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WAKA KOTAHI

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Your views

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Truck spraying water on new grit

Study consolidates understanding of frost, ice and crash risk

Research to determine how common treatments for frost and ice on roads affect the risk of crashing has shown that, although the risk decreases after treatment, there is a need to time applications carefully, in order to derive the maximum benefits.

Frost and ice are potentially serious hazards for New Zealand motorists, significantly increasing the risk of loss-of-control skidding crashes if affected areas are left untreated. Areas of the road network most routinely affected in winter include coastal and central Otago and Canterbury, and parts of central North Island.

Although favoured until the early 1980s, common salt is now no longer used as a treatment for frost and ice, due to public concerns about its effect on the environment and vehicle corrosion. The two most commonly used frost and ice treatments are now mineral grit, and the anti-icing and de-icing agent calcium magnesium acetate (CMA). CMA was chosen following a major review of anti-icing and de-icing agents in the 1990s, which showed it to be the most suitable agent for New Zealand conditions. The number of sites being treated with

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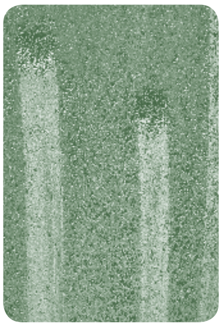
CMA each year has risen steadily ever since, with significant reductions in crashes and road closures at these sites as a result.

While road contractors now have significant experience in using CMA and grit, there were still a number of issues around their use that needed to be resolved. In particular, concerns about the effects that the treatments have on skid resistance, and how these effects vary over time from when treatments are applied, raised questions about best practice for their selection and use.

An NZ Transport Agency funded research project aimed to provide road network managers with the information they needed, enabling them to better assess when and in what conditions it was best to apply treatments for frost and ice.



Braking on grit

Test vehicle

The research

For the project, the effects of both grit and CMA were investigated, with the degree of crash risk associated with each type of treatment (and with no treatment) assessed at different times of day and in varying environmental conditions (including wet and dry). The degree of risk was calculated from the changes in skid resistance resulting from the treatments on different road surfaces and from varying traffic levels.

Onroad locked wheel braking tests were carried out at sites in Coastal Otago that are prone to frost and ice. Sites covered a variety of surface types (including fine and coarse chipseal, open-graded porous asphalt, asphaltic concrete and slurry seal) and traffic levels, and included both state highways and local roads. Skid resistance and braking distances were measured in wet and dry conditions with no treatment applied, and immediately following applications of CMA or grit. Additional tests with a GripTester looked at the variations in skid resistance with time following treatment, and also at the effect of dewfall after treatment had been applied.

Results showed considerable variations in skid resistance and stopping distance across the different frost and ice treatments, road surfaces and conditions. Untreated frost and ice conditions were much worse than any other road condition or treatment, making treatment desirable when there was a risk of freezing. Dry conditions were definitely best, although once it had dried, CMA performed as well as the dry surface (and at times better). However, the time that this drying took was heavily dependent on weather conditions, such as temperature, humidity and wind. Dewfall also tended to partially reactivate the CMA, hence decreasing its skid resistance. The skid resistance offered by grit also varied with the weather, although its performance tended to improve with time after application, as the grit was crushed and moved by the traffic.

Combining the changes in skid resistance identified with the variance in traffic levels to provide a measure of the crash risk, showed that:

- the time at which the change in road conditions occurred (either as a result of rain, dew, frost or ice, or through the application of frost and ice treatments) has a significant impact on the expected number of daily crashes
- expected crash rates are much higher for frost and ice than for any other road condition or treatment
- crash rates for all the different road conditions (except frost and ice) were much lower when these changes occurred outside of peak traffic times

Grip tester

- treating road surfaces with grit or CMA, either a short time before frost and ice were anticipated, or at a specific time as a routine maintenance procedure, considerably reduced the daily crash rate (compared to untended frost and ice conditions)
- there was very little difference in the crash rates for CMA applied a short time before frost and ice were anticipated or as a routine maintenance procedure, as long as the application occurred outside peak times
- CMA applied in either of these two circumstances was better than an application of grit, given that grit tended to be applied near to or at the time frost and ice began to form.

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Using risk analysis to assess treatments for frost and ice, NZ Transport Agency research report 382.

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Tool clarifies where the costs and benefits of waste minimisation lie

A methodology for quantifying the benefits of various waste minimisation techniques provides a useful tool for road controlling authorities when deciding whether or not to include such techniques in their road construction projects.

The methodology, developed between 2006 and 2009 from research and literature here and overseas, uses estimates of the energy and emissions involved in all operations, the raw and recycled materials used, and the costs, energy use and emissions associated with traffic delay. These estimates are then all input into a straightforward spreadsheet, which authorities can use to compare the costs and benefits associated with using particular waste minimisation techniques, and other construction techniques.

