Technical Report Documentation Page

1. Report No. ABC-UTC-ResearchDatabase-v1	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle **International Database of ABC Research**		5. Report Date May 2016 6. Performing Organization Code	
7. Author(s) David Garber		8. Performing Organization Report No.	
9. Performing Organization Name and Address Department of Civil and Environmental Engineering Florida International University 10555 West Flagler Street, EC 3680 Miami, FL 33174		10. Work Unit No. (TRAIS) 11. Contract or Grant No.	
12. Sponsoring Organization Name and Address Accelerated Bridge Construction University Transportation Center Florida International University 10555 W. Flagler Street, EC 3680 Miami, FL 33174		13. Type of Report and Period Covered Final Report 14. Sponsoring Agency Code	
15. Supplementary Notes Visit www.abc-utc.fiu.edu for other ABC reports and http://utcdb.fiu.edu for access to the database developed under this project.			
16. Abstract The body of knowledge in the Accelerated Bridge Construction (ABC) field is rapidly expanding. A number of federal, state, and local agencies have undertaken initiatives at different levels to use and enhance the use of ABC principles in practice. As with any new and emerging engineering topic, it is essential that measures are taken to (a) prevent repetition and (b) provide a source of information for various stakeholders which is both user friendly and easily navigable. Such information will allow the bridge industry to use their resources in an optimal manner and produce results that can add value and complement the existing knowledge. The work of this project expanded and enhanced a database initially developed by the Transportation Research Board (TRB) Subcommittee on ABC – AFF10-3. The main objective of the project was to compile information on new research needs statements (RNS), ongoing research, and completed research previously conducted research related to ABC technologies and present the information in a manner useful to researchers, research sponsors, bridge owners, designers and others in the bridge industry.			
17. Key Words accelerated bridge construction, research database		18. Distribution Statement No restrictions.	
19. Security Classification (of this report) Unclassified.	20. Security Classification (of this page) Unclassified.	21. No. of Pages 24	22. Price NA

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

International Database of ABC Research

Final Report

May 2016

Principal Investigator: David Garber

Department of Civil and Environmental Engineering
Florida International University

Research Assistant
Nazanin Rezaei

Author
David Garber

Sponsored by
Accelerated Bridge Construction University Transportation Center

A report from

Department of Civil and Environmental Engineering
Florida International University
10555 West Flagler Street, EC 3680
Miami, FL 33174
Phone: 305-348-2824 / Fax: 305-348-2802
https://cee.fiu.edu/

TABLE OF CONTENTS

LIST OF FIGURES

ACKNOWLEDGMENTS

This project was supported by Accelerated Bridge Construction University Transportation Center (ABC-UTC at www.abc-utc.fiu.edu) at Florida International University (FIU), as lead institution, and Iowa State University (ISU) and the University of Nevada-Reno (UNR) as partner institutions. The authors would like to acknowledge the ABC-UTC support.

The research team would like to extend special appreciation to the ABC-UTC and the U.S. Department of Transportation Office of the Assistant Secretary for Research and Technology for funding this project.

Thanks should be given to Ben Beerman for chairing the TRB Joint Subcommittee on ABC – AFF00(2) and for his efforts developing the initial research tracking sheet used to populate the research database. Thanks should also be given to Mary Lou Ralls for her guidance developing this database and the ABC Project Database (both hosted on the same website).

The authors would like to thank the project steering committee: Ben Beerman (FHWA), Carmen Swanwick (Utah DOT), Mike Culmo (CME Associates, Inc.), Nancy Daubenberger (Minnesota DOT), Thomas Donald (Massachusetts DOT), Bijan Khaleghi (Washington State DOT), Paul Liles (formerly Georgia DOT), Elmer Marx (Alaska DOT&PF), and Tom Ostrom (Caltrans).

The authors would also like to thank Alex Gonzalez-Vinas of AvanData for his help with the programming of this project.

EXECUTIVE SUMMARY

The body of knowledge in the Accelerated Bridge Construction (ABC) field is rapidly expanding. Numerous federal, state, and local agencies have undertaken initiatives at different levels to use and enhance the use of ABC principles in practice. As with any new and emerging engineering topic, it is essential that measures are taken to (a) prevent repetition and (b) provide a source of information for various stakeholders which is both user friendly and easily navigable. Such information will allow the bridge industry to use their resources in an optimal manner and produce results that can add value and complement the existing knowledge.

The work of this project expanded and enhanced a database initially developed through the Transportation Research Board (TRB) Subcommittee on ABC – AFF10-3. The main objective of the project was to compile information on new research needs statements (RNS), ongoing research, and completed research related to ABC technologies and present the information in a manner useful to researchers, research sponsors, bridge owners, designers and others in the bridge industry.

CHAPTER 1: INTRODUCTION

1.1. Background

In recent years there has been a significant push for more durable bridges that are less expensive and take less time to construct. These desires within the bridge community have led to numerous federal, state, and local agencies encouraging the use of accelerated bridge construction (ABC) practices. As with any new and emerging engineering topic, it is essential that measures be taken to prevent repetition of research and provide a source of information for various stakeholders.

1.2. Research Scope, Objectives, and Tasks

The main objective of this project was to create a resource that researchers, research sponsors, bridge owners, designers and others in the bridge industry could use to determine new research needs statements (RNS), on-going research and completed research related to ABC. The resource was to contain sufficient information to inform interested parties about the ABC research efforts.

The following tasks were completed to meet the objectives of the project:

1. Literature review
2. Data collection, synthesis, and analysis
3. Database development
4. Interface design
5. Final report

The work of this project ran concurrently with the ABC-UTC supported project "Compilation of Accelerated Bridge Construction (ABC) Bridges" [1]. The outcome of these tasks was the final database (https://abc-utc.fiu.edu/resources/project-research-databases/) as documented in this report.

1.3. Overview of Report

This report is intended to give readers an overview of the development of the ABC Research Database and its use. The functionality of the database is similar to the ABC Project Database, so readers can refer to the ABC Project Database User Manual [2] for more information on its use.

