TAC ATC

Synthesis of Practice

Highway Finance Theory and Practice

Fred Nix
Joseph Jones

Transportation Association of Canada
Association des transports du Canada

No. 2

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SOMMAIRE

L'objectif des travaux dont rend compte le présent document était de faire la synthèse des théories et pratiques liées au financement des routes dans les pays développés.

Ces travaux ont été exécutés par le biais d'une analyse de divers documents sur le sujet et d'une enquête auprès d'un nombre restreint de représentants des gouvernements provinciaux et territoriaux. Comme résultat de cet exercice, trois documents de travail ont été élaborés. Le premier porte sur les aspects théoriques du sujet, le deuxième traite de l'expérience concrète des administrations canadiennes dans le domaine du financement des routes tandis que le troisième examine de façon plus générale l'expérience et la philosophie d'autres pays développés en la matière. Le présent rapport se veut une synthèse de ces trois documents de travail.

Par le passé, les mesures de financement des routes prises par les provinces canadiennes se fondaient davantage sur la corrélation «avantages-taxation» (chapitre 3), c'est-à-dire qu'un lien plus étroit existait entre la perception de certaines taxes, telle la taxe sur l'essence, et les coûts de construction et d'entretien des routes. Cette méthode de financement a été abandonnée au cours des années cinquante et soixante, même si, à la lumière d'un certain nombre d'enquêtes, il était en définitive suggéré de mettre encore plus l'accent sur le principe du recouvrement des coûts auprès des usagers. La dernière de ces analyses a été celle de la Commission royale d'enquête sur un système national de transport des passagers. Dans son rapport, la Commission recommandait l'instauration, à titre d'objectif de la politique gouvernementale, d'un solide régime de recouvrement des coûts auprès des usagers, régime aux termes duquel les coûts des routes seraient déterminés selon des critères d'efficience. Il va sans dire que cette recommandation représentait un virage radical par rapport aux méthodes traditionnelles de financement des routes employées au Canada et dans les autres pays développés.

Comme le révèle l'examen des méthodes appliquées par les gouvernements étrangers (chapitre 4), de nombreux autres pays ont également eu recours aux stratégies fiscales conventionnelles à l'appui du financement des routes et ce, en dépit des conclusions de multiples études proposant des solutions de rechange, dont l'accentuation du rôle du secteur privé, le recours accru aux systèmes de péages, l'imposition de taxes fondées sur le poids des véhicules et les distances parcourues, la détermination du prix de revient de la congestion routière et la prise en compte des frais associés à divers facteurs externes dans le calcul du coût des routes. Cependant, pour les provinces disposées à faire l'essai de méthodes non traditionnelles - plusieurs d'entre elles sont d'ailleurs en train d'élaborer de nouvelles stratégies de financement des routes - le chapitre 4 offre un vaste choix de modèles.

Étant avant tout une «synthèse» de théories et pratiques, ce rapport ne préconise aucune méthode particulière de financement des routes au regard d'une quelconque administration gouvernementale canadienne. En effet, comme le laisse entendre le document de travail sur les aspects théoriques du sujet à l'étude (chapitre 2), il serait mal à propos de formuler de telles conclusions avant qu'un certain nombre de questions «politiques» concernant les routes n'aient été éclaircies et que les objectifs de la politique gouvernementale n'aient été cernés avec plus de précision.

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1. INTRODUCTION

The purpose of this research is to produce a synthesis of highway finance theory and practice in developed countries. The emphasis is on a documentation of new and innovative methods. "New and innovative," in the context of Canadian practices in the 1990s, means:

- methods other than the traditional method of paying for roads out of consolidated revenue funds (general, non dedicated tax revenue);
- the use of explicit price signals for road users, and
- the use of financial and/or economic criteria, rather than engineering or social policy criteria to make road investment decisions.

The traditional or "conventional" approach is described in Chapter 2.

This report is the result of a literature review and a brief survey of provincial officials. Because the subject of highway finance is so vast, the study can only provide an overview of many complicated issues.

Although the authors have their own perspectives on the subject, the purpose of the report is simply to present the arguments without advocating a particular point of view. For that reason, or almost by definition, the conclusions are neutral on the question of which highway financing policy is best or, indeed, whether or not a change from current practices is required. The authors see their task in the production of a "synthesis" as one of simply laying out the facts and arguments associated with the alternatives.

2. OVERVIEW OF THEORY AND PRINCIPLES

2.1 Introduction

Prior to describing highway finance practices, the terms of reference for this research asked for an overview of theory. To synthesize the vast quantity of literature, five different perspectives are presented: the conventional (Canadian) view, benefit taxation, user pay, economic efficiency and a macroeconomic perspective. They are compared in Table 2.1 at the end of the chapter. These five perspectives are necessarily simplified. In practice a wide range of qualifications and "grey" areas are skipped over.

There are two fundamental issues in adjudicating among these various and, to some extent, competing views of road finance:

- What is the nature of a road—a public good, a private good, or something in between? and
- What are the objectives of government policy—efficiency? regional development? income distribution? macroeconomic stability? growth?

This study **cannot** resolve either issue. All it can do is point out that different people answer these questions differently and, accordingly, hold different views on how roads ought to be financed.

2.2 Conventional Approaches

The conventional view—that is, the stance most provinces have taken over the last several decades—is that roads are a public good and, as a consequence, financing from general tax revenues is justified. No explicit link is made between any particular tax or fee and road expenditures. Further, the timing and choice of projects is based on engineering criteria, factors such as V/C ratios for capacity and pavement ratings for quality and, sometimes, non-engineering criteria for other goals such as regional employment, reflating the economy and even less noble purposes. In actual fact, in Canada, this conventional view is probably never stated this starkly.

Under the conventional view, "road finance" becomes a question of how finance

> The definition of a pure public good or a collective consumption good is one which, because it cannot be withheld from one individual without being withheld from all, must be supplied by the public sector. A private entrepreneur will not provide such a good or service unless there is assurance that all members of the community pay for its use (if "use" can be measured). Frequently cited examples of a pure public good include police protection, street lighting, or the provision of lighthouse services.
>
> Many have acted as if roads are a non-pure or a "quasi" public good, like hospitals. They are supplied by the state because it is argued that the quantity or quality supplied by the private sector would be inadequate.
>
> **Public Goods and Quasi-Public Goods**

ministers allocate funds among various departments. The road department is just one among many competing providers of public goods or social services.

There is little support for this conventional view in recent road finance theory. However, in the past, there was justification for considering roads a pure public good under some circumstances. A.A. Walters suggested that "As long as there is neither wear nor congestion, the service of the road should be free since they are pure social goods." (Walters, 1968, p 20). This argument is not heard often today. Most attention is on things like the impact of axle loads on pavements and the high cost of congestion or air pollution. Yet, oddly, this conventional view may still be justified in large areas of Canada. Think of automobile traffic (virtually no road wear) on roads in places other than major urban centres. There is not a lot of congestion at 2:00 a.m. on the Yellowhead between Saskatoon and Edmonton. What is the real cost of an automobile trip in this circumstance (i.e., other than the operator's cost)? Or, to turn it around, is this an instance of a pure (almost pure?) public good?

2.3 Benefit Taxation

Public finance theory looks at taxation in a number of ways. One view is that people who benefit from public expenditures should pay for them. This contrasts with the "ability to pay" view of taxation. Benefit taxation is often deemed acceptable where, among other things, benefits from a government-supplied service are primarily individual rather than collective and where possibilities of charging directly for a service are limited (i.e., costly to collect). (*Notice, then, there may be a conflict between this view of highway finance and the previous one over the nature of a road—pure or quasi public good--in that services which are "primarily individual" may not fit the notion of "collective consumption."*.)

In Canada, a good deal of lip service has been paid to the benefit view of road financing, particularly by finance ministers when announcing increased fuel taxes. Even so, this has rarely amounted to a formal method of taxing users for road use. At least for the last few decades there has been little inclination to dedicate or "earmark" taxes. This is in contrast to developments in the United States where, since the second world war, formal structures such as trust funds have been created.

The implementation of benefit taxation varies enormously and there is a great deal of literature on issues such as the calculations involved. Key issues include:

- The magnitude of "access" benefits for property owners or general "mobility" benefits to society as a whole. This is critical to the question of how much non-users should pay for roads.

- The difficulty in measuring benefits. Sometimes the calculated benefits for road users are virtually the same as allocated costs. In other cases, benefits are measured by factors such as the reduction in vehicle operating costs (e.g., arising from resurfaced pavements), the reduction in travel time (e.g., arising

from less congestion or more direct routes), or the reduction in accident costs (e.g., arising from safer roads).

To summarize, under the benefit taxation view of road finance, engineering criteria or other government objectives, such as regional development, are used to determine the amount of investment, while a range of analytical techniques, including highway cost allocation, are used to decide the level of taxes for both road users and non-users. Roads are not considered a public good or, at least, not a pure public good but, for some reason, they are still seen as something governments, rather than the private sector, should ordinarily provide. This does not rule out private ownership of some links in the road network. The method of financing roads is to tax users in proportion to benefits derived. This may or may not cover the whole cost of the road network as non-users may also receive benefits, and therefore be charged. This is seen as the way to finance roads, presumably because the alternative of charging directly for their use is viewed as impractical.

2.4 User Pay

A user pay approach to road finance may be similar in practice to benefit taxation. The key difference (for here) is that road users pay for the entire cost of the roads. In a sense, then, a user pay view of road finance is similar to viewing roads as a public or private utility where the users pay for the service with no subsidy from the general taxpayer.

At the broadest level, user pay simply means that, in aggregate, the charges paid by the totality of road users cover the costs of the road system. However, this begs a number of questions:

- Are all classes of users paying their fair share of the costs which they occasion when they travel by road?
- What is the degree of cost recovery for individual types of roads or even individual roads?
- What is meant by costs? Are these simply the costs of the highway agency, and if so, what should be included? Or should non-agency costs be considered, for example the costs of congestion or air pollution? and
- Should user pay apply to the entire road network or only to a subset (perhaps just the interprovincial highways)?

As far as can be determined, there is no strict definition of "user pay." All that is meant by the term here is that the finance policy accepts the principle that users pay for the service provided. In a sense, this is similar to telephone service of past decades where there was a requirement for telephone subscribers as a class to pay for the system. This "user pay" outlook may also have been a characteristic of other utilities or municipal services—water, sewers, electricity. etc—although clearly there is more emphasis on the costs occasioned by

individual users today than there was in the past. In any case, the choice of the term "user pay" to describe this third perspective is not really important.

The user pay view need not differ significantly from benefit taxation. Engineering criteria such as pavement condition rating, other government objectives such as creating regional employment, or even a cost-benefit analysis can be used to determine the expenditures. The tax policy is to make road users pay for it. Exactly how much each road user pays is unclear—perhaps it is based on some notion of benefits, perhaps on the basis of cost responsibility, perhaps on the perfectly legitimate pricing mechanism of "what the market will bear." In other words, the primary concern is to ensure that road users as a class pay for total road expenditures and not to worry too much about the specific level of taxes for some vehicles in some regions in comparison to other vehicles.

2.5 Economic Efficiency

Economists argue that the appropriate way to consider road finance is from the perspective of efficiency. The result is that road users are charged the marginal cost for their use of the road, ideally on a per trip basis. This ensures optimum resource allocation (the economist calls this point a "Pareto optimum" where no one person in society can be made better off without making someone else worse off). In other words, it is the most efficient point for a particular technology.

Further, the relevant marginal cost has to be the "marginal social cost" which includes externalities—that is, costs or benefits that are "spin offs" from the consumption or production of a good or service. Air pollution is the classical example of an external cost of road use. However, congestion delays are currently seen as the largest externality associated with road use in urban areas and even at points on the intercity network.

While traditionally it has been negative externalities, such as pollution or congestion, that have preoccupied economists in considering road prices, there has been a recent movement to argue that there are also very large positive externalities associated with road use. More about this in Section 2.6.

The eloquence of this efficiency perspective on highway finance is that it rations the use of a scare resource and ensures the optimal long-run investment in roads. That is to say, if consumers are confronted with the true marginal social costs of road travel, they will decide how much they really want. Responding to this demand for road capacity and quality, road builders will learn how much to provide. This is not to say that there will not be mistakes made along the way as it likely takes a long time, and perhaps a few inappropriate investments, before road builders learn how much roads of what quality to provide.

Marginal-cost pricing theory is complex and is not described here. One difficulty with pricing according to marginal costs or, preferably, marginal social cost is that total revenues brought in under such a scheme rarely match total costs. This is problematical when a road agency is mandated to price the use of the road in such a manner as to cover its total costs.

In the particular case of roads, the traditional argument has been that, because of economies of scale, marginal costs are less than average costs and, as a result, there will be a revenue shortfall if prices are set equal to marginal costs. More recently, however, as some have tried to calculate the marginal social costs of effects such as congestion or pollution, they have concluded that these costs are so high that, in fact, there would be a large revenue surplus if marginal cost pricing were used.

There are ways around these problems—government subsidies where marginal costs are lower than average costs (or, presumably, government appropriations where the opposite is true), "second best" pricing schemes, or two-part pricing strategies (sort of an entrance fee and then a use price based on marginal costs). These mechanisms are fully discussed in Gillen & Oum, 1992. From this it may be concluded that the revenue-expenditure mismatch is not necessarily an argument against this view of highway finance.

There is almost total agreement on this "efficiency" view of road finance—and, in particular, this linking of pricing and investment—by economists *as long as economic efficiency is an objective of government policy*. There is also any number of practical problems surrounding the implementation of such a policy, such as developing a system that can price the use of a particular road at a particular time. Finally, there has been almost universal opposition to such a policy by everyone other than economists and, perhaps, environmentalists who think that road users should be made to pay for their carbon dioxide and other harmful emissions.

