THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

December 8, 2016

DESIGN BULLETIN No. 16-03

SUBJECT: Policy for Accelerated Bridge Construction

The Illinois Tollway has implemented an Accelerated Bridge Construction (ABC) policy to be used on Illinois Tollway projects. A new section (Section 27.0 Accelerated Bridge Construction) has been added to the Structure Design Manual that will provide Design Section Engineers (DSEs) with a basic understanding of the different ABC methods available and help guide project specific evaluation. The new section is attached to this Design Bulletin.

Standard tools have been developed to aid the DSE in evaluating ABC technologies for each project. These tools, called the Decision Framework for ABC, include the **ABC Decision Matrix Tool (DMT)** and the **ABC Bridge Life Cycle Comparison (BLCC) Tool**. These tools define a comprehensive list of variables that need to be considered during the design phase development. An example has also been developed to aid DSEs in using the ABC DMT and ABC BLCC Tool. The example shows a step by step procedure to evaluate a structure for ABC and explains logical steps and explanations for the assumptions used to fill in the variable inputs in the tools. The tools and the example may be downloaded from the Illinois Tollway's internet site at www.illinoistollway.com, under Construction & Engineering, Consultant Resources, Manuals, Bridges & Structures.

In addition to the Decision Framework for ABC, the policy defines the different ABC technologies commonly used in the industry and discusses general guidance associated with each method to encourage the DSE to evaluate alternate bridge design and construction methods. These ABC technologies include:

- Prefrabicated Bridge Elements and Systems (PBES)
- ABC Materials
- ABC Connections
- Installation Methods
- Accelerated Foundation Construction Methods
- ABC Project Delivery Methods

To further encourage DSE's, a list of key references, publications and websites is also included in the policy to be used as resources for Accelerated Bridge Construction.

As part of the ABC policy, the DSE will be required to complete the ABC DMT and the ABC BLCC Tool during the design phase development. The following is the list of each Design Phase Project Deliverable required for ABC:

Master Planning or Pre-Conceptual Phase

- The DSE shall develop the Structure Condition Report and Life Cycle Cost Analysis in accordance with Section 2.0 of the Structure Design Manual.
    - The goal of the Structure Condition Report and Life Cycle Cost Analysis is to determine rehabilitation versus replacement.

- If a new structure, or replacement or reconstruction is recommended in the Structure Condition Report, the DSE shall complete the ABC DMT.

- The DSE shall incorporate the completed ABC DMT, any supporting material and a summary stating the ABC recommendation into the Master Plan Study.

Conceptual Design Phase (30%)

- If required by the ABC DMT, the DSE shall complete the ABC BLCC Tool.

- The DSE shall incorporate the recommended alternatives from the ABC BLCC tool into the Bridge Type Study and perform a cost comparison in accordance with article 3.2 of the Structure Design Manual. The DSE shall make a final recommendation.

    - Additional analysis at the request of the Illinois Tollway may be required to make a final recommendation.

- The final recommendation shall be incorporated into the Type, Size and Location (TS&L) Plans in accordance with Section 3.0 of the Structure Design Manual.

Preliminary (60%), Pre-Final (95%), and Final Design Phases (100%)

- The DSE shall refine and implement the final recommendation into the Construction Documents.

Design Section Engineers (DSE) are expected to incorporate this Design Bulletin into all Pre-Concept and Concept contracts currently under design. If the contract is beyond the Concept stage the Design Bulletin does not apply. Exceptions to this directive shall be coordinated with the project manager and documented as a design deviation.

Paul D. Kovacs, P.E.
Chief Engineer

12/9/14
Date

SECTION 27.0 ACCELERATED BRIDGE CONSTRUCTION

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27.1 Introduction

The purpose of the Accelerated Bridge Construction (ABC) section is to provide tools to be used by the DSE to evaluate the use of ABC on a project during the design phase development. These tools provide a consistent approach for evaluating, designing and constructing all projects utilizing ABC technologies.

This section is in the beginning stages of development and will continue to evolve in the future as ABC methodologies progress and adoption is instituted by the Illinois Tollway.

27.1.1 ABC Overview

ABC is defined as bridge construction technologies that use innovative planning, design, materials or construction methods in a manner to specifically reduce the onsite construction time and mobility impacts that occur when building or replacing bridges.

The most common technologies used in ABC applications are expediting the construction of bridges by using Prefabricated Bridge Elements and Systems (PBES) or the use of bridge movement and installation methods. In addition, there are ABC technologies that deal with materials, connections, foundations and the contractual aspects of project delivery. The combination of one or more of these ABC technologies has the potential to:

- Enhance the quality of the project
- Accelerate Project Delivery
- Encourage Innovation
- Increase the safety of the travelling public and workers
- Decrease user impacts
- Minimize the duration of maintenance of traffic
- Reduce project costs

Because of the potential economic and safety impacts, minimizing traffic disruptions is a goal that should be elevated to a higher priority when planning bridge related construction projects.

27.1.2 Illinois Tollway ABC Initiative

The Illinois Tollway is committed to providing its customers the best overall experience when using its system and is continually exploring opportunities to leverage innovations in the delivery of its construction projects. The application of ABC is consistent with the Illinois Tollway's desire to reduce user impacts during construction while maintaining a high quality product.

The Illinois Tollway initiative is to provide DSEs with a basic understanding of the different ABC technologies and project delivery methods available, help guide project specific evaluation and encourage the use of alternate bridge design and construction to meet project goals.

Standard tools have been developed to aid the DSE in evaluating ABC technologies for each project. These tools, called the Decision Framework for ABC, include the **ABC Decision Matrix Tool (DMT)** and the **ABC Bridge Life Cycle Comparison (BLCC) Tool**. These tools define a comprehensive list of variables that need to be considered by the DSE during the design phase development.

With ABC being a new technology, there will be a learning curve for all involved. Learning from other agencies who have implemented ABC successfully, engaging and collaborating with national ABC experts and adopting best practices will help minimize the initial learning curve. ABC is a growing trend within the industry and the Illinois Tollway will continue to collaborate with the industry to advance the state of practice with respect to ABC technologies by encouraging the involvement of local consultants, contractors, and suppliers to help further develop a policy that will continue to improve the delivery of bridge projects along the Illinois Tollway system.

27.2 Illinois Tollway ABC Committee

An Illinois Tollway ABC Committee has been established to identify ABC strategies, review current best practices, make recommendations and continue to develop the Illinois Tollway ABC policy. The committee consists of representatives from multiple disciplines within the Illinois Tollway, PMO and GEC as well as representatives from within the industry and is chaired by an Illinois Tollway Deputy Chief.

27.3 Decision Framework for ABC

This article defines the ABC decision making process during the design phase development. The Decision Framework for ABC helps the DSE "think" through and execute the design process and consists of two steps – completing the ABC DMT to determine if ABC technologies should be evaluated for a given bridge and performing

an ABC BLCC (if required) to compare and eliminate different ABC technologies to make a final recommendation.

An example to aid DSEs in using the ABC DMT and ABC BLCC Tool is available for download from the Illinois Tollway's internet site at www.illinoistollway.com, under Construction & Engineering, Consultant Resources, Manuals, Bridges & Structures. The example shows a step by step procedure to evaluate a structure for ABC, explains logical steps, and provides explanations for the assumptions used to fill in the variable inputs in the tools.

27.3.1 ABC Decision Matrix Tool (DMT)

The ABC DMT is a framework to help DSEs determine if ABC technologies shall be evaluated for a particular bridge. The ABC DMT shall be used during the Master Plan or Pre-Conceptual Phase and is a spreadsheet that may be downloaded from the Illinois Tollway's internet site at www.illinoistollway.com, under Construction & Engineering, Consultant Resources, Manuals, Bridges & Structures.

All new bridges or existing bridges to be replaced or reconstructed shall require an ABC DMT to be completed. Rehabilitation, retaining walls and culvert structures do not need to evaluate the use of ABC. An ABC DMT shall be completed for each individual bridge under consideration. For dual structures that have similar geometry, only one ABC DMT shall be required.

