

## **New Bridge Design Standard Practice**

### **Accelerated Bridge Construction Decision Matrix**

#### **User Guide**

##### **Background:**

The Department earlier issued Consultant Engineer Memorandum 11-05 that instructs bridge designers to consider accelerated bridge construction (ABC) methodologies in all projects. To further supplement the use of accelerated bridge construction methodology in design, a decision matrix has been developed for use in the preliminary design phase of projects to evaluate the suitability of ABC methodologies.

##### **Bridge Design Standard Practice:**

The attached ABC Design Decision matrix should be used during the preliminary design phase to evaluate the suitability and application of ABC methodology for all projects involving bridge deck replacement, superstructure replacement or entire bridge replacement. Designers are advised that some projects may warrant comparative accelerated bridge construction evaluations for several of accelerated bridge construction alternatives. An example of such would be a bridge superstructure replacement based on conventional girders and prefabricated bridge deck panels compared to a full prefabricated bridge superstructure installed using slide-in or self-propelled modular transporters. The matrix should be used as a tool in the evaluating the suitability for ABC methodology but should not be viewed as an absolute control in decision making. Other considerations not incorporated in the matrix may be significant in decision making for any individual project at the discretion of Department management.

The matrix input requires a measured response to each of several measures. The individual factors were pre-weighted within the body of the matrix through Department collaborative process measures and should not be revised. The pre-weighting of the individual measures was calibrated to ensure an ABC design approach will be positively considered when the estimated benefits are more significant than the estimated costs. The decision matrix may be reissued in the future as warranted to address any change in Department policies and practices that would affect the pre-weighting of the individual measures.

##### **General Information on Input:**

- Input is generally shown in the yellow boxes.
- White boxes are values generated by the spreadsheet.
- The weight factors on Sheet 3 should not be altered. These were set based on an evaluation of the relative importance of each measure.

**Base Sheet, Page 1**

**Site Information and Preliminary Road User Impact Analysis**

The purpose of sheet 1 in the matrix is to identify the site information and to determine the preliminary road user impacts with the proposed construction project.

The site information box identifies the project description and the potential type of ABC Technology. It is important to identify a potential ABC method prior to starting this process so that the impacts of the ABC construction can be compared to conventional construction. If more than one form of ABC is feasible, a separate decision matrix should be completed for each. The type of conventional construction should also be identified in order to compare impacts versus ABC.

Preliminary road user impacts are assessed by estimating and comparing the road user delay time for conventional construction to a proposed ABC construction methodology. Aggregate road user impact time is calculated in the form of person days. The comparison in between conventional and a subject ABC construction methodology in road user impact is calculated in the spreadsheet as a “User Impact Reduction” percent reduction (or increase) in road user impacts. A negative value would mean that the proposed ABC methodology would have more User Impact than conventional construction. The matrix analysis for the proposed ABC design methodology should be completed in any case however as values of other parameters in the matrix may still lead to a favorable ABC rating and possible decision to use the proposed ABC methodology in the project, even in a case where User Impact reduction is negative in value.

Roadway Inputs (on Bridge and under bridge):

Average Daily Traffic

- Enter the ADT on the bridge or under the bridge  
<http://www.ct.gov/dot/lib/dot/documents/dpolicy/traflog/TrafficLog2014.pdf>
- Delay Times: Determine and enter the AVERAGE delay time for road users on or under the bridge for construction detours, alternating one-way traffic, and/or travel lane reductions using the ABC Decision Matrix Supplementary Spreadsheet “Delay Time Calculations;” refer to next section for instructions for use.
- Determine and enter the Construction Impact Duration for each type of construction. This is the duration in days of construction.

## **DELAY TIME CALCULATIONS**

### **Detour Delay Time Sheet**

Note: engineering judgment should be used to determine if a detour is a suitable option.

Detour Segment Length:

- State roads: use Highway Log  
<http://www.ct.gov/dot/LIB/dot/Documents/dpolicy/hwylog/hwylog.pdf>  
or mileage in Digital HiWay
- Town roads: use Google Maps

Segment Speed Limit: refer to OSTA web page

<http://www.ct.gov/dot/cwp/view.asp?a=1394&q=259540>

Segment Congestion Factor: use table included on spreadsheet

### **Alternating One-Way Traffic Delay Time Sheet**

Complete following instructions on sheet

### **Reduced Lane Delay Time Sheet**

- Use 24-hour traffic counts if available  
ADT Town Maps & 24-hour counts:  
<http://www.ct.gov/dot/lib/dot/documents/dpolicy/policymaps/adt/2007-2014pdf/adtpdf.pdf>  
ADT Expressway Maps & 24-hour counts, and Permanent Count Station Data:  
<http://www.ct.gov/dot/cwp/view.asp?a=3529&q=305564>
- If no 24-hour traffic counts are available, use ADT method noted on spreadsheet

## **Base Sheet, Page 2**

### **Preliminary Cost Evaluation (Page 2):**

The purpose of this sheet is to determine the effect of ABC on the OVERALL cost of the bridge. The overall cost is both the bid price and the cost of managing the project (CE&I costs), which can be a major factor in the overall cost of the project.

The comparison is made between the total project costs for each construction method. The result is given as a percent increase (or decrease) in total project costs with ABC. A negative value means that ABC has a less overall cost when compared to conventional construction.

The net percentage of conventional cost value calculated on this sheet is used as one of the eleven measures in the ABC decision matrix (Sheet 3).