CHAPTER 2: BACKGROUND AND OVERVIEW OF ABC RESEARCH DATABASE

2.1. History of ABC Research Database

The Transportation Research Board (TRB) Standing Committee on General Structures (AFF10) recognized the importance of ABC to the future of bridge construction and in 2013 created the Subcommittee on ABC (AFF10-3). The objective of this subcommittee was to expand the knowledge and expertise to foster the implementation of ABC-related activities with the charge to the subcommittee to [3]:

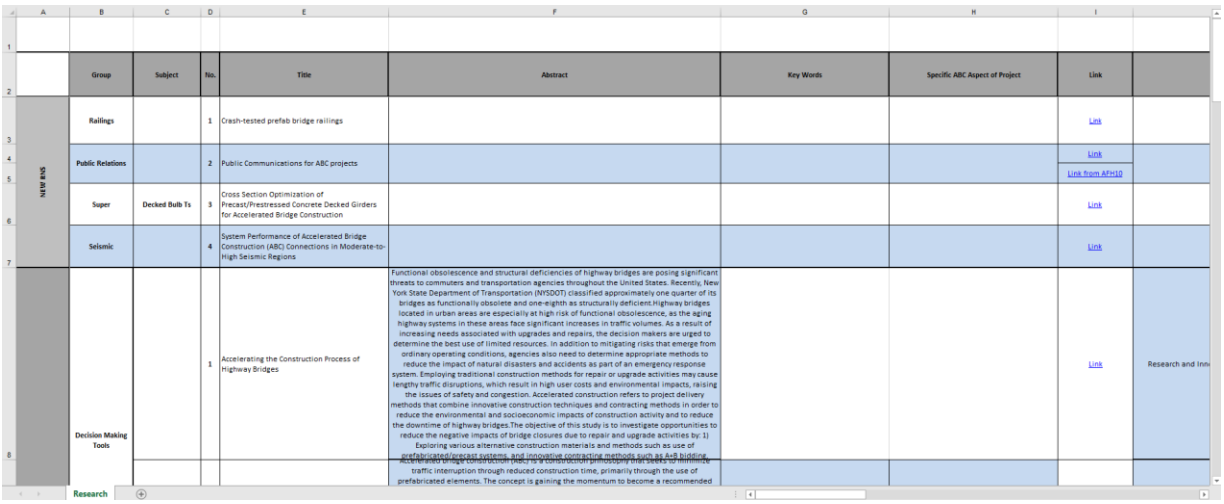
1. Stay informed on the current state of practice/art
2. Identify, prioritize and prepare research needs statement (RNS)
3. Collaborate RNS with State DOTs, FHWA, and AASHTO groups
4. Support research projects
5. Support technology transfer and implementation of research projects through workshops, paper, and poster sessions

Members of AFF10-3 realized that ABC-related research projects were being conducted by organizations around the country, and no available databases were compiling these projects and information about these projects. The ABC Research Tracking Spreadsheet was created in 2014 to fill this gap. Information on on-going and completed research projects related to ABC was gathered from subcommittee member input and stored in a spreadsheet that was hosted on the AFF10-3 website. RNSs were also added to the spreadsheet and commented on by committee members.

The ABC Research Tracking Spreadsheet was maintained and updated by AFF10-3 until it was transferred to the TRB Joint Subcommittee on ABC, AFF00(2) – the successor to AFF10-3, in 2016. The Subcommittee collaborated with the ABC-UTC on development of a more robust system.

2.2. Research Tracking Spreadsheet

As discussed above, the Research Tracking Spreadsheet was originally developed by the TRB Subcommittee on ABC as a Microsoft Excel spreadsheet containing basic information on completed research, ongoing research, and research needs statements. Basic information was contained in the spreadsheet to allow for keyword filtering. Links were provided to related webpages and downloadable resources. A sample of the spreadsheet is shown in Figure 2.1.



	Group	Subject	No.	Title	Abstract	Key Words	Specific ABC Aspect of Project	Link	
NEW RNS	Railings		1	Crash-tested prefab bridge railings				Link	
	Public Relations		2	Public Communications for ABC projects				Link Link from APH10	
	Super	Decked Bulb Ts	3	Cross Section Optimization of Precast/Prestressed Concrete Decked Girders for Accelerated Bridge Construction				Link	
	Seismic		4	System Performance of Accelerated Bridge Construction (ABC) Connections in Moderate-to-High Seismic Regions				Link	
	Decision Making Tools		1	Accelerating the Construction Process of Highway Bridges	Functional obsolescence and structural deficiencies of highway bridges are posing significant threats to commuters and transportation agencies throughout the United States. Recently, New York State Department of Transportation (NYSDOT) classified approximately one quarter of its bridges as functionally obsolete and one-eighth as structurally deficient.Highway bridges located in urban areas are especially at high risk of functional obsolescence, as the aging highway systems in these areas face significant increases in traffic volumes. As a result of increasing needs associated with upgrades and repairs, the decision makers are urged to determine the best use of limited resources. In addition to mitigating risks that emerge from ordinary operating conditions, agencies also need to determine appropriate methods to reduce the impact of natural disasters and accidents as part of an emergency response system. Employing traditional construction methods for repair or upgrade activities may cause lengthy traffic disruptions, which result in high user costs and environmental impacts, raising the issues of safety and congestion. Accelerated construction refers to project delivery methods that combine innovative construction techniques and contracting methods in order to reduce the environmental and socioeconomic impacts of construction activity and to reduce the downtime of highway bridges.The objective of this study is to investigate opportunities to reduce the negative impacts of bridge closures due to repair and upgrade activities by: 1) Exploring various alternative construction materials and methods such as use of prefabricated/precast systems, and innovative contracting methods such as A+B bidding, Accelerated Bridge Construction (ABC), a construction philosophy that seeks to minimize traffic interruption through reduced construction time, primarily through the use of prefabricated elements. The concept is gaining the momentum to become a recommended			Link	Research and Inn

Research

Figure 2.1: Sample of headings in the EXCEL Research Tracking Sheet

The Research Tracking Spreadsheet contained basic information on the research projects:

- Status
  - New Research Needs Statement (RNS)
  - Ongoing Projects
  - Completed Projects
- Group (“Topics” in ABC Research Database)
  - Railings
  - Public Relations
  - Superstructure
  - Substructure
  - Seismic
  - Design-Making Tools
  - Bridge Information Modeling
  - Standards
  - Design Specifications
  - Materials
  - Joints
  - Decks
  - Ultra-High Performance Concrete (UHPC)
  - Synthesis
  - Overlays
  - Systems
- Subject (e.g. Decked Bulb T’s, Durability, Elements & Systems)
- Research Project Title
- Links (e.g. TRB summary pages, final reports)
- Budget
- Length of Project
- Start Date
- Completion Date

- Status/Notes

The entered information was dependent on the status and the available information online.

