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**CANADIAN TRANSPORTATION RESEARCH FORUM
LE GROUPE DE RECHERCHES SUR LES TRANSPORTS AU CANADA**

PROCEEDINGS
of the 31st Annual Conference

ACTES
de la 31ème Conférence annuelle

**TRANSPORT GATEWAYS AND TRADE CORRIDORS
PORTES DU TRANSPORT ET CORRIDORS DE COMMERCE**

Winnipeg, Manitoba
May 26-29/26 au 29 mai
1996

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USER PAY TRANSPORTATION: FULL COSTS AND PRICING POLICY IMPLICATIONS

by

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This paper presents recent estimates of full transportation costs in Canada, by mode, and increases in user charges which would be required to recover them. It then deals with policy costing/pricing and institutional issues associated with cost recovery. It concludes by discussing the outlook for selected modes, with particular emphasis on road pricing.

FULL TRANSPORTATION COSTS BY MODE

The full costs of each transportation mode are made up of three components: **existing user charges** (what transportation users now pay in terms of capital and operating costs of vehicles and infrastructure, insurance, fares, tariffs, etc.); **basic subsidies** (infrastructure and other costs borne by government net of government revenues for the mode from user charges, transportation related taxes, etc.); and **external costs** (costs imposed on society by transportation - e.g. due to pollution, accidents - which are "hidden" in that they are not reflected in market charges and payments and/or are not attributed directly to the transportation mode).

Exhibit 1 (exhibits follow the text) presents recent estimates of user charges, basic subsidies, external costs and full transportation costs by mode for Canada in 1994. These are drawn from a report titled *Full Transportation Costs and Cost-Based Pricing Strategies* (IBI Group and Boon, Jones and Associates, Inc., November, 1995) prepared for the Transportation and Climate Change Collaborative, a group sponsored by the Ontario Round Table on Environment and Economy, National Round Table on the Environment and the Economy, Environment Canada, Canadian National and Canadian Global Change Program. Estimates of full transportation costs such as these are subject to uncertainties reflecting data sources/gaps and assumptions regarding which categories of costs and revenues are included; the table in Exhibit 1 is, however, based on a number of generally accepted sources and provides a reasonable indication of the amounts involved.

The intercity rail freight estimate does not include federal subsidies paid under the Western Grain Transportation Act (these were terminated on August 1, 1995) and the passenger car estimates assume that fuel taxes paid to the federal and provincial governments (net of provincial sales tax levels) are a transportation user charge (although they are almost exclusively used as general government revenue by both levels of government rather than being dedicated to meeting road construction, rehabilitation and maintenance costs).

USER CHARGE IMPLICATIONS OF FULLER COST RECOVERY

Exhibit 2 presents the same material as Exhibit 1 but expressed in cents per tonne-km or per passenger-km in order to provide cross-modal comparisons per unit of transportation effort. Basic subsidies per passenger-km are largest for the intercity passenger train and for urban transit and are also significant for the intercity air passenger mode and for the marine freight mode per tonne-km. Percentage increases in user charges to cover **basic (government) subsidies** would range from negligible for the urban passenger car, intercity bus, urban truck and intercity rail freight to 3-5% for the intercity car, truck and marine modes, 17% for intercity air passenger, 118% for urban public transit and 237% for intercity passenger train. The large increases which would be required for the latter three modes would significantly affect their viability, which raises issues of international economic competitiveness (for the marine mode), urban transportation capacity, compatibility, and equity (for urban public transit) and intercity travel reliability and choice (intercity passenger train).

If user charges were raised to cover **external costs** only, they would have to increase by about 6-10% for most modes with higher percentage increases for some (e.g. 14% for urban public transit, 18% for intercity truck, 22% for intercity passenger train and up to 47% for the urban passenger car if additional external costs [e.g. for parking, congestion, land/urban sprawl] are included in addition to the pollution and accident costs which are included in the external cost estimates for all modes). The relatively high increases per passenger-km for intercity passenger train and urban public transit reflect the low volumes currently carried by these modes relative to the available capacity and would be significantly lower if higher passenger load factors and more favourable characteristics could be achieved through public policy initiatives, including road pricing.

