

## **Transportation Infrastructure, Security, Safety and Environment - Do They Have Any Effect on Efficiency and Competition and Who Should Pay For the Externalities Arising From Them?**

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### **Introduction**

Today, transportation plays an essential role in the quality of our life and prosperity. Infrastructure, security, safety, environmental performance and economic efficiency have all become the cornerstone of our transportation system. During the recent review of transportation laws, the importance of these factors have been repeatedly emphasized in documents from the Minister of Transport such as the *Transportation Blueprint* and *StraightAhead*. Statements such as “High quality transportation infrastructure is key to our competitiveness,” “Safety and security are critical foundations upon which the general public’s confidence in the national transportation system is built,” “Environmental challenges will shape the transportation agenda in the years to come,” etc. have formed the motivation for examining issues arising from transportation infrastructure, security, safety and environment (TISSE).

Considerations arising from TISSE raise interesting questions. Do the costs or lack of expenditures on TISSE have an effect on efficiency and competition? Who should pay for the externalities arising from TISSE or the lack of expenditures on it? To examine these issues, this paper begins with a description of Canada’s TISSE in section I. Section II briefly mentions federal legislation and regulatory programs affecting TISSE. Section III examines whether TISSE have an effect on efficiency, pricing and competition and who should pay for externalities arising from TISSE or the lack of it. Finally, a few concluding remarks are made.

### **I. A Brief Description of Transportation Infrastructure, Security, Safety and Environment in Canada**

***Transportation Infrastructure:*** The Oxford dictionary defines

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\* \* The views expressed here are those of the authors and are not purported to be those of the Commissioner or the Competition Bureau, Industry Canada.

infrastructure as a 'system of airfields, telecommunications and public services forming a basis for defence'. In transportation, infrastructure has taken on a broader connotation to mean the network of roads, railway lines, airports, ports, waterways and terminals or any engineering construction capital spending of public administrators to build them which need not necessarily be used for defence. This infrastructure in Canada is described in Appendix IA.

**Security:** Security is commonly understood to mean 'thing that guards or guarantees'. Canadian transportation security consists of a number of measures in various modes of transportation not only to protect the personal safety of Canadians but also the prosperity of our nation from acts of terrorism or violence. Canadian Security in various modes is described in Appendix IB.

**Safety:** Safety in transportation involves requirements for transport vehicles, standards for the operation of transport vehicles together with codes of conduct for the crew operating these vehicles to protect the interests of travellers, vehicle operators, the public, their property and environment. Briefly mentioned in Appendix IC are the major safety standards that exist together with the major recent initiatives.

**Environment:** Canada's environment is its "surrounding; surrounding objects, regions, or circumstances." This would therefore include the elements such as the air, water, land and activities that have an effect (short or long run) on its natural resources including fish, wildlife and forest and trees. This environment is affected by the by-products generated by transportation activities and other industrial activities, some elements more than others. These are described in Appendix ID.

## **II. Federal Legislation and Regulatory Programs Affecting TISSE**

**Infrastructure:** The basic federal laws that affect infrastructure are: *Canada Transportation Act*; *Canada Marine Act*; *Fishing and Recreational Harbours Act*; *Canada Airport Act*; and *Civil Air Navigation Services Commercialization Act*. These are briefly described in Appendix IIA.

**Federal Regulatory Programs:** The Federal Government has announced a number of infrastructure programs, committing \$12 billion

since 1993. The most important are: the Canada Strategic Infrastructure Fund; the Municipal Rural Infrastructure Fund; the Infrastructure Canada Program; and the Border Infrastructure Fund. The first was basically intended to fund large-scale strategic infrastructure projects. Since it was established in 2001, \$4 billion has been committed to it. The second was designed to benefit the needs of communities of less than 250,000 people. Since it was established in 2003, \$1 billion has been committed to it. The third was created to enhance municipal infrastructure in urban and rural communities across Canada. Since 2000, \$2.05 billion has been committed to it. The fourth was set up in 2001 to improve efficiency at Canada's borders with a funding of \$600m. Mode specific important programs include: 1) The Airports Capital Assistance Program which has provided \$298 million for 375 projects at 143 airports since April 1, 1995; 2) The Strategic Highway Infrastructure Program set up in 2000 has provided \$600 million over four years to highway infrastructure over Canada; 3) The Toronto Waterfront Revitalization Project has \$500 million committed to fund its first phase in the fall of 2000; and 4) The Renaissance for Passenger Rail Program which basically consists of: funding for VIA Rail of \$1.09 billion since April 2000; funding for improvements to GO Transit's rail network of \$435 million in 2003; and funding (federal) for the Toronto Transit Commission of \$350 million over five years beginning in 2004.

