Accelerated Bridge Construction (ABC) Project Database

USER GUIDE

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CHAPTER 1: INTRODUCTION

The Accelerated Bridge Construction (ABC) Project Database is a national databank of projects that have incorporated Prefabricated Bridge Elements and Systems (PBES) with other innovative planning strategies and construction techniques to accomplish the objectives of ABC. The purpose of this database is to facilitate the exchange of ABC-related project information including (but not limited to):

- Project planning and geotechnical and structural solutions facilitating ABC,
- New technologies utilized,
- Lessons learned by engineers and contractors, and
- Cost comparisons between ABC and Conventional techniques.

This database is the culmination of a number of major efforts undertaken by the AASHTO Technology Implementation Group (TIG) PBES Lead States Team and FHWA. For more information on the history of the database, please consult the project report.
CHAPTER 2: SITE STRUCTURE AND NAVIGATION

The information found in the ABC Project Database is secured on servers that are housed at Florida International University (FIU); these servers are backed up daily. A dedicated website (http://utcdb.fiu.edu) was created to serve as a user interface with the developed database, so that users are able to easily access and search the data.

The home page of the ABC Project Database, shown in Figure 2.2, is the portal into the rest of the site. The home page features (highlighted in Figure 2.2) are:

- Interface with the ABC-UTC website (consistent through all subpages of site)
- Database navigation pane (consistent through all subpages of site)
- Keyword search feature
- Ability to list all projects contained in database
- Interactive map with all projects contained in database
- List of states to narrow down database search

The interactive map search feature will be discussed in more detail in Chapter 4.

Database navigation is accomplished through the navigation page on the right-hand side of the site, highlighted in Figure 2.2 and shown in Figure 2.2. The navigation pane remains consistent on all the subpages of the website and was designed to allow for easy navigation of the site. The navigation pane includes:

- **Home**: returns the user to the ABC Project Database homepage
- **Project Database**: takes user to a list of all the projects contained in the database, searchable with the faceted navigation and keyword search functions described below
- **Research Database**: takes user to a list of all the research efforts contained in the database, searchable with similar faceted navigation and keyword search functions described below (currently in development)
- **Submit Project**: allows user to submit a project for consideration into the ABC Project Database (two stage process)
- **Submit Research**: allows user to submit a research effort for consideration into the ABC Research Database (one stage process, currently in development)
- **Training Videos**: videos designed to help the user better utilize the database website
- **Downloadable Database**: allows user to download the ABC Project Tracking Sheet
- **Key Search Words**: displays list of ABC-related keywords to help user with database searches and new project submittals
Figure 2.1: ABC Project Database homepage with interactive map
As mentioned, a complete list of all of the projects contained in the ABC Project Database can be accessed in the “Project Database” page, shown in Figure 2.3. The complete database was designed to be searchable using faceted navigation and keyword search features; these search features will be described in more detail in Chapter 4.
The developed bridge summary sheets are accessed by selecting one of the projects from these two interfaces.
CHAPTER 3: BRIDGE PROJECT SUMMARY SHEETS

The bridge project summary sheet provides a clean and concise summary of all of the data for each bridge project contained in the database. A full version of the summary sheet is available for each of the bridge projects, as shown in Figure 3.1. These summary sheets contain the following information:

- Bridge project name
- Description of location
- State where bridge is located
- Coordinates of bridge (latitude and longitude)
- Bridge owner
- Year ABC component of bridge was built
- ID number (both State and National Bridge Inventory)
- Point of contact (generally the bridge owner)
- Mobility impact time (construction time savings using ABC)
- Impact category (Tier 1 through 6 based on total time of impact)
- Benefits of ABC
- Bridge information (length, spans, construction materials, ADT, etc.)
- Existing bridge description
- Replacement bridge description
- Construction methods description
- High performance materials used
- ABC aspects related to:
  - Planning
  - Geotechnical solutions
  - Structural solutions
- Costs
- Funding
- Incentive programs
- Designer contacts
- Fabricator contacts
- Supplier contacts
- Contractor contacts
- Subcontractor contacts

Available resources (which vary for each project) include:
- Photos
- Contract plans
- Specifications
- Bid tabs
- Schedule
- Other related information, including articles and other publications, URLs, etc.
Figure 3.1: Example of information contained in Project Summary Sheets
The bridge summary sheets also contain a gallery view feature for displaying all input images of the bridge project, as shown in Figure 3.2. The gallery view feature can be accessed by clicking on the photo in the summary sheet and allows users to easily view all input photographs and images.