2.3. Creation of Online Database

The first objective of this project was to create an online database to host all the information that was already contained the Research Tracking Spreadsheet. This database was generated by creating separate data tables in the database created for the ABC Project Database [4]. The MySQL database was hosted on a separate server at FIU. Data tables were created for basic information, research photos, and uploaded documents. These data tables were linked through the created website. The online database is backed up daily and is secured on servers that are housed at Florida International University (FIU).

2.4. Creation of Online Interface

A front-end interface was created to allow users to easily search and interact with the data. A webpage for the ABC Research Database was created on the website also hosting the ABC Project Database [4]. The home page for the ABC Research Database contains a list of all the projects, two ways to search the database (faceted navigation interface and keyword search), interface with the ABC-UTC website, and a menu to navigate around the database website, as shown in Figure 2.2.

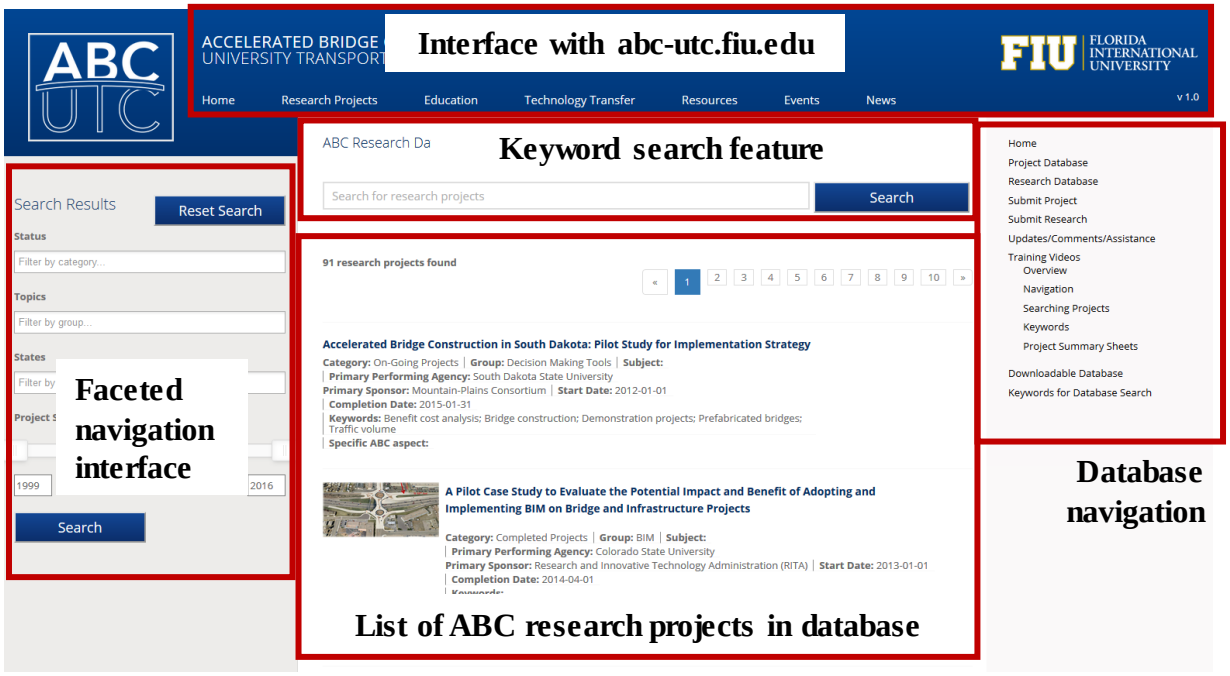


Figure 2.2: Main features of research database search interface

Summary pages for each research project or RNS can be accessed by selecting one of the research projects from the list of research projects.

2.5. Research Summary Sheets

Research summary sheets were created to present all the data for each research project in a clean and concise manner. A full version of the summary sheet is provided for each research project, as shown in Figure 2.3. These summary sheets contain the information from the Research Tracking Spreadsheet (as discussed in §2.2) and fields for:

- Primary sponsor
- Primary performing organization
- Other documents (with downloadable documents)

Research Project Summary Sheet

Development of Prefabricated Bridge Railings

Category: On-Going Projects

Group: Railings

Subject: Prefabricated Railing

Abstract: Many organizations are promoting and utilizing Accelerated Bridge Construction (ABC) practices to reduce traffic impacts and to reduce societal costs. One of the most common means to achieve ABC is to utilize prefabricated elements which are brought together, on-site, to construct the in-place bridge. The purpose of this research is to begin the process of developing crash-tested prefabricated bridge railings that have durable anchorage details. The need for this work has been previously identified by the AASHTO SCOBS Technical Committee for Construction.

Keywords: Prefabricated Railing

Specific ABC aspect: Prefabricated Railing

Budget and Timeline

Budget (USD): $0.00

Project length: 36 months

Start date: 2014-05-01

Completion date:

Primary Sponsor

Accelerated Bridge Construction University Transportation Center
10555 W. Flagler Street, EC 3680
Miami, Florida 33174, USA

Primary Sponsor Contact
Atorod Azizinamini
PhD, PE
Email: aazizina@fiu.edu
Phone: 305-348-0110

Primary Performing Organization

Iowa State University
394 Town Engineering
Aimes, Iowa 50011 USA

Principal Investigator
Terry Wipf
PhD, PE
Email: tjwipf@iastate.edu
Phone: 515-294-6979

Other documents:

View ABC-UTC-Progress-Report-June-ISU-1-Development-of-Crash-Tested-Prefabricated-Bridge-Railings-1.pdf
View T-4_Responseson2013RNSonCrash-TestedPrefabBridgeRailings_01-14-13.pdf

Other related URLs:

Go to: https://abc-utc.fiu.edu/research-projects/development-of-prefabricated-bridge-railings/

Figure 2.3: Example of information contained in Research Summary Sheets

The research summary sheets also contain a gallery view feature for displaying all input images of the bridge project, as shown in Figure 2.4. The gallery view feature allows users to easily view all input photographs and images.

