

Taking the High Road

Sustainable Transportation for the 21st Century

David Suzuki Foundation

Finding solutions

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Le rapport est également disponible en français.

Taking the High Road: Sustainable Transportation for the 21st Century

Executive Summary

The Federal Government has an opportunity to make Canada's transportation system sustainable in the 21st Century. Levelling the playing field between Canada's trucking and railway industries, along with strategic investment in urban transit infrastructure will strengthen Canadian communities, improve productivity, reduce air pollution, and safeguard the health of Canadians and their environment. These changes will also assist Canada in meeting its commitments under the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

Unfortunately, current federal/provincial/private-sector negotiations over the National Transportation Investment Strategy (NTIS) threaten these goals – priorities that are central to the federal government agenda. While maintaining safe highways is clearly important, the emphasis of the current \$5-15 billion NTIS plan is significantly expanding the national highway system. It will put more cars, and particularly trucks, on Canadian roads, exacerbating rather than alleviating congestion problems. It will also compromise new investments in urban transit, further eroding vital municipal infrastructure. This approach would increase greenhouse gas emissions, air pollution, public health expenses, as well as costly urban sprawl.

Highway Expansion Is Based on Inaccurate Data & Outdated Public Policy

The Auditor General and top Finance Department officials agree that the studies upon which Transport Canada estimates its “needy” highway projects are inflated, and the Department has provided inaccurate information to decision makers.^{1 2}

Transport Canada has neglected to update its National Highway Transportation Policy (dated 1974) in light of changing needs and recent developments, and similarly neglected to review whether its responsibilities reflect current circumstances, according to the Auditor General.³

Expert analysis has shown jurisdictions that have invested heavily in road construction have fared no better at easing congestion than those that have invested less.^{4 5}

While the railway industry finances and maintains its own “roadways”, the majority of costs incurred by Canada's public highway system from the use, wear and tear of the trucking industry are borne by governments.⁶

Canada is the only OECD country that does not provide federal support for municipal public transit infrastructure.⁷

Currently, local and provincial governments spend under \$3 billion per year on transit, whereas, all three levels of government spend more than \$12 billion annually on roads, streets and highways.⁸

A World Bank study shows automobile dependency reduces regional economic development, while transit investments contribute to more economically efficient and productive regional economies.⁹ Transit improvements can increase economic productivity, providing twice the return of highway investments.¹⁰

Transportation Impacts: Air Pollution, Climate Change, Human Health & Safety

A federal study estimated there were 1,169 commercial vehicle accidents per billion tonne kilometres of freight compared with only 3.6 rail accidents. For every 14 truck-accident deaths, only one died on the rails.¹¹ There are 20 times more fatal accidents by automobile per vehicle kilometre than for public transit.¹²

Every year up to 16,000 Canadians die prematurely from air pollution, according to Health Canada.¹³ Transportation is a big part of this problem. Annual air pollutant emissions include 95,524 tonnes of particulate PM₁₀ and 83,276 tonnes of PM_{2.5} and at least 1.3 million tonnes of NO_x.

Research indicates that the increase in hospital admissions for children with asthma in recent years is directly related to worsening air pollution.¹⁴ Hospitalization of young boys in Canada increased by 28 percent and for girls 18 percent between 1981 and 1990.¹⁵

NO_x is one of the primary pollutants that form ground level ozone. Some areas of Ontario are subject to high-level ozone episodes over 30 days per year. While rail carries 60% of overland freight, trucks emit three times more NO_x.^{16 17}

The health effects of fine particulate matter include respiratory illness, decreased lung function, premature mortality and exacerbation of asthma conditions. Trains emit 79-85 percent less particulate matter per tonne-km of freight hauled.¹⁸

While rail moves more than half of overland freight in Canada, it accounts for approximately 15% of greenhouse gas emissions in the overland freight sector.¹⁹ Trucks require almost four times more energy over a given distance, compared to rail.²⁰

Given current transit load factors, Canadian transit systems are almost 3.5 times more efficient in terms of greenhouse gas emissions per passenger-kilometre than automobile travel.²¹

Under business as usual forecasts, transportation's annual carbon dioxide emissions would grow by 24% from 124 million tonnes to 155 million tonnes between 1990 and 2010; while trends should concur with the Kyoto target which would be a 6 percent reduction.

The single largest contributor to greenhouse gas emissions in the transportation sector is passenger transportation, accounting for 55 percent of emissions from this sector.²² The largest area of growth will be in the use of diesel fuel for trucking in which emissions are projected to grow by 52 percent.

Over the same time period, local and regional air pollution can be expected to increase by up to 25 percent as a result of growth in transportation fuel use.

The NTIS threatens to further accelerate these emission growth trends, undercutting efforts by many other sectors to reduce greenhouse gas emissions, regional air pollution, and urban sprawl.

A Sustainable Transportation Strategy

Canada's urban transit infrastructure needs more than \$9.2 billion to sustain and moderately expand the system and attract new riders.²³

Shifting freight from roads to rails and increasing urban transit's share of commuter trips is the only scenario that will allow Canada to meet its Kyoto target and reduce air pollution in the transportation sector.

The federal government must level the playing field between the railway and the trucking industry by 1) ending subsidies to the private trucking industry; 2) assessing fairer taxes; and 3) start reflecting the full social and environmental costs of various modes of transportation.²⁴

Forty percent of Canadians believe that the greatest improvement to municipal transportation would be expanding or improving transit services, versus just 15% for improving or widening existing roads and just 6% for building new roads.²⁵

The federal government should establish an annual \$1.5 billion Sustainable Transportation Infrastructure Fund aimed at upgrading and expanding transit infrastructure and creating modal shifts away from the single occupancy vehicle.

