

0-6984: Evaluate Potential Impacts, Benefits, Impediments, and Solutions of Automated Trucks and Truck Platooning on Texas Highway Infrastructure

Background

This study assessed the potential impacts, benefits, and impediments of the introduction of automated trucks and truck platooning on Texas highway infrastructure. In cases where the research team identified negative impacts or impediments to the introduction of automated trucks and truck platooning, the researchers also identified potential solutions that may promote the successful introduction of automated trucks and truck platooning on Texas highway infrastructure.

The results from this study will aid the Texas Department of Transportation (TxDOT) in understanding the potential impacts, benefits, impediments, and solutions of automated trucks and truck platooning on the Texas highway infrastructure and may allow TxDOT's Strategy and Transportation Planning and Project Teams to proactively plan and anticipate the various issues associated with the introduction of these new technologies on Texas highway infrastructure.

The results from this research project produced a comprehensive research report summarizing the potential impacts of benefits, impediments, and solutions to deploy new automated and truck platooning technologies. This shall form the basis for planning decisions by TxDOT to ensure that engineers and planners make the right decisions resulting in successful longer-lasting infrastructure that is prepared for the coming introduction of truck automation and platooning technologies.

What the Researchers Did

The main research activities in this project are summarized by the following activities focused on assessing the impacts of automated and platoon trucks on the Texas Highway Freight Network:

- Performing a literature review and an online survey to establish the current state of the practice, as well as identifying research and development gaps.
- Assessing the planning and policy impacts for TxDOT that may occur as platooning and automated trucks are introduced on Texas highways under a variety of scenarios.

- Assessing the potential technical and performance impacts of platooning and truck automation on Texas infrastructure, including both bridges and pavements.
- Examining the impacts of truck platooning and truck automation on the overall vulnerability of the Texas Highway Freight Network.
- Performing an overall analysis of the economic benefits and costs to the overall economy of Texas.
- Identifying the potential technological, financial, organizational, and political barriers to the implantation of autonomous and platoon truck technologies.

What They Found

Highlighted research results from this project are as follows:

- The results from the literature review and the online survey showed that further testing and understanding of truck platooning and automated truck technologies under various operational conditions are necessary for successful implementation.

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Project Completed:

8-31-2020

- Truck automation and platooning could result in the following reduction in pavement service life:
 - For flexible pavements, a 22 percent reduction in average service life for top-down cracking, a 21 percent reduction in average service life for bottom-up cracking, and a 9 percent reduction in average service life for rutting.
 - For concrete pavements, significant reduction in pavement service life for all concrete pavement types, with jointed reinforced concrete pavements having the largest reduction in service life
- The research identified two possible pavement-hardening scenarios: building dedicated truck lanes, and hardening paved surfaces using polymer-modified asphalt.
- The bridge vulnerability study found that truck gap spacing had a moderate impact on bridge vulnerability, and the number of trucks in a platoon had a minor impact. An exception to this is very long-span structures in poor condition. Bridge material (steel versus concrete) has a minor impact, while bridge generation (i.e., the generation of the building code used to design the bridge) has a significant impact.
- The economic analysis of the overall potential costs and benefits to Texas from autonomous and platoon truck traffic found that the discounted net present value was \$1.9 billion in the low-growth scenario and \$2.4 billion in the high-growth scenario. The benefit-cost ratio was 6.62:1 in the low-growth scenario and 8.42:1 in the high-growth scenario, meaning that in the high-growth scenario, for every \$1 spent, there are \$8.42 of benefits.
- Finally, the results from the STREAM process were able to identify four main categories of potential barriers to platooned and automated truck implementation: technology barriers, financial barriers, organizational barriers, and political barriers. Each potential barrier was analyzed and described in detail in tabular form.

What This Means

The policy, planning, and/or investment implications of the pavement network analysis indicate consideration of the following:

- Introducing dedicated hardened freight routes and/or truck lanes with high polymer modification of asphalt concrete pavements.
- Not constructing future jointed reinforced concrete pavements on future autonomous/platoon truck highway lanes.
- Specifying how much wheel wander should be required by truck automation and platoon truck companies in order to negate the negative effects of truck automation.
- Introducing guidelines for platoon truck weight distributions.
- Not restricting platoons to right lanes only.
- Performing initial testing of truck platoons in more rural areas.
- Not introducing cooperative lane changing by platoon trucks to accommodate merging vehicles because it did not improve freeway performance.
- Adding longer auxiliary lanes for the ramps on corridors supporting autonomous and platoon truck traffic.

In addition, this research used a versatile and fast network tool for planning and strategy scenario evaluations, which could be implemented for broader use within TxDOT.

For More Information

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Keyword: Research