Issue 19 March 2013

ISSN 1174-0523 (print) ISSN 1174-0566 (online)

NZTA research

NZ TRANSPORT AGENCY
WAKA KOTAHI

SEEKING INNOVATION IN EXPORT SUPPLY CHAINS

Research into the freight and logistics component of selected export supply chains focused on opportunities for innovation, which could ultimately boost the competitiveness of New Zealand's export sector.

Conducted by Deloitte in New Zealand and Australia during 2012, the research examined the supply chains in three key New Zealand export industries to identify opportunities for, and barriers to, innovation and productivity gains in New Zealand's freight and logistics industry. The aim was to provide the government and the export sector with a range of initiatives that could improve the efficiency of New Zealand's freight logistics operations.

THE ROLE OF INNOVATION

Innovation within the freight and logistics sector has the potential to increase market value and reduce the costs of delivering goods and services, both to domestic markets and for export. The New Zealand government supports the need for innovation, maintaining a strong focus on improving freight efficiency in order to promote economic growth and productivity.

New Zealand's distance from its international markets poses a particular challenge for the export sector and the industries within it. Seeking out and implementing innovations within the freight system is crucial for distinguishing the country's capacity to sell into these markets, by driving down costs and improving services. Yet, at present, New Zealand does not have a strong international reputation for innovation (according to the World Economic Forum, New Zealand currently ranks 23 out of 34 OECD nations for its capacity to innovate).

Ros Warburton of Deloitte Australia says, 'Businesses tend not to invest in innovations unless there are demonstrable or tangible outcomes from doing so. Understanding the barriers and drivers to innovation was therefore a logical starting point for our research.'

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DRIVERS AND BARRIERS TO INNOVATION

Innovation drivers were defined as any force that facilitates or encourages innovative change in the freight and logistics sector. Barriers, on the other hand, were those factors that stifle or slow opportunities for innovation.

Key drivers identified included the need for exporters to:

- remain price competitive within the markets they serve
- continue to deliver high-quality products to those markets
- adapt to the changing transport environment.

Barriers facing exporters included:

- lack of scale, making it difficult to have influence in larger markets
- their small size, meaning they have less capacity to invest in innovation
- long and fragmented supply chains, with multiple participants, making it complex to implement change.

Identifying opportunities through barriers and drivers

- Price-driven market
- Cost of transport
- Infrastructure capacity
- Manual labour element
- Service delivery

- Cost and risk
- Fragmented supply chain
- Excessive interfacing between multimodal parties along supply chains
- Competitive positioning
- Numerous transactions along supply chains
- Low utilisation of technology
- Limited data availability
- High barriers to entry
- Long-term contracts with end users

A CLOSER LOOK AT THREE SECTORS

Three export industries were chosen for closer examination: meat, forestry and wine. Together they are representative of the broader export market, due to their already significant export volumes or their potential for growth. The dairy industry, by far New Zealand's biggest exporter, was not included, as it is already considered to represent best practice in terms of its international supply chain. The researchers considered that more value would be generated by focusing the research on export sectors that have not been studied as closely.

A wide range of innovations emerged from these studies, which are already being implemented and generating benefits for New Zealand's meat, forestry and wine industries. These included innovations relating to:

- **collaboration** – collaboration is being used to reduce costs, by generating economies of scale, improving purchasing power, and making better use of available freight capacity
- **IT** – IT is being used to match freight capacity against product flows and reduce waste (for example, through improving vehicle scheduling and monitoring the condition and location of consignments)
- **transparency and control** – producers are taking more control of supply chains for their products, thereby lowering costs
- **new transport technologies** – investment in better road and rail equipment is increasing payloads, lowering operating costs and improving equipment use, which in turn is lowering transport costs within supply chains
- **supply chain structuring** – chains are being structured to reduce transport costs (for example, by optimising the point at which products are packaged)
- **relationships** – international relationships are being leveraged to exploit economies of scale for production and purchasing power
- **cluster benefits** – choosing common locations for producers enables third parties to provide lower-cost packaging, storage and transport services.

Barriers to innovation identified within the industries included embedded practices, oversupply of freight capacity (particularly in the international shipping sector), limited networks with respect to IT, dispersal of industries and challenging geography.

POTENTIAL INITIATIVES

Ros says, 'Through our research we were able to identify several potential initiatives that, if put into action, would improve the competitiveness of New Zealand's export sector. The willingness of export and transport industry representatives to take part in our study indicates their desire to work with the government in this regard. While industry is leading the initiatives we looked at in the research, the government undoubtedly has an important role to play in facilitating these initiatives, be that through land use planning, the regulatory environment, information generation and sharing, or transport infrastructure.'

