Vehicle Classification Technologies for Toll Collection

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Lead Institution:

Oklahoma State University

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Tran-SET

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$ 94,000

Evaluating vehicle classification technologies' performance for toll collection

Toll facilities (roads, bridges and tunnels) are used primarily for revenue generation to repay for long-term debt issued to finance construction, capacity expansion, operations and maintenance of these facilities. Tolls are one form of a broad concept known as road pricing. In addition to revenue generation, road pricing is used for other reasons including transportation demand management to reduce peak hour travel and the recurring traffic congestion on some corridors. Tolling technologies have evolved rapidly in the past two decades and today offer many solutions for toll collection. Traditional (mostly cash) tolling has been gradually replaced by electronic toll collection (ETC) that enables users to go through toll lanes without stopping. In addition to improving traffic safety and enhancing the efficient use of the existing infrastructure, ETC results in reduction in toll collection costs. The aim of this study is to provide tolling authorities in Region-6 with detailed analysis of the fitness of various non-pavement-intrusive vehicle classification technologies (imaging, radar, Lidar, thermal profiling, etc.) under different roadway, traffic, and environmental conditions to inform decision-makers of the accuracy, performance, and lifecycle-cost of these technologies.

Problem Statement

Toll facilities (roads, bridges and tunnels) are used primarily for revenue generation to repay for long term debt issued to finance construction, capacity expansion, operations and maintenance of these facilities. Tolls are one form of a broad concept known as road pricing. In addition to revenue generation, road pricing is used for other reasons including transportation demand management to reduce peak hour travel and the recurring traffic congestion on some corridors. Tolling technologies have evolved rapidly in the past two decades and today offer many solutions for toll collection. Traditional (mostly cash) tolling has been gradually replaced by electronic toll collection (ETC) that enables users to go through toll lanes without stopping. In addition to improving traffic safety and enhancing the efficient use of the existing infrastructure, ETC results in reduction in toll collection costs. The three most important components of ETC are user account identification, vehicle classification (where vehicles are charged differently according to class), and determination of the distance traveled. Most of the tolling agencies in Region 6 (and most of the U.S.) determine the user fee based on the number of axles. The latter is often identified using induction loop sensors buried in the pavement and energized by low voltage electrical currents that produce electromagnetic fields above the roadway. Vehicles traveling through these fields produce digital signatures that are used to identify the number of axles. The loop sensors used by many tolling authorities in the U.S. are manufactured by TransCore, Inc. and are known as Intelligent Vehicle Identification System (IVIS). The IVIS sensors have high accuracy rate in classifying vehicles. However, loop detectors present several problems including the intrusive nature of their installation and maintenance (disruptive lane closures), high failure rate, sensitivity to rebar in concrete pavements, and their undermining of the structural health of the surrounding pavement. Loop failure can result because of several reasons including cracks across saw cuts, broken loop or lead in wires, and sealant failure.

Objectives

The aim of this study is to provide the tolling industry (operators, planners and designers) in Region-6 with detailed analysis of the suitability of various non-pavement-intrusive vehicle classification technologies (imaging, radar, Lidar, thermal profiling, etc.) under different roadway, traffic, and environmental conditions to inform decision-makers of the accuracy, performance, and lifecycle-cost of these technologies.

Intended Implementation of Research

This project will help improve the research and education infrastructure at OSU. In addition, the developed learning resources will be designed to further the professional capacity building and skills of the U.S. transportation workforce of the future. Webinar presentation will be made at the conclusion of the technical part of the project. Furthermore, the technical results will be published in archival journals and presented at conferences attended by representatives of industry and academia. The outreach activities that will be conducted as part of the study will focus on both practitioners and student audiences. The study will also leverage and participate in Tran-SET's programmatic outreach activities. The body of knowledge accumulated during this project will be incorporated into courses offered by the School of Civil & Environmental Engineering at OSU for both undergraduate and graduate students. This material will also be made available to other universities in the region.

Anticipated Impacts/Benefits of Implementation

This project develops needed professional capacity building resources to assist tolling agencies in Region-6 in learning and implementing best practices and emerging technologies for vehicle classification. The outcomes, in turn, will contribute to achieving the U.S. DOT goals and broader impacts of improving mobility, reducing congestion, promoting safety, preserving the environment and preserving the existing transportation system set forth in the DOT's draft report "Beyond Traffic 20145: Trends and Choices."

Web links

- Tran-SET's website https://transet.lsu.edu/research-in-progress/

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

Learn More

For more information about Tran-SET, please visit our website, LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Dr. Momen Mousa (Tran-SET Program Manager) directly at transet@lsu.edu.