Highway Provider View of Long Combination Vehicles

March 2005

•This presentation is designed to answer several critical questions about trucks and their impact on highways. As the owner and operator of a major highway network in western Canada (>20,000 miles of highways) Alberta Infrastructure and Transportation must address the impact of trucks.

•The trucking industry does not have the information to answer the questions posed by the public and other modes. Much of the data are proprietary to Alberta Infrastructure and Transportation and thus it rests with us to respond to the many contradictory claims about trucking impacts. Furthermore, the impact of different user groups on the highway network is the responsibility of the owner of the infrastructure.

•This research was conducted by Alberta Infrastructure and Transportation to support a sustainable highway network and to assist in serving the economy better.

•Alberta Infrastructure and Transportation supports the development of a multi-modal transportation system and recognizes the need for all modes to be viable in order to support a prospering and growing economy.

•Within a multi-modal network, highways play a key role and are the glue that hold together the network: grain and containers rely on highway access to railroads as do all passengers and freight moving to and from an airport; marine terminals also rely on road connections.

Why permit larger trucks?

- Must increase hwy productivity to maximize the return on public investment ($28.2 billion in Alberta)
- Increased productivity means:
  - reduced travel costs & improved safety
  - cheaper goods & services for consumers
  - minimum public investment (less infrastructure to move same amount of goods)

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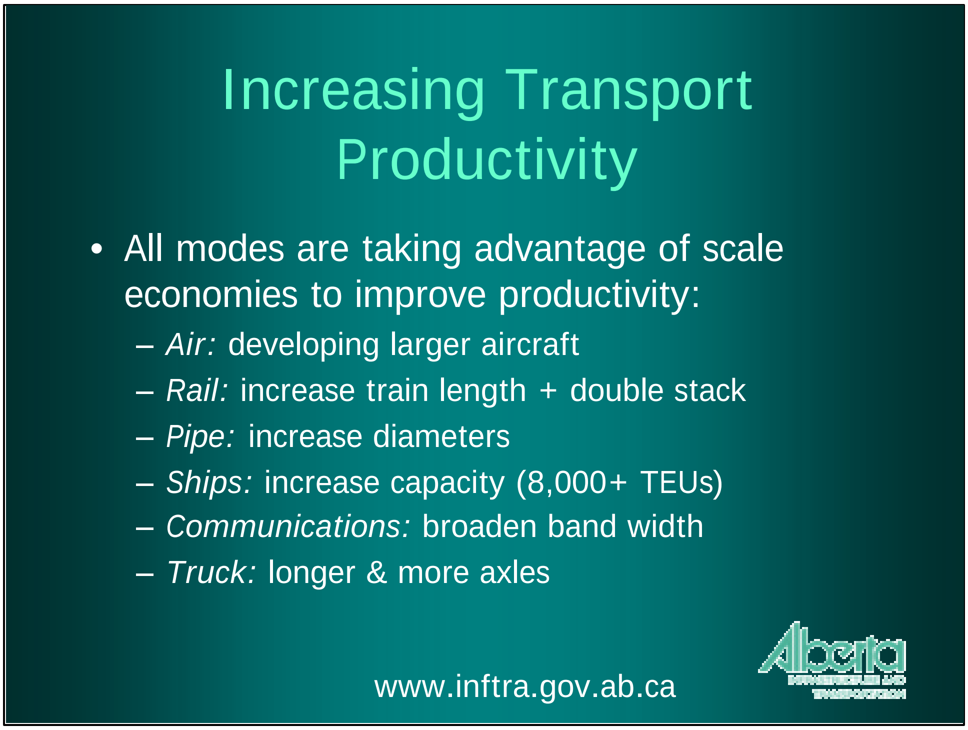
•First, it is important to understand why Alberta Infrastructure and Transportation allows LCVs or larger trucks to operate on provincial highways. These vehicles have a maximum GVW of 140,000 lbs requiring eight axles to distribute that weight. These vehicles vary in length from 82 to 125 feet. Those vehicles >125 feet in length are referred to as LCVs.

•Alberta Infrastructure and Transportation is constantly trying to maximize the use of the significant investment in the highway network made by Albertans through their fuel taxes and other charges. Although cars and passenger travel constitute the major customer group and time is critical to them, the economy relies heavily on a safe, cost-effective and uncongested intercity highway network to successfully reach markets.

•A more efficient trucking sector means cheaper goods and more jobs for the economy. The same is true for other modes.



•To understand what is going on in the trucking industry, one needs to look no further than what all other modes are doing today.

•As one can see, scale economies are the preferred way of achieving increased productivity to reduce transport costs and facilitate global trade.

Economic Efficiencies of LCVs

•Fertilizer:

Pocatello, ID – Calgary, AB

– 716 miles

105,000 lbs – 129,000 lbs: -19.6%

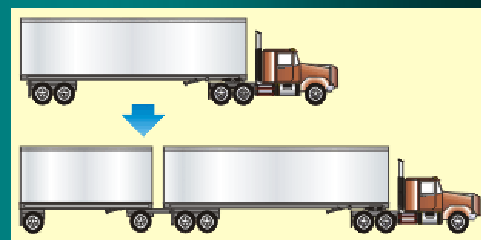
•Processed Meat:

Calgary, AB to Barstow, CA

– 1,454 miles

80,000 lbs – 129,000 lbs: -33.6%

•The longer the trip and the larger the payload gain, the greater the savings.



LCV Type	Total Logistics Savings	
	Average	Maximum
Rocky Mtn Doubles	22%	50%
Turnpike Doubles	23%	59%

Source: Middendorf and Bronzini, The Productivity Effects of Truck Size and Weight Policies, 1994

Alberta Infrastructure and Transportation

•The benefits of LCVs to shippers and consumers are lower transportation and logistics costs.

•Highway trucking costs are reduced from 20% to 33% depending on the increase in allowable gross vehicle weight.