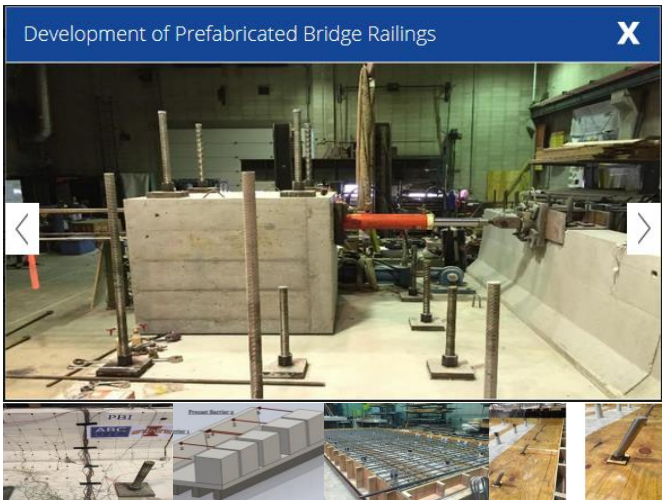


Figure 2.4: Gallery view feature for displaying research images

CHAPTER 3: ABC RESEARCH DATABASE – SEARCH FUNCTIONS

The ABC Research Database was designed to be easily navigated by users with two different search functions commonly used by other successful websites:

1. Faceted navigation and
2. Keyword search.

These search features function the same way as the features in the ABC Project Database [4].

3.1. Faceted Navigation

A faceted navigation feature, shown in Figure 3.1, was created to allow users to narrow down the ABC Research Database to show only research projects that interest them. There are four categories to narrow down the search:

- Status
- Topics ("Group" in ABC Research Tracking Spreadsheet)
- States
- Project Start Year

As shown in Figure 3.1, there are drop down menus with options to select for Status, Topics, and States. The Project Start Year criteria allows the user to either manually input a year range or use the sliders to select a year range. Only projects with starting dates between these two years will be shown. The slider defaults to include all research projects in the database (i.e. the first year shown is the earliest research project and last year shown is the most recent research project).

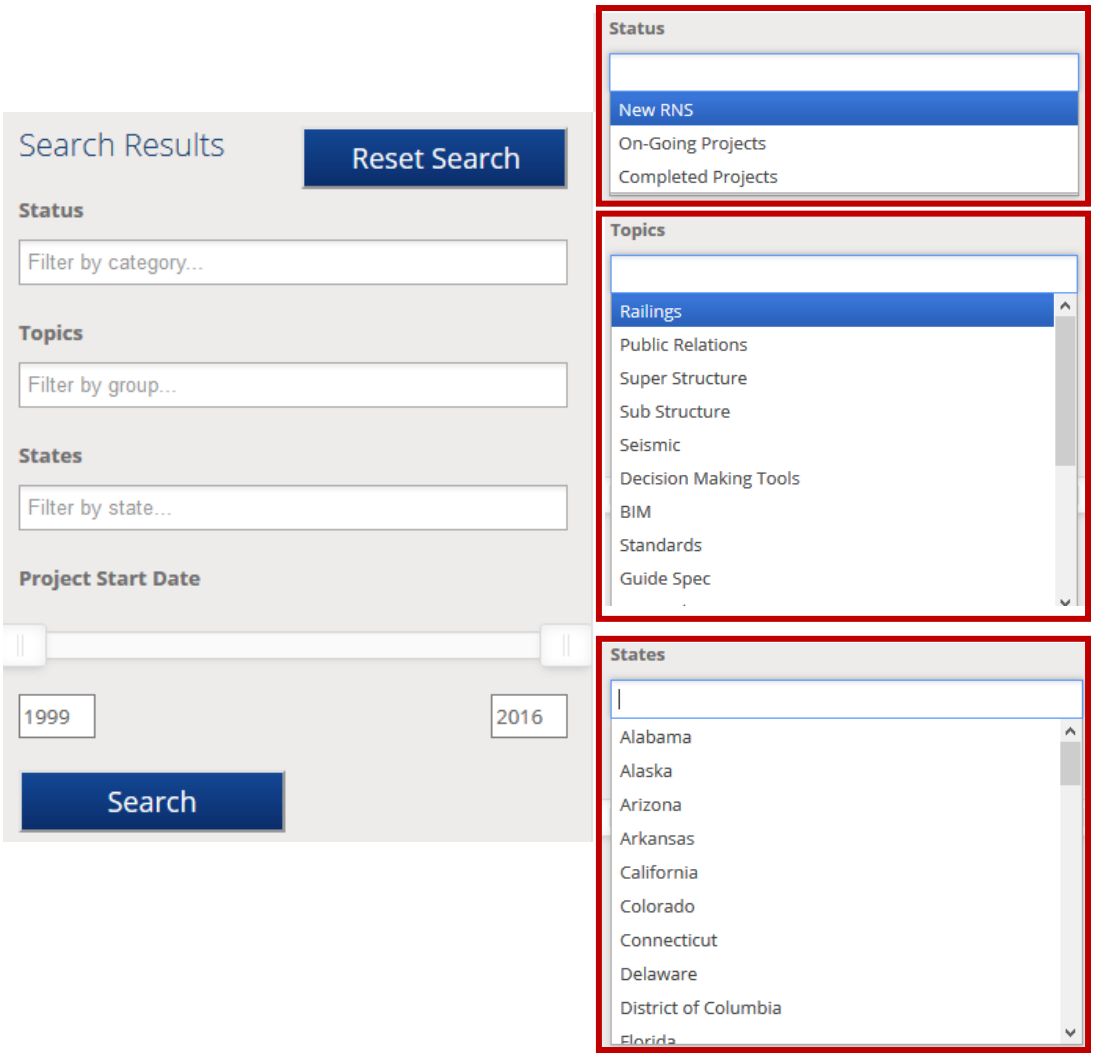


Figure 3.1: Overview of faceted navigation options

The search functions as an "OR" criteria within categories and "AND" criteria between categories. For example, if within "Status" both "On-Going Projects" and "Completed Projects" are selected, as shown in Figure 3.2, research projects will be included that are either on-going or completed; no RNS would be included.

