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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 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 fall 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 the 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 recognition 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) 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 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 relationship 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 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

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 to 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 the 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.

- As part of the new requirements, a Technology Transfer plan was established. Here within this report, we established goals for outputs, outcomes, and impacts.
 - Selection of Research Topics for Cycle 2, 2017-2018
- Cycle 2 research projects were approved by the RAB and commenced during this reporting period.

Following table provides a list of the research projects, with PI and status of project.

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	Active
FIU-2016-1-2	Field Demonstration-Instrumentation and monitoring of Accelerated Repair Using UHPC Shell	Kingsley Lau	Active
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	Active
FIU-2016-1-4	Innovative Foundation Alternative for High Speed Rail Application (Joint project with UNR)	Seung Jae Lee	Active
FIU-2016-2-1	Development of Non-Proprietary UHPC Mix (Joint project with all partner universities)	David Garber	Active
FIU-2016-2-2	Performance of Existing ABC Projects - Inspection Case Studies (Joint project with all partner universities)	Armin Mehrabi	Active
FIU-2016-2-3	Development of ABC Course Module- Available ABC Bridge Systems for Short Span Bridges	Armin Mehrabi	Active

Project #	Project Title	Principal Investigator	Status
FIU-2016-2-4	Laminated Wood Deck System For Folded Plate Girder	Atorod Azizinamini	Active
FIU-2016-2-5	Optimization of Advanced Cementitious Material for Bridge Deck Overlays and Upgrade, Including Shotcrete	Islam Mantawy	Active
FIU-2016-2-6	Robotics and Automation in ABC Projects	Islam Mantawy	Active
ISU-2017-1-1	Contracting Methods for Accelerated Bridge Construction Projects: Case Studies and Consensus Building	Katelyn Freeseaman	Active
ISU-2017-1-2	Bidding of Accelerated Bridge Construction Projects: Case Studies and Consensus Building	Katelyn Freeseaman	Active
ISU-2017-1-3	Accelerated Repair and Replacement Of Expansion Joints	An Chen	Active
ISU-2016-2-1	Development of Non-Proprietary UHPC Mix (Joint project with all partner universities)	Behrouz Shafei	Active
ISU-2016-2-2	Performance of Existing ABC Projects- Inspection Case Studies (Joint project with all partner universities)	Katelyn Freeseaman	Active
ISU-2016-2-3	Synthesis of available contracting methods	Jennifer S. Shane,	Active
ISU-2016-2-4	Development of ABC Course Module- Design of Link Slabs	Behrouz Shafei	Active
UNR-2016-1-1	Innovative Foundation Alternative for High Speed Rail Application (Joint project with FIU)	Mohamed Moustafa	Active
UNR-2016-1-2	Identify the Risk Factors That Contribute To Fatalities and Serious	Mohamed Moustafa	Active

Project #	Project Title	Principal Investigator	Status
	Injuries and Implement Evidence-Based Risk Elimination and Mitigation Strategies		
UNR-2016-1-3	More Choices for Connecting Prefabricated Bridge Elements and Systems (PBES)	Mohamed Moustafa	Active
UNR-2016-2-1	Development of Non-Proprietary UHPC Mix - Application to Deck Panel Joints (Joint project with all partner universities)	Mohamed Moustafa	Active
UNR-2016-2-2	Synthesis of available methods for repair of prestress girder ends	Mohamed Moustafa	Active
UNR-2016-2-3	Performance of Existing ABC Projects - Inspection Case Studies	Mohamed Moustafa	Active
OU-2016-1-1	Development Of Guide For Selection Of Substructure For ABC Projects (Joint project with all partner universities)	Mushrraf Zaman (Joint project with FIU)	Active
OU-2016-1-2	Rapid Retrofitting Techniques For Induced Earthquakes	Philip Scott Harvey Jr.	Active
OU-2016-2-1	Development of Non-Proprietary UHPC Mix (Joint project with all partner universities)	Royce W. Floyd	Active
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	Active
OU-2016-2-3	Performance of Existing ABC Projects - Inspection Case Studies (Joint project with all partner universities)	Musharraf Zaman	Active

