SOUTH ISLAND FREIGHT STUDY: IDENTIFICATION OF THE OPPORTUNITY FOR MODE SHIFT AND PREPARATION OF A MODE SHIFT IMPLEMENTATION PLAN

PREPARED FOR **ENVIRONMENT CANTERBURY (ECAN) AND THE SOUTH ISLAND REGIONAL TRANSPORT COMMITTEES (RTC) THROUGH THE SOUTH ISLAND RTC CHAIRS GROUP**

June 2019

Stantec

In association with

Richard Paling Consulting

Murray King & Francis Small

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Executive Summary

The Ministry of Transport has previously forecast considerable growth in freight traffic in the South Island. While some will be carried by rail and coastal shipping a large part of this growth is likely to be carried by road resulting in a range of environmental and safety issues. In part this growth in road traffic will be supported by the lack of pricing for externality effects which by making road transport relatively cheap compared to other competing modes is likely to exacerbate the emerging issues.

It is against this background that Environment Canterbury, on behalf of the South Island Regional Transport Committee Chairs Group commissioned Stantec in association with Richard Paling Consulting and Murray King & Francis Small Consultancy to investigate freight movements and costs in more detail and identify ways in which changes in the mode split might be achieved.

The study has identified and evaluated beneficial mode splits for freight in the South Island. It has concluded that there are substantial opportunities to achieve more beneficial mode splits by facilitating the movement of freight by rail, either by transferring this from road or providing opportunities for new development which would be rail served. Across the South Island this includes, for a likely investment of <$30 million, a shift equivalent to around 8% of existing road freight onto rail resulting in an increase in rail freight by around 40% and an externality benefit compared to the movement of all the goods by road of up to $12 million to $18 million per annum (including an annual $2 million to $3 million reduction in unmet road wear costs). If the improvements facilitated the development of opportunities which would not otherwise go ahead, the economic benefits in terms of increased activity are likely to be larger.

The approach of this study was:

- Engagement with key stakeholders and industry to identify freight supply chain issues related to transport mode choice from the perspectives of infrastructure providers, transport operators and producers.
- Research to:
  - update freight growth forecasts for the South Island,
  - review impact on infrastructure,
  - quantify externality costs and
  - identify relevant technology opportunities
- Development of mode shift opportunity case studies identified through the engagement process using the research to test and quantify costs and benefits of these opportunities
- Developing an action plan

Engagement with stakeholders identified the following problems (and opportunity) for freight in the South Island in the context of this study:

- Problems:
  - Increasing movement of freight vehicles on roads is increasing conflict with other road users leading to the potential for more deaths and serious injuries
  - The growing freight task is leading to more fossil fuel (diesel, petrol) being used to shift freight increasing the volume of harmful emissions released into the environment.
  - Limited capacity of port handling facilities, intermodal hubs and rolling stock constrains mode choice which limits supply chain reliability while increasing costs and environmental impacts.
  - Increased reliance on just in time delivery means there is inadequate stockpiling of essential goods in isolated communities (often key tourist destinations) leading to people and businesses becoming more vulnerable to the effects of transport network outages.
- Opportunity:
  - New technology and better-quality real-time data will enable faster adoption of more efficient ‘last mile’ delivery methods leading to higher levels of customer service and more sustainable use of transport infrastructure

It is expected that the key benefits that would be realised in the transport system by addressing these problems and advancing the identified opportunity are:

- Safety
- Environment and public health
- Economic
- Reliability
- Resilience

The potential benefits if traffic was shifted from road to rail were demonstrated for a number of case studies in this project as summarised below. It should be noted that some of these case studies were speculative intended to highlight the scale of any impacts. Investigation of coastal shipping indicated that the opportunities for shifting freight were more limited and were therefore not considered further at this stage It should also be noted that these include the West Coast waste to energy project which appears to have been abandoned since the analysis was undertaken but which nevertheless provides useful insights into externality issues.

If the provision of rail services facilitated the development of new projects rather than switching traffic from road to rail, the potential benefits are likely to be higher[1].

Case Study	Product	Annual Volumes (tonnes)	Annual volumes (m tonne-kms)	Total Annual Externality Benefits ($m pa)	Unmet Road Wear Costs ($m pa)
Stillwater logs	Logs	30,000	7.3	0.2	0.1
Milton/Milburn Logging terminal	Logs	50,000	9.0	0.2 for movements to Bluff	0.1
Garnet	Industrial materials	150,000	51.6	1.0	0.2
Water	Consumer products	400,000	92.4	3.2	0.4
Greymouth terminal	General freight	25,000	6.3	0.2	0.1
Waste	Waste	60,000	4-20	0.1-0.1 for alternative storage points 0.5 for movement from Christchurch	0.0 0.1
Port Chalmers Inland Port	General freight	285,000	3.7-7.7	0.2-0.2	0.0
Total		**1,000,000**	**174-198**	**5.8-5.9**	**0.8**

The Case studies above identify the opportunity to shift up to 200 million tonne-km (mtk) of freight off roads, and the study team believe there are total opportunities of around 500mtk across the South Island per annum.

In summary:

- In 2017 there is estimated to be in the order of 28.3 billion tonne-km (btk) movements per annum currently across all modes in New Zealand

[1] This is explored further in the detailed assessment of the movement of garnet.

- Approximately 8.1btk of these movements occur in the South Island (29 per cent of the total), and around 6.2btk of this is on roads
- The opportunities identified in this study could potentially reduce freight demand on roads in the South Island by nearly 8% and increase demand on rail by around 40% against current volumes, although in practice some of the effects may be to facilitate output for new projects rather than switch traffic from road.
- The case studies identified and the potential for wider application across the South Island would have externality and unmet road wear cost benefits in the order of up to $12-$18 million per annum (of which around $2 million-$3 million per annum would be the unmet road wear cost savings).
- These benefits would be realised through capital investment in public infrastructure of <$10 million for the case studies and potentially in the order of $20 million to $30 million total when including the remainder of the South Island

This study concludes that:

- Updated freight forecasts produced as part of the study confirmed that there is considerable freight growth forecast in the South Island reflecting economic and population growth and increasing production of a number of agricultural and mineral products.
- If this freight is moved by road even at current modal split levels, it will create pressures on transport infrastructure and on the broader community;
- There are externalities involved in movement of freight that are currently unrecognised in freight pricing. Those for road are very much larger than those for rail. These have been quantified by this research;
- Transfer to rail would bring externality benefits in terms of access, safety and environmental impact, but intervention is needed to internalise them or compensate for them (for example by funding particular interventions);
- The study has identified a number of opportunities (demonstrated with case studies) that could increase freight haulage by rail, possibly by substantial amounts, and these opportunities could be readily extended beyond the specific case studies that this research project considered;
- There are some very significant barriers and constraints to be overcome, including rolling stock capacity and rail reliability;
- New technology can help deal with the adverse impacts of freight growth within cities, but again intervention may be necessary.

This report provides evidence that there is a case for change towards a more optimised freight mode split in the South Island.

Outcomes to take from study:

- A rail provider exploring business cases to establish mode shift of freight from road to rail including consideration of new transfer hubs now has a methodology to be able to quantify the benefits that would likely accrue as a result of this shift, including quantified impact (benefits) on externalities
- Road infrastructure owners considering investment to address freight movement now have a methodology to quantify benefits of considering mode shift to rail options, including commentary on the types of freight movement that this would most readily apply to, based on feedback from supply chain industry stakeholders
- An action plan has been identified to facilitate movement towards a more beneficial mode split.

Key next step:

- Point of entry discussions for mode shift opportunities with infrastructure owners and transport operators (or other parts of the supply chain) to determine the respective lead agency and funding to explore those opportunities

Some shorter-term opportunities consistent with the findings of this study have also been identified and these are expected to be pursued with the commencement of single stage business cases at a regional level and then implementation within those regions. However, it is noted in the study that investment in infrastructure in one region to achieve a mode shift often leads to significant benefits from that mode shift in another region, particularly those regions with seaports such as Canterbury. This may lead in some instances to a region sponsoring investment in another region because of where the majority of the benefits from that capital investment lie.

Subsequent to completion of the body of this study, KiwiRail has made a decision to invest in a more detailed examination of the commercial viability of Milton/Milburn Logging Terminal case study. They are looking to make an investment decision by the end of 2019 in collaboration with PanPac Forestry, Clutha District and the NZ Transport Agency as to whether a new terminal is established in Milton or Milburn, and how this might be configured and delivered. In addition, they are investigating further opportunities in the Southland Region for similar new road/rail terminals. KiwiRail's work and these decisions are utilising the methodology developed in this report as part of that process.

Environment Canterbury (ECan) and the South Island Regional Transport Committees (RTC) through the South Island RTC Chairs Group and the South Island RTC Chairs Group

South Island Freight Study: Identification of the opportunity for mode shift and preparation of a Mode Shift Implementation Plan

1. Approach to the Study

1.1 Introduction

The Canterbury Regional Transport Committee (RTC) is implementing the Transport Workstream of the Canterbury Regional Economic Development Strategy (CREDS). This study has arisen because a key priority in CREDS is to investigate the opportunity for freight mode shift.

Freight mode shift is a South Island wide-concern, and the South Island RTC Chairs Group has therefore progressed this project collaboratively across the South Island. Environment Canterbury is leading this work on behalf of the South Island RTC Chairs Group.

The expectation underpinning this study at its outset was that the South Island freight task is expected to grow from approximately 12 billion tonne-km in 2012 to over 16 billion tonne-km annually in 2042. The majority of this growth is forecast to be in road freight and is therefore anticipated to place increasing strain on the South Island transport network.

A 2009 NZ Transport Agency report found that road freight has significantly higher negative externalities than rail and coastal shipping. To limit the adverse social, environmental and economic impacts of the projected growth in freight, it is important that we move toward a more optimal mode split for the South Island freight task. However, a Ministry of Transport assessment undertaken in 2005 shows that road and rail are subsidised to different degrees, due to different funding mechanisms, which has the consequence of incentivising road freight transport.

Environment Canterbury undertook an initial analysis of the Ministry of Transport National Freight Demand Study to establish the scale of the opportunity for more freight being carried by rail and coastal shipping across the South Island. However, more detailed analysis was needed in order to establish an optimal mode split which takes account of the true cost of the currently forecast growth in freight, as well as the barriers to effecting change. This information would be expected to inform the development of a mode shift implementation plan.

The primary outcomes that this proposed study seeks to achieve in the context outlined above are therefore:

1. Identification and evaluation of beneficial mode splits for freight in the South Island
2. Development of an action plan/s to facilitate movement towards a recommended mode split/s

1.2 Study Overview

This study has been undertaken in several distinct phases:

- Scope confirmation with Environment Canterbury and the Project Working Group (PWG)
- Background research including:
  - Review Freight Costs and Subsidies
  - Develop Freight Volume and Estimates and Models (Freight forecasts)
  - Identify and Consider Opportunities and Barriers (including potential technology changes) to mode shifts and identify Potential Case Studies
- Stakeholder engagement including:
  - Workshops with Project Working Group (PWG) to:
    - identify and confirm South Island freight supply chain issues / problems
    - agree principles for identifying, categorising and assessing case studies
    - confirm case studies
    - review case study outputs
    - agree action plan

- Interviews with key supply chain stakeholders to understand relevant mode selection issues in the South Island including:
  - Producers
  - Transporters (road, rail, coastal shipping)
  - Ports
- Meetings with transport infrastructure owners:
  - Regional transport officials' groups (local authorities, NZ Transport Agency)

- Case study and action plan development:
  - Identification of long list of beneficial case studies for review
  - Agreement on case studies and priorities to pursue in more detail
  - Completion of case studies
  - Present and review / evaluate case studies
  - Identify next steps and action plan
- Report development and presentation

This report presents the outcome of the above study.

2. South Island Freight Background

2.1 Introduction

In order to provide background to the case study analysis which forms the main part of the work, this section considers the volume and patterns of freight flows across the South Island. This is based on our update of the freight forecasts which are described in more detail in Section 5.2 below.

2.2 Current pattern of freight flows

2.2.1 Total

In 2017 the total freight movements impacting on the South Island (to, from and within) are estimated to be about 81.1m tonnes. This represents about 32 per cent of the national total. Of the SI total about 75.6m tonnes or 93 per cent is internal to the South Island with the balance 5.5 m tonnes representing movements to or from the North island.

2.2.2 Inter-regional patterns

The pattern of inter-regional freight within the South Island flows including the movement of international traffic to and from their ports of loading or unloading is set out in Table 2-1.

Table 2-1: Estimated inter-regional freight flows in the South Island 2017 (m tonnes)

From \ To	TNM	West Coast	Canterbury	Otago	Southland	Total by Region
TNM	8.7	0.3	0.6	0.0	0.0	9.7
West Coast	0.0	1.4	1.6	0.1	0.0	3.1
Canterbury	0.9	0.8	35.5	1.5	0.6	39.4
Otago	0.0	0.0	0.8	8.8	0.7	10.3
Southland	0.0	0.0	0.4	1.2	11.5	13.1
Total by Region	**9.7**	**2.5**	**38.9**	**11.6**	**12.8**	**75.6**

Of the total flow of 75.6m tonnes, about 65.9m tonnes or 87 per cent is intra-regional, with flows crossing regional boundaries amounting to just under 10m tonnes or 13 per cent of the total. Of these inter-regional flows, a large part, 3.8m tonnes or 40 per cent, is represented by flows outbound from Canterbury, reflecting to a large extent the importance of Christchurch as a distribution hub and entry port for the South Island as a whole.

Other important inter-regional flows include: -

- West Coast - Canterbury 1.6m tonnes - primarily coal and logs for export through Lyttelton
- Southland -Otago - 1.2m tonnes - including exports of dairy, timber and meat products through Port Chalmers and domestic movements of livestock

2.2.3 Key commodities

The breakdown of South Island freight traffic by commodity group in 2017 is set out in Table 2-2 and Figure 2-1.

Table 2-2: South Island freight traffic by commodity group 2017 (m tonnes)

Commodity group	Within South Island	To or from North Island	Total
Milk and dairy	11.5	0.0	11.5
Logs and timber	9.5	0.3	9.8
Meat and livestock	3.5	0.3	3.8
Other agriculture	4.2	0.5	4.7
Coal and petroleum	3.6	1.2	4.8
Aggregate and other building materials	17.0	0.1	17.2
Manufactured goods	24.5	3.0	27.5
Waste	1.8	0.0	1.8
Total	**75.6**	**5.5**	**81.1**

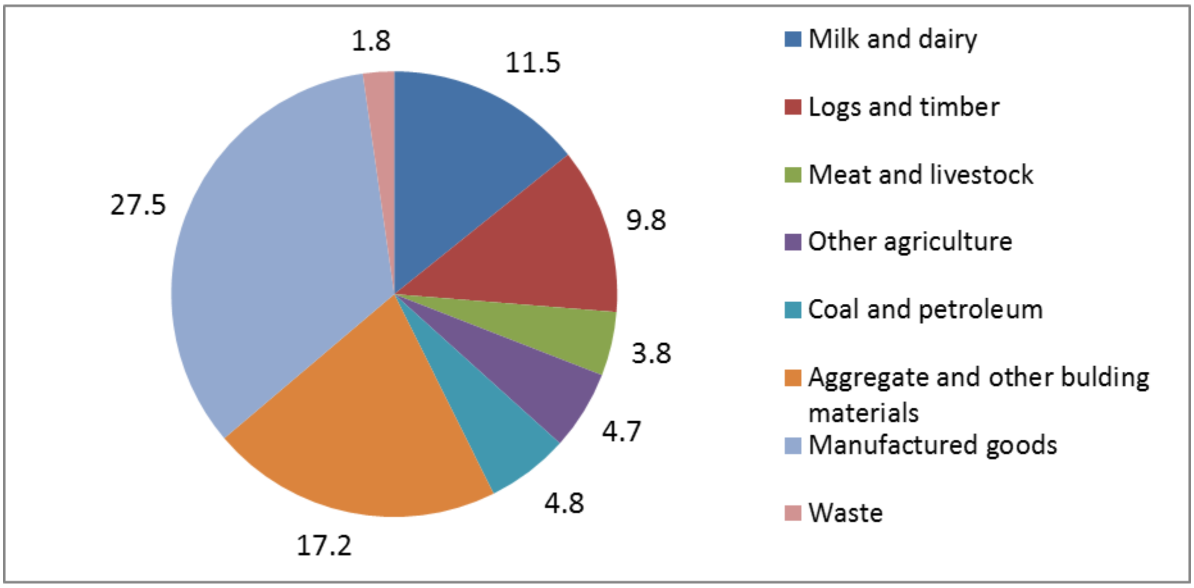


Figure 2-1: Breakdown of the 2017 South Island freight task by commodity (m tonnes)

Freight traffic in total is dominated by the movement of primary products with manufactured and retail goods contributing only about a third of the tonnages moved. Manufactured and retail goods do however dominate the movements into and out of the South Island reflecting the importance of Auckland as a national distribution hub.

2.3 Port and airport freight flows

The flows of international freight traffic through the South Island ports and airports in 2017 is set out in Table 2-3 and Figure 2-2.

Table 2-3: Flows of international freight traffic through South Island ports and airports 2017 (m tonnes)

SI Port/Airport	Exports	Imports	Total
Lyttelton	3.08	2.50	5.58
Timaru	0.87	0.89	1.76
Port Chalmers	1.94	0.26	2.21
Bluff	1.41	1.48	2.88
Nelson	1.49	0.13	1.62
Picton	0.66	0.00	0.66
Total seaports	**9.45**	**5.26**	**14.71**
Christchurch Airport	0.02	0.01	0.03
Total	**9.47**	**5.27**	**14.74**

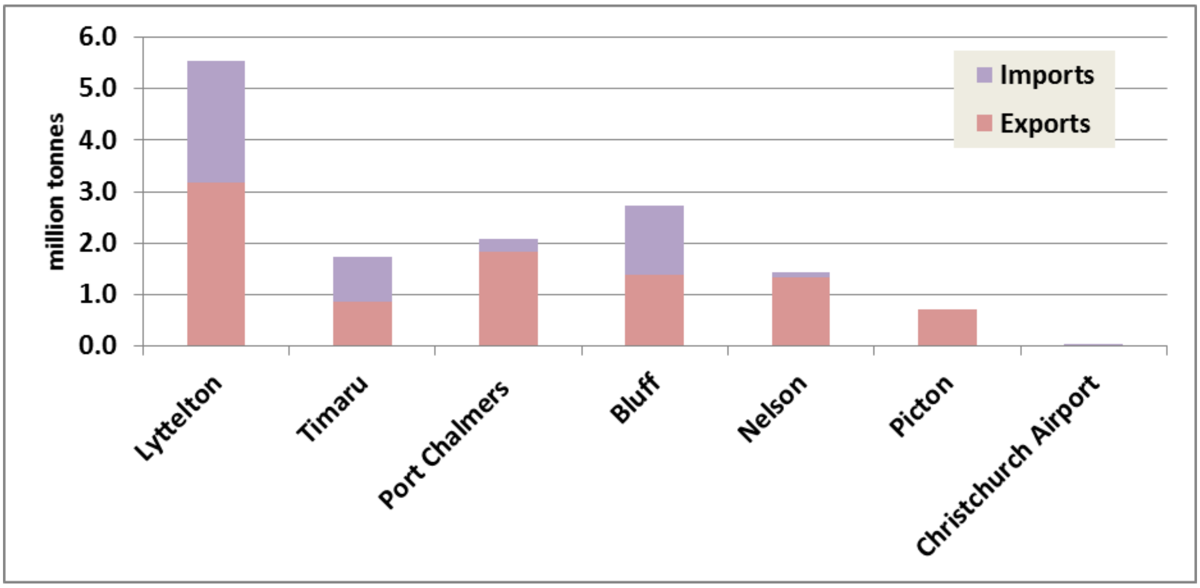


Figure 2-2: International freight traffic through South Island ports 2017 (m tonnes)

2.4 Modal shares

Using the results of the updated freight model and the rail flows for 2017 derived from FIGS, the shares of rail traffic in the flows for the South Island are set out in Table 2-4 and Figure 2-3.

