



## Program Progress Performance Report University Transportation Centers

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<b>1. ACCOMPLISHMENTS: What was done? What was learned?</b>	

The information provided in this section allows the grants official to assess whether satisfactory progress has been made during the reporting period. The ABC-UTC 2016 was awarded in December 2016, and at this time, it is in the process of topic selection for its first cycle to begin in the next period.

## **1.1 What are the major objectives of the program?**

The major goals of the ABC-UTC program falls into 6 different categories:

### **1.1.1 Research**

The objectives of the Accelerated Bridge Construction University Transportation Center (ABC-UTC) are to advance the frontier of Accelerated Bridge Construction (ABC); develop new ABC knowledge; effectively transfer the state-of-the-art ABC knowledge to the profession; develop a next-generation ABC work force; provide leadership in making contributions to solve national transportation issues and collaborate with the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), Departments of Transportation (DOTs), other UTCs, and the transportation profession to make ABC the best solution for the nation's aging bridge infrastructure, in line with ***Fixing America's Surface Transportation (FAST) Act research priority area: "Improving the Durability and Extending the Life of Transportation Infrastructure" and non-exclusive topic areas: "Construction Methodologies" and "Application of New Materials and Technologies."***

The ABC-UTC will also contribute to FAST Act's priority areas of "Reducing Congestion (Improve Operations)", "Promoting Safety (Transportation Worker Safety/ Construction Zones)," "Preserving the Environment (Environmentally Responsible Planning and Construction)," and "Preserving the Existing Transportation Systems (Retrofits and Multiple Uses of Infrastructure)".

### **1.1.2 Leadership**

The proposed ABC-UTC consortium members have well-established, working relationships with one another that span decades. Collectively, the five institutions have the expertise and synergy to accomplish the Center's objectives. The ABC-UTC's research team, many of whom are recognized experts in the field and are in leadership positions, is particularly well suited to solving the remaining barriers to widespread implementation of ABC practices and the construction of longer service-life bridges. The research team members will continue their leadership through professional publications, articles, media outputs, and conferences to extend their leadership beyond academic arena. The program will also invest in young faculty to become future leaders in the area. We demonstrate our leadership in innovations in education, workforce development, deployment of research results and conducting research.

### **1.1.3 Education and Workforce Development**

All ABC-UTC partners have well-established education and workforce development programs that will be further strengthened through the ABC-UTC. FIU, ISU, UNR, UW, and OU, each offer graduate degrees, leading to M.S. and Ph.D. degrees in all traditional fields of civil engineering, including transportation engineering, structural engineering and construction engineering. The quality of these programs is best evidenced by the many awards and recognitions their students have received in recent years.

The objectives of the Accelerated Bridge Construction University Transportation Center (ABC-UTC) are to develop successful programs in the areas of seminars, workshops, and training courses for graduate and undergraduate students.

#### **1.1.4 Technology Transfer**

One of the strongest aspects of the current ABC-UTC is the knowledge and leadership role that it has and will play in bridge engineering in terms of Technology Transfer. The keys to the FIU's ABC-UTC success in Technology Transfer are: a) a solid, extensive knowledge of ABC; b) a strong focus (ABC); c) coordination of its activities with AASHTO, FHWA, DOTs, and consultants; d) identification of the knowledge gaps, e) identification of the bridge community needs; f) team work; g) identification of the best means, methods, and format of transferring the knowledge, and most importantly; h) involvement of stakeholders and adopters early in the process, and continuously seeking and receiving feedback from the community and making necessary improvements and adjustments.

Some of the highlights of technology transfer will include:

- Partnerships across Sectors to Move Research into Practice
- Peer-reviewed Journals and Other Publications to Showcase Research Results
- Information Exchanges
- Academic and Continuing Education Programs
- Distance Learning
- Conferences, Webinars, and Workshops
- Assessment of Outreach and Progress Implementing Research Results

#### **1.1.5 Collaboration**

The ABC-UTC is a consortium of FIU (as lead university) located in Miami, Florida (Region 4); ISU located in Ames, Iowa (Region 7); UNR located in Reno, Nevada, (Region 9); OU located in Norman, Oklahoma (Region 6); and UW located in Seattle, Washington (Region 10). This structure will foster collaboration among experts in various areas of ABC and will result in wider dissemination of results. In addition to the partnerships that occur through individual projects and the pooled-fund program, ABC UTC will facilitate external collaboration through the Advisory Board and Advisory Panels consisting of external industry and US and State Transportation members.

