CONTRACT TIME DETERMINATION TOOLKIT FOR HIGHWAY PROJECTS

Quick Start Manual

VERSION II
October 2020
## Contents

1. General Instructions .................................................................................................................. 1  
   1.1 Getting Started ...................................................................................................................... 1  
   1.2 Launching CTD4HP ................................................................................................................. 1  
2. CTD Toolset for Design-Bid-Build Projects .............................................................................. 3  
   T2.1. Project duration estimation (PDE) methods ........................................................................... 3  
   T2.2. Project-specific production rates ............................................................................................ 4  
   T2.3. Generic tool for production rate estimation (GEN-PRET) ...................................................... 5  
   T2.4. Influential factors on PDE and CTD .................................................................................... 8  
   T2.5. "From PDE to CTD" tool (PD2CT) ......................................................................................... 10  
3. CTD Toolset for Design-Bid-Build Projects with Incentives ...................................................... 14  
   T3.7. Alternative Contracting Technique Evaluation Sheet ............................................................ 15  
   T3.8. CTD Guide Tool for ACT Projects ...................................................................................... 15  
4. CTD Toolset for Alternative Project Delivery Method Projects .............................................. 29  
   T4.1. Preconstruction Activity Duration Checklist ......................................................................... 29  
   T4.2. Preconstruction Period Estimation Tool (PRECON-PET) ..................................................... 30  
5. CTD Toolset for Risk Management ............................................................................................. 41  
   T5.1. Risk Breakdown Structure Template ...................................................................................... 42  
   T5.2. Risk Register Template ......................................................................................................... 43  
   T5.3. Risk Mitigation Plan (RMP) Register Template ..................................................................... 44  
6. CTD Toolset for Post-construction Contract Time Evaluation and Feedback Loop ..................... 45  
I General Instructions

This quick start tutorial is designed to help users become familiar with the Contract Time Determination Toolkit for Highway Projects (CTD4HP). This user-friendly toolkit helps highway agencies establish and maintain a systematic approach to determine credible and defensible contract times for projects using conventional and alternative contracting methods.

CTD4HP consists of five toolsets covering five main topics of contract time determination (CTD):

1. CTD for design-bid-build (DBB) projects.
2. CTD for urban projects with incentive provisions.
3. CTD for projects using alternative project delivery methods (APDMs).
4. Relationship of contract time to risk management.
5. Post-construction contract time evaluation and feedback loop.

Each toolset contains tools that support a step-by-step procedure for its corresponding topic (e.g., DBB projects, urban projects with incentive provisions, APDM projects, risk management, or post-construction feedback). Depending upon a specific step, the supporting tools can be automated tools, semiautomated tools, templates, or checklists. A tool description accompanies each tool to provide detailed information for usage.

1.1. Getting Started

To use the tool, the user should click the Enable Content, Enable Editing, or Enable Macros button that appears when the tool is first opened (depending on operating systems) (Figure 1). If a user’s computer is set up to enable macros automatically in advance, the user will not see the Security Warning Dialogue Box.

![Security Warning Dialogue Box](image)

Figure 1. Security Warning Dialogue Box.

1.2. Launching CTD4HP

Once the tool is opened, the user can see the Main Page, as shown in Figure 2. The user is provided with a brief introduction to the tool. The toolkit includes five toolsets corresponding to the five main topics (e.g., DBB projects, urban projects with incentive, APDM projects, risk management, or post-
construction feedback). Five buttons represent the topics. To go to a specific toolset, the user should click on the associated button.

```
Contract Time Determination Toolkit for Highway Projects (CTD4HP)

Instruction:
This user-friendly toolkit is designed to help highway agencies to effectively determine contract time for projects delivered with various contracting methods.

CTD4HP consists of five sets of tools and each set is designed with a unique step-by-step procedure. Each step is equipped with useful support tool(s) and description(s).

- Select “DBB Projects” if you are to determine contract time for a Design-Bid-Build (DBB) project
- Select “DBB Projects with Incentives” if your DBB project involves a certain type of incentive in order to accelerate the construction time
- Select “APDM Projects” if you are to determine contract time for a project delivered with an alternative project delivery method (APDM)
- Select “Risk Management” if you are to assess contract time risks.
- Select “Post-construction Feedback” if you are to evaluate post-construction contract time performance.

Please click one of the buttons below to START

[DBB Projects] [DBB Projects with Incentives] [APDM Projects] [Risk Management] [Post-construction Feedback]

WARNING:
For the toolkit to work properly, please make sure you click on “Enable Content/Macros” if the security warning appears.
```

Figure 2. Main Page of CTD4HP.

Each of the following sections provides detailed instructions for one of the five toolsets:

- Section 2: CTD Toolset for Design-Bid-Build Projects.
- Section 3: CTD Toolset for Design-Bid-Build Projects with Incentive Provisions.
- Section 4: CTD Toolset for Projects Using Alternative Project Delivery Methods.
- Section 5: CTD Toolset for Risk Management.
# CTD Toolset for Design-Bid-Build Projects

Figure 3 shows the summary page of the CTD Toolset for Design-Bid-Build Projects. The toolset contains five supporting tools, as shown in the second column:

- **T2.1.** Project duration estimation (PDE) methods.
- **T2.2.** Project-specific production rates.
- **T2.3.** Generic tool for production rate estimation.
- **T2.4.** Influential factors on PDE and CTD.
- **T2.5.** "From PDE to CTD" tool.

Each tool supports one or more steps in the proposed CTD procedure for DBB projects (see the “Step” column). The third and fourth columns contain icons to access tool descriptions and tools. Users should double-click on the icons to access the corresponding files.

<table>
<thead>
<tr>
<th>Step</th>
<th>Supporting Tool</th>
<th>Tool Description</th>
<th>Tool Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Estimate project duration in working days</td>
<td>T2.1. Project duration estimation (PDE) methods</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2.2. Project-specific production rates</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2.3. Generic tool for production rate estimation (GEN-PRET)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2: Determine milestone &amp; completion date constraints</td>
<td>T2.4. Influential factors on PDE and CTD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 3: Select contract time type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 4: Convert working days to calendar days</td>
<td>T2.5. &quot;From PDE to CTD&quot; tool (PD2CT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 5: Determine contract time</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Please click here to access tools for Contract Time Risk Management.