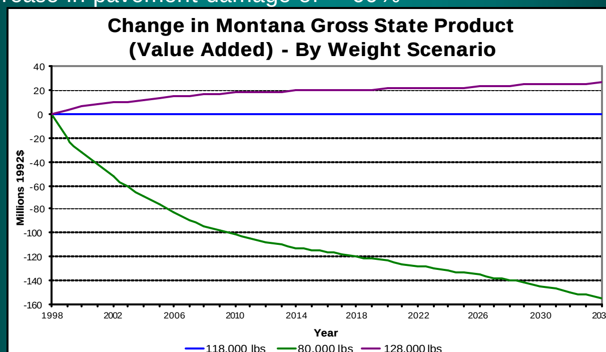
•Total logistics savings can range from an average of one quarter up to a maximum of one half of existing costs. This represents significant savings and will generate considerable benefits for the economy.

•Transport savings allow firms to reduce selling prices in existing markets, thus increasing their market share and associated sales. Additionally, firms are able to enter new markets that are further away. The result is increased plant production, new jobs and investment, i.e., economic growth.

Montana Study Findings

Currently at 118,000 lbs, but if reduced to 80,000 lbs:

- Increase in pavement damage of > 60%



▪ Freezing truck weights at 80,000 lbs or below the Interstate design standard of 129,000 lbs may restrict economic growth by up to 0.5% per annum.

- A Montana State University study demonstrates the impact of truck size and weight on the economy as a whole.
- Montana currently allows 118,000 lb trucks to operate in the State and the study assessed the impact of changing the gross vehicle weights allowed to 80,000 lbs. and to 128,000 lbs.
- If gross vehicle weights were reduced to 80,000 lbs., after 30 years the economy would be losing over $150 million. On the other hand, if the GVW was raised from 118,000 lbs. to 128,000 lbs., there would be an increase in the Gross State Product.
- The University research found that reducing truck GVW in Montana to 80,000 lbs. would have the impact of reducing economic growth or Gross State Product by up to 0.5% per annum!

- These are five of the most frequently asked questions (FAQs) that in turn address the common misconceptions that exist about trucks and in particular LCVs.
- The answers provided here are largely non-technical and in each response a case study is used to illustrate the point.

F.A.Q. #1

Don't big trucks do more damage to highways?

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•One of the most frequently asked questions concerns the damage done to highways by trucks, and the perceived notion that bigger trucks do more damage than smaller trucks.

Reduced Infrastructure Impacts

Impact of Moving 1,000,000 Tons of Freight

Truck Size (Gross Vehicle Weight)	Truck Payload Capacity	Truck ESAL's (Fully loaded)	Total ESAL Impact	Damage Index	Total Truck Trips
32,200 lb	15,435 lb	2.829	366,571	**1.00**	**129,576**
50,000 lb	23,153 lb	2.830	244,461	**0.67**	**86,382**
87,000 lb	56,007 lb	4.470	159,624	**0.44**	**35,710**
138,000 lb	94,933 lb	5.876	125,112	**0.34**	**21,292**

ESAL's - Equivalent Single Axle Loadings which is a measure of the wear and tear on a highway.

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•This chart is based on an example where a plant produces a million tons of product each year and ships it by truck to the consumer.

•The Long Combination Vehicle (LCV) fleet does two-thirds less cumulative damage to the highway compared to the smaller 2-axle truck; and the truck traffic is reduced even more - an 85% reduction.

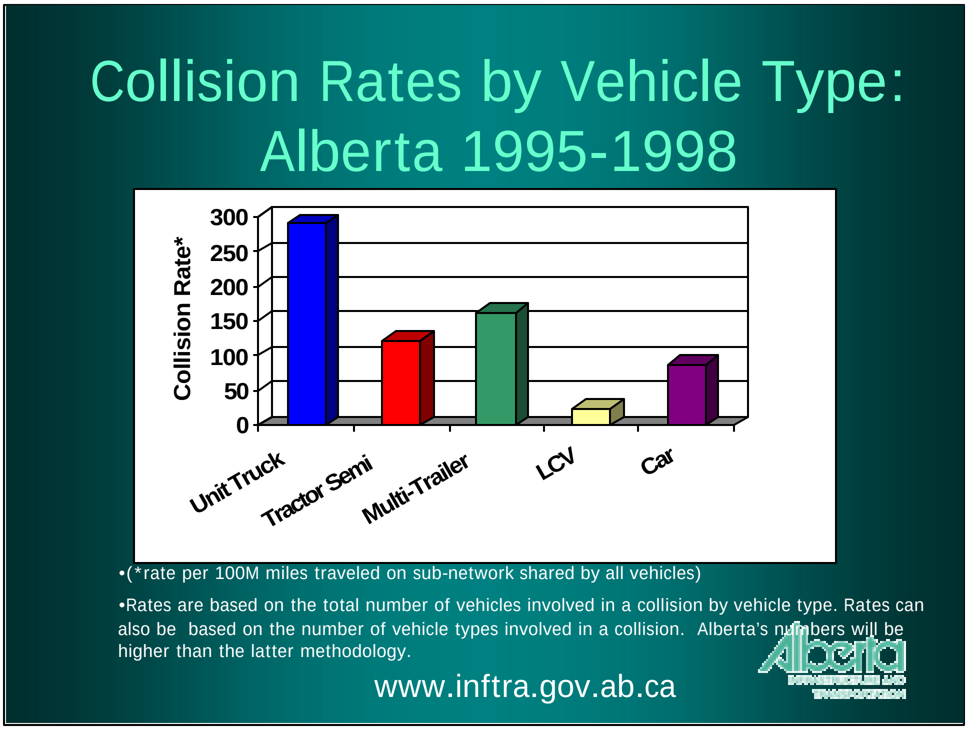
•The higher the truck gross weight, the greater the number of axles, i.e., same maximum weight per axle, but just more axles to achieve the higher gross weight.

