be derived from the Work Order.
  - Level of effort (LOE) activities must be created for each Summary Level activity.
  - Each LOE activity must be assigned a non-labor resource entitled resource ID: "MPA LS (MPA Lump Sum)". This resource has been created by MPA and is included within the schedule toolkit .XML file. An example is shown below.
  - Each LOE activity must be assigned a cost distribution curve.



Resource ID	Resource Name	Resource Type
MPA LS	MPA Lump Sum	Nonlabor

Figure 5: MPA Lump Sum Resource



Work Order Summary Line Items		0	01-Jan-20	01-Jan-20			\$3,500,000.00
Work Order #1		0	01-Jan-20	01-Jan-20		MPA G01-7 Day Workweek (No Hol)	\$3,500,000.00
MPA0001	Work Order #1 - Line Item 1	0	01-Jan-20	01-Jan-20	Level of Effort	MPA G01-7 Day Workweek (No Hol)	\$500,000.00
MPA0002	Work Order #1 - Line Item 2	0	01-Jan-20	01-Jan-20	Level of Effort	MPA G01-7 Day Workweek (No Hol)	\$1,000,000.00
MPA0003	Work Order #1 - Line Item 3	0	01-Jan-20	01-Jan-20	Level of Effort	MPA G01-7 Day Workweek (No Hol)	\$1,250,000.00
MPA0004	Work Order #1 - Line Item 4	0	01-Jan-20	01-Jan-20	Level of Effort	MPA G01-7 Day Workweek (No Hol)	\$750,000.00
Work Order #2		0					\$0.00

Activity: MPA0001   Work Order #1 - Line Item 1										
Resource ID Name	Price / Unit	Rate Type	Rate Source	Curve	Budgeted Cost	Actual Cost	Remaining Cost	Cost Account	Primary Resource	
MPA LS.MPA Lump Sum	\$0.00/h	Price / Unit	Resource	Linear	\$500,000.00	\$0.00	\$500,000.00			

Figure 6: Assigning LS Recourse to LOE Activities

- The use of a 'cost account' codes are not required
- The use of 'expenses' for cost loading will not be accepted.
- Cost should be maintained at the Project Level.
- All schedule submissions must adhere to the following Primavera cost settings:
  - The 'duration type' for each activity should be set to "Fixed Duration and Units" before associating any cost or resources to the activity.
  - In the activity view, select Enterprise/Resource, then select the Resource item that is tracking Cost (in the Toolkit, the resource field for cost is "MPA LS"). Then select the 'Details' tab, then ensure the boxes for "Auto Compute Actuals" and "Calculate Costs from Units" are unchecked.

### 3.5. Schedule Updates

#### 3.5.1.Update Cycle

The designer is requested to submit a monthly update for the work performed by the 10<sup>th</sup> of each month. The Data Date in each schedule submission should be the 1<sup>st</sup> (first) of each month. Designer should follow requirements in section 2.4

#### 3.5.2.Performance Measurement

Each activity should reflect the actual progress performed in each month period. This should be updated using **Estimated Finish Date** or a **Percent Complete**.

#### 3.5.3.Schedule Changes

When a new Work Order or a Work Order Amendment is submitted and approved, the Designer should update the schedule accordingly and notify Massport of any changes to the schedule in the Narrative. If changes affect milestone dates that requires changes in the Baseline schedule, Massport needs to be notified and approve any changes to the Baseline.

### 3.6. Schedule Narrative

As stated in the schedule specification, Design Contract, Article 1.3.7 all schedule submissions shall include a detailed written narrative. The Designer's narrative should address the following:

- Provide a milestone chart. Include the original and modified Contractual (or approved baseline) dates as well as the current and previous forecasted dates for all interim and Contractual milestones. Provide variance columns for the following a) current vs

Contractual, b) current vs modified Contractual, c) current vs previous.

Milestone ID	Milestone Description	Baseline Date	Previous Update Date	Current Date	Variance from Baseline	Variance from previous update
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- Provide executive summary.
- Provide list of Assumptions, if any.
- Provide a summary of work progress during the update period.
- Provide a list of all/any changes from last update.
- Provide a list of response required for key decisions. Indicate which items are critical or near critical (based on project total float), as well as the need date for the response.
- Planned Percent Complete Update.

### 3.7. Example (Work Order → Schedule Template)

Following is an Example of how to utilize the Project's Design Work Order and input the Work Order's Task Total Cost into P6 Summary Level activities (LOE). It is important to remember that the LOE activities summarizing the Work Order Tasks are linked (rolled up) from the Design detail schedule to determine the LOE duration, and this duration should match the duration listed in the Work Order.