![Figure 3. CTD Toolset for DBB Projects.](image)

## T2.1. Project Duration Estimation Methods

This tool serves as a comprehensive guide for existing and potential PDE methods. The home page lists the PDE methods (see Figure 4). To learn more about a method, click on it.
To go back to the home page, click on “Back to home page,” located at the top left corner of each worksheet (see Figure 5).

Figure 4. Home Page of the PDE Method Tool.

Figure 5. Screenshot of a PDE Method.

T2.2. Project-Specific Production Rates

This tool summarizes how 12 major influential factors on production rate are considered by state departments of transportation (DOTs) in the United States. For each factor, the tool briefly mentions the method currently used by some state DOTs and provides links to access the original DOT sources (see
Figure 6). To learn more about the practice of a specific DOT, click the link or the icon in the rightmost column, which will open the source of the information (e.g., table, tool, etc.).

### Project-Specific Production Rates (PRs)

**How do highway agencies currently consider influential factors on production rate estimation?**

<table>
<thead>
<tr>
<th>No.</th>
<th>Factor</th>
<th>State</th>
<th>Tool</th>
<th>Method</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maintenance of traffic</td>
<td>FL</td>
<td>PR table</td>
<td>Three categories of production rates (i.e., low, average, and high) for different levels of traffic.</td>
<td>Click here</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MO</td>
<td>PR table</td>
<td>Different PRs for heavy &amp; light traffic</td>
<td>Click here</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TX</td>
<td>PR table</td>
<td>Different PRs for heavy &amp; light traffic</td>
<td>Click here</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VA</td>
<td>PR table</td>
<td>PR adjustment factors for high, moderate, and high traffic conditions</td>
<td>Click here</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WI</td>
<td>PR estimation tool</td>
<td>Different PRs for low, moderate, and high traffic</td>
<td>Click here</td>
</tr>
<tr>
<td>2</td>
<td>Project complexity</td>
<td>VA</td>
<td>PR table</td>
<td>PR adjustment factors for low, medium, and high complexity</td>
<td>Click here</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Light = 1.0, Moderate = 0.86, High = 0.70</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Coordination with utilities &amp; relocation of utilities</td>
<td>FL</td>
<td>PR table</td>
<td>Different PRs for different levels of existing facilities</td>
<td>Click here</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WI</td>
<td>PR estimation tool</td>
<td>Different PRs for few utilities, some utilities, and significant utilities</td>
<td>Click here</td>
</tr>
</tbody>
</table>

Figure 6. Screenshot of the Home Page of the Project-Specific Production Rate Tool.

### T2.3. Generic Tool for Production Rate Estimation

This generic tool for production rate estimation (GEN-PRET) can be applied by any DOTs that maintain or are willing to calculate production rates of historical projects to establish a state-specific automated tool for estimating production rates. A DOT can use GEN-PRET to define its own factors influencing a specific construction activity and input corresponding historical data of the activity into the tool. Given the information of a new project, the tool can output the number of past projects that have similar characteristics with the new project, statistical measures of production rates (e.g., mean, median, first quartile, and third quartile), and two production rate estimates using two methods: linear regression and case-based reasoning.

Since GEN-PRET allows DOTs to establish a DOT-specific tool, the tool involves two phases:

- **Tool development using historical data.**
- **Tool application for a new project.**

**Steps for the tool development phase are as follows:**

**Step 1:** In the “Historical Data” sheet, input the highway agency name, activity description, and unit of measurement (see Figure 7). Each Excel file corresponds to a construction activity. Subsequently, identify the factors that influence the production rate of the activity, including factor name, variable name, and variable coding (e.g., 1 = urban project and 0 = rural project).
Step 1. Identify the factors that influence the production rate of the activity
1. Apart from “Quantity”, please identify at most 10 CATEGORICAL factors that the agency wants to consider.
2. For each factor, please input “Factor Name”, “Variable Name”, and “Variable Coding”.

<table>
<thead>
<tr>
<th>No.</th>
<th>Factor Name</th>
<th>Variable Name</th>
<th>Variable Coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project work type</td>
<td>Work_Type</td>
<td>E.g., 110 = Reconstruction/New Construction</td>
</tr>
<tr>
<td>2</td>
<td>District location of the project</td>
<td>District</td>
<td>1 = District 1, 2 = District 2, 3 = District 3, 4 = District 4, and 5 = District 5</td>
</tr>
<tr>
<td>3</td>
<td>Large project (&gt;= $2M) or small proj (&lt; $2M)</td>
<td>Budget</td>
<td>1 = Large project and 0 = Small project</td>
</tr>
<tr>
<td>4</td>
<td>Urban or rural area</td>
<td>Urban</td>
<td>1 = Urban project and 0 = Rural project</td>
</tr>
<tr>
<td>5</td>
<td>Season of work (e.g., construction season or winter season)</td>
<td>Season</td>
<td>1 = Winter Season and 0 = Construction Season</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7. GEN-PRET—Step 1 of Tool Development Using Historical Data.

Step 2: Input the corresponding historical data of the activity (see Figure 8). To go to the application phase, click on “Go to ‘New Project Screen.””

<table>
<thead>
<tr>
<th>No.</th>
<th>Project_ID (Optional)</th>
<th>Work_Type</th>
<th>District</th>
<th>Budget</th>
<th>Urban</th>
<th>Season</th>
<th>Influential factor</th>
<th>Quantity</th>
<th>Production Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0000000000</td>
<td>110</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0100000000</td>
<td>110</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0110000000</td>
<td>110</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0200000000</td>
<td>110</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0201000000</td>
<td>110</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0202000000</td>
<td>110</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0203000000</td>
<td>110</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0204000000</td>
<td>110</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0205000000</td>
<td>110</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0206000000</td>
<td>110</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 8. GEN-PRET—Step 2 of Tool Development Using Historical Data.