Moving towards more cost-based transportation pricing raises a number of challenging questions. For example, increasingly severe financial constraints on governments require that basic subsidies be reduced to zero if possible,

but, as a society, do we wish to price public transit and intercity passenger rail out of existence or transform them into luxury services affordable only by higher income people? Can we recover full basic subsidies from marine transportation users and still have Canadian ports and marine carriers remain viable in a highly competitive international market?

POLICY ISSUES

Answers to some of the more critical policy issues related to increased user pay transportation will depend considerably on the objectives sought. For example, if the rationale for increased user charges is **to provide funding for accelerated transportation improvements**, an indirect tax such as a fuel tax or registration fee may be just as effective as direct pricing such as a road toll or other facility user fee. If the rationale is **to moderate demand, achieve more efficient use of transportation systems, and thereby reduce transportation costs**, then direct pricing, charging more for a congested facility/service or one that provides a premium service level, will be more effective than an indirect tax in affecting user behaviour. If **deficit reduction** is the main objective, user charge increases should recover basic subsidies at least and preferably full costs. If **sustainable transportation** (e.g. environmental quality, reduced energy consumption, etc.) is the main objective, increased charges should concentrate on recovering external costs. If a **more efficient and integrated transportation system** is a primary objective, revenues from increased user charges should be dedicated to transportation (rather than going into the government's general revenue fund) and should be applied to improving complementary or alternative modes if this achieves a more cost-effective overall system (e.g. using some highway toll revenues to improve transit facilities/services where this can provide the needed capacity/service more efficiently, as in our larger urban areas). Finally, if **both funding for accelerated transportation improvements and pricing incentives to moderate demand and achieve more efficient/sustainable transportation** are the objectives, they will be met more comprehensively and quickly by applying increased user charges to **existing** as well as **new** facilities and services, rather than to new ones only.

COSTING, PRICING AND ECONOMIC ISSUES

There is a clear risk that, if transportation prices become higher, then **parts of Canada or the country as a whole may suffer economically** relative to competing areas. Great care is needed in setting increased user pricing levels and, if necessary, phasing them in and differentiating them by region,

type of facility and/or congestion level or load factor, in order to minimize the risk of becoming uncompetitive. In urban areas, it may be possible to address these by providing parallel services which are less costly or free. In other cases, this may not be feasible and there may be a social impact on low income people which could possibly be moderated by income supplements in extreme cases. **Should users pay a premium to support a "buy Canadian" purchasing policy (e.g. for new ice-breakers)?** The basic issue is economic competitiveness, and it would seem logical to set a limit on such a premium to avoid pricing Canadian transportation out of the market. Finally, there are increasing numbers of studies and projects (e.g. toll roads, airport user fees, etc.) which provide quantitative information on the **extent to which increased user charges are likely to moderate peak period demand and thereby reduce transportation costs** including reduced capital costs for system expansion and reduced operating, maintenance and rehabilitation costs. Such quantitative information is essential for setting and adjusting transportation user charges for greater cost recovery.

INSTITUTIONAL ISSUES

The most basic institutional question is **what are the best administrative arrangements to collect user charges, allocate revenue, and manage transportation facilities and services** in a manner which is cost-efficient yet provides the necessary level of public planning and control? There appears to be a growing preference for a combination of special organizations (e.g. trust funds, utilities), complemented as appropriate by private companies and crown corporations, with governments' ongoing transportation role focussing on policy setting, broad planning, and setting and monitoring safety performance standards.

Another institutional issue is **whether transportation users, if they pay more, should have more say in decisions affecting transportation facilities and services**. While certain groups of users would undoubtedly like to have voting power in transportation management organizations, there appears to be a broader view that users should be consulted in advance of key decisions where feasible, but their input should be advisory only.

