



**UTC Semi Annual Progress Report
University Transportation Centers**

Submitted to U.S. Department of Transportation
Research and Innovative Technology Administration

Federal Grant Number 69A3551747121

Project Title ABC-UTC (Accelerated Bridge Construction –
University Transportation Center)

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Submission Date 10/29/2021

DUNS and EIN Numbers DUNS: 07-129-8814
EIN: 237047106

Recipient Organization Florida International University
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Grant Period 11/30/2016-9/30/2022

Reporting Period Start Date **04/01/2021**

Reporting Period End Date **09/30/2021**

Report Frequency Semi-annual (Report #9)

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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 grant was awarded in December 2016.

1.1 What are the major objectives of the program?

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 of ABC to the profession; develop a next-generation ABC workforce; 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 fixing 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 also contributes 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)". The major goals of the ABC-UTC program fall into six categories:

1.1.1 Research

Under this category, the ABC-UTC advances the frontier of ABC and fills knowledge gaps. Activities include research categories on 1) decision making; 2) durability, service life, and inspection of ABC bridges, 3) next generation of ABC bridge systems and methods; 4) ABC bridge systems and methods for mitigating extreme events and challenges created by climate change; and 5) high-speed rail (HSR) in seismic areas. All research categories are related to FAST Act in terms of 1) construction methodologies; 2) improving durability, preserving existing transportation system and environment; and 3) application of new advanced materials.

1.1.2 Leadership

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 solve remaining barriers to widespread implementation of ABC practices and the construction of long-lasting bridges. The research team members continue their leadership through professional publications, articles, media outputs, and conferences to

extend their leadership beyond the academic arena. The program also invests in young faculty to become future leaders in the area. The ABC-UTC demonstrates 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 are further strengthened through the ABC-UTC. FIU, ISU, UNR, UW, and OU offer graduate degrees, leading to M.S. and Ph.D. degrees in all general areas of civil engineering, including transportation engineering, structural engineering, and construction engineering. The quality of these programs is best evidenced by the many awards and recognition that their students have received in recent years. The objectives of the ABC-UTC include development of 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 ABC-UTC is the knowledge and leadership role that it plays in bridge engineering in terms of Technology Transfer. The keys to the FIU's ABC-UTC success in Technology Transfer are: a) solid and extensive knowledge of ABC; b) a strong focus (ABC); c) coordination of its activities with AASHTO, FHWA, DOTs, and consultants; d) identification of knowledge gaps, e) identification of bridge community needs; f) teamwork; 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 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 the 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 fosters collaboration among experts in various areas of ABC and results in the wider dissemination of results. In addition to the partnerships that occur through individual projects and the pooled-fund program, the ABC-UTC facilitates external collaboration through its overarching Advisory Committee, its focus area Advisory Boards, and its Research and Technology Transfer Advisory Panels, each consisting of external industry and US and state transportation members.

Partnership with Government Agencies:

The ABC-UTC has a strong working relationship with the AASHTO Committee on Bridges and Structures, including Technical Committees T-4 (Construction), T-3 (Seismic Design) and T-11 (Research); FHWA; TRB ABC Joint Subcommittee; and NCHRP; and these relationships are expanding and continuing. Established communication capabilities allow for remote collaboration on experimental work conducted at the five partner university facilities. Such real-time viewing, control, and data manipulation is just one example of how the partner universities work together.

The requirements for all partner universities for effective collaboration include:

- 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

- 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 consortium of universities is diverse. Specifically, 1) the consortium composes 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 (FIU, ISU, and OU) regions; 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 to ABC, Intelligent Transportation Systems (ITS), and construction engineering expertise.
- ABC-UTC activities: FIU provides one of the best platforms for consortium member universities and other UTCs to attract and retain qualified underrepresented students to their graduate programs. OU has a large Native American student enrollment and provides opportunities for consortium members to attract Native American students; it 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.
- One of the measures of success in ABC-UTC diversity activities is 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

- The ABC-UTC continues to update the Operation Manual as needed to best fit our goals and objectives.
- In this period all active research projects in Cycles 1, 2, 3 and 4 are ongoing.
- The ABC-UTC has a total of 68 funded research projects that cover all research areas mentioned in Section 1.1.1.
- Total of 23 research projects were completed to date (including 12 projects during this reporting period). Most of the outputs, including final report, 5-min video presentation, ABC-UTC Guide, and project data, were reported to the USDOT and are published online (<https://abc-utc.fiu.edu/research-projects/>)
- 2021 Research Day 1 was held on April 29, 2021. PIs made a total of 14 online presentations that introduced Cycle 4 projects to the public. The next Research Day will be held on November 4, 2021 and will focus on the progress of the same projects.
- Two quarterly Research Seminars (see table below) were presented during the reporting period, with the number of registered independent sites also highlighted. Many sites have multiple attendees, so the actual number of attendees is higher. Research Seminars continue to give exposure of our students to the industry.
- The ABC-UTC maintains a Memorandum of Understanding with the lightweight concrete industry.
- Conducting meetings with more than 30 state bridge engineers and to discuss the research needs in the area of accelerated bridge construction.
- The ABC-UTC developed a Memorandum of Understanding with Brazilian Company developing new construction materials.
- The ABC-UTC maintains a cooperative working relationship with PEER (Pacific Earthquake Engineering Research Center at the University of California at Berkeley California).

	Date	Research Seminar Title	Student(s) Presenter	# sites registered
1	7/30/2021	Behavior and Strength of UHPC in Shear	Danielle Voytko, (M.S.C.E, UW)	724
2	4/30/2021	Connections for Concrete-Filled Steel Tubes in Bridge Applications	*	725

* Dr. Charles Roeder presented as the student researcher on this project was unable to present

The following table provides a list of the research projects, with PI and the status of the project (Gray rows show completed project with final deliverable posted and sent to the USDOT).

