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# A Good Example of Bad Transportation Performance Evaluation

*A Critique of the Fraser Institute Report,*

*"Transportation Performance of the Canadian Provinces"*

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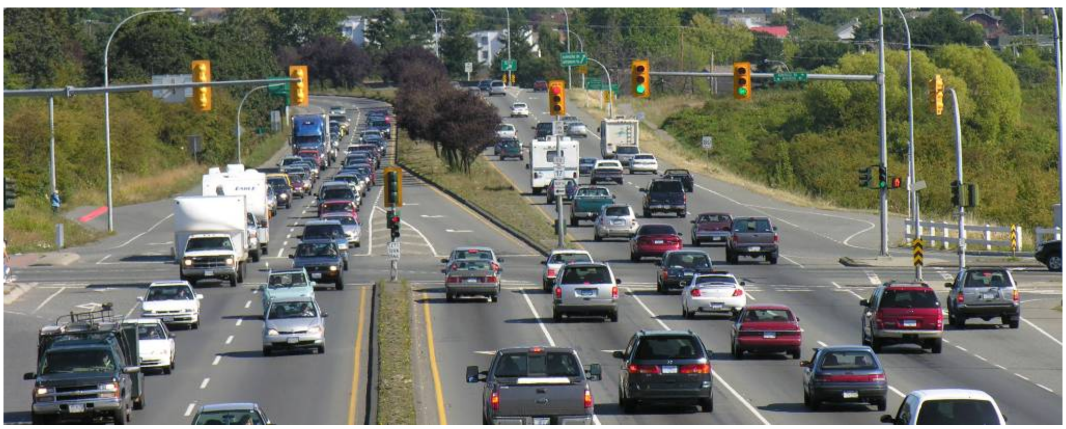

*Hartgen, Chadwick and Fields assume that increased vehicle traffic per lane-kilometer is economically beneficial and desirable, but most people call this "congestion."*

## Abstract

*Performance evaluation* refers to a process of monitoring and analysis to determine how well organizations perform with regard to their intended goals and objectives. This provides useful guidance for planning and management decisions. Performance evaluation must be carefully structured to accurately reflect goals. Inappropriate or incomplete evaluation can misdiagnose problems and result in bad decisions.

This paper discusses transportation performance evaluation concepts and methods, and critiques the report, *Transportation Performance of the Canadian Provinces* by Hartgen, Chadwick and Fields. That report uses a unique set of 23 indicators to evaluate the Canadian transport system. A few of these indicators are appropriate and widely used, but several are ambiguous and biased, and some are illogical. This paper examines these indicators and evaluates their appropriateness for planning and management applications.

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## Introduction

An effective health maintenance program includes regular checkups to monitor patients' fitness and medical conditions in order to help identify, prevent and manage problems. A responsible patient is comforted to hear their physician report, "The checkup indicates that you are overall healthy, but I am recommending some actions you can take to improve your fitness and health."

Similarly, organizations (including businesses, agencies and governments), need ongoing performance evaluation to identify potential problems and optimize productivity. Just as physicians track factors such as diet, body weight, blood pressure and lung capacity, good managers track various factors to monitor organizational fitness and health.

*Performance evaluation* refers to a monitoring and analysis process to determine how well policies, programs and projects perform with regard to their intended goals and objectives. *Performance indicators* (also called *measures of effectiveness*) are specific measurable outcomes used to evaluate progress toward established goals and objectives. A *performance index* is a set of performance indicators in a framework designed to facilitate analysis. Commonly used performance indices include school grades, sports ratings, economic productivity indicators, and investment rating systems.

Performance indices have many practical applications including trend analysis, comparisons, target setting, and incentives (such as rewards) for managers and employees. They provide a navigation system that indicates where the organization is, where it wants to go, and how to get there. They help identify developing problems and the effectiveness of solutions.

