Program Progress Performance Report
University Transportation Centers

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Table of Contents

1. ACCOMPLISHMENTS: What was done? What was learned?

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

- Ongoing update of the Operation Manual

We continue to update the Operation manual as needed to best fit our goals and objectives.

- Selection of Research Topics for Cycle 2, 2017-2018

In this period based on the input from the advisory board and partner universities research topics for Cycle 2 were proposed and assigned to the various partner universities. All PI's are currently working on their proposals and have a deadline of October 19th to submit.

The proposed topics are as follows:

1. Development of non-proprietary UHPC mix, with mix designed to achieve set structural and durability properties. Each partner university participating should have a separate project. All projects must be connected and coordinated by one university.

2. Performance of existing ABC projects – One university should develop protocol and each University inspect two existing bridges.

3. Synthesis of available contracting methods for ABC and their descriptions, using case studies.

4. Using case study to develop cost of ABC projects by types and region. This is not comparing cost of conventional construction to ABC approach. It is simply the provide information on total cost of existing ABC projects. Case studies should consider ABC types and region.

5. Dynamic effects during slide-in, SPMT move and modular pre-fabricated elements. This project is to follow up on recently NCHRP project that was completed and re-visiting the recommendations made.

6. Synthesis of available methods for repair of ends of prestressed girders and development of UHPC based guideline approach

7. Rapid Retrofitting for Tsunami-Resistant Bridges – This project also can cover the strengthening of bridge columns against truck crash

8. Development of ABC course modules - FIU will coordinate the development of the courses – Suggest courses that you can develop

9. UHPC based methods for retrofitting existing bridges

10. Alternative UHPC based ABC connections- Seismic and non-seismic

11. connections for connecting precast columns to cap beam or foundation

12. Automation in construction using robotics and 3D printing

- Technology Transfer Plan

As per the new requirement, we have drafted a technology transfer plan and submitted it to the USDOT. Feedback was received and we are currently making the required changes recommendations.

- Progress of current research projects

Following table provides a list of research projects, research advisory panel members for each project and progress made in the project during the reporting period.

Project #	Project Title	Principal Investigator	Progress (April 1, 2018 – September, 30 2018)
FIU-	Development of Guide for Selection of Substructure for ABC Projects	Armin Mehrabi	A comprehensive literature review was conducted and the different components of ABC bridge was identified. The ABC components are categorized into superstructure, substructure, and foundation. Also, preparing the questionnaire has been started.
FIU-	Envisioning Connection detail for Connecting Concrete Filled Tube (CFT) columns to cap beam for High Speed Rail Application	Atorod Azizinamini	The connection details are developed. Experimental and numerical work to follow.
FIU-	Field Demonstration-Instrumentation and Monitoring of Accelerated Repair Using UHPC Shell	Kingsley Lau & Atorod Azizinamini	Plan is completed. Vendor to instrument the bridge is identified. In the process of signing contract with vendor.
FIU-	Innovative Foundation Alternative for High Speed Rail Application	Seung Jae Lee	This project is a heavy collaboration with FIU and UNR where innovative foundation retrofit using micro-piles will be applied for high speed rail infrastructure. The team have identified potential HSR bridge prototype and is currently developing a detailed finite element model to perform seismic analysis with and without the innovative foundation retrofit.
ISU	Accelerated Repair and Replacement of Expansion Joints	An Chen	The literature review, is complete. The review focused on failure modes of commonly used expansion joints, repair methods of expansion joints, and replacement of expansion joints. Different concrete removal methods were studied, such as conventional mechanical methods (saw cutting/pneumatic hammering) and hydrodemolition. Additionally, concrete mixes with high-early-strength properties, such

Project #	Project Title	Principal Investigator	Progress (April 1, 2018 – September, 30 2018)
			as UHPC, elastomeric concrete, and magnesium phosphate cement, were reviewed. The next task focuses on further investigation on the advantages and disadvantages of demolition methods and high-early-strength mixes in an accelerated construction context. The most promising demolition methods investigated so far are hydrodemolition and saw cutting.
ISU	Bidding of Accelerated Bridge Construction Projects: Case Studies and Consensus Building	Katelyn Freeseman	In conjunction with the literature review, the ABC-UTC project database is being used to identify ideal candidates for case studies to garner further information. The project team has identified preliminary case study candidates and is currently creating a survey to send to state DOTs for further information collection. Case study data will be obtained via in person interviews whenever logistically possible. Two interviews were performed regarding 4 projects identified for possible case studies. These interviews were conducted with the Minnesota DOT and the Indiana DOT. Additional case studies will be explored, which include an on-going project in Memphis utilizing CMGC for ABC, as well as an additional state agency interview with the Tennessee DOT.
ISU	Contracting Methods for Accelerated Bridge Construction Projects: Case Studies and Consensus Building	Katelyn Freeseman	Information collection is underway and a literature review is in progress.
UNR	Identify the Risk Factors That Contribute To Fatalities and Serious Injuries and Implement Evidence-Based Risk Elimination and Mitigation Strategies	Mohamed Moustafa	Collaboration with the transportation group at UNR has been planned to collect and process data for traffic safety associated with bridge construction in one or two projects.
UNR	Innovative Foundation Alternative for High Speed Rail Application	Mohamed Moustafa	This project is a heavy collaboration with FIU and UNR where innovative foundation retrofit using micro-piles will be applied for high speed rail infrastructure. The team have identified potential HSR bridge prototype and is currently

