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THE FULL COSTS OF TRANSPORTING PEOPLE IN THE GREATER VANCOUVER REGION

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INTRODUCTION

As increasing numbers of people around the world spend more and more time on congested streets, and as governments' ability to provide sufficient road infrastructure to meet demand is hindered, many transportation planners and economists have begun to ask a set of probing questions:

- What are the full economic costs of transportation?
- Who is paying for our ability to move?
- Are the costs being borne fairly?
- What evidence exists of misallocation of resources?
- How can we improve our transportation system?

A number of agencies have begun formal programs to find the answers to these questions.

This paper presents the methodology and findings of one of the most comprehensive studies in this area. As will be shown, the study does not provide the definitive answers to the questions posed above, but does provide enough insight to begin to address some of the transportation problems society is facing. This work is also a useful starting point in developing newer and more comprehensive approaches to developing the information that is required to fully answer the questions.

THE TRANSPORT 2021 PROJECT

The Greater Vancouver Regional District (GVRD) and the Province of British Columbia initiated a process of developing a Greater Vancouver Transport Action Plan in 1992. This two-year project, entitled **TRANSPORT 2021**, had as its goal the formation of a transportation plan with which to guide the development of policies, programs and infrastructure for the movement of people in Greater Vancouver over the ensuing 30 years.

As part of this endeavor, the TRANSPORT 2021 staff commissioned a number of studies to help them develop their final recommendations for an effective long term transportation plan for the region. One of these studies was to conduct and analysis of the "full" economic costs of various modes of passenger transport. The specific objectives of the study were:

- To estimate the total economic costs of the different modes of passenger transport in the Greater Vancouver region.
- To determine how much of the costs are paid by the users of the different modes of passenger transport.
- To identify the groups that incur these costs either directly or indirectly.
- To identify the extent to which the movement of people is subsidized.

STUDY APPROACH

The study was undertaken within the context of an identification and quantification of costs. No attempt was made to present the findings in a benefit-cost analysis framework. The study did not attempt to determine exact costs, rather, the focus of the analysis was to identify all relevant costs and where necessary, make broad assumptions about the quantum.

The approach to this assignment was to modify a computer model developed by Mr. Todd Litman of Evergreen State College in Washington as part of his Masters Thesis. This structure of the model was modified to meet the needs of the study and to reflect data availability, which in many instances, was better than that used in the initial model.

Costs were assessed for the year 1991 for the movement of people in the following spatial and temporal groupings.

- Urban A.M. peak
- Urban off-peak
- Suburban
- Total

MODES OF PEOPLE TRANSPORT ANALYZED

Twelve modes of people transport were identified and included in the model as indicated in Exhibit 1.

Exhibit 1
Modes of Transport Used in the Model

Private Transport	Public Transport	Non-Motorized Transport
Average Car	Diesel Bus	Bicycle
Fuel Efficient Car	Trolley Bus	Pedestrian
Car Pool	Skytrain	Telecommute
Van Pool	Seabus	
Motorcycle		

It is important to note that these twelve modes are not complete substitutes for each other. However, many of these modes can be substituted for one another under certain conditions. For example, for very short distances, walking can be an effective substitute to driving. In addition, some modes (especially public transit) work in conjunction with one another.

Most of the modes are self-evident in terms of what they represent. Some of the others are not, and are described below.

- **Skytrain** - Skytrain is an Advance Light Rail Transit system which operates between the downtown area of Vancouver to North Surrey. The system is elevated for most of its length, except for the portion in the downtown area, which runs underground.

- **Seabus** - Seabus is a passenger ferry system which runs across Burrard Inlet from the downtown area of Vancouver to North Vancouver.

- **Telecommute** - Telecommuting does not actually directly involve the movement of people between their residences and places of work. People working out of their homes often have "clients" visit however, and hence do impose costs on the transportation system.

The study focuses on the private and public transport modal groups. The non-motorized modes of transport were reviewed, though the level of analysis was more of an overview of the costs.

