



NZ TRANSPORT AGENCY
WAKA KOTAHI

NZTA research

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NZTA research programme given the thumbs up

Research into how valuable NZTA research is for end users returned positive results, with users in all areas of the transport sector finding it useful and relevant.

The history of government-funded transport research in New Zealand stretches back to the 1950s when the National Roads Board established the Road Research Unit. The NZTA now manages that research programme – continued and evolved in the interim by successive government transport agencies.

The current NZTA research programme aims to fund innovative, applied research that leads the land transport sector. Research should produce results 'that can be applied in New Zealand in the short-to-medium term for longer-term impacts'¹. It must:

- have multiple end users
- not be for the commercial gain or benefit of a single supplier, product or organisation
- be supported by its intended end users.

Independent evaluators, Evaluate Research, assessed the current programme's efficacy in January 2011, focusing particularly on the 132 research reports published between 2005 and 2009. (Research funded in this time was principally industry-generated. From 2010, the NZTA changed its approach to directed research to ensure it invested to address the 'priority research needs of transport decision makers', ie the NZTA, the Ministry of Transport and local government.)

¹ NZTA (2008) *NZ Transport Agency's approach to research 2009-12 – GPS activity class: sector research*, NZTA, Wellington.

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Your views

NZTA research welcomes letters from readers. Letters should be addressed to:

The Editor, NZTA research
NZ Transport Agency
Private Bag 6995
Wellington 6141
New Zealand

www.nzta.govt.nz

Patricia McAloon, NZTA Manager National Programmes, is pleased that the findings of the evaluation ‘suggest that research funded by the NZTA is considered a valuable resource by users in all areas of the sector.’

The findings also endorse research programme developments that the NZTA has been putting in place. The change to directed research is enabling the research to be of more use for decision making, policy development and practical use. The research is moving to be at the forefront of sector thinking, to be innovative and credible, and to be applied in order to provide New Zealand based solutions for land transport sector issues.

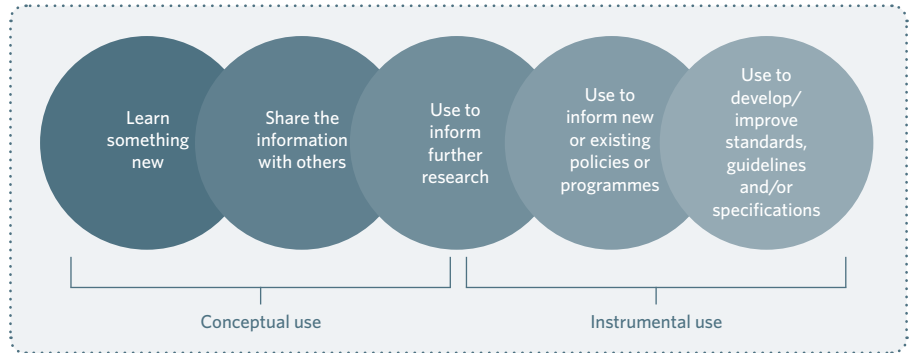
In addition the National Programmes Team has built on the report’s findings and recommendations by:

- providing for transport decision makers (the NZTA, the Ministry of Transport and local government) to lead the direction of the research
- more proactively requiring the research findings to be promoted and used
- ensuring NZTA research owners are appointed to chair project steering groups – to guide the research and to ensure the implementation of findings
- giving prominence to the research programme on the NZTA’s website so that it is more easily accessible (it now appears in ‘The programming process’ section under the ‘Planning, management & funding’ tab of the NZTA’s homepage – www.nzta.govt.nz/planning/programming/research.html)
- broadening the reach of the research programme, and providing for more people to:
 - access research reports, and other information about the research programme, on the NZTA’s website
 - read the quarterly newsletter
 - use the email notification service
 - plan for more conference presentations, seminars and workshops about research findings
 - respond to requests for proposals via the Government Electronic Tendering Service (GETS).

The methodology

Evaluate Research used a combination of interviews with key stakeholders, an online survey questionnaire and follow-up interviews to assess how useful and relevant respondents considered the NZTA research programme to be. Respondents were also asked about the usefulness of the three main mechanisms that the NZTA uses to disseminate information about the research, namely its website, its quarterly newsletter and the regular email notifications that are sent out about recently published reports.

Types of use for NZTA research



Evaluate Research worked with the NZTA to develop evaluative criteria to assess the research programme’s value and uptake.

To assess the programme’s end use, respondents were asked to comment on how often, when they read an NZTA research report, they: learned something new; used the information to inform further research or new or existing programmes; developed or improved standards, guidelines or specifications; or shared the information with others.

EVALUATIVE RUBRIC 1: RESPONDENTS’ USE OF NZTA RESEARCH

Respondents’ use of NZTA research	End user group	Evaluation rating
Learn something new	Researchers	Excellent
	Other end users	Excellent
Use research to contribute to decision making, programme/policy formation and/or improvement*	Researchers	Excellent
	Other end users	Adequate

* This dimension did not include an expectation that researchers would use research to contribute to decision making, programme/policy formation and/or improvement.

Overall the feeling was that the programme provided a reliable, independent source of research on transport issues, although some concerns were expressed about how research findings are put into practice. Respondents felt that a more ‘planned, deliberate and strategic approach’ (page 9) to the research would increase the research’s usability, ensuring that it had greater influence over policy and practice.