EXAMPLES AND OUTLOOK: NON-ROAD MODES

Air Mode

The main player is the federal government which, until recently, has owned and operated the country's 26 major airports (which carry some 90% of air

passenger traffic and virtually all air cargo) and a large number of secondary and local airports. Over the past decade Transport Canada has followed a policy of devolving its major airports to local airport authorities, which lease and operate the land and facilities. The purpose of this commercialization program is to achieve more flexible, proactive and efficient airport planning and management and reduce government subsidies. Cost recovery for federal airports is now about 65% of full annual costs, up from about 45% ten years ago. The intent is to achieve 100% cost recovery for the 26 major airports and significantly reduce subsidies on the secondary and local airports by a similar devolution approach or closure if there are no takers.

The federal government is in the process of negotiating the transfer of operation of the air navigation system to a private, not-for-profit organization which will operate under utility-type rules, charging airlines and airports for the services provided. Transport Canada will continue its critically important responsibilities for air safety standards, including performance standards for the air navigation system.

Marine Mode

Again the prime actor is the federal government, which has had a major role in owning and operating ports throughout the country and which has provided navigation facilities, ice-breaking, search and rescue services and pilotage. Federal cost recovery for the marine sector, including federal ports and Canadian Coast Guard services (the latter recently transferred from Transport Canada to the Department of Fisheries and Oceans) has been fairly stable at about 40% in recent years. A new fee structure of user charges for services has been developed and studied, with emphasis on the likely economic implications for the competitiveness of Canadian ports and marine services. It is intended that cost recovery for the marine mode will be significantly increased through such measures.

Rail Mode

While Canada's railways own their own infrastructure and pay for its expansion, maintenance and operation, they have traditionally received substantial subsidies from the federal government, generally aimed at assisting particular economic sectors (e.g. movement of some grains to export positions at Canadian ports) and geographic areas (e.g. the Maritime Provinces, to reduce the cost of rail and truck movements to central Canada). These subsidies are being phased out; in particular, the main transportation subsidies under the Western Grain Transportation Act were eliminated as of August 1, 1995. This change alone will reduce government

subsidies by some \$600 million per year and can be expected to affect the crops grown and agricultural product transportation patterns in Western Canada, probably leading to greater crop diversity, reduced overseas exports of grain, and more domestic consumption/processing of Western Canada's agricultural produce.

One of the major federal initiatives is commercialization of CN Rail, through sale of its shares by the government to private investors. In parallel with this, and to increase the financial viability of both CN and CP, Bill C-101 will relax economic regulations and provide greater flexibility for railways to exit from certain services through sale to shortlines or line abandonment.

VIA Rail

The federal government also has in effect a program of ongoing reductions in the annual subsidies paid to VIA Rail for providing intercity rail passenger services. Under this program, annual VIA subsidies have been reduced from \$441 million in 1990 to \$318 million in 1994, with further reductions expected, to \$233 million in 1997. A recently published high speed rail study conducted by the governments of Canada, Ontario and Quebec, shows a projected rate of return which appears insufficient to justify the level of risk and the required private investment to provide such a service in the Quebec-Windsor corridor. It seems likely, therefore, that VIA Rail passenger services will continue to be rationalized, concentrating on the higher density corridors in Central Canada, with a minimum ongoing level of transcontinental passenger rail service.

Cost Recovery at the Federal Level

Transport Canada is carrying out a substantial downsizing and is instituting programs such as those outlined above to achieve more complete cost recovery through increased user charges and more efficient, commercialized operations. The intent is that transportation services will be more efficient and equitable, government deficits reduced, and excessive debt loads paid down while achieving a "level playing field" of public versus private charges. Transport Canada expects to increase its transportation revenues by some \$450 million in the current year under its new cost recovery initiatives, with ongoing changes aimed at eliminating some \$1.5 billion in annual subsidies within the next few years.

Urban Transit

Municipal governments have prime responsibility for providing urban transit in most of Canada's urban areas, but rely extensively on provincial financial aid. Urban transit has a high level of government subsidy, representing 30-75% of operating and capital costs, depending on the size of the urban area, level of cost recovery from users and type of provincial funding formula in effect (Exhibits 1 and 2). While continuing fiscal pressure can be expected to lead to reduced levels of government financial support, it is unlikely that this will be completely eliminated, since transit plays an essential role in moving people to and from the central areas of the country's major cities and the alternative of building more radial highways is not feasible owing to space limitations, high costs and strong public opinion in favour of achieving more sustainable urban transportation. A more likely outcome, given these pressures, is increasing adoption of road pricing in Canada's larger urban areas in order to provide funding both for ongoing road maintenance/rehabilitation and selective expansion plus selective construction of new rapid transit lines, commuter rail improvements and implementation of priority bus services (on bus priority lanes where feasible, with traffic signal priority, and other "intelligent transportation system" features) to greatly improve the reliability and convenience of these "semi-rapid transit" services.

