PROGRAM PROGRESS PERFORMANCE REPORT

Awarding Federal Agency: US Department of Transportation, Office of the Assistant Secretary for Research and Technology of the Department of Transportation (OST-R)

Federal Grant Number: DTRT13-G-UTC28

Project Title: Center for Advanced Infrastructure and Transportation (CAIT) National UTC Consortium Led by Rutgers, The State University of New Jersey

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Submission Date: April 30, 2014

Signature of Submitting Official:

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

What are the major goals of the program?

The major goal of the CAIT National UTC Consortium is to build a program that will: 1) have a sharp focus on maintaining state of good repair of the nation's infrastructure and the interrelated activities of the Secretary of Transportation's strategic goals where the consortium can make significant impacts, and 2) foster intelligent, effective, and meaningful leveraging between institutions and stakeholders to achieve program goals and objectives.

State of Good Repair (SGR) has been identified as the consortium's **primary area of research** and Safety and Economic Competitiveness as secondary areas in which we believe our team's capabilities, resources, past experience, and track record qualify us to make significant impacts toward reaching the goals of the USDOT. To help fulfill these goals and objectives we will:

- **Sharply focus our research portfolio** to make significant and meaningful impacts during the lifetime of the grant. The UTC designation will be a catalyst for generating relevant and sustainable operations that can aid USDOT in fulfilling the objectives of its strategic plan.
- **Develop effective leveraging** with centers of critical mass and establish networks of researchers, laboratories, test-beds, proving grounds, and all other resources necessary to address the objectives of the strategic plan. Through intelligent leveraging, we will minimize potential duplication of effort and promote and encourage meaningful team work and collaboration.
- **Develop and enhance meaningful relationships with local, regional, national, and international stakeholders** to stay abreast of new problems and best practices; work together to address local challenges and needs; and partner in implementing research results and products.

The consortium will cultivate interest in the transportation industry through a comprehensive **education and workforce development program**. The education and workforce goals are to:

- Develop an educational program that will prepare current and future transportation professionals and researchers to be responsive to changes in the transportation field.
- Develop a strong multidisciplinary component that reflects changes in the organizational, intermodal, and global character of transportation, as well as the use of advanced materials and technologies relative to infrastructure.
- Develop educational activities with a focus on K-12 to foster an initial interest in transportation and create opportunities for the students to continue onto other programs, thereby sustaining awareness in transportation careers beyond the initial exposure.

The consortium supports knowledge sharing and is committed to move research results into practice through its **technology transfer initiatives**. The technology transfer goals are to:

- Ensure all research proposals include feasible implementation plans.
- Provide a forum to discuss the state of practice and innovative new technologies that support State of Good Repair, through conferences and symposiums.
- Continuously post reports and research findings in multiple online repositories and clearinghouses, such as the USDOT Research Clusters and CAIT website.

What was accomplished under these goals?

Major Goal Area	Major Activities	Specific Objectives	Significant Results	Key Outcomes
Research	Research Selection	Select projects that make significant and meaningful impacts during the lifetime of the grant	Two new projects have cleared the pre-proposal stage and are now being developed by the PI for full submission and review	Nothing to Report
	Design of accelerated infrastructure testing facility: Bridge Evaluation Using Accelerated System Testing (BEAST)	Construct a brand new facility that will generate new knowledge and can validate existing research through and facility that will test in an accelerated manner the effects of heavy loads, extreme temperatures, and salts on a full-scale concrete bridge deck. To reliably accomplish this, CAIT and its partners are constructing the first full-scale accelerated infrastructure testing facility for the evaluation of new and advanced materials and devices: the Bridge Evaluation Using Accelerated System Testing (BEAST) facility. Developing reliable performance models for early detection and intervention technologies requires an understanding of the deterioration process—and its root causes— on bridge decks; BEAST will use innovative mechanisms to simulate 25 years of temperature cycles, freeze-thaw, applications of deicing chemicals, bridge materials, coating systems, and repetitive live load actions on a full-scale concrete bridge deck in a fraction of that time. Without distorting their effects, the facility will finally resolve unknown questions about the longevity and performance of preservation treatments and materials exposed to decades of heavy traffic loads and extreme weather patterns. The conditions simulated in the BEAST facility are experienced in each region of the country, so findings from the first full-scale experiment have the potential to impact each of the 600,000 bridges in the United States. Bridge owners will gain a reliable means to forecast deck performance and safety and understand the durability of technologies and applied preservation techniques to enhance serviceability and performance. Finally, owners would be in a		BEAST will provide new and valuable information about the longevity and effectiveness of preservation treatments and concrete materials used across the United States. The study will also provide answers about the long-term effects of weight, weather, and temperature variations on bridges in a short period of time

