SPRING ROAD RESTRICTIONS--
the effect in Region 6E

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Minnesota has legislated maximum weight limits on roads to conserve them and to facilitate planning for highway construction and maintenance. Upper limits have been placed on: (1) gross weight of a vehicle; (2) gross weight on each axle or combination of axles; and (3) gross weight on each tire. Vehicles traveling Minnesota roads must have gross weights of less than 73,280 pounds. State statute 169.83 limits use of highways to vehicles with a gross weight on any wheel of less than 9,000 pounds and gross weight on any single axle of less than 18,000 pounds (hence the term 9-ton roads). ¹

These maximum load limits may be reduced in the spring when roads become more susceptible to damage. For about 10 months of the year, nearly all Minnesota roads are 9-ton roads. However, when the ground and the road base are thawing, roads are generally weakest: often not structurally able to handle 9-ton axle weights.

State-maintained roads are evaluated each fall and if judged incapable of bearing the maximum load during the spring thaw are posted at 4, 5, 6, 7, or 8-tons. Since the spring thaw does not occur uniformly statewide, imposing and lifting these restrictions is done by zone to reflect weather conditions. Consequently, some state roads are posted for very short periods of time.

The procedure differs for county and township roads. State law says that all non “cement concrete” roads are 5-ton roads from March 20 to May 15 unless otherwise posted by local authorities. Consequently, county and township roads must be posted in the spring or they are 5-ton roads for an 8-week period regardless of weather conditions.

There are reasons for these posting differences. The state highway department has more employees, resources, and technical capability than local governments. State roads are frequently more heavily trav-

¹For more detailed information on weight restrictions, see Minnesota statutes 169.83 through 169.87. Relevant statutes are reproduced in appendix B of Current Policies for Vehicle Weight Restrictions on the Roads in Region 6E, Todd, Department of Agricultural and Applied Economics, University of Minnesota.
eled, and they include a higher proportion of 9-ton roads than county and township roads. Local governments generally lack resources for extensive road monitoring and posting and have a large proportion of 5-ton roads.

Minnesota roads are normally planned and budgeted for a 20-year lifespan at a specified maintenance level. Movement of vehicles exceeding road capacity can significantly reduce this lifespan and/or add considerably to maintenance cost. However, the volume and spacing of heavy (those legally permitted) loads can affect the life of the road more than spring posting. Heavy traffic at other times of the year, of course, can destroy road structure even if the road has seasonal protection. Similarly, bituminous roads are not permanent structures but will deteriorate and wear out due to age and weathering regardless of traffic level. It is possible to overprotect a road and have it wear out from weathering instead of use.

The task of highway managers is to balance the effects of weight limits, expected traffic volumes, normal design life, and maintenance expenditures to provide an adequate road system. There are several kinds of costs a highway manager should consider to accomplish this: costs which can be controlled or influenced such as construction; maintenance due to use; and maintenance due to age. In addition, the public has to bear additional transportation costs of both time and money caused by road restriction and/or inadequate roads. There are also the costs of lost opportunities (described later) and product deterioration because of transportation restrictions.

This issue examines the major components of public costs caused by spring road restrictions in Region 6E while attempting to evaluate some of the alternatives and tradeoffs between the costs of road restrictions, new constructions, road monitoring, and increased maintenance.

Effects of Restrictions

When spring restrictions are in effect, transportation patterns change. The carrying capacity of vehicles is reduced from the normal 9-tons per axle, and shippers must alter their operations to allow for this.

Shippers basically have four choices: travel with lighter loads meeting the restrictions; avoid the restricted roads; store and curtail spring shipping; or travel with illegal loads. Each alternative means problems and costs.

Loading vehicles only to spring-posted weights involves extra costs. These costs will depend on how much less the shipper has to move per load and how far the loads must travel. If each load is reduced more trips are needed, either with the shipper’s trucks and/or with a hired trucker. The number of additional trips depends on the density of the cargo and the type of vehicle. Some light, bulky cargoes such as fiberglass insulation may fill a truck to capacity before weight limits are reached so road restrictions have little or no effect on the amount of cargo carried per trip. Plate steel, however, generally requires an immediate pound for pound reduction in payload when restrictions are in effect. Although not as dense as steel, most agricultural shipments require a reduced payload to meet road restrictions.

