



Impacts of Allowing Exceptions to Spring Load Restrictions

Prepared for
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Transportation Literature Searches are prepared for WisDOT staff and investigators to identify completed research and other authoritative information in an area of interest. The citations below are representative, rather than exhaustive, of available English-language studies on the topic. Primary online resources for the literature searches are OCLC's [WorldCat](#) and [TLCat](#), TRB's [TRID](#) database, the National Transportation Library ([NTL](#)), and other academic, engineering and scientific databases as appropriate.

To request a literature search, contact the WisDOT Library at library@dot.wi.gov or (608) 264-8142, or WisDOT Research at research@dot.wi.gov or (608) 267-6977.

Topic/Problem Statement: Impacts on pavement of exempting trucks carrying raw forest products from weight limits related to the spring thaw restrictions.

Keywords: Spring load restrictions, spring load limits, spring thaw restrictions, weight limits, overweight trucks, heavy trucks, logging trucks, forestry.

Summary

This literature search includes citations from **Minnesota** on the costs and benefits of enforcing or removing spring load limits, as well as one study from **Norway** on the same topic. Several provinces in **Canada** have taken a different approach—reducing heavy trucks' tire pressure to minimize damage to pavement during the spring thaw—but have faced the same need to evaluate the impact of this new initiative on damage to pavement.

This literature search concludes with two studies on **Calculating the Impact of Spring Load Restrictions on Pavement** and a sampling of **State Spring Load Restrictions Statutes**.

Citations

Links to online copies of cited literature are provided when available. Contact the WisDOT Library to obtain hard copies of citations.

Minnesota DOT

Minnesota DOT spring load restrictions Web page:

http://www.mrr.dot.state.mn.us/research/seasonal_load_limits/thawindex/slr.asp

Title: Economic Effects of Lifting the Spring Load Restriction Policy in Minnesota

Author(s): Brian Smalkoski, Kimley-Horn and Associates; Ning Li, Virginia Department of Transportation;

David Levinson, University of Minnesota, Twin Cities

Date: 2006

Source/URL: *Journal of the Transportation Research Forum*, Vol. 45, No. 2, 45-55;

<http://journals.oregondigital.org/trforum/article/viewFile/916/811>

Description: 11 pages

Abstract: Many countries and regions with cold climates have implemented Spring load restrictions (SLR) that regulate the weight per axle carried by heavy trucks during the spring thaw period. Although this policy aims to reduce pavement damage caused by heavy vehicles and extend the useful life of roads, it also imposes costs on the trucking industry. This paper reports the results of a cost/benefit study of SLR in Minnesota. The study is based on the results of surveys of industry costs, a pavement performance model, and a freight demand model. Findings indicate that the benefits of lifting the existing SLR policy outweigh the additional costs. It is recommended that the policy be repealed on all paved roads rated at 9 tons during non-spring load period. The additional costs incurred for maintaining and repairing roads should be recovered from those who benefit from this policy change.

Title: Cost/Benefit Study: Spring Load Restrictions

Author(s): David Levinson, Mihai Marasteanu, Vaughan Voller, Ioana Margineau, Brian Smalkoski, Maryam Hashami, Ning Li, Mike Corbett, Erland Lukanen; sponsored by Minnesota DOT

Date: March 2005

Source/URL: Report No. 2005-15; <http://www.lrrb.org/pdf/200515.pdf>

Description: 317 pages

Abstract: Across the state of Minnesota, asphalt roads under the jurisdiction of counties, cities and townships have been controlled by restrictions that limit the total weight of each truck that uses those roads during the spring thaw period. During this time, the pavement weakens and the bearing capacity of the roadway is reduced. These policies vary from county to county and from road to road, depending on the capacity of the roads—typically, 5, 7 and 9 tons.