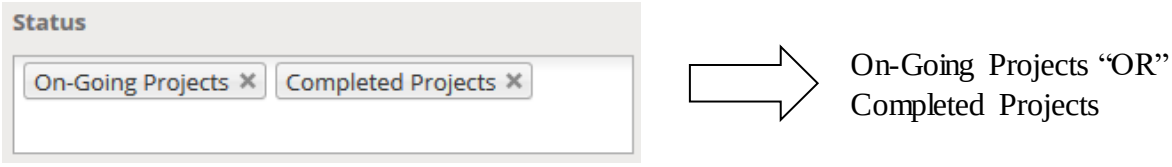


Figure 3.2: Example of "OR" criteria within categories

When multiple categories are selected, the search will filter using an "AND" search criteria. For example, if "On-Going Projects" and "Super Structure" are selected, then only research projects that are on-going and investigating superstructure components or systems will be shown after filtering, as shown in Figure 3.3.

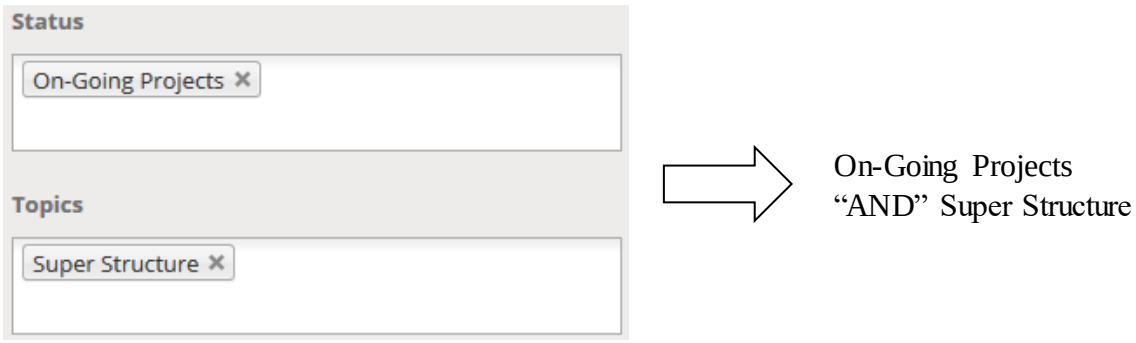


Figure 3.3: Example of "AND" criteria when multiple categories are selected

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 "On-Going Projects" and "Completed Projects" are both selected in Status and "Super Structure" is selected in Topics, then research projects will be listed that are either on-going or completed and focused on bridge superstructure components or systems, as shown in Figure 3.4.

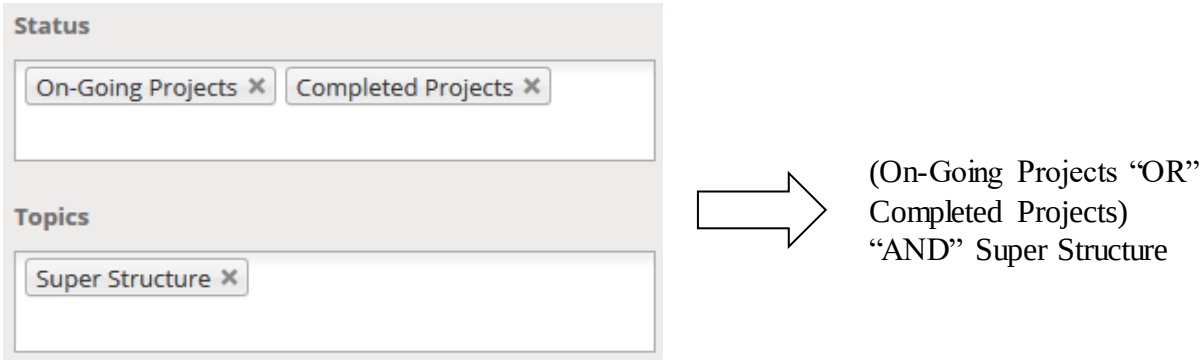


Figure 3.4: Example of "OR" criteria within category combined with "AND" criteria between categories

Search results from this example are shown in Figure 3.5. The user can then view additional details on any of these research projects by clicking on the research project names.

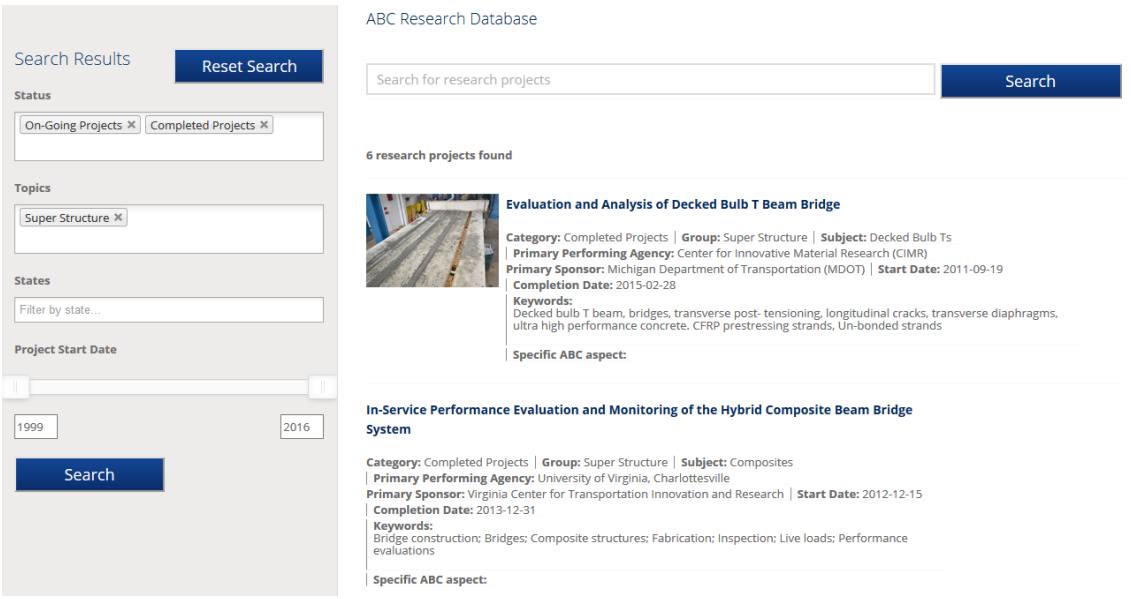


Figure 3.5: Example of faceted navigation search

The faceted navigation can be combined with the keyword search described below to conduct more detailed searches.