PRICING STRATEGIES

Two pricing/incentive strategies were developed and their implications broadly assessed for Ontario: a five year (short-term) strategy and a 20 year (long-term) strategy. Exhibit 3 provides a summary comparison of the short-term and long-term strategies. The strategies do not attempt to apply full cost pricing to each mode, but they do move in that direction for a number of modes, particularly those that impose larger external costs. There are three ways of moving towards full cost pricing for each mode:

1. Increasing user charges;
2. Reducing basic subsidies;
3. Reducing external costs.

The strategies were developed with all three approaches in mind, recognizing that there can be significant interactions among them.

The percent of full transportation costs (including basic subsidies plus external costs) paid by users would increase under both strategies for all modes. This reflects an increase in fuel tax of 3¢/litre per year for each of the five years of the short term strategy and the introduction under the long

term strategy of road pricing in Ontario's two largest urban areas (Greater Toronto, Greater Ottawa) to levels of 0-5¢/km in off peak conditions and 5-15¢/km in peak (congested) conditions. The percentage increases in user charges under the long term strategy tend to be higher for the urban auto (14.5%), air passenger (10.7%), intercity truck (7.1%), and intercity auto (6.1%) than for the other modes, which would have increases in the 1-4% range. It should be emphasized that, as shown in Exhibit 3, the strategies contain not only user charge increases but also a significant number of regulatory, voluntary/educational and transportation facility/land use practices as well as other economic instruments in addition to fuel tax increases and road pricing. Each strategy was designed to be an appropriate mix of measures. For example, significant improvements in urban transit were included to provide a reasonable alternative to the private automobile in the face of increased user charges for the auto, so that a reasonable alternative mode would be available for those wishing to change mode.

The estimates of carbon dioxide emissions in Ontario, shown in Exhibit 4, indicate that emissions from intercity truck, intercity rail freight, intercity passenger car, air passenger, intercity passenger train, urban passenger car and urban transit would decrease to about 33.2 megatonnes per year by the year 2000 under the short-term strategy, relative to about 36.3 megatonnes in that year under the base case. This would also be a slight decrease from the current (1994) CO₂ emissions from these modes of about 34.1 megatonnes. Under the long-term strategy, by 2015 the estimated CO₂ emissions would be about 38.0 megatonnes per year, considerably less than the 49.9 megatonnes under the base case projection by 2015, but some 4.0 megatonnes (or about 12%) higher than 1994 emissions of CO₂. The short term reduction is aided considerably by projected fuel efficiency and per vehicle emission reductions as mandated over the next 5-10 years, but these tend to be overwhelmed by projected vehicle-km growth in the longer term. Moderation in the growth rate of transportation demand would be required to hold CO₂ emissions at 1994 levels.

EXAMPLES AND OUTLOOK: ROAD MODES

Because roads carry over 90% of intercity passenger traffic, close to 90% of urban passenger traffic, close to 100% of urban goods movement and over one-third of intercity freight traffic (in tonnage terms), the last section of this paper focusses directly on the transportation modes which use roads.

Potential Road Pricing Concerns and Actions to Address Them

While initial public opinion has generally been positive regarding the Highway 407 toll road now under construction in the Greater Toronto Area and the Prince Edward Island Crossing which will also be a toll facility, more widespread road pricing, particularly on existing roads, will require careful study, public consultation and considerable political willpower. Surveys carried out in Canada and the U.S. suggest that about two thirds of those polled support road pricing if they are assured that the revenues will be dedicated to transportation improvements and will accelerate the construction of the toll facility itself. Support drops to about 10% if the tolls are seen as simply another general purpose tax.