2.6 Macro Economic & Other Objectives

The fifth perspective on road finance sees investment in transportation infrastructure as an instrument of economic growth and/or regional development. It is a view that has won a great deal of support in Canada from pre-Confederation days to the present. In the United States, it was popularized during the last presidential election by Robert Reich (to become Secretary of Labor) and has been promoted within the transportation policy community by people such as David Lewis of Hickling Lewis Brod Inc.

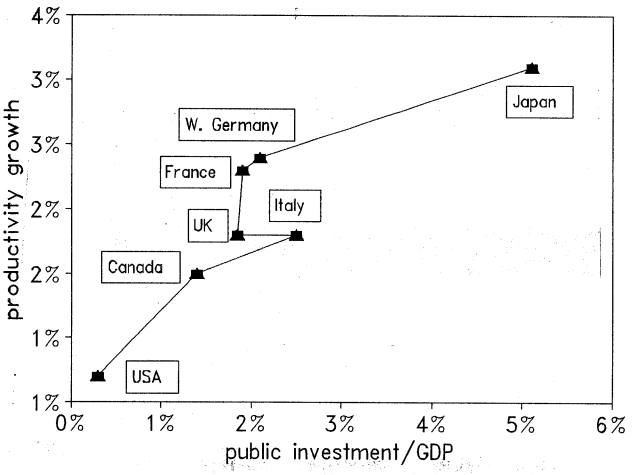

Figure 1: Public Investment and Productivity

Reich and economists such as David Aschauer have focussed on the macroeconomic level. (Hulton, Aschauer & Nadiri. 1994) Observation of US infrastructure spending levels over time or comparisons with other G-7 countries indicates a strong correlation between public

capital spending and economic prosperity. Despite the policy implications which some have drawn from this correlation, the jury is still out on the causes and nature of the linkages.[1] In particular:

- Does the strong correlation between public capital spending and productivity amount to a causal relationship? Or could Reich and his supporters have confused cause and effect: does economic growth free up resources for capital spending?

- Is there an optimal level of public spending for economic performance, in order words, can a point be reached at which diminishing returns set in?

- How long lasting is the effect and how does it vary by industry?

A major research project has been undertaken as part of the US Federal Infrastructure Strategy Program to address these and other questions. The relevance for this study is that the researchers are looking at the extent to which the method of raising funds for infrastructure investments has an impact on productivity. User charges, deficit financing and taxation are the three main methods under consideration. Intuitively, it would seem that each of these would have different implications for the degree of economic stimulus and the levels of private investment (e.g. the crowding out effect).

In addition to the macroeconomic perspective, David Lewis has promoted a project level, or micro, perspective. This, in effect, is a variant of cost benefit analysis. The argument is that, when projects yield benefits which exceed costs, these translate into productivity gains for business. "Benefits" are mainly time savings and reduced vehicle operating costs (with some disagreement as to whether this is for all vehicles or just those using the road for a commercial purpose). The novelty of Lewis's approach is that he has argued for the existence of very large benefits in reduced "logistics costs" which have not been fully picked up in conventional cost benefit analysis benefits. The policy conclusion, and this is where the microeconomic and macroeconomic views converge, is that the level of infrastructure investment has been less than optimal.

This view of road finance does not address the critical question of who should pay for these public investments—road users with specific charges or prices for individual trips, road users in a general sense through a user-pay tax policy, or a combination of road-user taxes and general taxation "subsidies" (if this is the correct term). Nevertheless, the implication seems to be that where these benefit-cost ratios are greater than one, governments should go ahead and pay for roads from general tax revenues.[2] Lewis emphasizes that it is not a *general* increase in infrastructure spending needed (e.g., a direct job creation program). Rather, he calls for infrastructure improvements that increase productivity and in turn lead to growth.

Table 2.1: Financing Mechanisms and Road Financing Perspectives

Financing Mechanism	Road Financing Perspectives				
	Conventional	Benefit Taxation	User Pay	Efficiency	Economic growth
general tax revenues	primary mechanism	possibly coinciding with benefits of non-road users	conflict	conflict	presumably acceptable
fuel tax	not necessarily in conflict*	justified if it corresponds to usage	justified if it corresponds to usage	justified; may not correspond to optimal price	not necessarily in conflict
vehicle registration tax	not necessarily in conflict*	justified as an "entrance fee"	justified as an "entrance fee"	justified as part of a two-price scheme	not necessarily in conflict
weight-distance tax	probably in conflict	possibly justified (if benefits are related to weight)	justified to the extent costs vary with weight	justified to the extent marginal costs vary with weight	not necessarily in conflict
earmarking (dedicated taxes, trust funds)	in conflict	acceptable	justified (assuming institutional arrangements)	essential	not necessarily in conflict, but appears to support the use of other tax revenues
congestion pricing	generally in conflict	not necessarily in conflict	possible	theoretically essential	not necessarily in conflict
tolls/charges for use of specific links	generally in conflict	not necessarily in conflict	justified	desirable	not necessarily in conflict
property taxes (local assessment areas, development charges, etc)	not necessarily in conflict*	justified	not justified	not justified	not necessarily in conflict
private ownership, public/private partnerships, etc	generally in conflict	generally in conflict	justified	probably highly desirable	not necessarily in conflict; subsidies may be justified
"green" taxes	not necessarily in conflict*	not necessarily in conflict	not necessarily in conflict	presumably essential	not necessarily in conflict
other sales or consumption taxes	not necessarily in conflict*	possibly justified	justified	possible?	not necessarily in conflict

* These may be perfectly acceptable taxes, but they are not directly linked to financing roads.

2.7 Summary

These five perspectives on road finance are archetypical. In practice, most transportation finance practitioners hold a combination of several of these views. Politically, the safest position is to have a muddled version of all five at the same time: this offends the fewest people. Each of these five views has significant implications on road finance mechanisms which are illustrated in Table 2.1.

The terms of reference for the study list "government objectives" and "roads as a public utility versus government responsibility," as the first two points under "theories and principles." There is no clear way out of the dilemma posed at the beginning of the chapter--the inability to resolve the issues of the nature of a road or the objective of government policy. That is, while economists talk about public goods—non-exclusivity in consumption being a key component—there is no universally accepted definition. In any case, the concept of non-exclusivity in consumption (i.e., something that can be supplied to no one or everyone) may not always apply. Examples of roads where it seems to apply include: the provision of a road in a new subdivision where it is not feasible to stop anyone—vehicles, cyclists, pedestrians—from using it; or, the use of a road by a light vehicle at a time when few others are using the road. Examples of roads where the concept of non-exclusivity in consumption may not apply include: the state revokes drivers' licences and/or remove registration plates thereby preventing some from using roads; toll roads; or, barrier gates on access ramps to freeways used during rush hour to prevent some from using the road.

In terms of government objectives, it is not clear there is any "theory" that says exactly what these are or should be. Rockerbie writes:

> ". . . public policy is defined as policies designed to achieve socially desirable objectives regarding the allocation, distribution and stabilization of scare resources. Trade-offs exist within each of these objectives and public choice theorists suggest various means by which these conflicts are resolved. The public choice function of government matches individual preferences against one another in making collective choices." (Rockerbie, 1992, p 479)

In other words, objectives are what the government (and the voters) deem them to be.

So, where does this leave the debate?

- Government objectives are whatever governments and electors decide they are. At the extreme, these could be to treat roads as a pure public good and, therefore, fund them out of general tax revenues; or to treat roads—or maybe just the intercity freeways—as a pure private good and let private producers operate them (and, obviously, charge prices for their use).

- While there are aspects of economic theory that might be used to support the view that some roads have characteristics close to those of a public good and,

therefore, provide guidance in choosing a finance mechanism, it is unlikely that this theory of public goods can be extended to cover the whole network. With a mature transportation sector and several competing modes, it is difficult to argue that roads such as Highway #407 in Toronto or the Coquihalla in BC exhibit any characteristics of a public good.

- Putting theory about government objectives and/or characteristics of roads aside, the point to observe is simply that there are growing pressures to view some roads and other major infrastructure developments as private goods.

- This tendency to view transportation infrastructure as a private good raises a number of issues: how does the state decide who should provide the service? how should these projects be funded? does the state have to regulate prices or rates of return to protect consumers?

- This leaves one remaining problem: if there is evidence that public infrastructure expenditures can increase productivity and, hence, promote economic growth, then a case can still be made that complete reliance on a user pay road finance mechanism is a mistake.

3 CANADIAN PRACTICES

3.1 Introduction

This chapter outlines Canadian highway financing practices in three sections: the early years when highway taxes were first introduced; the years after the Second World War when many provinces and the federal government conducted inquiries into the highway taxation methods; and the current practices.

3.2 The Early Years (pre 1950)

Nancy Bryan (1972) provides a history of the early years of road taxation in Canada. To summarize:

- The first motor vehicle act was passed in Ontario in 1903; other jurisdictions followed.

- Initially, registration fees were set quite low—presumably just to cover administrative costs. However, after World War I, fees increased rapidly. Many provinces treated the revenues from these fees as a road-user charge by either: earmarking the revenues (that is, the statute required governments to spend the equivalent amount of money collected on roads), or establishing a special fund. "Most of the provinces made earmarking provisions that fell short of establishing a formal road fund . . . ." (Bryan, 1972, p 22)

- "While it was generally accepted that drivers should contribute some portion of highway expenditures and general taxpayers another portion, no effort was made to define the relative responsibilities." (Bryan, 1972, p 22)

- Initially, most provinces assessed a flat registration fee per vehicle. However, since the 1920s, these fees have become considerably more complex in the sense of distinguishing among vehicle types (passenger car versus truck) or the use of the vehicle (private or commercial) or the size of the vehicle (number of cylinders for passenger cars or weight for trucks). The extent to which these differences in taxes were based on assumptions about road use (or, even road costs) is unclear.

- In the 1920s, there was no general sales tax and few provincial commodity taxes. The introduction of a gasoline tax, therefore, was unusual. There is no doubt that its introduction was intended as a specific road-user charge, as Bryan makes clear. She points out that seven out of the ten legislatures (counting Newfoundland, which at that time was a Dominion) had specific earmarking provisions in their initial legislation. Further, all of the initial acts made provisions ensuring that only gasoline used on public roads was taxed.

- Alberta was the first province to introduce a gasoline tax (2¢/gal in 1922) and by 1928 all other provinces had followed. (The territories did not have such taxes until later and Newfoundland actually had an import duty on crude petroleum starting in 1929.)

> *". . . it is clear that the gasoline tax was considered another user charge and a source of highway funds, as the Ontario statute [1925] indeed stated: 'For the purpose of providing for a fair contribution by the users of the roads in Ontario towards the cost of the construction and maintenance thereof, . . .'"*
>
> (Bryan, 1972, p 26)

- Earmarking, or dedicating all or a portion of these gasoline taxes was quite common:

Nfld - 1933 Public Works Act dedicates the import duty on kerosene and gasoline for road works.

PEI - 1924 Gasoline Tax Act dedicates the tax for highway maintenance and repairs.

NS - 1926 Gasoline Tax Act dedicates the tax to the Highway Fund which had been established earlier.

NB - 1926 Gasoline Tax Act assigns tax to highway fund.

Que - 1939 Gasoline Act allows Treasurer to dedicate receipts to charges on highway borrowing.

Ont - 1925 Gasoline Tax Act indicates tax is intended as a contribution to road construction and maintenance costs; 1926 Highway Improvement Act directs that gas tax be deposited to the Highway Improvement Fund.

Man & Sask there does not appear to have been any dedication of fuel taxes to road expenditures.

Alta - 1951 Municipal Assistance Act dedicated 4¢/gal of fuel oil tax to be paid into a fund for municipal grants.

BC - 1950 Highway Development Act puts 3¢/gal of gas tax into a fund to pay debt charges on loans authorized by the Act.

This short history of the years up to (about) 1950 serves to demonstrate what has generally been forgotten. When road taxes were first introduced in Canada (registration taxes, fuel taxes and a few others), they were often—if not usually—considered explicit charges for the use of the road. In many cases this went as far as dedicating the tax revenue raised for the specific purpose of financing roads. For some reason, this approach to highway

finance—including even the use of toll facilities—died out during and after the Second World War.

By 1972, Bryan notes that only three provinces—Québec, Nova Scotia and Prince Edward Island—retained vestiges of dedicated road-user taxes. And even these vestiges were pretty tame compared to the original intention of earmarking funds. (Bryan, 1972, pp 30-32). Further, although Bryan reports that there was some resurgence of interest in toll facilities in the 1950s and, in three provinces (Québec, Ontario and British Columbia) toll facilities were built, toll financing never caught on as it did in the United States.

3.3 Tax Inquiries, Commissions, Recommendations

Since the late 1950s there have been a number of government inquiries into the subject of highway financing. For the most part, their recommendations have been ignored.