Estimated conventional construction project cost:

- Enter the estimated bid cost for conventional construction including all Moot costs including temporary bridges and overbuild.

Estimated CE&I Costs per month:

- Enter the monthly cost of the field office. Guidance for this value is listed below the input area.
- Enter the CE&I staff monthly costs. Guidance for this value is listed below the input area.

Net Time savings for ABC:

- Enter the estimated reduction on construction time through the use of ABC.

Estimated Percent Premium for ABC

- Enter the percent increase in cost for the ABC method being investigated. This may require some analysis and some judgment. The cost of ABC is a function of speed of construction, complexity of construction and risk (to name a few). Simple projects with prefabricated elements and reasonable time may be approximately 10% more. Very complex weekend projects using SPMTs could result in a premium of up to 100%.

Maintenance and Protection of Traffic (MPT) Savings with ABC:

- This input contains the cost for conventional construction items that can be eliminated through the use of ABC.
  - Overbuild for staging: This would include the cost of additional structure that is often used to accommodate stage construction.
  - Temporary Bridge: This includes the cost for a temporary bridge, if required for conventional construction.
  - Temporary Signals: This includes the cost of temporary signals, if required for conventional construction. Refer to Section IV of Department's Cost Estimating Guidelines  
[http://www.ct.gov/dot/lib/dot/documents/aec/cost\\_estimating\\_guidelines.pdf](http://www.ct.gov/dot/lib/dot/documents/aec/cost_estimating_guidelines.pdf)
  - Other: This includes the cost of any other items that can be eliminated through the use of ABC.

**Base Sheet, Pages 3 & 4**

**ABC Rating Procedure:**

Ten measures of project constraints have been identified as being applicable to the ABC decision process. Following is a brief description of each measure and how they apply to project parameters and Department priorities.

Average Daily Traffic:

- Find the ADT using the latest traffic log from the CTDOT website:
- <http://www.ct.gov/dot/lib/dot/documents/dpolicy/traflog/TrafficLog2014.pdf>

- The goal of this measure is to account for the number of vehicles that are traversing the construction site. The value used should account for vehicles on the bridge and vehicles under the bridge (overpass structures).

User Impact Reduction:

- This value is a percent reduction of the time it takes for ABC construction compared to conventional construction. The results from Sheet 1 are used to define this measure. No input is required for this measure. The spreadsheet calculates the appropriate value based on the sheet 1 input.

Bridge Location:

- This is a measure of the location relative to the surrounding community and the impact on the economy when there is construction work on the bridge. A location that is vital to a connection to other transit would rate high in use of ABC. A location nearby a hospital would equally rate high.

Use of Typical Details:

- The complexity of design is a factor we use to calculate the ability to utilize ABC. A site with simple geometry rates high while a site with complex geometry rates low.

Work Zone Geometry:

- This measure pertains to safety both for workers and motorists. With alternating one-way traffic the potential for an accident is greater than if a project is constructed with a detour.

Site Conditions:

- This is a measure of site restrictions and how limited ROW or significant utilities impacts construction of the project.
- Numerous utilities that are not conducive to performing a utility break out project or prior to bridge construction could severely influence the ability to use ABC construction.
- Restrictive ROW (e.g. building that cannot be acquired) prohibits the use of certain types of ABC construction like lateral slides, potentially SPMT moves or crane placement for prefabricated bridge units. Other forms of ABC techniques such as precast deck panels and precast substructure elements may still be feasible for bridges over streams. The designer should not discount ABC techniques for bridge elements.
- The Designer must evaluate all site constraints and determine if these constraints prohibit the full use of ABC construction or portions thereof.

Railroad Impacts:

- This is a measure of the importance of maintaining rail traffic.

- A high volume of rail traffic or important rail lines benefit highly from ABC construction techniques.
- An important rail line is defined as one that has significant influence on commuters or the economic vitality of the region it serves.

Cost Analysis Factor:

- This is comparative measure between the additional costs associated with ABC methodology related to the additional cost of conventional construction.
- The cost factor is generated from Sheet 2 and shown to the left of the input box.
- Enter the applicable value based on the cost factor.

Environmental/Water handling Limitations:

- This is a measure of the impact on time-of-year limitations for in-water work in watercourses.
- Typically in-water work is required for installation and removal of cofferdams, and diversion pipes and other water handling measures. Typical in-water work is limited through environmental permitting to the period June 1<sup>st</sup> to September 30<sup>th</sup>. Standard construction methods for projects controlled by this regulation may require 2 or more construction seasons whereas accelerated construction methods may allow single construction season project durations.
  - Water handling measures may be less costly on a project where shorter water diversion duration is possible and where a lower design storm frequency may be used.

Waterway Limitations:

- This is a measure of the functional significance of a waterway beneath a structure and the degree to which restrictions are imposed on the waterway use by recreational and commercial users.

**ABC RATING TABLE**

The purpose of the ABC rating table is to compute a comparative rating for the ABC project methodology under evaluation. The rating table compiles all selected or computed rating measures, multiplies the rating measures by predetermined weighting factors, sums all weighted measures and then divides the sum of all weighted measures by a theoretical maximum rating score yielding a final comparative rating. Project ABC methodology ratings of 60 to 100 are considered good candidates for ABC implementation. Project ABC ratings of 50 to 60 are considered marginal for ABC implementation. Project ABC ratings of less than 50 are not generally considered good candidates for ABC implementation.