*Figure 3.2: Gallery view feature for displaying bridge images*

The bridge project descriptions all contain keywords in order to describe the ABC aspects of the project and allow for easy sorting. These keywords are listed and described in Chapter 6.
CHAPTER 4: ABC PROJECT DATABASE – SEARCH FUNCTIONS

The ABC Project Database has a user-friendly interface allowing all the information contained in the database to be easily accessed. The database interface borrows from several types of user interfaces that are commonly employed by other successful sites with search functions:

1. Interactive map search
2. Faceted navigation
3. Keyword search

Each of these searching techniques will be described briefly in the following sections.

4.1. Interactive Map

The location of all the ABC-related bridge projects contained in the database are shown in an interactive map, as shown in Figure 4.1. This interactive map allows for users to observe where in the United States ABC projects are being utilized.

![Interactive map displaying all ABC-related bridge projects contained in the database](image)

*Figure 4.1: Interactive map displaying all ABC-related bridge projects contained in the database*

The map allows for panning around (by left-clicking and dragging) and zooming in/out on (using the scroll on the mouse) the country to further investigate the locations of ABC-related bridge projects. For example, a user can pan and zoom into Iowa to view the number and location of ABC-related projects in Iowa, as shown in Figure 4.2.
The project summary pages can be accessed directly from the interactive map by clicking on any of the bridge markers and then link, as shown in Figure 4.3. Clicking on this link will take the user to the project summary pages described in Chapter 3.

4.2. Faceted Navigation

A faceted navigation search option, shown in Figure 4.4, allows users to narrow down the ABC Project Database to show only projects of interest. Faceted navigation functions by allowing users to narrow down their search through selection of desired search filters in various
categories. The categories that have been included in the faceted navigation feature of this site are shown in Figure 4.4 and include:

- State
- Beam Material
- Location (rural or urban)
- Spans (number of spans)
- Construction Equipment
- Traffic Impact Category
- Max Span Length
- Total Bridge Length
- Year ABC Built
- Average Daily Traffic
- Structural Solutions
- Geotechnical Solutions
- Project Planning
- Funding Source

![Figure 4.4: Overview of faceted navigation options](image)

The search functions as an “OR” criteria within categories and “AND” criteria between categories. For example, if within “Beam Materials” both “Concrete” and “Steel” are selected, as shown in Figure 4.5, bridges will be included that have either concrete or steel beam materials.
When multiple categories are selected, the search will filter using an “AND” search criteria. For example, if “Concrete” Beam Material and “Rural” Location are selected, then only bridges with concrete beam materials and in a rural location will remain after filtering, as shown in Figure 4.6.

When multiple options are selected within a single category and multiple categories are selected, the filter criteria will be a combination of the “AND” and “OR” gates. For example, if “Concrete” and “Steel” are both selected in Beam Materials and “Rural” is selected in Location, then bridges will be displayed that contain either concrete or steel beam material and are located in a rural location, as shown in Figure 4.7.
An example of a completed search using the faceted navigation is shown in Figure 4.8. If the user wanted to find a bridge with the criteria shown:

- Concrete beams
- One-span
- Use SPMTs for construction

Then the appropriate options can be selected. In this case (at the time of user guide publication), only two bridges in the ABC Project Database have concrete beams, are single spans, and used SPMTs in construction. The user can then view additional details on these bridges by clicking on the bridge names.

Figure 4.7: Example of “OR” criteria within category combined with “AND” criteria between categories
The faceted navigation can be combined with the keyword search described below to conduct more detailed searches.

4.3. Keyword Search

The keyword search feature, shown in Figure 4.9, provides a supplement to the faceted navigation feature and provides added search flexibility for the user. The keyword search functions similarly to the way additional categories function as described in the faceted navigation section.

Users can enter into the keyword search any words that may help them to narrow their search (e.g. lightweight concrete, UHPC, etc.). However, a user who may not be as familiar with ABC may go to the keywords page (described in Chapter 3) and use these predefined keywords in their search. Multiple keywords can be separated by commas in the search bar.

When a keyword (or keywords) is entered into the search bar in combination with some of the faceted navigation categories selected, the keywords search will act as an additional category with an “AND” criteria. For example, if two keywords are entered in addition to the search conducted in Figure 4.6, then only bridges in which keyword1 and keyword2 are found...
somewhere on the bridge summary sheet and with concrete beam materials in rural locations will remain, as shown in Figure 4.10.