Steps for applying the tool to a new project are as follows:

Step 1: Type in the values of the input variables for a new project and decide whether an input variable is considered in the estimation by checking or unchecking the corresponding box (see Figure 9).
Step 2: Based on the provided input, the tool will output the number of similar projects and the production rate range of those projects in blue cells (see Figure 10). If the number of similar projects is small, consider unchecking some of the factors in Step 1.

Step 3: GEN-PRET will also output the estimated production rates for the activity using linear regression and case-based reasoning (see Figure 11). For the case-based reasoning method, users can change the number of top similar projects used for the production rate calculation.
T2.4. Influential Factors on PDE and CTD

This tool offers a comprehensive list of influential factors on PDE or CTD and a detailed description of each factor.

The home page lists 42 factors influencing PDE/CTD. To learn more about a factor, click the factor on the home page (see Figure 12), and the tool will open the corresponding worksheet that contains detailed information on the selected factor.
Influential Factors on Project Duration Estimation and Contract Time Determination

To view another factor, click on “Back to home page” (see Figure 13), and then click on the factor of interest.

To use this tool as a checklist, evaluate whether each factor has been considered in the CTD procedure for the specific project and perform the following on the home page (Figure 12):

- Select “yes” to indicate the factor has been accounted for. The factor will then be highlighted in green.
Select “no” if this factor is applicable to the project under consideration but has not been considered. The factor will be highlighted in red, indicating further action is required.

Select “n/a” if this factor does not apply to the project under consideration. Use this option only if confident that it is not applicable.

T2.5. “From PDE to CTD” Tool

The “From PDE to CTD” tool (PD2CT) helps determine contract time given a project duration estimate in working days. The primary function of PD2CT is to help DOTs perform the conversion systematically and accurately with consideration of multiple factors that influence contract time. The tool also helps DOTs determine constraints, select contract time type, and determine contract time.

Step 1: Enter the following information: the earliest contract (construction) start date and project duration in working days (see Figure 14).

Step 2: To use the constraint checking function, enter the required completion date (i.e., the date the agency wants the project finished by) for each applicable category (see Figure 14).

Step 3: Answer some relevant questions to select the contract time type (see Figure 15). If “working day” is the type of contract time, the conversion from working days to calendar days is unnecessary. Otherwise, continue with these steps.

Step 4: Convert working days to calendar days as follows:

- Enter relevant information to describe the workday calendar(s) that applies to the project under consideration (see Figure 16). The tool can accommodate up to three different types of workday
calendars for three consecutive periods of time. For each period, enter the start date and select one type of calendar.

Figure 16. PD2CT—Workday Calendar.

- If necessary, enter the adjustment factor to account for reduced or increased productivity during a particular period (see Figure 17).
- Select or type in non-working days (see Figure 17):
  - Select all holidays (non-working) that are recognized by the agency.
  - Enter the monthly anticipated non-working days caused by adverse weather conditions.
  - Enter any applicable non-working periods.
  - Enter any other specific non-working days.

Figure 17. PD2CT—Adjustment Factors and Non-working Days.

- Click on “CLICK HERE TO GO TO THE NEXT STEPS” to obtain the project duration in fixed completion date or calendar days, as shown in Figure 18.
Step 5: The tool checks the constraints and outputs the contract time (see Figure 19). The tool also produces a bar graph illustrating the effect of the start date on the number of calendar days (see Figure 20).
Figure 20. PD2CT—Start Date vs. Number of Calendar Days.
3 CTD Toolset for Design-Bid-Build Projects with Incentives

Figure 21 shows the summary page of the **CTD Toolset for Design-Bid-Build Projects with Incentives**. This toolset contains several supporting tools, as shown in the second column, labeled “Supporting Tool Name.”

- Tools 3.1–3.6: Several existing tools that can be used in Steps 2 and 3.
- Tool 3.7: Alternative Contracting Technique Evaluation Sheet.
- Tool 3.8: CTD Guide Tool for ACT Projects.

Tool 3.7 is a document with detailed descriptions of several typical alternative contracting techniques (ACTs) used to incentivize a project, with their benefits, limitations, and best-use scenarios.

Tool 3.8 is an integrated CTD tool designed for DBB projects with incentives. These projects typically have high traffic volume. Thus, mobility impact is important to the CTD process of these projects.

![CTD Toolset for Design-Bid-Build Projects with Incentives](image)

**Figure 21. CTD Toolset for Design-Bid-Build Projects with Incentives (ACTs).**
T3.7. Alternative Contracting Technique Evaluation Sheet

This supporting document helps users select the most appropriate ACT for the project. It assists users in developing a better understanding of the benefits, limitations, and best-use scenarios of each ACT.

T3.8. CTD Guide Tool for ACT Projects

Tool 3.8 is the main tool used to conduct the CTD for projects with incentives (i.e., ACTs). The main purpose of the tool is to provide the user with a clear and well-structured CTD framework consisting of eight steps (see Figure 22). Users still need external tools to complete several tasks and input the results of these tasks into this tool to continue the workflow of the framework.

![Figure 22. The Eight-Step CTD Process for Projects with ACTs.](image-url)
General Instructions

The opening sheet of Tool 3.8 briefly introduces the framework (see Figure 22) of this tool and provides general instructions on how to find input cells and output cells. After reading the instructions, the user can proceed to Step 1 by clicking the button at the end of the instructions, as shown in Figure 23.

Figure 23. Proceed to Step 1 after Reading the General Instructions of Tool 3.8.
Step 1: Determine Appropriate ACT

In this step, the user goes through a checklist to determine the appropriate ACT for the current project. Tool 3.7 (supporting document on ACTs) can also help the user select the best ACT for the project. The process is shown in Figure 24.

Step 1: Determine Appropriate ACT

Step Overview
This worksheet will identify the most beneficial alternative contracting method, based on:
(1) urgency for accelerated project completion;
(2) potential traffic impact; and
(3) other project needs and characteristics.
Examples:
(A) A project that might cause high traffic impact is more suitable for A+R+H+D hoarding.
(B) A project that needs to be completed before a certain time (like school opening or major holiday) is a good candidate for NEB contracting.

Fill in the checklist based on project characteristics.

The tool will then recommend an appropriate ACT for the project.

Once an ACT is recommended, click this button to proceed to Step 2.