		far more informed position to manage maintenance and replacement activities as they continue to deal with difficult trade-offs and dwindling financial resources. The team will complete the design and construction of the facility in 2014; the BEAST will be up and running in January 2015.		
Education and Workforce Development	Designing Intersections Symposium (November 2013)	Generate knowledge and skills to foster a world class workforce for the transportation sectors	CAIT developed the program with traffic professionals state agencies and private industry	Nearly 100 engineers attended to learn about intersection safety and design for future improvement plans
	ITS New Jersey Annual Meeting (December 2013)	Generate knowledge and skills to foster a world class workforce for the transportation sectors	CAIT coordinated the annual meeting for the ITS New Jersey (a chapter of ITS America)	Over 200 professionals attended to learn about the region's ITS resources, technologies, needs, and challenges
	Short Course on FOS Sensors (Princeton, March 2014)	Generate knowledge and skills to foster a world class workforce for the transportation sectors	The consortium assisted in the promotion of the event to a target group of engineers	Regional bridge researchers and engineers learned the benefits of using fiber optic sensors in structural health monitoring
	57th Annual Paving Conference (March 2014)	Generate knowledge and skills to foster a world class workforce for the transportation sectors	CAIT assisted NJAPA in the coordination and promotion of the event to attract nearly 400 paving professionals from the area to the conference	Nearly 400 professionals from the region attended the conference to learn about the most recent advancements in design, construction, and maintenance
	Female students to attend the Women's Transportation Seminar (WTS) Annual Conference (May 2014)	Generate knowledge and skills to foster a world class workforce for the transportation sectors	The consortium will provide registration and travel support for 11 students to the conference in Portland, Oregon.	11 female college students from across the country will represent the CAIT consortium at WTS and learn about transportation engineering careers
	Planning and support for ICAMP 9 (VTECH, May 2014)	Support research projects that have significant and	Virginia Tech will host a national pavement conference in	This conference provides an outreach vehicle for

		meaningful impacts and disseminate knowledge and skills for the transportation workforce	partnership with major transportation decision-making and research agencies for researchers, private industry, government officials, and other civil engineers	researchers to distribute knowledge about pavement management to a nationwide network of engineers from public agencies, private industry, and academia
	Planning for ITS New Jersey "Data Silo" Workshop (June 2014)	Generate knowledge and skills to foster a world class workforce for the transportation sectors	The consortium will provide an interactive workshop led by transportation data experts to help professionals address data gaps and challenges	Nearly 100 transportation professionals will learn to overcome obstacles to traffic data collection and analysis used in road improvement plans
	Planning for New Jersey Governor's School (July 2014)	Generate knowledge and skills to K-12 students to cultivate a world class workforce for the transportation sectors	The consortium is currently developing a curriculum for exceptional high school science and math students that will include condition monitoring tools and pavement materials	This weeklong summer program will provide hands-on training and insights on asset management to future engineers
	Planning for TARGET (July 2014)	Generate knowledge and skills to K-12 students to cultivate a world class workforce for the transportation sectors	The consortium is currently developing a curriculum that will educate aspiring high school female engineers in a number of STEM disciplines	This program will educate a group of aspiring female engineers from New Jersey high schools about different engineering disciplines and career avenues
	Planning for NEXGEN (July 2014)	Generate knowledge and skills to undergraduate students to cultivate a world class workforce for the transportation sectors	The consortium is currently developing a curriculum that will educate underprivileged incoming Rutgers engineering freshmen in engineering topics	This program will educate about 60 underprivileged incoming Rutgers engineering freshen in technical transportation engineering topics and software
Technology Transfer	UTC Spotlight: Robotic Nondestructive Evaluation Tool Helps Bridge Engineers Validate Bridge Deck	Support research projects that have significant and meaningful impacts	CAIT outlined the capabilities of this NDE tool and how it may benefit bridge managers and engineers	This technology has been and will be used to accurately assess condition of bridge decks on structures selected