•The potential savings that are achievable are from changing to 8-axle configurations from 5-axle ones. This shift results in an almost 25% reduction in damage to highways and a 40% reduction in truck trips!

•The collision rates for various vehicle types were established in an independent study conducted by an outside consultant using Alberta Infrastructure and Transportation data collected over a four year period from 1995 to 1998.

•The comparison is based on a subset of the provincial highway network as LCVs are not allowed to operate outside specified routes (mostly 4-lane). This is the sub-network where all vehicle types are present in the traffic mix.

•The LCV sub-network consists of roughly 1,865 miles or 10% of the total provincial highway network.



•LCVs include vehicles from 102 ft to 121 ft in length with a max. weight of 137,812 lbs. (in 2000 raised to 140,000 lbs.)

•Collision rate is calculated on the number of vehicle types involved for every 100 million miles traveled.

•The error of estimate is plus or minus 10% which is not sufficient to change the rank order of rates by vehicle type.

•LCVs were involved in only 37 crashes in 4 yrs. (2 fatal); and none of fatal & major injury crashes were found to be the fault of LCVs.

•In fact, from 1995 to 1998 there were more fatal collisions on highways involving trains than LCVs. Note: none were the fault of the train.

Alberta LCV Safety Efficiency

(1,000,000 tons trucked 1,000 miles)

	# of Trips	Collision Rate (/100 M miles)	Potential Collisions	Collision Index
Straight Truck (3 axle)	**86,382**	**290.0**	**250.5**	**1.0**
Semi Trailer (5 axle)	**35,710**	**122.2**	**43.6**	**0.17**
LCV (8 axle)	**21,292**	**25.4**	**5.4**	**0.02**

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- This chart is based on a plant producing 1 million tons of product each year and shipped to a customer located 1,000 mile round trip from the plant.
- The use of larger trucks with bigger payloads provides a double or compound safety efficiency:
    - fewer trips or less exposure to traffic, plus
    - lower collision rates for larger trucks.
- The result is a 98% reduction in potential collisions using LCVs rather than straight or unit trucks (3-axle).
- Using LCVs rather than semi-trailers results in an almost 90% reduction in potential collisions.

F.A.Q. #3

Do big trucks pay their way?

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•This is a critical question and it is a complex one. Roads are built largely to accommodate cars as they make up over 85% on average of the total traffic and an even higher percentage during peak demand hours.

•A thumbnail sketch of highway cost allocation:

- •Construct highways to accommodate cars
- •Strengthen for trucks, and
- •Worn out largely by weather in Alberta.

•The US undertook a major study in the late 90's to assess the relative cost and revenue contributions of cars versus commercial traffic including trucks.

US Cost-Allocation Findings
(2000)

- US trucks are allocated 40% of all highway costs, same as Alberta estimate
- FHWA cost allocation study reveals that trucks cover 100% of their costs at the federal (0.9) and state (1.1) levels
- Single unit truck ratio is 1.1 vs. 0.9 for larger combination trucks

Table ES-5. Ratios of 2000 User Fee Payments to Allocated Costs for All Levels of Government

Vehicle Class	Federal	State	Federal and State	Local	All Levels of Government
Autos	0.9	1.0	1.0	0.1	0.7
Pickups and Vans	1.2	1.2	1.2	0.1	0.9
Buses	0.1	0.8	0.5	0.0	0.4
All Passenger Vehicles	1.0	1.0	1.0	0.1	0.8
Single Unit Trucks					
≤ 25,000 pounds	1.4	2.2	1.9	0.1	1.5
25,001 - 50,000 pounds	0.6	1.0	0.8	0.0	0.6
> 50,001 pounds	0.5	0.5	0.5	0.0	0.4
All Single Unit Trucks	0.8	1.2	1.0	0.1	0.8
Combination Trucks					
≤ 50,000 pounds	1.4	1.7	1.6	0.1	1.3
50,001 - 70,000 pounds	1.0	1.3	1.1	0.1	0.9
70,001 - 75,000 pounds	0.9	1.1	1.0	0.1	0.8
75,001 - 80,000 pounds	0.9	0.9	0.9	0.1	0.8
> 80,000 pounds	0.6	1.0	0.9	0.0	0.7
All Combinations	0.9	1.0	0.9	0.1	0.8
All Trucks	0.9	1.1	1.0	0.1	0.8

NOTE: These ratios are based on total revenues and expenditures nationwide. Ratios for individual States and local governments are expected to vary from these ratios. Federal ratios include obligations not financed from the HTF, and thus vary from equity ratios presented in other tables

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•The US findings allocate 40% of costs to trucks.

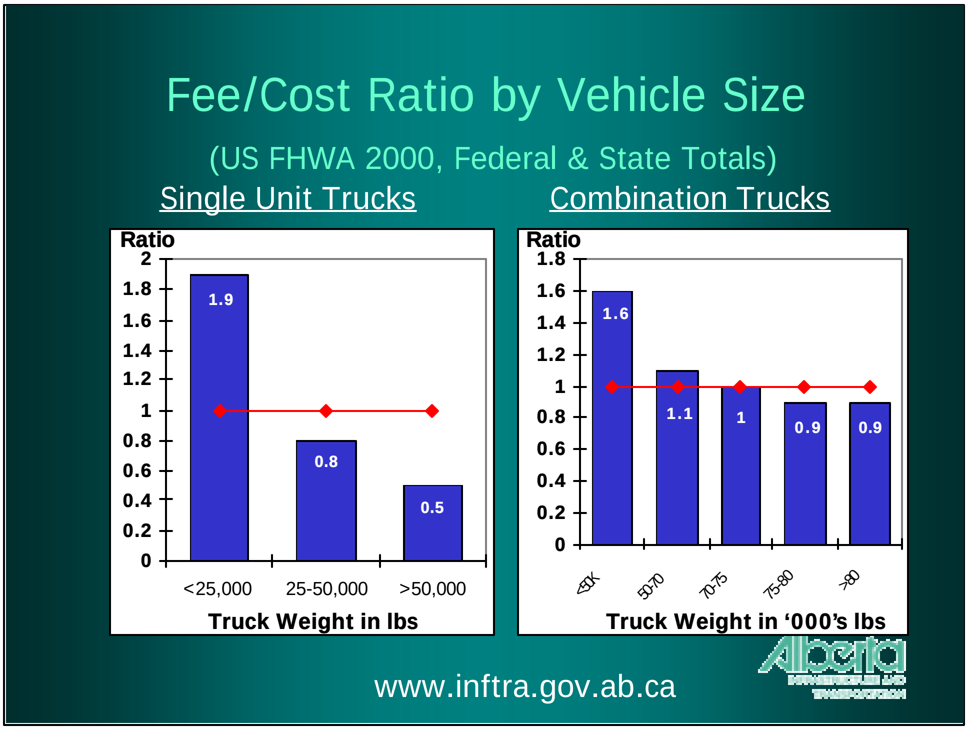
•At the state and federal levels, trucks cover their costs!

