

## LAND TRANSPORT PRICING STUDY

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### ABSTRACT

The Land Transport Pricing Study is part of a wide-ranging review of land transport services, designed to support New Zealand's policy goal of a "safe, sustainable transport system at reasonable cost" - as outlined in the Ministry of Transport's strategic plan *Transport Directions 1994 - 1999*.

This study arose in the early 1990s because insufficient research existed to understand the cost of roading, or to make sound comparisons between roading and other transport modes. The Government asked the Ministry of Transport, in consultation with Transit New Zealand, the Ministry for the Environment and Treasury to conduct the study.

Key elements of the study are examination of:

- infrastructure costs;
- safety costs; and
- environmental costs.

This paper provides an overview of the LTPS from the perspective of a consultant economist

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**LAND TRANSPORT PRICING STUDY**

***National Roothing Account:  
The Cost of Roothing Infrastructure***

July 1995

***National Roothing Account:  
Roothing as an Economic Good***

October 1995

***Environmental Externalities***

March 1996

***Safety Externalities***

May 1996

***National Traffic Data Base***

Transit New Zealand: May 1996

## STUDY CONTEXT

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### *How the Study came about... Where it fits into government policy*

- The Land Transport Pricing Study is part of a wide-ranging review of land transport services, designed to support New Zealand's policy goal of a "safe, sustainable transport system at reasonable cost" - as outlined in the Ministry of Transport's strategic plan *Transport Directions 1994 - 1999*
- This study arose in the early 1990s because insufficient research existed to understand the cost of roading, or to make sound comparisons between roading and other transport modes. The Government asked the Ministry of Transport, in consultation with Transit New Zealand, the Ministry for the Environment and Treasury to conduct the study.
- Transport reform has played an important part in New Zealand's improved competitiveness and economic growth.
- Roading is out of step with shipping, aviation and rail where the cost of infrastructure as well as day-to-day activity and safety all take place within a commercial framework. Users of these transport services pay not only for the direct operational costs of the services they use, but also for economic costs including depreciation and the cost of capital.
- The Government recognises that because pricing of public utility infrastructure services can have large effects on levels of use and thus social, economic and environmental impacts, pricing should aim at efficient allocation of resources.
- Public infrastructure services, such as roads, water supply, solid waste disposal, sewage systems and energy services can be implicitly subsidised by virtue of there being an inadequate asset valuation, and/or no requirement for a normal commercial rate of return on capital invested, and/or no user pays policy.
- The proposition that road pricing may be inappropriate has important consequences for economic efficiency. If charges for roading services are too low, in that they do not adequately reflect economic costs then compared to the situation under a regime of efficient prices:
  - ⇒ the level of road usage will be higher;
  - ⇒ associated costs, such as environmental damage, will be higher;
  - ⇒ additional expenditure will be required in order to meet the expanded demand; and
  - ⇒ demand for (and the production of) other transport modes will be artificially lowered.
- Pricing below economic costs diverts resources away from other uses more highly valued in the community lowering national economic welfare.
- The findings of the Land Transport Pricing Study will allow policy-makers to reach more informed decisions about a "level playing field" between roading and other types of transport. This supports the Government's aim over the last decade to promote a "multimodal" transport system in which each mode of transport plays its most efficient and effective role within the broader economy

## THE LAND TRANSPORT PRICING STUDY

*New Zealand will have a safe, sustainable transport system, at reasonable cost... How do we achieve this?*

- The Land Transport Pricing Study is central to developing a safe, sustainable transport system at reasonable cost that will meet the needs of New Zealand in the twenty-first century.
- This requires a pricing and regulatory framework which ensures that users face the full economic costs of their decisions to use land transport.
- The goals of the study are to:
  - ⇒ ensure the maintenance of New Zealand's roading network on a long term sustainable basis. By "sustainable", we mean taking account of the broad goals of the whole transport system including social, economic and environmental targets;
  - ⇒ ensure that the system has sufficient ability to cope with future changes in demand; and
  - ⇒ encourage efficiency and consistency between the public roading network and other transport modes such as rail and air, which operate in a largely commercial environment.
- Key elements of the study are examination of:
  - ⇒ infrastructure costs;
  - ⇒ safety costs; and
  - ⇒ environmental costs
- The study embodies the following research:

*The Cost of Roding Infrastructure (published July 1995)*

- ⇒ develops a set of accounts for the public roading network;
- ⇒ establishes economic costs of providing the physical structure of roading; and
- ⇒ identifies the consequent income requirement.

