Ensuring our transport system helps New Zealand thrive

Analytical Framework

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Contact
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Key points

The aim of this paper is to provide Ministry of Transport staff with a framework for analysing issues they are presented with, starting not with analytical tools but with openness to thinking about markets within the transport sector. That thinking will help decide on the best analytical approach and best response, which should be influenced by a view about how well the market is working. The paper also aims to help the Ministry decide on its work programme. Thinking about markets should help decide where to be ‘light handed’ and where to concentrate the Ministry’s policy work.

The analytical framework provides a link between the Ministry of Transport’s high-level objectives and its more detailed work. It stresses the role of transport markets. Some markets work better than others in helping a country use its resources efficiently. The Ministry’s work should be focused on government policies in areas where markets are absent or inadequate.

Some markets relate to infrastructure — roads, ports, airports, railways. Some relate to ‘vehicles’ — cars, buses, bikes, ships, planes, trains. Infrastructure has a fixed location and economies of scale. Vehicles share the infrastructure and can produce congestion.

In roughly descending openness to competition we have:

- **relatively open markets**: road freight, long-distance bus services
- **contestable markets** (few competitors but a threat of entry): domestic aviation, some international aviation, shipping
- **contestable monopolies**: urban public transport (periodic re-tendering of monopoly routes)
- **regional monopolies**: airports, ports (but with some inter-port competition)
- **monopolies**: roads, air traffic control
- **markets with restricted access**: certain international air routes
- **‘market failure’**: urban traffic congestion.

Markets that work well efficiently convey information and provide performance incentives. But markets can have problems dealing with externalities (for example pollution and congestion costs imposed on others), anti-competitive practices, large changes (for example, the Canterbury earthquakes), wider impacts (for example, interaction between transport and land use, and network effects) resilience needs and extended time horizons.

A first step in analysing a transport issue is problem definition. Careful thought about a problem will improve or even change the way it is understood. In some cases, the problem may turn out to be less important than had been originally thought — for example, if there is a self-correcting mechanism or if favourable changes are happening in the external environment.

Next, consider what is there now. What is the market? Is it working well or can it be made to work well?

If it cannot, then consider what levers can be used — or used less — to help achieve the objectives. The main ones, moving broadly from lighter interventions to help markets work, to heavier ones that partly substitute for markets are:

- information to help markets work better — for example, the Ministry’s transport statistics
- education — for example, safety
- monitoring of performance — for example, the main airports
- regulation — for example, for safety
- operating subsidies — for example, public transport
- public investment — for example, roads and public transport
- public ownership — for example, roads, KiwiRail, Airways Corporation and most ports.
Possible responses to problems include the following:

► making better use of what we have already — for example, encouraging avoidance of peak travel, ramp metering to manage motorways, better traffic light phasing
► small investments in easing choke points
► leaving it to the private sector to respond to changing incentives — for example, at ports and airports
► better designed regulation
► doing nothing (which is sometimes better than the alternatives).

Ministry analysis generally compares the benefits and costs of proposed policy interventions. Where there is enough data, cost-benefit analysis should be used.

Where there is uncertainty (usually on the demand side), a ‘real options approach’¹ should also be used.

The final steps are to produce policy advice based on the analysis, and later to review the outcome and draw lessons from it.

This paper aims to help Ministry staff with a framework for analysing issues, and to help the Ministry decide on when to be ‘light handed’ and on where to concentrate its policy work.

¹ See page 26.
Introduction

This paper presents a framework for the Ministry of Transport’s analytical work. The framework provides a link between the Ministry’s high-level objectives and its more detailed work. The paper responds to comments in a Performance Improvement Framework (PIF) review about improving the Ministry’s awareness of markets, its approach to planning and investment, its intervention logic and the communication of these messages to staff.²

The paper’s purposes are to:

► guide staff in thinking about the transport sector and how to analyse its problems
► help the Ministry determine which more detailed areas to focus on
► inform stakeholders how the Ministry approaches its analytical work.

The Ministry’s high-level objective is to maintain and further enhance a transport system that helps New Zealand improve economic and social outcomes while minimising any harm the system may cause. High-level objectives and strategies are elaborated in the Ministry’s Statement of Intent 2014 – 2018.³

Transport sector problems being addressed include:

► little productivity growth in parts of the transport system for a decade
► pressure for large uneconomic projects
► continuing poor transport connections for some parts of New Zealand society
► rising social expectations
► Auckland.

Opportunities for transport sector improvement are provided by, amongst other things:

► various information and communications technology (ICT) applications — for example, traffic management tools, real-time information for vehicle drivers and public transport users, fleet monitoring, road user charging and, eventually, driverless vehicles
► road improvements that allow the use of more productive (longer and/or heavier) trucks
► changing social attitudes and social networking that are moderating transport demand
► increased interest in cycling and walking
► improved appreciation of uncertainties in demand in regional development
► new analytical techniques to improve project decision making — for example, ‘real options’ when demand is uncertain
► new vehicle and aircraft technologies that reduce fuel consumption and emissions
► safer new vehicles
► scope for new funding mechanisms
► rationalisation of existing operations — for example Auckland’s plan for a simplified bus network with higher frequencies
► better understanding of agglomeration economics and of transport-land use interactions (discussed later in this paper).

The approach, shown in the following chart, reflects the logic of the introductory paragraph above. The first step is to define the transport sector by identifying the markets involved (such as airports and road freight). The next steps are to determine whether or not each market is working well, and how their performance relates to the high level objective for the transport sector. These steps define the

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² Performance Improvement Framework: Review of the Ministry of Transport, May 2013, pages 25, 26, 30, 31. This paper is one of several Ministry responses to these parts of the 2013 PIF report. Other relevant Ministry activities include major strategic studies, better regulation, research projects, a research hub, commissioned reports and an information domain.

³ Other relevant documents prepared by the Ministry include the Briefing to the Incoming Minister, the Government Policy Statement, and Annual Reports.
priority problems for Ministry focus. The next step is to consider analytical ways of addressing the problems and choosing the best policy levers for each case. That leads to advice to the government about which policies to adopt to better achieve the high level objectives.

**FIGURE 1: Analytical framework**

<table>
<thead>
<tr>
<th>IDENTITY MARKETS</th>
<th>Infrastructure</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are the markets working?</td>
<td>Yes</td>
<td>No - natural monopoly</td>
</tr>
<tr>
<td>Yes - with caveats</td>
<td>No - but can be improved</td>
<td></td>
</tr>
<tr>
<td>Compare outcomes against objectives</td>
<td>Economic</td>
<td>Social</td>
</tr>
<tr>
<td>Levers to better meet objectives</td>
<td>Regulation through ownership or concession</td>
<td>Investment</td>
</tr>
<tr>
<td>Policies</td>
<td>Advice on levers for improved performance</td>
<td></td>
</tr>
<tr>
<td>Ex-post evaluation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When analysing transport issues it can be useful to view transport operations as usually involving an infrastructure component and a vehicle component. The distinction between these components is that infrastructure is fixed (or at least confined to a site), while vehicles do the moving. This distinction can be applied to many types of transport markets, for example ports and ships, airports and aircraft, railway track and trains, roads and motor vehicles, cycle tracks and bicycles.

The following distinction between infrastructure and vehicles can provide insight:

- Infrastructure generally exhibits economies of scale (costs go up less than capacity) whereas some vehicles do not.\(^4\)
- Infrastructure use is often shared among many vehicles — there are multiple users of roads, airports and ports.

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\(^4\) Cars do not; trains, ships and planes do.
**Context**

Transport is vital to economic and social wellbeing. The economic aspects of transport can be grouped as follows:

- **Transport serves economic activity.** Transport is an intermediate service, needed not for its own sake, but to get people where they want to go and goods where they need to be.
- **Transport creates economic activity.** Transport on its own does not necessarily create economic activity. However, in some situations innovations in transport can create new economic opportunities, for example, opening new access to resources and connecting businesses to new markets.
- **Transport is itself an economic activity.** Transport comprises around five percent of New Zealand GDP and employment.

The social aspects of transport can be grouped as follows:

- **Transport responds to social needs.** Transport provides access to work, learning, health care shops, and social and leisure activities.
- **Transport helps shape society.** Transport allows people to take advantage of opportunities that are not available in the immediate neighbourhood.
- **Transport is itself a social activity.** The transport sector benefits society as a major employer. It also can contribute to social harms such as noise, pollution and crashes.

It follows that transport issues are often complex, so the analytical framework needs to be able to cope with multiple dimensions and tradeoffs. For a fuller discussion of the transport context, see the appendix.
Effectiveness of markets

The Ministry’s approach to its analysis of transport problems starts where we are now, with consideration of the markets within the transport sector, as the nature and state of each market determines what roles are sensible for the government (advised by the Ministry)\(^5\).

