

**Arizona Department of Transportation
BRIDGE GROUP**



**ACCELERATED BRIDGE CONSTRUCTION
GUIDELINES**

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1. Scope

ADOT Bridge Group encourages the exploration and use of Accelerated Bridge Construction (ABC) methods in delivering bridge design and construction projects for preservation, expansion, modernization and safety improvements of the state highway system. These ADOT ABC Guidelines outline steps and processes to follow in evaluating, recommending, deploying, and designing ABC technology on bridge projects.

During the development of all scoping documents involving bridge construction projects, ABC methods shall be evaluated for solutions to lesson impacts to stakeholders such as the travelling public, railroad, businesses and other entities. Improve the safety of the travelling public and contractor's personnel in the work zone, mitigate environmental impacts and shorten construction duration.

2. Acronyms

The following acronyms of current ABC methods are referenced throughout the document:

PBES – Prefabricated Bridge Element Systems.

SPMT –Self Propelled Modular Transport

GRS-IBS – Geosynthetic Reinforced Soil Intergrated Bridge Systems

3. Applicable Projects

Applicable projects including the following scope shall evaluate Accelerated Bridge Construction:

- New Bridge Projects
- Bridge Widening
- Full or Partial Bridge Replacement Projects
- Superstructure Replacement Projects
- Deck Replacement Projects

Emergency Bridge Replacement or Rehabilitation projects shall consider ABC methods upon project initiation. Performing an ABC Decision Matrix as outlined below is not required.

4. ABC Decision Making Process

During the scoping stage of the project development process, the project team shall go through the following decision making process to further evaluate ABC methods versus conventional bridge construction. The outcome of the ABC Decision Making Matrix (**Figure 2.1**) and the ABC Decision Flowchart (**Figure 2.2**) shall be discussed in a separate initial Bridge Study or included in the discussion of the preferred alternative of the scoping document. Initial costs shall be developed for both conventional

ADOT ABC Decision Making Matrix				
Category	Decision-Making Item	Possible Points	Points Allocated	Scoring Guidance
Railroad	Railroad/ Rail Transit under Bridge?	4		0 No track under bridge 2 Minor track under bridge 4 Major track(s) under bridge
Construction Impacts	ADT (Combined ADT on and under bridge)	10		1 ADT under 10,000 3 ADT 10,000 to 25,000 5 ADT 25,000 to 50,000 6 ADT 50,000 to 75,000 7 ADT 75,000 to 100,000 10 ADT 100,000+
	Allowable Lane Closure (Roadway on Bridge)	4		0 Long Term Lane Reduction Allowed During Construction 4 No Long Term Lane Reduction Allowed During Construction
	Allowable Lane Closure (Roadway under Bridge)	4		0 Long Term Lane Reduction Allowed During Construction 4 No Long Term Lane Reduction Allowed During Construction
	Allowable Bridge Closure (Roadway on Bridge)	6		0 Bridge Can closed - Viable Detour Available 6 Bridge Cannot be Closed
	Allowable Roadway Closure (Roadway under bridge)	4		0 Roadway under can be closed 4 Roadway under cannot be closed
	Permanent Align Shift w/ single phase an option	3		0 A permanent alignment shift is achievable to facilitate construction 3 A permanent alignment shift is achievable, but undesirable.
	Is phased construction with widening an option?	8		0 Widening will fit updated standards or future roadway improvements 6 Widening achievable, but undesirable due to unused investment 8 No alternatives available for widening
	Impact to Local Access (Local business access, Local resident access etc.)	6		0 Minor or no impact to access 3 Moderate impact to access 6 Major impact to access
Project Duration	Impacts Critical Path of the Total Project?	8		0 Minor or no impact to critical path of total project 4 Moderate impact to critical path of the total project 8 Major impact to critical path of the total project
	Restricted Construction Time (Environmental schedules, Economic Impact-e.g. local business access, special events, etc.)	10		0 No construction time restrictions 3 Minor construction time restrictions 6 Moderate construction time restrictions 10 Major construction time restrictions
	Seasonal Limitations for conventional construction?	4		0 No seasonal limitations for conventional construction 4 Seasonal limitations for conventional construction
Environment	Does ABC mitigate a critical environmental impact or sensitive environmental issue?	5		0 ABC does not mitigate an environmental issue 2 ABC mitigates a minor environmental issue 3 ABC mitigates several minor environmental issues 4 ABC mitigates a major environmental issue 5 ABC mitigates several major environmental issues
Safety	Safety (Workers Concerns)	8		0 Short duration impact 4 Normal duration impact 8 Extended duration impact
	Safety (Traveling Public Concerns)	8		0 Short duration impact 4 Normal duration impact 8 Extended duration impact
Economy of Scale	Bridge Economy of Scale (repetition of components in a bridge or bridges in a project) (Total spans=sum of all spans on all bridges on the project)	4		0 1 total span 1 2 total spans 2 3 total spans 3 4 total spans 4 5+ total spans
Risk Management	Does ABC allow management of a particular risk?	4		0-4 Use judgement to determine if risks can be managed through ABC that arent covered in other topics
	Total Possible	100		
		Sum of Points:	0	

