Advantage

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Contents

Using optimized truck tire pressures to minimize damage to rural roads: summary of two trials in Saskatchewan

Abstract

In 2000, the Saskatchewan Department of Highways and Transportation (SHT) conducted two trials of heavy trucks equipped with tire pressure control systems and operating on rural roads. The Forest Engineering Research Institute of Canada (FERIC) participated in an advisory capacity and prepared this summary of the trials. The main objectives involved quantifying the potential benefits of optimized tire pressures in minimizing damage to rural roads, and offsetting the incremental road damage caused by larger capacity trucks carrying enhanced weights. Tire heating and fuel consumption were also examined.

Keywords

Trucks, Tire pressure, Central tire inflation (CTI), Tire pressure control system (TPCS), Rural roads, Earth-surfaced roads, Road damage, Tire heating, Fuel consumption.

Author

A.H. Bradley,
Western Division

Introduction

The practice of optimizing (reducing) pressures of tires on heavy trucks to minimize damage to lower standard roads is becoming increasingly common in Canada. Central tire inflation (CTI) and tire pressure control systems (TPCS)[1] are proven technologies that enable operators of heavy trucks to monitor and vary tire inflation pressures from inside the truck cab while driving.

In October 1999, in response to public concerns about minimizing damage to rural roads by heavy trucks, FERIC and the Saskatchewan Department of Highways and Transportation (SHT) conducted a field demonstration of tire pressure control systems in southeastern Saskatchewan (Bradley and Stamatinos 2000). The outcomes of the demonstration prompted SHT and FERIC to follow up, in 2000, with a more exacting experiment of heavy trucks equipped with tire pressure control systems and operating on rural roads.

This report describes two trials conducted in Saskatchewan during 2000, and summarizes the findings.[2,3]

Background

Commercial truck traffic can significantly degrade the condition of lower standard roads (e.g., rural and forest roads). Typically, this will lead to additional or continued costly maintenance being required.

Although many road-related and truck-related benefits of reducing tire pressures have been identified, time constraints prevent

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[1] The terms *tire pressure control system (TPCS)* and *central tire inflation (CTI) system* are sometimes used interchangeably. System manufacturers use the term *tire pressure control system* to refer to a relatively complex computer-controlled system that can monitor, inflate, and deflate up to three tire groups on commercial trucks. *Central tire inflation system* refers to older, simpler technology which was developed for military applications and which lacks many of the computer and safety features necessary for commercial truck applications.

[2] A number of papers and reports have already been published on aspects of this research. The reader is referred to these works for detailed information on methods, analyses, and conclusions. See Stamatinos and Bradley 2002, Reggin et al. 2002, EBA Engineering Consultants 2002, and Bradley and Stamatinos 2000.

[3] The author of this summary was involved in the experimental design, testing, and results analysis of both the 1999 and 2000 projects.

drivers of commercial trucks from manually optimizing tire pressures in response to changes in truck load or speed limit. As an alternative, a tire pressure control system—an on-board electro-mechanical system—offers drivers a convenient means to monitor and optimize (inflate and deflate) tire pressures while driving. Currently, about 350 tire pressure control systems are in use in Canada. Many of these are used in Alberta log-hauling operations, but tire pressure control systems are gaining acceptance in other provinces and other industries (e.g., agriculture, concrete, and oil). Development trends for tire pressure control systems have been towards improving features and programmability, reducing component size, reducing weight and purchase price, and integrating tire pressure control systems with GPS-linked truck-monitoring systems to low standard roads.[4]

Research into the benefits of reducing the pressures of tires on heavy trucks has revealed the following:

- Significantly less damage occurred to paved, chip-sealed, and aggregate-surfaced roads—in both dry and saturated conditions—with both straight and curving alignments (Nevada Automotive Test Center 1987).
- Gravel loss (e.g., from aggregate breakdown, ravelling, and penetration into the subgrade) decreased by an estimated 25–40%, depending on aggregate quality (Bradley 1997).
- In a laboratory setting, less rutting occurred on three test sections of gravel road when the tire pressure was reduced by half. Halving the tire pressure and increasing wheel load by 82%, however, resulted in greater rutting (Douglas 1997).

In October 1999, FERIC and SHT conducted a field demonstration in southeastern Saskatchewan, near Walpole. The demonstration was conducted to show the potential for tire pressure control systems to minimize damage to rural roads, and thereby address the public's concerns about large trucks and payloads operating on rural roads.

The trucks in two identical B-train fleets were equipped with tire pressure control systems and Michelin tires. The tires on one fleet were inflated to the industry standard of 100 psi (690 kPa). The tires on the second fleet were inflated to optimized (reduced) levels which were recommended by Michelin. The two fleets cycled over adjacent lanes of a two-lane rural road having a compact clay surface crust on which a thin layer of gravel was spread to aid traction in wet weather.

