

Ishan Joshi – ASU – Review of annual transportation operation and capital budgets

- How much does it cost Canada in total for both your highway network and aviation networks? Do user fees come close to covering these costs? (unlikely) What does this public subsidy of highways and airports cost in total and per Canadian?

Year	Highway Network (in Billions)	Aviation Network (in Billions)
2020	\$31.03	\$1.12 (airports)
2021	\$33.50	\$1.12 (airports) + \$1.3 (COVID relief)
2022	\$34.50	\$1.26 (airports) + \$3.3 (Loans)
2023	\$34.80	\$1.50 (investments)

Year	Total Costs (Billion \$)	User Fees (Billion \$)	Coverage by User Fees (%)
<b>Highways</b>			
2020	\$31.03	\$18.3 - \$19.3	~60%
2021	\$33.50	\$18.3 - \$19.3	~55%
2022	\$34.50	\$18.3 - \$19.3	~53%
2023	\$34.80	\$18.3 - \$19.3	~53%
<b>Aviation</b>			
2020	\$1.12 (airports)	\$2.5	~55%
2021	\$4.42 (airports + loans)	\$2.5	~56%
2022	\$1.50 (airports)	\$2.5	~60%
2023	\$1.50 (airports)	\$2.5	~60%

Year	Highways Public Subsidy (Billion \$)	Aviation Public Subsidy (Billion \$)	Total Public Subsidy (Billion \$)	Population (Million)	Public Subsidy per Canadian (\$)
<b>2020</b>	\$14.0 - \$15.0	\$1.92	\$15.92 - \$16.92	38.01	\$419 - \$445
<b>2021</b>	\$14.2 - \$15.2	\$1.92	\$16.12 - \$17.12	38.13	\$423 - \$449
<b>2022</b>	\$14.2 - \$15.2	\$1.92	\$16.12 - \$17.12	38.5	\$419 - \$445
<b>2023</b>	\$14.2 - \$15.2	\$1.92	\$16.12 - \$17.12	39.0	\$413 - \$439

- How much carbon tonnage per user do highways, airplanes, [diesel electric] passenger rail generate?

Year	Highways (g CO2 per km)	Airplanes (g CO2 per km)	Diesel-Electric Rail (g CO2 per km)
2020	~ 180 - 250	~ 150 - 250 (domestic)	~ 40 - 178 (intercity)
2021	~ 180 - 250	~ 150 - 250	~ 40 - 100
2022	~ 180 - 250	~ 110 - 250 (domestic/long-haul)	~ 40 - 100
2023	~ 180 - 250	~ 110 - 250	~ 40 - 100

- How much damage to a roadway does a semi-truck cause compared to a single passenger vehicle? What added costs does this mean for maintenance?

In Canada, a standard passenger vehicle creates ten times less damage to the road surface than a semi-truck. Studies show that damage from a fully loaded semi-truck (around 80,000 pounds) can equal the damage from thousands of passenger vehicles. This is because of the Fourth Power Law, which says that weight has an exponentially greater impact on road damage. For instance, compared to a single automobile, a semi-truck may damage roads up to 160,000 times greater than a passenger vehicle.

Impact on Maintenance Costs: The additional harm that big trucks inflict results in noticeably higher highway maintenance expenses. Even while passenger cars usually add to pavement deterioration, trucks large loads quicken the process, necessitating more frequent repairs and resurfacing work. Heavy truck use in Canada raises the need for pavement restoration, adding to the expenses of infrastructure that are not entirely paid by trucking or user fees.

- How much wear and tear (and costs) from highways could be saved if Canada invested in shifting more traffic to railways? How much would the carbon savings be?

Category	Current Impact	Poten8al Savings with ShiR to Rail
<b>Highway Maintenance Costs</b>	Heavy trucks cause thousands of times more road damage compared to passenger vehicles.	Significant reduction in road maintenance costs as rail takes over more freight movement.
<b>Carbon Emissions (Trucks)</b>	Freight trucks account for a large por1on of transporta1on-related CO2 emissions.	Shifting 10% of freight from trucks to rail would save about <b>4 megatons of CO2 annually</b> .
<b>Rail Efficiency</b>	Rail moves 70% of Canada's intercity freight while producing less than 4% of transport emissions.	Rail is <b>3-4 times more fuel-efficient than trucks</b> , reducing fuel consump1on and emissions.
<b>Trucks Removed from Roads</b>	N/A	One freight train can replace up to <b>300 trucks</b> , reducing road conges1on and wear.