There are a number of potential problems and concerns associated with the introduction of road pricing; possible approaches have been suggested to address each concern. For example, concerns that tolls are simply new taxes could be addressed by an offsetting reduction in fuel taxes in the area affected by the new tolls. Perception of "auto and truck bashing" could be addressed by demonstrated service level improvements for all users which have been achieved on other tolled facilities. The use of electronic toll collection systems with debit cards instead of cash payment or monthly billing in arrears can eliminate disruption/congestion from toll plazas and invasion of privacy concerns. Concerns about economic losses (for example to truckers and/or to an urban area) can be addressed by demonstrating that tolls will be set at moderate levels such that truckers may be able to offset the toll charges through increased operating efficiencies, and urban areas are likely to achieve net economic benefits through reduced congestion levels, increased transportation service/reliability levels and reduced transportation costs for both passengers and freight. Finally, concerns about social equity, as discussed earlier, can be addressed by providing a choice of routes and modes and, if necessary, by market/welfare programs to assist low income people.

Recent Road Pricing Experience

The Highway 407 toll road now under construction in the Greater Toronto Area has been mentioned earlier. Without tolls, the first 45 km of this highway would have required 25 years to construct. With tolls, the first 35 km is scheduled to be opened during 1996 and the entire 69 km central section by 1998. This will be the first North American fully tolled road to use entirely electronic toll collection. Under the relevant legislation, the tolls will be discontinued when the capital costs of Highway 407 have been paid off from toll revenues, expected to occur some 35 years following

opening of the highway. There is considerable support for the highway by residents, reflecting concerns about existing levels of congestion in the corridor, and the desire for more road capacity. There are also concerns, however, that the road will contribute to continuing urban sprawl and auto dependency. Others accept that the new road is necessary to provide trunk capacity and an effective Greater Toronto Area bypass as part of the provincial highway network and that the demand-moderating influence of the tolls plus complementary policies to achieve more compact, mixed-use urban development and improved transit services will help achieve an appropriate modal balance and contribute to more sustainable transportation. Time, and the ongoing programs of relevant governments, will determine the outcome.

CONCLUSIONS AND POLICY CONSIDERATIONS

The combined impacts of increasing fiscal restraints on governments at all levels (a situation which will get considerably worse before it gets better) and a growing public and government awareness of the need to "internalize" transportation external costs (e.g. pollution, accidents) by charging users for them are such that increasing user charges are a virtual certainty for most or all transportation modes during the coming decade. Extensive programs to achieve this have already been announced at the federal level. A number of provincial governments are actively studying the introduction of toll roads in key corridors and cost recovery from adjacent land owners to help fund new transit facilities, and municipal governments are implementing transportation and land use initiatives aimed at more sustainable transportation. The underlying rationale is that increasing user charges to more closely reflect the true costs of transportation, (including government subsidies and external costs) will provide dedicated funding for system operation, maintenance and improvements, and will lead to moderated growth rates in demand, reduced costs for capital expansion and operations, lower environmental, accident and other external impacts on society in general, and improved transportation service levels, reliability and modal choice.

Realistic prices relative to market demand and supply are critical. Full recovery of basic (government) subsidies, which already exists for intercity rail freight, the urban auto and the urban truck in Ontario as estimated in the *Full Cost Transportation* report, is likely to be achieved during the coming decade for Canada's major airports as current policies are implemented. Increased recovery of basic subsidies, but less than 100%, is also likely for marine freight and intercity passenger rail. It is likely that users will increasingly pay external costs to help address climate change and other sustainability issues, and the magnitude of increased user charges to achieve

this, if strategies such as those illustrated in Exhibit 3 were implemented, would be in the range 1-7% in the short term and 1-15% in the longer term, with the larger increases in this range applying to those modes with higher external costs.

More widespread road pricing is conceivable over the next 10-15 years, particularly in Canada's larger urban areas. This is likely to come about because of increasing financial constraints facing governments at all levels and the need to find a source of funding which increases as transportation demand increases; a vitally important spin-off effect of road pricing will be its moderating effect on the rate of growth of single occupant automobile use and a related increase in urban transit usage and cost-effectiveness.

