

Center for Research and Education in Transportation Engineering Systems (CREATES)

National and Regional Impact

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Background

Center for Research and Education in Advanced Transportation Engineering System (CREATES) at Rowan university is a comprehensive transportation research center with a mission to conduct cutting-edge research and find innovative solutions to current and future challenges related to transportation engineering. CREATES has the capability to conduct research in Bituminous Materials / Sustainable Construction Materials, Concrete Materials, Pavement Technology and Asset Management, Soils and Geotechnical Engineering, Bridge Engineering, Structural Reliability, Intelligent Transportation Systems, and Transportation Safety and Mobility, Environment Remediation, and Sustainable Additive Construction.

CREATES is equipped with a state-of-the-art accelerated pavement testing facility and an HVS. In fact, CREATES is the only academic research center in the Northeast United States (US) equipped with such resources. The CREATES award is more than \$45M. CREATES provides hands-on experience to sixty undergraduate and graduate students in various fields of transportation. The POWER of CREATES is to conduct **P**rofessional development, **O**utreach, **W**orkforce development, **E**ducation and **R**esearch, in all the above-mentioned fields. CREATES recent grants, include, but not limited to:

- Received a \$1.5M US Department of Education Graduate Assistance in Areas of National Need (GAANN) titled “**GOSTARS: Graduate Opportunities in Safe Transportation and Resilient Systems** grant to fund ten doctoral students from underrepresented minority groups in infrastructure, safety and congestion.
- Received \$30M grant from the Department of Defense-US Army Corps, its largest at Rowan University to date, titled “Resilient Arctic Infrastructure: Innovative Solutions to Protect National Security Interest.”

Grow the funding footprint:

- CREATES has also received funding from new agencies, such as US Department of Education, Delaware River Port Authority and New Jersey Public Utilities/ Department of Energy.
- CREATES team is working with new industry partners and asphalt plants to develop new materials that are put on New Jersey roads, saving the State of New Jersey thousands of dollars. The Center is also conducting cutting-edge research in transportation safety, directly impacting the lives of New Jersey residents.

Direct Impact of research:

Safety:

- CREATES research team has developed an automated analysis of surrogate safety measures (SSM) and non-compliance behavior of road users at the intersections.
- According to the Federal Highway Administration (FHWA), more than 2.5 million intersection-related crashes happen annually across the county, accounting for more than 40 percent of all motor vehicle crashes involving intersections.
- In the state of New Jersey, more than 34 percent of total motor vehicle crashes involved intersections.
- The results of this project are expected to reduce the number of traffic conflicts at intersections using SSM through retiming traffic signals, which may result in reducing crashes up to 18 percent resulting in saving people's lives.

Innovative Materials:

- CREATES has conducted testing for several plants over the years allowing for research investigations into increasing Recycled Asphalt Pavement (RAP).
- In recent investigations, mix designs containing up to 30 percent and 40 percent RAP have been found to pass the performance testing requirements.
- According to the Federal Highway Administration, the savings per ton of mix using 30 percent RAP is about \$2.46. A standard two-lane road with a 3-inch layer of asphalt requires around 240 tons of asphalt.
- Based on this research, a 30 percent RAP design would save about \$588 per mile of road paved. The CREATES team used the design for two separate roadways in the state of New Jersey.
- If the total paving is estimated to be around 40 miles, implementing just these two projects with asphalt plants must have saved the state of New Jersey approximately \$24,000.

Innovative Pavement Systems:

- CREATES research team also investigated the potential use of new precast pavement system to improve concrete pavement repair strategies for the state of New Jersey. New Jersey DOT was using only one manufacturer based in New York.
- Approximately four additional precast pavement systems were identified as candidates for use in the state. The use of precast pavement systems increases efficiency and promotes the state's business development and job growth in the construction industry.
- The adoption of additional precast pavement systems has also shown an increase in contractor efficiency of 60 percent (32 panels per night work window compared to 20 panels per night work window), which translates to approximately 200 additional feet of roadway repair per construction window for intermittent-based repairs.
- Based on other states' DOT experiences, the adoption of multiple precast pavement systems can decrease the overall pavement rehabilitation costs by approximately \$5,000 per precast panel or an estimated \$1.7 million per lane-mile .