Performance indicators must be carefully selected to accurately reflect goals and identify problems. Inappropriate or incomplete indices can misdiagnose problems and misdirect decision-makers. For example, an index that only considers quantity will encourage organizations to produce abundant but inferior output, while an index that only considers quality can result in high quality but inadequate production quantity.

This paper discusses transportation performance evaluation concepts and principles, and critiques the 2008 report, *Transportation Performance of the Canadian Provinces,* by Hartgen, Chadwick and Fields, published by the Fraser Institute, a libertarian research organization located in Vancouver, Canada.

# Transportation Performance Indicators

Transportation professionals have developed considerable information on performance evaluation, including guidance for internal (within the organization) analysis (CalTrans 2008; TRB 2008), strategic planning (CTE 2008), and sustainable transport planning (CST 2003; STI 2008). Conventional transportation performance indicators, such as roadway Level-of-Service (LOS) ratings and average traffic speeds, primarily considered motor vehicle traffic conditions ("Multi-modal LOS" VTPI). They have been criticized for ignoring or undervaluing other impacts and objectives, such as cost efficiency, equity, community livability and environmental quality (SFCTA 2008). In recent years, many transport organizations have developed more comprehensive performance indicator sets that better reflect diverse planning goals and objectives (WSDOT 2008; Litman 2007).

Good performance indices reflect the following principles (FHWA 2000; CST 2003):

- Include various goals and perspectives.
- Effectively indicate how well goals and objectives are being met.
- Are clearly defined.
- Are simple, understandable, logical, and repeatable.
- Can be collected economically.
- Are suitable for trend and comparative analysis.
- Are accessible, understandable and useful to decision-makers and other stakeholders.

Transportation performance evaluation should generally be based on *accessibility* (the ability to reach desired services and activities) rather than just *mobility* (physical movement), because access is the ultimate goal of most transport activity (Levinson and El-Geneidy 2006; Litman 2003; "Accessibility," VTPI 2008). Mobility is one factor that affects accessibility, but other factors are also important, including land use patterns and mobility substitutes such as electronic communication. Mobility-based performance evaluation can lead to planning decisions that increase vehicle travel and associated costs but fail to improve overall accessibility. For example, automobile-oriented transportation improvements, such as road and parking expansion, and highway-oriented land use development, tend to reduce walking, cycling and public transit access and increase travel distances, reducing overall accessibility, particularly for non-drivers. In many situations, overall accessibility can be improved in ways that reduce total motor vehicle travel by improving alternative modes and creating more accessible and multi-modal land use development patterns. Accessibility-oriented indicators will recognize these benefits, but mobility-oriented indicators will not.

There are three general types of performance indicators:

- *Service quality* – These reflect the quality of service experienced by users.
- *Outcomes* – These reflect outcomes or outputs.
- *Cost efficiency* – These reflect the ratio of inputs (costs) to outputs (desired benefits).

Each type is important. Service quality reflects users' perspectives. Outcomes reflect planning objectives. Cost efficiency reflects economic performance. Table 1 illustrates examples of these indicators for various transport modes. Level-Of-Service (LOS) ratings are now available for evaluating most modes ("Multi-Modal LOS" VTPI, 2008).