Project #	Project Title	Principal Investigator	Status
FIU-2016-1-1	Development of Guide For Selection of Substructure for ABC Projects (Joint project with OU)	Armin Mehrabi & Hesham Ali	Completed Final Deliverables are posted

Project #	Project Title	Principal Investigator	Status
FIU-2016-1-2	Field Demonstration-Instrumentation and monitoring of Accelerated Repair Using UHPC Shell	Kingsley Lau	Completed Final Deliverables are posted
FIU-2016-1-3	Envisioning Connection Detail for Connecting Concrete Filled Tube (CFT) Columns to Cap Beam for High-Speed Rail Application (Joint project with UW)	Atorod Azizinamini	Completed. Final Deliverables will be posted in December. Final report is posted
FIU-2016-1-4	Innovative Foundation Alternative for High-Speed Rail Application (Joint project with UNR)	Seung Jae Lee	Completed. Final Deliverables are posted.
FIU-2016-1-5	Eliminating Column Formwork Using Prefabricated UHPC Shells: (Originally a subproject of "Envisioning Connection Detail for Connecting Concrete Filled Tube (CFT) Columns to Cap Beam for High-Speed Rail Application")	Atorod Azizinamini	Completed Final Report is posted
FIU-2016-2-1	Development of Non-Proprietary UHPC Mix (Joint project with all partner universities)	David Garber	Completed Final Deliverables will be posted in December. Final report is posted
FIU-2016-2-2	Performance of Existing ABC Projects - Inspection Case Studies (Joint project with all partner universities)	Armin Mehrabi	Completed Final Deliverables will be posted in December Final Report is posted
FIU-2016-2-3	Development of ABC Course Module- Available ABC Bridge Systems for Short Span Bridges	Armin Mehrabi	Completed Final Deliverables will be posted in December
FIU-2016-2-4	Optimization of Advanced Cementitious Material for Bridge Deck Overlays and Upgrade, Including Shotcrete	Islam Mantawy	65% Complete
FIU-2016-2-5	Robotics and Automation in ABC Projects: Exploratory Phase	Islam Mantawy	Completed Final Deliverables will be posted in December. Final report is posted
FIU-2016-2-6	Laminated Wood Deck System for Folded Plate Girder	Atorod Azizinamini	25% Complete
FIU-2016-2-7	Understanding Critical Impacting Factors and Trends on Bridge Design, Construction, and	Lu Zhang	Completed Final Deliverables are posted

Project #	Project Title	Principal Investigator	Status
	Maintenance for Future Planning		
FIU-2016-2-8	Complex Networks Perspectives Towards Accelerated Bridge Construction (ABC)	Arif Mohaimin Sadri	Completed Final Deliverables are posted
FIU-2016-3-1	Alternative Materials and Configurations for Prestressed-precast Concrete Pile Splice Connection	Armin Mehrabi	80% Complete
FIU-2016-3-2	Alternative Technical Concepts for Contract Delivery Methods in Accelerated Bridge Construction	Mohamed ElZomor	90% Complete
FIU-2016-3-3	Work Zone Safety Analysis, Investigating Benefits from Accelerated Bridge Construction (ABC) on Roadway Safety	Islam Mantawy	Completed Final Deliverables will be posted in December
FIU-2016-3-4	Use of UHPC in Conjunction with Pneumatic Spray Application and Robotic for Repair and Strengthening of Culverts- Phase I	Atorod Azizinamini	55% Complete
FIU-2016-3-5	Prefabricated Barrier System Utilizing UHPC Connections	Islam Mantawy	70% Complete
FIU-2016-3-6	Robotic Bridge Construction: Experimental Phase I	Atorod Azizinamini	65% Complete
FIU-2016-3-7	Rapid Repair and Retrofit of Timber Piles Using UHPC	Islam Mantawy	75% Complete
FIU-2016-3-8	Automated MFL System for Corrosion Detection	Atorod Azizinamini	60% Complete
FIU-2016-3-9	UHPC connection for SDCL steel bridge system	Atorod Azizinamini	Completed Final Deliverables will be posted in December
FIU-2016-4-1	Developing ABC Success Index to Support Contractors During Pre-Project Planning	Mohamed ElZomor	20% Complete
FIU-2016-4-2	Use of All Lightweight Concrete in Conjunction with UHPC Connection for Prefabricated Barrier System	Atorod Azizinamini	20% Complete
FIU-2016-4-3	Life-Cycle Cost Analysis of Ultra High-Performance Concrete (UHPC) in Retrofitting Techniques For ABC Project	Carlos M. Chang	40% Complete
FIU-2016-4-4	Integrated Flood and Socio-Environmental Risk Analysis for Prioritizing ABC Activities	Ali Ebrahimian	45% Complete

Project #	Project Title	Principal Investigator	Status
FIU-2016-4-5	Construction of Three Large-Scale Robots Capable of Constructing UHPC Shell, Repair of Culvert and Automated MFL	Anthony Abrahao	35% Complete
ISU-2016-1-1	Delivery Methods for Accelerated Bridge Construction Projects: Case Studies and Consensus Building	Katelyn Freeseaman	Completed Final Deliverables are posted
ISU-2016-1-2	Bidding of Accelerated Bridge Construction Projects: Case Studies and Consensus Building	Katelyn Freeseaman	Completed Final Deliverables are posted
ISU-2016-1-3	Accelerated Repair and Replacement of Expansion Joints	Brent Phares	Completed Final Deliverables are posted
ISU-2016-2-1	Development of Non-Proprietary UHPC Mix (Joint project with all partner universities)	Behrouz Shafei	98% Complete
ISU-2016-2-2	Performance of Existing ABC Projects- Inspection Case Studies (Joint project with all partner universities)	Katelyn Freeseaman	80% Complete
ISU-2016-2-3	Synthesis of available contracting methods	Jennifer S. Shane,	Completed Final Deliverables will be posted in December
ISU-2016-2-4	Development of Link Slabs: A Short Course Module	Behrouz Shafei	96% Complete
ISU-2016-3-1	Investigation of The Efficacy Of Helical Pile Foundation Implementation In Accelerated Bridge Construction Projects – Phase I	Justin Dahlberg	Completed Final Deliverables are posted
ISU-2016-3-2	Multi-Span Lateral Slide Laboratory Investigation: Phase 1	Katelyn Freeseaman	Completed Final Deliverables are posted
UNR-2016-1-1	Innovative Foundation Alternative for High-Speed Rail Application (Joint project with FIU)	Mohamed Moustafa	Completed Final Deliverables are posted
UNR-2016-1-2	Identify the Risk Factors That Contribute to Fatalities and Serious Injuries and Implement Evidence-Based Risk Elimination and Mitigation Strategies	Mohamed Moustafa	95% Complete Final Deliverables will be posted in December.
UNR-2016-1-3	More Choices for Connecting Prefabricated Bridge Elements and Systems (PBES)	Mohamed Moustafa	Completed Final Deliverables are posted.