Project #	Project Title	Principal Investigator	Status
UW-2017-1-1	Performance Evaluation of Structural Systems For High Speed Rail In Seismic Regions	John Stanton	Active
UW-2017-1-2	New Sesimic-Resisting Connections or Concrete-Filled Tube Components In High-Speed Rail Systems (Joint Project with FIU)	Dawn Lehman	Active
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	Active
UW-2016-2-2	Development of ABC Course Module- Seismic Connections	John Stanton	Active
UW-2016-2-3	Development of ABC Course Module - Design of CFST Components and Connections for Transportation Structures	Dawn Lehman	Active
UW-2016-2-4	Performance of Existing ABC Projects - Inspection Case Studies (Joint project with all partner universities)	John Stanton	Active
UW-2016-2-5	UW-2016-2-5- Tsunami Design Forces for ABC Retrofit	Marc Eberhard	Active

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

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

Task #	Brief Description of Task	10/1/18 to 3/31/19
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.	43 MS/PhD students have been supported
WD-2	Undergraduate Internships: Each ABC-UTC consortium member will be expected to support undergraduate students on research projects.	14 undergraduate students have been supported
WD-3	Student Publications: Each ABC-UTC consortium member will be expected to support students to publish and present their work.	19 publications (submitted, accepted, or published)
		7 conference presentations (presented)
WD-4	Travel Scholarships: Each ABC-UTC consortium member will be expected to support students travel to conferences to present their work.	5 travel scholarships provided
WD-5	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.	Total 3 students presented in 2 research seminars
		788 sites attended the seminars

The following Research Seminars were presented during the previous reporting period with the number of independent sites attending also highlighted. Many sites have multiple attendees, so the actual number of attendees is higher. The Research Seminars continue to give exposure to our students to the industry.

	Date	Research Seminar Title	Student(s) Presenter	# sites attending
1	1/25/19	An Integrated Project to Enterprise-Level Decision Making Framework for Prioritization of ABC	Ning Zhang (PhD, ISU)	339
2	11/1/18	Accelerated Repair of Existing Bridges Using UHPC	Mahsa Farzad (PhD, FIU) and Alireza Valikhani (PhD, FIU)	449

The following students were supported to travel during the previous reporting period.

	Student Name	Conference Name	Date	Location
1	Azadeh Jaberi	2019 Annual TRB Conference	11/12/19-1/16/19	Washington, DC
2	Syedmirasjad Mokhtarimousavi	2019 Annual TRB Conference	11/12/19-1/16/19	Washington, DC

	Student Name	Conference Name	Date	Location
3	Sheharyar-e-Rehmat	2019 Annual TRB Conference	11/12/19-1/16/19	Washington, DC
4	Mohamadtaqi Baqersad	2019 Annual TRB Conference	11/12/19-1/16/19	Washington, DC
5	Amir Sadeghnejad	2019 Annual TRB Conference	11/12/19-1/16/19	Washington, DC

In addition to these core Education and Workforce Development activities, the following activities were conducted:

- Mentorship programs are being formally developed at each university. A procedure for mentor assignment and responsibilities has been developed. Universities are identifying mentors and connecting them with students.
- “Engineering First!”, a four-week engineering module with daily one-hour lessons for K-5 classrooms was completed in a first grade classroom in Iowa. The materials continue to be refined. Two summer workshops are being planned for Reno (NV) and Seattle (WA).
- A one-day workshop was organized by the ACI Student Chapter at FIU (with assistance from Dr. Garber) at the Miami Lakes Branch Library on 10/6/18 to teach K-5 students about bridges and ABC. Students were led through several activities that were developed by the ABC-UTC. This activity was not reported during the previous reporting period.
- Dr. Garber went to Brownsville Middle School (Miami, FL) on 9/21/18 to teach students about bridges and ABC. Students were led through several activities that were developed by the ABC-UTC. This activity was not reported during the previous reporting period.
- ISU hosted a three-day bridge building competition, “Ready, Set, Build: Bridge Competition” for more than 180, 4th-to 8th grade students from schools throughout Iowa on 11/1/18 to 11/3/18. 20 volunteers from ISU and Iowa DOT helped with the event.
- Summer activity planning is underway. FIU plans to again host a parent-child camp. Two teacher workshops are planned to be led by ISU at UW and UNR.