Funding for this program could come from the \$4 billion collected in fuel taxes, \$500 million of which was expressly raised to reduce the financial deficit and could now be used to reduce Canada's environmental deficit.²⁶

Governments and industries must ensure that any efforts to strengthen environmental protection and long-term economic opportunities include transition strategies for specific communities, workers and businesses to minimize disruption and economic dislocation.

"To increase trade and economic growth, we must ensure that we have the capacity to move people and goods safely and efficiently. To maintain the quality of life in our cities and rural communities, we must ensure that we have clean air and water."

Right Honourable Adrienne Clarkson, Governor General,
Speech from the Throne, October 12, 1999

The NTIS: Paving the Way for More Air Pollution

The major thrust of the 10 year, multi-billion dollar National Transportation Investment Strategy (NTIS), currently discussed, is the National Highway Program. While some urban transit investments are being considered and maintaining a safe road system is clearly important, the emphasis of the NTIS is significantly expanding Canada's highway network. The most significant implications are subsidizing the trucking industry at the expense of the railway industry, and compromising new investments in urban transit, further eroding vital municipal infrastructure. Socially, economically and environmentally, the current NTIS is the wrong choice.

Long-term analysis reveals that jurisdictions that have invested heavily in road construction have fared no better at easing congestion than those that have invested less.^{1 2} In fact, expanding highways will put more cars and trucks on Canadian roads, increasing the total area of congestion, and exacerbating air pollution, sprawl, and climate change. This cycle of construction and congestion must be recognized in the allocation of transportation funds.

NTIS proponents argue new funding for highways is important to stay competitive with the U.S., citing a multi-billion dollar transportation infrastructure program south of the border. The Congressional Budget Office, however, concluded this spending is "unlikely to have perceptible effect on economic growth."³

The data to justify the NTIS is similarly inaccurate, according to the Auditor General's 1998 Report.⁴ A classified memo to the Minister of Finance from the Deputy Minister in December, 1998, concurs:⁵

- Transport Canada's cost estimates of \$17 billion for meeting minimum standards are based on "numerous instances where inaccurate information was provided to decision makers" and "design and service levels that are much higher than 'minimum levels'."
- A study prepared for the 1992 Royal Commission on National Passenger Transportation, "found only about one-sixth of the 'needy' highways projects (evaluated at \$12 billion in 1989) had net benefits." Transport Canada inflated values in an adjusted study, thereby boosting 'benefits' of highway spending, and even then concluded only one-third of the projects had net benefits. "Nevertheless, Transport has continued to emphasize the study showing \$17 billion in highway 'need'."
- Despite a requirement that "all projects be subject to cost/benefit analysis", "none of the projects approved for funding under the latest extensions of highway agreements have been subject to such analysis."

- "Despite government directives, [Transport] does not undertake an environmental impact assessment when making highway program decisions."

In his 1998 report, the Auditor General also recommended that in light of changing needs and recent developments, that Transport Canada update its National Highway Transportation Policy (dated 1974), as well as review whether its responsibilities reflect current circumstances.⁶ It is imperative that "sustainability" is central to this re-examination, and that broader national objectives are considered; reduce greenhouse gas emissions, local air pollution and public health costs, as well as prudently invest public money.

Macroeconomic research indicates that transit improvements can increase economic productivity, providing twice the return of highway investments.⁷ A World Bank study shows automobile dependency reduces regional economic development, while transit investments contribute to more economically efficient and productive regional economies.⁸

Climate Change, Human Health & Transportation

"Climate change is perhaps the single most important sustainable development challenge facing the transportation sector."

David Collenette, Transport Minister
November 15, 1999

Every year up to 16,000 Canadians die prematurely from air pollution, according to Health Canada.⁹ Vehicular emissions are a considerable source of this problem. In 1995 transportation was responsible for 95,524 tonnes of particulate PM₁₀ and 83,276 tonnes of PM_{2.5} and at least 1.3 million tonnes of NO_x. The trucking industry has further aggravated this problem by the continued use of defeat devices that sabotage the effectiveness of NO_x pollution control equipment.¹⁰ The railway industry, in contrast, has voluntarily capped its NO_x emissions.

Research indicates that the increase in hospital admissions for children with asthma in recent years is directly related to worsening air pollution.¹¹ Hospitalization of young boys in Canada increased by 28 percent and for girls 18 percent between 1981 and 1990.¹²

Thirty per cent of Canada's carbon dioxide emissions are from the transportation sector, and this share is growing. Under the Kyoto Protocol, Canada is committed to reducing annual emissions from greenhouse gases to 6 per cent below 1990 levels between 2008-2012.

Under business as usual scenarios, transportation's annual carbon dioxide emissions will grow from 124 million tonnes to 155 million tonnes between 1990 and 2010, an increase of 24 per cent over the Kyoto commitment period. Currently, the single largest contributor is passenger transportation, accounting for 55 percent of greenhouse gas emissions from this sector.¹³ The largest area of growth will be in the use of diesel fuel for trucking where emissions are projected to grow by 52 percent.

Throughout the '90s stagnation in transit expenditures has led to a rise in transit fares and erosion of transit infrastructure. At the same time, the costs of owning and operating an automobile have remained relatively constant. The convergence of costs is one of the primary reasons why the transit mode is not greater, and the automobile mode is growing, according to a final report for the Transportation Issues

Table of the National Climate Change Process.¹⁴ Since 1990, public transit usage has decreased by 13 percent as a total share of trips.¹⁵ Simultaneously, between 1990 and 1995 the number of passenger cars and trucks on the road increased from 14.74 million to 16.1 million (9%), while the average distance driven in cars and trucks increased by 6%.¹⁶ As a result of these trends between 1990 and 1995 greenhouse gas emissions increased by 10 MT (12 percent).¹⁷

To compensate for the increased greenhouse gas emissions, other sectors of the Canadian economy will have to make further reductions by over 40 million tonnes. In the same time period, local and regional air pollution can be expected to increase by up to 25 percent as a result of growth in transportation fuel use.