The existing restrictions affect the percent of normal payload differently for different types of vehicles. A standard 2-axle farm truck with a 13-ton gross weight on a 9-ton road can carry about 78 percent of its normal load under 7-ton restrictions. A five axle tractor-trailer rig with a 36-ton gross weight on a 9-ton road can carry about 85 percent of its normal load under a 7-ton restriction. On a road restricted to 5-tons, the farm truck can carry about 56 percent of the payload possible on a 9-ton road, while the tractor trailer rig can carry only about 48 percent of its 9-ton payload. Usually the payloads of tandem axle trucks are less affected by 7-ton restrictions than those of single axle trucks but are affected more by 5-ton restrictions.

Sometimes, normal routes can be altered. For example, if farmer B in figure 1 wants a load of feed from feedmill A, the normal route is highway 2. But highway 2 has an axle weight limit of 5-tons in spring. If highways 1, 4, and 3 remain 9-ton roads, the route can be changed by use of these roads. But transportation costs will rise because of increased distance and time. This option is available, however, only when both shippers and receiver are located on unrestricted 9-ton roads and if they are connected by an unrestricted route. For example, farmer C cannot receive a full load of feed legally because the load would have to move on restricted highway 2. Farmer C can transport 9-ton axle weights of feed to farm B and use lighter loads from farm B to farm C. But in addition to the added costs from increased distance and time, this option may require an extra handling cost at farm B.

Another way is to make earlier pickups (or later deliveries) on restricted roads. School buses often use this method. If highways 5 and 2 are 5-ton roads, highway 3 is a 7-ton road, and highways 4 and 1 are 9-ton roads, pickups would be made on 5-ton highways 2 and 5 first (e.g., farms C and D), then on 7-ton highway 3 (farm B), and the bus would be filled on 9-ton roads (e.g., farm E) on the way to school (A).

Another adjustment is to cease shipping during the restricted times, but this is not always a viable alternative. Transportation may be essential in the spring. Commodities such as milk cannot be stored for long, or a vital service may be involved such as school bus service. When spring road restrictions stop or reduce shipping, the costs of lost opportunities may be incurred. For example, a grain farmer may miss marketing a crop during high spring prices. Also if shipping ceases for 2 months, more has to be moved in a shorter time after road restrictions are lifted. Labor and equipment may lie idle in the spring while added workers must be hired and additional equipment purchased or leased before or after spring restrictions.

Even the fourth option, traveling with illegal loads, involves some adjustment trying to avoid arrest. Fines are levied against shippers caught with overweight loads.
However, if truckers can avoid being caught, this method is the least costly to them. At the same time, costs to the community can be substantial if the over weight loads cause structural or surface damage to the roads. Although travel with illegal loads apparently varies from county to county, it allegedly does occur in Minnesota. Sometimes, lenient law enforcement is evident. Truckers hauling illegal loads sometimes move at night, not only because of less likely detection, but also because the roadbeds have a tendency to freeze and then become stronger.

Some states adjust spring weight restrictions by considering tire size as well as weight per axle and weight per tire. Some truckers in Region 6E claim if such a system were adopted by Minnesota, they could haul heavier loads without damaging the roads in the spring by using wider tires.

However, Minnesota Highway Department officials say: “The stress within a flexible pavement developed to resist the wheel load must be able to resist significant deflections, or breakups will occur. It is our experience that a small increase in the tire contact area does not distribute the wheel load significantly or reduce deflections in the pavement.

Adjusting allowable axle load by tire pressure or contact area would bring about another complicating set of conditions. First, we would have to establish one tire size as a standard. In so doing, a loading penalty would have to be assessed to smaller tires and, conversely, a loading bonus supposedly would be given to larger tires. In a parallel way, the law would probably designate a dual tire axle as standard and provide a penalty for axles with single tires. As can be seen, this would

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Figure 2. Roads in Region 6E with spring restrictions above 5 tons
have the double edge sword effect. Decrease in the tire pressure would also cause a lower fuel efficiency for trucks with typical truck tires.\(^2\)

**Roads in Region 6E**

The rural highway system in Region 6E is good compared with other areas in south western Minnesota. Figure 2 shows the road system in the region classified to withstand axle weights of greater than 5-tons in spring. Unrestricted roads provide good east-west travel. These roads channel traffic and from the region’s major market the Twin Cities area. Service by north-south unrestricted roads is not as good.

