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Sustainable Transportation Performance Indicators

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Purpose of CST's STPI project

- To implement CST's founding *Action Plan* and respond to a letter from the Ministers of Environment and Transport.
- To provide an initial set of indicators of progress or otherwise towards sustainable transportation (ST) in Canada, rooted in the definition of an ST system developed by CST.
- To flesh out the definition of CST and allow determination of whether or not progress is being made towards EST.
- To help provide for continuous improvement of the STPI, both through additions and improvements to the data set on which they are based and through refinements and additions to the indicators.

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The Centre's definition (and that of the EU)

A sustainable transportation system is one that:

- Allows the basic access needs of individuals to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.
- Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy.
- Limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise.

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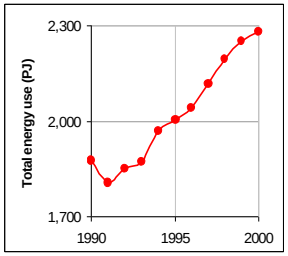
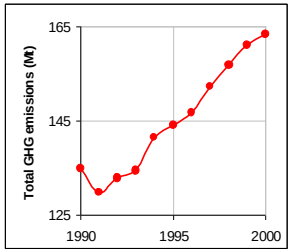
Project results to date

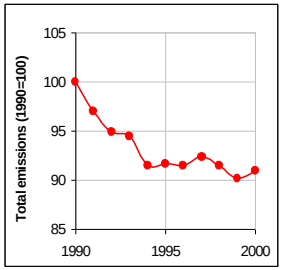
1. Use of fossil fuel energy for all transport



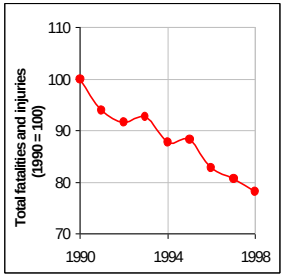
2. Greenhouse gas emissions from all transport



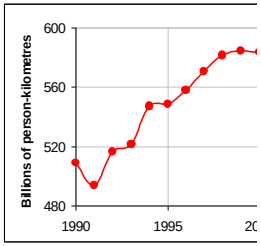
3. Index of emissions of air pollutants from road transport



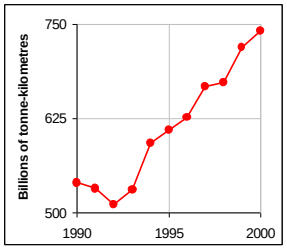
4. Index of incidence of road fatalities and injuries



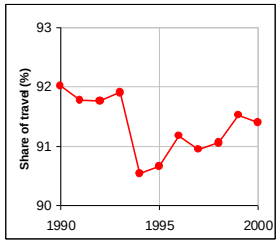
5. Total motorized movement of people



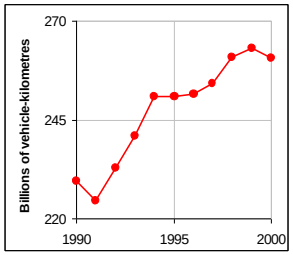
6. Total motorized movement of freight



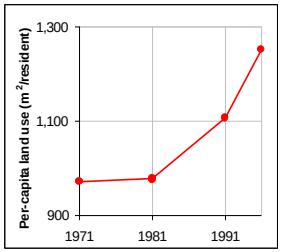
7. Share of motorized movement of people *not* by land-based public transport



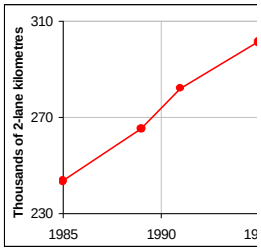
8. Movement of light-duty passenger vehicles



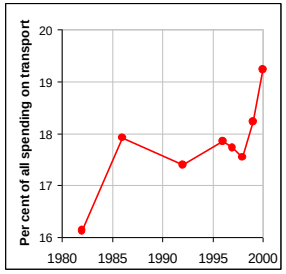
9. Urban land use per capita



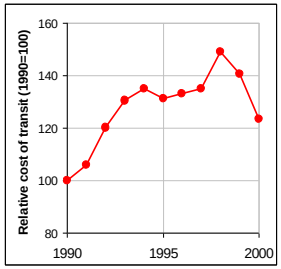
10. Length of paved roads



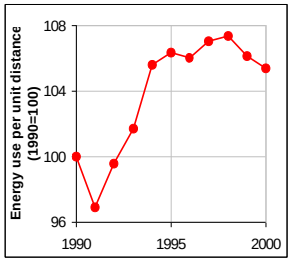
11. Index of relative household transport costs