Potential initiatives: issues and actions

Issue	Possible actions
Long-term trend towards larger vessels on international shipping routes	Encourage dialogue between shipping lines, exporters, port operators and land-based freight providers to better understand the key drivers for the shipping lines' actions.
	Exporters could work together to better understand the mix of cargoes to identify opportunities to build cargoes across export sectors for specific destinations.
	As an owner of rail and roads, government can support the private sector, the ports and developers by ensuring complementary landside infrastructure is available. Government can also provide support through land use planning and regulatory arrangements.
Integration and connectivity	Ensure transport and land use planning recognises and facilitates interconnectivity. Encourage investment in intermodal terminals and innovative equipment by ensuring roads and rail lines are operating efficiently.
Infrastructure investment	The provision of efficient freight infrastructure will encourage investment in related assets. Government should continue to investigate ways in which the private sector can invest directly in public infrastructure.
Regulatory environment	Ensure regulatory change is robust and undertaken in a timely manner. Any changes must be cognisant of the needs of and implications for transport providers and cargo owners.
Network resilience	Undertake a system-wide approach to freight infrastructure planning. Identify and understand existing and potential bottlenecks in the system. Identify alternatives and develop contingency plans in the case of system outages. Utilise short-term regulatory levers to overcome outages. Support continued interoperability capability between modes to improve supply chain resilience.
Economies of scale	Central and local government can facilitate intra-regional and cross-industry forums to leverage collaborative actions. Likewise industry peak bodies could facilitate information sharing. Ensure anticompetitive regulations do not inadvertently restrict collaboration opportunities for exporters who are competing on the world market, not within New Zealand. Identify information and encourage research that may assist industry and government agencies to develop a better picture of what is happening across industries and regions.
Higher payloads	Implement recommendations for application process as per September 2011 review of high-productivity motor vehicles (HPMVs). Address differences in the treatment of HPMV infringements versus other heavy vehicle infringements. Identify ways to incentivise local government to approve HPMV applications. Ensure regional and local plans have mechanisms to keep up with the changes in the private sector.
	Investigate the options for private sector investment in rail rolling stock (particularly wagons), intermodal terminals and private sidings. Assess opportunities for alternative contract arrangements to facilitate a lower-risk environment.
Information	Leverage data from electronic road user charges for road planning. Support the expansion of the Freight Information Gathering System to include all container ports and land-based container repositioning. New types of data such as the National Animal Identification Tracing (NAIT) system can be used to monitor livestock movements and identify potential efficiencies in the use of trans-regional transport operations. As such, NAIT data should be seen as a valuable source of transport information and be encouraged to make inter-regional 'flow' statistics publicly available.

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Supply chain innovation: New Zealand logistics and innovation, NZ Transport Agency research report 494
Available online at www.nzta.govt.nz/resources/research/reports/494

EARLY ASSESSMENT SUPPORTS BETTER DECISION-MAKING

A tool to quantify the effects that transport investment will have on economic productivity and land use will lead to more strategic decision-making about, and greater value for money from, transport investment projects.

The research aimed to facilitate a more strategic approach to transport decisions. This would be done through the development of a tool or framework that enabled projects to be evaluated before they were put through a more detailed analysis, such as that found in the NZ Transport Agency's *Economic evaluation manual* (2009).

Researcher John Williamson of Ascari Partners says, 'We considered that assessing projects early, before they underwent a full economic evaluation, was the best way to support integrated land use and planning. An early assessment of a project is most likely to lead to a change in its scope or priority in order to support better economic and land use outcomes.'

To this end, the project developed and tested methods that transport infrastructure providers can use to quantify the economic productivity and land use impacts that transformational or structural transport investments will have over time. Before the project there had been a knowledge gap in this area and, as a result, no way to be certain that infrastructure providers were making the 'best' investment decisions.

ADOPTING A CASE STUDY APPROACH

The research confirmed that no single tool or method was currently available to enable comprehensive analysis of the relationship between transport investment and land use change. However, a qualitative case study approach would provide a useable tool in the short term, and would be a good starting point for developing a more sophisticated and complementary quantitative model.

The research developed a preferred approach or tool that makes use of qualitative indicators and descriptive statistics (derived from case studies of previous projects) to provide insights into the likely land use and productivity effects of transformational investments. (Transformational transport investments are identified based on the predicted outcomes of the project, rather than its cost. A transformational project will bring about significant change in economic performance or land use, regardless of the size of the financial investment. Likewise, expensive projects are not necessarily transformational.)

Features of the tool

- It can rely on analysis of single or multiple case studies where a similar project has already been implemented (provided the data from the implemented project is transferable to the proposed one).
- It derives estimates of effects by comparing before and after conditions to generate a time series comparison. This allows a picture to be built up of what has actually happened in response to the project over time.
- It provides information about changes in surrounding land use following the announcement, building and completion of projects.