3.2. Keyword Search

The keyword search feature provides additional flexibility for users to navigate the ABC Research Database, shown in Figure 3.6. Users can currently enter one keyword to help them narrow down their search.

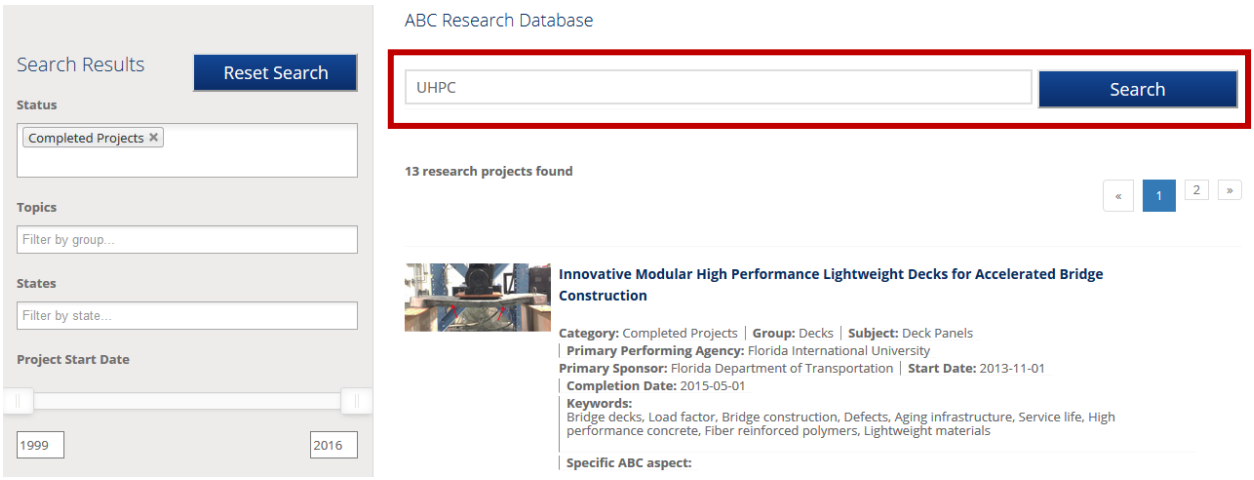


Figure 3.6: Keyword search bar

The keyword search can be used in combination with the faceted navigation menus. The keyword search functions as an additional category with an "AND" criteria between categories. In the example shown, when "UHPC" is entered in the keyword search and "Completed Projects" selected under Status, only completed projects related to UHPC will be shown in the search results, as shown in Figure 3.7.

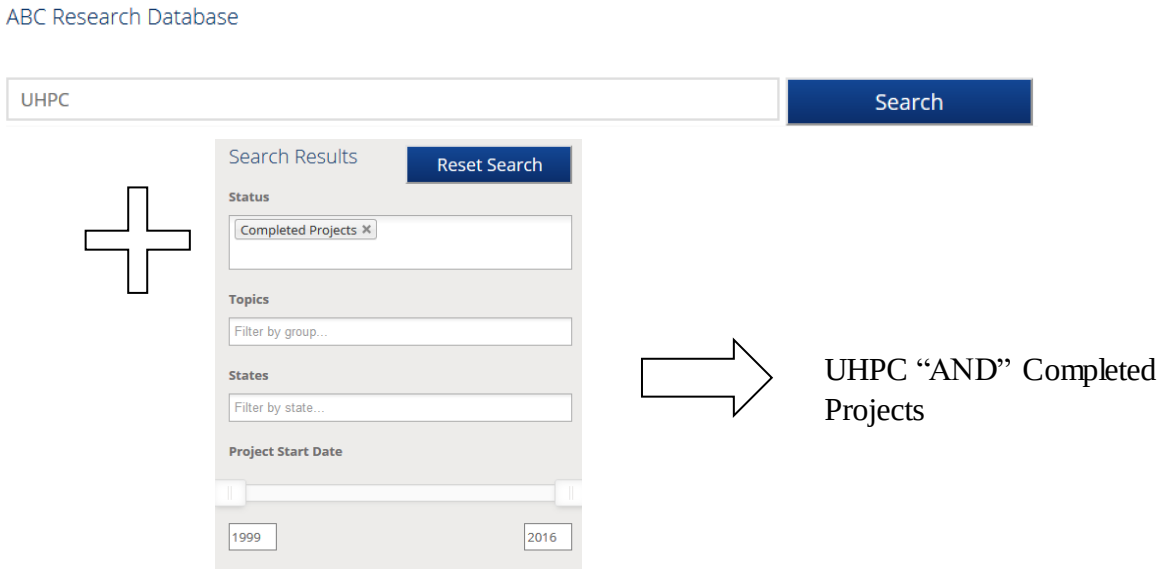


Figure 3.7: Example of keyword search bar in combination with faceted navigation tools

CHAPTER 4: ABC RESEARCH DATABASE – USER INPUT

Another primary objective was to create a way for any user to submit research needs statements, on-going research, and completed research related to ABC. A single-stage submission and review process, shown in Figure 4.1, was designed to ensure that any user can submit research projects, but only appropriate research projects make it into the final ABC Research Database.

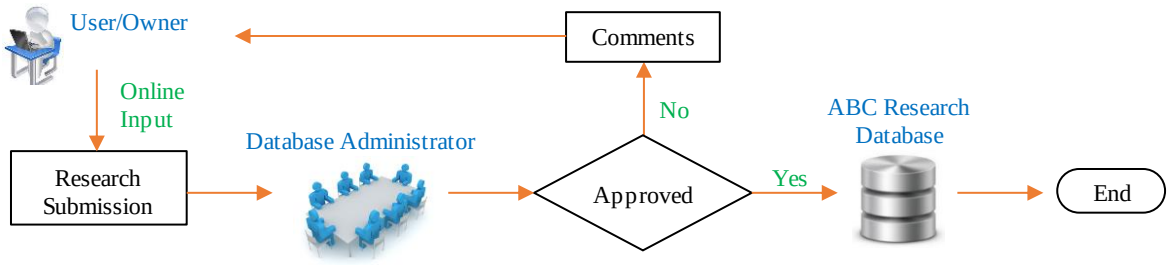


Figure 4.1: Flowchart for user input review process for ABC Research Database

The research project submission page can be accessed on the right-hand menu on the database website. The submission process requires filling out information in three steps. The first step contains contact information for the submitter, primary sponsor, performing organization and principal investigator, as shown in Figure 4.2. The required fields are highlighted in red.