The relative costs of automobile use and transit fares, plus the relative tax position and immense subsidies to the trucking industry in the form of almost unrestricted access to publicly-funded highways are key reasons for the growth. The growth of both greenhouse gas emissions and air pollution is expected to be more rapid with the current NTIS.

This will also result in enormous costs to Canadians and their health care system in the form of increased lost work days, emergency room visits, hospitalizations for respiratory problems, and premature deaths. This amounts to further indirect subsidies, since large transportation fuel consumers do not have to pay any more for the damages caused by air pollution than smaller consumers or non-users.

The safety performance of rail is also dramatically superior than commercial trucking.¹⁸ In 1994, the federal Railway Safety Act Review estimated there were 1,169 commercial vehicle accidents per billion ton kilometres of freight compared with only 3.6 rail accidents. For every 14 people who died in truck accidents, only one died on the rails.

A Sustainable Transportation Strategy for the 21st Century

With such an immense land mass, and more than 60% of the population concentrated in cities of more than 100,000, Canada has the ideal conditions for a transportation system that takes advantage of the economic, social and environmental benefits of railways, and urban transit. Meeting the Kyoto Target in the transportation sector is possible.

This paper explores some of the immediate priorities that can help start Canada moving down the right road with rail freight and urban transit, and avoid the unsustainable path of the NTIS.

Rail Freight: Taking Advantage of Canadian Productivity

Growth in air pollution and greenhouse gas emissions from diesel-powered trucks is not necessary. Forty per cent of Canada's exports depend on Canada's railway system. Rail already moves 60% of overland freight in Canada, yet accounts for less than 15% of greenhouse gas emissions in the overland freight sector. This is because moving an item by truck over a given distance requires almost four times more energy, compared to moving it by rail.¹⁹

In addition trains are becoming more energy efficient. Carbon dioxide emissions (per unit of traffic volume) from railway freight movement have decreased by over 1% per year since 1990 and this trend

is expected to continue until 2005. Trains also emit less air pollutants than trucks producing 35%-54% less nitrogen oxide, and 79%-85% less particulate matter, per tonne of freight hauled. As a result of these gains, if freight were moved by rail instead of truck, emissions per tonne of freight would decrease by 35-54 per cent for nitrogen oxides, 80-85 percent for particulate matter and up to 75 per cent for carbon dioxide.²⁰

In order to meet the Kyoto target for greenhouse gas emissions, the Centre for Sustainable Transportation has estimated that there must be a cut of 40% in trucking activity combined with a 35% reduction in fuel intensity in the trucking industry.²¹

A National Roundtable on the Environment and Economy study similarly concluded that improving fuel efficiency and/or increasing the efficiency of operations, in both truck and rail freight transportation, will not bring carbon dioxide emissions significantly closer to 1990 levels²². The NRTEE found the only scenario that comes close to achieving Kyoto targets is if at least 1/3 of freight transportation by road in the 500+ km distance is diverted to rail intermodal service. Clearly, swift and bold changes in transportation policy at the federal level are needed to go from an anticipated large increase to a significant decrease (33-40%) in freight trucking.

The greatest obstacles to this transition in the freight sector are unfair tax treatment towards the railway industry and the immense taxpayer subsidy of the commercial trucking industry with the provision of public highway infrastructure and the almost unrestricted right to pollute.

While the railway industry finances and maintains its own “roadways”, the majority of costs incurred by Canada’s public highway system from the use, wear and tear of the trucking industry are borne by governments.²³ The possibility of growing subsidies to the trucking industry at their behest, in an era of fiscal restraint, along with such great social and ecological costs is unfathomable.

Moreover, the trucking industry can depreciate investments far more rapidly than the railway industry. The trucking industry can write off investments in almost eight years, while railways may take 20.

Despite this unfair tax treatment, CPR and CN alone, invested \$1.84 billion in their operations last year. Over the last five years, they have invested \$6.1 billion in information technology, more energy efficient locomotives and freight cars, short-haul truck-trailer services between major cities, other high-tech infrastructure, and maintenance of much of Canada’s 50,000 km railway network.

Canada’s railways have the ability to increase their freight capacity and also have exceptionally competitive freight rates – the lowest per ton mile of all railways in the industrial world. To facilitate this, it is critical for the Canadian government to help create a level playing field with the trucking industry. Apogee Research International has outlined several appropriate measures:²⁴

- end subsidies to the private trucking industry;
- assess fairer taxes, i.e., provide more equitable capital cost allowance to the railway industry;
- begin reflecting the full social and environmental costs of various modes of transportation in the form of federal pollution charges on emissions.

Urban Transportation Infrastructure: Strengthening Canadian Communities

Transit is the second most popular means of transportation in Canada. Fifty-two percent of Canadians use transit, 19 percent frequently.²⁵ Currently, local and provincial governments spend under \$3 billion per year on transit, whereas, all three levels of government spend more than \$12 billion or more annually on roads, streets and highways.²⁶ Canada is the only OECD country that does not provide federal support for municipal public transit infrastructure.