John says, 'In our view, the retrospective case study approach provides a useful predictive tool for assessing the land use and productivity effects of transformational transport investments.

'One key factor that enables this is that the tool is intended to be employed at the project inception phase. It is not designed to precisely quantify productivity effects in the same way that agglomeration effects are quantified in the *Economic evaluation manual*. Instead, it is intended to indicate potential directions of changes to land use and productivity. Through these indications, it will provide feedback that can be used to better align transport investment with desired land use and economic change – but to do this from an informed perspective, based on what has been observed to happen in similar locations where similar projects have been implemented.

'Overall, we consider the proposed approach is a useful starting point, which in future could be extended into a quantitative analysis, using a regression tool that can work interactively with the qualitative findings. This would add greater rigour and predictive power to the tool, over time.'

In terms of the NZ Transport Agency's six-stage approach to planning, programming and funding (set out in its *Planning, programming and funding manual*, published in 2008), the proposed tool could be applied either during Stage 1 (Formulation) or early in Stage 2 (Assessment). Although it is technically an assessment tool, there are good reasons for using it at the formulation stage, including maximising its ability to inform the direction and scope of proposed projects, thereby supporting a more strategic approach to funding allocation.

In their report, the project team recommend that the assessment tool should be implemented immediately at the strategic planning and evaluation stage of transport projects. Other stakeholders could also be encouraged to take a more strategic approach to project formulation, using the proposed approach.

Further case studies of transformational transport investments could then be undertaken, to build data and understanding of their local land use and productivity effects (this could potentially be incorporated within current transport monitoring and evaluation processes). Development of a quantitative regression tool (begun during the project) could continue, leading eventually to a fully operational qualitative and quantitative assessment tool that took the case studies as its starting point. The eventual shape of this tool, as envisaged by the project team, is shown in the following table.

Key steps in the complete analysis

Part 1: Qualitative analysis
Approach: Qualitative and descriptive assessment of land use changes and productivity effects
Method: Assessment using case study(ies)
Indicators: Land values, land uses, population, dwellings, employment, firms, traffic counts, planning and zoning information
Outcome: Qualitative, contextually rich description of the observed land use and productivity effects of the case study project(s) at the micro (local) level

▼

Part 2: Quantitative analysis
Approach: Quantitative assessment of changes in land values arising from the case study project
Method: Regression analysis of observed land values sourced from QVNZ database
Indicators: Changes in land values with respect to coefficients
Outcome: A quantitative analysis of the response of land values within the case study area

▼

Part 3: Combined analysis
Approach: Combines the outcomes from Parts 1 and 2 to provide a quantitative analysis that is informed by the contextual and qualitative findings from Part 1
Outcome: A comprehensive, rigorous and contextually rich understanding of the land use and productivity changes within the case study area

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The economic and land use impacts of transformational transport investment, NZ Transport Agency research report 479
Available online at www.nzta.govt.nz/resources/research/reports/479

SEVEN-STEP MODEL HELPS EFFICIENCY PRACTICES STICK

A three-way investigation into the difficulties of implementing fuel efficiency measures for light and heavy vehicle fleets found that an evidence-based approach had the best track record, and most likelihood of success.

A model, based on the study's findings, will help fleet managers introduce fuel-efficient practices into their own operations.

The research, conducted by TERNZ between 2009 and 2011, drew on New Zealand and international best practice, workshops and interviews with transport operators and other key stakeholders, and case studies of selected vehicle fleets. Its aim was to identify the barriers that fleet operators face when implementing fuel efficiency measures in their day-to-day business, and suggest ways to overcome them.

REASONS FOR SAVING FUEL

Peter Baas of TERNZ says that saving fuel is a 'rare win-win opportunity', with benefits including:

- lower fleet operating costs, which in turn affects fleet productivity and profitability
- a stronger national economy, by reducing fuel imports while not adversely affecting employment
- greater national energy security, by reducing New Zealand's dependence on imported fuel
- reduced carbon dioxide and noxious gas emissions, with positive flow-on effects for the climate, environment and people.

'Few other initiatives offer this many concurrent benefits for fleet managers and the government,' says Peter.

New Zealand's Energy Efficiency and Conservation Authority is currently encouraging the freight sector to adopt fuel efficiency measures, promoting greater use of fuel-efficient vehicles, and low-carbon fuels and technologies.

Safety is another reason for adopting fuel efficiency measures. There is a strong link between safety and fuel consumption, with many of the ways of improving them the same: managing speed, anticipating the situation ahead, reducing aggressive driving, checking tyre pressure, keeping on top of vehicle maintenance and reducing the amount of travel, all have positive effects on both.