Project #	Project Title	Principal Investigator	Progress (April 1, 2018 – September, 30 2018)
			developing a detailed finite element model to perform seismic analysis with and without the innovative foundation retrofit.
UNR	More Choices for Connecting Prefabricated Bridge Elements and Systems (PBES)	Mohamed Moustafa	Polymer concrete has been identified as an alternative material to replace UHPC for prefabricated deck panel joints. An experimental program has been developed to comprehensively characterize polymer concrete behavior in tension and full scale deck panel tests will be conducted. Construction of full-scale deck panels is in progress.
OU	Development of Guide for Selection of Foundation for ABC Projects	Musharraf Zaman	During the last reporting period (April 1st to September 30th, 2018), an outline for developing guidelines for substructure and foundation by ABC method has been finalized with the help of FIU team working on this project. A literature review has been conducted focusing on the design and construction of foundation by ABC techniques. The state-of-the-art construction procedures/practices for foundations by different states and agencies are being reviewed and their limitations are being documented. Also, the literature review relates to the current evaluation techniques for existing substructures and foundations and problems associated with the evaluation techniques. A survey questionnaire is being prepared to document the current practices of foundation design and construction used by different agencies.
OU	Rapid Retrofitting Techniques for Induced Earthquakes	Scott Harvey	During the last period (April 2018 – September 2018), ground-motion accelerograms from induced earthquakes in Oklahoma during 2016 were compiled. These accelerograms were then processed to extract traditional intensity measures (PGA and Sa), as well as cumulative demand metrics (stress cycle counts and ranges). A framework to incorporate the cumulative demand into bridge analysis was developed, called a fatigue damage index (FDI). A case study is currently underway which involves modeling a “typical” Oklahoma bridge (3-span, PC-girder span bridge) and assessing the fidelity of FDI as a cumulative damage indicator.
UW	New Seismic-Resisting Connections or Concrete-Filled Tube Components	Dawn Lehman	The UW team, in collaboration with a research team at FIU, is studying new methods to directly connection CFT or RC piers (column) to CFT

Project #	Project Title	Principal Investigator	Progress (April 1, 2018 – September, 30 2018)
	In High-Speed Rail Systems		piles. The team is migrating the finite element analysis models from Abaqus to LSDyna. This change will enable simulation of non-ductile mechanisms including pullout and bond failure using recent advancements in the cumulative plasticity damage concrete model, which is now available in LSDyna. Current work is evaluating the values of important energy-based material parameters including fracture and compressive energies. The properties are used to validate the model with prior CFT and RC column to foundation connection tests to ensure accurate simulation of ductile and non-ductile mechanism.
UW	Performance Evaluation of Structural Systems For High Speed Rail in Seismic Regions	John Stanton	The team has begun to review high-speed rail systems throughout the world to identify those who terrain and seismic exposure are most similar to those faced by the California high-speed rail authority. The team has also had discussions with the California high-speed-rail engineers to exchange information on: (1) research capabilities within the ABC-UTC team, and (2) unresolved challenges faces for the rail authority.

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, several meetings were held with the Workforce Development Advisory Board (WDAB). The WDAB discussed workforce development tasks to pursue during the next year. Short 1 to 3 page needs statements were developed for each of the ideas. These needs statements outline the objective of each task and the work required to complete each task. The process being followed for the selection of the WD tasks is outlined in the Operation Manual for the center (see §3.6). The preliminary list of ideas with corresponding objectives are:

1. **Engineering First (K-5 Curriculum)**: This is a four-week engineering module with daily one-hour lessons that teachers can use in their K-5 classrooms. This task will include development and refinement of the curriculum and training and enabling teachers to implement the curriculum in their classroom.
2. **Community Outreach through Public Library**: This task involves partnering with public libraries to develop ABC and bridge engineering-related activities for after-school and weekends. Materials will be developed to be placed on the website and students at partner schools will help librarians run the activities.
3. **Community Outreach through K-12 Schools**: This task is similar to the outreach through the public library, only the focus will be on K-12 schools. These activities will be shorter than the Engineering First curriculum and have more emphasis on Grades 6 to 12.
4. **Parent/Child Bridge Engineering Camp**: This three-day camp aims to expose children of parents with non-engineering backgrounds to bridge engineering and equip families to continue to explore bridge engineering at home. The logistics of the camp will be formalized by FIU for partner schools and outside parties to adopt.
5. **Development of ABC Game**: This task will involve developing a printable board game that teaches ABC concepts to students. The board game will be made available for teachers to print for free from the center's website and will be used in the community outreach activities.
6. **Development of 3D Models**: Many schools and libraries now have 3d printers available, but are looking for new things to print. This task will involve developing 3d models of bridges using ABC concepts that can be printed using standard 3d printers. These models will be uploaded on the center's website for free download and will be used in the community outreach activities.
7. **Development of Compilation of ABC Training**: The objective of this task is to create a web-page compiling available training materials related to ABC and bridge engineering. This resource can be used by companies and DOT's to teach young engineers about ABC.
8. **Development of Career Path Models for Craft Workers**: The objective of this task is to identify skilled labor positions related to ABC that have shortages of workers and develop materials laying out possible career paths and training required to pursue these degrees to help recruit more K-12 students into these fields.

The next four tasks are a continuation of previous WD tasks conducted by the center.

9. **Continuation: Quarterly Research Seminar**: This is an online webinar on a research project that is presented by a graduate student and the principal investigator for the project. This task helps to develop the graduate student and disseminate research findings to practitioners.
10. **Continuation: Ready, Set, Build: Bridge Competition**: This is an annual balsa wood bridge building competition for K-12 students and families that is currently hosted by Iowa State University.

11. **Continuation: Go! ABC – part of Go! eZine for Teenagers**: This is an online magazine (e-zine) for teens on education and career opportunities in transportation. Five ABC-related articles will be published each year by the partner universities. These will help to educate K-12 students on ABC and ABC research.
12. **Continuation: Tom Maze Transportation Seminar**: This is a weekly transportation seminar for graduate students during the spring semester hosted by ISU. Several presentations each semester will be delivered by ABC-UTC researchers.

The final selection of WD tasks will be made during the annual in-person meeting of the center's advisory board in November.

A new task matrix is being developed to help to connect the WD tasks to the overall Technology Transfer plan. The center wants to make sure that all its efforts are best aligned to achieve its central mission outlined in this plan.

A tentative matrix of ongoing WD tasks is provided on the following page. This matrix will be modified based on review by the WDAB.

The following table lists different tasks related to workforce development (WD), provides a brief description of each task, and identifies the lead institution for each task. The outputs, outcomes and impacts and the performance measures and goals are also described to be consistent with the Technology Transfer Plan.

WD "outputs" (OP) are defined as products developed in the WD task. WD "outcomes" (OC) are the changes made in the stakeholders' environment (e.g. change in classroom curriculum) as a result of the use of the WD output. WD "impacts" (I) are the effects on student education (e.g. content, experience, etc.) of the adoption of the WD outputs. Note that a star (*) is included in the label if they line up directly with Technology Transfer outputs.

Other notes are made referencing where the information is gathered or where the activity is described.

Task #	Brief Description of Task	Lead Institution	Outputs, Outcomes, Impacts	Performance Measures and Goals	Notes
WD-1	**Student Education and Research Assistantships:** Each ABC-UTC consortium member will be expected to mentor a minimum of one graduate student for approximately each $75,000 in project work and provide research assistantship opportunities for graduate students.	ALL	• Graduate student development (OP*)	• # graduate students working on ABC-UTC projects (***Goal***: 1 per research project)	Reported on WD Activity Reporting Sheet (§A)
WD-2	**Undergraduate Internships:** Each ABC-UTC consortium member will be expected to support undergraduate students on research projects.	ALL	• Undergraduate student development (OP*)	• # undergraduate students working on ABC-UTC projects (***Goal***: 1-2 per year at each university)	Reported on WD Activity Reporting Sheet (§A)