As already indicated, urban transit investments promote regional economic development, and provide twice the return of highway investments, much of which is from keeping money in communities. Moreover, for every \$1 million invested in public transit, 21.4 full-time jobs are created.²⁷

Emissions per passenger-kilometre for diesel buses during peak operation compared to single occupancy vehicles are 75 percent less hydrocarbons, 96 percent less CO, 75 percent less NO_x, and about the same amount of particulate matter. Particulate emissions are expected to decline significantly over the next few years with design improvements.²⁸

Given current transit load factors, Canadian transit systems are almost 3.5 times more efficient in terms of greenhouse gas emissions per passenger-kilometre than automobile travel.²⁹

Public transit has only 0.41 fatal accidents per billion vehicle kilometres, about five percent of the 8.1 fatal accidents per billion kilometres for automobiles.³⁰

Forty percent of Canadians believe that the greatest improvement to municipal transportation would be expanding or improving transit services, versus just 15% for improving or widening existing roads and just 6% for building new roads.³¹ Canada's urban transit infrastructure needs more than \$9.2 billion to sustain and moderately expand the system and attract new riders.³²

To revitalize transit in Canada, the federal government should establish an annual \$1.5 billion Sustainable Transportation Infrastructure Fund aimed at upgrading and expanding transit infrastructure and creating modal shifts away from the single occupant vehicle. Funding for this program could come from the \$4 billion collected in fuel taxes, \$500 million of which was expressly raised to reduce the financial deficit and should now be directed to reduce Canada's environmental deficit.³³

Prioritization of funding should be managed through a cooperative effort on the part of the federal and provincial governments, in conjunction with municipal and regional governments. The fund should include programs to support traditional infrastructure as well as reduce transportation demand:

- Transit fleet expansion, replacement and modernisation;
- Light rail construction, light rail upgrading, and expansion or modernisation of rolling stock;
- Dedication of existing road space to transit and high occupancy vehicles;
- Transportation demand management programs (e.g. workplace and institutional trip reduction programs that facilitate carpooling, vanpooling and transit usage);

- Cycling and walking infrastructure aimed at increasing the modal share of pedestrians and cyclists;
- Improved inter-modal connectivity (e.g. bike racks on buses; service to airports/inter-city buses/train stations/ferries);
- Advanced technology fare collection and customer information systems, bus shelters, and bus bulges.

Such an investment would increase transit use from 10 percent to 25 percent of all commutes by the Kyoto target (year 2010), reduce single occupancy vehicle use from 73 per cent to 25 percent of all trips, and similarly reduce greenhouse gas emissions by 4.7 Mt from projected 2010 levels.³⁴

Increasing public transit usage and infrastructure will contribute to improvements in urban growth management, reducing the cumulative impacts of urban sprawl. As commercial centres and more compact residential developments occur along transit lines, the amount of land dedicated to urban areas is reduced. Additionally, as fewer cars are on the road and congestion decreases, less land is needed for new roads. In cities which practise compact growth management the amount of land needed for urban areas decreases dramatically, and the cost reduced for many infrastructure and service-related costs such as water, electricity, and policing.

For example the population of Portland, Oregon has grown by 50 percent over the last 20 years while the urban area has expanded by only 2 percent, while Chicago's population grew by 4 percent but has sprawled over 46% more land.

Just Transition

Governments and industries must ensure that any efforts to strengthen environmental protection and long-term economic opportunities include transition strategies for specific communities, workers and businesses in order to minimize disruption and economic dislocation. These transition strategies must include employee/union involvement and focus on the movement of employees into growth areas of the economy.

Conclusion

The Federal Government has an opportunity to make Canada's transportation system sustainable in the 21st Century. Levelling the playing field between Canada's trucking and railway industries, along with strategic investment in urban transit infrastructure will strengthen Canadian communities, improve productivity, reduce air pollution, and safeguard the health of Canadians and their environment. These changes will also assist Canada in meeting its commitments under the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

There are many other measures to support this transition. In particular, while the transit infrastructure investments begin to address the explosion in automobile growth, this problem requires much broader government attention. The proposals outlined in this paper will, however, begin to address the greatest growth in transportation energy use and in transportation-related environmental impacts during the last two decades: the growth in truck traffic.³⁵ The use of road diesel fuel has doubled over this period.

Unfortunately, current federal/provincial/private-sector negotiations over the National Transportation Investment Strategy (NTIS) threaten priorities central to the federal government agenda. While maintaining safe highways is clearly important, the emphasis of the \$5-15 billion NTIS would significantly expand the national highway system. It will put more cars, and particularly trucks, on Canadian roads, exacerbating rather than alleviating congestion problems. It will also compromise new investments in urban transit, further eroding vital municipal infrastructure. This approach would increase greenhouse gas emissions, air pollution, public health expenses, as well as costly urban sprawl.

Appendices

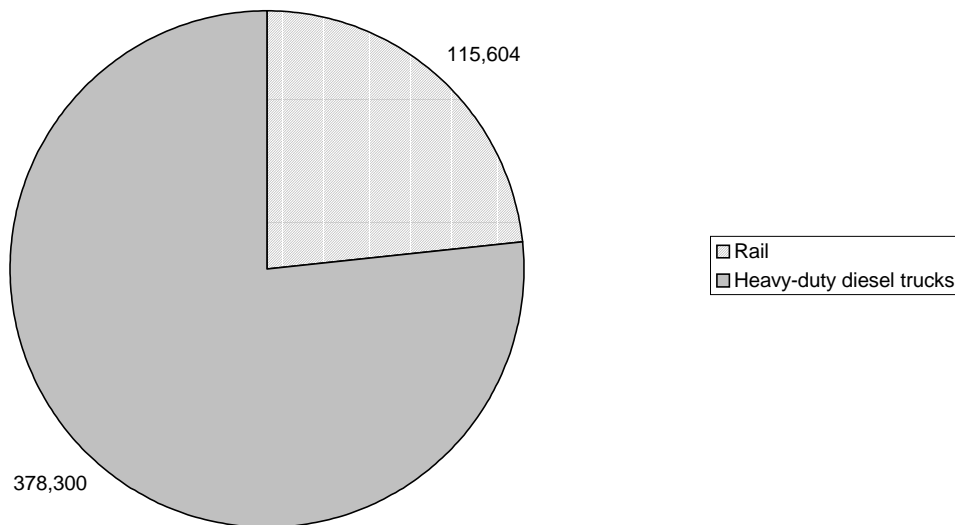
Appendix 1a) NOx From Rail & Heavy-Duty Diesel Truck

Emissions from heavy-duty diesel vehicles in the following chart are based on the 1995 Environment Canada Emissions Inventory for Criteria Air Contaminants. Following the publication of this data, the U.S. EPA discovered that 1.3 million heavy duty diesel trucks were produced in the U.S. since 1990, which incorporated on-board computer devices to disable pollution control equipment during highway driving. Since approximately 125,000 of these trucks were sold in Canada, up to 250,000 tonnes of Nitrogen oxides (NOx) were emitted by heavy duty diesel trucks in addition to the 378,000 tonnes listed in the 1995 inventory.