MEASURES AND BARRIERS

One of the most straightforward ways to lower fuel consumption is by reducing vehicle speeds. Contrary to popular belief, speeding has very little effect on trip time. In fact, it has been found that trip times often reduce when drivers are instructed not to speed and to use other fuel-efficient driving techniques.

Previous New Zealand research has confirmed that, by introducing relatively low-cost measures (such as driver training, vehicle maintenance and vehicle design), heavy vehicle fleet managers can achieve fuel savings of 10% and more. One established operator recorded fuel savings of 18% and a 50% reduction in safety-related incidents as a result of introducing fuel efficiency and speed management measures.

Measures discussed in depth in the report include driver training, speed management and improved fleet management practices. The latter is crucial to the success of all of the measures, as fleet operators and managers determine the priority that fuel efficiency and safety have within their operations. Managers purchase new vehicles, facilitate training, promote safe and fuel-efficient driving practices, and dictate vehicle maintenance schedules.

However, they also report numerous reasons why they do not put more effort into saving fuel. Commonly cited reasons include lack of time to implement measures and lack of awareness of what could be achieved, and also disappointing past experiences with fuel efficiency schemes, where the potential savings promoted had not been realised. Other reasons include an inability to make training stick (with drivers slipping back into old ways of doing things) and a lack of systematic fuel efficiency measurement within fleets.

Case studies developed tailored action plans to introduce fuel-efficiency measures into fleets

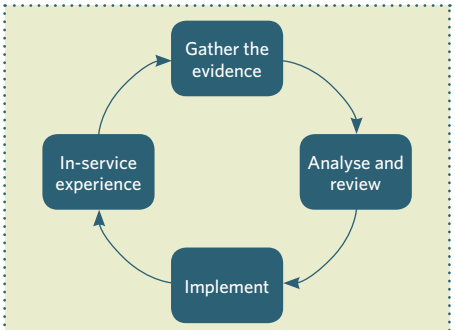
The government is encouraging the adoption of fuel-efficiency measures in New Zealand's freight sector

THE IMPORTANCE OF AN EVIDENCE-BASED APPROACH

The research found that a common feature of successfully implemented fuel efficiency practices and programmes, here and overseas, was the adoption of evidence-based practice.

Evidence-based practice is already widely used in New Zealand in the aviation, medical and education sectors. It involves basing decision-making on empirical data that has been repeatedly and rigorously gathered. A crucial aspect of evidence-based practice is providing positive and specific feedback to individuals about the practice or practices that are being implemented; doing so enables ongoing improvement to occur.

EVIDENCE-BASED PRACTICE FEEDBACK LOOP

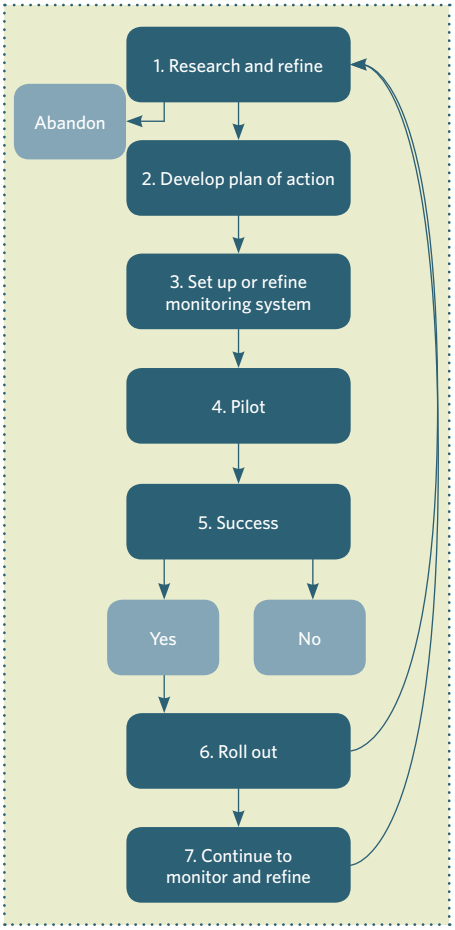


In the context of fleet fuel efficiency, this would involve providing feedback to drivers about their improvements in fuel consumption, speeds, engine idling and other key performance indicators.

Peter says, 'Unless fuel efficiency is embedded within the culture of an organisation, most of the benefits of driver training and other measures risk being lost as employees revert to their old familiar ways of doing things. Evidence-based practice is a way of embedding fuel-efficient practices, through providing meaningful feedback on factors that are within a driver's control.'

The report provides a model that fleet managers can follow to introduce problem-solving evidence-based fuel efficiency and safety improvement practices into their operations. The model contains seven elements or steps.

