Texas A&M Transportation Institute

Texas Department of Transportation

PROJECT SUMMARY REPORT

0-7124: Develop a New Tool for Evaluating Infrastructure and Planning Impacts from Changes in Truck Traffic and Truck Technologies

Background

This project developed a set of integrated infrastructure-based and economic models to evaluate the infrastructure and planning impacts of increased numbers of automated trucks and truck platoons operating on Texas highways. As automated and platooned truck technologies evolve and their use in Texas highway corridors continues to grow, it is critical that state transportation planners and engineers be able to quickly evaluate the potential impacts of, impediments to, and solutions for addressing the impacts of these vehicles upon Texas highway infrastructure. The project developed the geographic information system (GIS) dashboard-based Fast Web Tool, which uses user-input conditions to calculate physical infrastructure impacts on bridges and different types of asphalt and concrete pavements. The tool also has options for flooding or other soil conditions and can perform economic analysis of the impacts of a given scenario over time.

This project builds on the findings of Texas Department of Transportation (TxDOT) Project 0-6984, Evaluate Potential Impacts, Benefits, Impediments, and Solutions of Automated Trucks and Truck Platooning on Texas Highway Infrastructure, completed by the Texas A&M Transportation Institute in 2020.

What the Researchers Did

Researchers initially performed a literature review of the automated and platooned truck industry activities and planning within Texas to determine the types of factors that would need to be included in a flexible, fast tool that could perform realistic assessments in Texas highway corridors as changing truck freight technologies are implemented. The results of bridge, pavement, and flooding impacts from the previous TxDOT Project 0-6984 were incorporated into the development of the new Fast Web Tool along with updated cost and impact factors from the evolving and projected truck operations environment to update the economic impact analysis model. Skilled programmers on the research team used this information to create a user-input-driven tool that can augment and improve planning practices for the future freight network by integrating a broad range of input factors.

What They Found

During the project, researchers discovered that several of the automated truck companies identified first in Project 0-6984 had gone out of

Research Performed by:
Texas A&M Transportation Institute

Research Supervisor:
Curtis Morgan, TTI

Researchers:
Bjorn Birgisson, TTI
Jeffery Warner, TTI
Sushant Sharma, TTI
Bill Prieto, TTI
Maxwell Steadman, TTI
Inci Güneralp, Texas A&M University
Billy Hales, Texas A&M University
Rakibul Ahasan, Texas A&M University
Yadong Guo, Texas A&M University
Shengxin Cai, Texas A&M University

Project Completed:
12-31-2023

business or merged to create a different industry picture more focused on truck automation and testing of related technologies while plans for platooning of trucks have not advanced as rapidly. Several companies are actively testing in Texas freight corridors and have plans to expand further soon.

Development of the Fast Web Tool under this project includes four major integrated models in the following areas:

- Bridge impacts.
- Pavement impacts.
- Flood impacts.
- Economic analysis.

User-selected scenarios are used to produce indices showing the relative robustness of the selected study area of the Texas Highway Freight Network:

- The bridge and flooding impact models assess varied climate-driven impacts on bridges. The user can increase or decrease the loading factors of bridges for an individual bridge, those along a corridor, or those within a defined area to identify potential rehabilitation needs.
- The pavement impact model considers downloaded and archived weather reports, material properties, and structural impacts of changing truck operations from representative pavements. The model can use the Federal Highway Administration Long-Term Pavement Performance database, GIS traffic composition data (i.e., the number of cars and/or trucks, human-controlled or automated, etc.), or user-specified traffic files to analyze the desired study area over a user-input period of years.
- The economic analysis model allows selection of several factors to be adjusted in calculating the economic impacts of alternative operational scenarios. These factors can include average annual daily truck traffic, truck growth rate, trip lengths, corridor-specific commodity mixes, and cost factors for pavement types, bridge repair/replacement, fuel costs, and driver wages.

GIS dashboard displays and other graphic outputs from the four models allow the user to assess how each input scenario might contribute to the future health and success of the freight transportation system under new truck configurations, automated or human driver status, and physical roadway conditions. Outputs can also be used to generate .pdf format reports and graphics for presentations.

What This Means

The Fast Web Tool allows TxDOT and other planners to create, estimate, and test scenarios to assess the impacts of increased truck traffic, new truck technologies, and many other underlying factors to rapidly evaluate the capabilities and resilience of the Texas Highway Freight Network roadways. Because of the broad range of user-input factors that are variable from scenario to scenario, more accurate estimates of various planning, maintenance, and operational impacts can be assessed for a specific location, a roadway corridor, a user-defined geographic area, or even statewide.

For More Information

Project Manager:
Martin Dassi, TxDOT, (512) 416-4738

Research Supervisor:
Curtis Morgan, TTI, (979) 317-2562

Project Monitoring Committee Members:
Loretta Brown, Sondra Johnson, Jenny Li, Ibtissam Nasser, Christeen Pusch, and Charles Tapp

Research and Technology Implementation Office
Texas Department of Transportation
125 E. 11th Street
Austin, TX 78701-2483

www.txdot.gov
Keyword: Research

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