During the unloaded phase of testing, the fleet with the optimized tire pressures generated approximately two-thirds less washboard on the road's surfacing gravel than did the fleet with the higher tire pressures. During the loaded phase, the running surface of the lane traversed by the fleet with the optimized tire pressures displayed significantly less structural degradation than did the lane traversed by the fleet with the higher tire pressures.[5] The clay surface rutted very little, and the changes in rut depth proved statistically inconclusive (Bradley and Stamatinos 2000).

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[4] Since 1995, in its Trucking Partnership Agreements, SHT has recognized the road-related benefits of reducing truck tire pressures. SHT uses data from truck-based monitoring systems to ensure trucks and drivers comply with the terms of the Agreements.

[5] As indicated by pre-/post-trial differences in surface deflection (based on rebound measurements taken with a Benkelman Beam), and the occurrence of surface cracking.

Forest Engineering Research Institute of Canada (FERIC)

Find us Online! www.feric.ca

Eastern Division and Head Office
580 boul. St-Jean
Pointe-Claire, QC, H9R 3J9
☎ (514) 694-1140
(514) 694-4351
admin@mtl.feric.ca

Western Division
2601 East Mall
Vancouver, BC, V6T 1Z4
☎ (604) 228-1555
(604) 228-0999
admin@vcr.feric.ca

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Study objectives

The significant difference in lane performance observed in the 1999 field demonstration prompted SHT to conduct a scientifically controlled experiment in 2000 to quantify the potential of optimized tire pressures to minimize road damage on rural roads.

The core objectives of the follow-up research were to:

1. Quantify the reduction in road damage related to the use of reduced tire pressures that was observed in the 1999 field demonstration.
2. Determine whether the use of optimized tire pressures could offset the incremental damage to rural roads caused by larger capacity trucks carrying enhanced weights.[6]

Supplemental objectives of the follow-up research were to:

3. Determine the suitability of the reduced tire pressures by measuring the magnitude and distribution of heat on the surface of the trucks' tires.
4. Quantify changes in fuel consumption resulting from the use of optimized tire pressures on rural roads.
5. Examine how gravel loss from rural roads is influenced by aggregate size and application rate, and by truck speed and tire pressure (refer to Transportation Research Centre 2002).
6. Model the mechanisms that contribute to damage of rural roads.[7]

Methodology

Two trials, the Equal Axle Load Trial and the Equal Payload Trial, took place simultaneously from July 25 to August 1, 2000 in central Saskatchewan, near Wynyard.

Test roads

The test road in the Equal Axle Load Trial was 4.8 km long and the road in the Equal Payload Trial was 6.4 km long. Vehicles could cycle the test roads continuously by returning to the beginning of the road via connecting roads. The trucks were loaded with grain.

Construction and conditions. Both test roads were two-lane, low-volume roads constructed with the local clay-type till soils of medium plasticity.[8] Each test road was comprised of two surface types:

1. *Earth-surfaced sections.* For most of the length, the road surface was comprised of a 150 to 200-mm-thick, compact crust of native material overlain with a very thin (3–5 mm) layer of gravel to improve traction in wet weather (Figure 1).
2. *Thin-membrane-surfaced sections.* Each road also included a 300-m-long paved section consisting of a 40-mm-thick bituminous cold mix mat placed on top of the road crust (after first removing the traction gravel).

The test roads were very similar in construction to the earth-surfaced test road

[6] Enhanced weights: weights greater than the provincially regulated maximum gross and axle weights. In Saskatchewan, the practice of carrying enhanced weights under permit from Trucking Partnership Agreements has been restricted to trucks being allowed to carry primary highway legal weights when they travel on the secondary highway system.

[7] No results published at the time of printing.

[8] Fine-grained soils are classified largely by water content, with more-plastic soils containing greater amounts of water and being more readily deformed.

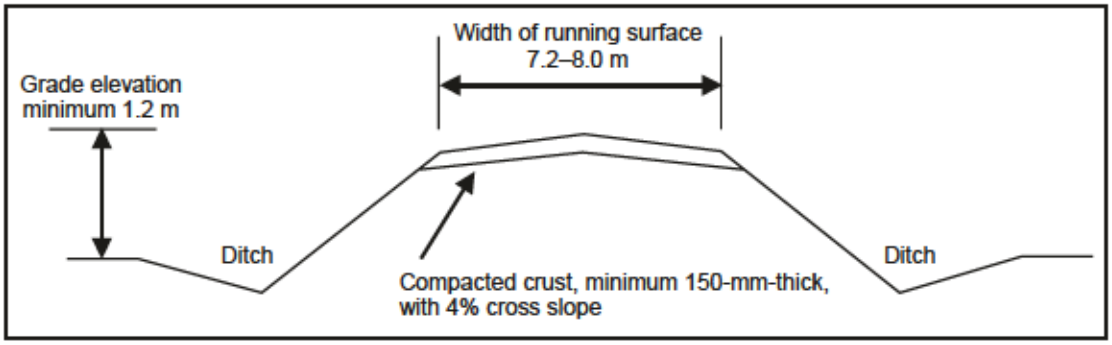


Figure 1. Cross-section of test road (not to scale).