***Table 1*** **Examples of Performance Indicators for Various Modes**

| Mode | Service Quality | Outcomes | Cost Efficiency |
|---|---|---|---|
| *Walking* | Sidewalk/path supply<br>Pedestrian LOS<br>Crosswalk conditions | Pedestrian mode split<br>Avg. annual walk distance<br>Pedestrian crash rates | Cost per sidewalk-km<br>Cost per walk-km<br>Cost per capita |
| *Cycling* | Bike path and lane supply<br>Cycling LOS<br>Path conditions | Bicycle mode split<br>Avg. annual cycle distance<br>Cyclist crash rates | Cost per path-km<br>Cost per cycle-km<br>Cost per capita |
| *Automobile* | Roadway supply<br>Roadway pavement condition<br>Roadway LOS<br>Parking availability | Avg. auto trip travel time<br>Vehicle energy consumption and pollution emissions<br>Motor vehicle crash rates | Cost per lane-km<br>Cost per vehicle-km<br>User cost per capita<br>External cost per capita |
| *Public transit* | Transit supply<br>Transit LOS<br>Transit stop and station quality<br>Fare affordability | Transit mode split<br>Per capita transit travel<br>Avg. transit trip travel time<br>Transit crash and assault rates | User cost per pass.-km<br>User cost per capita<br>Subsidy per capita |
| *Taxi* | Taxi supply<br>Average response time | Taxi use<br>Taxi crash and assault rates | Cost per taxi-trip<br>External costs |
| *Multi-modal* | Transport system integration<br>Accessibility from homes to common destinations<br>User survey results | Total transportation costs<br>Total average commute time<br>Total crash casualty rates | Total cost passenger-km<br>Total cost per capita<br>External cost per capita |
| *Aviation* | Airport supply<br>Air travel service frequency<br>Air travel reliability | Air travel use<br>Air travel crash rates | Cost per trip<br>External costs<br>Airport subsidies |
| *Rail* | Rail line supply<br>Rail service speed and reliability | Rail mode split<br>Rail traffic volumes<br>Rail crash rates | Cost per rail-km<br>Cost per tonne-km<br>External costs |
| *Marine* | Marine service supply<br>Marine service speed and reliability | Marine mode split<br>Marine traffic volumes<br>Marine accident rates | Cost per tonne-km<br>Subsidies<br>External costs |

*This table illustrates various types of performance indicators.*

Most indicators use *reference units*, measurement units normalized for comparing impacts, such as per capita, per kilometer, per trip, per vehicle and per dollar. The selection of reference units can affect how problems are defined and which solutions are considered. For example, distance-based units, such as per vehicle-kilometer favor rural and suburban conditions, where residents own more vehicles, drive greater distances at higher speeds, and have lower per-mile crash rates than in urban areas. Measuring impacts per trip or per capita favors urban conditions where residents own fewer vehicles, have more nearby destinations, use alternative modes more, and have less severe crashes.

With distance-based reference units such as per-kilometer- fuel-consumption and traffic-fatalities-per-billion-vehicle-kilometers, performance ratings tend to improve with increased annual vehicle mileage. Per-capita units measure *total* impacts, which do increase with mileage. Distance-based units ignore the increases in total consumer costs, accidents and pollution emission problems caused by increased vehicle travel, and the benefits of strategies that reduce total vehicle travel. Similarly, distance-based units ignore the potential benefits of strategies that improve High Occupant Vehicle (HOV) travel. For example, HOV lanes may carry a relatively small portion of total vehicle-kilometers, and so appear inefficient if measured in this way, but carry a larger portion of passenger-kilometers, and reduce total travel time and vehicle costs.

For these reasons, *per capita* and *annualized per capita* are generally the best reference units for evaluating overall costs and risks. Other reference units may be appropriate for evaluating specific projects. For example, congestion reduction impacts on a particular corridor can be evaluated *per additional peak-period person trip* accommodated.

Performance evaluation should also account for differences in conditions and demands. Like should be compared with like, or comparisons should include adjustment factors that account for geographic, demographic or economic differences. For example, urban roadways experience heavy traffic volumes and congestion, while many rural roads receive little use. As a result, urban roadways have high construction and maintenance costs per lane-kilometer, but low costs per vehicle-kilometer because the costs are divided by many vehicle-kilometers. Similarly, high urban traffic densities result in relatively high per-kilometer crash rates in cities, but these tend to be lower-speed crashes. Rural driving has lower crash frequencies but greater crash severities and more driving per capita, resulting in higher per capita traffic fatality rates in rural areas. As a result, it is inappropriate to compare urban and rural indicator values without acknowledging these differences and how the selection of reference units can affect results. Similarly, roadway performance analysis should account for the substantial differences in construction and maintenance costs between flatland and mountainous conditions, and freight performance evaluation should take into account differences in handling costs between bulk and manufactured goods. Failure to account for such differences in comparative analysis results in inaccurate results and unfair ratings.