**Security:** The key federal laws that affect security are: The *Marine Transportation Security Act*; The *Public Safety Act*; The *Aeronautics Act*; and The *Anti-Terrorism Act*. These are briefly described in Appendix IIB.

**Federal Regulatory Programs:** To address security initiatives, the Federal government committed \$7.7 billion to fight terrorism and reinforce public security. Mode specific important programs which have so far drawn from the committed funds are: 1) Airport and Air Security Measures Programs; 2) New Marine Security Projects; 3) Canada Customs Programs; and 4) Immediate Action Plan. The first, announced on October 11, 2001, consisted of \$79 million for new equipment and supporting activities at Canadian airports. Two months later, \$2.2 billion was committed to air security measures for the creation of CATSA and other measures discussed in the Appendix. The second, committed in the

December 2001 Budget, was \$60 million over six years. On January 22, 2003, a package consisting of \$172.5 million over a five year period, was committed to further enhance marine security. On April 27, 2004, the Canadian government committed \$308 million to increase maritime security and on May 7<sup>th</sup>, 2004, a three year Marine Security Program of \$115 million was announced to assist port and port facilities with security enhancements. The 2005 Budget added \$300 million over five years to improve marine security. The third, announced on October 11, 2001, consisted initially of \$12 million to meet staffing requirements related to public security and anti-terrorism programs. In 2001, the Smart Borders Action Plan - Free and Secure Trade and Nexus was initiated with \$600 million from the Border Infrastructure Fund. The fourth, provided \$110 million on November 23, 2005 to enhance the security of Canada's passenger rail and public transit systems.

**Safety:** The basic federal laws that affect safety are: *The Motor Vehicle Safety Act*; *The Motor Vehicle Transport Act*; *Commercial Vehicle Drivers Hours of Service Regulations*; *The Aeronautics Act*; *The Canadian Aviation Safety Board Act*; *The Canada Shipping Act*; *The Arctic Waters Pollution Prevention Act*; *The Seaway Property Regulations (Part I)*; *Pilotage Act*; *The Marine Transportation Security Act*; *The Railway Safety Act*; *The Canada Labour Code (Part II)*; *The Transportation of Dangerous Goods Act*; *The Safe Containers Convention Act*; *The Canada Transportation Accident Investigation and Safety Board Act*; and *The Government Property Traffic Act*. These are briefly described in Appendix IIC.

**Federal Regulatory Programs:** The important federal regulatory programs on safety that exist are: 1) Safety Programs for Highway Transportation - eg., Funding for the National Safety Code (\$86.4 million was committed between 1987-2008). 2) Safety programs for Air Transportation - eg., safety improvement projects at airports provided under ACAP (\$200 million was provided to airports in the major provinces of B.C., Alberta, Manitoba, Ontario and Quebec from 1995 to 2003). 3) Safety Programs for Rail Transportation - Under the Railway Grade Crossing Program the federal government contributes approximately \$7.5 million each year. Since 1994, \$111 million was

contributed to more than 860 projects. 4) Safety programs for Marine Transportation.

**Environment:** The key federal laws that affect environment are: The *Canadian Environmental Protection Act* (CEPA); The *Canadian Environmental Assessment Act*; The *Fisheries Act*; The *Transportation of Dangerous Goods Act*; The *Canada Shipping Act*; The *Navigable Waters Protection Act*; The *Motor Vehicle Safety Act*; The *Aeronautics Act*; and The *Railway Safety Act*. These are briefly described in Appendix IID.

**Federal Regulatory Programs:** On April 13, 2005, the government released the Kyoto plan indicating that it plans to spend \$10 billion over the next 7 years to support a sustainable environment. Transport Canada Environmental Affairs develops and implements programs and policies to protect the environment. The best known programs are: Moving On Sustainable Transportation (with a funding of \$4.3 million from 1999 to 2007); Urban Transportation Showcase Program (with a funding of \$40 million over 5 years); and The Freight Efficiency and Technology Initiative (with a funding of \$14 million over 5 years). Environment Canada has its own projects as environmental pollution arises from various sources and separating programs to deal with pollution from various sources in all situations is often difficult. Programs funded by Environment Canada include: Atlantic Coastal Action Program, Climate Change Action Fund, Community Interaction Funding Program, EcoAction Community Funding Program, Endangered Species Recovery Fund, Environmental Damages Fund, Great Lakes Sustainability Fund, Habitat Stewardship Program and Interdepartmental Recovery Fund.