EVALUATIVE RUBRIC 2: RELEVANCE OF NZTA RESEARCH

Relevance of NZTA research	End user group	Evaluation rating
To respondents’ work	All respondents	Excellent
To the transport industry	All respondents	Excellent

Although both the email notifications and the newsletter were rated as excellent by respondents, there was a low level of awareness about them among respondents (many did not know, or had no opinion, about them), suggesting that they need to be better promoted to maximise their use. Likewise, respondents felt that the website was not making the best use of the reports, and that greater prominence could be afforded to them on the site (which should also promote the email and magazine).

EVALUATIVE RUBRIC 3: ASSESSMENT OF NZTA DISSEMINATION MECHANISMS

Assessment of NZTA dissemination mechanisms	Mechanism	Evaluation rating
Respondents’ satisfaction with:	Website	Adequate
	Email notification	Excellent
	Research newsletter	Excellent

The findings

Mathea Roorda of Evaluate Research says the response was positive. 'The findings suggest that research funded by the NZTA is considered a valuable resource by users in all areas of the transport sector, mainly because it presents practical, innovative and New Zealand based solutions to current issues.

'At present, users find the research more valuable for its conceptual uses, in that most found that they always learned something new from the research and its findings. Fewer people said they actually use what they had learned in their work, for example to influence decisions or policies or make improvements. One group that did make practical use of their acquired knowledge were those working in research organisations, demonstrating that the research and its findings do have substantial applied value.'

Respondents rated the email notifications and quarterly newsletter about the research programme as excellent. Users who were short on time found them a quick and easy source of information about what research had been done.

The NZTA website did not fare so well, with respondents finding it hard to hunt down research on the site, particularly when they were using the search function. In general, the site was not considered to be user friendly.

Mathea says, 'Overall, the data gathered in our evaluation showed that the NZTA's research programme is relevant and used by stakeholders across the transport sector. More value could be gained from the programme by considering, up front, how research findings can be linked to policy and programme decision making.'

Many factors influenced how usable respondents found the research and its

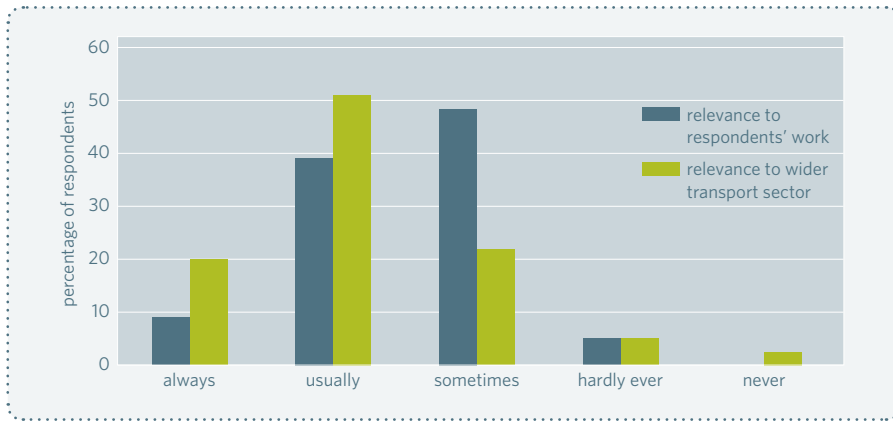
findings, including whether or not they had time to read the reports, and whether they were familiar with the content and able to understand the technical aspects of the research. Well-written reports and good summaries were also rated as important.

In terms of the programme's relevance, an overwhelming 95% of the respondents found the research 'always, usually or sometimes relevant to their work' (page 8), and only slightly less (93%) considered it 'always, usually or sometimes relevant to the New Zealand transport sector' (page 8).

Reasons given for these favourable assessments were that the research:

- was credible, innovative and focused on practical issues
- was New Zealand specific
- related to subjects that were a good match with the respondents' work.

RELEVANCE OF NZTA RESEARCH TO RESPONDENTS' WORK AND TO THE TRANSPORT SECTOR (%)



Source: online survey (n=148)

Contact for more information

Mathea Roorda
Evaluate Research Ltd

04 971 9981
 mathea@evalueresearch.co.nz

Evaluation of the value of NZTA research programme reports to end user

NZ Transport Agency research report 450

Freely available online at www.nzta.govt.nz/resources/research/reports/450/



Face-to-face best way to collect survey data

Research into the best way to collect data about walking, cycling and public transport trips has developed a simple, cost-effective and accurate survey method.

Although methods for surveying motor vehicle trips are now well established, there are fewer reliable procedures for measuring the generation of walking, cycling and public transport trips to and from activities. Access to this information is important, however, both for designing facilities that encourage non-car modes of transport and for gauging whether policies and initiatives to encourage alternative modes are proving effective.

Lee Pike of Traffic Design Group Ltd headed a research project to develop a survey method for recording data about non-car travel modes (walking, cycling and public transport), from which trip rates could then be calculated.

Lee says, 'We wanted a method that used a short questionnaire to ensure high sample rates, but also provided reliable and consistent results. By keeping things

simple, we reduced the potential for inaccuracies through interviewees failing to understand the question, or surveyors not understanding the answers.'