#### Work Order Example:

<b>Project: Example</b>		
<b>Design Work Order #1 - 30% Design Documents</b>		
<b>Task Number</b>	<b>Task Description</b>	<b>Task Total Cost</b>
<i>Task 1</i>	<i>Initial Studies and Commencememnt</i>	\$ 120,000.00
<i>Task 2</i>	<i>Prepare Initial Schematic Design Drawings (30%)</i>	\$ 360,000.00
<i>Task 3</i>	<i>Overall Site Management and Surveying</i>	\$ 150,000.00
<i>Task 4</i>	<i>Project Management</i>	\$ 220,000.00

Figure 7: Design Work Order Example

#### Work Order Summary Activates Tasks (LOE) in P6:

MPA Design Schedule Template - CM@RiskProjects (v1.0)		340	01-Jan-20	05-Dec-20	
MPA Project Start-Up		180	01-Jan-20	28-Jun-20	
Design Milestones		340	01-Jan-20	05-Dec-20	
MPA5000	Construction NTP	0	01-Jan-20		Start Milestone
MPA2300	Finish Design Documents (90%)	0		20-Mar-20	Finish Milestone
MPA2400	Finish Bid Documents (100%)	0		08-Jun-20	Finish Milestone
MPA2000	Design Selection and NTP	0		07-Aug-20	Finish Milestone
MPA2100	Finish Schematic Design (30%)	0		06-Oct-20	Finish Milestone
MPA2200	Finish Design Development (60%)	0		05-Dec-20	Finish Milestone
Work Order Summary Line Items		0	01-Jan-20	01-Jan-20	
Work Order #1		0	01-Jan-20	01-Jan-20	
MPA0001	Work Order #1 - Line Item 1	0	01-Jan-20	01-Jan-20	Level of Effort
MPA0002	Work Order #1 - Line Item 2	0	01-Jan-20	01-Jan-20	Level of Effort
MPA0003	Work Order #1 - Line Item 3	0	01-Jan-20	01-Jan-20	Level of Effort
MPA0004	Work Order #1 - Line Item 4	0	01-Jan-20	01-Jan-20	Level of Effort
Work Order #2		0			
Design Selection and NTP		40	29-Jun-20	07-Aug-20	
Schematic Design (30%)		60	08-Aug-20	06-Oct-20	
Design Development (60%)		60	07-Oct-20	05-Dec-20	
Design Documents (90%)		80	01-Jan-20	20-Mar-20	
Complete Construction Documents (100%)		80	21-Mar-20	08-Jun-20	
Construction		90	01-Jan-20	30-Mar-20	

Figure 8: Work Order Task Items in P6

MPA Design Schedule Template - CM@RiskProjects (v1.0)		340	01-Jan-20	05-Dec-20		
MPA Project Start-Up		180	01-Jan-20	28-Jun-20		MPA G01-7 Day Workweek (No Hol)
Design Milestones		340	01-Jan-20	05-Dec-20		
MPA5000	Construction NTP	0	01-Jan-20		Start Milestone	MPA G01-7 Day Workweek (No Hol)
MPA2300	Finish Design Documents (90%)	0		20-Mar-20	Finish Milestone	MPA G01-7 Day Workweek (No Hol)
MPA2400	Finish Bid Documents (100%)	0		08-Jun-20	Finish Milestone	MPA G01-7 Day Workweek (No Hol)
MPA2000	Design Selection and NTP	0		07-Aug-20	Finish Milestone	MPA G01-7 Day Workweek (No Hol)
MPA2100	Finish Schematic Design (30%)	0		06-Oct-20	Finish Milestone	MPA G01-7 Day Workweek (No Hol)
MPA2200	Finish Design Development (60%)	0		05-Dec-20	Finish Milestone	MPA G01-7 Day Workweek (No Hol)
Work Order Summary Line Items		0	01-Jan-20	01-Jan-20		
Work Order #1		0	01-Jan-20	01-Jan-20		MPA G01-7 Day Workweek (No Hol)
MPA0001	Work Order #1 - Line Item 1	0	01-Jan-20	01-Jan-20	Level of Effort	MPA G01-7 Day Workweek (No Hol)
MPA0002	Work Order #1 - Line Item 2	0	01-Jan-20	01-Jan-20	Level of Effort	MPA G01-7 Day Workweek (No Hol)
MPA0003	Work Order #1 - Line Item 3	0	01-Jan-20	01-Jan-20	Level of Effort	MPA G01-7 Day Workweek (No Hol)
MPA0004	Work Order #1 - Line Item 4	0	01-Jan-20	01-Jan-20	Level of Effort	MPA G01-7 Day Workweek (No Hol)

General

Status

Resources

Codes

Relationships

Notebook

Steps

Feedback

WPs & Docs

Expenses

Summary

Predecessors

Successors

ActivityMPA0001Work Order #1 - Line Item 1

Resource ID Name	Price / Unit	Rate Type	Rate Source	Curve	Budgeted Cost	Actual Cost	Remaining Cost	Cost Account	Primary Resource
MPA LS MPA Lump Sum	\$0.00/h Price / Unit	Resource			\$300,000.00	\$0.00	\$300,000.00		

Figure 9: Resource Load the Task LOE Activities



## 4. CTD Schedules

### 4.1. Purpose of CTD Schedule

The Contract Time Determination (CTD) Schedule will be developed, maintained by the Design Team. The CTD schedule will represent the theoretical sequence and phasing of the proposed construction project, broken down into phases at a high level that will be iterative through the end of the design phase

The development of a Contract Time Determination (CTD) schedule has many important considerations beyond just generating a suitable contract duration.

The CTD is used to:

- Improve the accuracy of bid price projections.
- Properly plan for the many various types of restrictions associated with construction operations.
- Properly communicate vital work restrictions to formulate the CM's bid price.
- Perform a more thorough review of the CM's Baseline schedule submission.
- Help the Authority plan its own forces, priorities, and improve programmatic cash demand projections.
- Help the Authority adjust to changes during construction.
- Prepare proactive recovery /acceleration plans during changes/delays during construction.
- Improve the ability to evaluate the Designer's ability to prepare well planned construction documents.
- Identify constructability issues that can be resolved prior to bidding the work.