MODEL FOR IDENTIFYING, ASSESSING, IMPLEMENTING AND MONITORING NEW INITIATIVES



1. **Investigate** what the options are and what has worked best for others.
2. **Develop** a plan of action, including the strengths and weaknesses of the various options for your organisation, the costs and benefits, and who will champion the project.
3. **Monitor** fuel consumption and other key performance indicators.
4. **Pilot** the initiative that has been selected. Provide feedback to drivers and other staff. Make refinements as the trial progresses.
5. **Evaluate** whether the pilot has been successful or not.
6. **Roll** the programme out across the whole fleet if the pilot was successful.
7. **Continue** to monitor and refine the programme.

The report also recommends ways that the government, industry associations and other stakeholders can encourage and support fleet managers to adopt fuel efficiency measures. These include awareness-raising campaigns, incentive-based accreditation schemes, support for the industry to adopt high-quality and useful monitoring regimes, and information, advice and training about fuel-efficient practices.

Peter says, 'Most governments in developed countries have introduced schemes aimed at improving transport fuel efficiency and environmental performance. The USA, Canada and the UK are currently leading the field. What their schemes have in common is the adoption of a progressive problem-solving approach that is evidence-based. Some countries, such as Australia, have also produced guidelines and other information to help transport operators adopt their own measures.'

CASE STUDIES DEMONSTRATE WHAT CAN BE ACHIEVED

Part of the project included providing assistance to several fleet managers to set up fuel efficiency measures. This included identifying barriers that managers had encountered in the past when implementing measures, and developing action plans to introduce evidence-based efficiency practices into their fleets.

Fleets were selected based on their nature (light or heavy, type of operation, number of vehicles, location), and their industry sector and whether they were representative of it (among other things). Vehicle and fleet data was collected about fuel consumption, distances travelled, idling, speeding and other information.

From this, tailored fleet action plans were drawn up with senior managers, aimed at developing more fuel-efficient fleets. Plans covered such things are driver training, driver incentive schemes, fleet speeding policies and on-board fuel monitoring based on global positioning systems.

The research team helped managers implement the plans, providing support, information and other assistance (along the lines of that typically available in the countries where measures have been successfully introduced). Fleets were monitored for at least three months post-implementation, followed by a review to determine what changes had been achieved, their effectiveness, and any problems and opportunities for further improvement.

The case studies were written up to demonstrate to other transport operators what had been achieved, and are available in the full research report. Fleets reported fuel savings ranging from 4% to 15% (the average saving was 10.7%), and a substantial reduction in speeding and safety-related incidents.

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Fleet management commitment to fuel efficiency,
NZ Transport Agency research report 482

Available online at www.nzta.govt.nz/resources/research/reports/482

STUDY PROVIDES WEALTH OF INFORMATION FOR DESIGNING SAFER ROUNDABOUTS

Measures to enhance the safety of roundabouts, and further encourage their installation, are the outcomes of a recently published study into the comparative safety of roundabouts and signalised urban intersections.

Large roundabouts are increasingly being favoured for major urban intersections overseas, due to growing recognition that they experience fewer serious injury and fatal crashes than traffic signals. However, in New Zealand their use is declining, with one of the main reasons being their perceived safety risks for pedestrians and cyclists.

This apparent disparity was the impetus behind a recent NZTA-funded research project that reviewed the relative safety performance of roundabouts and signalised intersections, and made recommendations for how roundabouts could be made safer for pedestrians. The research built on an earlier study into the needs of cyclists at multi-lane roundabouts. While based on urban intersections (with speed limits of 50km/h or less), many of the current study's findings are also relevant to intersections in higher-speed rural or highway locations.

PROJECT SCOPE

The scope of the study, and the resulting report, is substantial, reviewing extensive research and evidence about crash rates and safety measures, from New Zealand and overseas.

Topics covered by the report include:

- a comparison of the safety between traffic signals and multi-lane roundabouts for all users (injury crash rates and severity are purportedly lower at roundabouts, which suggests there is good reason to encourage their more widespread installation in New Zealand)
- an evaluation of the current guidelines for visibility at roundabouts, with a particular focus on sightlines
- an evaluation of the options for pedestrian facilities at roundabouts, including measures not yet used in New Zealand
- an evaluation of the use of vertical deflection devices at main road roundabouts (despite evidence that these are an effective means of speed control, many New Zealand road controlling authorities are reluctant to install them on main roads outside of the central business districts)
- an evaluation of the Netherlands-designed turbo-roundabout (a low-speed roundabout design that purportedly offers improved safety and capacity compared with conventional roundabouts).

The research was conducted by Duncan Campbell of Auckland Transport, Ivan Jurisich from Traffic Engineering Solutions Ltd and Roger Dunn from the Department of Civil and Environmental Engineering at the University of Auckland. The authors acknowledge that each of the study's five areas of enquiry represents a topic in its own right.