used in the 1999 field demonstration of tire pressure control systems, and were representative of many rural roads in Saskatchewan and elsewhere in Canada. Unlike the 1999 field demonstration, however, the roads in the 2000 trials were in a weakened state because the subgrade was very wet due to spring precipitation that ended just prior to the experiment. The test was conducted under these conditions to reduce the number of passes needed to reach road failure, and to quantify the maximum difference in performance between the fleets.

Sampling, measuring, and analysis. Prior to the experiment, the road soils were sampled for moisture, density, and classification. Soil strength was estimated from Dynamic Cone Penetrometer measurements. Measurements of surface rutting (measured in the inner wheel paths at established cross-sections) and surface deflection (Benkelman Beam rebound measured in the outer wheel paths at evenly spaced intervals) were taken before, during, and after cycling. Relative changes in road surface deflection during the experiment were taken as a proxy for changes in the strength of the road structure. Deflections were also gathered on the thin-membrane-surfaced sections. No analysis was possible, however, because an unknown portion of the deflection was caused by post-construction compression of the soft bituminous mat.

The soil data and pre-trial surface deflections were evaluated for bias between adjacent lanes of the test roads. Analyses were also conducted on soil-strength data, surface deflections, and rut depths to quantify and model road-damage mechanisms.

Visual record. During the experiment, a film truck drove the test roads at regular intervals to record their condition. Researchers used this visual record of road condition, calibrated by travel speed and distance markers located every 0.5 km in each lane, to quantify the length of displaced shear failures in each lane.

Tires, tire pressure, and on-board equipment

All test vehicles were provided by the Saskatchewan Wheat Pool and were equipped with Redline-Eltek tire pressure control systems, air-ride suspensions, 11R22.5 Michelin tires, and SOO Software GPS-based navigational systems. All tires on trucks that cycled the standard highway-pressure lanes were inflated to 100 psi (690 kPa), as per industry practice in Saskatchewan. The optimized cold-tire inflation pressures for trucks that cycled the reduced pressure lanes were approved by Michelin for the test speeds and loads: 80 psi (550 kPa) in the steering tires, 60 psi (414 kPa) in the drive axle tires, and 50 psi (345 kPa) in the trailer tires. Michelin researchers measured operating temperatures of the tires with an infrared camera. The magnitude and distribution of tire surface temperatures were then used to model tire stresses and evaluate the appropriateness of the tire inflation settings used during the experiment (Objective 3).

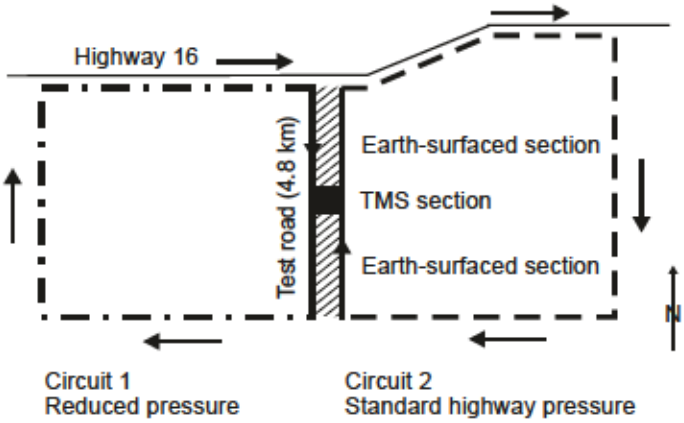


Figure 2. Map of equal axle weight trial area.

Equal Axle Load Trial

The Equal Axle Load Trial was designed to quantify the reduction in damage to typical, rural, Saskatchewan roads by trucks operating with optimized (reduced) tire pressures (Objective 1).