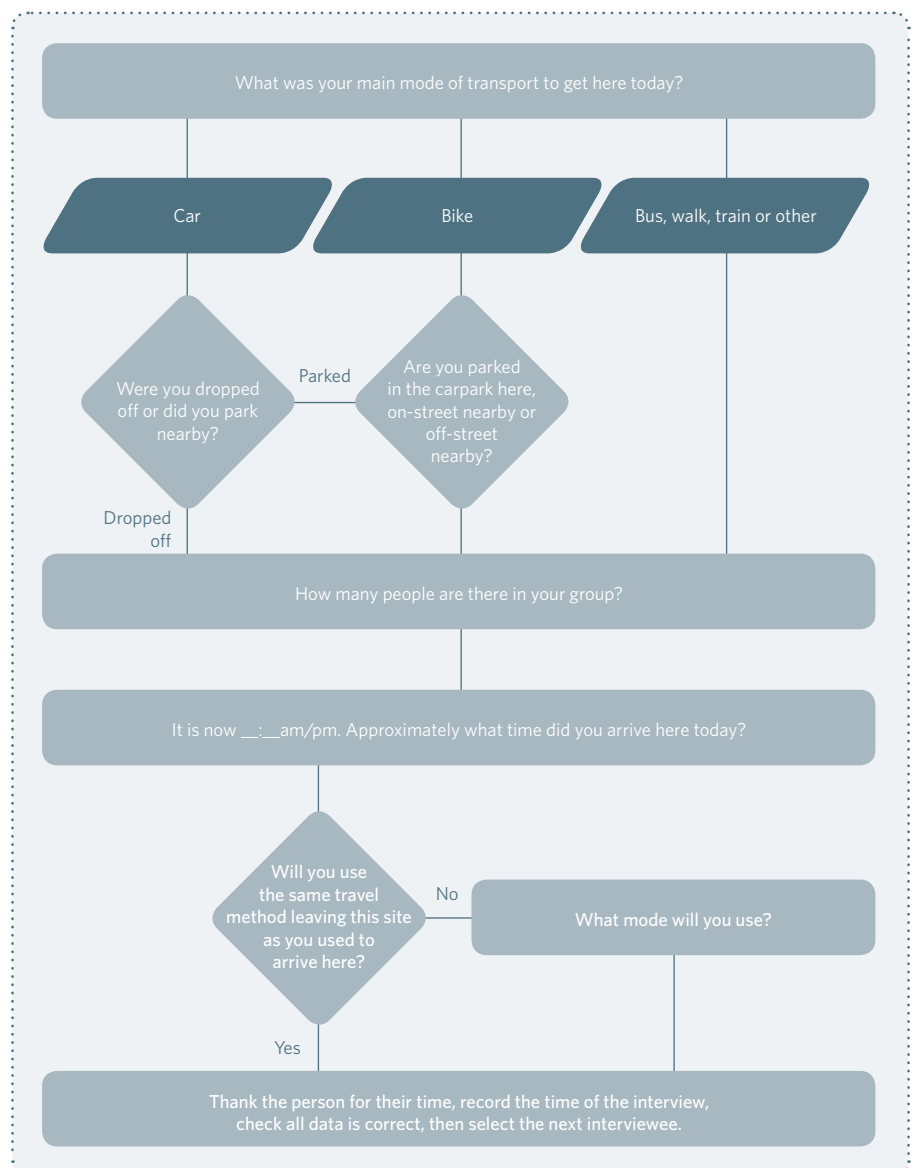
From the outset, face-to-face interviews were fixed on as the best way to capture information about non-car trips (from a trawl of international literature on the subject), and observer surveys were also used initially to enable the two

The survey questions

The refined survey was straightforward and relatively quick for surveyors and interviewees to complete.

- All interviewees were asked what mode they chose to arrive at the selected site (even though they were being interviewed as they left it).
- If they answered car, they were then asked whether they were dropped off or parked. If they replied parked, they were asked where.
- Interviewees who stated that they arrived by cycle were also asked where they had parked.
- All interviewees were then asked:
 - how many people were in their group
 - what time they arrived
 - whether they would use the same mode to leave the site as they used to arrive.

As a final stage, the surveyor recorded the time that the survey took place (the interviewee's departure time). Any refusals to complete the survey were also recorded.



methodologies to be compared. However, shortfalls quickly became apparent in the observer surveys, due to a tendency to overestimate the number of people arriving at sites by foot (when they had in fact driven, but parked their cars elsewhere), and a corresponding underestimation of the use of public transport. Face-to-face surveys, although more labour intensive, were more accurate and therefore more cost-effective.

Having selected the method, it was refined through a series of pilot surveys conducted in Auckland, Wellington and Christchurch during 2010. Pilot sites were selected using a formalised process.



Lee says 'Taking a formal approach ensured not only consistency, but also that we had all the information we subsequently needed about sites for the database. We went for sites that were self-contained with only one activity taking place at them. We wanted a range of activities, so chose an office, a medical centre and a retail site. Sites needed to be busy enough to provide meaningful information, but not too busy to make it difficult to carry out the surveys. We also, obviously, needed sites that could be reached on foot, bike or public transport, as there would be little point surveying sites that could only be reached by car.'

'One omission in the information we collected about sites was their floor area: you would need to know this if you were going to go on and use the data from the surveys to calculate trip rates. At this stage, however, we were only interested in refining the methodology used to collect the data.'

The following refinements were made in the survey method during the course of the research:

- People were interviewed for one direction of travel only. (Two-way



surveys were trialled, but it became apparent that if people had already been interviewed on arriving at a location, they were less inclined to answer the questions again on their way out.) Outbound was the direction selected, as people could usually give a relatively accurate estimate, from memory, of when and how they had arrived.