'Although quite separate topics, together they provide excellent background material for New Zealand road planners and traffic engineers, and will help them decide on appropriate intersection controls and design safer roundabouts for all users,' says Ivan.

The main findings from the report, with respect to each area of enquiry, are summarised below.

THE COMPARATIVE SAFETY OF ROUNDABOUTS AND TRAFFIC SIGNALS

Evidence in New Zealand and overseas demonstrates that well-designed roundabouts lead to fewer vehicle injury crashes (especially serious and fatal) than signalised intersections.

This suggests that, in order to reduce crash rates, it is preferable to use roundabouts at urban intersections, as opposed to traffic signals, and the report recommends that a 'roundabouts first' policy (as used in some North American jurisdictions) should be considered for adoption. Such a policy would set roundabouts as the default option for urban intersections and could require road controlling authorities to justify installing alternative intersection controls in locations where a roundabout is viable.

However, New Zealand crash rate modelling has suggested that three-leg signalised intersections are safer than multi-lane roundabouts. This is at odds with what has been found overseas, leading the researchers to conclude that the difficulty may lie with inadequate speed control and design standards for New Zealand roundabouts. Speeds must be slowed physically to a maximum of 50km/h, preferably nearer to 30km/h for pedestrians and cyclists.

Previous roundabout

New C-roundabout

Example of a C-Roundabout site where speeds have been reduced to a maximum of 30km/h to improve safety for cyclists and pedestrians

The study found that New Zealand roundabouts are not, at present, always being designed to meet best practice for speed control, and many have inadequate deflection measures and other shortcomings. This is skewing the modelling, and the report recommends that the crash rates in the NZ Transport Agency's *Economic evaluation manual* (2010) should be revised to better represent current best design practice, including adequate speed control (which would in turn affect the economic viability of proposed roundabouts).

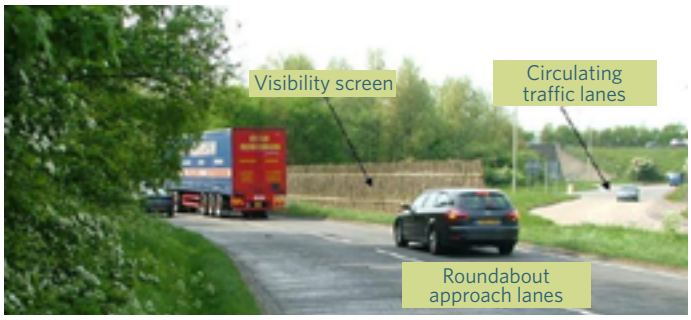
Crash models should also be further developed to enable practitioners to compare the safety performance of roundabouts and signalised intersections for particular sites.

Other recommendations related to improving crash rate data for pedestrians at roundabouts and signalised intersections, and trialling cyclist priority crossings at roundabouts, as these have demonstrated significant benefits overseas.

SIGHTLINES

Sightlines to the right have a significant effect on the speed at which vehicles approach and enter roundabouts, making sightline restrictions a potentially effective tool for improving safety and reducing crashes. This is especially relevant for cyclists and motorcyclists who are most commonly hit while traversing a roundabout by vehicles entering it.

The balance between excessive and overly restrictive sightlines is a fine one (both have safety implications), and the research report contains guidelines about the best use of sightline restrictions in order to design safer roundabouts. Further research is warranted, as sightlines can be an economically viable alternative to (more costly) geometric means of speed control.



High-visibility screens installed on the approaches to roundabouts are an effective way to restrict sightlines

PEDESTRIAN FACILITIES

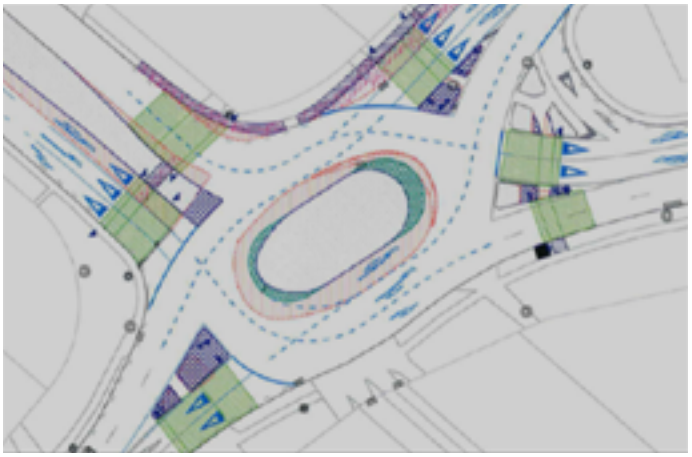
Well-designed multi-lane roundabouts can accommodate pedestrians safely (there are substantially more fatalities at signalised intersections), as long as there are appropriate speed controls and warning devices in place.