**Partnership with Government Agencies:** The existing ABC-UTC already has a strong working relation with AASHTO SCOBs T-4, T-3 and T-11, FHWA, TRB ABC Subcommittee, and NCHRP, and these relationships will expand and continue.

Communication capabilities already in place will allow for remote control and operation of experimental work conducted at any or all partner university facilities. Such real-time viewing, control, and data manipulation is just one example of how the partner universities will work collaboratively.

The requirements for all partner universities for effective collaboration includes:

- Linkage among Research, Education, Workforce Development and Technology Transfer Activities
- Working with Minority-Serving Institutions
- Advisory Boards and Committees
- Metrics for Measuring Collaboration Success

### 1.1.6 Diversity

FIU, the lead university, is a Minority Serving Institution and Hispanic Serving Institution. With a current enrollment of approximately 55,000 FIU is among the top 10 largest public universities in the U.S. and **annually grants more than 11,000 BS, MS, and PhDs to Hispanic students. FIU also has an R1 Carnegie Classification**, which is the highest research activity rating universities can achieve. FIU has an established national reputation for excellence in Accelerated Bridge Construction and has an excellent Transportation Engineering program. Additionally, the proposed consortium is diverse in ways beyond the call of the RFP. Specifically, 1) the consortium is made up of universities in large (Miami, Seattle), medium (Reno), and small (Ames and Norman) population areas; 2) the consortium encompasses the Eastern (FIU), Midwest (ISU and OU), and Western (UNR and UW) regions of the United States; 3) The consortium covers both seismic (UNR, UW) and non-seismic regions (FIU, ISU, and OU) and 4) The consortium is multi-disciplinary, including both engineering (construction, structural, geotechnical, transportation and safety) and non-engineering (policy and management) disciplines. Further, FIU contributes ABC, ITS, and construction engineering expertise. Through ABC-UTC activities, FIU will provide one of the best platforms for consortium member universities and **other anticipated UTCs** to attract qualified minority students to their graduate programs. OU has a large Native American student enrollment and provides opportunities for consortium members to attract Native American students. FIU also houses the Center for Diversity in Engineering and Computing (CDEC). The goals of the CDEC are to increase the overall number of students pursuing engineering careers and to increase the proportion of students from traditionally underrepresented populations in the overall number of students who pursue an engineering degree. The proposed ABC-UTC will work closely with the CDEC and take full advantage of the CDEC's expertise and the various outreach programs it has developed. Currently, the CDEC has several ongoing programs targeting elementary, middle, and high school level students.

Over the last twelve years, the CDEC has been focused on increasing the flow of traditionally underrepresented ethnic/gender groups and students with disabilities into the engineering and computing pipeline. At the K-12 level, the Center implements programs such as summer and academic enrichment programs, tutoring services, teacher training, mentorships, career/college/financial awareness seminars, dual enrollment, counseling services, parental workshops and physical fitness. Other programs such as the Florida-Georgia Louis Stokes' Alliance for Minority Participation (FGLSAMP) provide many FIU

STEM students with need/merit-based scholarships and opportunities to conduct research and receive faculty mentoring. These and other activities are supported by various grants from the U.S. Department of Education, NSF, Motorola Foundation, Miami-Dade County Public Schools, Miami Children's Trust, the Caterpillar Foundation, Office of Naval Research, and others.

The Center's Summer Transportation Program recruits 40 middle school students and engages them in a five-week summer program consisting of a host of activities designed to prepare and inspire them to pursue careers in the design, operation, safety and optimization of modern land, sea, space, and air transportation systems.

