

**PROJECT TITLE: DEVELOPMENT OF GUIDELINES FOR SELECTION  
OF SUBSTRUCTURE FOR ABC PROJECTS**

**Quarterly Progress Report  
For the period ending May 31, 2020**

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**ACCELERATED BRIDGE CONSTRUCTION  
UNIVERSITY TRANSPORTATION CENTER**

Submitted to:  
ABC-UTC  
Florida International University  
Miami, FL

## **1. Background and Introduction**

The concept of Accelerated Bridge Construction (ABC) using precast and prefabricated bridge elements are gaining popularity among transportation agencies primarily to minimize traffic delays and costs. Some other benefits associated with the ABC techniques are reduced on-site construction time, reduced impact on mobility, better work zone safety and improved quality. Previously, the focus of the ABC techniques was limited to specific prefabricated bridge elements such as bridge decks and pier caps. However, with the recent advancement in construction methods, many projects are using precast and prefabricated elements for other bridge elements such as substructures and foundations. In case of a new bridge construction, substructure design by ABC technique will allow rapid construction to accommodate superstructure installation. For replacing an existing bridge, the substructure construction by ABC technique will cause minimum interference with existing bridge operation. Currently, a number of potential ABC technologies are available to design and construct bridge substructures and foundations. A guideline will help the transportation agencies to select the suitable techniques for their specific need.

## **2. Problem Statement**

A number of previous studies are available focusing on the use of precast, prefabricated bridge superstructure elements. On contrary, only few studies can be found focusing on the design and construction of substructure and foundation by ABC method as most of the time it is assumed that the substructure already exists and ready to receive the load from superstructure. However, substructure construction can be the most time-consuming work for a bridge construction. There is a need to have specific guidelines for design and construction of substructures and foundations for new bridges to obtain full benefits of ABC method. Also, guidelines are needed for consideration of reusing, strengthening, and modification of substructure and foundations of an existing bridge. In addition, new, innovative and non-interruptive substructure and foundation design methods need to be explored and documented.

## **3. Research Approach and Methods**

The overall approach of this project is to conduct an extensive literature search and document the ABC technologies available for design and construction of substructure and foundation. The current evaluation techniques of an existing substructure and foundation and problems associated with the evaluation techniques will also be investigated for replacing an existing bridge. Also, methods for strengthening or modifying an existing substructure will be discussed. The issues with the state-of-the art practices of ABC techniques for constructing a new bridge will be identified and potential solutions will be proposed based on the literature review. Attempts will be taken to present few examples of new and innovative techniques of substructure and foundation construction. A survey will be conducted to find out the challenges faced by stakeholders during construction of bridge. The acceptability of new practices such as installation of prefabricated foundation elements, retrofitting etc. will be investigated through this survey.

## **4. Description of Research Project Tasks**

The following is a description of tasks carried out to date.

### **Task 1 – Develop Outline for the Guideline**

*Proposed task description:*

An outline will be proposed as a first step of developing a guide for substructure and foundation by ABC method. The outline will broadly encompass the topics related to substructure and foundation by ABC method such as ABC definitions, design methodologies for new and existing bridges, materials for bridge construction by ABC method, evaluation techniques of existing bridge elements and new methods of substructure and foundation construction. The outline will be updated periodically to prepare a comprehensive guide.

*Description of work performed up to this period:*

An initial outline has been developed. The outline was updated periodically, as needed.

### **Task 2 – Conduct Literature Search on Pertinent Topics.**

*Proposed task description:*

A comprehensive literature review will be conducted focusing on the design and construction of substructure and foundation by ABC techniques. Sources of literature include, but not limited to TRB, FHWA, NCHRP, and DOTs. Other sources such as society journals will be consulted. Moreover, national and international conferences, symposia and workshops will be reviewed. The literature review will be continued throughout the duration of this project.

*Description of work performed up to this period:*

A comprehensive literature review has been conducted focusing on the design and construction of substructure and foundation by ABC techniques. The result of the literature review has been presented in previous quarterly reports.

### **Task 3- Identify Stakeholders and Conduct Survey.**

*Proposed task description:*

A survey will be conducted to find out the state of the art practices of foundation design and construction methods by ABC method. Also, the challenges faced by engineers during construction of foundation will be investigated. The acceptability of new practices such as installation of prefabricated foundation elements, retrofitting etc. will be investigated through this survey. The questionnaire will be disseminated among DOTs and personals involve in research using ABC method.

*Description of work performed up to this period:*

A survey questionnaire form was prepared in consultation with FIU team members and was disseminated with the help of AASHTO Committee on Bridge and Structures. A total of twenty responses were received for this survey.

#### **Task 4- Analyze Literature Search and Survey Results**

*Proposed task description:*

The literature reviewed for this project will be summarized and analyzed in order to prepare the guidelines for this project. A report will be prepared on the survey feedback and will be included in the final guideline.

*Description of work performed up to this period:*

The literature review conducted for this project has been analyzed to prepare the construction and design guidelines for bridge foundation by ABC technique. Also, the survey was conducted with the help of AASHTO Committee on Bridge and Structures. The responses of the survey were presented in previous quarterly report.

#### **Task 5- Identify Issues and Potential Solutions**

*Proposed task description:*

Based on the literature review and survey results, issues with the state-of-the art practices of ABC techniques for constructing bridge foundation and substructure will be identified and potential solutions will be proposed.

*Description of work performed up to this period:*

Issues with the selection, design and construction of bridge foundation by ABC methods were documented from literature. This section has been presented in the final report.

#### **Task 6- Develop Draft Guideline**

*Proposed task description:*

One of the deliverables from this project will be a draft guideline on design and construction of bridge foundation and substructure by ABC techniques. The guidelines will be based on the literature search and survey results. The guidelines will cover the topics mentioned in the Task 1.

*Description of work performed up to this period:*

Dr. Musharraf Zaman is currently finalizing the draft guideline for bridge foundation. The draft will be disseminated for review by experts as soon as possible.

#### **Task 7- Prepare Final Report**

*Proposed task description:*

A final report will be prepared based on the outcome of the project. the final report and the draft guideline will be submitted to the ABC-UTC and other professionals for further review.