Table 2-4: Estimated rail modal shares for SI freight movements 2017

From \ To	TNM	West Coast	Canterbury	Otago	Southland
TNM	0.1%	0.0%	0.8%	0.4%	0.1%
West Coast	0.0%	0.8%	83.6%	15.8%	74.9%
Canterbury	0.2%	4.1%	2.8%	13.2%	17.8%
Otago	0.8%	2.8%	8.9%	5.5%	17.2%
Southland	0.0%	6.6%	41.8%	63.1%	1.0%

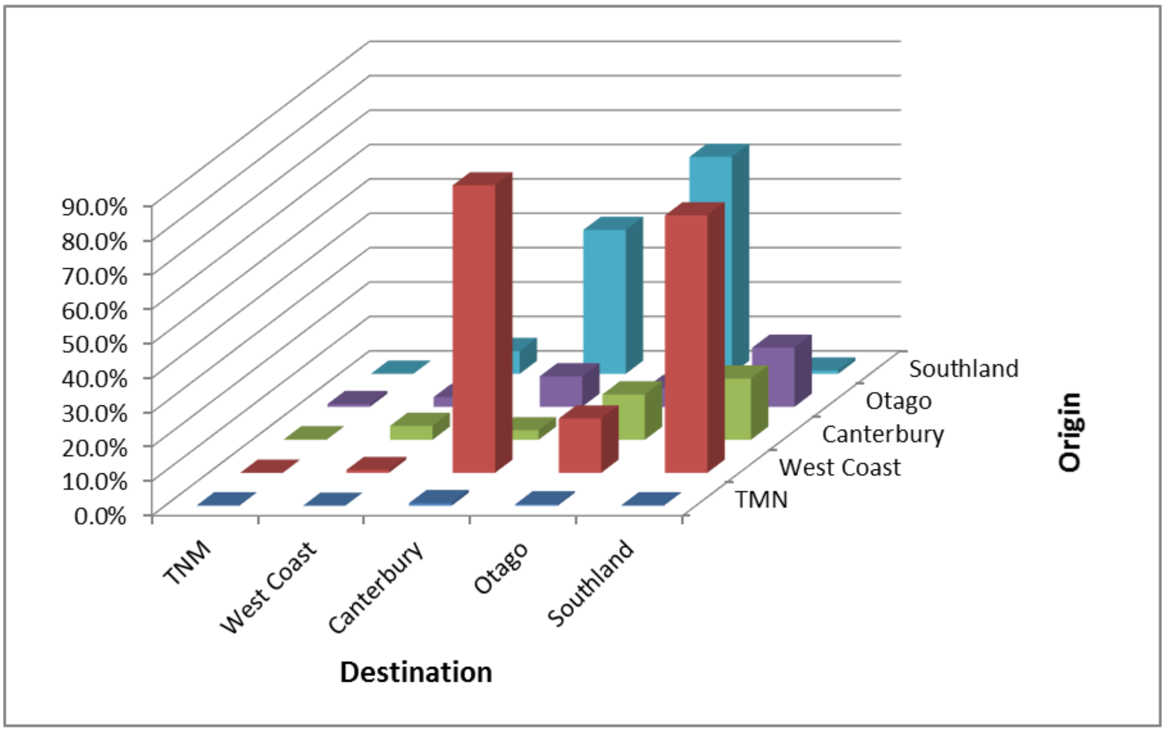


Figure 2-3: Rail modal share by movement 2017

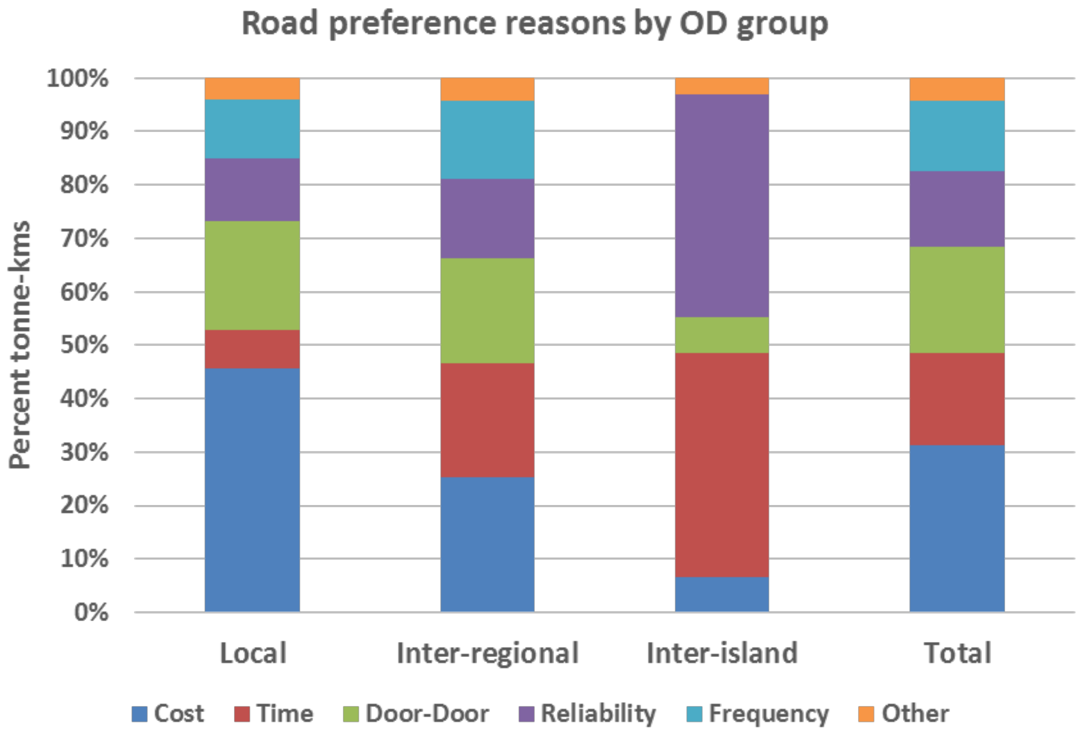
While rail typically has a fairly low share of the shorter distance movements within regions, for the longer distance inter-regional movements, the share of rail is much higher. For the major movement from the West Coast to Canterbury, dominated by the transport of coal dairy and logs, the share of rail exceeds 80 per cent and for movements from Southland to Otago it is about 63 per cent.

As well as reflecting the distances over which freight is moved, the choice of mode is also affected by the particular commodity being moved and the balance between cost, speed of delivery and other factors. This is discussed in the following section.

2.5 Factors affecting modal choice

Choice of mode includes many factors beyond the obvious one of price. Shippers value time and reliability very highly, so they may be prepared to pay a higher price for a quicker transit, and especially a more reliable service. Cost tends to dominate for short hauls, but other factors such as transit time, reliability, door to door service, and frequency all influence longer hauls. The potential for damage is not an important factor: rather it is assumed that no damage will occur, and transporters are quickly excluded if they damage freight.

For traffic, which is addressable by rail, the factors determining the choice of road over different distances are set out in Figure 2-4



Source : Ian Wallis and Murray King, [Valuing freight transport time and reliability](#) - Presentation to 2018 Transport Knowledge Hub Conference, Wellington

Figure 2-4: Road preference reasons by OD group (all NZ)

In terms of price, commercial prices for road transport do not reflect full externality costs. If they did, a choice of rail could be more viable, since, as this report shows, it produces fewer externalities. Case studies in this report illustrate this point. In some cases, shippers have perceived some external costs as directly impacting on them such as congestion and use rail even for short hauls (e.g. inland ports).

Some shippers value frequency. Because of the need to assemble large loads, modes such as rail and ship tend to be less frequent than road, for which movements of much smaller loads are viable. For those shippers that value frequency (which can be hourly or less) road is the only option, e.g. city deliveries. For bulk commodities like logs and water, which form some of the case studies, frequency is less important.

Some markets are not addressable by rail. Rail does not have the wide coverage of road (and sea even less so). Many sources of traffic have a long road haul to a railhead or port, which makes direct road attractive. Some hauls are too short for either rail or sea. Bulk milk, for example, is road hauled in the South Island, except from Canterbury to Westland. Many current logs hauls are by road over shorter distances. On the other hand, rail does handle short hauls from siding to siding, e.g. from Fonterra Mosgiel to Port Otago, and the case study illustrates the potential of an inland port for Port Otago, a very short rail haul. Most (but not all) markets within cities, such as concrete, cannot be done by rail. And rail may simply not offer a service for the particular commodity: for example, livestock movement is not undertaken by rail.

Even for traffic it can carry, rail may be constrained by lack of rolling stock, and the traffic then moves by road. This is illustrated by the case study of logs from Stillwater.

3. Stakeholder Engagement

3.1 Stakeholder Engagement Plan

Stakeholder Engagement was a fundamental part of this study. A Stakeholder Engagement Plan was developed, and an engagement register maintained for the duration of the project. An overview of the engagement approach is detailed below.

3.2 Engagement Purpose

The main purpose for engaging was:

- To involve key industry stakeholders both in the private and public sector in the framing of opportunities to improve the optimal use of transport infrastructure for movement of freight cognisant of the growing freight task.
- To seek relevant information from stakeholders to inform an understanding of the true costs and the optimal mode split of freight movement in the South Island.
- To understand the key problems and opportunities seen by the Sector in achieving an optimal mode split goal.
- To gain support and ideally commitment to an action plan that results in a positive change to achieve a more optimal mode split.

Relationship building was a secondary but an equally important purpose. The team worked to build upon the good relationships developed during earlier phases of Environment Canterbury work, and potentially extend these to a wider group of stakeholders. The whole project was seen, in effect, as an ongoing conversation contributing to the final outcome of the Study. With each group of stakeholders, the following applied:

- Set out expectations
- Be clear and genuine about the appropriate level of engagement
- Let them know what they can and can't influence
- Close the loop to ensure they understand decisions and outcomes.

3.3 Engagement Objectives

The engagement objectives for the project included:

- Ensure robust and thorough engagement to maximise support across key and targeted stakeholders and the Sector as a whole.
- Ensure stakeholders and the Sector are aware of the project at the appropriate time for us/them.
- Strengthen existing relationships and maintain open and honest dialogue with key stakeholders and the Sector.
- Identify key issues and concerns that stakeholders and the Sector have.
- Provide clarity as to how concerns and feedback given by stakeholders and the Sector have been considered and/or addressed.
- Ensure stakeholders and the Sector feel the project team has been open and transparent in their approach to producing the study outputs.
- Report back to stakeholders and the Sector on the final study and what happens next.

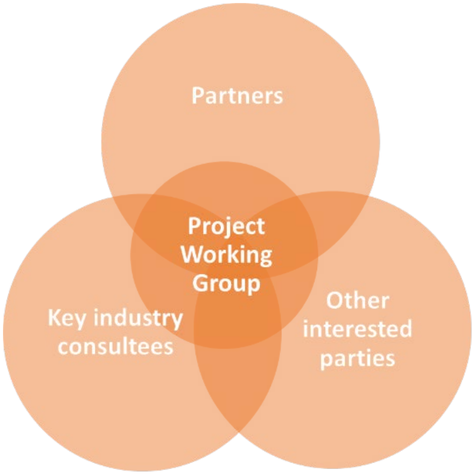
3.4 Stakeholders and Partners

The appropriate partners were agreed with Environment Canterbury to form the Project Working Group (PWG) in the development of the overall study (and case studies). The PWG has provided the following inputs at the study definition stage:

- Scope of study
- Scope of data collection
- Project objectives
- Key project outcomes

Throughout the course of the project, there was ongoing communication with stakeholders. All communications were recorded in the Engagement Register. The key stakeholders and partners are shown within Figure 3-1

A detailed contact database of stakeholders was maintained in the Engagement Plan.



The Project Working Group (PWG):	Partners:
Stephen Bateman (freight logistics advisor, independent peer reviewer) Ministry of Transport KiwiRail NZ Transport Agency Environment Canterbury Environment Southland	Representatives of South Island local authorities and regional councils Central Government
Key Industry Consultees	**Other interested parties**
Producers Transporters Ports (operations) Infrastructure owners	Road Transport Association NZ AA NZ Heavy Haulage Association Road Transport Federation NZ Iwi Emergency services

Figure 3-1: Stakeholders and Partners

3.5 Engagement Action Plan

Engagement actions are summarised below:

Activity	Description	Date
Workshops with Project Working Group (PWG)	• identify and confirm South Island freight supply chain issues / problems • agree principles for identifying, categorising and assessing case studies	7/8/18
	• confirm case studies	24/10/18
	• review case study outputs • agree action plan	22/11/18
Structured interviews with key supply chain	Included:	2/7/18 to 13/8/18

Activity	Description	Date
stakeholders to understand relevant mode selection issues in the South Island	• Producers • Transporters (road, rail, coastal shipping) • Ports	
Meetings with transport infrastructure owners	Regional transport officials' groups (local authorities, NZ Transport Agency)	As part of regularly scheduled meetings June 2018 to December 2018

The study team acknowledges the valuable time and input provided by the following organisations and their representatives to support this study:

Producers:

- Fonterra
- Westland Milk
- Synlait Milk Ltd
- PF Olsen
- Bathurst
- Progressive
- Foodstuffs
- The Warehouse

Transporters:

- Mainfreight
- Toll
- Hilton Haulage
- HW Richardson Group Ltd
- KiwiRail
- CODA
- Pacifica Shipping
- PBT

Ports:

- Port of Lyttelton
- Timaru
- PrimePort
- Port Chalmers
- SouthPort
- Nelson Port
- Picton
- Christchurch International Airport Limited (CIAL)
- Port of Tauranga

Responses were attained within the time available for all but one member of each of the stakeholder groups interviewed. The authors of the study gratefully acknowledge the time spent by a large number of these contributors helping us understand issues and identify opportunities to improve the supply chain across the South Island.

4. Issues Identified by Stakeholders

4.1 Issues identified by industry stakeholders

A series of structured interviews were held with a selected group of industry stakeholders to represent:

- Producers
- Transporters, and
- Ports.

The key issues identified from these interviews were:

- Shortage of rail capacity to meet demands.
- Need a long-term planning/funding horizon for rail.
- Concerns about reliability of rail services - possibly linked with shortages of capacity.
- Rail users typically want more although some exceptions where unreliability of rail is discouraging rail demand.
- Firms generally looking for environmentally sustainable solutions (including safety) but only if these achieved at little or no cost.
- There are exceptions, such replacing coal as heat source which also saves transport.
- Transporters seeking to eliminate waste – i.e. maximise two-way hauls.
- Little enthusiasm for paying more for environmentally good solutions in their own right.

Environment Canterbury South Island Freight Study

Notes for discussions with owners of goods (Producers and retailers)

What is the scale of your business in terms of the tonnages moved in the South Island? What are the main flows and particular commodities?

Do you make decisions about what types of vehicles are used? If so what are these?

Do you operate through inland ports or regional distribution centres? If so which ones and what volumes are transported through them? How do these fit into your distribution patterns?

What weight do you give to environmental sustainability in the transport operations undertaken for you? How much extra would you be prepared to pay for options that provided a more sustainable outcome? Are there examples of this?

Over the past 5 years or so, have you considered in outline or developed in more detail proposals that would result in traffic being switched from road to rail or in the more efficient or environmentally sustainable use of road vehicles? If so what were these and have they been implemented?

If these proposals were not implemented what were the barriers or constraints that meant that you did not progress them?

Do you have any other thoughts on how proposals like these for modal shift or more efficient operation could be implemented in a way which would be taken up by your organisation or similar organisations?

What are the main issues and constraints faced by your organisation in the movement of freight?

Do you think that new technology (electric vehicles, improvements in logistics, drone delivery, traffic management and prioritisation, self-driving vehicles etc) will affect your business? If so in what way and when might this happen?

Figure 4-1: Sample Notes for Discussion

Issues and opportunities identified by industry stakeholders and members of the PWG were evaluated and informed the identification of case studies.

Common issues were identified by industry stakeholders and the PWG. However, industry also identified a need for a long-term planning/funding horizon for rail. This is an important commitment required of the Government (as the owners of the freight rail business in New Zealand, both infrastructure and rolling stock) to provide sufficient assurance across the supply chain that rail is viable as a long-term mode choice for freight.

4.2 Issues Identified by Key Stakeholders

A workshop (Appendix A) was held with the Project Working Group (PWG) where a large number of specific issues were identified. Issues identified in discussion with other industry stakeholders were also introduced to this workshop by the Project Team. In summary, an assessment of the identified issues grouped them into five basic themes:

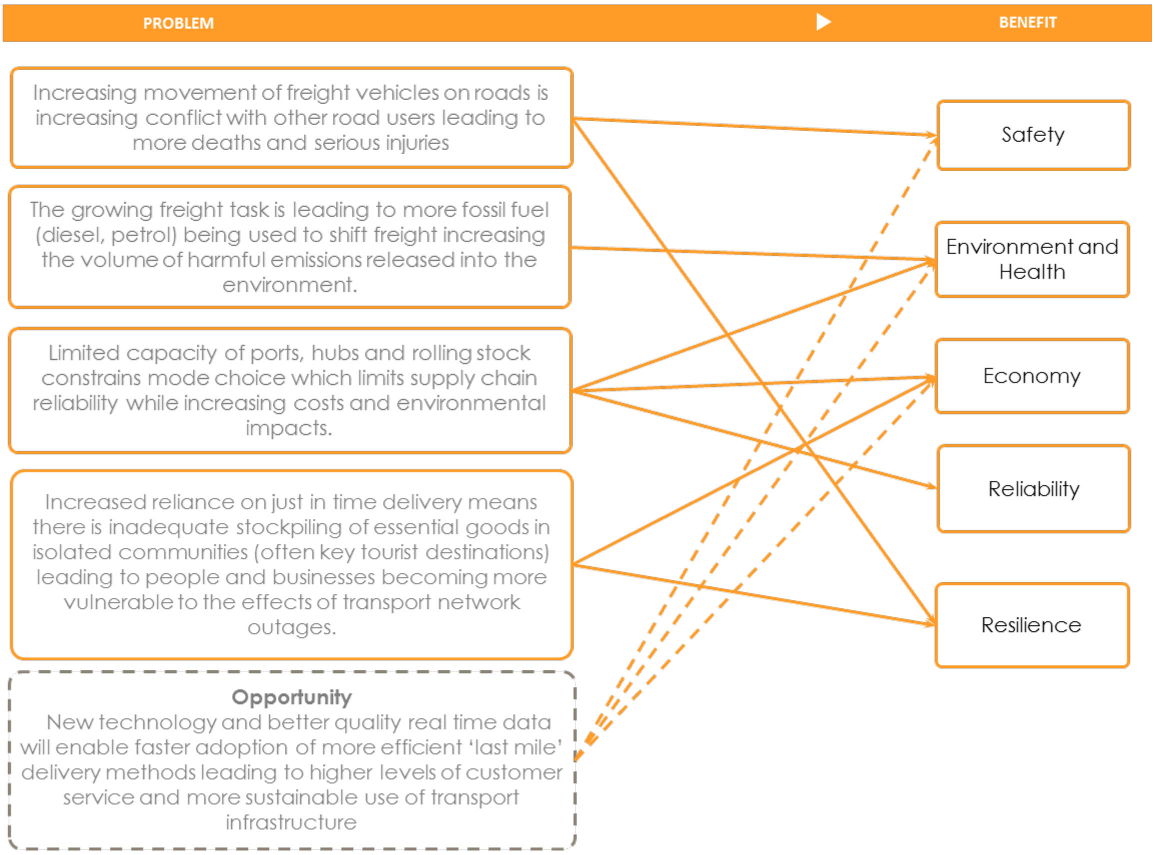
- Supply Chain (capacity, resilience)
- Infrastructure (capacity, reliability, resilience)
- Community outcomes (social, environmental)
- Economic certainty.

4.3 Problems and Benefits

The issues exploration was carried out consistent with an investment logic mapping (ILM) process by a qualified ILM facilitator (although not formally run and structured as a full ILM problem definition workshop).

As a result, post workshop, the study authors and the lead Agency developed draft problem, opportunity and benefit statements based on the issues identified, covering the key themes identified by stakeholders.

Further work will be required with key stakeholders to finalise these, weight them according to importance, confirm benefits and confirm relevant key performance indicators to support development of business cases.



The relevance and importance of these problems and the opportunity will vary across the South Island and depending upon the product or commodity being moved. For example:

- Safety, environment and health are likely to be common to all regions and both urban and rural environments.
- Limited capacity of ports, hubs and rolling stock were the most readily identifiable problems leading to the most direct opportunities to add value to the supply chain through additional investment in infrastructure and rolling stock, and many of the case studies were therefore targeted to helping solve this problem, which is common across most regions in the South Island.
- the opportunity identified may be relevant for Christchurch as an opportunity to pursue.
- Resilience was highlighted as an issue for Queenstown, the West Coast and to a lesser extent Nelson/Tasman.