•The ratio often cited is 0.6 for trucks >80,000 lbs at the federal level which does not include the revenues paid directly to the states (registrations, licensing, fuel, weight-distance taxes, etc.).

•Local government ratios are all low, as the revenues do not include property taxes & other revenue sources available to municipalities for infrastructure.

•Given that all trucks cover their costs, the question is:

- •Are charges fair by truck size?



•This chart illustrates the revenue/cost ratios by gross vehicle weight for trucks in the US.

•On average in the US, larger trucks, whether straight or tractor configuration, contribute less than their assigned costs; but, overall, contributing the total share assigned to all trucks.

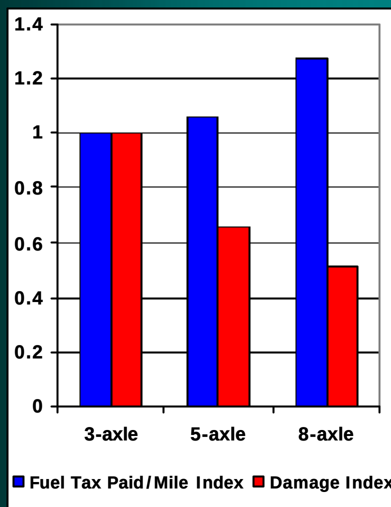
•The biggest ratio differential by weight is for the smaller straight trucks.

•The costs do not include the benefits of larger vehicles, i.e., the net cost/benefit. Subsequently, factors such as reduced truck volumes/trips are not taken into account. Reduced trips free up highway capacity and consequently reduce costs.

•Is this a fair allocation of costs?

    •With smaller trucks paying more than their "allocated" share and larger trucks paying less?

The Large Truck Paradox



The larger the truck, the greater the amount of fuel tax paid per mile

The larger the truck, the lower the cumulative damage/cost

For an 8-axle truck, the fuel tax is 27.2% more than a 3-axle BUT 48.8% less damage/cost

A large truck also pays higher fixed charges for registrations & licensing

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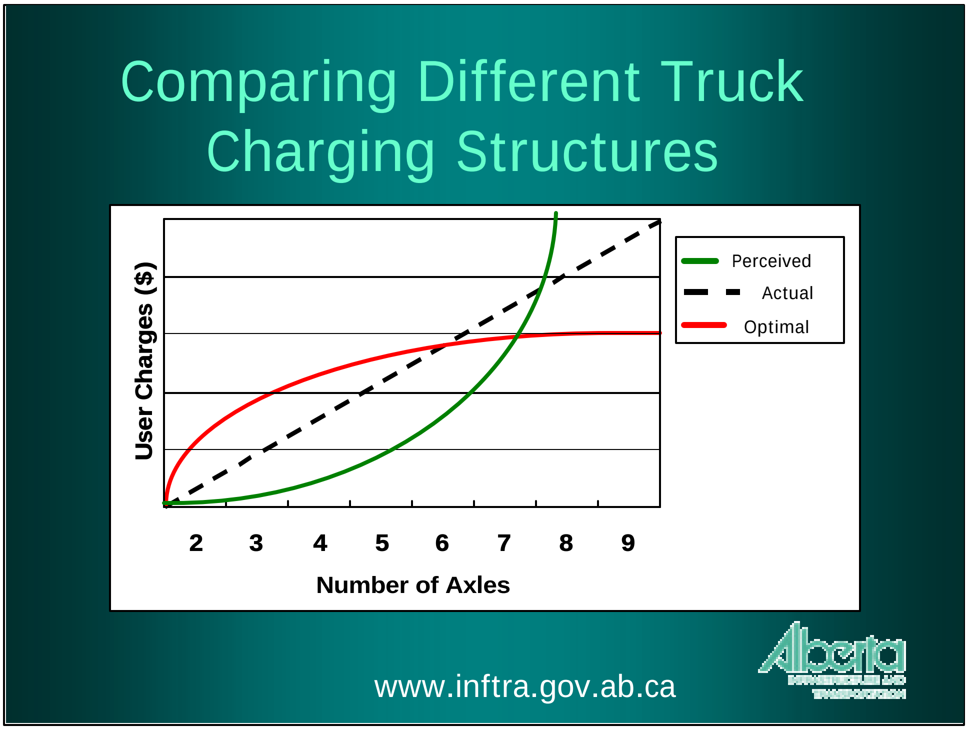


•Some people argue for the green or lower curve, as they believe that bigger trucks do more damage, but this is definitely not the case.