**Figure 4.10:** Example of keyword search bar in combination with faceted navigation tools
CHAPTER 5: ABC PROJECT DATABASE – USER INPUT

The “Submit Project” interface allows for any user to submit a bridge project for consideration to be included in the ABC Project Database. A two-stage submission and review process was designed to ensure that any user can submit a project, but only projects consistent with the current definition of ABC make it into the final database; this process is shown in Figure 5.1.

Figure 5.1: Flowchart for user input review process for ABC Project Database

There are two submittal and review stages for submitted projects. The first submission stage can be accessed by anyone (i.e., any user of the website can submit the first stage of the project submission). Stage 1 submission, shown partially in Figure 5.2, can be accessed from the sidebar navigation menu. This first stage submission can be quickly and easily completed as it only
Figure 5.2: Stage 1 submission page – partial view (1 page in length)

Upon completion of the project the user is shown confirmation of the submission, shown in Figure 5.3, and an email is sent to the ABC Project Database Committee chair. The chair then reviews the Stage 1 submission and discusses it with the ABC Project Database Committee as needed. If the project is deemed appropriate by the committee and the owner gives approval for the project to be included in the ABC Project Database, then a Stage 2 Project Submission link is sent to the point of contact. If it is decided that the project is not an ABC project or the owner does not give approval, then the submitter is contacted and no further submittal steps are taken.
The second stage of the submission process is more detailed and involves four steps (four pages to be completed). A sample of some of the data required for one of the steps is shown in Figure 5.4. The goal of Stage 2 is to collect all of the remaining data required for the project summary page and any relevant documents. The data required for Stage 2 includes:

- General Project Information
  - Spans
  - Dimensions
  - Traffic management alternative, if constructed conventionally
  - Existing bridge description
  - Replacement or new bridge description
  - Construction methods
  - Lessons learned or stakeholder feedback
- ABC Benefits
  - Mobility impact time (ABC versus conventional construction)
  - Impact category
  - Primary drivers (ABC benefits)
- General Bridge Information
  - Bridge length
  - Max span length
  - Primary beam material
  - Location type
  - Average daily traffic count
  - High performance materials
- Project Planning
  - Decision-making tools
• Site procurement
• Project delivery
• Contracting
• Geotechnical Solutions
  - Foundations and walls
  - Rapid embankment
• Structural Solutions
  - Prefabricated bridge elements
  - Prefabricated bridge systems
  - Miscellaneous prefabricated
  - Construction equipment description
• Cost and Funding Information
  - Cost description
  - Funding source
  - Incentive programs
• Contact Information
  - Primary designer
  - Primary contractor
  - Sub-contractors
  - Fabricators
  - Suppliers

There are several resources that are also collected during the Stage 2 submittal process, to the extent they are available and approved for posting by the owner. These include:

• Contract Plans
• Specifications
• Bid Tabs
• Construction Schedule
• Photos
• Other Related Documents
• Other Related URLs

The Stage 2 submission process is accessed via a URL link that is only connected to one project. **This unique link will allow multiple users to work on the submission by link sharing.**

Information on each page can be saved in a temporary database by clicking the “Next” button at the bottom of the page, shown in Figure 5.4. Saved data will reappear when the page is reopened.
The project submission will only complete once the “Submit” button is pressed on the page of the final step.

Figure 5.4: Sample of some information required for Stage 2 project submission

The user can also access an MS Word template of the project submittal sheet to ease with the submission process. This template can be accessed by anyone by clicking on the “Submit Project” link on the navigation pane and then on the “MS Word Template for Submission,” as shown in Figure 5.5.
Figure 5.5: Access to MS Word version of the project submission needed information

When Stage 2 of the project is submitted, users will be directed to a confirmation page, shown in Figure 5.5, and an email will be sent to the ABC Project Database Committee chair. Similar to Stage 1, the chair will then review the final submission and discuss with the committee its appropriateness for being included in the ABC Project Database. Any minor edits will be made by the committee and major edits will be completed by the submitter. Both the subcommittee and the bridge owner need to agree on the final version of the submitted project information.

Figure 5.6: Confirmation that Stage 2 of the submittal process is complete

When all of the Stage 2 data has been reviewed and the owner has given final approval, the project is then included into the ABC Project Database. The process described above was designed to ensure that only ABC projects with owner approval and well-written project summaries are included into the ABC Project Database. This process will allow for the expansion of the database while ensuring its integrity is maintained.
CHAPTER 6: KEYWORDS AND DEFINITIONS

The FHWA and AASHTO T-4 Committee developed a list of keywords that have been used to classify and describe each ABC project. These keywords can be used for searching the ABC Project Database, as described in Chapter 4, and should be used for the submission process, described in Chapter 5.