In many countries in the past few decades, markets, with some qualifications, have come to be seen as the best way to organise business-type activity\(^6\). They are an efficient way of conveying large amounts of information and allocating resources, and provide incentives to improve efficiency and match quality to customer preferences\(^8\). New Zealand had a largely market-based economy, moved to a mixed public-plus-private model in the middle decades of last century, and has moved back in the market-based direction from the mid-1980s.

Market problems

The main qualifications that can arise with markets are:

- **Externalities**, which are costs and benefits that are external to what is captured in markets, for example greenhouse gas emissions, particulate emissions, noise and congestion. Milder cases are usually ignored, but more serious cases of these “market failures” can be addressed with a charge (for example a carbon price or a congestion charge) so that the externality is ‘internalised’ (borne by the party causing it), or by regulation\(^9\). Charges or regulation reduce externalities compared with what would happen otherwise. In economic analysis of projects, the externalities are included as costs (see below).
- Some markets suffer from oligopolies, **anti-competitive practices**, and high barriers to entry.
- Some suffer from ‘**information asymmetry**’. For example, producers of technical products can be better informed than consumers, and consumers can be better informed than insurers.
- Markets work best at the margin — that is, with incremental changes — and do not always cope well with **large changes**. For example, financial markets were severely strained in the 2008 crisis, and markets alone might have struggled in dealing with aspects of the Christchurch earthquakes, such as an effective rebuilding process.
- Markets are not relevant where **incentives are absent**. For example, we need a regulation to ensure that we all drive on the same side of the road.
- **Human** behaviour may differ from self-interest. For example, altruism, emotional decisions, and some decisions influenced by advertisements.
- Market forces can produce **asset ‘bubbles’** followed by crashes if not moderated by government regulation.
- Markets alone may not provide the best solution when there is an **interaction between transport and land use**. Transport investment may lead to changes in land use that in turn have implications for transport. A negative example is urban sprawl that is encouraged by fast road or rail links: a positive example is moving logistics/warehousing industries alongside new Sydney and Melbourne ring roads that have removed some truck traffic from crowded inner areas.
- Markets may not pick up consequential effects of a project over a wider area, and separate policies may be needed — for example:
  - **network effects**, such as the impact of an upgraded road on another one in the area.

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\(^5\) This paper does not cover institutions needed for markets to work, such as property rights and their enforcement.

\(^6\) See World Bank 1995, *Bureaucrats in Business*. Other models include government/major company alliances as in South Korea’s establishment phase, and communism.

\(^7\) Efficiency means getting the most out of the resources used. There is debate about how relevant markets are to other objectives such as security and fairness.

\(^8\) For further discussion, see Paul Dalzeil and Caroline Saunders 2014, *Wellbeing Economics* (chapter 4), and John McMillan 2002, *Reinventing the Bazaar: A Natural History of Markets*.

\(^9\) In considering the response to market failure, “government failure” is relevant — that is, governments can be unsuccessful in implementing interventions, so the response becomes worse than the problem it is addressing.
the impact of improved transport on the efficiency with which metropolitan areas operate, for example business interactions and employment markets, known as ‘agglomeration benefits’.\textsuperscript{10}

Markets alone may not provide a transport system with as much resilience as we would like — the ability to cope with natural disasters (for example, major earthquakes and landslides) and man-made disasters (for example, terrorism). We may choose to ‘over invest’ to achieve a level of redundancy; we choose a trade-off between economic efficiency and risk. Investors’ time horizons may be shorter than those of the wider society, and they may make successive incremental decisions that produce outcomes that are suboptimal from a long-term perspective.

Openness to competition

Some New Zealand transport markets are more open to competition than others, for both historical and practical reasons. The general degree of openness across the whole sector is much greater than half a century ago, reflecting the developments in international thinking and international experience. Governments are more inclined to intervene in markets that suffer from the problems outlined above or when competition is weak.

The distinction between infrastructure versus vehicles as components of most transport systems is relevant. Competition issues are encountered more often with providing and pricing infrastructure than with providing and pricing the vehicle component. This reflects the fact that economies of scale tend to extend further for infrastructure and so sometimes infrastructure exhibits the characteristics of natural monopoly.

The following list considers markets according to their degree of competitiveness, moving from more competitive to less competitive cases. The discussion helps identify where the above problems occur in practice — they are more important in some markets than in others. The subsequent section has a more detailed discussion.

Open markets

- Road freight. Economic restrictions in the sector, notably a requirement that freight moving more than 150km was restricted to rail, were removed in 1983. Barriers to entry are low (although there is an expertise barrier for integrated logistics services). The sector is highly competitive.
- Long-distance bus services. Economic regulation was also removed in the early 1980s. Bus operators either experience actual competition or the threat of it (contestability).
- Taxis. Economic regulation (restrictions on the number of taxis) was removed in 1989. However, because of ‘information asymmetry’ (limited customer knowledge) driver and vehicle quality are regulated and fares must be clearly shown on the door. Uber and other app-based services are permitted and are adding to competition.
- Rental cars and other vehicles have an open competitive market. Short term rentals using charged cards (for example, Zipcar in the United States or Flexicar in Australia) may add to the types of service available.
- Motor vehicles, planes and ships. All are produced in the competitive international market. New Zealand is more liberal than most countries in that it has no import duties or restrictions, other than those related to safety or emissions, and allows imports of used vehicles.

Contestable markets

- These are markets with limited competition but a threat of entry, and hence a moderate incentive not to charge too much so as not to attract a competitor. An example is the New Zealand-North America air route where only Air New Zealand provides non-stop services, but other airlines have the rights to do so.

\textsuperscript{10} See page 30.
Oligopoly

► These markets have only a few providers (if two, the term is duopoly). There have been examples in the road construction and maintenance industry, international air freight and international shipping.

Monopolies

► New Zealand no longer regulates to confer a monopoly privilege on any transport business apart from some international aviation\(^{11}\) (see below), but there are cases of ‘natural monopoly’ where, because of economies of scale or scope, it would not be economic to have more than one operator. Such situations are more often encountered in providing the infrastructure component of transport services, rather than in the provision of the vehicle component. Many countries regulate such monopolies (as does New Zealand, through Part 4 of the Commerce Act in the electricity, gas and telecommunications sectors and, in a limited way, the three main airports). However, most such monopolies in the transport sector are publicly owned with implicit regulation through the ownership link. The main ones are:

► Rail freight services. The only operator, both of track and trains, is KiwiRail, but it faces strong competition from trucks and cars.

► Urban bus and train services. At any time only one operator is allowed on each route, but competitive discipline is achieved through periodic re-tendering of the operating rights and of access to subsidies. There is also competition from cars.

► Ports. Some of these are regional monopolies, but some face some competition from other ports, for example, Auckland versus Tauranga and Lyttelton versus Timaru.

► Airports are regional monopolies and only a small minority of passengers have an effective choice of airports, that is, people living partway between two airports.

► Roads are government owned monopolies, with service levels and prices (for example, fuel excise and road user charges) set by the government.

Markets where competition is regulated

► The last vestige of competition-inhibiting economic regulation is on certain international air routes to New Zealand, because of the protectionist policies of some overseas countries.

The Ministry is helping markets work better. It provides a wide range of transport statistics (see below) and is providing an increasing amount of information on freight flows and freight forecasts. It is considering the oligopoly problem in road construction, and undertaking an urban demand study.

Longer-term issues related to the openness of markets include institutional reform of road provision, and port and airport ownership.

\(^{11}\) Arguably the Aviation Security Service is a statutory monopoly.
State of the transport markets

The main transport markets, and their relative degree of openness to competition, are shown schematically in the chart.

FIGURE 2: Competitiveness of markets

The following conclusions may be drawn about how well some of the different transport markets are working relative to economic and social objectives, moving from satisfactory to less satisfactory cases. As expected from the earlier discussion, vehicle-related markets tend to be more open than infrastructure-related markets. Competition within modes works across some of these markets. Road, coastal shipping and rail compete for freight, and cars compete with urban public transport and with some domestic flights.

The road freight market appears to be working reasonably well, with low barriers to entry and intense competition, although productivity growth has been poor in recent years. About half a dozen firms have about half the market, and a large number of firms share the rest. However there are barriers to entry into integrated transport and logistics operations because of the skills and critical mass needed, and each main player is understood to dominate a sector within the freight market. Roles for the government have been confined to improving the administration of regimes related to maximum vehicle size and to road user charges (both of which are the subject of industry complaint); other safety regulations; and providing information (for example, publishing statistics and periodic freight forecasts reports). The separate role of the provision of roads is discussed later.

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12 Before 1983, in a measure to protect the railways, it was illegal to transport most freight more than 150km by truck. The result was an often expensive and unreliable rail service that undermined manufacturing, farming and exporting.