Increased rail transporta1on would help Canada reach its climate targets and ensure long-term infrastructure sustainability by reducing carbon emissions and saving a large amount of money on highway maintenance.

What is the fuel efficiency of semi trucking, diesel electric railroads, or airplanes per ton?

Semi-trucks: Generally speaking, semi-trucks get between 134 and 145 ton-miles per gallon of diesel fuel. This indicates that they can go 134 to 145 miles in one ton of freight for every gallon of fuel.

Diesel-Electric Railroads: When it comes to fuel efficiency, freight trains outperform trucks. One ton of goods may be transported by diesel-electric freight trains for between 470 and 500 miles per gallon of fuel. This results in a 3–4 times greater fuel efficiency compared to semi vehicles.

Airplanes: Out of all the three modalities, air freight uses the least amount of fuel. Aircraft use far less fuel per ton of freight than other modes of transporta1on, with an average fuel efficiency of between 30 and 50 ton-miles per gallon.

Mode of Transporta8on	Fuel Efficiency (Ton-miles per gallon)
<b>Semi-Trucks</b>	134 - 145
<b>Diesel-Electric Railroads</b>	470 - 500
<b>Airplanes</b>	30 - 50

- How much on average does a Canadian family spend on automobile costs? How does this compare province to province?

Region	Total Annual Automobile Cost (Approx \$)	Insurance (Monthly \$)	Fuel (Monthly \$)	Maintenance (Monthly \$)	Total Cost of Living (Annual \$)
Canada (Average)	~ \$9,500	~ \$111	~\$200	~ \$79	N/A
Ontario	~ \$10,500+	~ \$150	~\$200	~ \$79	~ \$71,876
Quebec	~ \$8,500	~ \$55	~\$200	~ \$79	~ \$58,208
Manitoba	~ \$9,500	~ \$110	~\$200	~ \$79	~ \$65,288
Nova Scotia	~ \$9,500	~ \$90	~\$200	~ \$79	~ \$59,763
Alberta (Average)	~ \$9,500	~ \$132	~\$200	~ \$79	N/A
Calgary	~ \$10,000+	~ \$1512 to \$2,180	~\$200	~ \$79	N/A

- How much lost productivity is there by inclement weather that shuts down roadways or airports?

Weather-related closures of airports and roads can have a major effect on the economy and productivity. Snowstorms, ice, flooding, and other weather-related disruptions are common in Canada and can result in road closures and delays at airports. Reduced retail sales, interrupted supply chains, and wasted work hours are the outcomes of these occurrences.

Lost Productivity: According to one research, North American impacted regions lose between \$1.4 billion and \$2.6 billion in pay each year as a result of snow-related shutdowns. Hourly workers are primarily impacted by these losses since they are unable to work during transit route closures.

Commercial Shipping and Supply Chain: Each year, delays brought on by bad weather cost the trucking sector some 32.6 billion vehicle hours. Trucking businesses may lose between \$2.2 billion and \$3.5 billion a year as a result of these delays.

Airports: There may be significant costs if an airport is forced to close due to bad weather. For instance, hundreds of flights may be delayed or cancelled at major Canadian airports due to severe weather-related delays, which has a knock-on effects on output across several industries.

Impact on Businesses: According to a poll of Canadian companies, 56% of participants said that extreme weather events have caused them to lose money. Furthermore, around 50% of

companies had immediate operational interruptions, which had a major impact on worker productivity and supply chains.

- Emphasize relationship with and respect to First Nations, bring in statistics of what added transportation costs, or amount of non-drivers First Nations may have compared to the broader Canadian populations.

Major transportation issues are a source of social and economic losses for First Nations communities in Canada. One major problem is the high cost of transportation, which, especially in rural areas, raises the cost of necessities like food, shelter, and medical care. Furthermore, the dearth of public transportation choices forces many First Nations people to rely on pricey private automobiles, which exacerbates mobility obstacles even further. As a result, there are more barriers to employment, healthcare, and education, which widens the economic divide with the rest of Canada.

Furthermore, data show that First Nations people have three times higher rates of traffic fatalities than non-Indigenous groups, making them more prone to confront transportation-related difficulties. These towns are frequently isolated and have less socioeconomic possibilities due to a lack of safe and effective transportation choices.

The Canadian government has implemented programs such as the Rural Transit Solutions Fund to enhance mobility in distant and rural Indigenous communities; yet, obstacles persist because of operational financial shortfalls. To properly address these concerns, there has to be a better respect for Indigenous Traditional Knowledge and more direct inclusion of Indigenous voices in transportation design.

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