The present unrestricted road system handles the bulk of the heavy commercial traffic carrying products into and out of the region and also between major locations within the region. Most of the heavy traffic using restricted roads is local, involving deliveries to and from scattered farms. For much of this traffic, 7-ton roads would substantially reduce the extra costs associated with spring restrictions. Figure 2 shows that 7-ton roads in the region are concentrated in McLeod County.

Highway administration is under three jurisdictions: state, county, and township; however, all but a few miles of 9-ton roads in Region 6E are administered and controlled by state officials. There are also 5, 6, and 7-ton state administered roads; all township roads are 5-tons or less.

Policy on spring road restrictions for county roads varies from county to county in Region 6E. Generally, the state imposed 5-ton restrictions from March 20-May 15 are maintained except on roads designed to accommodate 7-ton loads. Some counties do have stretches of 7-ton roads, but because they are bonded by 5-ton roads, they retain the 5-ton limits. Often there are plans to extend the 7-ton roads to link with other 7-and 9-ton roads. Occasionally restrictions have been lifted for special circumstances, such as access to towns a short distance from 9-ton roads.

Few resources are available for monitoring township roads: virtually all these roads are unpaved and are 5-ton roads during spring. There are 87 townships in the region; each township board is responsible for those township roads within its jurisdiction. Revenue generation at the township level is limited. Significant highway upgrading requires an influx of state, federal, or county funds and such windfalls are unlikely. Many townships are finding it difficult to maintain their present systems.

Highway construction budgets are also constrained at the county level. Until the early 1960’s, most county bituminous roads were 5-ton. At that time, counties also began building roads of 7-ton design. However, many bituminous roads built in the 1960’s were designed as 5-ton, ultimate 7-ton roads, meaning initial construction was a 5-ton road but with a base strong enough to support 7-ton traffic. The plan was to upgrade the road to full 7-ton design by a 2-3 inch overlay when surface maintenance was needed in the future. This is how the counties could spread out the construction costs. Much of the new mileage of 7-ton roads in the region is this type.

In 1970, the state decided that county roads constructed with state aid funds must be at least 7-ton. This policy has increased the near term cost of road construction while reducing the amount of possible highway upgrading. Thus, the current policy in all four counties in the region is that all new bituminous roads must be 7-ton, except where truck traffic is clearly minimal.

The counties currently have very few miles of 9-ton roads, though county highway engineers say more are needed. Funds are not available for any significant increase in 9-ton county roads. When roads with high volumes of truck traffic are rebuilt, they are being designed and constructed as 7-ton roads but with an adequate base to support 9-ton loads when adding the necessary overlay.

**Costs of Upgrading Highways**

Highway construction costs vary considerably from area to area and from mile to mile within the same area. County highway officials say costs of upgrading good 5-ton roads to 7-ton capacity average around $21,000 per mile when no shoulder improvement is needed and a 2½-inch bituminous overlay is applied. This type upgrading in Region 6E has been fairly standard in recent years.

However, where existing roadbeds must be improved before roads can be upgraded from 5-ton to 7-ton capacity, construction costs are substantially higher: from $50,000 to more than $100,000 per mile, depending on the quality of the existing roadbed, the volume of truck traffic, the grading required, and the adequacy of the shoulders. Average costs for such work has been about $75,000-$85,000 per mile.

Upgrading from 5-ton to 9-ton capacity takes more than a simple bituminous overlay. Highway department engineers indicate the cost in Region 6E would exceed $200,000 per mile because these roads would have to be straightened and widened to meet federal and state highway standards.

**Setting Priorities on Highway Projects**

The highway department must examine the road needs of the entire state to set priorities. The department recently completed a master plan, establishing priorities on construction through the 1980’s. Only very limited funds are included for upgrading seasonally restricted state highways in southern Minnesota.

Traffic count data for 1972 show that two stretches of restricted highway in Region 6E carried a high (170-249) average daily volume of heavy commercial traffic (1) Highway 4, which is restricted to 5-tons from Cosmos to Fairfax and 7-tons from Fairfax south; and (2) the 7-ton Highway 15 from Dassel to Hutchinson. Other restricted state roads in the county carry an average daily volume of fewer than 170 heavy commercial vehicles. These lower volume roads include those serving four Region 6E municipalities on state roads with no unrestricted access. These four municipalities are: Sunberg, New London, Lester Prairie, and Kingston.
A Real Dilemma

In Region 6E, many business enterprises and homesteads are on spring restricted roads. Currently, few of these businesses and home steads will obtain access to unrestricted roads. Often, the economic impacts of restricted roads are minimal; however, substantial added transportation costs can accrue to shippers as a result of spring restrictions.