Specific activities proposed for the proposed ABC-UTC will include: 1) adapting and modifying the outreach materials from CDEC for transportation careers and targeting the materials to K-12 and undergraduate student groups via websites and social media such as Facebook and Twitter; 2) offering fellowships that specifically target traditionally underrepresented students; 3) providing funding to support campus visits of prospective minority students; and 4) making presentations on transportation careers at major minority institutions and conferences.

OU highly values diversity and inclusion, and the university's Gallogly College of Engineering has full-time staff to organize and engage in activities targeted toward attracting and retaining minority students. Located in the heart of the Native American Country, Native American outreach is one of OU's strengths. The outreach activities include summer camps and summer bridge and site visits.

One of the measures of success in ABC-UTC diversity activities will be the number of minority students admitted from FIU into the undergraduate and graduate programs of ABC-UTC consortium member universities.

## **1.2 What was accomplished under these goals?**

### **1.2.1 Research**

#### **Development of Operation Manual**

Based on the earlier feedback from participants, the operation manual was modified and distributed in 2017. In our annual ABC-UTC meeting preceding the ABC conference in December 2017 the operational manual was presented for annual review to the advisory board and partner universities. This document is a living document and will be reviewed and refined at least once a year.

#### **Selection of Research Topics for Cycle 1, 2017-2018**

In this period based on the input from the advisory board and partner universities research topics were proposed and assigned to the various partner universities. Proposal from all PI's were collected and distributed amongst the advisory board for their feedback.

The proposed topics are as follows:

1. Development of Guide for Selection of Substructure for ABC Projects
2. Envisioning Connection Detail for Connecting Concrete Filled Tube (CFT) Columns to Cap Beam for High Speed Rail Application
3. Field Demonstration-Instrumentation and monitoring of Accelerated Repair Using UHPC Shell
4. Innovative Foundation Alternative for High Speed Rail Application
5. Accelerated Repair and Replacement of Expansion Joints
6. Bidding of Accelerated Bridge Construction Projects: Case Studies and Consensus Building
7. Contracting Methods for Accelerated Bridge Construction Projects: Case Studies and Consensus Building
8. Identify the Risk Factors That Contribute to Fatalities and Serious Injuries and Implement Evidence-Based Risk Elimination and Mitigation Strategies
9. Innovative Foundation Alternative for High Speed Rail Application
10. More Choices for Connecting Prefabricated Bridge Elements and Systems (PBES)
11. Development of Guide for Selection of Substructure for ABC Projects
12. Rapid Retrofitting Techniques for Induced Earthquakes
13. New Seismic-Resisting Connections or Concrete-Filled Tube Components in High-Speed Rail Systems
14. Performance Evaluation of Structural Systems for High Speed Rail in Seismic Regions

The proposals were approved and PIs were informed of their project approval. Research work began on these projects.

### **1.2.2 Leadership**

Several of the partner universities faculty members and students serve on national committees, panels and other volunteer positions.

### **1.2.3 Education and Workforce Development**

During the previous reporting period industry representatives and faculty from the partner universities were identified. A preliminary list of education and workforce development tasks were identified for pursuit in future cycles. This list will be re-evaluated and several items will be selected to be initially pursued. The list is broken down into the four primary groups that will be targeted through the education and workforce development program: K-12, undergraduate students, graduate students, and young professionals.

#### **K-12 Students and Teachers**

1. Summer activities (websites are of past activities at FIU)
  - a. K-12 teacher workshops (<https://abc-utc.fiu.edu/education/teacher-workshop/>)

- b. Student camps (<https://abc-utc.fiu.edu/education/fius-summer-transportation-camp/>)
  - c. Family camps (parent / child; grandparent / child) (<https://abc-utc.fiu.edu/2017-parentchild-bridge-engineering-summer-camp/>)
- 2. Partnerships with Local Organizations
  - a. Miami-Dade Public Library System – partner with after school activities / programs for kids in STEM
  - b. Boy Scouts – create some ABC patch that can be earned through some ABC-related activity
  - c. Network for Teaching Entrepreneurship (NIFTY)
- 3. ABC museum exhibit – mobile hands-on museum exhibit
- 4. Video competition – give K-12 students the opportunity to create and submit videos to be entered in video competition and posted on website
  - a. How your life has been impacted by construction traffic delays?
- 5. Bridge building competition – balsa wood bridge or origami bridge competition with an ABC component; similar competitions have been conducted during summer camp activities
- 6. Workshop/lecture for kids at local high school – visit local high schools to talk about ABC and introduce students to bridge engineering