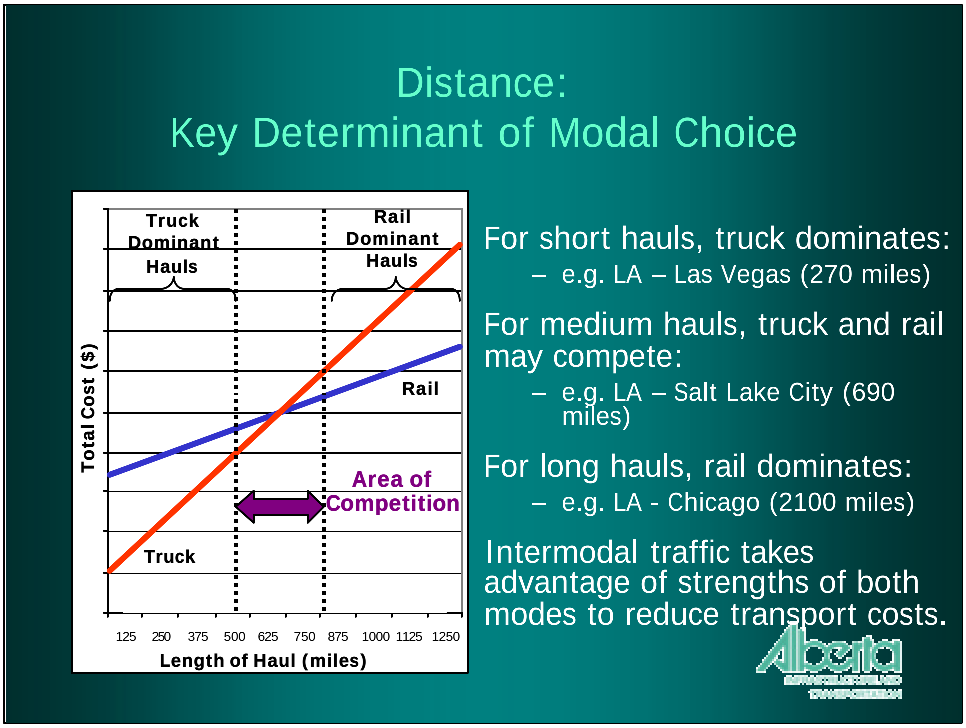
•The actual charge approximates a straight line with fuel taxes per mile rising with truck size/payload through added axles.

•The optimal charge regime would look like the red or top line, that increases at a decreasing rate & recognizes:

- •reduced cumulative damage to highway
- •reduced capacity requirements
- •shift to off-peak times & improved safety.

•Comparing optimal to actual, the cost recovery ratios would look like those derived in the US, with higher contributions than expected assigned to smaller trucks.

- This is a common question, but there is no definitive answer.
- The following points are designed to illustrate the relationship of truck and rail as freight carriers in western Canada which may or may not be reflected elsewhere.
- Alberta Infrastructure and Transportation is aware that any diversion of truck traffic to rail would have some positive impacts for highways; however, the rapid growth in highway traffic means that the benefits would be short-lived.



•The key factor, but not the only one, in determining which mode a shipper/consumer selects is the total cost of transport; and cost is directly related to distance. Trucking is generally cheaper for short hauls of less than 500 miles, but more costly than rail for longer distances over 800 miles. Rail has higher fixed costs but lower variable or operating costs per unit weight than trucking. After a given distance, the higher variable costs of operating a truck result in higher transportation costs. Overall, rail is more cost efficient for longer hauls as its fixed costs are spread over a greater shipping distance. As a result, there is very little competition between truck and rail for either short hauls where truck is predominant or long hauls where rail dominates.

•Truck and rail are cost competitive, however, on hauls between the 500 to 800 miles. Over this distance truck and rail compete for freight on factors such as service levels and not cost. In Canada, the Calgary-Vancouver corridor falls within this competitive zone: 605 miles by road and 640 miles by rail. An assessment of this corridor should provide some insight as to the degree of competition between rail and truck. This case study will also allow the assessment of the combined impact of all factors on transport decision-making, including cost/distance, levels of service, time sensitivity, etc.

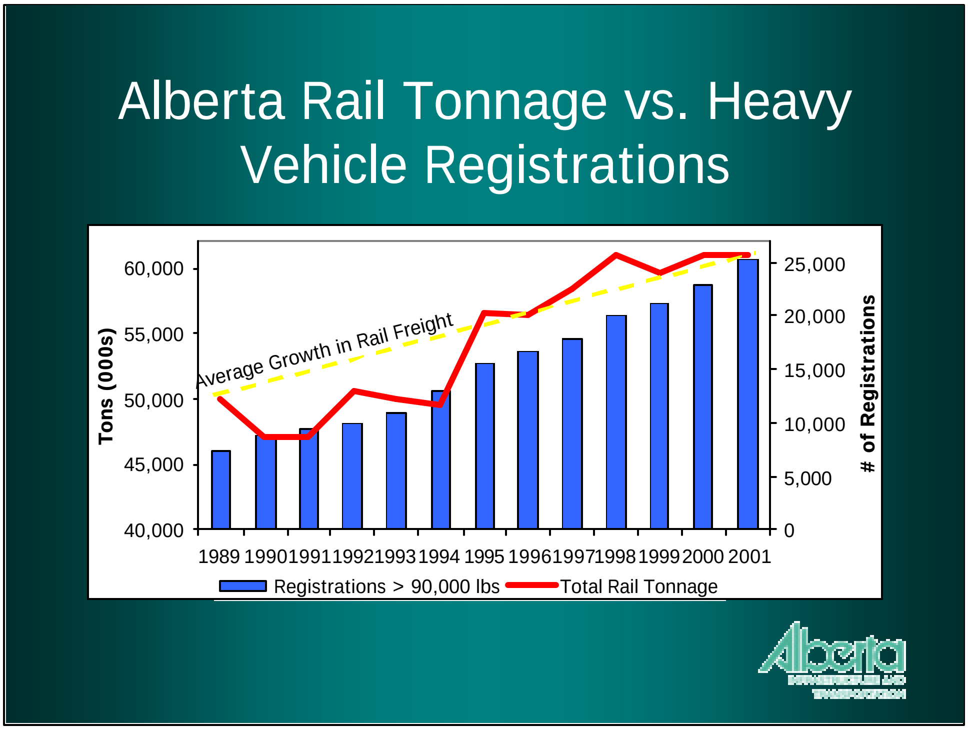
Calgary - Vancouver Corridor
(620 miles)

	1990		1997		Annual
	Ton/Miles (000's)	Percentage	Ton/Miles (000's)	Percentage	Growth Rate (%)
Air	20.4	0.9%	26.4	0.7	+3.8
Water	-	-	-	-	-
Rail	1,311.4	57.5	2,054.1	55.1	+6.6
Road	948.1	41.6	1,649.3	44.2	+8.2
Total	**2,279.9**	**99.1**	**3,729.8**	**100.0**	**+7.3**

(Source: Transport Canada)

Based on Transport Canada study, just over 10% of truck volumes are shiftable to rail, but only with incentives as shippers require the higher service levels of trucks.