The center continues to work with the Workforce Development Advisory Board (WDAB) to ensure efforts are best aligned to achieve its central mission and have the largest impact.

1.2.4 Technology Transfer

During this reporting period, work continued to develop educational materials and methods of delivery for implementing ABC at the state DOT agency level. An example of this reporting period is a collaboration between the ABC-UTC, the Oklahoma DOT, the University of Oklahoma, and the FHWA Oklahoma Division in conducting a half-day ABC workshop held in Oklahoma City on October 11. In addition to assistance in developing the agenda, the ABC-UTC gave several of the workshop presentations.

Work also continued to sponsor and host the International ABC Conference to be held in December 2019 in Miami, Florida. During this reporting period, the paper abstracts were received and program development began. More than 150 abstracts were received for about 100 spots available for presentation.

Six Monthly Webinars were conducted during the reporting period. For these webinars, the number of registered sites ranged from 700 to over 1,100 with multiple participants at many of the sites. One webinar was presented by the FHWA on its new foundation reuse manual, and another webinar was presented by the railway industry on one of its rail projects. The other four webinars featured presentations on state DOT ABC projects and activities.

The 2019 four-hour In-Depth Web Training was planned during this reporting period. The featured topic will be ABC in seismic regions.

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 November and January Research Seminars reported in the Workforce Development section of this report. Also, five 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.

Research	Goals	Research Performance Measures	10/1/18-3/31/19
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 All research projects are in progress.	0
	Research Seminar – Principal Investigator(s) and graduate student(s) will co-present project findings in quarterly Research Seminar series; products of research project, at completion, will be presented	Number of seminars	2

Research	Goals	Research Performance Measures	10/1/18-3/31/19
	Publications – Peer-reviewed publications on research products	Number of peer-reviewed publications on research products	19
	Presentations – Research projects presented at conferences and other events	Number and quality of conferences and events during which results of research are presented	7
	Development of Educational Materials – Continuing education courses, web-based trainings, part of conference workshops, or modules for college courses	Number of developed educational materials We are currently working on developing 5 short courses, work currently in progress. (See Research Section, project #'s FIU-2016-2-3; ISU-2016-2-4; OU-2016-2-2; UW-2016-2-2; uw-2016-2-3)	0
Outcomes	Separate Financial Contributions for Research Projects – The impact of the research projects will be assessed by the level of interest expressed by state DOTs and/or industry	Number of separate financial contributions for research projects, including follow-on research projects	0
	Use in ABC Projects – Product(s) used in an ABC construction project	Number of times research products are incorporated in bridge construction projects, as identified by the PIs in collaboration with the bridge owners	0
Impacts	Governing State, Local, and National Specifications	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
	Standard Use of Products in ABC Projects	Number of states using the products in their bridge construction as a standard practice, as identified by the PIs in collaboration with the bridge owners	0

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 was held on 11/15/2018 where the progress of each research project was presented by PI’s to a general audience (comprising of State DOTs, Industry, FHWA, and other affiliates).
- Quarterly Progress Reports posted on the website.
- Publications

- Presentations
- Conference Proceedings

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:

- Identification of project topics for Cycle 3 Research.
- Implementation of Education and Workforce Development activities
- Planning for the International ABC Conference, December 2019. We are expecting large participation, as for the first time conference has International Scope and covers three frontiers influencing ABC
- Monthly webinars and other related technology transfer activities
- Quarterly research seminar and semi-annual research day
- Continuation of Research Projects and other activities.

