TOURISM BENEFITS FROM SEALING UNSEALED ROADS: PERCEPTIONS OF DISCOMFORT & RISK

Transfund New Zealand Research Report No. 81

TOURISM BENEFITS FROM SEALING UNSEALED ROADS:
PERCEPTIONS OF DISCOMFORT & RISK

SYMONDS TRAVERS MORGAN (NZ) LTD
in association with McDERMOTT MILLER LTD
Wellington, New Zealand

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PO Box 2331, Lambton Quay, Wellington,New Zealand
Telephone (04) 473-0220; Facsimile (04) 499-0733

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EXECUTIVE SUMMARY

1. The Project

A research project was undertaken in 1994 to investigate motorists' perceptions of discomfort and risk factors associated with travelling on unsealed roads in New Zealand. The investigations particularly addressed the extent to which these factors were not included in the evaluation procedures used in the Transit New Zealand 1991 Project Evaluation Manual.

2. Methodology

The project involved:

- A review of international literature on motorists' perceptions of unsealed roads and on the perceived benefits to motorists of sealing such roads.
- Focus-group discussions with international tourists and domestic travellers to explore their perceptions of unsealed roads in New Zealand.
- Roadside surveys on sections of three unsealed roads, to investigate motorists' perceptions about these roads and their valuations of the benefits to them of having these roads sealed. These surveys involved a total of 226 interviews with drivers, taken on the Queenstown-Glenorchy road, the Crown Range road (SH89) and the Waipoua Forest road (SH12). The surveys involved the use of the "willingness to pay" approach, based on motorists providing estimates of how much they would be willing to pay (through a toll) to travel on a sealed road which was otherwise identical to the unsealed road surveyed.
- A survey to investigate the valuations that motorists place on the four main characteristics of unsealed roads (i.e. roughness, grip, dust, loose stones). This involved computer-assisted interviews with passengers on the Interislander Ferry (which operates between the North and South Islands of New Zealand).

3. The Principal Findings

The key finding is that motorists place substantial values on the discomfort and risk factors associated with the use of unsealed roads (compared to sealed roads). These factors are not reflected in the 1991 project evaluation procedures of Transit New Zealand.

Motorists' valuations of these factors increase less than linearly with the length of unsealed road involved. For a typical unsealed road, average valuations of these factors (in 1994 NZ$) range from about $2.20 for a 10 kilometre length (i.e. 22¢/vehicle kilometre) to about $5.50 for a 60 kilometre length (i.e. 9¢/vehicle kilometre).

Motorists' attitudes to and valuations of the discomfort/risk factors associated with unsealed roads showed a considerable variation. (The limited sample sizes used however reduced the statistical significance of results by market segment.) Findings included:

- A substantial minority of motorists (about 20% overall) preferred the road to be unsealed (they associated unsealed roads with a sense of adventure and enhanced wilderness experience).
- Valuations of the discomfort/risk factors tended to increase with age and income.
- The valuations of New Zealand motorists and motorists from overseas were not significantly different.

Of the four main discomfort/risk characteristics of unsealed roads, motorists tended to place the highest value on reducing roughness and increasing grip or traction, followed by reducing dust, and reducing loose stones was given the lowest value.

The valuations noted above for the discomfort/risk benefits from sealing typical unsealed roads are equivalent to around $5 to $10 per vehicle hour. Thus these benefits may be regarded as equivalent to increasing the unit value of time savings for sealed roads used in the Transit New Zealand Project Evaluation Manual (about $20/vehicle hour) by around 25-50% for unsealed roads.

4. Implications for Evaluation of Road Sealing Projects

Typical road sealing projects evaluated in the early 1990s using the Transit New Zealand Project Evaluation Manual procedures have shown total user benefits (time, operating cost and accident savings) of around 20-30¢/vehicle kilometre. The additional benefits, which this research indicates should be included for changes in discomfort/risk associated with road sealing, would add about 30%-100% to these present estimates. The project benefit/cost ratios would increase in broadly the same proportion. Such a change would result in a higher benefit/cost ranking of road sealing projects relative to other types of projects than is made at present.

The non-linearity in the valuation of discomfort/risk factors also has significant implications for sealing project and programme selection. It indicates that higher benefits are likely to be achieved by sealing the whole of one route over a relatively short period, then progressing to the next route, rather than spreading the funds around more thinly, as tends to happen at present.

5. Recommendations

The principal recommendations arising from this research are as follows:

- Modify the procedures in the Transit New Zealand 1991 Project Evaluation Manual to incorporate an allowance for the discomfort/risk benefits of sealing unsealed roads. The benefits per vehicle kilometre could appropriately be expressed as a decreasing function of the length of unsealed road. The benefit function would be based on unsealed roads in typical conditions, and would not be sensitive to differences in these conditions (such as roughness, dust, etc.).
- Undertake further research to quantify an improved discomfort/risk benefit of road sealing by further research. This research should focus on:

- Verifying the magnitude of the discomfort/risk benefit function and ensuring that it does not involve double-counting with other benefit components;
- Verifying the relationship between the level of benefits and the length of unsealed road;
- Further exploring the sensitivity of valuations to the range of conditions found on unsealed roads, for the key factors of roughness, grip, loose stones and dust.

ABSTRACT

A research project was undertaken in 1994 to investigate motorists' perceptions of discomfort and risk factors associated with using unsealed roads in New Zealand. The investigations particularly addressed the extent to which these factors were not included in the evaluation procedures used in the Transit New Zealand 1991 Project Evaluation Manual.

The project involved: a review of international literature on motorists' perceptions of the benefits of sealing unsealed roads; focus-group discussions with international tourists and domestic travellers to explore their perceptions of unsealed roads; roadside surveys on three unsealed roads, using a "willingness to pay" approach to assess motorists' valuations of the benefits of sealing these routes; and a survey to assess motorists' valuations of the four characteristics of unsealed road surfaces, of roughness, grip, dust, loose stones.

The surveys found that motorists place substantial values on the discomfort and risk factors associated with the use of unsealed roads (compared to sealed roads). These factors are not incorporated in the current evaluation procedures. The average values found were equivalent to increasing the unit value of travel time savings by 25-50% for unsealed roads relative to sealed roads. Incorporatng an allowance for the discomfort and risk factors in project evaluations would increase the benefits for typical road sealing projects by between 30% and 100%.

Recommendations are made to modify the project evaluation procedures and to better quantify the discomfort and risk factors of road sealing with further research.

1. INTRODUCTION

1.1 This Report

A research project was undertaken in 1994, for the then Transit New Zealand in association with the New Zealand Ministry of Tourism, to investigate motorists' perceptions of discomfort and risk factors associated with travelling on unsealed roads.

The project was undertaken by Symonds Travers Morgan (NZ) Ltd, transport planning consultants, working in association with McDermott Miller Ltd as market research consultants.

1.2 Project Objectives and Scope

The overall objective of the project was:

> *... to undertake a survey of road user perceptions of discomfort and risk factors associated with unsealed roads (by comparison with sealed roads).*

Specific points which amplified this objective and guided the scope of work required were as follows:

- The project was to particularly address the extent to which the discomfort and risk factors identified were not included in the values of time and accident savings given in the 1991 Transit New Zealand Project Evaluation Manual (PEM)[1].
- The project was to cover the perceptions of both international tourists and domestic travellers (whether on trips for tourist, recreation or other purposes), as well as the ways in which the condition of the road system may influence tourist behaviour.
- A general investigation of the discomfort and risk factors was required, rather than an investigation into perceptions of specific routes. Unsealed routes used mainly by tourists (domestic and international) and unsealed routes used principally for local domestic travel were to be included in the investigation.

1.3 Discomfort and Risk Factors For Investigation

The extent to which any (dis)comfort and risk factors associated with travel on unsealed roads were already included in the PEM methodology was to be assessed, and those factors not already included in PEM were to be separated out and, where possible, valued.

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[1] Transit New Zealand. 1991. *Project evaluation manual. Volume 1: Simplified procedures. Volume 2: Full procedures.* Transit New Zealand, Wellington, New Zealand.

The 1991 PEM methods allow (in principle) for changes in the following user cost components resulting from sealing an unsealed road:

- Travel time – extent of time savings multiplied by a standard unit value of time savings. (No allowance is made for any differences in values of time between sealed and unsealed roads, related to different comfort levels or other factors.)
- Vehicle operating costs – all operating cost changes (but with no specific allowance for differences in operating cost between an unsealed road and a sealed road of similar roughness).
- Accident costs – allowing for any differences in estimated accident numbers and severity between the unsealed and the sealed roads.

However, the 1991 PEM methods do **not** allow for:

- Any perceived differences in motorists' unit valuation of travel time savings between sealed and unsealed roads (related to comfort differences).
- Any motorists' perceptions of differences in risk between sealed and unsealed roads (other than those reflected in the actual accident statistics).

The project therefore focused on these two latter factors because they are not allowed for in the PEM. The approach adopted in the project surveys was to "standardise" for the factors already included in the PEM, in order to isolate the additional aspects of road user perceptions which are not included.

1.4 Report Structure

The remainder of the report is structured as follows:

- Section 2 – summarises the literature review and focus-group discussions undertaken initially, and the pilot surveys for the quantitative market research.
- Section 3 – presents the results from the first roadside survey of motorists on three lengths of unsealed road.
- Section 4 – presents the results of the second disaggregate (conjoint) analysis survey of motorists' attitudes to specific features of unsealed roads.
- Section 5 – draws conclusions from the overall project and outlines their implications for the evaluation of road sealing projects in general.

The appendixes to this report provide further details on the literature review, the focus-group discussions, the pilot survey and the main quantitative surveys.

1.5 Price Units

All costs and prices given in this report are in NZ dollars, at 1994 prices, unless otherwise noted.

2. INITIAL RESEARCH

2.1 Overview

The principal project tasks leading up to the main quantitative surveys were:

- A review of relevant international literature on motorists' perceptions of unsealed roads and the perceived benefits of sealing such roads.
- Focus-group discussions to explore, in depth, the perceptions of unsealed roads held by domestic travellers and international tourists.
- Survey design and piloting, to prepare for the two main quantitative surveys (described in Sections 3 and 4 of this report).

2.2 Literature Review

A review of international literature on motorists' perceptions of unsealed roads and on the perceived benefits (to tourists and others) of sealing unsealed roads was undertaken. Appendix 1 provides brief reviews of nine international reports/papers, some of which were identified in an earlier study for the Ministry of Tourism (Institute of Transport Studies 1992).

The review found that:

- The amount of relevant literature available is very limited.
- In particular, almost no information is available on the valuation of the discomfort and risk factors associated with unsealed roads.

The main findings of interest from the literature review are as follows:

- Road surface condition is rated a relatively important characteristic of the road system by motorists. Motorists are prepared to travel substantial additional distances to avoid rough and/or unsealed roads.
- Evidence on the effects of road sealing on traffic volumes indicates that the benefits from sealing roads are rated highly by motorists.
- Values of travel time savings by tourist travellers may, irrespective of the road condition, differ considerably from the average values for all motorists (which are incorporated in PEM). They will generally be lower for the first few hours of travel per day and, in scenic conditions, may be negative.
- Values of comfort and dust reduction benefits to motorists from sealing unsealed roads were estimated in one Australian study (Commonwealth Bureau of Roads 1974). However these values appear low and are open to doubt.

- Safety is perceived as a major issue by tourists using unsealed roads. Conventional valuations based on cost savings for reported accidents are likely to under-estimate the tourist valuations in such cases.

2.3 Focus-Group Discussions

An initial exploration into the perceptions of unsealed roads held by domestic travellers and international tourists was undertaken during November 1993 through two focus-group discussions. One group was held in Martinborough (North Island) of domestic travellers who used unsealed roads for local trips; the other was held on the north-bound Interislander ferry (operating between the North and South Islands) of international and domestic tourists who had recently driven on unsealed roads in New Zealand. A full description of the focus-group findings is given in Appendix 2.

Each group discussion involved informal semi-structured discussion to investigate views and experiences of unsealed roads in New Zealand, to identify relevant unsealed road attributes and perceptions of them, and to test understanding of terminology. The discussion programme explored both techniques for elucidating perceptions, and for explaining these perceptions themselves.

General perceptions of unsealed roads in New Zealand were variable, though generally negative. The views of international tourists, particularly, appeared to depend on whether they had experienced unsealed roads in other countries. New Zealand unsealed roads were not perceived to be worse than those found overseas, but they created most concern for those drivers who had never encountered unsealed roads before.

The features of unsealed roads foremost in motorists' minds related to safety. These included many aspects that do not involve surface quality, such as road width, bends, blind corners and bad drivers. Those features most relevant to this project related to roughness (e.g. potholes), lack of surface grip (e.g. winter mud), loose stones and dust.

Many variables may impact on the level of comfort and risk associated with the quality of road surface. Examples recognised included the vehicle (e.g. size/weight and tyre condition), the weather conditions, traffic levels, and the roadside vegetation.

The two discussion groups ranked the principal road surface attributes slightly differently. For domestic travellers the ranking (in descending order of importance) was:

1: degree of grip
2: amount of loose stones
3: roughness of road surface
4: level of dust generated

For the tourists the ranking was:

1: roughness of road surface
2: degree of grip
3: amount of loose stones
4. level of dust generated

Safety was the prime consideration for both groups: however, for the tourists roughness of road surface was perceived to be more strongly related to safety, while the domestic travellers perceived the degree of grip to be more strongly related to safety.

2.4 Pilot Surveys

Following a review of the findings from the literature review and the focus-group discussions, it was confirmed that the main quantitative surveys should focus on quantifying and, where possible, valuing the discomfort and risk factors associated with unsealed roads and hence the user benefits from sealing such roads, additional to the factors already included in PEM. The main task would be to quantify and value these discomfort/risk factors together. In addition, a further advantage would be gained if the overall benefits of road sealing could be disaggregated into the component benefits associated with the individual factors (of dust, ride roughness, grip, and loose stones).

These were challenging requirements, particularly the separation of those factors already included in PEM from other discomfort/risk factors. For instance, the "objective" risks of using unsealed roads (as reflected in the PEM accident analysis) would need to be separated in respondents' minds from the remaining stress factors induced by fear of accident or damage.

The general approach determined to meet these requirements was to specify several scenarios for respondents to consider, in each of which travel time, operating costs and accident rates were identical: respondents could then focus on the remaining comfort and risk factors, which differed between scenarios.

The scenarios that were presented required respondents to make trade-offs between the features of an unsealed road (either individually or together) and money. The respondents were asked to value these discomfort/risk features (relative to their values on a smooth sealed road), by ascertaining their willingness to pay a toll for use of the sealed road in preference to the unsealed road.

Two approaches to applying this "contingent valuation" methodology were investigated in the pilot survey:

1. Specific route valuation - survey of people who had just travelled on a specific unsealed road (Mt Holdsworth, Wairarapa), to ascertain their valuations of a similar sealed alternative.

2. Full scenario valuation - survey in which respondents were asked to imagine both the unsealed and sealed routes, and were given information (through descriptions, pictures, etc.) on other aspects of the scenarios.

The pilot survey also investigated the use of a "conjoint analysis" methodology to determine the valuation that motorists placed on the main individual features of unsealed roads (i.e. roughness, grip, dust, loose stones). The method again used hypothetical situations, asking respondents to make trade-offs between roads with different levels of each feature and price.

The pilot survey methodology and results are described in full in Appendix 3 of this report. Based on the pilot survey findings, it was determined that the main surveys should involve:

- Specific route (aggregate) valuations, using the contingent valuation method, at three roadside sites. This survey is described in Section 3.
- Disaggregate valuation, based on conjoint analysis methods, through interviews with passengers on the Interislander ferry. This survey is described in Section 4.

3. SPECIFIC ROUTE (AGGREGATE) SURVEY

3.1 Survey Overview

The overall objective of both the roadside (aggregate) survey on specific routes and the conjoint (disaggregate) survey was to assess, in monetary terms, the perceived value to motorists of reduced discomfort and risk resulting from the sealing of unsealed roads.

The focus of the specific route survey was the contingent valuation by motor vehicle drivers of the disbenefits of unsealed roads relative to sealed roads, by comparison with a scenario involving a toll payment on the sealed road. The survey used an interactive questionnaire administered by interviewers to 226 vehicle drivers stopped after they had travelled on long stretches of unsealed road in three tourist areas of New Zealand.

The survey attempted to eliminate from the valuation those factors which are already incorporated in the PEM procedures by including the following hypothetical conditions in the contingent valuation scenario described to respondents: that both roads "take the same time" and that "fuel consumption, operating costs, and the chances of having an accident are also identical". Assuming that respondents fully appreciated the implications of these conditions, the valuations measured in this survey represent an aggregation of discomfort and risk factors which are not accounted for in the PEM (1991).

The valuation of risk factors was not separated from that of discomfort factors, as the two are closely related. While the objective measure of risk in PEM accounts for costs associated with actual accidents, the approach here has focused on costs associated with the psychological stress of perceived risk, which may be regarded as a form of discomfort.

The questionnaire used in the survey is given in Appendix 4.

3.2 Survey Sites

Field work for the main survey was carried out in the period 18 - 20 March 1994, at roadside locations on the following three roads:

- the Queenstown-Glenorchy road, Central Otago (63 km unsealed length)
- the Crown Range road (SH89), Central Otago (29 km unsealed length)
- the Waipoua Kauri Forest road (SH12), Northland (10 km unsealed length).

These sites were chosen because of the length of unsealed road, convenient interviewing areas, and relatively high tourist traffic levels. The three roads have high

scenic attraction, ranging from sweeping mountain views on the Crown Range, to lake vistas en route to Glenorchy, to New Zealand kauri forest at Waipoua. The greatest physical difference between the three roads is the length of unsealed road surface, ranging between 10 km and 63 km.

The weather was very wet for the first half of the survey period at the two Otago sites, and this may have reduced tourist traffic on the roads. Rain showers also fell for a short time during the survey at Waipoua, and hence at all sites dust levels were relatively low.

In other respects, the stretches of road concerned may be regarded as fairly typical of unsealed sections of New Zealand's main road network (i.e. moderately rough, with reasonably good grip).

Traffic levels were perceived as generally light, increasing to moderate at times on the Crown Range and Waipoua roads.

Interviews were with vehicle drivers, immediately after they had traversed the unsealed section of route. High response rates were obtained, with very few refusals. (At Glenorchy most vehicle drivers entering the town participated in the survey; while at the Crown Range site, only one third of all vehicles using the road were involved.)

3.3 Respondent Demographics

In total 226 interviews were completed: 68 at Glenorchy, 69 on the Crown Range, and 89 in the Waipoua Forest. Information on sample demographics and other variables of interest was obtained, and full tables describing these results are given in Appendix 5 of this report.

