CENTER FOR TRANSPORTATION RESEARCH

PROJECT SUMMARY

Texas Department of Transportation

0-6817: Review and Evaluation of Current Gross Vehicle Weights and Axle Load Limits

Background

Overweight (OW) loads typically require innovative truck configurations that distribute the load more efficiently than traditional five-axle configurations, potentially reducing the infrastructure consumption. Therefore, it becomes important to understand the feasibility of such alternative vehicle configurations, assess the associated pavement and bridge consumption, and estimate necessary user fees for maintaining the infrastructure. This project's objective was to develop methodology to quantify the relative consumption of different axle loads and vehicle configurations on pavements and bridges. Guidelines were developed for more infrastructure-friendly vehicle configurations based on both structural and economic analyses. Alternative vehicle configurations are proposed based on the results obtained by considering varying factors such as axle type, distance between axles, and load per axle. In addition, a cost recovery structure was developed that adequately funds repairs to roads used by OW trucks. Finally, recommendations for implementing the findings of this study into a coastal corridor in Texas were developed.

What the Researchers Did

An extensive literature review was performed to review the Rider 36 and previous studies conducted on the impacts of OW or oversize vehicle configurations. The literature review summarizes truck weight and axle load limits in the US and other countries, current truck classifications and configurations both in the US and abroad and proposed alternative configurations by other research studies, and cost and benefits of OW truck configurations.

Following the literature review, a project advisory panel was selected to provide insight into future truck configurations. A series of alternative truck configurations were determined by synthesizing the literature and previous TxDOT research project efforts. The research team developed methodologies to analyze pavement and bridge consumption, calculating the consumption of each alternative truck configuration and performing a comparative analysis to identify infrastructure-friendly vehicles.

Finally, the research team reviewed the estimated costs imposed by use of OW vehicles and ways to allocate these costs to different vehicle classes. Existing cost recovery structures are explored, including any that can generate additional revenue to fund pavement repairs due to accelerated consumption by OW vehicles. The team also provides case study guidelines for implementing a recommended cost recovery structure.

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Project Completed:
8-31-2016

What They Found

Weight regulations and permit fee policies from states that border Texas as well as from other countries were reviewed. The review was helpful to identify a possible range of axle loads and gross vehicle weight (GVW) for which the infrastructure consumption were estimated. In particular, the axle and vehicle loads that harmonize with the Mexican trade through international crossings and ports were of particular interest.

The research study also identified the most important costs and benefits of modifying the GVW and axle load limits. For each factor, the study explored the methods to estimate the impact of each factor and the methods to quantify the impacts, with the goal of using this input to conduct a generalized benefit-cost analysis for infrastructure-friendly trucks.

The research team determined that the overall pavement consumptions due to a combination of different axles is equivalent to the sum of the consumption of each individual axle. Each truck's equivalent consumption factor was computed for all pavement structures with respect to rutting, fatigue cracking, and roughness. In the case of roughness, the research team found that data obtained do not follow the same pattern as rutting and cracking. In some cases, a significant difference was observed between the results of two aforementioned methodologies.

The product of the bridge consumption analysis is a network-level bridge consumption cost per vehicle-mile traveled by county, urban/rural area, and the aggregated highway class. It provides a useful tool to estimate the bridge consumption costs of different truck configurations for any given route in any Texas county.

Finally, the research team explored OW truck cost recovery methods, analyzing both US and international approaches to this issue.

What This Means

By modifying vehicle configuration (axle types and loads), it is possible to obtain tractor-semitrailer combinations that are infrastructure friendly and more efficient. For example, an 80-kips five-axle tuck causes approximately equivalent pavement consumption as four single axles of 18 kips, one 90-kip six-axle truck, or one 100-kip seven-axle truck.

This study recommends the implementation of an OW truck permit fee system for seven-axle vehicles weighing up to 97,000 lbs on segments of SH 146 and Spur 330 north of the Port of Houston Barbours Cut Container Terminal. Specifically, a straightforward permit fee system has been recommended. Numerous charging schemes could be employed on this corridor, including an annual permit, single-trip permits, a booklet of permits, or a toll tag system.

Should the corridor be extended or should heavier vehicles be permitted to operate on this corridor, a weight-distance based system is recommended. A weight-distance permit system more equitably recoups consumption costs from OW vehicles. The introduction of toll tags or weigh-in-motion scales could allow for partial automation of the permit system and easily allow further expansion of the corridor and implementation of a weight-distance system.

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Keyword: Research