### Undergraduate Students

- 1. Industry internships for undergraduate students (partial match from company and ABC-UTC)
- 2. ABC-UTC Student Chapter (or branch under ASCE or ACI Student Chapters)
- 3. ABC Seminar Series – monthly seminars in person and webcast given by ABC industry experts
- 4. Research experience for undergraduate students – hire undergraduate students to work on ABC-UTC research projects

### Graduate Students

- 1. ABC modules – create ABC-related course modules designed to be implemented in specific courses (e.g. Advanced Concrete Design, Bridge Design, etc.)
- 2. Industry sponsors for student fellowships and travel scholarships
- 3. Graduate research assistantships – hire graduate students to work on ABC-UTC research projects
- 4. Mentorship program – partner graduate students with industry mentors to help students transition from university to industry
- 5. Graduate student exchange for research projects – graduate students go to partner university to complete research project; graduate students from other universities come to ABC-UTC universities to work on ABC-UTC projects
- 6. Dissertation stage, implementation-based internships – partner students with a company or agency that is interested in implementing their ABC-UTC research;



students will have a one-semester internship to help the company or agency with implementation

### Young Professionals

1. Online ABC Certification Program – certification program to train designers and contractors in different aspects of ABC
2. Online Summer Professor Workshop – develop resources for professors to implement in their courses and then provide training on how it is envisioned to be implemented (“ABC in a Box”)
3. ABC Short Course – one day to one-week course introducing practicing engineers to ABC
4. DOT Introduction Materials – create training materials for DOTs to give to their young engineers

#### **1.2.4 Technology Transfer**

We are in the process of developing educational material and methods of delivery for implementing ABC at the state DOT agency level. We are in communication with FHWA and several DOT’s. We believe that this initiative will be one of our most effective means to promote ABC at a national level.

Additionally, efforts are on the way to host the 2019 International Accelerated Bridge Construction Conference: including automation, service life and ultra-high performance concrete. This conference will be sponsored by the ABC-UTC, will be held on December 12-13, 2019 in downtown Miami, Florida, with pre-conference workshops on December 11. This conference will be a great way to promote, educate and share information on ABC and new technologies to various state DOT’s, industry professionals, students and the public as a whole.

#### **1.2.5 Collaboration**

Collaboration among partner universities and advisory board members continue on an ongoing basis for the areas of research, technology transfer and education and workforce development.

#### **1.2.6 Diversity**

Nothing to report.

#### **1.2.7 How have the results been disseminated?**

Nothing to report.

#### **1.2.8 What do you plan to do during the next reporting period to accomplish the goals?**

Expected highlights of the next reporting period include:

- Selection of cycle 2 research topics
- Implementation of Education and Workforce Development activities

- Planning for the International ABC Conference, December 2019
- Monthly webinars and other related technology transfer activities
- Quarterly research seminar and semi-annual research day
- We are working with California High Speed Rail Authorities, Illinois Tollway Authorities and New Mexico DOT to develop joint research projects.

## 2 PRODUCTS

### 2.1 Publications, conference papers, and presentations

Nothing to report.

### 2.2 Website and other Internet Sites (Twitter, Facebook,)

**ABC-UTC Website (<https://abc-utc.fiu.edu/>):** The ABC-UTC website will continue to be upgraded and updated on an ongoing basis.

All social media outlets have been created and is updated on an ongoing basis, such as:

- Twitter
- Facebook:
- Instagram
- YouTube
- LinkedIn

### 2.3 Technologies or techniques

Nothing to report.