The most notable patterns evident in the sample characteristics were:

- **Sex** (Table A5.1). Only 20% of drivers in the overall sample were female (the proportion at Waipoua was slightly higher at 25%).
- **Age** (Table A5.1). 76% of the sample were aged between 25 and 59 years: no pronounced differences in the age profiles were observed at the three survey sites.
- **Trip purpose** (Table A5.3). On the Glenorchy road the majority (71%) of drivers were travelling for *leisure/recreation* purposes, while on the Crown Range and Waipoua routes, the largest single purpose was *touring* (54% and 61% respectively). This difference probably reflects the "dead end" nature of the Queenstown-Glenorchy route.
- **Origins - New Zealanders** (Table A5.4). Most (60%) of respondents at all sites were New Zealanders: 39% of the total sample were city or town-based New Zealanders and 21% from rural areas.

- **Origins - international visitors** (Table A5.4). The pattern of origin countries for international visitors was relatively constant between sites, with around 20% of all respondents being Australians and 10% each being North Americans and Europeans. A somewhat greater proportion of Australians were interviewed at Waipoua and more Europeans on the other roads. Few Asians were observed on the roads at all and even fewer were driving vehicles: only two respondents in the entire survey (interviewed on the Crown Range) were from Asia.

- **Unsealed road experience - New Zealanders** (Tables A5.5, A5.6). 76% of New Zealanders had *very limited* or *no* experience of unsealed roads abroad, while experience of unsealed roads in this country was described as *substantial* by 53% of urban New Zealanders and 90% of rural New Zealanders.

- **Unsealed road experience - international visitors** (Tables A5.5, A5.6). Of the international visitors, 47% had *no* or *very limited* experience of unsealed roads abroad, while only 41% had very limited unsealed road experience in New Zealand. For 18%, New Zealand had provided their first exposure to unsealed roads.

- **Pace of driving** (Tables A5.7, A5.8). 50% of all respondents preferred to drive at a *moderate* pace on New Zealand unsealed roads, 39% at a *sedate* or *leisurely pace* and 11% *as fast as possible*. Half of the fast drivers were rural New Zealanders; while half of the relatively small number on business or commuting trips (18 drivers or 8% of the total) preferred to drive as fast as possible.

- **Driving pace v age** (Table A5.9). A slightly higher proportion (45%) of the over 40 year olds surveyed compared to the overall sample (39%) preferred to drive at a *sedate pace* on New Zealand unsealed roads; while more of the under 40s (18%) preferred a *fast pace* than did the full sample (11%).

- **Vehicle type** (Table A5.10). Medium sized cars (42%), dominated. There was little relation between vehicle type and origin, income or driver age. Drivers of 4WDs showed a slight tendency to prefer a *fast pace*, however.

- **Trip length** (Table A5.11). Respondents were asked what was the length of their trip "so far today", as a measure of driver fatigue. Overall, 27% of respondents had been travelling for less than one hour (Crown Range 39%, Glenorchy 28%, Waipoua 17%); while 26% or respondents had been travelling for 3 hours or more before the interview (Crown Range 18%, Glenorchy 9%, Waipoua 47%).

- **Passengers** (Table A5.12). 17% of drivers were travelling alone, 45% were travelling with one other person and the remaining 38% with two or more people. The average group size for New Zealanders was higher, at 2.89 people (including the driver) than that for international visitors (2.36 people).

3.4 Rating of Unsealed Roads

3.4.1 Rated Attributes

The key attributes of road surfaces affecting perceptions of discomfort and risk for users, as identified in the qualitative stage of the research (Section 2.3), were:

- degree of grip provided by the surface
- amount of loose stones lying on the surface
- roughness of the road surface
- level of dust generated

Respondents were first asked to rate how important these four attributes were to them as drivers for unsealed road surfaces in general. They were then asked to indicate how well they regarded the section of unsealed road they had just used in relation to these attributes.

3.4.2 Importance of Attributes

The average importance rating for each attribute for the three survey sites (individually and in total) is illustrated in Figure 3.1. Good grip was clearly considered to be the most important surface feature. It was consistently rated between *very important* and *essential* across all sites. Surfaces that are not rough was the next most important attribute for all, except that Waipoua drivers rated no loose stones marginally higher. *Little dust* was thought to be *important* overall but less so for Glenorchy drivers than for drivers on the other roads.

3.4.3 Performance against Attributes

Respondents' assessments of the performance of the unsealed roads they had just used are summarised in Figure 3.2.

The ratings for the amount of dust were *good* to *very good*. This clearly reflects that any dust on the roads had been dampened by the recent rain.

The amount of grip and loose stones were both seen as *adequate* by respondents at all sites. Roughness appeared to be a problem on the Glenorchy road, however, with an average rating close to *poor*.

3.4.4 Comparison of Performance against Importance

Comparisons between the performance of the roads at the surveyed sites (averaged over the three sites) on each attribute and the perceived importance of the attributes are illustrated in Figure 3.3. This figure shows that, for the three sites together, the road surfaces performed best on the attribute that was rated least important (dust), and worst on the attribute that was rated second highest in importance (roughness).

As importance ratings may be influenced by recent driving experience, the low rating for dust has probably been affected by the wet weather before and/or during the survey. A seasonal pattern could well be possible therefore in driver expectations and judgements of road surface performance.

Figure 3.1 Average rating of importance of road surface attributes.

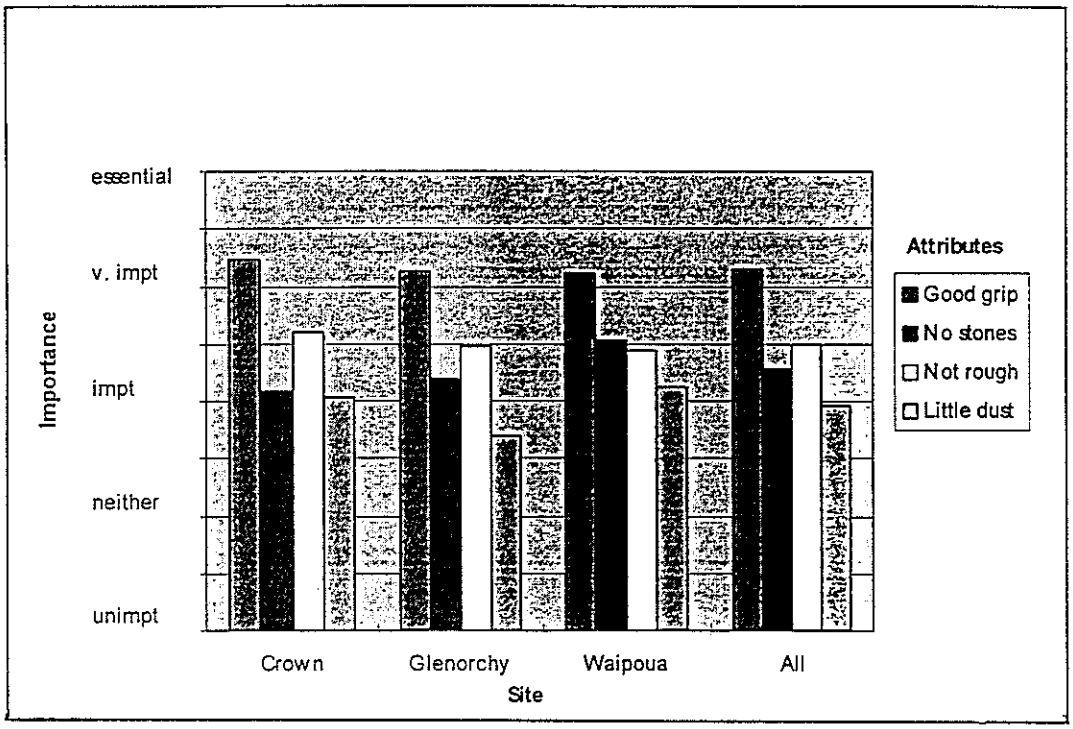


Figure 3.2 Average rating of performance of road surface attributes.

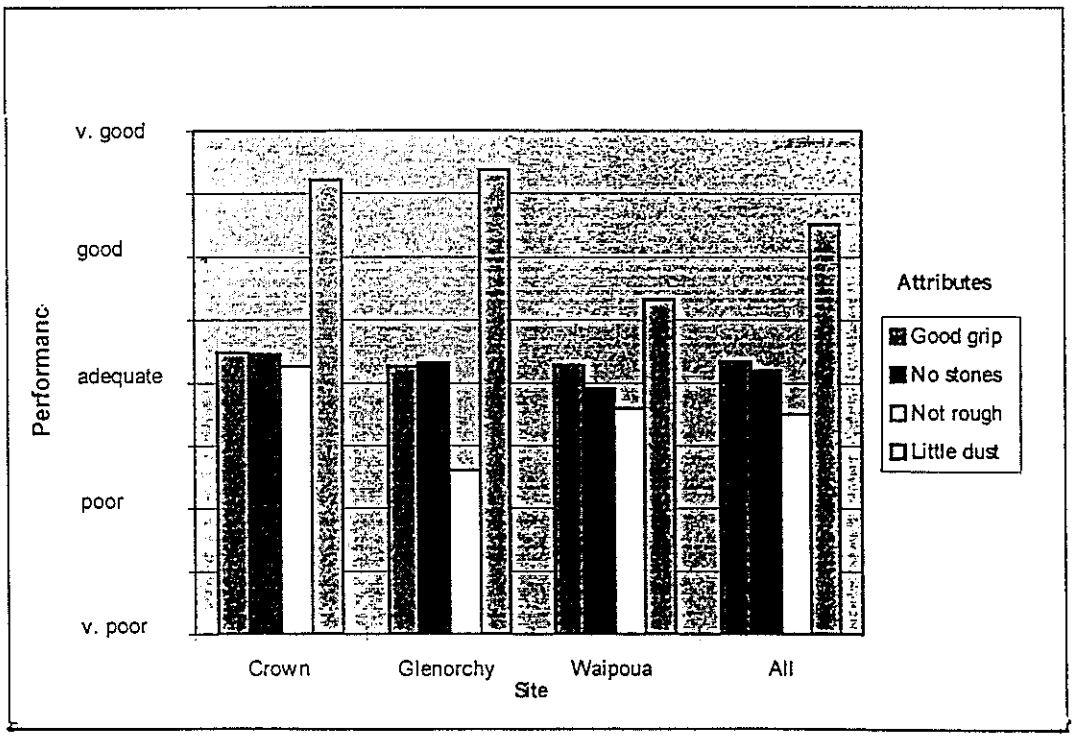
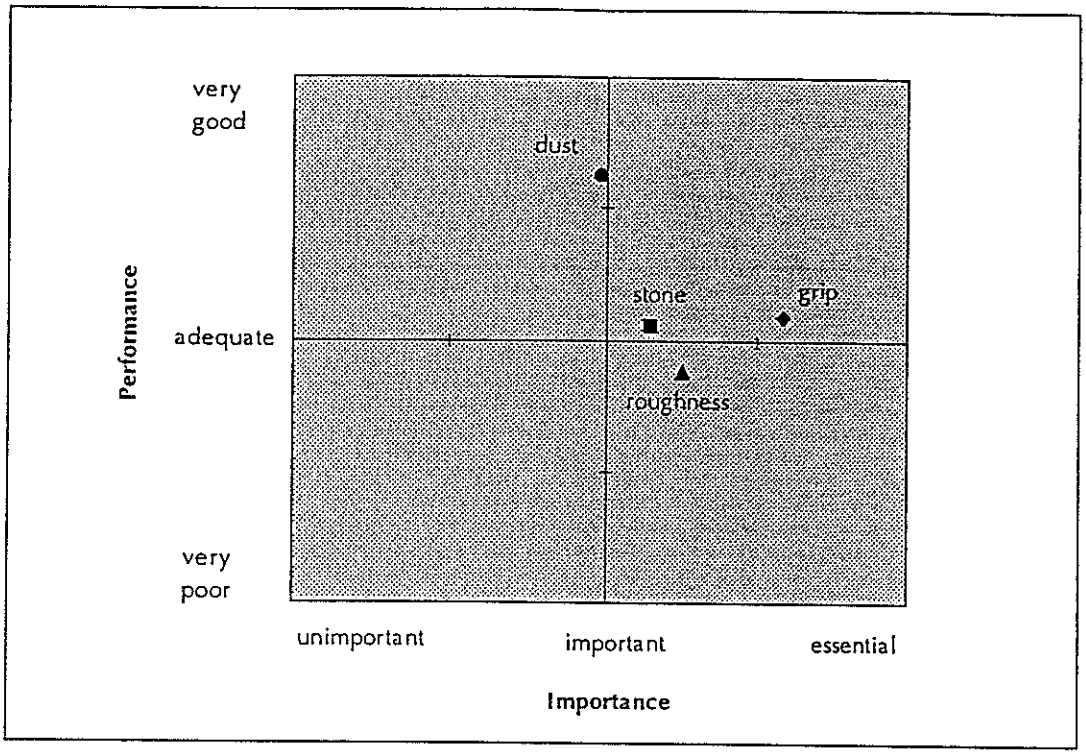


Figure 3.3 Road surface attributes: comparison of performance against importance for all sites.



3.5 Valuation Results

3.5.1 Valuation Approach

Measurement of the discomfort and risk benefits associated with road sealing was made using the contingent valuation approach (refer Section 2.4). Road users were asked about their willingness to pay to avoid an unsealed road surface and, hence by implication, their valuation of the benefits of road sealing.

Respondents were presented with a hypothetical situation in which they had to choose between the road they had just used and an imaginary alternative, identical in every way except that it was sealed. It was specified that this alternative would take the same travel time, have the same fuel consumption/vehicle operating costs, and involve the same chance of having an accident. A toll charge was then added for the preferred road and the question repeated, initiating a process of iterative questioning with the interviewer increasing or decreasing the toll until the maximum acceptable level was found (i.e. above this level the respondent would select the road that was not their first preference rather than pay the toll).

This route-specific approach was used in preference to one based on purely theoretical road scenarios described by the interviewer, because it increased realism and consistency. With the route-specific approach the driving experience was fresh in respondents' minds. Further external variables such as weather, traffic, scenery, hilliness/bendiness, and road width were constant for all respondents at each site.

3.5.2 Key Results

The principal dimensions of variation for the valuation results are the road to which the decision related and the choice of road surface to which the toll applied. The results are summarised in Table 3.1 and full tables are contained in Appendix 6 in this report.

Key findings include:

- Most (80%) respondents preferred the sealed alternative and were prepared to pay a maximum toll of $6.08 on average to avoid the unsealed surface. This represents an average of $0.27/km.
- Overall, 44 drivers, or about 20% of the sample, indicated preference for an unsealed surface, and were willing to pay an average of $4.48 ($0.28/km) for this. These drivers made up a substantial proportion (36%) of those surveyed on the Waipoua Forest road but a lower proportion at the Otago sites (around 9%). Reasons for the unsealed surface being preferred generally related to the scenic beauty, sense of adventure and enhanced wilderness experience that this gave. Some respondents at the Glenorchy site commented that they had chosen the trip specifically for the road.

Table 3.1. Maximum tolls by site and road choice.

Choice	Data	Crown	Glenorchy	Waipoua	Results
Sealed	Average toll	$5.64	$7.35	$5.23	$6.08
	Std deviation	$5.33	$4.93	$4.24	$4.93
	Average toll/km	$0.19	$0.12	$0.52	$0.27
	No. of respondents	62	60	57	179
Unsealed	Average toll	–$.86	–$12.00	–$3.22	–$4.48
	Std deviation	$6.99	$5.70	$4.09	$5.45
	Average toll/km	–$0.17	–$0.19	–$0.32	–$0.28
	No. of respondents	7	5	32	44
Either	Average toll	n/a	$0.00	n/a	$0.00
	Std deviation	n/a	$0.00	n/a	$0.00
	Average toll/km	n/a	$0.00	n/a	$0.00
	No. of respondents	0	3	0	3
Total	Average toll	$4.57	$5.60	$2.19	$3.94
	Std deviation	$6.32	$7.11	$5.82	$6.52
	Average toll/km	$0.16	$0.09	$0.22	$0.16
	No. of respondents	69	68	89	226

- For the surveyed sample overall, the net preference for a sealed surface is valued at a net $3.94 on average (taking the preferences of those who prefer an unsealed surface as having negative values). This equates to $0.16/km.

Valuation v road length

Figure 3.4 Sealed preference

Figure 3.5 Unsealed preference

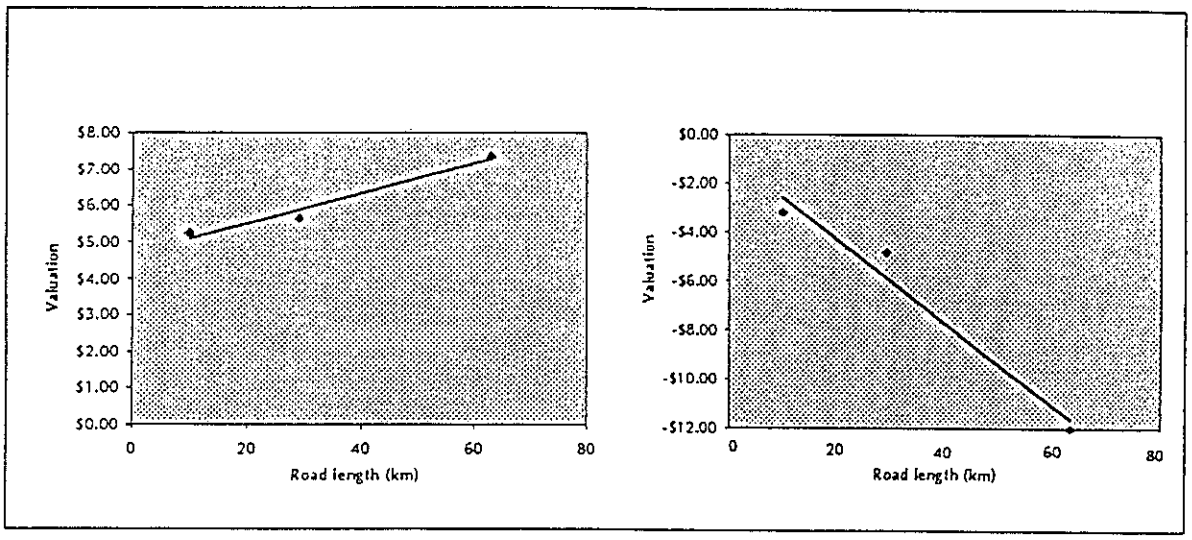
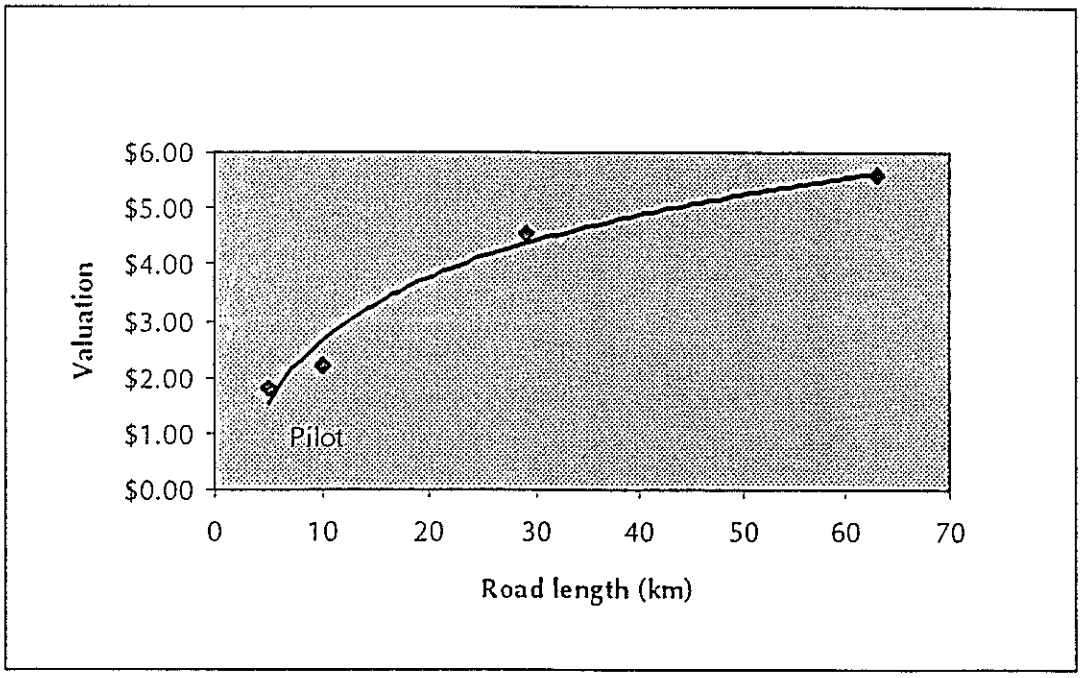


Figure 3.6 Valuation v road length: all respondents



- Valuation appears to increase with road length. Figure 3.4 shows the apparent relationship over the three sites between length of unsealed road and average valuation, for those people preferring the sealed option. Figure 3.5 shows the equivalent data for people preferring the unsealed option. In each case the relationships appear more-or-less linear. However, given the small number of road lengths surveyed and the large variation of individual respondent valuations about the averages, these apparent relationships are not statistically significant.