- The approach was changed when the site selected was residential. One-way surveys worked best when the site was an attractor, such as a workplace or retail complex. But for residential surveys, a two-way (inbound and outbound) survey was needed, as people had often arrived at home the night before and could not be expected to accurately recall when they had arrived.
- The survey was modified to ensure that data collected was reliable. Lee explains: 'With the initial surveys, sometimes key data would be missing. When this was the person's arrival or departure time it would undermine the viability of the survey, as trip rates are very time dependent. Anyone surveying trip rates needs to be able to give rates not only for the whole survey period but also for peak times.'



'Although all the surveyors felt that the survey had gone well, the quality of the data they collected varied. From this we identified that we needed to refine survey questions to ensure that the basic information, such as arrival and departure times, was always recorded. The refinements worked and we got a much greater level of accuracy.'

The survey method and questions were not the only factors to influence the accuracy and success of the survey: the type of person conducting the survey was also found to have material influence on the results. In general, more laid-back, friendly surveyors encountered greater success than their more driven counterparts. Younger interviewers were also found to be more accurate than older ones (possibly because they listened more attentively to instructions and made fewer assumptions about what was required).

Overall it was considered that clear, unambiguous instructions to surveyors were crucial to maintaining the quality of the data gathered. In addition, surveyors were less likely to skip questions if they were informed about how the data would be used and why each question was important. Surveyors also needed to be instructed to follow a random selection process, ie approaching every fifth person, rather than those they thought looked amenable.

Contact for more information

Lee Pike
Traffic Design Group Ltd
09 531 5006
lee.pike@tdg.co.nz

Generation of walking, cycling and public transport trips: pilot study, NZ Transport Agency research report 439

Freely available online at www.nzta.govt.nz/resources/research/reports/439/

Promising news and new issues for vehicle emission levels

Research into 'real-world vehicle emissions' in Auckland has shown that, while standards are working to reduce the average levels of emissions, there are still concerning trends that may require policy intervention.

Since 2005, New Zealand has had national environmental standards for air quality that must be met. Vehicle emissions are a major contributor to poor air quality, especially in urban areas. Within the transport sector, there has been an assumption that, as the proportion of new vehicles in New Zealand's light vehicle fleet grows, and as fuel and emissions reduction technologies improve, we will move closer towards meeting environmental standards and targets for emissions. However, without data to back this assumption up, it remains just that – an assumption.

Recent research set out to establish whether vehicle emissions were in fact reducing on a per vehicle basis in New Zealand, and to examine the impact (if any) that recent vehicle emission standards have had on any changes.

Jeff Bluett of NIWA who headed the research says, 'Vehicle emission reduction technologies are continually improving, so in theory, as more new vehicles enter the fleet and as fuel quality improves, we should be seeing less pollutants discharged on a per vehicle basis. However, it is unclear how much impact these improvements are actually having on real-world emissions from the light vehicle fleet as a whole. In our research, we were looking at whether the current business-as-usual scenario was working to reduce harmful emissions, and whether something more was needed in terms of policy or regulatory involvement to ensure that targets are met.'

The project used remote sensing to measure emissions at seven locations in Auckland in 2009, then compared the results with measurements from the same sites taken in 2003 and 2005. Emissions measurements were stored for various pollutants,



Photo provided courtesy of NIWA



Photo provided courtesy of NIWA

including carbon monoxide, nitric oxide, hydrocarbons and uvSmoke, together with information about the vehicles they came from. This enabled the vehicle's emissions readings to be assessed against the effects of variables such as vehicle age, fuel type, odometer reading and the emissions standard in place when the vehicle was manufactured or imported. It also enabled any trends or issues to emerge.

The study returned promising results, essentially showing that the vehicle emission standards introduced in New Zealand in 2003 are having their desired effect. Although the mean age of vehicles within our light vehicle fleet is increasing, the mean emissions, on a per vehicle basis, are decreasing significantly. Overall, average concentrations per vehicle reduced by 43% for carbon monoxide, 58% for hydrocarbons, 39% for nitric oxide and 27% for uvSmoke (as an indicator of fine particulate matter).

However, while the study produced encouraging results with regard to the standards' effectiveness, it also revealed other issues affecting overall vehicle emissions that will need to be addressed.

Jeff explains, 'Although nitric oxide levels have reduced since 2003, they appear to have plateaued, especially with respect to diesel vehicles. This is concerning because increasing levels of ambient nitrogen dioxide are an issue in New Zealand at the moment, especially in urban areas, and the standard alone may no longer be sufficient to address this.'

COMPARISON OF MEDIAN AND MEAN EMISSIONS FOR THE 2003, 2005 AND 2009 FLEETS

Campaign year	Carbon monoxide (%)		Hydrocarbons (parts per million)		Nitric oxide (parts per million)		uvSmoke	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
2003	0.72	0.24	306	200	823	369	NA*	NA*
2005	0.54	0.11	211	56	655	333	0.090	0.033
2009	0.41	0.07	129	52	504	197	0.066	0.022

* uvSmoke data for 2003 are estimated from RSD3000 opacity measurements. For petrol vehicles, uvSmoke data estimates appear to be unrealistically low.

