Assessment of public responses to policies designed to internalise environmental and social externalities associated with the transport sector in New Zealand

K.F.D. Hughey, G.N. Kerr and R. Cullen
LINCOLN UNIVERSITY
New Zealand

Summary
An integrated approach to the environmental and social externalities associated with the transport sector was explored within an omnibus biennial survey of peoples’ perceptions of the New Zealand environment carried out in 2006. Survey respondents were provided with information about greenhouse gas emissions, road and pollution-related deaths, and about direct consumer costs attributable to transport. They were then asked to evaluate four options considered most likely to result in reductions to one or more of these impacts. These options involved introducing or increasing road user charges, reducing the open road speed limit, fuel use efficiency standards, and mandatory exhaust gas quality standards for all cars. Results indicate an overall unwillingness to adopt these measures. Policy makers are nevertheless faced with the challenge of improving land transport sustainability and are therefore in the unenviable position of recommending best performing but least politically damaging policy options. To this end it appears that policies that target particular combinations of impacts are more likely to be supported than those that are more open-ended and generally aim at internalising the overall impacts of road use. However, it is also clear that vehicle users are more likely to support targeted policies that are unlikely to be the most effective in reducing these particular impacts or combinations thereof. This is because the most effective policies would involve all drivers, and have immediate impacts. Notably, however, female respondents and those using public transport were more likely to support of options that would likely have the greatest overall benefits. Lessons for policy makers can be drawn from this study, including how to improve the targeting of policy options to particularly difficult but potentially influential groupings.

Keywords: Transport, environmental and social impacts, policy options, public survey, evaluation

1. Introduction

New Zealand is not alone in facing a range of unresolved transport and related social, environmental and economic issues (see for example May and Tight 2006). Recent New Zealand debate has focused around major congestion issues in Auckland and increasingly elsewhere, around proposals for a carbon tax on transport fuels, and on the death toll associated with traffic accidents. The recent dramatic rise in fuel prices have raised even more issues and these are being heavily debated. The government has been heavily involved in these debates and from February to April of 2006 announced a range of initiatives that needed public discussion (e.g. Ministry of Transport 2005c).

Clearly, issues surrounding sustainable and integrated transport management are topical and worthy of further investigation (May, Kelly and Shepherd 2006, May and Tight 2006, Zhang et al. 2006). Much of this effort is focused on integrated systems development (e.g., Ülengin et al. In press) and on transport optimisation strategies (e.g., Zhang et al. 2006). And, although both May and Tight (2006) and Zhang et al. (2006) acknowledge the importance of public acceptability of policy options, it is not clear how and if these concerns have been combined in their proposed tools for integration. Perceptions research is widely incorporated into aspects of transport planning. Some examples relevant to this research include Johansson, Heldt and Johansson (2006) who examined attitudes and personality relationships with mode choice, Pogroski and Kockelman (2006) who assessed public perceptions of toll roads, and Schade and Baum (2006) who examined reactions towards the introduction of road pricing. None of this research seems to have examined the broader range of social, environmental and economic costs of land transport. This paper reports on an integrated study of people’s perceptions about a range of transport related issues, including policy approaches to internalising the full range of externalities associated with land transport management. But, first we provide some policy and issue context.

The Ministry of Transport is the government’s principal advisor on transport, with overall policy based on the New Zealand Transport Strategy released in 2002 (Ministry of Transport 2005a). The Vision of the Strategy is: “By 2010 New Zealand will have an affordable, integrated, safe, responsive, and sustainable transport system” (MOT 2005a: 22). Underlying the strategy are four principles, namely: sustainability, integration, safety and responsiveness. In effect and with respect to land transport the Ministry deals with policy issues and Land Transport NZ with promoting land transport sustainability and safe transport on land (Figure 1). The latter carries out these responsibilities by working proactively with partners who plan, operate, develop and maintain the land transport system, their communities and transport users (Land Transport NZ 2005).
Land Transport NZ has considered a range of major developments that are likely to have a large impact on land transport planning including:

- international trends in fuel supply and demand, and the influence this has on energy efficiency and affordability, fuel and vehicle choice, and choice of transport modes;
- increasing concerns about transport-related health issues, such as the effects that air pollutants and increasing motor vehicle dependence have on health (see for example Fisher et al. 2002);
- transport-related environmental impacts, such as noise and emissions to air and water;
- broader environmental issues such as global warming (and implications arising from involvement in international treaties); and
- land use development pressures, such as development patterns and the interaction of urban and peri-urban land use and transport corridors. (Source: Land Transport NZ 2005: 5-6).

It is the Ministry of Transport that is formally considering the policy options to address these issues in integrated ways (see Ministry of Transport 2005c).