- When the groups preferring sealed and unsealed conditions are combined, the concentration of unsealed road preference at the shortest length site (Waipoua) draws the trend line toward zero to give a more curvilinear appearance to the relationship (Figure 3.6). This is reinforced if the result for the pilot survey of 30 drivers on the Mt Holdsworth Road (Wairarapa) is included. The pilot survey related to a short (5 km) stretch of unsealed road and found an average valuation of $1.80 ($0.36/km).

- These results suggest that users perceive the disbenefits of unsealed road sections taper off (increase less than pro-rata) as the unsealed section increases in length, i.e. the disbenefits of an unsealed section of length 2 x kilometres are significantly less than twice those for a section of x kilometres. This result should be treated with some caution, based as it is on only four diverse sites: however intuitively it appears very plausible.

- Because of the small sample sizes and the multitude of factors influencing valuations, standard deviations are high and statistically significant distinctions could not be drawn between segments defined by the demographic characteristics described above. However, certain apparent differences are noted where inferences could possibly be drawn:

  - The amount that users are willing to pay for the benefits of road sealing appears to decrease with an increase in users' experience of unsealed roads (as might be expected).

  - A higher value was placed on a sealed surface by drivers who preferred a leisurely/sedate place than by those who sought to drive as fast as possible.

- Most demographic variables did not exhibit significant influences on the valuation results. No significant effects could be related to number of passengers, driver age, sex, trip length, household income, purpose, or vehicle type. However, some tendency was shown (not statistically significant with the small samples) for valuations to increase with both increasing age and increasing income (and this is not unexpected).

- Also no apparent difference was found between valuations of New Zealand drivers and those of drivers from overseas.

4. CONJOINT (DISAGGREGATE) SURVEY

4.1 Survey Overview

This section presents the results of a more in-depth investigation of road user attitudes to individual (disaggregated) features of unsealed roads, as a supplement to the aggregate valuation of the specific route survey described in Section 3. The investigation sought to identify and quantify the trade-offs that users would choose to make between road surfaces with different attributes and different levels of each attribute. It involved a survey, using conjoint analysis methods, of 30 users of unsealed roads among passengers on the Interislander ferry between the North Island and South Island.

Respondents were asked to imagine that they were travelling on a leisurely trip in a hired car (thus eliminating concern for operating costs associated with vehicle damage), and that they had the choice of several roads leading to their destination. All routes were 40 km (or 1 hour) long and identical in every way (same hills, bends, width, traffic, etc.) except for their surface condition.

The four attributes examined in the specific route survey were again used, with three levels of each to define the road surface condition. The attributes and levels were as defined in Table 4.1.

Table 4.1 Definition of levels for each attribute.

	Attributes			
Levels	**Level of Dust**	**Surface Roughness**	**Surface Grip**	**Loose Stones**
Good	dust-free	smooth	high degree	none
Moderate	moderately dusty	a bit rough	moderate degree	some
Poor	very dusty	very rough	low degree	considerable

A toll factor was also introduced with five levels. These were: $0.00, $2.50, $5.00, $7.50, and $10.00.

The conjoint analysis involved presenting respondents with a series of choices, each between two road surfaces made up of combinations of the above attribute levels, and measuring the strength of their preference for each. The relative valuation of each attribute level by respondents was then computed from the influence it had on their road surface selections overall.

This analysis method forces respondents to make trade-offs between different surface features and draws out personal perceptions of which they may not have been conscious. In this sense it is an effective means of explicitly seeking comparative ratings.

The method also gives results in a form that allows the analyst to make direct comparison between quite different and often non-numeric attributes, and enables calculation of the relative values of all the possible "packages" or combinations of attributes (representing different types of road surfaces). The values of these combinations are the aggregate of the individual scores, or *utility values*, assigned to each attribute level.

Further, by including toll levels in the scenarios, the utility values can be given an equivalent $ value. This enables attribute levels to be translated into absolute monetary values.

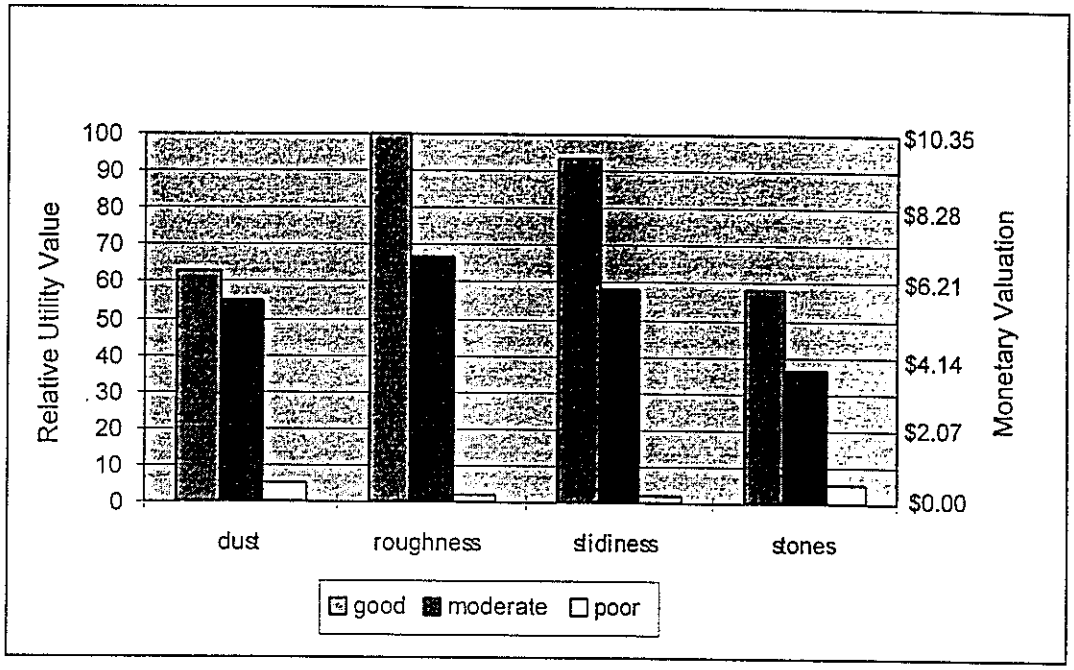
4.2 Results

The results for individual respondents were averaged across the entire sample to get an overall picture of the preferences for the different attributes and their levels. Figure 4.1 shows the relative utility values for each of the four physical road surface attributes. (Grip is presented by its inverse "slidiness" for consistency in direction of levels.) The utility values have been scaled so that the most valuable has been given a score of 100. The scale on the diagram also shows the monetary differences corresponding to the differences in utility.

Key results relating to the relative utilities include:

- The degree of roughness was rated as the most important single feature of a road surface.
- The attribute which gave the greatest benefit when improved from moderate to good levels was grip (or "slidiness"). This was closely followed by improvement in roughness from *a bit rough* to *smooth*.
- The ranking of attributes was in the order roughness, grip/slidiness, dust, and stones for all levels. At the poor level, surfaces that are *very dusty* or have *considerable loose stones* were slightly preferred to *very rough* or *very "slidy"* surfaces.
- The decrease in utility value from a *smooth* road to one *a bit rough* was only slightly smaller in magnitude than the decrease from a road with *a high degree of grip* to one with *a moderate degree of grip*. This means that users would be prepared to trade-off a fall in standard of one of these attributes against a rise in the standard of the other.

Figure 4.1 Average utility values for road surface attributes.



- A surface described as *a bit rough* was rated better than one that was *dust free* or one with *no loose stones*.
- The decrease in utility from either *a smooth* road to one *a bit rough*, or from a road with *a high degree of grip* to one with *a moderate degree of grip*, was not matched by the increase in utility from both improved dust and stones (*moderate* to *good*) put together. Hence removal of both dust and stones from a road with *moderate* levels of each would not make up for an increase from *good* to *moderate* levels in either roughness or slidiness.
- If three road surfaces are envisaged with good, moderate and poor levels of each attribute (from the 81 possible combinations of surfaces with these physical attributes and levels), the moderate surface would have a total utility value around two-thirds of the best surface. The best surface (with good levels of each attribute) broadly equates to a normal sealed road.

Figure 4.1 also shows (on the right-hand scale) the monetary valuations of the relative utility figures. Broadly a change of utility by one unit is equivalent to about $0.10.

The total utility value of different combinations of attribute levels, representing different surface conditions, may be estimated from aggregations of individual utilities. Comparisons between these show the increases (and decreases) in utility and hence monetary value when one surface type is transformed into another.

For instance, the valuations of the differences in total perceived discomfort and risk for a 40 km road between an extremely poor unsealed surface, a moderate unsealed surface and a good (sealed) surface are as follows:

- Difference good v moderate unsealed : $10.17 (or $0.25/km)
- Difference moderate v poor unsealed : $21.03 (or $0.53/km)
- Difference good v poor unsealed : $31.20 (or $0.78/km)

4.3 Comparison of Conjoint and Specific Route Surveys

The conjoint (disaggregate) survey and the specific route (aggregate) survey represented different approaches to the valuation of perceived discomfort and risk benefits from road sealing. The specific route survey sought an aggregate valuation of benefits, while the conjoint analysis sought to measure the relative worth of individual surface attributes, which may then be aggregated to compute an overall value for any attribute combination.

The specific route survey indicated, for a 40-km section of road, that the average discomfort/risk benefits of road sealing would be around $5.00 (Figure 3.6), or approaching $6.50 if those respondents who prefer the unsealed road were excluded (Figure 3.4).

The nearest equivalent in the conjoint survey to the three unsealed roads used for the specific route survey is probably a road with no dust and moderate levels of the other three attributes. From the conjoint survey the dollar difference in utility value between such a road and a road with good values of each attribute (approximating to a sealed road) would be around $11. This is broadly twice the average value found from the specific route survey.

While these comparisons are not as close as might have been hoped, they give confidence that the figures from both surveys are of the right order of magnitude.

5. CONCLUSIONS

5.1 Overview and Interpretation of Results

The methodology project has been generally successful in the investigation of road user perceptions of (dis)comfort and risk factors on unsealed roads, by comparison with sealed roads. The project has identified those factors not included in the 1991 PEM valuations, and has estimated the values that motorists place on these factors.

The specific route surveys derived estimated values for the aggregate of discomfort/risk factors associated with unsealed roads; the conjoint (disaggregate) survey provided additional information on the relative valuations associated with individual discomfort/risk factors (i.e. roughness, grip, loose stones, dust).

The key finding from the specific route (aggregate) survey was that the discomfort/risk factors (i.e. those not included in the 1991 PEM valuations) are valued quite highly by most motorists, and in a manner that appears to increase less than linearly with length of unsealed road. Average valuations for sealing a typical unsealed road (Figure 3.6) are approximately:

10 km unsealed length	\$2.20 (\$0.22/veh km)
20 km unsealed length	\$3.80 (\$0.19/veh km)
40 km unsealed length	\$4.80 (\$0.12/veh km)
60 km unsealed length	\$5.50 (\$0.09/veh km).

These valuations really represent motorists' willingness to pay to use a sealed road rather than use an unsealed road with moderate levels of roughness, grip and loose stones, and relatively low levels of dust.

The conjoint (disaggregate) survey suggests rather higher willingness to pay, of around twice the above values. However, given the somewhat idealised nature of the conjoint survey, the specific route survey is considered to give more reliable estimates of overall valuations.

The conjoint (disaggregate) survey provides information on the relative valuations of individual discomfort/risk factors. It indicates that:

- People place higher values on improving each discomfort/risk factor from a poor level to a moderate level than from a moderate level to a good level.
- Minimising roughness and "slidiness" were valued more highly than minimising loose stones.
- Reducing dust from poor levels to moderate levels was also valued relatively highly.

The results from the specific route surveys showed a considerable spread in motorists' attitudes to, and valuations of the discomfort/risk factors associated with, unsealed roads. A substantial minority (around 20% overall) of respondents preferred the

unsealed state. In the case of the Waipoua Forest road this proportion was 36% – this minority apparently appreciates the sense of adventure and enhanced wilderness experience associated with the unsealed road.

In general, the analysis of the specific route surveys did not identify major differences between market segments (defined by demographic characteristics) in attitudes to and valuations of discomfort/risk factors, although the modest sample sizes made identification of significant differences difficult. Valuations of benefit showed some tendency to increase with age and with income level. However no significant differences were determined between the valuations of New Zealand motorists and motorists from overseas.

The surveys were carefully designed to ensure that the factors addressed and valued were additional to those factors already incorporated in the PEM valuations (as at early 1994), i.e. changes in travel time (at a standard time value), in vehicle operating costs, and in accident rates and costs. However, this is a pioneering study in its field and factors already incorporated in PEM may not have been fully allowed for in the way the survey questions were answered. Also, because available international research is limited, the answers cannot be checked for consistency.

The discomfort/risk factors identified could be expressed as a change in motorists' valuation of travel time savings between unsealed and sealed roads. For a typical 15 km length of unsealed road, the discomfort/risk factors have been valued on average at about $0.20/vehicle kilometre. At a typical speed of 50 km/h, this corresponds to $10/vehicle hour.

This value may be compared with the typical travel time values used in PEM (which are based primarily on sealed roads) of around $20/vehicle hour for cars. Thus, for a moderate length (around 15 km) of typical unsealed road, the unit value of time savings would be around $30/vehicle hour, as against $20/vehicle hour on a sealed road. The $10/vehicle hour difference represents the user valuation of the benefits of reduced discomfort/risk from road sealing. For a longer length of unsealed road (around 50 km), the $10/vehicle hour difference reduces to around $5/vehicle hour. These seem plausible results.

5.2 Implications for Evaluation of Road Sealing Projects

5.2.1 Previous Evaluations of Road Sealing Projects

Recent evaluations (using PEM methods) of the benefits of sealing selected sections of six unsealed roads have given total benefits in the range 16¢ to 43¢/vehicle km. The ranges of the individual component benefits for the six schemes were:

Travel time savings	4¢ to 12¢/veh km
Vehicle operating cost savings	4¢ to 23¢/veh km
Accident savings	-6¢ to 20¢/veh km

Based on these evaluations, it appears that a "typical" road sealing project evaluated by applying the pre-1994 PEM values gives total benefits of 20¢ to 30¢/vehicle km.

5.2.2 Implications of Incorporating Discomfort/Risk Benefits

The additional benefits for road sealing associated with discomfort/risk factors are typically in the range 9¢/veh km (average over a 60 km unsealed section) to 22¢/veh km (average over a 10 km unsealed section). These figures are substantial compared with the benefits resulting from applying the pre-1994 PEM values. The additional benefits that should be allowed for improved discomfort/risk factors would add between about 30% and 100% to the previous PEM benefit estimates. The project benefit/cost ratio (BCR) values would increase in broadly the same proportion.

5.2.3 Non-linearity of Valuations and Its Implications

The research indicates a non-linearity of valuation with the length of unsealed road involved. This seems intuitively reasonable in that once drivers have become accustomed to the characteristics of a particular unsealed road, any additional distance travelled on the unsealed surface is perceived as less onerous. However this finding does have significant implications for project evaluation and programme development.

For instance, the results from the specific route survey (Figure 3.6) indicate that:

- Sealing 10 km of a 60 km section of typical unsealed road has discomfort/risk benefits of about 3¢/veh km
- Sealing 10 km of a 20 km section of typical unsealed road has discomfort/risk benefits of about 16¢/veh km
- Sealing the whole of a 10 km section of typical unsealed road has discomfort/risk benefits of about 22¢/veh km

Applying this apparent non-linearity in project evaluations would be a departure from the PEM methods, under which the benefits of any individual improvement project are generally independent of the condition of adjoining sections of road.

More important, the non-linearity has important implications for project selection. It suggests that the present practice of "spreading the road sealing funds around" between different routes may not result in optimum use of funds. As the largest benefits accrue from completing the sealing of a whole route, improved use of funds would tend to be achieved by sealing the whole of one route over a relatively short period, then progressing to the next route.

5.3 Actions

There are two alternative actions:

- modify the PEM procedures on the basis of the research reported here; or
- undertake further research to better quantify the discomfort/risk benefits of road sealing before modifying PEM.

5.3.1 Modifying PEM

To modify the PEM procedures on the basis of this research, then Figure 3.6 should be used as the basis for defining a discomfort/risk function that can be incorporated in PEM[2]. An average discomfort/risk benefit per vehicle kilometre could be used, based on typical lengths of unsealed roads (e.g. about 15¢/km for a 30 km unsealed length). Alternatively a non-linear function could be used, with the value of discomfort/risk benefits being read off the graph (or an equivalent table) according to the change in unsealed road length associated with a sealing project. In either case, the benefits assessed would be representative of a "typical" unsealed road, but would not differ according to the particular condition of the specific unsealed route.