COMPARISON OF EMISSIONS DISTRIBUTIONS FOR THE 2003, 2005 AND 2009 FLEETS



In these box plot graphs, the median values are indicated by the lines that run horizontally through the box. The inter-quartile (25th to 75th percentile) range is noted by the lower and upper edges respectively of the box. The whiskers extend to the 5th and 95th percentile values. Any values outside this range (outliers) are omitted from the plot. The mean values are indicated by the stars.

'Another issue identified was the increasing age of the vehicle fleet. People are hanging onto their cars for longer, and this is a nationwide trend, as on average the cars at the locations we monitored were slightly newer than the national fleet overall. The significance of age is that, in general for petrol vehicles, the older vehicles get and the greater number of kilometres they have travelled, the higher their levels of emissions. Most of the emissions reductions we measured come from newer, lower-emitting vehicles entering the fleet, but if people retain their cars for longer, then this effect will decline.'

The final issue flagged by the research was with respect to the number of vehicles on New Zealand's roads. Although emissions per vehicle may be reducing, to a certain extent this is being counteracted by the greater number of vehicles entering the country and the distances they are being driven, particularly in congested urban conditions.

The study recommends ongoing periodic monitoring of real-world vehicle emissions to monitor whether policy intervention is required, and to pick up on other emerging trends and issues. Following this recommendation, a fourth vehicle emission monitoring programme was undertaken in Auckland in 2011; the results of this study will be published by the Auckland Council in 2012.

Research into related areas (such as regional differences in vehicle fleets and emissions levels) and the impact of the 2003 standards on heavy duty vehicles (by far the largest contributors of particulate pollution from road transport) would also help build our understanding of how emissions levels in New Zealand are changing.

Emissions in New Zealand

Many places in New Zealand experience poor air quality, particularly in the winter months when fires are used for home heating. Vehicle emissions also make a major year-round contribution - up to 82% in places, depending on the day of the week and the pollutant being measured.

New Zealand first passed legislation supporting vehicle emission standards and control technologies in 2003 (Land Transport Rule: Vehicle Exhaust Emissions 2003). The Ministry of Transport and Ministry of Economic Development subsequently introduced joint policy measures to tighten controls on vehicle fuels and emissions, including strict emissions standards that all new vehicles were required to meet. Before this, there was no requirement for vehicles manufactured or imported into New Zealand to meet any standard and, although many vehicles built overseas in fact complied with local standards, no provision ensured that when they were imported their control equipment was still present and operational.

The current legislation with respect to emissions is Land Transport Rule: Vehicle Exhaust Emissions 2007. The rule specifies that new vehicles entering New Zealand's fleet must meet one of several roughly equivalent international standards (Australian, European, Japanese and US standards are specified).

In a related move, the Ministry for the Environment introduced national air quality standards in 2005, with the targets from these to be met by 2013. Responsibility for meeting the targets rests with regional authorities, with measures to date tending to focus on emissions from home heating and industry.

Contact for more information

Jeff Bluett
NIWA
03 343 7887
j.bluett@niwa.co.nz

Are the harmful emissions from New Zealand's light duty vehicle fleet improving?, NZ Transport Agency research report 441

Freely available online at www.nzta.govt.nz/resources/research/reports/441/

Study clarifies the friction-durability equation

Problems observed during a major urban road construction project were the impetus for a study into the durability of aggregates with high polished stone values (PSV).

The construction project in question, in the highly trafficked Grafton Gully in central Auckland, had included sections of pavement surfaced with a 40mm layer of stone mastic asphalt. The surface used a combination of a locally sourced aggregate and an aggregate from Poverty Bay, selected because of its especially high PSV; the latter was to be used for areas subject to particularly high surface shear loads from the traffic.

However, it soon became apparent that the macrotexture of the pavement was being reduced through flushing in the surfacing, and that this was worse where the imported high PSV aggregate had been used. (Macrotexture refers to the height of chips protruding above the bitumen in a chipseal road surface, or the depth of voids between the coarse stone in an asphalt surface.)

Frank Bartley of Bartley Consultants says, 'An initial investigation carried out by the Freeflow Alliance construction team revealed that the aggregate had been degraded, and that this had probably happened during construction.

'The issue that flowed from this, and that we chose to investigate more thoroughly, was whether the high PSV required to

achieve appropriate levels of skid resistance was undermining the durability of certain stone-on-stone mixes. What we were, and are, seeing is that aggregates that meet current specifications, and fulfil the two standard property tests of crushing resistance and weathering, can nonetheless continue to break down, sometimes quite quickly, when they are subject to compaction during construction, and later under traffic.'

The research, carried out over 2009–2010, had the objective of investigating the durability and mechanical integrity of aggregates with high PSV (> 60) used in hot mix asphalts (particularly stone-on-stone mixes, such as stone mastic asphalts and open-graded porous asphalts).

Aggregates with a range of PSV were selected from four different quarries:

- Brookby Quarry in South Auckland – a Waipapa greywacke; PSV 55–56
- Moutohora Quarry in Poverty Bay – an East North Island greywacke; PSV 65
- Pacific Steel in Otahuhu, Auckland – electric arc furnace slag; PSV 65
- Te Matai Pit in Palmerston North – Torlesse greywacke; PSV 58–59.

Dense versus open

A major difference between dense-graded asphalt and the more open-graded or stone-on-stone mixes used in high skid resistance pavement surfaces is the way in which applied wheel load is distributed through the asphalt to the pavement layers below.