NOx is one of the primary pollutants which form ground level ozone, a chronic pollution problem in many parts of Canada. Once emitted NOx can travel up to 600 miles. Recent analysis by Health Canada indicates that, for ozone there is no threshold level below which health impacts do not occur. Some areas of Ontario are subject to high level ozone episodes over 30 days per year.

For a more thorough comparison, see appendix 1b.

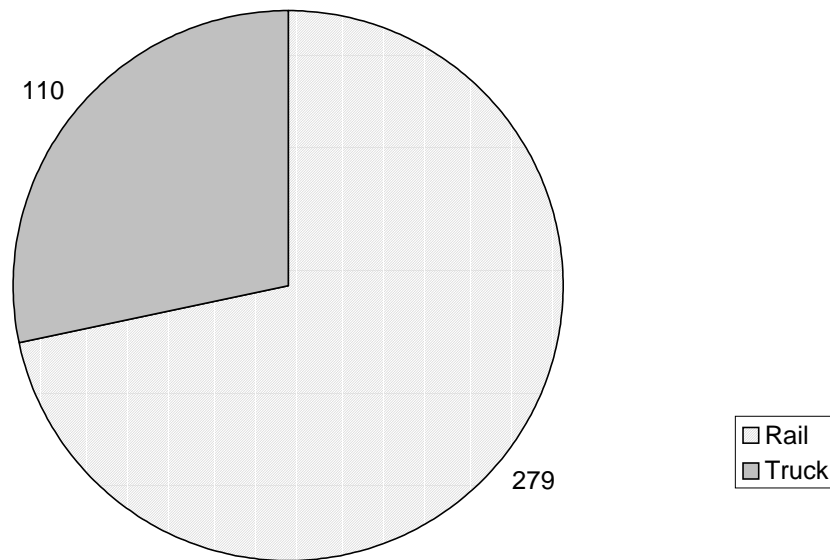
Tonnes of Nox From Rail & Heavy-Duty Diesel Trucks



Appendix 1b) Revenue Tonne Kilometres of Freight by Mode

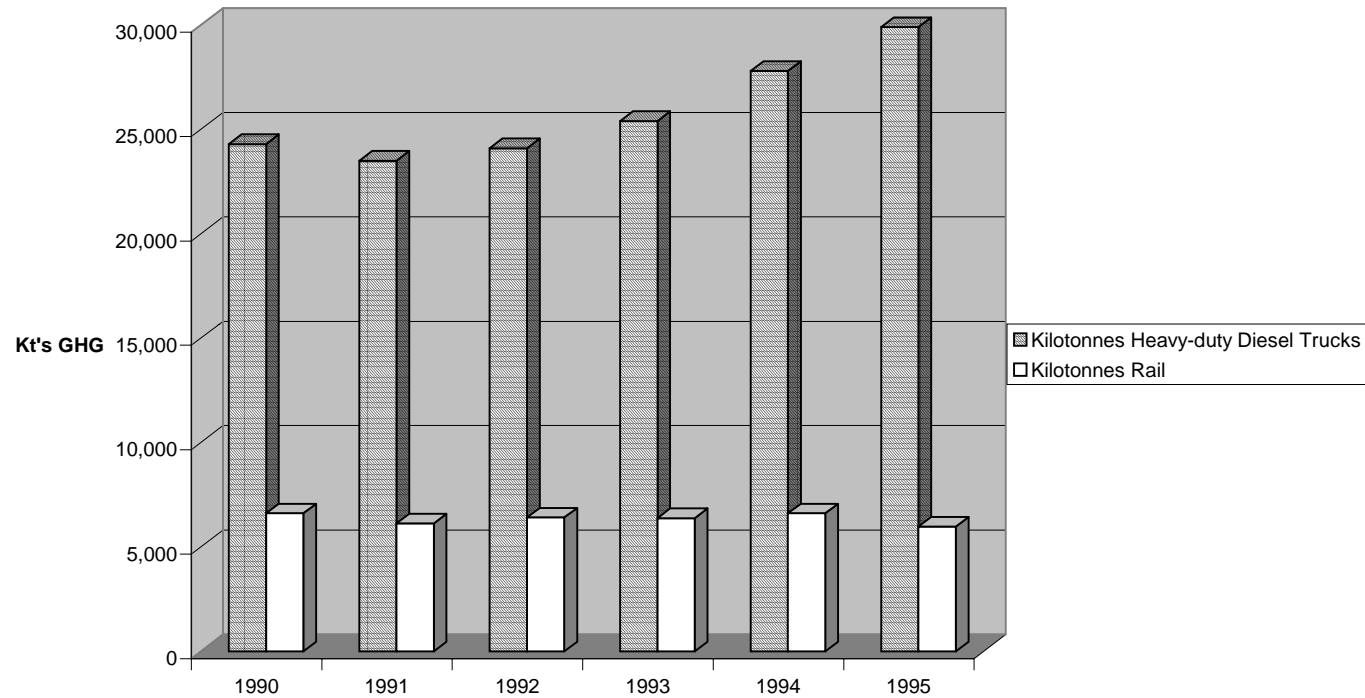
It must be recognized that while both forms of freight transportation use diesel fuel, rail transportation is a much more efficient means of moving freight and therefore generates far less particulate matter per tonne of freight.