To help the Designers provide a consistent and accurate contract durations and milestones, the Authority has created this tool kit for the designers use to develop a CTD deliverable.

#### 4.1.1. Schedule Updates and Approval

The CTD schedule is required to be included with each design proposal, at Schematic Design (30%) Design Development (60%), Design Documents (90%), and Construction Documents (100%)

A CTD is a procedure for determining the planned duration of construction contracts for placement in bid documents and documenting all time related aspects of the project planning that must be communicated to the bidders as an important basis. A major requirement of the CTD planning is to first start with an experienced construction planner working with the Designer's Project Manager/team, in the development of all aspects of sequencing, planning, and constructability. This CTD deliverable will be evaluated, by the Authority, as an important component of the Designer's overall design performance rating at the outcome of construction. In general, the CTD schedule must be performed in a way that:

- Allows the CM enough time to complete the project,
- To be based upon at least one reasonable/constructible solution,
- Utilizes any valuable information that has been developed in the estimate planning (if applicable),
- Considers all known limitations of construction operations that the CM will need to be made aware as part of the bid documents,
- Considers/conveys any unusual circumstances (specific location), that impact the time related

aspects of the construction.

It is important to note that the CTD is a Pre-construction planning and constructability tool. In no way, and at no time, shall the Designer or the Authority include the CTD in advertisement documents.

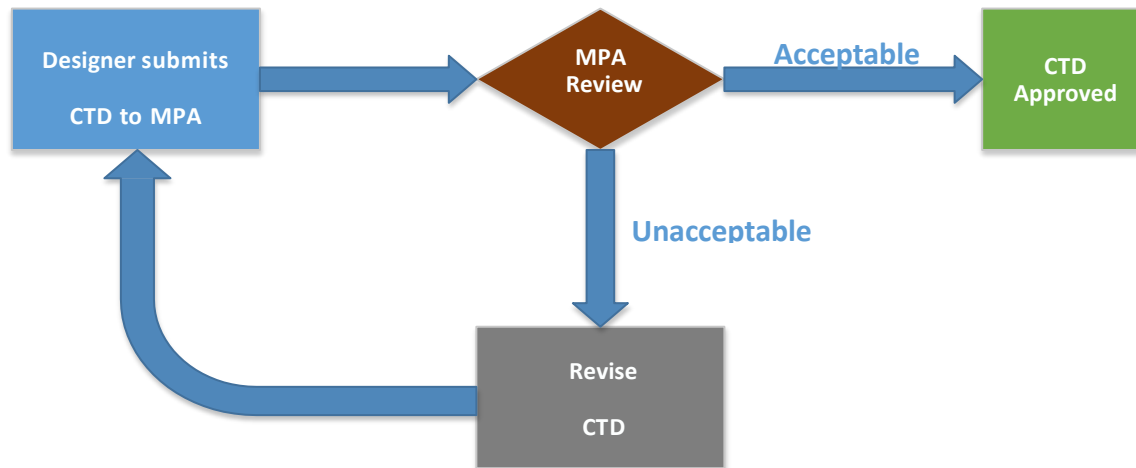


Figure 10: CTD Schedule Approval Process

## 4.2. CTD Schedule Requirements

P6 settings should follow the general settings in section 2.1. The Designer will also:

- Evaluate any special situations that might affect the duration of the project, such as unique site conditions, sensitive abutters, time of year restrictions (environmental restrictions for in water work), other construction projects being performed in the area, either public or private, material restrictions
- Consider CM means and methods, for key items of work, for at least one constructible plan
- Utilize the latest available plan, specifications and estimate
- Eliminate portions that are reflected in CM schedules updates
- Utilize the experience and professional judgment of the construction planner/scheduler (note: the CTD deliverable is a Designer responsibility – not to be put solely upon a sub-consultant)

For best results, the CTD must be prepared in P6 to properly evaluate the reasonableness and accuracy of the overall construction plan.

### 4.2.1. Factors to Consider

There are many factors which must be considered while preparing the CTD Schedule. It will be the Designer's responsibility to determine which factors apply and/or are most relevant to the specific project. Listed below are typical factors which must be given consideration.