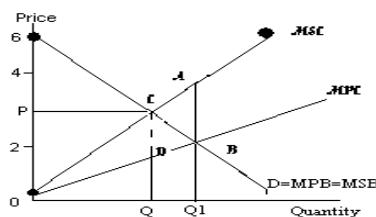
### **III. Does TISSE Have An Impact on Efficiency and Competition? Who Should Pay For the Externalities Arising From Them?**

#### **a) Do TISSE Raise Special Issues in Efficiency and Pricing?**

A problem that arises when dealing with TISSE is how should one efficiently produce and price for services where externalities arise from TISSE or the lack of it? An externality occurs when consumers or firms do not bear the full cost (benefit) from the harm (good) their actions do to others. To shed light on this issue, economic theory dictates that in the absence of: monopoly power, decreasing long run costs and externalities

(or missing markets) marginal social cost pricing will generate an optimal result.[1]

As is often the case in the real world, particularly in transportation, these conditions are rarely satisfied particularly with regard to infrastructure that is owned or operated by a monopolist or with regard to externalities arising from TISSE particularly the environment where externalities abound.[2] In addition, the monopolist often has decreasing long run cost. In situations where there is monopoly power, production of transportation services is less than what would arise under marginal social cost pricing and the same would apply to situations with decreasing long run costs. The former being dictated by requirements to maximize profit and the latter due to losses. In situations where only externalities arise,[3] consumption and production of transportation services will not occur **according to marginal social cost pricing** because it is often not possible: to exclude those who consume the service and do not pay for the service; or to capture certain cost from those who produce the service but do not pay for those costs. In such cases, production or consumption will be less or more than is optimal.

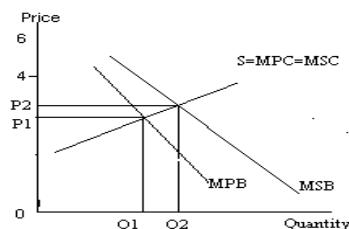


A simple diagrammatic exposition should be able to illustrate why this is so in the case for external costs. Suppose there is congestion on the road due to infrastructure constraints, or accidents, etc. In this case, there would be a divergence between marginal private costs (MPC) and marginal social costs (MSC) which is assumed to be the same in the absence of these externalities. As is evident from the diagram, the private individual or company would like to produce more than would be

produced under marginal social cost pricing (i.e.,  $Q_1 > Q$ ) determined by the intersection of MPC with the demand curve (i.e., the private marginal benefits or social marginal benefit curves).

At output  $Q$  too, social marginal cost is greater than the private marginal cost and to reflect efficient pricing for these services this difference has to be collected from the private individual or company. To resolve this, a tax or fee would have to be levied on the private individual or company equal to the difference between the two costs i.e.,  $CD$  (or marginal external cost).

What about marginal social benefits? If marginal social benefits arising from externalities is greater than marginal private benefits the private individual or company will produce less than what is optimal? In other words, if security is an externality the private individual or company may not be able to capture all the benefits and will be prepared to provide security protection that is less than is optimal ( $OQ_2 - OQ_1$  as shown in the diagram below).



To summarize, external economies and diseconomies can lead to a misallocation of resources even in the world of perfect competition. Too much may be produced by industries in which external diseconomies prevail, while there may be a less than optimal output of commodities whose production involves external economies. In principle, it is even possible that where there are external diseconomies, the presence of monopolies can lead to outputs smaller, and therefore more nearly optimal, than those which would result from competition.[4]

b) Fair and efficient pricing for externalities

The misallocation of resources resulting from the presence of externalities raises questions on how to reduce this misallocation. Two approaches are used: regulation and pricing. The past tradition has largely favoured the former, however, the latter has recently drawn attention due to its cost effectiveness.[5] This has led to consideration of fair and efficient pricing principles. The key characteristic of these principles are: the charges for transportation should be closely aligned to underlying costs; the charges should be differentiated since costs differ across time, space and modes; the pricing structure should be transparent; the charges should be non-discriminatory across modes; the prices of transport of individual journeys should be better aligned to the total costs of these journeys; and the full infrastructure costs of all infrastructure networks should be recovered from transport users in the long run, unless it is constructed for other reasons.[6] Raising revenues over and above what is needed to reduce misallocation is likely to lead to distortions in the economy and in the transport system. The purpose of charging for externalities is to reduce the misallocation of resources and not to generate a source of revenue or to increase the cost of transportation.

c) How should external costs be valued?