Project #	Project Title	Principal Investigator	Status
UNR-2016-2-1	Development of Non-Proprietary UHPC Mix - Application to Deck Panel Joints (Joint project with all partner universities)	Mohamed Moustafa	99% complete
UNR-2016-2-2	Synthesis of Available Methods for Repair of Reinforced Concrete and Prestressed Concrete Bridge Girders	Mohamed Moustafa	Completed Final Deliverables are posted
UNR-2016-2-3	Performance of Existing ABC Projects - Inspection Case Studies	Mohamed Moustafa	35% Complete
UNR-2016-3-1	Quantitative assessment of soil-structure interaction effects on seismic performance of bridges with ABC connections	Elnaz Seylabi	50% Complete
UNR-2016-3-2	Investigating the Potential Applications of Elastomeric Polymers (Such As Polyuria And Polyurethane) For Accelerated Bridge Construction And Retrofit	Hamed Ebrahimian	55% Complete
UNR-2016-3-3	Application of Methacrylate Polymers for Seismic ABC Connections	Mohamed Moustafa	80% Complete
UNR-2016-4-1	Robust Methods for UHPC Early-Strength Determination and Quality Control for ABC	Mohamed Moustafa	50% Complete
UNR-2016-4-2	Towards Autonomous Drone-Based Dynamic and Seismic Response Monitoring of Bridges	Mohamed Moustafa	30% Complete
OU-2016-1-1	Development of Guide For Selection of Substructure For ABC Projects (Joint project with all partner universities)	Musharraf Zaman (Joint project with FIU)	Completed Final Deliverables are posted
OU-2016-1-2	Rapid Retrofitting Techniques for Induced Earthquakes	Philip Scott Harvey Jr.	Completed Final Deliverables are posted
OU-2016-2-1	Development of Non-Proprietary UHPC Mix (Joint project with all partner universities)	Royce W. Floyd	99% Completed
OU-2016-2-2	Development of ABC Course Module - The risk due to Induced Earthquakes and Accelerated Solution (under technology transfer activity)	Philip Scott Harvey Jr	Completed Final Deliverables are posted
OU-2016-2-3	Performance of Existing ABC Projects - Inspection Case	Musharraf Zaman	99% Complete

Project #	Project Title	Principal Investigator	Status
	Studies (Joint project with all partner universities)		
OU-2016-3-1	Service Life Design Guidance for UHPC Link Slabs	Royce Floyd	75% Complete
OU-2016-3-2	Development of User-friendly Tools and Decision-making Algorithms for Service Life Design of ABC Bridges	Shima Mohebbi	55% Complete
OU-2016-4-1	Design Guidance for UHPC Connections of Precast Girders Made Continuous for Live Load	Royce Floyd	25% Complete
OU-2016-4-2	Project Management Plans to Support Successful Delivery of Accelerated Bridge Construction Projects	Matthew Reyes	65% Complete
FIU-OU-UNR-2016-4-Collab1	Risk and Resilience of Bridges: Toward Development of Hazard-Based Assessment Framework, Research Needs, and Benefits of Accelerated Construction	Islam Mantawy-FIU Musharraf Zaman-OU Mohamed Moustafa-UNR	34% Complete
UW-2016-1-1	Performance Evaluation of Structural Systems for High-Speed Rail In Seismic Regions	John Stanton	Completed Final Deliverables are posted
UW-2016-1-2	New Seismic-Resisting Connections or Concrete-Filled Tube Components In High-Speed Rail Systems (Joint Project with FIU)	Dawn Lehman	Completed Final Deliverables are posted
UW-2016-2-1	Development of Non-Proprietary UHPC Mix - Evaluation of the Shear Strength of UHPC (Joint project with all partner universities)	Paolo Calvi	99% Complete
UW-2016-2-2	Development of ABC Course Module- Seismic Connections	John Stanton	35% Complete
UW-2016-2-3	Development of ABC Course Module - Design of CFST Components and Connections for Transportation Structures	Dawn Lehman	99% Complete
UW-2016-2-4	Performance of Existing ABC Projects - Inspection Case Studies (Joint project with all partner universities)	John Stanton	70% Complete
UW-2016-2-5	Tsunami Design Forces for ABC Retrofit	Marc Eberhard	75% Complete
UW-2016-3-1	Design Guidelines for ABC Column-to-Drilled-Shaft	Marc Eberhard	99% Complete

Project #	Project Title	Principal Investigator	Status
	Foundation Connections in High Seismic Zones		
UW-2016-3-2	Economic Pier-to-Pile Connections for Permanently Cased Shaft (CFST) Piles	Dawn Lehman	99% Complete
UW-2016-4-1	Exploring Fiber-Reinforced Polymer Concrete for Accelerated Bridge Construction Applications	Travis Thonstad	30% Complete
UW-2016-4-2	Impact of Construction Eccentricity on Direct Pier-to-Pile Connections for Permanently Cased Shaft (CFST) Piles	Dawn Lehman	20% Complete

1.2.2 Leadership

Several of the partner universities faculty members and students serve on national committees, panels, and other volunteer positions. Below is a listing of the centers Co-Directors and their leadership roles.