Factor	Description
<b>Seasonal Limitations:</b>	Seasonal limitations for landscaping work must be considered and scheduled so that, for example, the contract completion date does not occur in March (see Winter Work), thereby allowing no time for the CM to do this work, which, typically, occurs at the end of a project.
<b>Winter Work</b>	Construction projects shall not be scheduled to automatically include a December 1 to March 15 shutdown period, because there are many work activities that can proceed during this time. Different calendars need to be used to properly account for certain activities non-work periods and to help monitor changes/impacts as the project evolves.
<b>Adjacent Contracts:</b>	Conflicting operations of adjacent projects, both public and private, must be considered. Coordination of two or more construction projects in the same area can influence the project schedule. Also, 3 <sup>rd</sup> party coordination is required (Utility work)
<b>Submittal Review Periods:</b>	Review time for demolition procedures, shop drawings, erection procedures, and other submittals must be considered. These periods should be aligned with the project's contractual requirements. For larger contracts, major submittals should be shown as occurring within the contract period, but at a reasonable amount of time before work starts.
<b>Fabrication Time:</b>	Time for fabrication of structural steel, precast concrete units, and other items must be considered. This work must be given careful consideration in the project schedule. In general, long lead items need to be considered appropriately.
<b>Permits:</b>	Certain permits may be required. The time required to obtain such permits will vary depending on the nature of the permit and the Authority granting the permit. Enough time, as determined by either the PM, should be allotted for this process, although in many instances it will coincide with other operations that can be performed. Any impacts to the project schedule must be determined and quantified in the schedule.
<b>Night Work:</b>	Contract provisions may restrict the CM to less than a full eight (8) hours of work per night. With the use of temporary lighting set-ups and other restrictions particular to night work, production rates are generally less than daytime operations and must be given careful consideration in determining project durations.
<b>Active Operations</b>	Conflicting operations of adjacent entities working within any of the Authority's owned properties must be considered; coordination with the entities and their operations will have a substantial impact on the project.
<b>Badging:</b>	Designers must consider the badging processing times when developing a schedule. The badging process takes between 45 – 90 days to be issued to consultants, CMs, and subcontractors. Individuals will be unable to access any area that has badge requirements on their own without proper clearance from the Authority.

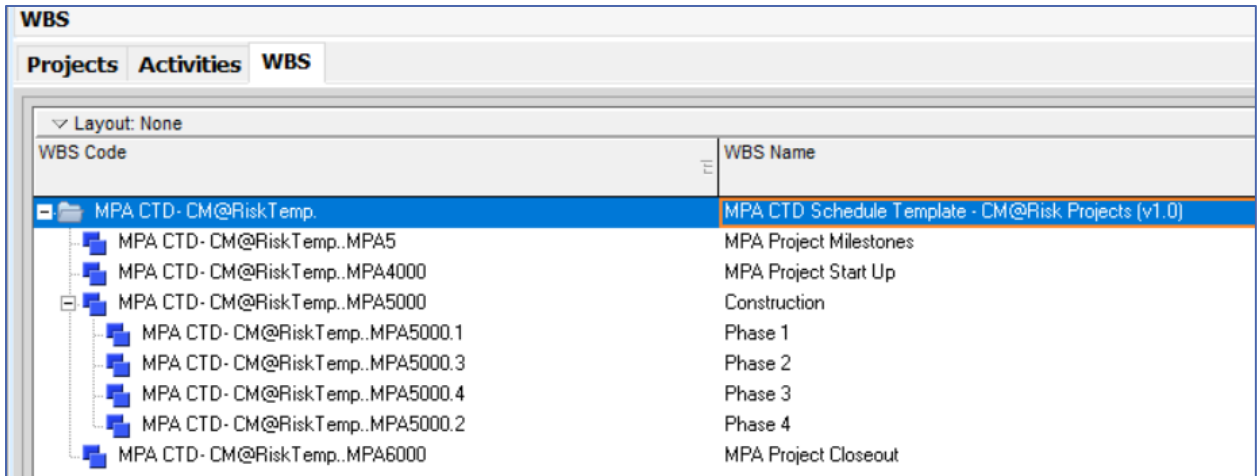
The above information is intended as guidance only. Each project is different and contains its own unique set of circumstances that may not be covered by this information. Care should be

exercised in the creation of the project schedule to ensure that each project's unique requirements and schedule impacts are captured.

#### 4.2.2. CTD Breakdown Guide – For Designer's Planner/Scheduler

The process for developing the schedule and determining the project duration is as follows:

- **Create a Work Breakdown Structure (WBS)** for the project: Create a sequence of operations by breaking the project down into phase or time-related groups of operations that are compatible with the designer's suggested method of construction contained in the documents. For a CTD, the WBS should at a minimum, break down the work into the divisions shown in the screenshot below.



WBS Code	WBS Name
MPA CTD - CM@RiskTemp.	MPA CTD Schedule Template - CM@Risk Projects (v1.0)
MPA CTD - CM@RiskTemp..MPA5	MPA Project Milestones
MPA CTD - CM@RiskTemp..MPA4000	MPA Project Start Up
MPA CTD - CM@RiskTemp..MPA5000	Construction
MPA CTD - CM@RiskTemp..MPA5000.1	Phase 1
MPA CTD - CM@RiskTemp..MPA5000.3	Phase 2
MPA CTD - CM@RiskTemp..MPA5000.4	Phase 3
MPA CTD - CM@RiskTemp..MPA5000.2	Phase 4
MPA CTD - CM@RiskTemp..MPA6000	MPA Project Closeout