Pavement Management:

- CREATES research team has also developed a cost-effective pothole detection system that can convert any government vehicle into an affordable pavement failure detection unit. A conventional system would typically cost \$50,000 to conduct a comprehensive detailed data assessment of a county with 300 miles of roadway. The system developed by CREATES would cost \$20,000. A savings of approximately \$30,000, which relates to a savings of \$100 per mile.

New Jersey Underserved Communities Electric Vehicle Affordability Program: CREATES team is making a socio-economic impact in towns across New Jersey by working on a project to implement a robust, yet affordable shared mobility program that uses Plug-in Electric Vehicles (PEV) that would be implemented in underserved communities in New Jersey. This research study has the following impacts:

- Help create a clear path for providing PEVs and shared mobility access to underserved communities in New Jersey.
- Reduce transportation costs for underserved communities and provide them access to economic, educational, employment and health and wellness opportunities through affordable transportation.

- Improve the health conditions of people in underserved communities; especially when research has shown that air pollution can cause heart attacks, asthma, strokes, cancer, and premature death when living near high traffic areas, which is typical for underserved communities with low income.

Contributions of CREATES Research to the Department of Defense

- Cold-in-place recycling technology developed by CREATES research team extends the paving season by two months and saves approximately \$40K/ln-mile; sustaining vital operations.
- A self-deicing system to enhance aircraft take-off/landing safety & continued operations under icy conditions. It also saves approximately 60 percent in ice removal cost savings.
- CREATES research team developed an alternative methodology of insulated pavements to protect the permafrost. This method will potentially save approximately \$1M/ln-mile.
- CREATES developed construction materials using highly elastic binders. These better performing sustainable paving materials with saving up to \$100K/ln-mile.

Establish a Pipeline of Undergraduate and Graduate Students: CREATES provides hands-on experience to sixty undergraduate and graduate students in various fields of transportation. These students directly contribute to the state's economy through staffing its public and private workforce and through finding innovative solutions for the transportation challenges of the future. As members of a high-paying sophisticated workforce, they are invested in their communities and contribute their tax dollars to the state's public infrastructure.

Professional Development Programs: CREATES offers professional development programs to meet the needs of municipal, county and state engineers and consultants. These programs help the workforce at these agencies to meet the strict requirements for federal and state projects and ensures professionals are current and aware of recent developments and innovations. These are offered at no cost to all government employees. In addition, CREATES has introduced monthly webinars, which are free, that is broadcasted all over the world and it highlights the impact of the CREATES projects on all aspects of transportation industry.

Excite a New Generation of High School Students and Introduce Them to Transportation Fields and Potential Career Paths: CREATES has been instrumental in providing hands-on experience for a diverse pool of sixty high school students in the past five years (2017–2021). The objective of these sessions is to introduce students to careers in transportation and civil engineering. CREATES team is looking forward to a cohort of high school students in summer 2023.

CREATES Impact on the State and Region

CREATES research team has made quite an impact on making roads and transportation in the State of New Jersey safer to travel and more efficient. The New Jersey Asphalt Pavement Association (NJAPA) has a strong partnership with Rowan University and the executive director of the Association has recently endorsed CREATES for its influence on several fronts. On the research front, the executive director of the association, Mr. Kevin Monaco, noted that *“Research conducted by Rowan was the direct basis for state law which allowed greater beneficial use of reclaimed asphalt pavements which is proven to reduce the cost of roadway projects to the public as well as significantly reduce carbon emissions for the manufacturing process.”* He continues his endorsement of CREATES research saying, *“also conducted research on pavement preservation and use of thin-lift asphalts which industry has used to broaden market share for asphalt products while also providing cost savings to the public.”* He further endorsed Rowan for its people, indicating the remarkable success NAPA has had with

training a successful workforce. Finally, Mr. Monaco states that CREATES work is beneficial in creating jobs and for socio-economic development in the form of tax savings, and environmental sustainability.