John Patrick of Opus Central Laboratories explains that the need for the methodology was identified from an earlier Transfund (now part of the NZ Transport Agency) research project.

'That project looked at ways to make greater use of recycled materials to enable more sustainable road construction,' says John. 'But it also examined the barriers that existed within the industry to making greater use of waste minimisation techniques. Among the barriers identified was the lack of any type of methodology that road controlling authorities could use to quantify the benefits of adopting these techniques. Hence our aim in the current project was to produce a tool for authorities, to enable them to make informed decisions about whether or not to adopt waste minimisation strategies in their area.'

What's in a benefit?

The research developed a matrix of benefits associated with waste minimisation techniques. Road controlling authorities can put into the spreadsheet their own values for these benefits as a basis for deciding which techniques they should use.

Benefits include both quantitative and qualitative benefits. Cost savings to the road controlling authority can be either:

- direct – using a lower cost technique, such as incorporating aggregate sourced from river management operations, or from reducing the quantity of material going to landfill, or
- indirect – reducing the materials and energy required for a project, or the emissions produced by it, or the traffic delays associated with it.

The benefits can be quantified using data from the NZTA's *Economic evaluation manual* (2010), but the spreadsheet also allows users to input costs for other benefits that may not be covered by the manual (such as resource depletion).

Using the tool

The methodology comprises a four-part spreadsheet that calculates and compares the benefits associated with using particular waste minimisation techniques.

John says, 'Our objective was not to develop a project-specific tool but rather a tool that would help authorities develop policies for using particular techniques within their areas. Authorities can input data about their local cost structure and the spreadsheet then produces an output summary, which they can use to compare the various construction methods.'

Following data input, the spreadsheet makes estimates of:

- energy and emissions associated with:
  - material manufacture
  - transport to site
  - construction
  - transport to waste
- quantities of raw and recycled materials used
- vehicle operating costs associated with traffic delays
- energy associated with traffic delay
- emissions associated with traffic delay
- traffic delay costs.

The spreadsheet is straightforward, incorporating flow diagrams to make the methodology as clear and simple to use as possible. It does, however, require users to know about construction techniques and equipment requirements. Users also need to be able to determine an appropriate energy and emissions framework for some of the techniques they wish to explore, and be able to estimate the delays associated with roadworks under different traffic conditions.

Following its development, the spreadsheet was trialled with respect to three waste minimisation techniques: constructing recycled asphalt pavement; incorporating recycled glass in the basecourse of road construction; and using in-situ stabilisation.

John says, 'What the examples demonstrated is that the major area where waste could be minimised is in association with construction methods that minimise traffic delays. This is because the costs of travel delays, in terms of wasted fuel and time, tend to be of a higher magnitude than the costs associated with other aspects of construction. The examples also illustrated the potential environmental gains from using recycling techniques, for example in reducing CO_2 emissions and slowing resource depletion.

'Overall, we feel that the spreadsheet provides a very useful tool for road controlling authorities in helping them determine the merits of using a particular waste minimisation technique, and to compare the benefits with the costs of implementing a particular waste minimisation policy.'