5. Research

5.1 Freight Costs and Freight Mode Subsidies

5.1.1 Introduction

Although the transport of freight is vital to the effective functioning of a modern economy and to supporting the movement of exports, this imposes costs on third parties. This includes:

- the impacts on other road users through accidents and congestion
- impacts on the wider community through externalities such as pollution and greenhouse gas emissions and
- impacts on infrastructure providers through the consumption of the assets on which the modes operate.

This section considers the possible sale of these different costs and also the extent to which these are recouped from users and which are therefore taken into consideration when transport decisions are made. An assessment of the possible scale of the various costs is developed from a review of work in New Zealand and overseas. The extent to which users are covering the costs particularly of the consumption of infrastructure is based on a broad analysis of New Zealand data.

5.1.2 Transport costs and charges in New Zealand

5.1.2.1 Introduction

There have been several attempts in New Zealand to estimate on a comprehensive basis the scale of the full costs of transport including the associated externalities. There have however been challenges in keeping these updated in the light of changes in transport technology and the nature of freight transportation.

The initial investigation was probably the **Surface Transport Costs and Charges** study (STCC) published in 2005. This was based on data collected in 2001/02. A subsequent analysis of this which provided a simple allocation of costs (and revenues) by vehicle type was undertaken for the Auckland Regional Council in 2007 (**The True Costs of Transport by Road and Rail**).

The publication of the NZTA **Economic Evaluation Manuals** subsequently provided what was often an updated source of information. However, this was typically more focussed at an overall project level and the extent to which the costs identified could be allocated to different modes was less well defined. However, these figures supplemented by information from other sources was used the **Coastal Shipping and Freight Mode Choice** report undertaken by Rockpoint, which considered the costs to the community of alternative modes and in particular illustrated this with some case studies looking at specific movements.

In considering the external costs of transport it is important to recognise that with changes in technology the impacts may be changing over time. Changes in fuel consumption as engines become more efficient will reduce the level of greenhouse gas emissions although this may be offset by the use of more powerful engines with higher fuel consumption. In addition, improvements in technology may result in reduced pollution from road vehicles, a factor which would be aided by any reductions in fuel consumption. Both of these will be spurred on by the competition from electric vehicles and more rigorous legislative constraints on vehicles on fuel consumption and emissions.

Because of the age of the STCC and the extent to which the relationships identified in this have evolved over time, there has been little comprehensive assessment of the costs of different vehicle types and the benefits that might be achieved by changing the modes or methods of operation of these in recent years, especially since the demise of the "Alternative to Roading" assessments. Where any assessment has been undertaken this has typically been in the form of truck movements avoided or the reduction in CO2 emissions and there has been virtually no examination of other wider impacts. This current study is therefore intended to provide a basis for this comparative assessment developing a set of guidelines and framework which can be used to identify the relative costs of movement by different modes and the benefits that might result from mode switching. This has then been used to illustrate the impacts of mode switching through a selection of case studies.

5.1.2.2 The True Costs of Transport by Road and Rail

Although the STCC provides the basic framework, subsequent analysis based on this was set out in the "True Costs of Transport by Road and Rail"[2]. This considered the total costs of road transport under 5 main categories:

- Return on Recoverable Assets
- Maintenance and Depreciation
- Administration
- Accidents
- Environmental Costs.

Congestion costs were excluded from this list since these were considered as users costs rather than costs external to road users as a whole,

In particular it considered the balance between costs and revenues for different vehicle classes at a slightly greater level of detail than was undertaken in the STCC.

The results are summarised in Table 5-1.

Table 5-1: Breakdown of Costs and Revenues by Vehicle type 2001/02 ($bn)

	Total	Car	Truck					
			LCV	MCV	HCV1	HCV2	Total HCV	Total Truck
Total Costs								
Return on Recoverable Assets	0.75	0.42	0.11	0.05	0.03	0.13	0.16	0.32
Maintenance and Depreciation	0.78	0.44	0.12	0.05	0.03	0.13	0.16	0.33
Administration	0.36	0.27	0.05	0.01	0.01	0.02	0.02	0.09
Total Costs of Provision and Administration of road network	**1.88**	**1.13**	**0.28**	**0.11**	**0.07**	**0.28**	**0.35**	**0.74**
Accidents	0.67	0.51	0.11	0.02	0.01	0.03	0.04	0.18
Environmental Costs	1.17	0.67	0.20	0.15	0.05	0.10	0.15	0.49
Subtotal Social Costs	1.84	1.18	0.31	0.17	0.06	0.13	0.20	0.67
Total Costs	**3.73**	**2.30**	**0.59**	**0.28**	**0.13**	**0.41**	**0.54**	**1.41**
Social costs as % of total	*49%*	*51%*	*52%*	*61%*	*48%*	*32%*	*36%*	*47%*
Revenues to Road System Providers								
User Charges and Fees	2.33	1.48	*0.26*	*0.04*	*0.19*	*0.29*	*0.48*	0.79
Allocation of Local Roading Rates	0.29	*0.16*	*0.04*	*0.02*	*0.01*	*0.05*	*0.06*	*0.12*
Total revenues to road system providers	2.62	1.65	0.30	0.06	0.21	0.34	0.54	0.91
Financial Indicators								
Revenues as % of operating costs + accidents	139%	146%	108%	58%	304%	120%	155%	123%
Revenues as % of operating costs + ROA + accidents	103%	101%	77%	48%	261%	107%	138%	99%
Revenues as % of total costs	71%	71%	52%	23%	159%	81%	100%	64%

Notes Highlighted Cells are estimated for this note but are not allocated in the STCC Report

The key points from this table which is based on the position in 2001/02 which are developed in the report include-

[2] The True Costs Of Transport By Road And Rail A Brief Review For The Auckland Regional Land Transport Committee, Richard Paling Consulting October 2006

- For all vehicle types, revenues covered the costs of maintenance and administration of the road network and the costs of accidents.
- The revenues from cars and trucks as whole cover the costs of maintenance and administration of the road network, the costs of accidents and the return on recoverable assets. Within the truck category, there are significant differences by vehicle type, and the revenues from lighter vehicles (LCV and MCV) may not cover these costs.
- For HCVs, the focus of this study, as a whole they covered about 100 per cent of their costs including environmental costs HCVs

The differences between the vehicle types are extreme and these results therefore should be treated with particular caution. In particular, there appears to be an issue with the allocation of road user charges between the different classes of HCV (HCVI and HCVII). For these the allocation of RUC is approximately 43%:57% whereas the allocation by vehicle-kms would give a split of 30%:70% and by net tonne-kms would give 15%:85%. For this reason, we therefore consider it more appropriate to consider the position for heavy goods vehicles as a single class rather than consider the results for the two sub-classes.

On the basis set out in the report, the heaviest goods vehicles (HCVIIs) fell short of covering their total costs although for the lighter HCVIs the revenues were estimated to exceed the allocated costs.

The study also looked at rail costs and charges. For the rail network which at that time was owned by Toll, the estimated position for freight operations is included in in Table 5-2.

Table 5-2: Allocation of Rail Costs and Revenues by Sectors ($billions)

	Rail Freight	LD Pass	Urban Pass	Total
		Costs		
Costs of operation	0.23	0.02	0.04	0.30
Return on rolling stock	0.05	0.00	0.01	0.06
Return on recoverable assets	0.11	0.00	0.02	0.13
External costs – not allocated				0.01
Total costs of operation and return on rolling stock	0.29	0.02	0.05	0.36
Total costs of operations including return on recoverable assets	**0.40**	**0.02**	**0.07**	**0.49**
		Revenues		
Revenues	0.33	0.02	0.05 (1)	0.40
		Financial Indicators		
Revenues as % of operating and rolling stock costs	112%	96%	101%	110%
Revenues as proportion of total costs	82%	96%	75%	82%

Notes (1) Includes subsidy

All rail sectors broadly covered their immediate operating costs (including rolling stock provision) but failed to cover the full costs of the operation including a return on recoverable assets. This finding also applied to urban passenger services which were subsidised, indicating that even with this support the revenues were not sufficient to allow a reasonable return on assets.

In general, therefore for the movement of freight, heavy road vehicles as a group were estimated to cover the full costs of their movement (although there were issues about the allocation of costs within this group) and movements by rail while covering the costs of operation including rolling stock, did not cover the full estimated costs including the return on recoverable assets.

5.1.2.3 Coastal Shipping and Freight Mode Choice (the Rockpoint report)

The 2008 Coastal Shipping and Freight Mode Choice report undertaken for NZTA considered in more detail the externalities arising from the movement of freight by different modes, particularly in the context of changing the supply chains potentially involving coastal shipping. This analysis was largely derived from material in the EEM, which although still quite old, was based on more up to date data than the STCC.

Using these figures, externality costs were estimated on an overall system basis and these are set out in Table 5-3 below.

Table 5-3: System wide Externality Costs by Mode (2002 prices

Externality Costs by Mode (2002 prices)		
Type of Externality	Total Cost in 2002 ($million)	Average cost (cents per tonne-km)
Movement by Heavy Road Vehicles		
Greenhouse Gas Emissions	28	
Air Pollution	101	
Noise and Vibration	20	
Accidents	44	
Total	193	1.4
Movement by Rail	9	0.2
Movement by Coastal Shipping (1)	2-3	0.1

Notes (1) Relates to greenhouse gas emissions only and is estimated based on the difference between the emission rates for rail and shipping set out in Figure x.1.

On the basis of these figures the report concluded that

On a tonne-km basis, the externality costs associated with road are clearly much higher than those associated with rail and coastal shipping movements, with the average costs associated with road transport being 6 times as high as those for rail and 12 times as high as those for coastal shipping. However, these differences in the levels of externality costs are tempered by the typical need for road transport collection and delivery within the urban area to support movements for which rail or coastal shipping provides the line haul. This may be a particular issue for coastal shipping since ports are by definition almost always at the fringe of the urban area, involving relatively long road movements whereas rail intermodal terminals may be more centrally located reducing the length of road collection and delivery services.

This issue of the costs for through movements was illustrated in Table 5-4.

Table 5-4: Total Externality Costs - Auckland to Christchurch (2002 prices)

	Road	Rail	Coastal Shipping
Greenhouse Gas and Air Pollution	66	29	23
Accidents	144	18	12
Congestion	16.3	3.2	11.7
Total	226	50	47

A number of the movements by rail or coastal shipping particularly of general cargoes are likely to generate a need for collection and delivery within urban areas often at relatively fixed times limiting the ability to avoid congestion. As a result, the balance between the externality costs for a typical through journey from Auckland to Christchurch between the different modes is much closer than would result if only a single mode was used. The estimated costs via rail and coastal shipping are broadly similar with costs by road being about 4-5 times higher.

It was considered that the balance between road user charges and the costs associated with heavy freight were probably more favourable than had been estimated for the STCC given the likely reductions in the pollution costs as the road vehicle fleet modernised. This would suggest that for heavy vehicles as a whole, road user charges matched or more than matched the total costs imposed by these vehicles, using the parameters then current in the EEM.

5.1.2.4 The Value of Rail in New Zealand

The Value of Rail in New Zealand study was undertaken for the NZ Transport Agency in 2016[3]. This considered the effects if the freight (and also passengers) transported by rail had to be transported by other road-based modes. This however does not allow a comparison of the costs of movement by road and rail, being just concerned with the difference between the two and so is not easily comparable with the earlier studies quoted.

The main findings from the work were that the use of rail rather than road for freight resulted in the following main benefits: -

Table 5-5: The Value of Rail in New Zealand - Main Findings

Category of Net Benefit	Total Benefits ($m)	Percent of Total (1)
Net Congestion Benefit of Time Delays	$207.56m –$200.27m	59%
Net Safety Benefits	$60.50m -$56.24m	17%
Net Maintenance Benefits	$80.39m –$77.23m	22%
Net Emission Benefits	$6.27m-$5.79m	2%
Total Net Benefits	$354.72m -$339,53m	100%

Notes (1) Based on midpoint of range

Of the total impacts about 60 per cent are in respect of increased congestion, 22 per cent for maintenance, 17 per cent for safety and 2 per cent for emissions. Within the savings in congestion, about $82m or 40 per cent is in respect of travel in Auckland and Wellington with the balance $265m being for the remainder of the country.

On the basis of a total rail freight flow in 2015 of about 4.4bn tonne-kms the net effects per tonne-km of a transfer to road are set out in Table 5-6.

Table 5-6: The Value of Rail in New Zealand - Net benefits per tonne-km

Category of Net Benefit	$ per tonne-km
Congestion	0.047
Safety	0.013
Maintenance	0.018
Emissions	0.001
Total	0.079

Again, the high congestion value reflects in part the shares of Auckland and Wellington in the total.

While a detailed investigation of the impacts is outside the scope of the current study it should be noted that: -

- No allowance appears to be made for the reduction in road movements associated with getting traffic to and from railheads particularly in urban areas.
- The analysis assumes all rail freight will switch to road. No allowance is made for any switch to coastal shipping.
- Emissions only include CO_2 and exclude any other forms of pollution. In addition, they are valued at then current spot price, estimated at about $18 per tonne.

Maintenance benefits are assumed to be the same as the associated road user charge revenues from the additional heavy vehicles, which on this basis would be revenue neutral to the Transport Agency. This however is a different form of cost to the other elements of the benefits quoted which are externalities imposed on the community and not recovered from users.

[3] "The Value of Rail in New Zealand –2016" EY for the NZ Transport Agency

5.1.3 Studies in other countries

5.1.3.1 Introduction

A number of studies have been undertaken in other countries to assess the comparative environmental costs of different freight transport modes. To some extent the results from these reflect the organisations involved in the publication of these figures.

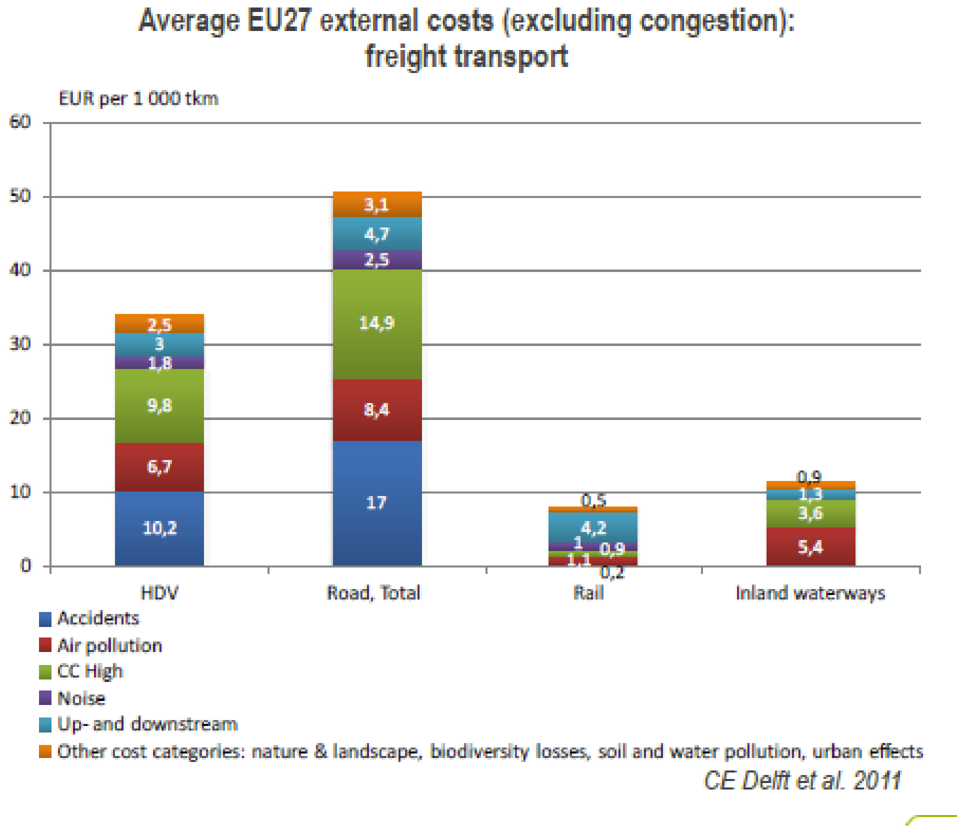
5.1.3.2 The EU

In the EU, detailed analysis of the externality costs of different forms of transport have been undertaken by the Delft Group These have taken into account a wider range of externality costs. These included: -

- Accidents
- air pollution
- greenhouse gas emissions,
- noise
- upstream and downstream costs and
- other environmental factors.

Congestion effects were excluded.

The position from recent studies[4] is summarised in Figure 5-1. These are based on a high carbon cost (CC High) of about Euro146 per tonne



Note Although the table refers to Up and downstream costs, it is only upstream costs that are included

Figure 5-1: Average external costs for freight transport in the EU

In this case the external costs of a heavy-duty road vehicle (HDV) at about 3.5 EU cents per tonne-km are 4-5 times higher than for rail (0.08 cents per tonne-km) and inland waterways at 1.1 cents per tonne-km

[4] CE Delft, Infras & Fraunhofer ISI 2011, External costs of transport in Europe: update study for 2008, CE Delft, Delft, Netherlands

about 1.4 times higher than rail. It should be noted that these figures just cover the costs of movement for the individual modes. For most journeys by rail or inland waterways one or more road legs would be added so increasing the overall environmental costs for the complete journey.

In terms of $NZ in 2011, the average costs would be 6.2 cents per tonne-km for road (HDV), 1.4 cents per tonne-km for rail and 1.9 cents for inland waterways. Although using different approaches, the balance between road and rail costs is similar to that estimated in the Rockpoint Study and set out in Table 5-4.

5.1.3.3 Canada

External freight transport costs have been examined in Canada and a report for Transport Canada [5] gives rather different results based on the comparative costs for selected point to point journeys. These journeys were

- Scenario 1 Great Lakes – Solid bulk – 25000 tonnes - Distance about 1500 km.
- Scenario 2 St Laurence System- Truck trailers and containers – 10,000 tonnes- distance about 1250 kms for rail and road and 1950 for shipping.
- Scenario 3 East Coast – Petroleum products – 35,000 tonnes, distance 1600 kms for rail and 550-650 for road and marine.
- Scenario 4 West Coast – Containers – 25000 tonnes – distance 1500kms for road and rail 700 kms for marine.

The results are presented in Table 5-7 below. The costs have been converted to NZ dollars.

Table 5-7: Total Environmental and Social Costs (NZ cents per tonne km)

Mode	Scenario			
	1	2	3	4
Rail	0.51	0.32	0.23	0.17
Road	1.27	1.03	1.00	0.61
Marine	0.10	0.21	0.03	0.08
Road as multiple of rail	2.5	3.2	4.4	3.7
Road as multiple of marine	12.2	5.0	30.4	7.8
Rail as multiple of marine	4.9	1.6	6.9	2.1

It should be noted that the figures in the table are again based on direct flows between origin and destination and do not include any movements by road to transport the cargoes to or from rail. This would typically reduce the differences between the modes, except where rail or shipping could serve the complete journey.

The differences between the costs for specific journeys in the table vary significantly reflecting in part the different journey lengths by the various modes and the effects of the different types of vessel for the different cargoes. The rail costs may also reflect the differences in the ways in which different cargo types are handled.

For the road/rail comparison the differences lie in the range of 2.5-4.4 with the highest figure reflecting the movement of petroleum. For containers and truck trailers the differences lie in the range of 3-4 with a slightly lower difference for bulks. These figures are probably broadly consistent with but slightly below those derived from the EU data, with the higher EU figures possibly reflecting the higher population densities and hence exposure to pollutants and accidents.

These ratios can also be compared with those derived from New Zealand studies. The Rockpoint study suggested an average ratio nation-wide for road/rail costs of 6 but a lower figure for the movement between Auckland and Christchurch which takes into account the use of road as part of the intermodal journey by rail of 4.5.

[5] *Evaluation of Environmental and Social Impacts and Benefits of Shortsea Shipping in Canada*"

5.1.3.4 Australian research

Research has been conducted in Australia by Austroads into the appropriate values of externalities associated with the movement of freight by road and rail for use in project assessment.[6] This provides a very comprehensive and relatively up to date compendium of the costs in Australia for urban and rural freight transport across 8 externality types as follows: -

- Air pollution
- Greenhouse
- Noise
- Soil and water
- Biodiversity
- Nature and landscape
- Additional urban/barrier effects
- Upstream and downstream.

To a significant extent this draws on the EU experience by CE Delft et al[7] outlined above in Section 5.1.3.2 but adapts this where necessary and feasible to Australian conditions. As part of this it develops separate values for movements in rural and urban areas.

The values that result converted to New Zealand dollars and updated to 2017 are set out in Table 5-8 for rural movements and Table 5-9 for urban movements. The movements by train and HCV per 1000 kms are highlighted to facilitate their comparison. The key costs are summarised in Figure 5-2.