Over the course of the past 4-5 years the Ministry has commissioned wide ranging research to quantify the impacts of transport, e.g., Fisher et al (2002) and Booz Allen Hamilton (2005), which together indicate a range of social, environmental and economic costs which are not being internalised or managed on a true cost basis (Ministry of Transport 2005c). In considering policy options to address these issues the Ministry and government face some potentially unpalatable choices, e.g., unpopular actions such as increasing taxes on fuels to address climate change policy requirements. It is within the context of needing to address complex problems and integrated policy responses that this survey was undertaken. The following section summarises the survey and analysis methods used.
2. Methods

A case study of sustainable land transport policy options was included as a component of the fourth (2006), biennial environmental perceptions survey (see Hughey et al. 2004a,b for example). The survey is constructed around the Pressure State Response model of environmental reporting and addresses 11 resources including air, freshwater and marine fisheries. Each survey includes a specific case study, with transport chosen for 2006.

A survey was mailed to 2000 individuals 18 years and older, randomly selected from the electoral roll. A follow up post card was sent to non respondents and finally a repeat mail out was made to all subsequent non respondents. The survey achieved an effective response rate of 46.5%, comparable with the three earlier surveys.

In preparing the transport case study relevant literature and policy documents were first reviewed. Liaison then occurred with Ministry of Transport policy analysts in Christchurch and Wellington. Topics and finalised questions were developed in an iterative manner until agreement was reached on the final set. Pretesting was undertaken and changes made as appropriate.

The transport section of the survey addressed the following aims. Two series of questions concerned context, i.e.,

- current ownership and use of private vehicles and people’s perspectives on public transport; and
- the extent of satisfaction with the land transport system and trends in traffic congestion.

Given this context three specific topics were probed:

- In the first instance the survey explored people’s willingness to pay for road use impacts. This question was based on the fact that road users have major impacts on society and the environment (e.g., air pollution, noise pollution, water pollution and habitat loss). It has been estimated that these impacts cost about $1.2 billion per year and are not covered directly by road users (Booz Allen Hamilton, 2005). Each vehicle’s share of these costs is around $600 per year.
- Second, the survey explored a range of methods of paying for these costs given that road users pay only a part of the full road building and maintenance, social and environmental costs they are causing were then examined. Some examples of what owners or operators pay directly have been estimated to be:
  - Trucks, 56% of costs,
  - Cars, 64% of costs, and
  - Buses, 68% of costs.
Some of the rest of the costs are paid by society, generally through taxes. Survey respondents were asked about the extent to which they would support or oppose a range of methods to address these costs.
- Finally, alternatives to broad policy tools and payment methods including the targeting of specific impacts or combinations thereof (e.g., reduced green house gas emissions and fewer and less severe accidents) were examined. Four main targeting options were identified and people were asked about their level of support for each option.
While some of the context questions contained simple yes/no categorical responses, most were built around 5-point Likert scales. These data were analysed descriptively and where appropriate cross-tabs were undertaken to explore relationships between responses to different questions and demographic influences.

In order to identify factors influencing levels of support for cost internalisation mechanisms, exploratory analysis has been undertaken using an ordered logit model. This model derives a linear function of parameters that generates a latent variable. Respondents are probabilistically allocated to classes of response according to the value taken by the latent variable and a series of estimated cut-off points for each response category (Greene, 2000).

3. Results

3.1. Transport context

A range of questions were asked to develop a picture about the use of cars and other forms of private and public transport to help explain responses to the more serious road user impact management issues. The survey results indicated that each household contained an average of 2.18 cars, vans or light trucks. This figure was then compared to the NZ Census result of 1.52; when adjusted to the classes used in the census then the 2.18 reduced to 1.73 per household, a roughly consistent figure and perhaps consistent with the overall bias of the survey in over representing those with higher incomes and other related characteristics. The reliance on this form of transport is further reinforced by the fact that over 95% of respondents reported at least one vehicle in their household.

Given that most people had cars or similar then the extent to which individuals also used other forms of land transport, e.g., bike or public transport, was also tested. As shown in Figure 2 a minority of respondents used bikes or public transport.

Figure 2. Use of alternatives to cars for transport
Given the expected relatively low level of public transport respondents were asked why people chose not to use public transport for work purposes if it was reasonably accessible (Figure 3). In this analysis some respondents were removed, e.g., they were retired or were working from home. However, despite this improvement it is clear that only two substantive reasons are given, i.e., timing and routing related issues, and the need to take children to school, which together amounted to 28% of responses. The remaining responses merely reflect peoples’ preferences for alternative options.