Figure 2.1

ABC Decision Flowchart

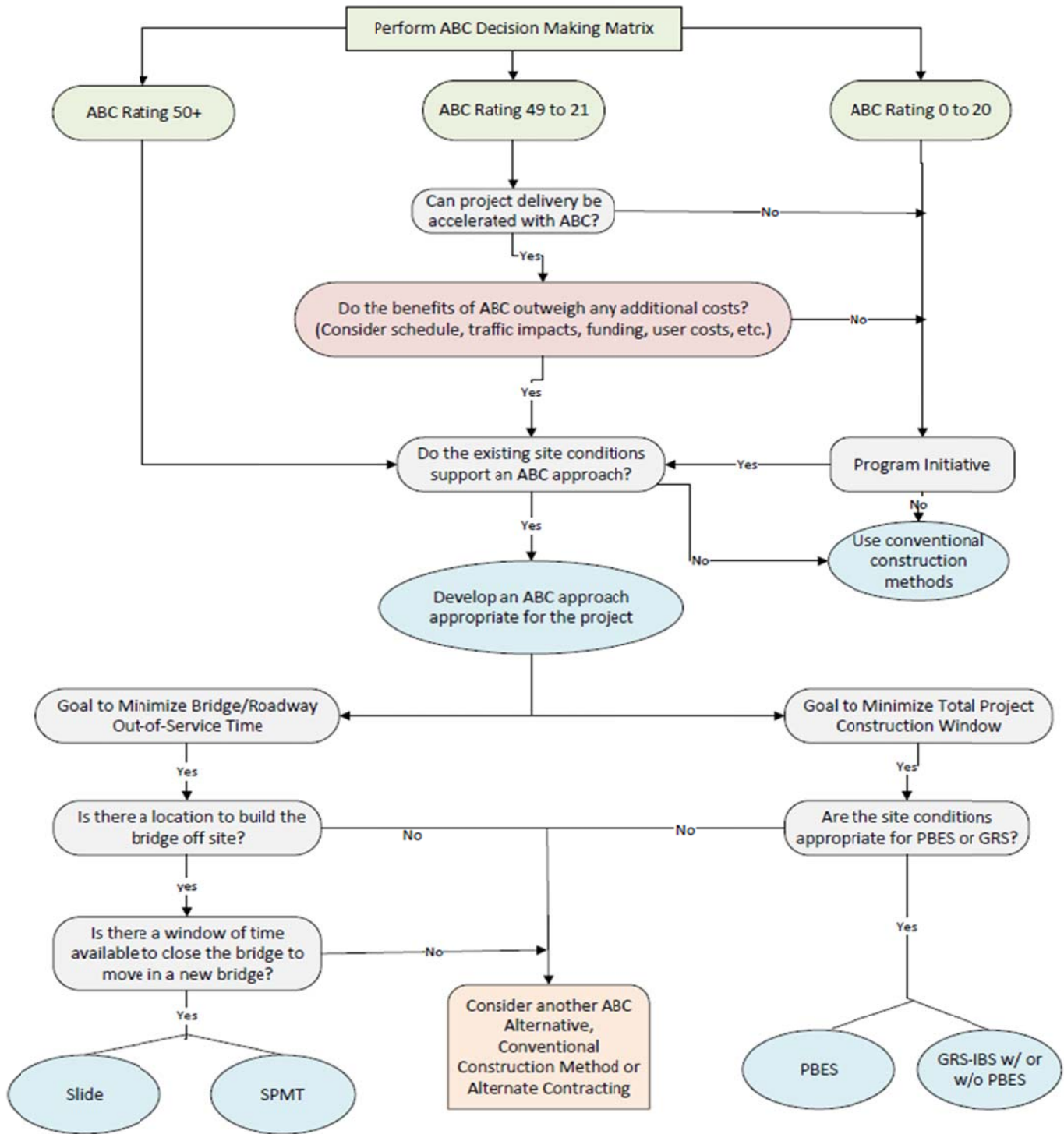


Figure 2.2

construction and ABC methods when deemed to have a strong potential of application by the project planning team. The initial costs of an ABC approach should be used to answer the question in the ABC Decision Flowchart. **“Do the benefits of ABC outweigh any additional costs?”**

The ABC Decision Matrix shown in **Figure 2.1** shall be developed by the Design Team with input from the ADOT construction District and Technical Groups for both consultant and in-house developed projects. A consensus should be reached on the score and documented in the scoping document and the matrix attached in the appendix.

The ABC rating score is a numerical value from 0 to 100 indicating the viability of bridge construction projects in considering ABC concepts. The higher the score the more suited a project is for ABC.

4.1 Matrix Questionnaire Categories

The following categories and definitions shall be used as guidance in determining the appropriate points to be assigned in the decision making matrix.

4.1.1 Railroad

4.1.1.1 Railroad under Bridge

This is a measure of how railroad traffic under the bridge will be affected by the project. If a major railroad line runs under the bridge that would disrupt construction progress significantly, provide a high score here. If a railroad track runs under the structure, but it is used rarely enough that it will not disrupt construction progress significantly, provide a low score here. Consider if the railroad traffic is able to be suspended long enough to move a new bridge into place. If there is not a large enough window to move a new bridge into place, SPMT could be eliminated as an alternative for this project. For this case, PBES may be a more applicable alternative. If there is no railroad under the bridge, assign a value of zero here.