Figure 24. ACT Selection Procedure in the Integrated CTD Tool for Projects with Incentives.
Step 2: Identify an Alternative Construction Scenario

In this step, the user defines key project constraints and identifies an applicable construction time window for a construction alternative. The process is shown in Figure 25.

**Step 2: Identify Alternative Construction Scenario**

**Define project constraints here. Alternatives cannot violate these constraints.**

**Click to show or hide Construction Window Selection Guide.**

**Select the construction window template from the four candidates: nighttime, weekend, weekday, and weekday with shifts.**

**If it is not nighttime, set the detailed start and end time here.**

**If it is nighttime, set the detailed start and end time here.**

Once finished, click this button to proceed to Step 3.

If using Tool 3.1 CA4PRS for Steps 3 and 4, click this button instead.

Figure 25. Define Construction Alternative.
Step 3: Estimate Project Duration

In this step, the user employs an external tool or method to estimate the project duration needed to complete the project with the identified construction alternative in Step 2 and then inputs the results into this tool in the form of the construction windows needed. If the user chooses to use CA4PRS in the last step, a detailed step-by-step guide is available to demonstrate how the user can get the estimated project duration with CA4PRS.

The procedure in Step 3 (or Step 3 with CA4PRS workflow) is shown in Figure 26.

**Figure 26. Fill in Project Duration Estimates.**
If the user chooses the CA4PRS workflow in Step 2, the detailed guidelines shown in Figure 27 on how to use CA4PRS to acquire the needed results are available.

**Step 3b: Use CA4PRS to Estimate Project Duration**

*Step Overview*

This worksheet will provide guidelines on how to use CA4PRS to estimate project duration with inputs:
1. total centerline lane-miles of the project;
2. section profile of the project; and
3. construction window of the project from Step 2.

Example used in this guidance is a project with concrete slab. Though CA4PRS also provides templates for other common construction methods. Those templates will follow a similar procedure.

For more information, please visit: [https://www.dot.state.pa.us/construction/c4prss.doc](https://www.dot.state.pa.us/construction/c4prss.doc)

**Figure 27. Fill in Project Scope Information.**

At the end of this step, the user needs to fill in the estimated project duration based on the CA4PRS analysis, as shown in Figure 28.

**Figure 28. Fill in CA4PRS Schedule Analysis Results.**
Step 4: Assess Mobility Impact

In this step, the user utilizes an external tool or method to estimate the mobility impact measured by road user cost and maximum delay for the identified construction alternative in Step 2 and then inputs the results into this tool. If the user chooses to use CA4PRS in Step 2, a detailed step-by-step guide is available to explain how to conduct traffic analysis with CA4PRS to get the results needed.

The procedure for Step 4 (or Step 4 with CA4PRS workflow) is shown in Figure 29.

Figure 29. Fill in Mobility Impact Results.
If the user chooses the CA4PRS workflow in Step 2, the detailed guidelines shown in Figure 30 on how to use CA4PRS to acquire the needed results are available.

![Figure 30. Fill in Work Zone Information.](image)

At the end of this step, the user needs to fill in the traffic impact results based on the CA4PRS analysis, as Figure 31 illustrates.

![Figure 31. Fill in CA4PRS Mobility Analysis Results.](image)

CA4PRS traffic analysis will estimate delay costs for both directions; input them here.

Input the higher delay value from the results of both directions.

I've done the CA4PRS work-zone mobility analysis, and recorded the daily user cost and maximum delay. Proceed to Step 5.

Click here to proceed to Step 5.
Step 5: Select the Best Alternative

In this step, the tool collects results from Steps 3 and 4 for each alternative, and the user defines project alternative evaluation criteria (such as project priority and rubrics) and evaluates each alternative based on these criteria. The first part of the procedure is to define project soft constraints and collect information on all alternatives, as shown in Figure 32.

**Figure 32. Part A of Step 5—Fill in Alternative Analysis Results.**

Steps 2, 3, and 4 are repeated for all construction alternatives of the project.
Once the procedure is completed for all alternatives, the user goes through Steps 5.3 and 5.4 to select the best-value alternative. The procedure is shown in Figure 33.

1. Evaluate if each construction alternative satisfies all project hard constraints.

<table>
<thead>
<tr>
<th>Project Hard Constraints</th>
<th>Threshold</th>
<th>Notes</th>
<th>$1</th>
<th>$2</th>
<th>$3</th>
<th>$4</th>
<th>$5</th>
<th>$6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum number of open lanes on each direction for peak hour traffic during weekend</td>
<td>$1</td>
<td></td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allow lane closures from 7 a.m. to 10 a.m. and 4 p.m. to 6 p.m. on weekdays?</td>
<td>$2</td>
<td></td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper limit of queue length is more than one hour miles</td>
<td>$3</td>
<td></td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum allowable deflection in inches</td>
<td>$4</td>
<td></td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Available drainage resources and capacity?</td>
<td>$5</td>
<td></td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance of Traffic (MPT) when materials must have non-contractability scores?</td>
<td>$6</td>
<td></td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allow night time construction?</td>
<td>$7</td>
<td></td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Assign scores for each alternative of how well the construction alternative would perform on those user-defined project soft constraints.

<table>
<thead>
<tr>
<th>Project Soft Constraints</th>
<th>Weight</th>
<th>Notes</th>
<th>$1</th>
<th>$2</th>
<th>$3</th>
<th>$4</th>
<th>$5</th>
<th>$6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost ($000)</td>
<td>60</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle operating costs</td>
<td>20</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of days to project completion</td>
<td>50</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic associated construction cost</td>
<td>15</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average time to construction phase (days)</td>
<td>25</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance score</td>
<td>40</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environment impact</td>
<td>30</td>
<td></td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. The tool will check hard constraints’ compliance and calculate the overall weighted scores for each alternative and rank them.

4. The tool will then select the best construction alternative based on whether all hard constraints are satisfied and the total weighted score.

5. Once a best-value alternative is determined, click here to proceed to the next step.

Figure 33. Part B of Step 5—Evaluate Each Alternative and Select the Best Alternative.
Step 6: Assess Risk Factors

This step uses the risk analysis tool discussed in more detail in Section 5. The user begins by going back to the main CTD toolset, as shown in Figure 34.