The ABC DMT is a qualitative assessment of the impact ABC technologies may have on a project when compared to conventional construction and does not identify specific ABC technologies that may be used. Because this is a qualitative process that requires engineering judgment, there is an acknowledged level of subjectivity to the tool.

The tool requires the user to assign a score for input variables based on specific scoring criteria and constraint descriptions that have been established to compare ABC to conventional construction. A description of each input variable and basic guidance for the specific scoring criteria are provided in Figures 27.3.1.1, 27.3.1.2 and 27.3.1.3. The user shall fill in the scores and other requested information in only the yellow highlighted cells in the spreadsheet. See Figure 27.3.1.4. The assigned weights, scoring criteria and formulas shall not be changed without prior approval from the Illinois Tollway. The scores are a function of the bridge location and shall be filled in for an individual bridge.

The ABC DMT automatically calculates an ABC Rating Score based on the input by the user. See Figure 27.3.1.5. The user shall then use the ABC Rating Score – Decision Flow Chart to work toward a recommendation. See Figure 27.3.1.6. If an ABC Rating score of 30 or less is recorded, Conventional Bridge Construction is the most logical choice to evaluate further. The threshold of 30 is intended to capture any bridge

receiving a score of 5 in the most heavily weighted variable, Traffic Impact. If an ABC Rating score of 60 or more is recorded, Accelerated Bridge Construction is the most logical choice to evaluate further. The threshold of 60 is intended to capture any bridge receiving a score of 5 in all three of the most heavily weighted variables, Average Daily Traffic, Traffic Impact, and Maintenance of Traffic. For ABC Rating scores between 30 and 60, the user shall consider additional factors prior to making a final decision on ABC. These factors include project delivery and schedule, traffic volumes, site conditions, project risk and structure geometry. See Figure 27.3.1.6.

Prior to making a final recommendation, the DSE shall take a look at the project from a global perspective and determine if ABC technologies provide a benefit with all the project-specific information considered. If the project contains multiple structures within a corridor, the DCM and DSE shall take into consideration the overall corridor project delivery and MOT schemes.

The completed ABC DMT, any supporting material and a summary stating the recommendation from the DSE shall be included in the Master Plan Study or a technical memorandum (if a Master Plan Study is not required). The Master Plan Study or technical memorandum shall provide justification for the recommendation including the major factors affecting the ABC DMT Rating Scores and if ABC technologies provide a benefit with all the project-specific information considered. See article 27.3.3 for a complete list of design phase project deliverables.

If the final recommendation is to evaluate ABC further, the DSE shall use the ABC BLCC Tool to help compare potential ABC and conventional construction technologies that meet project specific goals.

27.3.2 ABC Bridge Life Cycle Comparison (BLCC) Tool

The ABC BLCC Tool is a framework to help DSE's compare potential ABC technologies for a given project and help eliminate the ABC technologies that may not be perceived as the most economical. The tool is a spreadsheet that may be downloaded from the Illinois Tollway's internet site at www.illinoistollway.com, under Construction & Engineering, Consultant Resources, Manuals, Bridges & Structures and shall be used during the Concept Phase.

All ABC DMT results that recommend ABC to be evaluated further shall require an ABC BLCC Tool to be completed. If conventional bridge construction was recommended to be evaluated further, then the ABC BLCC Tool is not applicable and no further Decision Framework analysis is required.

The ABC BLCC Tool is a qualitative analysis used to evaluate the long-term economic efficiency between bridge alternatives including conventional construction and various ABC technologies, and does not calculate actual life cycle costs. In addition, the tool does not capture impacts due to service disruptions including traveler delay and revenue impacts. Final recommended bridge alternatives may require additional analysis to determine service disruptions if requested by the Illinois Tollway.

Because this is a qualitative process that requires engineering judgment, there is an acknowledged level of subjectivity to the tool. The tool makes assumptions about costs and service life. If the DSE determines that cost breakdowns or service life information for a given project is different than the tool's assumptions, the input scores may be adjusted accordingly by the user.

The tool requires the user to assign a score for multiple input variables in three major categories: Initial Costs (IC), Traffic Impact Costs (TIC), and Maintenance Costs (MC). Initial Costs are intended to capture the direct costs associated with construction, Traffic Impact Costs are intended to capture the indirect costs associated with traffic impact, and Maintenance Costs are intended to capture routine maintenance and future replacement costs. Each input variable is based on specific scoring criteria and constraint descriptions that have been established to help identify lower long-term costs. Higher input variable scores represent the potential for lower costs for the bridge alternative being considered. A description of each input variable and basic guidance for the specific scoring criteria are provided in Figures 27.3.2.1, 27.3.2.2, and 27.3.2.3. The user shall input the scores and other requested information in only the yellow highlighted cells in the spreadsheet. See Figures 27.3.2.4, 27.3.2.5 and 27.3.2.6. The assigned weights, scoring criteria and formulas shall not be changed without prior approval from the Illinois Tollway. The scores are a function of the bridge location, material, equipment, maintenance of traffic and future maintenance, and shall be filled in for an individual bridge.

The ABC BLCC Tool automatically calculates individual Rating Scores in each of the three major categories and a Total ABC BLCC Rating Score based on the input by the user. See Figure 27.3.2.7. A higher Total ABC BLCC Rating Score represents a more economical choice when compared to other bridge alternatives. Bridge alternatives may consist of individual ABC technologies or a combination of ABC technologies and at a minimum shall be compared to a conventional construction, bridge alternative with no upper limit on the number of bridge alternatives allowed. The number of bridge alternatives shall be based on engineering judgment, site constraints, and project goals. The user of the tool may elect to add additional bridge alternatives to the ABC BLCC Tool to accurately compare all bridge alternatives. A separate ABC BLCC score shall be

calculated for each bridge alternative investigated by creating additional tabs in the spreadsheet.

For cross road bridges with an Inter-Governmental Agreement (IGA), the bridge alternatives shall be coordinated with the local agency to ensure the selected ABC technologies are permitted.

The Individual and Total ABC BLCC Rating Scores obtained for each bridge alternative shall then manually be entered into the summary tab of the spreadsheet. See Figure 27.3.2.8. The summary provides a visual comparison of individual and overall scores of each bridge alternative considered. Based on the summary of the ABC BLCC analysis, the DSE shall identify the applicable ABC or conventional construction technologies that best fit the project specific goals. It is suggested that multiple bridge alternatives be carried forward to be able to develop costs and determine a final recommendation. The user of the tool may elect to add additional bridge alternatives to the comparison summary. The DSE shall again evaluate the project from a global perspective and determine if the bridge alternatives with the higher scores provide a benefit with all the project-specific information considered prior to making a final recommendation.

The completed ABC BLCC Tool for all bridge alternatives, supporting material and summary stating the recommendations from the DSE shall be incorporated into the Bridge Type Study. The Bridge Type Study shall include a cost summary comparison for the recommended bridge alternatives in accordance with Article 3.2 to determine a final recommendation. Additional analysis may be required to determine a final recommendation at the request of the Illinois Tollway. The final recommendation shall be incorporated into the Type, Size and Location (TS&L) Plans in accordance with Section 3.0. See article 27.3.3 for a complete list of design phase project deliverables.

27.3.3 ABC Design Phase Project Deliverables

The following is the list of each Design Phase Project Deliverable required for ABC:

Master Planning or Pre-Conceptual Phase

- The DSE shall develop the Structure Condition Report and Life Cycle Cost Analysis in accordance with Section 2.0.
    - The goal of the Structure Condition Report and Life Cycle Cost Analysis is to determine rehabilitation versus replacement.

- If a new structure, replacement or reconstruction is recommended in the Structure Condition Report, the DSE shall complete the ABC DMT in accordance with Article 27.3.1.

- The DSE shall incorporate the completed ABC DMT, any supporting material and a summary stating the ABC recommendation into the Master Plan Study or technical memorandum (if a Master Plan Study is not required).