The research looked into crossing types and designs for roundabouts favoured in New Zealand and overseas, and made recommendations about wait times, signals, signage and design features that should be adopted here. This included flashing signals, part-time signals, signal lane arrows and larger Belisha disks.

VERTICAL DEFLECTION DEVICES

Vertical deflection devices are widely used in some overseas cities in conjunction with roundabouts, and have proven benefits for cyclist and pedestrian safety.

In New Zealand, their use tends to be limited to central business districts and shopping centres, but the report recommends that this should be extended. Road controlling authorities should seriously consider making greater use of vertical deflection devices for speed control at roundabouts on main roads, as they are an economic alternative to geometric means of speed control, and any noise impacts are likely to be minor. (The possible exception is some types of large vehicles, but this should still be assessed and the report contains guidance on doing this.) Vertical deflection devices often do not have a significant impact on capacity, as speeds at congested roundabouts in peak periods are usually low. Options include raised speed platforms, humps and cushions, with the general rule being that the higher the profile of the deflection device, the greater its speed reduction impact.



Layout for a three-lane roundabout using speed tables to slow speeds to 50km/h through the roundabout

TURBO-ROUNDABOUTS

Turbo-roundabouts are designed and used in The Netherlands, and use spiral lane arrangements with mountable lane dividers to improve the safety and capacity of roundabouts. Their downside is that they are expensive to install.

Despite this, the study stated that they represent a viable low-speed design option for New Zealand, and recommended that an example be built and evaluated here to assess the safety impacts in local conditions.

A turbo-roundabout in The Netherlands, showing the typical layout

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Improved multi-lane roundabout designs for urban areas,
NZ Transport Agency research report 476

Available online at www.nzta.govt.nz/resources/research/reports/476

NEW RESEARCH REPORTS

Seismic design of New Zealand highway bridges under spatially varying ground excitations

Research report 504

B Li, J Butterworth and N Chouw – The University of Auckland

Free online at www.nzta.govt.nz/resources/research/reports/504

Bridge damage, especially due to pounding and unseating at expansion joints, has been observed in almost all major earthquakes. It is the result of large relative displacements of girders, in excess of the designed gap width and seating length. Research shows that relative displacements of neighbouring bridge segments depend on the fundamental frequencies of the adjacent structures, spatially varying ground motions and soil–structure interaction (SSI). To evaluate the significance of the influence of these factors, three identical bridge models with a scale ratio of 1:125 were tested using shake tables. Another study involved one of these models pounding with movable abutments. Lastly, another scaled model of 1:22 was field tested to study the SSI effect in comparison with the fixed-base results. The scaled models were designed in accordance with the principles of similitude. The results obtained by isolating and varying each individual influence factor are presented and discussed in this report. The results show that the spatially varying effect of ground motions increases the maximum relative displacements and pounding forces between adjacent bridge girders even if adjacent segments have the same fundamental frequency. Recommendations are made for new bridge design which will take into consideration the spatially varying effect of ground excitations.

Identify, evaluate and recommend bus priority interventions

Research report 506

M Harvey, A Tomecki and C Teh – AECOM New Zealand

Free online at www.nzta.govt.nz/resources/research/reports/506

The purpose of the research topic was to develop a practical decision-assisting tool for identifying appropriate bus priority interventions for any given situation based on route and intersection characteristics.

In developing a proposed methodology the research team was keen to ensure the final product would be an active 'live' decision-assisting tool available at a person's desktop and not simply a forgettable piece of research landing on a shelf with limited life and audience. With this approach applied throughout the study, the final tool was developed so it is relevant to today's situations and takes future scenarios into consideration.

The principal objective of this research therefore was to develop an easily disseminated computerised application for practitioners to identify appropriate bus priority treatments. The resulting bus priority assessment tool (BAT) is unique in that it is not an off-the-shelf modelling product but has been specifically designed and developed for this research work using Microsoft Excel 2007 and Visual Basic for Applications (VBA).

This research report describes the development of BAT, and includes a copy of the BAT user manual as appendix D.

Obtaining NZTA research reports

All research reports published since 2005 are available free of cost for downloading from the NZTA's website – www.nzta.govt.nz/planning/programming/research.html.

PDF scans of research reports published prior to 2005 are available by emailing research@nzta.govt.nz.

The next generation of rural road crash prediction models: final report

Research report 509

S Turner, R Singh and G Nates – Beca Infrastructure Ltd

Free online at www.nzta.govt.nz/resources/research/reports/509

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 proactive safety improvements.