Table 5-8: Externality Values: Freight Transport -Rural ($NZ 2017 prices))

Externality Type	LCV		HCV		Rail
	$/1000 tkm	$/1000 vkt	$/1000 tkm	$/1000 vkt	$/1000 tkm
Air pollution	0.00	0.00	1.40	15.53	0.02
Greenhouse	14.18	3.21	3.24	36.06	0.60
Noise	0.00	0.00	0.30	3.33	0.02
Soil and water	0.02	0.01	0.15	1.67	0.01
Biodiversity	0.01	0.00	0.10	1.11	0.00
Nature and landscape	0.01	0.00	1.15	12.76	0.10
Additional urban/barrier effects	0.00	0.00	0.00	0.00	0.00
Upstream	15.90	3.60	3.41	37.99	8.15
Total	30.13	6.82	9.74	108.44	8.91
Total exc upstream	14.23	3.22	6.33	70.45	0.76

[6] Updating Environmental Externalities Unit Values 2014 Austroads Publication No. AP-T285-14

[7] CE Delft, Infras & Fraunhofer ISI 2011, *External costs of transport in Europe: update study for 2008*, CE Delft, Delft, Netherlands

Table 5-9: Externality Values: Freight Transport - Urban ($NZ at 2017 prices)

Externality Type	LCV		HCV		Rail
	$/1000 tkm	$/1000 vkt	$/1000 tkm	$/1000 vkt	$/1000 tkm
Air pollution	31.75	7.19	13.99	155.72	2.78
Greenhouse	14.18	3.21	3.24	36.06	0.60
Noise	9.69	2.19	2.97	33.01	2.23
Soil and water	2.93	0.66	1.46	16.22	0.74
Biodiversity	1.20	0.27	0.98	10.95	0.00
Nature and landscape	1.56	0.35	0.11	1.25	0.01
Additional urban/barrier effects	5.59	1.27	0.95	10.54	0.29
Upstream	15.90	3.60	3.41	37.99	8.15
Total	82.80	18.75	27.11	301.74	14.79
Total exc upstream	66.90	15.15	23.70	263.75	6.64

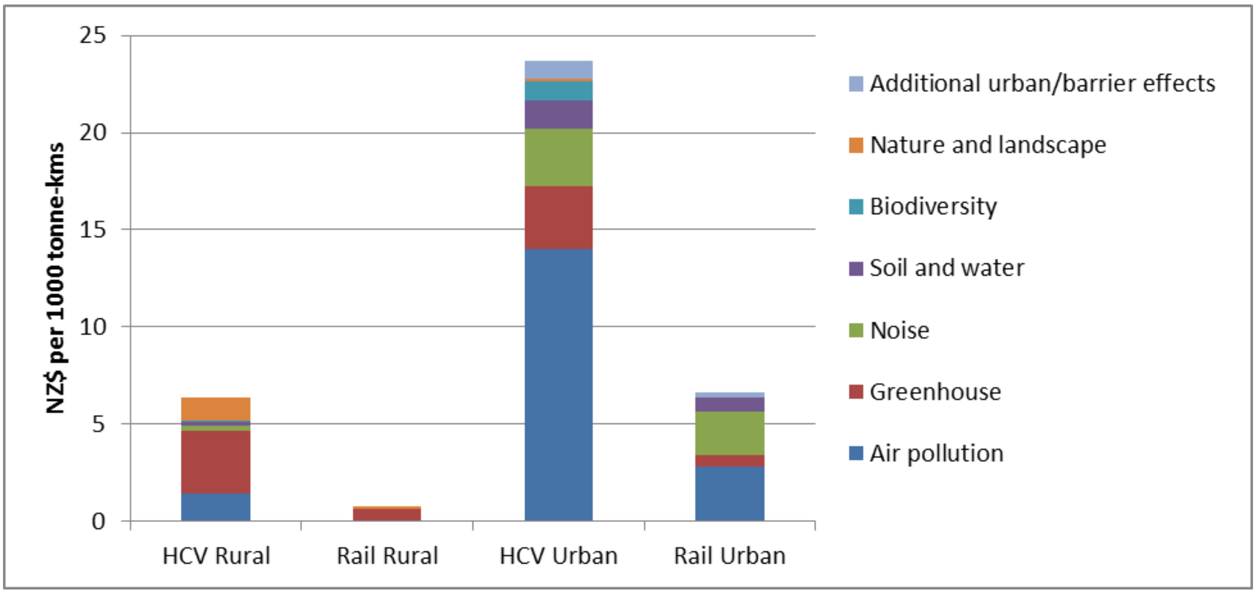


Figure 5-2: Environmental costs from AustRoads analysis ($NZ per 1000 tonne-km at 2017 prices. NB excludes upstream costs

A key element of the costs identified in the Australian analysis is "Upstream and downstream costs". These relate to the costs of fuel and electricity production which results in emissions (air pollution and greenhouse) due to extraction of raw materials, transport of the fuels and transmission of electricity. A detailed assessment of the rationale for this selection is outlined in CE Delft et al. (2011). It is not clear whether these are appropriate to New Zealand conditions, especially in relation to electricity generation, and they have therefore been excluded from the analysis.

Given the comprehensive nature of the Australian work and its likely applicability to New Zealand conditions the values derived for this study when converted to New Zealand dollars and updated to 2017 prices have been used for the subsequent analysis. It should be noted that this work is based on a carbon cost equivalent to Euro25 per tonne, which the Austroads work considered the most appropriate. This is equivalent to about $NZ60 per tonne in current prices which is substantially above the spot price but slightly below the value of $65 per tonne set out in the most recent version of the EEM.

To give a more comprehensive assessment, separate material on accident costs and the costs of congestion, which are not included in the Australian material have been determined separately.

5.1.4 Costs for use in the South Island Freight Study

5.1.4.1 Environmental costs

Environmental costs for use in this study have been derived from the Australian research described above with the details of this set out in Table 5-8 and Table 5-9. For the case studies the costs for HCVs have generally been based on vehicles carrying a payload of 30 tonnes outbound and empty for the reverse journey which would be typical for many of the movements considered. In the event that the payload was less, the environmental and other externality costs per tonne-km would be higher and so the costs estimated may be conservative for flows other than the types considered in the case studies.

5.1.4.2 Accident costs

5.1.4.2.1 Road accident costs

Average accident data for HCVs in the South Island has been derived from an analysis of the numbers and types of accidents for on the State Highway network over the period 2013 to 2017 from the NZTA database[8]. This has then been compared to the total heavy vehicle kms on the South Island State Highway network obtained from the Ministry of Transport database[9] to get a typical accident rate for the State Highway network. It was also not possible to gain a reliable estimate of heavy vehicle flows on the local road network. While it is recognised that HCVs use both local and national road networks, the effects of the proposed case studies are mainly focussed on routes on the State Highway network and so a factor derived for this was considered appropriate.

Taking account of accidents where heavy vehicles were not judged to be at fault[10] the total number of truck accidents over the 5-year period were about 60 fatal and 1,530 serious.

The average crash costs were estimated using the unit values from the EEM updated to 2017 values. These were calculated as $4.89m for a fatal injury crash and $0.52m for a serious injury crash. Applying these to the observed crash rate gave an average cost per vkt of about $0.22. This was then applied to the road distances.

5.1.4.2.2 Rail accident costs

Rail accident costs are small. Based on material in the Rockpoint report the costs per tonne-km were estimated about 1/8 of those observed for road vehicles. This ratio is similar to that determined as part of the Canadian externalities study reviewed above in Section 5.1.3.3.

5.1.4.3 Congestion costs

For most of the case studies the majority of travel takes place outside the main urban areas where any congestion effects are likely to be small. Congestion costs (taken as the impact of the removal of traffic) for the urban areas were estimated using the figures in Table SP10.1 of the EEM. This provides separate estimates for Christchurch and other urban areas (taken to be Dunedin for the movements identified in this study) for peak and off-peak conditions. The figures used for the analysis after appropriate adjustment and updating are set out in Table 5-8.

For areas away from the major urban areas, it was recognised that there would be some benefits from the removal of heavy goods vehicles from the roads particularly in the hilly areas which characterise much of the South Island. Examination of the studies discussed above suggested that the benefits from the reduction of congestion caused by the removal of these vehicles could be about 10 per cent of those in urban areas and this figure, about $0.04 per vehicle km was applied in the estimation of the overall congestion costs of vehicles.

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[8] https://opendata-nzta.opendata.arcgis.com/datasets/crash-analysis-system-cas-data
[9] http://www.nzta.govt.nz/assets/userfiles/transport-data/VKT.html
[10] This follows the approach in the STCC Study

5.1.4.4 Summary of road and rail externality costs

The costs identified in the previous sections are summarised in Table 5-10.

Table 5-10: Summary of Externality Costs for Road and Rail Movements Used in Case Studies

Cost item	Road Transport Costs ($ per 1000 tonne--kms) (1)		Rail Transport Costs ($ per 000 tonne-km)	
	Urban	Rural	Urban	Rural
GHG	2.4	2.4	0.6	0.6
Other Emissions	10.4	1.0	3	0
Other environmental costs	4.8	1.3	3	0
Accidents (21)	14.9		2.4	
Total exc congestion	32.5	19.6	9	3
Congestion				
	Christchurch	Other major urban centres	NA	
Peak	38.9	30.3		
Off-peak	17.8	14.7		
Rural - all areas	2.5			

Setting aside congestion, rail costs per 000 tonne kms are about 25-30 per cent of those for road for urban areas and about 15 per cent of those in rural areas. These are illustrated in Figure 5-33.

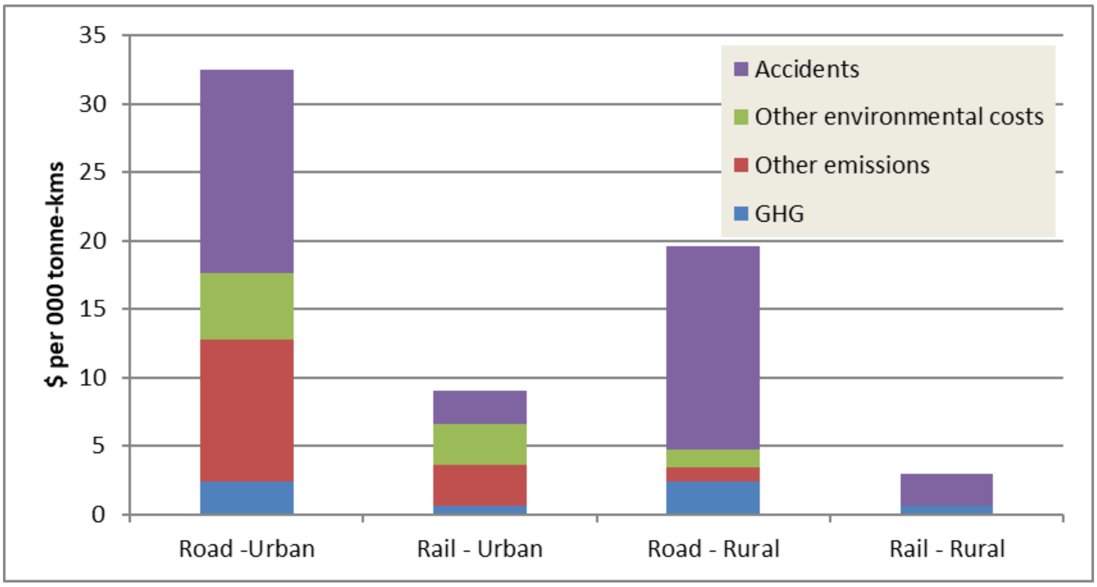


Figure 5-3: Comparative externality costs excluding congestion for road and rail ($ per 1000 tonne-kms)

5.1.4.5 Coastal Shipping Costs

We have also made a brief assessment of coastal shipping costs, although no shipping options where been considered in the case studies, apart from barging in the Marlborough Sounds.

The EU data on which the Austroads work was based focussed on shipping by relatively small vessels on inland waterways and so is not considered appropriate in a New Zealand context.

The Rockpoint work quoted earlier in Section 5.1.2.3 reported that for a journey between Auckland and Christchurch, taking into account truck movements for the initial and final legs of the movement, the externality costs associated with coastal shipping were about 21 per cent of the costs by road and about 95 per cent of the total externality costs by rail. For just the modal movements, the gap was more substantial with coastal shipping costs being about half of those by rail. This finding is broadly supported by the Canadian research quoted in Section 5.1.3.3.

Using this figure of 50 per cent and taking into account the balance of rail costs by rural and urban areas, the total environmental costs for coastal shipping have been estimated at about $2.00 per 000 tonne-kms

5.1.4.6 Road wear costs

For some specific truck movements and routes, the averaging used in the setting of road user charges means that the charges may not match the actual costs of the resulting road wear. The discrepancy does not lie in the road user charge rates themselves. The Ministry of Transport uses their Cost Allocation Model (CAM) to set road user charge rates per vehicle-kilometre for each vehicle class at a level that can fully recover the national aggregate costs of road wear caused by the national aggregate travel by each vehicle class, as well as other allocated costs. Rather, the discrepancy stems from the fact that road user charge rates are set based on the rated loading of the vehicle and an average load factor. The nature of averages is that there will be some circumstances where the road user charge rate is likely to be higher (or, conversely, lower) than cost for specific roads and vehicle load conditions. In particular, a heavy loaded vehicle on a low-quality road is likely to cause more road wear than it is paying for in road user charges. Conversely a lightly loaded vehicle on a high-quality road is causing less damage than it is paying for.

The averaging used in setting road user charge rates should make it roughly equally likely that the costs of a given movement will be under- or over-recovered. However, when examining the externality costs for the specific examples considered in the case studies, it is worth assessing whether there may be unmet road wear costs that should be regarded as an additional externality. An investigation was, therefore, undertaken to attempt to assess representative road wear cost figures. Road wear costs are an area where the research undertaken overseas discussed above provided no guidance.

Road wear is determined by two main factors.

- The total loadings of the vehicles using the pavement over time and the distribution of the loadings across the axle sets.
- The structural capacity of the different layers of pavement and their different abilities to resist a range of loads.

These two factors determine the extent to which the pavement damage affects the costs of maintaining the road in reasonable condition over time. Pavement damage will be especially high when the actual loadings exceed the design capacity of the pavement.

The damage caused by a vehicle is dependent on the way in which it is loaded and the weights to which each of the axles, or groups of axles, is subjected. Engineers measure the propensity of a vehicle to cause pavement damage in terms of its "Equivalent standard axles" (ESAs), where damage is proportional to the number of ESAs. ESAs are measured by comparing actual axle loadings to a standard axle loading. However, the relationship between axle loadings and ESAs is not proportional: an actual axle loading that is twice the standard axle loading is not two ESAs, but something considerably higher. This is because pavement damage increases rapidly with increases in axle loadings. There has been considerable debate about the relationship that should be assumed. The CAM assumes that a “fourth power rule” applies. To provide consistency with that model, this fourth power rule was assumed here.

Initially three vehicle types were considered, an 8-axle truck and trailer with a maximum gross vehicle weight of 44 tonnes, a 9 axle 50MAX vehicle with a maximum gross vehicle weight of 50 tonnes, and an 8-axle truck and trailer operating as an HPMV with a maximum gross vehicle weight of 53 tonnes. However, following a review of the vehicles likely to be used in the case studies identified, and to simplify the analysis, attention was focussed on the 50 MAX vehicles which were considered to be the most representative for the movements identified. Three possible operating arrangements were considered:

- A 50MAX truck and trailer fully loaded in one direction and empty in the reverse direction;
- A 50 MAX truck and trailer unit fully loaded in one direction and carrying two empty containers with a mass of 2.25 tonnes each in the reverse direction;
- A 50MAX truck and trailer fully loaded in one direction with the trailer loaded on the truck in the reverse direction, as is commonly the case for logging traffic.

Similar effects would be experienced for other vehicle types.

The loadings by axle that were assumed for a loaded 50 MAX vehicle are set out in Table 5-11. These would aim to minimise the damage caused by the vehicle and may therefore represent a lower bound of the damage caused. Offsetting this is the possibility that vehicles are not loaded to the full 50 tonnes gross vehicle weight, which would reduce the damage factor.

Table 5-11: Assumed Axle Weights and Forces for a Loaded 50 MAX Vehicle

Axle	1	2	3	4	5	6	7	8	9	Total
Mass (kg)	5000	5000	7000	7000	5200	5200	5200	5200	5200	50000
	Truck 24000				Trailer 26000					50000
Force (kN)	49.05	49.05	68.67	68.67	51.01	51.01	51.01	51.01	51.01	490.50

On this basis, the typical ESAs per axle group and in total for a loaded 50 MAX vehicle were estimated as shown in Table 5-12.

Table 5-12: Assumed Axle Weights, Forces, and ESAs for a Loaded 50 MAX Vehicle

Axle	1	2	3	4	5	6	7	8	9	Total
Mass (kg)	5000	5000	7000	7000	5200	5200	5200	5200	5200	50000
Force (kN)	49.05	49.05	68.67	68.67	51.01	51.01	51.01	51.01	51.01	490.50
ESA - exponent of 4	1.41		1.07		0.33		0.51			3.32

Using the same approach, the total ESAs for an empty vehicle were estimated at 0.35 where an empty trailer is towed, 0.65 where the return load includes two empty containers, and 0.92 for a logging truck with the empty trailer loaded on the truck. Taking into account a journey combining a fully laden movement in the outbound direction and the assumed mode of empty running in the reverse direction, this would give ESAs of 3.67, 3.97 or 4.24 per loaded kilometre, respectively.

Assumptions about the road asset consumption costs associated with the three specific movements identified above have been taken from CAM and are set out in Table 5-13.

Table 5-13: Road asset unit costs for heavy vehicle movements

Road damage-Cost per ESA ($ per 000 kms)	188.76
Other costs - costs per heavy vehicle ($ per 1000 kms)	
HV	13.85
PC	38.47
GVW	59.94
PV	42.02
Total other costs	154.27

On the basis of the ESAs determined for the particular movements identified above, the total costs for a movement fully laden in one direction and empty on the return are set out in Table 5-14.

Table 5-14: Total road asset costs for movement of 1000kms – 50 per cent loaded and 50 per cent empty ($)

Movement type	Cost per 1000kms ($)
50MAX towing empty trailer on return journey	501
50MAX returning with empty containers on truck and trailer on return journey	529
50MAX with trailer loaded onto truck for return journey	554

These road asset costs can be compared with the revenue that would be derived from road user charges. On the basis of the current price schedule a 50MAX vehicle would face the road user charges set out in Table 5-15.

Table 5-15: Current Road User Charges for 50 MAX Vehicles

Vehicle Type	Description	RUC Rate ($ per 1000km GST inclusive) as of 1 Oct 2018
H94	Towing vehicle that is part of an overweight combination vehicle consisting of a type 14 RUC vehicle towing a type 951 RUC vehicle with a permit weight of not more than 50,000kg.	392
951	Unpowered vehicles with five or more axles	161
Total RUC (($ per 1000km GST inclusive)		553
Total RUC (($ per 1000km GST exclusive)		**481**
Total RUC (($ per 1000km GST inclusive) laden in one direction with trailer stowed in reverse		473
Total RUC (($ per 1000km GST exclusive) laden in one direction with trailer stowed in reverse		**411**

For a trip of 1000 kms, laden in one direction and empty in the reverse, the total revenue to NZ Transport Agency (i.e. exclusive of GST) would amount to between $411 and $481 depending on whether the trailer was loaded onto the truck for the reverse journey.

Table 5-16 compares the modelled road asset costs from Table 5-14 to the current road user charges shown in Table 5-15.

Table 5-16: Comparison of road asset costs and RUC revenues for modelled heavy vehicle movements ($ per 000 kms)

Movement type	Modelled road asset costs	RUC revenue	Estimated unmet costs
50MAX towing empty trailer on return journey	501	481	20
50MAX returning with empty containers on truck and trailer on return journey	529	481	48
50MAX with trailer loaded onto truck for return journey	554	411	143

These figures have been used for the assessment of externality costs in the particular case studies identified. It is recognised that these figures, particularly for the actual road wear costs, can vary significantly from case to case depending on the specific road design load and actual loading, and will need to be reviewed for any more detailed analysis of specific opportunities.

While this analysis is considered to represent a reasonable assessment of the incremental position for the types of flows examined in the case studies, it should be stressed that these conclusions do not apply to heavy goods vehicle movements in general, as the CAM-recommended RUC rates are designed to recover the full costs of each vehicle class. A typical heavy vehicle would not be as heavily laden as the examples considered here, and so would not impose the same level of costs on the road network.