Changes in transportation user charges will have to be introduced incrementally, with careful monitoring of economic and social impacts. A phased, integrated strategy will be necessary, with extensive inter-government and private consultation and coordination, to achieve modal, geographic and sectoral equity. Road pricing can be expected on **existing** as well as **new** roads, particularly in urban areas, in order to provide funding not only for road improvements/expansions but - more fundamentally - for operations and maintenance; deferred maintenance of roads and urban transit is an increasing problem as government financial constraints worsen, and a funding source must be found soon to prevent serious problems and greatly increased future costs for rehabilitation. Financial arrangements will therefore be required under which some of the revenue stream achieved from road pricing will be available for operations/maintenance as well as capital improvements and for public transit as well as for roads.

While there are concerns about how the increased user charges and more privatized transportation management/operations will be administered (e.g. to achieve lower overheads and greater management responsiveness) and about economic and social impacts if user charges are increased too much or too quickly, there appears to be general support for these moves by transportation carriers, and to a lesser extent, shippers. Informed members of the public also appear to accept these initiatives as a necessary step towards greater fiscal responsibility and more sustainable transportation. The key to maintaining this support and achieving the desired effect will be the manner in which increased transportation user charges are introduced and managed during the next few years and beyond. An informed public, transportation industry and government sector will be centrally important, and it is hoped that the information presented in this paper will help contribute to a successful outcome.

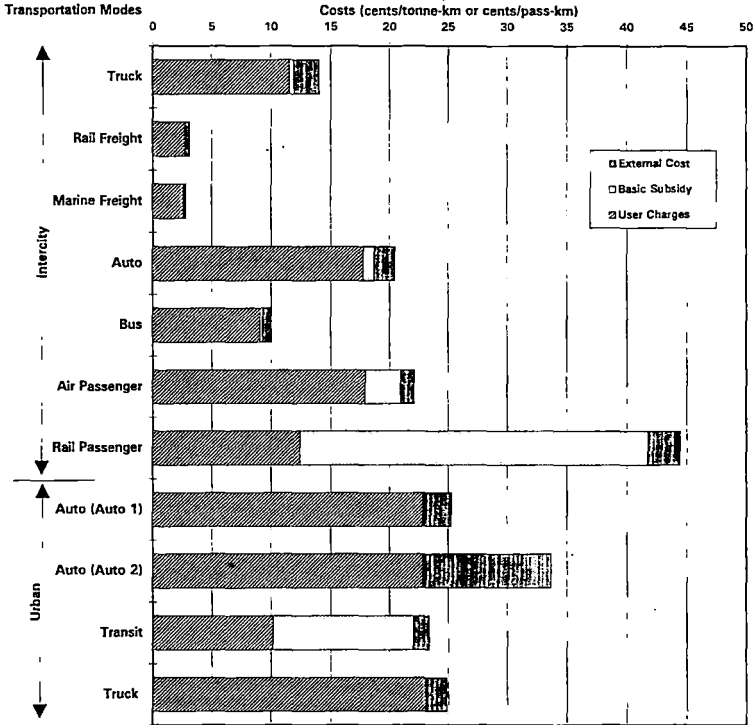
EXHIBIT 1
FULL TRANSPORTATION COST ESTIMATES
CANADA - 1994
(\$1994 BILLIONS)

Mode	1. User Charges	2. Basic Subsidies	3. External Costs	4. Full Costs = 1+2+3
INTERCITY				
TRUCK	12.91	0.45	2.37	15.73
RAIL FREIGHT	7.04	(0.08)	1.06	8.02
MARINE FREIGHT	7.85	0.30	0.48	8.64
PASSENGER CAR	37.34	1.97	3.65	42.96
PASSENGER BUS	0.27	0.01	0.02	0.30
PASSENGER AIR	4.49	0.75	0.30	5.54
PASSENGER RAIL	0.17	0.41	0.04	0.62
URBAN				
PASSENGER CAR (AUTO 1)	56.01	0.29	5.66	61.96
PASSENGER CAR (AUTO 2)	56.01	0.29	26.24	82.54
TRANSIT (Excluding GO)	0.89	1.05	0.12	2.06
TRUCK	4.15	0	0.33	4.48

Numbers may not add to row totals due to rounding.