While spring load restrictions serve to extend the useful life of the road, they also add significant burdens to truckers who are forced to re-route their vehicles and/or increase the number of trips in order to adhere to the policies. This study assesses the economic impact of lifting all vehicle restrictions during the spring thaw period. Economic benefits of lifting the bans include reduced cost to carriers; potential cost includes reduced pavement life. Their research concludes that if the policy is changed, the costs of additional damage could be recovered from those who use the roads. Recovering those costs could take the form of annual fees, appropriate fuel taxes and/or user charges paid by vehicle operators.

Title: Framework for Analyzing Effects of Spring Load Restrictions

Author(s): David Levinson, Ning Li, Xi Zou, Brian Smalkoski, and Maryam Hashami

Date: 2004

Source/URL: *Transportation Research Record* No. 1874, pages 181–188, <http://nexus.umn.edu/Papers/SLR-Framework.pdf>

Description: 8 pages

Abstract: Spring load restrictions (SLR) impose restrictions on heavy trucks during the spring thaw period. Although the policies have been implemented for many years, their economic effects on truckers remain uncertain. This study provides an overview of practices around the world and sets up a framework to estimate the benefit–cost of the SLR policy. A freight demand model in Minnesota was built to estimate the impacts of SLR on the freight transportation pattern. The model allows various policy scenarios to be tested before being put into practice. A preliminary result of the freight demand model indicates the SLR policy increased truck vehicle kilometers of travel in Lyon County, Minnesota, by about 13%.

Norway

Title: Lifting All Seasonal Load-Restrictions in Norway in 1995: Background and Effects

Author(s): Geir Refsdal, Paul Senstad and Arne Soerlie; sponsored by the Norwegian Public Roads Administration

Date: 2004

Source/URL: *Transportation Research Record* No. 1874, pages 174-180.

Description: 7 pages

Abstract: To preserve invested capital and to protect the existing road network against excessive damage during thaw periods, the Norwegian Road Authority adopted extensive axle load restrictions on both national and county

roads up to 1995. On January 1, 1995, all axle load restrictions during the spring thaw period within national and county road networks were lifted after calculations indicating that the total efficiency gain after an administrative lifting would be considerable, provided it was followed by extra funds to maintain the surfacing serviceability. However, without such extra funds, a lifting of restrictions would result in reduced surfacing serviceability and considerably increased cost for all road users. As of 2003, there are no indications that the lifting of load restrictions in 1995 has resulted in reduced road surfacing serviceability. This is remarkable, as the annual budgets for resurfacing during the same period have been considerably reduced. One or more of the following items can explain why it has been possible to maintain the road surfacing serviceability at the 1994 level during a period with reduced budgets: road users have not fully utilized the new possibilities in higher axle loads; there has been a slow but steady increase in surfacing service life from 1985 to 2002 from 10 to 15 years for national roads and from 13 to 18 years for county roads; there has been a reduced use of studded tires during winter; and there has been a general development of asphalt techniques and procedures, such as thin surfacings.

Canada

The following citations detail the efforts of some Canadian provinces to test a system that allows heavy trucks to travel on weight-restricted roads during a portion of the period of spring load limits provided that they reduce their tire pressure. The testing methodologies used by these provinces to determine the trucks' effects on the roadways may be relevant to WisDOT's efforts.

Title: Using Road-Friendly Technologies to Carry Full Legal Axle Weights on Seasonally Weight-Restricted Pavements in British Columbia

Author(s): A.H. Bradley

Date: October 2005

Source/URL: *Advantage*, Vol. 6, No. 30

Description: 26 pages

Abstract: This report documents the results of a trial conducted in British Columbia during 2003 to investigate the potential for extending the hauling season during weight-restricted periods by using road-friendly technologies. The Forest Engineering Research Institute of Canada (FERIC) modelled the test roads with a layered elastic analysis program and predicted when trucks could resume hauling without accelerating damage. In addition, FERIC measured pavement distress changes and assessed operational savings. This report also documents the results of four operational hauls that were conducted in 2004 under the B.C. Ministry of Transportation's tire pressure control system (TPCS) spring hauling program.