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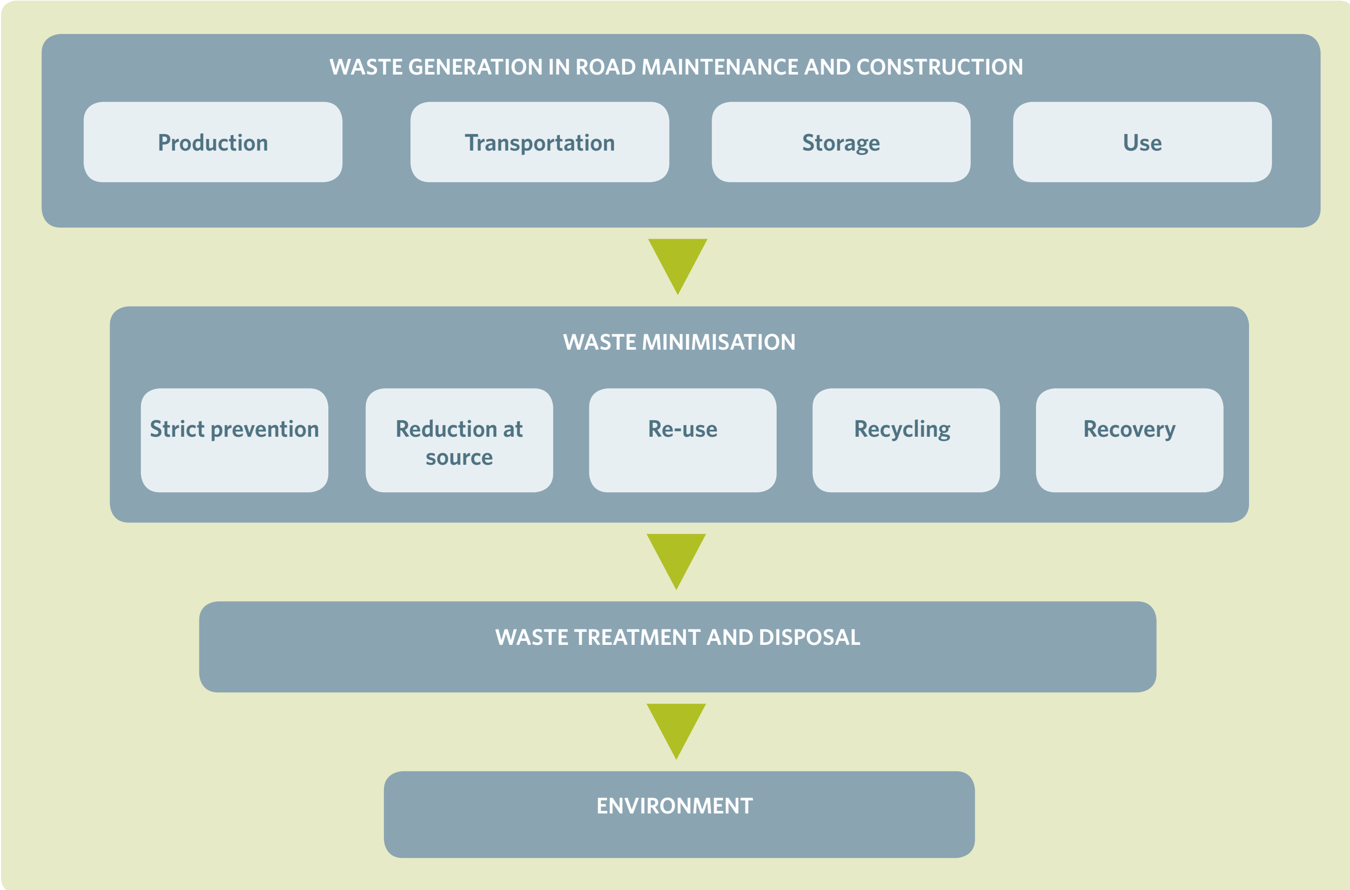
Table 1.1 Waste generation and waste minimisation in road maintenance and construction



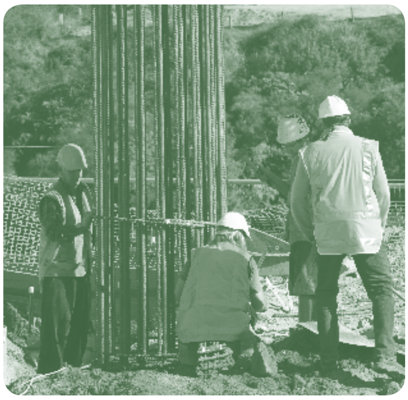
Waste minimisation in the road industry

According to the Ministry for the Environment[1] waste is any material, solid, liquid or gas, which is unwanted or unvalued, and discarded or discharged by its owner. Waste minimisation can therefore be defined as a chain of measures developed to prevent or reduce waste discharges through strict avoidance, reduction at source, reuse, recycling and recovery.

In the context of the road industry, this translates as:

- strict avoidance – prevents waste being generated during the road construction or maintenance process by avoiding the use of waste-generating technologies and materials, and replacing them with environmentally clean materials and modern technologies. As a result, wastes are not discarded or discharged into the environment
- waste reduction at source – is a measure to reduce waste during the road construction and maintenance process. Waste reduction can be achieved by more efficient use of raw materials
- recycling – reduces the discharge of wastes and the use of raw materials. Implementing this measure involves processing used building materials for re-use. For the roading industry, recycling reduces the need for new building materials such as gravel, sand, clay and limestone that are used as a basecourse layer. Recycling is a means to avoid disposing of used materials into landfills
- reuse – involves finding a beneficial purpose for recovered waste. Four factors are considered when determining a material's potential for reuse: the chemical composition of the waste and its effects on the reuse process; the economic value of the waste and whether this justifies modifying a process to accommodate it; the availability and consistency of the reused waste; and energy recovery.

[1] Ministry for the Environment. (2003). The New Zealand waste strategy. Wellington: Ministry for the Environment. Contact for more information



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Quantifying the benefits of waste minimisation, NZ Transport Agency research report 406.

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Keeping up with demand for flexible transport

While demand responsive transport is seen as an attractive alternative to traditional bus services in low-demand areas, there are some pitfalls that operators need to avoid if their services are to remain viable in the long-term.