### 2.4 Inventions, patent applications, and/or licenses

We have developed the concept of, “ABC made conventional” that is believed to make a paradigm shift in ABC.

### 2.5 Other products

Nothing to report.

## 3 PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS: Who has been involved?

### 3.1 What organizations have been involved as partners?

- Atorod Azizinamini, Florida International University
- Ahmad Itani, University of Nevada, Reno
- Mohamed A. Moustafa, University of Nevada, Reno
- Brent Phares, Iowa State
- Terry Wipf, Iowa State University
- John Stanton, University of Washington

- Musharraf Zaman, The University of Oklahoma University

### **3.2 Have other collaborators or contacts been involved?**

The ABC-UTC has an Advisory Committee that provides recommendations on ABC-UTC operations. The ABC-UTC also has advisory boards that provide recommendations under each of its focus areas of Research, Workforce Development, and Technology Transfer. Additionally, advisory panels and committees make recommendations on specific projects or activities. The members of the Advisory board can be found by visiting <https://abc-utc.fiu.edu/about-us/advisory-members/>.

## **4 IMPACT: What is the impact of the program? How has it contributed to transportation, education, research, and technology transfer?**

### **4.1 What is the impact on the development of the principal discipline(s) of program?**

The ABC-UTC is taking a national lead in ABC area and has established a very good working relation with FHWA and AASHTO T-4 that is responsible for developing the national roadmap for State DOTs for implementing ABC. The Director of ABC-UTC was also elected to be liaison between the newly formed TRB ABC committee and ABC-UTC. These connections and activities are allowing ABC-UTC to better fill the knowledge gap, especially in the research and workforce development areas. ABC-UTC has also made major accomplishments in developing a close working relationship with State DOTs. Twenty-Six States have Co-sponsored the 2017 National ABC Conference. Thirty-two State DOTs are sponsoring 2015 National ABC Conference and plans are for having the next conference in 2019. The State DOT engineers of sponsoring State DOTs work very closely with ABC-UTC. The connection created with State DOT bridge engineers will greatly facilitate the implementation of ABC-UTC work.

### **4.2 What is the impact on other disciplines?**

ABC-UTC has identified research areas that will help the ABC cause and that falls outside the mission of ABC-UTC. In coming months, we will be contacting other UTC for developing collaborative work in these areas.

### **4.3 What is the impact on physical, institutional, and information resources at the University or other partner institutions?**

The university has provided 250k to construct part of a facility to test large scale specimens. In addition, FIU has purchased state of the art testing equipment at a cost of 500k which will be installed by October 2018.

### **4.5 What is the impact on technology transfer?**

The ABC-UTC monthly webinars are proving to be the most effective means of transferring the

knowledge to the profession. Having more than 4000 bridge professional participate in these monthly webinars are unparalleled. The 2017 National ABC conference was co-sponsored by 32 state who actively participated in this event. These activities are providing opportunities for effective communications with State DOTs and bridge professionals, making the task of Technology transfer much easier.

#### **4.6 What is the impact on society beyond science and technology?**

Increasing safety, enhancing mobility, being environmentally responsible, building bridges that are resilient and sustainable are important consequences of using ABC. The major goal of ABC-UTC is to make the ABC the method of choice for bridge replacement and retrofit and in future to call it BC. This, in turn, will improve the mobility and save the society in many different ways. One of the most important contributions of ABC to society is reducing the number of accidents and therefore significantly enhancing the safety. A single accident could cost taxpayers millions in litigation and legal expenses.

## **5 CHANGES/PROBLEMS**

### **5.1 Changes in approach and reasons for change**

Nothing to report.

### **5.2 Actual or anticipated problems or delays and actions or plans to resolve them.**

Nothing to report.

### **5.3 Changes that have a significant impact on expenditures**

Nothing to report.

### **5.4 Significant changes in use or care of human subjects, vertebrate animals, and/or Biohazards**

Nothing to report.

### **5.5 Change of primary performance site location from that originally proposed**

Nothing to report.

## **6 Additional information regarding Products and Impacts**

Nothing to report.