4.1.2 Construction Impacts

4.1.2.1 Average Daily Traffic (ADT)

This is a measure of the total amount of traffic crossing the bridge site. A higher ADT value at a site will help support the use of accelerated bridge construction methods. Use the ADT value from the National Bridge Inspection item #29 equal to the sum of the traffic on the structure and under the structure. For cases where there is a very high ADT on the bridge and very low or no ADT under the bridge, consider using a “slide” method (or SPMT’s, which can be very cost effective ABC techniques for this situation.

4.1.2.2 Allowable lane closures, roadway on bridge

This is a measure of the impact imposed on the travelling public due to long term lane reductions during construction on the bridge, utilizing conventional construction methods. If long term lane closures can

be allowed with minimal impact to the travelling public, provide a low score here. If no long term lane closures are allowed due to impacts to the travelling public, then provide a high score here.

4.1.2.3 Allowable lane closures, roadway under bridge

This is a measure of the impact imposed on the travelling public due to long term lane reductions during construction under the bridge, utilizing conventional construction methods. If long term lane closures can be allowed with minimal impact to the travelling public, provide a low score here. If no long term lane closures are allowed due to impacts to the travelling public, then provide a high score here.

4.1.2.4 Allowable Bridge closures, roadway on bridge

This is a measure of the impact imposed on the travelling public due to a long term full bridge closure. If long term closure can be allowed with a viable detour and minimal impact to travelling public, provide a low score here. If a long term closure is not allowed due to impacts to the travelling public, then provide a high score here.