*Roding as an Economic Good (published December 1995)*

- ⇒ defines the economic characteristics of New Zealand's roading network;
- ⇒ considers alternative ways of raising the funds needed to pay for roads;
- ⇒ considers economic criteria for efficient pricing and their application to roading;
- ⇒ reviews international experience on road pricing; and
- ⇒ considers relevant competition and institutional issues.

*Environmental Externalities (published March 1996)*

- ⇒ reviews the international and New Zealand literature surrounding each of the externalities;
- ⇒ assesses the magnitude of the externalities in the New Zealand context;
- ⇒ considers the appropriate mechanism for valuing the externalities;
- ⇒ provides a preliminary estimate of the value of the externalities; and
- ⇒ identifies future areas of research and issues for policy development.

*Safety Externalities (published May 1996)*

- ⇒ examines the accident costs that each user imposes on society when they choose to travel by road;
- ⇒ considers how successful the existing institutional structure and regulatory system are in internalising the costs of road crashes;
- ⇒ assesses the nature and magnitude of any remaining external costs; and
- ⇒ considers whether or not there is a role for road pricing in influencing safety.

*National Traffic Database (published May 1996)*

- ⇒ Transit New Zealand integrate existing sources of road use data and traffic surveys to produce a database of the traffic flow on every road in New Zealand
- In addition, companion research is likely to be required in other areas of land transport, including options for managing the future road vehicle fleet, assessment of the efficiency of existing road prices, congestion and public transport issues, the environmental impact of railways and network analysis.

## ***NATIONAL ROADING ACCOUNT: THE COST OF ROADING INFRASTRUCTURE***

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- This report examines ways of assessing the cost of the physical assets of the roading network, and suggests a framework to develop more accurate roading accounts
- The findings draw on leading research in its field to provide New Zealand with the framework for a world-best transport strategy. It is a world first in its range and scope
- Maintaining high quality public roading is of vital importance to all New Zealanders. To plan for the future, it is important we have accurate information on the cost of roading
- The transport system must be developed in a manner that accommodates increased concern about its impact on the environment and the safety of users. Social equity in the availability of transport must also be considered. The Land Transport Pricing Study will examine all of these costs in future reports.
- In order to determine where the country stands in terms of its roading network, an important first step is to accurately assess how income derived to pay for roads under the current funding system relates to the cost of the infrastructure.
- This report develops a set of financial accounts for the country's roading network, so that future decisions can reflect the economic cost of roads. It focuses on the economic costs of roading infrastructure. Further research on road safety and environmental issues will be published later before any decisions are considered on future policy.
- The National Roding Account suggests that in the current system funds collected are broadly in line with estimated economic costs. This result assumes that the fuel excise currently going into the Crown Account is used to cover the costs of roading and that there are no costs other than those considered in this paper.
- This means that income for roading currently collected is reasonably well balanced with the economic cost of the existing roading infrastructure.
- The preliminary findings show that there is no immediate need to alter charges for road use, on the basis of the physical costs of roading infrastructure. However, these figures do not deal with additional funds for new roading, or other costs associated with road transport like social and environmental costs, which will be included in the study at a later stage.
- The report makes no judgements about the type of road pricing system New Zealand should adopt - that is a matter for policy-makers in the future. It simply seeks to establish a framework for a more accurate pricing regime by identifying the costs of national roading infrastructure.

**Summary Balance Sheet  
as at 30 June 1993**

<b>Owner's Equity (\$ million)</b>		<b>Assets (\$ million)</b>	
Crown	7,055	State Highways	7,430
Territorial Local Authorities	18,775	Local Roads	18,400
<b>TOTAL</b>	<b>25,830</b>	<b>TOTAL</b>	<b>25,830</b>

**Mid Range Summary Income and Expenditure Account  
for the year ended 30 June 1993**

<b>Income (\$ million)</b>		<b>Expenditure (\$ million)</b>	
Central Government Funds	1,205	Maintenance and Economic Depreciation	750
Territorial Local Authority Funds	265	State Highways Capital Charge	470
<b>TOTAL INCOME</b>	<b>1,470</b>		
<b>BALANCE</b>	<b>(250)</b>		
	1,220	<b>TOTAL ECONOMIC COSTS</b>	<b>1,220</b>

- Key questions arising from the findings include:
  - ⇒ should economic accounts be adopted for public roading;
  - ⇒ should a capital charge, or rate of return, be applied to the State Highway network and whether roads owned by local authorities should be treated in the same way; and
  - ⇒ should the current revenue collection system for roads be changed?