Figure 11: CTD Schedule WBS

- **Assign Durations:** In general, CTD activities should be planned in a manner that allows for activity durations to be no less than 3 work days and no greater than 30 calendar days, to ensure that proper logic, sequencing and critical paths, are developed and maintained as the CTD is finalized. Once the individual activities are identified, the Scheduler/Planner is to determine the activity's duration based on the following considerations:
  - Estimated quantities contained in the Estimate.
  - By comparing critical operations of recently completed similar projects.
  - The Design Team's professional judgment and experience.
  - Construction Estimating Guides and Published Documents (i.e. RS Means etc.) and/or any other data, information that help determine the time required to complete various activities.
  - A normal, eight (8) hour per day, five (5)-day work week, unless there are special considerations to justify other working hours.
  - Submittal review time should be aligned with the project's contractual requirements.
  - Potential Long lead items should be identified, and the time assumed should be used.
- **Assign Work Calendars:** For each activity, either select an existing calendar, one that matches all the required non-work days in the project, or, if an existing one does not match the project's requirements, create and use a new, project-specific calendar. The new work calendars should be created to match any contract requirements and what has been delineated as the basis of work in the requirements, estimate, and schedule.
- **Determine Logic Relationships between activities:** The Scheduler/Planner is to identify and apply logic between the activities in the schedule to represent the intent of the staging plans, required

work sequences and any assumptions in the basis of estimate. The Scheduler/Planner is to be sure to include activities for early post NTP activities such as office trailer set-up, preconstruction meeting, and early submittals whose approval is required prior to start of work. Ensure that each activity, excluding NTP and Field Completion, has at least one predecessor and one successor and there are no 'open ends.'

- **Apply Access Restraints and Milestones.** The CTD is also used to adequately plan for significant changes during the design and procurement phases to best anticipate consequential impacts related to possible calendar/work restriction impacts. A project with two seasons may turn into three construction seasons if the bid opening slips just a few weeks. The Scheduler/Planner is to prepare the CTD with consideration to the advertising date and bid opening date. A constraint is to be assigned to the anticipated NTP date, and for any other required Milestones or Access Restraints. Add project events such as the advertising date, the bid opening date, the award date, the NTP date and the pre-construction meeting. The Scheduler/Planner should also be certain to add activities (calculated from NTP) for the Substantial Completion milestone and the Final Completion milestone. Constraints should only be used to hold contractual dates, such Access Restraints and Milestones.
- **Consider key Resources/Restrictions.** As part of the CTD basis, the major resources that make up the bulk of the work should be considered in the evaluation of critical activities in the schedule
- **Calculate and Review the Schedule.** After logic has been applied, the Scheduler/Planner should calculate the schedule and review the Critical Path. Critical Path Method (CPM) calculations result in start times, finish times and float calculations of the activities. A resulting Bar Chart should be developed to show work will be performed and the duration of each activity and will be a representation of the entire project. Once the schedule is calculated, a more accurate check can be made to make sure that the overall schedule appears to be reasonable, there are no obvious errors or mistakes in logic and that the project duration and construction contract completion date also appears to be reasonable.
- Based on the schedule, the Designer should prepare a memo providing the project duration and containing the information listed below:
  - Project duration
  - Construction Contract Completion Date

#### 4.2.3.CTD Reporting Milestones

The Contract requires the following Reporting Milestones to be included with all schedule submissions. All reporting milestones should be assigned the 7-day calendar with no holidays provided. These Reporting Milestones are used solely to for Massport Reporting purposes, and they do not serve as "Contractual Milestones" unless they are applicable with the contract

As noted in the schedule specification, the activity ID and activity name must match what has been provided in the specification (as listed below). In addition, the activity ID and activity name must not change through the life of the project.

The Designer should inform Massport if the some of these Reporting Milestone are not applicable to their project or require utilizing different milestone

MPA CTD Milestones	
Activity ID	Activity Name
MPA 5010	Advertise Date
MPA 5050	Bid Opening
MPA 5020	Contract Award
MPA 5000	Notice to Proceed (NTP)
MPA 5300	Weathertight
MPA 5400	Commissioning/Testing Complete
MPA 5500	Substantial Completion (TCO)
MPA 5600	Construction Cert. of Occupancy (COO)
MPA 5700	Final Completion

**SUBSTANTIAL COMPLETION** – Substantial Completion has been achieved as per the Authority’s and Project Manager’s definition and requirements. Generally, Substantial Completion Milestone will have the same predecessor as the project Punchlist activity before the Final Completion.

**FINAL COMPLETION** - All physical contract Work is complete including the punchlist. The Contractor has fully de-mobilized from the field operations.

The milestones listed above should adhere to the following naming convention. These milestones have been created within the CTD template.

There should be no successor activities to the Final Completion milestone. If the project asks for a contractual completion dates for each, then the activities should be assigned a “finish on or before” constraint of the contract date.

#### 4.2.4. Schedule Narrative

A written narrative is required for all CTD. The narrative should expand upon what is contained in the Basis of Estimate and explain all elements of the schedule, any assumptions made by the Designer and with special attention to the critical path, and near critical paths.

The narrative should expand upon what is contained in the Basis of Estimate (if applicable) and explain all elements of the schedule, with special attention to the critical path, and near critical paths. The narrative should include the following:

- Discuss the Designer’s site management plan.
- Describe the Designer’s overall planned approach and the resulting description of the critical path.
- Describe the basis of any and all significant resource issues.
- Identify any significant risks that the Authority be made aware of.
- Provide a summary of the basis and assumptions for critical activity durations and logic.
- Summarize all of the Access Restraints and Milestones.



- Confirm compliance with winter weather requirements and other work-restrictions.
- Explanation of the use of Calendars.
- Discuss any work that must take place outside of normal work hours.
- Explain any schedule compression/acceleration that was used to achieve any required dates.
- Identify any constructability considerations that the Design team should address.
- Explain any Means & Methods that were considered.
- Identify any other important time-related considerations.
- If this CTD is an update of a previous submission, describe all significant changes that have been included.