1957 An Ontario Select Committee on Toll Roads and Highway Financing identifies two basic issues: the appropriate division of road costs between users and non-users; and, the appropriate division of the road users' share among vehicle classes. The answer to the first is firmly in the user pay view of highway finance: road users should pay for all (provincial) road costs. According to Bryan, ". . . the Committee . . . felt that the provincial highway system should be self-supporting, for it suggested that the Department of Highways be financed similarly to the Ontario Hydro-Electric Power Commission . . . (Bryan, 1972, p 68) On the second question, the Committee recommends a weight-distance tax and a general increase in both gasoline and registration taxes. Until a weight-distance tax can be implemented, it recommends as an interim measure a variable fuel tax for heavy vehicles and an adjustment to the licence fee to reflect both vehicle weight and distances driven. (Ontario Select Committee, 1957, as reported in Bryan)

1959 A British Columbia Commission conducts one of the most thorough investigations of road-user costs ever undertaken in Canada. It has to borrow US technical studies to do this. (British Columbia Commission of Inquiry into Road-use Charges, 1959, as reported in Bryan) It concludes that road users should pay two-thirds of provincial road costs and that, of this amount, commercial vehicles should pay 25% of the base road costs. Any costs over-and-above base costs, because of building roads for heavier vehicles, should also be paid for by commercial vehicles. From these conclusions, it recommends either a commercial vehicle licence fee on the basis of gross weight (at the time, they were assessed on tare weight) and a higher tax for diesel, or a moderately higher registration tax schedule on the basis of weight plus a weight-distance tax. (*The province did first introduce a differential diesel tax rate in 1959.*)

1961 The MacPherson Royal Commission notes that there are some who contend that trucks are not paying an appropriate charge for their use of the road and, alternatively, that there are others who argue that trucks are paying more than their fair share of road costs. It concludes "The proof of either contention is far from being satisfactorily demonstrated." (Canada: Royal Commission on Transportation, 1961, Vol II, p 28)

1964 An advisory group established by the Nova Scotia government examines charges such as fuel and registration taxes but does not link these to road expenditures. Its outlook is the conventional view described in Chapter 2. (The *Provincial and Municipal Taxation Study* as described by Bryan, 1972, p 72)

1965 The McLeod Commission in Saskatchewan adopts a position on highway financing mid-way between user pay and the conventional view. (Saskatchewan: Royal Commission on Taxation, 1965, as reported in Bryan) It notes there is a general understanding that fuel and registration taxes are user charges but that the government does not attempt to maintain a fixed level between these taxes and road expenditures. It recommends against earmarking and cost allocation.

1965 The Bélanger Commission in Québec also goes half-way towards a user pay view of highway finance. (Québec: Royal Commission on Taxation, *Report*, as described in Bryan) ". . . the motor fuel tax in Quebec can no longer be properly be called a road tax . . . . " It makes this remark in part because the fuel tax is levied on fuel used by off-road vehicles, by pleasure boats and by other, small household engines. Its recommendations are a mixture of viewing taxes such as the fuel tax as nothing more than a general revenue source and of viewing motorists with some responsibilities for paying taxes in accordance with benefits received.

1966 An inquiry in Alberta, the "Public Expenditure and Revenue Study Committee," develops the firmest view against benefit financing of any of the provincial commissions and inquiries. Although it recommends an increase in fuel taxes and vehicle registration taxes, these are simply revenue measures. It makes no link between these taxes, the motorist's use of the road, and expenditures on roads. (Bryan, 1972, p 71)

1967 The Ontario Committee on Taxation (the Smith Committee) "enunciates a rigorous benefit-financing doctrine . . . " (Bryan, 1972, p 71) It recommends that users pay for 65% to 75% of provincial road costs. Further, using cost-allocation work completed by the Ontario Department of Transport and technical studies from the US, it

recommends that : i) all minor fees such as driver's licence fees and public vehicle fees be set just to cover the cost of issuing them (these were not seen as road-user charges); ii) registration taxes be slightly adjusted; iii) the fuel tax be used as the primary mechanism to charge road users for road use (road costs are a function of miles driven and, further, the fuel tax is the most appropriate charging mechanism for miles driven); and iv) there be no exemption for fuel from the sales tax (i.e., fuel should be subject to both the fuel tax as a road-user charge and, like all other final consumption goods, the sales tax).

1969 Prince Edward Island undertakes an inquiry which, according to Bryan, concludes with an informal benefit-financing view of the relationship between road costs and various taxes (fuel, etc). Quoting from the report, Bryan writes ". . . there is an implicit understanding that there is a close relationship between motor fuel [tax] revenues and highway expenditures." (Bryan, 1972, p 73)

1992 The Royal Commission on National Passenger Transportation was the last of the major commissions making recommendations on highway finance. Its position is unequivocally user pay **or** efficiency. That is, from the theoretical principles enunciated, it is clear that the Royal Commission was strongly influenced by the arguments outlined in Chapter 2 under the efficiency view of highway finance. However, recognizing the practical difficulties involved in charging motorists the marginal social costs of road use, the final recommendations of the Royal Commission back off somewhat and, at best, really belong under the user-pay perspective on highway finance. Specific recommendations include a continued reliance on registration and fuel taxes, but with an understanding these taxes are explicitly for the payment of roads. Therefore, except for externalities (air pollution) the Commission recommends that the federal government cease collecting fuel taxes and that provincial governments cease levying their fuel taxes on non-road modes. The Commission also suggests that fuel taxes be kept within reasonable levels--not too far above marginal costs of road use--so as not to discourage road use unnecessarily. The only option, apparently, is much higher registration taxes and such devices as weight-distance taxes for heavy vehicles. The Commission also favours greater use of toll facilities, particularly where new capacity is added to the intercity network and possibly where it is feasible to use tolls as a congestion charge in urban areas (i.e., tolls that vary by time of day and day or the week). Finally, the Commission addresses the issue of rural roads with light traffic volumes, where marginal costs are considerably lower than average costs. It acknowledges that in such instances, other devices—say property taxes—have to be used to pay for the roads.

3.4 Current Practices

The following notes are based on published information and interviews with officials in all provinces and territories. The interviews were conducted in the first week of December 1994 and relied on a mixture of telephone calls and a simple questionnaire sent out by fax. In most cases, interviews, or faxed survey responses, were with **both** transport officials and officials from departments of finance. Because of the informal nature of these interviews, it is likely that not all details on the subject have been captured.

3.4.1 Newfoundland

No direct link is made between taxes paid by motorists and expenditures on roads. All road expenditures, other than federal-provincial agreements, come out of the Consolidated Revenue Fund. All revenues received are paid into Consolidated Revenue. The annual budget for roads is determined more-or-less by starting with the figures from the previous year, adding in any major new projects, and then seeing what Treasury Board approves.

Charges for intraprovincial ferries are set approximately equal to the cost of operating an automobile over an equivalent distance. Revenues are paid into Consolidated Revenue.

3.4.2 Prince Edward Island

While these is no explicit link between taxes paid by motorists and road expenditures, the relationship between the two is not entirely forgotten. "We sometimes look at the level of road tax revenues and road expenditures." It is not clear just what happens after someone looks at the revenue/expenditure relationship or, indeed, what taxes are considered as being related to the use of the road.

The "fixed link" is a separate issue, obviously, as it involves federal expenditures. The private consortium building the link will receive an annual amount from the federal government equal to that now being spent on the ferry service. The expectations are that this subsidy will pay for about two-thirds of the cost of the facility. The balance will be met by tolls, the level of which will be subject to regulation.

3.4.3 Nova Scotia

The link between taxes (fees, tolls) collected from motorists and the amount spent on roads is more explicit in Nova Scotia than in other provinces:

- As an example, the annual report from the Department of Transportation and Communications lists certain revenues associated with road use. These include tolls from the Canso Causeway, ferry revenues and revenues from motor vehicle registrations. (The last report reviewed was for the fiscal year ending March 31, 1989 so that some of these items are no longer relevant).

- Although currently there are no of toll roads, there were tolls on the Canso Causeway until two years ago and the province may be considering re-introducing them. There are two bridges in the Halifax area that are more-or-less financed from user tolls although on occasion the government has had to assist with finances. The province is just now considering the completion of the four-lane highway system from Truro to the New Brunswick border with a public/private toll facility. Details have not yet been determined although, since traffic volumes are not high enough to generate sufficient toll revenues, there will have to be general tax-payer support. Finally, there are ferries in Nova Scotia that are run on a (partial) cost-recovery basis.

- Nova Scotia's "Public Highways Act" contains a provision allowing for the establishment of a "Provincial Highway Fund." The Act sets out a list of taxes, fees, fines and other contributions which are to (or may) accrue to the Fund and it sets out a list of expenditures which may be charged against the fund (basically, all road capital and maintenance expenditures). Nova Scotia has not made use of this provision of the Act. (MacDougall, 1991)

- Under the Gasoline and Diesel Tax Act of 1989, a Transportation Trust Fund was established. This was used, starting in 1990/91, to accumulate an additional 2¢/litre gasoline tax and an additional 4.5¢/litre diesel fuel tax. These were expected to generate about $35 million in 1991/92. The money was to be used to upgrade the 100 Series Highways in the province. One concern raised at the time the fund was established was that the government would simply reduce the general allocation of money to the highways department in proportion to the amount of money raised in the trust fund so that there would be no net increase in highway expenditures. While these fears may still exist, no clear evidence has been found that this has happened. The trouble trying to prove anything on this point is that all departmental expenditures have been cut back recently so it is difficult to determine how much the "general allocation" would have been without the trust fund revenues.

To summarize: the primary mechanism used to fund roads in Nova Scotia is the traditional general taxation approach. That said, Nova Scotia has been experimenting with a few attempts at more directly linking user fees to road use.

3.4.4 New Brunswick

There is no relationship between taxes (fees, levies, etc) and road expenditures in New Brunswick. In 1989, the province experimented with a trust fund concept—the Arterial Highway Trust Fund (1989/90 to 1992/93). Certain fuel taxes, a few pennies per litre over and above the regular tax, were deposited in the fund and used to upgrade arterial highways. For unknown reasons, the fund was abandoned at the end of the 1992/93 fiscal year.

The province does use dedicated funding (trust funds) in certain other areas (environment, arts, sports, etc) and it is understood there is one toll facility (federal?) in the province (Saint John Harbour Bridge).

Highway budgets are set in the same manner as other departmental budgets—that is, the department submits a proposal and the Board of Management makes an allocation based on its assessment of the needs of all other departments.

3.4.5 Québec

There are no special procedures for financing roads in Québec and toll facilities have disappeared from the province. Road budgets are set in the same way as any other departmental budget through a general appropriation of funds by the Finance Department. However, the Ministère des Transports du Québec is doing work in this area, the intent of which (it is understood) is to develop new funding mechanisms:

- A study by SNC-Lavelin was commissioned to explore funding alternatives. It recommends that electronic tolls be considered to finance the construction and extension of the highway network. Maintenance of the highway network by the private sector should also be considered.

- It is understood that Michel Boucher of the Université du Québec is examining (for the Ministère) the relationship between road expenditures and road taxes over the last twenty or so years.

- One other research contract may soon be let. This will examine tax revenue/road expenditures in the Montreal region and compare the relationship between taxes and road-user costs for various vehicle classes.

None of this work necessarily changes anything. That is, it is being done for the Ministère des Transports. The finance department has to approve any changes.

3.4.6 Ontario

Ontario is moving in the same direction as British Columbia. That is, it has established the Ontario Transportation Capital Corporation (OTCC) which will eventually handle the funding of all (or all major?) capital projects (highways, transit, airports, etc). Capital expenditures will no longer be treated on an expensed basis and the OTCC will be able to tap its own funding sources.

The major current project for the OTCC is the Highway #407 north of Toronto. This public/private venture will see a private corporation build and operate the facility, a private corporation operate a tolling system, and it will see the OTCC raising the capital with toll revenues being used to fund the project (interest and debt).

Plans for the OTCC beyond the #407 project are still being developed. Nevertheless, these appear to incorporate the following features:

- Eventually, the OTCC will handle all capital projects for the Ministry of Transportation.

- The OTCC will be able to tap three sources of funds: i) "own source" such as, for example, toll revenues from the #407 (other examples, as in BC, could include capturing increased land values); ii) dedicated taxes (there are tentative plans to turn vehicle registration and driver-licence fee revenues over to the agency); and iii) the (traditional) Consolidated Revenue Fund which would only be used as a backup.

- Other road costs—that is, operations, maintenance, rehabilitation, etc—will be financed in the traditional fashion (i.e., out of the Consolidated Revenue Fund). However, Ontario has not ruled out making these costs more "user pay" orientated.

- Eventually, Ontario may even decide to look at the level of taxes (say the vehicle registration fee schedule) in relation to some measure of cost/use/value or other factors.

3.4.7 Manitoba

Manitoba's approach to highway financing is the same as any other departmental budget proposal: the department proposes and the financial people decide. There is no link between taxes and road expenditure, there are no toll facilities, and there has been no consideration of any new or different method for financing highways. Manitoba Highways and Transportation, however, has begun to look into financing issues such as, in broad terms, the relationship between road-user taxes and road expenditures. No details about this are known.

3.4.8 Saskatchewan

A recent paper from Saskatchewan Highways and Transportation (Hossack, 1994) makes the following points:

- Although there is not an explicit link between fuel taxes and road expenditures, the public perceives such a link. The same is not true of vehicle registration fees where the public sees these as an administrative charge for the government-run insurance agency.

- The province has completed a "revenue and expenditure" review. Presumably this is a comparison of fuel and registration taxes and road expenditures although the paper does not make this clear nor does it provide actual numbers. Under the "options" section of the paper, the statement is made that

> if the province moved to a "full dedication" system (i.e., fuel and registration taxes fully dedicated to the provision of roads), "fuel taxes and registration fees could be dropped by up to 43%."

At the time the paper was written (May 1994), the author noted that "we do not expect any movement in this area [dedicated road taxes] soon." There is, apparently, more hope for the establishment of trust fund legislation that could be used to channel money from a variety of sources, including the private sector, into road building or maintenance.

More recent information (discussion with Saskatchewan Highways and Transportation in January 1995), suggests the province is proceeding with its idea of establishing a crown corporation that could hold funds in trust for public/private partnerships. The importance or even the role of this crown corporation are not known. In the meantime, the primary method used to pay for roads is the Highways and Transportation department's annual budget proposal which is submitted to the Department of Finance every year. This proposed budget is developed by starting with prior year figures, adjusting where appropriate, and then submitting a final proposal.

Although the province does not dedicate fuel and/or registration fees to roads and has no toll facilities, and therefore has no real need to conduct road-cost allocation studies, there is one small qualification to this. For some time now, Saskatchewan has had a "bulk hauling policy" that allows truckers and/or shippers to operate over-weight trucks as long as the province is compensated for any additional infrastructure costs (pavement, bridges). Details on this policy are not, apparently, available in any document, so it is not possible to provide examples of just how this works. The principle, however, may be important.