This report presents the third and final stage of a study that aims to develop crash prediction models for two-lane rural roads using data from almost 7000km of the rural state highway network. The report builds on the findings of Stage 1 (Scoping Study) and Stage 2 (Pilot Study) to determine the most important parameters affecting safety on rural roads in New Zealand. The models have quantified the mathematical relationship between crashes and traffic volumes, road geometry, cross-section, road surfacing, roadside hazards and driveway density. These crash prediction models have enabled a better understanding of how safety is impacted by these factors and how they interact with each other. They can also be used to determine which improvements are best to reduce crashes (for example, whether to realign a road, widen the shoulder or remove roadside hazards).

The contribution of public transport to economic productivity

Research report 514

T Hazledine, S Donovan and J Bolland

Free online at www.nzta.govt.nz/resources/research/reports/514

The objective of this research was to quantify the contribution of public transport to economic productivity. Based on their review of the literature the researchers decided to extend and apply Venables' microeconomic model of the productivity benefits of transport improvements, which considers the interplay between commuting costs and agglomeration economies. They extended Venables' model in two ways: first, they incorporated non-linear congestion costs that are typical of major urban centres in which public transport tends to operate; second, they allowed for space previously used for car parking to be reallocated, primarily for employment, which in turn would generate additional agglomeration economies. The model was subsequently applied to two transport case studies and found additional productivity benefits in the order of 3% to 19% of conventional transport benefits. These findings have implications for the economic evaluation of public transport improvements and transport funding priorities.

Economic evaluation of the impact of safe speeds: literature review

Research report 505

Bill Frith – Central Laboratories, Opus International Consultants

Freel online at www.nzta.govt.nz/resources/research/reports/505

The Safe System approach to road safety implies the goal of removing fatal and serious injury crashes from our road network. This review addresses:

- alternative ways of classifying roads in relation to speed, across the road network, compatible with the Safe System approach
- how speed relates to crashes, fuel consumption and emissions
- the values currently placed on the costs of serious and fatal crashes, travel time and fuel savings in the developed world
- how on a macroscopic scale these values can be translated into greenhouse gas emissions savings
- how these values relate in the cost–benefit analysis context under a Safe System approach to speed.

Well-attested relationships were found between speed and crashes. Safe System road types related to the maximum speeds above which serious or fatal injury would occur in various types of crashes.

Internationally, valuation of crashes is mainly based on willingness-to-pay criteria. The values placed on time are constant unit values, which is a less conservative approach as there are strong grounds for sometimes discounting the values of small time periods. Macroscopic fuel savings can be linked to greenhouse gas emissions with costs expressed as unit values per kilogram of emissions.

NEW RESEARCH REPORTS *cont*

The implications of road investment

Research report 507

Ian Wallis, Don Wignall and Chris Parker – Ian Wallis Associates Ltd

Free online at www.nzta.govt.nz/resources/research/reports/507

The objective of this research (undertaken in 2010–12) was to provide improved evidence (potentially leading to improved modelling, monitoring and evaluation methods) on the implications of major road investments in New Zealand on significant factors, including travel demand, operational performance, environmental effects, emissions, road safety, development patterns and economic effects.

The research methodology involved:

- assessing New Zealand (principally) and international evidence on the actual impacts and implications for all significant factors of major road investment projects
- assessing the procedures used in New Zealand for the post-evaluation of major road projects, and drawing conclusions on the strengths, weaknesses and priorities for improvement in current New Zealand post-evaluation procedures and practices
- comparing the post-evaluation evidence, from selected New Zealand case studies, with the pre-appraisal forecasts of scheme impacts, and drawing conclusions on the strengths, weaknesses and priorities for improvement in current New Zealand forecasting and (economic) pre-appraisal methods.

Conclusions and recommendations were developed covering five main topic areas: travel behaviour; economic appraisal; social, environmental, health and safety effects; post-implementation review procedures; and lessons from New Zealand post-evaluation case studies.

SUPPLEMENTARY ISSUES OF THE *NZTA RESEARCH* NEWSLETTER

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

In 2011 and 2012, three supwplementary editions were published each year in May, August and November. Similarly, there will be three supplementary editions published in May, August and November in 2013, in addition to the standard quarterly editions.

A NOTE FOR READERS

NZTA research newsletter

NZTA research is published quarterly by the NZ Transport Agency (NZTA). 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.

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

Contributed articles are also welcome, should not exceed 1000 words and are to be emailed to research@nzta.govt.nz. Illustrations must be of high quality. *NZTA research* reserves the right to edit, abridge or decline any article.

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Enquiries on articles should be made to the authors of research reports whose details are listed at the end of the articles. Otherwise all general correspondence, queries related to conference notices, and requests for additions or amendments to the mailing list, should be made to research@nzta.govt.nz.

Editions of this newsletter, *NZTA research*, are available in hard copy or on the NZTA website at www.nzta.govt.nz/resources/nzta-research/. Back editions are available online only.

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