5.3.2 Undertaking Further Research

Given the substantial magnitude of the discomfort/risk benefits estimated in this report, and the lack of any thorough international research against which to compare the results, further research on this topic would seem well worthwhile. It is recommended that such research should focus on:

- Verifying (or modifying) the magnitude of the total discomfort/risk benefit effect, and particularly ensuring that it does not involve double-counting with the present PEM values.
- Verifying (or modifying) the relationship, tentatively established in this report, between the level of benefits and the length of unsealed road.
- Further exploring the sensitivity of valuations to the range of conditions found on unsealed roads (in terms of roughness, grip, loose stones and dust).

The results of such research would be used to derive an improved discomfort/risk benefit function, incorporating a greater degree of statistical reliability. This would most likely express the discomfort/risk benefits of road sealing as a function of both the length and condition of the unsealed road.

[2] At the conclusion of this research, PEM was modified to include a discomfort/risk function.

APPENDICES

APPENDIX 1
LITERATURE REVIEW

APPENDIX 1 LITERATURE REVIEW

A1.1 Overview

This appendix covers ... *a review of international literature on traveller perceptions of unsealed roads and on the perceived benefits (to tourists and others) of sealing unsealed roads.*

Two points were made in the original research brief:

- The amount of literature available which is relevant to this project is quite limited.
- Most of the relevant international literature was generally reviewed in a recent study for the New Zealand Ministry of Tourism (Institute of Transport Studies 1992).

Brief reviews of nine international reports/papers, some of which were identified in the 1992 study, are provided in this appendix (full references are given at the end of this report).

The review has indeed found that the relevant literature is very limited. In particular, almost no information is available on the valuation of comfort and risk factors associated with unsealed roads.

The main findings of interest from the literature review are summarised as follows:

- Road surface condition is rated a relatively important characteristic of the road system by motorists. Motorists are prepared to travel substantial additional distances to avoid rough and/or unsealed roads.
- Evidence on the effects of road sealing on traffic volumes indicates that the benefits from sealing roads are rated highly by motorists.
- Values of travel time savings by tourist travellers may, irrespective of road condition, differ considerably from the average values for all motorists (which are incorporated in PEM). They will generally be lower for the first few hours of travel per day and, in scenic conditions, may be negative.
- Values of comfort and dust reduction benefits to motorists from sealing unsealed roads were estimated in one Australian study (Commonwealth Bureau of Roads 1974). However these values appear low and are open to doubt.
- Safety is perceived as a major issue by tourists using unsealed roads. Conventional valuations based on cost savings for reported accidents are likely to under-estimate the tourist valuations in such cases.

A1.2 Cairney, P. (1985). Roads for Tourists

This paper addresses issues relating to the needs of recreational travellers using the Australian road system. Conclusions drawn include:

- Two studies to measure user perceptions of quality of service aspects of the road system found that road surface condition was ranked highly.

- Unfamiliarity with vehicles is a significant cause of accidents. A US study (noted by Cairney) found that people with less than 240 km experience of driving a specific vehicle were six times more likely to have an accident than the general driving population. This suggests that overseas visitors who typically rent cars when travelling in New Zealand, are particularly at risk.

Cairney concluded that:

> ... *as so much tourist activity depends on access by road, improving the comfort, convenience and safety of tourist roads while at the same time maintaining or enhancing their scenic attraction is an important contribution to the development of the tourist industry....*

A1.3 Commonwealth Bureau of Roads (1974). Evaluation of Roadworks - Principles and Procedures

This report discusses the treatment of benefits to generated traffic. For major road improvements, such as conversion of earth to gravel roads and conversion of gravel roads to sealed roads, which result in a relatively large decrease in travel time or vehicle operating costs, additional traffic is likely to result.

This report discusses evaluation procedures for major road projects. When any unsealed road was improved, comfort benefits to passengers (expressed in cents per vehicle mile) were assumed to occur. If the existing unsealed road was regarded as having an excessively dusty surface, additional benefits were obtained. Valuations were obtained from a survey of travellers on the Eyre Highway, Western Australia, in early 1972. Values of comfort benefits to passengers were estimated (in terms of the original study and converted to NZ$1992 values) at:

- unpaved to gravel road: 0.3 cents/veh mile (c1.0¢/veh km)
- unpaved to sealed road: 0.5 cents/veh mile (c1.6¢/veh km)
- gravel to sealed road: 0.2 cents/veh mile (c0.7¢/veh km)
- additional dust benefits: 0.4 cents/veh mile (c1.3¢/veh km)

Where projects result in relatively large decreases in travel time or vehicle operating costs, additional traffic is assumed to be generated and its benefits need to be assessed. An elasticity coefficient of 0.55 was derived (from data supplied by the Main Roads Department, Queensland) and the benefits to generated traffic were valued at one-half of the rate of benefits to existing traffic (as derived above).

A1.4 Institute of Transport Studies (1992), Quantifying Tourism Economic Benefits and Evaluation of Road Projects

This report involved a comprehensive literature review and discussion of the issues involved in the evaluation of tourism benefits of roading projects. (The report covered a much wider scope than this present study.) A number of the references reviewed in the report are also summarised separately in this Appendix 1.

Key points in the report, additional to those covered elsewhere in this Appendix, include:

- Safety related to unsealed roads is often an issue raised by tourists, and the New Zealand Ministry of Tourism places highest priority on ensuring that tourist roads do not present unnecessary safety hazards (p.12). Valuing safety based only on reported accident rates may under-value the importance that tourists place on safety issues on unsealed roads (p.19).
- Benefits that tourists are likely to value, that are not measured by current evaluation procedures, include the value of a more comfortable ride, reductions in dust coverage and better views (p.14).
- Values of travel time savings for vacation travel are typically very low, perhaps under 10% of the wage rate, and may be negative in some situations. Individuals may be willing to pay for the first few hours of travelling in scenic conditions, with travel time becoming a disutility only after several hours. Such valuations are likely to combine values placed on enjoyment of scenery and on changes in travel time (p.18; also see Walsh, Sanders and McKean 1990).
- The values of benefits found in Australian work (Commonwealth Bureau of Roads 1974) from the more comfortable ride arising from road sealing appear too low considering the extent of traffic generation resulting from the sealing of major routes (pp.20-21). The extent of traffic generation also indicates that the lack of sealing is a major deterrent to tourist travel.

The report makes recommendations for further research, including that on the following aspects:

- Valuation of travel time savings for tourists, especially when driving on scenic roads.
- Valuation of reducing the perceived risk of being involved in an accident.

- Valuation of comfort, and the interrelationships between valuation of comfort, scenic experience, safety and travel time savings.
- Extent of traffic generation from sealing roads.

A1.5 Potter, D. et al. (1992). An Investigation of Car Users' Perceptions of the Ride Quality of Roads

This study by the Australian Road Research Board for AUSTROADS involved a pilot investigation (carried out in 1990) into:

- the relationship between the users' perceptions of ride quality and an objective measure of road roughness;
- how acceptable is a specific level of road roughness for trips of different lengths;
- how far users were prepared to travel to avoid rough roads.

The study involved groups of road users (car drivers and passengers) rating specific sections of urban and rural roads for ride comfort, on a 10-point scale, and also responding to additional questions about acceptability and extra distance. The road sections, each about 500 metres long and sealed, had average roughness values in the range 20-200 counts/km (measured on the NAASRA Roughness Index).

Results of relevance included:

- A wide variation among respondents in perceived levels of ride comfort for any given road section.
- A good correlation between mean perceived ride comfort and the NAASRA Roughness index.
- The roughness level typical for new roads (50 counts/km) was perceived to provide a very good ride quality, acceptable to virtually all car users.
- A roughness level of 100 counts/km was acceptable to approximately 80% of car users. However, most people would be prepared to travel 10% further on a perfectly smooth road.
- For a roughness level of 150 counts/km, opinions on ride quality varied from poor to fair. The proportion of car users who considered the ride acceptable varied from 28% to 75%, and users were prepared to travel 15-65% further if the option of a smooth road existed.

The report notes that motorists' preparedness to travel further on smooth roads provides an additional basis for determining the increase in user costs associated with an increase in road roughness.

A1.6 Stanley, J., Starkie, D. (1982). A Revised Framework for Evaluating Investment in Rural Local Roads

This paper reviewed methods used to evaluate rural local roads in Australia. It suggests that the community perceives additional benefits from such roads which are not reflected in the conventional economic evaluations. These additional benefits include increased comfort, reduction in production losses (associated with road dust and road roughness), and generated traffic. These wider benefits amount to between 12% and 60% of the total benefit stream.

Rural roads may be perceived as a "merit good", first fulfilling basic access requirements. Once these basic requirements are achieved, emphasis is placed on reducing driver stress, and in turn, once this is achieved, emphasis then shifts to reducing travel time.

A1.7 Travers Morgan (1992). Sealing the Alpine Way: An Economic Assessment

For this study, people visiting the Kosciusko National Park from Victoria were asked about their reasons for not using the Alpine Way (a major unsealed route). 44% of visitors did not use this route, despite its substantial travel time advantage. For those not using this route, despite it being the shortest route, reasons given were:

Reason for NOT using Alpine Way	**Percentage**
Going to/visiting places on other route	62%
Did not know about road	14%
Road too dangerous	7%
Road may damage car	5%
Alternative road is faster	4%
Road makes passengers car sick	2%
Road closed	2%
Road is too rough	2%
Caravans not allowed on road	2%

This indicated that 16% of the respondents who did not use the route were avoiding it for comfort/risk reasons (too dangerous, too rough, makes passengers car-sick, may damage car). This 16% is the majority of those (24%) who knew about the road and were not going to other places en route.

These findings indicate that a lack of road sealing may be an important factor in route choice for tourist/recreational travellers.

A1.8 Walsh, Sanders and McKean (1990). The Consumption Value of Travel Time on Recreational Trips

The authors reviewed the limited research available on driving for pleasure and then conducted an experiment on willingness to pay for travel time savings in the USA.

They found that the published research on travel time savings on recreational trips indicated wide variations, from zero to 100% of the wage rate. Indeed some studies found that travel time savings were viewed as a disbenefit. One major US study found that the value of travel time savings on *intercity driving for vacation trips* was only 6% of the average wage rate.

The authors conducted a survey of how much people would be prepared to pay if they wanted their recreational trip time increased or decreased. Main findings were:

- For the first hour of driving on mountain valley roads, people were willing to pay significant sums (US$9/hour) to extend their trip time.
- As travel time increases, the willingness to pay for each hour decreases until travel time becomes a disutility at the end of the fourth hour. As travel time increases further, the marginal cost per hour increases further.

A1.9 WA Main Roads Department (1980). Origin and Destination Survey - Eyre Highway at Norseman 1978

This report summarises the results of vehicle travel surveys on the Eyre Highway in Western Australia to investigate the changes in traffic resulting from the sealing of the road. The report concludes that:

> *... although the trend since the completion of the sealing is a little unclear ... it appears that a higher standard of road linking two regions could generate a 50% increase in demand following the completion of the link. ...*

However, the traffic count data suggest that there was a one-off surge in traffic volumes following completion of the sealing (in 1976), but that the traffic increase after the first two years was considerably less than the 50% suggested.

A1.10 Works Consultancy Services (1993). Economic Disbenefits of Dust from Unsealed Roads

This Transit New Zealand Research Project and Report involved a literature survey of international and New Zealand research on the economic disbenefits accruing from dust on unsealed roads.

Its main findings relating to motorists were:

1. **Vehicle operating costs.** Australian evidence indicates that a dusty environment could increase operating costs by about 40% because of the need for additional oil changes and air filters.
2. **Travel time.** Dust will have a significant effect on travel time in some circumstances, but more often the speed will be governed by the skid resistance of the road surface.
3. **Accidents.** Any increase in accidents in dusty conditions is likely to be small, although there is very little evidence to quantify any effect.

These three effects should, in principle, already be incorporated in the PEM and are therefore not of concern to the present project. The Works Consultancy Services report does not address any effects of dust on road user discomfort and perceptions of risk.

A1.11 References

Cairney, P. 1985. Roads for tourists. Pp.25-30 in Bullock, M., Eddington, N. (Eds.) *Ergonomics in the Tourist, Agricultural and Mining Industries*. Proceedings of 22nd Annual Conference of the Ergonomics Society of Australia and New Zealand.

Commonwealth Bureau of Roads. 1974. *Evaluation of roadworks - principles and procedures Part 2.* Prepared by Evaluation Branch, Transport Planning Division, Commonwealth Bureau of Roads, Melbourne.

Institute of Transport Studies, University of Sydney; Beca Carter Hollings & Ferner. 1992. *Quantifying tourism economic benefits and evaluation of road projects.* Report to NZ Ministry of Tourism, November 1992.

Potter, D., Hannay, R., Cairney, P., Makarov, A. 1992. An investigation of car users' perceptions of the ride quality of roads. *Road and Transport Research 1:* March 1992.

Stanley, J., Starkie, D. 1982. A revised framework for evaluating investment in rural local roads. *7th Australian Transport Research Forum 2:* 447-460.

Transit New Zealand. 1991. *Project Evaluation Manual, Volume 1: Simplified procedures. Volume 2: Full procedures.* Transit New Zealand, Wellington, New Zealand.

Travers Morgan Pty Ltd. 1992. *Sealing the Alpine Way: An economic assessment - final report.* Report to National Parks and Wildlife Service, NSW.

Walsh, R.G., Sanders, L.D., McKean, J.R. 1990. The consumption value of travel time on recreation trips. *Journal of Travel Research 29 (1):* 17-24.

Western Australia Main Roads Department. 1980. *Origin and destination survey: Eyre Highway at Norseman 1978.* WA Main Roads Department, East Perth.

Works Consultancy Services Ltd. 1993. Economic disbenefits of dust from unsealed roads. *Transit New Zealand Research Report No. 16.*

APPENDIX 2
REPORT ON FOCUS-GROUP DISCUSSIONS

APPENDIX 2 REPORT ON FOCUS-GROUP DISCUSSIONS

A2.1 Introduction

The initial studies included an in-depth exploration into the perceptions of unsealed roads held by domestic travellers and international tourist drivers. Two focus groups were held during November 1993, one in Martinborough (North Island) among domestic travellers who use unsealed roads for local trips; and one on the north-bound Interislander ferry among international and domestic tourists who had recently driven on unsealed roads in New Zealand.

Each session involved informal semi-structured discussion to investigate views and experiences, to identify relevant unsealed road attributes and perceptions of them and to test understanding of terminology. The discussion programme explored techniques for elucidating perceptions as well as exploring the perceptions themselves.

A2.2 Discussion Structure

Discussions were guided along the following broad path:

- General impressions of New Zealand unsealed (and sealed) roads, including comparison with overseas.
- Particular features of unsealed roads, gathered through recollection of unpleasant and pleasant driving experiences.
- Identification of unsealed road attributes, their variance, and independence.
- Ranking of the relative importance of the attributes.
- Contingent valuation of road sealing using a toll scenario.

The insights gained in the course of the discussions were subsequently used to assist in design of the quantitative surveys.

A2.3 General Impressions of New Zealand Roads

A2.3.1 Unsealed Roads

Overall impressions of New Zealand unsealed roads among motorists showed considerable variation, depending upon their specific experiences.

The most negative view was expressed by an Englishman who, having driven with his family some 3000 km in the North and South Islands of New Zealand, said that he was "amazed that any (public) road could be left in that (i.e. an unsealed) condition". He was unhappy about a lack of warning regarding unsealed roads, relating an experience he had had in the North Island in which he unwittingly selected a route that turned out to be unsealed for its entire 120 km length. He was also disconcerted that

no signs were along the road to warn of localised dangerous or difficult conditions such as winding stretches, sharp corners, or an especially steep gradient. Overall he had found the road "slippery", and the dust nuisance "extreme". The dust generated by his own car obscured his rear vision, and that generated by any car in front made it impossible to see ahead. Driving on this road had given him a "very insecure" feeling.

The same tourist contrasted this experience with that on an unsealed road in the South Island: although he had been warned about this road beforehand by the locals and by "the insurance", it was in fact "better" since it had "open tracks" worn into it, thus giving a smoother ride and providing a better grip. There was also less chance of loose chips/stones flying off the surface and hitting the windscreen. He also added that the road had been wider than the North Island example, therefore providing better visibility and more room to pass. In summary he said that "the country was fantastic; the roads won't put me off!"

A more positive view was expressed by an Austrian couple, who had completed their tour of the South Island and were now embarking on a tour of the North Island. They said that they had "no problem" with driving on unsealed roads in New Zealand: they were used to unsealed Austrian mountain roads, which were "quite rough" in comparison.

A moderate view was expressed by a New Zealand resident who had been to a conference in the South Island, and was taking a leisurely drive home through the North Island. His feeling was that New Zealand unsealed roads were, on the whole, "not bad", including those in specific tourist areas of which he had considerable experience. The very nature of the road, he added, was such that it caused one to be careful and watchful while driving on it.

One theme to emerge was recognition of the dangers inherent in unreasonable driving. The Austrian couple criticised "New Zealand drivers who ignored the speed limit signs" along those sections of road where new seal had been laid and where there were still many loose chips on the surface. They had suffered a broken windscreen as the result of one such speeding driver, and still felt very annoyed about it.

A university student, touring north to Gisborne via the West Coast from Dunedin thought that New Zealand unsealed roads were generally "very safe - good conditions, so long as the driver was reasonable". He added that the danger factor was probably the driver, and in any case the road surface was just one condition amongst many. He advised "one cannot expect that driving will occur in perfect conditions every time - so take care".

Other general difficulties with unsealed roads were presented. These related to the lack of a centre line (seen as a potential source of legal difficulties when apportioning blame in the event of an accident), heaped gravel (which is "a bit rough on the car base"), and frequently narrowness with no defined boundary or space for passing.

Domestic travellers using unsealed roads believed there are comparatively many unsealed roads in this country but that, despite the increase in both volume and weight of traffic in recent years, their quality had undoubtedly improved. They felt that New Zealand unsealed roads were "fairly unique" but, at least in tourist areas, were of "slightly better" quality than unsealed roads in other countries.

The domestic travellers felt that "if you've driven on one unsealed road, you've driven on them all really", and that in general there was little to choose between unsealed roads with respect to potential overall risk and comfort factors. Echoing the tourists somewhat, they emphasised that experience in driving on unsealed roads was an important safety factor, instilling greater care and vigilance.

The type of car was also noted as important for safety reasons (whether front-wheel or rear-wheel drive) and for comfort reasons (larger vehicles giving a smoother ride).

A2.3.2 Comparison With Unsealed Roads Overseas

Domestic travellers considered the high proportion of unsealed roads in New Zealand as unusual in the western world. Britain was cited as having only asphalted roads, albeit often quite narrow with little room to pass in country areas.

Similarities were drawn with Australia in the length of unsealed roads but the Australian equivalents were thought to be "better because they don't even have metal" despite being very dusty. A domestic traveller who had also travelled extensively in Australia stated that Australian unsealed roads were better in terms of smoothness of ride and grip than New Zealand roads because they were not metalled but had a hard surface, a kind of "hard-pan".