Billions of Revenue Tonne Kilometres - 1995



Appendix 2a) Greenhouse Gas Emissions by Freight Transportation Mode

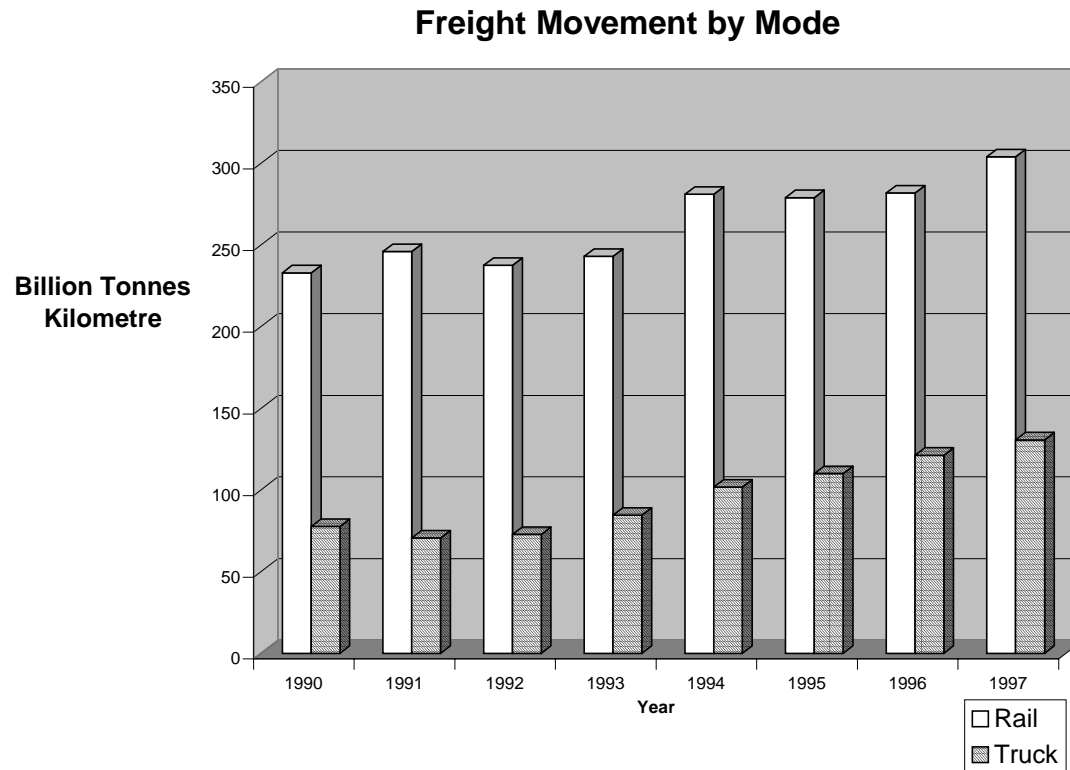
Greenhouse Gas Emissions by Freight Transportation Mode



Source: Trends in Canada's Greenhouse Gas Emissions 1990-95

Data include emissions from all heavy-duty diesel trucks rated at a gross weight of more than 3,900 kilograms (excluding off-road use).