13 Recent increases in maximum truck weights are expected to improve productivity.

14 The government also determines immigration rules for drivers. The government has removed drivers from the list of preferred job categories and the industry argues for their reinstatement on the list.
The railway system is, in a narrow sense, a natural monopoly. However, for container freight, it is subject to market disciplines because of competition from trucks and, to some extent, coastal shipping. Rail's suitability for commodity freight gives it market power for coal and may give it some market power for milk and logs, but so far the business has not been financially viable.\textsuperscript{16}

Port markets have a partial regional monopoly. However, there is some competition between the larger ports; some areas (e.g. South Auckland) are served by more than one port, land transport and coastal shipping facilitate some inter-port competition, and smaller ports must struggle to compete with larger ones or accept a secondary feeder role. The competitive mix will change in the future as ships get bigger (lowering direct costs), however, longer landside or coastal shipping links will be needed for freight to/from areas no longer served by ships (increasing costs). Local government ownership may be affecting port efficiency by diluting commercial pressures. The central government's roles are confined to safety regulation and providing information on freight flows; however, there are consequences for road and rail investment, which are discussed below.

Non-urban bus markets are competitive in some cases and contestable in all cases. The threat of bus competition, and competition from airlines, cars and in some cases rail, provides discipline to the market. The market has evolved well, with a mix of both higher quality and lower-cost services and a proliferation of local scheduled and on-demand services for markets such as small towns, and outdoor recreation destinations. However, there is an unresolved policy issue about the extent to which the government should subsidise bus or minibus/shuttle services in small towns to improve social access for those who do not have access to a car (for example, younger people, older people and those with health problems or disabilities). Unlike in large towns, there is no congestion argument for subsidies, and the question arises of where to draw the line and whether the funding should come (as now) from road users or whether it should come from local or central government.

Domestic and some of the main international aviation markets are contestable (open to competition) but in practice appear to be too small to sustain full competition.

- One operator (Air New Zealand) dominates the domestic market; its competitor (Jetstar) does not offer equivalent frequencies or network reach. Several other competitors have tried in the past. Domestic aviation is deregulated but it appears New Zealand does not have the critical mass for strong competition.
- Only one airline operates non-stop flights between New Zealand and mainland North America\textsuperscript{17} (Air New Zealand) even though others are permitted to do so; some have exercised those rights in the past (United Airlines, Qantas).
- Non-stop flights between New Zealand and some Asian cities are only operated by one airline, or by two that cooperate commercially.

Some trans-Tasman routes have more competition involving airline groups (Qantas, Jetstar and Emirates; Air New Zealand and Virgin). The New Zealand-UK route is also contestable and served by many carriers — Australian, New Zealand, Asian and Middle Eastern. These markets have long since been deregulated and the government's role is confined to competition policy such as periodically reviewing the airline alliances.

Overseas shipping markets have shown oligopolistic tendencies, addressed in a recent Productivity Commission report\textsuperscript{16} that recommended getting rid of exemptions for agreements involving price-fixing, or limiting capacity with the intent of raising prices. Instead, it recommended that authorisation mechanisms should be relied upon for assessing whether these agreements are in the public interest. The government has not yet announced a decision.

\textsuperscript{15} The provision of the infrastructure component (the rails) could be separated from the provision and operation of the vehicle component (the trains). This structure was used briefly in New Zealand, and operates in Australia and the UK.

\textsuperscript{16} International Freight Transport Services, NZ Productivity Commission, April 2012
Coastal shipping markets are thin but open to competition. Most of the services are provided by foreign ships on links between New Zealand ports that are a part of international voyages. Competition is provided by road and rail services. The Government's roles are mainly to keep the market open (for example, avoiding any pressure for cabotage\(^\text{17}\) protection) and regulate safety.

Airports, more so than ports, are natural monopolies. Therefore, a competition policy question is raised about whether to regulate them and, if so, to what extent. The present regime applying to the three major airports is information disclosure under Part 4 of the Commerce Act as determined by the Commerce Commission. In accordance with a specific provision of the Commerce Act, the Commission has recently reported on the effectiveness of information disclosure regulation of these airports. There is an implied threat of more direct regulation if the Minister concludes that monopoly powers are being abused. At smaller airports Air New Zealand has monopsony (single buyer) power, and at some airports the landing fees do not cover costs.

Unlike well-known overseas cases such as Heathrow, New Zealand airports do not have a capacity problem. Most have substantial spare capacity and the biggest one, Auckland, has scope for a second runway when needed. There may be a resilience issue with one airport per city, but in many cases there is a smaller one nearby (Whenuapai for Auckland, Paraparaumu and Ohakea for Wellington, Timaru for Christchurch).

Urban public transport markets (bus and train) are a type of natural monopoly. It is possible to have competing services but they usually do not work in providing the characteristics sought by travellers, notably: service frequency, interchangeable tickets and low fares, as shown by the debacle of open slather deregulation in the UK (except London) in the 1980s. Partly as a result of that experience, it is now generally accepted that best practice is to have a monopoly operator on each route in each area, with periodic re-tendering of the route in order to maintain competitive discipline. The tendering criteria include minimum levels of service, various quality dimensions, maximum fares, and interchangeable tickets; competitive elements are minimum subsidies and innovation. Depending on local geography there may be a small amount of competition where routes overlap but generally they are designed to complement each other. New Zealand has recently adopted this practice.

Roads are a natural monopoly, disciplined not by market forces or regulation but by local and central government ownership. Decisions on construction and maintenance work are based on multiple criteria with benefit cost analysis a major component (as described below). Such work is usually contracted out. Questions have arisen about the robustness of this contracting, the way the choice is made between different projects, and the amount of maintenance required.

There is scope for private partnerships in providing and maintaining investment in new roads. Tolling has been resisted in New Zealand, with only two small and problematic toll roads in place (they have insufficient net revenue\(^\text{18}\)). In some overseas countries private toll roads are more common. Public private partnerships, both with and without tolling, and with and without the private partner bearing the demand risk, are found overseas. A first public private partnership (the Transmission Gully or Wellington Gateway project) with the private partner responsible for maintenance of the road but not bearing the demand risk, has been negotiated. A public private partnership with tolling, and the private partner bearing the demand risk, is a possibility where it is feasible to have tolling at a level that recovered costs, but it would need careful thought, design and public acceptance.

There are concerns about oligopoly in the construction industry that builds and maintains roads. A recent report commissioned by the Ministry of Transport on the road construction sector highlighted the problems arising from a monopsony (single buyer) combined with a limited number of substantial providers (two of whom have particular access to bitumen plants and quarries). This is a factor in prices rising faster than inflation.

\(^{17}\) Restriction of services to New Zealand operators.

\(^{18}\) They have to carry the cost of manual toll booths, and there is only a small traffic base to cover the base cost of electronic charging. In contrast, the much busier, and successful, Melbourne toll roads use all-electronic charging.
Urban road traffic is a clear and major case of market failure. In terms of the infrastructure versus vehicle component distinction, congestion is a consequence of sharing infrastructure. Once a road is busy, additional traffic produces escalating congestion. An individual motorist entering a busy road does not bear the congestion costs that the extra vehicle imposes on others. Scarce road space is rationed by queuing rather than by price. The economic and social costs of high congestion are large — for example, freight vehicles do fewer trips per day than they could, passenger journeys are longer than necessary, all traffic faces unreliability (and hence the need to build ‘fat’ into schedules), and there is no means of paying extra for urgent trips (for example, medical). Congestion used to occur at particular times of the day but on some roads it now lasts all day. It would be too costly to eliminate all congestion by constructing more roads. Urban congestion is a complex issue and there are several mutually reinforcing ways the government could use to help address it, which are discussed in the next section.

As discussed above, flights on some international air routes are restricted at the behest of overseas governments. Government-set restrictions are imposed on the number of flights that may be operated and in some cases on the types of connecting passengers that may be carried. The examples of greatest economic significance to New Zealand are China, India and the European Union. Some of the other major routes from New Zealand, notably trans-Tasman, United States and United Kingdom, have been deregulated (‘open skies’). The Ministry continues to negotiate with other countries with the aim of liberalising air service agreements.

There can be interaction between transport and land use. Planning, zoning and development decisions can add to congestion and to the need for road or public transport investments. Improved roads can stimulate investments in new subdivisions or industrial areas. In such cases, government decisions about whether or not to intervene become more complex.

The above discussion of markets is mainly relevant to governments’ economic and social objectives. Broadly speaking, the markets are achieving these objectives, with the exception of urban transport – a major part of the total sector.

Markets have a less direct effect on the two other Ministry objectives, minimising harm (for example, accidents, noise and pollution) and resilience. Technical improvements, driven by market pressures and regulation in major countries, are producing vehicles that are safer, quieter and less polluting than their predecessors. In principle, charges for road use could be increased to include the cost of externalities, similar in concept to the carbon charge. Market forces could be harnessed to improve the vehicle fleet by better publicising vehicles’ safety and environmental attributes.

Resilience requires policy decisions about the trade-off between cost and adding mitigation measures, and/or redundant capacity in the most vulnerable places. Although vulnerable points can be identified (for example, earthquake fault lines, steep slip-prone slopes in wet areas) and the costs of resilience-enhancing investments (for example, diversion roads and protective walls) can be estimated, judgement is required because the probabilities and timings of the negative events are not known.
An economic perspective

(This section covers the ground again but from a fresh perspective – economics).