2. PRODUCTS

2.1 PUBLICATIONS, CONFERENCE PAPERS, AND PRESENTATION

2.1.1 Journal Articles Submitted

Citation for Article	Peer Reviewed?
Author(s). "Article Title". <i>Journal Title</i> , Submitted <Month>, <year>.	Yes or No
Mokhtarimousavi, S., Azizinamini, A., Hadi, M., "Evolutionary Algorithms Approach for Performance Enhancement of Machine Learning Techniques to Predict Work Zone Crash Severity," Submitted for publication in <i>Journal of Safety Science (under review)</i> .	Yes
Mohamadreza Shafieifar, Mahsa Farzad, Atorod Azizinamini "An Investigation on a Detail for Connecting Precast Columns to Precast Cap Beams Using Ultra High Performance Concrete (UHPC)", ASCE's Journal of Bridge Engineering 2019 (<i>under review</i>)	Yes
Nerma Caluk, Islam Mantawy, Atorod Azizinamini "Durable Bridge Columns using Stay-In-Place UHPC Shells for Accelerated Bridge Construction", <i>Infrastructures (under review)</i> .	Yes
Alireza Valikhani, Azadeh Jaber Jahromi, and Atorod Azizinamini "Robust Upgrading Technique Using Ultra High-Performance Concrete for Resilient Bridge Superstructure" <i>Infrastructures (under review)</i> .	Yes
Sheharyar Rehmat, Amir Sadeghnejad, Islam Mantawy and Atorod Azizinamini "New Connection Details for Concrete Filled Tubes using UHPC for Resilient Bridge Substructure" <i>Infrastructures (under review)</i> .	Yes

Amir Sadeghnejad, Sheharyar Rehmat, and Atorod Azizinamini “Feasibility Study of Using Stay-in-Place UHPFRC Formworks for Short-Span Bridge Superstructures” Infrastructures (under review).	Yes
Naeimi, N., M.A. Moustafa, (2019). “Uniaxial compression behavior of confined UHPC cylinders by steel spirals”, 2nd Int. Symposium on Ultra-High Performance Concrete, June 2-4, 2019, Albany, NY	Yes
Aboukifa, M., M.A. Moustafa, A. Itani, (2019). “Behavior of UHPC Columns Subjected to Combined Axial and Lateral Loading”, 2nd Int. Symposium on Ultra-High Performance Concrete, June 2-4, 2019, Albany, NY	Yes
Rani, S., Ghabchi, R., Ali, S.A., and Zaman, M. “Laboratory Characterization of Asphalt Binders Containing a Chemical-Based Warm Mix Asphalt Additive.” Submitted to <i>ASTM Journal of Testing and Evaluation</i> . (Accepted)	Yes
Ghabchi, R., Rani, S., Zaman, M., and Ali, S.A. “Effectiveness of WMA Additive on PPA-Modified Asphalt Binders Containing Anti-Stripping Agent.” Submitted to <i>International Journal of Pavement Engineering</i> . (Accepted)	Yes
Rani, S., Ghabchi, R., Zaman, M., and Ali, S.A. “Evaluation of Liquid Anti-Stripping Agent on the Performance of Asphalt binders and Mixes containing Polyphosphoric Acid.” Submitted to <i>International Journal of Pavement Research and Technology</i> . (Under Review)	Yes
Rani, S., Ghabchi, R., Ali, S.A, Zaman, M., and O’Rear, E.A. “Evaluation of Moisture-Induced Damage Potential of Asphalt Mixes Containing PPA and ASA Using SFE Approach.” Submitted to <i>Road Materials and Pavement Design</i> . (Under Review)	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 Road Materials and Pavement Design</i> , Submitted <October>, <2018>.	Yes

2.1.2 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
Azizinamini, A., Rehmat, Sheharyar., Sadeghnejad, Amir. Transportation Research “Enhancing Resiliency and Delivery of Bridge Elements Using Ultra High Performance Concrete as Formwork”, April 2019.	YES

Farzad, M.; Fancy, S.F.; Lau, K.; Azizinamini, A. Chloride Penetration at Cold Joints of Structural Members with Dissimilar Concrete Incorporating UHPC. <i>Infrastructures</i> 2019, 4, <u>18</u> .	Yes
Farzad, M.; Shafieifar, M.; Azizinamini, A. Experimental and numerical study on bond strength between conventional concrete and Ultra High-Performance Concrete (UHPC). <i>Eng. Struct.</i> 2019, 186, 297–305.	Yes
Mokhtarimousavi, S., Anderson, J.C., Azizinamini, A., Hadi, M., “Improved Support Vector Machine Models for Work Zone Crash Injury Severity Prediction and Analysis,” <i>Transportation Research Record: Journal of the Transportation Research Board</i> , 2019 (In Press).	YES
Farzad, Mahsa, Mohamadreza Shafieifar, and Atorod Azizinamini. "Experimental and numerical study on an innovative sandwich system utilizing UPFRC in bridge applications." <i>Engineering Structures</i> 180 (2019): 349-356.	YES
Farzad, Mahsa, Mohamadreza Shafieifar, and Atorod Azizinamini. "Experimental and numerical study on bond strength between conventional concrete and Ultra High-Performance Concrete (UHPC)." <i>Engineering Structures</i> 186 (2019): 297-305.	YES