3.4.9 Alberta

Alberta has recently made a significant change to its method of financing roads .

> "Revenues from road user taxes and fees (fuel taxes, vehicle registration and drivers' licenses) are being dedicated to departmental requirements; the Department will also be able to access funds it generates (e.g., log haul fees to improve roads and bridges that serve the industry). Net budgeting will improve accountability to the public; users will know where and how their dollars are spent. Transportation and Utilities will operate on a business-like user pay basis." (Alberta Transportation and Utilities, 1994, p 7)

This user-pay framework for road financing may not be quite as tight as the above statements suggest. First, the department's numbers indicate that, in fact, total road-user taxes are projected to exceed expenditures (i.e., road users will actually pay for more than the Department's annual expenditures.) Second, the system as described matches, or comes close to matching current expenditures with current taxes. This is not the same as making taxation equal to the costs of the road system. For one thing, there is no recognition of the cost of capital. One of the problems here is that to-date Alberta Transportation and Utilities does not have the means to carry over funds from one year to another. Presumably, then,

once a budget is set—and the budget includes both capital and operating amounts—it must be spent or lost. If this is the case, this reinforces the first point--there is not an exact equation of dedicated tax revenues with road expenditures--and it probably explains the second point--capital almost has to be treated as an annual expense item.

It is anticipated that, once the government has succeeded in balancing its budget, all transportation revenues will be reserved for transportation expenses. It is also anticipated that the utilities portion of the Alberta Transportation and Utilities budget will be funded from general revenues, not road-user fees.

In addition or, perhaps in association with this new policy of user pay, Alberta Transportation and Utilities is looking at the possibility of a form of public/private partnership in the building of urban freeways in and around Edmonton and Calgary. (Price Waterhouse, 1994). From the work done to date on these projects, and with a toll rate of $0.06/km, there does not appear to be sufficient traffic to make these projects feasible without assistance from general taxpayers. In fact, for the Southwest Edmonton ring road, it is estimated that the government would have to pick up between 65% and 75% of the entire cost.

Alberta is still developing its highway finance policies. To date, for example, it has not yet developed a means of paying for new facilities with debt (that is, a debt instrument directly related to a construction project). This may happen when and if it makes the decision to build ring roads in Edmonton or Calgary with some form of public/private initiative. As another example, while the province has undertaken a cost allocation study (*not reviewed*), this work has not directly influenced the level or structure of the road-user taxes. Alberta is also planning to begin amortizing capital expenditures as of 1995-1996.

3.4.10 British Columbia

British Columbia had a significant user-pay approach to highway financing thirty years ago. (See the description of the 1950 Highway Development Act in Section 3.2. or Seymour, 1992.) In addition, starting in the mid-1950s, the province established the "BC Toll and Highway Authority" which, at its peak, operated seven major water crossings on a toll basis. In 1964 the province abandoned both the dedicated fuel tax and the road (bridge, tunnel) toll concepts. Tolls were re-introduced as a funding mechanism in 1986 with the building of the Coquihalla. The concept of user pay and/or dedicated revenue sources is quite common in terms of the provision of other transportation or other services: BC Hydro, BC Ferry Corp, BC Rail and BC Transit.

More recently, British Columbia has made significant changes to the way it finances new roads in the establishment of the BC Transportation Financing Authority. The BCTFA was established in 1993 and given broad powers to undertake a variety of transportation infra-structure projects (i.e., more than just roads). The initial focus will be on additions to highway capacity although specific plans await the development of a more comprehensive plan. (Huggett, 1994) The BCTFA is funded through a 1¢/litre tax on clear gas and diesel

and a $1.50/day tax on vehicle rentals. These bring in $55 million annually.[3] According to Huggett, the most significant change is that the BCTFA will be able to amortize construction costs over the life of a project (rather than treat all capital expenditures as an annual cost in the year incurred). This allows a more appropriate calculation of costs and will assist in borrowing requirements. That is, the BCTFA will be able to borrow for specific projects and, assuming a revenue source, can plan a repayment schedule. The BCTFA has powers to establish tolls for transportation facilities, although Huggett suggests that tolls may not be the primary source of new funds: "[tolls] are viewed by some as an easy funding option, [however] other equally promising methods exist . . ." It seems that "land appreciation capture" and "public/private sector partnerships," are the "equally promising methods" being considered.

More recent information suggests that, of the $55 million from the two dedicated taxes, $4 million is used to operate the agency, $14 million is given to the Ministry of Transportation and Highways as a contribution towards overheads (*overheads related to capital projects*) and the balance of $37 million is available to fund debt. Very roughly, then, BCTFA could probably support in the neighbourhood of half a billion dollars of debt. For the most recent year, the BCTFA has committed $290 million for capital projects (*understood to be all highway related*), the largest portion of which ($180) is for the new Island highway. The only new revenue source approved to date, other than the two dedicated taxes, involves a public/private agreement whereby the Ministry of Transportation and Highways is building (improving?) a road to a ski resort and a provincial park. The resort owner has agreed to a $2 toll on lift tickets to finance the road. Two other similar agreements are in the planning stage. In terms of the Island highway, the total cost (less BCTFA costs) is projected to be $1.226 billion, an amount greatly in excess of what the BCTFA's current revenue sources would allow to be financed. No details on what other revenue sources will be tapped are known, but it can be speculated that "land appreciation capture" is a strong possibility. This may involve land purchases (pre-construction) for later sale (post-construction when the value has been enhanced by the new highway).

Other road costs in British Columbia—maintenance, rehabilitation and operations—are funded in the traditional fashion. That is, the Ministry of Transportation and Highways lines up with other Ministries for its share of revenues out of the Consolidated Revenue Fund.

3.4.11 Northwest Territories

Roads are financed from general tax revenues.

3.4.12 Yukon

Roads are financed from general tax revenues, with the exception that a large portion ($37.5 of $52.3 million) of the construction budget in the latest year was actually paid for by other governments (US government {*? or the state of Alaska ?*} for the Alaska highway and the Canadian federal government for other projects. Yukon is considering tolls for one possible bridge project.

4 HIGHWAY FINANCE METHODS IN OTHER DEVELOPED COUNTRIES

4.1 Introduction

> "It does not seem necessary that the expense of those public works should be defrayed from...public revenue....The greater part of such public works may easily be so managed, as to afford a particular revenue sufficient for defraying their own expense, without bringing any burden upon the general revenue of the society."
>
> Adam Smith, *The Wealth of Nations*

Approaches to highway finance in the developed world are many and varied, falling along a spectrum which runs, on the political left, from public responsibility for most of the key activities in the provision of highway services to an approach whereby many of these activities are delegated to the private sector. These two archetypes are summarized in Table 4.1 and are the subject of this chapter.

Table 4.1: Examples of Roles and Responsibilities in the Provision of Highways

	Conventional Approaches	Public/Private Partnerships
Project Selection	Public sector	Public—private sector may have input (e.g. California)
Design Standards	Public sector	Public—but may be expressed as performance criteria, leaving private sector to determine the best way to satisfy them
Financing		
by whom	Public sector	Private, in whole or in part
typical methods	Budget appropriations Trust funds Deficit financing	Project financing, secured by revenues from users; real estate development
Construction	Public sector, usually contracted out	Private sector, subject to public supervision
Maintenance	Public sector, with some degree of contracting out	Private sector, subject to public supervision

4.2 Conventional Approaches to Highway Finance

4.2.1. The Mainstream Approach

The characteristics of the conventional approach have been discussed in Chapter 2: roads are a public good to be provided by the state and funded out of general tax revenues. Under this perspective, the state orchestrates the provision of highway services, planning the network, adopting a 'command-and-control' approach towards design, and raising the funds for capital expenditures from budgetary appropriations (and sometimes through deficit financing). Even if the road-user charges cover capital and operating costs in aggregate, there is generally no

way of assessing the adequacy of charges for an individual facility. Road taxes are levied for the use of vehicles on all roads at all times, not on specific roads at specific times.

A review of current sources of highway revenues confirms this generalization. The main sources, as defined by the International Road Federation, include:

- acquisition taxes (purchase or transfer taxes and import duties)[4];
- annual ownership taxes;
- taxes on use (notably fuel, lubricant and tire taxes, taxes on passenger or freight carriers);
- tolls on specific routes; and
- other special taxes (e.g., special insurance tax in France, motorway user tax in Switzerland).

Table 4.2 compares the sources of highway revenues in the other members of the G-7 countries and provides a general indicator of road taxation levels (road taxes as a percentage of GDP). The table is derived from data produced by the International Road Federation. Taxes include only those reported by member countries as "'special' road-user taxes, i.e., taxes levied exclusively on the road user" (IRF, 1990). Hence, for France, acquisition taxes include registration fees plus a portion of sales tax, because sales tax on vehicles is higher than the general rate.

It is noteworthy that:

- All countries rely heavily on "second structure" taxes on use, predominantly fuel taxes, as a primary means of recovering revenue from highway users;
- Even in countries noted for toll roads (e.g., France), these revenue sources account for only a small percentage of total highway revenues; and
- In terms of the levels of road-use taxation, the United States and Germany impose relatively low taxes, while France, Italy and the United Kingdom impose relatively high taxes. Despite the low ratio of road taxes to GDP, road-user charges are relatively high in Japan. The low road tax/GDP ratio is due to lower per capita vehicle ownership and shorter annual distances travelled. (IRF, 1990)

Table 4.2: Sources of Highway Revenues in Other G-7 Countries

1985	France	Germany	Italy	Japan	U.K.	U.S.A.
Taxes on Acquisition of Vehicles	11%	0%	18%	20%	19%	17%
Annual Vehicle Ownership Taxes	8%	23%	11%	32%	21%	7%
Taxes on Use	65%	77%	70%	48%	60%	43%
Tolls	6%	0%	1%	0%	0%	4%
Other	10%	0%	0%	0%	0%	30%*
Road tax/GDP	3.1%	1.7%	3.1%	1.6%	4.0%	1.4%

1992	France	Germany	Italy	Japan	U.K.	U.S.A.
Taxes on Acquisition of Vehicles	17%	0%	18%	21%	28%	15%
Annual Vehicle Ownership Taxes	8%	21%	12%	32%	17%	7%
Taxes on Use	58%	79%	67%	47%	55%	41%
Tolls	9%	0%	3%	0%	0%	4%
Other	8%	0%	0%	0%	0%	33%*
Road tax/GDP	4.1%	2.1%	4.3%	1.5%	4.2%	1.4%

* It is not apparent from the notes to the tables why "other" is so large for the United States.
Source: World Road Statistics [International Road Federation]

Under the conventional approach, the role of the private sector is restricted to the provision of services under contract to the state, which not only controls the strategic direction of the highway sector, but also participates, to a greater or lesser degree depending on the country and the time period, in the provision of highway infrastructure. In some countries, the central role of the state is a long standing tradition. The role of the French state in planning, financing and constructing transportation infrastructure (initially for military purposes, later as a nation-building device) goes back several hundred years. Germany, Italy, Belgium and Russia are also countries with a strong statist tradition. On the other hand, the role of the private sector in Eighteenth Century Britain was broader than anything seen in the contemporary industrialized world, encompassing project selection, design, financing, construction and maintenance. Here the treatment of transportation infrastructure as a public good (epitomised by hostility to tolls) became a successful populist demand by 1800 and has shaped transportation policy ever since.

Equity-based notions of the proper roles of the state and the private sector are still deeply rooted in many European countries today. Commenting on political resistance to the commercialization of transportation infrastructure, Rothengatter states that the German "people are not prepared to regard transport infrastructure as a private business and use their political power to resist such plans." (Rothengatter, 1992, 1)

4.2.2 User Pay and Dedicated Revenues

It would be simplistic to suppose that the conventional view of highway finance has gone unchallenged. In the three largest G-7 economies, Japan (see textbox), the United States and Germany, dedicated funding mechanisms have been in place for many years, while in most industrialised countries, pockets of direct charging via tolls have survived, often despite an unfriendly political climate.

In Germany for many years, one third of fuel tax revenues were dedicated to construction and maintenance of national roads and expressways, while the remainder were sent to local governments to finance municipal roads. (Cervero, 1989)

In the United States, the Federal Highway Trust Fund (HTF) was established in 1956 as the funding source for the Federal-aid highway program. Federal excise taxes on fuel, tires, trucks/trailers and heavy vehicle use, as well as fines and penalties, are deposited in the fund. The main impetus for the HTF was to provide a funding mechanism for the National System of Interstate and Defense Highways, which had been identified in 1944, but had only advanced slowly since then for lack of funds.

Japanese Approaches to Highway Construction and Improvement

Road Development Special Account

This is an account consisting of fuel- and other motor vehicle taxes; it is used to finance general road projects by the central government, to subsidize road capital spending by local governments, to provide the government's share of the capital of public highway corporations [providers of toll roads] and to back loans for road related projects.

The Land Readjustment Project

The purpose of this project is to simultaneously develop public facilities and private housing by replotting land holdings. Every land lot on a project site is redrawn, without changes to title, ie, each land plot is reduced in size. This land reduction is referred to as "Gembu" or "contribution", and is considered as the charge to landowners for benefits generated by public facility development and the resulting increases in land prices.

Source: Morichi, 1992.

The dedicated funding philosophy has deep roots in the United States. Lobby campaigns against the diversion of the gas tax to non-highway purposes began at an early date. In 1932, Alfred Sloan, the President of General Motors, organized the National Highway Users Conference for this purpose. (Perl, 1993, 149) Penalties against states that diverted revenues were voted by Congress under the Haydon-Cartwright Act of 1934. By 1960, over half of the states had enacted Constitutional amendments against diversion. The federal HTF of 1956 consolidated this widespread commitment to the principle of dedication.

