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NZTA research

NZ TRANSPORT AGENCY
WAKA KOTAHI

PUBLIC TRANSPORT USE AND PRIORITIES LINKED TO GENERATIONS

A study to examine the public transport usage and priorities for Generation Y has found that, with careful targeting, future investment could significantly increase public transport patronage across multiple generations.

International trends show that members of Generation Y are not only likely to use public transport more frequently than previous generations, but are also more likely to continue using it for longer. Members of Generation Y are also less likely to hold a driver licence, or register or own a car.

These trends have emerged all around the globe, from the USA and Canada to Australia, Japan, the UK and many other European countries. In New Zealand, however, little evidence has been available to suggest whether or not the trends are borne out here.

The NZ Transport Agency commissioned Opus Research to research this knowledge gap, and thereby enable an evidence-based approach to future policy and investment decision-making for public transport.

Jared Thomas of Opus says 'We wanted to understand why Generation Y was using public transport more than prior generations, whether this was an ongoing trend, and how we could better tailor service improvements and investment for this high-use group. We were also interested in how these priorities differed from those of the older generations and where the areas of cross-over were.'

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TAKING A CLOSER LOOK AT GENERATION Y

The Generation Y cohort, as defined in the study, consists of individuals aged between 15 and 35 years in 2014, or born between 1979 and 1999 (inclusive).

Internationally, public transport is not the only area where Generation Y's travel behaviour differs from that of previous generations. Overall, members of this cohort appear to be travelling less, particularly for recreational travel. When they do travel, there is a greater preference, than is found in other generations, for public transport.

The Opus study used a multi-pronged approach to analyse whether these travel patterns, preferences and priorities were evident in New Zealand. Key steps involved analysing New Zealand datasets (particularly the New Zealand Household Travel Survey), holding qualitative focus groups with members of Generation Y from high-density (Auckland) and lower-density (Hawke's Bay) regions, and conducting online surveys on the travel behaviour of 1,191 travellers, in order to compare the behaviour of the Generation Y cohort with that of an older control cohort of travellers (aged 36 years and older).

Jared says, 'What we found was that many of the trends emerging overseas are reflected here. So despite our history of car dominance, New Zealanders do see public transport as a more viable option, with evidence of large, sustained growth. The real question is – are we agile enough and bold enough to take the lead-investment opportunities and respond to our changing travel needs?'

One Generation Y Auckland participant, quoted in the research report (p89), summarised the need for New Zealand to be more proactive.

'Something has to give, either first the transport companies say "oh let's give it a go" or it could take 20 years before people change and by then Auckland will be 3 million people so again it will be the same problem... So someone has to do something about it and proactively, whether that is a discount, trying to encourage people to use public transport. Because the moment they do, there will be more money to put more buses on the road and everything will just start working. But somehow, the ball has to start rolling.'

Other key findings of the study were as follows.

- Members of Generation Y currently use, and are projected to continue to use, public transport at a higher rate than their older counterparts, indicating the increased use is not temporary and that overall investment in public transport should be maintained.
- There is a high latent demand for public transport both among members of Generation Y and older travellers in New Zealand. A key reason for this is likely to be that existing public transport investment strategies are having an impact, and as a result New Zealanders are seeing public transport as a more viable option. Further investment should target this latent demand.
- There is also latent demand for active transport modes (such as walking and cycling), with some evidence that this demand may be in fact higher than that for public transport: more respondents indicated a desire to increase their travel by cycling, followed by walking and then public transport. This was true for older generations as well.
- For Generation Y's main trips, the proportion of public transport users is projected to increase from 35.3% (at present) to 48.7% (in the next five years) if no major improvements to public transport services and infrastructure are introduced. With improvements, the increase could be in the order of 53.7%.
- Overall rates for Generation Y's other trips (such as recreational trips) are projected to more than double, with a baseline of 18.6 % increasing to 42.6% if we maintain status quo, and 48.8% with improvements. This is even more likely to happen if the service can improve around non-commuter trips, which are often at more varied times of day and location.
- Travel patterns can be difficult to shift, but 90% of Generation Y members anticipate their travel patterns will change in the next five years (as opposed to 50% in the older group), indicating an opportunity to encourage positive changes in travel for Generation Y.

SETTING PRIORITIES FOR SERVICE IMPROVEMENTS

One particular focus area for the research project was on priorities for public transport service improvements. While there was some overlap between the priorities identified by members of Generation Y and members of the older control group, there were also distinct differences. The identified priorities for each group are summarised in the table below.