The user then goes back to Tool 3.8 and proceeds as shown in Figure 35.

**Step 6: Assess Risk Factors**

**Step Description**

This worksheet will help you assess various risk factors for the final HDT alternative:

1. I've already evaluated all risk factors and assigned risk levels. Proceed to Step 7.
2. The risk level is too high. I want to modify my alternatives or start a new one. Back to Step 2!

**Figure 34. Access Risk Analysis Tool in the Unified CTD Toolset.**

**Figure 35. Determine Risk Level in Tool 3.8.**
Step 7: Adjust Project Duration and Incentive/Disincentive (I/D) Valuation

In this step, the user determines the I/D discount factor and acceleration factor based on the selected ACT and the agency’s own practice and policy. The procedure is shown in Figure 36.

---

This section contains the user guidelines and some rules of thumb to determine an appropriate discount factor for I/D valuation.

---

Step 7: Adjust Project Duration and I/D Valuation

Determine Discount Factor for Incentives

Incentive/Disincentive (I/D) valuation should be greater than contractor’s acceleration costs (CA), but no more than the agency savings, represented by the Daily Road User Cost (DRUC). The daily I/D rate \( A \) equals to the DRUC listed above multiplied by a discount factor (DF).

\[ A = DRUC \times DF \quad \text{and} \quad AC < A < DRUC \]

Thus, determine the value of DF is critical for the accuracy of the CTD. Too high, contractors would be overpaid, which could be very politically controversial and likely fail to protect the benefit of the public; too low, contractors might not have much motivation to accelerate contract, as well as much less deterrence against schedule delay (since in most cases the incentive and disincentive amounts are the same).

However, there is very little well-established practice to calculate an accurate value of DF. Here are some rules of thumb based on existing literature:

1. Generally, DF value should be between 0.25 and 0.5.
2. Total incentive amount should be less than 5% of the total project cost (FHWA guide).
3. Contract time should be expected to be an accelerated schedule (usually 15% faster) for A+B+ID contracting when contractors submit their biddings.
4. For NEB contracting, there is usually a desired project duration for the agencies that is often much shorter than normal project duration. The fix-amount bonus then should be based on the accelerated days.
5. For LR contracting, contractor usually will have some flexibility over project schedule. Lane rental fee should be based on CADD/RS traffic simulation for a single lane closure.

---

Step 7.1 - Determine Discount Factor (DF) and Acceleration Factor

| Discount Factor for I/D Valuation: | 0.5 |
| Acceleration Factor (for A+B+ID & NEB): | 15% |

---

Click the button below to get the adjusted final alternative snapshot...

Get Adjusted Final Alternative Snapshot

---

Final Alternative Snapshot (Calculated by Excel)

| Selected ACM for Final Alternative is: | A+B+ID |
| Estimated Calendar Days for Final Alternative is: | 1834 |
| Accelerated Calendar Days for Final Alternative is: | 1595 |
| Daily Road User Cost (DRUC) for Final Alternative: | $32,457 |
| Daily Incentive/Disincentive (I/D) Rate: | $41,324 |

---

The Final Alternative is Adjusted. Proceed to Step 8...

---

Figure 36. Adjust Project Duration and Determine ACT Incentive Values.
Step 8: Convert to Final Calendar Days for Contract Time

This step uses the working days to calendar days conversion tool described in Section 2. The user begins by going back to the main CTD toolset (see Figure 37).

![CTD Toolset for Design-Bid-Build Projects with Incentives (Alternative Contracting Technique)](#)

<table>
<thead>
<tr>
<th>Step</th>
<th>Supporting Tool Name</th>
<th>Tool Description</th>
<th>Tool Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Determine Appropriate ACT</td>
<td>T3.7. Alternative Contracting Technique Evaluation Sheet</td>
<td>This is a supporting document</td>
<td></td>
</tr>
<tr>
<td>Step 2: Identify &quot;What-If&quot; Scenarios</td>
<td>T3.8. CTD Guide Tool for ACT Projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 3: Estimate Project Duration</td>
<td>T3.1 CAAPRS, T3.2 P8, T3.4 ICSES, T3.6 KY-CTDS</td>
<td></td>
<td>Use the tool of your choice. Then input the results into the corresponding cells in Tool 3.8</td>
</tr>
<tr>
<td>Step 4: Assess Mobility Impact</td>
<td>T3.1 CAAPRS, T3.3 QuickZone, T3.5 COG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 5: Select the Most Feasible Alternative</td>
<td>T3.8. CTD Guide Tool for ACT Projects</td>
<td>Use Tool 3.8</td>
<td>Tool 3.8</td>
</tr>
<tr>
<td>Step 6: Determine Risk Level</td>
<td>T6.3. Qualitative risk analysis tool - Risk matrix, T6.4. Quantitative risk analysis process, T6.5. Risk mitigation plan register</td>
<td>See tool description in Risk Management</td>
<td>Go To</td>
</tr>
<tr>
<td>Step 7: Adjust Project Duration in Step 2</td>
<td>T3.8. CTD Guide Tool for ACT Projects</td>
<td>Use Tool 3.8</td>
<td>Tool 3.8</td>
</tr>
<tr>
<td>Step 8: Convert To Calendar Days</td>
<td>T2.5. &quot;From PDE to CTO&quot; tool (P2CT)</td>
<td>See tool assumption in GDB project</td>
<td>Go To</td>
</tr>
</tbody>
</table>

Figure 37. Access Calendar Days Conversion Tool in the Main Toolset.
Back in Tool 3.8, the user then enters the results from the calendar days conversion tool, as shown in Figure 38.

**Step 8: Convert to Final Calendar Days for Contract Time**

**Step Overview**

The Calendar Days for the Final Alternative so far does not consider holidays and weather factors. This sheet will convert it to Final Calendar Days based on:

(i) Project Start Date; and

(ii) historical weather record of the work zone;

---

**Step 8.1 - Convert to Final Calendar Days**

Please use the CTD Calendar Day Conversion Tool developed by NCHRP 08-114 Team.