The Equal Axle Load Trial took place on Circuits 1 and 2 (Figure 2). This trial was conducted with one fleet of five identical 9-axle B-trains. The fleet travelled, on alternate days,

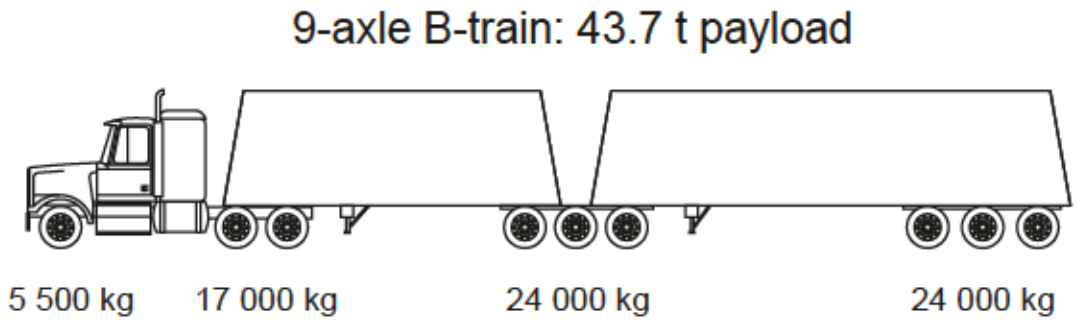


Figure 3. Nine-axle B-trains were used in the Equal Axle Load Trial.

Optimized tire pressures	
Steering	80 psi
Drive	60 psi
Trailer	50 psi

Standard highway tire pressures	
Steering	100 psi
Drive	100 psi
Trailer	100 psi

the designated "reduced-pressure lane" (Circuit 1) with tires inflated to optimized levels, and the designated "standard highway-pressure lane" (Circuit 2) with tires inflated to 100 psi (690 kPa). The trucks travelled in a convoy with speed kept uniform and under 80 km/h by the front truck (and by a designated lead driver). The trucks used in this trial are illustrated in Figure 3.

Cycling continued at a rate of 140 passes per day until the lane surface failed, at which point the lane was closed. A lane was judged failed if an extensive length of the running surface showed considerable shearing and displacement, or deep rutting. Cycling continued in the adjacent lane until its surface was comparably damaged or until its mean surface deflection (i.e., strength) reached that of the failed lane.

Fuel consumed and distance travelled were recorded at the end of each day. From these data, daily fuel-consumption rates were estimated (Objective 4).

Equal Payload Trial

The Equal Payload Trial was designed to determine whether the use of reduced tire pressures could offset the incremental damage to rural roads caused by larger capacity trucks carrying enhanced weights (Objective 2).

The Equal Payload Trial took place on Circuits 3 and 4 (Figure 4). This test was conducted with two different fleets of grain trucks: a "high-efficiency/ large-capacity" fleet of trucks (Circuit 3), and a "conventional fleet" of trucks (Circuit 4). The trucks used in this trial are illustrated in Figure 5.

The high-efficiency fleet was comprised of five 9-axle B-trains loaded to enhanced axle weights[9] and using optimized (reduced) tire pressures. The maximum enhanced gross combined weight (GCW) for the 9-axle trucks was 70.5 tonnes (corresponding to its maximum GCW for travel under permit on primary highways in Saskatchewan).

The conventional fleet was comprised of four 8-axle B-trains and three 6-axle tractor/

[9] See Footnote 6.

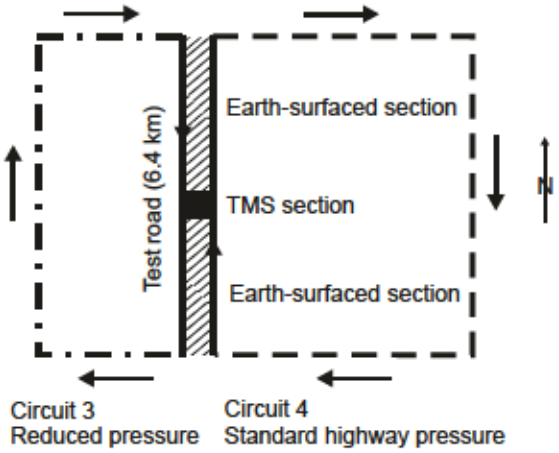
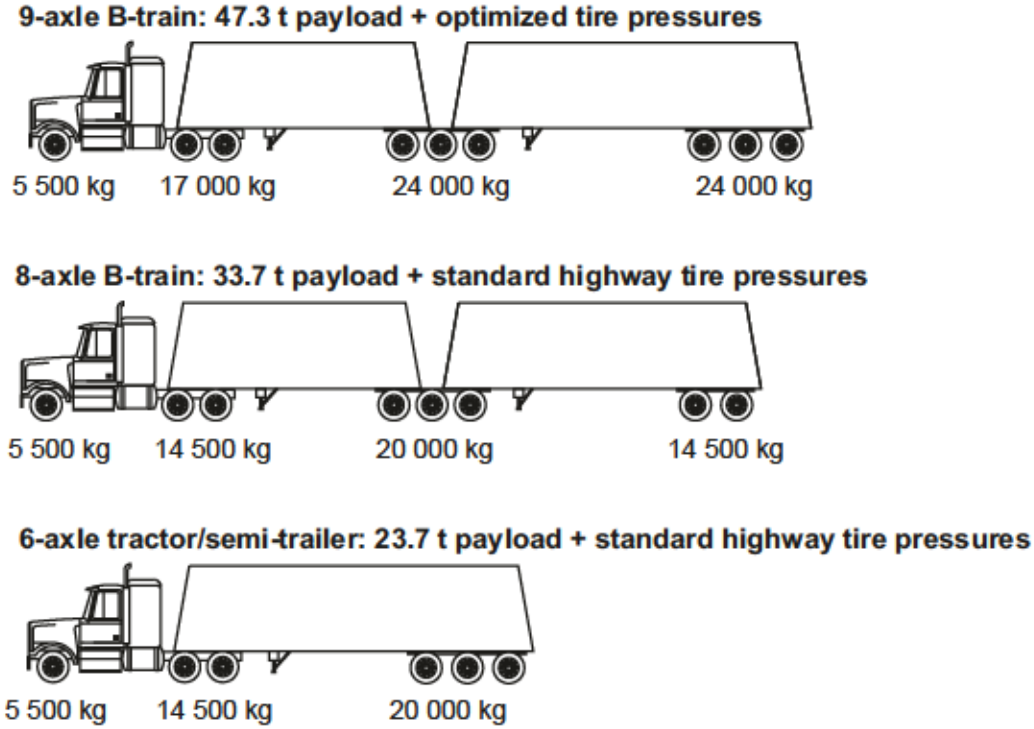