## A Good Example of Bad Indicators

The 2008 report, *Transportation Performance of the Canadian Provinces*, by Hartgen, Chadwick and Fields published by the Fraser Institute uses a unique set of 23 indicators to evaluate and compare transportation system performance of Canadian provinces. The report's stated intent is to improve transportation performance nationwide by establishing key baseline information that can be used to track performance over time. The report rates provinces from best to worst with regard to specific indicators and aggregate indices.

The authors provide little information about how their index was created. A project like this usually starts with a review of existing literature, discussing what the authors consider good and bad about various approaches, and specific descriptions of how they selected their indicators. Although the authors list numerous references from popular and technical sources, they mention none of the performance evaluation guides by leading transportation professional organizations (OTM 2008; WSDOT 2008; TRB 2008), and although they provide general comments about performance evaluation they offer no details about the indicators they considered and their selection process.

Table 2 shows their performance index. Although some indicators are appropriate and commonly used, others are ambiguous, and a few are illogical for comparative analysis. For example, the safety indicator (*fatality rate per billion vehicle km*) and congestion indicator (*annual hours of delay per capita*) are widely used, but the roadway indicator (*vehicle kilometers of travel per two-lane kilometer of road*) is ambiguous (a higher value could indicate cost efficiency or inadequate roadway supply and congestion) and inherently favors more urbanized provinces over more rural provinces.

The highway cost efficiency indicator (*provincial expenditures per kilometer of major road*) favors provinces with inexpensive, low-volume roads, although the results would be reversed if based on expenditures per *vehicle-kilometer*, which recognizes that the economic value of roads results from their use. Aviation indicators (*passengers* and *tonnes of cargo per flight*) favor provinces with major airports. A road freight efficiency indicator (*Total employment per truck border crossing*) is ambiguous, and rail and marine indicators (*Origin tonnes per km of first line track* and *Port operator expenditures per tonne handled*) ignore differences in handling costs between different types of freight. It implies a province that ships more bulk goods (such as aggregates and potash) has a more productive transport system than one that ships high value manufactured goods.

The study evaluates safety using distance-based indicators such as *fatality rate per billion vehicle km*, which as mentioned earlier, ignores the safety impacts of changes in vehicle travel. *Per capita fatality rates* are more appropriate to measure overall risk, and allow traffic accidents to be compared with other health risks. Congestion costs are measured per capita, as is appropriate. Although government costs are included, there are no indicators of user costs or affordability (such as per capita transport expenditures, or transit and airline fares relative to incomes), business costs (such as parking facility costs and subsidies), user convenience or comfort (such as transit service quantity and crowding), or environmental impacts (such as air and noise pollution).