In New Zealand, providing more public transport is an important aspect of government policy. External factors, such as the ever increasing price of oil, the need to respond to climate change concerns, and an aging and less mobile population, are also making additional public transport provision an attractive option.

However, traditional public transport depends heavily on having adequate numbers of users within a sufficiently close radius to support the services and make them economic. Traditional public transport also requires a baseline level of mobility from its users in order to get to and from established stops and routes.

In New Zealand, the problem has become more pronounced in recent years with the growth in low-density urban areas. While the main urban corridors tend to be relatively well serviced by traditional public transport, it can prove uneconomic to extend these services into lower density suburbs, leaving some residents with lessened mobility. Other areas where traditional public transport provision can become an issue include small towns and rural areas, where the populations are too small to support regular services. Services that do run to these places tend to be heavily subsidised and are often so infrequent as to adversely affect patronage.

Demand responsive transport is seen as an answer in these low-demand situations, offering the ability to provide a more flexible service for more dispersed populations. Situations that tend to suit demand responsive transport services include:

- specialist community-based services for older people and people with disabilities
- services in rural and other low-density areas
- services during off-peak times, like evenings and weekends
- where greater levels of service flexibility are required
- where more affordable forms of transport than single-hire taxis are required.

New Tele departing Chirnside Park Shopping Centre

KatiKati community van, Lions Club sponsors

What is demand responsive transport?

Demand responsive transport is used to refer to a range of flexible (in terms of route or timetable), shared ride, passenger responsive transport services that operate somewhere between a traditional bus service and a taxi. Demand responsive transport services may be available to everybody or be limited to specific groups of passengers, such as people with disabilities or the elderly.

Demand responsive transport's popularity and use has increased in recent years, mainly in response to more dispersed land use patterns and the inflexibility of traditional public transport services. Operators and transport authorities see demand responsive transport as a way of providing public transport services in low-demand situations, while policy makers and communities see them as a means of reducing social exclusion and providing social services transport. Demand responsive transport can also provide a more affordable form of flexible transport than conventional, single hire taxis.

Demand responsive transport is typically described according to the characteristics of the service that is being provided, as demonstrated in the following table.

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However, despite their growing popularity in Australasia and further afield, demand responsive transport services are not always successful.

Richard Scott, formerly of Booz and Co, led a recent research project to determine what made the difference between those services that folded and those that thrived, especially in low-demand situations.

'Demand responsive services, both here and overseas, have a history of mixed success,' says Richard. 'It is fair to say that many services have failed to learn from other services that have been discontinued, and as a result providers and operators often have unrealistic expectations about the costs involved and the likely level of patronage for a given service. We found that street patterns that consist of narrow curved cul-de-sac mazes are not conducive to efficient transport and will not be efficient to serve by conventional fixed bus routes or demand responsive services. We wanted to look into and draw from past experience of services, both successful and unsuccessful, and from them develop the role and scope for providing a successful demand responsive transport service in a low-demand situation in New Zealand.'

The project reviewed overseas experiences, plus three local case studies, to see what lessons could be learned. The case studies covered a range of services including:

- the Katikati and Te Aroha community vans, both of which are volunteer services whose main function is to deliver people to medical appointments at Tauranga and Waikato hospitals respectively, although both services also occasionally run further afield and for other purposes (eg to provide mobility for people in wheelchairs)
- a commercially run demand responsive wheelchair-accessible transport service operating in the greater Auckland area and catering for the mobility market
- a demand responsive bus service operating in north-eastern suburban Melbourne, offering a hybrid between a full dial-a-ride and a fixed-route bus service.

Te Aroha Red Cross community van

Table 2.1 from page 10 of full report

CHARACTERISTICS	ALTERNATIVES	DESCRIPTION
Scheduling type	Fixed schedule	Timetable with specific departure times at predefined stops
	Demand responsive	Various options including timetable with allowance for deviations, as required at specified intervals, or solely in response to demand
	Unscheduled	Fully on-demand or continuous (multi) hire
Route type	Fixed route	Predefined route and stops between two fixed points
	Route deviation	Fixed/partially fixed route and schedule but with deviations within a predefined area for passenger pickups or set-downs. Generally operating between two fixed points
	Flexible route	Either operating anywhere within a specified area but with one or more fixed points; operating anywhere within a specified area; or operating anywhere as required by the passenger(s)
Vehicle type	Taxi	Standard 4–5 seat motor vehicle
	Minivan/ maxitaxi	Up to 8–10 seats. Can be modified to carry wheelchairs
	Minibus/midibus	8-30 seats. Can be modified to carry wheelchairs
	Bus	Passenger carrying capacity of 30-200 (bi-articulated bus). Can be modified to carry one or two wheelchairs
Origin-destination relationship	One to one	Trips between two fixed points
	One to many	Patronage concentrated at one of the two trip ends. Services often run to/from a key hub, eg train station, bus depot or shopping centre
	Many to one	
	Many to many	Covers multiple trip origins and destinations. May involve a transfer to a different vehicle during the trip, eg as a feeder to a conventional bus service
Origin-destination service	Door to door	Service runs between points specified by the passengers, generally being their home, and/or operator, ie may be a predetermined location or one requested by passengers
	Checkpoint	Service runs via predetermined points, passing through the checkpoint at a specified/scheduled time