Figure 4. Map of Equal Payload Trial area.

Figure 5. Vehicles used in the Equal Payload Trial: 9-axle B-trains carried enhanced axle weights and used optimized tire pressures, and 6-axle and 8-axle trucks carried regulation axle weights and used standard highway tire pressures.



Optimized tire pressures		Standard highway tire pressures	
Steering	80 psi	Steering	100 psi
Drive	60 psi	Drive	100 psi
Trailer	50 psi	Trailer	100 psi

semi-trailers. These vehicles were loaded to maximum regulation axle weights and their tires were inflated to the standard highway tire pressure. The maximum legal GCWs for travel on secondary (rural) roads in Saskatchewan by the 8-axle and 6-axle trucks are 54.5 and 40 tonnes, respectively.

The high-efficiency fleet travelled in the designated "reduced-pressure lane", and the conventional fleet travelled in the "standard highway-pressure lane". Cycling was timed such that the fleets did not pass each other on the test section of the circuit.

The number and size of trucks were selected so each fleet had approximately the same total combined payload. The truck traffic was controlled such that the total payload carried over the lanes remained equivalent during the experiment, thereby allowing side-by-side comparisons of road damage for any given total payload. It was often necessary to stop cycling the trucks to allow for spot repairs (i.e., filling, grading, compacting) of shear failures in the road surface to prevent damage to the vehicles.[10]

Fuel consumption was not examined in this trial.

Results

Bias

Statistical comparisons were made of the pre-trial condition of each test road so that any initial differences could be accounted for when interpreting the results. These analyses found no significant difference, at a 95% confidence level, between the pre-trial mean soil strengths of each pair of lanes. Similarly, no significant difference was found between the mean surface deflections of the lanes. Nor was any bias found in a

[10] A number of "soft spots" in the conventional fleet lane were repaired soon after the start of cycling so that the test could continue until a more extensive portion of the lanes had failed.

comparison of lane geometry (EBA Engineering Consultants 2002).

Equal Axle Load Trial

By the end of this trial, 3.5 times more payload had been carried over the optimized-pressure lane (34 100 tonnes) than over the standard highway-pressure lane (9460 tonnes) (Table 1).

At 140 passes/day, the standard highway-pressure lane was closed to traffic after 200 passes because the trucks had extensively sheared the outer wheel path (Figure 6). However, the optimized-pressure lane remained passable throughout the experiment; travel likely could have continued to 800 passes or more before equivalent levels of damage resulted.

On the earth-surfaced section of the road, 50% of the lane length had surface shearing after 200 passes (Table 1). In contrast, no surface shearing in the optimized pressure lane was apparent after 200 passes, and only 5% of the lane length was sheared after 721 passes (Stamatinos and Bradley 2002).