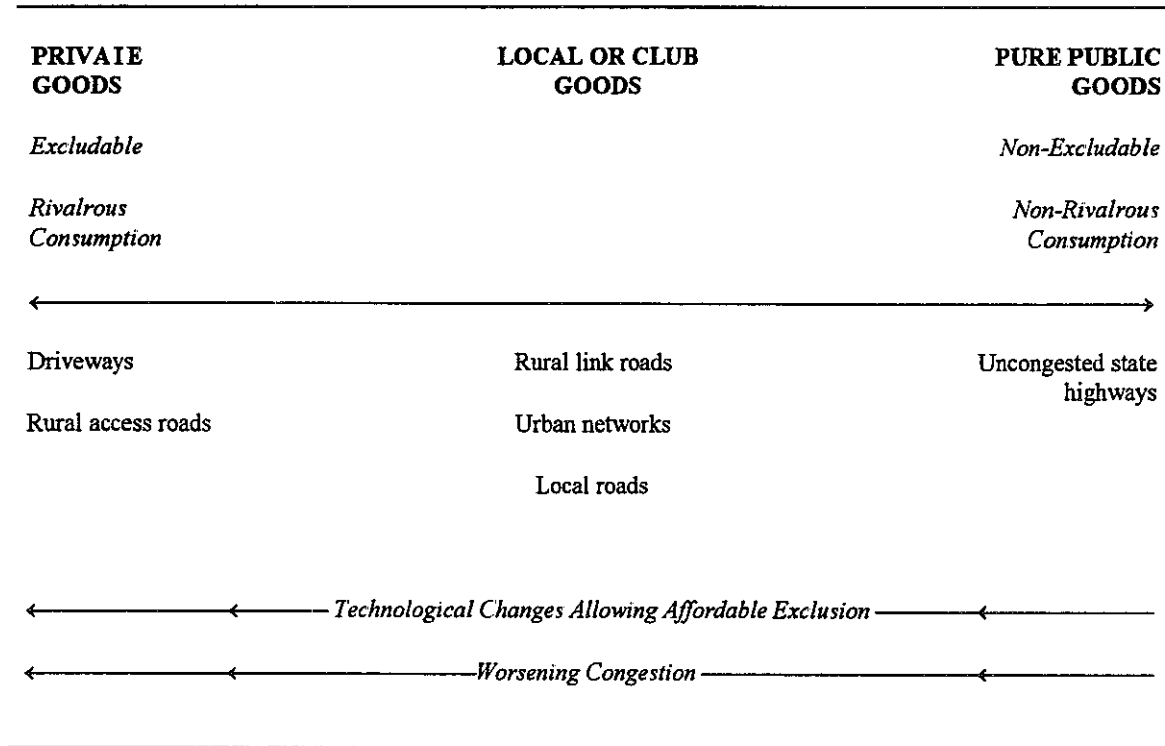
## **NATIONAL ROADING ACCOUNT: ROADING AS AN ECONOMIC GOOD**

- This report extends our understanding of the roading network by defining its economic characteristics and researching ways in which road services might be priced more efficiently. It looks at alternative ways of charging for roads to better reflect their true cost and send more accurate price signals to users.
- The report is a discussion document to assist future policy decision making. It is not a policy document. It analyses our road transport network and identifies issues that need to be considered in future policy development.
- Achieving an efficient pricing system for New Zealand's roads is important if future transport policy is to ensure fair competition between different types of transport, so as to make the best use of the country's transport resources.
- The roading network can be defined as what economists term a "public good". Roding is defined this way because, with current technology, it is difficult to prevent non-paying users from using roads. Once a road has been provided for one user it is available for all.
- Public goods are often provided by governments through taxation because the private sector is unable to provide them. Historically this is one of the factors explaining extensive government involvement in roading.
- Pricing a public good like roading, where market conditions do not apply, is extremely complex. It involves balancing a number of factors, including the nature of the market, available technology, and the balance between demand and capacity.
- It may also be necessary to take account of indirect costs or benefits that arise from road use, including safety and environmental costs, as well as the value that individual roads provide because of the access they give to the rest of the network.
- Efficient allocation of the costs of roading to users is difficult due to the joint supply to different types of user and the very long run time period over which maintenance and investment activity is undertaken.
- Roads are a network and investment in, or charges on, one sector will affect traffic flows and return on other sectors. This also has implications for pricing.
- Optimal pricing for roading has to be considered in conjunction with available and potential technology for road user charging. Ideally users should be charged according to the costs they impose on the roading system and the benefits they derive. Where it is difficult to measure these costs and benefits, and expensive to levy closely targeting charges, more pragmatic solutions will be required.
- New Zealand's existing charging regime is recognised as sophisticated in both design and application compared to those of other countries.
- The high cost of direct charging, for example via electronic tolling, and New Zealand's low traffic density, suggest that there is currently limited scope for the introduction of pricing instruments differentiating by time and space. This may change as technology makes direct charging cheaper and more feasible.