***Table 2*** **Performance Index** (Hartgen, Chadwick and Fields 2008)

| Mode | Dimension | Measure | Measure weight | Modal weight (trips or tonnes) | Grand weight (trips & tonnes) |
|---|---|---|---|---|---|
| **Passenger** | | | | | **90%** |
| *Highway* | Traffic Vehicle | km of travel per two-lane km of road | 1/8 | 96.50% | |
| | Cost | Provincial expenditures per km, major road | 1/8 | | |
| | Condition | Percent of major roads in fair or poor condition | 1/8 | | |
| | Access | Travel time to Ottawa | 1/8 | | |
| | Access | Travel time to US border | 1/8 | | |
| | Safety | Fatality rate per billion veh-km | 1/8 | | |
| | Congestion | Annual hours of delay per capita | 1/8 | | |
| | Access | Avg. round trip commute time | 1/8 | | |
| *Transit* | Traffic | Ridership per capita served | 1/2 | 3.24% | |
| | Cost | Operating cost per trip | 1/2 | | |
| *Air* | Traffic | Passengers per flight | 1/2 | 0.17% | |
| | Safety | Accidents per million passengers | 1/2 | | |
| *Rail* | | Not evaluated | | 0.01% | |
| *Marine* | Traffic | Government operating cost per passenger | 1/2 | 0.08% | |
| | Safety | Accidents per million passengers | 1/2 | | |
| **Freight** | | | | | **10%** |
| *Highway* | Traffic | Tonnes of truck traffic per km of road | 1/3 | 23.80% | |
| | Safety | Fatal collisions per million tonnes | 1/3 | | |
| | Trade | Total employment per truck border crossing | 1/3 | | |
| *Air* | Traffic | Tonne of cargo per flight | 1.0 | 0.10% | |
| *Rail* | Traffic | Origin tonnes per km of first line track | 1/2 | 27.20% | |
| | Safety | Rail accidents per million originating tonnes | 1/2 | | |
| *Marine* | Traffic | Port operator expenditures per tonne handled | 1/3 | 48.90 | |
| | Safety | Port expense/revenue ratio | 1/3 | | |
| | Trade | Shipping accidents per mill. tonnes | 1/3 | | |

*This table summarizes the performance indicators used by Hartgen, Chadwick and Fields.*

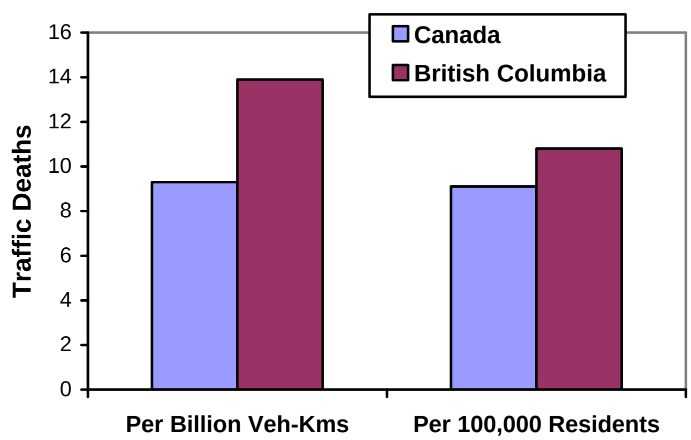
Because the index gives passenger transport 90% of the total weight, and highway transportation 96.5% of that, highway transport receives 87% of total weight. These weights are based on each mode's share of trips, although for economic analysis they should be weighted based on value, which would raise the importance of air and freight transport, and perhaps public transit. This weighting favors lower-value transport, such as bulk goods movement over higher value transport. For example, it assumes that a percentage improvement in highway travel speed, safety and cost efficiency is much more important than the same proportional improvement to other modes.

The index assumes that increased vehicle travel per roadway kilometer is desirable and so favors policies that encourage driving such as more dispersed land use development (sprawl), minimal fuel prices and road tolls, and minimal provision of alternative modes. Roadway cost efficiency is evaluated based on provincial expenditures per road-kilometer, which favors construction of more low-cost roads, offloading costs to other levels of government, and toll financing. Those may be appropriate, but are not necessarily indicators of overall improvement in transport system performances.

The study includes highway *access* indicators (travel times to Ottawa, the U.S. border and for commuting) but no comparable indicators for other modes. This reflects a misunderstanding of the concept of accessibility, which is multi-modal. There are no indicators of non-motorized travel, although walking and cycling have greater mode share than many of the modes the study includes. Public transit gets only 3% of the weight of highway transport. Although it considers transit ridership desirable, user comfort and safety are not measured and transit service cost minimization is favoured. No or cheap transit service is considered better than comprehensive transit service providing basic mobility over a broad area, or high quality urban transit service designed to attract travelers who would otherwise drive on congested highways. Similarly, air, rail, ferry, and the various forms of freight transport would only receive modest support, due to their low weights. The index favors cheap ferry services (acknowledging that ferry service costs are really incomparable, the study arbitrarily reduces New Brunswick, Newfoundland and Labrador ferry performance ratios).