Conceptual Design Phase (30%)

- If required by the ABC DMT, the DSE shall complete the ABC BLCC Tool in accordance with Article 27.3.2.

- The DSE shall incorporate the recommended bridge alternatives from the ABC BLCC tool into the Bridge Type Study and perform a cost comparison in accordance with Article 3.2. The DSE shall make a final recommendation.

- Additional analysis at the request of the Illinois Tollway may be required to make a final recommendation.

- The final recommendation shall be incorporated into the Type, Size and Location (TS&L) Plans in accordance with Section 3.0.

Preliminary (60%), Pre-Final (95%), and Final Design Phases (100%)

- The DSE shall refine and implement the final recommendation into the Construction Documents.

27.4 ABC Technologies

This article defines the different ABC technologies commonly used in the industry and discusses general guidance associated with each technology. This article is not intended to be all inclusive and is provided for general guidance and to encourage the DSE to evaluate alternate bridge design and construction. It is the responsibility of the DSE to determine the types of ABC technologies during the Decision Framework for ABC that best represent the most viable options for the project based on engineering judgment, site constraints, and project goals. It is important to emphasize that the application of ABC design and construction should not reduce the durability of the structure or increase the maintenance costs over the life of the structure when compared to bridges built conventionally in accordance with current standards.

27.4.1 Prefabricated Bridge Elements and Systems (PBES)

Prefabricated Bridge Elements and Systems (PBES) are structural components of a bridge that are fabricated before arriving at the job site and then rapidly assembled. PBES can be fabricated on-site if ROW is available. An entire bridge may be composed of prefabricated elements, or individual bridge elements may be combined with other ABC technologies.

The DSE shall consider PBES during the Decision Framework for ABC. PBES are cost effective when repetitive and simple details are used, the number of connections is minimized, and the system provides tolerances to allow for fit-up inconsistencies. The main advantage to PBES is the reduction in time at the project site for concrete forming, installation of rebar, and concrete placement since PBES are constructed in prefabrication plants or at Illinois Tollway approved on-site casting yards.

PBES elements shall be sized so that they are able to be moved from where they are fabricated to where they are installed. A staging area with adequate space and clearances to place the prefabricated elements is required.

The most commonly used PBES on ABC Projects are as follows:

Precast Concrete Bridge Approach Slabs

Precast Concrete Deck Panels

Precast Concrete Pier Caps

Precast Concrete Pier Columns

Precast Concrete Abutments

Precast Concrete Foundations

Precast Concrete Wingwalls/ Retaining Walls

Precast Concrete Parapets

Prefabricated Superstructure Systems

Prefabricated Superstructure/Substructure Systems

Prefabricated Total Bridge Systems

Constructability and erection procedures shall be thoroughly investigated prior to consideration of PBES. The DSE shall evaluate the most appropriate and feasible PBES for the bridge based on site constraints, construction procedures, cost and

impacts to traffic. For example, the use of precast concrete deck panels may not be cost effective with the use of large wide top flange Bulb-T's due to the large joints between panels and the extensive use of Ultra High Performance Concrete. Precast concrete pier caps and pier columns may not be cost effective if sufficient head room is not available to place the elements.

For all Prefabricated Bridge Elements and Systems, shop drawings are required in accordance with Section 25.0.

The TRB SHRP2 R04 Accelerated Bridge Construction Research Project has generated a "Tool Kit" document that contains sample calculations, details, and specifications for projects ranging from deck work to complete superstructure and substructure replacement with precast concrete elements.

27.4.2 ABC Materials

During the Decision Framework for ABC, the DSE shall consider material choices carefully for implementation on the Illinois Tollway system as service life and durability are important factors for each project. The DSE shall use caution in selecting material types not typically used on Illinois Tollway projects. Coordination with Illinois Tollway Materials is required to select the appropriate materials, pay items, special provisions and construction procedures.

The most common ABC Material being utilized is Ultra High Performance Concrete (UHPC). UHPC is a composite material that allows high compressive strengths of 14 ksi in relatively short time periods with ultimate strengths of 20-25 ksi. It consists of fiber reinforcement in densely packed concrete and exhibits high ductility and durability. It has been widely used in field-cast connections between precast elements.

UHPC allows for shorter reinforcement development lengths, potential increased durability in severe exposure environments, and potential longer service life if designed and installed properly.

The FHWA has published a report "Ultra-High Performance Concrete: A State-of-the-Art Report for the Bridge Community" that provides more specific information and design considerations for UHPC.

Section 15.0 shall also apply to all structures utilizing ABC technologies in which the Illinois Tollway utilizes High Performance Concrete (HPC) Mix Designs and considers stainless steel reinforcement bars in the deck in order to extend the service life of the bridge superstructures by reducing cracking and inhibiting corrosion induced failures. The Illinois Tollway's objective with current standards for cast-in-place bridges is to obtain a bridge deck service life of at least 50 years and a 75 year or longer service life

for bridge decks with HPC and stainless steel reinforcement combined. Similar objectives shall be applied to all structures no matter what ABC technology is used except as noted below:

- Precast Modular Concrete Superstructure Elements
  - HPC Mix Design with less emphasis on crack control shall be utilized in order to inhibit chloride penetrations.

- Prestressed Precast Modular Concrete Superstructure Elements
  - HPC Mix Design with less emphasis on crack control shall be required.

27.4.3 ABC Connections

The DSE shall consider the type of connections and detailing requirements during the Decision Framework for ABC to help limit durability issues. It is important to simplify the details of these connections both for ease and quickness of construction and to reduce the risk of different elements not fitting together.

The most common ABC connections used on ABC Projects are as follows:

Grouted Splice Couplers

Concrete Closure Joints

Traditional Post-Tensioning

Grouted Post-Tensioning

Welded Connections

Bolted Connections

The FHWA has published a manual entitled “Connection Details for Prefabricated Bridge Elements and Systems” that provides more specific information about the many different types of prefabricated element connections.

27.4.4 Installation Methods

This article defines the available ABC technologies for expediting construction using bridge movement and installation methods. The benefit of these installation methods provides contractors with increased speed in removing and installing bridges. The DSE may consider these installation methods during the Decision Framework for ABC.

The most common ABC installation methods used on ABC projects are as follows:

Lateral Sliding

Self-Propelled Modular Transporter (SPMT)

Longitudinal Launches

Crane Based Projects

For all ABC installation methods, an erection plan shall be required in accordance with the Illinois Tollway Special Provisions.

It should be noted that installation methods are considered Contractor's means and methods. Contracting Provisions shall be established and discussed with the Illinois Tollway to determine how the project will be bid and packaged.

27.4.4.1 Lateral Sliding

Lateral Bridge slide-ins consist of building the proposed structure on temporary supports adjacent to an existing bridge, removing the old bridge and transporting the new bridge onto the substructure by sliding or rolling over bearings. In locations where sufficient space exists adjacent to the existing bridge and the site has limited profile changes and limited geometric constraints, bridge slide-in may prove to be a viable option. Lateral sliding is typically used on single span structures. The DSE shall use caution in evaluating lateral slide-ins for a multi-span structure.

Several factors shall be considered in the design of these bridge installation methods:

- Lateral slide-in is most effective when ADT under the bridge is low and over the bridge is high.
- A staging area parallel to the structure is required to build the superstructure on temporary supports.
- The superstructure may be pushed transversely onto the new substructure using a hydraulic ram or pulled with winches.
- The lateral slide may utilize roller bearings or a smooth low friction surface.
- Adequate vertical clearance is required under the existing structure.
- Lateral slide-in shall not be used on bridges with high skews.
- The number of spans and length of the bridge are key factors.
- The superstructure stresses, deflections and drift tolerances during the move shall be considered.
- Concrete and steel girder bridges may both be used in lateral slide-ins.
- Abutment selection shall be evaluated to allow the opportunity to jack the bridge superstructure and mount the various sliding systems.