Atorod Azizinamini-FIU	Vasant H. Surti Professor of Civil Engineering; Director, Moss School of Construction, Infrastructure and Sustainability; Director, Accelerated Bridge Construction University Transportation Center (ABC-UTC); Director, Preeminent Institute for Resilient and Sustainable Coastal Infrastructure (InteRaCt).
Mary Lou Ralls Newman	Principal of Ralls Newman, LLC; ABC-UTC Director of Technology Transfer
Armin Mehrabi- FIU	Associate Professor in the Civil and Environmental Engineering Department of the College of Engineering and Computing. Director of Research, Florida International University
David Garber-FIU	Associate Professor, Civil and Environmental Engineering Department at Florida International University (FIU) and Director of Workforce Development, Florida International University
Islam Mantawy-FIU	Research Assistant Professor, Civil and Environmental Engineering Department at Florida International University (FIU) and Assistant Director for Research QA/QC
Terry Wipf- ISU	Professor, Civil Engineering Department Co-Director, Iowa State University
Brent Phares- ISU	Director of the Bridge Engineering Center, Iowa State University; Co-Director of the National Center for Wood Transportation Structures; Associate Director, Iowa State University Institute for Transportation
Mohamed Moustafa- UNR	Assistant Professor, Civil and Environmental Engineering Department, University of Nevada, Reno
John Stanton-UW	Professor, Civil and Environmental Engineering, University of Washington.
Marc Eberhard- UW	Professor, Civil and Environmental Engineering, University of Washington
Musharraf Zaman- OU	David Ross Boyd Professor and Aaron Alexander Professor of Civil Engineering; Alumni Chair Professor of Petroleum and Geological Engineering; Director, Southern Plains Transportation Center
K.K. Muralee Muraleetharan-OU	Kimmell-Bernard Chair in Engineering; David Ross Boyd; Presidential Professor of Civil Engineering and Environmental Science at OU; Associate Director of the National Institute for Risk and Resilience at OU.

1.2.3 Education and Workforce Development

The core Education and Workforce Development tasks continued during this reporting period. These are summarized in the below table.

Task #	Brief Description of Task	10/1/20 to 3/31/21
WD-1	Student Education and Research Assistantships: Each ABC-UTC consortium member is 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.	50 (FIU, UNR, ISU, OU, UW) MS/Ph.D. students have been supported
WD-2	Undergraduate Internships: Each ABC-UTC consortium member is expected to support undergraduate students on research projects.	9 (FIU, UNR, ISU, OU) Undergraduate students have been supported
WD-3	Student Publications: Each ABC-UTC consortium member is expected to support students to publish and present their work.	11 journal articles submitted, 13 journal articles published
WD-4	Travel Scholarships: Each ABC-UTC consortium member is expected to support students who travel to conferences to present their work.	There were no travel scholarships provided during this period. We anticipate scholarships will be reported in the next report.
WD-5	Quarterly Research Seminars: Selected graduate students are required to give a technical presentation at the conclusion of their research study. These presentations are delivered electronically as part of the ABC-UTC technology transfer activities.	There were 2 quarterly research seminars, with 1 student participating in the first one. Due to scheduling issues the graduate student was unable to deliver the presentation for the second research seminar. 1456 sites registered for the seminars

In the current period the following Education and Workforce Development activities were conducted:

- 2021 Professors' Workshop Series 1: The ABC-UTC held its first Professors' Workshop Series during August 10 to 20, 2021. The workshop series was designed for professors who teach structural engineering and want to incorporate ABC in their courses and others who already teach or would like to teach ABC in their organization. The attendees of the workshop were provided with resources (e.g., presentation slides) to help them implement what they learned into their classroom or office. An archive of the Professors' Workshop Series can be found at <https://abc-utc.fiu.edu/education/professors-workshop-series-archives/>.
- FIU Professor Lu Zhang, supported in the organization of She Builds Summer Camp, which aims to introduce construction-related topics to middle school or high school girls. The camp took place in August 2021.

- As part of the Engineering First! initiative, Iowa State University partnered with a local elementary school to develop customizable lesson plans for K-5 students that includes Next Generation Science Standards. They also developed an overview presentation with embedded videos of some activities to help interested teachers learn about the materials. The lesson plans are available at no cost on the ABC-UTC website.
- OU Engineering Days Summer Camp – In the month of June 2021 OU hosted a day long summer camp session with 29 high school students and 2 high school teachers from Oklahoma and surrounding states. This camp was conducted as part of the OU Boeing Engineering Days organized by the Gallogly College of Engineering. While the day-long camp was focused on civil engineering in general with some discussion of Environmental Engineering and Environmental Science, the majority of the day was spent on activities focused on structural engineering and designed to progress through concepts required for bridge design and accelerated bridge construction. One graduate student and two undergraduate students assisted OU Dr. Royce Floyd in the preparation and execution of the camp.

In addition to these core Education and Workforce Development activities, the following activities are being planned:

- Additional sessions for the Professors' Workshop Series are being planned based on feedback from the initial series.
- ABC Coloring Book – We are in the initial stages of developing an ABC-related coloring book to help introduce children to basic ABC concepts.
- 3D Printing Model Development – partnering with Miami Beach Urban Studios on 3D printing and model development.
- Public Library Outreach – the ABC-UTC is continuing discussions with the public library system (MDPLS) to explore future opportunities for collaboration.

We continue to evaluate future 2021 WD based on the current situation with COVID-19. The ABC-UTC continues to host all their digital K-12 resources at <https://abc-utc.fiu.edu/education/k-12-resources>.

1.2.4 Technology Transfer

During this reporting period, planning continued for the virtual 2021 International Accelerated Bridge Construction Conference to be held in December. The decision was made to have a Call for Awards for international projects in addition to the Call for Abstracts. The Call for Abstracts and Awards publication was developed and distributed. The slate of keynote speakers was developed, and invitations were sent. Abstracts were received. The draft program was developed and submitted to the Conference Planning Committee for their review and input.

The ABC-UTC Director attended the virtual 2021 American Association of State Highway and Transportation Officials (AASHTO) Technical Committee for Construction (T-4) Annual Meeting in July 2021 and presented an update on ABC-UTC activities per their request.

The 2021 In-Depth Web Training was held on September 7, 2021. This year's free training featured the Connecticut DOT's programmatic implementation of ABC. The 4-hour training consisted of six 40-minute modules, each with a 30-minute presentation and 10-minute Q&A session. The training was well attended, with 405 registered sites.