Analysis of transport policy issues draws on a wide range of analytical tools, which in turn are derived from a number of different fields of study. While the analytical frameworks used when considering transport policy issues are based on forms of analysis commonly encountered when considering policy issues in general, their application is shaped by certain specific characteristics of transport systems.

The role of transport services

Transport services have a spatial dimension as their defining feature. Therefore, transport services are complementary to all the ways in which spatial characteristics affect economic activity and welfare. Among other roles, transport services:

(a) are the central factor determining the extent to which agglomeration economies can be realised
(b) often have a major effect on spatial development and property values.

Transport services are intermediate services — they are an input into production of goods or other services rather than being purchased for their own sake. This implies a need to consider transport implications in most analyses of economic and social development.

Features of transport systems particularly relevant to policy issues

Transport services typically involve infrastructure assets that are fixed or at least confined to a site. These assets characteristically have long economic lives. That implies a need to forecast future demand, which in turn implies challenges for investment evaluation and decision-making.

Infrastructure assets often involve economies of scale. Where these economies of scale are not exhausted by demand, issues of pricing efficiency and of natural monopoly arise.

The vehicle component of transport systems often shares the use of the infrastructure component. The implications of sharing include congestion. Wide time-of-day variation in demand implies that a correspondingly large short-term variation in pricing would be required to avoid congestion, which may not be feasible for technical or other reasons.

By definition, transport services involve motion. Motion combined with sharing the infrastructure means safety, particularly of operators and passengers, becomes a major concern.

Thus two forms of cost that are often minor considerations in the economics of most goods and services play a large role in some transport services, namely:

(a) the time required to deliver the service
(b) the risk of personal injury during the delivery of the service. A range of transport policy issues involve a trade-off between these two forms of cost, for example road speeds and air transport security checks.

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19 When analysing transport issues it can be useful to view transport services as usually involving a vehicle component and an infrastructure component. The distinction between these components is that vehicles do the moving whereas the infrastructure is fixed (or at least confined to a site).
The implications of New Zealand’s size and isolation

New Zealand’s population limits the vigour of domestic competition in those markets where economies of scale dictate there will be few competitors or even geographic monopolies. In contrast to many other countries, New Zealand domestic transport service providers typically do not face competition from overseas providers (coastal shipping and some domestic air routes being the exceptions).

New Zealand primary sector exports tend to have a high volume-to-value ratio which in turn results in high transport cost-to-value ratios. The shift of the centre of gravity of New Zealand’s export destinations towards South East and East Asia is helpful, but distances are still long and efficiency in transport — with entry of new transport service providers and vigorous competition — is a crucial factor in export success.

The government’s role

Governments (central and local) have an essential role to play in transport, given the many externalities, monopolies and information asymmetries in the transport sector.

Government has a choice of instruments to intervene in transport markets, for example to fund, own and/or regulate, and the choice of instrument should be subject to an assessment of how well it works compared with alternatives. For example, many of New Zealand’s transport markets are characterised by government ownership (of roads, rail, air (partial) and many ports) even though government subsidy or regulation may be a more efficient policy instrument in many cases.

The transport sector is changing rapidly, with innovations in technology (for example, global positioning systems (GPS), driverless cars, 3D printing and the information revolution) and management practices (for example, better supply chain management). Such technological change may influence the most efficient form of government intervention. Therefore, interventions that may have been relevant in the past may not necessarily be the most efficient in the future.
Levers to better meet objectives

As shown near the bottom of Figure 1, a range of levers is available to the government to improve the extent to which its objectives are achieved compared with the no-intervention (markets only) case. These are discussed, moving broadly from heavier to lighter interventions.

(a) Ownership

Government ownership can be a means of addressing the natural monopoly problem, aiming to achieve reasonable prices and levels of investment and capacity. It has also been used to channel more investment and/or operating funding than the markets would provide (as is the case with KiwiRail), or to ensure the provision of uneconomic services that are deemed to be socially desirable. An alternative model for achieving the same objectives is to subsidise private operators.

Earlier last century in New Zealand and in many other countries, government ownership of businesses was seen as worthwhile in key sectors of the economy, but the experience was often disappointing. Weak commercial incentives and government interference often resulted in slow innovation, poor customer focus and/or high costs. Thus, there has been a trend to privatisation since the 1980s. A wide body of World Bank, New Zealand and other literature based on this experience now makes the case for private ownership of businesses (potentially regulated when they are natural monopolies). However, public opinion is often negative and public ownership may suit cases where the goals are non-commercial20.

Four substantial parts21 of the transport sector are publicly owned:

► **KiwiRail** and its associated buses and ferries. The decisions to resume public ownership and implement a turnaround plan are recent and are not revisited in this paper.

► **Roads**. These are owned by the public sector (local and central government) and managed by public sector agencies, with the maintenance and construction work undertaken by private sector contractors subject to competitive procurement processes. In principle they could be sold to one or more private operators who presumably would be regulated in order to achieve objectives of service quality and price. Some or all of fuel taxes, road user charges and other aspects would be channelled to the operators. There is a modest amount of literature exploring this idea, including an early paper by the former New Zealand Business Roundtable, and a government paper proposing corporatisation (central and government owned road companies).22 However, the gains from private involvement in providing roads are generally considered to require involvement in the construction of the roads. Once constructed, many of the aspects where private sector ownership would potentially be beneficial (e.g. innovation, procurement of construction, contract management, risk management) are foreclosed. In practice, bearing demand risk requires that private sector involvement occur prior to construction. Therefore, sale of existing roads is not the central issue. Instead, the issue is the use of public private partnerships at the time of construction. That approach is common in Australia and elsewhere.

► **Airports**. The two largest, Auckland and Wellington, are majority privately owned with local authorities as substantial minority shareholders. Christchurch airport is owned by local authorities and the central government. Most medium/small airports are fully owned by local authorities in the areas they serve23.

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20 An alternative is private ownership subject to regulation, taxes and/or subsidies to achieve wider goals.
21 There are also smaller publicly owned operations, such as Christchurch buses. And the government has a majority shareholding in Air New Zealand.
23 Paraparaumu Airport is privately owned. Queenstown Airport is majority owned by the local authority with Auckland Airport a minority shareholder.
Ports. Five New Zealand ports were partially privatised in the 1980s, but all are majority owned by local authorities. Private stevedores load and unload the ships at some ports. Rather than increased private ownership, the recent tendency has been increased local authority ownership — with reversion to full local authority ownership for Auckland in 2005 and to a high level of local authority ownership in Lyttelton. Management at some ports would prefer greater private ownership. Many overseas ports are privatised or about to be, for example 99 year leases in Australia. The case for privatisation is:

- higher incentives for innovation and efficiency
- avoidance of owner-induced distortions (political interference, and extraction of abnormally high dividends or provision of commercially unjustified subsidies)
- a major one-off source of revenue that can be used to reduce debt and/or increase investment in transport or other projects ('capital recycling'). Revenue from the recent privatisation in Brisbane and earlier privatisations in Victoria was used to reduce excessive State debt. Revenue from the recent privatisation in Sydney will be used to build a new toll road linking the port, airport and two other freeways.

However, local authorities have tended to reverse privatisation. The government could in principle force them to divest, but opposition could be even greater than that against privatising state owned companies, given that overriding local preferences would be involved.

(b) Restrictions on competition

As discussed earlier, in many countries including New Zealand, there has been a widespread move away from government restrictions on entry into particular lines of business. Protecting particular firms, usually the incumbents, effectively protected inefficiency and conservatism, and locked out innovative or low-cost newcomers.24

(c) Investment

Governments spend on transport (capital investment or operating subsidies) when natural monopoly characteristics appear easier to address through ownership rather than by regulation, or for other reasons: for example, difficulties pricing effectively or where it is considered private owners would not invest enough to meet wider goals.

The main type of public transport sector spending in New Zealand is roads, approximately $4 billion per annum, $3 billion of which is by central government (funded from road user charges, registration fees and petrol excise) and $1 billion by local government (funded from rates). This can be seen as a substitute for a market mechanism — road users are charged and the revenue is used to provide the roads. However, the pricing is rough, with a high degree of averaging across different road types, times of day, loads, and to some extent vehicle types.

Other significant areas of investment are:

- public transport, recognising that if vehicles had to pay for the congestion costs they cause people might switch to public transport. Without that extra patronage, farebox revenue alone would not provide enough public transport (covered in the next section)
- the KiwiRail turnaround plan, reflecting analysis that concluded that without the main rail services greater expenditure on roads would be needed, that rail is better suited to commodity exports than is road freight, and that rail services provide wider benefits that are not paid for by users
- operating public sector transport agencies25 (relatively minor).

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24 There is a broader debate, outside the scope of this paper, about mixed models found in some successful Asian countries.
Decision tools for government transport investment are discussed in the next section of this paper.