In addition, the federal government has used its power of distributing highway funds to achieve specific social and economic objectives. The current examples of this are the provisions for funding transit (Highway Revenue Act of 1982) and the encouragement of multimodalism (ISTEA). But social objectives have always shaped policy. Back in 1916, when the influence of the pro-rural Progressives was still powerful, the federal aid program was structured in such a way as to favour the rural states over the urban ones: the allocation

formula was based one third on population, one third on area, and one third on mileage. By 1950, according to a critic, 148,000 miles of roads which served no essential traffic function had been built. Gasoline revenues were collected from urban areas and spent in the countryside. (Owen and Dearing, 1951)

What follows are general observations on trust funds:

- Trust funds tend to be viewed as permanent features in the American landscape. In fact, other models for highway financing were popular prior to 1956, notably deficit financing (based on supply side notions of the economic benefits associated with highway investments) and, to a lesser extent, toll roads. (Owen and Dearing, 1951)

- The creation of the HTF, after years of deadlock and two unsuccessful bills put forward by the Eisenhower administration, was the outcome of a successful political alliance of road builders, federal public servants, the states--especially the rural ones (the lure of federal funds)--and the trucking industry, which accepted the increases in taxation which accompanied the 1956 Highway Act provided it was uniform (i.e., comparable to the increase applied to automobile users).

Problems with current system include:

- HTF...discriminates against the private provision of roads and, because funds are filtered through government bureaucracy, inflates highway costs by 20-30 percent.
- The HTF enables states to implement low-priority projects at federal expense.
- Many states have laws prohibiting private provision of highways.

Recommendations to improve highway management:

- Assign ownership and responsibility of each highway segment to one clearly defined entity...to clarify accountability for maintenance and expansion needs.
- Revise state laws to allow for private ownership and provision of roads.
- Allow the HTF to expire, along with the federal taxes that provide it with revenues, to free much-needed road funds from political battles in Washington; so highway funds can be put to use more readily and where demand is most urgent.

Other recommendations include:

- Strengthen the link between prices paid and costs imposed by users.
- Use of axle load charges to assist in maintaining highways.
- Use of pricing systems to free traffic flow in urban areas.
- Use of financial profitability criteria for investment in highways.

Source: Roth (1990).

Highway Finance in the U.S.: A Critique from the Right

- When the HTF was created, a conscious decision was taken to exclude consideration of other modes. This was in contrast to an earlier policy paper of the federal Bureau of Public Roads which recommended a "superhighway finance agency" with the responsibility of distributing infrastructure resources to promote "a balanced transport network, one in which rail, water, and air

carriers were put on an equal footing with truckers." (*Interregional Highways*, 1944, quoted in Perl, 1993) The trend since the 1970s has been one of cautious movement towards intermodalism, exemplified by the earmarking of part of the gasoline tax revenues for transit, and the pro-intermodal initiatives in the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA).

- The dedication principle has been eroded by the diversion of 2.5 cents/gallon for reduction of the national debt.

- The HTF has been criticized for discouraging efficiency and politicizing the infrastructure investment process. One such view is quoted in the text box on the previous page. The ISTEA has addressed some of these criticisms, notably the concern that the trust fund discriminates against the private sector.

- Trust funds tend to be associated with 100% cost recovery. In fact, Cervero found in his survey of four countries which use trust funds that the cost recovery ratios ranged from 51% (Japan) to 106% (Germany).[5]

- In addition to overall cost recovery, the issues of "horizontal" and "vertical equity" are important. Horizontal equity means that vehicles within the same class are contributing equitably to highway costs, while vertical equity applies to the contributions of vehicles in different classes (e.g., small cars and 5-axle combination vehicles).

4.3.3 Toll Financing and Public/Private Partnerships

Throughout the industrialised world, there has been a sporadic but growing interest in alternatives to conventional highway financing techniques. In particular, there is a revived interest in toll roads and bridges in both developed and emerging economies (see textbox).[6] These alternative mechanisms have varied significantly from country to country, in terms of both timing and approach (see Table 4.3).

Advertisement in *Globe and Mail*, 22/11/94

$167 billion. That's a lot of tolls.

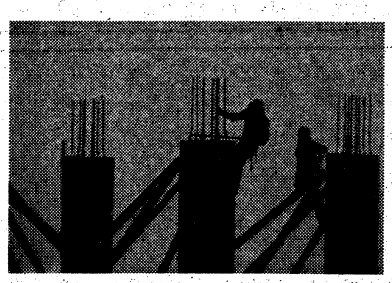

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Table 4.3: Alternative Approaches to Financing Highways: An International Summary

Country	Timing	Issue(s)	Main approach
France	1955 on	Raise funds for national freeway network (catch up with other European countries, e.g., Germany, Italy)	Concessions; cross subsidization of low traffic roads. Plans for 3,800 km of new autoroutes to be operated as tolls roads.
Spain	1967 on	Stimulate infrastructure modernization—build 2,000 km of expressways	Concessions; relative freedom to set rates—no cross subsidization, but considerable traffic diversion to untolled roads.
Japan	Since 1950s	Infrastructure modernization	Publicly owned toll roads
Germany	1990s	Budgetary crisis; reunification; demand for new infrastructure projects	Introduction of direct charges for trucks in Germany, Denmark, Netherlands, Belgium & Luxembourg, 1995. Experiments with private build/finance autobahn sections.
Britain	1990s	Budgetary crisis	Discussion of options including sale of road network, electronic charging on divided highways.
Norway	Late 1980s	Raise revenue for specific construction projects	Local initiatives. Public sector responsible for planning, construction, maintenance. Toll companies responsible for financing, toll collection and administration.
Denmark	1990s	Finance the Great Belt Bridge between Zeeland and Funen	State owned company will construct, operate and finance the bridge.
Finland	1994	How to apply direct charges in a low volume system with many intersections	Finnish National Road Administration will propose comprehensive road financing model including marginal cost pricing.
Austria	Since 1964	Speed up construction of highways through the Alps	Toll collecting companies have been government owned. 1991 law allows all federal highways to become toll roads by executive order. Also allows private (concessionaire) companies.
US	1940s	Speed up modernization of highway system	By 1950, over 30 states had built or planned to build publicly owned facilities to fill gaps in the network. Legal and regulatory status of toll roads differed from state to state.
	1980s/90s	Develop strategies to address congestion Promote desirable but unfundable projects	Private roads sponsored at state level. Pilot projects through ISTEA.

Toll financing and private sector involvement are separable. In fact almost all existing toll roads in the United States are publicly operated. But the revenue stream from tolls is a

necessary inducement to private partners to offset the risks inherent in participation in a major infrastructure project.

Generally, the government impetus for soliciting private sector involvement has been to expand the pool of available capital, either to overcome a lag in highway investment (France in the 1970s, South Korea in the 1980s) or because highways were being squeezed out by competing public expenditures (the US in the 1990s, Spain in the 1960s).

As indicated in Table 4.4, despite the considerable volumes of ink which have been spilled on the subject of public/private toll facilities in the United States, the current level of activity is relatively modest and most of the main projects are at an early stage. It is possible to comment on process issues, but premature to speculate about operating or financial results.

Table 4.4: Status of Major Public/Private Partnerships in the United States*

State	Project(s)	Status
Arizona	Toll facilities	Development on hold
California	SR91 Express Lanes SR125 SR 57	Under construction In development
Colorado	Front Range Toll Road	In development
Florida	Miami Toll Road	In development
Massachusetts	Rte 3 private toll concession	In development
Minnesota	Minneapolis/St. Paul area toll roads	In development
South Carolina	Conway Bypass near Myrtle Beach	RFP out
Texas	Camino Columbia Toll Road	In development
Virginia	Dulles Greenway	Under construction
Washington	Four toll road projects	In development

* as of October 1994

Source: Schreiner et al (1994)

4.4 Approaches to Public/Private Financing

4.4.1 General Models

The examples of toll road facilities cited in Tables 4.3 and 4.4 have only one thing in common: they were all funded, at least in part, by direct charges levied on users of the facility, as opposed to being funded (solely) out of general revenues or from non-specific road-user charges (e.g., fuel taxes). But, other than this one common feature, there have been a wide variety of approaches taken to toll facilities. These range from the Japanese approach of government owned toll companies to genuinely private facilities such as the Ambassador Bridge. Table 4.5 provides a simplified summary of the most important models

for public/private partnership. The table runs from models with the most private content at the top to the ones with the least private content.

Table 4.5: Summary of Models for Public/Private Partnerships

Model	Finance	Build	Own	Operate	Transfer?	Revenue Collection
Build New Facilities						
Build-Own-Operate (BOO)	Private	Private	Private	Private	No	Private
Build-Operate-Transfer (BOT)	Private	Private	Private, for franchise (20-40 years)	Private, for franchise period	At end of franchise period	Private, during franchise period
Build-Transfer-Operate (BTO)	Private	Private	Public, after construction period	Private, for franchise period	At end of construction period; lease back to private sector	Private, during franchise period
Public Toll Company	Public	Public/ private	Public	Public	N/A	Public
Improve Existing Facilities						
Buy-Build-Operate (BBO)	Private	Private	Private, bought from gov't	Private	No	Private
Lease-Develop-Operate (LDO)	Private	Private	Government leases to private	Private, for duration of lease	No, remains in gov't hands	Private, during lease period
Temporary Privatization	Private	Private	Government leases to private	Private, for duration of lease	No, remains in gov't hands	Private, until capital investment recouped
Wraparound Addition	Private	Private	Government owns core facility; private owns addition	Private (entire facility)	No, continued shared ownership	Shared

Source: based on PIARC, 1994.

The appropriateness of the models depends on the objectives and constraints of both the public and private sectors, including the legal and regulatory context.

- The turnpike trusts of Eighteenth Century Britain were essentially BOO projects, in that the private sector retained ownership of the facility throughout its life. There are relatively few other BOO projects, primarily because of public unwillingness to cede permanent control of vital communications links to the private sector.

- The BOT approach, or variations, such as Build-Own-Operate-Transfer, has become the most popular model in both developed and emerging economies. Examples include French, Spanish and Mexican toll roads, the Channel Tunnel, the PEI fixed link and many more. One attractive feature of BOT, given public scepticism towards private ownership of key infrastructure facilities, is the provision for the facility to revert to public ownership at the end of the franchise period. Under the BOT umbrella, there are many potential options for structuring concessions. Halliday et al (1991) illustrate this point effectively in their discussion of the contrasting French and British approaches to the concession for the Channel Tunnel.

- In California, among other places, the BTO model has been adopted primarily in order to reduce the liability risks faced by the private sector during the operations phase of the project.

- The Ontario Highway 407 project is a hybrid. The highway construction aspect of the project is a Build-Operate project, while the toll collection side is essentially a BTO.

4.4.2 The Dynamics of Franchise Models

Table 4.5 is highly simplified: many permutations and combinations exist, depending upon the circumstances. It is also static. Concessions or franchises are generally intended to last for several business cycles. Twenty to 40 year franchises are usual, although in Mexico during the 1980s, franchises lasting as short as 5-10 years were encouraged, because of the lack of a market for long-term debt. Over the life of the project, the project economics can undergo substantial changes, primarily as a result of: i) escalating costs of construction, financing and/or operations; ii) overoptimistic revenue forecasts; and, iii) changes in the policy/ regulatory climate.

Cost Risks

The three main categories of cost risk concern construction (including development/ environmental compliance costs), finance (cost of capital) and operations. Given the cost structure of typical transportation infrastructure projects, the first two risk categories are by far the most serious.

Construction cost overruns can arise for a variety of reasons:

- Aggressive bidding in franchise competitions.

- In most instances, bidders are obliged to develop cost estimates on the basis of existing studies, because of time and financial constraints, including contingency allowances to cover unforeseen increases in unit costs and quantity

requirements. In the case of highly complex projects (e.g., Channel Tunnel), such allowances often prove insufficient.

- The costs of complying with environmental requirements, including changes in design, mitigation costs, etc. One suggestion to minimize such cost overruns has been "Clearing-Before-Awarding." This is where the government selects the project, defines it and obtains environmental clearance prior to awarding the contract. (Fielding and Klein, 1993) The disadvantage is that the stimulation of innovation through private sector involvement in project selection and design may be lost.

- Completion risks due to weather, labour disruptions or changes in major materials costs.

Financing cost risks can arise because of fluctuations in the cost of capital (an exogenous factor) or because of delays in opening the project to revenue-paying patrons. In cases where projects are partially financed from international sources, foreign currency risk can be significant. The Spanish government, which guaranteed the foreign debt of toll companies, faced major costs following the depreciation of the peseta.

Revenue Forecast Risks

Revenue forecasts for major infrastructure projects are inevitably risky because of long lead times, uncertainty concerning consumer reaction to the tradeoffs between improved amenity and increased out-of-pocket cost (especially in areas unfamiliar with tolls), and the dependence of the forecast on the prediction of related variables, such as economic performance and fuel prices. In some instances, these variables are subject to factors which are difficult to model, such as changes in government policy. The risk can be reduced, but not eliminated, by employing a variety of approaches, by doing sensitivity analysis and by periodically updating the forecasts. In extreme cases, it may be necessary to extend the franchise period in order to provide the required rate of return to the private investors. This occurred in Mexico, where toll companies, facing short concessions, initially charged such high tolls that patronage and revenue targets could not be met.

Political Risks

If concessions are designed to last for several business cycles, they must also endure over several political life cycles and be sufficiently robust to accommodate such changes. Gomez-Ibanez and Meyer (1993) contrast the experience of French and Spanish toll roads to illustrate this point (Table 4.6). The French government changed the rules of the game on several occasions, for understandable policy reasons, whereas Spain has been less interventionist.