The in-person half-day Midwest/Great Plains Regional Contractor/Owner Collaboration on ABC Programs Workshop was held in Nebraska on September 30, 2021. The invitation-only workshop was well attended. The workshop summary report will be produced in the next reporting period.

Six Monthly Webinars were conducted during the reporting period. For these free webinars, the number of registered sites ranged from 772 to 1,054 although the web room software limit is 1,000 participants. Three presentations were given by bridge owners (Idaho DOT, Nebraska DOT, and South Dakota DOT) and their industry partners, featuring design and construction details and lessons learned on state-of-the-art ABC technologies incorporated in recently completed highway bridge projects in their states. One presentation focused on a Michigan railroad berm project presented by the project manager and precast concrete element supplier. One presentation focused on FHWA's A-GaME geotechnical tools for ABC applications, presented by FHWA representatives. Lastly, one presentation focused on how contractors can help owners deliver better ABC projects, presented by a panel of bridge owner and construction contractors.

The ABC-UTC website (<https://abc-utc.fiu.edu/>) was updated with the latest ABC-UTC research and workforce development activities. Included were postings of documents for the Monthly Webinar, Research Seminar, Research Day, and In-Depth Web Training Archives. Also, work was initiated to upgrade the ABC Project and Research Databases to a more robust and secure platform. In addition, various other ABC events, news items, and details were posted on the website.

1.2.5 Collaboration

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

1.2.6 Diversity

The ABC-UTC is committed to advancing diversity, inclusion, and equity. Our students come from various demographics and identify with many cultural groups. Some of the cultural groups are Asian or Pacific Islander, Black or African American, Hispanic, Native American, White, etc. In the recent period we graduated a total of 4 students, 2 females and 2 males.

1.2.7 How have the results been disseminated?

- Research Day 1 was held on 4/29/2021 where the progress of each 2016 Cycle 4 research project was presented by PIs to a general audience (comprising of State DOTs, Industry, FHWA, and other affiliates)
- Quarterly Progress Reports posted on the website
- Publications
- Presentations
- Conference Proceedings
- Webinars, Research Seminars, In-depth Web Training

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:

- Completion of 10 additional research projects currently near completion
- Implementation of Education and Workforce Development activities pending COVID-19
- Planning of the Summer 2023 CUTC Meeting

- Facilitate the 2021 Virtual International ABC Conference that will be held December 8-10, 2021
- Virtual Workshop with Live Demonstration of Mixing UHPC December 9-10, 2021 as part of 2021 Virtual International ABC Conference
- Monthly Webinars and other related technology transfer activities
- Quarterly Research Seminars will take place in October 2021 and January 2022
- Semi-annual 2021 Research Day Two will take place on November 4, 2021
- Continuation of research projects and other activities
- Working with bridge owners to implement the results of research projects developed by ABC-UTC
- Commercialization of patented products developed by ABC-UTC
- Assisting State DOT engineers to identify funds available through demonstration projects for implementing ABC-UTC developed products and bridge solutions
- Develop a cooperative working relationship with US Forest Service
- Develop small companies for marketing products and solutions developed by ABC-UTC
- Work with State DOTs, FHWA and bridge owners to organize workshops across the U.S. for educating bridge professionals with latest in the ABC area; specifically, we are attempting to organize a day-long ABC workshop at different locations
- Work with State DOT engineers and other entities who have developed Non- Proprietary Ultra-High-Performance Concrete (UHPC) mixes to organize a daylong workshop that will include hands-on activities to promote the use of UHPC which is an advanced cementitious material

2. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS: Who has been involved?

2.1 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
- Terry Wipf, Iowa State University
- Brent Phares, Iowa State University
- John Stanton, University of Washington
- Musharraf Zaman, The University of Oklahoma University

2.2 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. These groups include representatives from state DOTs, FHWA, and industry.

3. OUTPUTS

PERFORMANCE METRICS FOR CURRENT REPORTING PERIOD:

Research	Goals	Research Performance Measures	4/1/21-9/30/21
Outputs	ABC-UTC Guides documents – Short documents that provide essential information needed to put results of research into practice; note that projects with similar topics may have a combined document	Number of documents submitted	2 (see 1.2.1 research table for projects: FIU-2016-1-8, FIU-2016-2-7)
	Research Seminar – Principal Investigator(s) and graduate student(s) will co-present project findings in quarterly Research Seminar series; products of the research project, at completion, will be presented	Number of seminars	2 (see 1.2.1)
	Publications – Peer-reviewed publications on research products	Number of peer-reviewed publications on research products	13 (see 3.1.2)
	Presentations – Research projects presented at conferences and other events	Number and quality of conferences and events during which results of the research are presented	15 (see 3.1.3)
	Development of Educational Materials – Continuing education courses, web-based training, part of conference workshops, or modules for college courses	Number of developed educational materials We are currently finalizing the development of four short courses, work currently in progress. (See Research Section, project #'s FIU-2016-2-3; ISU-2016-2-4; UW-2016-2-2; UW-2016-2-3)	1(see 1.2.1 research table)

3.1 PUBLICATIONS, CONFERENCE PAPERS, AND PRESENTATION

3.1.1 Journal Articles Submitted

Citation for Article	Peer-Reviewed?
Author(s). "Article Title". <i>Journal Title</i> , Submitted <Month>, <year>.	Yes or No
Khedmatgozar Dolati, S.S., and Mehrabi, A., "Alternative system and materials for splicing prestressed-precast concrete piles," Transportation Research Records (TRR) of Transportation Research Board (TRB), TRB, 2021.	Yes
Khedmatgozar Dolati, S.S., and Mehrabi, A., "NSM FRP pile splice system for prestressed precast concrete piles," Composite Structures, Elsevier, 2021.	Yes
Ahmed, M.A., Sadri, A.M., Mehrabi, A., Azizinamini, A. "Identifying Topological Credentials of Physical Infrastructure Components to Enhance Transportation Network Resilience: A Case of	Yes