In dense mixtures, the coarse aggregate is fully supported by the smaller stone and the bitumen. In more open-graded mixes, the load is transferred by stone-on-stone contact. The stability and durability of the layer therefore depends on the aggregate's ability to withstand the high point stresses generated during construction and by subsequent traffic. Degradation predominantly occurs when the sharp points of the coarse aggregate are forced against each other, generating sand- and silt-sized particles.



Test sections were then laid in a road contractor's yards in Taupo and Auckland, with samples taken to compare the aggregates' particle size distribution before and after construction, and after seven months of intensive trafficking.

Frank says, 'The comparisons showed that significant degradation was occurring in all the aggregates during construction, particularly as a result of the stresses imposed by laying and compaction. Interestingly, there was then relatively little further degradation at the end of the seven months, although we did find a decrease in air voids and texture depth. Ideally we need to take further samples in a couple of years' time to get a more accurate picture of the effects of trafficking.'

Source property tests were also carried out to see whether any of them could be used to predict the degradation that had occurred in the test sections. Although the Los Angeles and Micro-Duval abrasion tests produced the best results, none were considered particularly useful for assessing an aggregate's durability.

Frank says, 'Overall, we concluded that stone mastic asphalts can be expected to degrade and that when it comes to selecting an aggregate with a high PSV a geological evaluation will provide the most useful assessment of the properties that are required.'

'Our research has provided a good set of baseline data, and we can now build on that to provide a better understanding of the aggregate properties that will support high friction-resistant surfacing. Ultimately we'd like to see the results incorporated in selection procedures in asphalt specifications for stone-on-stone mixes. If pavement designers have a good durability test, they can then choose the best aggregate source for their needs and location. For example, for certain sections of road, a designer may choose a shorter service life to ensure that the pavement delivers maximum skid-resistance.'

Contact for more information

Frank Bartley
Bartley Consultants Ltd
09 529 0276
fgb@xtra.co.nz

Abrasion resistance of aggregates in asphalt,
NZ Transport Agency research report 433

Freely available online at www.nzta.govt.nz/resources/research/reports/433/

New research reports

Obtaining our research reports – These research reports may be profiled in future editions of *NZTA research* but are already freely available online at www.nzta.govt.nz/research. Email research@nzta.govt.nz to order any of these reports, or to ask any questions regarding the NZTA's research programme.

Investigation into the use of point-to-point speed cameras

Research report 465

AECOM NZ Ltd

Freely available online at www.nzta.govt.nz/resources/research/reports/465/

Road safety is an issue that impacts on all levels of government and population. Since a high of 843 fatalities in 1973 the overall crash rate has been declining and 384 fatalities were recorded on New Zealand roads in 2009. Although this represents a significant reduction in casualties, there is still a need to reduce the current rate of about one fatality per day.

Lessening the incidence of exceeding the speed limit is one way that can effectively reduce these rates.

Speed enforcement technology has now progressed to the current state of point-to-point (P2P) speed cameras. P2P cameras operate by photographing all vehicles passing both the start and end of a section of road under consideration. The photographs are time stamped which allows travel time to be derived. Computer software identifies the number plates of passing vehicles and matches the images taken. The cameras are a known distance apart and hence the average speed can be calculated.

Photographs of vehicles exceeding the trigger speed can be forwarded to the infringement division for validation.

This research report comments on the technology and application of these devices to New Zealand, and sites that may be suitable for these devices.

High-stress corners

Research report 466

Opus Central Laboratories

Freely available online at www.nzta.govt.nz/resources/research/reports/466/

A programme of research was undertaken to better understand chip loss on curves with the aim to improve chipseal design and selection practices. The research involved: on-road measurements and computer simulation of tyre forces during cornering manoeuvres; correlation analysis using road surface, road geometry and traffic variables contained in the NZTA's RAMM database; and finite element analysis of pavement surface stresses induced by a cornering truck.

The key findings were:

- 1 There was not a particular chipseal type more prone to chip loss than others.
- 2 It was determined from the finite element modelling that even at lateral accelerations five times the level normally expected for properly designed curves, the stresses generated in single coat chipseals were insufficient to cause failure of the binder in large enough areas to cause chip loss.
- 3 The RAMM variable that correlated the strongest with chip loss on curves was the NZTA administration region, suggesting climate, sealing properties or construction practices are the main drivers, not lateral acceleration.

These findings support previous research that it is not seal design but construction practices, notably the use of controlled traffic to bed the sealing chips, which have the largest influence on mitigating chip loss.

continued on page 10

National travel profiles part B: trips, trends and travel prediction

Research report 467

Abley Transportation Consultants Ltd

Freely available online at www.nzta.govt.nz/resources/research/reports/467/

Using data held within the New Zealand Household Travel Survey (NZHTS), this research examined changes in travel behaviour between 2003 and 2010 and sought to determine whether travel behaviours such as journey times, mode choice, trip complexity and trip generation rates differed by area type and region. A key aim of the research was to unlock further value from the data for the benefit of transport planners and engineers. The research explored the extent to which NZHTS data could be used in a predictive context and examined a method to extract and arrange NZHTS data into a form that would allow practitioners to quickly undertake a range of enquiries based on user-specified variables such as car ownership and household compositions to reveal area-specific travel behaviours.

The research provided an additional reference source for policy makers by allowing them to view changes in travel behaviours over time that might be attributed, in part, to past and present transport policy. The research findings offer an addition to multi-modal trip generation resources for the benefit of traffic engineers and can also assist travel planning coordinators to achieve the most effective use of existing transport resources.