The report indicates that British Columbia has a relatively high traffic crash rate. Although British Columbia has a 49% higher fatality rate than the national average measured by distance (13.9 versus 9.3 deaths per billion vehicle-kilometers), it is only 19% higher when measured per capita (10.8 versus 9.1), which is generally a better indicator of overall risk and transport system performance as previously discussed.

***Figure 1*** **Traffic Accidents**[1]




*British Columbia has a relatively high distance-based crash rate but less if measured per capita.*

[1] *Canadian Motor Vehicle Traffic Collision Statistics* (www.tc.gc.ca/roadsafety/tp/tp3322/2005/page5.htm)

Two indicators are particularly illogical: *Travel time to Ottawa* and *Travel time to US border*. Although accessibility indicators (such as jobs within 30 minute commute of homes) are appropriate and increasingly used to evaluate transport systems (Levinson and El-Geneidy 2006), these are inappropriate because they assume:

- Canada has only two economically important destinations: Ottawa and the U.S. In fact, Canada has many regions each with multiple economic activity centers. Economic success requires access to diverse destinations within and between regions.
- Ottawa is Canada's economic center. Although a major administrative center, it has only modest economic importance. If a single city were to be selected, it should be Toronto.
- All travelers drive to Ottawa, although most (particularly business and wealthy tourists who have the most economic importance) generally fly when traveling longer distances.

Consider the transport policies and conditions these indicators imply are desirable:

- *Km of travel per two-lane km of road*. Vehicle travel should be encouraged and concentrated on minimal road kilometers. Provinces with busier roads have better transport systems than provinces with lower-volume roads.
- *Annual hours of congestion delay per capita* and *average commute times*. Rural areas have better, more productive transport systems than dense, urban areas with heavy commute volumes, although cities actually tend to have higher per capita economic productivity.
- *Provincial expenditures per km of major road*. Provinces should minimize highway expenditures even if that reduces service quality or off-loads costs to other levels of governments. Provinces with better highways and more challenging terrain are inferior.
- *Travel time to Ottawa* and *Travel time to US border*. Central and southern provinces have better transport systems than western, eastern and northern provinces.
- *Total employment per truck border crossing*. Provinces should minimize border crossings.
- *Government costs per ferry trip*. Provinces should only subsidize short, high volume routes.
- *Port operator expenditures per tonne handled*. A province is more productive if it transports easily handled products (for example, coal rather than automobiles).

Unsurprisingly, the study ranks Ontario first (it has the fastest highway travel time to Ottawa, is highly urbanized and is a major transfer center); British Columbia last for personal transport (it is distant from Ottawa and has many costly, mountainous roads); and Newfoundland and Labrador last for freight transport (they have minimal rail and air freight volumes). These conclusions are meaningless. The study's analysis may be precise (calculated to several significant figures), but useless for planning and management applications. For example, unless the British Columbia Ministry of Transportation can move the province closer to Ottawa, highway travel time to that city indicates nothing about the provinces' transport planning problems and priorities. Similarly, unless its provincial government can make Newfoundland and Labrador into major rail and air freight transport hubs, its ranking by this methodology will stay low.

Table 3 critiques Hartgen, Chadwick and Fields' index. Many of their indicators are ambiguous and biased. Only a few are really useful for transport planning. The index has significant omissions. Below are examples of indicators that could be added to more accurately reflect overall transport system performance:

- Nonmotorized transport service quality indicators (sidewalk, crosswalk and path supply, facility quality, safety).
- Public transit service quality indicators (service supply, crowding, safety and affordability)
- Freight transport value (rather than volume).
- Energy consumption and efficiency.
- Consumer transportation costs and affordability.
- Pollution emissions.
- Quality of mobility for non-drivers (universal design of sidewalks and transit services, paratransit availability, fare discounts for disadvantaged populations).
- Accessibility (portion of jobs and affordable housing located in areas with nearby services, walkability, bike paths and transit services).