	Condition Assessments (December 2013)			by FHWA
	Hosted site visit for New Jersey Senator Robert Menendez on autism topics	Generate knowledge and support research projects and programs that have significant and meaningful impacts	CAIT hosted Senator Menendez for a site visit to inform him about research findings related to public transportation options that cater to individuals with autism	Senator Menendez learned about the transportation options for adults with disabilities that can be used for legislative decision-making to improve independence and facilitate job opportunities for these individuals
	SPAR 3D International Presentation on LiDAR and Superstorm Sandy recovery	Support research projects that have significant and meaningful impacts	CAIT presented on LiDAR capabilities and how it can be used in disaster recovery efforts and data collection	Over 1,000 information management professionals from around the world attended to learn about LiDAR and other research technologies
	Participation in UK-US Future Cities: Intelligent Transportation conference (February 2014)	Generate knowledge and support research projects and programs that have significant and meaningful impacts	CAIT presented on its state-of-good-repair mission and organizational structure to introduce the consortium to a select group of engineering delegates from the U.S. and other nations	The consortium exchanged knowledge on ITS, transit, and USDOT state-of-good-repair mission with high-level researchers and engineers from North America and Europe
	CAIT Update eNews (monthly between September and March 2014)	Generate knowledge and support research projects and programs that have significant and meaningful impacts	CAIT recorded and electronically delivered nearly 30 newsworthy items to showcase since September 2013	Disseminated information about transportation research initiatives, applications, and training opportunities to 6,000 practicing professionals
	Creation of Automated Vehicle Institute (USF)	Support research projects that have significant and meaningful impacts	USF created a clearinghouse and task force to conduct research and inform on ITS policy and	The institute will provide information and resources to engineers to incorporate ITS into

			automated vehicle technologies to regional transportation professionals and partners and stakeholders around the country	existing and future facilities
	Establishment of a New Jersey Freight Advisory Committee	Support research projects that have significant and meaningful impacts	CAIT will build a freight advocacy group consisting of freight experts from NJDOT, all three New Jersey metropolitan planning organizations (MPOs), industry and business leaders, elected officials, and freight transportation stakeholders to facilitate communications between experts	The advocacy group will create a knowledge exchange network for the improvement of busy Northeastern freight facilities and transportation systems to move goods and people more efficiently
	Planning for CUTC Summer Meeting	Support collaborative efforts and technology transfer	This event, hosted by CAIT, will facilitate communication between UTC administrators nationwide, generate cross-country research collaborations, and create new policies and products founded on UTC research	UTC researchers and administrators will attend the conference to network with other university researchers, learn how to maintain research collectives that align with USDOT goals, and produce meaningful research projects that have national applications
	Sponsorship of 2014 Accelerated Bridge Construction Conference	Support research projects that have significant and meaningful impacts	The consortium sponsored the 2014 ABC Conference, hosted by Florida International University	The consortium will create knowledge about ABC technologies for engineers and researchers within and outside the UTC network

What opportunities for training and professional development has the program provided?

This information has been integrated into the table above for the "what was accomplished under these goals?" section. Please see table above.

How have the results been disseminated?

This information has been integrated into the table above for the "what was accomplished under these goals?" section. Please see table above.

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

- **RESEARCH ACTIVITIES:**
  - **Ongoing Review of Research projects by the Research Advisory Board:** As previously described.
  - **Modify Agreements to Approve expenditure of Research Funds:** No research activities can start until the projects have been reviewed and approved as outlined in the prime proposal submitted to OST-R. CAIT has and will continue to issue modifications to the master agreements with each partner as research projects are approved.
  - **Ongoing Research:** Each of the consortium members will continue to perform SGR oriented research.

- **EDUCATION AND WORKFORCE DEVELOPMENT ACTIVITIES:**
  - Deliver NEXGEN, T.A.R.G.E.T., New Jersey Governor's School programs, and other K-12 programs to support STEM and workforce development goals for the consortium
  - Conduct a work zone safety awareness conference for 300 law enforcement and public works personnel to reduce traffic incidents in road construction sites
  - Work with partner schools to develop new training seminars based on research

- **TECHNOLOGY TRANSFER ACTIVITIES:**
  - Deliver the annual State of Good Repair summit
  - Continue to promote consortium research and applications through vehicles like UTC Spotlight and quarterly newsletter

2. <u>PRODUCTS</u>: What has the program produced?

Management

Subcontract agreements have been issued to the consortium members.

Research projects awarded:

"Nothing to Report"

Publications, conference papers, and presentations

"Nothing to Report"

Journal publications.

"Nothing to Report"

Books or other non-periodical, one-time publications.

"Nothing to Report"

Other publications, conference papers and presentations.