6.1. Funding Type

The funding type category describes the primary source of the funds for the bridge project. The types of funding are shown in Table 3.1.

<table>
<thead>
<tr>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal only</td>
</tr>
<tr>
<td>State only</td>
</tr>
<tr>
<td>Federal and state</td>
</tr>
<tr>
<td>Local</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

6.2. Incentive Programs

The incentive program category contains information on federal incentive programs that were utilized by the project. A list of the current incentive programs that have been used by ABC projects in the database to date is shown in Table 3.2.

<table>
<thead>
<tr>
<th>Incentive Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>HfL Highways for LIFE</td>
</tr>
<tr>
<td>IBRD Innovative Bridge Research and Deployment Program</td>
</tr>
<tr>
<td>SHRP 2 Strategic Highway Research Program</td>
</tr>
<tr>
<td>ARRA American Recovery and Reinvestment Act</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>
The Highways for LIFE (HfL) program was created by the FHWA with the purpose “to advance Longer-lasting highway infrastructure using Innovations to accomplish the Fast construction of Efficient and safe highways and bridges” [1]. The Innovative Bridge Research and Deployment Program (IBRD) was created to provide funds for the promotion of innovative designs, materials, and construction methods in construction, repair, and rehabilitation of bridges and other highway structures[2]. The Strategic Highway Research Program (SHRP2) provided funding for more than 100 research programs and led to development of a toolkit for use by bridge engineers[3]. The final incentive program that has been utilized by bridge engineers to date is the American Recovery and Reinvestment Act (ARRA). The ARRA was authored by President Obama in 2009 and led to $26.6 billion being invested into more than 12,000 bridge projects across the country and 51 TIGER grants awarded to creative bridge projects representing the future of the diversity of our infrastructure[4].

Additional incentive programs will be added to the keywords as they are created and utilized.

6.3. Impact Category

The impact categories describe the total amount of time traffic flow is negatively impacted due to the construction of a bridge. Impact category definitions were initially developed by FHWA. Definitions were recently updated by the AASHTO T-4 Committee. A list of the impact categories and updated list of definitions is included in Table 3.3.

<table>
<thead>
<tr>
<th>Impact Categories</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1</td>
<td>Traffic impacts within 1 day</td>
</tr>
<tr>
<td>Tier 2</td>
<td>Traffic impacts within 3 days</td>
</tr>
<tr>
<td>Tier 3</td>
<td>Traffic impacts within 2 weeks</td>
</tr>
<tr>
<td>Tier 4</td>
<td>Traffic impacts within 1 month</td>
</tr>
<tr>
<td>Tier 5</td>
<td>Traffic impacts within 3 months</td>
</tr>
<tr>
<td>Tier 6</td>
<td>Overall project schedule is significantly reduced by months to years</td>
</tr>
</tbody>
</table>
6.4. Project Planning

There are four different aspects of the project planning process that can be modified to accommodate or encourage ABC. These subcategories along with a list of ABC related project planning techniques or tools are shown in the below list.

- **Decision-Making Tools**
  - FHWA process
  - State process
  - TPF-5(221) (ABC decision making model developed by pooled fund study)
  - Benefit/cost methods
  - Other

- **Site Procurement**
  - Programmatic agreements
  - Right-of-way acquisition
  - Relocation incentives
  - Flexibility in utilities
  - Early environmental clearance and permitting
  - Electronic shop drawing submittal and approval process
  - Fabrication drawings prior to bid
  - Material procurement prior to contract award
  - Other

- **Project Delivery**
  - Design-Bid-Build
  - Design-Build
  - Design-Build by in-house forces
  - CMGC (construction manager / general contractor)
  - Alternative technical concept
  - Alternative ton (foundation)
  - Other

- **Contracting**
  - A+B bidding
  - A+B+C bidding
  - Full lane closure
  - Warranties
  - Lane rental
  - I/D clauses (incentive/disincentive clauses)
  - No-excuse bonus
6.5. Foundations and Walls

There are several types of foundation and wall systems that are currently considered an ABC technique or technology. These systems are shown in Table 3.4.