The authors acknowledge that their index is arbitrary and incomplete and so offer the following defence:

> Of course, some provincial road managers would immediately point out that the provinces are not comparable. For example, British Columbia has road traffic, congestion, cost-of-business, weather, terrain, and climatic conditions that are vastly different from Saskatchewan. That might be, but other provinces might counter that they do not have the fiscal resources that the more populous provinces have and, therefore, are constrained as to actions they can take. Following this logic, one would be quickly led to the absurd conclusion that no comparisons between provinces are ever possible. Our view is that, even with different circumstances, each province is responsible for the road system's upkeep and expansion using the resources it has. And each province is dependent on others for accessibility, since modal systems connect provinces. Therefore, a measure that shows how much each province has to work with, relative to system and size, is a useful comparative measure of resources that should translate into results.

This fails to enlighten. The wording is unclear, particularly the last sentence. It implies that only a few "road managers" would question the study's assumptions and methods. It appears to argue that since performance must be evaluated, any index can be used for comparison, regardless of how arbitrary and biased. This is irrational and unfair, particularly if results are used to rate organizations or jurisdictions as *good* and *bad*, as Hartgen, Chadwick and Fields do, rather than simply a time series analysis of individual jurisdictions.

***Table 3*** **Performance Index Evaluation Summary**

| Indicator | Critique | Favors (Direction of Bias) | Grade |
|---|---|---|---|
| Kilometers of vehicle travel per two-lane km of road | Ambiguous. Could indicate inadequate road supply. | Urban conditions and increased vehicle traffic. | D |
| Provincial expenditures per major road kilometer | Inappropriate. Ignores geographic and traffic volume differences. | Rural conditions, and cheap, inferior roads. | C |
| Percent of major roads in fair or poor condition | Appropriate | | A |
| Roadway travel time to Ottawa | Inappropriate. Misrepresents the concept of access. | Central provinces, particularly Ontario and Quebec. | F |
| Roadway travel time to US border | Inappropriate. Misrepresents the concept of access. | Southern provinces. | F |
| Traffic fatality rate per billion vehicle-kms | Mobility-based. | Increased motor vehicle travel. | C |
| Annual hours of congestion delay per capita | Appropriate, but data are limited to a few cities. | Provinces with few large cities. | B |
| Average round trip commuting time | Inappropriate as a road indicator; should apply to all modes. | Smaller cities and rural areas. | B |
| Transit ridership per capita served | Appropriate if one of several transit quality indicators. | Larger cities. | B |
| Transit operating cost per trip | Appropriate. | Larger cities. | B |
| Aviation passengers per flight | Inappropriate. Misrepresents the concept of load factor. | Cities with major airports. | D |
| Aviation accidents per million passengers | Appropriate. | | A |
| Government operating cost per ferry passenger | Inappropriate. Ignores differences in costs. | Provinces with shorter and cheaper ferry services. | D |
| Accidents per million ferry passengers | Appropriate. | | A |
| Tonnes of truck traffic per km of road | Ambiguous. Could indicate inadequate roads. | Urban areas and increased freight truck volumes. | D |
| Fatal collisions per million tonnes | Mobility-based. | Increased motor vehicle travel. | B |
| Total employment per truck border crossing | Inappropriate. Provides meaningless information. | Provinces with more jobs and fewer border crossings. | F |
| Tonnes of cargo per flight | Inappropriate. Misrepresents the concept of load factor. | Cities with major airports. | D |
| Origin tonnes per km of first line track | Ambiguous. Indicates little about true cost efficiency. | Provinces that generate high rail freight volumes. | C |
| Rail accidents per million originating tonnes | Appropriate. | | A |
| Port operator expenditures per tonne handled | Ambiguous. Indicates little about true cost efficiency. | Provinces with cheaper-to-handle marine freight. | D |
| Port expense/revenue ratio | Appropriate, but fails to account for factors such as investment. | Provinces not currently improving port facilities. | B |
| Shipping accidents per million tonnes | Fails to account for different types of freight | Provinces with safer-to-handle marine freight. | B |