Figure 3. Reasons for not using public transport

Finally, peoples’ views of trends in traffic congestion (Figure 4) and the quality of the transport system (Figure 5) were investigated. Overall, most people considered traffic congestion to be getting worse nationally with no differences in perceptions based on a regional demographic analysis. However, respondents from Auckland/Northland were much more likely to express very negative views (P=0.000). The quality of the nation’s roading system was considered higher by South Island respondents (P=0.01), while respondents in Auckland/Northland had a much worse view of their region’s roads than did those in other regions (P=0.000). There was a similar pattern with respect to views about the national bus service system with Auckland/Northland respondents being significantly more negative in their views (P=0.000). Conversely, however, there was no significant difference between respondents’ views of their region’s bus system with most reporting it to be adequate to poor. Finally, perceptions of the rail system ranged from poor to very poor at both national and regional levels of analysis. For both of these analyses (P=0.006 and P=0.000 respectively) the Rest of the North Island had a more positive view than other New Zealanders with this response probably attributable to the urban rail transport system in Wellington City which is part of Greater Wellington Regional Council Region (see Figure 6: P=0.002 when comparing the two distributions).
Figure 4. Perceptions of national and regional changes in traffic congestion, by regional response

3.2 Willingness to pay for road use impacts

The following proposition was put to respondents: ‘Road users have major impacts on society and the environment, for example, air pollution, noise pollution, water pollution and habitat loss. It has been estimated that these impacts cost about $1.2 billion per year and are not covered directly by road users. If each vehicle was charged their full share of these costs then this would be around $600 per vehicle per year’. Respondents were then asked whether or not they agreed with the following: ‘The full costs of vehicle use, including social and environmental costs, should be paid for by vehicle owners’. Figure 7 shows the response which clearly illustrates most people would not be willing to pay the for their road user impacts.

Figure 5. Perceptions of the quality of roading, bus and rail systems, analysed by regional responses
Figure 6. The quality of New Zealand’s rail system vs the quality of my region’s rail system for Wellington Regional Council region respondents

![Graph showing quality comparison]

Figure 7. Willingness to pay the full costs of road user impacts

![Graph showing willingness to pay]

A comparison of public transport use (dichotomous) versus willingness to pay was then undertaken (Figure 8). There was a slight, but significant tendency for those who use public transport for travel to work to be also less unwilling to pay the full costs of their road use impacts (P=0.02).
3.3. Options for paying for impacts

Despite the not surprising negative response to the willingness to pay question a further question was asked about methods of paying for this damage (Figure 9). The question posed was: ‘Suppose it had been decided that vehicle owners must pay full costs of road use including all of the environmental and social costs. Please indicate your views about the following payment methods. Note that ALL revenue collected would be used specifically for road building and maintenance and meeting environmental and social costs from road use’. Five options were given which could be assessed on a five point Likert scale anchored by Strongly support (1) and Strongly oppose (5). Almost all options were either opposed or strongly opposed although there was reasonable support for the introduction of road user charges for all vehicles; conversely higher fuel taxes were strongly opposed. Ranked mean Likert scores, from most opposed to most supported of the options were:

- Higher fuel taxes 3.8
- Higher registration fees 3.6
- Higher passenger fares or freight charges 3.4
- Increase road user charges for existing users 3.4
- Introduction of road user charges for all vehicles 3.2
3.4 Targeting impacts

Perhaps the most difficult of the questions addressed the targeting of specific impacts or combinations of impacts. Respondents were given some factual material about major social and environmental issues, e.g., that 40% of New Zealand’s greenhouse gas emissions come from road transport. The following table (Table 2) was then presented which incorporated an evaluation of some of the benefits and costs of four options for reducing these impacts.

Table 2. Transport effect mitigation options and evaluation of likely benefits

<table>
<thead>
<tr>
<th>Likely effects of implementing each option:</th>
<th>Option 1: New and/or increased road user charges, based on distance travelled and size of vehicle</th>
<th>Option 2: Open road speed limit reduction from 100 to 90 kph</th>
<th>Option 3: Fuel use efficiency standards for new cars</th>
<th>Option 4: Exhaust gas quality standards for all cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Green House Gas emissions</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Less other pollutants</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fewer and less severe accidents</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Reduced vehicle running costs</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
</tbody>
</table>
Respondents were then told asked ‘based on the above what do you think about each of the four options?’ These options are presented below in terms of their ranked level of support, as expressed by mean Likert scores, from most to least supported:

- Fuel use efficiency standards for new cars 1.7
- Exhaust gas standards for all cars 1.9
- Speed reduction 2.7
- Road user charges 2.9

As also shown in Figure 10, options (3) and (4) were strongly supported (P<0.000). What is perhaps most notable is that the two options that either (a) are considered to be least effective; and/or (b) would apply to only a relative small proportion of the vehicle fleet are the two most highly supported.