5.1.4.7 Rail infrastructure costs

In line with the estimation of unmet road wear costs a similar exercise has been conducted for the rail network.

For rail the position is rather more complicated because of the difficulties of establishing the marginal costs of increased rail use for rail freight given the use of parts of the network for other passenger services, which would be applicable in the case of additional rail flows between the West Coast and Canterbury In addition less information is available on the detailed costs imposed by incremental rail movements, which in some instances are likely to be very small, if additional wagons can be added to existing trains, or may be much larger if new train services are required. As a result, for this study the marginal costs of rail movement are assumed to be met by the additional revenues earned and no further adjustment has been included.

5.1.5 Comparison of externality costs with transport charges

Using the figures derived above it is possible to make an assessment of relationship of externality costs to the charges paid by shippers for transport. The position has been examined for the movement of logs from Stillwater to Lyttelton and the results are set out in Table 5-17.

Table 5-17: Comparison of Transport Charges and Externality Costs: Logs from Stillwater - Lyttelton

Mode	Transport Charges ($ per tonne)	Externality costs ($ per tonne)	Externality Costs as Percentage of Transport Charges
Road	50	8.3	17%
Rail - includes road haul to rail head	37	2.0	6%

For this example, the road transport the estimated externality costs amount to about 17 per cent of the charges for moving the logs, largely reflecting the unmet road wear costs and accident costs associated with the movement. For rail the externality costs would amount to only 6 per cent of the charges with about 15 per cent of these being associated with the delivery of the logs by road to the railhead.

5.2 Updating the Freight Forecasts for the South Island

5.2.1 Introduction

In order to support the case studies updated freight forecasts have been developed. These forecasts are based on the numbers originally set out in the 2014 NFDS and subsequently incorporated and revised in the MoT freight Outlook Model (labelled in this section as "Original"). The updated model takes into account more recent data on the production of primary products and estimates of population and regional GDP but assumes that distribution patterns remain broadly unchanged. These are denoted by "Revised"

As well as looking at regional patterns of production some analysis has been undertaken at a more detailed level and this is also included.

5.2.2 Approach

5.2.2.1 Introduction

The Freight Outlook model as developed makes forecasts at 10-year intervals from the 2012 base year to 2042/3. These forecasts are mainly generated in two ways: -

- forecasts based directly on the forecasts in the NFDS for the supply driven commodities or
- forecasts for other commodities which are calculated within the model and which are mainly based on separate predictions of economic activity primarily regional GDP, population and productivity.

The split of commodities between these two approaches is set out in Table 5-18.

Table 5-18: Split of Commodities by Modelling Approach

Commodity	Method of Forecasting
Liquid milk	Direct estimates
Manufactured dairy products	Direct estimates based on availability of liquid milk
Logs	Direct estimates
Manufactured timber products	Calculated within model
Meat	Direct estimates
Livestock	Direct estimates
Horticulture	Direct estimates
Wool	Direct estimates
Fish	Direct estimates

Commodity	Method of Forecasting
Other agriculture	Direct estimates
Aggregate	Direct estimates
Coal	Direct estimates
Petroleum	Calculated within model
LCF	Calculated within model
Steel and aluminium	Calculated within model
Manufactured and retail products	Calculated within model
Waste	Calculated within model
Other minerals	Direct estimates

Of the 18 commodity groups identified, 12 are directly forecast from the NFDS results and 8 are calculated within the model itself.

5.2.2.2 Updating the forecasts

For each of the commodities identified, implied forecasts for 2017 at a regional level were generated from an interpolation between the forecasts for 2012 and 2022, before any changes were made to the model inputs. This then provided a basis against which revised figures for 2017 again at a regional level could be compared. Forecasts for future years were made using the growth figures from 2017 derived from the original model but applied to the revised 2017 figures. In effect this implied that different levels of output in 2017 compared to the original forecasts would push up or down the forecasts for future years in proportion to the differences between modelled and observed in 2017. This is illustrated in Figure 5-45 based on the forecasts for milk output in Canterbury.

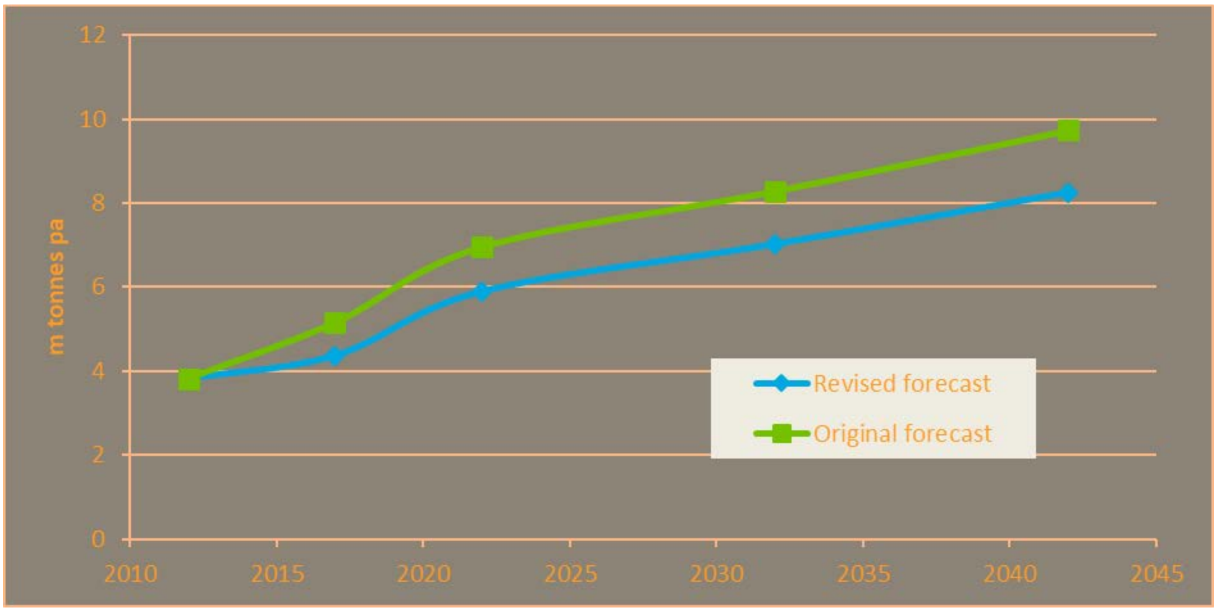


Figure 5-4: Comparison of original and revised forecasts for a typical product

A similar approach was taken for GDP forecasts where differences between the implied estimates for 2017 and the regional GDP estimates published by Statistics New Zealand were assumed to carry forward into the future, while retaining the original forecasts of GDP growth.

In addition, for the supply driven commodities it was assumed that the inter-regional patterns of movement between the regions would remain unchanged as a proportion of the regional total. For the commodities for which forecasts were generated in the model, the regional pattern would be also be determined within the model.

5.2.2.3 Comparison of position for 2017

The observed position for regional output for 2017 for the supply driven commodities has been derived from a number of sources[11] and for commodities for which figures were only available at an aggregated level, approaches were developed to allocate these to specific regions. For the non-supply driven commodities, the forecasts are based on the model outputs adjusted to reflect the updated GDP and population estimates. The comparison between the original and revised figures for the whole country is set out in Table 5-19.

Table 5-19: Comparison of Original and Revised Forecasts of Output by Commodity for 2017 (m tonnes)

Commodity	Original	Revised
Liquid Milk	24.17	20.70
Manufactured Dairy	6.55	5.65
Logs	35.37	30.56
Processed timber	10.01	10.03
Meat	1.38	1.51
Livestock	9.26	8.44
Horticulture	6.02	5.95
Wool	0.27	0.27
Other ag	6.93	8.89
Fish	1.11	1.11
Coal	4.47	2.85
Petroleum	8.43	8.43
Aggregate	30.02	26.69
Limestone, cement, fertiliser	13.74	13.53
Concrete	8.73	9.88
Steel and Aluminium	4.70	4.71
Manufactured and retail	85.09	86.05
Waste	8.14	8.28
Other Minerals	1.06	1.11
Total	265.46	254.64

The revised estimates by region and the comparison with earlier estimates for 2017 is set out in Table 5-20.

Table 5-20: Comparison of Original and Revised Forecasts of Originated Tonnes by Region for 2017 (m tonnes)

Region	Original	Revised
Northland	18.25	17.03
Auckland	56.63	57.29
Waikato	34.87	31.99
Bay of Plenty	30.70	26.62
Gisborne	4.42	4.86
Hawke's Bay	12.22	10.50
Taranaki	8.34	8.13
Manawatu	11.57	11.06
Wellington	9.32	9.79
TNM	10.69	10.15

[11] Mainly Statistics New Zealand sand Ministry of Primary Industries

West Coast	3.90	3.13
Canterbury	38.87	40.34
Otago	11.56	10.50
Southland	14.11	13.25
Total	265.46	254.64
Total SI	79.13	77.38

5.2.3 Forecasts for 2042

Using the growth factors derived from the original Freight Outlook model and the revised 2017 flows, the revised forecasts for 2042 are set out in Table 5-21.

Table 5-21: Originated Tonnes by Region (m tonnes pa)

Region	2042 Revised forecast	2042 earlier forecast
Northland	20.86	23.01
Auckland	90.22	89.83
Waikato	43.01	48.12
Bay of Plenty	35.22	37.94
Gisborne	5.17	4.85
Hawke's Bay	13.27	15.30
Taranaki	10.16	10.32
Manawatu	12.95	13.91
Wellington	13.47	12.81
TNM	12.41	13.32
West Coast	4.35	3.77
Canterbury	61.12	60.04
Otago	13.85	15.48
Southland	16.76	18.32
Total Output	352.82	367.02
South Island	108.48	110.93

The total growth forecast over time for the country as a whole is set out in Figure 5-5.

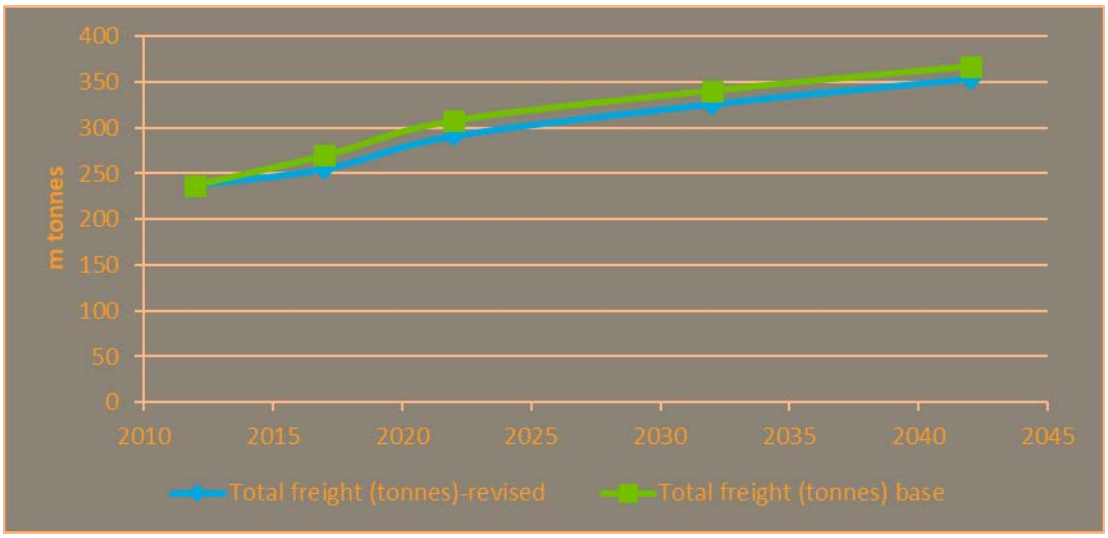


Figure 5-5: Comparison of total NZ freight forecasts (m tonnes)

The position for the South Island regions is set out in Figure 5-6.

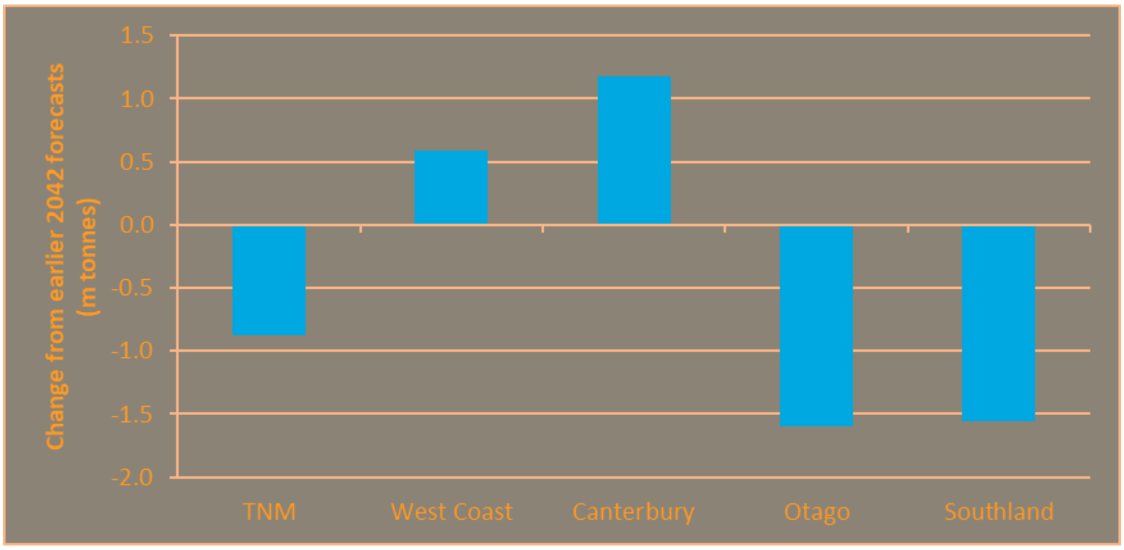


Figure 5-6: Changes in freight forecasts for 2042 - South Island regions only

The changes mainly reflect differences in the forecasts for primary products, particularly milk, logs and aggregates. The differences in the forecasts by commodity for 2042 for the South Island regions is set out in Figure 5-7.

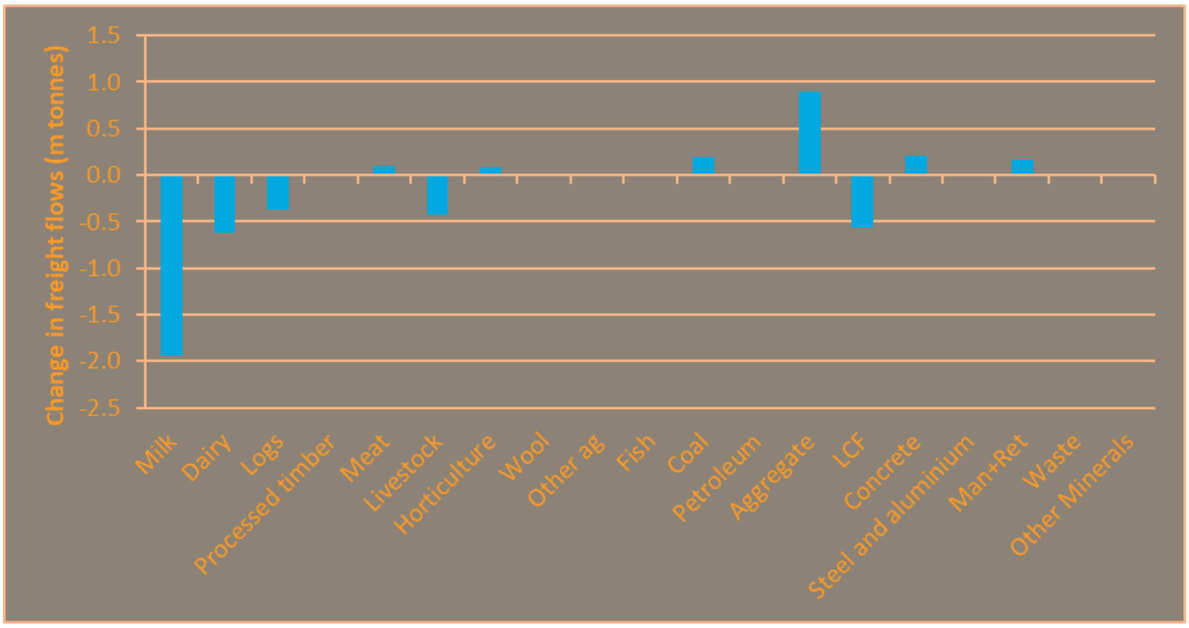


Figure 5-7: Change in South Island forecasts by commodity 2042 (Revised - original)

The major changes in the forecasts of South Island commodity flows are in the volumes of milk and associated dairy products and also in the volumes of LCF and livestock which may be related to this. Logging flows were also somewhat lower than earlier forecast. The main increases in the forecasts for 2042 are in respect of aggregates and concrete and also manufactured and retail goods, all of which probably reflect higher levels of economic growth than were previously forecast. Export coal is also expected to grow from its current low base (it is coking coal, used for steel making, and so not declining like thermal coal).

5.2.4 Forecasts at a more disaggregated level

Logs forms one of the major commodities transported across the South Island and data is available[12] to produce forecasts at a more disaggregated level, based on the age of the forests and the likely harvesting strategy. The forecasts are set out in Table 5-22:

Table 5-22: Log Harvest Forecasts by TLA (000 tonnes pa)

TLA	2017	2027	2037
Nelson City	118	149	163
Tasman District	1329	1480	1206
Marlborough District	1387	925	960
Kaikoura District	35	12	3
Buller District	41	16	43
Grey District	51	144	96
Westland District	94	152	71
Hurunui District	469	627	243
Waimakariri District	171	96	52
Christchurch City	228	96	36
Selwyn District	200	71	61
Ashburton District	41	34	29
Timaru District	179	186	51
Mackenzie District	85	53	17
Waimate District	188	167	64
Waitaki District	259	375	159
Dunedin City	200	90	273
Queenstown-Lakes District	14	4	0
Central Otago District	81	133	36
Clutha District	1026	1505	707
Gore District	64	102	4
Southland District	933	1532	587
Invercargill City	5	1	0
Total	7200	7950	4862

The pattern of forecast log production by area is illustrated in Figure 5-8.

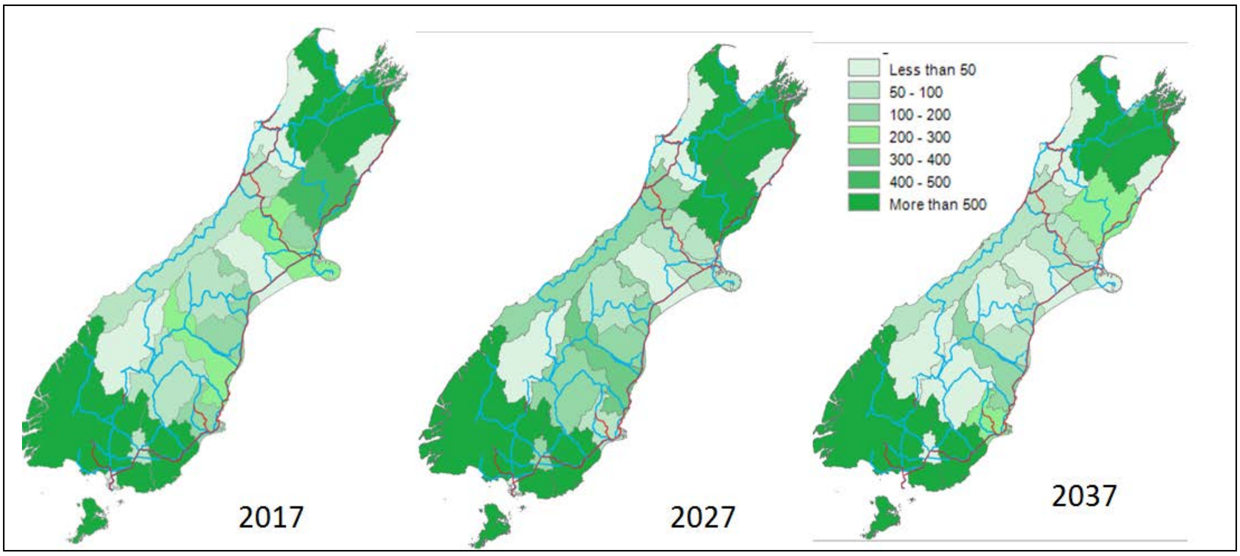


Figure 5-8: Forecast log production by district 2017, 2027 and 2037 (000 tonnes)

[12] National Exotic Forest Description MPI 2017

Above Figure 5-8 illustrates the dominance of the northern and southern parts of the South Island in log production and by considering these in association with the rail lines also included in the figure provides indications of the areas where there may be particular opportunities for diversion to rail.