Table 3.4: Foundation and wall element keywords

<table>
<thead>
<tr>
<th>Foundation and Wall Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous flight auger piles</td>
</tr>
<tr>
<td>Micropiles</td>
</tr>
<tr>
<td>High-capacity piles</td>
</tr>
<tr>
<td>GRS integrated bridge system</td>
</tr>
<tr>
<td>CIP substr under traffic</td>
</tr>
<tr>
<td>Reused subst units</td>
</tr>
<tr>
<td>Pre-grouted voids</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

6.6. Rapid Embankment Construction

There are several types of rapid embankment construction techniques that are currently utilized in ABC. These systems are shown in Table 3.5.
Table 3.5: Rapid embankment construction

<table>
<thead>
<tr>
<th>Rapid Embankment Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPS geoform</td>
</tr>
<tr>
<td>Self-compacting backfill</td>
</tr>
<tr>
<td>Smart compaction</td>
</tr>
<tr>
<td>Fully-contained flooded backfill</td>
</tr>
<tr>
<td>Embankment surcharge</td>
</tr>
<tr>
<td>Lightweight fill</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

6.7. Prefabricated Bridge Elements and Systems

Numerous prefabricated bridge elements and systems are currently utilized in accelerated bridge construction. These elements and systems are grouped into categories related to the portion of the structure that is prefabricated, extent of prefabrication, type of prefabricated element, or type of connection detail used. A list of these keywords divided by sub-category is presented below:

- Deck Elements
  - Partial-depth precast deck panels
  - Full-depth precast deck w/PT
  - Full-depth precast deck w/o PT
  - FRP deck panels
  - Exodermic deck
  - Steel grid (open)
  - Steel grid (concrete filled)
  - Aluminum
  - Orthotropic deck
  - UHPC waffle deck
  - Other

- Deck Beam Elements
  - Adjacent deck bulb tee beams
  - Adjacent tee beams
  - Adjacent inverted tee beams
- Adjacent box beams
- Adjacent slab beams
- Adjacent slab beams w/ backwalls
- Modular Decked Beams (MDcBs) [concrete deck on steel beams]
- Modular Decked Beams (MDcBe) [concrete deck on concrete beams]
- PT concrete through-girder
- Other decked beam

- Full-Width Beam Elements
  - Truss span without deck
  - Arch span without deck
  - Precast segmental
  - Steel segmental
  - Other full-width beam element w/o deck

- Pier Elements
  - Precast pile caps
  - Steel pile caps
  - Precast cap shells
  - Prefab caisson caps
  - Precast footings
  - Precast footing shells
  - Steel columns
  - Precast columns
  - Steel column caps
  - Precast column caps
  - Steel caps and columns
  - Precast caps and columns
  - Other

- Abutment and Wall Elements
  - Precast abutment caps
  - Precast backwalls
  - Precast abt cap w/ backwall
  - Precast abutment stems
  - Precast wing walls
  - Precast cheek walls
  - Precast footings
  - Steel sheet piling
  - Precast sheet piling
- Precast lagging panels
- Precast full-height wall panels
- Precast retaining walls
- MSE walls
- Modular block walls
- GRS abutments
- Proprietary walls
- Precast 3-sided culvert
- Other

- Closure Joints
  - CIP reinf closure joints
  - Grouted keys
  - Grouted blockouts w/shear connectors
  - Bars in splice couplers
  - PT ducts, grouted
  - PT ducts, not grouted
  - Match casting
  - Grouted ducts in precast substructure
  - CIP pockets in precast substructure
  - High-early-strength low-shrinkage concrete joints (HESt-LSh)
  - UHPC closure joints
  - Epoxy joints
  - Other

- Overlays
  - Standard concrete
  - HPC
  - High-density concrete
  - Asphalt w/ membrane
  - Asphalt w/o membrane
  - Latex-modified
  - Micro-silica
  - Thin-bonded epoxy
  - Polymer concrete
  - Rapid set
  - Asphalt chip seal, no membrane
  - Other

- Other
6.8. Construction

The final group of keywords used in the bridge project descriptions is related to the construction methods, techniques or technology used in the ABC project. These are broken down into the five different sub-categories shown below:

- **Self-Propelled Modular Transporters (SPMTs) Moves**
  - SPMTs
  - SPMTs with gantry system
  - SPMTs on barge
  - Other
• Longitudinal Launching
  o Longitudinal launch (Skids)
  o Longitudinal launch (Rollers)
• Lateral Slide (Slide-in Bridge Construction)
  o Lateral Slide (Rollers)
  o Lateral Slide (Skids)
• High-Capacity Crane
  o High-capacity crane
  o High-capacity crane on barge
• Other
  o Strand jacks
  o Towed modular transporters
  o Float in
  o Gantry system
  o Multi-axle flatbed trailers

There are instances in which conventional construction equipment is used in accelerate bridge construction. Conventional construction equipment is commonly used with prefabricated elements to offer similar erection costs and convenience.