Rut depths on the standard highway-pressure lane were twice those in the optimized-pressure lane (Reggin et al. 2002). Surface deflections were, on average, 32% more in the standard highway-pressure lane than in the optimized-pressure lane (Figure 7). That is, when the trucks used

Table 1. Length of shear failures in Equal Axle Load Trial

	Total truck passes (no.)	Total payload (tonnes)	Extent of section failed in shear: Earth-surfaced section (% of lane length)	Extent of section failed in shear: Thin-membrane-surfaced section (% of lane length)
Standard highway-pressure lane	200	9 460	50 (after 200 passes)	100 (after 70 passes)
Optimized-pressure lane	721	34 100	0 (after 200 passes) 5 (after 721 passes)	<5 (after 70 passes) 40 (after 721 passes)

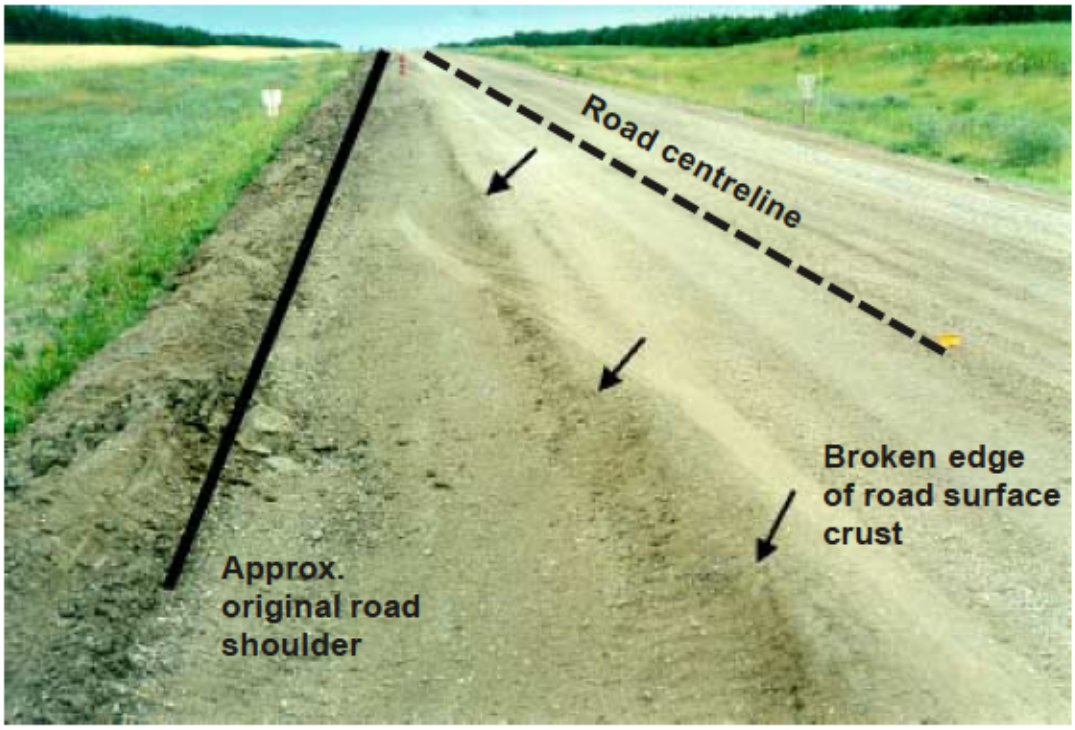


Figure 6. The test road in the Equal Axle Load Trial, after 200 passes on the standard highway-pressure lane (left lane) and 400 passes on the optimized-pressure lane (right lane). The standard highway-pressure lane was closed to traffic after 200 passes because it had extensive failures.

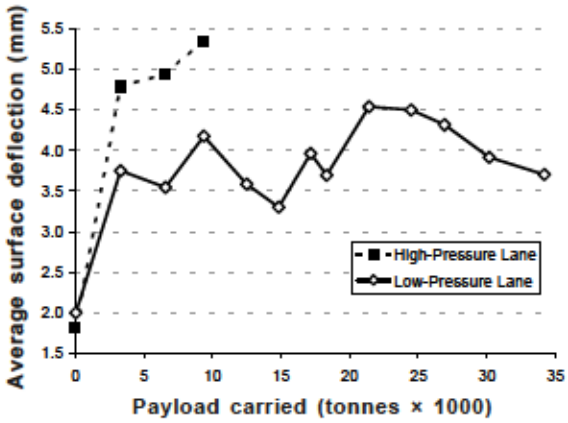


Figure 7. Average surface deflection measured on the test road in the Equal Axle Load Trial.

optimized (reduced) tire pressures they caused much less structural degradation to the roadway.

The surface deflection of the optimized-pressure lane did not consistently increase with increasing truck traffic. Instead, average surface deflection increased linearly until 3500 cumulative tonnes of payload had traversed the lane, and thereafter alternately decreased and increased. This suggests that some unidentified secondary mechanism(s) partially offset the weakening effect of truck traffic after some damage to the surface crust had taken place (EBA Engineering Consultants 2002). This effect was not observed in the standard highway-pressure lane, where failure occurred relatively rapidly.

Equal Payload Trial

The standard highway-pressure lane was closed frequently for repairs. This resulted in 32% more payload being carried over the reduced-pressure lane (17 970 tonnes) than over the standard highway-pressure lane (13 634 tonnes) (Table 2).