Since markets for these externalities rarely exist (eg. cleaner air or lower levels of noise) evaluation of these costs are required and assigning a monetary value for external costs becomes necessary. The well known evaluation methods will be briefly described.[7]

1) *Damage Function / Dose-Response Approach*: This approach takes a dose-response relationship and a relationship is established based on scientific knowledge - environmental pressure and observable impact eg. particulate emissions and mortality. Then with regard to this impact a monetary valuation is attempted. The main disadvantages of this approach is that it is based only on visible costs (eg. hospital costs) and no attempt is made to evaluate people's preferences.

2) *Avoidance Cost Approach*: This approach takes the cost of measures to reduce transport externalities as an approximation for the value of these externalities. The main advantage of this approach is that avoidance costs

are easy to establish. The main disadvantages of this approach are: the risk of circular reasoning; and preferences captured are only in an aggregate way.

3) *Hedonic Prices Approach*: This approach looks for a market in which goods or factors of production are traded and records how environmental attributes affect the market prices. For example, the difference between prices of similar houses in a noisy airport and a quiet area, provides an implicit valuation of the economic costs of noise.

4) *Contingent Valuation / Stated Preferences Approach*: This approach (willingness-to-pay) relies on interviews or written questionnaires to citizens to quantify how their well being is affected by the externality. In an alternative approach (willingness-to-accept), individuals are asked how much they are willing to accept as compensation for the externality (eg. deterioration in the environment). The choice of method (pay vs. accept) depends on one's belief of rights and the existing situation.

In sum, the choice of method in general does not provide the same amount of monetary value. There are pros and cons for each. However, the final method is now generally accepted based on the conclusions of an expert panel of eminent economists.[8]

#### d) Does TISSE Have An Impact on Competition?

There is ample evidence that TISSE costs raise competition concerns between transport sectors within Canada and between them and transport sectors abroad if funded or dealt with differently. Most recently, these concerns were expressed with regard to funding of infrastructure and payment for security as they raise the cost of transportation services and could lead to shifts of traffic not only between modes but also to diversion of cargo and passengers to the United States. Some important views indicating competition concerns will be described.

**Infrastructure:** “The [Canada Transportation Act Review Panel] Panel believes that US government expenditures on marine infrastructure do, in the longer term, represent a competitive threat to Canada’s largest ports. About half of all US ports receive some form of funding assistance, ... The Panel suggests that the government should continually scrutinize the performance of Canadian ports relative to US competitors and be prepared to take policy action if US government funding seriously distorts competitive traffic patterns.”[9] Similarly, the *Report on Competitiveness of Canadian Ports* states “The expansion taking place in the U.S. ports, supported by public funding, has to

be regarded as a serious competitive issue for the Canadian port system and its users. ... In the long run, this could lead to erosion of traffic from Canadian ports, ...”[10] Recently, the Premier of B.C. announced that “It is clear that we need to act now to ensure B.C. ports can retain and expand their competitive advantage as a gateway of choice between Asia and North America.”[11]

**Security:** Security costs in various modes increase the cost of transportation within that mode. Since various modes have varying security requirements they have differential impact on costs in various modes which can affect their competitive position and competition between countries. An example of the latter is the recent event where it was reported that “Air Canada is seeing an upsurge in business as passengers opt to fly via Canada rather than brave the tighter visa and security regime facing transit passengers at U.S. airports.”[12] The airlines reported that traffic destined to Latin America originating outside Canada had tripled in the first 11 months of 2004. Between countries (eg. the US and Canada), even if the security requirements are the same, the impact of these requirements may not be the same if there are economies of scale in providing security services. For example, the cost of processing a container or a passenger through O’Hare airport may be half the cost of processing a container or a passenger through Pearson given that the X’Ray and screening equipment are the same but the volume of traffic is not the same. In another situation “The agreement [Container Security Initiative] followed complaints by the EU that maritime security measures adopted by the U.S. in wake of the Sept. 11 terrorist attacks threatened to distort competition between ports in EU countries that has signed bilateral CSI deals with the U.S. and those that had not.”[13]