Florida Bridge.”, ASCE Journal of Transportation Engineering Part A: Systems, Submitted June, 2021	
Ali, S.A., Zaman, M. and O’Rear, E. “Effects of Surface Free Energy Estimation Methods and Probe Liquids on the Moisture-Induced Damage Potential of Asphalt Mixes.” <i>ACS Omega</i> , Submitted April, 2021.	Yes
Ali, S.A., Foley, K.A., Zaman, M. and Walters, K.B. “Micro-Structural Evaluation of The Effects of Aggregate Type, Aging, and Additives on The Moisture Susceptibility of Binder-Aggregate Systems Using Chemical and Thermodynamic Approaches”. <i>International Journal of Adhesion and Adhesives</i> , Submitted May, 2021.	Yes
Ghos, S., Sumter, C.R., Arevalo, P.C., Ali, S.A., Zaman, M., Hobson, K.R. and Kalicki, G., “Performance of Asphalt Mixes Containing Post-Consumer Recycled (PCR) Plastic using Balanced Mix Design Approach and Dry Process”. <i>Annual Meeting-Transportation Research Board 2022</i> , Submitted August, 2021.	Yes
Larrain, M.M., Hanlon, B., Zaman, M. and Razzaghi, T., “Prediction of Unconfined Compressive Strength in Oklahoma Clays using Linear Regressions and Random Forest Models.” <i>Annual Meeting-Transportation Research Board 2022</i> , Submitted August, 2021.	Yes
Abokifa, M., M.A. Moustafa, “Mechanical characterization and material variability effects of emerging non-proprietary UHPC mixes for accelerated bridge construction field joints”, <i>Construction and Building Materials</i> , Submitted June 2021	Yes
Abokifa, M., M.A. Moustafa, “Experimental Behavior of Precast Bridge Deck Systems with Non-Proprietary UHPC Transverse Field Joints”, <i>Materials (MDPI)</i> , Submitted September 2021	Yes
Amir Sadeghnejad and Atorod Azizinamini “Simple for Dead Load and Continuous for Live Load Connection Detail Using UHPC for Steel Bridges in Non-Seismic Areas”, <i>Structures</i> , Submitted Summer 2021	Yes
Amir Sadeghnejad and Atorod Azizinamini “UHPC Connection Detail for Simple for Dead Load and Continuous for Live Load Steel Bridges in Seismic Areas”, <i>Structures</i> , Submitted Summer 2021	Yes

3.1.2 Journal Articles Published (TT Plan Output)

Citation for Article	Peer-Reviewed?
Author(s). “Article Title”. <i>Journal Title</i> , vol., pp, date.	Yes or No
Muhaimin, A.M.M., Zhang, L., Dhakal, S., Lv, X., Pradhananga, N., Kalasapudi, V.S., Azizinamini, A. “Identification and Analysis of Factors Affecting the Future of Bridge Design, Construction, and Operation”. <i>Journal of Management in Engineering</i> , 37(5): 04021049. June 2021	Yes
Rehmat, Sheharyar, Amir Sadeghnejad, Islam M. Mantawy, and Atorod Azizinamini. "Experimental study on concrete filled steel tubes to footing connection using ultra-high performance concrete." <i>Engineering Structures</i> 242 : 112540. August 2021	Yes
Mokhtarimousavi, Seyedmirsajad, Jason C. Anderson, Mohammed Hadi, and Atorod Azizinamini. "A temporal investigation of crash severity factors in worker-involved work zone crashes: Random parameters and machine learning approaches." <i>Transportation Research Interdisciplinary Perspectives</i> 10: 100378. June 2021	Yes
Ali, S.A., Ghabchi, R., Zaman, M., Rani, S. and Rahman, M.A. “Laboratory Characterization of Moisture-Induced Damage Potential of Asphalt Mixes Using Conventional and Unconventional Performance-Based Tests.” <i>International Journal of Pavement Research and Technology (IJPRT)</i> , 1-18, July 2021	Yes

Ali Javed, Islam M Mantawy, Atorod Azizinamini, "3D-Printing of Ultra-High-Performance Concrete for Robotic Bridge Construction", 3D-Printing of Ultra-High-Performance Concrete for Robotic Bridge Construction. September 2021. Transportation Research Record, 03611981211011645	Yes
Ghos, S., Ali, S. A., Zaman, M., Hobson, K. R., Larrain, M. M., and Behm, M. "Causes of Fatigue Cracking in Flexible Pavements in Oklahoma: A Case Study Using Laboratory and Field Investigation and AASHTOW are Simulation". <i>Journal of Testing and Evaluation</i> , July 2021	Yes
Ghos, S., Ali, S. A., Zaman, M., Chen, D. H., Hobson, K. R., and Behm, M. "Evaluation of Transverse Cracking in Flexible Pavements using Field Investigation and AASHTOWare Pavement ME Design". <i>International Journal of Pavement Research and Technology (IJPRT)</i> ,1-16, June, 2021	Yes
Rahman, M.A., Ghabchi, R., Zaman, M., and Ali, S.A. "Rutting and Moisture-Induced Damage Potential of Foamed Warm Mix Asphalt (WMA) Containing RAP." <i>Innovative Infrastructure Solutions (IISS)</i> , Vol. 6, No.158, September, 2021	Yes
Abokifa, M., M.A. Moustafa, A. Itani, "Comparative Behavior of Precast Bridge Deck Panels with UHPC and Polymer Concrete Transverse Field Joints", <i>Engineering Structures</i> , November 2021	Yes
Abokifa, M., M.A. Moustafa, "Full-Scale testing of Non-Proprietary Ultra-High Performance Concrete for Deck Bulb Tee Longitudinal Field Joints", <i>Engineering Structures</i> , September 2021	Yes
John Stanton, The Role of Analytical Tools in Innovation. <i>PCI Aspire</i> , pp 40-42, August, 2021	Yes
Shahrokhinasab, E., Looney, T., Floyd, R., and Garber, D. "Effect of Fiber, Cement, and Aggregate Type on Mechanical Properties of UHPC." <i>Civil Engineering Journal</i> , Vol. 7, Iss. 8, August 2021.	Yes
Shahrokhinasab, E. and Garber, D., "Long-term performance of full-depth precast concrete (FDPC) deck panels." <i>Engineering Structures</i> , Vol. 244, October 2021.	Yes