BASIC STATISTICS

Basic statistics about the transportation system were collected from the Greater Vancouver Regional District, B.C. Transit and other sources. These statistics were used to portray costs in the appropriate unit basis (e.g. cost per passenger kilometre).

The Greater Vancouver region had a population in 1991 of about 1.76 million, with a total driver population of 1.16 million. The region contains about 1.03 million vehicles, which consumed 1.7 billion litres of fuel and travelled over 11,319 kilometres of roads.

During 1991, about 1.3 billion person-trips were taken in automobiles in the Greater Vancouver region. The average trip length was slightly less than 14 kilometres. This means that over 17 billion kilometres were travelled by residents and visitors in 1991. The annual average distance driven by a car is estimated to be 15,500 kilometres

The average occupancy in a car on any given trip was 1.43 people. About 8% of total automobile trips were made in the urban A.M. peak period, while 50% were made in the urban off-peak period. Private automobile travel accounted for over 90% of all trips made in motorized vehicles (i.e. public or private vehicles) in 1991. During the urban A.M. peak period, private motorized vehicles accounted for about 80% of total trips.

During 1991, about 127 million person-trips were made using public transit. A person-trip could involve the use of a combination of buses, Skytrain and Seabus. Thus while B.C. Transit reports 175 million riders on its bus system and 35 million riders on Skytrain, only 127 million person-trips were involved. The average distance travelled by a bus passenger was about 10 kilometres while the average distance travelled by a Skytrain passenger was 18 kilometres.

ASSESSMENT OF COSTS

The cost model was based on twenty key categories of cost grouped under six general headings, as indicated in Exhibit 2.

Exhibit 2
Cost Categories Used in the Model

Direct User (operating) Costs	Indirect Parking Costs	Transport Infrastructure	Time	Urban Sprawl	Environment & Social Impacts
Fixed Vehicle Costs	Residential	Road Construction	Personal	Infrastructure	Unaccounted Accident Costs
Variable Vehicle Costs	Commercial	Road Maintenance	Commercial Delays	Loss of Open Space	Air Pollution
Parking Fees and Fines	Government	Roadway Land Value		Future Transport Options	Water Pollution
		Transit Land Value			Noise Pollution
		Protection Services			

Direct User (Operating) Costs

Direct user costs (operating costs) represent the costs incurred by the owner of the vehicle/mode, including fixed costs, variable costs, and parking fees and fines. The following describes the costs included in each category and the principal sources of information.

Fixed Vehicle Costs - Fixed vehicle costs can be defined as time and ownership related costs. For private motor vehicles, these include insurance, licence and registration, depreciation and financing. In the case of public transit, the costs include insurance, depreciation, financing and management. For telecommuting, the costs pertain to the equipment required to enable working at home, namely a computer system and a fax machine.

The Canadian Automobile Association's "1992/93 Car Costs" was the source of most of the information regarding motorized vehicles. B.C. Transit provided information on the four modes of public transit. The B.C. Bicycle Association provided estimates for the costs of owing a bicycle, while KPMG developed estimates for the fixed costs of telecommuting. We did not ascribe any fixed costs to pedestrians.

Variable Vehicle Costs - Variable vehicle costs can be defined as the costs that vary directly with usage of the mode. For motorized vehicles, these include fuel (gasoline, propane, electricity, etc.), oil, maintenance, tires and labour costs. For bicycles, the costs relate to repair and maintenance, while for pedestrians, the cost pertain to shoes.

The sources of information are the same as those for fixed vehicle costs.

Parking Fees and Fines - Parking fees and fines represent the costs paid directly by users for parking facilities such as parking meters and parking lots, as well as municipal parking fines. Municipal records were used to obtain information on parking meters, municipally owned/operated parking lots and parking fines. Parking meters contribute about $5.4 million to municipal revenues annually while parking fines contribute about $7.3 million.