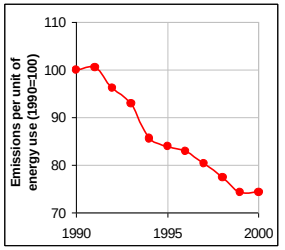
12. Index of the relative cost of urban transit



13. Index of the energy intensity of cars and trucks



14. Index of the emissions intensity of the road vehicle fleet



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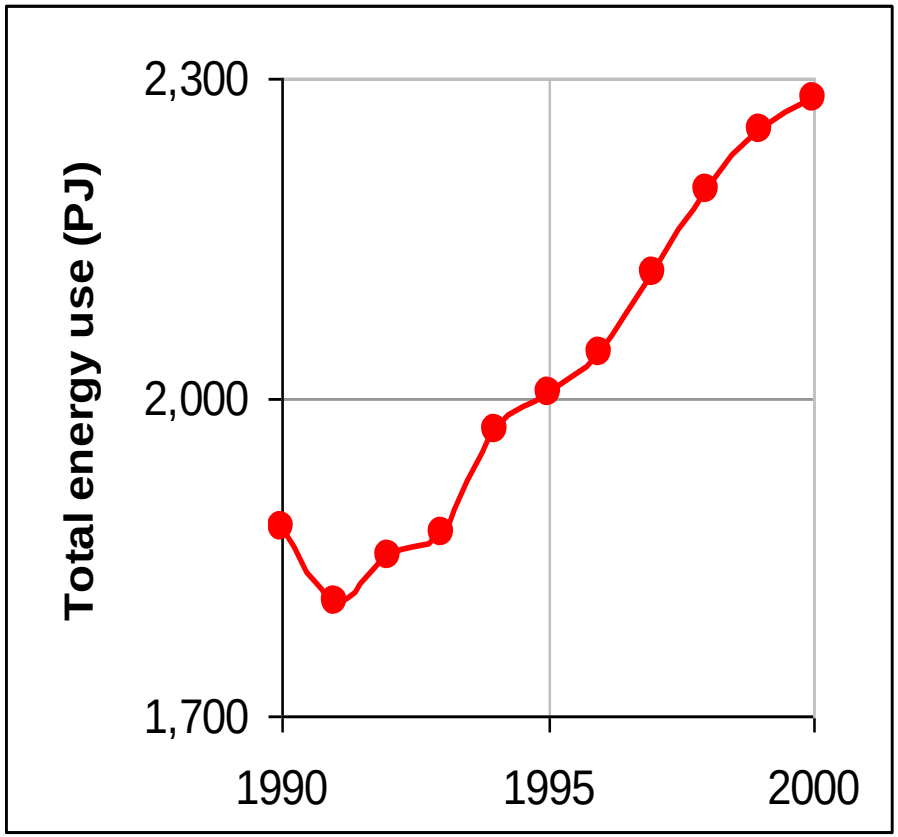
Indicator 1: Use of fossil fuel energy for all transport

This indicator relates to the definition of a ST system as one that "minimizes consumption of non-renewable resources". It comprises actual estimates of energy use for transport operations, in petajoules.

It is the most important of the 14 indicators in the initial set of STPI. It is related to resource depletion, environmental impacts, and the financial cost of transport. The actual indicator shown is *all* energy use for transport, which presently is 99.8% fossil fuels (99.1% oil).