3.1.3 Meeting/Conference Presentations/Posters Made by key researchers & Students (TT Plan Output)

Meeting / Conference Name	Citation for Presentation
Meeting/Conference name, location, mo/yr	Author(s). "Presentation Title"
Expert Talk - Civil School of Engineering, Lovely Professional University, Virtual, June 2021	Atorod Azizinamini, "Accelerated Bridge Construction in U.S"
AASHTO Committee on Bridges & Structures' Technical Committee for	Atorod Azizinamini, "Update on ABC-UTC," Virtual meeting

Construction (T-4), Virtual, July 2021	
AISI Steel Bridge Task Force, Virtual, August 2021	Atorod Azizinamini, "Redundancy of Two Steel Box Girder Bridges"
Contractor/Owner Collaboration on ABC Programs Workshop, Omaha, NE, Sept. 2021	Mary Lou Ralls Newman, "Workshop Objective & ABC Technologies Review"
American Society for Engineering education (ASEE) Annual Conference, Virtual, 07/2021	Mohamed ElZomor, Piyush Pradhananga, Rubaya Rahat, "Renovating Contract Delivery Education to Bridge the Gap Towards Current Practices"
ABC-UTC Research Day 1, Virtual, April 2021	14 key researchers presented: https://abc-utc.fiu.edu/mc-events/2021-research-day-1/?mc_id=650
ASCE-EWRI World Environmental & Water Resources Congress, Atlanta, GA, June 2022	Nasim Mohamadiazar & Ali Ebrahimian. "Integrated Flood and Socio-Environmental Risk Analysis Using a Spatial Multicriteria Approach"
2021 Oklahoma Transportation Symposium, Oklahoma City, July 2021	Paul Cancino, Musharraf Zaman, Islam Mantawy, and Mohamed Moustafa "Evaluation of Risk and Resilience of Bridges: Expanding From 4R-Methodology to 5R-Methodolgy"
2021 Oklahoma Transportation Symposium, Oklahoma City, July 2021	Larrain, M.M., Hanlon, B., Zaman, M. and Razzaghi, T., "Prediction of Unconfined Compressive Strength in Oklahoma Clays using Linear Regressions and Random Forest Models"
2021 Oklahoma Transportation Symposium, Oklahoma City, July 2021	Ghos, S., Sumter, C.R., Ali, S.A., Arevalo, P.C., Hobson, K.R. and Zaman, M. "Assessment of asphalt Mixes Containing Recycled Plastics for Pavement Construction Using a Balanced Mix Design Approach"
International Airfield and Highway Pavement Conference, Online, June 2021	Ghos, S., Sumter, C.R., Ali, S.A., Zaman, M., O'Rear, E. and Hobson, K.R. "Issues with the Design of Asphalt Mixes Containing Post-Consumer Recycled Plastic"
SPARC Hub International Workshop on Intelligent Compaction (IC), online, September 2021	Zaman, M., Rahman, M.A., Ghos, S., and Ali, S.A. "Intelligent Asphalt Compaction Analyzer (IACA) for Quality Control of Asphalt Pavement"
PCI Professors Workshop, Sacramento, CA, June 2021	M. Moustafa. "Introduction to UHPC and Highlights of UHPC Structural Applications"
PCI UHPC Workshop, Rosemont, IL, September 2021	M. Moustafa. "Mechanical characterization and strength maturity assessment of ABC-UTC non-proprietary UHPC"
PCI UHPC Workshop, Rosemont, IL, September 2021	M. Moustafa. "Structural Behavior of Axial and Seismic UHPC Columns"

3.1.4 Conference Proceedings (TT Plan Output)

Nothing to report

3.2 WEBSITE AND OTHER INTERNET SITES (TWITTER, FACEBOOK, INSTAGRAM)

ABC-UTC Website (<https://abc-utc.fiu.edu/>): The ABC-UTC website continues to be updated on an ongoing basis to document the status of research, workforce development, and technology transfer activities.

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

- Twitter: <https://twitter.com/ABCUTC>
- Facebook: <https://www.facebook.com/abc.utc/>
- Instagram: <https://www.instagram.com/abc.utc/>
- YouTube: <https://www.youtube.com/watch?v=XovjfLDA3Lk>. For links to unlisted webinars, please visit our website monthly webinar archives page at <https://abc-utc.fiu.edu/webinars/webinar-archives/>
- LinkedIn: <https://www.linkedin.com/company/abc-utc>

3.3 TECHNOLOGIES OR TECHNIQUES

We have initiated joint projects with all partner universities to develop a non-proprietary UHPC mix that will be available at the end of the year, promising low cost and availability to all users.

3.4 INVENTIONS, PATENT APPLICATIONS, AND/OR LICENSES

- Systems and Methods for Quantifying Concrete Surface Roughness. Submitted August 2021, Lead PI- Atorod Azizinamini. Status: Pending
- Systems and Methods for Analyzing a Physical Infrastructure. Submitted May 2021, Lead PI- Arif Mohaimin Sadri. Status: Pending
- FRP sheet/jacket splices for prestressed precast concrete piles. Submitted May 2021, Lead PI- Armin Mehrabi. Status: Pending

3.5 OTHER PRODUCTS

Nothing to report.

4. OUTCOMES: What outcomes has the program produced? How are the research outputs described in section (3) above being used to create outcomes?