The total revenue from parking lots was more difficult to calculate. We used figures from the B.C. Assessment Authority on the total number of revenue parking stalls in the Greater Vancouver region, adjusted for the assumption that 50% of these revenue stalls were free stalls with a time limit. With a total of about 135,000 revenue parking stalls, this means that about 68,000 stalls represents the number that actually receive revenues. Discussions with parking lot operators indicated that average annual revenue from a parking stall varied from $200 to $1,200 per year with an overall average of about $500. This results in total annual revenues of about $33.9 million. Parking costs are assessed at the average for automobiles, at 120% of average for vans and 50% for motorcycles.

A summary of the costs is presented in Exhibit 3.

Exhibit 3
Summary of Direct User (Operating) Costs ($ per vehicle kilometre)

Mode	Direct Costs	Variable Costs	Parking Fees/Fines
Average Car	$0.228	$0.104	$0.004
Fuel Efficient Car	0.185	0.083	0.004
Car Pool	0.228	0.104	0.004
Van Pool	0.274	0.124	0.005
Motorcycle	0.205	0.052	0.002
Diesel Bus	0.883	2.442	0.000
Trolley Bus	1.666	4.510	0.000
Skytrain	8.014	1.300	0.000
Seabus	5.675	0.338	0.000
Bicycle	0.015	0.059	0.000
Pedestrian	0.000	0.104	0.000
Telecommute	0.154	0.000	0.000

Indirect Parking Costs

Indirect parking costs represent the costs of non-market parking such as that provided by business and government, as well as that provided at residential dwellings.

Commercial Parking - Commercial parking is defined as the the free parking provided to customers of commercial establishments such as shopping malls and company parking spaces provided for employees of a business. This cost category does not include the cost of parking in pay lots provided for company employees.

The costs of commercial parking were determined through discussions with parking lot operator. The range in capital costs is $1,500 to $30,000 per stall for surface level and underground parkade respectively. The range in annual costs is $360 to $4,830. The land consumed by commercial parking was assessed at $233,000 per hectare and amortized over 10 years.

The B.C. Assessment Authority has identified about 131,000 commercial parking stalls, but notes that they have omitted an unknown number due to data limitations. Accordingly, we based our estimate on the findings of American studies which indicate that about 85% of commuters are provided with free parking. The resulting estimate of the number of free parking stalls is 206,000.

The resulting calculations reveal a total cost of commercial parking of about $117 million per year.

Government Parking - Government parking is defined as the parking provided free-of-charge to employees and visitors. A total of about 57,000 parking stalls have been identified by the B.C. Assessment Authority. The methodology of calculating the annual cost of providing these parking stalls was the same as that for commercial parking. The total cost of government parking is estimated to be about $26 million per year.

Residential Parking - Residential parking is defined as the portion of residential dwellings used for parking. This includes the land consumed,and any improvements such as paving and construction of garages or carports.

Very little data exists on the number and type of residential parking stalls. Accordingly, a model was developed that assumes that three-quarters of all ground-oriented dwellings have a parking stall and all apartment units have a parking stall. The result of this calculation is an estimate of about 547,000 residential parking stalls.

The annual costs were determined by examining the typical construction costs for carports, garages and underground parkades, and the value of land consumed by parking. The annualized ownership and operating costs average about $750 per stall. The value of land consumed, amortized over 10 years, amounts to about $46 million. The total annual cost thus amounts to about $454 million.

The cost per vehicle kilometre for this non-market parking is as follows:

- Automobile - $0.050 per kilometre
- Van - $0.060 per kilometre
- Motorcycle - $0.025 per kilometre

Transport Infrastructure

Transport infrastructure costs include the costs of building and maintaining infrastructure, including the costs of land and protection services (police, fire, etc.).

Road Construction - Road construction costs are defined as the total annual costs of road construction that are not financed bu user fees such as fuel taxes and vehicle registration fees. The major difficulty with calculating these costs is that government accounts for capital expenditures on roads as an annual expense. Annual expenditures on roads also fluctuate significantly making the process of determining a typical level of expenditure difficult.