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Re-Li-On-Us Mobility Services van

The high-demand conundrum

One of the main challenges facing developing services is the pay off between reliability and affordability. Many services that start off small are able to offer fully flexible door-to-door services to patrons, although often at relatively high cost. As demand for the service grows, however, this model becomes increasingly unsustainable, with added demand leading to delays and reduced reliability, which in turn creates a drop in patronage.

'In essence, this creates a self-equalising low-demand service pattern,' says Richard. 'What we found is that door-to-door services are really only practical where demand is low. Once demand increases, the required journey length to pick everybody up creates long, slow journeys with winding routes, which detracts from the service's appeal.

'The answer in this situation is usually to reduce the flexibility of the service. There are various options for doing this, such as changing to fixed route commuter and school trips during peak times, operating the counter peak direction as an express, and limiting drop-off and pick-up points to the entrance to dead-end streets to avoid doubling back. All of these strategies enable a degree of flexibility to be retained for users, as demand increases, without the service folding. Experience shows that keeping a fully flexible service in high-demand situations is likely to lead to failure.'

Other findings from the research include suggestions for the best way to introduce demand responsive services into suburbs (start off fully flexible, with long-term subscriptions to encourage patronage, then, once the route is established, introduce some fixed route trips). In small towns and rural areas a community van is often the most cost effective option.

Among the many critical factors identified for making demand responsive transport a success were:

- operating in a confined area, thereby reducing the scope for deviation and reducing delays
- serving several market segments by altering the route or pick-up and drop-off options by time of day, and offering fixed route trips for peak commuters and school children, and flexi-route or door-to-door routes for off-peak shoppers
- encouraging repeat bookings to create an economic backbone for the service
- using low-cost booking technologies (many services that have invested in complex computer systems have faced high costs, which can prove difficult to recover)
- reducing costs through volunteer labour, sticking to simple vehicle allocation methods, and making best use of excess vehicles during off-peak times (for example to cater for shoppers)
- increasing revenue, eg by charging passengers a premium if they elect to be dropped closer to home.

Richard says, 'We certainly think that demand responsive transport has, and will continue to have, a role to play within New Zealand. By adopting the practices of successful services and avoiding the pitfalls that have caused others to fail, then services can ensure their ongoing viability. Basically, we found that those services that have continued to operate have taken steps to reduce their complexity and cost over time. Transport planners and operators should emulate these services, making adjustments as necessary for local conditions and demand.'

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Demand responsive passenger transport in low-demand situations, NZ Transport Agency research report 425.

Freely available online at www.nzta.govt.nz/research.

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Reconsidering moisture levels in NZ pavements

A project to develop a more accurate way to estimate pavement moisture conditions will open the door for less conservative pavement designs in locations where the risk of moisture ingress is judged to be low.

Based on a model developed and applied across the US (which due to its size includes areas with similar climatic conditions to our own), the new model developed by the research project will enable more accurate estimates to be made of pavement subgrade and basecourse materials here in New Zealand.

Haran Arampamoorthy and John Patrick of Opus International Consultants who carried out the research say that, in the past, New Zealand has taken a risk averse approach to pavement design.

'This sees pavements typically designed on the assumption that they will encounter the worst possible moisture conditions, that is, complete soakage,' says Haran. 'The approach tends to persevere even in areas where, the risk of moisture ingress is substantially lower. This creates a situation where it can be difficult for pavement designers to use a greater range of pavement materials, because of this pervasive fear of moisture ingress, which could in turn lead to premature pavement failure.