5.3 Study of Technology Impacts and Risk Analysis

5.3.1 Overview

In considering how technological impacts may impact freight mode selection it is important to also consider the wider social and political drivers as shifts in policy, regulation and indeed public opinion and choice can driver quicker, or slower, adoption of new technology. On the New Zealand horizon are likely

- Shifts to drive Carbon Neutrality by 2050
- Increased focus on Zero Harm or road deaths on the road (or at least efforts to stem the current increases in fatalities)
- Continued steadily increasing volumes of on-line shopping
- Continued emphasis on regional economic and social wellbeing.

The role of technology in addressing any of these is best considered using a framework of where technological innovation is likely to occur. In particular this can be considered in terms of;

1. Changes in Engine Efficiency or Fuel Type
2. Vehicle Connectivity
3. Improvements in Logistics and
4. Innovations in “last-mile” delivery

Each of these areas of potential innovation are discussed below.

5.3.2 Areas of potential innovation

5.3.2.1 Improvements in Engine Efficiency and/or Changes in Fuel

Electric Vehicles improved, and “continuous” charging capability and hydrogen cell technology are currently all advancing at rapid rates. This is fuelled by a combination of disruptive innovators, policy changes and a general move in demand to more sustainable/green choices.

Some European countries, Cities and US States have voiced commitment actions such as banning either sales of new internal combustion engines by 2040 or earlier or banning such vehicles from city centres (Appendix B Examples of Fuel Commitments). It can be expected that the same push will occur sooner or later in NZ. In any event, as NZ is dependent on vehicle imports, these external policy initiatives are likely to drive changes in the availability and relative costs of different vehicle fleets and so flow on effects to the NZ market and vehicle fleet will occur.

Whether these changes in vehicle fleet will significantly change the current relative economics of different modes is yet to be seen or determined. Whether hydrogen cell powered rail freight will have significant additional economic or other advantages over electric trucks than the existing diesel options provide is unlikely without regulatory or policy incentives.

5.3.2.2 Improvements in Vehicle Connectivity

Technology improving vehicle connectivity is improving in terms of vehicle to vehicle (v2v), vehicle to infrastructure (v2i) and vehicle to other (v2x) needs. This is likely to lead to improved ability to platoon and increased safety.

Currently much of the v2v and platooning technology is focussed on long haul, straight roads in good weather conditions. In these circumstances significant energy and fuel savings can be accrued however the combination of NZ road and weather conditions and generally shorter hauls mean that these benefits will not be as great. However, v2v technology also has the potential to increase safety through a combination of communication of safety, road and traffic conditions between vehicles allowing early warning of hazards. Other initiatives such as Samsung’s “see-through” trucks (Figure 5-9) allow drivers of following vehicles improved knowledge of hazards ahead.

Figure 5-9: Samsung see through truck

Other benefits that are being explored are using v2i technology to improve intersection efficiency and reduce emissions at intersections by allow heavy vehicles priority. This is currently being trialled in Sydney on intersections with steep grades where poor heavy vehicle acceleration limits intersection throughput.

5.3.2.3 Improvements in Logistics

Technology and specifically the Internet of Things (IoT) is allowing the freight supply chain to be become increasingly "smart" with IoT enabled containers, vehicles, pallets, and overall transport systems. This combined with increased communication and data analytic power allows increased visibility and management options through the whole freight system for supply chain managers, purchasers, shippers, and freight forwarders.

It is expected that this increased visibility will drive new business models, new players, higher axle loads all aimed at improving truck delivery efficiency and improved service. In terms of this study the biggest implication is likely to be increased axle loads as the ability to improve manage loading improves. This will be somewhat limited in some cases by;

- Single use carriers and trailers for many bulk freight items and
- The one-way flow of freight in much of the South Island
- The increasing need for rapid delivery making the assembly of large loads more difficult.

5.3.2.4 Innovation in Last-Mile Delivery

The global rise in on-line shopping is resulting in changes in last-mile delivery regimes. New Zealand is not immune to this trend. Concurrent changes in logistics capabilities, "delivery-vehicles" and commercial management options mean that there are a potential variety of last mile freight implications.

Figure 5-10: Percentage of New Zealanders shopping online

Some of the implications potentially might include;

- A rise of both land and air drones making last mile deliveries
- The establishment of either fixed or mobile pick up locations

- An ability to integrate or combine delivery from multiple companies in specific zones
- A rise in demand and/or requirements to pick up returns or packaging.

Other jurisdictions are looking at a variety of regulatory and management options to respond to these changes and opportunities. These include;

- Requiring delivery in urban locations be made by electric vehicles for primarily noise and air quality reasons. This will become increasingly common as manufacturers develop more and more electric commercial vehicles.
- Controlling the locations of pick up and drop off locations with the intent of ensuring these do not cause unintended network efficiency or safety issues and developing appropriate design standards for these sites.
- Licensing operators in particular areas to limit the volume of traffic in heavily congested zones.
- Considering controls on drone delivery to ensure compatibility with pedestrian, cycle or other modes.

5.3.3 Next steps for technology Implementations

Significant time and money could be spent on trying to understand the impacts of technology and how to manage these impacts in New Zealand. Experience overseas is to expedite this understanding through the implementation of trials.

Regional Councils and regulatory authorities in general should be focused on encouraging and enabling trials. Experience in other countries is that the sooner trials are started the sooner issues and opportunities are identified.

Trials generally should cover the following:

Table 5-23: Technology Trials

Area to be Investigated	Private or Public Interest
The new technology itself – does it work	Private enterprise focus
Any regulatory or legislative issues	Public sector focus
The physical and systems issues – e.g. connectivity, power supply, design detail issues	Public sector focus
Public acceptance	Public sector focus
Economics	Private enterprise focus

Some specific areas of interest for Councils in the South Island should be:

1. What will be the electricity/charging demand if a lot of the last mile delivery fleet is converted (by compulsion or other) to electric
2. What will be the electricity/charging demand if the HCV fleet changes to electric?
3. What will be the policy, regulatory and physical needs to facilitate drone (air or other) last mile delivery
4. What will be the policy, regulatory and physical needs for mobile delivery/pick up locations?

5.4 Constraints and Opportunities

5.4.1 Rail operations

This section identifies a number of barriers and constraints to modal transfer, particularly from road to rail. It also posts opportunities for solutions.

5.4.1.1 Interaction with rail

Discussion with stakeholders revealed a number of issues they perceived as restricting the ability of rail to haul increased levels of freight. Individually or in combination they have led to a view expressed by many stakeholders that rail is difficult to deal with. That perception needs to be changed if efforts to transfer freight from road to rail are to be successful.

5.4.1.2 *Line* capacity

The capacity of rail routes was raised, particularly in relation to the Midland line between Rolleston and the West Coast. Like nearly all the railways in the South Island, this line is a single-track line, meaning the one track is used by trains in each direction, under controlled conditions. Capacity on a railway can be impacted by several factors: locomotive power, availability of wagons, distance between crossing loops (on single track lines), number of wagons per train axle load for wagons, and clearances.

In addition, the Midland Line includes a long steep tunnel, the Otira Tunnel, which imposes additional capacity constraints. It is 8.55 km long and on a 1 in 33 grades from west to east (that is, it rises 1 metre every 33m, or 30.3m per kilometre, a very steep gradient by railway standards). This grade limits the load a train can carry eastbound (or requires more locomotives per train, increasing costs). Train travel through the tunnel is at limited speed, and in addition the use of multiple locomotives means the tunnel has to be artificially ventilated. The need to clear the tunnel of fumes after the passage of a train, and the need to allow for trains in the reverse direction, limits eastbound movements to 12 trains per day. To make a difference to that would require longer and heavier trains (which have been trialled in the past for coal), or a change to electric or other low-emission locomotives (e.g. hydrogen powered). Longer trains would increase the capacity of the coal trains (and potentially water trains) by 50%; alternative power sources could more than double the tunnel's capacity.

At present there are only seven eastbound trains including the *Tranz Alpine* passenger train, so the tunnel capacity is not an issue. At present the export coal volumes are about 1.3m tonnes, handled by four weekday trains. Given the increasing resistance to the mining and use of coal, it is unlikely to revert to previous high levels. The export coal is however coking coal for steel making and is a necessary ingredient in that process. So, we estimate that the levels could return to 2m t in the future, an increase 50% or two trains. Even then it would not fill the tunnel.

There is a misconception that the capacity through the tunnel is controlled by Solid Energy's successor, Bathurst Resources, either for minerals or any traffic. Both Bathurst and KiwiRail assure us that that is not the case for coal, other minerals, or other commodities.

The tunnel is therefore open to further traffic increases if there were successful moves to make further use of rail. The obvious case is the potential movement of bottled water, which could increase over time to quantities requiring an extra daily train, of similar size to current coal trains. Other possible traffics are of smaller volumes and would be likely to be carried on the existing non-coal trains. These trains currently carry dairy products, logs, meat, and general traffic. They used to carry gold slurry from Reefton before that deposit was worked out, so there is a gap in their demand that could be filled (by garnet for example) before any new trains are required. Even so, even if the modal transfer efforts were so successful as to require another extra train, there is room for it.

Note that nearly all current traffic is carried west to east. There is substantial capacity available for additional tonnes moving from east to west, (for waste, as an example). While wagons moving from the West Coast have to be balanced by wagons moving in the other direction, these wagons are largely empty and do not pose any weight limitation. They do occupy train paths through the tunnel, but KiwiRail has recently experimented with combining two empty coal trains into one 60 wagon train, which frees a westbound path through the tunnel.

Outside the Otira Tunnel, there are more train paths available. Generalising is difficult, because crossing loops vary in length and so longer trains may not be able to pass at all of them. However, there are 13 places where trains can pass in the 198km of the Midland line outside the tunnel section, and the line speeds are such that none of the sections poses a capacity constraint anywhere approaching that of the tunnel.

Clearances on the Midland line are restricted by a number of tunnels. They can accommodate 8ft 6in (2.6m) containers on ordinary wagons but not "hi-cube" 9ft 6in containers (2.9m) except on a limited number of low deck wagons. Westland Milk traffic could use the additional space in a hi-cube container without overloading it, and so is restricted by these tunnels. They would cost in the tens of millions of dollars to increase the available height. However, Coda has developed a curtainsider body to fit a standard container wagon and achieve increased loading without breaching the height limit (which is typically at the top corners of an ISO container). These containers are about to be trialled in the Westland Milk traffic. Westland Milk is the largest user of containers on the line.

This section has focussed on the Midland line, as that was the route for the traffic in most of the case studies. Elsewhere in the South Island, all routes are available for 2.9m containers (and indeed the main line south of Port Chalmers uses 3m (10ft) high non-export containers). There are adequate crossing loops to allow for current and likely future numbers of trains. With some minor exceptions, all routes, including the Midland Line, can accept 18t axle loads, or 72t gross per wagon.

5.4.1.3 Rolling Stock

Many stakeholders raised the question of availability of locomotives and wagons, because they had been turned away by KiwiRail because of an asserted inability to provide enough wagons or locomotives for the traffic. KiwiRail's South Island locomotive fleet is finite and does come under pressure. KiwiRail is planning to replace its South Island fleet with new locomotives, which will relieve that situation. The timing would probably coincide with the increased demands related to the traffic arising from the case studies. Some of the North Island fleet of the same type as used in the South Island may be able to transfer south as new locomotives are added to the North Island fleet, although traffic levels are increasing there too, especially logs. There is also a shortage of locomotive drivers.

There is pressure too on the wagon fleet especially in the peak dairy season. KiwiRail is buying new wagons; in 2018 some 235 new container wagons were added to the fleet. Most of these replaced older wagons (some of which found new uses in the forestry sector). If the case study traffic is profitable for KiwiRail, then it should justify the purchase of further wagons. If this traffic is not commercially viable but should be transferred to rail for externality reasons, then external funding would be required.

Some caution should also be taken with respect to the interpretation of stakeholders' comments. Some experienced shortages of capacity when the Main North Line to Picton was restricted because of earthquake damage. Subject to ferry capacity, this should now have been solved, although adverse perceptions may linger. Extrapolations from one wagon type to another, or generally over all wagons, should be avoided. KiwiRail for example was unable to carry a line of river protection boulders on the West Coast, because they required specialist wagons that KiwiRail did not have. That they did not have these wagons has nothing to do with their ability to carry other traffic such as coal and containers.

A particular shortage noted was that of log wagons. Much of KiwiRail's fleet of log wagons consists of container wagons that have been de-rated to carry a lighter load. As it buys more new container wagons so more wagons can be converted to log wagons. In the case study of logs at Stillwater, a different solution to increasing log carrying capacity has been found. The current wagons have log bolsters (cradles) that can handle two "bunks" (bundles) of logs. As the logs being moved are short logs, there is room for another set of cradles, so the wagons can carry 3 "bunks". The log-loading siding at Stillwater is also limited to 17 wagons. Adding the extra set of cradles is estimated to increase the capacity of both the wagons and the siding by 25%. As well, KiwiRail are considering additional siding sites, and improving the turnaround of wagons at Lyttelton. Improving turnaround means a greater volume can be carried by a given number of wagons.

5.4.1.4 Resilience and reliability

Stakeholders also raised the reliability and resilience of the railway service. These concepts often overlap, but it is convenient to separate them: reliability to mean consistency of service in every day operation, including short term outages, accidents, and other disruptions, and resilience to mean not being subject to random outages, principally of the track, caused by weather or other natural phenomena, and longer-term equipment failures.

Reliability is highly valued by shippers, who expect consistent service. Poor reliability can be caused by locomotive or driver unavailability (e.g. sickness), failures en route, excessive loads for scheduled trains, and infrastructure failures like signalling. As well as there not being enough locomotives, they are also old (the average age of South Island locomotives is 42 years). KiwiRail's 2018 Annual Report notes there was an unexpected locomotive refurbishment programme required during the year, for South Island locomotives, which affected reliability. Both number of locomotives and age tend to impact on reliability, despite upgrades and intensive maintenance. The planned replacement of these locomotives should help address the reliability issues, although again adverse perceptions may remain. Positive actions by KiwiRail may be required to counter these.

Resilience is less tractable. The Midland line has been closed by a fire and a washout in the last two years. The washout lasted several days, and the fire several weeks, as it burnt out a bridge. The Main North Line was clearly wrecked by the Kaikōura earthquake and took 10 months to reopen for trains. The line south of Dunedin was recently closed by floods, for 8 days, disrupting the flow of dairy products for export. In most of these cases the parallel state highway was also affected. In a number of cases the rail and state highway are not closed simultaneously, and each can offer resilience to the other. Some resilience gains can be made by better preparedness, but otherwise improving resilience is a capital-intensive problem, and not generally able to be dealt with systematically. The risk of fire though is being abated by the ongoing removal of timber components in bridges across the country, including in the South Island. KiwiRail also monitors the stability of all key slopes on the network and deals with them on a case by case basis. Capital improvements for resilience need not be confined to one mode, as each will help the other. So, investment in ports and rail should be considered as well as road.

5.4.2 Opportunities for developing intermodal transfer facilities

Some of the case studies involve the establishment of small inter-modal transfer terminals, based broadly on the model of Tokoroa. For these to work, they need adequate land over a reasonable length, and a paved area to accommodate forklifts. Several factors need to come together to make these works.

First, there is the need for a reasonable level of throughput. Although the terminals can be quite small, there still needs to be a level of traffic that will make use of the terminal, say 7.5 wagons a day on average for a 15-wagon capacity terminal. 7.5 wagons can carry approximately 400t of freight in each direction, although the traffic is likely to be unbalanced as to direction (itself another constraint). But wagons are unlikely to be fully loaded, depending on the commodity. Assuming 200t per wagon, over a 240-day year, this is just under 50,000t (p.an in one direction). It is understood though that the use of Tokoroa is less than this.

To generate this level of traffic in the relatively small communities that such a terminal would be useful for, a major user is needed, as an equivalent to an "anchor tenant" in a shopping centre. For example, a small distribution centre would suit. Such a firm could manage the terminal itself, allowing public access for others to use it, or it could simply be a user of a terminal run by KiwiRail or a local council. In both cases, it is useful if it can integrate with other potential freight sources like logistics operations, warehousing, or manufacturing. The terminal at Tokoroa is run by a transport and logistics business, which has a large store on site from which it distributes animal supplements throughout the country and is in the middle of an industrial area which includes manufacturing firms.

If the terminal is built and owned privately, it is important that other parties have access to the terminal, both to build volume and as a likely condition of any external funding.

This raises another constraint the availability of land, on either a private site or on KiwiRail land. It obviously has to be adjacent to a railway line and would be of the order of a minimum 250m long by 20m wide, including the siding and hardstand (not including any related stores).and level. If it is on private land, KiwiRail is likely to treat it as a private siding, and charge fees to establish and maintain it, as well as rent for any portion on KiwiRail land. If the site is however more of a common user site, and established on KiwiRail land, it may be treated as one of their freight handling sites and no discrete fees paid (rather the costs would be reflected in the freight rates). The cost of land purchase, an issue with a private siding, would be avoided if it was a KiwiRail facility.

The site will need permission under the Resource Management Act 1991 to be built and to operate. Rail transfer sites involve the use of heavy machinery and can generate noise; and as well by definition they generate road traffic. It may draw objections. If the site is within railway land, then the designation of that land for railway purposes should cover the operational aspects, though no doubt the change in traffic levels would need some consultation with, if not permission from, the local authority. The designation does not cover regional council matters like drainage and water and air quality. If the site is on private land, it may be better sited within an existing industrial area where the impacts are within the limits already established.

The paving on the terminal needs to be heavy duty to enable heavy containers to be handled. We have estimated that this is a minimum 15m wide over the 250m length, at a cost of $250 per square metre.

The proposal would need a number of parties to be enthusiastic about it to succeed. KiwiRail would obviously need to be supportive, which probably means a certain minimum level of traffic is required. Councils and NZTA also need to be enthusiastic to adjust their roading systems to the new traffic flows, and potentially to provide funding or support applications to other agencies.

A trip by rail naturally involves and origin and a destination. We were told of some potential rail traffic not being available to transfer because facilities were not available at one or the other end, especially the destination. This need not be another common user facility but could be a simple private siding.

Building a terminal does not mean it can automatically be economically served by rail operations. Depending on its location, special shunting services may be required, and shunting staff brought in from their base. Turnarounds on the terminal might have to be short to match the train pattern, and to avoid demurrage on containers. If the volume of freight is significant, however, it may be possible to alter the train pattern to suit it.

A small-scale terminal may also not be a priority for KiwiRail. A restriction on the length of time over which KiwiRail can lease land to other parties may also be a barrier to private investment. And the lease prices themselves may be a barrier.

Operating the terminal (for example, managing loading and unloading, coordinating traffic to share the site and wagon capacity, providing lifting equipment, monitoring container dwell times, ensuring health and safety) needs expertise. A suitable manager needs to be responsible for the operation. Clearly this could be KiwiRail, or it could be a major customer with suitable equipment and experience, such as the "anchor tenant" mentioned above.

Similar considerations apply to the provision of inland port facilities, which are entirely privately owned.

New terminals are likely to generate increased employment for the staff required to manage and operate the facilities. We have tentatively estimated these at about 2.5 persons for a small facility although that would increase with high levels of throughput.

5.4.3 Market issues

A key factor affecting the potential use of inland terminals are the relative charges for movement of particular commodities by road and rail especially if the full costs of provision of the terminal facilities (including land purchase and development) have to be recovered from those transferring goods between road and rail. This is affected by the costs which transport operators themselves face which in the case of road transport in particular are below the full resource costs of the movement. The analysis elsewhere in this report indicates that these externality costs which are not recovered from transport operators and which do not therefore affect modal choice decisions can be substantial. These costs can be taken into account in the development of cases for public sector investment by agencies such as NZ Transport Agency, and central and local government but internalising them by appropriately valuing and charging for them may be a better long-term approach.

Another barrier to modal transfer may be the disruption that implies to existing supply chains. Where that is a matter of cost, that can be dealt with by the mechanisms above. However, where it involves time, it may be less tractable. Transfers to and from rail take time, and the rail journey itself is likely to be slower than for road. Time is more highly valued for some commodities than others and seeking to transfer the likes of fast-moving supermarket goods will be difficult. All the case studies considered in the context of modal transfer have involved commodities for which time is not critical.