(d) Subsidies
Governments subsidise activities when markets do not provide enough revenue for the level of activity sought on wider public policy grounds.

The main type of transport subsidy in New Zealand is for public transport — mainly buses, but also trains and ferries in Auckland and Wellington, and cycling infrastructure. These are subsidies because they are funded by non-users.

The analytical framework supporting the subsidy regime was reviewed in 2009–2011 and applied from 2013. It is known as the Public Transport Operating Model (PTOM). The review was led by the Ministry. It replaced a regime that was performing poorly\textsuperscript{26}. The main components are:

► Contracts between local authorities and bus operators that provide a monopoly on all services on a route or in an area, with competitive discipline achieved through periodic re-tendering (usually nine years) — that is ‘competition for the market’ rather than ‘competition in the market’. Operators tender on the basis of the subsidy they require. Alternatively a contract (for six years) can be negotiated based on benchmark costs.

► The contracts set minimum frequency levels and various quality criteria, including service coordination. Fares are set by the local authorities. The objective is a farebox recovery level of 50 percent of costs (compared with 46 to 49 percent achieved in recent years). This reflects a judgement, reached after extensive consultation, of a balance between the direct benefits to users (covered by fares) and wider benefits of reduced congestion, reduced environmental impacts and providing social services designed by the community (covered by ratepayers and road users).

► League tables within each region that show relative performance and encourage improvement.


► Provisions for Regional Public Transport Plans, transparent provision of revenue and patronage data, and fully commercial (unsubsidised) operators.

Unlike the previous regime, PTOM is ‘incentive compatible’, meaning the operators have a financial incentive to pursue a goal that is desired by government and the public, being growth in patronage and improved efficiency without a growth in subsidy. This in turn supports economic growth and productivity.

Approximately 90 percent of the subsidies go to Auckland, Wellington and Christchurch, which experience New Zealand’s worst congestion. Good public transport will help those cities thrive (agglomeration economies).

The effectiveness of PTOM will be supported by plans in Auckland and Wellington to simplify the networks and offer increased frequencies of service. Research has shown that patronage increases when timetables are not needed, meaning frequencies of at least every 10 minutes. It is hoped that the new arrangements will increase demand, but where it is still too low to justify high frequencies the alternatives are low frequencies, higher subsidies or the use of jitneys (minibuses that share some of the characteristics of buses and taxis, with intermediate fares, as in Noumea and Manila).

\textsuperscript{26} Between 2000/01 and 2009/10, government funding for urban bus and ferry services increased by approximately 131\% in real terms, yet patronage grew by only 44\%. 

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PTOM is in line with good international practice. It is broadly similar, for example, to the regimes in Melbourne and the United Kingdom, which both have private bus and train operators.

It will be appropriate to review PTOM towards the end of the nine-year contract period. The issues for review should include whether experience shows that operators are responding well to the incentives, whether the 50 percent farebox recovery criterion still meets society's views about a fair distribution of the burden, whether farebox recovery is falling short on particular services or on rail, and whether fares should be differentiated by peak/shoulder/off-peak (the latter should arguably be considered earlier).

Subsidies are provided to public transport because of the benefits they confer on other parties. It can equally be argued that other parties should pay for transport they indirectly benefit from. This is the basis for congestion pricing in London, Singapore and Stockholm and for ‘value capture’ in many countries — typically a charge related to property whose value has increased because of the transport improvement.

(e) Regulation

Introduction

Governments regulate when they consider there are insufficient forces in play (for example, customs, market incentives) to achieve desired outcomes. An example is regulations about tyre tread depth, that give a basis for enforcement against careless drivers who do not notice they have bald tyres. Regulations need to suit the problem they are addressing, not impose disproportionate costs, and be practical to implement and enforce. Absent these conditions being met, the costs of regulation, including both expenditure and potential distortion of incentives, may outweigh the benefits.

The Ministry of Transport already has a good analytical and strategic framework for better regulation in its Transport Regulatory Policy Statement, its Transport Regulatory Handbook (2012) and the Treasury’s Regulatory Stewardship Expectations. These documents are consistent with good regulatory practice including the Government Statement on Regulation: Better Regulation, Less Regulation (2009) and are broadly consistent with the principles proposed in the Report of the Registry Responsibility Taskforce (September 2009). Key issues are:

► the need for careful problem definition
► the need to consider all feasible alternatives including non-regulatory responses and do-nothing
► the importance of consulting with parties that that are affected by rules and regulations
► flexibility to cope with new circumstances and technologies.

27 Examples are Tax Increment Financing in the United States, and a supplement to local rates within a certain distance of new train lines or stations (for example, Melbourne’s loop line). A variant is joint development of real estate and the transport facility – a developer builds, for example, a new railway station or bus interchange in exchange for air rights for a property development above it (for example, Hong Kong, Tokyo, London’s Liverpool Street station). These approaches are further considered in the Ministry’s strategic project on future funding.
Context

Regulations and rules\textsuperscript{28} are a means by which governments use their power through the legal system to force people to behave in certain ways. An obvious case is the requirement to drive on the left hand side of the road. Regulations are generally intended to improve the operation of the economy and society by preventing one party from having negative impacts on another. The other drivers of regulation in the transport system are safety and international obligations.

In recent decades, awareness of the costs imposed by excessive or unnecessary regulation has been increasing. This awareness has drawn on developments in economic thinking linked to New Zealand and on international experience with differing levels of regulation, for example, negative experiences with higher levels of regulation in New Zealand prior to the 1980s and currently in many less developed countries, and positive experiences with reduced regulation such as the removal of entry restrictions in aviation.

In New Zealand most types of economic regulation of transport activities (that is, restricting entry of new competitors) were removed in the 1980s. Most other sectors of the economy were also freed up. Many other Western countries did the same. The result is a more flexible, resilient and innovative economy.

Remaining regulations are technical rather than economic. Many relate to safety (standards for owners, pilots/operators, crews and passengers, vehicles and the associated service industries). Most of the remainder relate to infrastructure (access, ownership, management and accountabilities). Miscellaneous regulations include those that cover meteorological services and transport accident investigations.

Analytical framework for quality regulation

Regulations, if unnecessary or excessive, distort choices by individuals or organisations and impose compliance costs. It is commonly asserted that the degree of regulation has increased, in part because those making the regulations, at both the political and the government department/agency levels, do not face the costs they cause.

To comply with the Ministry's objectives of improving economic and social outcomes while minimising harm, the process of making and reviewing regulations needs to involve problem definition, considering alternatives to regulation, considering the best form of regulation, consultation and review. All of these are included in current Ministry documents.

Ministry application of the framework

The Ministry is part-way through applying this framework to a review of the 270 pieces of legislation it covers. Recent and current reviews include:

► updating and simplifying the Civil Aviation Act
► updating the Warrant of Fitness regime that resulted in less frequent checks for newer cars
► improved safety for agricultural vehicles
► streamlining the Maritime operating system to improve flexibility and responsiveness
► identifying where the transport Registry system is inhibiting the effective operation of markets
► improved and timelier processes for rules development.

In 2014/15, of the 40 proposed changes, 7 relate to the Government's Business Growth Agenda, 4 contribute to wider economic growth, 4 contribute to Safer Journeys, 16 contribute to the

\textsuperscript{28} In New Zealand regulations require the approval of the Governor-General, whereas rules only require the approval of the relevant Minister. The distinction was to allow detailed changes to be made more readily (through rules), though it is not clear this has been achieved. In this paper both are referred to as ‘regulations’.
Government's Better Regulation agenda, 5 respond to New Zealand's international obligations and 4 are on the ‘business as usual’ technical changes. 33 percent of the changes will simplify regulations, 51 percent will simplify rules and 13 percent will address international obligations.

Some areas remain where regulation may be unnecessarily prescriptive, or where greater delegation of powers could occur. These will be addressed in forthcoming reviews of land and maritime legislation.

In reviewing regulations, or in “clean sheet of paper” work, it is important to understand the views of the regulated parties (airlines and other air operators, shipping companies, truck firms, etc) through direct discussions with a sample of them. We should not limit our information gathering to what we hear from the regulators.

(f) Monitoring

In many parts of the transport sector, competitive forces are at work and customers have an interest in drawing attention to problems that arise. The government’s default position when markets are working well is to take no action other than providing information, keeping people informed as issues emerge over time, and rectifying these issues when it can. Formal government monitoring of these markets would not be a good use of resources.

Monitoring is in place where competitive pressures are weak, notably airports through the Commerce Commission’s price surveillance regime. Monitoring could be put in place for other markets if problems arose that were not readily addressed and were serious enough to justify the cost of monitoring.