- Loading and stresses of the abutment seat and end diaphragm shall be considered during the move.
- The structure tie-in with the roadway shall be considered.

The FHWA has published a manual "Slide-In Bridge Construction Implementation Guide" that provides more specific information and design considerations.

27.4.4.2 Self-Propelled Modular Transporter (SPMT)

SPMT is a motorized vehicle with a combination of multi-axle platforms that are remotely controlled though a computer system capable of transporting very large or heavy loads. The use of SPMT is ideal for carrying large structures, such as bridges from offsite locations, lifting them into their final position, and exiting the site within a very short period of time. In locations where high traffic volumes exist, the structure is over a railroad or navigable waterway, or the project site has overhead constraints, SPMT may prove to be a viable option.

Several factors shall be considered in the design of these bridge installation methods:

- SPMTs are most effective when ADT is high under or over the bridge.
- A staging area with adequate space to build the bridge on a temporary structure is required.
- The travel path from the staging area to the final location shall have sufficient clearance, proper grades and the appropriate bearing capacity to support the heavy construction loads.
- A geotechnical investigation shall be conducted for the proposed staging and travel path to determine if the soils can support the SPMT loads.
- Concrete and steel girder bridges may both be used with SPMTs.
- The design of the superstructure shall consider the SPMT loads during placement, movement and lifting.
- Support conditions shall be checked when the structure is placed on the SPMT.
- Pick points shall be identified in the plans and checked for out of plane forces.
- Deflections and twist of the superstructure shall be analyzed with respect to the stroke of the SPMT.
- Deflections and twist of the superstructure shall be continuously monitored and controlled during the bridge move.
- The deck and parapet shall be analyzed for potential stress reversal conditions encountered during the move since any negative moment over the pick points has the potential to cause cracking.

The FHWA has published a manual “Use of Self-Propelled Modular Transporters to Remove and Replace Bridges” that provides more specific information and design considerations.

27.4.4.3 Longitudinal Launches

Longitudinal launching consists of erecting the bridge superstructure in a launching pit and pushing the unit out over the substructure. The most common launches are used in segmental construction. Longitudinal launching is ideal for bridges over areas that are inaccessible by crane such as deep valleys, roadways with a high ADT or heavily travelled waterways.

Several factors shall be considered in the design of these bridge installation methods:

- Longitudinal bridge launching is effective when ADT under the bridge is high and over the bridge is low.
- A staging area behind the abutments is required to build the superstructure on temporary supports.
- The superstructure may be pushed longitudinally out over the spans using a sliding or rolling system.
- Concrete and steel girder bridges may both be used in longitudinal launches.
- Curved structures can utilize longitudinal launches.

This installation method is more complex than lateral slides. Launching systems usually pertain to specialty bridge types (long multi-span type bridges) which are not as common on the Illinois Tollway system.

More information on longitudinal launching can be found in an NCHRP report entitled “Bridge Construction Practices using Incremental Launching”.

27.4.4.4 Crane Based Projects

Crane based projects consist of using large capacity cranes to lift partial or completed bridge structures into place. These types of cranes are most effective when the structure is over a roadway, railroad or navigable waterway and an accessible staging area is available. Foundation conditions within the staging area must be able to support the heavy loads.

Conventional cranes that are used for erection of beams and girders can be used for installation of PBES such as deck panels; however, it is fairly common for heavy lifting cranes to be used in conjunction with PBES.

Gantry cranes are a type of crane built on top of a gantry used to straddle a construction site. These types of cranes are most effective for long viaduct structures, when there is limited access or inaccessible areas under the structure for conventional or heavy lifting cranes and can be used for both demolition and erection procedures.

Installation methods are predominantly determined by the Contractor; designers shall carefully evaluate the constructability of the design, develop suggested construction and installation plan details and prepare project special provisions for incorporation into the contract documents.

When planning to use cranes to place a bridge, consider the following:

- Required crane size
- Potential crane locations
- Required reach to place sections
- Weight of sections placed
- Lifting Points and lifting devices
- Stresses at lifting points
- Connection details
- Location of overhead and underground utilities
- Method of delivery
- Location of delivery
- Sequence of construction
- Limits of Right-of-Way

27.4.5 Accelerated Foundation Construction Methods

Accelerated foundation construction consists of construction methods that reduce the time for foundation installation. The most common foundation installation methods used on ABC projects are as follows:

Continuous Flight Auger (CFA) Piles – method of constructing deep foundations that combines augering, injecting concrete and inserting reinforcement into wet concrete into one continuous process.

Rapid Embankment Construction – use of lightweight Expanded Polystyrene (EPS) Geofoam blocks to reduce long-term settlement.

Additional means of construction such as advance foundation construction or use of low-boy drilling equipment that allow bridge construction activities to occur without impacting traffic shall also be considered. However, these methods shall not be considered ABC methods and scored in the Decision Framework for ABC.

The FHWA has published a Geotechnical Engineering Circular (GEC) No. 8 titled "Design and Construction of Continuous Flight Auger Piles" that provides more specific information and design considerations. In addition, more information can be found at the FHWA website.

27.5 ABC Project Delivery Methods

The ABC technologies listed in Article 27.4 are ways to accelerate on-site bridge construction. ABC project delivery and innovative contracting are ways to accelerate bridge construction during the planning stage. These methods can reduce time required to plan, design and bid the project.

Two common innovate contracting methods for ABC are Design Build (DB) which combines the design and construction into one contract and Construction Manager General Contractor (CM/GC) which includes the owner as part of the design team and selects bids based on qualifications. Based on current legislation, both of these methods are usually not allowed on Illinois Tollway projects.

To accelerate bridge construction during the planning stage, contracting provisions may be incorporated into the project delivery method given the right conditions, application, and support. The DSE shall consider these contracting provisions and provide recommendations during the planning process. The recommendations will be reviewed by the Illinois Tollway and approved on a project by project basis. The most commonly used contracting provisions on ABC projects are as follows:

Best Value Selection – technical evaluation of contractor proposal and bid price which are combined to determine "best value."

A+B and A+B+C Bidding – assigns value to base bid price and time component of construction and low bid is combination of value components.

Incentive/Disincentive (I/D) Clauses – contract provisions that are used to financially compensate or penalize the contractor for time spent on the construction of a project. This clause is not part of Liquidated Damages.

Lane Rentals – the contractor is charged for the amount of time that a lane is out of service during construction and the charge may vary by time or day of the week. The bid includes a base bid for construction and a secondary bid for lane rental and a best value selection is made.

Advanced Contracts – consists of expedited contracts in advance of the construction contract for fabrication of structural elements, procurement of specialized equipment or material or to minimize traffic impacts.

Alternate Design/Alternate Bid (AD/AB) – contractor is permitted to bid an alternate concept when contract provisions allow for a specified project benefit.

27.6 ABC References

The following is a brief summary of key references, publications and websites that can be used as resources for Accelerated Bridge Construction.

KEY REFERENCES

- FHWA through their initiatives, Every Day Counts (EDC) and Highways for LIFE has been promoting, supporting, and advancing ABC efforts nationwide.

- The ABC University Transportation Center (ABC-UTC) supports research and initiatives to provide the transportation industry with the tools needed to effectively and economically utilize the principles of ABC. ABC-UTC has assembled a group of experienced and knowledgeable bridge academics and engineers to engage the industry and support the use of ABC.

- AASHTO Innovation Initiative supports and champions the implementation of ABC technologies that yield significant economic or qualitative benefits to the users.

PUBLICATIONS

- FHWA, “PBES Cost Study: Accelerated Bridge Construction Success Stories”, 2006

- FHWA-HFL, Publication No. HIF-12-013, “Accelerated Bridge Construction – Experience in Design, Fabrication and Erection of Prefabricated Bridge Elements and Systems – Final Manual”, November 1, 2011.

- TRB-SHRP2, Publication No. S2-R04-RR-2, “Innovative Bridge Designs for Rapid Renewal, ABC Toolkit”, 2013.