Table 4.6: Effects of French and Spanish Rate Regulation Policies

	France	Spain
Toll policies	Toll formula existed in original concessions French government disavowed toll formula in 1970s Ministry of Finance has allowed smaller increases for private company because it is more profitable than public ones.	Tolls set by formula agreed upon by industry and government in original concessions No political interference
Impact on tolls	Tolls are moderate	Tolls are high
Impact on profitability	Majority of industry now profitable (but only one private company remains) Systematic cross-subsidization within companies	Majority of industry is profitable Excess profits on high density roads are a possibility
Impact on un-tolled roads	6-7% of traffic diverted to untolled roads	Significant diversion to untolled roads
Impact on investment decisions	Because of cross-subsidization, "toll financing does not seem to have encouraged financial discipline or careful cost-benefit analysis in France" (Gomez-Ibanez and Meyer, 1993).	Positive

4.4.3 Advantages and Disadvantages of Toll Financing

An abundant literature exists on the advantages and disadvantages of toll financing. Table 4.7 summarizes the main assertions of supporters and detractors of toll facilities. The issues concern economic efficiency (and its counterpoint, equity), as well as the financial consequences of tolling.

Table 4.7: Summary of Advantages and Disadvantages of Toll Financing

Advantages	Disadvantages/Concerns
Economic Issues	
Users can be charged directly (not taxpayers)	Tolls amount to double taxation because users of toll roads are already paying indirect user charges (e.g., fuel tax)
Tolls encourage efficient resource allocation — priority to economically profitable projects.	Issues of social and geographic equity — private toll roads would only benefit the most prosperous individuals and regions
Concessionaire companies are able to accomplish productivity gains (and lower costs) by grouping expertise in finance, management, construction, maintenance and operations in one multidisciplinary structure.	Little evidence exists on this point because of lack of direct comparisons. Experience of Cofiroute, the private French firm, supports the theory. Toll roads face higher administrative/collection costs (particularly manual systems), from 10% to 35% of revenues (Europe versus US).
Tolls as a means of congestion pricing, encouraging efficiency (route choice, mode choice).	Diversion of traffic to lower quality roads (but insofar as one reason for tolls is to decongest main arteries, this is not necessarily bad). Congestion pricing is politically unpopular—but see comments in the last paragraph of 4.6.
Financial Issues	
Supplementary source of funding (compared to ordinary public financing).	Unless foreign capital is attracted, the most likely result is to displace investment from another sector of the economy.
Costs can be spread over life of project (versus annual appropriations, public borrowing).	Additional construction costs (for toll collection, modification of interchanges): 1-10% of total costs. The cost of capital is lower for government than for private enterprise
Toll projects can generally be built sooner because complete funding is available at the beginning of the project.	True in theory. However, a difficult regulatory/ environmental climate may offset this advantage.
Other	
Toll financing encourages greater innovation, e.g., projects are undertaken which the public sector would not undertake, new ideas, etc.	Strong evidence to support this.
Toll facilities subject to greater scrutiny than free roads; encourages good maintenance practices	No firm evidence to support this theory.

Efficiency/Equity Issues

The evidence concerning the impact of toll financing on efficiency suggests that this is not a given, but rather depends upon the policy framework which is created. The "correct" balance between efficiency and equity concerns is by nature subjective. The textbox illustrates one such balancing act.

There are two efficiency issues which are often considered in tandem, but, for the sake of clarity, ought to be examined separately:

- the introduction of direct charges or tolls and
- the private provision of transportation infrastructure.

Tolls, *regardless of who levies them*, introduce a direct pricing mechanism for highway users, with potentially beneficial (efficiency) effects on investment choices and route selection/mode choice decisions. (The private sector is less likely than the public sector to be deflected by other considerations from applying the price mechanism consistently. To some, this will appear to be praiseworthy; to others, not; and still others will argue about the level of private sector consistency.)

Balancing Efficiency and Equity Criteria

"One particularly important aspect is 'geographical equity....Clearly, profitability criteria (both economic and financial) give more weight to the busiest routes and hence to the most developed regions, thereby aggravating regional inequalities.

"One attempt to take this into account was made [in France]....Taking as its starting point the motorway program deemed optimal on purely economic criteria, the exercise consisted in testing the consequences of different policy options, construction priorities being modified in the light of regional planning criteria. To this end the various motorway projects were ranked according to specific criteria.

A number of different policy options were defined, the two extremes being projects assigned priority on purely economic or on purely regional policy grounds. The intermediate options were those for which motorway completion dates were brought forward or back according to the value of the scheme for regional development. The corresponding economic losses (measured by the loss in overall discounted profit) served as a yardstick for assessing the costs associated with regional planning priorities and hence as a source of quantified data for multicriteria selection."

Source: OECD, 1987.

Supplementary advantages are often attributed to *private sector activity* in infrastructure provision, notably the encouragement of innovation and greater cost efficiency. The jury is out on the cost issue: the only firm evidence of greater cost efficiency concerns France in the early 1970s. This arose in almost equal measure because of streamlined design and higher construction productivity. (Cost savings are anticipated on Highway 407 in Ontario.) The observation that toll roads have higher administration/ collection costs than tax-financed roads is applicable to all toll roads, regardless of their ownership status. It is also less compelling as electronic collection technologies are developed commercially.

There is a broad consensus that the introduction of private enterprise is conducive to greater innovation. This is supported by a few nuggets of evidence from North America as well as offshore:

- The Channel Tunnel RFP, which did not prescribe how England and France were to be linked, elicited a range of technical proposals (road-rail tunnel, rail-only bored or immersed tunnels, road-rail combined bridge-tunnel, bridge-only scheme)
- The Caltrans private roads RFP led to proposals for both development and congestion-relieving roads which had previously been identified as desirable but infeasible by the public sector.

'The government can borrow cheaper'

"A persistent theory is that the government can borrow cheaper than the private sector, and therefore any reliance on private market finance would necessarily be more expensive.
"This is as hollow an argument as it is possible to be. For while the 'government' can indeed borrow at lower rates of interest than nearly all other institutional borrowers, the taxpayer assuredly can not. The favourable rates of interest extended to the government are only possible because the government does not default on its loans, so lenders can entrust loans to the government in complete confidence....
"But the reason why the government does not default is that it is large enough to absorb its own risks, and that it passes on any increased costs because of project failures to its taxpayers. If the government borrows to back a disastrous project, lenders do not suffer; the costs are passed on to the taxpayer who is always there to sign a blank cheque in the Treasury's favour. The total costs of conventional and private financing are therefore precisely the same, although the ability of the government to pass on its risks to taxpayers disguises the fact."

Walters, 54, in Butler, 1982.

Financial Issues

Again, there is some confusion between toll/tax and private/public issues. The existence of tolls provides a basis for capitalized project financing, regardless of whether the toll authority is in the public or private sector. As a result, it is possible to finance commercially attractive projects at a faster rate than would be possible under pay-as-you-go budgetary appropriations. (In this respect, public toll roads are similar to a French high speed rail project, financed by government backed loans.) The issue of the cost of capital is a public/ private issue. The usual argument which justifies public financing, is that the cost of capital is lower for governments than for private corporations. A counter-argument is advanced in the textbox, based on the notion that it is ultimately the taxpayer, not the government, who finances public sector activity. Again, this is less a technical question than one of political tastes.

4.5 Alternative Financing Mechanisms

4.5.1 Introduction

The main sources of highway revenue in the major industrial countries were summarized in Section 4.2: primarily, budgetary appropriations for capital projects and indirect user fees for maintenance. This section provides a brief summary of alternative financing mechanisms.

4.5.2 Financing Mechanisms for Highway Construction

In the United States, a wide range of financing instruments has existed for many years. These have generally been debt instruments and land use exactions (described below), but little in the way of equity financing. Rusch (1984) summarized the most important from the pre-ISTEA period, reproduced in Table 4.8. The two main types of debt instrument are:

- **general obligation bonds:** "a security backed by the full faith and credit of a State, locality or other governmental authority. In the event of a default, the holders of general obligation bonds have the right to compel a tax levy, additional borrowing, or legislative appropriation in order to satisfy the debt obligation" (FHWA, 1994); and

- **revenue bonds:** "bonds whose principal and interest are payable exclusively from earnings of a public enterprise" (FHWA, 1994), e.g., tolls.

In addition, there is a long tradition, dating back to 13th Century England and present in the New World since the 1690s, of financing various local services, including transportation infrastructure, through land use exactions (Altshuler and Gómez-Ibáñez, 1993). There are various mechanisms for accomplishing this. In some instances, infrastructure is constructed by the developer(s) and dedicated to the city. In other instances, Special Assessment Districts or similar mechanisms are used. Snyder et al (1986) define these as follows: "a financing district is established which coincides with the area benefited from the project, and the properties in the district are assessed the cost of the project based on front footage, acreage or some similar measure". Altshuler and Gómez-Ibáñez estimate that whereas 10% of US localities imposed land use exactions in 1960, by the mid-1980s, the figure was approximately 90%.

In general, land use exactions have been employed for urban infrastructure. The process of allocating costs is: i) to divide the city in zones and estimate development cost levels by zone; ii) to estimate the traffic generated by the different land uses and iii) to set the fees based on this analysis. Traditionally, the segments of roads which serve developments outside city limits have been financed from public revenue sources, although Orlando and Orange County, Florida, for example, developed an agreement to extend land use-financed transportation to the county level.

In the late 1980s, a variety of mechanisms were proposed to extend the principle of land use exaction to intercity transportation to finance intercity ground transportation projects in Florida, California and elsewhere (the "value capture" concept). The depressed real estate market of the early 1990s appears to have dampened this trend.

Table 4.8: Funding Mechanisms for US Toll Facilities (Pre-ISTEA)

	Facility	General Obligation Bonds	Revenue Bonds	Lease Arrange-ments	Gasoline Tax Pledge	Federal Aid	Privately Financed
CA	Golden Gate Bridge		X			X	
	Oakland Bay Bridge		X			X	
CT	Connecticut Turnpike	X			X		
DE	Del. Transport^{n} Authority		X		X		
FL	County toll roads			X	X		
	Florida Turnpike		X				
	Sunshine Skyway	X	X			X	
IL	Illinois Tollway		X				
IN	Indiana Toll Road		X	X			
KA	Kansas Turnpike		X				
KY	Kentucky Turnpike			X			
LA	Various toll facilities	X	X				
ME	Maine Turnpike		X				
MD	Ft.McHenry Tunnel		X			X	
MI	Ambassador Bridge						X
NH	New Hampshire Turnpike	X					
NJ	Delaware River Port Authority toll facilities		X				
	New Jersey Turnpike		X			X	
	Garden State Parkway		X				
NY	Port Authority of NY/NJ		X				
	New York State Thruway		X			X	
OH	Ohio Turnpike		X			X	
OK	Oklahama Turnpike System		X				
PA	Pennslyvania Turnpike		X				
TX	Dallas North Tollway	X	X				
	Hardy, West Belt toll roads	X	X				
VA	City of Richmond tollways	X	X				
	Richmond-Petersburg Turnpike		X			X	
	Chesapeake Bay Bridge/Tunnel		X				
	Norfolk-Virginia Beach Toll Road		X				
WV	West Virginia Turnpike		X			X	

4.5.3 Alternative Methods of Charging Users. I: Weight-Distance and Similar Taxes

A number of jurisdictions have used weight-distance taxes as a supplement to or as an alternative to fuel taxes. These weight-distance taxes are "any highway use tax that uses both vehicle weight and distance travelled to establish the tax liability of a specific vehicle or fleet of vehicles." (US DoT, 1984) The rationale for them is that they allow a closer match than do other taxes between user fees and the highway agency costs occasioned by different vehicles. This section describes approaches which have been followed in the United States, New Zealand and Australia.

At the federal level in the United States, the two main strategies for charging heavy vehicles for the additional costs they occasion have been to exact a higher tax on diesel fuel than on gasoline (the "diesel differential") and to charge an annual heavy vehicle use tax (based on weight, rather than weight and distance).

Oregon has applied a weight-distance tax since 1947, based on registered gross vehicle weight and the distance travelled in the state. The tax affects vehicles weighing over 26,000 lbs. The tax rate increases at 2,000 lb increments. Above 80,000 lbs, vehicles are classified by both GVW and the number of axles. In 1990, the weight-distance tax accounted for 28% of Oregon's highway tax revenues.

A recent report of the General Accounting Office reviewed the recent US experience with weight-distance user fees (US GAO, 1994), focussing on the six states which still apply them and five states which abandoned them between 1989 and 1991. The main findings were:

- Administrative/enforcement costs depend on the fee design: they are only 2.2-2.8% in states with simple fee structures (e.g., Arkansas) and 3.8-4.4% in Oregon. Costs were much higher (20%) in Wyoming and Colorado, which charged on the basis of actual weight and mileage per trip.

- Evasion is high in states with complex fees or with inadequate enforcement staff.

- Carrier compliance costs also depend on the complexity of the fee structure.

The GAO concluded:

> "A strong economic rationale exists for charging highway users explicitly according to the wear they cause to the nation's highways. The potential long-term benefits of replacing some or all of the current federal highway user fees with a weight-distance fee could be substantial in terms of additional revenues and reduced pavement wear, especially if heavy trucks are only paying 50 percent of their fair share, as FHWA found out in 1982....We believe it is now time for FHWA to conduct another formal cost allocation study." (US GAO, 1994, p 18)

New Zealand's road charging system, revamped following the Road User Charges Act of 1977, was deemed to be the best in the world in an international review carried out in the mid-1980s by the Australian Bureau of Transport Economics. (Ingham et al., 1985) The fundamental objective was to ensure that truckers paid for infrastructure costs in the same way as the railways; that these charges were "realistic and rational", reflecting "real long-term economic costs", and that they made a "relevant contribution towards the financing of roading." (Starkie, 1988, quotations from the 1979 Working Party on Road User Charges) The central features of the system are:

- Licence fees for most heavy vehicles (including buses) are directly proportional to distance travelled;
- Fee scale depends on the type of vehicle (powered/trailer), the number and spacing of axles and the number of tires;
- Fee scales rise sharply with increasing GVW up to a threshold of 30 tonnes, whereafter there are linear charges per tonne;
- Vehicles affected by the scheme are fitted with a hubodometer.

