



PUTTING RESEARCH TO WORK

BRIEF

Regulating Heavy Permit Vehicles on Wisconsin Bridges

Trucking is vital to the economy, accounting for about 80 percent of expenditures on freight transportation in the United States. However, heavy trucks may damage or reduce the service lives of roads and bridges. Consequently, Wisconsin regulates the weights of trucks traveling within its borders. Trucks with axle configurations and gross weights that exceed statutory limits require permits from WisDOT to travel within Wisconsin. WisDOT quantifies these limits according to the load capacity of existing bridges, providing a permit rating weight for each bridge based on Wisconsin's Standard Permit Vehicle, or Wis-SPV. New bridges are designed to accommodate the load effects of Wis-SPV, which specifies a standard vehicle weight and axle configuration. The permit rating values provide a convenient means for trucking companies to apply for permits and plan routes via bridges with the load ratings their permits allow.

What's the Problem?

WisDOT issues on average more than 200 oversize-overweight permits every day to trucking businesses. While issuing single-trip permits involves a rigorous review of truck configurations and routes, multi-trip permits do not. Further, because the size and weight of trucks have steadily increased over the years, WisDOT needed to evaluate its decision-making procedures for issuing these permits—specifically by studying whether Wis-SPV can still be considered a reasonable gauge of the effects of overweight trucks with permits on Wisconsin's bridges.

Research Objectives

The objective of this study was to statistically quantify the size, weight and axle configurations of overweight vehicles traveling on Wisconsin roads so that WisDOT could assess whether its Standard Permit Vehicle specification requirements properly account for the effects of overweight vehicles.

Methodology

Researchers began by conducting statistical analyses of weigh-in-motion field data for overloaded trucks running on Wisconsin highways in 2007. Weigh-in-motion devices consist of sensors placed in the road to record the axle load and configurations of vehicles that cross them without requiring those vehicles to stop at weigh stations along the side of the road.

Using this data, researchers identified the heaviest 5 percent of overloaded vehicles traveling on Wisconsin highways. Then they divided this set into several subgroups sharing the same number of axles and reflecting AASHTO classes four through 15. Statistical analyses were used to identify representative configurations—consisting of vehicle gross weights, lengths, axle weights and axle spacings—for each of these subgroups. Dimensions such as length and axle spacing are important to determining the distribution of a vehicle's weight and, thus, its load effect on bridges.

Researchers then calculated the forces that a vehicle randomly selected from the heaviest 10 percent of each vehicle subgroup would have on the girders of typical Wisconsin bridges with varying span lengths; they compared those effects with those caused by the vehicles representative of Wis-SPV. They performed a similar analysis of trucks identified in 50,000 oversize-overweight vehicle permit records issued in Wisconsin between 2004 and 2007 as well as for typical permit vehicles from neighboring states that are likely to operate on Wisconsin highways, including Minnesota, Iowa, Michigan and Illinois.

Results

Analysis of weigh-in-motion vehicle data showed that while most overweight vehicles traveling within Wisconsin are accounted for by Wis-SPV specifications, about .035 percent exceed it. Of these,

Investigator



"This study provides WisDOT with necessary information to assess its Standard Permit Vehicle and related rating practices in light of heavy vehicles currently traveling on its highways."

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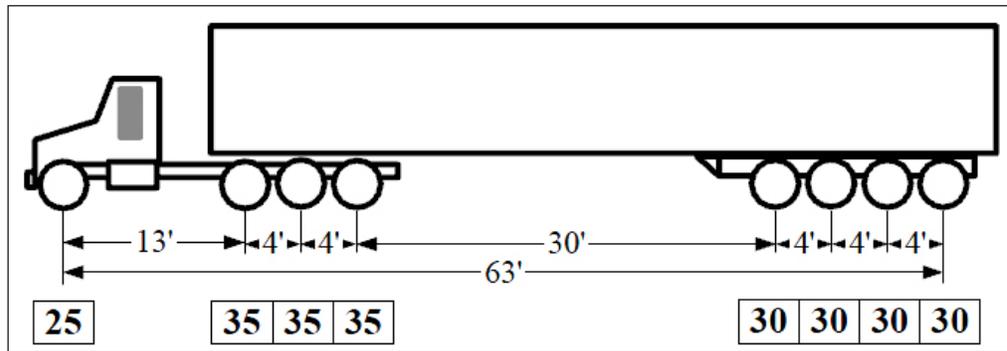


“This study gives us a better understanding of the actual configuration of permit vehicles on Wisconsin roads and will allow us to design new bridges that can better accommodate them.”

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Wisconsin's Standard Permit Vehicle establishes the configuration of truck that Wisconsin highways may accommodate with a permit, specifying gross weight, length, axle weight and axle spacing. Longer trucks spread their loads over a greater area, reducing axle weight and potential damage to infrastructure.

some shorter overweight vehicles had loads that could exceed the effects of vehicles representative of Wis-SPV. These vehicles include Class 7 trucks with multiple lift axles, some Class 9 short trailers and some Class 13 truck-trailer combinations.

Wisconsin single-trip permit records showed that Wis-SPV currently covers almost all single-unit trucks with less than nine axles, accounting for 80 percent of all permits issued. However, some shorter vehicles could cause larger girder responses than accounted for by Wis-SPV, with some of the largest discrepancies associated with vehicles that include lift axles. One kind of permit vehicle of those analyzed from neighboring states can also exceed Wis-SPV on two- and three-span continuous bridge girders.

Implementation and Benefits

Based on these analyses, researchers proposed modifications to current Wisconsin permitting practices, including the addition of a shorter five-axle truck to Wis-SPV and related modifications of permit ratings in the WisDOT Bridge Manual. The Bureau of Structures will review the proposed modifications to determine whether and when to implement them.

Further Research

Researchers recommend further study to develop permit fee structures that better reflect the impact of overload vehicles on the service lives of bridges and bridge decks. They also recommend further study of Class 9 vehicles, whose load distribution in this study differed from that described in a [2003 NCHRP study](#).

This brief summarizes Project 0092-08-15, “Analysis of Permit Vehicle Loads in Wisconsin,” produced through the Wisconsin Highway Research Program for the Wisconsin Department of Transportation Research Program, 4802 Sheboygan Ave., Madison, WI 53707.

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