A wider look at how travellers value the quality and quantity of travel time

Research report 469

Carolyn O'Fallon, Pinnacle Research & Policy Ltd

Ian Wallis, Ian Wallis Associates Ltd

Freely available online at www.nzta.govt.nz/resources/research/reports/469/

In the context of transport policy, travel time is widely treated in purely economic terms, with the key aim of 'saving' or reducing what is seen as unproductive travel time.

The current emphasis on travel time savings uses mean values for different modes, and assumes that people want to minimise (save) their travel time irrespective of what mode they use. Our work explored the possibility that some people value their travel time, particularly for commuting, and may not want to reduce it, irrespective of what mode they usually use. We examined a range of issues through data gathered from an online survey of approximately 500 commuters based in Auckland and Wellington, including the following:

- Does the bulk of commuters' existing commute trip travel time lie above or below their 'ideal' commute travel time – what are the implications for the value used for travel time savings?
- How do people use the time they spend commuting and do they value this time? Even if they 'do nothing' on their commute trip, do commuters value it for its 'anti-activity' nature?
- Is how they value their commuting travel time related to the purpose for travel, their enjoyment of their current job or course of study, and/or to other attitudes about travel mode and the environment?

Living in intensified urban environments: residential self-selection and travel behavior

Research report 468

Carolyn O'Fallon, Pinnacle Research & Policy Ltd

Ian Wallis, Ian Wallis Associates Ltd

Freely available online at www.nzta.govt.nz/resources/research/reports/468/

In this research project we used a combination of a literature review, an analysis of secondary data and accessibility indices, and an online survey of inner city and non-inner city residents in Auckland and Wellington to examine the impact of urban intensification on people's travel behaviour, mode choice and household vehicle ownership.

A core finding was that inner city residents were more likely to walk and less likely to drive, for any trip purpose, than residents living elsewhere in Auckland/Wellington cities and metropolitan areas. Inner city residents also had demonstrably fewer vehicles per adult in the household.

Our analysis of 2006 census data indicated that, on their own, neither the population nor employment density of major New Zealand cities appeared directly correlated with the choice of mode for the journey to work. Rather, our review and primary data analysis determined that density worked in conjunction with the mix of activities/destinations in an area and destination accessibility to affect travel patterns and vehicle ownership. In addition, we found that attitudes and neighbourhood preferences (self-selection) were important determinants of mode use, rather than the built environment, although the built environment facilitated residents to actively demonstrate their favoured travel and vehicle ownership behaviours.

Incorporating travel time reliability in the estimation of assignment models

Research report 464

AW Brennand

Freely available online at www.nzta.govt.nz/resources/research/reports/464/

Route choice is determined by some function of mean travel time and distance on the routes available in most traffic assignment models. Increasing traffic volumes on a route increases delay, making a particular route less desirable.

The NZTA's *Economic evaluation manual* (2010) allows the benefits of improved network reliability to be monetised. However, our network models are unable to provide a convenient means of calculating the road user responses to travel time variability.

Route choice is a more complex issue than a comparison of relative travel times and distance. It appears that road users are also considering travel time variability in their route choice. Variability may occur as a result of congestion in cities or on any network as a result of road geometry, a high volume of heavy vehicles on narrow steep roads, or other reasons.

This research was carried out during 2008–2011 using Wellington data and sought to identify a methodology that best incorporated travel time variability into route choice models. The research determined the most useful formulation for use in models and the appropriate measure of travel time variability.

New Zealand Bus Policy Model

Research report 472

Ian Wallis and Daan Schneiders – Ian Wallis Associates Ltd

Freely available online at www.nzta.govt.nz/resources/research/reports/472/

A methodology and computer-based model was developed to analyse the performance of urban bus services in terms of their operations, market indicators and financial performance.

The main input to the methodology and model is a database of existing bus services, disaggregated by route and time period, and including operating statistics, patronage, fare revenues and unit costs.

The New Zealand Bus Policy Model operates at a route level and has two main applications:

as a service performance diagnostic tool, ie to examine the performance of existing services in operational, market and financial terms

as a scenario analysis tool, to assess the impacts on the bus system and its performance of changes to services, fares or unit costs and/or changes in external factors affecting the demand for bus travel (eg changes in fuel prices, impacts of population and urban development changes).

The model uses MS Excel software. It was developed and piloted with the public transport planning and funding authority in Wellington, New Zealand. The main end users of the model are expected to be government authorities involved in the planning and funding of urban public transport services and the operators of these services.

Calibration of trip distribution by generalised linear models

Research report 473

John Shrewsbury – University of Canterbury

Freely available online at www.nzta.govt.nz/resources/research/reports/473/

Generalised linear models (GLMs) provide a flexible and sound basis for calibrating gravity models for trip distribution, for a wide range of deterrence functions (from steps to splines), with K factors and geographic segmentation. The Tanner function fitted Wellington Transport Strategy Model data as well as more complex functions and was insensitive to the formulation of intrazonal and external costs. Weighting from variable expansion factors and interpretation of the deviance under sparsity are addressed.

An observed trip matrix was disaggregated and fitted at the household, person and trip levels with consistent results. Hierarchical GLMs (HGLMs) were formulated to fit mixed logit models, but were unable to reproduce the coefficients of simple nested logit models. Geospatial analysis by HGLM showed no evidence of spatial error patterns, either as random K factors or as correlations between them.