#### 4.3. Ownership and Responsibilities

The CTD schedule will be developed by the developed by the Design Team and submitted and updated through the design development of the project. It will be utilized as a basis for reference through the advertisement and bidding phase of the project. The CTD is for the Authority's use only as a tool for cost and duration evaluation, and is not intended to be shared with the prospective Construction Manager or General Contractor

Schedule Type	Design Phase	Bidding Phase	Construction Phase
CTD Schedule	Basis for Construction Duration	Basis for Construction Duration	N/A
Construction Schedule	N/A	Under Development	Basis for Construction Duration

## 5. Construction Schedules

### 5.1. Baseline Schedule

The Construction Manager, Design Team, and Massport will work together to agree on when to establish an approved baseline for the project as a team. The Baseline Schedule shall be submitted at the time of Contract Execution. The Baseline Schedule is required to be submitted through PMWeb and is required to reflect the entire scope of work that has been awarded to the Construction Manager. Once Accepted by Massport, the Baseline Schedule will be held as the project's Baseline Schedule of Record and will be the measurement tool used to track and compare all progress on the project against.

In an effort to track schedule variance over time (against previous schedule submissions), all schedule reports must include variance tracking to the previous month and current accepted baseline schedule. The previous month's schedule file should be set as the "Primary Baseline", the current accepted baseline file should be set to the "User Baseline - Primary". This setting can be found in Primavera at "project/assign baseline"

### 5.2. Construction Reporting Milestones

The Contract requires the following Reporting Milestones to be included with all schedule submissions. All reporting milestones should be assigned the 7-day calendar with no holidays provided. These Reporting Milestones are used solely to for Massport Reporting purposes, and they do not serve as "Contractual Milestones" unless they are applicable with the contract

As noted in the schedule specification, the activity ID and activity name must match what has been provided in the specification (as listed below). In addition, the activity ID and activity name must not change through the life of the project.

The CM should inform Massport if the some of these Reporting Milestone are not applicable to their project or require utilizing different milestone

Construction Activities – (CM@Risk Project)	
Activity ID	Activity Name
MPA 5000	Construction NTP
MPA 5100	Enabling Work Complete
MPA 5200	Environmental Remediation Complete
MPA 5300	Weathertight
MPA5400	Commissioning / Testing Complete
MPA 5500	Construction Substantial Completion (TCO)
MPA 5600	Construction Cert of Occupancy (COO)
MPA 5700	Final Completion

**Enabling Work Complete** - All activities necessary to be completed before starting construction activities (Installation of Erosion Control, Enabling Work, Mob to site, Fencing...)

**Environmental Remediation Complete** – Completion of all environmental remediation activities before start of construction (Removing Contaminated Soil, Groundwater, Sediments...)

**SUBSTANTIAL COMPLETION** – Substantial Completion has been achieved as per the Authority’s and Project Manager’s definition and requirements. Generally, Substantial Completion Milestone will have the same predecessor as the project Punchlist activity before the Final Completion.

**FINAL COMPLETION** - All physical contract Work is complete including the punchlist. The Contractor has fully de-mobilized from the field operations.

### 5.3. Schedule WBS

Each schedule submission must adhere to the WBS provided below. This WBS is included in the schedule toolkit .XML file. The WBS structure shown below is the primary means for schedule organization and grouping. Additional WBS detail may be added and utilized at the CM’s discretion.

WBS	
Projects	Activities
WBS	
Layout: None	
WBS Code	WBS Name
MPA Const. - CM@RiskTemp.	MPA Construction Schedule Template - CM@Risk Projects (v1.0)
MPA Const. - CM@RiskTemp..Const	Construction
MPA Const. - CM@RiskTemp..Const.MS	Contractual Reporting Milestones
MPA Const. - CM@RiskTemp..Const.Summ	Summary Reporting
MPA Const. - CM@RiskTemp..Const.Cost Summ	Cost Summary Reporting
MPA Const. - CM@RiskTemp..Const.Proc	Procurement
MPA Const. - CM@RiskTemp..Const.Proc.BP-01	Buy Packag-01 (Concrete) [EXAMPLE]
MPA Const. - CM@RiskTemp..Const.Proc.BP-02	Buy Packag-02 (Sitework) [EXAMPLE]
MPA Const. - CM@RiskTemp..Const.P1	Phase 1
MPA Const. - CM@RiskTemp..Const.P2	Phase 2
MPA Const. - CM@RiskTemp..Const.P3	Phase 3
MPA Const. - CM@RiskTemp..Const.P4	Phase 4
MPA Const. - CM@RiskTemp..Const.P5	Phase 5
MPA Const. - CM@RiskTemp..Const.Close	Close-Out
MPA Const. - CM@RiskTemp..Close	Project Close-Out

Figure 12: Construction Schedule WBS

#### 5.3.1.Summary Activities

The CM is required to develop Summary Level Activities (LOE) from the project’s detailed activities. These Summary Activities should match the planned Buy Packages (BP) to be awarded. These Summary Activities will roll up to the reporting milestones. These LOE activates should summarize the BP related work in the CM schedule.

#### 5.3.2.Activities Settings

Schedule Activities duration should not be shorter than 5 days. These activities should roll up to the Summary Level Activities.