Domestic travellers thought that international tourists "hated" New Zealand unsealed roads, and were "petrified" of them. Views held by international tourists themselves varied from "terrible" for an American couple, to "marginally better than unsealed roads in similarly mountainous areas at home" for Austrians. An English tourist described driving on unsealed New Zealand roads as "quite an experience - equivalent to driving on a rally track in England".

A2.3.3 Sealed Roads

New Zealand sealed roads were generally regarded highly by both domestic travellers and international tourists. One tourist stated that, although they had a "noisy surface", they were otherwise "fantastic".

Domestic travellers' comments included adjectives such as "really good", "fantastic", and "absolutely first class". One dissenting opinion, however, was that New Zealand sealed roads were "not well built": they were neither wide enough for the traffic most of them carried, nor were they well designed.

A2.3.4 Comparison With Sealed Roads Overseas

New Zealand sealed roads compared well to those overseas in the views of both domestic travellers and tourist groups. The road markings and signs in general were very good, "well-defined" and "very clear" compared with those in Britain. It was noted that overseas roads may appear to be "better designed" because they "probably carry a lot more vehicles".

A2.4 Features of Unsealed Roads

The groups were asked to recall the most unpleasant and the most pleasant unsealed roads that they had experienced in order to focus discussions on specific features of unsealed roads.

A2.4.1 Most Unpleasant Features

The most unpleasant unsealed roads were characterised by:

- lots of potholes;
- lots of bends;
- slips;
- blind corners;
- "dropouts" (subsidences);
- "townies" who drive too fast and do not move off main tracks to let others pass;
- a lack of metal (road base exposed, muddy and slippery in winter);
- straightening - such "improved" single roads often lead to higher speeds because of increased perceived safety, but instead this "magnifies the whole [dangerous] aspect of it";
- dust, both as nuisance and hazard.

A2.4.2 Most Pleasant Features

The most "pleasant" unsealed road was characteristically one which:

- was wider - in which case it was "not so bad": this was seen as the most important aspect of a "pleasant" unsealed road, and the wider it was, the safer it was perceived to be, and the greater was the feeling of security of the driver;
- had recently had rain on it, thus settling the dust;
- had car traffic which did not go "too fast": the notion was expressed that the more cars are designed "for faster speeds on tarsealed roads, and streets ... the worse cars are for second class (metalled) roads".

A2.5 Key Attributes of Unsealed Roads

Discussions were further focused on the surfaces of unsealed roads. The different types of road surfaces experienced included:

1. mud
2. pit metal
3. riverbed metal mixed with silt

4. pumice metal
5. roads with random areas of hardness
6. corrugations
7. extensive potholes
8. freshly graded surfaces
9. Tauherenikau gravel
10. Hikawera gravel
11. crushed greywacke
12. crushed mudstone
13. "small white pebbles"
14. "symmetrical chips"
15. tire tracks moulded into the gravel
16. heaped gravel
17. oiled road
18. exposed road base
19. freshly resurfaced roads with many loose chips

The four attributes of unsealed roads that influence perceptions of comfort and risk were explored under the categories *roughness of ride, amount of dust generated, grip,* and *amount of loose stones.*

A2.5.1 Roughness of Ride

Reasons for a rough ride that were suggested include:

- Corrugations in the road base - these were most "effective" in producing a rough ride. Corrugations occur most frequently on the corners of unsealed roads, and especially on those which were regularly used by heavy trucks. Also, the steeper the hill, the worse the corrugations or ruts that were formed.

- Extensive potholing - almost as effective as corrugations in producing roughness of ride.

- "Upturned stones" in the road base, caused by grading the road, and the filling of isolated spots with a harder material.

- Symmetrical chips, which "tend to slide in a uniform way".

- Angular chips which, if the road is not maintained, sink into the base and form localised hard patches.

- Small white pebbles, which remain on the surface after grading.

A2.5.2 Level of Dust Generated

Local drivers suggested that the level of dust generated "depends a lot on the metal used". In this respect:

- "Pit metal" was the best, because it generated the least amount of dust. It is quarried "out of the hills", and bound with clay when spread on the road, to form a hard, homogeneous surface with a relatively low level of dust generation.

- River metal (from the Whakapuni Stream) was poorest. It tended to "just break up" (producing dust in the process).

- Mudstone and greywacke were perceived to generate high levels of dust, because they were "softer", and broke down relatively easily.

- Crushed aggregate/metal produced, in one domestic tourist's experience, an "extreme" amount of dust.

- Tauherenikau gravel was "one of the best" (i.e. generated low levels of dust), because it was harder.

The level of dust generated was somewhat seasonal, with more dust being generated in summer, especially in hot, dry summers.

A2.5.3 Grip

In the experience of these drivers, grip was affected by:

- Mud - tyres tended to slide on braking, or unexpectedly coming off an adjacent drier surface.

- Pumice metal - this gave the "worst experience of driving" for one person; others agreed that a pumice surface was associated with decreased vehicle control.

- Corrugations - the roughness of ride led to decreased control of the vehicle.

- Freshly graded surface - the even spread of shingle was "quite dangerous" because it "just hides the fault by hiding the grooves the tyres mould into", and decreases control of the car. Driving on an evenly shingled surface can be "like driving on ball bearings".

- Angular chips - these were best for road grip. It was suggested that their random movement within the mass caused them to adhere to each other more readily, thus promoting a relatively homogeneous, stable, surface.

- Symmetrical chips - on the whole these were not good for grip. If braking suddenly, these tend to "pile up in front of you". Large trucks, if stopped on such shingle, are known to be unable to start again because "their wheels spin on it".

- Riverbed metal mixed with silt - "in a dry spell you just couldn't stay on it".

A2.5.4 Amount of Loose Stones

The amount of loose stones varies depending on the road surface:

- Mud - where the road base was insufficiently covered with aggregate, or where pit metal had more than the optimum proportion of clay to metal.
- Pit metal - if the right proportion of clay to aggregate was in the mix, loose stones do not pile up in large heaps.
- Freshly graded - gives an apparently even layer hiding uneven distributions of loose stones.
- Tyre tracks moulded into gravel - causes distribution of loose stones that varies from almost none in the wheel tracks to heaping along the sides and the centre.
- Exposed road base - occurs on ridges and where the stones are blown off by the wind. Such bald spots are often unexpected, especially to drivers unfamiliar with an area, and the sudden change from one kind of surface to another may contribute to loss of control of the vehicle.
- Freshly resurfaced - gives lots of small, loose chips.

A2.5.5 Attribute Causal Factors and Inter-Relationships

Each attribute was considered in relation to the others and to other causal factors.

The **level of dust** generated varied not only with the type of surface chip and the presence or absence and quantity of sand/rock dust, but also with external variables including:

- the vehicle speed, size, weight, and configuration, and the level of use of a road
- the dryness of weather
- the level of the water table
- density and height of surrounding vegetation

Grip was thought to vary with:

- depth, type, and distribution of loose stones
- configuration of the underlying (often unseen) road base
- presence and extent/depth of corrugations
- potholes (roughness of ride)
- degree of slope

Grip may also vary depending on:

- Vehicle tyres: "old-fashioned tyres are actually better on ordinary metal" than radial ones; depth of tyre tread is also important
- Front-wheel, or rear-wheel drive
- Weather: when rain had last fallen

Roughness of ride varies not only with road surface, but with the size of car. Smaller cars provide less cushioning against a rough road than larger cars.

The amount of **loose stones** on a road was considered to depend on the number and weight of vehicles which use it, as well as to the angularity of the stones themselves. Roads extensively used by large vehicles, such as logging trucks, form corrugations more quickly than those not so used. First the loose stones pile up between wheel ruts, then the road base becomes corrugated as a result.

A2.6 Ranking of Attributes

Recognising that any one of the four attributes could become hazardous given the right conditions, the group of domestic travellers ranked their overall importance in the following (descending) order:

1. Grip
2. Amount of Loose Stones
3. Roughness of Ride
4. Level of Dust Generated

These drivers felt that the first two attributes were primarily related to safety, and were therefore most important. Lack of grip on the road would be the worst thing. A little less important was the factor of loose stones: on a freshly graded road, these tend to hide depressions or projections or to "heap", thus potentially leading to loss of control. Roughness and level of dust were perceived as relating more to comfort than to safety. Of these, a rough ride was seen as more undesirable than dust generated: dust was perceived to be an irritating, but largely unavoidable, part of driving on unsealed roads.

The general conclusion of this group was that the only consistent thing about unsealed roads was their inconsistency, and this generated a need for continual vigilance while driving on them. Accidents and mishaps were associated with a lack of experience of driving on unsealed roads in general, and a lack of knowledge of local conditions in particular.

The Interislander tourists ranked the four attributes somewhat differently:

1. Roughness of Ride
2. Grip
3. Amount of Loose Stones
4. Level of Dust Generated

As with the domestic travellers, safety was the prime consideration in these rankings. However, roughness of ride was perceived to be more strongly related to safety than was grip.

A2.7 Valuation

The two focus groups were presented with the following scenario:

> *Imagine you are travelling by car and have the choice of two routes of equal scenic beauty and other features except one is sealed and would take 40 minutes, while the other is unsealed rough and dusty and would take 60 minutes. Vehicle wear and tear is not your concern as you are driving a hired car. There is a toll charge for use of the sealed road. What toll level would cause you to take the unsealed road?*

Responses included various small sums, ranging from 50 cents, through $1, $2, "any reasonable amount", to $5.

Other influences that came into play in the choice included:

- The rustic attraction of gravel roads and being "off the commercialised track".
- Whether they were driving alone or whether the family was on board. If the family was in the car, then they would favour the sealed route.
- The respondents' frequency of use of the routes and the purpose of the trip.

New Zealanders in both groups thought that they might be inclined to work out the costs and benefits of using the unsealed road versus the sealed road with toll, and that they might decide, on balance, to use the unsealed road.

All the international tourists stated that they would definitely take the sealed route. Most of the individuals in both groups, whatever else their views regarding tolls, thought that around NZ$2 was a reasonable sum to pay as a toll to use the sealed route.

APPENDIX 3
REPORT ON PILOT SURVEY

APPENDIX 3 REPORT ON PILOT STUDY

A3.1 Introduction

The pilot survey was carried out over the weekend of 19-20 February 1994 at two locations: 30 respondents were interviewed at the Mount Holdsworth picnic area, Wairarapa (North Island), and 16 on the Interislander ferry.

This evaluation of the questionnaires covers the contingent valuation approaches tested, the conjoint analysis, sampling, and general design and wording.

A3.2 Contingent Valuation Approaches

The contingent valuation of perceived discomfort and risk benefits of road sealing was the focus of the survey. Respondents were presented with a hypothetical situation in which they had to choose between two alternative routes, identical in every way except one was sealed and the other unsealed. A toll charge was then added for the sealed road and the question repeated, initiating a process of iterative questioning with the interviewer increasing or decreasing the toll until a level was identified which was just acceptable to the respondent

This worked well, with respondents making considered decisions. There were few philosophical objections to the toll concept and, where these occurred, reassurance as to the objective of the survey was sufficient to overcome these. Respondents appeared not to be influenced by the initial toll level, as there was no apparent relationship between it and the final valuations reached.

A key objective of the pilot survey was to determine the best contingent valuation approach for the main survey. Two approaches were tested:

1. Route-based valuation;
2. Fully scenario-based valuation.

A3.2.1 Route-Based Valuation

The first approach, used "on-site" at Mt Holdsworth, sought respondents' valuations of the benefits of a hypothetical sealed road as an alternative to the unsealed road that they had just used. Respondents therefore had to imagine only the alternative route.

The results are summarised in Table A3.1. This shows that the maximum toll that respondents would pay for a sealed alternative to the existing road at Mt Holdsworth was $1.80 on average. There was significant variation around this average, however, with a standard deviation of $2.80. If the driving time had increased to 40 minutes, the maximum toll increased only slightly to $2.17 on average (with standard deviation $2.96, see Table A3.2). On a per kilometre basis, the mean valuation fell from around $0.36/km for the existing road to around $0.05/km for the longer road.

Valuations were very skewed toward zero as 53% of respondents would not pay any toll for a sealed alternative to the existing Mt Holdsworth road. This proportion fell only slightly, to 47%, when the roads were hypothetically lengthened to 40 minutes driving time.

These results illustrate three limitations of the approach:

1. Valuations are very site and context-specific. The Mt Holdsworth road is less than 5km long and hence the duration of discomfort and risk would have been relatively short. Further, the leisure/recreation purposes of many of its users were outdoor-oriented. Respondents may have been in a frame of mind to "rough it" and therefore be less averse to road discomfort and risk. While such people are a component of the overall population of unsealed road users, their proportion at the Mt Holdsworth site would be much higher than the average on unsealed roads in New Zealand. The implication is that care must be taken with generalisation of results.
2. The potential is for respondents' wider perceptions to be coloured by their immediate experience. It is possible that valuations for the subsequent scenario in which the road length was increased were influenced by the relatively short duration of discomfort encountered on the existing road.
3. The last limitation arises from the small change in valuation that resulted from an increase in driving time. This may mean duration of trip is not a strong determinant of valuation, or that there is a complex non-linear relationship between the two. It may also mean, however, that respondents were having difficulty relating to the scenario. This is a potential problem for both the route-based valuation approach and the fully scenario-based approach.

The advantage of the route-based approach to valuation, however, is its realism and consistency. Memories of the driving experience are fresh in respondents' minds and all respondents have experienced the same unsealed road surface on which the valuation was based.

A3.2.2 Fully Scenario-Based Valuation

The second approach asked respondents to imagine both the unsealed and the sealed routes as well as prescribed components of a hypothetical scenario including trip purpose, vehicle type/size, and weather. It was tested with passengers on the Interislander ferry.

The scenario was an idealised situation in which the major external influences on valuations were fixed. It was verbally described, portrayed with photographs, and presented as a reference table to evoke a consistent and full picture of the alternatives in people's minds.

All respondents expressed willingness to pay for their preference. One respondent indicated he would pay $10 for the unsealed road as it would be "more interesting and

unspoilt". However the other 15 respondents preferred the seal. The average maximum toll that these 15 would pay to avoid the 40 km unsealed road was $5.80 ($0.15/km) with a standard deviation of $3.10 (Table A3.3).

The difficulty with this valuation approach is whether respondents have full and consistent understanding of the specified scenario. For the results to have any meaning, respondents must have fully understood the various aspects of the scenario and taken these into account in their decisions. This cannot be measured and can only be maximised with careful interviewing and clear description. The scenario must cover the key external influences on the valuation, but not be too complex for people to imagine, nor too abstract for them to relate to.

A3.2.3 Conclusion

The choice between the two valuation approaches is therefore a trade-off between realism and certainty regarding the consistency of the scenario on which valuations are based, and control over the scenario design and the external variables.

It is difficult to make measurable improvements to the fully scenario-based approach. However, if suitable sites could be found, the context and site-specific influences of the route-based approach may be controlled.

It was therefore proposed that the main survey should adopt the route-based approach provided that sites could be found that have:

- a significant length of unsealed road (at least 15 km);
- a moderate level of traffic containing a significant proportion of international tourists;
- a popular stop en route or immediately after.

The following sites were suggested following the pilot survey:

- Crown Range road between Wanaka and Arrowtown (South Island). This route has a travel time of one hour, is heavily used by domestic travellers and international tourists, and has an alternative, sealed road. Possible survey sites included: the summit, the Cardrona Hotel, visitor information centres, or petrol stations in Wanaka, Arrowtown, or Queenstown.
- The road to Cape Palliser, Wairarapa. This rough, unsealed road is 15 km in length, leads to a seal colony, lighthouse, and the southernmost point of the North Island. The small settlement of Ngawi at the end of the road has fishing/holiday homes, and a motel.
- Advice on other possibilities in the North Island (for example, Coromandel and Waikaremoana) would be sought from Transit New Zealand regional offices.

A3.3 Conjoint Analysis

The conjoint analysis was completed by all 16 respondents in the survey which was carried out on the Interislander ferry. Interviewer assistance was required at times to interpret the meaning of words such as "road grip" and "considerable", particularly for international tourists. Help was also needed in understanding of questionnaire requirements in the calibration section of the survey.

Three levels were assigned to each of the four key road surface attributes of roughness, grip, dust, and loose stones. Figure A3.1 depicts the utility values calculated for each level of the individual attributes. Attributes were generally ranked, in descending order of importance, from roughness to road grip, to dust level, and then amount of loose stones. The relative magnitude of preferences for the individual levels of variation highlights the importance of road roughness to respondents.

If results of the valuations of discomfort and risk benefits of the sealed alternative from the previous section are applied, the corresponding "package" of surface features (i.e. smooth, high grip, dust free and no loose stones) may be assigned a value of $0.15/km relative to the poorest quality of unsealed road. A road surface representing medium levels of each of these attributes may then be assigned a value of around $0.10/km, given the relativities illustrated in Figure A3.1.

Introduction of a toll to the attribute list may improve on this crude approach as it would seek explicit trade-offs against price of different packages of road features (or different grades of road surface).

The Interislander ferry provided a useful laboratory for determining road user views and is an appropriate site for the conjoint computer interviewing as well as more generalised aspects of the survey.

A3.4 Sampling

Sampling for the pilot surveys was fully randomised with a low refusal rate of 4%. Tables A3.4 and A3.5 describe the two samples in terms of age, sex, and income characteristics, and Tables A3.6 and A3.7 list their experience of unsealed roads in New Zealand and internationally by respondent origin.

The samples contained a relatively small but representative proportion of international tourists. For the Interislander ferry survey, five overseas tourists were interviewed (or 31% of the sample): two from Hong Kong and one each from England, Sweden, and Germany. The number of international tourists sampled on the ferry is in line with McDermott Miller's estimate from previous work of the international tourist share of annual Interislander passenger numbers (34%).

No international tourists were interviewed at Mt Holdsworth. This is a reflection of the localised attraction of the Tararua Forest Park recreation area. Given the importance of the international tourist component to the project, it would be desirable for tourist numbers to be increased in the main survey sample. This would be helped by the use of quotas and careful selection of sites.

On the Interislander ferry, 75% of those interviewed had encountered unsealed roads in the course of tourist-related activities (touring or on leisure/recreation trips). At Mt Holdsworth, all but one of the respondents (the park ranger) were seeking leisure/recreation.

A3.5 Questionnaire Design and Wording

Most of the questions in the survey were answered easily by respondents with no added interpretation or assistance from the interviewer. Only the valuation section of the questionnaire required interviewer interaction, and the remainder could be completed by the respondent alone.

From the pilot survey, the survey design was recommended to be adjusted slightly for self-completion of all questions leading up to the valuation section. This would mean a more user-friendly layout, particularly for the questions on the rating of surface features, and expansion or elaboration of questions such as the income categorisation. Terms such as "road grip" should be defined, particularly for foreign tourists.