The increasing values indicate *movement away from sustainability.*



Data source: Natural Resources Canada

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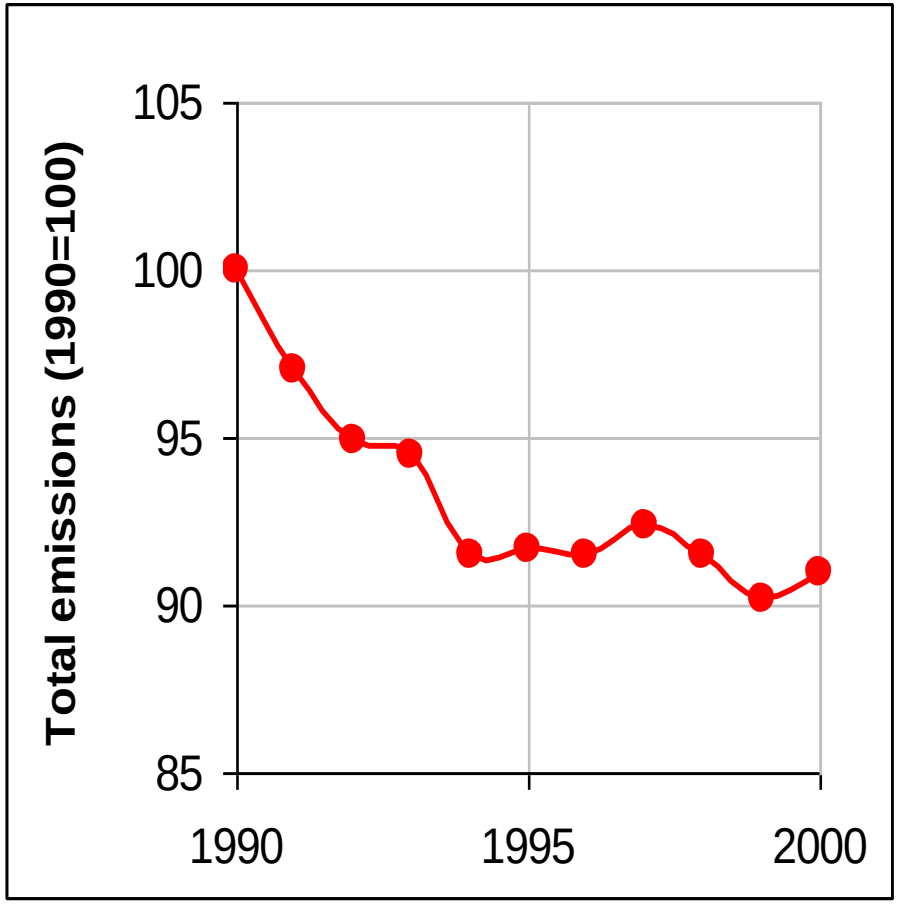
Indicator 3: Index of emissions of air pollutants from road transport

This indicator relates to the definition of a ST system as one that "limits emissions and waste within the planet's ability to absorb them".

The indicator is a *index* constructed from estimates of the weights of emissions from transport operations of sulphur dioxide, nitrogen oxides, carbon monoxide, and volatile organic compounds. The estimates were weighted according to their 1990 values, combined, and adjusted so that the 1990 value equals 100.

The declining values indicate *progress towards sustainability* (although with little progress since the mid-1990s).



Data source: Environment Canada

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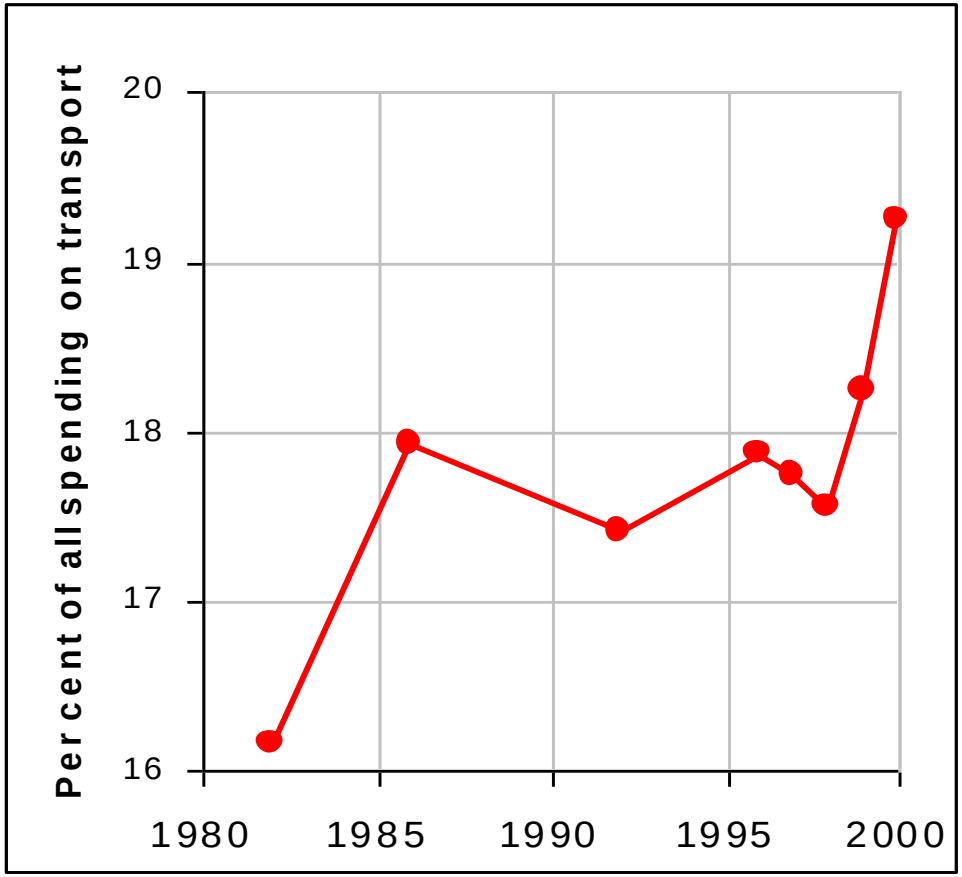
Indicator 11: Index of household transport costs