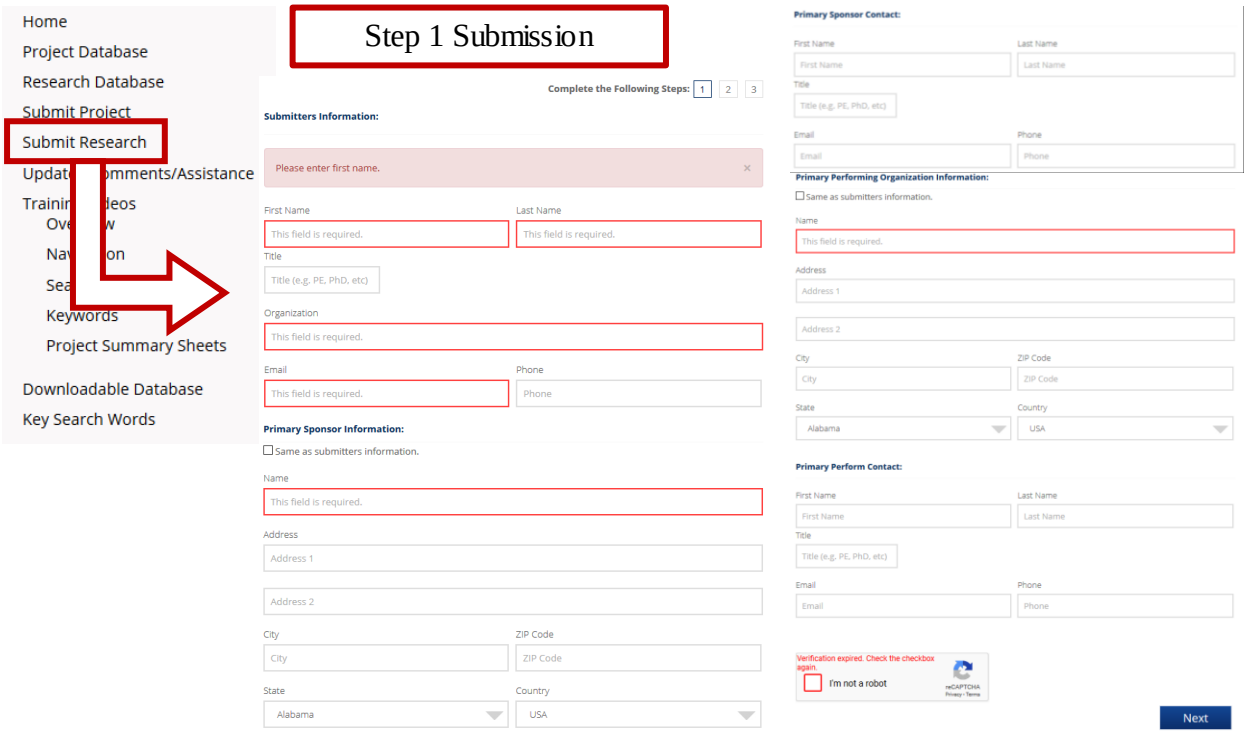


Figure 4.2: Step 1 submission page

Step 2 of the submission process, shown in Figure 4.3, requires input about the research project. This information includes:

- Title
- Category (New RNS, On-Going Project, or Completed Project)
- Group
- Abstract for project
- Keywords
- Specific ABC aspect
- Other notes
- Budget and timeline
- Any related ABC bridge projects that are contained in the ABC Project Database

Information for new RNS should be entered as anticipated for the proposed project.