---

**Step 8.2 - Final Calendar Days**

This tool will calculate the final project calendar days. This is the main outcome of this CTD process.

Input the project start date and end date calculated by the conversion tool.

Figure 38. Final Step—Determine Final Contract Time Duration.
4 CTD Toolset for Alternative Project Delivery Method Projects

Figure 39 shows the summary page of the CTD Toolset for Alternative Project Delivery Method Projects. This toolset contains two supporting tools, as shown in the second column.

- Tool 4.1. Preconstruction activity duration checklist.
- Tool 4.2. Preconstruction period estimation tool (PRECON-PET).

Both Tool 4.1 and Tool 4.2 support the second step in the proposed CTD procedure for APDM projects. The third and fourth columns contain icons to access the tool descriptions and the tools themselves. Users can double-click on the icons to access the corresponding files.

Figure 39. CTD Toolset for APDM Projects.

T4.1. Preconstruction Activity Duration Checklist

This checklist (see Figure 40) contains a list of questions (and some tips) regarding the status, requirements, and risks associated with the preconstruction period. Users should review each item listed (if applicable) and adjust the duration estimate of the corresponding preconstruction activity accordingly.
Preconstruction Activity Duration Checklist

1. Will the project require an accelerated schedule?
2. Will you allow construction to start before the design is complete?
3. Consider how project phasing/staging may affect the preconstruction duration.
   - E.g., certain project segment/phase can proceed to construction much earlier than other segments/phases
4. Consider how certain project milestones may affect the start of design of certain components/segments of the project.
   - E.g., Earlier opening of certain segment
5. Will the NEPA clearance be complete by the time the APDM contract is awarded?
6. Will the project require design exceptions from FHWA?
7. What is the magnitude of impact on existing utilities?
   - Relocation anticipated
   - Coordination effort

Figure 40. Screenshot of Preconstruction Activity Duration Checklist.

T4.2. Preconstruction Period Estimation Tool (PRECON-PET)

Launching PRECON-PET

Once the tool is opened, the user will see the “READ ME—General Instructions” sheet shown in Figure 41. The user is provided with important assumptions that this tool makes regarding the preconstruction period, as well as a general overview of the procedure to determine the preconstruction period.

The user should select the “Click to START” button (Figure 41) to advance to the first step.

Figure 41. PRECON-PET—READ ME—General Instructions Sheet.
Step 1: Establish Design Work Packages

After selecting “Click to START,” the user sees the “1-Design Work Packages” sheet, as shown in Figure 42.

**Click this button AFTER all substeps are done.**

**Click to proceed to next step**

Figure 42. PRECON-PET—1-Design Work Packages Sheet.

In Step 1.1, the user should first list the design phase work packages involved in the project of interest (see Figure 43). A generic list of design phase work packages is provided in Step 1.1, but the user can replace any of them or include additional design packages, as necessary.
For each listed work package, the user should do the following (as shown in Figure 44):

- Check the “A” column if the work package will be complete when the project is advertised.
- Check the “B” column if the work package cannot be released for construction (RFC) until after the notice-to-proceed (NTP) of the overall construction.
- Leave both A and B options unchecked if neither statement applies.

After completing this step, the user should select the “Click to proceed to next step” button (Figure 42) to access the “2-Precon Activities & Milestones” sheet shown in Figure 45.
Step 2: Estimate Preconstruction Activity and Milestones

In this step, the user should begin by clicking the “Show Preconstruction Period Work Packages” button (Figure 45). The “Preconstruction Work Packages” table will only show work packages that were determined by the tool to be included in the preconstruction period based on user input in Step 1.

**Step 2: Identify Preconstruction Activities & Milestones**

**Step Overview**

Preconstruction period design activities are those that take the design as shown in the RFP and advance it to the point where the first work package is released for construction (RFC).

**Instructions**

1. Click the button “Show Preconstruction Period Work Packages” to only show work packages that will occur in the preconstruction period (Based on response in Step 1, column E).
2. For each preconstruction work package shown, identify the activities required to complete each work package. List them down in Step 2.1.
3. In Step 2.2, list milestone that will constrain the final preconstruction schedule.
4. Click the button “Click to proceed to next step” once all the steps above have been completed.

**Note**

1. You may choose to color code the activities in Step 2.1 with their corresponding work package by changing the cell’s fill color.

**Preconstruction Work Packages**

- Right-of-way / Land Management (acquisitions, temporary construction easements, permanent easements, public land leasing / agreements)
- Environmental / Natural Resources - Permits, consents, commitments, etc.
- Utilities - Existing, relocation, future (pipe rights, agreements, negotiations)
- Design - Bridges & other structures
- Design - Mobility / Other assets (roadway geometrics, assets within ROW)
- Design - Drainage / Hydraulics (stormwater management, NPDES, drainage assets, etc.)
- Design - Traffic (maintenance & protection of traffic, signage, striping, lighting, signals, etc.)

**Figure 45. PRECON-PET—2-Precon Activities & Milestones Sheet.**
In Step 2.1, the user lists the activities required to complete each preconstruction work package shown (Figure 46). The user may choose to color code the activities with their corresponding work package by changing the cell’s fill color. For example, “Complete SUE study” and “Negotiate utilities agreements” are two activities associated with the work package “Utilities—Existing, relocation, future (prior rights, agreements, negotiations).”

In Step 2.2, the user lists all milestones that are anticipated to constrain the preconstruction schedule (Figure 46).

Once Step 2.1 and Step 2.2 are completed, the user should select “Click to proceed to next step” (Figure 45) to be taken to the “3-Precon Activity Duration” sheet shown in Figure 47.
Step 3: Estimate Preconstruction Activity Duration

In this step, the user begins by selecting the “Copy Activities from Step 2” button (Figure 47), which will populate Column B in Step 3.1 with the activities identified in Step 2.1.