Other points of interest are as follows:

- The system was based on a major cost allocation study, the main compromise in implementation being to apply a linear scale (versus a geometric scale) for vehicles over 30 tonnes.
- Indirect costs (e.g., landscaping) are incorporated in the variable charge, instead of being captured through an additional fixed charge, as would be theoretically preferable.
- Congestion costs are addressed partially (the cost allocation study included costs associated with the space requirements of heavy vehicles, but no account is taken of the delay costs imposed on other road users), while accident costs are also treated partially through the imposition of a fixed annual accident compensation levy.

Administrative and enforcement costs, after five years of implementation, ran at a little less than four per cent. Starkie's conclusion is that the system is "sophisticated...an impressive approach to the taxation of heavy vehicles". Its main limitations are a reportedly high level of evasion and a failure to link the charging scheme with an economic investment appraisal process for highway investment.

A number of cost allocation and road pricing studies were conducted in Australia in the late 1980s. In December 1991, the National Road Transport Commission was established with

the objective of framing a uniform system of registration charges for heavy trucks and buses (National Road Transport Commission, 1992), a mandate which was later extend to encompass other road vehicles. (Hensher, 1993) The outcome is a charging schedule which is to be implemented on July 1, 1995. Hensher describes the reforms as follows:

> "NTRC has three charging instruments available—registration fees, mass-distance charges and shadow fuel charges—the latter an allocation of a notional share of diesel excise. The remainder is defined as a tax."

Externalities are excluded. Road charges will be linked (tenuously) with highway expenditure, not on the basis of the economists' preferred short-run marginal social cost, but to something approximating long-term marginal costs. Hensher argues that the practical economic impact of the reform will be limited: road transport costs average two per cent of input costs to other industries, while the proposed road-user charges will generally, with some exceptions, be less than five per cent of truck operating costs.

4.5.4 Alternative Methods of Charging Users. II: Congestion Pricing

An abundant literature exists on both the theory (Hau, 1991; Newbery, 1990; Small et al, 1989) and the practice of congestion pricing (see especially Hau, 1992). It is not possible here to do more than summarize the main issues.

Elliott (1992, p 527) has provided a pithy summary of the rationale for congestion pricing:

> "Our roads are no more 'doomed' to hopeless congestion than our meat counters would be if we sold steak for the price of dog food. The 'shortages' in every case would be man-made and man-fixable by rational pricing, not hopeless, irremediable acts of God."

The central issues, now that the technical obstacles to electronic pricing are well on the way to solution, are ones of political acceptability.

The motives for introducing road pricing are likely to depend on the stakeholder. The two most important are typically:

- Manage urban congestion by charging road users the real economic cost of travel, differentiated by the time and place of road usage (the key underlying assumption being that it is impossible to match the supply of road space to the growth in traffic); and

- Generate revenues, for example for local transportation infrastructure.

Nevin and Abbie (1993) point out that these two aims are based on conflicting notions of the price elasticity of demand for road space: aim #1 presupposes it is elastic, while aim #2 only works if it is inelastic.

Conventional (indirect) road charges, via vehicle ownership or vehicle usage, are much too blunt to address congestion issues, suppressing travel in peak/off-peak periods and on congested/uncongested facilities alike. The four generic types of congestion pricing instruments are (Hau, 1993):

- Supplementary vehicle licensing (e.g., Singapore, since 1975);
- Cordon pricing via manual toll booths (e.g., Bergen Toll Ring, since 1986);
- Direct charging via automatic vehicle identification [AVI] (Oslo, Trondheim, 1990/91; and Dulles Toll Road, Va. from 1994) and
- Smart card technology, applied to a single cordon point or to a zone (proposed in Randstad, Netherlands; Italian autostrada 1990).

The third and fourth approach represent different forms of electronic road pricing (ERP).

Hau (1992) provides a discussion of each of these congestion pricing mechanisms, including detailed case studies. These are then distilled into a mammoth six page table which evaluates each mechanism from the perspective of the user (four criteria), the road authority (seven criteria) and society (eight criteria). The criteria are indexed and the congestion charging mechanisms ranked. Table 4.9 provides a simplified summary of Hau's evaluation. His basic finding is that electronic pricing schemes are generally superior from the perspectives of users, road authorities and society.

Table 4.9: Summary of Hau's Evaluation of Congestion Pricing Mechanisms

CONGESTION CHARGING MECHANISM	MANUAL		ELECTRONIC	
	1	2	3	4
Description	Cordon pricing (Manual and reserved lanes)	Supplementary Licensing (single zone)	ERP with AVI	ERP with Smart Card Technology
Case	Bergen Toll Ring	Singapore	Hong Kong ERP scheme	Netherlands ERP proposal
From users' point of view	Positive, but monthly pass encourages over-usage	Positive, but encourages congestion near cordon	Positive, except for privacy concerns	Positive
From road authority's point of view	Scores low on economic efficiency, responsiveness to demand, reliability	Scores medium on efficiency, responsiveness to demand, reliability; low on security	Scores high except for responsiveness to demand and provision for occasional visitors (medium)	Scores low on security, medium on reliability, provision for occasional visitors
Revenue/cost ratios	6.3:1	6.9:1 to 11.8:1	7.9:1 to 10.4:1	2.6:1
From society's point of view	Main drawbacks are environmental intrusion, ability to accommodate add-on items[a] and tolerance to varied geography	Main drawbacks are ability to accommodate add-on items, tolerance to culture of non-compliance[b] and tolerance to varied geography	Main issue is perception of fairness/availability of alternatives	Main issue is perception of fairness/availability of alternatives
Long run cost per transaction (US 1990 cents)	11.0c	5.6-9.9c	6.6c	12.5c
Hau's Ranking	4	3	1	2

Notes: [a]: e.g., automatic route guidance; [b]: not defined in Hau's table, presumably means the vulnerability of the system in a society where evasion is socially acceptable

Table 4.10: Synthesis of Evaluation of Congestion Pricing by US Experts

Type of Project	Grading Criteria					
	Economic Efficiency	Impact on Environment	Energy Savings	Traffic Impacts	Ease of Collection/ Enforcement	Likelihood of Implementation
Point tolls (e.g., bridge, tunnel)	Good/high	No consensus (mildly positive to high)	No consensus (mildly positive to high)	Medium/ high	High	High
Area Licence Scheme [ALS] (Singapore model)	High	High	High	High, depending on price levels	No consensus (low to high)	Does not meet criteria
Area wide parking (daily/monthly permits)	Good	Good	Medium	Dependent on fee	Easy collection, difficult enforcement	Good
Expanded ALS incorporating all social costs	High	High	High	High	Low	Does not meet criteria
AVI-based graduated pricing in downtown (Cambridge model)	High	High	High	High	Medium	Low
Convert existing facility to HOV	Good	Medium	Good, could be further enhanced with bus use	Potential problems	Potential problems	High
Create additional HOV lane(s) in existing rights of way	Good	Medium	Low	Merge problems at exits	Low	High
Multimodal electronic fare media (smart cards) to set fares according to local needs	High	Good	Good	Positive	Achievable	High

Source: adapted from FHWA, 1992a.

Congestion pricing has moved higher up the policy agenda in North America in the past five years, after an earlier but unsuccessful period in the sun in the 1970s. This is reflected in the provision within ISTEA for funding for up to five congestion pricing pilot projects involving state and local governments. Up to US$25 million/year are available, with a maximum of US$15 million for an individual project.

An FHWA workshop on the subject (US FHWA, 1992a) suggests that decision makers regard more modest pricing schemes as attainable, while more comprehensive or sophisticated schemes (incorporating social costs or time/place-dependent prices, respectively) are economically desirable, but unlikely to gain acceptance. Table 4.10 is a synthesis of a number of similar tables in the FHWA 1992 report, with an interpretation of the workshop participants' views.

Notwithstanding these positive economic evaluations, congestion pricing remains conspicuous by its relative absence. Investigations of attempted implementation in the United States in the 1970s, in Britain, in Scandinavia and elsewhere have produced a relatively consistent set of suggestions to explain this failure and to suggest ways of remedying it. Among the main reasons for failure are:

- Road user suspicions that this is "just another tax", which will disappear into general revenues (a reasonable response, given that raising revenue has been an important objective in some jurisdictions).

- Popular confusion of marginal cost with average cost (road users may on average be paying for the road system in a given jurisdiction, but the peak hour user of a congested road may only be paying a fraction of the marginal cost).

- Concerns regarding income effects (i.e., higher peak charges will discriminate against the less affluent).

These suspicions have generally not been addressed effectively by policy makers.

A 1992 survey by Touche Ross into road pricing issues in eleven historic British cities "provided a clue as to how public resistance might be overcome: namely, by integrating it within a comprehensive traffic management strategy, and allocating revenues from road pricing towards the costs of public transport subsidies and other measures to improve traffic conditions for all users." (Nevie and Abbie, 1993) Reflecting on the US experience, Higgins (1994), concludes that "rigid organizations unwilling to solicit and pay heed to objections and concerns risk failure. Therefore, an important condition for any viable congestion pricing program is an ongoing public relations system designed not to sell a fixed concept, but to help the operating organization respond to concerns and objections."

4.5.5 Alternative Methods of Charging Users. III: Externality Charges

Externality charges are variable charges designed to force transportation users to be accountable for the social consequences of their activity. Externality charges are economic instruments, rather than regulatory or "command-and-control" ones, because they encourage economic actors to respond to price signals, rather than regulatory edicts.

In Sweden, which has the longest experience in applying externality charges, they have been introduced in a context which is explicitly linked to transportation infrastructure considerations. (Hansson, 1992; Jones, 1992) Following the introduction of the Transport Act of 1988, rail and highway infrastructure charges were harmonized as follows:

- Responsibility for rail infrastructure was severed from rail operations, so that the relationship of rail carriers to their infrastructure would be similar to that of highway carriers.

- Externality charges were levied on both rail and highway carriers based on studies of their respective contributions to air pollution and accident costs.

- In view of the much higher level of external costs imposed by highway users than by rail users, and the political impossibility, in the short run, of charging highway users fully for their external costs, the new rail infrastructure company was allowed to charge rail users only a fraction of the full economic cost of access to the tracks (under 20 per cent).

This multimodal approach to infrastructure financing has been the subject of considerable discussions within the European Community over the past four years.

Externality charges were considered, and quantified, in the last major federal highway cost allocation study in the United States, but were relegated to an appendix. They will also probably be addressed in the recently begun new federal study. Key issues to be resolved concerning externality charges in the United States are:

- The continuing uncertainty about the appropriate values to be applied—a wide range of estimates has been produced for key variables, depending upon assumptions, models, local conditions, etc;

- The fact that there is no guarantee that a set of charges based on economic efficiency principles (i.e., incorporating externality charges) will cover the costs of constructing and maintaining the highway system—depending on circumstances, there might be a huge surplus or a deficit;

- The political feasibility of introducing such a scheme. In large parts of the country (away from congested hubs), externalities are generally not a high priority.

4.6 Conclusions

Based on this review of highway finance methods in the developed world, conclusions are as follows:

i Tax financing continues to be the dominant highway finance method in the developed world.

ii. There is a widespread interest in both toll financing and the private provision of transportation infrastructure. However, the arguments of Gomez-Ibanez and Meyer (1993) are persuasive that toll financing will continue to occupy only a small (but growing) niche in advanced economies: "Finding a project where the revenues will cover most, if not all, construction and operation costs seems to be a ... serious objection to tolling. The basic difficulty is that the United States has already built 54,000 miles of high-performance expressways,

including most of those with sufficiently high traffic volumes to be supported from toll revenues" (179). The best opportunities for tolling are neither in the wealthiest countries, nor in the poorest (which lack the resources for user financed infrastructure), but in emerging economies (Spain in the 1970s, Mexico in the 1980s/90s).

iii There is some evidence to support the notion that the privatization of infrastructure is conducive to innovation and to greater economic efficiency. This evidence is qualified. The potential for private sector innovation may have to be traded away (through governmental pre-clearance of environmentally sensitive projects) in jurisdictions where development risk is particularly high.

iv The private/public distinction is far from clear cut in highway finance. Even where privatization has been encouraged, the role of the public sector remains significant. Responsibility of designating projects to be undertaken generally remains with government. Unlike in Eighteenth Century England, where private enterprise designated the routes to be tolled, the planning function continues to be exercised by governments:

- In Spain, governments specified where, when and to what standards roads could be built, including the construction schedule and financing arrangements. (Hirshhorn, 1992)

- In France, new highway projects are identified by the state as part of the national and regional infrastructure planning process.

- In Norway, projects are proposed by local interests, who lobby for local political support, prior to national parliamentary approval. (PIARC, 1994)

- A more liberal approach has been adopted in California, under their 1988 legislation. Caltrans solicited proposals from the private sector, who were allowed to pick their own projects, provided these fitted into Caltrans' plans.

In any case, many of the traditional players are involved in both private and public projects: the same construction companies, the same banks. The main differences are the funding mechanisms and the revenue sources.

v A somewhat different example of private/public convergence comes from the United Kingdom, where in April 1994, highway officials in the Department of Transport were transferred to the Highways Agency, structured like a private corporation and responsible for building and maintaining expressways and truck roads in England. The Highway Agency will promote the use of

design/build contracts, which are intended to account for about one-third of all contracts by the mid-1990s.

vi A variety of mechanisms for charging for use of highway infrastructure have been introduced in a number of jurisdictions. Each of these addresses specific concerns about conventional user charges: their lack of differentiation across time and space (congestion charges), their failure to charge users equitably on the basis of the costs occasioned to the highway agency (weight-distance taxes), and their failure to incorporate the social costs (externality charges). Increasingly, the key issues surrounding the adoption of such charges are political, rather than technical.