4.1.2.5 Allowable Bridge closures, roadway under bridge

This is a measure of the impact imposed on the travelling public due to long term full roadway closure on the roadway beneath a bridge. If long term closure can be allowed with minimal impact to travelling public, provide a low score here. If a long term closure is not allowed due to impacts to the travelling public, then provide a high score here.

4.1.2.6 Is a permanent alignment shift with single phase an option?

This is a measure of how utilizing permanent alignment shifts to facilitate Maintenance of Traffic (MOT) requirements can be accomplished with conventional construction methods. If a shift in alignment is not needed or can be accomplished to facilitate construction and MOT needs, with minimal impact to geometry and other constraints, provide a low score here. If a permanent shift is undesirable and potentially cost prohibitive, provide a high score here.

4.1.2.7 Is phased construction with widening an option?

This is a measure of how Maintenance of Traffic (MOT) requirements can be met with widening the bridge to facilitate appropriate traffic lanes to remain open. Will the widening approach to facilitate MOT be able to fit with updated standard clear roadway widths or future roadway improvements? If conventional construction fits this scenario, provide matching score here. Will widening with conventional methods be achievable, but will leave the project with unused or undesirable shoulder widths? Consider the use of temporary bridges and temporary realignments in the same category. If so, provide the score meeting these criteria here. No alternatives for widening will yield the maximum score.

4.1.2.8 Impact to Local Business

This is a measure of the impact to the local businesses around the project location. Consider how the construction staging, road closures, etc. will impact local businesses (public access, employee access, etc.). A high impact to local business equates to a high score here. A low impact to local business equates to a low score here.

4.1.3 Project Duration

4.1.3.1 Impacts Critical Path of Total Project

This is a measure of how the construction schedule of the structure impacts the construction schedule of the entire project. If the construction of the structure impacts the critical path of the entire project, and utilizing ABC methods provides shorter overall project duration, provide a high score here. If other project factors are more critical for the overall project schedule and utilizing ABC methods will not affect the overall project duration, provide a low score here.

4.1.3.2 Restricted Construction Time

This is a measure of how the construction schedule is impacted by environmental and community concerns or requirements. Items to consider are local business access windows, holiday schedules and traffic, special event traffic, etc. If there are significant restrictions on construction schedule, provide a high score here. If there are little to no restrictions on the construction schedule, provide a low score here.

4.1.3.3 Seasonal Limitations for Conventional Construction

This is a measure of seasonal restrictions that the local weather causes for on-site construction progress. Accelerated bridge construction methods may allow a large portion of the construction to be done in a controlled facility, which helps reduce delays caused by inclement weather (rain, snow, etc.). Depending on the location and the season, faster construction progress could be obtained by minimizing the on-site construction time. Limitations on construction season for areas that experience considerable snowfall events or monsoons shall be considered.

4.1.4 Environment

4.1.4.1 Does ABC mitigate a critical environmental impact or sensitive environmental issue

This is a measure of how using accelerated bridge construction methods can help mitigate impacts to the environment surrounding the project. Since accelerated methods allow a shorter on-site construction time, the impacts to the environment can be reduced. If the reduced on-site construction time provided by accelerated bridge construction methods mitigates a significant or critical environmental concern or

issue, provide a high score here. If there are no environmental concerns that can be mitigated with accelerated construction methods, provide a low score here.

4.1.5 Safety

4.1.5.1 Safety (Worker Concerns)

This is a measure of the relative safety of the construction workers between conventional construction methods and accelerated construction methods. The reduced on-site construction time from using accelerated bridge construction methods reduces the exposure time of workers in a construction zone, thus increasing safety. If an increase in safety can be seen by utilizing accelerated construction methods, provide a high score here. If utilizing accelerated construction methods does not provide additional safety, provide a low score here.

4.1.5.2 Safety (Traveling Public Concerns)

This is a measure of the relative safety of the traveling public between conventional construction methods and accelerated construction methods. The reduced on-site construction time from using accelerated bridge construction methods reduces the exposure time of the traveling public in a construction zone, thus increasing safety. If an increase in safety can be seen by utilizing accelerated construction methods, provide a high score here. If utilizing accelerated construction methods does not provide additional safety, provide a low score here.