In addition to the capital costs of establishing a transfer facility, transfers to rail also cost for the equipment time and staffing. This is a cost that is not borne by a purely road journey. In some cases, if other value is added at the point of transfer (e.g. sorting, grading) this cost is no longer simply a function of the intermodal transfer.

A number of the case studies have considered products or commodities that as yet are not produced. One of the key barriers in these cases is the economics of the commodity concerned. These commodities are often traded internationally and have alternative sources of supply if New Zealand costs are too high resulting in possibly volatile demands. Thus, they may actually not eventuate. And if they do, they will be seeking to minimise costs. A case in point is garnet, which may have the option of moving by road to Timaru (for the first stage at least) because a backload has been secured.

The competitive position of rail compared to road tends to improve with distance. For example, we understand that log transfer to rail is not likely to be competitive (in the absence of externality pricing) for rail haul distances of under 75-80 km. There are however exceptions to this, for example inland ports work over very short distances. In these cases, the key factor is typically not the cost of transfer and rail haul, but the savings in land and other costs that take place at the port (which may have a very constrained footprint). Inland terminals may also benefit from cheaper land for distribution and logistics activities than if they were located in proximity to the ports.

The directional imbalance issues discussed above can be exacerbated by container supply. One container is not generally substitutable for any other container. For a start, food grade containers are required for dairy exports, and internal movement of food products. Such containers cannot be used in an otherwise empty leg for products that may contaminate them, such as waste (at least, not without extensive cleaning and preparation). For some food exports, refrigerated containers are required, which further reduces their alternative uses. But even for plain dry containers, different shipping company ownership means that one company's containers may not be interchangeable with other companies' containers. This hinders two way loading and matching of inbound and outbound loads at sites remote from ports.

5.4.4 Technology issues

The report has identified opportunities for improving urban distribution with alternative technologies like electric vans, and through better coordination of multiple deliveries.

Clearly the technology has to be available to be deployed. Constraints like battery life and range are being addressed, but there are still barriers to scaling up the technology from cars to vans to trucks. New

Zealand experience is so far limited. Examples at present appear to be vehicles with a fixed route and stop-start operation, like waste pick up. Right now, purchase cost is also a barrier. Beyond urban distribution, there appear to be barriers to the use of electricity for long haul and heavy vehicles. Biofuels and hydrogen may offer better solutions.

Our market is also small and remote, which means there is limited supplier interest in it until the scale of production becomes much greater.

Urban delivery at present depends on high utilisation of vehicles and staff. If electricity was to be used extensively, then a denser network of charging stations would need to be provided. As well, the time taken to recharge detracts from the utilisation, and may be a barrier to uptake. The lack of higher capacity power supplies to charging points is thus another constraint.

Multiple deliveries to a single address are becoming an issue in the US and is likely to develop here with increasing on-line shopping. Coordinating these deliveries (e.g. through an intermediate warehouse) to reduce urban trips is likely to be difficult. Companies value speed of delivery, and as well multiple deliveries appear to save them coordinating costs. To impose a coordination seems to cut across these drivers.

5.4.5 Summary

In summary the key constraints and barriers to the movement of goods by alternative means are as follows:

- Potential capacity issues on rail, mainly in relation to availability of wagons, e.g. for logs, but also locomotives. In some cases, clearances can be an issue. Line capacity is not an issue, though with significant growth the Otira Tunnel might be a constraint.
- Reliability of rail services exacerbated by recent locomotive problems. KiwiRail plans to renew its South Island fleet.
- Resilience of rail to natural events.
- A perception arising from these issues that rail is difficult to deal with. This will need to be addressed if transfer from road to rail is to be successfully achieved.
- Availability of traffic to support local transfer terminal development, and to enable it to be served economically by KiwiRail. A large user would help anchor such terminals.
- Availability of land for terminals, and planning permission to use it. KiwiRail may have land available.
- Lack of a mechanism to compensate rail for its better performance relative to road with respect to externalities. Note that businesses are starting to focus on social and environmental KPI’s to tell a story that attracts customers to their brand, so better alignment of externality costs across modes will also align better with industry expectations.
- Economics of developing particular traffics make forecasting and investment difficult – some proposals may not eventuate.
- Development of electric or other alternatively powered vehicles is in its early stages, especially in relation to heavy vehicles.
- Coordination of multiple urban deliveries is likely to be necessary to limit urban traffic and emissions, but difficult to achieve.

6. Case Studies

6.1 Introduction

In order to examine the potential for diverting freight from road to rail or of other ways of reducing its environmental impact a number of case studies were identified. These considered cases there was a reasonable expectation that there might be realistic opportunities to achieve a modal switch which would have beneficial impacts for the community as a whole. These comprised a combination of movements of specific commodities and the development of terminals or inland ports which could be used for a variety of commodities. A long list of opportunities was initially developed which was subsequently reduced in size to match the resources available from the study.

It should be noted that these include the West Coast waste to energy project which appears to have been abandoned since the analysis was undertaken but which nevertheless provides useful insights into externality issues. Other case studies were intentionally speculative in order to investigate a range of options which might eventuate.

All the case studies have considered the position and benefits where the flows identified are switched from road to rail. In some instances however, the availability of rail may be necessary to allow the projects to proceed. While these options have not all been investigated in detail, it is likely that the broader benefits in these cases would be larger than the figures set out in this report[13].

6.2 Case studies considered

The case studies identified and considered in more detail comprised: -

Theme	Scheme
Better use of existing infrastructure	Expansion of existing log flows from West Coast.
New opportunities with existing infrastructure	Port Otago Inland Port.
New terminal infrastructure	Greymouth as well as general traffic this could potentially include water and garnet which possibly could be consolidated at a Greymouth hub.
	Milton (logging hub).
New commodities	Waste to West Coast plant industry As noted above this project appears to have been abandoned since the analysis was undertaken but which nevertheless provides useful insights into externality issues.
	Water (potentially consolidated through proposed Greymouth terminal).
	Garnet (potentially consolidated through proposed Greymouth terminal).
Change in distribution methods	Urban distribution with electric vehicles, including serving railheads.

For each of these an assessment was made of the scale of the freight flows likely to be affected and the potential externality costs that would be avoided in the event that the traffic transferred. By talking to the stakeholders involved, an assessment was made of the likelihood of transfer and any issues that would arise with the shift to rail.

6.3 Case Study Assessment

The details of the examination of the case studies are set out in Appendix C but the key highlights of the investigations are set out below.

[13] See the garnet case study for more details

Table 6-1 Case Studies - Key Highlights

Commodity	Movement	Potential Volume which Might Transfer	Existing or new flow	Estimated Annual Externality Benefits with Transfer	Issues	Potential for Achieving Transfer
Logs from West Coast	Stillwater-Lyttelton	30000 tonnes	Existing traffic currently travelling by road	0.2	Route is currently used by logging traffic using the existing fairly basic facilities, but limited availability of rolling stock constrains volumes which can be handled. Significant expansion would require some investment at a new site to increase capacity and replace life expired items and also at the port to improve the handling there.	Moderate-high likelihood
Milton/Milburn Logging terminal	Milton/Milburn - Bluff or Port Chalmers	50,000 tonnes?	Logging traffic currently all by road	0.2 for movements to Bluff	Needs development of new terminal and sufficient rolling stock to handle new traffic. KiwiRail are currently undertaking more detailed assessment of possible logging terminals in south Otago and Southland.	Moderate likelihood
Water	West Coast to Lyttelton for export	400,000 tonnes	New traffic	3.2	Plan for packing facility for goods which are primarily for export currently being progressed. Developer keen on use of rail. Product would be handled by container either from site or possibly via Greymouth terminal.	Moderate-high likelihood
Garnet	Hokitika-Timaru	100-150,000 tonnes	New traffic	1.0	Plans being progressed to exploit large garnet resource near Hokitika although details of scale and exacting method of handling not finalised. Anticipated that initial production would be handled by road as backhaul to Timaru. Possible that any subsequent increases in output might be available for rail. Issues with handling of product. Would either need transfer facility in or near Hokitika or if containerised could use new Greymouth terminal.	Uncertain particularly over short term

Commodity	Movement	Potential Volume which Might Transfer	Existing or new flow	Estimated Annual Externality Benefits with Transfer	Issues	Potential for Achieving Transfer
Waste	Christchurch - Westport	80,000 tonnes +	New traffic	0.1-0.1 for alternative storage points 0.5 for movement from Christchurch	Plans still appear to be very fluid and consents for waste-energy plant still to be obtained with potential for substantial objection. Scheme initially involves the movement of baled waste from a site in Christchurch for storage on the West Coast while the plant is being constructed and subsequently the movement of waste material direct to the plant. Proposed that rail would be used for movement to West Coast.	Uncertain Project depends on consents being obtained for waste-energy plant and availability of sufficient waste to make scheme viable.
Greymouth terminal	Flows primarily between West Coast and Christchurch	25000 tonnes of general freight notionally assumed	Existing traffic although possible new garnet and water flows	0.2	Possible expansion of existing KiwiRail facility to create a small common user intermodal terminal to carry a range of primarily unitised traffic between Christchurch and West Coast. Probably needs an anchor tenant with regular flows or using the terminal for warehousing and logistics to ensure viability. Water could provide a possible baseload flow.	Moderate likelihood on basis of possible flow of water traffic
Port Otago Inland Port	Development of inland port to transfer all containerised freight traffic through Port Chalmers to rail,	19000 TEUs of containerised traffic	Existing traffic	0.2-0.2	Acceptability of plan to users depends on gaining access to a suitable site for the transfer facilities. Possible locations in Dunedin or at Mosgiel.	Moderate likelihood

These findings are summarised in Table 6-2

Table 6-2: Case Study Summary

Case Study	Product	Annual Volumes (tonnes)	Annual volumes (m tonne-kms)	Total Annual Externality Benefits ($m pa)	Unmet Road Wear Costs ($m pa)
Stillwater logs	Logs	30,000	7.3	0.2	0.1
Milton/Milburn Logging terminal	Logs	50,000	9.0	0.2 for movements to Bluff	0.1
Garnet	Industrial materials	150,000	51.6	1.0	0.2
Water	Consumer products	400,000	92.4	3.2	0.4
Greymouth terminal	General freight	25,000	6.3	0.2	0.1
Waste	Waste	60,000	4-20	0.1-0.1 for alternative storage points 0.5 for movement from Christchurch	0.0 0.1
Port Chalmers Inland Port	General freight	285,000	3.7-7.7	0.2-0.2	0.0
Total		**1,000,000**	**174-198**	**5.8-5.9**	**0.8**

7. Extension of Case Studies to Broader South Island Objectives

The scope for extending the results of the case studies to a wider range of transport options across the South Island is set out below in Table 7-1.

Table 7-1: Extendibility of Case Study Findings

Scheme	Possible Extendibility	Need for Supportive Action Separate to Intermodal Terminals	Possible Project Sponsor
Milton/Milburn Logs	Possible applicability to a number of other locations across the South Island where substantial harvesting of logs at locations more than 80 kms from a port can conveniently be served by rail. Also, possibility of terminals more remote from sources of logs where road distances saved are more substantial.	Access links (including short distance HPMV upgrades?)	MBIE (PGF). Regional Councils (reflecting externality benefits). NZTA/TLAs (reflecting reduction in road wear costs.
Stillwater logs	Findings included above.		As above.
Garnet	Possibility of extending approach to other sources of minerals. However, each of these probably have different characteristics in terms of volumes and employment generation opportunities and so approach would have to be specifically tailored within approaches developed for garnet.	Improved access routes (including short distance HPMV upgrades?) Planning consents for industrial activities and interchange development.	MBIE/NZTA (Employment opportunities). Districts (employment opportunities as for Tokoroa). Regional council - environmental benefits. EDAs - employment opportunities. NZTA/RCAs reduction in road wear costs.
Waste	Specific circumstances of proposal mean that possibility of extension to other projects is limited.		
Urban distribution	Potential for expansion for wider applicability with more vehicles and/or in different centres.	Low emission zones. Better access for electric vehicles because of lower noise.	EECA, (Environmental benefits and support for EVs). ECan (environmental benefits). City councils (Environmental benefits).

Scheme	Possible Extendibility	Need for Supportive Action Separate to Intermodal Terminals	Possible Project Sponsor
Water	Extendable to other water projects on West Coast and commodities with similar loading characteristics (i.e. need for high weight containers that are difficult to handle on routes not available for HPMVs).	Access links. Possible short distance HPMV routes to interchange terminal if access not available at processing plant.	MBIE (PGF). Regional Councils (reflecting externality benefits). NZTA (reflecting reduction in road wear costs.
Greymouth terminal	Potential for associated activities - warehousing/distribution. Possible model for other small centres such as Ashburton, Gore, Kaikoura.	Improved access routes (including short distance HPMV upgrades?). Planning consents for industrial activities and interchange development.	Local transport operators (for possible logistics type operations). MBIE/NZTA (Employment opportunities). Districts (employment opportunities as for Tokoroa). Regional council - environmental benefits. EDAs - employment opportunities. NZTA/RCAs reduction in road wear costs.
Dunedin inland port	Limited since Lyttelton and Southport already have existing facilities. Note: Beyond the South Island this is a possible model for North Island ports with constrained sites, and for short distance shuttles for other commodities.	Identification of suitable site. Improved access links. Public acceptability of increased freight activity in city centre.	NZTA (reduction of road wear on road route to Port Chalmers.) Local authorities (environmental impacts both positive and negative).

7.1 A Broader South Island Perspective

In addition to the specific opportunities identified in the case studies for which the flows and benefits have been quantified, we have also extended this analysis, which is based on the shift to rail to look more generally at the opportunities for increasing the rail mode split for movements in the South Island. These would take into account the findings set out in Table 6.1.

The scope for increasing the rail share is affected by a number of factors including: -

- The choice between road and rail is constrained by the more limited coverage of the rail network relative to road and also by the shortages of rolling stock and locomotive capacity across the rail network as whole, and for the South Island in particular. Without support from third parties, this issue may only be resolved only slowly, and interventions may be required to ensure that the capacity available can meet emerging opportunities identified in this study.
- While changing prices for road and rail transport to reflect externality costs would give some switch to rail, because of the different characteristics of the service offered by road and other modes, relative price is only one factor that is taken into account in any choice between modes.
- The case studies undertaken in this study have identified the short-term potential for increasing the movement of freight by rail by up to 1 million tonnes. Our review of the possible extension of these suggests that there could be further increases in rail flows by a further 1-1.5 million tonnes pa in the medium term, mainly focussed on forestry, minerals, and water, and to a lesser extent on additional traffic through small terminals and the expansion of inland ports.
- The switch of traffic resulting from the identified case studies would increase rail flows across the South Island by about 20 per cent and with a possible further increase of 20-30 per cent from the possible extensions to these. Further growth beyond these figures may be possible over time although this has not been evaluated.
- The externality benefits from these additional flows are tentatively estimated to lie in the range of $6-$12m per year over and above the $6m for the identified case studies
- These increased flows identified would assume that: -
  - Funding was available to provide support for these or that changes were made to give a better reflection of the relative externality costs of road and rail and that: -
  - Any constraints on the capacity of the rail network to accommodate these higher flows in terms of rolling stock (and possibly track capacity) were overcome. This could involve substantial investment especially if a number of the case studies were progressed over the short-term. Given the scale of the externality benefits there may be scope for the regions to provide support either directly or in developing a case for central government investment.
- On this basis the rail mode split for movements impacting on the South Island could increase from a current estimated value of about 7 per cent to 8-10 per cent, the range reflecting the difference between the identified case studies and their possible expansion. The associated reduction in externality costs either to the community in general or from unmet road wear costs would amount to between $6m and $12-18m per year.

While there was no specific case study of coastal shipping, apart from a brief assessment of barging of logs in the Marlborough Sounds, most of these factors would also apply to coastal shipping:

- Access to coastal shipping is even more constrained than rail, relative to road
- Other factors than price and externalities also affect choice of coastal shipping, such as transit time
- Funding would also be needed to develop ports (e.g. on the West Coast) or modify existing ports
- The externality benefits would apply to ships as well as rail, potentially at greater levels.
- Volumes would have to be enough to give an economic load for a ship, which is rather more than that required for a train and many times a truck load.

Coastal movements can already be arranged through use of spare capacity on international ships. Even with this cheap capacity, shippers still use road and rail from the North Island, for reasons including cost and frequency. There is clearly a part of the market that coastal shipping does not cater for. Apart from bulk commodities like cement and logs, there is unlikely to be significant volume for coastal shipping for lanes within the South Island which does not need the service advantages of road and rail.

8. Action Plan

The following action plan was developed in discussion with the Project Working Group (Appendix D) with a focus on more immediate actions.

The key assumption of the following action plan is that a South Island Strategic Case is completed early in 2019, including development of key performance indicators, based on this study. This Strategic Case would then support the development of a range of actions and business cases leading towards implementation of projects that would create more beneficial mode splits across the South Island.

Table 8-1: Action Plan

Reference	What	Who	When
Action 1:	• SI Chairs to identify lead agency. • Lead agency to complete point of entry document • Have point of entry discussion with potential funders/investors relevant to opportunity • Projects (possible lead agency): ○ Stillwater (West Coast Regional Council) ○ Milton/Milburn (KiwiRail / Southland / Otago Regional Council) ○ Bottled water from the West Coast (West Coast Regional Council) ○ Garnet from the West Coast (KiwiRail / West Coast Regional Council) ○ Greymouth freight terminal (KiwiRail / West Coast Regional Council) ○ Port Chalmers (Port Chalmers / KiwiRail). • Undertake business case to confirm next steps for these opportunities.	SI Chairs	January 2019
Action 2:	• Undertake a study to identify and prioritise (with quantified transport and economic benefits) a comprehensive long list of roads to rail opportunities across the South Island. • Undertake preliminary evaluation (modelled on the approach taken with case studies for the SI freight mode shift study) of the potential benefits of each of the opportunities. • Have point of entry discussions with potential investors by regional priority.	SI Chairs	January 2019
Action 3:	• Propose research to NZ Transport Agency / MoT: ○ Complete study on impacts in cities of electric vehicle uptake: ○ Complete study on impacts in cities of increased online shopping and increased volume of door to door deliveries in urban environment. • (if needed following the previous action) Develop infrastructure planning and design guidelines for electric vehicles and for increasing urban distribution for Christchurch in consultation with industry (such as Foodstuffs and Courier companies).	SI Chairs	January 2019
Action 4:	• Explore "alternatives to road" capital investment funding.	NZ Transport Agency	Now

9. Conclusions and Lessons Learned

The study has identified and evaluated beneficial mode splits for freight in the South Island. It has concluded that there are substantial opportunities to achieve more beneficial mode splits. An action plan has been identified to facilitate movement towards a more beneficial mode split.

This study concludes that:

- There is considerable freight growth forecast in the South Island reflecting economic and population growth and increasing production of a number of agricultural and mineral products. An updated forecast was developed for this research;
- If this freight is moved by road even at current modal split levels, it will create pressures on transport infrastructure and on the broader community;
- There are externalities involved in movement of freight that are currently unrecognised in freight pricing. Those for road are very much larger than those for rail. These have been quantified by this research;
- Transfer to rail would bring externality benefits in terms of access, safety and environmental impact, but intervention is needed to internalise them or compensate for them (for example by funding particular interventions);
- The study has identified a number of opportunities (demonstrated with case studies) that could increase freight haulage by rail, possibly by substantial amounts, and these opportunities could be readily extended beyond the specific case studies that this research project considered;
- There are some very significant barriers and constraints to be overcome, including rolling stock capacity and rail reliability;
- New technology can help deal with the adverse impacts of freight growth within cities, but again intervention may be necessary.

This report provides evidence that there is a case for change towards a more optimised freight mode split in the South Island.

Outcomes to take from study:

- A rail provider exploring business cases to establish mode shift of freight from road to rail including consideration of new transfer hubs now has a methodology to be able to quantify the benefits that would likely accrue as a result of this shift, including quantified impact (benefits) on externalities
- Road infrastructure owners considering investment to address freight movement now have a methodology to quantify benefits of considering mode shift to rail options, including commentary on the types of freight movement that this would most readily apply to, based on feedback from supply chain industry stakeholders
- An action plan has been identified to facilitate movement towards a more beneficial mode split.