*This table critiques performance indicators used by Hartgen, Chadwick and Fields.*

## Performance Index Bias

Overall, Hartgen, Chadwick and Fields' performance index favors mobility over accessibility and automobile transport over other modes, as indicated by the use of volume and distance-based indicators which assume that increased vehicle travel improves transport system performance and imposes no additional costs or risks. The report provides no discussion of these issues although they are widely acknowledged by transportation professionals (Levinson and El-Geneidy 2006; Litman 2003).

The index evaluates automobile travel more sensitively than other modes. Six of eight highway indicators reflect service quality (roadway condition, travel times, congestion delays, fatality rates), but public transit is evaluated based only on outcomes (ridership) and cost efficiency (operating costs); non-motorized modes are ignored altogether although they serve more total trips than public transit, air, rail or marine. The authors might claim they are simply responding to demands (most personal travel is currently by automobile) and data constraints (data on walking, cycling and public transit are limited), but this reflects a self-fulfilling prophecy: inadequate data results in undervaluation and underinvestment in alternative modes, resulting in inadequate data collection. The report fails both to discuss these issues and to recommend reforms.

Another indicator of bias is the lack of consideration of transport energy consumption as an indicator. This is both an economic and an environmental issue, since energy is a major economic cost to consumers and businesses, in addition to imposing ecological damages and risks.

The authors' bias is indicated by the following quote (p. 52),

> A particularly thorny area of evaluation is the impact of transportation investment on induced travel and development. This is a subject of considerable research in recent years, but the findings remain elusive. Even the definitions of such terms as "induced travel" are open to a wide variety of interpretation and measurement problems. While many researchers believe that these impacts exist, it is extremely difficult to demonstrate their presence even for aggregate investments and certainly for a specific project. For this first round, we take the conservative position that these impacts are not sufficiently quantifiable for measurement at the provincial level.

This statement is inaccurate and indicates the authors are either ignorant or intentionally misrepresenting current knowledge regarding induced travel. A 1994 study by leading transportation economists concludes that expanding congested roadways induces significant amounts of additional vehicle travel, and provided guidance for modeling induced travel effects (SACTRA 1994). In 1996 a special edition of the journal *Transportation* was devoted to induced travel which included numerous articles on the subject. Many other studies and articles on the subject have been published in the professional literature since (Litman 2001). Ignoring induced travel exaggerates highway expansion benefits, leading to waste, which is the opposite of *conservative*.

## Conclusions

Performance evaluation indicates an organization's progress (or lack thereof) toward its goals and objectives. This is essential for effective planning and management. Which indicators are used and how they are defined can significantly affect analysis results, and therefore planning decisions.

Various professional organizations offer guidance on transport performance evaluation. Current practices apply indicators that reflect accessibility rather than just mobility, multiple modes rather than just automobile transport, and diverse planning objectives rather than just vehicle traffic conditions.

The report, *Transportation Performance of the Canadian Provinces* by Hartgen, Chadwick and Fields applies a unique set of 23 indicators to evaluate provincial transportation systems. A few of these indicators are appropriate and widely used, but some are ambiguous and biased, and several are illogical. The study makes interprovincial comparisons that are inappropriate due to substantial geographic, demographic and economic differences.

The results of this analysis are useless for planning and management. They imply that increasing motor vehicle travel and freight transport volumes are inherently beneficial. They provide no guidance on public transit service quality, nonmotorized transportation, or factors such as consumer costs and fuel efficiency. If applied they would bias decisions to favor mobility over accessibility and automobile travel over other modes.

Transportation professionals sincerely interested in performance evaluation can find plenty of good information resources for developing useful and appropriate indicators. Hartgen, Chadwick and Fields provide a useful service by demonstrating what not to do.

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## About the Author

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