2.1.3 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"
ABC–UTC Research Day, Miami, FL, 11/18 (Webinar)	Seung Jae Lee, Atorod Azizinamini, Roberto Rodriguez, Mohamed Moustafa and Mohammad Abbasi. “Innovative Foundation Alternative for High Speed Rail Application”
Presented at the 6th Annual University Transportation Center (UTC) Conference for the Southeastern Region, Clemson University, South Carolina, October 25th, 2018.	Mokhtarimousavi, Azizinamini, A., Hadi, M., “Work Zone Crash Injury Severity Prediction and Analysis Using Support Vector Machines Optimized by a Swarm Intelligence Based Metaheuristic Algorithm and Mixed Logit Model,”

TRB Annual meeting Washington DC, Jan/2019	Atorod Azizinamini, Sheharyar Rehmat, Amir Sadeghnejad. "Enhancing Resiliency and Delivery of Bridge Elements using Ultra-High Performance Concrete as Formwork".
Transportation Research Board 2019	Enhancing Resiliency and Delivery of Bridge Elements Using Ultra High Performance Concrete as Formwork
EMI International Conference 2018, Nov 2-4, 2018, Shanghai, China	Naeimi, N., M. Aboukifa, S. Dhakal, M.A. Moustafa, "Section and Finite Element Analysis of Seismic UHPC Bridge Piers with High Strength Steel",
ACI Convention, Oct 14, 2018, Las Vegas, NV	Naeimi, N., M. Aboukifa, M.A. Moustafa, "Finite Element Modeling of Seismic Behavior of Ultra-High Performance Concrete Bridge Columns",
Dawn Lehman	PEER (Pacific Earthquake Engineering Research Center) Annual meeting

2.1.4 Conference Proceedings (TT Plan Output)

Citation for Conference Proceedings	Peer Reviewed?
Author(s). "Article Title". <i>Conference proceedings</i> , year, pp.	Yes or No
Su, Y.-F., Bhattacharya, S., Lee, C., Shin, M. & Lee, S. J. "Allometric Description of Granular Materials", <i>IS-Atlanta 2018: Geomechanics from Micro to Macro in Research and Practice</i> , Georgia Tech, Atlanta, GA on Sep. 9-12	Yes

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 are updated on an ongoing basis, such as:

- Twitter
- Facebook:
- Instagram
- YouTube

- LinkedIn

2.3 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.

2.4 INVENTIONS, PATENT APPLICATIONS, AND/OR LICENSES

Nothing to report.

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 the 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 a 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 30 state DOTs, FHWA and TRB 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. Bridge engineering is a multi-disciplinary field and ABC-UTC research activities are having influence on several other disciplines, such as robotic, automation, computer science and development of new field in damage assessment that is related to service life design of bridges.

4.3 WHAT IS THE IMPACT ON PHYSICAL, INSTITUTIONAL, AND INFORMATION RESOURCES AT THE UNIVERSITY OR OTHER PARTNER INSTITUTIONS?

As a result of US DOT supporting ABC-UTC at FIU, similar to other partner universities, are receiving many new resources that otherwise would not be provided to the group. As an example Alumni and state is helping FIU to build a state of the testing facility capable of testing very large bridge segment.

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 mobility and save 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. ABC is future of bridge engineering and FHWA is very actively promoting ABC. Thanks to US DOT to dedicate a Tier One UTC to this very timely area. We are hearing many comments from our stakeholders, indicating that they are looking at ABC-UTC, its web site, research products, webinars and conferences, as a single point where they can go to get answer to their questions. We are expanding our activities on a daily basis and adjusting our activities based on feedbacks we are receiving from stakeholders, to better achieve our mission and goals and fulfil what we promised in our proposal.

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.