**Safety:** “The recent ICONS [International Commission on Shipping] report underscored the fact that a small minority of shipowners were indeed deriving a competitive advantage over their more scrupulous competitors by not running ships in compliance with international safety standards and by not dealing with international labour standards...”[14] “...On small vessels the Canadian standards are more stringent, particularly with respect to lifesaving equipment and fire protection. US vessels which call at Canadian ports are not subject to the same standards, which translates into an advantage of lowering operating costs.”[15]

**Environment:** The NTARC states “The overall impact of environmental legislation will be to increase the costs associated with transport investment and operations. While all industries will have to incur similar costs, transport operations will not be adversely affected by the CEPA relative to competing industries. However, the inefficiency associated with the environmental review process could place the Canadian transportation system at a competitive disadvantage vis-à-vis that of the U.S.”[16] Similarly an

OECD study states “If sub-standard operators are able to derive a competitive advantage from non- or partial- compliance with environmental regulations, it is because this course of action is worth the risk.”[17] The Maritime Transport Committee has established that “non-compliance, as well as entailing risks for the safety of life at sea and for the protection of the environment, distorts competition in the shipping market.”[18] Some sources may view this as being in conflict with the Porter and van der Linde hypothesis that tougher environmental standards can enhance competitiveness by pushing companies to use resources more productively. In other words, stricter regulation first induces innovation which in turn yields productivity improvements which in turn leads to greater competitiveness or competitive advantage.

In sum, TISSE costs do have an impact on competition. The Canadian literature emphasizes this generally when there is a competition issue between Canada and other countries, particularly the US.

e) Who should pay for the externalities arising from TISSE costs?

In most economies throughout the world, external costs or benefits of transportation are rarely paid for by users or recouped from consumers. Given the above theory, it is not surprising that output and pricing will not be optimal and that marginal social costs are likely to be excessive if not fully taken into account in network planning and investment decisions and in users’s transportation choices. The simplest way to address this inefficiency is to ensure that users pay directly for **all** social costs (i.e., internal and external) by including these costs in the price of transportation services. There are, however, problems in deciding and estimating these costs and determining if these costs are excessive. One additional explanation why users in the past have not paid for external costs is because the transaction costs of collecting the cost imposed by externalities are greater. In addition, should the internalization of costs (even beyond what the market will provide) apply to all TISSE costs or should each component of TISSE be treated differently. The nature of external costs associated with each component of TISSE may not be the same or the cause may not be the same? Environmental pollution is a direct technological consequence of production whereas terrorist threats are due to lack of security. Similarly, externalities arising from infrastructure or safety are a result of lack of them. They shall therefore

be examined separately.

*Infrastructure:* Transportation infrastructure or the lack of it can impose congestion on the roads and border crossings, airports and airport runways; ports and port terminals, and railway terminals, i.e., externalities. Establishing a financial value for the external costs that congestion imposes is often imprecise (attempts are sometimes made to classify them into objective vs subjective external costs). It is possible to estimate objective external costs i.e., time losses (eg. increase in travel time due to a decline in speed, delays in plane take-off and landings, etc.) which lead to an increase in production costs; increases in operating costs; and lower productivity (eg. fewer miles flown or road miles driven). However, establishing subjective external costs (i.e., additional consumption of services that may lead to a reduction in valuation of such services) may be more difficult to estimate.

There is lack of consensus that users or producers should be held responsible for these costs. For example, if government introduces a new policy such as trade liberalization or deregulation that increases congestion due to additional traffic movement, who should pay for it? Or who should pay for increases in congestion if municipal zoning laws change traffic flow patterns? Since these costs, which increase the price of transportation services are imposed by society, then society should pay for them. For example, the MacPherson Report (or Royal Commission on Transportation 1961, p. 275) states “First, the burdens of being borne by any mode, because of law and public policy, must be offset by adequate recompense. It becomes a simple axiom of policy that, where the public obliges services to be continued beyond the commercial demand for them, the public shall pay. To do otherwise is to distort the true competitive competence of the mode.” On the other hand, if congestion is the result of gradual increase in demand for transportation services then it may not be so evident that society should pay for it. In such situations, there may be greater consensus that transportation users should be held responsible for these costs.