The methodology employed to calculate these costs was to determine the level of capital expenditure by the provincial and municipal governments over the previous 20 years. This figure was then multiplied by a factor of 2.0 to arrive at an estimate of the historical cost of all road infrastructure in the Greater Vancouver region. An estimate of the opportunity cost of capital employed was then calculated by using a long term interest rate of 10%. The previous two years of capital expenditures were used to develop a proxy of the necessary repayment of principal.

These costs were further adjusted by adding administrative costs, deducting transfers between parties (to avoid double-counting) and deducting provincial vehicle licences, fuel taxes and fines. The results of this analysis are as follows:

Interest Expense	$448 million
Principal Repayment	$217 million
Administration	$10 million
Taxes/Licenses/Et c.	$239 million
Total	$436 million

The costs are assigned by mode based vehicle kilometres and a road space index, which represents the the relative area occupied by different types of passenger vehicles. The index ranges from 1.0 for an automobile to 3.0 for a transit bus.

Road Maintenance - Road maintenance and rehabilitation costs include the costs associated with roads, bridges, street lights, traffic signals, drainage and traffic control. Also included are the costs of operating, maintaining and/or subsidizing the cost of two minor ferry operations.

The costs were developed from provincial and municipal records and totalled $173 million. Road maintenance costs were allocated to modes based on annual kilometres driven and an index of average axle weights.

Protection Services - Protection services costs include the annual operating costs of fire and police protection, and ambulance and court costs identified with traffic safety. The identification of costs was undertaken in conjunction with representatives of the municipalities, Ministry of Attorney General and Ministry of Health. The total costs were estimated to amount to about $43 million.

Protection service costs were allocated to modes based on annual kilometres driven and an estimate of the frequency with which the services would be required by mode. The frequency of use was estimated to be 10% of that of automobiles for buses, 5% for Skytrain and Seabus, and 1% for pedestrians. These figures are not based on hard evidence, rather they represent an informed guess of the individuals involved in the provision of the services.

Roadway Land Value - Roadway land value is defined as the annualized value of the land used for roads in excess of a basic transportation network. This cost category was perhaps the most difficult to deal with in that a standard, widely accepted methodology had never been proposed in the past.

Roads are used for walking, bicycling, utility corridors, emergency access and other activities besides driving. Roadway land costs thus should not be charged entirely to automobile users. We defined a basic road right-of-way as being 7 metres wide. The value of land dedicated to roads in excess of this amount is then considered to be a subsidy to vehicles.

The total area devoted to roads was determined from municipal and provincial records. This was then combined with information about the length of the road system to develop an estimate of the excess land. The calculations indicate that of the 28,188 hectares dedicated to roads, 20,265 hectares can be classified as excess land.

Part of the value of land is derived from its accessibility. Reduced accessibility through smaller roads would reduce land values. Therefore, roadway land should not be valued at full assessed value. No definitive studies have been undertaken to place a value on roadway land, hence the project Steering Committee decided that roadway land value should be discounted by 70% from the full assessed value. Insofar as roads account for about 8% of all land in the region, this has the impact of reducing average land value by about 6%.

The discounted value of the excess roadway land was estimated to be about $5.8 billion in 1991. The opportunity cost of this land was determined by assuming an interest only loan at 10%. The annual cost of the excess roadway land is thus about $580 million. These costs are assigned to the modes of transport using the roads on the basis of vehicle kilometres and the road space index previously described.

Transit Land - Transit land was valued in a similar fashion to excess roadway land. Land is used solely for transit purposes for the Skytrain right-of-way, Skytrain and Seabus terminals, bus loops and depots, and park-and-ride facilities. The discounted assessed value is about $70 million, resulting in an annual cost of $7 million.

The land cost associated with each of the transit modes are dealt with on an individual basis. These costs are assigned solely to the transit modes on the basis of passenger kilometres.

Time

Time costs include the cost of personal time involved in travelling within the region as well as the cost of delay time for commercial/business drivers resulting from peak period congestion.