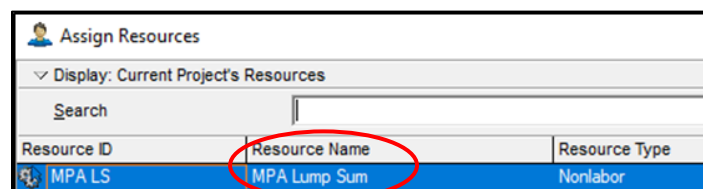
## 5.4. Cost Loading Requirements

The Authority requires that each schedule submission include cost loading. The following process is required for all schedule submissions:

- Each schedule submission will reflect the total project value. Each Summary Activity must be cost loaded.
- The Summary Cost Loading LOE must match the approved budget of the relevant Buy Package.

Cost Summary Reporting		261	11-Dec-18	28-Aug-19		Kit01-7 day calendar (no holiday)	\$3,888,000.00
6005	Cost Summary - Buy Package 2: Sitework [EXAMPLE]	261	11-Dec-18	28-Aug-19	Level of Effort	Kit01-7 day calendar (no holiday)	\$3,333,000.00
6000	Cost Summary - Buy Package 1: Concrete [EXAMPLE]	176	11-Dec-18	04-Jun-19	Level of Effort	Kit01-7 day calendar (no holiday)	\$555,000.00

- Each LOE activity must be assigned a non-labor resource entitled resource ID: “MPA LS (MPA Lump Sum)”. This resource has been created by MPA and is included within the schedule toolkit .XML file. An example is shown below.



Cost Summary Reporting		261	11-Dec-18	28-Aug-19		Kit01-7 day calendar (no holiday)	\$3,888,000.00
6005	Cost Summary - Buy Package 2: Sitework [EXAMPLE]	261	11-Dec-18	28-Aug-19	Level of Effort	Kit01-7 day calendar (no holiday)	\$3,333,000.00
6000	Cost Summary - Buy Package 1: Concrete [EXAMPLE]	176	11-Dec-18	04-Jun-19	Level of Effort	Kit01-7 day calendar (no holiday)	\$555,000.00
Procurement		180	13-Sep-18	04-Jun-19		Kit02-5 day calendar (w holiday)	\$0.00
Buy Packag-01 (Concrete) [EXAMPLE]		120	13-Sep-18	08-Mar-19		Kit02-5 day calendar (w holiday)	\$0.00
5001	Bid & Award Foundation [EXAMPLE]	30	13-Sep-18	25-Oct-18	Task Dependent	Kit02-5 day calendar (w holiday)	\$0.00
5002	Shop Drawings Foundation [EXAMPLE]	30	26-Oct-18	10-Dec-18	Task Dependent	Kit02-5 day calendar (w holiday)	\$0.00
5003	Fabricate Deliver Foundation [EXAMPLE]	60	11-Dec-18	08-Mar-19	Task Dependent	Kit02-5 day calendar (w holiday)	\$0.00
Buy Packag-02 (Sitework) [EXAMPLE]		180	13-Sep-18	04-Jun-19		Kit02-5 day calendar (w holiday)	\$0.00

General	Status	Resources	Codes	Relationships	Notebook	Steps	Feedback	WPs & Docs	Expenses	Summary	Predecessors	Successors
		Activity	6000	Cost Summary - Buy Package 1: Concrete [EXAMPLE]								
Resource ID Name	Price / Unit	Rate Type	Rate Source	Curve	Budgeted Cost	Actual Cost	Remaining Cost	Cost Account	Primary Resource			
MPA LS: MPA Lump Sum	\$0.00/h	Price / Unit	Resource	Linear	\$555,000.00	\$0.00	\$555,000.00		<input type="checkbox"/>			

- The use of a ‘cost account’ codes are not required
- The use of ‘expenses’ for cost loading will not be accepted.
- Cost should be maintained at the Project Level.
- All schedule submissions must adhere to the following Primavera cost settings:
  - The ‘duration type’ for each activity should be set to “Fixed Duration and Units” before associating any cost or resources to the activity.
  - In the activity view, select Enterprise/Resource, then select the Resource item that is tracking Cost (in the Toolkit, the resource field for cost is “MPA LS”). Then select the ‘Details’ tab, then ensure the boxes for “Auto Compute Actuals” and “Calculate Costs from Units” are unchecked.

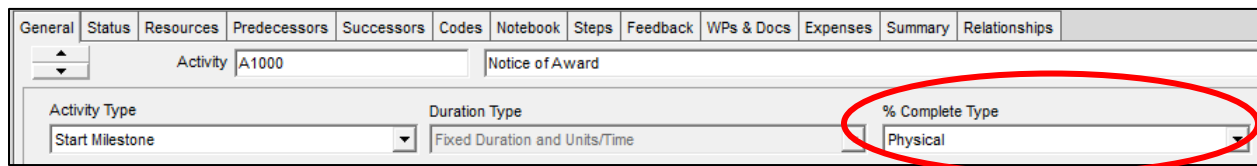
## 5.5. Schedule Updates

### 5.5.1. Update Cycle

The CM is required to submit a monthly update for the work performed by the 10<sup>th</sup> of each month. The Data Date in each schedule submission should be the 1<sup>st</sup> (first) of each month. The CM should follow requirements in section 2.4

### 5.5.2. Performance Measurement

The Authority requires that all activities set % Complete Type as “Physical”. Each activity should reflect the actual progress performed in each month period.