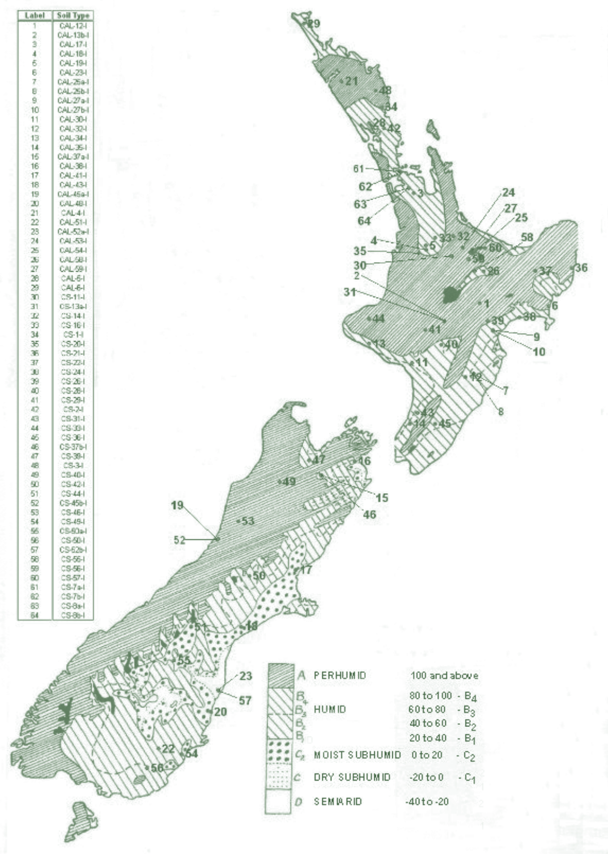
'In recent years, however, there's been increasing debate among pavement designers about the many pavements that have performed extremely well, despite being made up of theoretically substandard materials, and what this means in terms of the model that we are currently using. The current research grew out of this debate, with the aim of developing a model that was better able to estimate existing pavement conditions, and hence open the way for a greater range of base materials to be used.'

Seeking an accurate design saturation model

The level of moisture that is considered unsatisfactory in a given pavement layer is the level that creates a high degree of saturation of the layer's material. Pavement designers need guidelines that help them accurately determine these saturation conditions, taking into account factors such as the proposed pavement construction materials, and the traffic, topography, drainage and climate of the site. In particular, the main factors that affect moisture levels in pavement layers, and that need to be take into account are:

- thickness of the sealed surface
- any distress of the surface layers, such as cracks
- slope of the shoulder and the camber of the sealed surface
- effectiveness of any drainage
- land terrain
- intensity and duration of rainfall
- depth to water table.

An extensive literature review of models used overseas identified a US model for estimating saturation in subgrade and basecourse materials (the Perera model) as having the best potential for the New Zealand context. This model is based on the Thornthwaite index, which combines rainfall and temperature into an 'environmental' index. The project then applied this model to existing field data in order to make recommendations about a model for use in New Zealand.



Field trial sites used in the research: data for the analysis was selected from New Zealand state highway long-term pavement performance monitoring programme sites. The sites are labelled on the contour map and show the range of climate areas covered, as defined by Thornthwaite's moisture index.

Note: the contour map is reproduced with the permission of the New Zealand Royal Society.

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Conclusions included:

- that pavements typically settle to an equilibrium moisture content, which is a function of pavement materials and environmental conditions
- for granular basecourses in New Zealand, this equilibrium moisture content is typically in the range of 50% to 60%
- for subgrade soils in New Zealand, the equilibrium moisture content is typically greater than 85%
- these values are typical throughout New Zealand's climatic range.

Haran says, 'The value for subgrade soils was higher than we initially predicted, which may be because the depth to the ground water at the field trial sites was closer than we had assumed in our analysis. The research suggests feature development, which uses 10-year climate data to estimate pavement performance.

'From the data, we were able to recommend that laboratory characterisation of the long-term performance of pavement materials should be performed at 60% saturation for granular bases and at saturated conditions for subgrades. There are some pre-conditions for when these assumptions can apply, but in general they should provide designers with greater flexibility when selecting pavement materials than the previous straight assumption of saturation allowed.'

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Design moisture condition guidelines for pavement design and material assessment, NZ Transport Agency research report 424.

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Pedestrian safety and the use of countdown timers

Recent research into the safety effects from installing pedestrian countdown timers at busy urban intersections has shown that it is not simply a matter of putting in a timer. More analysis of pedestrian behaviour at each individual site is needed, if the impact on safety is to make itself felt.

Pedestrian countdown timers have already been installed at numerous intersections in cities around New Zealand. The research project, conducted by MWH New Zealand Ltd, aimed to assess the impact of such timers on pedestrian safety and traffic efficacy.

David Wanty of MWH says, 'Previous trials at intersections in Auckland's CBD had indicated that, when used in suitable locations, pedestrian countdown signals could encourage changes in pedestrian behaviour that increased people's safety. We were interested to see if these types of results could be expected at all sites where pedestrian countdown timers were installed, or whether other factors also came into play.'