PERFORMANCE METRICS FOR CURRENT REPORTING PERIOD:

Research	Goals	Research Performance Measures	4/1/21-9/30/21
Outcomes	<i>Separate Contributions for Research Projects, or Follow-on Research Projects</i>	Number of separate financial or in-kind contributions for research projects, or follow-on research projects	2
	<i>Activities Requested by Outside Entities – Presentations, workshops, etc.</i>	Number of activities conducted	1

	Use in the Field – Output(s) used in processes or projects	Number of times research outputs are incorporated in bridge processes, construction projects, etc.	1
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Outcomes descriptions for current period (4/01/2020 – 9/30/2021)

#	Title	Outcomes (Separate Contributions for Research Projects, or Follow-on Research Projects; Activities Requested by Outside Entities; or Use in the Field)
2016-OU-02-01	Development of Non-Proprietary UHPC Mix	Related follow-on research project awarded to Jeffery S. Volz (PI) and Royce Floyd (Co-PI) from Oklahoma DOT, “Innovative Multi-Hazard Resistant Bridge Columns for Accelerated Bridge Construction”, \$198,000. Project award date is October 1, 2021 to September 30, 2023.
2016-UW-03-01	Design Guidelines for ABC Column-to-Drilled-Shaft Foundation Connections in High Seismic Zones	Invited article published in <i>PCI Aspire</i> magazine, July 2021
2016-UW-03-01	Design Guidelines for ABC Column-to-Drilled-Shaft Foundation Connections in High Seismic Zones	Follow-up funding from PEER (Berkeley), \$180,000. Project started in January 2019. Article published June 2021: https://www.ce.washington.edu/news/article/2021-06-15/research-reality
2016-UW-03-02	Economic Pier-to-Pile Connections for Permanently Cased Shaft (CFST) Piles	Use of CFST piles on the new Mukilteo Ferry Terminal. The construction completed in 2020. *This project was not listed in the previous reporting period.

5. IMPACTS: What is the impact of the program? How has it contributed to transportation, education, research, and technology transfer?

PERFORMANCE METRICS FOR CURRENT REPORTING PERIOD:

Research	Goals	Research Performance Measures	4/1/21-9/30/21
Impacts	<i>Influence on Practice</i>	Number of changes that are made to the way an outside entity is doing business, as a result of research outputs	0
	<i>Governing State, Local, and National Specifications</i>	Number of changes, to incorporate products, that are made to state, local, or national (e.g., AASHTO) bridge design and/or construction specifications or guidelines	0

	<i>Use of ABC-UTC Activities in Practice</i>	Number of uses of ABC-UTC activities in practice	0
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Impact descriptions for Current period (4/01/2021– 9/30/2021)

There are no identified impacts to report for the current period. For previous impacts, please view the UTC-Semi Annual Progress Report 8, by using the following link. <https://abc-utc.fiu.edu/wp-content/uploads/sites/52/2021/05/UTC-Semi-Annual-Progress-Report-8.pdf>

5.1 WHAT IS THE IMPACT ON THE EFFECTIVENESS OF THE TRANSPORTATION SYSTEM?

ABC-UTC works closely with stakeholders to enhance the transportation systems with a focus on accelerated bridge construction techniques. For example, ABC-UTC works closely with the lightweight concrete industry to expand the use of lightweight concrete in ABC applications. ABC-UTC works closely with the Vermont AOT to address deficiencies in culverts by repairing them using UHPC through shotcrete. As a response to the bridge industry expressing the lack of prefabricated barriers, the ABC-UTC is also developing UHPC connections for prefabricated barriers.

5.2 WHAT IS THE IMPACT OF TECHNOLOGY TRANSFER ON INDUSTRY AND GOVERNMENT

ENTITIES, ON THE ADOPTION OF NEW PRACTICES, OR ON RESEARCH OUTCOMES WHICH HAVE LED TO INITIATING A START-UP COMPANY?

The ABC-UTC has identified research areas that will help the ABC cause and that fall outside the mission of the ABC-UTC. Bridge engineering is a multi-disciplinary field, and ABC-UTC research activities are having an influence on several other disciplines, such as robotics, automation, computer science and development of the new field in damage assessment that is related to service life design of bridges. As listed in Section 5, DOTs are interested in implementing research outputs. Iowa DOT has expressed interest in a county-level demonstration for the use of helical piles as accelerated foundation option, Oklahoma DOT is considering ABC-UTC non-proprietary UHPC mix as one of their standard options and was included in project bid. For industry, Bridge Preservation LLC is utilizing UNR for proof testing of their polyuria products.

5.3 WHAT IS THE IMPACT ON THE BODY OF SCIENTIFIC KNOWLEDGE?

ABC-UTC researchers contribute to the body of scientific knowledge by publishing journal articles in top engineering journals such as Construction and Building Materials, Journal of Bridge Engineering, Engineering Structures, among others. Dr. Azizinamini was guest editor for the Special Collection on Accelerated Bridge Construction in ASCE Journal of Bridge Engineering with more than 20 articles published on various aspects of ABC in this special collection, including precast concrete segmental columns, seismic design for ABC, pretensioned concrete bent caps, prefabricated composite box girders, ABC methods such as lateral slide and SPMT, etc. (https://ascelibrary.org/page/jbenf2/accelerated_bridge_construction). Dr. Azizinamini is the guest editor for MDPI- Materials Journal on the recent advances in UHPC (https://www.mdpi.com/journal/materials/special_issues/ultrahigh_performanceconcrete).

5.4 WHAT IS THE IMPACT ON TRANSPORTATION WORKFORCE DEVELOPMENT?

ABC technologies are increasingly being specified on bridge replacement and new construction 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 number 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.

6. CHANGES/PROBLEMS

6.1 CHANGES IN APPROACH AND REASONS FOR CHANGE

Nothing to report.

6.2 ACTUAL OR ANTICIPATED PROBLEMS OR DELAYS AND ACTIONS OR PLANS TO RESOLVE THEM.

Most of the laboratories at FIU and partner universities resumed normal operation last spring with some backlog in conducting experiments in their laboratories due to lab closures or lab limitation during the lockdown due to COVID 19 Pandemic. We are monitoring the situation continuously to ensure all research projects are on-track.

6.3 CHANGES THAT HAVE A SIGNIFICANT IMPACT ON EXPENDITURES

Nothing to report.

6.4 SIGNIFICANT CHANGES IN USE OR CARE OF HUMAN SUBJECTS, VERTEBRATE ANIMALS, AND/OR BIOHAZARDS

Nothing to report.

6.5 CHANGE OF PRIMARY PERFORMANCE SITE LOCATION FROM THAT ORIGINALLY PROPOSED

Nothing to report.

7. Additional information regarding Products and Impacts

Nothing to report.