**Step 3: Estimate Preconstruction Activity Duration**

**Instructions**

1. Click the button “Copy Activities from Step 2” to populate Step 3.1 below with the activities listed in Step 2.1.
2. For each activity in Step 3.1, enter the following three duration estimates in term of number of weeks:
   - Column C: Best possible duration
   - Column D: Most likely duration
   - Column E: Worst possible duration
3. Column F gives the unadjusted, rounded duration estimate using the default adjustment weightage.
4. In Step 2.1, check the statements/conditions that apply to the project.
5. For each activity in Step 3.1, select the applicable issue type provided in Step 2.2. Select option “default” if no adjustment is thought to be required. Column J gives the final (adjusted/unadjusted), rounded duration based on the type and severity of the issue.
6. Click the button “Click to proceed to final step” once all the above steps are completed.

**Note**

1. The worksheet will automatically use the adjusted weightage if majority (≥ 50%) of the issues within a same type were checked.
2. You may choose to change the duration weightage in Step 3.3.
3. The current worksheet can only accommodate up to 5 issue types (e.g., A, B, C, D, and E). Issues A, B, and C have been pre-populated. The user can enter new issue types with corresponding issues in the space provided for issue D and/or issue E.
4. The issues suggested in Step 3.2 are meant to be generic. User can choose to remove, replace, or add issues within the pre-populated issue types.

Figure 47. PRECON-PET—3-Precon Activity Duration sheet.
For each preconstruction activity shown, the user should enter the following three duration estimates in terms of number of weeks (Figure 48).

- Column C: Best possible duration.
- Column D: Most likely duration.
- Column E: Worst possible duration.

![Table of Preconstruction Activities]

Enter estimated durations in WEEKS.

Assign issue type AFTER completing Step 3.2 to enable duration adjustment.

**Figure 48. PRECON-PET—Step 3.1.**
Next, in Step 3.2, the user checks the issues that apply to the project of interest (Figure 49). Note that the issue types (e.g., third party/ROW, design issue, construction issue) and accompanying issues currently displayed are generic. Users can add additional issue types (e.g., D and E) or replace/add any issue within the pre-populated issue types.

![Step 3.2: APDM Issues Impact Checklist]

### (A) Third Party/ROW
- ROW acquisition is not complete before APDM contract award
- NEPA clearance will not be complete before APDM contract is awarded
- Level of effort to obtain remaining necessary permits greater than normal
- Number of third parties (i.e., railroads, utilities, environmental, etc.) is higher than normal
- The magnitude of impact on existing utilities is greater than normal
- Utility coordination responsibilities will not assigned to the private sector

### (B) Design Issue
- Project design is expected to be more than 30% complete at the time of advertisement
- The project requires design exceptions from FHWA
- At least one project milestone will constrain the start of design of certain components/segments of the project
- In-house design resources will constrain design submittal review time

Add new issue here

**Figure 49. PRECON-PET—Step 3.2.**

Once Step 3.2 is completed, the user assigns an issue type for each preconstruction activity (Figure 48). Users should select the “default” option if no adjustment to duration is thought to be needed.
In Step 3.3 (Figure 50), the user can choose to alter the adjustment weightage that is used by the tool to calculate the risk-adjusted duration tabulated in Column J.

<table>
<thead>
<tr>
<th>Duration Adjustment Weightage</th>
<th>Best possible case</th>
<th>Most likely case</th>
<th>Worst possible case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Adjusted (Applies to all issue types)</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Change weightage here (OPTIONAL)

Figure 50. PRECON-PET—Step 3.3.

Once the above steps are completed, the user should select the “Click to proceed to final step” button (Figure 47) to access the “4-Precon Schedule” sheet described in Step 4.
Step 4: Determine Preconstruction Duration

In this step, the user should first select the “Copy Activities and Durations from Step 3” button (see Figure 51) to populate the bar chart (Column B and C) with activities and their adjusted duration.

**Step 4: Determine Preconstruction Duration**

**Figure 51. PRECON-PET—4-Precon Schedule Sheet.**

For each activity, the user needs to input the appropriate duration (e.g., round up, round down, or no change) in Column D of the bar chart (Figure 52) based on the estimated duration shown in Column C.

Based on the duration displayed in Column D, the user then develops a bar chart schedule by changing the cell’s fill color. The user also needs to consider the activity relationship. Figure 52 shows an example.

**Figure 52. PRECON-PET—Step 4.1.**

The user can click the “Clear Bar Chart” button (Figure 51) if needed to erase and redevelop the entire bar chart schedule.

---

**IMPORTANT NOTICE**

1. This worksheet requires user input and is NOT fully automated.
2. The resulting duration (or date) should not be assumed to be definitive. User must apply professional judgement before selecting the contract time.
Once the bar chart schedule is developed, the user determines the total duration and enters it into Cell D114. The user also needs to input the anticipated contract start date in Cell D115 (Figure 53).

Based on the user-input start date (Cell D115) and tool-calculated end date (Cell D116), the user can examine whether the current preconstruction schedule meets all constraints listed in the “Preconstruction Milestones” table (from Step 2.2).

The user can adjust the schedule, as necessary. Whenever a change is made, the user must remember to revise the activity duration (Column D), the bar chart schedule, and/or the estimated total duration (Cell D114), if applicable.

Once satisfied with the revised schedule, the user manually enters all three required parameters in Step 4.2 (Figure 54), which concludes the preconstruction period estimation process.
5  CTD Toolset for Risk Management

The schedule risk management tool is an MS Excel-based tool that provides templates for use in the major schedule risk management steps as follows:

- Tool 5.1. Risk breakdown structure template for risk identification.
- Tool 5.2. Risk register template for qualitative risk analysis.
- Tool 5.3. Risk mitigation plan register for risk mitigation and monitor.

Figure 55 shows the summary page of the tool. Users can double-click on the icons to access the corresponding files.

<table>
<thead>
<tr>
<th>Step</th>
<th>Supporting Tool</th>
<th>Tool Description</th>
<th>Tool Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Risk identification</td>
<td>Use influential factors as risk checklist</td>
<td>T5.1. Risk breakdown structure</td>
<td></td>
</tr>
<tr>
<td>Step 2: Select risk analysis method</td>
<td>Selecting risk analysis method mainly bases on project size/complexity. The detailed criteria for selection are at Section 5.2.2 of the Guidebook.</td>
<td>T5.2. Qualitative risk analysis tool</td>
<td>Tool5.1</td>
</tr>
<tr>
<td>Step 3: Risk analysis</td>
<td>T5.2. Qualitative risk analysis tool</td>
<td>Quantitative risk analysis process</td>
<td></td>
</tr>
<tr>
<td>Step 4: Risk mitigation &amp; monitor</td>
<td>T5.3. Risk mitigation plan register</td>
<td>R2.3. Risk mitigation plan register</td>
<td>Tool5.1</td>
</tr>
</tbody>
</table>

Double-click icon to access the corresponding files.