RANK	GENERATION Y (N=342)	TOTAL %	OLDER CONTROL GROUP (N=291)	TOTAL %
1	Increased frequency (peak)	29.8%	Improved coverage	32.6%
2	Improved coverage	24.6%	Increased frequency (peak)	28.2%
3	Bus priority lanes	22.2%	Increased frequency (evening and weekend off-peak)	22.3%
4	Free service transfers	20.5%	Integrated ticketing	21.0%
5	Increased frequency (evening and weekend off-peak)	22.8%	Shorter overall trip times	17.5%
6	Shorter overall trip times	19.3%	Bus priority lanes	13.4%
7	Integrated ticketing	16.4%	Increased frequency (daytime off-peak)	16.5%
8	Increased frequency (daytime off-peak)	13.7%	Cycle facilities on-board	14.8%
9	Improved real-time info	15.2%	Short transfer wait times	14.1%
10	Wifi on services	10.5%	Bus signal priority at lights	11.7%

Jared explains, 'There is a lot of overlap in basic service improvement priorities between members of Generation Y and their older counterparts, such as service frequency and coverage. This means that any service improvements for Generation Y are likely to have flow-on positive effects for the rest of the New Zealand population. We need to get the basics right first, just as, if you wanted to improve your home, you might start with some better insulation before you purchase new carpet.'

Priorities more specific to Generation Y relate to pricing mechanisms for transfers and improved information (both real-time travel information and general information access through a Wifi service). However, these improvements still promise to deliver benefits across the generations.

Jared says, 'Introducing smarter pricing mechanisms to reward and retain loyal customers and adding in desirable extras, such as free Wifi, are likely to create a positive attitude to public transport across the generations. Everyone has a story to tell around a public transport issue; let's create some positive stories by making public transport trips more desirable.'

Other recommendations in the research report include:

- targeting the top priorities that are consistent between Generation Y and older travellers, as these are likely to have the largest impact on usage rates
- introducing smarter ticketing options that reward regular users and create the feeling of receiving a 'win'. Potential interventions might include fare reductions to compensate for late-running services or other inconveniences, free public transport use for secondary and tertiary students, free bonus trips to reward frequent users, and promotions to encourage recreational or social trips
- targeting interventions to encourage positive travel behaviour at particular life stages, such as when people are moving locations (where the research found there was a strong desire among movers to maximise accessibility and review their transport options); attending a tertiary institution (when there tends to be a marked increase in public transport use); and starting a family (when there tends to be an increase in the use of private vehicles, but interventions could promote ongoing public transport use).

Public transport and the next generation, NZ Transport Agency research report 569

Available online at **www.nzta.govt.nz/resources/research/reports/569**

CHIPSEALING STUDY RAISES POSSIBLE NEW APPROACH TO BASECOURSE

Tests to investigate the effects of water on chipseal and basecourse on high-volume roads have returned some surprising results, raising questions about the optimum basecourse material to use for unbound pavement construction in New Zealand.

The tests were conducted at the NZ Transport Agency's Canterbury Accelerated Pavement Testing Indoor Facility (CAPTIF) in Christchurch. They were the foundation of a broader study to investigate the relationship between the permeability of chipseals, water film thickness, basecourse moisture sensitivity, heavy traffic volumes and premature pavement failure following construction.

Dave Alabaster of the Transport Agency led the team conducting the research, which also comprised members from Opus International Consultants and the University of Auckland.

He says, 'Our study's ultimate purpose was to inform how to best construct chipsealed unbound pavements to ensure they remain sufficiently waterproof for use on today's and tomorrow's road networks. These are roads subject to high traffic volumes and high tyre pressures, in situations where pavement designers are increasingly using marginal or recycled materials.

'The results from our testing were surprising, in that the traditional M/4 basecourse favoured for unbound pavements in New Zealand was the worst performer in all cases. However, it has to be borne in mind that this research can only be considered applicable to scenarios involving first-coat seals, with high water film thicknesses at very high traffic volumes. It does raise some interesting questions though, to be explored through further research.'

OUTLINE OF THE RESEARCH

The research was the result of concerns among the Transport Agency and the wider roading industry about recent pavement failures on major roads. In particular, the concern is that these failures may indicate current techniques for chipsealing are not controlling water ingress enough to prevent early failures on high-volume roads with unbound granular pavements.

To this end, the research project investigated three distinct areas, namely:

- the permeability characteristics of the most commonly used surface type in New Zealand, compared with alternative sealing practices
- the performance of selected materials in relation to changing moisture contents
- the hydraulic modelling issues related to run-off and infiltration water, which would be an additional benefit in improving environmental contaminant modelling.