Title: Notice to Truckers—2011 Load Restrictions

Author(s): Ontario Ministry of Transportation

Source/URL: <http://www.mto.gov.on.ca/english/trucks/loadnotice.shtml>

Excerpt:

Under an experimental program, qualified forest companies may move full summer loads on load-restricted highways, for a period of up to a month before the removal of reduced load restrictions, provided they meet the Tire Pressure Control Systems TPCS Program Requirements set out by the Ministry of Transportation for TPCS use in Ontario.

Title: Central Tire Inflation Commercial Trial

Author(s): Ontario Ministry of Transportation

Date: 2007

Source/URL: *Road Talk*, Ontario's Transportation Technology Transfer Digest, Fall 2007, Vol. 13, Issue 3

<http://www.mto.gov.on.ca/english/transtek/roadtalk/rt13-3/#a7>

Excerpt:

British Columbia carried out trials in 2000, 2003, and 2004 before allowing CTI-equipped trucks to haul full loads during the latter part of their SLR period. ... In order to make a decision on CTI policy, MTO proposed a trial to demonstrate that the technology can be used under commercial, large-scale hauling conditions and that it can be regulated by simple, inexpensive means, based on solid scientific principles, specifically, a model utilizing a combination of PFWD measurements, freeze-thaw depths, and Road Weather Information System (RWIS) data.

Title: Under Pressure: Northern Haulers Are Using TPCS to Save Their Roads and Their Pocketbooks

Author(s): TPC International and FP Innovations

Date: November 2009

Source/URL: http://www.forestrysolutions.net/userfiles/content/focus_on_fe_2009/Under%20Pressure%20-%20Northern%20hauliers%20are%20using%20TPCS%20to%20save%20their%20roads%20and%20pocketbooks%20-%20Brian%20Spreen.pdf

Title: Evaluating Tire Pressure Control System to Improve Productivity and Mitigate Pavement Damage

Author(s): Fazal Mabood

Date: 2008

Source/URL: Master's thesis, University of Waterloo,
<http://uwspace.uwaterloo.ca/bitstream/10012/3978/1/Thesis.pdf>

Description: 111 pages

Abstract: The introduction of the use of Tire Pressure Control Systems (TPCS) to improve the productivity of the Canadian trucking industry is gaining momentum. The imposition of seasonal load restrictions (SLR) on the thaw-weakened secondary roads interrupts the transportation of raw materials to processing facilities. For the forestry industry in particular, this has very significant impacts on productivity and costs. FPInnovations-Feric Division (Feric) has investigated the potential for TPCS-equipped trucks to travel with full, legal loading during the SLR period without accelerating road wear and tear. The TPCS monitors and adjusts the inflation pressure of the trucks' tires while driving and allows the operator to optimize the inflations for changes in loading, travel speed, or road quality encountered in the trip.

This thesis describes an investigation to determine whether TPCS can be used to mitigate traffic generated damage to secondary roads and also reduce the need to implement load restrictions. The project involves a partnership with the Ontario Ministry of Transportation Ontario (MTO), Forest Engineering Research Institute of Canada (FERIC), Ontario Ministry of Natural Resources (MNR) and the Centre for Pavement and Transportation Technology (CPATT) located at the University of Waterloo.

The thesis will describe the methodology, design, and instrumentation of the two test sites which are located in Dryden, Ontario and Chapleau, Ontario. In addition, repeated Portable Falling Weight Deflectometer (PFWD) testing is being carried out at these sites and the initial results of this examination and associated impacts of the environment and traffic on the road will be presented. This study also involves looking into the reliability of using the portable FWD, offering a lower cost alternative instead of the trailer mounted FWD to monitor pavement strength for the identification the SLR period. The use of innovative sensors and data collection techniques are proving to be very informative and are advancing pavement engineering knowledge. Moreover, the thesis is aimed at exploring the possibilities of achieving the current objectives of the government DOTs such as TPCS potential for addressing the timber industry in crisis, reduced road maintenance budgets, and global warming increasing road damage.