Source: *Full Cost Transportation and Cost-Based Pricing Strategies*, IBI Group and Boon, Jones and Associates, Inc., 1995.

EXHIBIT 2
COMPARISON OF CURRENT (1994) COSTS BY MODE - CANADA
 User Charges, Basic Subsidies and External Costs



Notes: When Basic Subsidy is negative, User Charge bar is shortened by that amount.
 External Costs for all modes (except "Auto 2") include emissions, accidents and related health care and policing costs since relatively consistent dollar value estimates were available for Canada, for these items. "Auto 2" illustrates the large increases in external costs attributable to the urban auto if several other items (parking, congestion and land costs) are included, drawing on more approximate estimates (i.e. Litman, 1994)

Source: Full Cost Transportation and Cost-Based Pricing Strategies, IBI Group and Boon, Jones and Associates, Inc., 1995.

EXHIBIT 3
INITIATIVES TOWARDS SUSTAINABLE TRANSPORTATION:
TWO STRATEGIES

MEASURE	SHORT-TERM (0-5 YEARS)	LONG-TERM (5-20 YEARS)
REGULATORY		
- IMPROVED FUEL EFFICIENCY STANDARDS *		
- IMPROVED EMISSIONS STANDARDS *		
- ENFORCE EXISTING HIGHWAY SPEED LIMITS	(X)	(X)
- REDUCE HIGHWAY SPEED LIMITS		
- EMISSIONS INSPECTION PROGRAM	X	(X)
ECONOMIC INSTRUMENTS		
- INCREASE MOTOR FUEL TAX	X	
- ADDITIONAL EMISSIONS CHARGES (CARBON TAX PREMIUM ON FUEL)		X?
- REDUCE/ELIMINATE DIRECT SUBSIDIES	X	X
- VEHICLE SCRAPPAGE PROGRAM	X	
- FUEL/TAILPIPE EMISSIONS PREMIUM	X	(X)
- INCENTIVES FOR ALTERNATIVE FUELS	(X)	X
- CONGESTION PRICING FOR ROAD USE		X
- WEIGHT-DISTANCE TAX		X?
- FULL-COST PARKING/PARKING SUPPLY MANAGEMENT	X	X
- TAX BREAK FOR EMPLOYER-SUPPLIED TRANSIT PASSES		X?
VOLUNTARY/EDUCATIONAL MEASURES		
- FLEET PROCUREMENT/MANAGEMENT DEMONSTRATION PROGRAMS	(X)	(X)
- VEHICLE EMISSIONS/LABELLING PROGRAM	X	X
TRAVEL BEHAVIOUR/LAND USE PRACTICES		
- PROMOTE TRANSIT-SUPPORTIVE LAND USE PRACTICES	X	X
- ENCOURAGE TELECOMMUTING, ALTERNATIVE WORK STRATEGIES	X	X
- IMPROVE/ENCOURAGE URBAN TRANSIT	X	X
- IMPROVE CYCLING/WALKING ENVIRONMENT	X	X
- TRANSPORTATION DEMAND MANAGEMENT	X	X
- PROMOTE INTERMODAL FREIGHT TRANSPORTATION	X	(X)
- DEVELOP HIGH SPEED PASSENGER RAIL		X?

NOTES: X = A COMPONENT OF THE STUDY EXPECTED TO HAVE A SIGNIFICANT EFFECT
 (X) = A COMPONENT EXPECTED TO HAVE A LESSER EFFECT
 X? = MAY BECOME A COMPONENT DEPENDING ON RESULTS OF MORE DETAILED STUDIES
 * = PROJECTED IMPACTS INCLUDE IMPROVEMENTS MANDATED ELSEWHERE WHICH AFFECT VEHICLES IN ONTARIO

**EXHIBIT 4
COMPARISON OF CO₂ EMISSIONS - ONTARIO**

Kilotonnes of CO₂ per year