The project was given increased urgency by the diminishing availability of quality aggregates (especially around the Auckland region), and the correlating drive to use more non-traditional marginal and recycled materials. Previous research had tested these materials under dry conditions, but only anecdotal evidence was available about their moisture sensitivity.

The research team's starting hypothesis was that the risk of premature pavement failure would be a function of the amount of water entering the pavement and the reaction of the pavement materials to that water. The amount of water entering the pavement would itself be a product of water film thickness around and above the surfacing aggregate particles, the permeability of the seal and basecourse, and the frequency and intensity of the heavy loading; while how the pavement reacts would be related to the moisture sensitivity of the basecourse.

The team's hypothesis appeared to be disproved, however, by the results of the tests. The conventional testing of grading, fines quality, permeability and repeated load triaxial (RLT) laboratory testing used on the three different basecourses investigated in the research all suggested that the M/4 basecourse should have performed the best. Yet in all cases it was the worst performer. The RLT testing suggested that the fines-added basecourse would be the worst performer, yet it was consistently the middle performer. And the laboratory permeability test ranked the materials in the reverse order to what had been expected: the lowest permeability performed the best.

The second round of experiments incorporated surfacing with an unprimed two-coat and an unprimed racked-in seal. Here the results were also not what had been expected. The behaviour of the two-coat seal suggested that priming only allowed a better seal to be created; it did not add to the waterproofness of a well-laid seal. The racked-in seal appeared to be less waterproof than the two-coat seal (although pin-holes had formed in it, which may have contributed to its poor performance). It certainly did not provide better performance, as had been thought likely.

However, the researchers and study report stress the limitations on these findings, in particular their restricted applicability (first-coat seals, high water film thickness and very high-volume traffic). Despite these limitations, the study does raise some interesting questions for further consideration, especially around the possible benefits of moving away from the traditional M/4 envelope for basecourse production towards the denser gradations used in Australia. Again, however, the researchers urge caution.

'Denser gradations have considerable construction benefits in that they are easier to lay, and should also be more rut resistant in the longer term,' says David. 'However, they are harder to dry back before sealing and may draw more water in from the edges of the pavement in the longer term. These trade-offs need to be considered before the use of denser gradations is widely implemented. Suffice to say if this path is followed, a number of field trials will be required first, to validate the long-term implications of our project.'

Despite the expressed limitations, the project team was able to make several recommendations as a result of the research, including:

- prime all new pavements before first-coat sealing to reduce the risk of early failure
- condition new seals before they are loaded in wet conditions, ie avoid the practice of sealing just before it rains as this is likely to increase the probability of failure
- avoid geometric designs that generate large water film thicknesses
- do not delay in placing second-coat seals on high-volume roads
- use unsaturated hydraulic models for modelling moisture movement in pavements
- review first-coat seal failures for the factors observed in this report
- undertake field trials of lower permeability M/4 alternatives.

Effects of water on chipseal and basecourse on high-volume road, NZ Transport Agency research report 564

Available online at **www.nzta.govt.nz/resources/research/reports/564**

EXAMINING THE VALUE OF TRAVEL TIME SAVINGS

A recent project has examined how travel time savings are valued in the context of economic appraisals for transport initiatives.

The project focused on travel time savings for non-business travel. At present, the approach for valuing such time savings used in New Zealand economic evaluation procedures is based on summing the time savings (individually generally small, positive or negative) to all transport users affected by an initiative, and then applying a standard (equity) unit value of time savings to the total time saved. This unit value is the same for all transport users (for a given trip purpose); it does not take account of possible variations in the value that different users may have, for example, variations due to the extent of the time savings, the trip duration, the urgency of the trip or the income level of the person making the trip.

The current New Zealand approach, as incorporated in the NZ Transport Agency's *Economic evaluation manual* was last changed in 2013. Prior to that, rather than adopting equity values, the New Zealand values had been differentiated by mode and other trip characteristics, based more closely on people's willingness to pay, as stated in preference surveys undertaken in 2001. There has been some debate as to whether the current equity approach is more appropriate for the valuation of travel time benefits of initiatives, and how it compares with international best practice in this field.

The research, carried out by Jacobs NZ Ltd and Ian Wallis Associates Ltd, set out to address this issue, along with a number of other areas of debate (in New Zealand and internationally) on the most appropriate valuation functions for travel time savings. It covered four main aspects of travel time savings.