General	Status	Resources	Predecessors	Successors	Codes	Notebook	Steps	Feedback	WPs & Docs	Expenses	Summary	Relationships
Activity		A1000										
Notice of Award												
Activity Type		Duration Type		% Complete Type								
Start Milestone		Fixed Duration and Units/Time		Physical								

Figure 13: Performance Measurement Settings

Physical % completes should be reviewed and statused each update period. Physical % complete should be representative of the work that was accomplished.

## 5.6. Change Management

### 5.6.1. Schedule Changes

When Bulletins are issued and approved, the CM should update the schedule and submit as a part of a schedule update through PMWeb for Massport approval.

### 5.6.2. Cost Changes

Changes that have a Cost impact should be reflected in the updated schedule by applying the following changes accordingly:

- **Bulletins:** Each Bulletin should be cost loaded with the approved value of the Bulletin. Every Bulletin issued/approved with a **schedule impact** needs to be added under a “Bulletin” WBS level under “Procurement”.
- **Lump Sum Changes:** Each Bulletin cost should be added to the associated Buy Package summary level activity to represent the approved new budget/value of the buy package.
- **Earned Value Change Process:** The CM should follow the Earned Value Guidelines for when to update the CPM Schedule in an event of a change. *Refer to Massport’s Earned Value Guidelines.*

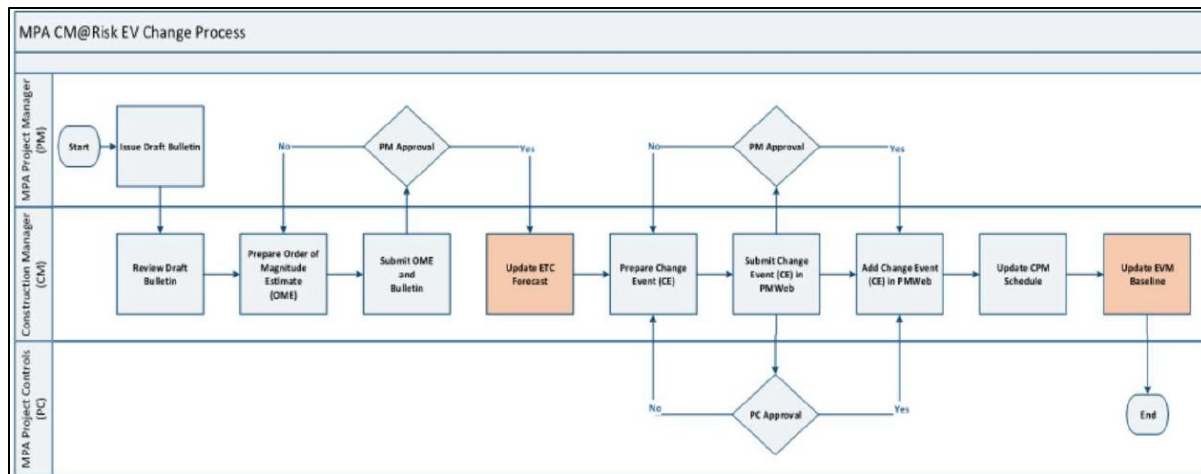


Figure 14: CM@Risk EV Change Process

## 5.7. Schedule Narrative

As stated in the schedule specification, Division IIB, Article 45, all schedule submissions shall include a detailed written narrative. The CM's narrative should address the following:

- Provide a milestone chart. Include the original and modified Contractual (or approved baseline) dates as well as the current and previous forecasted dates for all interim and Contractual milestones. Provide variance columns for the following a) current vs Contractual, b) current vs modified Contractual, c) current vs previous.

Milestone ID	Milestone Description	Baseline Date	Previous Update Date	Current Date	Variance from Baseline	Variance from previous update
--------------	-----------------------	---------------	----------------------	--------------	------------------------	-------------------------------

- Provide executive summary.
- Longest Path.
  - Describe the scope of work and major sequences for all activities on the Longest Path. Provide explanation for any changes since the previous schedule update.
  - Provide a comparison of early and late dates for longest path activities. Provide explanation for changes on the top three longest paths;
  - Describe the CM's plan, approach, methodologies, and resources to be employed for completing the work for top three longest paths.
- Progress:
  - Provide a summary of work progress during the update period.
  - Provide a summary of the look-ahead for the forthcoming update period.
  - Provide a summary of all changes to the schedule during the update period; including additions, deletions or changes to the following: milestones, activities, logic relationships, codes, WBS, etc.



- Provide references to any Notice of Delay that has been issued. Provide a detailed discussion of added activities within the schedule that reflect the delay and how delay affects the project critical path.
- Provide explanation for all areas where any specification requirements are not being addressed or followed.
- Provide a list of response required for key decisions. Indicate which items are critical or near critical (based on project total float), as well as the need date for the response.
- Provide explanation of possible considerations to achieve early completion or schedule recovery.
- Provide a list of all activity calendar being used. Provide explanation for use of shift work. Provide explanation for any changes to activity calendar usage since previous schedule submissions.
- Provide explanation for all out-of-sequence schedule logic. Provide explanation for each instance of out-of-sequence activity logic.
- Provide a project monthly cash flow, by the CSI level. In addition, address variance from the previous forecasts.
- Planned Percent Complete Update.