Personal Time - Transportation economists typically value personal time at 50% of the average wage rate for drivers and 35% of the average wage rate for passengers. The average wage rate of residents of the Greater Vancouver region in 1991 was about $18 per hour. Accordingly, the value of time is $9 per hour for drivers and $6 per hour for passengers.

The value of travel time during the A.M. peak period was factored upwards by 1.5 to account for the higher value placed on time by individuals experiencing congested traffic conditions. This approach is currently in wide use in the B.C. Ministry of Transportation and Highways in estimating the impacts of highway investment.

Average speeds used in the calculation are as shown in Exhibit 4.

Exhibit 4
Average Speeds and Trip Length by Mode (kilometres per hour/kilometres)

Mode	Speed - Urban A.M. Peak	Speed - Urban Off-Peak	Speed - Suburban	Trip Length
Automobile	30	40	55	13.7
Motorcycle	35	45	60	13.7
Diesel Bus	20	25	35	12.2
Trolley bus	20	25	N.A.	8.3
Skytrain	43	43	N.A.	17.7
Seabus	20	20	N.A.	7.1
Bicycle	17	17	18	13.7
Pedestrian	3.4	3.5	4	13.7

While the distances shown for bicyclists and pedestrians are not realistic, the per kilometre costs are typical.

The total value of time was estimated to be $5.0 billion and was distributed by passenger kilometres by mode according to the factors discussed above.

Commercial Delays - Commercial delays are defined as the incremental delays to commercial and business traffic during the peak periods. The calculation of the cost of these delays is based on the decrease in average speeds during the peak period and an opportunity cost of twice the average wage of the driver. For commercial vehicles, the distance travelled during the A.M. peak period was estimated to be 24.8 million kilometres. Business-related travel by automobile was estimated to be 10% of total travel during this period, i.e. 108.4 million kilometres.

The total cost of commercial delays was estimated to be $95 million for both the A.M. and the P.M. peak periods. These costs were assigned to the individual modes based on vehicle kilometres and the road space index.

Urban Sprawl

The costs of urban sprawl manifest themselves in a number of ways, including:

- Through increased infrastructure costs (roads, sewers, utilities, school transportation, etc.).
- Through the loss of wildlife habitat and other indirect environmental impacts.
- Through the imposition of higher transportation costs on future generations.

These costs were not examined in detail in this study. Instead, the study relies on the findings of a report entitled "Transportation Cost Survey" by Mr. Todd Litman. This report estimates the costs to be as follows:

Infrastructure Costs	- $0.006 per vehicle kilometre
Loss of Open Space	- $0.017 per vehicle kilometre
Future Transport Costs	- $0.005 per vehicle kilometre

Environmental and Social Impacts

The environmental and social impact include unaccounted accident costs and air,water and noise pollution.

Unaccounted Accident Costs - Unaccounted accident costs are defined as the costs to society which are not accounted for in insurance claims. The calculation of these costs involved a detailed assessment of the number and types (fatal, bodily injury and property damage) of accidents in 1991. The frequency of involvement by the various modes was also identified. Blame was assigned on a 50:50 basis to the participants in the accidents as more detailed information was not available.

The social costs of an accident were develop based on a study entitled "The Costs of Highway Crashes" by Ted Miller for the Federal Highway Administration. This study identified the per accident costs as being:

Accident involving a fatality	- $3.620 million
Accident involving an injury	- $0.088 million
Accident involving property damage	- $0.006 million

The total costs were estimated to be about $1.5 billion after the payment of insurance benefits. These costs were allocated by mode based on vehicle kilometres travelled and an unaccounted accident cost index that reflects the relative incidence of accident costs not covered by insurance. This index ranges from 0.53 for buses to 5.8 for pedestrians.

Air Pollution - The costs of air pollution were measured for the most common pollutants: carbon dioxide, methane, carbon monoxide, nitrogen oxides, sulphur dioxide, volatile organic compounds, particulate matter and chlorofluorocarbons (CFCs). A detailed analysis of emission levels and sources was undertaken based on data provided by the Greater Vancouver Regional District.