Task #	Brief Description of Task	Lead Institution	Outputs, Outcomes, Impacts	Performance Measures and Goals	Notes
WD-3	**Student Publications:** Each ABC-UTC consortium member will be expected to support students to publish and present their work.	ALL	• Graduate student development (OP*) • Publications (OP*) • Presentations (OP*) • Junior Faculty Development (OP*)	• # publications (***Goal***: ≥1 per research project) • # conference presentations (***Goal***: ≥1 per research project)	Reported on WD Activity Reporting Sheet (§B)
WD-4	**Travel Scholarships:** Each ABC-UTC consortium member will be expected to support students travel to conferences to present their work.	ALL	• Graduate student development (OP*) • Presentations (OP*)	• # travel scholarships provided (***Goal***: ≥1 per year at each university)	Reported on WD Activity Reporting Sheet (§C)
WD-5	**Mentorship Program** – Development of a mentoring program where students are put in direct contact with industry representatives who are active in the field of ABC.	ALL	• Graduate student development (OP*)	• # students and mentors participating in the program (***Goal***: all graduate students participating in program)	Procedure has been formalized in the Operation Manual (§3.4)
WD-6	**Research Seminars** – Each graduate student will be required to give a technical presentation at the conclusion of their research study. These presentations will be delivered electronically as part of the ABC-UTC technology transfer activities.	FIU (students from ALL participate)	• Graduate student development (OP*)	• # students presenting (***Goal***: all graduate students have opportunity to present) • # sites attending seminar (***Goal***: ≥400 sites per presentation)	Joint TT/Research task.

1.2.4 Technology Transfer (MARY LOU TO COMPLETE-INFO FROM 1.2.4 WAS WHAT WAS REPORTED LAST PERIOD)

During this reporting period, work continues to develop educational materials and methods of delivery for implementing ABC at the state DOT agency level. An example this reporting period is collaboration between the ABC-UTC, the Oklahoma DOT, the University of Oklahoma, and the FHWA Oklahoma Division in developing a half-day ABC workshop to be held in Oklahoma City during the next reporting period.

Work also continues to sponsor and host the International ABC Conference to be held in December 2019 in Miami, Florida. As of this reporting period 30 state DOTs have accepted the ABC-UTC's invitation to be non-financial co-sponsors of the event. Also during this reporting period the Call for Abstracts was opened, with program development to begin in the next reporting period.

Six Monthly Webinars were conducted during the reporting period. For these webinars the number of registered sites ranged from 750 to almost 1,400 with multiple participants at many of the sites. Two of the webinars were hosted in collaboration with SHRP2, a partnership between AASHTO, FHWA, and TRB. The other four webinars featured presentations by state DOTs highlighting their ABC projects.

The annual four-hour In-Depth Web Training was held during this reporting period. Featured was the Vermont Agency of Transportation's programmatic implementation of ABC. The training was well attended, with 330 registered sites participating in the six 40-minute modules.

The ABC-UTC website (https://abc-utc.fiu.edu/) was updated with the latest ABC-UTC research and workforce development activities. Also posted were the Monthly Webinar and In-Depth Web Training recordings and other documents. Archives were similarly posted for the April and July Research Seminars reported in the Workforce Development section of this report. Also, four completed ABC construction projects were added to the ABC Project Database after receiving approval from the bridge owners to have these projects posted on the open web. In addition, various other ABC events, news items, and details were posted.

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?

- Research Day held 8/31/2018 where the progress of each research project was presented by PI's to general audience (comprising of State DOTs, Industry, FHWA and other affiliates).

- Quarterly Progress Reports posted on website.

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:

- Project proposal for Cycle 2 will be completed and submitted for review to the Research Advisory Board (RAP)
- Subcontracts will be finalized and research projects to be initiated
- 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 will continue 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.

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 state DOTs Co-sponsored the 2014 National ABC Conference, thirty State DOTs co-sponsored the 2015 National ABC Conference, 32 state DOTs co-sponsored the 2017 National ABC Conference and to date 31 state DOTs have co-sponsored the 2019 International ABC Conference Including Automation, Service Life and UHPC to be held in December of 2019 at Hyatt Regency Hotel in Miami, FL. The State DOT engineers of sponsoring State DOTs work very closely with ABC-UTC director to develop the conference program. 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?
ABC technologies are increasingly being specified on bridge replacement projects as state DOTs and other bridge owners and their partners gain understanding and expertise in ABC. The ABC knowledge is expanding in part due to the large numbers of participants in the ABC-UTC conferences and the various ABC-UTC web activities, in addition to stakeholders' use of resources on the ABC-UTC website. Also, the close involvement of state DOT, FHWA, and industry partners in the ABC-UTC's Advisory Committee, Research Advisory Board, Workforce Development Advisory Board, and Technology Transfer Advisory Board is providing the exposure needed to understand the benefits of implementing ABC in their projects.

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.