- FHWA-HFL, Publication No. FHWA-IF-09-010, “Connection Details for Prefabricated Bridge Elements and Systems”, March 30, 2009.

- FHWA, Publication No. FHWA-HRT-13-060, "Ultra-High Performance Concrete: A State-of-the-Art Report for the Bridge Community", June 2013.

- FHWA, Project #F-ST99 (232), "Slide-In Bridge Construction Implementation Guide", November 2013.

- FHWA, Manual on Use of Self-Propelled Modular Transporters to Remove and Replace Bridges, June 2007.

- NCHRP Project 20-07, Task 229, "Bridge Construction Practices Using Incremental Launching", December 2007.

- Proceedings of the 1st International ABC Conference in Miami, FL December, 2014.

- Proceedings of the 2nd International ABC Conference in Miami, FL, December, 2015.

- FHWA Geotechnical Engineering Circular (GEC) No. 8 "Design and Construction of Continuous Flight Auger Piles", April 2007.

WEBSITES

- ABC University Transportation Center (ABC-UTC) at Florida International University. http://www.abc-utc.fiu.edu/

- Transportation Research Board (TRB) ABC Subcommittee under TRB AFF10 General Structure Committee. http://www.trbaff103.com/

- Federal Highway Administration (FHWA) Accelerated Bridge Construction website: http://www.fhwa.dot.gov/bridge/abc/

- FHWA Every Day Counts (EDC) http://www.fhwa.dot.gov/everydaycounts/

- Strategic Highway Research Program (SHRP 2) Innovative Bridge Designs for Rapid Renewal, Project R04, website http://www.fhwa.dot.gov/goshrp2/

- AASHTO Innovation Initiative website http://aii.transportation.org.

- FHWA's Slide-In: Bridge Lateral Move In Technology website: http://www.slideinbridgeconstruction.com/

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - DECISION MATRIX TOOL (DMT) CONSTRAINT DESCRIPTION TABLE

Constraint	Description
Average Daily Traffic	This accounts for the volume of traffic crossing the bridge construction site. The total combined construction year traffic over and under the structure shall be used. Higher ADT values will support the use of ABC methods.
Traffic Impact	This accounts for the possibility of service disruptions (including traveler delay and cost incurred by the Illinois Tollway due to drivers diverting to non-toll routes) that would result from lane closures during bridge construction activities by calculating a severity index for a given bridge location. The latest edition of the Illinois Tollway Lane Closure Guide was used to assess the possible severity of service disruptions based on lane closures for time of day, peak versus off-peak closures, and weekend, nightly or weekly closures. The results are summarized in the severity index tab of this spreadsheet. The user shall use the severity index tab to score this variable by finding the specific bridge location based on interstate, direction and milepost. The severity index tab has pull down charts that can be easily sorted. The user shall use the weekly severity index unless there are specific project restrictions that would indicate otherwise. Higher severity index scores will support the use of ABC.
Maintenance of Traffic	This accounts for the safety of workers and travelers, and the amount of time and cost of staging during the construction process. "Short duration" shall be defined as a duration of 3 months or less, "normal duration" shall be defined as a duration between 3 and 9 months, and "long duration" shall be defined as a duration of 9 months or greater. "Simple MOT scheme" shall be defined as construction with 2 stages or less. "Multiple staging" shall be defined as construction with more than 2 stages. Longer duration and higher cost staging will support the use of ABC methods.
Economic Impact	This accounts for the negative economic impact on local businesses and limited access for customers and employees at a given site caused by construction activities. Construction sites serving larger populations with higher business impacts will support the use of ABC methods.

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - DECISION MATRIX TOOL (DMT) CONSTRAINT DESCRIPTION TABLE

Constraint	Description
Bridge Classification	This accounts for bridges that are along evacuation/military routes or provide primary access to emergency facilities. These descriptions match the operational classifications given in Articles 1.3.5 and 3.10.5 of the latest AASHTO LRFD Bridge Design Specifications. Bridge Classification shall be based on the factor relating to operational classification. Essential and critical bridge classifications will support the use of ABC.
Railroad/Waterway Impact	This accounts for how railroad traffic or waterways may be affected by construction activities. Impacts to railroads that may require longer temporary track closures or flaggers shall receive high values. Structures that may require work in waterways, particularly waterways that carry commercial boat traffic, shall also receive high values. The volume of rail or waterway traffic shall also be considered when assigning this value. Consideration shall also be given to the capacity of channels and railroad tracks to support and allow Self-Propelled Modular Transporters (SPMT's) and Lateral Bridge Slides (LBS). Structures that affect multiple railroad tracks and/or waterways with commercial boat traffic will support the use of ABC.
Environmental Impact	This accounts for impacts to the environment during construction activities. These impacts can include impacts to streams and lakes, presence of endangered or protected species and potential for contaminated soils which could delay the construction schedule. Projects can also be limited by noise, wetlands, air quality, natural resources, land use or extreme weather which could also limit the allowable construction windows. Structures with significant environmental impacts will support the use of ABC.
Economy of Scale	This accounts for the potential cost savings on a project caused by the use of repetitive elements and operations. The total number of bridge spans for each structure shall be used. Structures with high potential for economies of scale will support the use of ABC.

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - DECISION MATRIX TOOL (DMT) CONSTRAINT DESCRIPTION TABLE

Constraint	Description
Use of Typical Details	This accounts for the level of simplicity of details that can be used for a given bridge. A more symmetric and simpler structure can use more standard details and minimize errors in the field. Examples of "simple" are structures that are straight, have parallel substructure elements, bridge skews 10 degrees or less, etc. Examples of "some complexity" are structures with varying deck width, curved structures, bridge skews from 11 to 29 degrees etc. Examples of "complex" are structures with severe skew (bridge skews 30 degrees or greater), substructure elements not parallel, a unique framing plan, etc. Structures that can utilize more typical details will support the use of ABC.
Accessibility	This accounts for the area available to the Contractor to accommodate prefabricated bridge elements or bridge movement methods near the construction site. Sites that are congested and do not have open areas for fabrication, transportation and installation shall receive low values. Examples of "plenty of ROW available" are structures near interchanges with large infield areas. Examples of "some ROW available" are structures that have available areas along the approach roadways. Examples of "no ROW available" can consist of structures near railroad or waterways. Structures with high levels of accessibility will support the use of ABC.

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - DECISION MATRIX TOOL (DMT)

Prepared By	XX	**Prepared On**	xx/xx/xxxx
Checked By	XX	**Checked On**	xx/xx/xxxx
Bridge No.	XXXXX	**Mile Post**	xx.xx
Location	xxxxxx		

ABC Rating Procedure **December 2016**

Note to User: Refer to Structure Design Manual Article 27.3.1 for general guidance on using this tool.

Average Daily Traffic (Combined over and under)		0	No traffic during construction
		1	Less than 20,000
		2	20,000 to 50,000
		3	50,001 to 100,000
		4	100,001 to 150,000
		5	More than 150,000
Traffic Impact (Based on Severity Index)		0	Least severe traffic impact
		1	More severe traffic impact than 0
		2	More severe traffic impact than 1
		3	More severe traffic impact than 2
		4	More severe traffic impact than 3
		5	Most severe traffic impact
Maintenance of Traffic		0	No impact
		1	Short duration with simple MOT
		2	Short duration with multiple staging
		3	Normal duration
		4	Long duration with simple MOT
		5	Long duration with multiple staging
Economic Impact		0	Low business impact
		3	Medium business impact
		5	High business impact
Bridge Classification		0	Typical bridge
		3	Essential bridge
		5	Critical bridge
Railroad/Waterway Impact		0	No railroad or minor railroad spur or no waterway
		3	One mainline railroad track or waterway
		5	Multiple mainline railroad tracks or waterway with commercial traffic
Environmental Impact		0	No impact
		1	Minimum impact
		3	Medium impact
		5	Maximum impact
Economy of Scale (Total number of spans)		0	1 span
		1	2 or 3 spans
		3	4 or 5 spans
		5	More than 5 spans
Use of Typical Details		0	Complex or unsymmetrical geometry
		3	Some complexity
		5	Simple, symmetrical geometry
Accessibility		0	Unfavorable site with no ROW available
		3	Favorable site with some ROW available
		5	Favorable site with plenty of ROW available

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - DECISION MATRIX TOOL (DMT)

Prepared By	**XX**	**Prepared On**	**xx/xx/xxxx**
Checked By	**XX**	**Checked On**	**xx/xx/xxxx**
Bridge No.	**XXXXX**	**Mile Post**	**xx.xx**
Location	**xxxxxx**		

ABC Rating Procedure **December 2016**

Note to User: Refer to Structure Design Manual Article 27.3.1 for general guidance on using this tool.
Note: Do not adjust weight factors without prior approval from the Illinois Tollway.