(g) Information and education

Information

Provision of information that is otherwise not readily available to individuals or companies can help them make better decisions about the transport they use or provide. The information the Ministry provides on its website includes:

► headline transport indicators
► transport volume, on the use of the transport system including motorised and non-motorised modes
► the age and composition of the fleet
► reliability of the transport network, and congestion
► access to the transport system including indicators related to affordability, social connectivity, access to motor vehicles, travel perceptions and accessibility of public transport
► travel patterns — the use of various transport modes, including walking and cycling, for everyday journeys such as to work and school
► transport safety statistics
► public health effects of transport — noise levels and air quality
► infrastructure investment and the size and quality of transport infrastructure
► environmental impacts of transport including climate change emissions, energy use, land use and water quality
► transport-related price indices.

The Ministry also commissions and publishes reports that are useful sources of information to firms in the industry, their advisers and other analysts. Recent or forthcoming releases include:

► Intelligent Transport Systems technology action plan
► National Freight Demand Study — covering the current freight task and forecasts to 2042
► Household Travel Survey
► Freight Information Gathering System
► Future Freight Scenarios study — looking at choices New Zealand has in responding to changes in national shipping
► Transport Domain Plan — to reach a shared understanding of the strengths and deficiencies within transport information and statistics
► Transport Research Strategy — a sector-wide transport research hub to coordinate transport research.

Education

Government transport education roles focus on safety, through the Safer Journeys programme. Education (for example, publicity campaigns and an internet site on the safety rating of different vehicles) relates to the safe vehicles, safe speeds and safe road use aspects of Safer Journeys (the other aspect is safe roads – see kiwirap.org.nz – and roadsides).

Ministry discussion with logistics firms have identified an education issue related to skills shortages and an ageing workforce. Transport firms can cooperate with specialist tertiary education providers to train or upgrade staff, and arguably should not need Ministry facilitation to address this issue.
Problem definition and analytical tools

Introduction

This section complements the rest of the paper with a discussion of the main assessment processes and analytical tools available when preparing policy advice. It concentrates on government investment in transport infrastructure — roads, railways, ports and airports.

New Zealand spends heavily on transport infrastructure and maintenance. This expenditure has been growing faster than GDP for over a decade and local and central governments face pressures for more. It is not clear what is being gained, compared with other countries, for the high expenditure. How is it contributing to the national goals of economic and social development with minimisation of harm? Does it take into account other possible activities, or possible tax or debt reductions, that are crowded out by the diversion of resources into transport?

Therefore, it is important that transport infrastructure investment decisions are made carefully so that the transport sector contributes to economic and social goals rather than undermining them. It is worth comparing expanding infrastructure capacity versus managing use of existing infrastructure. The core issue is that vehicles share use of the infrastructure. When combined with time-of-day variations in demand, the issue is how to manage access to (or use of) the infrastructure efficiently. In some cases this means finding ways to price access to the infrastructure to best effect, where the infrastructure is a common asset (or cost) with congestion arising intermittently.

Infrastructure policies should be made in a wider context, as the best policies sometimes involve better use of existing infrastructure (for example, better phased traffic lights or IT applications that help manage road and rail traffic). Modern communications allow some trips to be avoided — access is a broader concept than transport alone. Transport infrastructure decisions can also be complex, such as when there is an interaction between transport and land use, or when there is a feasible choice between transport modes (road/rail/sea/air).

A sound transport infrastructure strategy requires using a suite of techniques that will collectively steer resources to their best uses. For road and rail transport especially, the Government has a special interest in analytical frameworks, as it is the owner of most of the infrastructure.

Making the case

The first step in thinking about investment in transport infrastructure is problem definition.

► What are the contexts where improved or new transport infrastructure would help achieve economic and social objectives?
► Is the problem large and multidimensional, such as many of the investments in Auckland?
► Is the apparent problem really a symptom of a deeper cause or the result of something wider, for example a network issue?
► Is there good data or other information that confirms the problem is real?
► Is the problem expected to get worse in the future or will changed circumstances make it less important?
► What uncertainties are there? Changes in technology and behaviour (for example, fewer young people getting driving licences) mean that past trends are not necessarily a good guide to the future. Transformational technologies, notably driverless vehicles, may reduce the demand for road infrastructure well within the lifespan of new projects and within the period covered in benefit-cost analyses.

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29 This is addressed in the Ministry’s strategic study on future demand.
Careful thought about the problem definition will improve, and may even change, the understanding of it, and will help determine the best solution. In some cases the problem may turn out to be less important than had been thought, or even not to exist, and in others it may be found that there is a self-correcting mechanism, or that favourable changes are happening in markets or the external environment so no action is needed.

How to respond?

Provided there is a significant problem that is not going to go away, the next step should be to consider the best course of action rather than jumping to the conclusion that infrastructure spending is called for. There is a repertoire of possible responses, of which more infrastructure is one.

► Make better use of what we have already. This can involve either the demand or the supply side.
  ► On the demand side, the possibilities include publicity campaigns to spread peak demand, encouraging switching to public transport, encouraging current trends to replace some travel with social networking, ramp metering (controlling access to freeways), real-time information so motorists can avoid congested areas, other IT/Internet/real-time applications, 24/7 opening of major warehouses and distribution centres to encourage trucking at night and so reduce congestion near ports, and pricing (for example, United States-type high occupancy vehicle lanes, tolls on freeways and key link roads or bridges, or wider congestion pricing as in Stockholm, Singapore and London).
  ► On the supply side the possibilities include more efficient signalling. For example, better phasing of traffic lights, bus priority at traffic lights, EU-type in-cab signalling for trains, judicious increases in public transport services (and subsidies) when likely to lead to diversion from cars, and relatively small investments in chokepoints so the rest of a railway or road can be used better.
  ► Invest in alternative types of infrastructure, notably investment in many small high-return projects rather than a few large low-return projects.
  ► Have wider metropolitan area policies, for example zoning changes that allow higher density apartments nearer to where people work or in public transport corridors, freight precincts near freeways and railways, and changes over time to road networks that shift traffic from congested roads.
  ► Leave it to the private sector to respond to changing incentives, with or without ‘nudges’. This may be relevant to some ports and airports.
  ► Build up capacity in stages rather than in one hit, in order to manage uncertainty (see below).
  ► Invest in classic capacity-building infrastructure.

The alternatives should be carefully weighed up before deciding on a particular course of action.

Core analysis

If infrastructure investment emerges as likely to be the best solution, the long-established economic technique to help determine whether to proceed is benefit-cost analysis (BCA). Basic BCA is simple: estimate the costs of the project in each year (for example, construction costs at first, operating costs in later years), estimate the benefits in each year, adjust them for the value of time using a discount rate (similar to an interest rate), and work out whether the benefits exceed the costs. Those unfamiliar with BCA should do an introductory course. The Government Economics Network (GEN) run them from time to time, and we can get one put on in the Ministry if there is sufficient demand.

BCA is captured in remarkably consistent guidelines issued by various public agencies in New Zealand and abroad. (The NZ Transport Agency and Treasury have guidelines, and a major revamp of the main Australian guidelines will be issued in late 2014.) Properly done, BCA is fully consistent with the objectives of contributing to New Zealand’s economic and social progress while minimising
harm. It covers all or most of the key impacts of a project (most quantitatively, some qualitatively) and allows comparisons with alternative uses of resources in other projects in transport or elsewhere.

The Ministry’s own economic analysis of public sector transport investments is centred on BCA using government guidelines, supported where necessary by other forms of analysis. This thinking is reflected in advice to the Government and in the Government’s Policy Statement on Land Transport Funding (GPS), which provides broad guidance to the independent NZ Transport Agency and local authorities.

The central part of BCA is to estimate capital costs, ongoing maintenance costs, and the value of benefits (usually dominated by savings in travel time and reduced crashes) year by year, and convert them to a present value using a discount rate (broadly akin to an interest rate without the inflation component30). The main results are net present values (NPVs) and benefit-cost ratios (BCRs). The BCR should be well above 1 to allow for the distortional effects of raising taxes, and arguably well above 2 because other uncommitted projects have BCRs well above 2 (the ‘opportunity cost’ argument).

BCA of projects should carefully define the problems/issues being addressed and identify feasible alternatives including non-construction alternatives. BCA should be as broad as practicable. It should cover the estimated direct costs and benefits of the project, and externalities (for example, estimated values of the costs of noise and pollution). Where relevant, it should include wider impacts such as network, corridor, land use and agglomeration effects. For example:

► Each project in a corridor or area may contribute a small amount in isolation (for example an upgraded intersection may just shift the problem elsewhere) but when they all happen together there is a sudden step up in benefits.
► BCA benefits are often dependent on parallel non-transport decisions, for example land use. Where relevant, mainly in urban areas, the integrated planning context should be considered alongside the BCA.

These effects typically involve a greater degree of assumption and uncertainty than the direct costs and benefits and so should be reported separately with the caveats identified, and the overall results shown with and without these effects. In some cases quantitative estimates will be too difficult and a qualitative assessment should be provided.