To evaluate the costs of restrictions in a rural area like Region 6E, gross or macro data are of limited value. Points of origin and destination vary widely. The sizes and types of operations using these roads differ substantially. Therefore, specific operations and locations must be examined in order to determine the appropriate costs.

Data on traffic patterns on rural roads such as in Region 6E are very limited. The State Highway Department makes periodic traffic counts on state and county roads, but no data exist on what commodities are being shipped, routes being followed, or pounds being transported. The department does special counts to determine volumes of heavy commercial traffic using these roads. However, these are not normally done in spring and vehicle weight is not checked, neither is information collected on the commodities being transported nor on the origins or destinations of the vehicles transporting these commodities.

To determine where and to what degree transportation is being affected by seasonal road restrictions, interviews were conducted by the authors with persons interested in and associated with highway transportation in Region 6E. Contacts were made with people involved in grain, poultry, and dairy product transportation, and with state, township, and county officials and employees. These contacts do not provide a basis for a detailed cost analysis, but do indicate how people view the problem of seasonal road restrictions.

Views on Seasonal Road Restrictions

On the basis of the interviews, the highway system in Region 6E is generally considered adequate to meet springtime transportation requirements, but milk producers and turkey growers seem more affected than other farmers by spring road restrictions.

Trucks must pick up milk from milk producers on a regular basis, normally every 2 or 3 days and spring is the period of highest milk production. Moreover, the dairy industry has become more concentrated, with fewer, larger processing plants drawing milk from more distant farms. It means large bulk milk trucks carry heavier loads over longer distances. The number of receiving stations is also decreasing as milk is trucked directly from the farm to processing plants. As milk processors rely more heavily on large trucks, the effects of spring restrictions are more likely to be felt.

Milk Transport

Milk haulers and milk processors in Region 6E roughly estimated that transportation costs rose from 10-30 percent in spring as a result of road restrictions. This type of cost data cannot be broken down to assign costs to specific road segments.

In a study of the economics of farm-to-plant milk assembly, Nolte and Koller used the economic engineering method to synthesize milk trucking costs. They estimated the "annual average milk assembly costs of making an extra trip between route area and plant for two months in the spring because of posted roads." Additions to assembly costs resulting from making extra route trips due to posted roads in spring ranged from 44 percent during spring restrictions.

Turkey Growers

Turkey production and turkey processing are important to the economy of central Minnesota. Road restrictions especially affect three elements in turkey production: movement of feed to turkey farms; movement of litter (used to keep buildings with heavy concentrations of turkeys sanitary) to farms; and transport of the finished birds from farms to market or processing plants.

Historically, the turkey industry is cyclical with yearly peaks just prior to the Thanksgiving-Christmas holiday season. The industry is trying to spread production more uniformly throughout the year to affect more efficient use of production facilities. This change places added strain on turkey growers on restricted roads.

Turkey growing operations are becoming larger and use substantial inputs of feed. As production becomes less seasonal, the feed requirement in spring increases. Large operations must receive 2-3 deliveries of feed per week.

Growers estimate that road restrictions add from 60-100 percent to the cost of the delivery of feed in spring due to longer routes to avoid restricted roads or extra trips with partially filled trucks.

Costs of delivering live turkeys are borne directly by turkey processors whose bid price to farmers is quoted for delivery at the farm gate. These costs can be expected to increase if more consistent year-round production is achieved.

The cost consequences of road restrictions on the delivery costs for litter are less important than for feed or for live turkeys. The total amount moved is limited and growers can often plan to prepare their broods before spring restrictions are imposed.

Turkey growers have indicated that locational advantages and disadvantages are considered in decisions on locating new growing operations. However, new and large growing operations have been planned and built on restricted roads in recent years especially when land cost and availability advantages overshadowed transportation disadvantages. It appears that the added costs associated with transportation on restricted roads have not been so severe as to eliminate profitability.

Crop and Livestock Farming

Crop farming is an important agricultural enterprise in Minnesota. Major crops include: corn, soybeans, wheat, oats, barley, hay, beans, and sugar beets. The domi-
nant cash grain crops are corn and soybeans.

Farmers growing these crops can be affected by spring road restrictions in two ways: in field preparations which are made in spring, and in marketing crops.