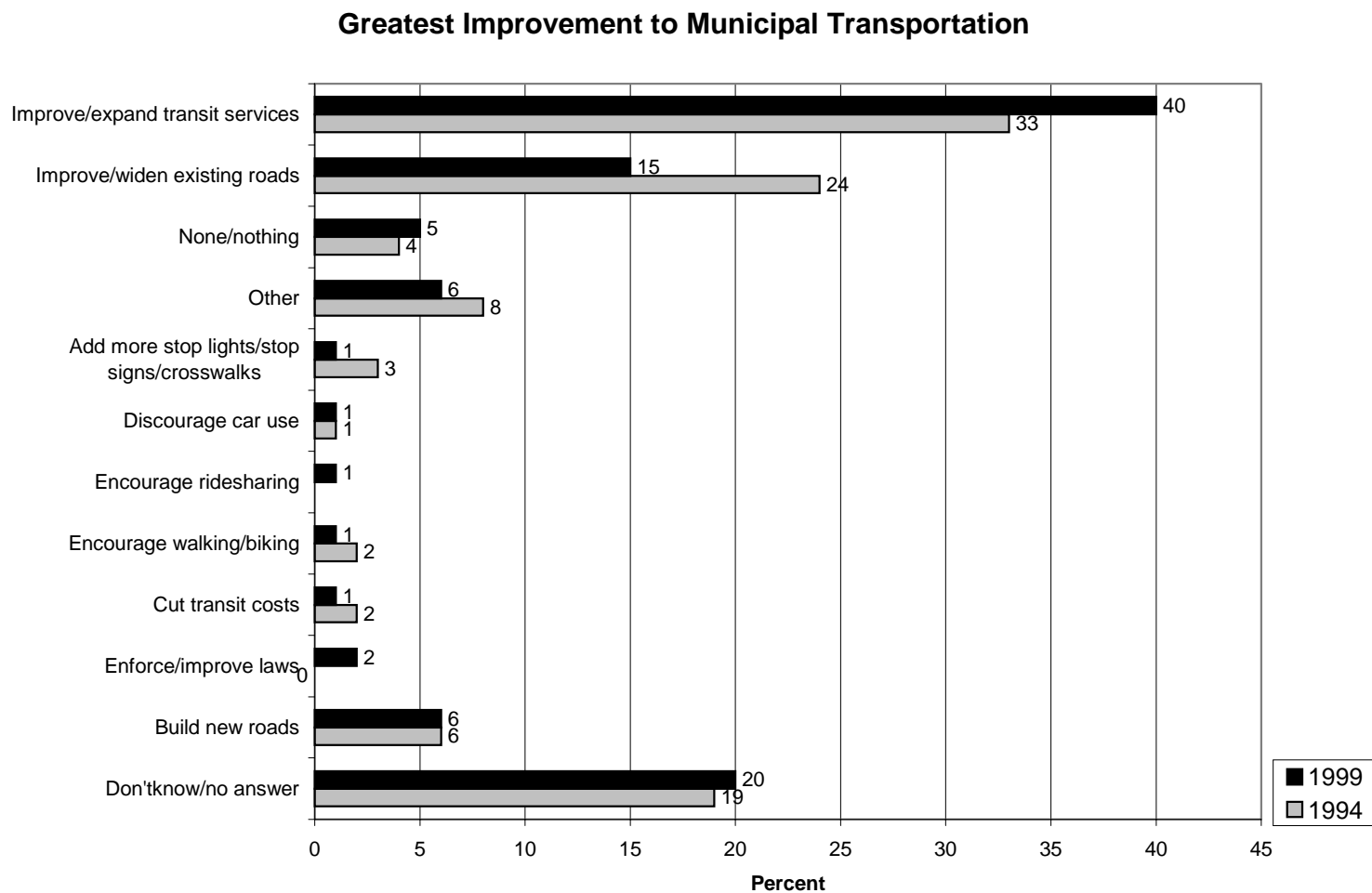
Appendix 2b) Freight Movement by Mode



Source: Transport Canada, "Transportation in Canada," 1998, & The Railway Association of Canada, "Annual Report and Railway Trends," 1999.

Data is restricted to freight hauled by hired trucks and does not include freight hauled by companies for their own use. e.g. supermarkets who use their own fleet for distributing in a given area. The Canadian Trucking Research Institute estimates that these privately owned trucks haul as much freight as the for hire trucks. If this were true then the amount of freight depicted by the shaded column in this graph would double.

Appendix 3a) Canadians' Priorities for Municipal Transportation Improvement



Source: Environics International, "Environmental Monitor," National Fielding Survey, July 1999.

Open-ended question: What is the single greatest improvement your municipality could make to improve local transportation?
(DO NOT READ ANSWERS... CODE ONLY ONE)

Endnotes

Executive Summary

- ¹ Office of the Auditor General, "1998 Report of the Auditor General of Canada," Chapter 25, December 1, 1998.
- ² Clark, C. Scott, Memorandum to Minister of Finance, classification, secret: "Auditor General Report on Transport Canada's Highway Programs", December 4, 1998.
- ³ Office of the Auditor General, "1998 Report of the Auditor General of Canada," Chapter 25, December 1, 1998.
- ⁴ Surface Transportation Policy Project, "An Analysis of the Relationship Between Highway Expansion and Congestion in Metropolitan Areas", 1998.
- ⁵ Centre for Sustainable Transportation, "Sustainable Transportation Monitor," No. 2, February, 1999.
- ⁶ The IBI Group in association with Bonn, Jones & Associates, "Full Cost Transportation and Cost-Shared Pricing Strategies," (Prepared in support of the transportation and climate change collaborative.) November, 1995.
- ⁷ Submission by the National Task Force to Promote Employer Provided Tax Exempt Transit Passes to the House of Commons Standing Committee on Finance.
- ⁸ Transport Canada, "Transportation in Canada, Annual Report 1997," 1998.
- ⁹ Summarized in Todd Litman et al., "Indicators of Transport Efficiency in 37 Global Cities," Sustainable Transportation Research Group, Murdoch University (Perth), for the World Bank, February, 1997.
- ¹⁰ Aschauer, David, "Transportation Spending and Economic Growth: The Effectes of Transit and Highway Expenditures
- ¹¹ Transport Canada, Report by the Railway Safety Act Review Committee, 1994.
- ¹² Data provided by the Canadian Urban Transit Association.
- ¹³ Government of Canada, "Canada's Response to U.S. EPA Proposal on Transboundary Air Pollution," 1998, based on the study by Burnett, R.T. et al., "The Effect of the Urban Ambient Air Pollution Mix on Daily Mortality Rates in 11 Canadian Cities," *Canadian Journal of Public Health* 89.3 (May-June 1998), pp. 152-156.
- ¹⁴ Raizenne, Mark et al., "Air Pollution Exposures and Children's Health," *Canadian Journal of Public Health*, Vol. 89 (supp. 1), 1998.
- ¹⁵ Dales, R et al, "Prevalence of childhood asthma across Canada," *International Journal of Epidemiology*, Vol. 21, 1994
- ¹⁶ Environment Canada, "Emissions Inventory for Criteria Air Contaminants, 1995," 1999.
- ¹⁷ Railway Association of Canada, "Canada's Railways and the Environment" Briefing Paper, 1999.
- ¹⁸ Canadian National based on data from Transport Canada, "CN: Committed to a Clean Environment," available at www.cn.ca, 1999.
- ¹⁹ Approximations are based on comparisons between heavy duty diesel vehicles (excluding off road, which is primarily trucking freight transport) and rail in Jaques, A et al., "Trends in Canada's Greenhouse Gas Emissions (1990-1995)," Environment Canada, 1997.
- ²⁰ Canadian National based on data from Transport Canada and Federal Railroad Administration, "CN: Committed to a Clean Environment," available at www.cn.ca, 1999.
- ²¹ IBI Group & Management of Technology Services, "National Climate Change Process, Transportation Issue Table, Final Report: Tax Exempt Status for Employer-Provided Transit Benefits," 1999.
- ²² Hornung, Robert et al., "Canadian Solutions: Practical and Affordable Steps to Fight Climate Change," David Suzuki Foundation & Pembina Institute, October, 1998.
- ²³ Canadian Urban Transit Association, "Report on a Survey of Infrastructure Needs for Canadian Urban Transit Systems," October, 1999.
- ²⁴ Apogee Research International, Paper presented at the University of Denver, Colorado, 1997.
- ²⁵ Envirionics, "Environment Monitor July Fielding Survey", 1999.
- ²⁶ Finance Canada, "1995 Budget Fact Sheets 1: Key Actions & Impacts," (Federal excise tax on gasoline increased by 1.5 cents per litre to help reduce the deficit), www.fin.gc.ca/budget/95/facte/FACT_1e.html.