- The analysis was based on corridor trade over 7 years from 1990 to 1997.
- All modes show an increase in ton/miles, with rail's output growing 6.6% and road 8.2%. The result is that the road share of the total traffic increased from 41.6 to 44.2%, and rail dropped from 57.5 to 55.1%.
- The researchers determined that just over 10% of the freight was divertible from road to rail, and only if incentives were in place.
- Thus, the maximum amount of freight that would be contestable is 10%, whereas 90% is mode specific and not up for competition.
- To say that rail & truck compete based on just 10% is a stretch.



•Since 1989 large truck (GVW >90,000 lbs.) registrations have continued to increase as shown. At the same time, rail tonnage carried to and from Alberta has increased. During the same period both modes have demonstrated growth in the amount of freight carried.

•As was the case with the Calgary-Vancouver Corridor, it is apparent that growth in trucking is increasing at a faster rate than rail.

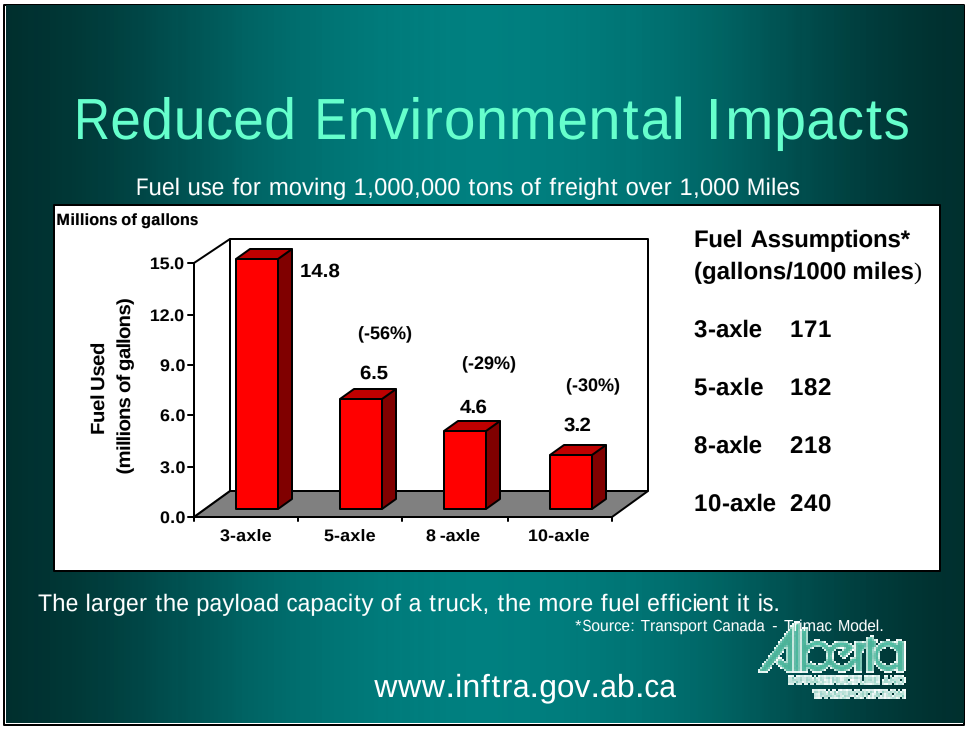
•This joint rail and truck growth is partly in response to the dramatic increase in intermodal traffic such as containers. Container traffic on rail has increased substantially over the last decade. All of these containers are moved to/from rail terminals by truck, thus growth in one mode is matched by growth in the other. The same is true for grain traffic from the farm that starts its journey in a truck to the elevator and is transshipped to rail.

•This chart clearly demonstrates that truck and rail thrive together and are far more complementary than competitive.

•Many questioners are concerned that commercial traffic generates too much CO_2 and air pollution. In a large part this perception is based on the visibility of diesel combustion versus gasoline.

•As a highway provider, Alberta Infrastructure and Transportation’s only concern is whether the design of highways and regulations result in more or less vehicle emissions within the highway mode.

•Vehicle emissions are directly related to fuel consumption and fuel is a large part of trucking costs. Thus, trucking has a vested interest in reducing costs through reduced fuel consumption and subsequently reduced vehicle emissions.



- This chart is based on the example of a factory producing 1 million tons in a year and located 1,000 miles round trip from its customer.
- The fuel consumption assumptions are shown: the larger the truck, the higher the fuel consumption per mile traveled.
- However, the greater efficiencies of the larger truck results in less fuel being consumed and fewer emissions being generated to move a fixed amount of freight.
- This is not to say that trucks are as fuel efficient as rail (nor rail as water); but if road providers want to reduce the fuel consumed within the mode, larger trucks would provide significant reductions in emissions, over 25% reduction using LCVs rather than semi-trailers.

Idling and Waiting

Idling time and fuel consumption when moving 1,000,000 tons of freight

	Number of trips	Idling Fuel Consumption (gallons/hour)	Fuel Consumed (1000 gallons)	Index	Total CO_2 Produced (tons) **	Total N_2O Produced (pounds) **
3 axle	86,382	0.9	77.8	**1.000**	886	260
5 axle	35,710	1.0	35.8	**0.460**	408	120
8 axle	21,292	1.2	24.4	**0.31**	278	82

*Based on an average of 1 hour idling time per vehicle trip (borders, vehicle inspections, traffic congestion, etc.)