In setting up a BCA, care is needed with problem definition and identifying feasible alternatives. Assumptions and complexities need to be carefully discussed. Apart from for the simplest of projects it will be prudent to produce a range of BCA results reflecting alternative reasonable assumptions. For example:

► for many transport projects the main benefit is saving time. The values attached to the time savings were standardised for many years, but recently debate over these values has emerged. For example, if a business person can make good use of their travelling time then not much is saved by making the journey faster.
► the Treasury’s central discount rate is 8 percent real (i.e. with inflation removed) but the NZ Transport Agency has moved to 6 percent real. Literature has emerged overseas supporting the lower rate for long-life projects, and the issue merits further research in New Zealand. For now, it would be prudent to produce alternative results using 4 percent, 6 percent and 8 percent discount rates.

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30 The Treasury discount rate is 8 percent real (i.e. with inflation removed); the NZ Transport Agency uses 6 percent. There is an argument for a lower discount rate for long life projects, reflecting how individuals make decisions – a high implied discount rate when buying consumer electronic products that will last few years, and low implied discount rate for decisions about provision for children and grandchildren. Lower discount rates favour more expensive but longer life projects.
A common assertion that BCA is too narrow is misconceived because thorough BCA includes many of the wider aspects:

- environmental harms (such as pollution and noise) are treated as costs and their impact can be estimated from the volume of activity using standard values or tailor-made values
- social impacts, positive or negative, can also be estimated or treated qualitatively (though distributive issues may need separate assessment)
- broader impacts can be analysed, sometimes in part quantitatively, with the analysis incorporated in the overall report so that the decision maker can make allowances. Broader issues may include network effects, corridor effects, agglomeration effects, resilience, isolation, particular social circumstances, and cases where public perceptions remain strong in the face of contrary evidence.

For simple projects such as improving a rural intersection, the wider aspects will be negligible. In more complex cases the wider aspects should be assessed and reported alongside the core BCA results. The decision maker needs to see them both separately and amalgamated, because wider aspects tend to be more difficult to estimate and the numbers are more ‘rubbery’.

Application of BCA to roads in New Zealand before about 2009, in the days of Transit (the New Zealand Crown entity responsible for operating and planning the New Zealand State Highway network from 1989 to 2008) was criticised because mechanistic application of simple BCA meant that worthwhile network, corridor improvements and other wider aspects were given insufficient weight. This is a valid criticism. The wider aspects should be assessed and included in the BCA. The alternative of bringing all elements together in a multi-criteria analysis has seen the pendulum swing too far the other way — economic aspects can have a low weighting and large expensive projects with poor benefit-cost ratios too readily approved. The Ministry is participating in a NZ Transport Agency review of the approach. It considers that the public would be well served by readily accessible ex-post reporting on the NZ Transport Agency website of the analysis behind each road project. This reporting would include the benefit-cost analysis and the other factors that were taken into account.

There is also room for debate about ‘lead’ versus ‘lag’ investment. Some leading investments have proven to be transformational (Vogel’s railways, the Erie Canal, the Auckland harbour bridge) and some to be white elephants (for example the Darwin railway line). The saying ‘build it and they will come’ works sometimes (for example, the M25 ring road in London) but is now discredited as a general rule.

The analysis of maintenance expenditure does not normally need to include wider considerations, and BCA is the appropriate technique for considering trade-offs between the type of maintenance (for example, patching, resurfacing, rebuilding), timing of maintenance activities over the road life cycle, and cost. The regime is currently undergoing an in-depth review.

BCA is a useful way of evaluating investments in improved safety. The cost of the investment (for example, additional safety barriers or additional speed cameras) will usually be straightforward, and the benefits are the expected number of lives saved, and the expected number of disability-impaired years avoided, multiplied by standard values (for example, value of statistical life), with multiple runs if there are different views about the standard values. Separate research is needed to provide input into the BCA on the expected number of lives saved, which depends on the type of investment and the level of traffic.

Real options approach

A new approach that needs to be more extensively applied in New Zealand uses a real options framework (otherwise known as adaptive management or a staged approach), to supplement BCA in situations of uncertainty (which is usually on the demand side). BCA alone is inadequate in such cases because it is entirely dependent on whatever information is available upfront and cannot incorporate new information that emerges later. The use of high/medium/low scenarios and/or
different discount rates does not solve the problem as they also use upfront information and are arbitrary.

Real options based decision making sees each stage of the project (for example, concept/design, land acquisition, approvals, site preparation, construction) as buying the option to proceed to the next stage or to delay/modify/cancel in the light of new information emerging from the preceding phase and in the light of new external information. The first stages, desktop preparations and various approvals, are relatively cheap. The next stage, preconstruction (for example site preparation) is also relatively cheap. The final stage, construction, accounts for the bulk of the cost. Being prepared to decide at the end of each stage whether to continue as originally envisaged, modify, delay or cancel, preserves the option of constructing a worthwhile project while also preserving the option of avoiding a white elephant. The cost of preserving those options is a small part of the total. In some cases, a project that would fail a BCA can proceed under real options analysis.

An example is ports. There is uncertainty about the impact that increasing ship sizes will have on the relative growth or decline of individual ports (bigger ships have lower costs but fewer port calls, implying greater use of relatively expensive coastal shipping, rail or road links). In that context BCA alone will not provide sound answers about which ports need improved road and/or rail links. The real options approach would build in this uncertainty and focus on preparing for the improvements (for example by preserving corridors) while delaying construction until demand became clearer (with modest investments in chokepoints, if necessary, in the meantime).

The appropriate analytical technique behind real options analysis is a decision tree, incorporating judgements expressed as probabilities, with firm review points (continue, modify, delay, cancel) at the end of each stage. It is usually not necessary to value the options — what matters is the decision logic and incorporating new information as it emerges.

Other approaches

**General equilibrium analysis** provides estimates of the local, regional and economy wide impacts of a project on output, value-added and employment. This information is sometimes useful to decision-makers. However, it is not a decision tool.

**Wider economic impacts, or agglomeration analysis**, assesses additional impacts, beyond those captured in a BCA, of improved business connections and employment markets in urban agglomerations. It is a relatively new approach that is still stabilising, and that needs good urban transport data to be robust. Care is needed to avoid double counting with BCA and to avoid outright exaggeration. Guidelines in New Zealand (NZ Transport Agency), United Kingdom (WETag) and the new guidelines emerging shortly in Australia help provide discipline for the analysis. It was used to help get Crossrail over the line in London — it roughly doubled the estimated benefits — but subsequent review suggested that the increase should have been much smaller. It plausibly added 6 percent to the estimated benefits for new light rail in Sydney, but implausibly turned a 0.8 BCR for a Melbourne road project into 1.4. If used with care, wider economic impact analysis is likely to be relevant in Auckland.

**Transport and land use interaction**

Decision making about transport investments becomes more complex when there is substantial interaction between transport and land use. In many regional areas, now that the basic networks are in place, improved transport infrastructure will not make a significant difference (assuming incremental increases in road capacity occur when justified by demand). However, in large metropolitan areas transport investments may be proposed to cope with demand created by new land uses, but themselves may change the pattern of land use. Therefore, with care transport investments can become a planning tool to encourage particular land uses and discourage others.
Examples are the relatively new freeways in outer western Sydney and Melbourne, which rapidly led to growth on adjacent land of warehouses, transport and logistics centres, and other activities dependent on trucks. These activities moved from congested inner-city areas where land values had become high because of alternative uses. Another type of example is where zoning rules are changed to encourage higher density residential buildings near train lines and bus corridors, leading eventually to improvements in those public transport services.

Experience

In the past decade or more in New Zealand and in some similar countries, several problems have arisen with infrastructure development that can be reduced in the future if good economic analysis is made available to decision-makers.

► There is a tendency to favour large projects over small ones, even though many of the small ones in the queue have better BCAs. Some, but not all, of the big projects may have substantial wider benefits: objectives of supporting economic growth and social well-being would be better met by not crowding out smaller projects with high BCAs.

► Targeting resources towards better projects can be helped if there is a label or theme that resonates with the public. ‘Black spots’ is an example of a successful label that generally encouraged spending on relatively small projects that had good returns because of the value of lives saved. ‘Choke points’ might be a useful label in the future - it can be linked to the attractive notion of making better use of what we already have.

► Some in the public domain imply that any infrastructure is worth investing in, with an automatic link to future productivity and prosperity and little, if any, discrimination between economic and uneconomic cases. It will be worth periodically pointing out that a cavalier attitude to investment can result in white elephants such as the Darwin railway line and the earlier extension of Christchurch airport’s runway. There will always be a few debatable transport projects that slip through, but if there are too many of them the performance of the whole economy will be held back.

► Demand for new urban road projects is extremely difficult to predict because of traffic diversion and traffic creation. Some new roads get clogged on the first day (for example, London’s M25) and some are white elephants. New South Wales and Queensland have seen a few recent failures, which have collectively undermined confidence in public private partnership road investments. A body of knowledge and literature builds upon better methods of urban traffic prediction in the context of major new projects.