- While the government will continue to be the appropriate funder of roads, there may be scope for greater private sector involvement, notably in management, design and operation of publicly owned networks. Possible mechanisms include franchising of highways and use of shadow tolling.
- The report makes no judgements about the type of road pricing system New Zealand should adopt - that is a matter for policy-makers in the future. It simply seeks to establish the economic background necessary for analysis of appropriate pricing regimes
- The following diagram describes the roading network as it is currently.

### Placing Roads on the Public/Private Goods Continuum



## ***ENVIRONMENTAL EXTERNALITIES***

- This report has as its goal the analysis of social costs associated with environmental impacts of the road transport network. This stems from increased awareness of roading's impact on the environment. The roading network must be operated in a manner that accommodates these concerns.
- The report covers four major areas of environmental impact: noise pollution, air quality, greenhouse gases and water quality. The results presented are very preliminary and should be treated with caution.

### **Annual Social Costs of each Pollutant Category (\$ Million)**

<b>Pollutant Category</b>	<b>Comments</b>	<b>Range</b>	<b>Best Estimate</b>
Noise	<ul style="list-style-type: none"> <li>• includes only total noise dose</li> <li>• specific effects of high level single events not included</li> <li>• based on hedonic pricing applied to house prices</li> <li>• range obtained by altering house price depreciation index and threshold of sound having adverse impact</li> </ul>	230 to 2,650	290
Local Air Quality	<ul style="list-style-type: none"> <li>• includes PM<sub>10</sub>, benzene, benzo(a)pyrene and formaldehyde</li> <li>• excludes temporary impairment from elevated carboxyhaemoglobin levels from carbon monoxide exposure</li> <li>• based on health damage cost estimates using value of statistical life, unit risk factors and shortened life estimates</li> </ul>	not assessed but very wide range	700
Greenhouse Gases	<ul style="list-style-type: none"> <li>• includes CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and CFCs</li> <li>• based on estimated damage costs</li> </ul>	25 to 580	290
Water Quality	<ul style="list-style-type: none"> <li>• based on costs of mitigation measures for entire roading network</li> <li>• data on environmental costs actually attributable to run-off from roads very incomplete</li> </ul>	35 to 170	100

- The areas were selected on the basis of previous research which showed that they were likely to be the most significant environmental impacts. It is recognised that there are other important environmental impacts such as community severance and visual impacts.
- The estimates are based on different methodologies and are not, in any rigorous sense, comparable. The ranges indicate the lowest and highest estimates encountered. They are presented as a preliminary indication of the relative scale of the problem, and a rough guide to the magnitude of social costs impacting on the environment.
- Double counting may occur if the reported costs are simply added together.
- The report makes a first attempt at identifying social costs arising from road use, but lacks sufficient data to identify accurately the proportion of these which are externalities and the proportion which are private costs.
- Externalities are those unpriced environmental effects associated with the production, distribution, and consumption of goods and services.
- The external environmental costs of economic activity should be borne by those firms or individuals who benefit from the activity.
- There can be confusion between the concepts of social and external costs and benefits. Social costs are the sum of private costs and external costs. Private costs of an activity are costs borne by those engaged in the activity, for example the costs of petrol and car maintenance borne by road users.
- Ideally an estimate of the extent of a deviation between private and social costs is required for policy development. In practice this will rarely be possible.
- The complexities and uncertainty of estimating the value of externalities mean that such estimates should not be used as the sole determinant of policy. In keeping with other public policy areas the Government uses a range of tools and principles such as those discussed in the *Environment 2010 Strategy*. Common sense and judgement are required in assessing the appropriate response of government to the existence of externalities.
- The report is a discussion document to assist future policy decision making. It is not a policy document. It analyses selected environmental costs associated with our road transport network and identifies issues that need to be considered in future policy development.
- Key questions arising from the findings include:
  - ⇒ which of the environmental effects of land transport are you most concerned with;
  - ⇒ what should the focus of further research be; and
  - ⇒ what policies should be considered in response to the main findings presented in this report?

