



Project Requirements Form USDOT
CREATE UTC Contract Number 69A3552348330
Center Lead: Texas State University; Texas State University

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| Research Project Name: Development of deep learning based automated data collection technology for coastal highway pavements | |
| Improving the Durability and Extending the Life of Transportation Infrastructure | |
| Principal Investigator: Feng Wang, f_w34@txstate.edu, 512-245-5258; 0000-0002-1528-9711, TXST | |
| Project Partners: Texas Department of Transportation | |
| Research Project Funding: | |
| Federal: \$113,599 | Match: \$66,051 (TxDOT & TXST) |
| Project Start Date: 09/01/2023 | Project End Date: 12/10/2025 |
| Project Description: The harsh environmental conditions of coastal areas, including extreme weather events, saltwater corrosion, tides, winds, and waves, make maintaining these roads a significant challenge. One solution to improve the durability of coastal roads is through improved pavement maintenance, which involves maintaining roads at the right time to extend their service life cost-effectively. However, accurately monitoring the conditions of coastal roads is a challenge. Therefore, the research problem is to identify and evaluate available technologies for pavement condition evaluation in coastal areas, and assess their efficiency, accuracy, and cost-effectiveness. The research aims to provide a solution to the challenges faced in evaluating the performance of coastal roads which can support a maintenance program specific to coastal roads. The research will improve the durability of coastal roads, reduce repair costs, and promote the economic growth of coastal areas. | |
| Automated pavement condition data collection using image processing is currently the most widely used technology for monitoring pavement conditions. Over 33 states in the U.S. use this technology to assess network-level pavement conditions. However, the accuracy of these technologies is significantly impacted by various environmental factors when using traditional image processing methods. With the advent of Artificial Intelligence (AI) and Machine Learning (ML), there is an opportunity to improve automated pavement condition data collection technologies, enabling accurate and efficient detection of pavement conditions. | |
| Thus, the objective of this research is to use AI/ML enhanced automated pavement condition data collection technologies to monitor coastal road pavements. This will be achieved by developing an algorithm specifically tailored to the environmental characteristics of coastal areas. To accomplish this research objective, the following specific goals will be met: 1) To establish a library of pavement surface images from coastal areas, representing various combinations of pavement distress types and severity levels under different coastal environmental conditions. 2) To develop AI/ML models and tools for coastal pavement condition assessment based on pavement surface images. The AI/ML models will have sufficiently high accuracy for detecting distresses under coastal environments. 3) To test and validate the developed AI/ML models on actual pavement case studies representing coastal environmental conditions. | |
| US DOT Priorities: The proposed project aligns with Priority Area D (Infrastructure) of the US Department of Transportation (US DOT) Strategic Plan and the following Strategic Goals: 1) Improve Durability and Performance of Transportation Infrastructure: The project addresses the need for durable coastal roads to ensure safe passage for the public and maximize coastal investments. 2) By using AI/ML-enhanced pavement condition data collection technologies, the | |



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project will improve the efficiency and accuracy of pavement evaluation, support maintenance decisions, and prolong pavement service life.

Outputs: The proposed research aims to develop an AI/ML enhanced automated pavement condition data collection technology for monitoring coastal road pavements. Upon successful completion of the research, the technology will be ready for implementation by the highway agencies responsible for maintaining the coastal highways. The following technology transfer and implementation strategy outlines the steps to ensure successful implementation of the technology: 1) Demonstrate the effectiveness and benefits of the technology: The research will demonstrate the accuracy, efficiency, and cost-effectiveness of the developed technology for pavement condition evaluation in coastal areas. The research team will highlight the related benefits of the technology, including its ability to prolong pavement service life and reduce total repair costs. 2) Collaborate with highway agencies for technology implementation: The research team will collaborate with highway agencies and governments responsible for successful implementation of the technology. To ensure effective use of the technology, the research team will develop training programs and user manuals for the highway agency personnel who will be using the technology.

Outcomes/Impacts: Promote Innovation. The project involves the development and application of new technologies in pavement evaluation, specifically tailored to the environmental characteristics of coastal areas. This aligns with the US DOT Strategic Goal to promote innovation in transportation to improve safety, mobility, and economic competitiveness.

Final Research Report: <https://rosap.ntl.bts.gov/view/dot/88180>



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Web Links: <https://create.engineering.txst.edu/>

Index Terms (Keywords to describe Project):

pavement; coastal area; automated condition assessment; machine learning; image processing

Subject Areas (Check all that apply, for more details about topic areas see <https://rip.trb.org/>):

Design and Construction: Bridges & other structures; Construction; Design;
 Geotechnology; Hydraulics & Hydrology; Materials; Pavements

Operations and Preservation: Maintenance and Preservation; Operations & Traffic Management;
 Securities & Emergencies

Planning and Environment: Economics; Energy; Environment; Planning & Forecasting; Society

Policy & Organization: Administration & Management; Data & Information Technology; Education & Training
 Finance; History; Law; Policy; Research; Transportation (general)

Safety, System Components, and Users: Freight Transportation; Passenger Transportation Safety & Human Factors; Terminals & Facilities; Vehicles & Equipment