ABC RATING SCORE: VARIABLES AND WEIGHTS

Variable	Score	Weight Factor	Adjusted Score	Maximum Score	Adjusted Score
Average Daily Traffic	0	10	0	5	50
Traffic Impact	0	15	0	5	75
Maintenance of Traffic	0	10	0	5	50
Economic Impact	0	5	0	5	25
Bridge Classification	0	3	0	5	15
Railroad/Waterway Impact	0	5	0	5	25
Environmental Impact	0	3	0	5	15
Economy of Scale	0	3	0	5	15
Use of Typical Details	0	3	0	5	15
Accessibility	0	5	0	5	25
		Total Score	0	Max. Score	310

ABC Rating Score: 0

ABC Rating Score = [(Total Score)/(Max. Score)]*100

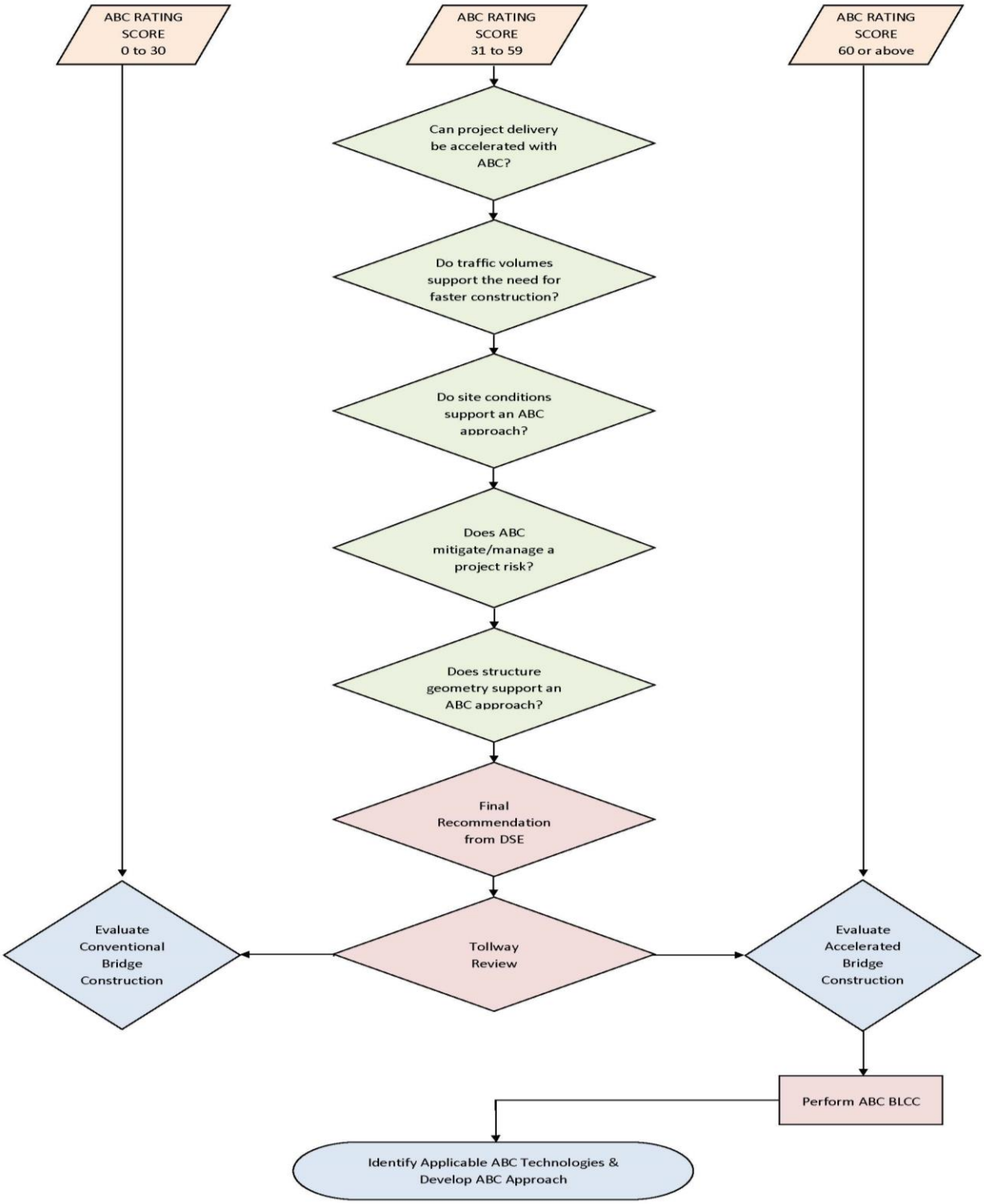
THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - DECISION MATRIX TOOL (DMT)

Prepared By	**XX**	**Prepared On**	**xx/xx/xxxx**
Checked By	**XX**	**Checked On**	**xx/xx/xxxx**
Bridge No.	**XXXXX**	**Mile Post**	**xx.xx**
Location	**xxxxxx**		

ABC Rating Procedure **December 2016**

ABC RATING SCORE - DECISION FLOW CHART



THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - BRIDGE LIFE CYCLE COMPARISON (BLCC) TOOL
CONSTRAINT DESCRIPTION TABLE

INITIAL COSTS (IC)	
Constraint	Description
Total Labor	This accounts for both on-site and off-site labor costs during the duration of the construction project. This constraint shall include time for items specifically on the bridge construction site and time for items constructed "near-site" (such as items constructed at a site adjacent to the bridge and moved into place via slide-ins or SPMT's). Projects that require longer construction periods will generally lead to higher labor costs and will have lower scores in this category.
Deck Material	This accounts for the material cost of the deck portion of the construction project. Cast-in-place concrete decks are assumed to have a higher initial cost due to the need to construct and strip forms and place concrete on-site and will have lower scores in this category. If cost breakdowns for a given project suggest otherwise, the BLCC scores can be adjusted accordingly.
Superstructure Material	This accounts for the material cost of the superstructure portion of the construction project. A precast concrete or steel superstructure is assumed to have the the cheapest initial cost and will have higher scores in this category. If cost breakdowns for a given project suggest otherwise, the BLCC scores can be adjusted accordingly.
Substructure Material	This accounts for the material cost of the substructure portion of the construction project. Precast concrete substructures are assumed to have the cheapest initial cost and will have higher scores in this category. If cost breakdowns for a given project suggest otherwise, the BLCC scores can be adjusted accordingly.
Equipment	This accounts for the equipment cost of the construction project. Conventional equipment that is used for normal concrete and/or steel construction will be considered the most benefitial. As the equipment required becomes more complex and expensive, the scores in this category will decrease. The need for specialized equipment, such as that required for Heavy Lifting or Gantry Cranes, Self-Propelled Modular Transports and Slide-Ins, shall result in lower scores in this category.
Agency Costs	This accounts for the additional costs incurred by the Illinois Tollway as an agency during the construction project. "Normal agency coordination" shall defined for conventional construction methods which present the least likelihood for agency costs during construction and will receive the highest scores in this category. Construction projects that use methods that are less familiar to the agency and contracting community present a higher likelihood for more agency involvement and coordination and will receive lower scores in this category.
Right-of-Way	This accounts for the Right-of-Way aquisition costs required for the bridge construction only. Smaller areas of required Right-of-Way acquisition shall receive higher scores in this category. Scores shall be increased at the descretion of the User if large areas of temporary easement are required. ROW acquisition required for roadway construction (alignment shift, widening etc) should not be included in this variable.
Environmental Impact Costs	This accounts for the cost to mitigate environmental impacts during construction activities and for items requiring permiting that could delay the construction schedule. The environmental impacts can include impacts to streams and lakes, presence of endangered or protected species and potential for contaminated soils. Projects can also be impacted by noise, wetlands, air quality, natural resources, land use or extreme weather which could incurr cost or limit the allowable construction windows. The maximum impact of a particular type shall govern the overall score.