*Security:* Security or the lack of it also results in harm beyond transportation. One study states “Transport operations and equipment can be hijacked and used as weapons of terror. The consequence is to impose substantial costs on persons not involved directly in market transactions, i.e., externality.”[19] Similarly, transportation infrastructure can be used as centres of terrorist activities

as they attract a large number of people (eg. railway stations, airports, bus depots, etc.). Examples of externalities that have arisen because of lack of security are the 9-11 incident where use of an aircraft caused harm not only to the air travellers but to people or entities not related to air transport, the commuter train bombing in Madrid, Spain that killed 191 people in March 2004, London bombings that killed 56 people in July 2005, etc. Increased security requirements can also lead to externalities that directly affect transportation (i.e., increased delays, lower productivity due to fewer miles flown or road miles driven).

Who should pay for these externalities? Prior to the terrorist activity of 9-11, travellers and the industry in Canada met the increased cost. But since society demands an even higher level of security (after the 9-11 incident) than the market will supply, who should pay for the benefits of increased security? One authority states "It follows that the costs of bearing the increased security is appropriately borne by the ... industry and partly by society at large".<sup>[20]</sup> "In such circumstances this calls for a greater level of security than would be optimal solely from an industry perspective. It is probably accurate to say that such a higher level of security is being pursued today. But it is not clear that the air industry and users should bear the full costs of providing the enhanced level of security. To the contrary, insofar as the benefits of security activities accrue to society at large, it is optimal that they bear a portion of costs rather than burdening and thus discouraging the air industry." <sup>[21]</sup>

**Safety:** Safety or the lack of it results in harm beyond transportation i.e., externalities. For example, the transportation of explosives, dangerous chemicals or gases, etc. can result in harm to individuals, the environment and entities not related to transportation. Externalities that have arisen because of lack of safety are the train disaster carrying chemicals through Mississauga, Toronto, which affected the health of residents in that neighbourhood or the Valdez oil spill, the PRESTIGE oil spill, etc. which killed bird population feeding in the waters where the spills occurred.

Costs imposed because of safety requirements are usually met by travellers and the industry. Since users or suppliers of transportation services are responsible for these external costs they should pay for them. However, if society imposes safety requirements in Canada beyond those recognized internationally as adequate, then it is not apparent that users or the suppliers of transportation services should pay for these additional costs. A case exists for society to pay the costs or the additional benefits

they demand.

*Environment:* Environmental pollution (air, water and land) that results from operation of transportation go far beyond their operation affecting health of humans, wildlife loss, natural resource degradation together with climate change, i.e., externalities. Projects have being undertaken to study these externalities. For example “An EU sponsored project entitled ‘ProGRESS’ is designed to test the feasibility of road user charges in eight major European cities: Bristol, Copenhagen, Edinburgh, Genoa, Gothenburg, Helsinki, Rome and Trondheim, over a three year period beginning in 2000.”[22]

It is generally believed by economists that since users or producers of transport are responsible for these external costs they should pay for them. As a result, several countries have implemented a list of economic measures which have been documented in *Road Travel Demand: Meeting the Challenge*.<sup>[23]</sup> These “economic measures are applied to the transport sector to influence travel demand by charging drivers the true costs of travel. These costs include externalities such as environmental impacts caused by vehicles, productivity losses due to increased congestion levels and wear and tear on the physical infrastructure.”[24]

Before concluding, some of the problems in dealing with external costs will be briefly mentioned. First, establishing what should be included in the costs (eg. common costs, joint costs, etc.) has to be considered. Common costs (i.e., costs incurred in variable proportion from producing non homogenous outputs from a common facility) and joint costs (i.e., costs incurred in fixed proportion) do not generally prevent the market mechanism from generating efficient prices as the presence of scope economies are generally not large enough to result in long run decreasing costs. Common costs could be recovered through annual network fees and joint costs from users of the specific service. Second, should charges be differential (i.e., by different class of users, type of vehicle, road, time and season)? A differential pricing scheme based on the value of service could be economically efficient. Though it may seem arbitrary, establishing different charges based on each of the above categories to reflect value and use has been undertaken by Road Funding Agencies. Third, determining if these costs are excessive due to inefficiency as opposed to just increases due to increased output is difficult to determine. Notwithstanding these problems, some countries are adopting official policies for charging directly for these external costs.