The per unit environmental costs were obtained from a report entitled "Evaluation of External Costs Associated With Natural Gas Use" by G.E. Bridges for B.C. Gas. The costs per tonne ranged from $5.45 for carbon dioxide to $29,430 for CFCs.

The total cost was estimated to be $432 million, of which $422 million was assigned to private vehicles, while the remaining $10 million was assigned to transit vehicles. The costs within each mode were assigned by vehicle kilometres and relative fuel efficiency.

Water Pollution - The cost of water pollution was examined in detail. Instead, the study relied on the findings of the report entitled "Transportation Cost Survey" by Todd Litman. This report estimates the cost of water pollution to be $0.002 per vehicle kilometre. This cost is adjusted by relative fuel efficiency of the various modes.

Noise Pollution - The cost of noise pollution relates to the decrease in property values because of the noise generated by high volumes of vehicle traffic. The study used a methodology employed by the B.C. Ministry of Transportation and Highways which indicates that property values decrease by 0.6% for each decibel of noise above 50 decibels (average).

The investigation of this matter indicates that about 790 kilometres of road have average noise levels above 50 dB(A), and that with current traffic volumes, the average noise level is 64 dB(A). The affected lands are estimated to have an assessed value of about $7.2 billion. The reduction in land value is thus about $600 million, which on an annualized based equates to about $60 million. This cost is assigned to the modes on the basis of vehicle kilometres and a noise index which ranges from 1.0 for automobile to 2.0 for diesel buses and 3.0 for motorcycles.

FINDINGS

The principal findings of the study are shown in Exhibit 5. This exhibit indicates the unit costs (per passenger kilometre) for the twelve modes.

Exhibit 5
Summary of Unit Costs ($ per passenger kilometre)

Mode	Urban A.M. Peak	Urban Off-Peak	Suburban	Average
Average Car	$0.99	$0.69	$0.61	$0.68
Fuel Efficient Car	0.94	0.64	0.57	0.64
Car Pool	0.65	0.42	0.36	0.41
Van Pool	0.52	0.31	0.26	0.31
Motorcycle	1.33	1.03	0.95	1.01
Diesel Bus	0.78	0.61	0.50	0.6
Trolley Bus	0.80	0.67	N.A.[2]	0.7
Skytrain	0.48	0.79	N.A.[2]	0.74
Seabus	0.71	0.96	N.A.[2]	0.90
Bicycle[1]	1.03	0.80	0.77	0.82
Pedestrian[1]	3.77	2.68	2.42	2.67
Telecommute[1]	0.19	0.19	0.20	0.19

[1] *Caution should be exercised in using the numbers shown for these modes due to the lack of good data.*
[2] *N.A. - Not applicable.*

The principal conclusions which can be reached from the results shown in Exhibit 5 are as follows:

- Car pools and van pools are among the least cost options for the movement of people during peak periods. The reason for the low cost is the relatively inexpensive vehicles involved and the use of volunteer drivers. While results are also shown for car and van pools during the urban off-peak period and in suburban areas, very little usage of such services would typically occur.

- Skytrain is the lowest cost option for moving people during peak periods and amongst the highest during the off-peak periods. This is a direct result of the relatively high fixed costs of the system. These results indicate that any initiatives to increase ridership could have a substantial impact on average costs.

- The cost advantage flips between transit and private vehicles in the peak versus the off-peak periods, as shown below.

	Peak	Off-Peak
Combined Transit	$0.72	$0.68
Private Vehicles	$0.94	$0.67

- The bicycle and pedestrian modes have significantly higher costs than most of the other modes. This is due to the combined effect of the value of time and average speed, and the relatively high accident costs attached to each of these modes due to the assumption that blame is assigned on a 50:50 basis to the two parties involved in each accident.

Exhibit 6 provides a summary of the total costs for private vehicles and public transit.