Several respondents noted that valuation will also depend on factors not included in the scenarios prescribed, for example driver fatigue levels and characteristics of the group in the vehicle. This suggests that more questions should relate to the respondent's current trip and the demographics of the group as well as of the driver respondent.

A3.6 Recommendations

As a result of the pilot surveys it was recommended that the main surveys should comprise:

1. route-based (aggregate) valuation at three sites (sites to be agreed);
2. disaggregate (conjoint) survey, to be undertaken on board the Interislander ferry.

Table A3.1
Maximum toll paid for sealed road:
Mt Holdsworth pilot- existing road

Sex	(All)
Income	(All)
Origin	(All)
vehicle	(All)
purpose	(All)
pace	(All)

Age	Data	*Total*
<25	respondents	7
	average max toll	$1.14
	std deviation	$1.86
25-39	respondents	9
	average max toll	$1.89
	std deviation	$3.41
40-59	respondents	10
	average max toll	$2.00
	std deviation	$3.23
>60	respondents	4
	average max toll	$2.25
	std deviation	$2.22
Total respondents		30
Total average max toll		$1.80
Total std deviation		$2.80

Table A3.2
Maximum toll paid for sealed road:
Mt Holdsworth pilot- 40 minute road

Sex	(All)
Income	(All)
Origin	(All)
vehicle	(All)
purpose	(All)
pace	(All)

Age	Data	*Total*
<25	respondents	7
	average max toll	$2.57
	std deviation	$2.76
25-39	respondents	9
	average max toll	$1.89
	std deviation	$3.62
40-59	respondents	10
	average max toll	$2.80
	std deviation	$3.05
>60	respondents	4
	average max toll	$0.50
	std deviation	$1.00
Total respondents		30
Total average max toll		$2.17
Total std deviation		$2.96

Table A3.3
Maximum toll paid for sealed road:
Ferry pilot- scenario-based evaluation

Sex	(All)
Income	(All)
Origin	(All)
vehicle	(All)
Purpose	(All)
pace	(All)

Age	Data	*Total*
<25	respondents	3
	average max toll	$3.33
	std deviation	$2.08
25-39	respondents	6
	average max toll	$5.50
	std deviation	$3.62
40-59	respondents	5
	average max toll	$6.80
	std deviation	$2.17
>60	respondents	1
	average max toll	$10.00
	std deviation	
Total respondents		15
Total average max toll		$5.80
Total std deviation		$3.10

Table A3.4
Mt Holdsworth pilot sample demographics

			Income					
Age	Sex	Data	*<30*	*30-49k*	*50-100k*	*>100k*	*n/a*	***Grand Total***
<25yrs	M	respondents	1	0	4	0	0	5
		% of sample	3.3%	0.0%	13.3%	0.0%	0.0%	16.7%
	F	respondents	1	1	0	0	0	2
		% of sample	3.3%	3.3%	0.0%	0.0%	0.0%	6.7%
<25yrs respondents			2	1	4	0	0	7
<25yrs % of sample			6.7%	3.3%	13.3%	0.0%	0.0%	23.3%
25-39yrs	M	respondents	1	1	4	1	0	7
		% of sample	3.3%	3.3%	13.3%	3.3%	0.0%	23.3%
	F	respondents	0	0	2	0	0	2
		% of sample	0.0%	0.0%	6.7%	0.0%	0.0%	6.7%
25-39yrs respondents			1	1	6	1	0	9
25-39yrs % of sample			3.3%	3.3%	20.0%	3.3%	0.0%	30.0%
40-59yrs	M	respondents	1	6	3	0	0	10
		% of sample	3.3%	20.0%	10.0%	0.0%	0.0%	33.3%
40-59yrs respondents			1	6	3	0	0	10
40-59yrs % of sample			3.3%	20.0%	10.0%	0.0%	0.0%	33.3%
>60yrs	M	respondents	2	0	0	0	1	3
		% of sample	6.7%	0.0%	0.0%	0.0%	3.3%	10.0%
	F	respondents	0	1	0	0	0	1
		% of sample	0.0%	3.3%	0.0%	0.0%	0.0%	3.3%
>60yrs respondents			2	1	0	0	1	4
>60yrs % of sample			6.7%	3.3%	0.0%	0.0%	3.3%	13.3%
Total respondents			6	9	13	1	1	30
Total % of sample			20.0%	30.0%	43.3%	3.3%	3.3%	100.0%

Table A3.5
Ferry pilot sample demographics

			Income				
Age	Sex	Data	*<30*	*30-49*	*50-100*	*>100*	***Grand Total***
< 25yrs	M	respondents	1	0	0	0	1
		% of sample	50.0%	0.0%	0.0%	0.0%	6.3%
	F	respondents	1	2	0	0	3
		% of sample	50.0%	40.0%	0.0%	0.0%	18.8%
< 25yrs respondents			2	2	0	0	4
< 25yrs % of sample			100.0%	40.0%	0.0%	0.0%	25.0%
25-39yrs	M	respondents	0	1	3	0	4
		% of sample	0.0%	20.0%	42.9%	0.0%	25.0%
	F	respondents	0	0	1	1	2
		% of sample	0.0%	0.0%	14.3%	50.0%	12.5%
25-39yrs respondents			0	1	4	1	6
25-39yrs % of sample			0.0%	20.0%	57.1%	50.0%	37.5%
40-59yrs	M	respondents	0	1	2	1	4
		% of sample	0.0%	20.0%	28.6%	50.0%	25.0%
	F	respondents	0	0	1	0	1
		% of sample	0.0%	0.0%	14.3%	0.0%	6.3%
40-59yrs respondents			0	1	3	1	5
40-59yrs % of sample			0.0%	20.0%	42.9%	50.0%	31.3%
> 60yrs	M	respondents	0	1	0	0	1
		% of sample	0.0%	20.0%	0.0%	0.0%	6.3%
> 60yrs respondents			0	1	0	0	1
> 60yrs % of sample			0.0%	20.0%	0.0%	0.0%	6.3%
Total respondents			2	5	7	2	16
Total % of sample			100.0%	100.0%	100.0%	100.0%	100.0%

Figure A3.1
Surface attribute conjoint analysis

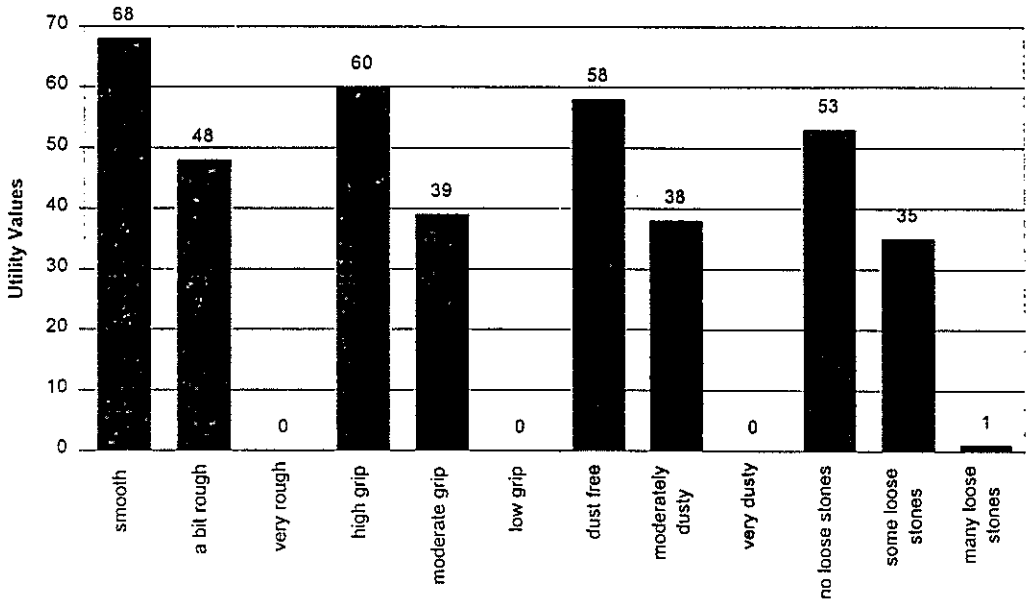


Table A3.6a
Mt Holdsworth pilot sample: overseas experience of unsealed roads, by origin

		Origin		
Overseas experience	Data	*NZ urban*	*NZ rural*	***Grand Total***
zero	respondents	12	3	15
	% by experience	44.4%	100.0%	50.0%
	% by origin	80.0%	20.0%	100.0%
very limited	respondents	6	0	6
	% by experience	22.2%	0.0%	20.0%
	% by origin	100.0%	0.0%	100.0%
moderate	respondents	6	0	6
	% by experience	22.2%	0.0%	20.0%
	% by origin	100.0%	0.0%	100.0%
substantial	respondents	3	0	3
	% by experience	11.1%	0.0%	10.0%
	% by origin	100.0%	0.0%	100.0%
Total respondents		27	3	30
Total % by experience		100.0%	100.0%	100.0%
Total % by origin		90.0%	10.0%	100.0%

Table A3.6b
Mt Holdsworth pilot sample: NZ experience of unsealed roads, by origin

		Origin		
NZ experience	Data	*NZ urban*	*NZ rural*	***Grand Total***
very limited	respondents	5	0	5
	% by experience	18.5%	0.0%	16.7%
	% by origin	100.0%	0.0%	100.0%
moderate	respondents	9	3	12
	% by experience	33.3%	100.0%	40.0%
	% by origin	75.0%	25.0%	100.0%
substantial	respondents	13	0	13
	% by experience	48.1%	0.0%	43.3%
	% by origin	100.0%	0.0%	100.0%
Total respondents		27	3	30
Total % by experience		100.0%	100.0%	100.0%
Total % by origin		90.0%	10.0%	100.0%

Table A3.7a
Ferry pilot sample: overseas experience of unsealed roads, by origin

		Origin				
Overseas experience	Data	*NZ urban*	*NZ rural*	*Europe*	*Asia*	***Grand Total***
zero	respondents	5	1	1	1	8
	% by experience	55.6%	50.0%	33.3%	50.0%	50.0%
	% by origin	62.5%	12.5%	12.5%	12.5%	100.0%
very limited	respondents	3	1	0	1	5
	% by experience	33.3%	50.0%	0.0%	50.0%	31.3%
	% by origin	60.0%	20.0%	0.0%	20.0%	100.0%
moderate	respondents	1	0	1	0	2
	% by experience	11.1%	0.0%	33.3%	0.0%	12.5%
	% by origin	50.0%	0.0%	50.0%	0.0%	100.0%
substantial	respondents	0	0	1	0	1
	% by experience	0.0%	0.0%	33.3%	0.0%	6.3%
	% by origin	0.0%	0.0%	100.0%	0.0%	100.0%
Total respondents		9	2	3	2	16
Total % by experience		100.0%	100.0%	100.0%	100.0%	100.0%
Total % by origin		50.0%	10.7%	28.6%	10.7%	100.0%

Table A3.7b
Ferry pilot sample: NZ experience of unsealed roads, by origin

		Origin				
NZ experience	Data	*NZ urban*	*NZ rural*	*Europe*	*Asia*	***Grand Total***
very limited	Respondents	4	0	1	1	6
	% by experience	44.4%	0.0%	33.3%	50.0%	37.5%
	% by origin	66.7%	0.0%	16.7%	16.7%	100.0%
moderate	Respondents	4	1	1	1	7
	% by experience	44.4%	50.0%	33.3%	50.0%	43.8%
	% by origin	57.1%	14.3%	14.3%	14.3%	100.0%
substantial	Respondents	1	1	1	0	3
	% by experience	11.1%	50.0%	33.3%	0.0%	18.8%
	% by origin	33.3%	33.3%	33.3%	0.0%	100.0%
Total Respondents		9	2	3	2	16
Total % by experience		100.0%	100.0%	100.0%	100.0%	100.0%
Total % by origin		56.3%	12.5%	18.8%	12.5%	100.0%

APPENDIX 4
SURVEY QUESTIONNAIRES

SPECIFIC ROUTE SURVEY

PERCEPTIONS OF COMFORT AND RISK - ROAD USER SURVEY

Location: ..... Interview #: .....

Traffic levels : .....

Weather: current: ..... recent: .....

Thank you for agreeing to help with our survey. The questions should only take a few minutes and your views will help the national roads authority, Transit NZ, evaluate priorities for improving the NZ road system.

Firstly we need to find out some background information to help put your views in context....

1. Would you say that your experience of driving on unsealed roads in NZ was:

very limited ☐ moderate ☐ substantial ☐

1.1 What about overseas?

zero ☐ very limited ☐ moderate ☐ substantial ☐

2. What type of vehicle are you driving now?

small car ☐ medium car ☐ large car ☐ campervan ☐

4WD ☐ other (please specify) .....

3. What is the MAIN purpose of your present trip?

touring ☐ leisure/recreation ☐

commuting/on business ☐ visiting friends or relatives ☐

other (please specify) .....

4. When driving on this road today would you PREFER to drive:

- at a sedate/leisurely pace?; ☐
- at a moderate pace? ☐
- as fast as possible? ☐

5. How long has your trip been so far today? ..... hours

6. Now thinking in GENERAL terms about the actual surface of an unsealed road... please rate the following attributes of unsealed road surfaces in terms of their IMPORTANCE TO YOU as a driver: *(mark the appropriate box)*

	essential/critical	very important	important	neither important or unimportant	unimportant
good grip/ adhesion	☐	☐	☐	☐	☐
no loose stones	☐	☐	☐	☐	☐
not rough	☐	☐	☐	☐	☐
little dust	☐	☐	☐	☐	☐

7. **Now please indicate HOW GOOD you think the section of unsealed road you have just used is for each of these attributes:** *(mark the appropriate box)*

	essential/critical	very important	important	neither important or unimportant	unimportant
amount of grip	☐	☐	☐	☐	☐
amount of loose stones	☐	☐	☐	☐	☐
amount of roughness	☐	☐	☐	☐	☐
amount of dust	☐	☐	☐	☐	☐

Before our inteviewer asks you the last set of questions, we need some general demographic information to help in our analysis...

Please mark the boxes below that apply to YOU, as the driver of the vehicle:

8. Are you a: NZ resident? ☐ visitor to NZ? ☐

8.1 If you are a NZer, do you live: in a city/town? ☐ or in rural NZ? ☐

8.2 If you are a visitor, what country are you from? .....

9. To what age group do you belong?

Under 25 yrs ☐ 25 to 39 yrs ☐ 40-59 yrs ☐ 60 yrs or over ☐

10. Please estimate the combined income of your household (in NZ dollars):

less than $30,000 per year ☐ $30,000-$49,999 per year ☐

$50,000-$100,000 per year ☐ greater than $100,000 per year ☐

11. Are you: male? ☐ female? ☐

12. Now, FOR THE PEOPLE IN YOUR VEHICLE, please place a number in the following boxes to indicate how many people are:

NZ residents? ☐ visitors to NZ? ☐

12.1 If visitors, what country or countries are they from? .....

.....

13. To what age group do they belong (place a number in the appropriate boxes)?

Under 25 yrs ☐ 25 to 39 yrs ☐ 40-59 yrs ☐ 60 yrs or over ☐

THANK YOU FOR YOUR HELP, OUR INTERVIEWER WILL NOW ASK YOU THE FINAL FEW QUESTIONS ...

VALUATION QUESTIONS

"Imagine there is an alternative road (on the other side of the valley/hill) to the one you have just taken to get here. This road is SEALED, it is less direct/longer, but takes the same time. It is similar in all other aspects, including hills, bends, and scenery, to the road you have just taken. Fuel consumption, operating costs, and the chances of having an accident are also identical. Is this scenario clear in your mind?"

14. Which road would you take if you were to make this trip again under the same circumstances ?

15.Now, suppose there is a toll charge for use of the sealed road but no toll for the unsealed road...If the sealed road toll was $X, which road would you take?

Interview #	14. Road Selected	15. First Toll ($X)	Maximum Toll ($X)
1		3	
2		4	
3		5	
4		6	
5		7	
6		8	
7		9	
8		10	
9		3	
10		4	
11		5	
12		6	
13		7	
14		8	
15		9	
16		10	
17		3	
18		4	
19		5	
20		6	
21		7	
22		8	
23		9	
24		10	
25		3	
26		4	
27		5	
28		6	
29		7	
30		8	
31		9	
32		10	
33		3	

Interview #	14. Road Selected	15. First Toll ($X)	Maximum Toll ($X)
34		4	
35		5	
36		6	
37		7	
38		8	
39		9	
40		10	
41		3	
42		4	
43		5	
44		6	
45		7	
46		8	
47		9	
48		10	
49		3	
50		4	
51		5	
52		6	
53		7	
54		8	
55		9	
56		10	
57		3	
58		4	
59		5	
60		6	
61		7	
62		8	
63		9	
64		10	
65		3	
66		4	

Interview #	14. Road Selected	15. First Toll ($X)	Maximum Toll ($X)
67		5	
68		6	
69		7	
70		8	
71		9	
72		10	
73		3	
74		4	
75		5	
76		6	
77		7	
78		8	
79		9	
80		10	
81		3	
82		4	
83		5	
84		6	
85		7	
86		8	
87		9	
88		10	
89		3	
90		4	
91		5	
92		6	
93		7	
94		8	
95		9	
96		10	
97		3	
98		4	
99		5	
100		6	

[If objection expressed to toll concept then repeat the question, starting as follows...] **There is no toll charge but, fuel consumption for the sealed road is higher than for the unsealed road. If the extra cost of fuel was $X, which route would you take?**

THANK YOU FOR YOUR HELP, ENJOY THE REST OF YOUR DAY

CONJOINT SURVEY

PERCEPTIONS OF COMFORT AND RISK - ROAD USER SURVEY

Interview Number:

Ferry direction: Southbound ☐ Northbound ☐

Thank you for agreeing to help with our survey. The questions should only take a few minutes and your views will help the national roads authority, Transit NZ, evaluate priorities for improving the NZ road system.

Firstly we need to find out some background information to help put your views in context....

1. Would you say that your experience of driving on unsealed roads in NZ was:

very limited ☐ moderate ☐ substantial ☐

1.1 What about overseas?

zero ☐ very limited ☐ moderate ☐ substantial ☐

2. When driving on NZ unsealed roads over the last 2 yrs, what type of vehicle have you normally been in?

small car ☐ medium car ☐ large car ☐ campervan ☐

4WD ☐ other (please specify) .....

3. When driving on NZ unsealed roads in the last 2 yrs, what has the MAIN purpose of your trip usually been?

touring ☐ short leisure/recreation trips ☐

to or from work/on business ☐ visiting friends or relatives ☐

other (please specify) .....

4. When driving on NZ unsealed roads on such trips would you normally PREFER to drive:

- at a sedate/leisurely pace? ☐
- at a moderate pace? ☐
- as fast as possible? ☐

5. What New Zealand unsealed road STANDS OUT MOST IN YOUR MEMORY?

.....