CST's definition of sustainable transportation requires that transport be affordable. Accordingly, this indicator shows the cost of transport in relation to all household spending. The fundamental assumption is that a lower share going to transport reflects greater affordability.

The indicator is an index constructed from ratios of real transport expenditures to real total expenditures, with the 1996 value set to 100.

The indicator provides no suggestion of a longer-term trend towards or away from *sustainability*.



Data source: Statistics Canada

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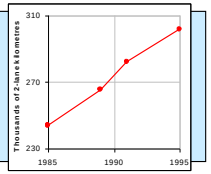
Popular version of indicators report

Indicator 10
Length of paved roads



About this indicator

A *sustainable transportation system* is one that "minimizes consumption of non-renewable resources" and "minimizes the use of land". This indicator—length of paved roads in Canada—touches on both of these requirements. Road construction and maintenance require *energy*, which comes mostly from *non-renewable fossil fuels* (also see Indicator 1). Roads also use land, already addressed in part by Indicator 9.

Another feature of roads is that they can generate traffic. In a large urban area, more roads mean more traffic because limited road space helps limit the amount of traffic. Where road capacity does not limit traffic, adding road space would result in inefficient use of *infrastructure*. It would be contrary to another part of the definition, which says that a sustainable transportation system "operates efficiently".

Thus, in several ways, additional road capacity in Canada generally represents movement away from sustainable transportation. This may not be true everywhere, even in Canada. Certainly in some poorer countries, adding proper roads can produce improvements in the movement of people and freight that offset the roads' negative impacts.

What this indicator shows

Length of paved roads in Canada increased by 23.6% between 1985 and 1995, from 243,800 to 301,300 *two-lane-kilometre equivalents*. Because added road capacity can mean more energy use for construction, more land taken for transport, and more traffic, this increase indicates movement away from sustainability.

Additional comments

More than other indicators in this set, this indicator should be used with caution. There are only four data points, and there is some question as to whether the data for these four points were collected in a uniform manner. The indicator is included, nevertheless, because of the importance of the topic and the need to represent some aspect of transport infrastructure.

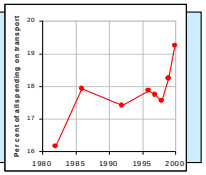
Data about roads are now being collected using aerial photography in conjunction with *Geographical Information Systems* that result in precise measurements of road length and width. Use of these data will mean that there can be greater confidence in the indicator.

Paved roads comprised only about a third of all road capacity in Canada in 1995. The total was just over 900,000 two-lane-kilometre equivalents. However, almost all traffic is on paved roads. The amount of unpaved roadway—mostly with gravel surfaces—has been declining, so that the total of all road capacity has remained almost constant. More than half of Canada's unpaved road capacity is found in Alberta and Saskatchewan.

Considering paved roads alone, the growth in road capacity between 1985 and 1995 (23.6%) was just a little more than the growth in the number of registered road vehicles (20.8%).

☹ Indicator 10 shows an increase in paved road capacity. This represents more land and energy use, and can stimulate traffic, indicating movement away from sustainability.

Indicator 11
Household spending



About this indicator

A *sustainable transportation system* is by definition "affordable". Thus, other things being equal, a good indicator of progress towards sustainable transportation is one that shows household spending on transport in relation to available income.

There is a problem here. If transport is too cheap, too much of it could be used. With present patterns of *transport activity*, this would not represent progress towards sustainability. On the other hand, another feature of a sustainable transportation system is that it "allows the basic access needs of individuals to be met". If transport is expensive, poorer people may have inadequate *access*. Moreover, if half of the average household's *after-tax spending* went towards transport, little would remain to meet other important needs.

Indicator 11 shows the share of households' after-tax spending going to transport. This share does not necessarily represent the *affordability* of transport. If it goes up, it could mean that more transport is being consumed rather than transport is less affordable. However, we know from other indicators that the changes in transport activity in relation to population growth have been small (see Indicators 5 and 8) except for freight movement (see Indicator 6).