Figure 10. Options for targeting specific impacts or combinations of impacts

Factors influencing responses to these questions were analysed using ordered logit models (Table 3). Support for options 1 and 2 appear to be influenced by different factors than support for options 3 and 4. For example, females and public transport users were more supportive of both options 1 and 2, but there factors did not influence support for options 3 and 4. People from households that owned large numbers of vehicles supported options 3 and 4 at lower levels than households with fewer vehicles. One effect common to all options was that people born in New Zealand are less supportive of each option than respondents who were born abroad.
Table 3. Influences on support for mitigation options

<table>
<thead>
<tr>
<th>Option 1:</th>
<th>Option 2:</th>
<th>Option 3:</th>
<th>Option 4:</th>
</tr>
</thead>
<tbody>
<tr>
<td>New and/or increased road user charges, based on distance travelled and size of vehicle</td>
<td>Open road speed limit reduction from 100 to 90 kph</td>
<td>Fuel use efficiency standards for new cars</td>
<td>Exhaust gas quality standards for all cars</td>
</tr>
</tbody>
</table>

More supportive
- Females*
- Bike riders**
- Public transport user**
- Degree****

Female****
- Age**
- Degree**

Age****
- Bike riders***

Less supportive
- Born in NZ**
- Other ethnicities**
- Wealthy***
- Other ethnicities**

Born in NZ****
- Wealthy****
- Other ethnicities**

Number of vehicles owned **
- Born in NZ***
- Wealthy*
- Maori***
- Pacific**
- Asian***

Number of vehicles owned***
- Born in NZ**
- Pacific***
- Asian*

KEY: *: P<0.1; **: P<0.05; ***: P<0.01; ****: P<0.001

Ethnic categories used were: Maori, NZ European, Pacific Island, Asian, Other

4. Discussion and policy conclusions

New Zealanders judge that their roads, bus and rail services are adequate to poor quality. There is a widespread perception that traffic congestion is increasing in New Zealand, but more especially in the Auckland region. However, most people judge that there are few viable alternatives to use of their car for commuting to work. However, despite this problematic context New Zealanders are not willing to pay the full costs (i.e., including the social and environmental costs) of transport. Such a situation places policy makers in a difficult situation – they face the prospect of having to deal with social and environmental problems with an unwilling group of stakeholders. In such situations what can policy makers do to progress what is increasingly being referred to as a ‘wicked’ problem (see Bardwell 1991)?

The first major analysis in this paper explored generalised approaches to willingness to pay for land transport social and environmental and other related problems. A clear majority were opposed to paying directly for the problem (i.e., at around $600 per vehicle per year; see Figure 7). However, there was slightly more support when five payment methods were assessed (although it should be noted that higher fuel taxes were especially strongly opposed. Given then that overall WTP was low and that support for individual payment methods was in general only slightly higher, it was also important to assess how integrated and targeted responses to the range of externalities might be perceived.

In order to assess targeted options respondents were provided with some background factual information about the real environmental, social and economic costs of running vehicles. They were then provided with four options and an evaluation of how each of these would benefit or not aspects of environmental, social and economic performance. Overall, there was a much higher level of respondent support for these
options than those considered in the generalised payment methods approach, i.e.,
targeting is a better policy prospect. Analysis showed however (Figure 10) that
options 3 and 4 (fuel use efficiency standards and exhaust gas quality standards
respectively) received much higher levels of support. Notable from further analysis
here was that female respondents were more likely to support road user charges
(option 1) and speed reduction (option 2), the latter perhaps consistent with generally
held perceptions that women are safer drivers (which is also reflected in lower
insurance premiums for this group). Both these options were considered in the
background information to lead to ‘fewer and less severe accidents’. Again, from a
policy and marketing perspective it might be possible use this information in
designing a robust public discussion on policy directions in these areas. For example
using the facts that women are safer drivers, women support these options and men
need to catch up might be a strategy that could be sold to decision markers.

Overall then this research indicates the benefit of designing perceptions surveys
around complex and ‘wicked’ problem areas. Detailed analysis allows policy makers
an insight to the structure of the demographics of acceptability thus making targeted
policy discussions more likely to positive. Further work is nevertheless necessary in
these areas and will be undertaken with the considerable data set that is now available.

REFERENCES

Bardwell, L.V. 1991. Problem-framing: a perspective on environmental problem-

Booz Allen Hamilton. 2005. Surface Transport Costs and Charges Study: Main

Fisher, G.W. et al. 2002. Health effects due to motor vehicle air pollution in New

Saddle River, New Jersey.

Hughey, K.F.D., Kerr, G.N. Cullen, R. 2004a. Public Perceptions of New Zealand's

Hughey, K.F.D., Cullen, R., Kerr, G.N. Cook, A. 2004b. Use of the Pressure-State-
Response model to explore peoples’ perceptions of the State of the Environment in

Land Transport NZ. 2005. Post Election briefing for the incoming Minister of
Transport. Land Transport NZ, Wellington.

May, A.D., Kelly, C., Shepherd, S. 2006. The principles of integration in urban