5.1 What do you remember most about it? .....

.....

6. **Now thinking IN GENERAL TERMS about the actual surface of an unsealed road... please rate the following attributes of unsealed road surfaces in terms of their IMPORTANCE TO YOU as a driver:** *(mark the appropriate box)*

	essential/critical	very important	important	neither important or unimportant	unimportant
good grip	☐	☐	☐	☐	☐
no loose stones	☐	☐	☐	☐	☐
not rough	☐	☐	☐	☐	☐
little dust	☐	☐	☐	☐	☐

7. **Now please indicate HOW GOOD you think Zealand unsealed road surfaces IN GENERAL rate for these attributes:** *(mark the appropriate box)*

	essential/critical	very important	important	neither important or unimportant	unimportant
amount of grip	☐	☐	☐	☐	☐
amount of loose stones	☐	☐	☐	☐	☐
amount of roughness	☐	☐	☐	☐	☐
amount of dust	☐	☐	☐	☐	☐

Before our computer asks you the last set of questions, we need some general demographic information to help in our analysis...

Please mark the boxes below that apply to YOU, as the driver of the vehicle:

8. Are you a: NZ resident? ☐ visitor to NZ? ☐

8.1 If you are a NZer, do you live: in a city/town? ☐ or in rural NZ? ☐

8.2 If you are a visitor, what country are you from? .....

9. To what age group do you belong?

Under 25 yrs ☐ 25 to 39 yrs ☐ 40-59 yrs ☐ 60 yrs or over ☐

10. Please estimate the combined income of your household (in NZ dollars):

less than $30,000 per year ☐ $30,000-$49,999 per year ☐

$50,000-$100,000 per year ☐ greater than $100,000 per year ☐

11. Are you: male? ☐ female? ☐

12. Now, FOR THE PEOPLE YOU WOULD MOST LIKELY HAVE TRAVELLING WITH YOU IN YOUR VEHICLE, please place a number in the following boxes to indicate how many are:

NZ residents? ☐ visitors to NZ? ☐

12.1 If visitors, what country or countries are they from? .....

.....

13. To what age group do they belong (place a number in the appropriate boxes)?

Under 25 yrs ☐ 25 to 39 yrs ☐ 40-59 yrs ☐ 60 yrs or over ☐

THANK YOU FOR YOUR HELP, OUR COMPUTER WILL NOW ASK YOU THE FINAL FEW QUESTIONS ...

CONJOINT COMPUTER QUESTIONNAIRE FRAMES

F# 1

WELCOME TO THE "MIND BENDING" PART OF THIS SURVEY *

We would now like to explore the trade-offs you might make (consciously or subconsciously) when you choose between roads of different SURFACE conditions.

You can answer all our questions by typing numbers from the top row of the keyboard.

Please press any key now *

F# 2

You shouldn't have any difficulties - if you do just ask.
If you want to go back and review a question or change an answer, just press the X key.

For the following series of questions imagine you are on a leisurely trip in a hired car and are faced with several roads of 40 km leading to your destination. All routes are identical in every way (hills, bends, width, traffic etc) except for their surface condition.

Press any key to continue.

F# 20

We will present to you a series of road surface features that together make up the "road condition".

We will now ask you how IMPORTANT each of these road surface features is to you as driver.

Press any key to continue.

F# 34 (example)

If two roads had surfaces that were acceptable in all other ways, how important would THIS DIFFERENCE be to your choice of route? To answer, type a number from the scale below.

A: VERY DUSTY

versus:

B: DUST FREE

4 = Extremely Important (I could almost never accept B)

3 = Very Important (B would have to be outstanding in other ways)

2 = Somewhat Important (I would not base my decision on this)

1 = Not important At All

Type X to back up or correct an error.

F# 22

Based on what you've told us, we're going to make up some different road surfaces for you to look at.

In each question we present two road surfaces, both described by combinations of features. One is shown on the left of the screen, and the other is shown on the right.

We ask you which road you would prefer and how strong your preference is.

Press any key to continue.

F# 23

For example, two road descriptions are shown below.

Decide which one you would prefer, and how strong your preference is.

If you prefer the one on the left strongly, type a number from the far left side of the scale. If you prefer the one on the right strongly, type a number from the far right side of the scale. Choose a middle number if your preference is not strong, and 4 if you don't care at all.

Smooth Ride but Very Dusty	OR	Rough Ride but No Dust

Strongly Prefer Left	1	2	3	Don't Care 4	5	6	7	Strongly Prefer Right

F# 35 (example)

WHICH WOULD YOU PREFER?
Type a number from the scale below to indicate your preference.

moderately dusty high degree of road grip road toll $5.00	dust free moderate road grip road toll $2.50

Strongly Prefer Left — Don't Care — Strongly Prefer Right

1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7

F# 26

This is the last section. Based on everything you've told us, we're making up some road surfaces for you to look at.

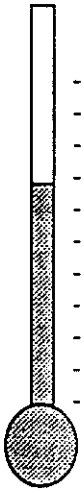
You should like the first road least, the second one more, and the last one best.

I'll ask how to rate how well each road surface appeals to you on a percentage scale (for your leisurely trip in a hired car).

Press any key to continue.

F# 37 (example)

HOW APPEALING WOULD A ROAD WITH THIS SURFACE BE?
* Answer by typing a percentage from the thermometer scale.



Very Appealing

- 100%
- 90%
- 80%
- 70%
- 60%
- 50%
- 40%
- 30%
- 20%
- 10%
- 0%

Not At All Appealing

Smooth
High degree of road grip
Very Dusty
No loose stones
Road toll $2.50

Type a number from 0 to 100, then press ENTER.
(Type X for review.)
Previous Answers: 5% 20% ___ ___ ___

F# 27

Thank you very much for your help.

Enjoy the rest of your trip

F# 30

We will now set up for the next

interview. Bon voyage!

APPENDIX 5
ROADSIDE SURVEY–DEMOGRAPHIC RESULTS

APPENDIX 5: ROADSIDE SURVEY - DEMOGRAPHIC RESULTS

Table A5.1: Age versus Sex versus Survey Site

			Survey			
Age	Sex	Data	*Crown*	*Glenorchy*	*Waipoua*	*Grand Total*
<25	Male	respondents	3	3	4	10
		% of row	30.00%	30.00%	40.00%	100.00%
		% of column	4.35%	4.41%	4.49%	4.42%
	Female	respondents	1	0	3	4
		% of row	25.00%	0.00%	75.00%	100.00%
		% of column	1.45%	0.00%	3.37%	1.77%
<25 respondents			4	3	7	14
<25 % of row			28.57%	21.43%	50.00%	100.00%
<25 % of column			5.80%	4.41%	7.87%	6.19%
25-39	Male	respondents	21	21	24	66
		% of row	31.82%	31.82%	36.36%	100.00%
		% of column	30.43%	30.88%	26.97%	29.20%
	Female	respondents	4	8	6	18
		% of row	22.22%	44.44%	33.33%	100.00%
		% of column	5.80%	11.76%	6.74%	7.96%
	n/a	respondents	0	1	0	1
		% of row	0.00%	100.00%	0.00%	100.00%
		% of column	0.00%	1.47%	0.00%	0.44%
25-39 respondents			25	30	30	85
25-39 % of row			29.41%	35.29%	35.29%	100.00%
25-39 % of column			36.23%	44.12%	33.71%	37.61%
40-59	Male	respondents	23	20	21	64
		% of row	35.94%	31.25%	32.81%	100.00%
		% of column	33.33%	29.41%	23.60%	28.32%
	Female	respondents	6	4	10	20
		% of row	30.00%	20.00%	50.00%	100.00%
		% of column	8.70%	5.88%	11.24%	8.85%
	n/a	respondents	0	1	1	2
		% of row	0.00%	50.00%	50.00%	100.00%
		% of column	0.00%	1.47%	1.12%	0.88%
40-59 respondents			29	25	32	86
40-59 % of row			33.72%	29.07%	37.21%	100.00%
40-59 % of column			42.03%	36.76%	35.96%	38.05%
>60	Male	respondents	8	10	17	35
		% of row	22.86%	28.57%	48.57%	100.00%
		% of column	11.59%	14.71%	19.10%	15.49%
	Female	respondents	1	0	3	4
		% of row	25.00%	0.00%	75.00%	100.00%
		% of column	1.45%	0.00%	3.37%	1.77%
	n/a	respondents	2	0	0	2
		% of row	100.00%	0.00%	0.00%	100.00%
		% of column	2.90%	0.00%	0.00%	0.88%
>60 respondents			11	10	20	41
>60 % of row			26.83%	24.39%	48.78%	100.00%
>60 % of column			15.94%	14.71%	22.47%	18.14%
Total respondents			69	68	89	226
Total % of row			30.53%	30.09%	39.38%	100.00%
Total % of column			100.00%	100.00%	100.00%	100.00%

Table A5.2: Household Income versus Survey Site

		Survey			
Income ($000)	Data	*Crown*	*Glenorchy*	*Waipoua*	***Grand Total***
<30	respondents	16	15	27	58
	% of row	27.59%	25.86%	46.55%	100.00%
	% of column	23.19%	22.06%	30.34%	25.66%
30-49	respondents	23	14	19	56
	% of row	41.07%	25.00%	33.93%	100.00%
	% of column	33.33%	20.59%	21.35%	24.78%
50-100	respondents	20	23	27	70
	% of row	28.57%	32.86%	38.57%	100.00%
	% of column	28.99%	33.82%	30.34%	30.97%
>100	respondents	9	9	6	24
	% of row	37.50%	37.50%	25.00%	100.00%
	% of column	13.04%	13.24%	6.74%	10.62%
n/a	respondents	1	7	10	18
	% of row	5.56%	38.89%	55.56%	100.00%
	% of column	1.45%	10.29%	11.24%	7.96%
Total respondents		69	68	89	226
Total % of row		30.53%	30.09%	39.38%	100.00%
Total % of column		100.00%	100.00%	100.00%	100.00%

Table A5.3: Trip Purpose versus Survey Site

		Survey			
Purpose	Data	*Crown*	*Glenorchy*	*Waipoua*	***Grand Total***
touring	respondents	37	7	54	98
	% of row	37.76%	7.14%	55.10%	100.00%
	% of column	53.62%	10.29%	60.67%	43.36%
leisure/rec	respondents	21	48	23	92
	% of row	22.83%	52.17%	25.00%	100.00%
	% of column	30.43%	70.59%	25.84%	40.71%
business	respondents	9	5	4	18
	% of row	50.00%	27.78%	22.22%	100.00%
	% of column	13.04%	7.35%	4.49%	7.96%
VFR	respondents	1	5	8	14
	% of row	7.14%	35.71%	57.14%	100.00%
	% of column	1.45%	7.35%	8.99%	6.19%
other	respondents	1	3	0	4
	% of row	25.00%	75.00%	0.00%	100.00%
	% of column	1.45%	4.41%	0.00%	1.77%
Total respondents		69	68	89	226
Total % of row		30.53%	30.09%	39.38%	100.00%
Total % of column		100.00%	100.00%	100.00%	100.00%

Table A5.4: Origin Detail versus Survey Site

		Survey			
Origin detail	Data	*Crown*	*Glenorchy*	*Waipoua*	***Grand Total***
Urban NZ	respondents	27	29	31	87
	% of row	31.03%	33.33%	35.63%	100.00%
	% of column	39.13%	42.65%	34.83%	38.50%
Rural NZ	respondents	16	16	16	48
	% of row	33.33%	33.33%	33.33%	100.00%
	% of column	23.19%	23.53%	17.98%	21.24%
Europe	respondents	16	13	12	41
	% of row	39.02%	31.71%	29.27%	100.00%
	% of column	23.19%	19.12%	13.48%	18.14%
Asia	respondents	2	0	0	2
	% of row	100.00%	0.00%	0.00%	100.00%
	% of column	2.90%	0.00%	0.00%	0.88%
Australia	respondents	2	3	19	24
	% of row	8.33%	12.50%	79.17%	100.00%
	% of column	2.90%	4.41%	21.35%	10.62%
N. America	respondents	6	7	11	24
	% of row	25.00%	29.17%	45.83%	100.00%
	% of column	8.70%	10.29%	12.36%	10.62%
Total respondents		69	68	89	226
Total % of row		30.53%	30.09%	39.38%	100.00%
Total % of column		100.00%	100.00%	100.00%	100.00%

Table A5.5: Origin Detail versus Experience of New Zealand Unsealed Roads

		NZ exp.			
Origin detail	Data	*very limited*	*moderate*	*substantial*	***Grand Total***
Urban NZ	respondents	8	33	46	87
	% of row	9.20%	37.93%	52.87%	100.00%
	% of column	17.78%	41.25%	45.54%	38.50%
Rural NZ	respondents	0	5	43	48
	% of row	0.00%	10.42%	89.58%	100.00%
	% of column	0.00%	6.25%	42.57%	21.24%
Europe	respondents	14	20	7	41
	% of row	34.15%	48.78%	17.07%	100.00%
	% of column	31.11%	25.00%	6.93%	18.14%
Asia	respondents	2	0	0	2
	% of row	100.00%	0.00%	0.00%	100.00%
	% of column	4.44%	0.00%	0.00%	0.88%
Australia	respondents	13	9	2	24
	% of row	54.17%	37.50%	8.33%	100.00%
	% of column	28.89%	11.25%	1.98%	10.62%
N. America	respondents	8	13	3	24
	% of row	33.33%	54.17%	12.50%	100.00%
	% of column	17.78%	16.25%	2.97%	10.62%
Total respondents		45	80	101	226
Total % of row		19.91%	35.40%	44.69%	100.00%
Total % of column		100.00%	100.00%	100.00%	100.00%

Table A5.6: Origin Detail versus Experience of Overseas Unsealed Roads

		O/Sexp					
Origin detail	Data	*zero*	*very limited*	*moderate*	*substantial*	*n/a*	*Grand Total*
Urban NZ	respondents	44	24	14	5	0	87
	% of row	50.57%	27.59%	16.09%	5.75%	0.00%	100.00%
	% of column	56.41%	36.36%	31.11%	14.29%	0.00%	38.50%
Rural NZ	respondents	18	16	6	7	1	48
	% of row	37.50%	33.33%	12.50%	14.58%	2.08%	100.00%
	% of column	23.08%	24.24%	13.33%	20.00%	50.00%	21.24%
Europe	respondents	5	12	16	7	1	41
	% of row	12.20%	29.27%	39.02%	17.07%	2.44%	100.00%
	% of column	6.41%	18.18%	35.56%	20.00%	50.00%	18.14%
Asia	respondents	0	2	0	0	0	2
	% of row	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%
	% of column	0.00%	3.03%	0.00%	0.00%	0.00%	0.88%
Australia	respondents	9	7	4	4	0	24
	% of row	37.50%	29.17%	16.67%	16.67%	0.00%	100.00%
	% of column	11.54%	10.61%	8.89%	11.43%	0.00%	10.62%
N. America	respondents	2	5	5	12	0	24
	% of row	8.33%	20.83%	20.83%	50.00%	0.00%	100.00%
	% of column	2.56%	7.58%	11.11%	34.29%	0.00%	10.62%
Total respondents		78	66	45	35	2	226
Total % of row		34.51%	29.20%	19.91%	15.49%	0.88%	100.00%
Total % of column		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table A5.7: Origin Detail versus Preferred Pace on Unsealed Roads

		Pace			
Origin detail	Data	*sedate*	*moderate*	*fast*	*Grand Total*
Urban NZ	respondents	41	40	6	87
	% of row	47.13%	45.98%	6.90%	100.00%
	% of column	46.59%	35.09%	25.00%	38.50%
Rural NZ	respondents	12	24	12	48
	% of row	25.00%	50.00%	25.00%	100.00%
	% of column	13.64%	21.05%	50.00%	21.24%
Europe	respondents	15	21	5	41
	% of row	36.59%	51.22%	12.20%	100.00%
	% of column	17.05%	18.42%	20.83%	18.14%
Asia	respondents	1	1	0	2
	% of row	50.00%	50.00%	0.00%	100.00%
	% of column	1.14%	0.88%	0.00%	0.88%
Australia	respondents	9	14	1	24
	% of row	37.50%	58.33%	4.17%	100.00%
	% of column	10.23%	12.28%	4.17%	10.62%
N. America	respondents	10	14	0	24
	% of row	41.67%	58.33%	0.00%	100.00%
	% of column	11.36%	12.28%	0.00%	10.62%
Total respondents		88	114	24	226
Total % of row		38.94%	50.44%	10.62%	100.00%
Total % of column		100.00%	100.00%	100.00%	100.00%

Table A5.8: **Trip Purpose versus Preferred Pace on Unsealed Roads**

		Pace			
Purpose	Data	*sedate*	*moderate*	*fast*	***Grand Total***
touring	respondents	38	54	6	98
	% of row	38.78%	55.10%	6.12%	100.00%
	% of column	43.18%	47.37%	25.00%	43.36%
leisure/rec	respondents	40	43	9	92
	% of row	43.48%	46.74%	9.78%	100.00%
	% of column	45.45%	37.72%	37.50%	40.71%
business	respondents	3	6	9	18
	% of row	16.67%	33.33%	50.00%	100.00%
	% of column	3.41%	5.26%	37.50%	7.96%
VFR	respondents	4	10	0	14
	% of row	28.57%	71.43%	0.00%	100.00%
	% of column	4.55%	8.77%	0.00%	6.19%
other	respondents	3	1	0	4
	% of row	75.00%	25.00%	0.00%	100.00%
	% of column	3.41%	0.88%	0.00%	1.77%
Total respondents		88	114	24	226
Total % of row		38.94%	50.44%	10.62%	100.00%
Total % of column		100.00%	100.00%	100.00%	100.00%

Table A5.9: **Age versus Preferred Pace on Unsealed Roads**

		Pace			
Age	Data	*sedate*	*moderate*	*fast*	***Grand Total***
<25	respondents	2	10	2	14
	% of row	14.29%	71.43%	14.29%	100.00%
	% of column	2.27%	8.77%	8.33%	6.19%
25-39	respondents	28	41	16	85
	% of row	32.94%	48.24%	18.82%	100.00%
	% of column	31.82%	35.96%	66.67%	37.61%
40-59	respondents	40	41	5	86
	% of row	46.51%	47.67%	5.81%	100.00%
	% of column	45.45%	35.96%	20.83%	38.05%
>60	respondents	18	22	1	41
	% of row	43.90%	53.66%	2.44%	100.00%
	% of column	20.45%	19.30%	4.17%	18.14%
Total respondents		88	114	24	226