Figure 55. CTD Toolset for Risk Management.
The risk breakdown structure (RBS) tool is used for identifying and categorizing risks through a hierarchical structure. It is a multilevel breakdown table that shows potential risk source and category. The RBS is an effective tool for organizing and mitigation planning of risks in a project.

**Level 1: Risk Categories/Sources**
- Users can use their own classification of risk sources by editing text in this row.
- Add columns to the right to address more categories.

**Level 2: RBS ID and Risk Subcategories**
- RBS ID is composed of an alphanumeric code of the Level 1 category (e.g., Technical [TECH], Environmental [ENV], etc.) and the order of the subcategories (e.g., the first listed subcategory is TECH 10).
- Listed are some common risk subcategories as a reference; users may delete, add, or modify the subcategories.
- Add rows to the bottom to address more subcategories.
The qualitative risk analysis involves (1) assessing the likelihood and impact of risk factors in terms of subjective ratings; (2) ranking risk factors by calculating risk scores (the product of risk likelihood and impact); and (3) assessing total potential schedule delay and adding it to CTD results.

<table>
<thead>
<tr>
<th>Risk Description</th>
<th>Likelihood (1-5)</th>
<th>Impact (1-5)</th>
<th>Risk Score (Likelihood x Impact)</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation Commission approval as a Limited Project is not received</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Obtaining NEPA approval - need FHWA approval for a CE checklist in order for ROW process to commence. The risk is that the FHWA doesn’t agree that project is a CE and/or info needed for CE completion is not available in a timely manner</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>ROW process - ROW plans under review and not approved for taking yet. Risk is the length of ROW process and obtaining ROW Certificate for advertising.</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Due to high traffic volumes proposed staging to maintain two lanes in each direction of roadway, limiting any additional lane closures/perm closure to off-peak hours/weekends. Restrictions to off-peak lane closures limits the contractor’s flexibility/options to maintain the schedule.</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Coordination during design with adjacent projects/designers.</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

**RBS ID** is assigned based on the categorization code in RBS sheet. When the user clicks each cell in **Columns 5, 6, 11, and 12**, a pop-up message will appear to provide a short explanation of input.

**Columns 7, 8, and 9** are generated automatically.

**Columns 7 and 9**: Both a risk matrix and risk ranking are used to help the project team select and focus on significant risks. A risk matrix gives a general idea about the significant levels (high, medium, low), while a risk ranking helps to make a choice inside the significant level.

**Column 11**: After ranking the risks, it would be prudent to concentrate on the top-ranked risks (fewer than five risk factors) and estimate the potential delay caused by each. In this template, the potential delays caused by the top three risks are evaluated.

**Column 12**: To evaluate the combined total potential delay before mitigation, the user needs to decide if the potential delays due to these risk factors are additive (affecting sequential activities in the CPM) or concurrent (affecting parallel activities in the CPM). For concurrent cases, the user needs to further decide what portions are additive. The combined effect of delay will be added to the base project duration.
T5.3. Risk Mitigation Plan Register Template

The risk mitigation plan (RMP) register is an expanded section of the risk register that summarizes the contents of the RMP report. The RMP register should focus on the top risk factors. Based on the 80/20 Rule, 80% of the effects are due to 20% of the causes. The user can decide on the number of risks to be dealt with in the RMP, but there should generally be fewer than five risks. For example, in this tool, the top three risks in the risk register go to the RMP.

**Column 10:** Risk mitigation strategies generally include:
- Avoid the risk, for example, through design changes or policy actions.
- Reduce the potential impact of the risk by similar actions used in eliminating the risk.
- Transfer/share all or part of the risks to other parties by instruments such as insurance or contract clauses.
- Accept the risk, possibly without further actions by using schedule contingency.

The user can select the most effective plan to alleviate the impact of risk from the dropdown menu.

**Column 11:** The user can write a brief but detailed plan of action to deal with each of the top risks.

**Column 12:** The risk manager is the person responsible for action, implementation, and follow-up.
6  CTD Toolset for Post-Construction Contract Time Evaluation and Feedback Loop

Figure 56 shows the summary page of the CTD Toolset for Post-Construction Contract Time Evaluation and Feedback Loop. This toolset contains one supporting tool, which is:


Tool 6.1 supports the first step in the proposed procedure for an effective contract time-related lessons learned program. The third and fourth columns contain icons to access the tool descriptions and the actual tools, respectively. Users can double-click on the icons to access the corresponding files.


This checklist (Figure 57) helps DOTs assess their performance in establishing and executing the contract time of a project. It should be used during the post-construction meeting or during interim project performance meetings (for multiphase, longer projects). Through the use of influential factors to categorize its content, this checklist also serves as a template to capture lessons learned in a consistent and systematic manner. For maximum effectiveness, users should gather as many inputs for each question as possible from project team members.
## Post-Construction Contract Time Performance Evaluation Checklist

### Contract Time Overview

- What was the original number of contract days? 
  (What was the original scheduled completion date?)
- Was this duration in 
  A. Working days, or 
  B. Calendar days
- What was the adjusted (i.e., time extension included) number of contract days/completion date?
- What was the date of the first working day? (mm/dd/yyyy)
- What was the date the project was accepted (the final working day)? (mm/dd/yyyy)
- Did the project complete earlier or later than expected?
- By how many days?
- Compute schedule growth.

### Schedule Extensions/Suspensions

- How were time extensions/suspensions request evaluated?
- Was there adequate written documentation on file to support the additional time granted?
- List extensions/suspensions and reasons for approving.

<table>
<thead>
<tr>
<th>Extensions/Suspensions</th>
<th>No. of days granted</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 57. Screenshot of Post-Construction Contract Time Performance Evaluation Checklist.**