"Nothing to Report"

Website(s) or other Internet site(s)

CAIT has established two internet sites:

- http://cait.rutgers.edu/cait/research to disseminate research results
- http://cait.rutgers.edu/cait/program-sites to inform about consortium program activities

Technologies or techniques

CAIT and multiple DOT and university partners are creating the nation's first accelerated bridge deck testing facility in Piscataway, New Jersey. This facility, called the Bridge Evaluation Using Accelerated System Testing (BEAST), will test the effects of many years of heavy loads and extreme temperature and weather patterns on a full-scale concrete bridge deck over a short period of time. To leave the experiments undisturbed, observations will be recorded using a 24-hour closed circuit video recording system. The results of the study will give bridge engineers valuable new information about the longevity of preservation treatments and concrete materials that can be incorporated into future bridge repair and construction projects.

The team is preparing its final blueprints for the massive facility, and construction will be completed by the end of 2014. BEAST will be fully operational in January 2015.

Inventions, patent applications, and/or licenses

"Nothing to Report"

Other products: outreach activities, courses and workshops

"Nothing to Report"

3. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS:

What individuals have worked on the program?

Program Director: Dr. Ali Maher

Project Directors: Dr. Sue McNeil (University of Delaware), Dr. Paul J. Barr (Utah State University), Dr. Raimondo Betti (Columbia University), Dr. Lazar N. Spasovic (NJIT), Dr. Branko Glisic (Princeton University), Dr. Abdul R. Pinjari (University of South Florida), Dr. Soheil Nazarian (University of Texas at El Paso, Dr. Carin Roberts-Wollmann and Dr. Gerardo Flintsch (Virginia Polytechnic Institute).

Consortium Universities Involved:

Rutgers, The State University of New Jersey (Lead)
University of Delaware, Newark, DE
Utah State University, Logan, UT
Columbia University, New York, NY
New Jersey Institute of Technology, Newark, NJ
Princeton University, Princeton, NJ
University of Texas, El Paso, TX
University of South Florida, Tampa, FL
Virginia Polytechnic Institute, Blacksburg, VA

What other organizations have been involved as partners?

The consortium has collaborated with a number of external agencies across the United States:

New Jersey Department of Transportation	Trenton, NJ	Financial support and collaborative research on multiple projects, including ITS research and a time-accelerated infrastructure testing facility that will simulate extreme loads and environmental conditions in on a real

		bridge deck
Virginia Department of Transportation Virginia Center for Transportation Innovation and Research (VCTIR)	Richmond, VA	Collaborative research on multiple projects, including a time-accelerated infrastructure testing facility that will simulate extreme loads and environmental conditions in on a real bridge deck
Applied Research Associates, Inc.	Panama City, FL	Collaborative research on multiple projects, including a time-accelerated infrastructure testing facility that will simulate extreme loads and environmental conditions in on a real bridge deck
Drexel University	Philadelphia, PA	Collaborative research on multiple projects, including a time-accelerated infrastructure testing facility that will simulate extreme loads and environmental conditions in on a real bridge deck
ITS New Jersey (a state chapter of ITS America)	Trenton, NJ	Collaborative research and personnel exchanges for workshops, meetings, and conferences on ITS research
Parsons Brinckerhoff	New York, NY d	Collaborative research and support on a number of research and technology transfer activities, including workshops, meetings, and conferences on ITS research
New Jersey Asphalt Paving Association	Trenton, NJ	Personnel resources, knowledge exchange, and technology transfer collaboration for annual paving conference
New Jersey metropolitan planning organizations (North Jersey Transportation Planning Authority, Delaware Valley Regional Planning Commission, and South Jersey Transportation Planning Organization)	Newark, NJ; Philadelphia, PA; Vineland, NJ	Collaborative research and knowledge exchange for freight advisory committee and other improvement task forces and projects

Have other collaborators or contacts been involved?

- **collaborations with others within the lead or partner universities; especially interdepartmental or interdisciplinary collaborations**

Partner Meeting/Communication: the partners have plenty of communications and virtual meetings through this reporting period.

Research Collaborations: The research selection process will yield many collaborative proposals to perform joint research with partners.

Specific project collaborations for this reporting period include:

Virginia Polytechnic Institute
National Pavement Management Conference
Virginia Polytechnic Institute will host the ICPMA 9 national paving conference in the DC area to generate knowledge and foster a world class transportation workforce. Hundreds of researchers, government officials, and private industry pavement experts are expected to attend the conference in the DC area to share ideas and learn about implementing proven research findings into everyday practices. This conference is also held with support from TRB, AASHTO, and the Virginia Department of Transportation.

Rutgers' Edward J. Bloustein School of Public Planning and Policy
Transportation Options for Individuals with Autism Spectrum Disorders
Bloustein provided collaborative research and personnel resources for multiple national and regional planning and engineering research projects, including an engineering and psychology program designed to help adults with autism and other developmental disabilities navigate available transportation options and lead more independent lives. This project is supported by the New Jersey Governor's Council and the New Jersey Department of Health and Senior Services.