Originally intended to run at two sites, the research was eventually only conducted at one, following major changes to the second site, which prevented meaningful before and after assessments being made. The remaining site was at the intersection of Queens, Bunny and Margaret streets in Lower Hutt, where a trial countdown timer was installed in July 2007.

Results show that safety is not an automatic consequence

The research, which was conducted over seven months during 2007 and 2008, involved before and after video surveys of pedestrian behaviour at the intersection, plus pedestrian

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questionnaires aimed at gauging public reaction to the timers and whether they had influenced people's crossing behaviour.

The video surveys recorded, and were subsequently used to analyse: the total number of pedestrians crossing per phase; the number of elderly and sensitive users (including any pedestrians with children in pushchairs); the number of pedestrians starting to cross when the signal was flashing red; the number of pedestrians on the road when the solid red man was displayed; the number of pedestrians running to complete their crossing; the number of aborted crossings; the number of pedestrians crossing on a vehicle phase (violators); and the number of pedestrian and vehicle conflicts.

David says, 'What we found was that some measures of pedestrian safety identified an increased risk to pedestrians after the trial countdown timers were installed. This was contrary to the expectations raised by both the previous Auckland trial and by research overseas, which suggested that pedestrian safety should improve once the timers were in place. At the Lower Hutt site, we found that not only was there an increase in the percentage of pedestrians remaining in the roadway after the solid red man was displayed, but there was also an increase in the percentage of pedestrians who started to cross after the flashing red man was showing.

'Although on the face of it this would seem like an increase in risky pedestrian behaviours, we concluded that the difference between our results and those recorded in Auckland was possibly due to the significantly different characteristics of the two sites. In particular, the Lower Hutt site has an exceptionally long diagonal crossing and, from the pedestrian questionnaires, it appears that pedestrians may be underestimating the time required to make this crossing. This would explain the greater number of pedestrians crossing late, as well as the lower percentage of pedestrians running to finish their crossing, when probably they should have been.'

Key findings of the study included:

- an increase in the number of pedestrians remaining in the roadway at the end of the pedestrian phase
- an increase in the number of pedestrians commencing crossing at the display of the flashing red man (late starters)
- a decrease in the number of pedestrians running to complete the crossing (late starters)
- a decrease in the number of pedestrians crossing on vehicle phases (violators).

In addition:

- nearly all pedestrians interviewed thought the countdown timers added to pedestrian safety
- most pedestrians understood the timers' function
- most pedestrians underestimated the time required to cross the intersection diagonally, with the current green man phase too short to enable slower pedestrians to make this crossing safely.

Recommendations focused on the nature and configuration of the signals, including a change to the land transport rules to enable animated displays to be used, and a preference for two aspect sets (as used in Auckland) as opposed to three aspect sets (as used in the trial), although with room for flexibility to cater to the differing geometries, phase times, and pedestrian and traffic flows of crossing sites.

The signals

Countdown timers are used at signalised pedestrian crossings to advise pedestrians how much time they have left to cross the road safely. They are believed to improve safety by clearing more pedestrians from the crossing before the end of the pedestrian phase. This is based on the premise that, with the timers, pedestrians will make more informed decisions about when to cross and will speed up in order to complete their crossing in time. Timers are also intended to reduce the number of crossings that are made outside of the pedestrian phase.

Various permutations of signals are used in New Zealand and overseas, most incorporating a solid green man (for the crossing phase), a flashing red man (to show that the crossing phase is coming to an end), a solid red man (indicating that the phase has now ended), and a timer. Timers can either count down to the time when the solid green man will show and pedestrians can cross, or to the time when the flashing red man will appear. Signals may either have two aspects (one for the flashing and solid red man, and one for the green man and countdown timer) or three aspects (one for each of the red and green men, and one for the countdown timer), or variations on this arrangement (including, overseas, hand and walking men signals).

For the trial, a three-aspect signal was selected, with the top aspect displaying the red man, the middle the countdown timer, and the lower aspect an animated (walking) green man. Two signals were installed, to supplement existing signals at a four-way intersection. Adjustments were made to ensure that the signals were visible from all four corners of the intersection.

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Trialling pedestrian countdown timers at traffic signals, NZ Transport Agency research report 428.

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New research publications

Next generation of rural roads crash prediction models – pilot study

Research report 437

Beca Infrastructure, and MWH New Zealand

Freely available online at www.nzta.govt.nz/research

Hard copy $35.00

The majority of fatal and serious crashes in New Zealand occur on rural two-lane roads. Data on historic crash patterns is not always sufficient to enable a suitable diagnosis of the safety deficiencies of various sections of this rural road network. It also cannot readily identify safety issues on low-volume roads and shorter sections of highway, where the relative scarcity of crashes may mask the considerable potential for safety improvements.