Trip distribution was calibrated from aggregate data by the MVESTM matrix estimation package, incorporating period and direction factors in the intercepts. Counts across four screenlines showed a significance similar to a thousand-household travel survey. Calibration was possible only in conjunction with trip end data. Criteria for validation against screenline counts were met, but only if allowance was made for error in the trip end data.

Development of tensile fatigue criteria for bound materials

Research report 463

Dr Greg Arnold, Pavespec Ltd

Clarence Morkel and Gerhard van der Westhuizen, New Zealand Institute of Highway Technology

Freely available online at www.nzta.govt.nz/resources/research/reports/463/

Flexural beam breakage and fatigue tests were conducted in 2008–2011 to determine their relationships with pavement fatigue life and tensile strain for a range of New Zealand materials for use in pavement design of stabilised aggregates. The results showed that the tensile fatigue relationships from several fatigue tests under repetitive loading could be approximated by single flexural beam breakage tests. These relationships resulted in significantly longer pavement lives than the Austroads pavement design criteria but still predicted shorter fatigue lives than what actually occurred at the Canterbury Accelerated Pavement Testing Indoor Facility test track, indicating some conservatism in the approach. Further research is required to validate the tensile fatigue design procedure against actual field data.

The benefits of public transport – option values and non-use values

Research report 471

I Wallis and D Wignall – Ian Wallis Associates Ltd

Freely available online at www.nzta.govt.nz/resources/research/reports/471/

This research was undertaken in New Zealand in 2010–11 to investigate the economic concepts of option values and non-use values as applied to public transport services, and to undertake primary market research in New Zealand to estimate approximate valuations.

The primary market research involved telephone-based surveys of a random sample of households in four peri-urban/semi-rural communities within the outer catchment area of major urban centres. The surveys used contingent valuation methods to establish household willingness-to-pay for the provision of enhanced public transport services to/from the nearest main centre, and to estimate the various components (consumer surplus, option value, non-use value) of the overall willingness-to-pay value.

The survey results were used to derive: the average willingness-to-pay per household; the component of this that is not included in conventional transport economic appraisals; and the underlying factors (eg service and household characteristics) influencing the willingness-to-pay values. The results were also compared with the equivalent findings from the small number of research studies undertaken internationally on this topic.

Recommendations were made on an appropriate set of default option/non-use values (per household) for use in the economic appraisal of public transport projects in New Zealand.

Australasian Road Safety Research, Policing and Education Conference

The Australasian Road Safety Research, Policing and Education Conference is the most inclusive annual road safety event in Australia and New Zealand. It brings together leading researchers, practitioners and policy-makers from New Zealand, Australia and overseas to discuss and share developments in road safety. This year the conference will be held jointly with the New Zealand Local Authority Traffic Institute (TRAFINZ), highlighting the role of local authorities in road safety and traffic management.



The conference will take place from Thursday 4 October to Saturday 6 October in Wellington, New Zealand.

Another related conference is being held in Wellington at this time. The first day of the Road Safety Research, Policing and Education Conference will overlap with the final day of the 2012 World Safety Conference and some sessions will be shared. For more information about the World Safety Conference, go to www.conference.co.nz/worldsafety2012.

The theme of the 2012 conference is 'Reducing the cost of road safety'. It will reflect the four pillars of the Safe System approach – safe roads and roadsides, safe vehicles, safe users, and safe speeds – as adopted in New Zealand's 10-year strategy *Safer Journeys* (www.transport.govt.nz/saferjourneys). The conference will have a particular focus on innovation and cost-effectiveness.

Bookmark our website, and keep checking it for updates – www.transport.govt.nz/ourwork/land/roadsafetyconference2012/.

Supplementary issues of the NZTA research newsletter

The significant number of research reports published during recent years has resulted in the need for supplementary editions of *NZTA research*, which are in addition to the standard March, June, September and December quarterly editions.

In 2011, three supplementary editions were published – in May, August and November.

In 2012, three further supplementary editions will be published – again in May, August and November, and again in addition to the standard quarterly editions.

The NZTA has a number of other publications you might be interested in.

NZTA connect provides a snapshot of the NZTA's projects and initiatives that are relevant to the work approved organisations are doing in the area of land transport in New Zealand.

Exchange is the Public Transport Leadership Forum's quarterly e-newsletter. It informs transport sector leaders and rail, bus and ferry operators across New Zealand about the forum's vision, synergies, and planned initiatives to improve the effectiveness of public transport in New Zealand.

For more information about these newsletters, go to www.nzta.govt.nz/about/newsletters.

NZTA research

NZTA contacts

Patricia McAloon
Nigel Curran
Karen Johnson

For any enquiries, email research@nzta.govt.nz.

NZTA research is published quarterly by the NZ Transport Agency. Its purpose is to report the results of research funded through the NZTA's Research Programme, to act as a forum for passing on national and international information, and to aid collaboration between all those involved. For information about the NZTA's Research Programme, see www.nzta.govt.nz/planning/programming/research.html.

Contributed articles are welcome, and should be typed in double spacing and not exceed 1000 words. Illustrations may be either black and white or coloured, and must be of high quality. *NZTA research* reserves the right to edit, abridge or decline any article.

Advertisements of forthcoming conferences and workshops that are within this publication's field of interest may be published free of charge, when space permits.

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Inquiries on specific articles should be made to the author. Otherwise, all general correspondence and queries related to conference notices and mailing list requests should be made to: research@nzta.govt.nz.

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