Overall, the high-efficiency fleet caused considerably less road damage than did the conventional fleet (Table 2). On the earth-surfaced section of the road, surface shearing was far more extensive in the standard highway-pressure lane (60% of lane length) than in the reduced-pressure lane (10% of lane length).

Unlike in the Equal Axle Load Trial, road failures in the Equal Payload Trial often extended across the entire lane and had to be patched so that cycling could continue. Had these repairs not been effected, the standard highway-pressure lane would likely have been closed after 10 000 tonnes total payload.[11] The high-efficiency fleet also caused less damage to the thin-membrane-surfaced section, although both of these lanes were 100% failed after incurring only 1000 tonnes total payload.

[11] Kelvin Shuvera, Project Manager, Engineering Services, SHT, Regina; and onsite supervisor of the 2000 trials; personal communication, August 2000.

Table 2. Length of shear failures in Equal Payload Trial

	Total truck passes (no.)	Total payload (tonnes)	Extent of section failed in shear: Earth-surfaced section (% of lane length)	Extent of section failed in shear: Thin-membrane-surfaced section (% of lane length)
Standard highway-pressure lane	478	13 634	60 (after 13 634 tonnes payload)	50 (after 1 000 tonnes payload) [a] 100 (after 5 750 tonnes payload) [b]
Optimized-pressure lane	380	17 970	10 (after 17 970 tonnes payload)	5 (after 1 000 tonnes payload) 60 (after 5 900 tonnes payload)

[a] Total payload carried in 15 passes by a 6-axle truck, plus 20 passes by an 8-axle B-train.
[b] Total payload carried in 84 passes by a 6-axle truck, plus 112 passes by an 8-axle B-train.

The thin-membrane-surfaced section was bladed and compacted to restore a smooth running surface so that testing of the earth-surfaced sections of the road could continue. Despite their heavier axle loads, the trucks in the high-efficiency fleet caused less damage to the road than did the conventional fleet. This is because fewer high-efficiency truck passes were required to carry a given payload[12] and because the impact of these trucks was lessened through the use of reduced tire pressures.

The earth-surfaced section of the reduced-pressure lane was less rutted than the corresponding section of the standard highway-pressure lane. The difference in rut depth, however, was not statistically significant (Reggin et al. 2002). Surface deflections were, on average, 11% less in the reduced-pressure lane than in the standard highway-pressure lane, with a range of +3% to -20%. That is, the high-efficiency fleet caused no more damage than the conventional fleet, despite having heavier axle loads. As with the test road in the Equal Axle Load Trial, average deflection did not consistently increase with increasing traffic. Instead, the average surface deflection of both lanes increased linearly at first and then alternately decreased and increased. This suggests that the road was subjected to some unidentified secondary mechanism(s) that partially offset the weakening effect of traffic (EBA Engineering Consultants 2002).

Tire heating

For trucks operating with reduced tire pressures, Michelin North America (Canada) measured peak surface temperatures of 44°C on the drive tires and 42°C on the trailer tires. These temperatures were hotter than with normal, highway, tire pressures but the increase was within acceptable operating limits and presented no reason for concern.[13]

Fuel consumption

The average rate of fuel consumption by the fleet of trucks in the Equal Axle Load Trial was 100 L / 100 km when travelling the standard highway-pressure lane. Consumption decreased by 9%, to 91 L / 100 km, when the fleet was on the reduced-pressure lane.

Figure 8 shows the range[14] and average difference between fuel-consumption rates at the two tire pressure modes, for each truck. Each of the trucks had a lower rate of fuel consumption when operating on the optimized tire pressure lane; this is indicated by the fact that the difference in consumption rates is always negative in Figure 8. The data reveal a trend towards decreased fuel consumption when the trucks were using optimized tire pressures on earth-surfaced roads.

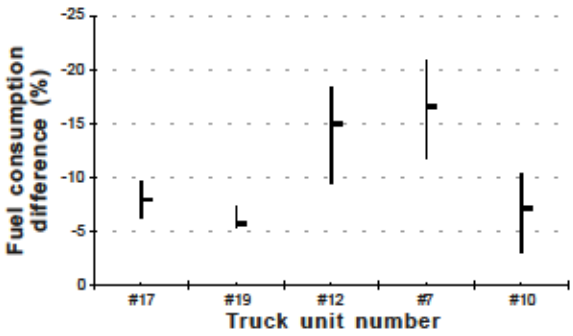


Figure 8. Reduction in fuel consumption due to optimized tire pressures: Equal Axle Load Trial. The maximum, minimum, and average reduction are shown.