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - BRIDGE LIFE CYCLE COMPARISON (BLCC) TOOL
CONSTRAINT DESCRIPTION TABLE

TRAFFIC IMPACT COSTS (TIC)	
Constraint	Description
Maintenance of Traffic Costs	This accounts for the safety of workers and travelers, and the amount of time and cost of staging during the construction process. "Short duration" shall be defined as a duration of 3 months or less, "normal duration" shall be defined as a duration between 3 and 9 months, and "extended duration" shall be defined as a duration of 9 months or greater. "Simple MOT scheme" shall be defined as construction with 2 stages or less. "Multiple Staging" shall be defined as construction with more than 2 stages. More complex, higher duration MOT will cost more and shall receive lower scores.
Economic Impacts	This accounts for the negative economic impacts on local businesses and limited access for customer and employee traffic at a given site caused by construction activities. A bridge alternative affecting larger population with more business impacts will receive a lower score.
Railroad/Waterway Impacts	This accounts for the impact to railroad or waterway traffic and users due to construction activities. Bridge alternatives requiring longer track closures or work in waterways, particularly navigable waterways, shall receive a low score. "Short duration" shall be defined as a duration of 1 week or less, "normal duration" shall be defined as a duration between 1 week and 3 months, and "extended duration" shall be defined as a duration of 3 months or greater.

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - BRIDGE LIFE CYCLE COMPARISON (BLCC) TOOL
CONSTRAINT DESCRIPTION TABLE

MAINTENANCE COSTS (MC)	
Constraint	Description
Maintenance / Rehabilitation Life Cycle Costs	This accounts for the cost of routine maintenance, repair and rehabilitation to the structure. It is assumed that precast elements have a longer life cycle than CIP elements and would require less frequent repairs than CIP elements. The more precast element types utilized, the longer the service life and less frequent repair cycle. Refer to Structure Design Manual article 27.4.1 for precast element types to consider. Precast concrete beams should not be considered as a precast element for this variable. If multiple of the same type of precast elements are utilized such as precast pier columns, the scoring shall be based on one precast element type used. Scores shall be increased at the descretion of the User if precast deck panels are used since the deck condition typically controls the frequency of repair.
Cost of Repair	This accounts for the cost to repair different components of the bridge. The cost should be based on the quantity, material, labor and time to perform the repair and not the frequency or cycle of repair. It is assumed that precast deck panels will cost more to repair than CIP decks, since the entire panel will most likely be replaced, requiring fabrication, shipping, etc. It is assumed that steel girders will cost more to repair than precast beams since steel girders require more repair over time. It is assumed that precast substructure elements will cost more to repair than CIP substructure since PBES may require additional joints and grout ports. Therefore, if the bridge alternative under consideration utilizes any of these items, it would cost more to repair than if not utilizing.
Total Replacement Costs	This accounts for the cost for total replacement of the structure. New Illinois Tollway structures have a 100 year service life and the decision to replace the structure is based on the condition/age of the girder/beams and substructure. The deck condition/age does not factor into the decision to completely replace the structure. The structure can be easily re-decked. The scoring criteria is based on PBES elements having a longer life cycle than CIP elements. However, the service life will be determined by the worst condition of either the girders/beams or substructure. The assumption is that utilizing both precast beams and precast substructure will extend the service life of the bridge. If only one precast element is used, the corresponding non-precast element will control the service life of the structure.
Future TIC for Routine Maintenance	This accounts for the cost associated with future routine maintenance of the structure. This item covers all the constraints listed in theTraffic Impact Costs (TIC). The worst condition of the TIC variables (MOT duration or complexity of staging, economical, railroad, waterway, or vulnerability impacts) impacted during future routine mainentance shall govern the scoring.
Future TIC for Rehabilitation and Replacement	This accounts for the cost associated with future rehabilitation or replacement of the structure. This item covers all the constraints listed in theTraffic Impact Costs (TIC). The worst condition of the TIC variables (MOT duration or complexity of staging, economical, railroad, waterway, or vulnerability impacts) impacted during future rehabilitation or replacement shall govern the scoring.
Joint Durability	This accounts for the maintenance cost required to repair joints on the structure. PBES elements tend to require additional joints which may create durability issues. Durability issues could lead to lower service life for the structure.
Unforseen Performance	This accounts for cost associated with maintenance for unforseen performance of PBES elements. PBES elements could offer a greater risk for maintenance compared to CIP or conventional components since historical data or performance data is not readily available for these elements. In addition, the PBES elements have not been widely used on the Illinois Tollway; therefore, Contractors have limited experience with this type of construction. Precast concrete beams shall not be considered a PBES for this scoring.
Salvage Value	This accounts for the salvage value of the superstructure. Steel girders are more easily recycled than Precast Concrete Beams.

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - BRIDGE LIFE CYCLE COMPARISON (BLCC) TOOL

Prepared By	**XX**	**Prepared On**	**xx/xx/xxxx**
Checked By	**XX**	**Checked On**	**xx/xx/xxxx**
Bridge No.	**XXXXX**	**Mile Post**	**xx.xx**
Location	**xxxxxx**		

ABC BLCC Tool **December 2016**

Note to User: Refer to Structure Design Manual Article 27.3.2 for general guidance on using this tool.

INDIVIDUAL ABC BLCC RATING SCORE INPUT

INITIAL COSTS (IC)

Total Labor (On-Site and Off-Site)		1	Estimated construction time >= 18 months
		2	13 months <= Estimated construction time < 18 months
		3	8 months <= Estimated construction time < 13 months
		4	3 months <= Estimated construction time < 8 months
		5	Estimated construction time < 3 months
Deck Material		1	Deck type is cast-in-place concrete
		2	Deck type is precast concrete panels
Superstructure Material		1	Superstructure type is cast-in-place concrete
		2	Superstructure type is precast concrete or steel
Substructure Material		1	Substructure type is cast-in-place concrete
		2	Substructure type is precast concrete
Equipment		1	Self-Propelled Modular Transport equipment required
		2	Bridge Slide-In equipment required
		3	Specialty Crane Based equipment required
		4	Prefabricated Bridge Element System or Longitudinal Launch required
		5	Typical cast-in-place concrete/steel construction equipment required
Agency Costs		1	Extensive agency coordination
		2	Moderate agency coordination
		3	Normal agency coordination
Right-of-Way		1	Required R.O.W. acquisition > 1 acre
		2	0.5 acres < Required R.O.W. acquisition <= 1 acre
		3	0.25 acres < Required R.O.W. acquisition <= 0.5 acres
		4	0 acres < Required R.O.W. acquisition <= 0.25 acres
		5	Required R.O.W. acquisition = 0 acres
Environmental Impact Costs		1	Maximum impact
		2	Medium impact
		3	Minimum impact
		4	No Impact

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - BRIDGE LIFE CYCLE COMPARISON (BLCC) TOOL

Prepared By	**XX**	**Prepared On**	**xx/xx/xxxx**
Checked By	**XX**	**Checked On**	**xx/xx/xxxx**
Bridge No.	**XXXXX**	**Mile Post**	**xx.xx**
Location	**xxxxxx**		

ABC BLCC Tool **December 2016**

Note to User: Refer to Structure Design Manual Article 27.3.2 for general guidance on using this tool.