This pilot study covers the second stage of a three-stage research project that aims to quantify the impact of all key road features on the safety of two-lane rural roads. This stage of the study involved the collection of road alignment, roadside environment, traffic flow, and crash data for 200 sections of rural road, each one 400m long, throughout the Waikato region of New Zealand. The data was used to develop preliminary crash prediction models for two-lane rural roads, using generalised linear regression model techniques developed by Beca.

The data collection exercise covered a total of 28 predictor variables used for developing the preliminary model. The preferred model showed that the crash rate was most influenced by five predictor variables – namely, traffic volume, absolute gradient, distance to non-traversable hazards, skid resistance (SCRIM), and number of accessways.

Slow zones: their impact on mode choices and travel behaviour

Research report 438

Pinnacle Research and Policy, and Capital Research

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Given that the safety impacts of traffic management measures, including their effect on traffic speed, have been reasonably well-established, we wanted to explore the potential impact of such treatments on mode choice and travel behaviour such as travel patterns. We created the term 'slow zone' treatment or programme to generically describe the aim of any programme that modified the physical road environment in a way that would moderate driver behaviour, slow vehicle traffic, and/or improve the environment of the neighbourhood.

We adopted an evaluability assessment framework as the methodological approach for this research project. Evaluability assessment is a systematic process that helps identify whether a planned programme evaluation is justified, feasible and likely to provide useful information. In the first stage of an assessment, one output is an evidence-based logic model. In completing the tasks for this stage, we found the evidence review did not allow us to develop a comprehensive logic model as planned, because we could not clearly identify slow zone programme 'best' practice(s) for facilitating mode shifts or changes in transport mode use. Hence, we developed less detailed guidance for a monitoring framework to help collect appropriate outcome and impact data.

Generation of walking, cycling and public transport trips: pilot study

Research report 439

Traffic Design Group

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This research investigated a method for collecting data relating to walk, cycle and public transport trips to land use activities.

A method needed to be developed that would require a short questionnaire to ensure higher sample rates, while also providing reliable and consistent results. This data could subsequently be used in calculating trip rates for walk, cycle and public transport trips, when combined with trip rate units such as floor area.

Multi-modal trip data has been collected for some time in the UK. The survey method developed in this research was simpler than the UK method by interviewing in only one direction for the vast majority of land uses, apart from residential where the recommended method was to interview in both directions.

A face-to-face questionnaire method was developed over a series of different site surveys in Auckland, Wellington and Christchurch during 2010. The research also identified that collecting non-car mode trip information through purely observer methods was not sufficiently accurate and that simple questionnaire surveys were necessary with clear instructions from the survey organiser to ensure all relevant information would be collected.

Potential of the Wehner-Schulze test to predict the on-road performance of aggregate

Research report 443

Opus Central Laboratories

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The specification for aggregates for use on New Zealand roads includes the British Polished Stone Value (PSV) test. This test and the acceptance criteria were adopted in New Zealand in the 1990s, based on British experience that they were the best available method of predicting the onroad friction performance of aggregate. However, research performed by a number of people in New Zealand has shown that the prediction of performance by the PSV test is extremely variable.

The Wehner-Schulze (WS) test method, developed in Germany in the 1960s and commonly used there, can test samples taken from

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the road. This research, which was carried out between December 2009 and August 2010, aimed to assess the potential of the WS test for predicting chipseal surface friction.

The chipseal samples taken from New Zealand roads could not be used for testing because their very high texture imposed too much stress on the equipment. Therefore, hand-placed chips were tested (a specified variation in the test method). Six New Zealand quarry aggregates, covering a range of on-road friction performance, were used to assess the WS test. The test results showed that PSV and WS test results on the hand-placed samples were highly correlated. Therefore, in this form the test is not a better predictor of onroad friction than the PSV test.

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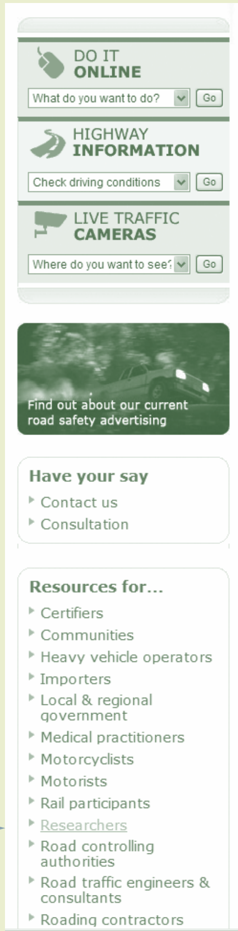

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NZTA Connect provides a snapshot of the NZTA's projects and initiatives that are relevant to the work approved organisations are doing in the area of land transport in New Zealand.

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 http://www.nzta.govt.nz/about/newsletters/index.html

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