In sum “numerous studies have shown that internalizing external costs improves economic efficiency and total societal benefits (European Commission, 1996; Apogee Research Inc., 1997).”[25] The same reasoning holds for external benefits. The question of who should pay for it is a much more difficult to generalize. In the case of environmental costs of pollution, most economists believe that users or producers who are responsible for them should pay for the **full social cost** of transportation. In the case of infrastructure costs or safety or security costs, there is lack of consensus that users or producers should be held responsible for these social costs **beyond what the market will provide** after meeting a minimum standard required. A recent publication indicates that society should pay for additional benefits demanded at least in part. It is my opinion that society should pay for all additional benefits demanded or additional costs imposed by it.[26] The reason is that it would not only be equitable but also similar to the treatment of dealing with environmental costs. It would also avoid the difficult question of what proportion should be borne by the private vs the public. The same reasoning applies to social costs of safety that are demanded by society beyond those normally required (i.e., compared to other advanced countries) or what the market will provide. In some countries, externalities arising from security, safety and environment are treated as public goods where all costs arising from them are paid for by society.

#### IV. Conclusion

This paper in part attempts to provide my views on the social costs (internal and external) of transportation as “The Government is searching for broader consensus on the full costs of transportation and practical solutions”.

The first part briefly describes transport infrastructure, security, safety and environment (i.e., TISSE) in Canada in various modes of transport with details in Appendix I. In the second part, those aspects of key federal laws most applicable to TISSE were briefly indicated together with the major federal regulatory programs with details on the former in Appendix II. The latter reveals that the federal government funding (spent over the last few years or committed to the future) on major transportation projects related to TISSE is: \$12 billion for infrastructure;

\$7.7 billion for security; and \$10.058 billion for the environment. Some observers believe that this funding is inadequate compared to Canada's nearest competitor, the United States. The third part, the focus of this paper, examines issues such as do externalities arising from TISSE raise pricing and efficiency concerns; fair and efficient pricing of external costs; evaluation methods of these costs; and competition concerns? Finally, should users pay for the full social cost of TISSE, the most controversial of these issues.

Most economists hold that internalizing social costs and benefits improves economic efficiency and total societal benefits. This is not surprising given that in the presence of externalities, the efficient allocation of resources will not occur according to marginal social cost pricing.

TISSE costs can affect competition. As a result, payment of social costs by users and suppliers of transportation services in Canada could tilt the competitive field either by raising the cost of exports or affecting the present and future competitiveness of Canada's ports or airports, if external costs or funding of TISSE expenditures are treated differently by competitors in the US. This has been pointed out in some studies where competition concerns have been cited. It can also distort competition between transportation modes. Profillidis assessed the external costs of different transport modes and concluded that "Internalization of external costs will surely benefit railways while making road transport much more expensive." An EU Directive attempted to correct for this but did not achieve significant results as it was resisted by special interest groups.

To date, users or suppliers of transportation services have not paid for external costs either because the transaction costs of collecting these external costs are greater or because of some other problems associated with them. In the case of environmental costs of pollution arising from transportation, most economists believe that the transportation sector should pay for the **full social cost**. As a result, in a number of countries projects are being undertaken to determine the feasibility of collecting these external costs. In the case of externalities arising from infrastructure or security or safety, there is lack of consensus that users or suppliers of transportation services in Canada should be held responsible for these external costs **beyond what the market will provide** after meeting a

minimum standard required. It is my opinion that society should pay for the additional social benefits demanded by them or additional costs imposed by them. (Appendices can be obtained from the Authors).

