

Minnesota Truck Size and Weight Project

final report

prepared for

Minnesota Department of Transportation

prepared by

Cambridge Systematics, Inc.

with

SRF Consulting Group, Inc.
Harry Cohen

Table of Contents

Executive Summary	ES-1
Minnesota Truck Size and Weight Project Final Report	1
Introduction.....	1
Background: Minnesota’s Freight Challenge	1
Minnesota Truck Size and Weight Laws within the National and Upper Midwest Regional Context.....	3
TS&W Issues and Considerations	10
Project Approach	15
Findings and Recommendations.....	19
Expected Outcomes.....	25
Appendix A	
Changing Business Practices and Economic Forces	A-1
Appendix B	
Scope, Limits, and Administration of Existing Truck Size and Weight Laws in Minnesota	B-1
Appendix C	
Review of Selected Truck Size and Weight Laws and Practices Elsewhere.....	C-1
Appendix D	
Heavy Truck Equipment, Configuration, and Technology Trends	D-1
Appendix E	
Heavy Truck Safety Considerations	E-1
Appendix F	
Truck Size and Weight Impact Analysis Methodology	F-1
Appendix G	
Outreach Efforts for Minnesota Truck Size and Weight Project.....	G-1

Minnesota Truck Size and Weight Project – Executive Summary

■ Introduction

This report summarizes the approach, findings, and recommendations of the Minnesota Truck Size and Weight (TS&W) Project led by the Minnesota Department of Transportation (Mn/DOT) in cooperation with other public and private stakeholders. The purpose of the project is to assess changes to Minnesota's TS&W laws that would benefit the Minnesota economy while protecting roadway infrastructure and safety.

■ Background: Minnesota's Freight Challenge

Minnesota's industries and economy depend on an efficient multimodal transportation network. Each year, nearly \$600 billion in goods are transported in Minnesota, supporting agriculture, manufacturing, and retail growth throughout the State. Over the last few decades, demand for freight transportation has grown significantly and freight demand is projected to further increase by about 60 percent by 2020 according to Mn/DOT's *Statewide Freight Plan*.¹ All modes of freight transportation are being challenged to increase capacity and improve productivity to respond to this growth.

The State of Minnesota continues to make investment in its highway network to support population and economic growth, and has developed several intermodal freight programs, including the Minnesota Rail Service Improvement Program and the Port Development Assistance Program, to preserve and modernize basic freight infrastructure. An integrated network of more efficient freight facilities and services for all modes (highway, rail, water, and air) is needed to foster Minnesota's competitiveness, including access to markets outside of Minnesota.

In recent years, Minnesota lawmakers have considered many proposals to change TS&W laws. A number of these legislative proposals tailored to specific industry needs have been enacted, clearly demonstrating the need for a more comprehensive approach to future

¹ *Minnesota Statewide Freight Plan*, prepared for the Minnesota Department of Transportation, Office of Freight and Commercial Vehicle Operations by Cambridge Systematics, Inc., May 2005.

TS&W changes that consider economic, infrastructure, safety, and other impacts. As a result, the Minnesota TS&W Project was initiated in the spring of 2005.

■ Issues and Considerations

Industry Challenges and Considerations

Minnesota operates in a global economy, and competes especially with states in the Upper Midwest and with Canada. Several of these jurisdictions have higher weight limits than Minnesota, potentially putting Minnesota industries at a competitive disadvantage. For example, North and South Dakota allow vehicles with weights up to 105,500 and 129,000 pounds, respectively, (versus an 80,000-pound limit in most instances within Minnesota). Many agricultural industries in Minnesota directly border these states and are impacted competitively by the lower vehicle productivity in Minnesota. TS&W limits affect freight transportation costs because they control the amount of payload that can be carried in a truck. Increases in truck weight limits increase the allowable weight per trip, so fewer trips are required to carry the same amount of goods. Freight transportation cost savings due to increases in TS&W limits accrue to shippers, carriers, and consumers.

Pavement Considerations

Engineers design roads to accommodate projected vehicle loads, in particular, heavy vehicle axle loads. The life of a pavement is related to the magnitude and frequency of these heavy axle loads. Pavement engineers use the concept of an equivalent single-axle load (ESAL) to measure the effects of heavy vehicles on pavements. Any truck axle configuration and weight can be converted to this common unit of measure. Adding axles to a truck can greatly reduce the impact on pavement. A conventional five-axle tractor-semitrailer operating at 80,000 pounds gross vehicle weight (GVW) is equivalent to about 2.4 ESALs. If the weight of this vehicle were increased to 90,000 pounds (a 12.5 percent increase), its ESAL value goes up to 4.1 (a 70.8 percent increase), because pavement damage increases at a geometric rate with weight increases. However, a six-axle tractor-semitrailer at 90,000 pounds has an ESAL value of only 2.0, because its weight is distributed over six axles instead of five. An added pavement benefit of the 90,000-pound six-axle truck is that fewer trips are required to carry the same amount of payload, resulting in almost 30 percent fewer ESAL miles per payload ton-mile.

The effect of ESALs on pavements is not constant throughout the year. During the winter, when the ground is frozen, a truck carrying a given load causes much less damage to pavements than at other times of the year. During the spring, the inverse is true: pavement layers are generally in a saturated, weakened state due to partial thaw conditions and trapped water, causing greater pavement damage by the same truck.

Bridge Considerations

Increases in truck weight limits can affect bridges in several ways. Should the legally allowable limits change, and the limits exceed the design criteria for a bridge, the bridge must be posted (signed for restricted use) to prevent those heavy vehicles from using it. Changing allowable limits will increase agency costs for inspecting and rating bridges and for posting signs. Concrete decks and other bridge elements can wear out with repetitive loadings by heavy vehicles. The number, spacing, and weight of individual axles, as well as the GVW carried on a truck, are important considerations for bridges. To protect bridges from over-stress, Minnesota law includes a table of maximum weights for truck axle groups.

Highway Safety Considerations

Changes in TS&W regulations can affect highway safety by: 1) increasing or decreasing the amount of truck traffic; 2) causing or requiring changes in vehicle design and vehicle performance that may affect crash rates and severity; and 3) causing trucks to shift to highways with higher or lower crash rates. Crash rates per vehicle-mile increase slightly with gross weight primarily because loading a truck heavier raises its center of gravity and thereby increases the possibility of rollover. However, crash rates per payload ton-mile decrease with a gross weight increase because fewer truck trips are required to haul a given amount of freight.

All heavier vehicles proposed in the project were evaluated against and found to meet internationally accepted safety performance standards. Review of international practice revealed that technology enhancements also can improve the safety performance of heavy trucks. For example, special couplings for double-trailer trucks, as proposed in this study, significantly improve vehicle stability related performance measures.

Finally, study results show that there is greater surplus brake capacity for all of the proposed vehicle configurations than for the standard five-axle tractor semitrailer, therefore the stopping distance of the proposed configurations should be better than for standard tractor semitrailer.

■ Project Approach

A set of guiding principles was established early in the project in cooperation with the project's advisory committees. These guiding principles set the parameters for analysis of proposed alternatives. In summary, the principles provided that any changes would: be in concert with Federal law; seek to protect highway infrastructure and safety; provide benefit to Minnesota's industries and economy; promote ease and uniformity of application; and seek to cover costs imposed on the system.

An extensive outreach process was conducted for the project. Regional meetings were held around the State and more than 35 meetings were held with stakeholder organizations.

The outreach process culminated in a Northstar Workshop held on October 25, 2005, where project findings and candidate TS&W proposals were presented and discussed by a broad cross section of about 140 stakeholders.

Mn/DOT conducted an extensive analysis of TS&W alternatives in cooperation with the advisory committee for the project who represent a variety of industries, all levels of government, and other interested organizations. The analysis methodology for the project was based on nationally accepted methods utilized by the National Academy of Sciences and the U.S. Department of Transportation.

■ Key Findings

Key findings of the outreach process were:

- The variations in TS&W laws across Minnesota road systems work against freight productivity. A more extensive “10-ton” road system is needed.
- The complexity of TS&W laws results in added cost to industry and complicates compliance. TS&W laws need to be simplified and industry training provided.
- Lack of consistency among states creates barriers to cross-border freight movement.
- Enforcement of TS&W laws, and the permitting process for heavy trucks, is inconsistent across jurisdictions; a centralized system may be needed.
- Spring load restrictions cause circuitry of travel and loss of business.
- There needs to be increased flexibility of weight limits and vehicle configurations to allow greater payloads.
- There are concerns about the infrastructure impacts of increased weight limits, particularly on local roads and bridges.
- There are safety concerns about proposed increases in truck weight or length.
- There needs to be more investment in infrastructure and improved operations to achieve a more productive freight system.
- The proliferation of exemptions, exceptions, and tolerances in TS&W laws creates inequities and adversely impacts enforcement and infrastructure.

The key finding of the technical analyses was that four heavier truck configurations were found feasible and generated net statewide benefits. A set of changes to spring load restrictions and other related TS&W regulations were also developed and found to offer net benefits. Each of the proposed changes is further discussed below under Recommendations. The benefits and costs of each of the proposed changes are reported in Table ES.1. The evaluation considered transport savings, pavement costs, bridge inspection costs, rating and posting impacts, bridge fatigue and deck wear effects, increased bridge design load requirements, safety, and congestion.

Table ES.1 Truck Size and Weight Proposal Benefits
(Benefits in Millions of Dollars per Year; Negative Values Represent Increased Costs)

Truck Size and Weight Package Elements	Transport Savings	Pavements	Bridge Inspection, Rating & Posting	Bridge Fatigue and Decks	Increased Bridge Design Loads	Safety	Congestion	Total Net Benefits
Proposed Vehicle Configurations								
6-Axle 90,000 lb. Semi	\$3.68	\$1.27	\$-0.05	\$0.15	\$-0.96	\$0.15	\$0.18	\$4.43
7-Axle 97,000 lb. Semi	4.00	2.24	-0.01	0.22	-0.64	0.23	0.23	6.27
8-Axle Twin 108,000 lb.	2.01	1.25	-0.01	0.14	-0.72	0.05	0.08	2.79
SU up to 80,000 lb.	6.27	0.55	0.00	0.10	-0.13	0.06	0.05	6.90
<i>Subtotal</i>	<i>\$15.96</i>	<i>\$5.31</i>	<i>\$-0.07</i>	<i>\$0.61</i>	<i>\$-2.45</i>	<i>\$0.49</i>	<i>\$0.54</i>	<i>\$20.39</i>
Spring Load Restrictions and Other Legislative Policy Issues								
Change SLR	\$8.82	\$-2.34	\$0.00	\$0.04	\$0.00	\$0.44	\$0.17	\$7.12
80,000 lb. on 9-Ton System	24.82	-8.49	0.00	-0.83	0.00	1.65	0.72	17.87
<i>Subtotal</i>	<i>\$33.64</i>	<i>\$-10.83</i>	<i>\$0.00</i>	<i>\$-0.79</i>	<i>\$0.00</i>	<i>\$2.09</i>	<i>\$0.89</i>	<i>\$24.99</i>
Total Package	\$49.60	\$-5.52	\$-0.07	\$-0.18	\$-2.45	\$2.57	\$1.43	\$45.38

■ Recommendations

Based on technical analysis of alternative changes to TS&W laws, as well as the input from the outreach process, advisory committee feedback, the Northstar Workshop, and Departmental deliberations, the TS&W proposals detailed in Table ES.2 were recommended and advanced by Mn/DOT for legislative consideration consistent with the policy principles adopted for this study. The recommendations represent a balanced approach that protects highway infrastructure and safety while providing industry productivity improvements that will benefit Minnesota's economy and competitiveness.

■ Expected Outcomes

Based on the analyses conducted for this study, the proposed package of TS&W law changes is expected to have significant net statewide benefits:

Impacts of Proposed Vehicle Configurations

- Increased payloads and fewer truck trips will lower transport costs significantly.
- Additional axles and fewer truck trips will result in less pavement wear.
- A modest increase in bridge postings and future design costs will be necessary.
- Proposed trucks have slightly higher crash rates but, given fewer overall truck miles (due to increased payloads) than would be experienced otherwise under existing weight limits, safety would improve slightly.
- The proposed vehicle configurations for operations above 80,000 pounds GVW meet internationally accepted heavy vehicle safety performance standards.

Impacts of Changing Spring Load Restrictions and Increasing Nine-Ton System to 80,000 Pounds

- Increased payloads and fewer truck trips will lower transport costs significantly.
- Pavement costs will increase somewhat due to increased weights carried on existing truck configurations.

Table ES.2 Minnesota Truck Size and Weight Recommendations

Proposed Vehicle Configurations ^a		Spring Load Restrictions and Other Legislative Policy Issues
<p>6-Axle 90,000 lb. GVW on Non-Interstate 10-ton Network</p> <ul style="list-style-type: none"> • Must meet bridge formula, axle, and tire weight limits • 53 ft. maximum trailer length (no change) • 99,000 lb. GVW winter and seasonal increases; no further tolerances or exemptions • Allowed on 10,000-mile 10-ton Network (not on Interstates) • Requirements: permits with fees; axles to be added by certified remanufacturer; brakes required on every wheel 	<p>7-Axle 97,000 lb. GVW on Non-Interstate 10-ton Network</p> <ul style="list-style-type: none"> • Must meet bridge formula, axle, and tire weight limits • 53 ft. maximum trailer length (no change) • 99,000 lb. winter and seasonal increases; no further tolerances or exemptions • Allowed on 10,000-mile 10-ton Network (not on Interstates) • Requirements: permits with fees; axles to be added by certified remanufacturer; brakes required on every wheel 	<p>Change Spring Load Restrictions (SLR)</p> <ul style="list-style-type: none"> • All county roads default to 7 tons per axle unless posted otherwise (instead of current 5 tons per axle) • State trunk highways remain at 10 tons per axle unless posted otherwise • City streets and township roads continue to default to 5 tons per axle unless posted otherwise • SLR for gravel roads ends two weeks later than paved roads
<p>8-Axle 108,000 lb. Twin Trailer on Non-Interstate MN Twin Trailer Network and National Truck Network</p> <ul style="list-style-type: none"> • Must meet bridge formula, axle, and tire weight limits • 28.5 ft. each maximum trailer length (no change) • Allowed on pre-approved state trunk highway routes only (approximately 6,700 miles) • No harvest or winter increases; no tolerances or exemptions • Requirements: permits with fees; B-train coupling; axles to be added by certified remanufacturer; brakes required on every wheel; driver CDL endorsement required for double trailer operation 	<p>80,000 lb. GVW Single Unit (SU) Truck on 10-ton Network (including Interstate)</p> <ul style="list-style-type: none"> • Must meet bridge formula, axle, and tire weight limits • Vehicle length increase up to 45 ft. max (from current 40 ft.) • Lift axles must be down with loads • Axles in excess of 4 must be self-steering steering wheels • Requirements: permits with fees; axles to be added by certified remanufacturer; breaks required on every wheel 	<p>There are a number of other legislative policy issues to be considered parallel to potential weight increases, which include:</p> <ul style="list-style-type: none"> • Eliminate liability exemptions for farm implements that damage roads or bridges • Remove the 73,280 lb. GVW limit for 5-axle semi-trailers on 9-ton roads and allow axle weights and the bridge formula to control up to 80,000 lbs. GVW • Eliminate seasonal harvest permits (still allow 10 percent harvest increase, but no requirement to obtain permits) • Expand seasonal harvest allowance to include all farm crops

Note: ^a All configurations and drivers must meet Federal Motor Carrier Safety regulations.