NORTH DAKOTA STRATEGIC FREIGHT ANALYSIS

SUMMARY REPORT

Regional Strategic Freight Study on Motor Carrier Issues

Developed for North Dakota Department of Transportation

by

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Fargo, North Dakota

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EXECUTIVE SUMMARY

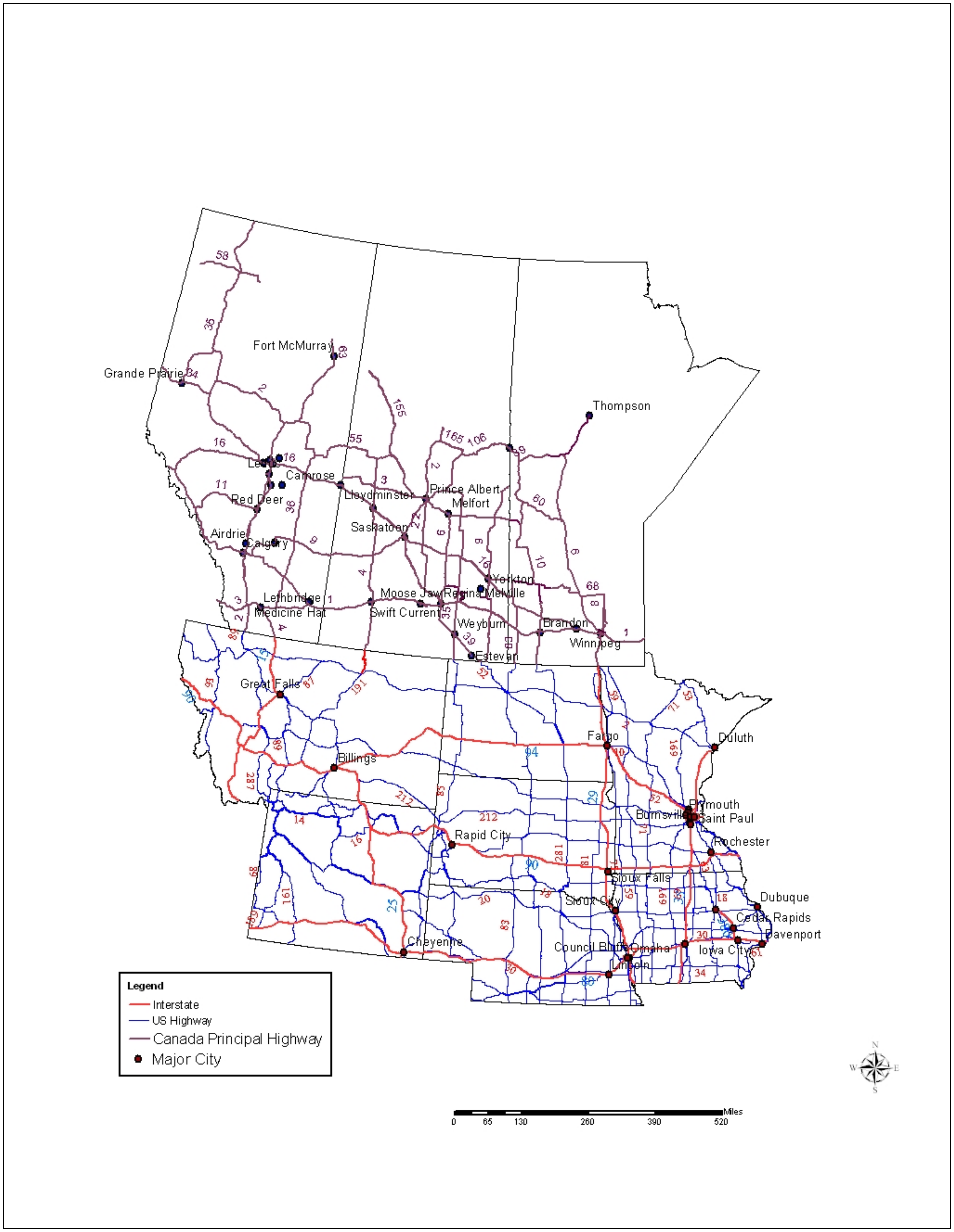
Introduction

Truck transportation plays a vital role in the central North American regional economy. Throughout the region, including the states of Minnesota, Iowa, South Dakota, North Dakota, Montana, Wyoming, and Nebraska and the provinces of Manitoba, Saskatchewan, and Alberta, truck transportation is the first and last mode for moving commodities, raw materials, and finished goods. Much of the region's economy is based on the movement of natural resources, and an efficient truck transportation system is crucial for stimulating economic growth.

Trade within the region, especially since the implementation of the North American Free Trade Agreement (NAFTA), has increased dramatically. In a study released by Northern Great Plains, Inc., the value of trade between many of the states and provinces within the region grew by almost 700% in the first five years after the passage of NAFTA. Ever increasing regional trade volumes creates a sense of urgency for states and provinces to develop a dialog that will result in a more efficient and economically competitive truck transportation system.

A myriad of different truck size and weight regulations exist, increasing shipper costs and making the region's businesses less competitive. Truck size and weight regulations are meant to promote safety and to prevent excessive damage to highways and bridges. Truck size and weight regulations are set by the Code of Federal Regulations, Title 23, (CFR 23) for the Interstate System and Primary Federal-Aid Highway System. Truck route designations along with length, width, and weight limitations are described in Part 658 of CFR 23. Confusion exists in interpreting some regulations. Therefore, the Federal Highway Administration (FHWA) has a role in deciphering the rules and enforcing compliance by states. Because of "Grandfather Provisions," regulations on truck size and weight are not consistent among bordering states, and Canadian provinces have their own truck regulations.

In 2002, the North Dakota Department of Transportation (NDDOT) published a statewide strategic transportation plan called, "TransAction." TransAction Initiative 8 states, *"North Dakota will determine the opportunities for, and the economic and safety impacts of, a regional uniform truck size, weight and permitting system."* To accomplish the initiative's intent, NDDOT contracted with the Upper Great Plains Transportation Institute to analyze truck size and weight regulations, and permitting processes in the region. This report shares the study's findings and provides an opportunity to improve the region's economic competitiveness by beginning a dialogue on truck issues.



U.S. Federal Aid Highways in the Seven States and Canadian Principal Highway System in the Three Provinces.

Justification

TransAction states, *"A complex regulatory environment governs tire and axle loads, gross vehicle weights, vehicle heights and widths, trailer and semi trailer lengths, and combination vehicle lengths."* This statement asserts the problems businesses face in trying to ship within the region. An ever-increasing volume of trade is conducted between the region's states and provinces, and it would be beneficial to explore opportunities to harmonize vehicle size and weight regulations and provide a permitting process that would allow for seamless movements of freight.

Objectives

This project's three objectives were to provide:

1) economic and safety information on the impacts of a regional uniform size and weight regulatory and permitting system,
2) information on the differences in size and weight regulations in the region, and
3) information for the different departments of transportation (DOTs) policy makers, and others, allowing them to examine economic costs of restrictions and regulations on motor carriers and their customers.

Summary

Trade is the basis for economic expansion. Traditionally a large portion of the region's economy is based on natural resource sectors such as farming and mining. Recently the region has also experienced growth in manufacturing and technology industries. Much of the region is without water transportation and has only limited rail competition and service. Truck transportation provides advantages in terms of accessibility, flexibility, and door-to-door services. Efficient transportation service for these industries is crucial to maintaining, stimulating, and diversifying economic growth.

This study explores the regulatory environment that shippers face in moving freight by truck throughout the region and highlights differences in regulations that exist among the region's states and provinces. Truck size and weight regulations in the region's states and provinces are controlled and specified by state departments of transportation and provincial departments of highways, rural municipal councils, major urban transportation agencies, U.S. Department of Transportation, national parks, public works, tribal governments, and other government agencies and services. Because of the inconsistencies in size and weight regulations, problems exist. This study provides a snapshot of current regulations and conditions. The reader should note that truck size and weight laws are continually evolving.

Permitting information was gathered from the region's states and provinces, which allowed similarities and differences to be identified. Examining the permit regulations in each state and province reveals inconsistencies that prohibit seamless freight transportation. For the region to remain competitive, policy makers and transportation departments in the region should work together to provide a uniform permitting system.

The study also analyzes safety, which is an important issue for truck drivers and owners, communities, and transportation policy makers. Some safety advocates argue that larger trucks are involved in a greater number of crashes than other vehicles and the severity of these crashes result in more damage, injuries, and fatalities. Motor carriers are a major transportation mode for shipping commodities and other goods in the study area. Deaths and injuries involving trucks can be a critical factor affecting transportation costs and regional economies. High fatality and crash rates can significantly increase economic and social costs and reduce the efficiency of the transportation system. By examining different data sources, the research team determined that the data were not consistent, and therefore confident analysis could not be completed.

The information in this report provides the basis for discussing the inconsistencies that exist for size, weight, and permitting regulations in the region. Cooperation among public and private sector leaders is needed to improve the region's truck transportation system and make the region more competitive.

Findings

1. With the advent of ISTEA in 1991, many federal and state planning documents have since called for more uniformity in truck size and weight regulations.
2. State and provincial truck size and weight regulations and permitting processes are complex, difficult to define, and provide for a less than amicable business environment.

   > *"A complex regulatory environment governs tire and axle loads, gross vehicle weights, vehicle heights and widths, trailer and semi trailer lengths, and combination vehicle lengths."* *TransAction 2002*

3. Projections of increased freight volumes throughout the region highlight the need for the states and provinces in the study area to consider the development of a regional truck freight transportation system.
4. State and provincial truck size and weight regulations are continually evolving. By identifying and working toward a harmonized set of truck size and weight regulations and a uniform permitting system, the region's economic competitiveness can be improved.
5. Development of a regional truck freight transportation system and harmonization of truck size and weight regulations may reduce truck numbers and create efficiencies for businesses throughout the region.
6. A truck freight transportation system that allows larger trucks may reduce trips and congestion, resulting in overall cost savings. The additional cost of designing and constructing bridges and pavements to carry heavier loads may be offset by cost savings to the business community.
7. In some cases, larger trucks with the correct number and spacing of axles may do less road damage than smaller trucks.
8. Differences between how states collect and report safety data makes it difficult to confidently compare truck crash statistics with those of other vehicles.
9. Truck data and the laws of physics may provide evidence that larger trucks cause more damage when crashes occur, but there is no evidence to support a claim of improved safety for a smaller number of larger trucks or larger numbers of smaller trucks.
10. An ever-increasing volume of regional trade creates a sense of urgency for states and provinces to begin a dialog that will result in a more efficient and economically competitive truck transportation system.
11. Inefficiencies exist because of the differences between state and provincial permitting processes. For the region to become more competitive, policy makers and transportation departments in the region should work together to provide a uniform permitting system.
12. And most importantly, cooperation among states, provinces, and private and public sector leaders is needed to bring about a plan for uniform regulations and a seamless truck freight transportation system that enhances the region's economic competitiveness.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

This study includes truck size and weight regulations, permit costs, operating costs, and pavement impacts by truck type, safety statistics, and corridor analysis. The intention is to provide information initiating a dialogue among the neighboring states and provinces about resolving the inconsistencies that exist in the truck regulatory environment and permitting process. The study region includes Minnesota, Iowa, South Dakota, North Dakota, Montana, Wyoming, and Nebraska as well as the Canadian provinces of Manitoba, Saskatchewan, and Alberta.

Truck transportation plays a vital role in the central North American regional economy. Throughout the region, truck transportation is the first and last mode for moving commodities, raw materials, and finished goods. Since much of the region's economy is based on the movement of natural resources, an efficient highway network is crucial for stimulating economic growth.

In 2002 the North Dakota Department of Transportation published a statewide strategic transportation plan, titled "TransAction." The plan was developed using an advisory committee to develop a vision, mission, and goals. Focus group meetings were held with city, county, township organizations, metropolitan planning organizations, and tribal planners. Several initiatives in the plan focused on motor carrier issues. These initiatives provided the impetus for this study.

Truck size and weight regulations are set by the Code of Federal Regulations, Title 23 for the Interstate System and Primary Federal-Aid Highway System. Truck route designations along with length, width, and weight limitations are described in Part 658 of CFR 23. Confusion exists in interpreting some regulations. Therefore, the Federal Highway Administration (FHWA) has a role in deciphering the rules and enforcing compliance by states. Because of "Grandfather Provisions," regulations on truck size and weight are not consistent among bordering states, and Canadian provinces have their own truck regulations. Differences in regulations increase shipper costs and may result in an inefficient transportation system.

2. JUSTIFICATION

TransAction describes areas of need for North Dakota's transportation infrastructure and impediments that exist in the system. Initiative 8 describes the multi-jurisdictional problem as: "*A complex regulatory environment governs tire and axle loads, gross vehicle weights, vehicle heights and widths, trailer and semi trailer lengths, and combination vehicle lengths*." This statement asserts the problems businesses face in trying to ship within the region. Leading trading partners are neighboring states and provinces, and it would be beneficial for the states and provinces to investigate opportunities to harmonize vehicle size and weights or provide a mechanism such as a permitting process allowing for seamless movements of freight. The existing permitting system varies from state or province to another province or state, reducing transportation efficiency.

Businesses and carriers are directly affected by truck weight and size restrictions. Motor carriers, farmers, and businesses desire load restriction free roads for all season delivery of commodities and products. Seasonal and year-round road restrictions imposed by states, cities, and counties may result in increased costs through reduced payloads and extra trips for businesses. These restrictions often present confusion, frustration, and additional costs for those trying to transport products within the state or region. In some cases, multiple permits may provide a motor carrier the authority to transport freight across different counties and state highways or within the region. However, problems exist in the system of obtaining the necessary permits. A company may have to obtain permits from several jurisdictions to complete a trip and uniform permits may not be available. This inconvenience is often costly and may result in re-routing or postponing a movement.

3. OBJECTIVES

This project's three objectives were to provide:

1) economic and safety information on the impacts of a regional uniform size and weight regulatory and permitting system,
2) information on the differences in size and weight regulations in the region, and
3) information for the different departments of transportation (DOTs) policy makers, and others, allowing them to examine economic costs of restrictions and regulations on motor carriers and their customers.

4. REGIONAL TRUCK SIZE AND WEIGHT REGULATIONS

Canadian provinces and many U.S. states are looking for opportunities to harmonize truck size and weight standards. The Transportation Equity Act for the 21st Century (TEA 21), enacted June 9, 1998, authorized federal surface transportation programs for highways, highway safety, and transit from 1998 to 2003. The language in TEA 21 encourages regions to harmonize truck size and weight regulations. Size and weight regulations in the region are controlled and specified by state departments of transportation and provincial departments of highways, rural municipal councils, major urban transportation agencies, U.S. Department of Transportation, national parks, public works, tribal governments, and other government agencies and services. The regulations are enforced by law enforcement agencies in both the United States and Canada.

Two current standards that provide wide-spread application and influence in terms of basic limits are the U.S. Federal Truck Size and Weight Laws (Title 23), and the Roads and Transportation Association of Canada (RTAC) Weight Provisions. The U.S. Federal Truck Size and Weight Laws (Title 23) define size and weight regulations (see Appendix 2) on the Interstate System and National Network (NN). The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) restricts the operation of longer combination vehicles (LCV's) on the Interstate System and commercial motor vehicle (CMV) combinations with two or more cargo-carrying units on the NN to the types of vehicles in use on or before June 1, 1991, subject to whatever state restrictions were in effect on that date. Section 1023 of the ISTEA required states to submit to the Secretary of Transportation a complete list of: 1) all operations of LCV's being conducted as of June 1, 1991; 2) state laws, regulations, and any other limitations and conditions, including routing-specific and configuration-specific designations governing the operation of LCV's; and 3) a copy of such laws, regulations, limitations, and conditions. Because of grandfather rights set forth by Title 23 in each state, maximum weights for LCV configurations vary.

The RTAC weight provisions regulate principal highways in Alberta, Saskatchewan, and Manitoba. Basic differences between the two systems include:

- Basic RTAC limits are higher for tandem axle weights, tridem axle weights, and gross vehicle weights compared to the United States on both interstate and non-interstate highways.
- The RTAC system is vehicle specific whereas the U.S. system is not (for example, a higher gross vehicle weight limit for an 8-axle B-train compared with an 8-axle A-train).
- The RTAC system controls front steering axle loads (5500 kg or 12,125lbs. on tractors), whereas the U.S. system generally does not.
- The RTAC system has no explicit bridge formula, whereas the U.S. system uses Bridge Formula B explicitly for controlling gross vehicle weights and tridem axle weights as it relates to axle spreads[1] (Montufar and Clayton 2002).

Table 1 encompasses truck weights and dimensions in the region. A point needing to be established is that Table 1 summarizes regulations on truck size and weights, but these regulations are difficult to decipher from lengthy statutes and regulatory documentation composed by each state and province. The 2000 U.S. Department of Transportation Truck Size and Weight Study summed up the regulations in a quote, " Vehicle size and weight laws in each state and province are continually evolving due to several factors

[1] $W = 500 [(LN / N-1) + 12N + 36]$

W = The maximum weight in pounds that can be carried on a group of two or more axles to the nearest 500 pounds.

L = The spacing in feet between the outer axles of any two or more consecutive axles.

N = The number of axles being considered.

including the nature and extent of natural resources, local industrial development, climate, relative strength of special interest groups, and the national economic condition." Because of these continual changes, along with conflicts of regulations from different sources, the reader should note that this table is a snap-shot of current regulations and conditions. In various parts of Table 1, superscripts representing footnotes explain a weight or dimension exception in which the value may vary depending on various scenarios (Appendix 3).

Table 1 Regulation on Truck Maximum Weight and Dimension

	Width [1] (inches)	Length[2]	Height	Gross Vehicle Weight Interstate Highways	Maximum Gross Vehicle Weight Other Highways[16]	Single Axle (lbs)	Tandem Axle[4] (lbs)	Tridem Axle (lbs) [15]	(**) "Routine" Permit Maximum GVW (lbs)	"Routine" Permit Maximum Single Axle / Tandem Axle	(**) Special Review Permit Highest GVW with Sufficient Axles
North Dakota	102	110'	14'[3]	80,000	105,500	20,000	34,000	48,000	103,000	24,000/ 45,000	150,000
South Dakota	102	110'	14'	80,000	129,000[12]	20,000	34,000	43,000	116,000	31,000/ 52,000	Determination on a case by case basis
Minnesota	102[5]	75'	13'6"	80,000	80,000[11]	20,000[7]	34,000	43,000	92,000[6]	20,000/ 40,000	144,000
Montana	102	110'	14'	80,000	131,060	20,000	34,000	46,300	105,500[8]	20,000/ 48,000	126,000
Nebraska	102	105'	14'6"	80,000	95,000	20,000	34,000	42,500	99,000	20,000/ 40,000	110,000
Iowa	102	110'	13'6"	80,000[14]	80,000[18]	20,000	34,000	42,500	100,000	20,000/ 40,000	160,000
Wyoming	102	110'	14'	80,000[17]	117,000	20,000	36,000	42,500	85,000	25,000/ 55,000	135,000
Alberta	102	82'	13'6"	87,082[13]	76,059[13]	20,062[13]	37477[13]	52,910[9]	139,993[13]	20,062/ 37,478 Determination on a case by case basis	Determination on a case by case basis
Manitoba	102	(*) 114'9"/ 75'5"	13'6"	87,082[13]	76,059[13]	20,062[13]	37,477[13]	52,910[9]	137,788[13]	20,062/ 37,478 Determination on a case by case basis	Determination on a case by case basis
Saskatchewan	102[10]	(*) 114'9"/ 75'5"	13'6"	87,082[13]	76,059[13]	20,062[13]	37,477[13]	52,910[9]	137,788[13]	20,062/ 37,478 Determination on a case by case basis	Determination on a case by case basis

4.1 Seasonal Load Restrictions

Permits are available during the spring and winter months in some states and provinces. During spring months, states and provinces in the region experience “Spring Thaw” in which warmer temperatures causes frost in the ground to melt thus, reducing the maximum allowable weight which can be carried over the roadway (Table 2). States and provinces in the region generally post signs along the highways that are most vulnerable, indicating a lower-weight road. During the winter months, when the underlying road surface is hardened by frost, some states and provinces increase load limits on highways by as much as 10%. Carriers that desire to move loads during the 10% winter weight increase may obtain a seasonal permit for such movements. Table 2 provides a snapshot of state and province’s spring load restrictions and winter weight premium policies. Nebraska, Iowa, and Wyoming do not have regulations pertaining to spring load restrictions or winter weight premiums. North Dakota, Minnesota, Montana, and Manitoba have spring load restrictions as well as a 10% winter premium. South Dakota has spring load restrictions but does not have a winter premium. In Alberta, drive, tandem, and tridem axles are limited to 90%, 75%, or 50% depending on thaw index calculations in the spring. Spring restrictions are also placed in Saskatchewan; and in both Alberta and Saskatchewan, winter weights are based on maximum gross weights on various axle configurations, not a percentage of gross vehicle weight.

Table 2 Seasonal Load Restrictions

	Spring Load Restriction	Winter Premium Weight
North Dakota	single axle Tandem axle Tridem axle Gross Weight (unit: lbs) Class A Load Restrictions: 18,000 16,000 42,000 105,500 No. 1 Load Restrictions: 15,000 15,000 36,000 80,000 No. 2 Load Restrictions: 12,000 12,000 30,000 65,000 Highway Restrictions : 20,000 17,000 48,000 105,500 * Values show Order 5, effective March 16, 7:00 AM.	10% increase in GVW
South Dakota	The weight per axle may not exceed that allowed by the Load Restriction Map or addendum spring Load Restriction Reports. The maximum weight per axle shall be limited to the smallest of 20,000 pounds per axle or 450 pounds per inch width of tire.	No winter premium weight
Minnesota	The weight on any single axle shall not exceed 5 tons on a county highway, town road, or city street. The gross weight on consecutive axles shall not exceed the gross weight allowed in restriction reports.	10% increase in GVW
Montana	8 tons (16,000 pound) for a single axle. 16 tons (32,000 pound) for tandem axle. 600 pound per inch of tire width for steering axle. 400 pound per inch of tire width for all other axles which have single tires. The maximum weight allowed is determined by ton limit or pound per inch of tire width.	10% increase in GVW
Alberta	There are no restrictions on steering axles. However, drive, tandem, and tridem axles are limited to 90%, 75%, or 50% depending on thawing index calculations.	Winter weights are based on maximum gross weights on various axle configurations, not a percentage of gross vehicle weight.
Manitoba	There are no restrictions to primary system or gravel roads. Steering axles are not restricted. For other axles, there are two restriction levels: Level 1 Restriction (Beginning of thaw for 14 days): RTAC routes (90%of basic load), class A1 (90%of basic load), class B1(95% of basic load) Level 2 Restriction (Imposed 14 days after Level 1 and removed 1 week before removal of Level 1): class A1 (65% of basic load), class B1 (65% of basic load)	10% increase in GVW
Saskatchewan	The maximum load on steering axles is 560 pound per inch, to a maximum of 6,060 pound on each wheel or 12,120 pound on the steering axle. Maximum loads on all other wheels will be limited to 350 pound per inch width of tire to a maximum loading of 3,636 pound per wheel.	Winter weights are based on maximum gross weights on various axle configurations, not a percentage of gross vehicle weight.

4.2 Maximum Weights for Longer Combination Vehicles (LCVs)

Figure 1 displays maximum weights for common Longer Combination Vehicles (LCVs) in states and provinces. Both Iowa and Minnesota prohibit LCV operation in their states. Wyoming prohibits three trailing unit LCVs. Nebraska does not allow cargo carrying or weighted triple trailer configurations; only empty triple trailer configurations are allowed.

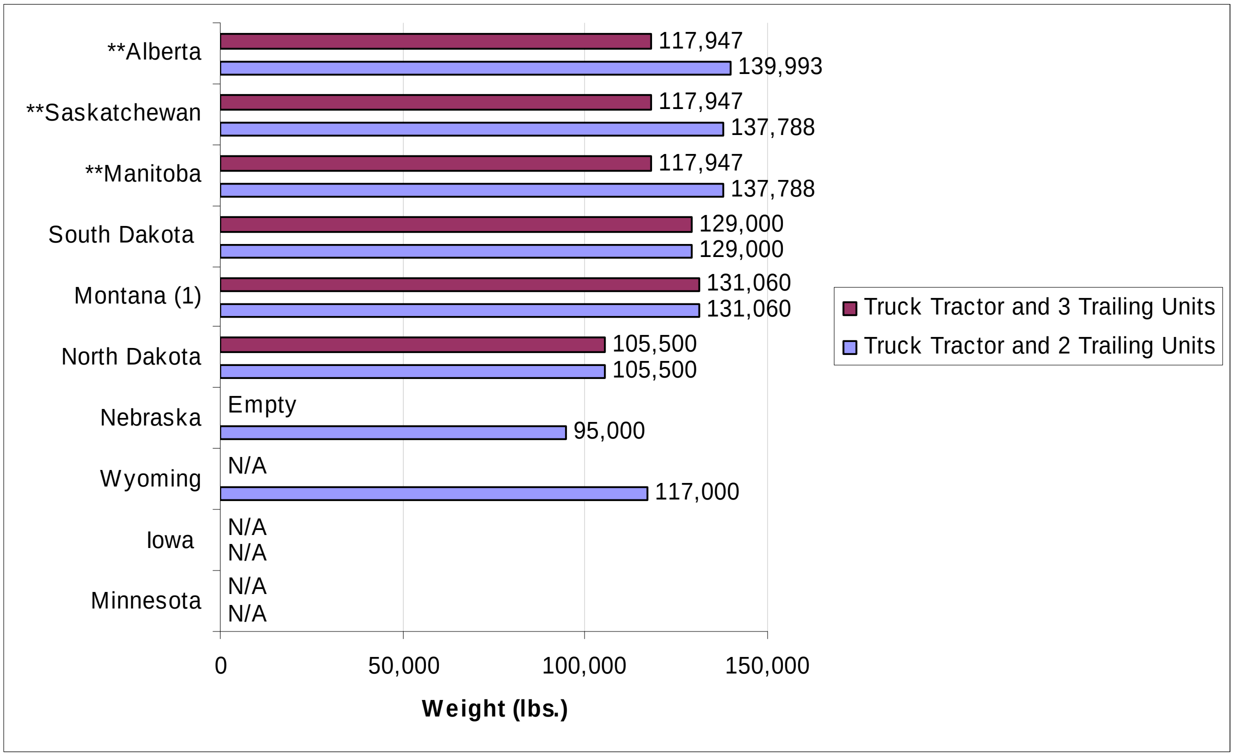


Figure 1 Maximum Weight for Vehicles Subject to the ISTEA Freeze (LCV's)

** Weight was converted from metric measurement which may include rounding error.

(1) 137,800 pounds for vehicles operating under the Montana/Alberta Memorandum of Understanding (MOU).

4.3 Maximum Lengths for Longer Combination Vehicles (LCVs)

Figure 2 displays the maximum lengths for common LCVs in the region. Regulations for the length of LCVs varies from 103 feet in North Dakota to 81 feet in Wyoming with both Iowa and Minnesota prohibiting LCV operations altogether. The State of Wyoming prohibits trucks with three trailing units.

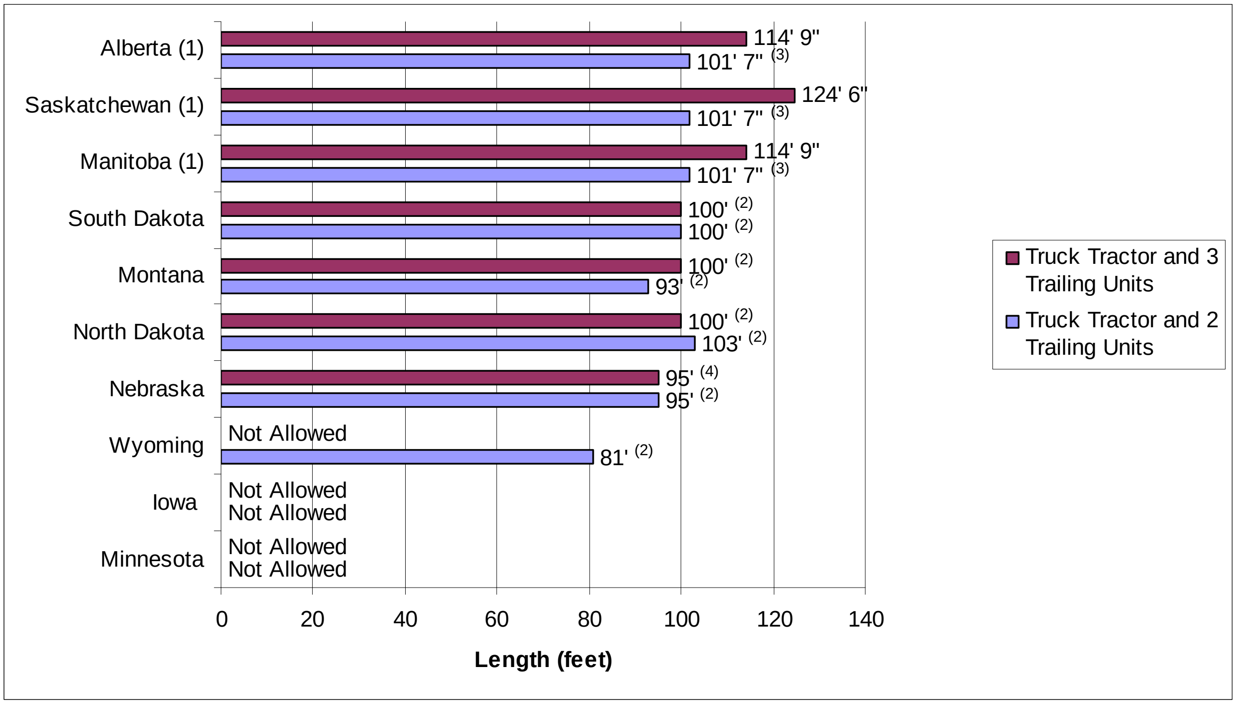


Figure 2 Maximum Length for Longer Combination Vehicles (LCVs)

(1) Overall maximum lengths for Canadian Provinces-Roads and Transportation Association of Canada (RTAC).
(2) Combined Trailer Length (CTL).
(3) Rocky Mountain Double configuration overall length. Turnpike Double maximum overall length is 124' 6" in each Province.
(4) Empty trailer only.

There are ten common configurations allowed to operate throughout the entire region, including the most common truck configuration on American and Canadian highways, which is the five axle semi-truck (first ten configurations in Figure 3). There are three truck types shown that may not operate through out the entire region including the Rocky Mountain Double, the Turnpike Double and the Triple Trailer Combination.

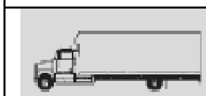
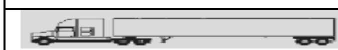
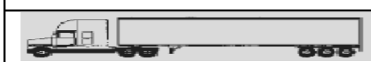
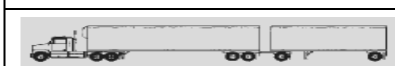
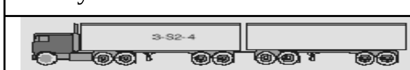
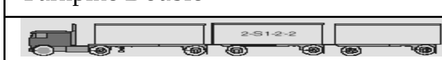
Configuration	**ND**	**SD**	**MN**	**NE**	**IA**	**MT**	**WY**	**MB**	**SK**	**AB**
 Straight Truck 2 axles	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
 Straight Truck 3 axles	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
 Tractor & Semi-trailer 4 axles	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
 Tractor & Semi-trailer 5 axles	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
 Tractor & Semi-trailer 6 axles	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
 Truck & Tandem Pony	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
 Truck & Tandem Pony	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
 Truck & Full Trailer 5 axles	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
 Truck & Full Trailer 6 axles	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
 Twin Trailer Combination	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
 Rocky Mountain Double	✔	✔		✔		✔	✔	✔	✔	✔
 Turnpike Double	✔	✔		✔		✔		✔	✔	✔
 Triple Trailer Combination	✔	✔		✔		✔		✔	✔	✔

Figure 3 Common Truck Configurations by State and Province

(✔) Indicates the configuration can be found in the state.

4.4 Permitting Differences across States and Provinces

In the United States, oversize/overweight permits are needed for 5-axle combination vehicles transporting loads weighing over 80,000 pounds on the NN (National Network). A single axle is limited to 20,000 pounds, and tandem axles are limited to 34,000 lbs.[1] The legal dimensions for vehicles on the NN are a maximum of 14 feet high, 11 feet wide, and a 53-foot trailer length. These weights and dimensions are not applicable to all highways and local limits. Permits may be issued for loads exceeding the above listed regulations for only non-divisible loads on the NN. State highways and other jurisdictions may require permits for different scenarios.

The Federal Bridge Formula is used by each state to determine acceptable load limits on highway infrastructures. The formula limits the weight carried by groups of axles to reduce the risk of damage to highway bridges. The maximum allowable weight depends on the number of axles and the axle spacing. Spreading axles allows the bridge and pavement to recover from first group of axles before flexing under the next group of axles. According to the bridge formula, transportation of 80,000 lb gross weight requires a distance between the first and the last axle on the truck to be at least 51 feet.

Vehicle maximum heights and weights vary without permits within each state and province, and some underpass and bridge structures are constructed at less than the allowable height of a given truck or load (Table 1). Oversize/overweight permits are required on interstate highways, state highways, and county roads. Single-use permits are issued every time a load weighing more than 80,000 pounds is transported on interstate highways, state highways, designated local highways, and other city, county, or township highways.[2] Oversized/overweight permits may be issued for a single trip or annually for unlimited trips.

Tables 3 and 4 list the types of permits and costs associated with obtaining each type of permit for the region. In Montana and the Canadian provinces, permit costs are based on miles or kilometers, respectively. For example, a vehicle traveling in Manitoba is charged 6 cents for each kilometer traveled or $18, whichever is greater. Each jurisdiction’s terminology varies with regards to the type of permit issued. For example, Nebraska uses the term “Continuous Permit” when a permit is issued to vehicles or combinations of vehicles that move frequently or repeatedly to several destinations within a limited area. Alternatively, Iowa uses the term “Multiple Trip Permits” for those permits that are issued to vehicles that move frequently or repeatedly to several destinations within a limited area.

[1] In Wyoming tandems are limited to 36,000 pounds.
[2] In Minnesota, most city, county, and township roads are considered “9-ton Routes” with a maximum gross vehicle weight of 73,280 pounds.

Table 3 Permit Costs (Single Trip)

State/Province	Single Trip	Single Trip permit time available	Single Trip Oversize Only	Single Trip Overweight Only	Single Trip Oversize and Overweight
North Dakota	$20- Official receipt permit; $10- Receipt issued "Interstate Only"; $5- Self Issue "Interstate Only"	72 Hours	$20 Up to- 14'6" Width; 15'6" Height; 120' Length	150,001-160,000 lbs. $30; 160,001-170,000 lbs. $40; 170,001-180,000 lbs $50; 180,001-190,000 lbs. $60; 190,001 lbs and over $70; $.05 per ton per mile is assessed upon the portion of Gross Vehicle Weight exceeding 200,000 pounds.	Varies
South Dakota	$15 Commercial Vehicle	72 Hours	$25	$25	
Minnesota	$15	120 Hours	$135 for width over 14'6" up to 16' during Spring Load Restrictions		
Iowa	$10 oversize permit fee which also includes loads requiring bridge reviews	72 Hours			
Nebraska	$15	72 Hours	$15	$20	$25
Montana	Single trip permit fee for vehicles that do not exceed axle limits: Under 100 Miles $10; 101-199 Miles $30; Over 200 Miles $50	72 Hours	$10	$3.50 for each 5,000lb increment overweight moved up to 25 miles that exceed axle limits. For example, a load which is 10,000lbs over legal weight and moved 95 miles would result in a $28 permit fee.5,000lbs @ $3.50 x 2 = 10,000lbs = $7.00. 95 miles is rounded to 100 miles. $7.00 x 4 (4-25 mile increments are 100) = $28.	
Wyoming	$20 single unit / $40 combination	96 Hours			
Alberta	Varies based on mileage and net weight factors	72 Hours			
Manitoba	$18 or $.06 per kilometer traveled, whichever is greater	24 Hours			
Saskatchewan	$10 or $.06 per kilometer traveled, whichever is greater	24 Hours			

Table 4 Permit Costs (Annual, Multiple, Continuous, and Seasonal Trips) (Permit Definitions in Appendix 4)

State/Province	Annual Oversize	Annual Oversize and Overweight	Multiple Trip	Continuous Trip	Seasonal
North Dakota				N/A	$50 per year
South Dakota	$60	N/A	$5 per month for each designated county, not to exceed $20 for all of the designated counties.	N/A	$60 custom harvest oversize only.
Minnesota	$120 -Includes vehicles that meet the following criteria: Mobile cranes; Construction equipment, machinery and supplies; Manufactured homes; Implements of husbandry; Double-deck buses; Commercial boat hauling. Implements of husbandry not exceeding 14' width =$24	Varies from $200-$800 (Limited commodities)	Job Permit $36 (fee increased if vehicle is also overweight)	N/A	$60 -10% winter weight jncrease, sugar beet, potato, and carrot harvest.
Iowa	$25	$300	$200	N/A	
Nebraska				$25	
Montana	$75 for vehicles licensed in Montana.	Vehicles in excess of the oversize/ overweight limits are assigned the following fees: Up to but not exceeding 5,000 lbs = $200.[1] Up to but not exceeding 10,000 lbs = $500.[1] Up to but not exceeding 15,000 lbs = $750.[1] Up to but not exceeding 20,000 lbs = $1000.[2]		N/A	$25 for 30 days; $50 for 60 days. Renewable for 120 days per calendar year.
Wyoming				N/A	
Alberta				N/A	
Manitoba				N/A	
Saskatchewan				N/A	

[1] No axles to exceed 5,000lbs in excess axle weight.
[2] No tandem to exceed 15,000lbs in excess axle weight.

The maximum useable time for a single trip permit in each state and province varies from 24 hours in Saskatchewan and Manitoba to 120 hours and 96 hours in Minnesota and Wyoming respectively. Five states (Montana, Iowa, Nebraska, South Dakota, and North Dakota) and the Province of Alberta issue single trip permits for 72 hours.

During spring months, states and provinces in the region experience “Spring Thaw” in which warmer temperatures causes frost in the ground to melt thus, reducing the maximum allowable weight which can be carried over the roadway. States and provinces in the region post restrictions on affected routes. In Montana, for example, signs indicate the tonnage per-axle load allowed on restricted routes. In Montana, the standard spring weight restrictions on the NN are 8 tons for single axles and 16 tons for tandem axles. In Minnesota, a five ton limit is set on most county highways, town roads, and city streets during spring load restriction. During the winter months, when the underlying road surface is hardened by frost, some states and provinces increase load limits on highways by as much as 10%. Carriers that desire to move loads during the 10% winter weight increase may obtain a seasonal permit for such movements.

In summary, truck regulations from state to state and state to province differ dramatically. There are some commonalities such as the 5-axle semi which is used and allowed almost exclusively to operate at 80,000 pounds GVW. This section points out the region’s problems in truck size and weight regulation uniformity. Permitting uniformity is also problematic, as there are many variations and costs.

5. PROPOSED INTERREGIONAL CORRIDORS

The region's limited access to water transportation, with the exception of Iowa and Minnesota, and the lack of competitive rail service emphasizes the need for an interregional truck (freight) network. The Federal Highway Administration is predicting freight traffic to double on some highways over the next 20 years. Designating highways as freight corridors for heavy trucks may mitigate the impacts of increased freight volumes. Interregional corridors promote regional, state, and provincial economies by connecting businesses. Corridors also enhance regional tourism and trade by connecting recreational places and businesses. Minnesota Department of Transportation (MNDOT) developed an interregional corridor study in 1999. Minnesota's goal of corridor designation was "*to proactively manage the important connections between regional centers in a more cost-effective manner.*"[3]

MNDOT defined trade centers to develop interregional corridors. The Center for Urban and Regional Affairs (CURA) built a model ranking regional trade centers (an eight-level hierarchy) from metropolitan areas to hamlets. The model uses population and the number and types of business establishments in an area. Level 0 shows the largest population and business establishments. The trade center levels (levels 0 to 3) cover 90% of the state's population and 95% of the state's employment. CURA defines interregional corridors in seven states (Minnesota, Iowa, Montana, Nebraska, North Dakota, South Dakota, and Wisconsin). MNDOT adopted the model to observe relative growth of trade centers and transportation needs.

Although MNDOT has defined interregional corridors in Minnesota, and some surrounding state DOTs have attempted to construct corridor networks, there is no widely used methodology. Therefore, there are no recognized integrated interregional corridors in the region. This study adopts MNDOT's methodology to propose interregional corridors in the study region.

The criteria for a trade center designation in the region uses CURA levels 0 to 2. This captures communities or metropolitan areas having high supply and demand of freight shipment. For example, using this criteria, North Dakota has eight trade centers including Fargo, Bismarck, Mandan, Jamestown, Dickinson, Grand Forks, Williston, and Minot. Because CURA has not defined trade centers in Wyoming, Alberta, Saskatchewan, and Manitoba, the researchers use population to identify trade centers.[4] The average population for trade center levels 0, 1, 2, and 3 are 653,352; 102,504; 28,142; and 11,036, respectively. This study uses the mean population (19,589) between level 2 and 3 to designate trade centers. Wyoming has four trade centers (Cheyenne, Laramie, Casper, and Gillette) using this method.

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[3] The Statewide Interregional Corridor Study, MNDOT. (http://www.oim.dot.state.mn.us/projects/irc/index.html)

[4] Trade Centers of the Upper Midwest 1999 Update, William Casey, the CURA

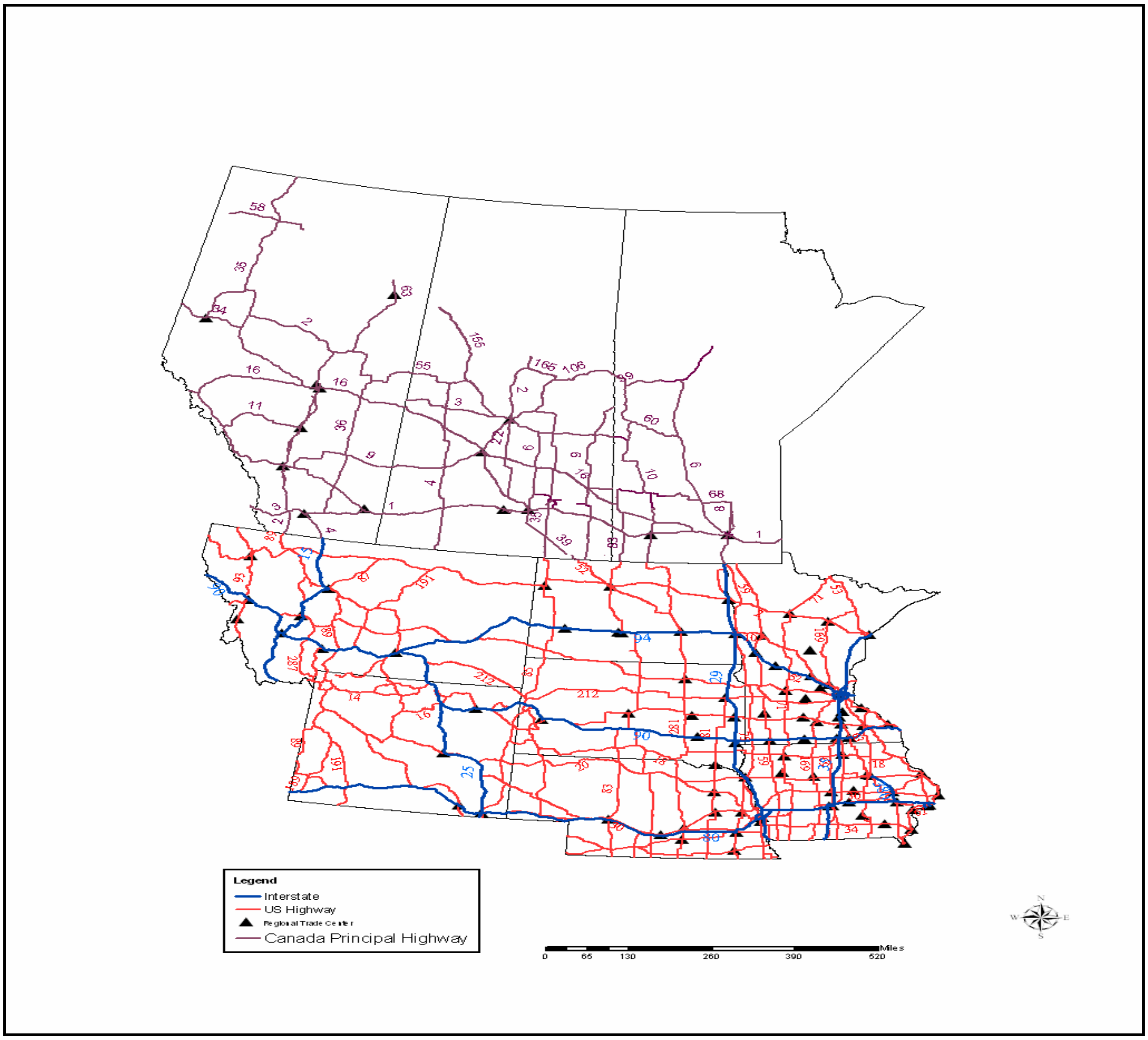

Figure 4 Regional Trade Centers (Level 0-2) and Interstates, U.S. Highways, and Canadian Principal Highways in the Selected Region

Major highways having high freight volumes connect the trade centers. Interstate highways and other NN highways connecting trade centers could be used to identify potential interregional corridors. Using the Freight Analysis Framework (FAF) Highway Capacity Network Files, highway segments with high freight volumes are identified. Table 5 points out the need for designated freight corridors as the number of average daily trucks almost doubles from 1998 through 2020.

Table 5 Average Daily Trucks on the Identified Highway Segments for Estimated and Projected Years

	Estimated	**Projected**	
Year	**1998**	**2010**	**2020**
I-94			
Point A (near Billings)	800	1,156	1,522
Point B (near Fargo)	1,801	2,344	2,860
Point C (near St. Paul)	5,050	4,889	6,384
I-29			
Point A (near Grand Forks)	2,239	3,272	4,235
Point B (near Fargo)	2,308	3,358	4,333
Point C (near Omaha)	2,780	3,934	4,938
I-80			
Point A (near Cheyenne)	8,827	12,828	17,037
Point B (near Lincoln)	6,619	10,211	13,483
Point C (near Des Moines)	7,238	10,469	13,647

(Source: FAF Highway Capacity Network Files, Federal Highway Administration)

In summary, the projections of increased freight volumes throughout the region highlight the need for states and provinces to adopt freight corridors for the efficient movement of goods. Harmonization in truck size and weight regulations on these identified routes may reduce truck numbers and provide a more efficient highway network serving businesses throughout the region.

6. COSTING MODEL

The trucking industry reflects many aspects of a perfectly competitive industry in that information is easily obtained, entry and exit are not prohibitive, and operators are mostly price takers because of competition. Truck costs or rates for shippers are directly correlated to operating costs incurred either from for-hire operations, or costs incurred from their own fleet. Even though differences exist in operational characteristics for individual trucking entities, both fixed and variable costs can be estimated. Fixed costs are incurred, operating or not, and variable costs increase with distance, time, or both. Fixed costs include equipment depreciation, insurance, license fees and taxes, and any management and overhead costs. Variable costs are labor, fuel, tires, and maintenance and repair.

Motor carrier rates differ from costs based on the supply and demand of transportation services. Rates may be lower or higher than the actual full cost of operating, but in the long run rates are based on operating characteristics such as age and cost of equipment, fuel price, insurance rates, license fees and taxes, and labor. These costs may vary depending on location and operating characteristics. Differences in costs are due to varying equipment prices and the use of that equipment. Varying equipment prices impact depreciation costs, and higher utilization of equipment spreads fixed costs over more miles, resulting in lower fixed costs. Because the trucking industry reflects a perfectly competitive industry, costs provide a good proxy for rates and many times are similar to rates charged.

In determining costs associated with different payloads, both fixed and variable costs need to be included. It could be argued that only variable costs increase as extra trips are needed to haul lower-weight payloads based on restrictions for gross vehicle weight (GVW). However, if a shipper is hiring transportation services, all costs are relevant and may be reflected in the rates.

A costing model developed by UGPTI to estimate truck costs allows costs comparisons of different truck configurations and GVWs experienced by a motor carriers moving through the region. The model was developed to cost owner/operator applications, but can be adapted to fit other applications. The original model was formulated to estimate a limited number of truck types and configurations. The model can provide cost estimations for many different truck types, and weights.

The model uses formulas to derive costs for tires, fuel, labor, insurance, sales tax, and license costs. Equipment prices and vehicle weights are determined from tables. The flexibility of the model allows inputs to be changed for the different configurations and provides estimations of costs for those truck types.

Differences in state and provincial size and weight regulations limit what a motor carrier can legally haul. Therefore, any interregional trip is limited to the level of the lowest GVW allowed in any state or province. The cost of shipping is impacted by the differences among states’ and provinces’ size and weight regulations.

This case study simulates differences in estimated shipping costs based on the size and weight regulations for the different states and provinces. A previous section discussed in depth the differences in interregional truck size and weight regulations. The cases compare the costs for moving through different states with alternate origins and destinations.

First a simulation will assume a truck needs to move through all states and provinces within the region for demonstration purposes. The most common over-the-road truck is the 5-axle semi, which was used for the first simulation. A common trailer is the 48' or 53' van. Vans can be either refrigerated (reefer) or not. A reefer hauls less because of the weight of insulation in the roof, walls, and floor and the weight of the refrigeration equipment. The literature review reveals the normal maximum weight for a 5-axle semi in the study area.

The GVW allowed on the U.S. Interstate Highway System in all states is 80,000 pounds. State and provincial highways have differing regulations. For example, North Dakota allows a RMD (Rocky Mountain Double) to operate at 105,500 pounds on designated highways, but Minnesota does not allow these vehicles. Montana allows a double-trailer semi to operate at a maximum of 131,060 pounds with permit and up to 137,800 pounds from Shelby to Sweetgrass.[5] This was a special provision to accommodate Canadian trucks delivering to, or picking up from, the intermodal terminal located in Montana. The extreme differences of weight regulations provide for a less-than-optimum transportation system and may confuse shippers desiring low-cost interstate or interstate/provincial movements.

However, cost to the shipper is only one component of the truck size and weight debate. Other factors considered in the truck size and weight debate include safety and highway infrastructure preservation. Truck costs were estimated for four different truck types to demonstrate differences in costs.

The first cost estimate is a 5-axle semi operating at 80,000 pounds GVW, the most common truck configuration on the highway as it is legal most everywhere in the continental United States and Canada. Many truck configurations are not loaded to their maximum GVW as they "cube out" before they "weigh out."[6] Other assumptions made to determine costs are shown in Table 6. These are the variables that need to be estimated before the model can determine costs. The model is most sensitive to equipment usage. This variable is also difficult to estimate, but for commercial truckers it is estimated they operate at least 100,000 miles per year. Other variables may differ depending on location and operation characteristics including fuel, wages, insurance, and taxes and license fees.

Table 6 Operational and Trip Characteristics and Input Prices for 5-Axle Semi

Miles Per Year	100,000
Trip Distance (miles)	1,000
% Time Loaded	100%
Backhaul Miles	500
Deadhead Miles	0
Adjusted Percent Time Loaded	100%
Payload (pounds)	53,200
GVW (pounds)	80,000
Tare Weight (pounds)	26,800
Labor Rate (Per Mile)	$0.33
Interest Rate (percent)	8%
Average Speed (Miles per Hour)	55
Fuel Price (per gallon) (8/2004)	$1.55
Maintenance & Repair (per mile)	$0.09

[5] The Shelby facility has since closed.
[6] "Cube out" is when a truck trailer's cubic capacity is filled before it reaches its maximum legal weight. "Weigh out" is when a truck reaches its legal weight before its cubic capacity is filled.

The different options available for tractors make it difficult to estimate a universal cost. Tractors capable of operating at or above 80,000 pounds GVW come in a wide range of options and horsepower ratings, varying the costs. A tractor with a “day cab” will sell for considerably less than a tractor with a sleeper unit and all the options that can be added to an over-the-road truck. New semi tractors vary in price from less than $85,000 to more than $125,000.

Because of the variation, assumptions must be made to estimate truck costs. All simulations use the same tractor costs, but trailer and other costs change based on the configuration. The model provides truck costs that can be expressed in different performance measures. Performance measures are the output of the model. Many different measurements can be developed as needed by the user. The measures can be per mile, per hundredweight, per ton, per ton-mile, or unit, or other measures. Table 7 shows the estimated performance measures of a 5-axle semi operating at 80,000 pounds.

Table 7 Performance Measures of a 5-Axle Semi Operating at 80,000 Pounds GVW

Cost Summary	**Cost Per Mile**	**Cost Per Hour**	**Cost Per Cwt**	**Cost Per Trip**	**Cost Per Ton**	**Cost Per Ton-Mile**
Variable Costs						
Fuel	$0.27	$14.89	$0.52	$270.75	$10.35	$0.0104
Labor	$0.33	$18.15	$0.63	$330.00	$12.62	$0.0126
Tires	$0.05	$2.65	$0.09	$48.22	$1.84	$0.0018
Maintenance	$0.11	$6.12	$0.21	$111.34	$4.26	$0.0043
Total Variable Costs	**$0.76**	**$41.82**	**$1.45**	**$760.32**	**$29.08**	**$0.0291**
Fixed Costs						
Equipment Cost	$0.27	$14.74	$0.51	$267.97	$10.25	$0.0102
License Fees and Taxes	$0.03	$1.70	$0.06	$30.83	$1.18	$0.0012
Insurance	$0.07	$3.95	$0.14	$71.85	$2.75	$0.0027
Management and Overhead	$0.11	$5.90	$0.21	$107.22	$4.10	$0.0041
Total Fixed Costs	**$0.48**	**$26.28**	**$0.91**	**$477.86**	**$18.27**	**$0.0183**
TOTAL COSTS	**$1.24**	**$68.10**	**$2.37**	**$1,238.17**	**$47.35**	**$0.0473**

After developing the model, running simulations provides cost estimates for different truck types and weights. Comparing the different truck costs determines the most economical truck types from a shipper’s perspective. The lowest cost per ton-mile is the Turnpike Double operating at 137,800 pounds (Table 8). The geographical operation of this truck is extremely limited. It is only allowed on primary highways in Alberta, Manitoba, and Saskatchewan and one route in Montana that allows these heavy Canadian trucks.

Table 8 Ton-Mile Costs for Different Truck Configurations

GVW (pounds)	80,000	94,000	105,500	137,800
	5-axle	6-axle	RMD	Turnpike Double
Variable Costs				
Fuel	$0.0104	$0.0090	$0.0093	$0.0072
Labor	$0.0126	$0.0100	$0.0097	$0.0067
Tires	$0.0018	$0.0018	$0.0020	$0.0029
Maintenance	$0.0043	$0.0038	$0.0040	$0.0034
Total Variable Costs	**$0.0291**	**$0.0246**	**$0.0251**	**$0.0203**
Fixed Costs				
Equipment Cost	$0.0102	$0.0082	$0.0062	$0.0060
License Fees and Taxes	$0.0012	$0.0009	$0.0005	$0.0003
Insurance	$0.0027	$0.0022	$0.0021	$0.0015
Management and Overhead	$0.0041	$0.0033	$0.0032	$0.0022
Total Fixed Costs	**$0.0183**	**$0.0146**	**$0.0120**	**$0.0101**
TOTAL COSTS	**$0.0473**	**$0.0392**	**$0.0371**	**$0.0304**

The RMD (Rocky Mountain Double) and the 6-axle semi have similar costs, with the RMD being the more cost effective of the two. The tare weight of the RMD provides only 2,200 pounds more payload than the 6-axle. The 6-axle could be used in all states or provinces covered in the study. However, Minnesota does not allow the tridem to operate without a special permit at a GVW of 94,000 pounds.

Table 9 shows the differences in payloads for different configurations. For many products, GVW impacts shipping costs. As previously stated, these costs are directly affected by truck costs. The ratio of payload in the table shows the relationships between the different truck configurations. Using the 5-axle semi with a 53,200 pound base payload and the payloads presented in Table 9 for the other configurations shows the relationships among different truck types and the efficiencies of larger trucks. For example, assume that there are 10,000 tons of materials/products to move 250 miles from point A to point B. The movement would require 376 loads with a 5-axle semi at a maximum GVW of 80,000 pounds, 305 loads with the 6-axle semi at 94,000 pounds, 295 loads with the RMD at 105,500 pounds, and 205 loads with the Turnpike Double loaded to 137, 800 pounds.

Table 9 Payloads for Truck Types

	5-Axle Semi	6-Axle Semi	RMD	Turnpike Double
Payload	53,200	65,700	67,900	97,800
Tare Weight	26,800	28,300	37,600	40,000
GVW	80,000	94,000	105,500	137,800
Ratio of Payload	1	1.23	1.28	1.84

7. PAVEMENT IMPACTS

Using the number of loaded and empty trips, equivalent single axle load (ESAL) factors for each configuration can be calculated for 10,000 tons moved 250 miles.

Calculating gross ESALs and comparing different truck types on flexible pavement, the 6-axle semi configuration does the least damage followed by the 5-axle semi, RMD, and Turnpike Double respectively for the defined GVWs. Results change using the total number of trips to haul 10,000 tons 500 miles (calculating loaded and empty movements) from point to point. The combined gross and tare ESAL calculations for flexible pavement in this scenario is lowest for the Turnpike Double configuration, followed by the 6-axle semi, 5-axle semi, and RMD respectively (Table 10). Combined gross and tare ESALs for rigid pavement reveals different results. The combined gross and tare ESALs is lowest for the Turnpike Double configuration, followed by the RMD, 6-axle semi, and 5-axle semi respectively (Table 10).

Gross vehicle weight varies among the different truck types, thereby affecting payload for different truck configurations. The Turnpike Double, which is not allowed to operate freely throughout the region, provides the lowest operating costs and less pavement damage than the other configurations shown in the 10,000 ton product/material movement scenario.

Case studies for both truck cost and pavement impacts point out that larger trucks may provide lower costs for operating and the least pavement damage. However, LCVs may operate at less than maximum GVW, and in some cases businesses desire to become more efficient by reducing inventory and shipment size. Costs of holding inventory may be much greater than the cost of shipping in smaller lots. Just-in-time manufacturers may want to stock only enough inventory for a set time frame and will carry safety stock to insure adequate inventory levels. High-cost transportation is offset by the cost savings of lower inventory levels.

Other impediments to larger trucks may also be restricted routes. A truck needing to move over a designated route to reach a destination may experience a restricted road or bridge limiting the GVW or axle weights of the truck. Bridge Formula B is used by most states to regulate GVW and axle weights on bridges. The formula dictates the needed length of a vehicle and spacing between axles to conform to the formula.

Table 10 Equivalent Single Axle Load for Truck Types Varying from Lowest Legal to Highest Legal Limit in the Region[7]

	5-Axle Semi	6-Axle Semi	RMD	Turnpike Double
GVW (pounds)	80,000	94,000	105,500	137,800
Gross ESAL Flexible	2.37	2.30	3.08	3.44
Gross ESAL Rigid	4.07	4.67	4.36	5.93
Tare ESAL Flexible	.06	.06	.07	.07
Tare ESAL Rigid	.07	.07	.08	.07
Number of Trips (Max Payload)	376	305	295	205
Number of Trips (Tare Weight)	376	305	295	205
Total Trips (Max Payload and Tare Weight)	752	610	590	410
Gross Total ESALs Flexible per 10,000 Tons Moved 250 Miles	222,744	175,038	226,804	175,869
Gross Total ESALs Rigid per 10,000 Tons Moved 250 Miles	382,519	355,403	321,060	303,170
Tare Total ESALs Flexible per 10,000 Tons Moved 250 Miles	5,639	4,566	5,155	3,579
Tare Total ESALs Rigid per 10,000 Tons Moved 250 Miles	6,579	5,327	5,891	3,579
Combined Gross and Tare ESALs Flexible	228,383	179,604	231,959	179,448
Combined Gross and Tare ESALs Rigid	389,098	360,731	326,951	306,748

[7] Does not include bridge impacts.

Providing corridors to use larger trucks to reduce trips may provide efficiency for businesses and reduce truck traffic. Designing bridges and pavements to carry heavier loads may result in overall cost savings. Pavement and bridge costs may be more than offset by efficiency gains for the business community. Cost savings increase as payloads increase using the costing model developed by UGPTI. Safety concerns provide an obstacle for allowing larger trucks. However, safety data does not provide evidence that larger trucks are less safe than smaller trucks.

8. SAFETY

Road safety is an important issue for drivers, communities, and transportation policy makers. High fatality and crash rates significantly increase costs in the form of human and economic loss for society. A goal listed in TransAction, is to provide "safe and secure transportation for residents, visitors, and freight." One of the USDOT's strategic goals is to *"promote public health and safety by working toward the elimination of transportation-related deaths, injuries, and property damage"* (USDOT Strategic Plan 2000-05). It is argued by some safety advocates that larger trucks are involved in a greater number of crashes than smaller trucks, and the severity of these crashes result in more damage, injuries, and fatalities. Consistency in data collection and stratification makes it difficult to support or deny that claim.

8.1 Data

Truck crash data was collected from four sources including Crash Profile Data,[8] Fatality Analysis Reporting System (FARS),[9] Trucks Involved in Fatal Accidents (TIFA)[10] and the North Dakota Department of Transportation. Raw crash data is presented then combined with vehicle miles traveled (VMT). Canada is lacking crash data involving large trucks. Therefore, there is no analysis for Canada.

National statistics reported by the Federal Motor Carrier Safety Administration, show that 4,542 large truck crashes resulted in 4,897 fatalities in 2002.[11] The Crash Profile data reports fatal and non-fatal crash statistics by state. The Crash Profile defines a large truck as a truck with a GVW of 10,000 pounds or higher. Nationally, more than 96,200 large trucks were involved in non-fatal crashes, resulting in 72,590 injuries. In the region, 287 large trucks were involved in fatal crashes with 309 fatalities, and 6,360 large trucks were involved in non-fatal crashes resulting in 4,580 injuries (Crash Profile Data 2002).

8.2 Crash Parameters of Large Trucks vs. Passenger Vehicles in the United States

The Crash Profiles summarize crash statistics for large trucks and buses involved in fatal and non-fatal Crashes that occurred in the United States[12] and are made up of data from the Fatality Analysis Reporting System (FARS) and the Motor Carrier Management Information System (MCMIS). A truck weighing more than 10,000 pounds is considered a large truck using this data.

Crash statistics per vehicle miles traveled (VMT) are used to compare crash data. Large trucks have a lower crash rate than passenger vehicles at 46.31 per 100 million truck miles traveled (TMT) versus 78.50 per 100 million VMT. However, passenger vehicles have a lower fatality rate than large trucks at 1.52 per 100 million VMT versus 2.49 per 100 million TMT. And inversely, large truck injuries per 100 million TMT are less than passenger car injuries per 100 VMT, 65.36 and 119.26 respectively (Table 11).

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[8] Federal Motor Carrier Safety Administration (FMCSA) has operated and maintained the crash profiles since 1993. The crash profiles contain information on crash statistics for large trucks and buses involved in fatal and non-fatal crashes.

[9] The National Highway Traffic Safety Administration (NHTSA) has collected the FARS since 1975. The FARS contains information on all fatal motor vehicle crashes.

[10] University of Michigan Transportation Research Institute (UMTRI) has conducted an annual national survey on fatal accidents involving medium and heavy trucks since 1980.

[11] Crash Profile, http://ai.volpe.dot.gov/CrashProfile/CrashProfileMainNew.asp

[12] http://ai.volpe.dot.gov/CrashProfile/CrashProfileMainNew.asp

Table 11 Crash Parameters for Trucks and Passenger Cars in the United States from 1999 to 2002

Large Trucks*							
	Crashes**	Fatalities	Injuries	Truck Miles Traveled TMT (Millions)	Crashes per 100 million TMT	Fatalities per 100 million TMT	Injuries per 100 million TMT
1999	99,560	5,380	142,000	202,688	49.12	2.65	70.06
2000	100,573	5,282	140,000	205,520	48.94	2.57	68.12
2001	90,451	5,111	131,000	209,032	43.27	2.45	62.67
2002	94,183	4,897	130,000	214,530	43.90	2.28	60.60
Average	**96,192**	**5,168**	**135,750**	**207,943**	**46.31**	**2.49**	**65.36**
Passenger Cars							
	Crashes**	Fatalities	Injuries	Vehicle Miles Traveled VMT (Millions)	Crashes per 100 million VMT	Fatalities per 100 million VMT	Injuries per 100 million VMT
1999	2,039,163	38,571	3,175,000	2,470,122	82.55	1.56	128.54
2000	2,051,379	38,695	3,123,000	2,523,346	81.30	1.53	123.76
2001	1,988,496	38,725	2,974,000	2,571,539	77.33	1.51	115.65
2002	1,911,803	39,174	2,863,000	2,624,824	72.84	1.49	109.07
Average	**1,997,710**	**38,791**	**3,033,750**	**2,547,458**	**78.50**	**1.52**	**119.26**

* Large truck's GVW is 10,000 pounds or higher.
** Total crashes including fatal and injury crashes.
(Source: Crash Profile 2002 Report:
http://ai.volpe.dot.gov/CarrierResearchResults/HTML/2002Crashfacts/2002LargeTruckCrash Facts.htm)

8.3 Regional Crash Parameters of Large Trucks

Wyoming has the highest fatality rate at .36 fatalities per 100 million VMT, while Minnesota has the lowest fatality rate at .16 fatalities per 100 million VMT. Wyoming has the highest injury rate at 4.53 injuries per 100 million VMT, while South Dakota has 0.87 injuries per 100 million VMT (Table 12).

Table 12 Number of Fatalities and Injuries by Large Trucks* in 2002

	# of fatalities	# of injuries	Annual VMT (million)**	Fatalities per 100 million VMT	Injuries per 100 million VMT
ND	19	194	7,336	0.26	2.64
SD	19	74	8,499	0.22	**0.87**
NE	59	750	18,719	0.32	4.01
MN	86	1,622	54,562	**0.16**	2.97
IA	68	1,276	30,847	0.22	4.14
MT	26	256	10,395	0.25	2.46
WY	32	408	9,007	**0.36**	**4.53**

(Source: Crash Profile State Report)
* Large truck's GVW is 10,000 pounds or higher.
** Vehicle-miles of travel by functional system (table VM-2), Highway Statistics 2002, FHWA.

8.4 Crash Parameters of Large Trucks vs. Non-Trucks in North Dakota

This section provides truck crash characteristics in North Dakota. The study used the most recent four years of crash data (2001-2004) collected from the North Dakota DOT. A truck is defined as having more than two axles with a minimum GVW of 26,000 pounds and excludes pick-ups, farm trucks, and construction equipment. Table 13 shows crash parameters for trucks and other motor vehicles excluding trucks on the National Highway System (NHS)[13] excluding interstates. Trucks have a lower crash rate than other motor vehicles at 74.68 per 100 million TMT versus 193.87 per 100 million VMT. Trucks have lower injury rates per 100 million TMT at 18.21 versus 30.69 per 100 million VMT but higher fatality rates than other motor vehicles at 2.87 per 100 million TMT versus 1.05 per 100 million VMT. This result is consistent with the findings in national crash parameters (Table 11).

[13] NHS includes interstates, other principal arterials, Strategic Highway Network (STRAHNET), major strategic highway network connectors and intermodal connectors.

Table 13 Crash Parameters for Trucks and Other Motor Vehicles Excluding Trucks on North Dakota National Highway System Excluding Interstates from 2001 to 2004

Trucks							
	Crashes	Fatalities	Injuries	Truck Miles Traveled (TMT)	Crashes per 100 million TMT	Fatalities per 100 million TMT	Injuries per 100 million TMT
2001	140	5	46	233,554,950	59.94	2.14	19.70
2002	168	10	34	245,706,805	68.37	4.07	13.84
2003	218	8	55	249,508,130	87.37	3.21	22.04
2004	202	5	42	243,317,905	83.02	2.05	17.26
Average	**182**	**7**	**44**	**243,021,948**	**74.68**	**2.87**	**18.21**
Vehicles Excluding Trucks							
	Crashes	Fatalities	Injuries	Vehicle Miles Traveled (VMT)	Crashes per 100 million VMT	Fatalities per 100 million VMT	Injuries per 100 million VMT
2001	2,256	20	387	1,317,628,675	171.22	1.52	29.37
2002	2,661	11	429	1,369,470,530	194.31	0.80	31.33
2003	2,853	9	474	1,379,703,165	206.78	0.65	34.36
2004	2,831	17	386	1,393,378,470	203.18	1.22	27.70
Average	**2,650**	**14**	**419**	**1,365,045,210**	**193.87**	**1.05**	**30.69**

(Source: North Dakota Department of Transportation)

Table 14 displays crash statistics for trucks and other motor vehicles on North Dakota interstates. Again, the results are very similar to those found in the crash characteristics on non-interstate NHS (Table 13). Trucks have higher fatality rates at .90 per 100 million TMT than other motor vehicles at .43 per 100 million VMT. However, in 2001, truck crash fatalities were lower than other motor vehicles with a rate of .63 per 100 million TMT compared to .74 per 100 million VMT (Table 14). For injuries per 100 million TMT and VMT, all observations are lower for trucks than other motor vehicles. Again, the higher fatality and lower injury rates per 100 million TMT for trucks are consistent with the truck crash parameters at the national level (Table 11).

Table 14 Crash Parameters for Trucks and Other Vehicles Excluding Trucks on North Dakota Interstates from 2001 to 2004

Trucks							
	Crashes	Fatalities	Injuries	Truck Miles Traveled (TMT)	Crashes per 100 million TMT	Fatalities per 100 million TMT	Injuries per 100 million TMT
2001	144	2	22	316,694,470	45.47	0.63	6.95
2002	152	4	27	327,132,895	46.46	1.22	8.25
2003	160	3	36	336,700,265	47.52	0.89	10.69
2004	173	3	25	349,867,690	49.45	0.86	7.15
Average	**157**	**3**	**28**	**332,598,830**	**47.23**	**0.90**	**8.26**
Vehicles Excluding Trucks							
	Crashes	Fatalities	Injuries	Vehicle Miles Traveled (VMT)	Crashes per 100 million VMT	Fatalities per 100 million VMT	Injuries per 100 million VMT
2001	1,078	9	192	1,222,196,285	88.20	0.74	15.71
2002	1,089	4	154	1,276,526,380	85.31	0.31	12.06
2003	1,123	4	161	1,320,097,450	85.07	0.30	12.20
2004	1,243	5	154	1,382,845,000	89.89	0.36	11.14
Average	**1,133**	**6**	**165**	**1,300,416,279**	**87.12**	**0.43**	**12.78**

(Source: North Dakota Department of Transportation)

Comparing the averages from Table 13 and 14 for crashes, fatalities, and injuries per 100 million miles traveled for both trucks and other motor vehicles shows significantly lower averages on interstate highways versus non-interstate NHS highways. Average crashes per 100 million TMT on interstate highways are 47.23 compared to 74.68 on the non-interstate NHS highways. Average fatalities per 100 million TMT on interstate highways are .90 compared to 2.87 on the non-interstate NHS highways. The average injuries per 100 million TMT on interstate highways are 8.26 compared to 18.21 on the non-interstate NHS highways.

8.5 Cost of Large Truck Crashes

Costs for fatal and non-fatal crashes include medical, property damage, emergency service, travel delay, productivity loss, legal and court, insurance administration, etc. A National Highway Traffic Safety Administration (NHTSA) report[14] considered these factors and calculated economic costs due to roadway crashes in 2000. The study estimates the U.S. annual economic costs associated with motor vehicle crashes at $230.6 billion. The total economic cost is estimated from the present value of lifetime costs for 41,821 fatalities, 5.3 million non-fatal injuries, and 28 million damaged vehicles. The main cost factors include $61 billion in lost workplace productivity, $20.2 billion in lost household productivity, $59 billion in property damage, $32.6 billion in medical costs, and $25.6 billion in travel delay costs.

[14] The Economic Impact of Motor Vehicle Crashes 2000, NHTSA 38-02, May 9, 2002 http://www.dot.gov/affairs/nhtsa3802.htm

The Federal Motor Carrier Safety Association (FMSA)[15] examined crashes for large trucks with 10,000 GVW or higher using data from the Fatality Analysis Reporting System (FARS) and the General Estimates System (GES) in 1997. According to the study, the total cost of large truck crashes in 1997 was $24.4 billion. The main cost factors include $13.1 billion in quality-of-life losses, $8.7 billion in productivity losses, $1.5 billion in property damage, $941 million in medical costs, and $58 million in emergency services. The total crash cost of straight trucks is $9.5 billion, and the cost of truck tractors is $14.8 billion (Table 15).

Table 15 Crash Costs of Large Trucks* by Truck Type in 1997 (1999 $Millions)

	TYPE OF COST (1999 $Millions)					
Type of Vehicle	**Medical**	**Emergency Services**	**Property Damage**	**Lost Productivity**	**Monetized Quality-of-Life Years**	**Total**
Straight Truck	$460	$25	$676	$3,492	$4,913	$9,566
Truck Tractor	$477	$32	$835	$5,205	$8,188	$14,738
Unknown	$4	$0	$9	$34	$25	$72
All Large Trucks	$941	$58	$1,520	$8,731	$13,127	$24,376

* Large truck's GVW is 10,000 pounds or higher.
(Source: Cost of Large Truck- and Bus-Involved Crashes, FMCSA-MCRT-01-005, March 2001 http://www.fmcsa.dot.gov/documents/ab01-005.pdf)

The study estimates average crash cost for large trucks at $75,637 per crash in 1997. Among the truck types, truck tractors with two or more trailers show the highest cost ($117,309 per crash). Other truck types include straight truck with no trailer at $64,667 per crash and straight trucks towing a trailer at $69,203 per crash, bobtail (tractor without a trailer) at $74,695 per crash, and truck tractor with one trailer at $84,588 per crash.

Using 2003 North Dakota data in the crash profile, annual total truck crash costs are estimated. Truck tractors pulling one trailer have the highest total costs at $16.8 million. The total annual truck crash costs are estimated at $28.5 million in 2003 dollars (Table 16).

[15] Cost of Large Truck- and Bus-Involved Crashes, FMCSA-MCRT-01-005, March 2001 http://www.fmcsa.dot.gov/documents/ab01-005.pdf

Table 16 Estimated Annual Crash Costs of Large Trucks* Involved in Fatal and Non-Fatal Crashes in North Dakota (2003)

Vehicle Configuration	Large Trucks involved in Fatal Crashes	Large Trucks involved in non-fatal Crashes	Total Large Truck Crashes	Per-Crash Cost (1999 dollars)	Total Crash Cost in ND (1999 dollars)	Total Crash Cost in ND (2003 dollars using CPI)
Straight Truck	4	83	87	$64,667	$5,626,029	$6,215,293
Straight Truck/ Trailers		18	18	$69,203	$1,245,654	$1,376,122
Bobtail		3	3	$74,695	$224,085	$247,555
Tractor/One Trailer	10	170	180	$84,588	$15,225,840	$16,820,578
Tractor/Double and Triple		12	12	$117,309	$1,407,708	$1,555,149
Other**		2	2	$75,637	$151,274	$167,118
Unknown**		25	25	$75,637	$1,890,925	$2,088,978
Total	14	313	327		$25,771,515	$28,470,794

* Large truck's GVW is 10,000 pounds or higher.
** Average large truck crash cost is used ($75,637).
(Source: Crash Profile)

This section compares crash parameters for trucks and other motor vehicles at national and state levels. There are higher fatal and lower injury crash rates for trucks than other motor vehicles per 100 million miles traveled. Because of this inverse relationship, it is difficult to draw a conclusion about truck crash characteristics. Averaging the data, crashes, fatalities and injuries per 100 million miles traveled for both trucks and other motor vehicles reveals significantly lower averages on interstate highways versus non-interstate NHS highways.

9. SUMMARY AND CONCLUSIONS

Transportation plays an important role in the economy. A large portion of the region's economy is based on natural resources. Therefore, efficient transportation service for these resources is crucial for stimulating economic growth in the state. In the region, truck transportation offers advantages in terms of accessibility, flexibility, and door-to-door services.

Specifically, this study explores the regulatory environment shippers face in moving freight throughout the region and highlights differences in regulations that exist among bordering states and provinces. Truck size and weight regulations in the north central states and provinces are controlled and specified by state departments of transportation and provincial departments of highways, rural municipal councils, major urban transportation agencies, U.S. Department of Transportation, national parks, public works, and other government agencies and services. Truck size and weight regulations are meant to promote safety, as well as prevent excessive wear and tear on highways and bridges. However, because of the inconsistencies in size and weight regulations, problems exist for seamless freight transportation. This report provides a snapshot of current regulations and conditions, and the reader should note that vehicle size and weight laws are continually evolving, depending on various scenarios.

Permitting information was gathered from regional states and provinces that identify and compare similarities and differences. Examining the permit regulations in the region reveals inconsistencies in the permit system that prohibits seamless freight transportation. Because of the inconsistencies across state and provincial borders, it may be advantageous for policy makers and transportation departments in the region to work toward a uniform permitting system.

This study also analyzes truck safety, which is an important issue for drivers, communities, and transportation policy makers. It is argued that larger trucks are involved in a greater number of crashes than smaller trucks, and the severity of these crashes result in more damage, injury, and fatalities. Because motor carriers are a major transportation mode to ship commodities and other goods in the study area, deaths and injuries by truck can be a critical factor affecting transportation costs and regional economies. High fatality and crash rates can significantly increase economic and social losses and reduce the efficiency of the transportation system. Trucks show higher fatal crash rates and lower injury crash rates than other motor vehicles per 100 million miles traveled. Because trucks have opposing characteristics for fatal and injury crashes, no conclusions can be drawn about the characteristics of crashes. Crashes, fatalities, and injuries per 100 million miles traveled for both trucks and other motor vehicles are significantly lower on the interstate highway system versus the non-interstate NHS.

The information in this report provides the basis for discussing the inconsistencies that exist for size, weight, and permitting regulations in the region. Cooperation among states, provinces, and government leaders is needed to bring about a plan for uniform regulations and a seamless freight transportation system that enhances commerce within the region.

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APPENDIX 1. LITERATURE REVIEW

In reviewing the literature, Transportation Research Board's (TRB) Report 267 and 225 provide information about truck size and weight regulations. TRB Special Report 225 was published in 1990, and TRB Special Report 267 was published in 2002. These reports were published 12 years apart, and in that time there were very few changes in truck size and weight regulations.

TRB 225

The report was developed from a group effort of transportation professionals. The study focuses on four issues that involve potential changes to federal weight limits for interstate highways:

- "Elimination of existing grandfather provisions,
- Alternative methods for determining Gross Vehicle Weight (GVW) and axle loadings,
- Adequacy of current federal bridge formula, and
- Treatment of specialized hauling vehicles (SHVs) – garbage trucks, dump trucks, and other trucks with short wheelbases that have difficulty complying with the current federal bridge formula."

Grandfather Provisions

Grandfather provisions provide exemptions to federal truck size and weight regulations by allowing certain truck types and movements that were in effect prior to implementation of the federal rules. The study concludes that elimination of the grandfather provisions would increase trucking costs nationally by an estimated 3.7%. The costs increases would be concentrated in the Specialized Hauling Vehicles (SHVs) especially in the New England states and in the western states where Rocky Mountain Doubles (RMDs) would be eliminated.

The total number of vehicles required to haul the same amount of freight would increase if grandfather provisions were eliminated, negatively affecting traffic flow and increasing air pollution. The study suggests the positives of removing grandfather exemptions were that enforcement of truck weight and length laws would be standardized simplifying the process of enforcement. Also, elimination of these laws would reduce pavement and bridge wear brought on by heavier trucks. The study states that even though grandfather provisions may be important to an individual state, they are arbitrary and inequitable in determining means for exemptions to federal regulation.

Alternative Gross Weight and Axle Limits

In 1956 the maximum gross weight on the Interstate System was set at 73,280 pounds. This was changed in 1974 through the Federal-Aid Highway Amendments Act increasing GVW to 80,000 pounds. The reason for the increase was to conserve energy. The speed limit was also reduced to 55 miles per hour with the same legislation.

The change to 80,000 pounds reduced truck costs because of the higher allowed payload. It was estimated that truck costs would be reduced by 1.6%. It was also estimated that the increased GVW would impact bridges over the routes, and some 8,000 bridges at the national level and 22,000 additional bridges on non-primary routes would have to be strengthened, posted, or replaced to accommodate the heavier loads. Pavement costs would not be appreciably changed because axle weights were similar. To reach the heavier weight, trucks would add axles.

At the time of the study, most states strictly regulated truck and trailer length. If the states choose to increase lengths, the cost savings because of more productive trucks could increase dramatically; however, bridge costs would increase, and more bridges would have to be weight- posted or replaced.

According to the study, the bridge formula is overly cautious when applied to the Interstate System, and fewer than a 1,000 of the 50,000 bridges were constructed with a design load of H-15 or less. If the 30% overstress criterion for H-15 bridges was dropped, the bridge formula could allow higher weights for shorter trucks. The opposite is true for non-interstate highways. The study estimates that 120,000 of the 550,000 bridges on the non-interstate highway system do not have the load-carrying capacity for heavier loads and are posted. When bridge formulas are applied to vehicles of more than 80,000 pounds, stresses over the 5% threshold may be violated.

Alternatives to the Bridge Formula

The Texas Transportation Institute (TTI) was asked by the Federal Highway Administration (FHA) to develop a new bridge formula. They developed a formula that allowed higher weights for shorter trucks, but was somewhat more restrictive on longer vehicles. This formula was rejected by trucking groups because they believed it was much too cautious.

TTI then developed a modified version of the formula that keeps the 5% criterion for HS-20 bridges but drops the 30% criterion for the H-15 bridges. This formula allows much higher weights for shorter trucks. A triple axle truck, under the current formula, could have a GVW of 56,000 pounds. With the proposed formula it could increase the GVW to 64,000 pounds. New configurations designed to take advantage of the new formula could gross up to 70,000 pounds. Again, this formula is weight neutral for longer vehicles like TTI's original formula and therefore would be rejected by western truckers using Rocky Mountain Doubles (RMDs) at heavier weights.

TTI proposed a scenario where the TTI HS-20 formula would be applied to trucks with two to six axles, and the original bridge formula would be applied to trucks with seven axles or more. Truckers in western states would still be able to operate under their grandfather provision and SHVs would become more efficient.

The committee developed a variation of the combined TTI HS-20/Formula B approach and provided stronger incentives to operate trucks with more load-bearing axles, discouraged the use of dummy axles, and promoted a more even distribution of weight among axles. Under this alternative, vehicles more than 80,000 pounds could operate at weights permitted by Bridge Formula B (for nine axles) provided that these vehicles met the following axle weight limits:

- Single axle 15,000 pounds,
- Tractor-drive axles, 34,000 pounds per tandem pair, and
- Other tandem axles, 30,000 pounds per tandem pair.

Canadian Provincial Limits

In 1988, the Canadian Council of Ministers of Transportation and Highway Safety agreed on a common set of limits for tractor trailers and multiple trailer combinations. No bridge formula was used. Instead of a bridge formula, minimum axle spacing was used to spread the load. These provisions are much less restrictive than the U.S. federal bridge formula and allow much higher weights. An example in the study was of an 8-axle truck double trailer 75 feet in length limited to 109,000 pounds in the United States, but allowed to operate in Canada at 131,000 pounds.

Freightliner Proposal

Another proposal covered in the study was produced by the Freightliner Corporation in 1988. The proposal exempted the steering axle from the bridge formula on combination trucks. The theory was that it would make trucks much more aerodynamic and maneuverable. It would increase load carrying capacity from 12,000 pounds on the steering axle to 14,000 pounds or even up to 20,000 pounds. However, it was discovered that there was a problem with handling and stability when steering axle weights were more than 14,000 pounds. It was concluded that higher weights would have a negative impact on pavements, particularly because steering axles are more damaging to pavements than non-steering axles with dual tires.

Summary

The steering committee for TRB report 225 identified four alternatives to the bridge formula that may have merit for developing new regulatory policies:

- "The uncapped Formula B would reduce transport costs for freight moving in combinations at or near 80,000 pounds.
- The TTI HS-20 Bridge Formula would reduce transport costs for single-unit trucks and shorter combination vehicles.
- The combined TTI HS-20/Formula B would benefit both single-unit and combination trucks.
- The new approach is similar to the combined TTI HS-20/Formula B approach, but with reduced axle weights for vehicles over 80,000 pounds."

The tradeoff for each scenario is more efficient transportation versus bridge costs. It was concluded that the transport costs savings outweighed the bridge costs by a considerable margin. However, there are problems for highway agencies in obtaining the needed revenue to rebuild or upgrade bridges.

It was also concluded that the Freightliner scenario may have merit if the steering axle weight limit is less than 14,000 pounds. The Canadian Interprovincial Limit (CIL) scenario holds little promise because of the large number of primary bridges that would have to be replaced. The TTI Bridge Formula scenario would also be rejected because it is very similar to the existing bridge formula.

Specialized Hauling Vehicles

Specialized hauling vehicles (SHVs) generally have short wheelbases and special equipment. Many times, more than half of their allowed GVW is tare weight. Examples include garbage and concrete trucks. Because of their short wheel base, the GVW is usually determined by the bridge formula. Because of the need for maneuverability and safety considerations, users of these vehicles cannot just spread the wheelbase to increase GVW permitted.

The study examines a scenario presented by the National Truck Weight Advisory Council (NTWAC), an organization that represents industries involved in heavy hauling of products like construction material, solid waste, forest products and many others. The NTWAC proposes, because of grandfather provisions, that any state should be able to permit for SHVs to operate "at weights up to those that exceed the 'operating rating' of an HS-20 bridge."

"According to the Manual for Maintenance Inspection of Bridges (AASHTO, 1983), the operating rating is the absolute maximum permissible load level to which a bridge may be subjected. Special permits for heavier-than-normal vehicles may be issued only if such loads are distributed so as not to exceed the structural capacity determined by the operating rating of the bridge over which the vehicle will travel."

The study analyzed the NTWAC proposal and assumed:

- "80,000 pounds for a 3-axle single-unit truck with a wheel base of 16' or more,
- 85,000 pounds for a 4-axle single-unit truck with a wheelbase of 22' or more, and
- 110,000 pounds for a 5-axle tractor semi-trailer with a wheelbase of 36' or more."

The study concludes that the vehicles at the weights listed above would not exceed the operating rating of an HS-20 bridge and are consistent with the NTWAC proposal. It is estimated that the proposal would reduce transport costs by $5.4 billion per year. Another result would be reduced truck traffic, increasing safety overall. Other positive benefits may include fewer dummy axles and incentive for users to bring their vehicles into compliance with these relaxed weight regulations.

The negative side of the NTWAC proposal is the higher pavement and bridge costs. It is estimated that some 167,000 bridges would have to be posted, strengthened, or replaced. If all 167,000 bridges were replaced, the costs were estimated at $3.7 billion per year, and if only primary bridges were replaced the costs would still be $1.5 billion per year. Pavement costs under this scenario would increase an estimated $350 million annually. The committee concluded that the NTWAC proposal is overly permissive looking at the broad definition of SHVs used in the study.

Table 17 Simulates the Estimates the Committee Determined for the Different Scenarios

	Change in Cost ($billion/year) for			
Scenario	Transport	Pavements	Bridges	Total
Grandfather Clause Elimination	7.8	-0.2	-0.3	7.3
Uncapped Formula B	-2.1	0	-0.7	-1.4
NTWAC Proposal	-5.4	0.4	3	-2
Canadian Interprovincial Limits	-11.7	0.5	2.4	-8.8
TTI HS-20 Bridge Formula	-2.7	0	0.3	-2.4
Uncapped TTI HS-20 Bridge Formula	-5.1	0.1	0.4	-4.6
Combined TTI HS-20 Formula B	-5.2	0	0.9	-4.3

Table 17, which was duplicated from the study, shows that for six of the seven scenarios transport costs would decrease. If "Grandfather Provisions" were eliminated weight limits would decrease, dramatically impacting the trucking industry and shippers. The largest reduction in shipper costs is elimination of the bridge formula, inserting the Canadian weight limits resulting in an estimated $12 billion transport cost savings in 1990 dollars. The largest increase in pavement costs would also result from the Canadian Interprovincial Weight Limit scenario.

The estimated impacts of the scenarios on total vehicle miles traveled (VMT), fatal accidents and diversion from rail are summarized in Table 18.

Table 18 Canadian Interprovincial Weight Limit Scenario

Scenario	Percent Change in Heavy Truck VMT	Percent Change in Rail Ton-Miles	Change in Number of Fatal Accidents
Grandfather Clause Elimination	3.2	0.08	350
Uncapped Formula B	-2.2	-2.2	-60
NTWAC Proposal	-1.1	-0.9	-40
Canadian Interprovincial Limits	-6.3	-6.6	-430
TTI HS-20 Bridge Formula	-0.5	0	-40
Uncapped TTI HS-20 Bridge Formula	-2.2	-2.5	-40
Combined TTI HS-20 Formula B	-2.5	-2.5	-110

Study Recommendations

The study finds that increasing truck weights increases efficiency or reduced trucking costs, and those cost savings under the scenarios presented are less than the cost of pavement damage and bridge replacement or maintenance. The study suggests caution in implementing any new regulation because of an inability to find the revenue to upgrade bridges or maintain highways. If new regulations are implemented without the proper funding of highways and bridges, deteriorating highways and bridges will increase vehicle repair costs, reduce fuel economy, cause traffic delays and accidents, and adversely affect comfort.

The study also states that "increasing truck weights has both positive and negative effects on safety and traffic operations. 1) Reduced truck traffic decreases truck-related accidents and congestion. 2) Simply allowing more weight on existing trucks could adversely affect truck operating characteristics and increase accident rates." Other concerns include diversion of rail traffic if truck rates do not increase at the same level as per mile costs. If this new truck traffic is not offset by adequate bridge and highway funding, the end result may be that the final infrastructure costs could exceed the savings in transportation costs.

The study had five recommendations guided by a set of six objectives:

- "To select, from the various proposed changes in truck weight regulations from industry groups and others, the most practical means to realize the productivity benefits of increased truck weights while reducing or eliminating possible adverse effects;
- To make changes in weight limits that would reduce truck accidents and encourage safety improvements in truck design and operation;
- To provide mechanisms to match user fees with added costs for pavements and bridges;
- To promote uniformity in the administration of truck weight regulations;
- To balance the federal interest in protecting the national investment in the interstate system and facilitating interstate commerce with the interest of states in serving the needs of their citizens and industries; and

- To develop proposals that are realistic and feasible, and would have a reasonable chance of being implemented."

Recommendation 1: New Bridge Formula

Congress should replace Bridge Formula B with the following:

W=1,000 (2L+26) for $L \leq 24$	If L =24' then W=74,000 GVW Maximum
W=1,000 (L/2+62) for L>24	If L=75' then W= 99,500 GVW Maximum
	If L=110' then W=117,000 GVW Maximum

Where:

W=the maximum weight in pounds carried on a group of three or more axles.
L=the length of the axle group rounded to the nearest foot. (75' is the current maximum allowed on the Interstate System without permit) (80,000 pounds GVW is maximum on Interstate System without permit)

States would have to identify all deficient bridges that must be posted or replaced and costs associated with bringing them up to standard. Taxes on heavy vehicles would be raised to offset the cost of damaged pavement and bridges.

The above formula and examples show extremes in weights because trucks would still be regulated by the axle weight restrictions. For instance, under the current formula a 3-axle 22' truck can operate at 52,500 pounds, and a 22' 4-axle truck can operate at 56,500, a difference of 4,000 pounds. Under the new recommendation, a 22' 3-axle truck could operate at 54,000 pounds, but the 4-axle 22' truck could operate at 70,000 pounds, a difference of 16,000 pounds.

The above formula is the TTI HS-20 formula. The recommendation in the study is that the formula along with federal axle limits would apply to vehicles with GVW of 80,000 pounds or less. A permit program would be developed for vehicles over 80,000 pounds. Recommendation 2 deals with the permit program over 80,000 pounds GVW.

The study estimates the truck costs would decrease by $2.7 billion annually, but $.3 billion would be collected in higher user fees for heavier trucks to cover bridges and pavements. The study estimates the number of bridges that must be posted or replaced would increase by 22,000. Currently 120,000 of the nation's 600,000 bridges are posted. It was estimated that replacing all 22,000 bridges would cost $350 million dollars per year.

Recommendation 2. Special Permit Programs

Congress should adopt the process of exemption so all states could allow trucks to operate at 80,000 pounds without the grandfather exemption. "Rather all states should be allowed to establish permit programs for heavier vehicles, provided that such programs included provisions to control the characteristics and operations of permit vehicles. Key features of the program would be designated routes, maximum weights, fee structures, and safety restrictions for permit vehicles."

Recommendation 3: Grandfather Rights

"Congress should take no action to restrict grandfather rights that have already been claimed by states, but should prevent future expansion of these claims."

If recommendations 1 and 2 are adopted then, motor carriers that operate LCV in states under a grandfather rule may operate in any state that chose to set up such a process.

Recommendation 4: Increased Enforcement

Increased enforcement of weight and size regulations would benefit state agencies in the form of reduced pavement and bridge damage. Increased enforcement would benefit the trucking industry in the form of not having to compete with illegally loaded trucks. The study recommends the federal government study the issue and attempt to educate local law enforcement and judges as to the damage that can occur from overweight vehicles.

Recommendation 5: Regional Cooperation in Standardizing Limits and Permit Practices

"States should pursue opportunities for standardizing limits and permit practices at the regional level."

Regions similar in industry, terrain, weather, and other variables should attempt to standardize truck size and weight regulations for the economies of the region. The study lists the ongoing efforts in western states to standardize operations allowing for LCV operations and agreement among northeastern states to implement a common set of procedures for issuing oversize weight permits for trucks.

TRB Report 267

The Transportation Equity Act for the 21st Century directed the Secretary of Transportation to request that the (Transportation Research Board) TRB "conduct a study regarding the regulation of weights, lengths, and widths of commercial motor vehicles operating on federal-aid highways to which federal regulations apply and develop recommendations regarding any revisions to law and regulations that the Board determines appropriate."

With this directive TRB formed the "Committee for the Study of the Regulation of Weights, Lengths, and Widths of Commercial Motor Vehicles" to conduct this study. The committee presented conclusions and recommendations based on performances of existing regulations.

According to the executive summary, a problem that exists with this type of study, and found by previous attempts to study truck size and weight issues, is the lack of information needed to conduct sound benefit cost analysis in regard to truck size and weight issues. Because of the information void and the nature of such a complex task, risks will undoubtedly accompany any regulatory decisions based on study results. The committee believes that this risk is unnecessary if "basic research for conducting evaluation and monitoring became a permanent component of the administration of the regulations."

The committee provided post-study conclusions:

1. "Opportunities exist for improving the efficiency of the highway system through reform of the federal truck size and weight regulations. Such reform may entail allowing larger trucks to operate."

The committee states that the federal standards for truck size and weight regulation resulted from a series of historical happenings instead of a set of clear objectives and evaluations of possible alternatives. The committee's opinion is that in many instances the regulations are a poor fit to the needs of international commerce. Furthermore, their effectiveness is being eroded by ever-expanding numbers and types of special exemption that are awarded without proper analysis of consequences. The awarding of those exemptions creates an environment where, many times, freight traffic bypasses interstate highways to use less restrictive secondary roads, where the costs generated by that traffic are many times much higher. The committee's belief is that the greatest deficiency of the present environment may be that it discourages private-public sector innovation aimed at improving highway efficiency and reducing the total costs of truck traffic. The present vehicle regulations are inflexible and shippers and transportation providers do not pay for all the costs they generate.

2. "Appropriate objectives for federal truck size and weight regulations are to facilitate safe and efficient freight transportation and interstate commerce, to establish highway design parameters, and to manage consumption of public infrastructure assets."

The committee contended that legislative history indicates that the objectives listed above are consistent with the intentions of Congress in enacting regulations. Therefore, the objectives are worthwhile and truck size and weight regulations by the federal government contribute to achieving that end, and regulations should be complemented by other policies to reach the same goals. With that in mind, any analysis of federal size and weight regulation should take into account how they affect all costs of highway transportation.

3. "Changes in truck size and weight regulations made in coordination with complementary changes in the management of the highway system offer the greatest potential to improve the functioning of the system."

The committee suggests that a better control of existing and future truck traffic is by "coordinating practices in all areas of highway management: design and maintenance of pavement and bridges; highway user regulations, including vehicle and driver regulations related to safety; and highway user fees." The committee's opinion is that the imposition of cost-based user fees is a regulatory approach that could usefully supplement or maybe partially replace size and weight regulations. The goal is to provide a more efficient control of public and private costs of truck transportation.

4. "The methods used in past studies have not produced satisfactory estimates of the effect of changes in truck weights on bridge costs."

Previous studies have not analyzed proposed changes in truck size and weight and the risk of bridge failure or decreases in useful life. They instead estimate the costs of maintaining the existing relationship of legal loads to bridge design capacity with bridge replacement. The replacement of bridges is the largest cost component in making the case for or against larger trucks. The committee concludes that replacements would reduce risks only marginally. It also concludes that quantitative evaluation has not been studied to assess the possible alternative methods of attaining risk reduction with fewer costs.

5. "It is not possible to predict the outcomes of regulatory changes with high confidence."

The committee sees merit in developing models to analyze the cost of operating trucks of different type and design. The data and models may never adequately replicate how institutions, markets, and technology would react to regulatory changes. However, this is not argument for inaction, because maintaining the status quo guarantees lost opportunities for cost reduction.

6. "It is essential to examine the safety consequences of size and weight regulation. Research and monitoring needed to understand the relationship of truck characteristics and truck regulations to safety and other highway costs are not being conducted today."

The understanding of these relationships is needed to improve highway design, vehicles, safety management, pollution control programs, and provide a base for truck size and weight regulations. A problem identified by the committee is the lack of progress in reducing uncertainty in the last decade and longer. The ability to predict impacts of change would be to allow tests to evaluate the impacts and performance.

Some technologies exist for changing large trucks to improve performance and safety. Some of these are being brought to bear in the form of enforcement tools; however, other logical and promising technologies are deemed too risky to purse because of the knowledge gap.

7. "Although violations of size and weight regulations may be an expensive problem, monitoring of compliance with the regulations is too unsystematic to allow the costs involved to be estimated."

There is a need for observation of the frequency and impacts of oversize and overweight vehicles to evaluate costs. Enforcement methods and effectiveness also needs to be measured. Again the study states that the technology for low-cost monitoring is available.

Recommendations of TRB 267

1. Establishment of the Commercial Traffic Effects Institute.

    This organization would observe and evaluate performance of trucks and monitor effects of truck size and weight on the highway, bridges, environment, and the safety of the motoring public. The institute could recommend systematic changes in truck size and weight regulation and monitor the results.

    The objective of the institute would be to reduce the private and public costs of truck transportation. The institute should provide innovations and technological change to the industry and regulatory environment.

2. Evaluation of the consequences of changes in truck size and weight regulations through pilot studies.

    Congress should allow the Secretary of Transportation to allow pilot studies on providing exceptions for vehicles operating with different limits for experimental purposes. This controlled program would allow for longer term studies to evaluate impacts of new regulation.

3. Immediate changes in federal regulations.

    Federal law should allow any state to participate in a federally advised permit program for vehicles heavier than current federal regulations. This program would be done in conjunction with states.

    The goal would be to present opportunities for multi-state agreements on truck size and weight permits. Fostering multi-state agreements should further the evolution toward more rational and homogenous standards or regulation nationally. The committee recommends size and weight provisions.

4. Longer combination vehicles.

5. Routes and roads to which federal standards should apply.

6. Research.

APPENDIX 2. TRUCK REGULATIONS AND EXCEPTIONS

U.S. Code of Federal Regulation Title 23 explains so-called “Grandfather Provisions” which allow states to permit truck size and weight on the Interstate System if that state had provisions in place prior to July 1, 1956, and meets other rules that will be discussed. Also the bridge design criteria as in H-15, HS20, and HS-25, and Bridge Formula B is presented.

Title 23-S127
The laws put in place to protect the National Network of Highways (NN) and the Interstate system from oversize and overweight trucks is known by the industry as Title 23. Section 127 of Title 23 provides for the weight regulations passed by Congress. The law states that a single axle may not exceed 20,000 pounds, and a tandem axle may not exceed 34,000 pounds, and a combination vehicle may not exceed 80,000 pounds. States in which vehicles exceeding the federal gross limit and were in operation before the enactment of the federal limit and were allowed to “grandfather” truck size and weight regulations exceeding the Title 23 limits.

These states may continue to use the limits they had in place, if they meet the axle criteria and do not exceed Bridge Formula B.[16] This applies to state permit operations as well as to general state limits. The federal regulation exemptions were set in both 1956 and 1973 based on interpretation of the state laws (Appendix 1).

Bridge Design Criteria H-15, HS-20, & HS-25
The weight and distances of axle groups can directly affect the stress level of bridges. The American Association of State Highway and Transportation Officials (AASHTO) developed truck type classifications for the design of highway bridges. An H-15 vehicle is a truck with one 6,000 pound axle and one 24,000 pound axle. The total weight of the vehicle is 30,000 pounds (15 tons) and the two axles are separated by 14 feet. The number (15) after “H” stands for the number of tons (15 tons). An HS-20 truck is a truck with one 8,000 pound axle and two 32,000 pound axles. The total weight of an HS-20 truck is 36 tons. The “S” stands for semi-trailer combination, which adds in the additional weight. For heavier trucks, some states designed for HS-25 loads, which are 25% larger than the HS-20 loads. Figure 5 shows these AASHTO design trucks. The figure shows the weight and length of axles for H-15 and HS-20 loads.

The HS-20 bridge load design was introduced in the 1940s and has been required as a minimum for bridges erected on the interstate system. The design criteria determines the strength or load- carrying capacity of a bridge, Bridge Formula B, is based on assumptions that the design loading can be safely exceeded for different types of bridges (Comprehensive Truck Size and Weight Study, 1995). Bridge Formula B assumes that a 30% overstress for an H-15 bridge and 5% overstress for an HS-20 bridge are safe.

[1]W = 500 [(LN / N-1) + 12N + 3

W = The maximum weight in pounds that can be carried on a group of two or more axles to the nearest 500 pounds.

L = The spacing in feet between the outer axles of any two or more consecutive axles.

N = The number of axles being considered.

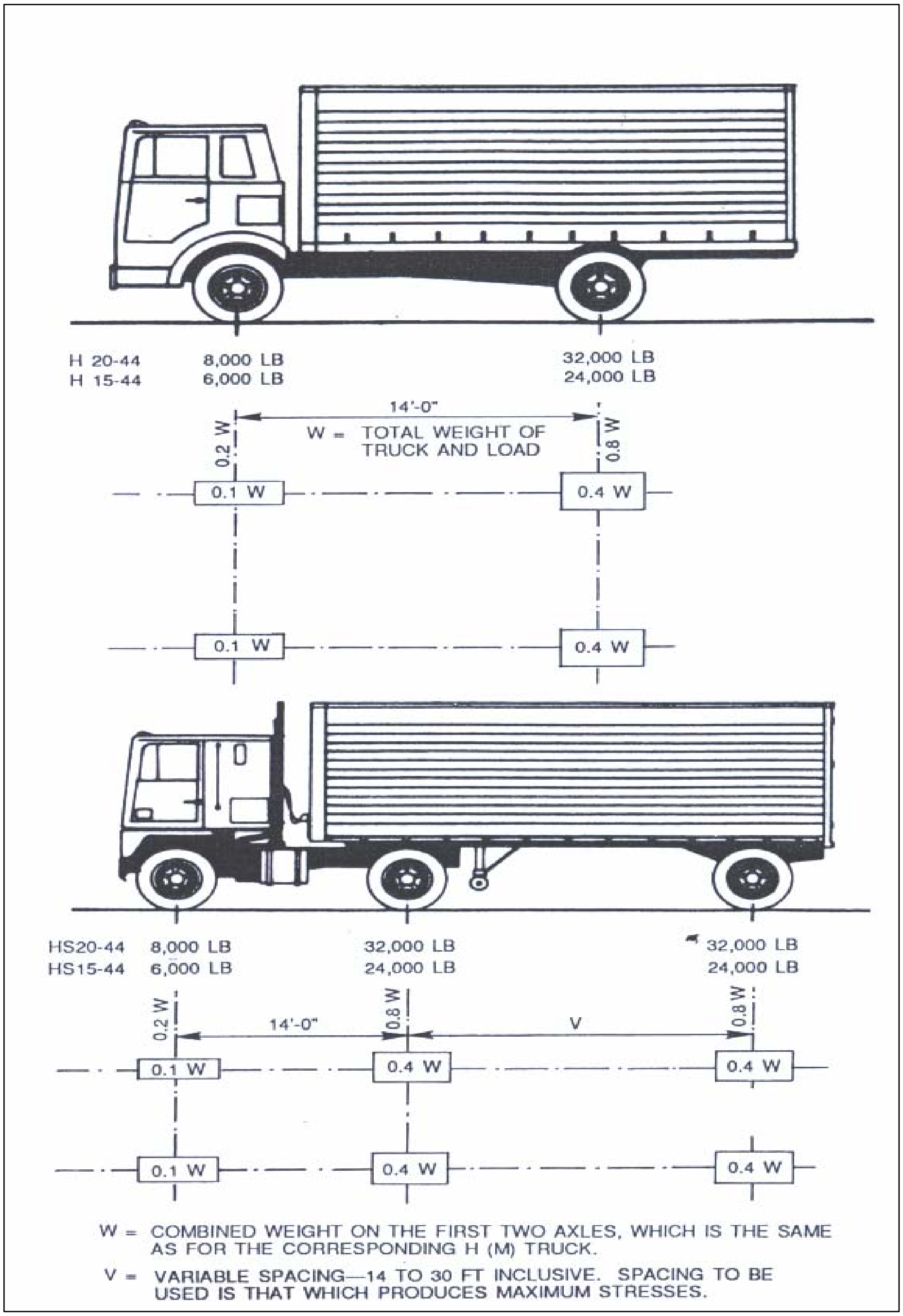


Figure 5 AASHTO Design Vehicles
(Source: Truck Weight Limits, Special Report 225)

The overstress criteria can be applied to design bridges on the Interstate system. The overstress criteria relate to the point at which a structural member (a load-carrying component) of a bridge undergoes permanent deformation, that is, the bridge member does not return to its original size or shape after the load is removed.[17] Specifically, "yield stress" is the stress level at which this permanent deformation occurs. The "inventory rating" is 55% of the yield stress and the "operating rating" is 75% of the yield stress." Loadings less than 5% over the design stress would function for 50 years or more without the need for replacement. These stress levels are demonstrated in Figure 6.

Figure 6 Relationship of Overstress Criteria to Design Stress and Bridge Ratings
(Source: Comprehensive Truck Size and Weight (CTS&W) Study, 2000)

The federal bridge formula known as Bridge Formula B was derived because vehicles will stress bridges, and the bridge formula will regulate those stresses. The American Association of State Highway and Transportation Officials (AASHTO) recommends that the minimum design load be HS-20. However HS-15, a much lighter design load, has been used on many bridges on non-interstate highways. The federal bridge formula was designed to avoid exceeding design stresses by more than 5% in HS-20 design bridges and 30% in HS-15 design bridges.

It is important to point out that different truck configurations provide different stresses. Axle spacing and total weights affect bridge performance and expected useful life of bridges. Therefore, care is needed in adopting increases in truck size and weight.

[17] Comprehensive Truck Size and Weight (CTS&W) Study, FWHA, USDOT, 2000.

Regional Truck Size and Weight Regulations

Canadian provinces and many U.S. states are looking for opportunities to harmonize truck size and weight standards. The Transportation Equity Act for the 21st Century (TEA 21) was enacted on June 9, 1998, and authorizes the federal surface transportation programs for highways, highway safety, and transit for a six-year period from 1998 to 2003. The language in TEA 21 encourages regions to harmonize truck size and weight regulations. Weight regulations in the northern Great Plains are controlled and specified by state departments of transportation and provincial departments of highways, rural municipal councils, major urban transportation agencies, U.S. Department of Transportation, national parks, public works, and other government agencies and services. The regulations are enforced by law enforcement agencies in both the United States and Canada.

Two standards currently in place that provide wide spread application and influence in terms of basic limits are the U.S. Federal Truck Size and Weight Laws (Title 23), and the Roads and Transportation Association of Canada (RTAC) Weight Provisions. The U.S. Federal Truck Size and Weight Laws (Title 23) define size and weight regulations (see appendix I) on the Interstate and National Network (NN). Furthermore, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) restricts the operation of longer combination vehicles (LCV's) on the Interstate System and commercial motor vehicle (CMV) combinations with two or more cargo carrying units on the NN to the types of vehicles in use on or before June 1, 1991, subject to whatever state restrictions were in effect on that date. Section 1023 of the ISTEA required states to submit to the Secretary of Transportation a complete list of 1) all operations of LCV's being conducted as of June 1, 1991; 2) state laws, regulations, and any other limitations and conditions, including routing-specific and configuration-specific designations governing the operation of LCV's; and 3) a copy of such laws, regulations, limitations, and conditions. Due to grandfather rights set forth by Title 23 in each state, maximum weights for LCV configurations vary.

The RTAC weight provisions regulate principal highways in Canada including the study provinces of Alberta, Saskatchewan, and Manitoba. Basic differences between the two systems include 1) Basic RTAC limits are higher for tandem axle weights, tridem axle weights, and gross vehicle weights compared to the United States on both interstate and non-interstate highways; 2) The RTAC system is vehicle specific whereas the system is not (for example, a higher gross vehicle weight limit for an 8-axle B-train compared with an 8-axle A-train); 3) The RTAC system controls front steering axle loads (5500 kilograms or 12,125 pounds on tractors), whereas the system generally does not; and 4) The RTAC system has no explicit bridge formula, whereas the U.S. system uses Bridge Formula B explicitly for controlling gross vehicle weights and tridem axle weights as it relates to axle spreads (Montufar and Clayton, 2002).[1]

[1] $W = 500 [(LN / N-1) + 12N + 36]$

W = The maximum weight in pounds that can be carried on a group of two or more axles to the nearest 500 pounds.

L = The spacing in feet between the outer axles of any two or more consecutive axles.

N = The number of axles being considered.

Table 3 encompasses truck weights and dimensions in the states of North Dakota, South Dakota, Minnesota, Montana, Nebraska, Iowa, and Wyoming and the provinces of Alberta, Manitoba, and Saskatchewan. Table 4 shows the seasonal restrictions in the states and provinces. As Table 4 indicates, some states are very restrictive while others are more relaxed. Tables 3 and 4 summarize the important size and weight limits applicable to roadways in each state and province. A point needing to be established is that Table 3 summarizes regulations on truck size and weights, but these regulations are difficult to decipher from lengthy statutes and regulatory documentation composed by each state and province. The 2000 U.S. Department of Transportation Truck Size and Weight study summed up the regulations in a quote, “Vehicle size and weight laws in each state and province are continually evolving due to several factors including the nature and extent of natural resources, local industrial development, climate, relative strength of special interest groups, and the national economic condition.” Due to these continual changes, along with conflicts of regulations from different sources, the reader should note that this table is a snapshot of current regulations and conditions. In various parts of Table 3, superscripts are used to note a weight or dimension with exceptions in which the value may vary depending on various scenarios.

APPENDIX 3. FOOTNOTES OF TABLE 1

REGION'S TRUCK SIZE AND WEIGHT REGULATIONS

* In the Canadian Provinces of Saskatchewan and Manitoba, the first length (left) is the Roads and Transportation Association of Canada (RTAC) vehicle guideline. The second length (right) is the Non-RTAC vehicle guideline which includes a 5-axle truck-tractor and semi-trailer.

** "Routine" Permit GVW: is the highest weight a 5-axle unit can gross before special (other than routine) review and analysis of an individual movement is required. The Special Review Permit is the highest gross weight any unit with sufficient axles can gross before special review is required.

1. Width limitation does not include special cases in certain states that allow moving farm machinery/equipment without permit during daylight hours.

2. Maximum length any given configuration with exceptions for the following in which length limitations do not apply:
   a) building moving equipment.
   b) emergency tow trucks towing disabled lawful combinations of vehicles to a nearby repair facility.
   c) vehicles and equipment owned and operated by the Armed Forces of the United States or the National Guard.
   d) structural material of telephone, power, and telegraph companies.
   e) truck-mounted haystack moving equipment, provided such equipment does not exceed a length of 56 feet.
   f) safety and energy conservation devices and any additional length exclusive devices as determined by the highway patrol for the safe and efficient operation of commercial motor vehicles. Length exclusive devices are appurtenances at the front or rear of a commercial motor vehicle semitrailer or trailer, whose function is related to the safe and efficient operation of the semitrailer or trailer.

3. The limitation does not apply to vehicles that are at most 15'6" high when all of the following apply:
   a) the vehicle is an implement of husbandry and is being moved by a resident farmer, rancher, dealer, or manufacturer.
   b) the trip is at most 60 miles.
   c) the trip is between sunrise and sunset.
   d) none of the trip is on an interstate highway.

4. Axles spaced over 40 inches apart and less than 8 feet apart.

5. Exclusive of rear view mirrors or temporary load securement devices that may extend an additional three inches on each side of the vehicle or load.

6. Any vehicle combination with five or more axles with minimum spacings. Special permit over 80,000 lbs.

7. The value is for designated highways (interstates, U.S. highways. MN state truck highways and certain designated local highways). Weight limit for non-designated highways (all other streets and county roads within the state) is 18,000 pounds.

8. Maximum allowable gross weight for vehicles operating under the Montana/Alberta Memorandum is 137,800 pounds.

9. Tridem axle weights (RTAC A-train) depend on inter-axle spacing. (All weights converted from metric measurement which may include rounding error).
   52,910 pounds - 11'8" to 12'1"
   50,706 pounds - 9'8" to 11'8" (In Alberta maximum weight remains 52,910 at this axle spacing)
   46,297 pounds - 7'8" to 9'8"

10. Width exceptions (house trailer during daylight hours only — 10'; mirrors may extend on each side of the vehicle and additional 8"; tie down or load securing devices may extend an additional 4" on either side of the vehicle).

11. Maximum gross vehicle weight on most city, county, and township roads is 73,280 lbs.

12. The maximum is directly controlled by the Federal Bridge Formula. The maximum practical gross is 129,000 lbs, given the state's length laws.

13. Weight was converted from metric measurement which may include rounding error.

14. 96,000 pounds for construction and livestock vehicles. Special permit issued for vehicles over 80,000 pounds.

15. 9' Spacing.

16. Maximum according to individual state trucking handbook weight tables with proper axles and spacing.

17. Bridge Formula B used. With proper number of axles and spacing up to 117,000 lbs. can be moved on the interstate as well as primary and secondary highways.

18. Iowa allows vehicles from South Dakota and Nebraska access to terminals that are located within the corporate limits of Sioux City and its commercial zone as shown in 49 CFR 1048.101 on November 28, 1995. 129,000 pounds when entering Sioux City from South Dakota or South Dakota from Sioux City; 95,000 pounds when entering Sioux City from Nebraska or Nebraska from Sioux City. These vehicles must be legal in the state from which they enter Iowa.

APPENDIX 4. DEFINITIONS FOR DIFFERENT TYPES OF PERMIT

Single Trip - Single trip permits are required for legal size divisible load vehicles or combinations of vehicles exceeding the federal gross vehicle weight cap of 80,000 pounds for movement on the interstate highway system. A single trip permit is issued for the movement of a vehicle or combination of vehicles with or without loads from a single point of origin to a single destination.

Single Trip Oversize Only - A permit issued for the movement of a vehicle or combination of vehicles with or without loads from a single point of origin to a single destination. A single trip oversize permit may be issued to vehicles or loads that are non-divisible or over the height, width, or length limits set forth by an individual state.

Single Trip Overweight Only - A permit issued for the movement of an “overweight only” vehicle or combination of vehicles from a single point of origin to a single destination. The specific vehicle or combination of vehicles meets dimension limits but exceeds weight limits set forth by an individual state.

Single Trip Oversize and Overweight - A permit issued for the movement of vehicles originating from a single point of origin to a single destination in which the vehicle or combination of vehicles exceeds legal state limits in any combination of the height, width, length, and weight.

Annual Oversize - A permit issued for vehicles or combinations of vehicles carrying indivisible loads such as manufactured homes, mobile cranes, or other items where it is not possible to further reduce the dimensions of the load. Annual oversize permits are prorated and are generally valid for a period no less than one calendar quarter and no more than one calendar year.

Annual Oversize and Overweight - A permit issued for vehicles or combinations of vehicles carrying indivisible loads where the overall dimensions and weight of the load exceeds legal limits set by each individual state or province. Annual oversize and overweight permits are prorated and are generally valid for a period no less than one calendar quarter and no more than one calendar year.

Multiple Trip - Term used by several states that refers to a permit issued to a overweight or oversize vehicle or combination of vehicles that moves frequently within a limited area with or without loads.

Continuous Trip - Term used by Nebraska Department of Roads that refers to a permit used for frequent or repeated movement of a vehicle or combination of vehicles, with or without loads, to several locations within a limited area. A continuous permit is essentially the same as what other states and provinces refer to as an annual permit. The continuous permit is designated for a time period not exceeding one year.

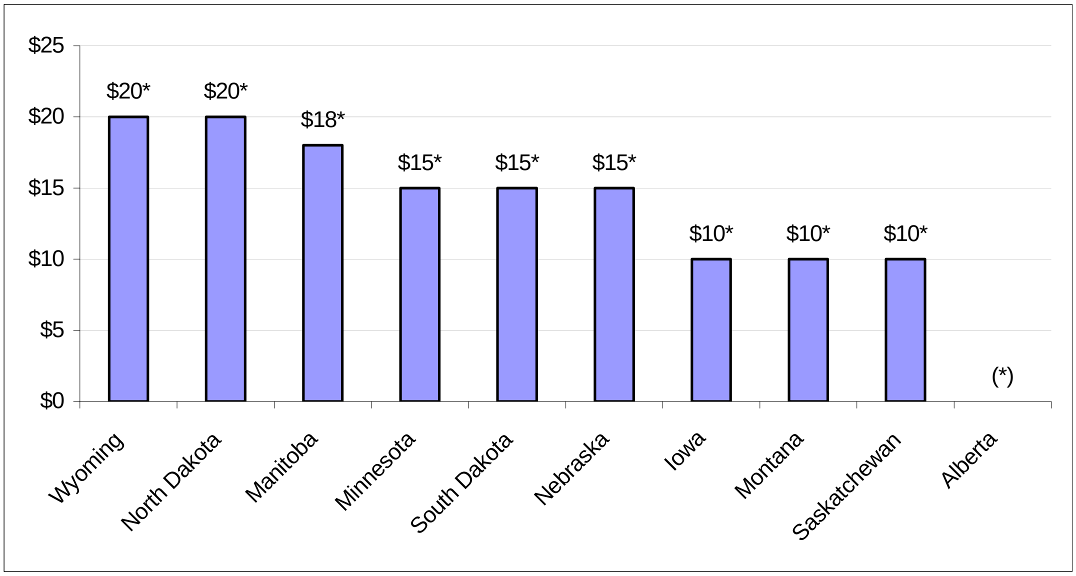
Seasonal - In most states and provinces, seasonal harvest permits may be issued to oversize/overweight vehicles or combinations of vehicles hauling seasonally harvested products from the field where they are harvested to market, storage, or stockpile within a reasonable distance. As an example, in Nebraska, vehicles or combinations of vehicles can be up to 15% heavier than the maximum weight and up to 10% greater than the maximum length set by law and are allowed to move for distances up to 120 miles (Nebraska Truck Information Guide). The distance limitation may be waived for vehicles or combinations of vehicles when carrying dry beans from where they were harvested, to another distant location when the dry beans are not normally stored in the local area. Vehicles carrying sugar beets in Nebraska are allowed a 25% greater length than the maximum allowed by Nebraska law. The state of

Nebraska has an overweight exception for seasonally harvested products in which no permit[18] is required for vehicles or combinations of vehicles hauling grain or other seasonally harvested products from the field where such products are harvested to market, storage, stockpile or factory up to 70 miles. These provisions do not apply to the interstate system.

[18] The owner of the agricultural product must sign a statement indicating the origin and destination and submit it to the driver to be carried in the loaded vehicle.

APPENDIX 5. PERMIT COSTS

Figure 7 Single Trip Permit Costs



Permit cost structures vary based on mileage, type of issue, and configuration (i.e. “self issue,” “Interstate only,” “Overweight Only,” “Oversize Only,” etc.). The following is a list of exceptions and conditions in each state and province:

- Alberta permit costs vary based on mileage and net weight factors, (see Manitoba and Saskatchewan).
- Manitoba permit costs are $18 or $.06 per kilometer traveled, whichever is greater.
- Saskatchewan permit costs are $10 or $.06 per kilometer traveled, whichever is greater.
- Wyoming permit costs for combination vehicles are $40.
- North Dakota permit costs are $10 for receipt issued “Interstate Only” and $5 for self issued “Interstate Only.” Single trip “Oversize Only” permits are $20 with dimensions up to 14'6" width, 15'6" height, and 120' length. Single trip “Overweight Only” permits are as follows:

150,001-160,000 lbs. $30	160,001-170,000 lbs. $40
170,001-180,000 lbs. $50	180,001-190,000 lbs. $60
190,000 lbs and over $70	

  $.05 per ton mile is assessed upon the portion of Gross Vehicle Weight (GVW) exceeding 200,000 pounds.

- Minnesota single trip “Oversize Only” permits are $135 for width over 14'6" up to 16' during spring load restrictions.
- South Dakota single trip “Oversize Only” and “Overweight Only” permits are $20 each.
- Nebraska single trip “Oversize Only” permits are $15, “Overweight Only” permits are $20, and single trip “Oversize and Overweight” permits are $25.
- Iowa has a $10 permit fee, which also includes loads requiring bridge reviews.

- Montana permit fees are $10 under 100 miles, $30 for 101-199 miles, and $50 over 200 miles for vehicles that do not exceed axle limits. An additional $3.50 for each 5000 lb. increment overweight moved up to 25 miles is charged to vehicles that exceed axle weight limits.