- Their relative weight and significance – how significant are travel time savings relative to the total benefits (both monetised and non- monetised) of typical transport investment projects?
- Their relationship to trip duration – does the value that people attach to travel time savings vary significantly with the overall duration (or distance) of their trip? And, if so, what is the pattern of variation?
- Their relationship to the extent of time saved – do the values that people attach to travel time savings vary substantially between small time savings and larger time savings? If so, what is the pattern of variation?
- Their relationship to travellers' income – should the valuation of travel time savings used in economic appraisals be based directly on travellers' willingness to pay for time savings? Should these values be adjusted to offset the effects of income differences? Or should a single equity value of (non-business) time be adopted for all trips?

CURRENT EVALUATION APPROACHES AND SIGNIFICANCE OF TIME SAVINGS

For most major initiatives, travel time savings were the dominant component of overall (quantified) benefits. In more recent years, a wider range of economic benefits have been included in appraisals and, in some cases, quantified through *Economic evaluation manual* procedures (eg greenhouse gas emissions, agglomeration benefits). In addition, economic appraisals have become only one part of a wider business case framework for prioritising transport projects.

Kerstin Rupp of Jacobs NZ, who managed the research project, says, 'The unit value of time savings has been one of the most important parameters in transport economics. Typically, travel time savings account for around 80% of the conventional economic benefits that flow from most transport projects. However, the moves over recent years to both expand the scope of economic appraisals and to incorporate these appraisals within a wider multi-criteria analysis framework have reduced the importance of time savings in the overall decision-making process.'

THE IMPACTS OF TRIP DURATION AND THE EXTENT OF TIME SAVINGS

The project examined the international research evidence, and the theoretical and practical arguments, as to whether and in what manner the value that travellers assign to travel time savings varies with the duration of the trip and the size (extent) of the travel time savings in question.

Most of the international evidence indicated there is a strong relationship between the unit value of travel time savings and trip duration. Typically, market research has found that the unit value (per minute) assigned for longer distance trips (say, of over three hours in length) was between 50% and 100% greater than the values assigned for shorter trips (say, of less than 20 minutes).

In their report, the research team explains, 'If the unit appraisal values used in economic appraisals are to reflect the actual values that travellers are willing to pay to make time savings, then there's a good case to be made for differentiating these values by trip duration. For this to happen, further New Zealand-based market research would be needed to establish the appropriate value function and the most appropriate measure of trip duration in this function (eg distance, time, or some measure of costs).'

In terms of how values may vary with the extent of time savings, the key issue identified was whether small time savings (however 'small' is defined) should be valued at a lower unit rate than larger savings. The international market research evidence on this topic is that unit values of time savings derived by stated preference methods are consistently relatively low for small time savings, but increase quite rapidly up to a normal and constant level for greater time savings (eg over 20 minutes). Typically, the unit values attributed to small time savings, of say three to five minutes, were only around half this normal value.

The research also examined how market research on the valuation of smaller time savings was dealt with in the economic evaluation procedures of some other countries. It was apparent that most of them, with a few exceptions, adopt a constant unit value approach (ie based on normal rates with no discounting of values for small time savings).

There are three good reasons for adopting the constant unit value approach. First, the lower values for smaller time savings are considered, to an extent, to be an artifice of the market research methods adopted. These methods tend to encourage a respondent to consider the question from only a shorter-term perspective where it is difficult to make use of small time savings (whereas, in the longer term, people are more likely to be able to rearrange their activities to consolidate and make use of such savings).

Second, taking a longer-term perspective, travellers will only be interested in the time their trip actually takes and will be indifferent to whether this arises through a set of larger or smaller time savings from previous investments.

The third issue is a practical one: assessing an initiative's benefits would be considerably more complex if different values of time savings were to be applied to different groups of travellers based on their actual time savings. Given these factors, the research concluded the case for retaining the current constant unit value approach is a strong one.

EXPLORING TRAVELLERS' PREFERENCES

To help shed light on international findings as to how the value of travel time savings varied in response to trip duration and the extent of time savings, the research team conducted their own exploratory New Zealand web-based survey (attracting around 600 responses).

The survey adopted a different methodology from that generally used in research of this type and used stated preference methods that asked respondents to choose between two time-saving options in every case. The responses were then analysed to understand travellers' preferences between different levels of time savings in different situations, rather than the more usual approach of estimating specific monetary values for these savings.