► Investment programmes can be influenced by transport fads. Overseas examples are light rail (suitable in densely populated corridors but not in low-density areas), asserting that regional development will follow construction of new rail lines (unlikely if the basic road network is already in place), and new airports close to existing airports.

The Ministry, working with transport agencies, can assist decision-makers by providing solid economic analysis that they can weigh up with other factors. Decision-makers may have good reasons for not always following the order of priority suggested by economic analysis, but are entitled to have the information before them and be aware of the tradeoffs.

Conclusion

This paper has aimed to help Ministry of Transport staff with a framework for analysing issues they are presented with, starting not with analytical tools but with openness to thinking about markets within the transport sector. That thinking will help decide on the best analytical approach and best response, which should be influenced by a view about how well the market is working.

The paper also aims to help the Ministry decide on its work programme. Thinking about markets should help decide where to be ‘light handed’ and where to concentrate the Ministry’s policy work.
Appendix – transport context

Transport and the economy

Transport is vital to economic wellbeing in many ways. These can be grouped in three categories.

(a) Transport serves economic activity

Transport for the most part is an intermediate service — it helps achieve economic and social ends, rather than being a final product like a new house or a television. Apart from a few examples such as car rallies, transport is needed not for its own sake but to get people where they want to go and goods where they need to be. Transport provides the essential links along production and distribution chains comprising raw materials (or imports) to final consumption (or exports). Apart from short trips that can be walked, transport is needed to get people to work and to social and leisure activities. Transport generally expands and adapts to growing and changing demand, although with some caveats that are discussed in this paper. Transport infrastructure and services expand along with cities and production.

(b) Transport creates economic activity

Generally, transport is a necessary but not sufficient condition for creating economic activity.

In certain situations however, innovations in transport can be the primary factor that create new economic opportunities, for instance where they connect new resources to businesses and businesses to new markets, and where additional transport connections create markets of sufficient scale to support new or more specialised types of activity. Some examples:

► Refrigerated shipping from the 1880s allowed New Zealand to compete in overseas meat markets.
► The range of out-of-season fruit and vegetables on sale has improved because of lower transport costs from more distant regions with different climates.
► It is now feasible, unlike a century ago, to travel quickly from country areas to large metropolitan hospitals for specialised medical services that are not available locally.
► On the basis of cheaper transport New Zealand has large efficient multi-product dairy factories compared with the small inefficient ones of a century ago.

Improvements in transport can increase the time available for economic activity, or increase wellbeing. Faster journeys allow more productive use of truck or train fleets, and quicker turnarounds at ports allow more productive use of ships. Faster passenger journeys reduce the time needed for commuting and for business travel.

Good transport helps achieve ‘agglomeration economies’, that is benefits from proximity in location, in major centres. Improvements in transport can improve the feasibility of grouping together a pool of employees, a set of facilities and a range of employers where they are more productive than if they were dispersed between different locations. This increases the pool of talented personnel available to businesses and the range of employers available to workers, thus increasing the likelihood of finding the best people for the jobs and the best jobs for the staff. Transport can increase the size of the market that a business can serve, allowing it to realise economies of scale and scope. It can also allow more firms to compete in a market, increasing competition and driving innovation.

The quality of transport links can affect the relative competitiveness of one area over another because of impacts on quality of life, costs to access resources and markets, and access to larger markets. This would be an issue in Christchurch if transport links were not strengthened following the Canterbury earthquakes, and will be an issue in Auckland if transport policies do not keep up with growth.
Lack of effective transport links can inhibit economic activity. Earlier in New Zealand’s history, economic activity relied on shipping and was held back until parts of the country were opened up with New Zealand Premier Sir Julius Vogel’s railways of the 1870s. New Zealand now has a mature transport network. However, if development in certain areas gets ahead of transport capacity, the resulting congestion adds to costs and slows growth. A past example was the primitive Cook Strait ferry Tamahine that preceded the roll-on roll-off rail ferries. A present example (for which solutions are now being considered) is the congested east-west link serving Auckland’s main transport and logistics companies.

However, putting in a new or improved transport link will not guarantee increased economic activity in the area served. It depends on the case — for example, the dramatic economic impact of the Auckland Harbour Bridge, compared with the ‘Bridge to Nowhere’. Investment in transport can reduce economic well-being if the projects are more expensive than can be justified by demand, because of the diversion of resources from better uses elsewhere in the economy.

(c) Transport is in itself an economic activity

Transport in itself is an economic activity, as is investment in transport infrastructure. Transport accounts for approximately five per cent of New Zealand GDP and five percent of employment. Employment (other than aviation) is especially important at the lower end of the income scale, providing work for people without post-school qualifications for relatively good wages.

Transport and society

Transport is also vital in many ways to social wellbeing, discussed under three categories below.

(a) Transport responds to social needs

In early times most peoples’ lives were limited to a radius determined by walking, and later by horse or boat travel. Transport improvements since the 19th century have since greatly opened up social opportunities:

► Access to work. Besides commuting, this includes tradespeople and others travelling to their worksites—although some access to work now involves communications technology rather than transport. Much of this travel is to central business districts (CBD) and similar clusters, which have developed because of the efficiency of ‘agglomerations’, for example, proximity to suppliers and customers. Public transport often suits this concentrated travel, as does walking and cycling for the increasing numbers who live in inner areas. Another large component of work travel is between homes and places of employment (for example warehouses and factories) that are dispersed across metropolitan areas so cars are the main form of transport. Commuting patterns have been changing, with broader peak periods, an increased share for public transport (although from a low base), and a greater variety of work arrangements besides the classic 40 hour work week.

► Access to learning. Most of this travel is from home to kindergarten/school/tertiary education, and some is from workplaces for offsite courses. The portion of the population involved in education has increased greatly in recent decades, with consequent effects on travel patterns. Younger children used to walk to school but now are often taken by car, overlapping with the morning peak commuting traffic. Many older children and tertiary students use public transport.

► Access to health care. This includes travel to medical facilities and travel by health practitioners to homes. Long-term changes affecting this category include improving health status, ageing, shorter

31 Assuming New Zealand is broadly similar to the US, as reported by the Brookings Institution 2014) in Beyond Shovel-Ready: the Extent and Impact of US Infrastructure Jobs.

32 The technological underpinnings of Western European transport were much the same in the first century A.D., ninth century A.D., and 18th century A.D., yet the social and economic structures were radically different.
hospital stays, and a relative growth in large metropolitan hospitals because of the specialities they can offer.

► Access to shops, restaurants and services. Local shops can sometimes be accessed on foot or by bike, while larger shopping complexes are usually accessed by car, with consequential local congestion at favoured shopping times. A move to online shopping replaces some of this pressure with delivery vans.

► Access to social, cultural, sporting and other outdoor activities. Some of this suits public transport, for example CBD activities and avoidance of drink-driving. Much of it suits cars because venues are dispersed.

► Leisure and tourism. Improved transport has widened the travel choices within New Zealand and overseas, and opened New Zealand to overseas visitors.

(b) Transport helps shape society

Transport is one of the main reasons our society is so vastly different from how it was in early times, as a much greater range of interactions (social, employment, and leisure activities) is now possible. New Zealanders have responded to the opportunities offered by successive transport improvements by travelling further and taking advantage of opportunities that are not available in the immediate neighbourhood. Those opportunities were able to evolve only because transport allowed people to get to them—for example factories, hospitals, movie theatres, shopping complexes and resorts.

These immediate effects had feedback effects on society. For example, most of us now choose to live in cities because of the variety of employment and social opportunities they offer, and we take for granted leisure activities that involve travel (trips to the beach, mountains).

Recently parts of society have chosen to organise themselves so as to reduce their transport use, such as inner city living and online tools used to work and socialise. These developments are discussed in the Ministry’s strategic project on future demand.

The ways transport affects society are not always positive — for example, it is an input into burglaries and wars.

(c) Transport is a social activity

The New Zealand transport sector employs approximately 84,000 people. The employment intensity of freight transport (employees per net tonne kilometre) has been declining as vehicles and planes get bigger and as rail improves its mode share. The ‘employment’ intensity of passenger transport, high when there is just the driver in the car, is declining as public transport becomes more popular. It will decline further if there are driverless cars. Transport’s share of total New Zealand employment is declining as freight transport is no longer growing as fast as GDP.

Transport also has social dis-benefits, for example noise, pollution, crashes, the division of communities by major roads and contribution to urban sprawl. At the analytical level these are addressed as externalities in benefit cost analysis (see below). At a practical level they can be mitigated with, for example, noise barriers, noise and emissions standards, road safety barriers and other safety measures, and designs that avoid urban divides or use tunnels.

It follows from this summary of the economic and social roles of transport that as the issues are often complex, the analytical framework needs to be able to cope with multiple ‘dimensions’, wider implications need to be identified and considered, and trade-offs need to be made.

33 Although, as noted earlier, social change can occur without transport changes. And very different societies exist with broadly similar transport services, for example, India and Brazil, Japan and Germany.

34 National Freight Demand Study, Deloitte for Ministry of Transport, March 2014