4.1.6 Economy of Scale

4.1.6.1 Bridge Economy of Scale

This is a measure of how much repetition is used for elements on the project, which can help keep costs down. Repetition can be used on both substructure and superstructure elements. To measure the economy of scale, sum the total number of spans that will be constructed on the project. For example, if there are 2 bridges on the project that each have 2 spans, the total number of spans on the project is equal to 4. Use the notes in the matrix for scoring guidance here.

4.1.7 Risk Management

4.1.7.1 Does ABC allow management of a particular risk?

This is an opportunity to add any project-specific items or unique issues that have risk associated with them that are not incorporated into another section in this text. Consider how ABC may or may not manage those particular risks.

4.2 ABC Decision Flowchart

Once an ABC Decision Matrix is developed and the score agreed upon by the project team including the construction District and ADOT Technical Groups, the ABC Decision Flowchart shown in **Figure 2** shall be followed. This flowchart shall be used to further advance the discussion on the appropriate ABC approach for a given project. Discussion of the outcome shall be documented in the scoping document. The key is to identify and describe potential solutions of different ABC methods that should be further evaluated in Stage II (30% level) of the project development process.

5. ABC Techniques and Concepts – Bridge Selection Report (BSR)

If an ABC approach is deemed appropriate for the project, an alternative analysis shall be performed along with the evaluation of the bridge type alternatives involving any applicable alternatives such as; bridge moves via Sliding, longitudinal launching, SPMT or modular construction systems of PBES, or GRS-IBS. The alternative analysis of the ABC methods and recommendation shall consider the following (but not limited to):

- Addressing the major categories in the ABC Decision Making Matrix and Flowchart
- Site conditions and constraints
- Constructability
- Fabrication availability/limits
- Erection Limits
- Durability
- Cost

6. ABC Design Provisions

Provisions in the applicable sections of the AASHTO LRFD Bridge Design Specifications and the ADOT Bridge Design Guidelines shall be met, including any areas requiring ADOT Bridge Group approval.

Contract provisions for ABC methods including Bridge moves involving laterals slides, longitudinal launching and SPMT shall be incorporated in the contract plans and special provisions supplementing the ADOT Standard Specifications for Road and Bridge Construction.

The use of GRS-IBS structures are subject to following limitations:

- GRS maximum wall height shall be 30 feet or less
- Single span bridge only
- Use on interstate or state route highway overpass bridges will require Bridge Group approval
- Similar foundation soils beneath each abutment

- Restricted over waterways, unless deemed appropriate for calculated scour, migration of the waterway and long-term aggradation and degradation of the stream bed (The need for scour mitigation reduces cost effectiveness of these structure systems).
- Skew is limited to 15 degrees or less

7. ABC Design and Construction References

The following is a list of relevant references on the subject of Accelerated Bridge Construction. This list is not inclusive and will be updated as manuals, specifications and guidelines are further developed and made available to the bridge industry.

Accelerated Bridge Construction – FHWA-HIF-12-013, November 2011

Connection Details for Prefabricated Bridge Elements and Systems – FHWA-IF-09-010, March 2009

Engineering Design, Fabrication, and Erection of Prefabricated Bridge Element and Systems - FHWA-HIF-17-019, June 2013

Geosynthetic Reinforced Soil Integrated Bridge System Interim Implementation Guide – FHWA-HRT-11-026, June 2012

Innovative Bridge Designs for Rapid Renewal ABC Toolkit – SHRP2 S2-R04-RR-2 2013

Manual on the Use of Self-Propelled Modular Transporters to Remove and Replace Bridges FHWA-HIF-07-022, June 2017

Slide-In-Bridge Construction Implementation Guide - FHWA-UDOT Project #F-ST99(232)

Slide-In-Bridge Construction (SIBC) Cost Estimation Guidelines - (FHWA) February 2015