Exhibit 6
Summary of Total Costs ($ x billion)

Cost Category	Private Vehicles	Public Transit	Non-Motorized
Direct Operating	$3.85	$0.45	$0.04
Indirect Parking	0.61	-	-
Transport Infrastructure	1.21	0.03	-
Time	3.90	0.48	0.61
Urban Sprawl	0.34	-	-
Environmental & Social	1.84	0.01	0.21
Total	$11.75	$0.98	$0.87

As indicated in Exhibit 6, private vehicles account for $11.75 billion or 86% of the total economic costs of people movement in the Greater Vancouver region. Private vehicles are responsible for 97% of transportation infrastructure costs, and virtually all of the indirect parking and urban sprawl costs.Time is less of a factor with private vehicles than it is with transit and non-motorized transportation.

Exhibit 7 provides a summary of who pays the costs attributed both private vehicles and and public transit. As indicated in this exhibit, users pay 77% of the total economic costs of private vehicles and 63% of the total economic costs of public transit. Provincial taxpayers contribute much more to the costs of public transit than the costs of private vehicles, 23% for public transit through direct financial subsidies versus 2% for private vehicles. On the other hand, society pays much more of the costs of private vehicles, due to the large component of environmental and social costs.

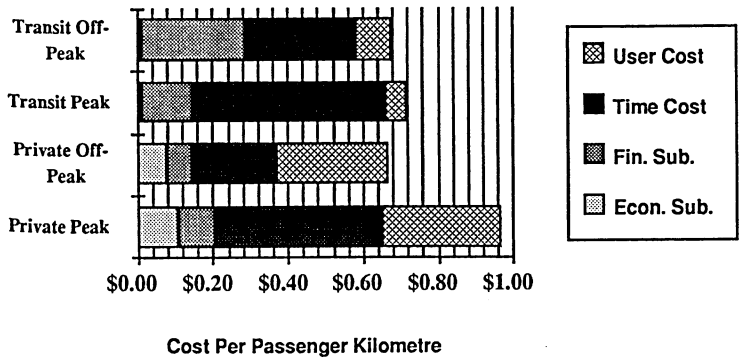
Exhibit 7
Payment of Costs by Stakeholders (% of total costs)

Stakeholder	Private Vehicles	Public Transit
Users	77%	63%
Automobile Drivers	0%	5%
Households	0%	1%
Business	3%	3%
Municipal Taxpayers	5%	3%
Provincial Taxpayers	2%	23%
Society	13%	2%

The total financial and economic subsidy to private vehicles amounts to 23% of total costs or about $2.7 billion. The principal components of this subsidy are road construction and maintenance ($600 million), roadway land value ($601 million), air, water and noise pollution ($512 million), urban sprawl ($282 million) and unaccounted accident costs ($397 million).

The total financial and economic subsidy to public transit amounts to 37% of total costs or about $360 million. The principal components of the subsidy are provincial government contributions of about $224 million and the transit tax on gasoline paid by automobile drivers of about $51 million.

Exhibit 8
Composition of Costs - Peak Versus Off-Peak



As indicated in Exhibit 8, the level of subsidy to transit is significantly reduced during the peak periods. Accordingly, initiatives that stimulate ridership throughout the day would significantly reduce the per passenger kilometre cost of transit. On the other

hand, initiatives that result in private vehicle operators bearing more of the full costs could make transit a more attractive option on the basis of user costs.

CONCLUSIONS

The identification of the full economic costs of transporting people is an exercise that is problematic in several respects:

- The methodologies used to identify and quantify the costs, in many cases, have not been developed or have not become commonly accepted.
- The data required to undertake many of the analyses of specific cost elements is not available or is not in the most suitable format.
- Diverse opinions exist amongst the stakeholders regarding the appropriateness and level of costs.
- Realization has to occur that the cost model is not intended to provide detailed information about matters such as ridership on a particular bus, or the benefits attributable to having a company salesperson drive from customer to customer.

Despite these and other problems, the study commissioned by TRANSPORT 2021 provides a reasonable insight into the nature of costs and their likely magnitude. The composition of costs provides signals to the types of initiatives that might increase transit ridership or reduce traffic congestion for example. The magnitude of costs indicates how significant some of the barriers and problems are.