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### Footnotes

1. Given the distribution of income, an efficient allocation of resources requires net social benefits [i.e. total social benefits minus total social cost. Total social benefits are defined as the sum of all individual increments of satisfaction (benefits) enjoyed by members of a society. The total social cost of producing additional units of one commodity is equal to the amount of satisfaction that is foregone because less of another commodity is produced] from the consumption of goods and services be at a maximum. The maximization of net social benefits occurs when marginal social benefits (MSB) = marginal social costs (MSC) (marginal being defined as a change resulting from a change in an additional unit). From the standpoint of individual consumption, an optimal position is reached by maximizing net private benefits, i.e., when marginal private benefits (MPB) = marginal private cost (MPC). (MPB is defined as the benefit which accrues to the individual consuming the good or service, and MPC as the cost incurred by the consumer or producer in the production of the good or service). Private and social costs and private and social benefits are not necessarily equal. Under most conditions, MPB and MPC schedules are equivalent to demand and supply schedules. MPC is equivalent to the cost that the producer or consumer incurs in the production of goods, and thus in order to maximize private benefits, an individual will purchase units of the goods where MPC = MPB = price. An efficient allocation of resources requires that MSB = MSC. If MPB = MSB and MPC = MSC in every market, the market-determined allocation of resources will be an efficient allocation. Marginal social cost pricing is a necessary condition for obtaining an efficient allocation of resources. If all markets are perfectly competitive, the market mechanism will automatically generate prices such that price = MSC = MSB (a result referred to as a Pareto optimal allocation of resources).
2. In addition, the production and consumption of transportation services generate special types of problems such as joint and common costs, consumption at peak times, congestion, demand that depends on service, etc.
3. This concept of externalities was first formulated by the renowned English economist, Alfred Marshall in the 1890s and led to a great deal of ambiguity in the early 1900s. See Ellis, Howard, S. and Fellner, William, External Economies and Diseconomies, *The American Economic Review*, Vol. XXXIII, 1949, pp. 493-511. Also see references therein.
4. Baumol, W. J., *Economic Theory and Operation Analysis*, Prentice-Hall Inc. N.J., 1965, p. 371.
5. *Towards Fair and Efficient Pricing in Transport*, European Commission, Com(95)691/Provisional.
6. *Id.*
7. *Id.* p. iv.
8. *Id.* p. vi.

9. *Vision and Balance*, Canada Transportation Act Review, June 2001, pp.137-8.
10. *Report on Competitiveness of Canadian Ports*, p. 43.
11. B.C. examines ways to improve province's ports, December 17, 2004 ([www.ctl.ca](http://www.ctl.ca)).
12. Air Canada gains from U.S. crackdown, *Financial Post*, December 13, 2004, p. FP3.
13. EU, U.S. team on container security, *The Journal of Commerce*, Nov. 16, 2004, [www.joc.com](http://www.joc.com).
14. *Summary Record* of the meeting in Paris on 4-5 December 2001, DSTI/DOT/MTC (2001) 2, p. 2.
15. *National Transportation Agency of Canada*, Annual Report, 1994, p. 173.
16. *Competition in Transportation*, Policy and Legislation in Review, Volume II, NTARC, p. 166.
17. *Cost Savings Stemming From Non-Compliance With International Environmental Regulations in the Maritime Sector*, Working Paper, 28-June-2002, DSTI/DOT/MTC (2001) 2, p. 5.
18. *Shipping and Environment: Dealing with Substandard Ships*, Prepared by Canada, January 8-9, 2003, Paris, OECD. Also see *Competitive Advantages Obtained by Some Shipowners as a Result of Non-observance of Applicable International Rules and Standards*, 1996, OECD/GD/(96)4.
19. Waters II, W. G. and Zhang, Anming, *Air Transportation Security as an Externality*, Paper Presented at the CTRF, [Unpublished] May 2004.
20. *Id.*
21. *Id.*
22. *Road Travel Demand: Meeting the Challenge*, OECD, April 2002, p. 82.
23. *Id.* pp. 85-93.
24. *Id.* p. 81.
25. *Id.* p. 83.
26. See footnote 19.
27. Reforms were introduced in 1986 after the tragic events of Air India Flights from Vancouver for the security of checked baggage which was not always systematically searched.
28. These were; 1) increasing surveillance and tracking of marine traffic; 2) screening passengers; 3) installing new detection equipments in ports to screen containers for radiation; 4) providing new funding to enhance the RCMP Emergency Response Teams; 5) enhancing collaboration and coordination among government departments and agencies; 6) improving port security further; 7) developing and implementing new security pre-requirements in line with recent IMO recommendations; 8) participating in the International Convention for the Safety of Life at Sea and the International Ship and Port Facility Security Code; and 9) drafting a Code of practice by the ILO which covers security in port areas not covered by the IMO's ISPS Code through the ILO maritime Security Group.
29. *Transport in Canada 1996*, Annual Report 1996, Transport Canada, p. 150.