Some caution should be exercised in interpreting the results, however, because the magnitude of the improvement was surprisingly large and is based on a small number of measurements. Other studies (Nevada Automotive Test Center 1987; Kreyns 1993) have concluded that operating trucks with reduced tire pressures on unpaved or soft roads can result in fuel-consumption improvements in the order of 1 to 3%. This improvement can be explained as resulting from both reduced wheel slip (i.e., better

[12] Because a truck's steering axle is generally acknowledged to cause the greatest amount of road damage, reducing the number of trucks required to transport a given payload (at regulated axle weights) will result in less road damage.

[13] François Beauchamp, Manager, Engineering Support, Michelin North America (Canada), Montreal; presentation to the Steering Committee of this experiment in Regina; February 2000.

[14] The upper value of the range was the percent difference between the fleet's maximum fuel-consumption rates, and the lower value of the range was the percent difference between the minimum fuel-consumption rates.

traction, less energy is wasted) and less rutting (i.e., less motion resistance) when the truck uses reduced tire pressures and operates on soft road surfaces. For trucks operating with optimized tire pressures on hard road surfaces, such as pavements, these studies reported no improvement in fuel consumption—likely because the gains in traction and motion resistance are minimal on hard surfaces and are cancelled out by the tires' added rolling resistance.

In this experiment, the fuel-consumption improvement at optimized tire pressures varied from 3 to 21% overall, but was more consistent for any given truck (Figure 8). This variation is not easily explained given the similarity in trucks, drivers, loads, and test conditions. Circuits 1 and 2 varied slightly in length, but 75% of their length was earth-surfaced and 25% was paved (see Figure 2). An analysis of GPS-calculated truck speeds found that the average speed around the two circuits was comparable—varying from 59 to 62 km/h—and remained stable throughout the test period.

[illegible]

In two different trials, fleets of heavy tr ucks cycled a test section of a lower-standard, rural road consisting of both an earth-surf aced section and a thin-membrane-surfaced section.

In the Equal Axle Payload Trial, for both types of surfaces, 90% less shear failure, 50% less rutting, and much less degradation of structural strength occurred when the trucks used optimized (reduced) tire pressures than when they used normal highway tire pressures. These results are applicable to other lower-standard roads in Canada; however, the magnitude of the benefits would vary with road strength and truck traffic levels.

In the Equal Payload Trial, high-capacity trucks were loaded to enhance axle weights and used optimized (reduced) tire pressures. These trucks caused less road damage and carried more total payload than conventional trucks that were loaded to regulation axle weights and using standard, highway tire pressures.

No evidence of bias was found between pre-trial measurements of lane geometry, soil strength, or soil properties. That is, the test lanes were comparable.

The tire manufacturer, Michelin, measured tire heating at the optimized tire pressures and concluded that it was within acceptable limits and presented no cause for concern.

[illegible]

The results of the Equal Axle Load Trial indicate that damage to typical rural roads can be reduced through the use of optimized (reduced) tire pressures. The results of the Equal Payload Trial indicate that rural road damage will not increase, and may decrease, with the use of truck configurations that carry greater payloads (as per loads permitted on primary highways) and use optimized tire pressures. Rural road administrators and forest companies with earth-surfaced and thinly paved mainlines may be able to reduce road maintenance costs (for repairing rutting and shearing failures) by encouraging the use of optimized tire pressures. The forest sector could work with rural road administrators to extend the hauling season (which in turn would help reduce log inventory size and improve delivered wood freshness), and reduce road-user costs through the use of optimized (reduced) tire pressures on rural roads.

The reduction in road damage due to the use of reduced tire pressures can be expected to be greatest under weak road conditions and/or with high traffic volumes (Bradley 1997). As noted by EBA Engineering Consultants (2002), however, under stronger road conditions and/or with lower traffic volumes, trucks operating with reduced tire pressures would still be expected to cause less road damage than trucks operating with higher tire pressures, but the magnitude of the benefit would be less.

Vehicles travelling on unpaved rural roads with rough and/or unbound surfaces may be able to reduce fuel consumption by optimizing tire pressures. Given that fuel is typically the second largest component of truck operating costs, even a small improvement in fuel consumption may generate significant cost reductions. Therefore, it is recommended that controlled testing be undertaken to quantify the influence of truck tire pressure on fuel consumption when trucks operate on unpaved rural roads.

On-board data loggers linked to a global positioning system and a tire pressure control system may be necessary to gain regulatory approval for carrying enhanced axle weights or for allocating road-user costs. Additionally, these data can be used for fleet management (Berthelot et al. 2001).

Tire pressure control systems are becoming common in many forestry operations in Canada and are recognized in Trucking Partnership Agreements developed by SHT. However, the benefits of variable tire pressure technology have yet to be recognized and implemented by rural municipalities, other provincial regulators, and other truck-based industries.

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