Farmers need supplies of materials: fuel, fertilizer, herbicides, and seed when they prepare their fields in spring. While spring road restrictions may increase the transportation costs associated with moving these products to the farm, the overall impact of such costs may be minimal. Some of these inputs, for example, seed and herbicides, can be purchased prior to the period of restrictions and stored. Requirements of these materials are often small enough to avoid transport in trucks loaded to 9 ton axle weights.

Spring road restrictions can also influence both the cost of hauling grain to market and the price received for the grain. Corn and soybeans are harvested in fall. Many farmers store a large portion of these crops on their farms with the expectation of selling later at higher prices. Many expect highest prices in spring. As figure 3 suggests for corn, past prices do not always support this view. Spring prices for corn have not exhibited great strength. In addition, spring prices for soybeans have been erratic. There are no high peaks in the prices paid to farmers for grain in spring. Such peaks could be expected if an external force, such as road restrictions over a large geographic area, were restricting the flow of grain into marketing channels.

Hog and beef farmers might also be affected by spring weight restrictions. Like grain, this is a situation where some adjustments can be made to alter the time when the animals are marketed in an attempt to avoid restrictions. Few of these farmers produce animals in such quantities that spring restrictions are a problem for transportation.

Some farmers do, however, transport their animals to market in semis. Farmers who live on restricted roads and market their animals in spring often park their semis on non-restricted roads, and move the animals from farm to the semis with smaller trucks.

### School Buses

The effects of spring restrictions on school bus operations do not appear substantial. According to State Statute 169.87, Subdivision 1, the state imposed 5 ton spring restrictions do not apply to school buses. For school buses spring restrictions are raised to 7-tons per axle unless highway authorities give school boards 24-hour notice of lower axle weight restrictions.

Some school bus routing changes are made in spring to keep weight off weaker roads. Sometimes early pickups are made on weaker roads or smaller buses are used. When unpaved roads are very soft, parents are expected to transport their children to a bus stop on the nearest paved road.

### Conclusions and Recommendations

The existing set of spring road restrictions cause shippers to make adjustments such as changing routes, using partially filled trucks, or loading illegally. However, if there is a longer unrestricted route available or if the trip with a partial load is to a local community, the total additional costs of transportation are generally small compared with costs of upgrading roads. This is not true of all road segments, but these specific segments have to be evaluated individually considering the type and amount of actual and potential traffic, its origin and destination as well as the cost to upgrade the road.

Unfortunately, current methods of highway planning are probably biased against increasing access to unrestricted roads. The principal method of need determination for highway improvements is traffic count data and not type, origin, and destination of traffic. Only after deciding that improvements are necessary are surveys made to determine the weights of vehicles using the routes; this information is then used in cost benefit analysis.

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\[\text{Figure 3. Prices received by Minnesota farmers for corn (mid-month average, dollars/bushels, 1971-74)}\]
To correct this, the new Minnesota Department of Transportation should improve its planning capabilities by using more extensive traffic surveys. Better information about what commodities are moving on rural roads; the origins, destinations, and routings of such movements; and the types and weights of the trucks involved are required for evaluating the current rural transportation system and its potential needs. County highway departments should be encouraged to initiate traffic counts and surveys to determine the volumes and origins of truck traffic.

The current statewide statutory requirement for spring load limits for 8 weeks is probably unduly restrictive and a cause of unnecessary additional transportation costs. An intensified spring highway monitoring program at the county level might help decrease the period of road restrictions to closely correspond to the period of potential damage. Such a program would require additional expense for equipment and manpower, but on selected routes, might be an alternative to major upgrading.

On roads with a minimum of heavy traffic, the lowest cost solution might be to rely on permits which allow a shipper(s) to move a limited number of 9-ton or less, under specific conditions, such as the timing between loads, e.g., once a day early in the day. Allowing essential traffic to move by permit if accompanied by a strict program of enforcement should reduce illegal loads and fully accommodate transportation requirements while protecting rural roads. Such a program would require administration costs and possible added enforcement cost.

Finally it should be determined whether the funds available for local roads continue to be used to bring roads (and bridges) up to high standards such as 9-ton bases and 66-foot rights-of-way. Inflation and limited funds now severely limit the number of miles of these roads that can be constructed. In many areas it might be feasible to bring 3 or 4 times as many miles of road to a 7-ton level on existing right of way as to construct 9-ton roads. The answer may vary from area-to-area and county-to-county, but there could be major benefits if the number of 7-ton roads were increased.
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