## ***SAFETY EXTERNALITIES***

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- This report analyses the nature and scale of safety externalities within New Zealand's system for pricing roads and dealing with road safety costs
- Of all the daily activities undertaken by New Zealanders, transport carries the greatest risk of accidental death and injury. Because transport is risky, governments face continuing pressure to modify the way the road transport system operates so as to minimise crashes. One example is the call to do something about the perception that higher volumes of heavy goods traffic decrease overall road safety.
- Great progress was made initially in bringing down the number of traffic fatalities even with increased road use and greater mobility. The situation today, in most OECD countries, is that the decrease in the absolute number of road crashes has come to a halt.
- Even so, traffic safety as measured by casualties per unit of travel has steadily improved. The general trend is that long term growth in mobility and improved safety appear to be able to occur together.
- Very little research exists in terms of an economic analysis of road safety externalities. The term externalities when applied to road safety refers to a situation where an individual's well being is affected by the action of another road user who does not bear the consequences of that action.
- An externality may result from behaviour which leads to a crash or behaviour which increases the risk of crashes and requires others to adjust their road use patterns. For example if someone avoids the motorway in the evening because they are worried about dangerous drivers, then the cost to that person of travelling a longer route is an externality.
- Mixed traffic, with pedestrians, cyclists, cars and trucks using the same road also leads to avoidance costs. All road users need to take more care when there is mixed traffic than would otherwise be necessary.
- Earlier reports in the Land Transport Pricing Study highlighted the benefits of including externalities in any efficient road pricing system. This report assesses safety externalities in the context of New Zealand's institutional arrangements, including road pricing, legal and accident compensation systems.
- Total expenditure directly attributable to road safety by the Crown and ACC was approximately \$550 million in the 1994/95 June year.
- Local government, community and industry organisations also spend significant amounts on activities related to road safety.
- A decision to use the road system is, in principle no different from any other decision to consume a product or service. Understanding road use as an economic decision is important to analysing safety externalities and differentiating between these and private costs.
- A key issue in determining the extent of safety externalities is whether road users already bear safety costs through existing institutional arrangements so that they are no different, in principle, to the costs of petrol and car maintenance.
- The total social cost of road crashes in New Zealand was approximately \$3.4 billion in 1994.
- There is little international work focusing on what proportion of social costs are externalities.

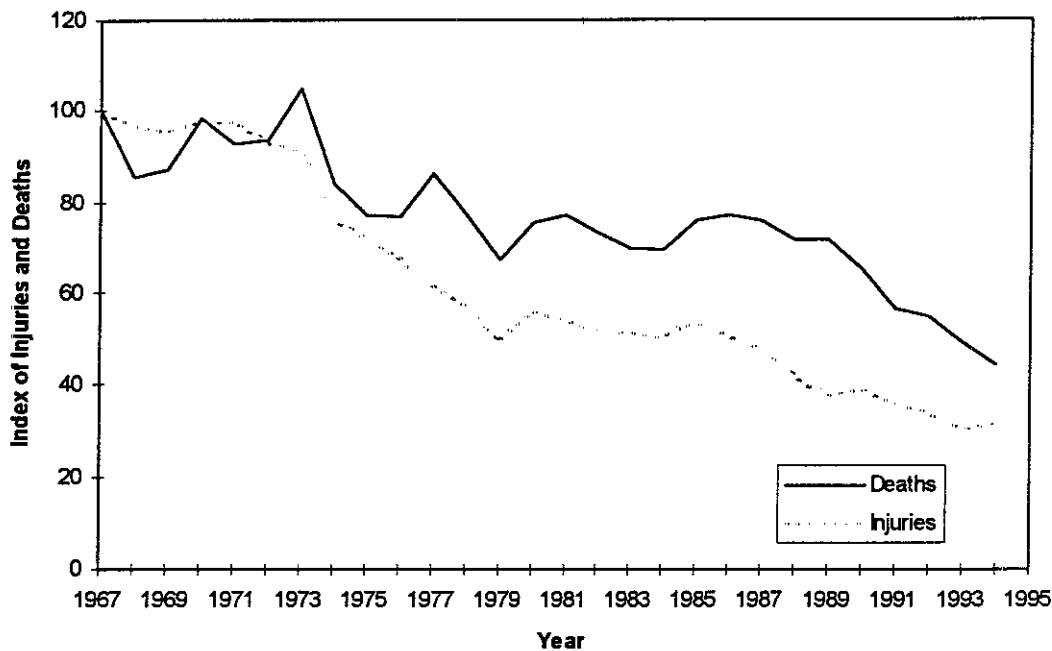
- The right to use the roading network is equivalent to a property right that all New Zealanders enjoy, providing they meet qualifying conditions such as licensing and adherence to the Road Code.
- Existing institutional arrangements, such as ACC and mechanisms for redress through the courts or private insurance, effectively assign property rights. This results in a low level of *ex post* safety externalities.
- The report recognises that externalities do arise in the area of avoidance behaviour, as illustrated by defensive driving. This is a class of externalities previously ignored by analysis which has concentrated on the aftermath from crashes. We have no straightforward means of estimating *ex ante* costs.
- There are also resource costs associated with the enforcement of the Road Code and means by which injured road users and those who suffer property damage gain recompense for costs incurred.
- Road pricing appears to have a limited role in influencing safety behaviour. Under present technology it is not possible to target risky drivers *ex ante*.
- The report is a discussion document to assist future policy decision making. It is not a policy document. It analyses the safety of our road transport network and identifies issues that need to be considered in future policy development.
- The report makes no judgements about the type of road pricing system New Zealand should adopt - that is a matter for policy-makers in the future. It simply seeks to establish the relevance of safety externalities to alternative pricing regimes.