ENDNOTES

1. A very interesting article on this whole subject, received too late to be incorporated in the text, is by Edward Gramlich.

2. Although, in a recent unpublished article, the authors suggest in a footnote that privatization of public works "where possible, can be desirable." (Lewis & Freidrichs, 1993, p 13.)

3. Latest available figures, according to D. Hibbin.

4. Insofar as these are general consumption taxes, they are generally not considered to be 'road-user charges'.

5. The fourth country was South Korea.

6. This chapter describes the developed world, but the issue is also pertinent elsewhere. See World Bank, 1994.

REFERENCES

Alberta Transportation and Utilities. 1994. "Business Plan 1994-95 to 1996-97," memo, Edmonton.

Altshuler, A.A. and J.A. Gómez-Ibáñez. 1993. *Regulation for Revenue: The Political Economy of Land Use Exactions*. Washington, D.C.: The Brookings Institution.

Applications Management Consulting Ltd. 1993. *Transportation Financing In Alberta: Alternative Financing Techniques Study, Final Report*. Alberta Transportation and Utilities, Edmonton.

British Columbia. Commission of Inquiry into Road-user Charges. 1959. *Report*. Victoria.

Boadway, R. 1990. "The Role of Equity Considerations in the Provision and Pricing of Passenger Transportation Services." *Directions*. Royal Commission on National Passenger Transportation, Vol 3 of Final Report, Ottawa.

Bryan, N. 1972. *More Taxes and More Traffic*. Canadian Tax Papers, No. 55, Canadian Tax Foundation, Toronto.

Butcher, P. (Informetrica). 1992. *Financing Municipal Infrastructure: Alternative Methods*. prepared for the Canadian Home Builders' Association.

Butler, E., ed. 1982. *Roads and the Private Sector*. London and Virginia: Adam Smith Institute.

Canada. Royal Commission on National Passenger Transportation. 1992. *Directions: The Final Report of the Royal Commission on National Passenger Transportation*. Supply and Services Canada, Ottawa.

Canada. Royal Commission on Transportation. 1961. *Report*. 3 volumes (March 1961, Dec. 1961, July 1962), Queen's Printer, Ottawa.

Canada. Treasury Board. 1982. *Benefit-Cost Analysis Guide*. cat no BT 35-2-1976E, Supply and Services Canada, Ottawa.

Catling, Ian and Gabriel Roth. 1987. "Electronic Road Pricing in Hong Kong: An Opportunity for Road Privatization," *Private-Sector Involvement and Toll Road Financing in the Provision of Highways*. Transportation Research Record 1107. Transportation Research Board, Washington. D.C.

Cervero, R. 1989. *Highway Finance and Economic Development in Korea, West Germany, Japan and the United States*. University of California at Berkeley, Working Paper 503.

De Serpa, A.C. 1988. *Microeconomic Theory Issues and Applications*, Alleyn and Bacon, Boston.

Due, John F. 1968. *Government Finance: Economics of the Public Sector*. 4th edition, Richard D. Irwin, Homewood Illinois.

Elliott, W. 1992. "Peak-Hour Road Charges for Southern California: Has Their Time Come Round At Last?", *Transportation Quarterly*, vol.46, no.4, 517-528.

Fielding, G.J. and D.B. Klein. 1993. "How To Franchise Highways", *Transportation Research Board: 72nd Annual Meeting*, January 10-14, Washington, D.C.

Geltner, David and Fred Moavenzadeh. 1987. "An Economic Argument for Privatization of Highway Ownership." *Private-Sector Involvement and Toll Road Financing in the Provision of Highways*. Transportation Research Record 1107. Transportation Research Board, Washington, D.C.

Gillen, David, and Tae Hoon Oum. 1992. "Transportation Infrastructure Policy: Pricing, Investment and Cost Recovery." in *Directions: the final report of the Royal Commission on National Passenger Transportation*, vol. 3, pp. 503-612. cat. no. Z1-1989/1-1992E, Supply and Services Canada, Ottawa.

Gómez-Ibáñez, J.A. and J.R. Meyer. 1993. *Going Private: The International Experience with Transport Privatization*. Washington, D.C.: The Brookings Institution.

Gramlich, E.M. 1994. "Infrastructure Investment: A Review Essay." *Journal of Economic Literature*. Vol XXXII (Spetember 1994) pp 1176-1196.

Halliday, I., G. Marcou and R. Vickerman. 1991. *The Channel Tunnel: Public Policy, Regional Development and European Integration*. London and New York: Belhaven Press.

Hansson, L. 1992. "Socio-economic Aspects of Transportation: A European Perspective", paper presented to Transportation Association of Canada annual conference.

Hau, T.D. 1991. "Economic Fundamentals of Road Pricing: A Diagrammatic Analysis". Manuscript received from author.

Hau, Timothy D. 1992. "Congestion Pricing Mechanisms: An Evaluation of Current Practice," draft, The World Bank, Washington, D.C.

Hau, T.D. 1992. *Congestion Charging Mechanisms for Roads: An Evaluation of Current Practices*. Washington, D.C.: World Bank.

Hensher, D.A. 1993. "The Transportation Sector in Australia: Economic Issues and Challenges", *Transport Policy*, vol.1, no. 1, 49-67.

Higgins, T.J. 1994. "Congestion Pricing: Implementation Considerations", *Transportation Quarterly*, vol.48 no.3, 287-298.

Hirshhorn, R. 1992. *The Ownership and Organization of Transportation Infrastructure—Roads and Airports*. Report prepared for the Research Division of the Royal Commission on national Passenger Transportation.

Hossack, M.A. 1994. "Transportation Revenues and Expenditures in Saskatchewan," *Proceedings*, 29th annual meeting of the Canadian Transportation Research Forum, Victoria, pp 338-351.

Huggett, J.R. 1994. "The Funding Options for Transportation Infrastructure Projects," *Proceedings*, 29th annual meeting of the Canadian Transportation Research Forum, Victoria, pp 352-363.

Hulten, C.R., D. Aschauer & M.I. Nadiri. 1994. *Infrastructure in the 21st Century Economy: An Interim Report — Volume 2: Three Conceptual Papers Exploring the Link Between Public Capital and Productivity*. Washington, D.C.: Federal Infrastructure Program, IWR Report 94-FIS-8.

Ingham, M.W., D.P. Luck and A.J. Shaw. 1985. *Review of Road Pricing in Australia and Overseas*. Canberra: Bureau of Transport Economics, Occasional Paper 73.

International Road Federation. Annual. *World Road Statistics*. Geneva/Washington, D.C.

Jones, J. 1992. *Social Cost Accounting: The European Experience.* Kingston: Canadian Institute of Guided Ground Transport, Report 91-14.

Lefebvre, Sylvie and John Simke. 1994. "Public-Private Partnerships - The Way of the Future or Just Another Buzz Word?" *Proceedings*, 29th annual meeting of the Canadian Transportation Research Forum, Victoria, pp 222-233.

Lewis, David. 1993? "Objectives and Decision Criteria for Infrastructure Investment, A Summary of Research Findings of Project 2-17 of the National Cooperative Highway Research Program, National Research Council."

Lewis, David and P. Friedrichs. 1993. "Linkages Between Infrastructure and Productivity: A Comparison of Canada and the United States," unpublished paper presented at a seminar on infrastructure and competitiveness, Investment Canada, Ottawa.

MacDougall, D.J. 1991. "Nova Scotia's Dedicated Fuel Tax Initiative," presentation, Transportation Association of Canada annual meeting.

Morichi, S. 1992. "Governmental Institutions and Financing for Transport Infrastructure in Japan". Paper presented at the 6th World Congress on Transport Research, Lyon.

National Road Transport Commission. 1992. *Discussion Paper on Heavy Vehicle Charges*. Melbourne.

Nevin, M. and L. Abbie. 1993. "What Price Roads? Practical Issues in the Introduction of Road-User Charges in Historic Cities in the UK", *Transport Policy, vol.1(1), 68-73.*

Newbury, D.M. 1990. "Pricing and Congestion: Economic Principles Relevant to Pricing Roads", *Oxford Review of Economic Policy*, vol.6, no.2, 22-38.

Nix, F.P., M. Boucher and B. Hutchinson. 1990. "Road Costs." *Directions*. Royal Commission on National Passenger Transportation, Vol 4 of Final Report, Ottawa.

Ontario Committee on Taxation. 1967. *Report*. Queen's Printer, Toronto.

Ontario Select Committee on Toll Roads and Highway Financing. 1957. *Final Report*. Toronto.

Organization for Economic Cooperation and Development. 1987. *Toll Financing and Private Sector Involvement in Road Infrastructure Development*. Paris.

Orski, C.K. 1992. "Congestion Pricing: Promise and Limitations", *Transportation Quarterly*, vol.46, no.2, 157-167.

Owen, W. and C.L. Dearing. 1951. *Toll Roads and the Problem of Highway Modernization.* Washington, D.C.: The Brookings Institution.

Perl, Anthony D. 1993. *Comparative Transport Finance: The Institutional Logic of Infrastructure Development in Canada, France and the United States*. Doctoral dissertation, University of Toronto.

Permanent International Association of Road Congresses [PIARC]. 1994. *International Scan of Highway Toll Financing and Public Private Partnerships.*

Price Waterhouse. 1994. *Alberta Transportation and Utilities: Framework for Public-Private Partnerships in Transportation Infrastructure.*

Québec. Royal Commission on Taxation. 1965. *Report*. Québec.

Reina, P. 1994. "U.K. Starts New Agency", *Engineering News Record* (March 7).

Rockerbie, K., 1993, "Public Policy Considerations in the Adoption of User Pay Highway Financing," *Proceedings*, 28th annual meeting of the Canadian Transportation Research Forum, Fredericton, pp 478-488.

Roth, G. 1990. "Perestroika for US Highways: A Bold New Policy for Managing Roads for a Free Society", *Policy Insight*, no.125 (November).

Rothengatter, Werner. 1992. "Problems of Financing the Infrastructure in Germany". Paper presented at the 6th World Congress on Transport Research, Lyon.

Rothengatter, W. 1994. "Do External Benefits Compensate for External Costs of Transport?" *Transportation Research A*. V 28A (4). pp 321-328.

Rusch, W.A. 1964. *Toll Highway Financing*. Washington, D.C.: Transportation Research Board.

Saskatchewan: Royal Commission on Taxation. 1965. *Report*. Regina.

Schreiner, J. 1994. "E-470 Goes to Higher Court", *Engineering News Record* (November 7).

Schreiner, J., S.H. Daniels & W.J. Angelo. 1994. "Gold in the Hills of Privatization", *Engineering News Record* (October 24).

Seymour, Jonathan. 1992. "Highway Infrastructure Funding Alternatives" paper prepared for the British Columbia Ministry of Transportation and Highways, Transportation Policy Branch, Victoria.

Small, K.A., C. Winston and C.A. Evans. 1989. *Road Work, A New Highway Pricing and Investment Policy*. Washington, D.C.: The Brookings Institution.

SNC-Lavalin. 1994. *Identification et conditions d'application de nouvelles sources de financement pour le réseau routier québécois*. Report for the Quebec Ministry of Transport.

Snyder, T.P. and M.A. Stegman. 1986. *Paying for Growth: Using Development Fees to Finance Infrastructure*. University of North Carolina at Chapel Hill.

Sonnen, C.A. (Informetrica). 1989. *National and Provincial Economic Impact of National Highway Policy*, prepared for Roads and Transportation Association of Canada, Ottawa

Stafford, F.P. and K. Chen. 1993. "Economic Aspects of Public-Private Partnerships for the Provision of Roadway Services", *Transportation Research Board: 72nd Annual Meeting*, January 10-14, Washington, D.C.

Starkie, D. 1988. "The New Zealand Road Charging System", *Journal of Transport Economics and Policy*, vol.xxii, no.2, 239-245.

Szostak, R. 1991. *The Role of Transportation in the Industrial Revolution: A Comparison of England and France*. Montreal: McGill-Queen's University Press.

Texas Transportation Institute. 1993. *Microcomputer evaluation of highway user benefits: Final Report for NCHRP 7-12*. College Station, Texas

US Congressional Budget Office. 1985. *Toll Financing of U.S. Highways*. Washington, D.C.

US Congressional Budget Office. 1992. *Paying for Highways, Airways, and Waterways: How Can Users Be Charged?* CBO Washington, D.C.

US General Accounting Office. 1994. *Highway User Fees: Updated Data Needed to Determine Whether All Users Pay Their Fair Share*. Washington, D.C.: GAO/RCED-94-181

US Federal Highway Administration. 1982. *Final Report on the Federal Highway Cost Allocation Study*. report of the Secretary of Transportation to the United States Congress, Washington, D.C.

US Federal Highway Administration. 1992a. *Examining Congestion Pricing Implementation Issues, Summary of Proceedings: Congestion Pricing Symposium*. Searching for Solutions, A policy Discussion Series, No. 6, FHWA, US Department of Transport, Washington, D.C.

US Federal Highway Administration. 1992b. *Exploring Key Issues in Public-Private Partnerships for Highway Development*. US Department of Transportation, Washington, D.C.

US Federal Highway Administration. 1993. *Highway Statistics: 1992*. US Department of Transportation, Washington, D.C.

US Federal Highway Administration. 1994. *Bond Financing and Transportation Infrastructure: Exploring Concepts and Roles*. US Department of Transportation, Washington, D.C.

US Department of Transportation. 1984. *Alternatives to Tax on Use of Heavy Trucks: Surface Transportation Assistance Act of 1982: Report to Congress*. Washington, D.C.

Verhoef, E. 1994. "External Effects and Social Costs of Road Transport," *Transportation Research A*, V 28A (4). pp 273-287.

Walters, A.A. 1968. *The Economics of Road User Charges*. The John Hopkins Press, Baltimore.

World Bank. 1994. *Rapport sur le développement dans le monde: une infrastructure pour le développement*. Washington, D.C.