



Artificial Intelligence and Mobile Phone-Based Pavement Marking Condition Assessment and Litter Identification

CTIPS-007 – UTC Project Information

Recipient/Grant Number:	North Dakota State University, University of Utah Grant No. 69A3552348308
Center Name:	Center for Transformative Infrastructure Preservation and Sustainability
Research Priority:	Preserving the Existing Transportation System
Principal Investigator(s):	Jianli Chen, Ph.D.
Project Partners:	USDOT, Office of the Assistant Secretary for Research and Technology – \$50,000 Utah Department of Transportation – \$50,000
Total Project Cost:	\$100,000
Project Start and End Date:	5/6/2024 to 5/5/2026

Project Description

Pavement marking, as a transportation asset, is highly related to safety and mobility but has a short service life. Faded pavement marking presents a significant concern for road users, compromising their ability to navigate safely. Additionally, litter (e.g., vehicle debris) on the roadways poses a substantial hazard that can significantly contribute to traffic accidents. To address these issues, regular inspection and maintenance of the pavement are necessary, including repainting the faded markings and cleaning the litter on the roadways, to ensure the pavement is in good, clean, and safe condition. However, traditional inspection methods still heavily rely on manual efforts, which are subjective, labor-intensive, and time-consuming, which are not suitable for large-scale and frequent implementation. The advancements in artificial intelligence (AI), particularly deep learning and computer vision, have provided new solutions to inspect transportation infrastructure. However, there is limited application in assessing the conditions of pavement markings and identifying roadway litter. Also, counting and locating the identified issues are less involved in prior studies. Therefore, this AI-based project aims to develop a lightweight, affordable, and automated approach to inspect pavement marking conditions and pavement cleanliness, facilitating efficient planning maintenance work and ultimately improving the safety of road users.

USDOT Priorities

Pavement, as a critical transportation asset, needs to be inspected and maintained regularly, including repainting of pavement markings and cleaning litter on the roadways, to ensure its proper functioning and

provide a safe environment to road users. The proposed work introduces an effective, cost-effective, and lightweight approach to inspect the condition of pavement markings and identify the litter on the roadways automatically, which would facilitate a larger-scale, more frequent, and more cost-efficient pavement inspection and maintenance. The proposed AI models in this project can serve as a valuable tool to enable effective pavement maintenance and preserve the existing pavement system in decent and safe conditions.

Outputs

The developed models in this study provide an efficient, lightweight, and affordable solution to inspect pavement markings and pavement cleanliness. These works will be directly utilized in the practice of UDOT road asset maintenance. Meanwhile, the project outcomes will be documented and shared in conferences held by UDOT, the Transportation Research Board Meeting, and other journals in relevant fields. Also, the project impact will be broadened through YouTube videos the team will make and publish on the website to facilitate the technology transfer.

Outcomes/Impacts

The expected outcomes of the project will be validated AI algorithms for auto-inspecting pavement marking conditions and auto-identifying litters on the roads without boot on the ground. Also, the developed models can count the identified issues in a road section, which is critical information to determine to severity of these identified issues in this road section or if there exist any urgent maintenance needs. Besides, the developed models are able to locate the identified issues, informing specific locations that need maintenance in practice.

The developed models can be applied to infrastructure inspection. Once successfully deployed, the lightweight and affordable approach can be employed in the DOT vehicle fleet to help assess the conditions of pavement markings and pavement cleanliness efficiently and periodically, hence, contributing to enhanced road safety.

Final Report

Upon completion, the final report link will be added to the [project page on the CTIPS website](#).