**Road Safety Summary Income and Expenditure Account  
for the year ended 30 June 1995**

Income (\$ 000)		Expenditure (\$ 000)	
Land Transport Fund	222,253	Land Transport Safety Authority, S(A)P	45,126
Territorial Local Authorities	21,221	Police, S(A)P	131,130
ACC - Motor Vehicle Account Income	302,685	State Highways	24,776
		Local Authority Roads	42,442
Internal Affairs (Fire Service)	4,100	ACC - Motor Vehicle Account Payout	282,642
		Motor Vehicle Account Surplus	20,043
		Fire Service	4,100
<b>Total</b>	<b>550,259</b>	<b>Total</b>	<b>550,259</b>

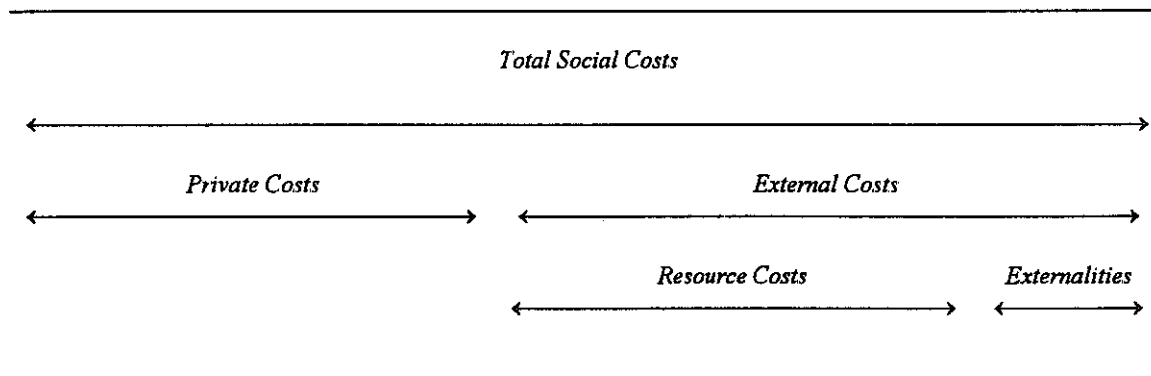
*Note: All numbers are GST exclusive.*

## Fatalities and Reported Injuries as a Percentage of Traffic Volume



Deaths Index = Number of Deaths/Rural Traffic Volume Index (1967 = 100)  
 Injuries Index = Number of Injuries/Urban Traffic Volume Index (1967 = 100)

## Social and Private Costs



- Key questions arising from the findings presented in this report include:
  - ⇒ does the existing regulatory and institutional environment establish optimal arrangements for dealing with safety issues;
  - ⇒ is an appropriate weighting for avoidance costs (for example those associated with risky driving or mixed traffic) provided for by existing arrangements;
  - ⇒ is the existence of offsetting behaviour recognised by the current approach to safety policy;
  - ⇒ what should the focus of further research be; and
  - ⇒ what policies should be considered in response to the main findings presented in this report?