Utah State University
Accelerated Bridge Construction Education
Utah State University provided financial support and resources for the 2014 Accelerated Bridge Construction (ABC) conference hosted by Florida International University to provide a meaningful exchange about ABC technologies to engineers and researchers within and external to the UTC network. The conference will attract bridge engineers and decision-makers to learn about expedited and cost-effective construction techniques for safe and resilient new bridges.

• collaborations or contact with others outside the UTC

Oregon Transportation Research and Environmental Center (OTREC), Portland State University
STEM Career Education for Young Women
The consortium collaborated with another National UTC, OTREC, to create a hands-on engineering Challenge Project for the Women's Transportation Seminars (WTS) 2014 Transportation YOU Summit in Washington, DC, to encourage female high school students from around the country to enter into STEM career fields. Each year, the highlight of the conference is the Challenge Project, which gives the students a close-up look into the daily job functions, responsibilities, and societal impacts of a transportation engineer; the project also introduces them to USDOT mission and focus areas. The 2014 Challenge Project was designed by CAIT and OTREC, and CAIT and OTREC staff will also serve as professional mentors. Aligning with USDOT focus areas of equality, access, and economic growth, the students will survey underprivileged sectors (Anacostia and U Street) of DC and perform a neighborhood equality and access analysis. The students will then work in teams to identify issues of inequality and

propose solutions that improve access and economic growth. The Challenge Project will take place during the WTS 2014 Transportation You Summit on June 27, 2014.

Florida International University
Accelerated Bridge Construction Education
The CAIT consortium sponsored the 2014 ABC Conference, hosted by Florida International University, to help bring ABC technologies to engineers and researchers, not only within the UTC network, but external to it.

Multiple DOT and University Partners
Accelerated Infrastructure Testing Facility*: *Bridge Evaluation Using Accelerated System Testing (BEAST)
The consortium created a working group to exchange ideas and knowledge about the construction of a massive, time-compressed facility that will study the effects of extreme weather and temperatures on real concrete bridge decks. Partners include NJDOT, VDOT, Advanced Research Associates, Drexel University, the University of Delaware, and Utah State University.

- **collaborations or contacts with others outside the United States or with an international organization (country(ies) of collaborations or contacts).**

The Transportation Safety Resource Center (TSRC) at CAIT is investigating the feasibility of building a crash data analysis software that will help safety engineers working for the nation of Qatar to create proactive road improvement plans in advance of a major international sporting event.

4. <u>IMPACT:</u> What is the impact of the program? How has it contributed to transportation education, research and technology transfer?
The consortium's research activities and conclusions will be made available through workforce development and technology transfer efforts and reach over 12,000 transportation professionals nationwide, including consortium members, external university partners, government officials, and private industry partners.

What is the impact on the development of the principal discipline(s) of the program?
"Nothing to Report"

What is the impact on other disciplines?
"Nothing to Report"

What is the impact on the development of transportation workforce development?
It is anticipated that research projects will lead to the adoption of new practices, policies, or methods that will be disseminated to the transportation workforce through training. These training events will enhance the transportation industry through the creation of new career paths and an industrywide understanding of best practices and the USDOT state-of-good-repair mission.

What is the impact on physical, institutional, and information resources at the university or other partner institutions?
It is anticipated that CAIT and its partners will share personnel and technological resources to streamline research, workforce development, and technology transfer efforts. For example, CAIT provides labor and online registration capabilities to record planned attendances to various conferences and workshops for other organizations, like ITS New Jersey.

What is the impact on technology transfer?
It is anticipated that research projects will lead to the adoption of new or more efficient practices or inform policy.

What is the impact on society beyond science and technology?
Workshops and conferences on advanced technologies, materials, and best practices will lead to the maintenance and construction of intelligent, resilient infrastructure systems that enhance commercial vitality and improve the safety, security, and quality of life for Americans who depend on them.

5. <u>CHANGES/PROBLEMS</u>

Changes in approach and reasons for change
"Nothing to Report"
Actual or anticipated problems or delays and actions or plans to resolve them
"Nothing to Report"
Changes that have a significant impact on expenditures
"Nothing to Report"
Significant changes in use or care of human subjects, vertebrate animals, and/or biohazards
"Nothing to Report"
Change of primary performance site location from that originally proposed
"Nothing to Report"

6. <u>SPECIAL REPORTING REQUIREMENTS</u>

"Nothing to Report"