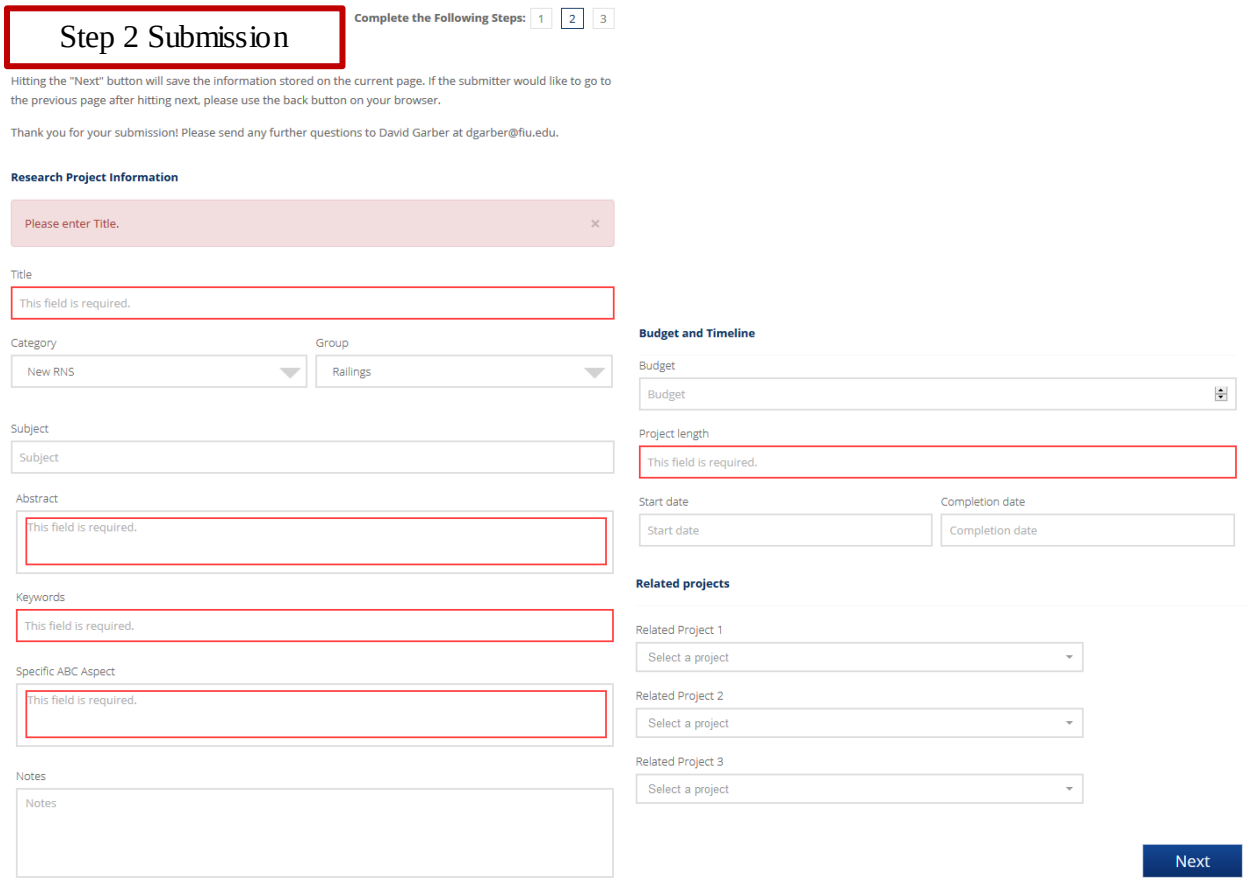


Figure 4.3: Step 2 submission page

Step 3 of the submission process, shown in Figure 4.4, allows users to upload related images, reports, and other documents. Related URLs can also be input during this step.

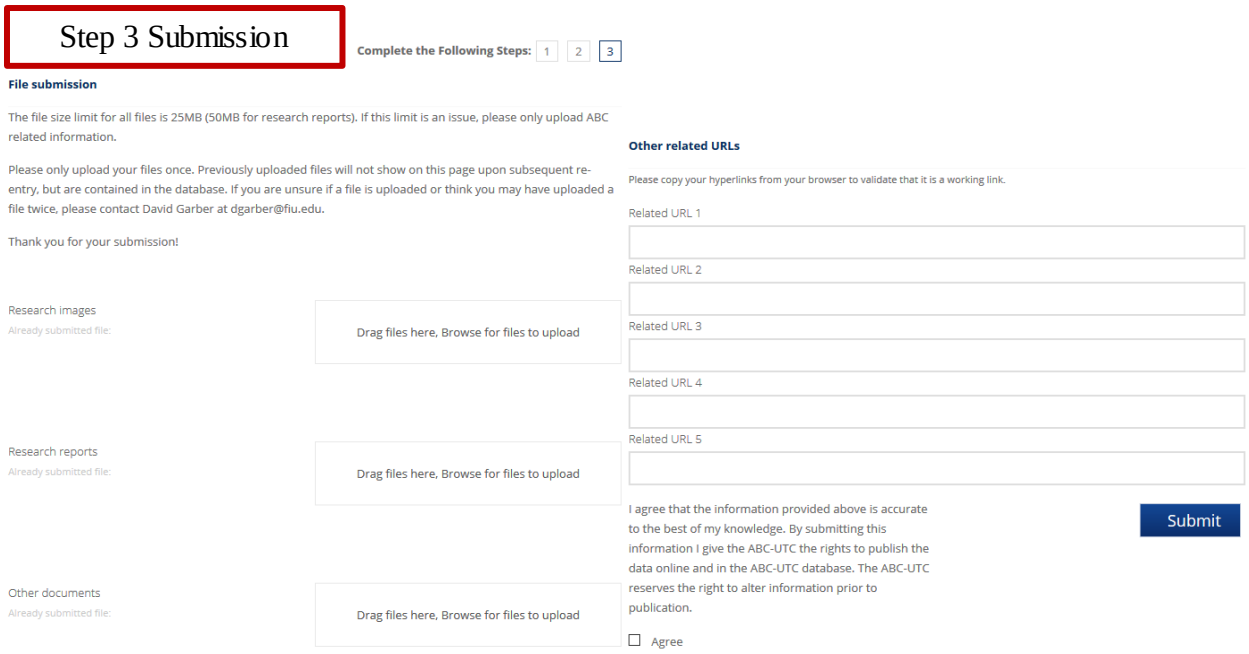


Figure 4.4: Step 3 submission page

Upon completion of the research project entry, the user will be directed to a confirmation page. The ABC Research Database Administrator will then review the entry and either approve the entry or send comments back to the submitter. When the ABC Research Database Administrator and submitter are both satisfied with the entry, it will be moved into the official ABC Research Database. This process will ensure the integrity of the database is maintained while allowing for its expansion.

CHAPTER 5: SUMMARY

The recent push for more durable bridges that are less expensive and take less time to construct has led to numerous federal, state, and local agencies encouraging the use of accelerated bridge construction (ABC) practices. This has in turn led to more research related to ABC being conducted. The ABC Research Database was created to provide various stakeholders with information on ABC-related research to help to prevent repetition and help disseminate available research, both on-going and completed. The ABC Research Database also allows for an exchange of research needs between stakeholders and researchers.

The ABC Research Database is a fully online database located on the same server and website as the ABC Project Database. The functionality of both databases is similar to allow users to easily navigate both. The search interface is accomplished through:

- *Faceted Navigation*: borrowing from popular shopping sites to allow for easy filtering of the full database using predefined categories and options
- *Keyword Search*: allowing for users to have additional flexibility in their search of the database

Summary pages were created for all research projects in the database with detailed information on the research, pictures, reports, other relevant documents, and related URLs.

Additionally, a detailed submission process was designed to allow any user to submit a research project for consideration to the ABC Research Database but only include appropriate research projects in the official database.

REFERENCES

[1] D. Garber, “Compilation of Accelerated Bridge Construction (ABC) Bridges,” Florida International University (FIU), Miami, 2016.

[2] D. Garber, “Accelerated Bridge Construction (ABC) Project Database - User Guide,” ABC-UTC, Mar. 2016.

[3] “TRB Committee on General Structures (AFF10) Subcommittee on Accelerated Bridge Construction (AFF10-3).” [Online]. Available: https://sites.google.com/site/trbaff103/.

[4] D. Garber and M. L. Ralls, “ABC Project Database,” 2016. [Online]. Available: http://utcdb.fiu.edu/. [Accessed: 24-May-2016].