Calculating the Impact of Spring Load Restrictions on Pavement

Title: Assessing Spring Load Restrictions Using Climate Change and Mechanistic-Empirical Distress Models

Author(s): J. Crowder, A. Shalaby, R. Van Cauwenberghe, A. Clayton, Transportation Association of Canada

Date: 2008

Source/URL: *2008 Annual Conference and Exhibition of the Transportation Association of Canada—Transportation: A Key to a Sustainable Future*

Description: 11 pages

Abstract: Nearly 58% of the Manitoba Provincial pavement network is subjected to spring load restrictions, and most of these roads consist of a thin flexible pavement or an asphalt surface treatment. This paper relates pavement deflection data from FWD testing to environmental indices such as the thaw index. Deflection data collected since 1990 on pavement sections and the LTPP site in Manitoba are used to establish network-level and statistically representative values for pavement properties during the thaw weakening and recovery period. The base and subgrade moduli during spring thaw are computed using a back-calculation algorithm and categorized in terms of ranges of the thaw index. The data is used with the prediction models of the AASHTO Mechanistic Empirical Design Guide to assess the impact of spring load restrictions on pavement service life. Five scenarios are considered and these accounted for base conditions on an unrestricted road and for the cases of reducing axle loads, with and without an increase in the number of trips, required to transport a certain payload.

Title: Sensor Technology for Decision Support of Spring Load Restrictions

Author(s): Xinbao Yu, Nina Liu, Xiong (Bill) Yu, Ning Li

Date: 2008

Source/URL: *Transportation Research Record*, No. 2053, pages 17-22

Description: 6 pages

Abstract: Spring load restrictions (SLR) are commonly used as a pavement preservation strategy in cold regions. Implementation of SLR has been found to bring about significant economic benefits by extending the pavement service life. Monitoring the degree of soil freeze–thaw status is crucial for making sound decisions on SLR implementation. Current tools to assist this decision are limited; they are unreliable and unable to provide timely data. As a result, the decisions on starting and ending of SLR, as well as the magnitude of load restrictions, are highly subjective. There remains room to optimize the benefits of this important transportation policy. A sensor and analysis method based on the time domain reflectometry (TDR) principle was developed that can accurately measure the degree of soil freeze–thaw status. Interesting results were obtained by using this technology to study the effects of freeze–thaw on soil mechanical behaviors. This sensor technology can assist in the implementation of SLR by (a) helping set the duration of SLR from accurately determining the degree of soil freeze–thaw status and (b) optimizing the level of road restrictions to optimize the cost and benefit between pavement preservation and freight industry. A field implementation of this technology is being conducted at Mn/Road, the world’s largest and most comprehensive outdoor roadway laboratory.

State Spring Load Restrictions Statutes

The following is a sampling of Web pages that link to states’ statutes on spring load restrictions:

North Dakota: <http://www.dot.nd.gov/roadreport/loadlimit/loadlimitinfo.asp>

South Dakota: http://www.sddot.com/operations/cvo/spring_load_limits/index.htm

Saskatchewan: <http://www.highways.gov.sk.ca/springroad-restrictions/>

New Hampshire: http://www.nhlgc.org/publications/item_detail.asp?TCArticleID=265

Excerpt:

Q. Are there any exceptions to the restrictions that need to be allowed?

A. Yes. RSA 231:191 permits landowners and commercial enterprises which use the road to be granted an exception if they show that “practical difficulty or unnecessary hardship” will result from the weight limit. The exception granted may be subject to conditions, and the user may be required to post a bond for the cost of restoring the road. RSA 236:3-a may allow heating fuel trucks and trucks delivering processed milk products to be granted an exception. RSA 266:19-a exempts fire fighting equipment from the restrictions. RSA 266:21 exempts winter maintenance equipment that is owned, leased or rented by the state or any political subdivision of the state. RSA 266:24 exempts “implements of husbandry” (farm equipment) from the restrictions.