**Source: Environment Canada. "Trends in Canada's Greenhouse Gas Emissions 1990-1995".

- At border crossings, vehicle inspection stations or stuck in traffic, idling truck engines consume fuel. This example of moving 1 million tons is applicable to any of these situations. It is based on idling 1 hour on each trip required.
- The larger the truck, more fuel is consumed while idling.
- Because fewer trips are required by larger trucks to deliver the 1 million tons of freight, the larger truck burns less fuel in idling/waiting.
- For every shift in trucks from 5-axle to 8-axle or LCV, there would be just under 50% saving in fuel consumed while idling/waiting. This results in significant reductions in CO2 and N2O pumped into the atmosphere.

•The use of larger trucks and their scale economies generate significant productivity gains for highway providers as well as the users of the road network. More importantly, the public will get more from their investment.

•The trucking industry, shippers and indeed, the entire economy are the beneficiaries of lower transportation/logistics costs generated by scale economies.

- LCVs are already operating on a small part of the CANAMEX Corridor.
- Local cooperation has succeeded in allowing the deployment of LCVs to assist their respective economies and facilitate trade.

•Montana and Alberta have signed the Shelby Agreement which covers about 40 miles of Interstate highway and about 400 miles of Alberta provincial highways.

•Non-conforming trucks from either jurisdiction are able to travel on specified routes based on a permit system.

•Montana A-trains can travel as far north as Edmonton, Alberta while Alberta B-trains at 140,000 lbs can travel on Interstate 15 to Shelby, Montana and the BN/SF rail terminal.

US-Canada Cooperation

- Montana & Alberta have already begun to harmonize on part of CANAMEX Corridor:
  - annual permitting
  - joint vehicle inspection station
  - allow each other's truck weights & dimensions
- Proven to be beneficial to both sides of the border and both rail & road
- Alberta is working on an agreement with Alaska to increase vehicle weights and dimensions

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•It is possible for individual jurisdictions, like Montana and Alberta, to work together bilaterally to reduce barriers to trade.

•Alberta is also working with Alaska on highway and rail connections to Canada and the lower 48 states. The highway initiative involves harmonizing weights and dimensions and it is hoped that some compromise can be achieved where both Alaska and Alberta benefit as well as the Yukon Territory and the Province of British Columbia.

•Bridges are the critical links in any highway system and are the key determinants of regulations governing truck weights and dimensions.

•The bridge data used in this research were provided by the Federal Highway Administration and are based on 1999/2000 information. The FHWA provided valuable assistance in the interpretation of the data, however, responsibility for the analysis is the authors'.

Introduction:

- Another concern has been raised regarding potential bridge costs associated with higher gross vehicle weights.
- FHWA reports that 28% of US bridges are in "deficient" condition.
- Bridge design loads and conditions need to be identified to establish a solid understanding of the impact for CANAMEX.

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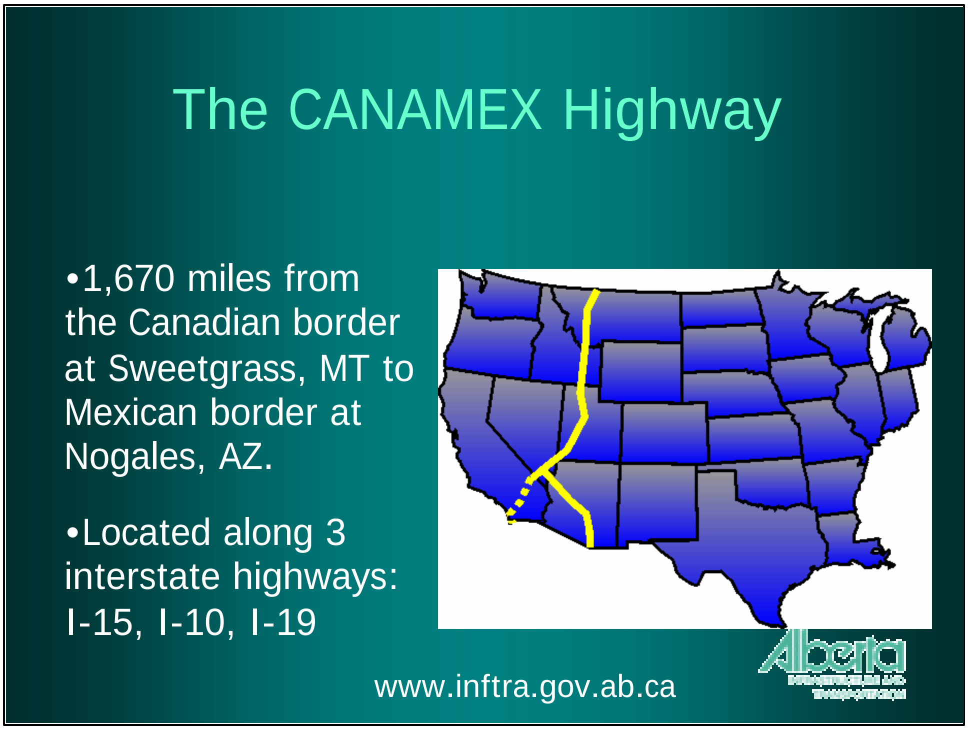
•This research is being undertaken in light of a background that a significant portion of the bridges on the US Interstate system are in a "deficient" condition. A recent AASHTO bulletin (July 11, 2003 - ASSHTO Journal) suggests that 28% of bridges nationally are deficient and the cost of fixing or replacing them is $36.5 billion.

•To determine the design capability of the CANAMEX Trade Corridor to accommodate a proposed standard of 129,000 lbs, this research undertook to examine the design loads of existing bridges and their current condition.