'By adopting a different methodology we hoped to explore whether the results obtained using the usual stated preference methods might be an outcome of the specific research method adopted, rather than a true reflection of traveller preferences, and in this way to make a contribution to international research evidence on this topic,' say the researchers.

Significant findings from the exploratory survey were as follows.

- For a given total time saving per week, respondents would clearly prefer this to be saved from a single trip, rather than from small savings over multiple trips. In addition, respondents generally felt indifferent about saving 15 minutes on a single trip versus two minutes on each of 10 trips (ie 20 minutes in total). This revealed their unit (per minute) value for two-minute travel time savings was only around 75% of that for larger (15-minute) savings.
- Although these results for small time savings showed a similar pattern to those found in the international research, the survey indicated there was a lower level of discounting for the values for small time savings than is generally found overseas. This in turn indicated there may be a good case for considering using the research survey methodology more widely.
- With regard to the effects of trip duration, the survey results indicated, for a given time saving (in minutes), the unit valuations decreased with trip length, rather than increased as is conventionally estimated. The results gave some support to the theory that valuations are proportionate to the length of the trip involved – a theory that has been discussed internationally but as far as the researchers understand, never previously been subject to serious market research. Again, this differing result was probably largely due to the different survey methodology used, suggesting there would be value in further investigating this new approach and the reasons for it generating different findings.

THE TREATMENT OF INCOME

The final aspect of the project was the effect of personal (or household) income on people's willingness-to-pay valuations of time savings, and how this should (or should not) be reflected in the values of time adopted for evaluation purposes.

The important issue here is that people with higher incomes generally have greater willingness (and ability) to pay for time savings than those on lower incomes, ie higher values of time. If evaluation values are based strictly on willingness to pay, this will tend to bias investment towards those areas, modes and

investment initiatives that will be used mainly by those on higher incomes (which in itself could over time exacerbate income differences across the population). Given this situation, the approach adopted in a number of countries (including the UK and, since 2013, New Zealand) is to standardise values of time across modes, areas and trip types.

However, it may be argued that this approach seriously distorts investment signals and is a very blunt instrument in terms of addressing the equity issue. For example, under this approach, no differentiation would be made between values of time for use of a bus or taxi for a particular trip – despite the fact that when an individual is in a hurry (ie has a high value of time) they are likely to take a taxi (and be willing to pay more for it), whereas when they are less time constrained they will use the bus.

In the light of this concern about the present equity method incorporated in the *Economic evaluation manual*, the research explored the differing approaches applied internationally. The team identified the approach adopted in Sweden as having significant merits, as it starts from behavioural (willingness-to-pay) values established through market research, and then adjusts these to remove the effects of income differences (by applying known value of time elasticities with respect to income levels). The result is a set of equity values that have been adjusted for underlying income differences (between households, areas etc) but are still differentiated for other effects unrelated to income.

The research team says 'Our research included an initial exploration of the merits of such an income-adjusted approach and of how it could be applied in practice. We regard this as one of the more important issues to be addressed in enhancing the valuation of travel time savings structure currently used in New Zealand, and we recommend that more detailed research is carried out into the approach's merits and practical application.'

CONCLUSIONS

Two of the project's research findings in particular differed from the majority of findings and dominant practice internationally. These were:

- the finding that unit values of time savings (per minute) are lower, rather than higher, for longer distance (duration) trips
- the use of an income-adjusted approach to adjusting willingness-to-pay values for income differences, rather than the present equity approach of adopting equal values for all travellers on all modes, has considerable merits as a means of adjusting for income differences.

Travel time saving assessment, NZ Transport Agency research report 570

Available online at **www.nzta.govt.nz/resources/research/reports/570**

NEW RESEARCH REPORTS

Approaches to valuing injury and mortality risk in transport assessments

NZ Transport Agency research report 571

Available online at www.nzta.govt.nz/resources/research/reports/571

This report describes a review of literature on approaches to valuing injury and mortality risk in transport assessments. It provides background on why injury and fatality risk need to be valued in transport risk, and how New Zealand has arrived at its current practices in using a value of statistical life (VOSL) in transport policy and project appraisals. It examines theoretical and empirical literature on the scope of valuations and what methods are used for application in both transport and other safety contexts, and the policy implications of the current state of methods. Drawing on the literature and some recent meta-analyses of values, this review makes recommendations on the updating of the current value and what additional information would be a priority for supplementing the basic VOSL.

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A NOTE FOR READERS

NZTA research newsletter

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The spreadsheet has two worksheets; the first worksheet lists research reports with associated key words and the second lists research reports with the report abstracts.

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New Zealand Government