INDIVIDUAL ABC BLCC RATING SCORE INPUT

TRAFFIC IMPACT COSTS (TIC)

Maintenance of Traffic Costs		1	Extended duration with multiple staging
		2	Extended duration with simple MOT
		3	Normal duration
		4	Short duration with multiple staging
		5	Short duration with simple MOT
Economic Impacts		1	High business impact
		2	Medium business impact
		3	Low business impact
Railroad/ Waterway Impacts		1	Complete closure
		2	Extended duration, disruption or closure
		3	Normal duration, disruption or closure
		4	Short duration, disruption or closure
		5	No disruption or closure of Railroads/Waterways

Note:
Service disruptions (including traveler delay and revenue impacts) are not directly included in the ABC BLCC Tool. Additional analysis required if requested by the Illinois Tollway.

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - BRIDGE LIFE CYCLE COMPARISON (BLCC) TOOL

Prepared By	**XX**	**Prepared On**	**xx/xx/xxxx**
Checked By	**XX**	**Checked On**	**xx/xx/xxxx**
Bridge No.	**XXXXX**	**Mile Post**	**xx.xx**
Location	**xxxxxx**		

ABC BLCC Tool **December 2016**

Note to User: Refer to Structure Design Manual Article 27.3.2 for general guidance on using this tool.

INDIVIDUAL ABC BLCC RATING SCORE INPUT

MAINTENANCE COSTS (MC)

Maintenance / Rehabilitation Life Cycle Costs (Frequency)		1	If No Precast element types are used (Highest Repair Frequency)
		2	If One Precast element type is used
		3	If Two Precast element types are used
		4	If Three or more Precast element types are used (Lowest Repair Frequency)
Cost of Repair (Material, Labor and Time)		1	If Three of the Listed Materials are used (Most Expensive Cost)
		2	If Two of the Listed Materials are used
		3	If One of the Listed Materials are used
		4	If None of the Listed Materials are used (Cheapest Cost)
			Note: Listed Material: Precast Deck Panels, Steel Girders, PBES Substructure.
Total Replacement Costs (Estimated Service Life)		1	If only super is precast or if only sub is precast or neither
		2	Precast Beams and Precast Substructure
			Note: The decision to replace structure is based on superstructure and substructure condition. Excludes deck.
Future TIC for Routine Maintenance		1	Weekday Peak shift or Extended MOT Duration or Major Impact
		2	Weekend or night time closure or Medium MOT Duration or Medium Impact
		3	Off peak closure or Shorter MOT Duration or Minimal Impact
		4	No Closure or Shortest MOT Duration or No Impact
Future TIC for Rehabilitation and Replacement		1	Weekday Peak shift or Extended MOT Duration or Major Impact
		2	Weekend or night time closure or Medium MOT Duration or Medium Impact
		3	Off peak closure or Shorter MOT Duration or Minimal Impact
		4	No Closure or Shortest MOT Duration or No Impact
Joint Durability		1	Additional joints between precast elements
		2	Typical Jointed Bridge
		3	Jointless Bridge
Unforseen Performance (Risk)		1	High (More than one PBES element)
		2	Medium (Single PBES element)
		3	None or Low (Conventional Construction material)
Salvage Value		1	Precast Concrete Beam
		2	Steel Girders

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - BRIDGE LIFE CYCLE COMPARISON (BLCC) TOOL

Prepared By	**XX**	**Prepared On**	**xx/xx/xxxx**
Checked By	**XX**	**Checked On**	**xx/xx/xxxx**
Bridge No.	**XXXXX**	**Mile Post**	**xx.xx**
Location	**xxxxxx**		

ABC BLCC Tool **December 2016**

Note to User: Refer to Structure Design Manual Article 27.3.2 for general guidance on using this tool.

INDIVIDUAL ABC BLCC RATING SCORE INPUT

Note: Do not adjust weight factors without prior approval from the Illinois Tollway.

Individual ABC BLCC Rating Score = (Total Score)/(Max. Score)*100
Total ABC BLCC Rating Score = 0.33(IC) + 0.34(TIC) + 0.33(MC)

INITIAL COSTS (IC)

Variable	Score	Weight Factor	Adjusted Score	Maximum Score	Max Adjusted Score
Total Labor	0	10	0	5	50
Deck Material	0	10	0	2	20
Superstructure Material	0	10	0	2	20
Substructure Material	0	10	0	2	20
Equipment	0	10	0	5	50
Agency Costs	0	5	0	3	15
Right-of-Way	0	5	0	5	25
Environmental Impact Costs	0	3	0	4	12
		Total Score	**0**		**212**

IC ABC BLCC Rating Score: 0 **(33% of Total Score)**

TRAFFIC IMPACT COSTS (TIC)

Variable	Score	Weight Factor	Adjusted Score	Maximum Score	Max Adjusted Score
Maintenance of Traffic Costs	0	10	0	5	50
Economic Impacts	0	5	0	3	15
Railroad/Waterway Impacts	0	5	0	5	25
		Total Score	**0**		**90**

TIC ABC BLCC Rating Score: 0 **(34% of Total Score)**

MAINTENANCE COSTS (MC)

Variable	Score	Weight Factor	Adjusted Score	Maximum Score	Max Adjusted Score
Maintenance / Rehabilitation Life Cycle Costs	0	10	0	4	40
Cost of Repair	0	10	0	4	40
Total Replacement Costs	0	10	0	2	20
Future TIC for Routine Maintenance	0	5	0	4	20
Future TIC for Rehabilitation and Replacement	0	3	0	4	12
Joint Durability	0	5	0	3	15
Unforseen Performance	0	3	0	3	9
Salvage Value	0	3	0	2	6
		Total Score	**0**		**162**

MC ABC BLCC Rating Score: 0 **(33% of Total Score)**

TOTAL ABC BLCC Rating Score: 0

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

ACCELERATED BRIDGE CONSTRUCTION (ABC) - BRIDGE LIFE CYCLE COMPARISON (BLCC) TOOL

Prepared By	XX	Prepared On	xx/xx/xxxx
Checked By	XX	Checked On	xx/xx/xxxx
Bridge No.	XXXXX	Mile Post	xx.xx
Location	xxxxxx		

ABC BLCC Tool **December 2016**

Note to User: Refer to Structure Design Manual Article 27.3.2 for general guidance on using this tool.

TOTAL ABC BLCC RATING SCORE SUMMARY

Total ABC BLCC Rating Score = 0.33(IC)+ 0.34(TIC)+ 0.33(MC)

DIRECTIONS FOR USER:

User to Input values

User may elect to add additional bridge alternatives to the ABC BLCC Tool to accurately compare all options.

Construction Type = Enter the type of construction (Conventional or ABC)
Deck = Enter the type of deck material (CIP or Precast Panels)
Super = Enter the type of Superstructure (CIP, Precast or Steel)
Sub = Enter the type of substructure (CIP or PBES)
Method = Enter the type of construction method (Conventional, Lateral Slide, SPMT, Longitudinal Launch, Crane Based)

Bridge Alternates Investigated					
Name	Construction Type	Deck	Super	Sub	Method
Bridge Alternative #1					
Bridge Alternative #2					
Bridge Alternative #3					
Bridge Alternative #4					
Bridge Alternative #5					

Manually Input results for different Bridge Alternatives Investigated:

Total ABC BLCC Rating Score					
	Alt #1	Alt #2	Alt #3	Alt #4	Alt #5
Initial Costs (IC)					
Traffic Impact Costs (TIC)					
Maintenance Costs (MC)					
Total ABC BLCC Rating Score	0	0	0	0	0

User may elect to add additional Recommended Bridge Alternatives to the ABC BLCC Tool to evaluate further in the Bridge Type Study and perform a cost comparison.

Recommended Bridge Alternatives
Bridge Alternatives to Consider Based on Total ABC BLCC Rating Score: