

**REPORT TO  
THE MINNESOTA LEGISLATURE ON  
LOAD RESTRICTIONS AND SEASONAL LOAD  
INCREASES IN THE NORTHERN ZONE OF  
MINNESOTA**

**FEBRUARY 1, 2003  
PREPARED BY THE MINNESOTA DEPARTMENT OF  
TRANSPORTATION PURSUANT TO  
LAWS 2002, CHAPTER 364, SECTION 38**

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**The cost to prepare this report was \$15,646.00.**

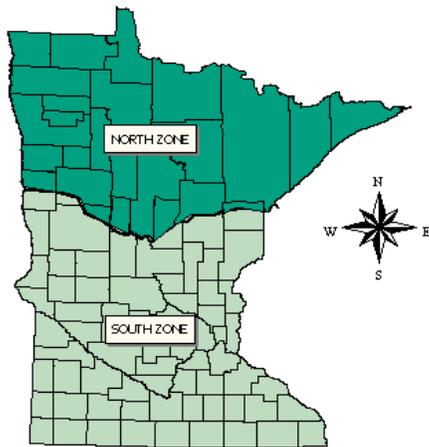
# NORTHERN ZONE LOAD STUDY EXECUTIVE SUMMARY

## BACKGROUND

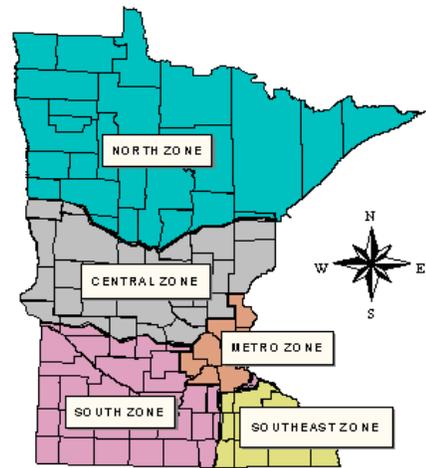
Laws 2002, Chapter 364, Section 38, requires the Commissioner of Transportation to study establishing more zones for winter load increases.

State law regulates the weight of vehicles and the loads they carry in order to protect pavement from damage from heavy loads. There are four sets of laws that govern the weight of vehicle loads: 1) the law imposes standard vehicle and load weight limits that apply most of the year; 2) the law restricts the amount of weight that may be carried during spring thaw when the ground under roads is wet and soft (spring load restrictions); 3) the law allows additional weight to be carried during winter when the ground under roads is frozen and stronger (winter load increases); and, 4) the law allows vehicle operators to obtain special permits to carry heavier loads than normally allowed in specified special cases.

This report addresses the winter load increases. State law prescribes the basic weight limits and the special cases when permits to carry heavier loads may be granted. State law also divides the state into 2 winter load increase zones that are described in the law. The Commissioner of Transportation establishes the zones for spring load restrictions.



Winter Load Increase Zones



Spring Load Restriction Zones

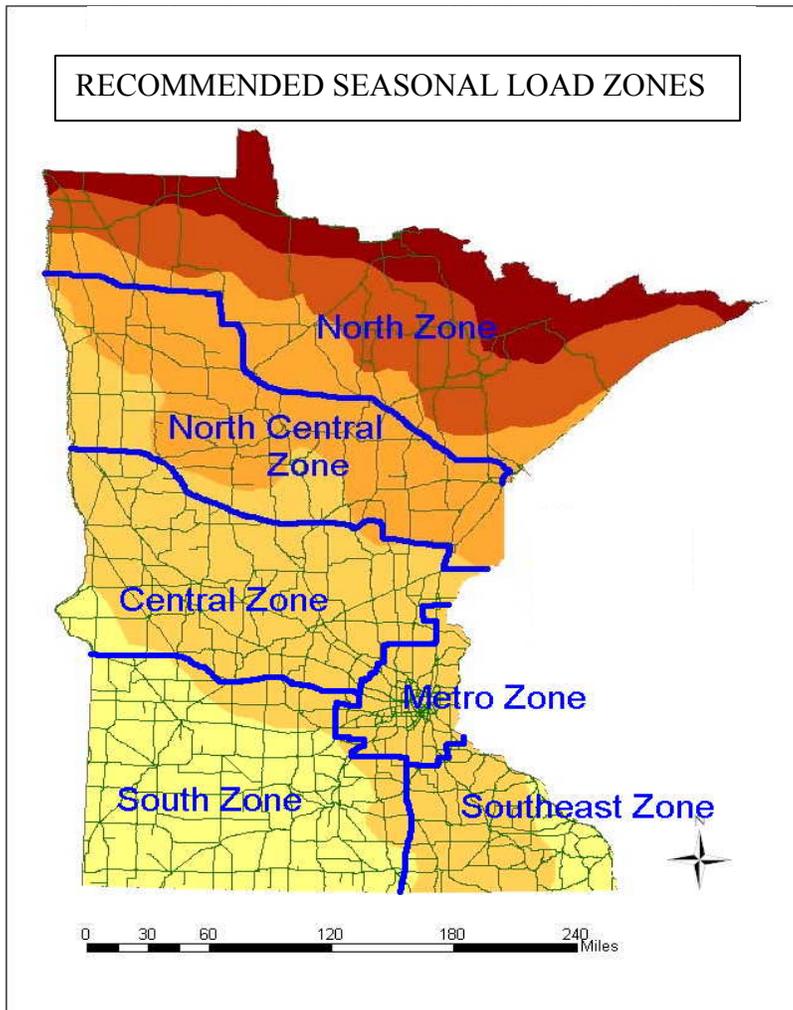
The North Zone is the same for both winter load increases and spring load restrictions.

A Task Force assisted the department of transportation in conducting the study required by the legislature. It analyzed weather patterns, timber production, timber hauling and general freight movements. It reviewed the state law that gives the commissioner of transportation flexibility to determine the geographic area of the zones and starting and ending dates for spring load restrictions.

### **TASK FORCE RECOMMENDATIONS**

The Task Force recommended granting the Commissioner of Transportation the same authority to establish the zones for winter load increases as the commissioner now has for the spring load restrictions.

Although the legislature required the commissioner to study only the zones for winter load increases, the task force studied other related issues and made additional recommendations to the commissioner. The task force also recommended that the allowable weights on 9 ton county roads be raised to 88,000 pounds during the period when the commissioner allows the winter load increase in that zone. Other recommendations from the task force included targeted development of a 10-ton system at the county level, educating the public about freight economics and truck safety, and studying truck axle configurations to achieve increased standard loads along with emerging safety technologies.



**COMMISSIONER OF TRANSPORTATION RECOMMENDATIONS**

The Commissioner recommends that:

1. The commissioner of transportation be given authority to describe the geographic zones for winter load increases;
2. An additional zone be created in the northern area of the state; and
3. Allowable weights on 9 ton county roads be raised to 88,000 pounds during the winter load increase period in each zone.

## NORTHERN ZONE LOAD STUDY

### I. BACKGROUND

Laws 2002, chapter 364, section 38, provides: “The commissioner of transportation shall conduct a study of load restrictions and seasonal load increases in the northern zone of Minnesota and make recommendations regarding the establishment of one or more new zones given the varying climate in the northern area of the state. The commissioner shall report findings back to the committees of the senate and house of representatives with jurisdiction over transportation policy by December 15, 2002.”

In response to this direction, the commissioner of transportation assembled an advisory task force of representatives from industry, local units of government and from within the Department of Transportation. Membership of the group is listed below:

Rachel Benishek – Timber Producers Assoc.  
Lisa Bilotta – Mn/DOT  
Duane Blanck – Crow Wing County  
Dave Christy – Itasca County  
Bruce Drotts – Blandin Paper Co.  
Bob Dunnell – Grand Rapids Area Chamber of Commerce  
Glenn Engstrom – Mn/DOT  
Graig Gilbertson – Mn/DOT  
Andy Hubley - Arrowhead RDC  
Patrick Hughes – Mn/DOT  
Rick Kjonaas – Mn/DOT  
Chris Morris – St. Louis County  
Chuck Sanft – MN/DOT  
Wayne Skoe – Logger YPA  
Curt Turgeon – Mn/DOT  
Bob Wolfe – North Itasca Joint Powers Board

The members of the task force agreed that the goal should be to obtain the optimal utilization of the roadway system with respect to allowable loads in all seasons.

A roadway’s strength depends upon the thickness of the pavement and base materials, the stiffness of those layers and the in-place soil stiffness. The layers are significantly stiffer when frozen. This frozen condition allows winter load increases. The winter load increase law allows trucks that have registered and paid the tax on the additional vehicle weight and that have obtained a permit to carry 10% more weight on certain roadways. In the spring, the roadway thaws from the top down and moisture is trapped above the still-frozen layers. The thawed, moisture-laden layer is extremely weak. If the pavement and base material are not thick enough to withstand this condition, the allowable loads must be decreased to prevent major damage to the road. Under these conditions, spring load restrictions are put in place to decrease the trucks’

allowable loads. Spring load restrictions do not apply to concrete pavement or to asphalt pavements designed with a 10-ton axle load capacity.

### A. Winter Load Increases

The current zones for winter load increases are displayed in Figure 1. Minnesota Statutes, Section 169.826, subdivision 1, designates the two zones for winter load increases. The north zone is the area north of and including the line from Duluth, following trunk highway 210 to its intersection with trunk highway 10 (at Motley) then following trunk highway 10 to the North Dakota border. The remainder of the state is the south zone.

The start of winter load increases is based upon a freezing index model. The research to develop this model revealed a direct correlation between the average daily air temperature and the depth of frost. As described in the attached Mn/DOT Technical Memorandum, a daily freezing index is calculated. The daily freezing index is accumulated as the season progresses. When the accumulated freezing index reaches 280 degree-days, enough frost should be present to begin allowing weight increases. Average daily air temperatures are monitored at several locations within each zone.

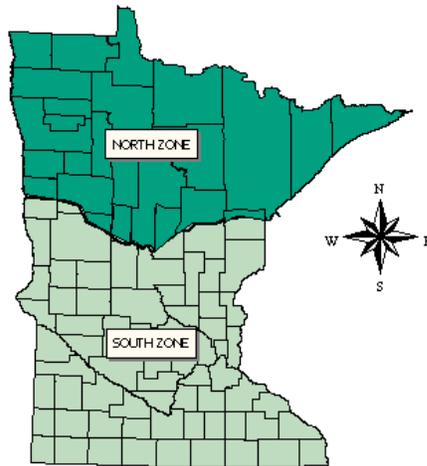


Figure 1

Ending winter load increases is not directly tied to the start of spring load restrictions. All changes from the statutorily prescribed weight limit to the winter load increase and back to the statutory weight limit or to the spring load restriction are based upon seven-day forecasted weather data and require a three-day public notice prior to going into effect. If the start of spring load restrictions appears imminent, winter load increases will be ended. It is desirable to have a gap of several days between the end of winter load increases and the start of spring load restrictions to allow operators of heavier vehicles to reach their destinations. However, it is possible that the end of winter load increases and the start of spring load restrictions may occur on the same day.

## B. Spring Load Restrictions

Minnesota Statutes, Section 169.87, allows the Commissioner of Transportation to establish the zones for spring load restrictions. The north zone for spring load restrictions has been designated to coincide with the north zone established by the legislature for winter load increases. The remainder of the state has been divided into Central, Metro, South and Southeast Zones as shown in figure 2.



Figure 2

The determination of the start of spring load restrictions follows a weather-based model detailed in the Mn/DOT Technical Memorandum “MRR-02 Guidelines for Seasonal Load Limit Starting and Ending Dates, July 26, 2002.” A thawing index is computed based upon the average daily temperature with consideration given to the angle of the sun’s rays. When the cumulative thawing index reaches 25 degree-days, it is anticipated that enough thawing has occurred to significantly weaken the pavement structure. The air temperature in several cities is monitored in each zone. If the air temperature in one or two cities in the zone indicate significant thawing, spring load restrictions will be imposed for the whole zone. Major damage can occur to pavement during this weakest period, therefore, delays for even a small portion of a given zone are avoided.

Spring load restrictions will be removed based upon several climate factors. It is the Department’s intent to limit the length of spring load restrictions to a maximum of eight weeks. Climate data may provide opportunities for even shorter durations.

## II. ANALYSIS

### A. Weather Patterns

Weather data is the key to the current system of seasonal load determination. Thirty years of daily temperature data for 140 Minnesota locations was obtained from the University of Minnesota’s Climatology Department. The average start date of winter load increases and average start date of spring load restrictions was calculated for each of the 140 locations. A contouring computer program was used to “fill in the gaps” between the discrete locations.

Maps were developed to provide a statewide picture of the 30-year average dates for the start of winter load increases and spring load restrictions. Figure 3 shows the 30-year average winter load increase dates. Figure 4 shows the 30-year average date of spring load restrictions. The black lines denote the current zones for each. Each color on the map represents a 4-day increment. Based upon the 30-year average date, each color represents a “zone” that changes status 4 days before/after the adjacent color. It does not mean that a significant change occurs when stepping across a line from one color zone to another, just that the 30-year average data can be grouped as shown.

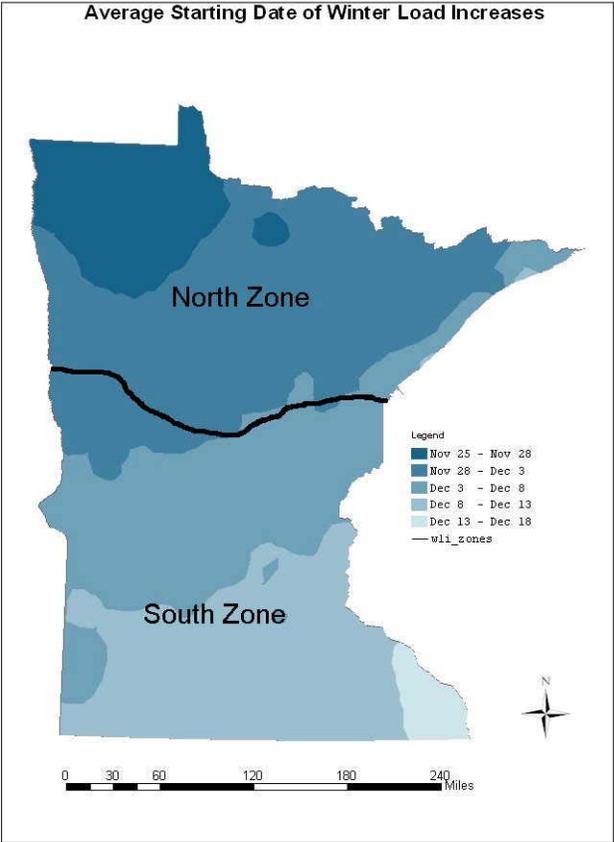


Figure 3

Figure 3 shows the northwest corner of the state achieving the desired accumulation of freezing degree-days first. Four days later, the region similar to the current north zone achieves the desired accumulation of freezing degree-days. Three more 4-day increments are shown in the south zone with the extreme southeast corner reaching the desired accumulation of freezing degree-days last. If the existing south zone were divided into three zones, additional time could be provided for trucks to operate under winter load increases.

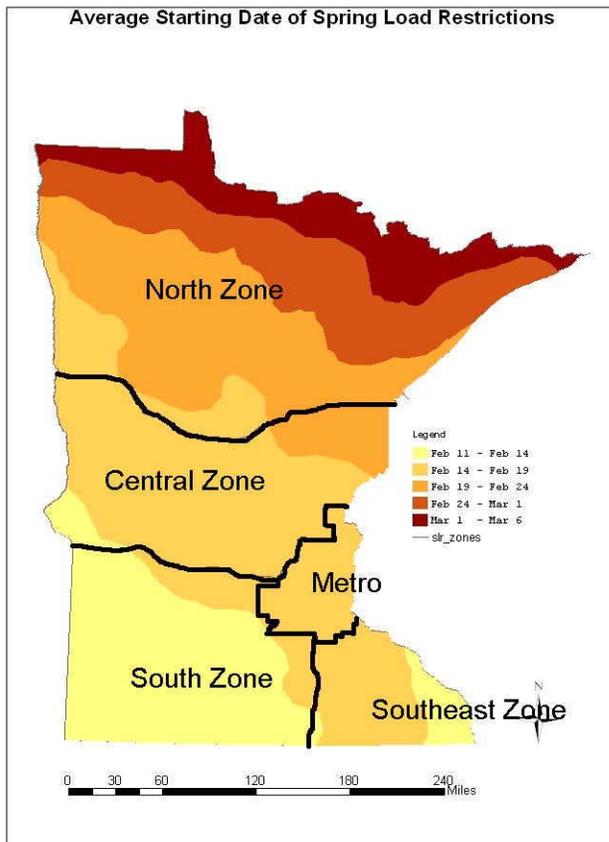


Figure 4

As seen in Figure 4, an area similar to the current south zone reaches the required accumulation of thawing-degree days first, along with a portion of the tip of the southeast zone. The remainder of the southeast zone, the metro zone and most of the central zone achieve the defined number of thawing-degree days within the next four days. The current north zone contains all or portions of four different colors. Since each color represents the passing of four days, the thawing criterion for imposition of spring load restrictions is met at the southern border of the north zone approximately 12 to 16 days ahead of the extreme northern part of the zone. This indicates an opportunity to delay imposing spring load restrictions in the northern reaches of the north zone.

A map combining the data from Figure 3 and Figure 4 was generated to determine the 30-year average length of winter load increases and is shown in Figure 5.

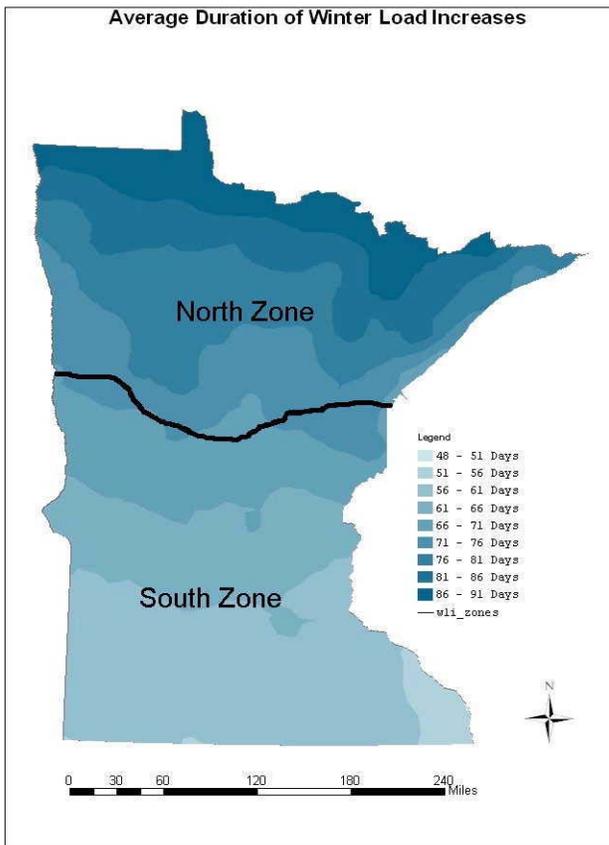


Figure 5

The 30-year average weather data is an excellent indication of general patterns. Unfortunately, Minnesota's weather is rarely average. Use of weather data as the sole measure for establishment of seasonal load zones is not recommended. For example, March 2002 was significantly colder than February 2002. Weather-based models were not ideal for situations where weather doesn't follow a predictable or average pattern.

### B. Timber Hauling Patterns

The second factor analyzed was the timber harvest and hauling patterns. The locations of the major mills and the winter load increase average start dates are shown in Figure 6. Approximately 65% of timber is moved during the winter load increase period. Extending the period when heavier loads may be carried, while retaining access to the mills, is a priority for the timber haulers.

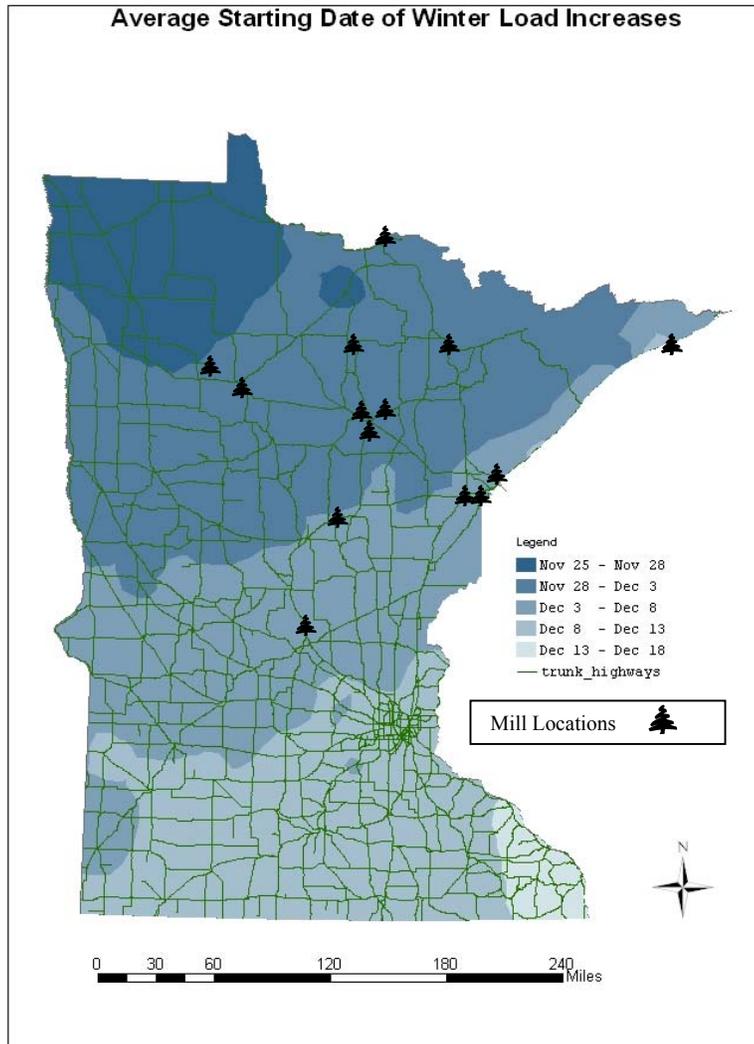


Figure 6

### III. CONCLUSIONS

The weather data indicated a possibility for extending the winter load increase period by creating a new zone within the current north zone. Creation of the new zone would allow the commissioner to delay the imposition of the spring load restriction period in the new northern zone. Spring load restrictions start when the first signs of thawing occur within a zone. It is best to target the spring load restrictions to when thawing actually occurs. For the north zone, load restrictions are placed when portions on the southern edge begin to thaw. Weather data indicates that there are areas in the northernmost part of the zone that don't begin to thaw until 12 to 16 days after the southern edge of the zone begins to thaw. If load restrictions are in place for no more than the preferred maximum of eight weeks, the roads in the northernmost part of the state, which begin to thaw later, have had nearly two weeks less time to fully recover.

Splitting the current North Zone into 2 zones should allow earlier winter load increases and delayed spring load restrictions. This will extend the busiest part of the timber hauling season. The new North Zone should allow extended access to mills in Duluth, Cloquet, Grand Rapids, Bemdji and all mills further north.

#### **IV. COMMISSIONER'S RECOMMENDATIONS**

1. The law directed the commissioner of transportation to make recommendations regarding the establishment of one or more new zones in the northern area of the state. The task force recommends the creation of an additional zone in the northern area of the state. The law directed the commissioner of transportation to make recommendations regarding the The commissioner concurs in that recommendation. This would create two zones in the north. The north zone would include all portions of the state north of and within two miles of a line starting in Oslo, then east along trunk highway 1 to the junction with trunk highway 89, then south along trunk highway 89 to the junction with trunk highway 2, then east along trunk highway 2 to, and including the city limits of Duluth. The rest of the northern portion of the state would become the north central zone and would include all portions of the state south of the north zone, but north of and including a line starting in Moorhead, then east along trunk highway 10 to the junction with trunk highway 210, then along trunk highway 210 to the junction with trunk highway 18, then along trunk highway 18 to the junction with I-35, then south along I-35 to the junction with trunk highway 48, then along trunk highway 48 to the Wisconsin border.
2. The task force also recommends that the commissioner be given authority to describe the geographic area of the zones for the winter load increases and authority to establish starting and ending dates for winter load increases. The commissioner now has authority to describe the zones and set starting and ending dates for spring load restrictions and authority to establish starting and ending dates for winter load increases. This recommendation, if adopted, would make the processes for establishing both winter load increases and spring load restrictions consistent. The commissioner concurs in this recommendation.
3. The commissioner also concurs in the additional recommendation the task force made (see V. Additional Task Force Recommendations, number 1. Standardization of Loan Increase) to raise the maximum allowable gross weight on 9 ton county roads to 88,000 pounds during the period when winter load increases are in effect in that zone.

These recommendations require amending Minnesota Statutes, section 169.826, subdivisions 1 and 5.

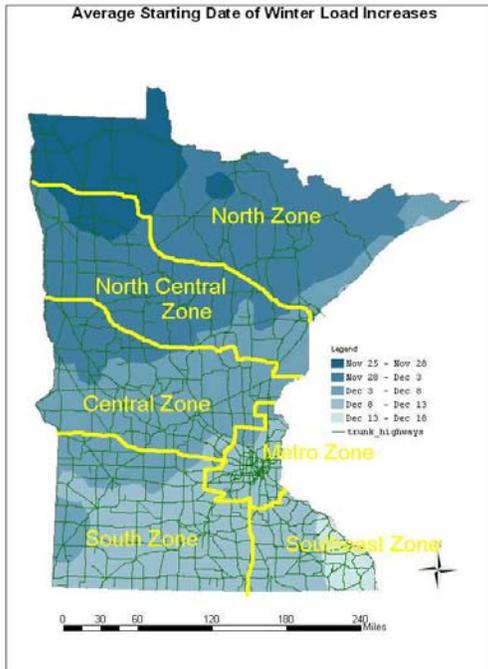


Figure 7

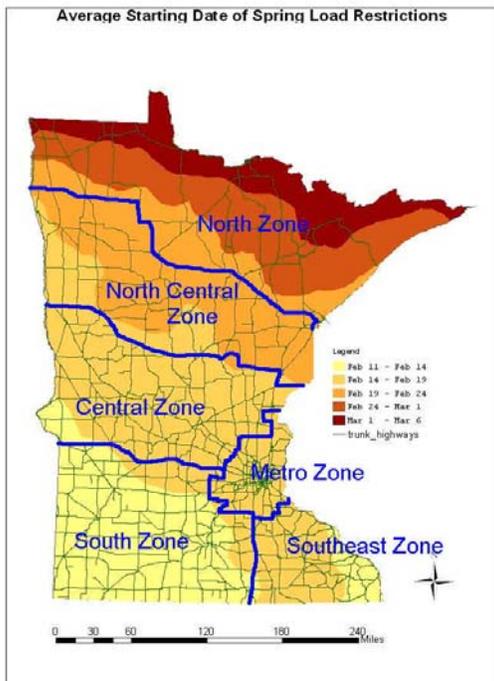


Figure 8



Figure 9

## V. ADDITIONAL TASK FORCE RECOMMENDATIONS

Although the law requiring this study required the commissioner to make recommendations only about establishing a new zone in northern Minnesota, the task force’s overall goal of optimizing the use of the roadway system led to discussions on several related topics.

### 1. **Standardization of Load Increase**

For purposes of regulating the weight that may be carried on roads in Minnesota, there are three general categories of roadways:

- a. Roadways posted at less than the standard axle tonnage. Signs typically designate the roadway to carry vehicles with 3-, 5-, or 7-ton axle weights;
- b. The 9 ton axle system comprised of the unposted county, city and township roadways; and
- c. The 10 ton axle system comprised of all unposted trunk highways and designated local truck routes.

(If no sign has been placed, the roadway is considered “unposted”. The maximum axle weights for unposted roads are established by statute with respect to the route’s designation.)

Winter load increases do not apply to roads described in category a; the sign's maximum weight limit applies year round. During the winter load increase period, the weight of loads on the 9-ton and 10-ton roads may be increased by 10 percent. Under current law, the maximum weight for a 5 axle vehicle rises to 80,608 pounds on a 9-ton road and to 88,000 pounds on a 10-ton road.

The structure of a 9-ton pavement is slightly less robust than the structure of a 10-ton pavement. However, during the frost period, the load carrying capability of these two pavement types is nearly indistinguishable. Having separate winter load increases for these two pavement types during the frost period is not necessary.

The Task Force recommends raising the maximum allowable weight on 9-ton roads to 88,000 pounds when winter load increases are in effect on the trunk highway system in that zone. This would provide a uniform maximum vehicle weight of 88,000 pounds for the trunk highway system and for the 9 ton county system when the winter load increase is in effect in that zone.

The remainder of the 9-ton system, that is most city and township roads, should continue with the current winter load criterion until the effects of increasing the weights on the 9 ton county system to 88,000 pounds are evaluated.

## **2. Targeted Development of a County Level 10 ton system**

Additional portions of the county system should be integrated into the 10-ton system.

This topic included suggestions related to:

- a. Working with local industries to determine priority routes at the county level.
- b. Developing a pavement strength evaluation protocol to aid local units of government in determining the feasibility of using the pavement at heavier weights.
- c. Streamlining the truck route designation system when requested by local units of government.

The task force members representing industry and local government feel that funding should be made available for upgrades to specific routes based upon the potential for regional economic gain. Improving access to certain plants or sites could benefit industries and businesses making them more competitive. Reconstructing roads to meet the 10-ton limit will also remove those routes from spring load restrictions.

## **3. Education.**

The task force members feel the important role and the economic contributions made by freight transportation are not always recognized. Efforts are needed to educate the public on this issue. The climate seems to overstate fear of trucking, and specifically logging trucks, over the economic vitality for the timber industry region. They feel that cooperative efforts are needed from the private and public sector for educational efforts to emphasize safety and the value of freight movement.

#### **4. Truck / Axle Configurations**

Other states, provinces and countries allow significantly different truck designs and axle configurations. Task force members feel that axle configurations can be developed to carry heavier loads without increased damage to pavements. Equipment can also be configured to maintain stopping distance, stability and to meet other safety requirements.

The Task Force members representing industry and local government recommend consideration of carefully designed and controlled pilot studies for truck improvements. They believe such studies have the potential to define more productive, safer and compatible vehicle configurations. At this time, capital expenditures for new equipment are not within the capabilities of many truckers. They believe that pilot studies would benefit Minnesota by moving the state toward the development of better vehicles/configurations over the long term.