Table A5.10: Vehicle Type versus Preferred Pace on Unsealed Roads

		Pace			
Vehicle	Data	*sedate*	*moderate*	*fast*	***Grand Total***
small car	respondents	18	17	1	36
	% of row	50.00%	47.22%	2.78%	100.00%
	% of column	20.45%	14.91%	4.17%	15.93%
medium car	respondents	36	50	8	94
	% of row	38.30%	53.19%	8.51%	100.00%
	% of column	40.91%	43.86%	33.33%	41.59%
large car	respondents	14	16	6	36
	% of row	38.89%	44.44%	16.67%	100.00%
	% of column	15.91%	14.04%	25.00%	15.93%
campervan	respondents	8	10	2	20
	% of row	40.00%	50.00%	10.00%	100.00%
	% of column	9.09%	8.77%	8.33%	8.85%
4WD	respondents	5	10	5	20
	% of row	25.00%	50.00%	25.00%	100.00%
	% of column	5.68%	8.77%	20.83%	8.85%
other	respondents	7	11	2	20
	% of row	35.00%	55.00%	10.00%	100.00%
	% of column	7.95%	9.65%	8.33%	8.85%
Total respondents		88	114	24	226
Total % of row		38.94%	50.44%	10.62%	100.00%
Total % of column		100.00%	100.00%	100.00%	100.00%

Table A5.11: Trip Length So Far versus Survey Site

		Survey			
Trip length	Data	*Crown*	*Glenorchy*	*Waipoua*	***Grand Total***
<0.5hr	respondents	3	0	3	6
	% of row	50.00%	0.00%	50.00%	100.00%
	% of column	4.35%	0.00%	3.37%	2.65%
0.5-1hr	respondents	23	19	11	53
	% of row	43.40%	35.85%	20.75%	100.00%
	% of column	33.33%	27.94%	12.36%	23.45%
1-1.5hr	respondents	13	30	10	53
	% of row	24.53%	56.60%	18.87%	100.00%
	% of column	18.84%	44.12%	11.24%	23.45%
1.5-3.0hr	respondents	15	13	20	48
	% of row	31.25%	27.08%	41.67%	100.00%
	% of column	21.74%	19.12%	22.47%	21.24%
>3.0hr	respondents	12	6	39	57
	% of row	21.05%	10.53%	68.42%	100.00%
	% of column	17.39%	8.82%	43.82%	25.22%
n/a	respondents	3	0	6	9
	% of row	33.33%	0.00%	66.67%	100.00%
	% of column	4.35%	0.00%	6.74%	3.98%
Total respondents		69	68	89	226
Total % of row		30.53%	30.09%	39.38%	100.00%
Total % of column		100.00%	100.00%	100.00%	100.00%

Table A5.12: Number of Passengers versus Origin versus Vehicle Type

			Vehicle2				
Origin	Passengers	Data	*car*	*campervan*	*4WD*	*other*	*Grand Total*
NZ	0	respondents	20	2	1	3	26
		% of row	76.92%	7.69%	3.85%	11.54%	100.00%
		% of column	12.05%	10.00%	5.00%	15.00%	11.50%
	1	respondents	35	0	9	2	46
		% of row	76.09%	0.00%	19.57%	4.35%	100.00%
		% of column	21.08%	0.00%	45.00%	10.00%	20.35%
	2	respondents	17	3	3	2	25
		% of row	68.00%	12.00%	12.00%	8.00%	100.00%
		% of column	10.24%	15.00%	15.00%	10.00%	11.06%
	3	respondents	15	1	1	1	18
		% of row	83.33%	5.56%	5.56%	5.56%	100.00%
		% of column	9.04%	5.00%	5.00%	5.00%	7.96%
	4+	respondents	8	2	4	6	20
		% of row	40.00%	10.00%	20.00%	30.00%	100.00%
		% of column	4.82%	10.00%	20.00%	30.00%	8.85%
Overseas	0	respondents	8	0	1	3	12
		% of row	66.67%	0.00%	8.33%	25.00%	100.00%
		% of column	4.82%	0.00%	5.00%	15.00%	5.31%
	1	respondents	45	8	1	1	55
		% of row	81.82%	14.55%	1.82%	1.82%	100.00%
		% of column	27.11%	40.00%	5.00%	5.00%	24.34%
	2	respondents	10	3	0	0	13
		% of row	76.92%	23.08%	0.00%	0.00%	100.00%
		% of column	6.02%	15.00%	0.00%	0.00%	5.75%
	3	respondents	7	0	0	0	7
		% of row	100.00%	0.00%	0.00%	0.00%	100.00%
		% of column	4.22%	0.00%	0.00%	0.00%	3.10%
	4+	respondents	1	1	0	2	4
		% of row	25.00%	25.00%	0.00%	50.00%	100.00%
		% of column	0.60%	5.00%	0.00%	10.00%	1.77%
Total respondents			166	20	20	20	226
Total % of row			73.45%	8.85%	8.85%	8.85%	100.00%
Total % of column			100.00%	100.00%	100.00%	100.00%	100.00%

APPENDIX 6
ROADSIDE SURVEY–VALUATION RESULTS

APPENDIX 6: VALUATION RESULTS

Table A6.1: Road Surface Preference versus Survey Site versus Origin

			Origin		
Choice	Survey	Data	*NZ*	*Overseas*	***Grand Total***
Sealed	Waipoua	average toll	$5.62	$4.90	$5.23
		std deviation	$4.81	$3.74	$4.24
		average toll/km	$0.56	$0.49	$0.52
		respondents	26	31	57
	Crown	average toll	$4.91	$6.95	$5.64
		std deviation	$4.52	$6.45	$5.33
		average toll/km	$0.17	$0.24	$0.19
		respondents	40	22	62
	Glenorchy	average toll	$7.76	$6.58	$7.35
		std deviation	$4.51	$5.66	$4.93
		average toll/km	$0.12	$0.10	$0.12
		respondents	39	21	60
Sealed average toll			$6.14	$5.99	$6.08
Sealed std deviation			$4.72	$5.23	$4.93
Sealed average toll/km			$0.25	$0.31	$0.27
Sealed respondents			105	74	179
Unsealed	Waipoua	average toll	-$2.52	-$4.55	-$3.22
		std deviation	$3.61	$4.76	$4.09
		average toll/km	-$0.25	-$0.45	-$0.32
		respondents	21	11	32
	Crown	average toll	-$2.33	-$6.75	-$4.86
		std deviation	$2.52	$9.07	$6.99
		average toll/km	-$0.08	-$0.23	-$0.17
		respondents	3	4	7
	Glenorchy	average toll	-$15.00	-$7.50	-$12.00
		std deviation	$5.00	$3.54	$5.70
		average toll/km	-$0.24	-$0.12	-$0.19
		respondents	3	2	5
Unsealed average toll			-$3.89	-$5.41	-$4.48
Unsealed std deviation			$5.34	$5.65	$5.45
Unsealed average toll/km			-$0.23	-$0.36	-$0.28
Unsealed respondents			27	17	44
either		average toll	$0.00	#DIV/0!	$0.00
		std deviation	$0.00	#DIV/0!	$0.00
		average toll/km	$0.00	#DIV/0!	$0.00
		respondents	3	0	3
Total average toll			$4.00	$3.86	$3.94
Total std deviation			$6.27	$6.92	$6.52
Total average toll/km			$0.15	$0.18	$0.16
Total respondents			135	91	226

Table A6.2: **Road Surface Preference versus Survey Site versus Experience**

			NZ exp.			
Choice	Survey	Data	*very limited*	*moderate*	*substantial*	***Grand Total***
Sealed	Waipoua	average toll	$4.71	$4.48	$6.76	$5.23
		std deviation	$4.15	$3.73	$4.79	$4.24
		average toll/km	$0.47	$0.45	$0.68	$0.52
		respondents	17	23	17	57
	Crown	average toll	$6.25	$6.95	$4.43	$5.64
		std deviation	$6.52	$5.02	$4.91	$5.33
		average toll/km	$0.22	$0.24	$0.15	$0.19
		respondents	12	21	29	62
	Glenorchy	average toll	$8.70	$7.59	$6.75	$7.35
		std deviation	$6.65	$4.61	$4.46	$4.93
		average toll/km	$0.14	$0.12	$0.11	$0.12
		respondents	11	17	32	60
Sealed average toll			$6.27	$6.20	$5.89	$6.08
Sealed std deviation			$5.76	$4.59	$4.78	$4.93
Sealed average toll/km			$0.30	$0.28	$0.25	$0.27
Sealed respondents			40	61	78	179
Unsealed	Waipoua	average toll	-$9.33	-$2.57	-$2.60	-$3.22
		std deviation	$1.15	$3.41	$4.14	$4.09
		average toll/km	-$0.93	-$0.26	-$0.26	-$0.32
		respondents	3	14	15	32
	Crown	average toll	-$20.00	-$3.50	-$1.75	-$4.86
		std deviation	#DIV/0!	$2.12	$2.36	$6.99
		average toll/km	-$0.69	-$0.12	-$0.06	-$0.17
		respondents	1	2	4	7
	Glenorchy	average toll	-$5.00	-$15.00	-$12.50	-$12.00
		std deviation	#DIV/0!	$7.07	$3.54	$5.70
		average toll/km	-$0.08	-$0.24	-$0.20	-$0.19
		respondents	1	2	2	5
Unsealed average toll			-$10.60	-$4.06	-$3.38	-$4.48
Unsealed std deviation			$5.64	$5.30	$4.77	$5.45
Unsealed average toll/km			-$0.71	-$0.24	-$0.22	-$0.28
Unsealed respondents			5	18	21	44
either		average toll	#DIV/0!	$0.00	$0.00	$0.00
		std deviation	#DIV/0!	#DIV/0!	$0.00	$0.00
		average toll/km	#DIV/0!	$0.00	$0.00	$0.00
		respondents	0	1	2	3
Total average toll			$4.39	$3.81	$3.85	$3.94
Total std deviation			$7.81	$6.38	$6.05	$6.52
Total average toll/km			$0.19	$0.16	$0.15	$0.16
Total respondents			45	80	101	226

Table A6.3: Road Surface Preference versus Survey Site versus Preferred Pace on Unsealed Roads

			Pace			
Choice	Survey	Data	*leisurely*	*moderate*	*fast*	*Grand Total*
Sealed	Waipoua	average toll	$7.10	$3.91	$6.67	$5.23
		std deviation	$4.84	$3.47	$2.89	$4.24
		average toll/km	$0.71	$0.39	$0.67	$0.52
		respondents	21	33	3	57
	Crown	average toll	$5.00	$6.67	$4.96	$5.64
		std deviation	$5.28	$5.99	$4.02	$5.33
		average toll/km	$0.17	$0.23	$0.17	$0.19
		respondents	25	24	13	62
	Glenorchy	average toll	$8.18	$6.70	$7.50	$7.35
		std deviation	$6.43	$3.71	$2.89	$4.93
		average toll/km	$0.13	$0.11	$0.12	$0.12
		respondents	24	32	4	60
Sealed average toll			$6.72	$5.66	$5.73	$6.08
Sealed std deviation			$5.67	$4.52	$3.69	$4.93
Sealed average toll/km			$0.32	$0.25	$0.24	$0.27
Sealed respondents			70	89	20	179
Unsealed	Waipoua	average toll	-$5.73	-$2.22	$0.00	-$3.22
		std deviation	$4.31	$3.54	$0.00	$4.09
		average toll/km	-$0.57	-$0.22	$0.00	-$0.32
		respondents	11	18	3	32
	Crown	average toll	-$6.75	-$3.50	$0.00	-$4.86
		std deviation	$9.07	$2.12	#DIV/0!	$6.99
		average toll/km	-$0.23	-$0.12	$0.00	-$0.17
		respondents	4	2	1	7
	Glenorchy	average toll	-$12.50	-$11.67	#DIV/0!	-$12.00
		std deviation	$3.54	$7.64	#DIV/0!	$5.70
		average toll/km	-$0.20	-$0.19	#DIV/0!	-$0.19
		respondents	2	3	0	5
Unsealed average toll			-$6.76	-$3.57	$0.00	-$4.48
Unsealed std deviation			$5.72	$5.06	$0.00	$5.45
Unsealed average toll/km			-$0.45	-$0.21	$0.00	-$0.28
Unsealed respondents			17	23	4	44
either		average toll	$0.00	$0.00	#DIV/0!	$0.00
		std deviation	#DIV/0!	$0.00	#DIV/0!	$0.00
		average toll/km	$0.00	$0.00	#DIV/0!	$0.00
		respondents	1	2	0	3
Total average toll			$4.04	$3.70	$4.77	$3.94
Total std deviation			$7.76	$5.91	$4.00	$6.52
Total average toll/km			$0.17	$0.15	$0.20	$0.16
Total respondents			88	114	24	226

Table A6.4: **Age versus Survey Site versus Road Surface Preference**

		Choice			
Age	Data	*Sealed*	*Unsealed*	*either*	***Grand Total***
<25 yrs	average toll	$3.70	$0.00	$0.00	$2.64
	std deviation	$3.53	$0.00	#DIV/0!	$3.41
	average toll/km	$0.19	$0.00	$0.00	$0.14
	respondents	10	3	1	14
25-39 yrs	average toll	$5.49	-$3.80	$0.00	$3.72
	std deviation	$4.80	$5.57	$0.00	$6.04
	average toll/km	$0.20	-$0.26	$0.00	$0.11
	respondents	68	15	2	85
40-59 yrs	average toll	$6.96	-$5.68	#DIV/0!	$4.17
	std deviation	$5.33	$5.72	#DIV/0!	$7.54
	average toll/km	$0.29	-$0.37	#DIV/0!	$0.14
	respondents	67	19	0	86
>60 yrs	average toll	$6.22	-$3.67	#DIV/0!	$4.74
	std deviation	$4.47	$4.97	#DIV/0!	$5.73
	average toll/km	$0.42	-$0.09	#DIV/0!	$0.34
	respondents	34	6	0	40
n/a	average toll	#DIV/0!	-$10.00	#DIV/0!	-$10.00
	std deviation	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	average toll/km	#DIV/0!	-$1.00	#DIV/0!	-$1.00
	respondents	0	1	0	1
Total average toll		$6.08	-$4.48	$0.00	$3.94
Total std deviation		$4.93	$5.45	$0.00	$6.52
Total average toll/km		$0.27	-$0.28	$0.00	$0.16
Total respondents		179	44	3	226

Table A6.5: **Passenger Numbers versus Road Surface Preference**

		Choice			
Passengers	Data	*Sealed*	*Unsealed*	*either*	***Grand Total***
0	average toll	$7.36	-$3.75	$0.00	$4.83
	std deviation	$5.17	$6.82	#DIV/0!	$7.12
	average toll/km	$0.34	-$0.16	$0.00	$0.23
	respondents	29	8	1	38
1	average toll	$5.84	-$5.00	$0.00	$4.07
	std deviation	$5.06	$5.01	#DIV/0!	$6.40
	average toll/km	$0.26	-$0.37	$0.00	$0.16
	respondents	84	16	1	101
2	average toll	$5.80	-$3.50	#DIV/0!	$3.36
	std deviation	$4.64	$3.95	#DIV/0!	$6.06
	average toll/km	$0.33	-$0.25	#DIV/0!	$0.17
	respondents	28	10	0	38
3	average toll	$5.50	-$3.60	$0.00	$3.46
	std deviation	$4.91	$4.98	#DIV/0!	$6.03
	average toll/km	$0.18	-$0.36	$0.00	$0.06
	respondents	19	5	1	25
4+	average toll	$6.16	-$6.80	#DIV/0!	$3.46
	std deviation	$4.52	$8.44	#DIV/0!	$7.57
	average toll/km	$0.25	-$0.18	#DIV/0!	$0.16
	respondents	19	5	0	24
Total average toll		$6.08	-$4.48	$0.00	$3.94
Total std deviation		$4.93	$5.45	$0.00	$6.52
Total average toll/km		$0.27	-$0.28	$0.00	$0.16
Total respondents		179	44	3	226

Table A6.6: **Household Income versus Road Surface Preference**

		Choice			
Income	Data	*Sealed*	*Unsealed*	*either*	***Grand Total***
<30	average toll	$5.74	-$2.36	$0.00	$3.59
	std deviation	$3.75	$5.42	$0.00	$5.42
	average toll/km	$0.30	-$0.12	$0.00	$0.19
	respondents	42	14	2	58
30-49	average toll	$5.22	-$4.10	$0.00	$3.46
	std deviation	$4.43	$4.33	#DIV/0!	$5.65
	average toll/km	$0.21	-$0.35	$0.00	$0.11
	respondents	45	10	1	56
50-100	average toll	$7.30	-$6.00	#DIV/0!	$4.64
	std deviation	$5.81	$4.08	#DIV/0!	$7.67
	average toll/km	$0.33	-$0.45	#DIV/0!	$0.17
	respondents	56	14	0	70
>100	average toll	$7.10	-$6.33	#DIV/0!	$5.42
	std deviation	$5.66	$7.77	#DIV/0!	$7.33
	average toll/km	$0.24	-$0.21	#DIV/0!	$0.18
	respondents	21	3	0	24
n/a	average toll	$3.63	-$6.67	#DIV/0!	$1.92
	std deviation	$3.25	$11.55	#DIV/0!	$6.33
	average toll/km	$0.24	-$0.11	#DIV/0!	$0.18
	respondents	15	3	0	18
Total average toll		$6.08	-$4.48	$0.00	$3.94
Total std deviation		$4.93	$5.45	$0.00	$6.52
Total average toll/km		$0.27	-$0.28	$0.00	$0.16
Total respondents		179	44	3	226

Table A6.7: Trip Purpose versus Road Surface Preference

		Choice			
Purpose	Data	*Sealed*	*Unsealed*	*either*	***Grand Total***
touring	average toll	$5.56	-$4.42	#DIV/0!	$3.62
	std deviation	$4.86	$4.02	#DIV/0!	$6.14
	average toll/km	$0.33	-$0.35	#DIV/0!	$0.20
	respondents	79	19	0	98
leisure/rec	average toll	$6.86	-$6.47	$0.00	$4.32
	std deviation	$4.78	$6.96	#DIV/0!	$7.35
	average toll/km	$0.23	-$0.32	$0.00	$0.12
	respondents	74	17	1	92
business	average toll	$5.25	$0.00	$0.00	$4.08
	std deviation	$5.71	$0.00	#DIV/0!	$5.47
	average toll/km	$0.21	$0.00	$0.00	$0.16
	respondents	14	3	1	18
VFR	average toll	$6.33	-$0.60	#DIV/0!	$3.86
	std deviation	$5.79	$1.34	#DIV/0!	$5.75
	average toll/km	$0.34	-$0.06	#DIV/0!	$0.20
	respondents	9	5	0	14
Other	average toll	$3.67	#DIV/0!	$0.00	$2.75
	std deviation	$3.21	#DIV/0!	#DIV/0!	$3.20
	average toll/km	$0.06	#DIV/0!	$0.00	$0.04
	respondents	3	0	1	4
Total average toll		$6.08	-$4.48	$0.00	$3.94
Total std deviation		$4.93	$5.45	$0.00	$6.52
Total average toll/km		$0.27	-$0.28	$0.00	$0.16
Total respondents		179	44	3	226