What this indicator shows

The share of household spending on transport increased from 16.1% to 19.2% between 1982 and 2000. The increase involved two steep rises: between 1982 and 1986, and between 1998 and 2000.

Transport consumed more of household income and probably became less affordable over this period. Given that affordability is one of the requirements of a sustainable transportation system, this trend would appear to be movement away from sustainability.

Additional comments

Closer analysis of the household spending data shows that what increased the most were the costs of car purchase and other *fixed costs*, e.g., insurance. *Real* spending on fixed costs—mostly car purchase—increased by 69.2% between 1982 and 2000, with most of the increase occurring between 1982 and 1986 and between 1996 and 2000. Real spending on *operating costs*, mostly fuel, declined by 0.8% between 1982 and 2000.

In 2000, average household spending on *personal vehicles* totalled $6,906 ($4,430 on fixed costs, $2,476 on operating costs). Average spending on urban transit was $216, and spending on other purchased transport, mostly by air, was $454.

On average, just over 90 minutes of each day's employment is dedicated to paying for the costs of ownership and operation of personal vehicles. Canadians' average commuting time is just over 60 minutes (i.e., about 30 minutes each way).

CARTOON BY AND Y SINGER

☹ Indicator 11 shows an increase in the share of household after-tax spending going to transport, which thus became less affordable and less sustainable.

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Smiley faces

INDICATOR	Progress?
Indicator 1 shows a rise in energy use for transport. This represents an increase in the use of non-renewable fossil fuels, and thus movement away from sustainability.	☹
Indicator 2 shows an increase in greenhouse gas emissions from transport. This represents movement away from sustainable transportation.	☹
Indicator 3 shows a decline in locally acting emissions—and thus progress towards sustainable transportation—although mostly in the early 1990s.	☺⇨😐
Indicator 4 shows a decline in injuries and fatalities from road transport, and thus progress towards sustainable transportation.	☺
Indicator 5 mostly shows increased movement of people. Present transport patterns mean this represents movement away from sustainability.	☹⇨😐
Indicator 6 shows substantial growth in the movement of freight. Because of freight's impacts and costs, this represents movement away from sustainable transportation.	☹
Indicator 7 shows the share of all movement of people by more polluting as opposed to less polluting modes. There has been no clear trend in this share.	😐
Indicator 8 mostly shows growth in the movement of personal vehicles. Present transport patterns mean this represents movement away from sustainability.	☹⇨😐
Indicator 9 shows an increase in the amount of urban land used per person. This can result in more transport activity and thus movement away from sustainability.	☹
Indicator 10 shows an increase in paved road capacity. This represents more land and energy use, and can stimulate traffic, indicating movement away from sustainability.	☹
Indicator 11 shows an increase in the share of household after-tax spending going to transport, which thus became less affordable and less sustainable.	☹
Indicator 12 shows an increase and then a decrease in relative transit costs, indicating movement away from then towards sustainable transportation.	☹⇨☺
Indicator 13 shows initial increases in the energy intensity of cars and trucks, representing movement away from sustainable transportation.	☹⇨😐
Indicator 14 shows a decline in the overall emissions intensity of road vehicles, and thus progress towards sustainable transportation.	☺

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What next (until 2005-2006)?

1. Maintain and improve the initial set of STPI.

2. Develop some or all of the proposed shorter-term additions.

3. Prepare for development of some or all of the proposed longer-term additions.

Other major projects developing performance indicators for sustainable transportation

1. The European Union's TERM project

- TERM stands for Transport and Environment Reporting Mechanism.
- TERM is a major project of the European Commission, executed by the European Environment Agency.
- TERM's first report on indicator development appeared in 2000, with subsequent reports in 2001 and 2002.
- To date, 41 indicators have been developed or identified, organized in seven groups, all with a focus on transport's environmental impacts.
- Recent work has focussed on inclusion of data on the EU's accession countries.

Other major projects developing performance indicators for sustainable transportation

2. Rand Europe's SUMMA project

- SUMMA stands for SUstainable Mobility, policy Measures and Assessment.
- SUMMA is also funded by the European Commission.
- More than TERM, SUMMA is concerned with economic and social aspects of transportation as well as environmental aspects.
- To date, well over 100 potential indicators have been identified, but none has yet been developed.
- More than TERM, SUMMA's work is guided by the EU's (i.e., the Centre's) definition of sustainable transport.