•The results, besides providing an indication of the capability of the route to accommodate heavier trucks, will provide the background for assessing the potential financial impact of a pilot study permitting higher GVWs.

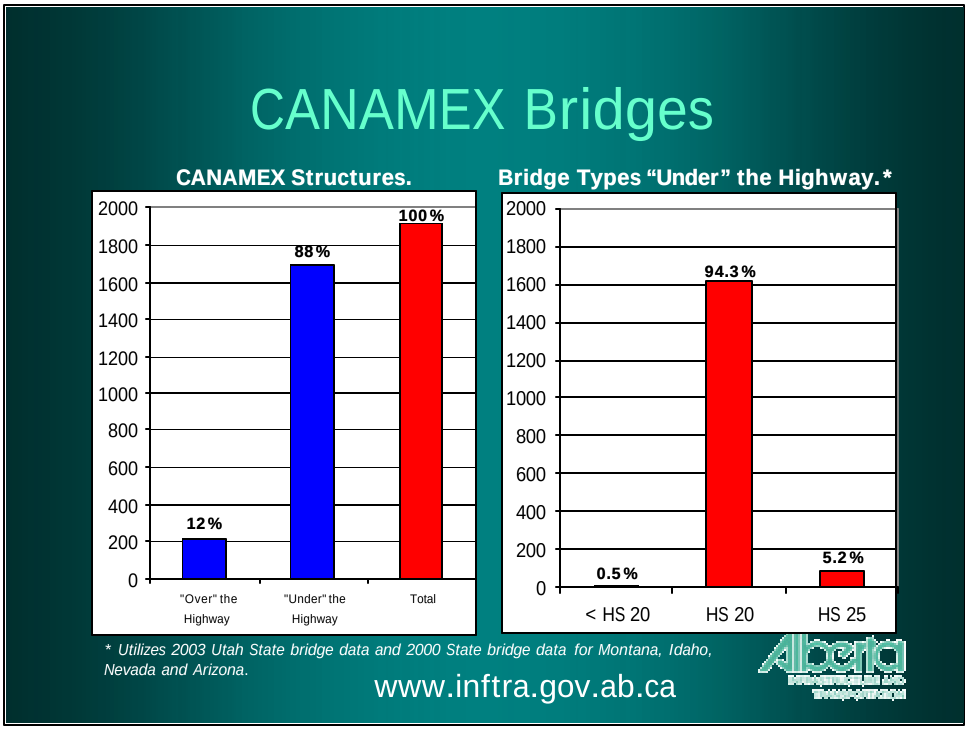


The CANAMEX Trade Corridor extends almost 4,000 miles, linking the 3 countries of CANada, AMerica and MEXico, from Anchorage, Alaska to Mexico City, D.F.

The US portion of the route is 1,670 miles long and runs along I-15 from the Canadian border at Sweetgrass, Montana, through Idaho, Utah, Nevada and Arizona where it follows I-10 and I-19 to Nogales, Arizona on the Mexican border.

The bridges described in this study are located along the CANAMEX Trade Corridor. Although bridge ratings were not provided for all bridges in the database, it is expected from a statistical sense that the available bridge data will provide a reasonably accurate picture of the condition of the bridges along the Corridor.

Most of the bridges rated “Not Applicable” were in Arizona, while the remaining CANAMEX states had very few bridges that were rated “Not Applicable”.



There are around 1,900 bridges along the CANAMEX Trade Corridor:

•12% of these bridges are "over" the highway and do not play a role in determining the weight and size of trucks;

•88%, or just under 1,700 bridges, are "under" CANAMEX and are determinants of truck weights and dimensions.

Of those bridges "under" CANAMEX:

•99.5% are HS20 or stronger, and

•only 0.5% are smaller than HS20.

For HS20 or stronger bridges:

•based on Bridge Formula B, which determines maximum GVWs, these bridges can all support a maximum GVW of 129,000 lbs;

•129,000 lbs. is the proposed maximum GVW for the CANAMEX pilot project.

•the other bridges, roughly 1/2 of 1%, may or may not be capable of supporting 129,000 lbs. (and may be scheduled to be replaced).

Bridge Conditions by State:

State	Total State Bridges	CANAMEX Routes Examined	Bridges"Under" the Highway	Bridges in "Fair" or better Condition	Bridges in "Poor", "Serious" and "Failed" Condition
Montana	5,972	I - 15	240	100%	0%
Idaho	4,435	I - 15	118	100%	0%
Utah	3,634	I - 15	418*	>99% *	<1% *
Nevada	1,500	I - 15	151	100%	0%
Arizona	6,945	I -15 I -10 I -19	790	>99%	<1%
Total	**22,486**		**1,717**	**99.3%**	**0.7%**

* Based on 2003 Utah State bridge data.

** Based on bridges with ratings other than "Not Applicable".

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The state-by-state assessment of the condition of bridges reveals that:

•3 of 5 states, Montana, Idaho & Nevada, have no bridges in "poor" or worse condition; and

•Utah and Arizona have 1% or less of their bridges in "poor" or worse condition.

•99.3% are rated "fair" or better; and

•only 0.7% are in "poor" or worse condition and this amount is within the "normal" limits of 2%. (far better than the national average).

The study results for CANAMEX bridges reveal that:

•99.5% of bridges are HS20 or stronger; and using Bridge Formula B can accommodate 129,000 lbs. GVW; and

•the bridges are in relatively good condition and less than 1% are in "poor" or worse condition.

These results suggest that the potential cost to rehabilitate, strengthen or replace deficient bridges would be relatively small or within regular annual budgets.

In conclusion, raising GVWs of trucks to 129,000 lbs for a pilot project along the CANAMEX Corridor should not present a significant additional cost for the states involved. That is, the costs should be within the "normal" expenditures for bridge maintenance and reconstruction.

Thank you for your attention.

If you need any further information, please feel free to contact me at:

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or

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