Report

- ¹ Surface Transportation Policy Project, "An Analysis of the Relationship Between Highway Expansion and Congestion in Metropolitan Areas", 1998.
- ² Centre for Sustainable Transportation, "Sustainable Transportation Monitor," No. 2, February, 1999.
- ³ Congressional Budget Office, "The Economic Effects of Federal Spending on Infrastructure and Other Investments", 1998.
- ⁴ Office of the Auditor General, "1998 Report of the Auditor General of Canada," Chapter 25, December 1, 1998.

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- ⁵ Clark, C. Scott, Memorandum to Minister of Finance, classification, secret: "Auditor General Report on Transport Canada's Highway Programs", December 4, 1998.
- ⁶ Office of the Auditor General,
- ⁷ Aschauer, David, "Transportation Spending and Economic Growth: The Effectes of Transit and Highway Expenditures
- ⁸ Summarized in Todd Litman et al., "Indicators of Transport Efficiency in 37 Global Cities," Sustainable Transportation Research Group, Murdoch University (Perth), for the World Bank, February, 1997.
- ⁹ Burnett, R.T. et al., "The Effect of the Urban Ambient Air Pollution Mix on Daily Mortality Rates in 11 Canadian Cities," Canadian Journal of Public Health 89.3 (May-June 1998), pp. 152-156.
- ¹⁰ McIlroy, Anne, "Big Truck Makers Evaded Pollution Rules: Smoke-Belching Rigs Have Emission Controls Disabled," The Globe & Mail, February 27, 1999, A1.
- ¹¹ Raizenne, Mark et al., "Air Pollution Exposures and Children's Health," *Canadian Journal of Public Health*, Vol. 89 (Supp. 1), 1998.
- ¹² Dales, R et al, "Prevalence of childhood asthma across Canada," *International Journal of Epidemiology*, Vol. 21, 1994
- ¹³ Hornung, Robert et al., "Canadian Solutions: Practical and Affordable Steps to Fight Climate Change," David Suzuki Foundation & Pembina Institute, October, 1998.
- ¹⁴ IBI Group & Management of Technology Services, "National Climate Change Process, Transportation Issue Table, Final Report: Tax Exempt Status for Employer-Provided Transit Benefits," 1999.
- ¹⁵ Pucher, John, "Back on Track - Eight Steps to Rejuvenate Public Transport in Canada" *Alternatives Journal* Vol. 24:1 Winter, 1998, p27.
- ¹⁶ Jaques, A.P. "Trends in Canada's Greenhouse Gas Emissions (1990-1995)", Environment Canada, April 1997, Table 2.134, p 26.
- ¹⁷ Ibid Appendix A-2.
- ¹⁸ Transport Canada, Report by the Railway Safety Act Review Committee, 1994.
- ¹⁹ Canadian National based on data from Transport Canada and Federal Railroad Administration, "CN: Committed to a Clean Environment," available at www.cn.ca, 1999.
- ²⁰ Canadian National based on data from Transport Canada, "CN: Committed to a Clean Environment," available at www.cn.ca, 1999.
- ²¹ Centre for Sustainable Transportation, "Sustainable Transportation Monitor," No. 1 March, 1998.
- ²² National Roundtable on the Environment and the Economy, "A Strategy for Sustainable Transportation in Ontario: Report of the Transportation and Climate Change Collaborative," November, 1995.
- ²³ The IBI Group in association with Bonn, Jones & Associates, "Full Cost Transportation and Cost-Shared Pricing Strategies," (Prepared in support of the transportation and climate change collaborative.) November, 1995.
- ²⁴ Apogee Research International, Paper presented at the University of Denver, Colorado, 1997.
- ²⁵ Canadian Urban Transit Association, "The Need for Infrastructure Funding in Support of Public Transit, and its Benefits to the Environment and the Economy," House of Commons Finance Committee Submission, November, 1999.
- ²⁶ Transport Canada, "Transportation in Canada, Annual Report 1997," 1998.
- ²⁷ Litman, Todd et al., "Automobile Dependence and Economic Development," Presented to the Transportation Research Board 1998 Annual Meeting.
- ²⁸ Greater Vancouver Regional District, "GVRD Air Quality Management Plan: Stage 2 Draft Report: Priority Emission Reduction Measures," May, 1992.
- ²⁹ IBI Group & Management of Technology Services, "National Climate Change Process, Transportation Issue Table, Final Report: Tax Exempt Status for Employer-Provided Transit Benefits," 1999.
- ³⁰ Data provided by the Canadian Urban Transit Association.
- ³¹ Environics, "Environment Monitor July Fielding Survey", 1999.
- ³² Canadian Urban Transit Association, "Report on a Survey of Infrastructure Needs for Canadian Urban Transit Systems," October, 1999.
- ³³ Finance Canada, "1995 Budget Fact Sheets 1: Key Actions & Impacts," (Federal excise tax on gasoline increased by 1.5 cents per litre to help reduce the deficit), www.fin.gc.ca/budget_95/facte/FACT_1e.html.
- ³⁴ Hornung, Robert et al., "Canadian Solutions: Practical and Affordable Steps to Fight Climate Change," David Suzuki Foundation & Pembina Institute, October, 1998.
- ³⁵ Centre for Sustainable Transportation, "Sustainable Transportation: reflections on the movement of people and freight," April, 1998.