Key next step:

- Point of entry discussions for mode shift opportunities with infrastructure owners and transport operators (or other parts of the supply chain) to determine the respective lead agency and funding to explore those opportunities

Some shorter-term opportunities consistent with the findings of this study have also been identified and these are expected to be pursued with the commencement of single stage business cases at a regional level and then implementation within those regions. However, it is noted in the study that investment in infrastructure in one region to achieve a mode shift often leads to significant benefits from that mode shift in another region, particularly those regions with seaports such as Canterbury. This may lead in some instances to a region sponsoring investment in another region because of where the majority of the benefits from that capital investment lie.

Appendices

Appendix A Workshop 1 Issues Identification Presentation

A.1 Workshop Notes - Final

A.2 ECan Freight Study Workshop – 7 August 2018 Presentation

Stantec

Meeting Notes

Environment Canterbury Freight Mode Shift Study

File Name

Date/Time:	August 7, 2018 / 10:00 AM
Place:	Environment Canterbury, Christchurch
Next Meeting:	Next Meeting Date
Attendees:	Project team: Andrew Maughan, Stantec New Zealand Murray King, Murray King & Francis Small Consultancy Ltd Richard Paling, Richard Paling Consulting Ltd Project Working Group (PWG): Darren Fidler, Environment Canterbury Kevin Stratful, West Coast Regional Council Russell Hawkes, Environment Southland Stephen Bateman, independent advisor to Environment Canterbury Ralph Samuelson, Ministry of Transport Cole O'Keefe, NZ Transport Agency Aaron Masagnay, NZ Transport Agency
Absentees:	Jeanine Benson, Kiwirail Steve Higgs, NZ Transport Agency
Distribution:	PWG

Agenda:

1. Issues, objectives
2. Progress to date
3. Desktop analysis
4. Stakeholder engagement
5. Case studies
6. Next steps

Workshop notes:

Issues and Objectives:

Objectives:

- Darren Fidler outlined objectives of study
- Russell Hawkes provided additional context about why the study had been established

Issues:

- Increasing freight on local roads impacts on safety and amenity for non-freight travel (walking, cycling, public transport, cars)
- More trucks on road is a contributor to more congestion and emissions

- There are more pollutants in water from road run-off
- Sector needs to be able to adapt to changing technology and maximise opportunity from this change
- There is conflicting messaging around what zero emissions means. There are potential impacts on the resale values of internal combustion engine vehicles and a financial impact reflecting increased depreciation because of expectations around the uptake of electric vehicles
- There are emerging resilience risks with the supply chain, particularly for consumer goods/consumption
- Sea level rise and earthquakes (Alpine Fault) have significant impact on infrastructure ability to support a resilient supply chain. NZTA categorises resilience events on transport routes into crashes, environmental (such as slips) and weather events (such as floods, snow/ice)
- Transport links are less resilient because of companies seeking to reduce the costs to the consumer through just in time supply chain management and minimising warehousing costs at the expense of resilience
- It is unclear whether pricing signals particularly in relation to delivery times are aligned with true costs and where benefits are realised
- Rail has aging rolling stock which is leading to increasing reliability issues
- The cost of freight movement in South Island is high leading to affordability issues. Contributors to high costs and affordability issues are considered to be:
    - Sparse population, lack of population density
    - Challenging topography and distance from main supply centres
    - Lack of consolidation of freight
    - Lack of cooperation between companies
    - Lack of distribution points
    - Lack of rail capacity
    - Nelson only port to get freight out of West Coast
- Infrastructure and operational constraints mean that freight movements do not have a full range of mode options available leading to supply chain inefficiency, for example customers choosing road transport when they would prefer rail.
- Infrastructure constraints include:
    - Rail infrastructure constraints:
        - ♦ Tunnel sizes in feeder lines on high cubed containers
        - ♦ Lease arrangements on rail line (ex Solid Energy)(needs confirmation)
        - ♦ Limited capacity of Port access to West Coast
        - ♦ There are load constraints on some freight routes (particularly bridges)
        - ♦ Resilience – in some areas particularly the West Coast, the infrastructure has limited ability to recover as quickly from 'shocks'

- Technology is increasing the agility across the supply chain of freight movers to adapt to changing circumstances and move quickly to provide another solution with high traceability of product, which means there are more opportunities to more efficiently move freight especially if constraints are removed or minimised.
- Reduced spare capacity in the supply chain (tighter supply chains with 'less slack') to adapt increasing risks to reliability and cost pressures on in the South Island including:
    - Food distribution is increasingly being managed in a closed loop (New World, Countdown) which reduces the access for others in the market to backload capacity which in turn increases costs to those 'outside the loop'
    - Big companies are leaving the South Island reducing capacity of the supply chain to adapt
    - Becoming more dependent on supply from North Island so if this is cut for any period reducing resilience for shock events such as earthquakes
    - Resilience example: 3 days fuel supply if West Coast is cut off
    - Cheaper for companies to have fewer distribution points
- Coastal shipping delivery times are not fast enough for consumers
- Only one local coastal shipping, reliance on spare capacity in international shipping is a risk
- The ability of international shipping lines to use their spare capacity for domestic freight may be constrained by the needs of their overall shipping schedules of which NZ is only a small part (tight schedules)
- There is no environmental standard for trucks which means that to some extent investment is not being made in the most sustainable freight vehicles. However most major freight operators are investing in more sustainable vehicles which helps reduce their operating costs.
- Rail versus road delivery times and reliability - perceptions of this sometimes pushes freight onto road when it could in principle be readily moved by rail

Progress to date

- Stantec team presented to slides

Desktop analysis

- Stantec team presented to slides

Stakeholder engagement

- Stantec team presented to slides

Case studies

- Stantec team presented to slides
- Case studies discussion:
- Case study priorities:
    - New opportunities versus existing good practice
    - Internal within South Island or interisland movement of freight

- Improved road freight efficiency, use of hubs, mode shift from road to rail

- Case study benefit realisation, measures of success:
  - Supply chain cost
  - Tonne.km shifted off roads as proportion of total freight task in South Island
  - Early adoption of initiatives (case studies) identified
  - Trigger for business case for new opportunities
  - Document provides steerage of best transport mode, sufficient to demonstrate benefits of change
  - "Best distribution model for stock and freight around country"
  - Measure of failure:
    - Nobody uses it, no changes are realised
- PWG identified additional possible case studies:
  - Is there potential to use Rolleston as a case study:
    - How does it work
    - Could it be copied
    - Hubbing strategy long term future
    - Increase domestic use of rail freight
  - Mataura River Dairy:
    - What were influences to select site
    - What is supply chain strategy
    - Hokitika/Greymouth:
    - Greymouth hub
  - New terminal:
    - Replace Gore with Milton
  - Hubs:
    - Best practice on what a hub might look like
    - Where are opportunities to put in place best practice hubs elsewhere in the South Island? What are the fundamentals?
    - Tokoroa Hub identified to the PWG as possible example
    - Is there a case study around efficient use of space and delivery opportunities?
  - Coastal shipping:
    - Need to outline whether this is or isn't an opportunity and why a case study is not proposed for this. Focus has been South Island internal freight movement.
  - New technology:

- Not a specific case study but this needs discussion in the study.
- What changes to planning are needed to enable new technology opportunities
- What changes will it make to the supply chain
- What is a planning timeline horizon for new technology?

Next steps

- Stantec team presented to slides

Attachments: Powerpoint presentation (pdf)

Stantec

Workshop 1
7 August 2018

Environment Canterbury South Island Freight Study

In association with

Richard Paling Consulting and

Murray King & Francis Small

Agenda

1. Issues, objectives
2. Progress to date
3. Desktop analysis
4. Stakeholder engagement
5. Case studies
6. Next steps

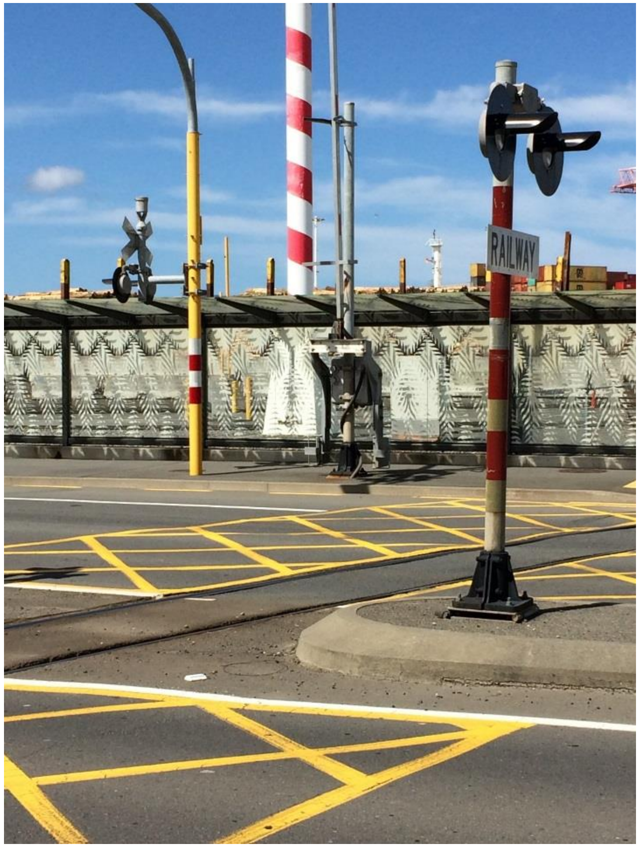
Issues and study objectives

- South Island Freight Study:
  - Identification of the opportunity for mode shift and preparation of a mode shift implementation plan
- What are the key problems and issues to be addressed
- Actions:
  - focus on case studies to investigate possible solutions

Progress to date

- Introduction
  - ✓ Freight origin and destination study
  - ✓ Freight mode subsidy review
  - ✓ Opportunities, Barriers and Constraints
  - ✓ Technology Review and Risk Analysis

- Different work strands
  - ✓ Desk top analysis
  - ✓ Stakeholder engagement – ports, transporters, shippers, rail
  - ✓ Development of framework for identification of possible case studies



Desktop analysis

- Literature review
  - Evidence from a range of countries including NZ, Australia, Canada, Korea, EU
- Main areas considered include:
  - GHG
  - Crashes
  - Other environmental costs
- Costing of environmental components and potential externality costs of road freight
- Also considering balance between RUC and road damage
- Simple model to assess environmental costs for road and rail by route and traffic volume
- Estimation of relative environmental costs for specific routes and comparison with charges and RUC revenues

Desktop analysis – diversion potential

- Potential for diversion to rail or coastal shipping
  - Long distance point to point flows
  - Movements with potential for consolidation or adding value at inland ports or intermediate points
  - Products with limited requirement for quick delivery
  - Products with regular or predictable flows
  - Products which can benefit from higher container load factors
  - Movements which avoid the need for travel through congested areas .
  - Products where rail has achieved a high modal split in other locations
  - Good access to rail for intermodal journeys – role of hubs/inland ports
- Use of electric trucks
  - Urban distribution
  - Short distance movements serving rail heads/inland ports
  - Within site movements suitable for electric haulage

Desktop analysis - modal shift measures

- Facilitation
- Integration of planning and rail access
- Local body contributions or support in kind including land and consenting
- Funding
- Local changes eg relaxation of constraints on truck movements for electric vehicles
- National changes - RUC changes, tighter emission rules, carbon pricing

Stakeholder engagement

Producers	Fonterra
	Westland Milk
	Synlait Milk Ltd
	PF Olsen
	Bathurst
	Progressive
	Foodstuffs
	The Warehouse
Transporters	Mainfreight
	Toll
	Hilton Haulage
	Richardsons
	HW Richardson Group Ltd
	KiwiRail
	CODA
	Pacifica Shipping
	PBT
Ports	Port of Lyttelton
	Timaru
	PrimePort
	Port Chalmers
	SouthPort
	Nelson Port
	Picton
	CIAL
	Port of Tauranga

Environment Canterbury South Island Freight Study

Notes for discussions with owners of goods (Producers and retailers)

What is the scale of your business in terms of the tonnages moved in the South Island? What are the main flows and particular commodities?

Do you make decisions about what types of vehicles are used? If so what are these?

Do you operate through inland ports or regional distribution centres? If so which ones and what volumes are transported through them? How do these fit into your distribution patterns?

What weight do you give to environmental sustainability in the transport operations undertaken for you? How much extra would you be prepared to pay for options that provided a more sustainable outcome? Are there examples of this?

Over the past 5 years or so, have you considered in outline or developed in more detail proposals that would result in traffic being switched from road to rail or in the more efficient or environmentally sustainable use of road vehicles? If so what were these and have they been implemented?

If these proposals were not implemented what were the barriers or constraints that meant that you did not progress them?

Do you have any other thoughts on how proposals like these for modal shift or more efficient operation could be implemented in a way which would be taken up by your organisation or similar organisations?

What are the main issues and constraints faced by your organisation in the movement of freight?

Do you think that new technology (electric vehicles, improvements in logistics, drone delivery, traffic management and prioritisation, self-driving vehicles etc) will affect your business? If so in what way and when might this happen?

Stakeholder engagement

- **Key issues emerging**
  - ✓ Shortage of rail capacity to meet demands
  - ✓ Need a long term planning/funding horizon for rail
  - ✓ Concerns about reliability of rail services - possibly linked with shortages of capacity
  - ✓ Rail users typically want more although some exceptions where unreliability of rail is discouraging rail demand
  - ✓ Firms generally looking for environmentally sustainable solutions (incl safety) but only if these achieved at no cost
    - There are exceptions, such replacing coal as heat source which also saves transport
  - ✓ Transporters seeking to eliminate waste – ie maximise 2 way hauls
  - ✓ Little enthusiasm for paying more for environmentally good solutions in their own right

Case studies – framework

- What in principle provides potential for a good case study
- Potential types of opportunity
  - Development of hierarchy
- Preliminary examples

Case studies – hierarchy of proposals

- Schemes that look to make better use of existing infrastructure and for which potential demand appears to exist.
- Schemes that look to make better use of existing infrastructure but for which demand would have to be generated
- Better management of existing supply chains to minimise empty running
- Schemes which need new patterns of operation and supply chains
- Schemes which need new infrastructure – sidings, hubs etc
- Major new flows
- Schemes which require changes to institutional structure

Case studies – initial examples (1)

- **Better use of existing infrastructure (ie more of the same)**
  - ✓ Logs – West Coast to Lyttelton
  - ✓ General freight – Auckland-Christchurch
  - ✓ More daily rail services to hubs

- **New opportunities using existing infrastructure**
  - ✓ Milk - Rolleston-Hokitika
  - ✓ Dairy products – Synlait
  - ✓ Gold from the West Coast

Case studies – initial examples (2)

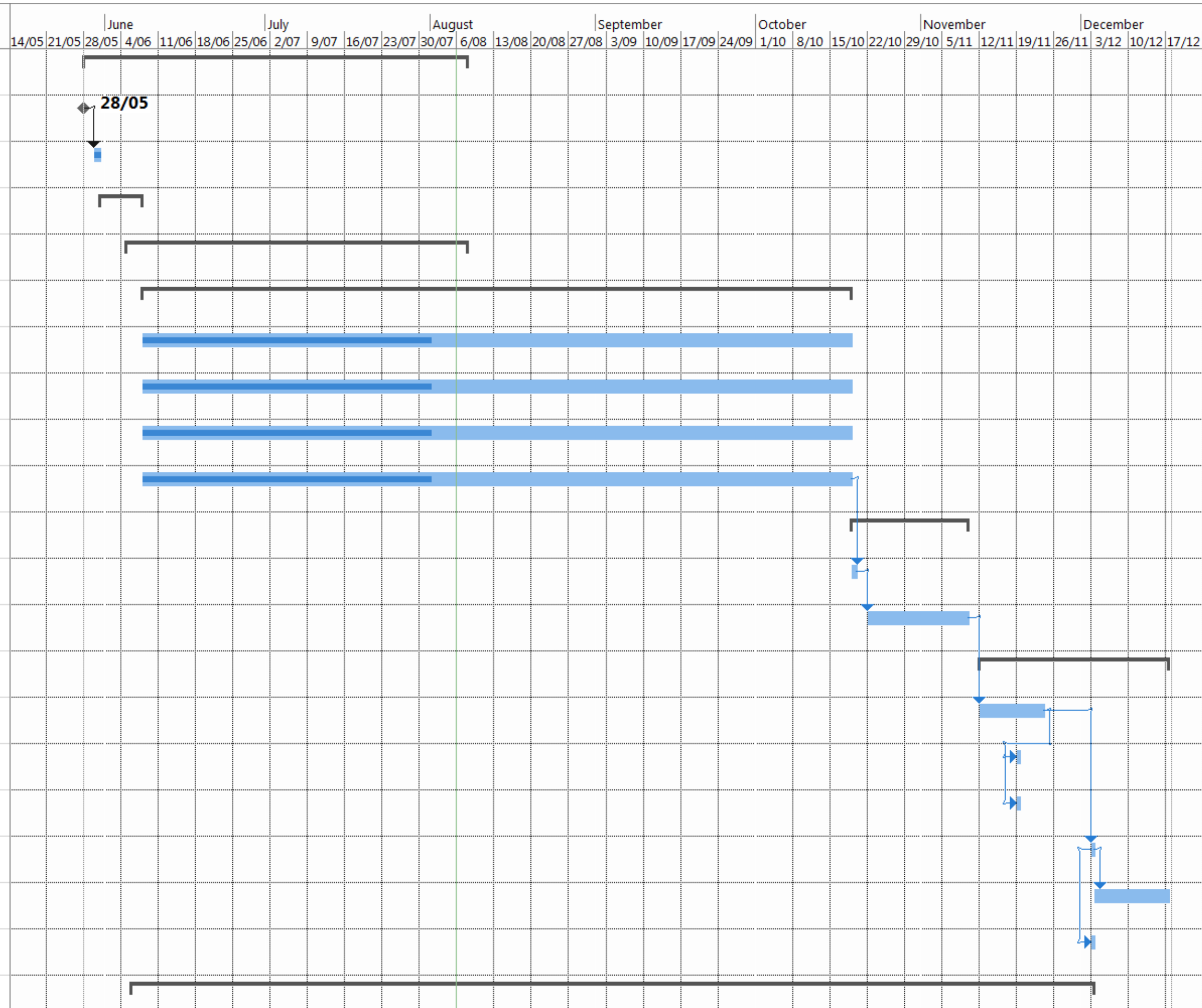
- **Possible new terminal infrastructure on existing routes**
  - ✓ West Coast - Hokitika/Greymouth
  - ✓ Ashburton
  - ✓ Gore
  - ✓ Wairio
- **New commodities**
  - ✓ Diatomite
  - ✓ Garnet
  - ✓ Water
- **Change in methods of distribution**
  - ✓ Distribution in urban areas by electric vehicles
  - ✓ Serving railheads with heavy electric vehicles
  - ✓ On site haulage with electricity

Case studies – approach, priorities

- Is this approach reasonable
- Are the types of schemes identified appropriate
- What has to be done to make them happen
- Are there other schemes
- Discussion on priorities

Next steps

ID	Task Name	Start	Finish
1	**Project establishment and start up**	**Mon 28/05/18**	**Tue 7/08/18**
2	Contract award	Mon 28/05/18	Mon 28/05/18
3	Kick off meeting	Wed 30/05/18	Wed 30/05/18
4	**Project start up deliverables**	**Thu 31/05/18**	**Thu 7/06/18**
9	**Context workshop**	**Tue 5/06/18**	**Tue 7/08/18**
14	**Understanding the South Island Freight Tas**	**Fri 8/06/18**	**Thu 18/10/18**
15	Freight origin and destination study	Fri 8/06/18	Thu 18/10/18
16	Freight mode subsidy review	Fri 8/06/18	Thu 18/10/18
17	Opportunities, Barriers and Constraints	Fri 8/06/18	Thu 18/10/18
18	Technology Review and Risk Analysis	Fri 8/06/18	Thu 18/10/18
19	**Assessment of Mode Shift Opportunities**	**Fri 19/10/18**	**Fri 9/11/18**
20	PWG workshop to review outputs so far and agree case studies	Fri 19/10/18	Fri 19/10/18
21	Development of Case Studies	Mon 22/10/18	Fri 9/11/18
22	**Output Finalisation**	**Mon 12/11/18**	**Mon 17/12/18**
23	Development of Action Plan	Mon 12/11/18	Fri 23/11/18
24	PWG workshop: action plan review	Mon 19/11/18	Mon 19/11/18
25	Stakeholder workshop: action plan review	Mon 19/11/18	Mon 19/11/18
26	Study outcomes review meeting: PWG	Mon 3/12/18	Mon 3/12/18
27	Finalise reporting outptus including Freight Study chapters	Mon 3/12/18	Mon 17/12/18
28	Present findings to stakeholders	Mon 3/12/18	Mon 3/12/18
29	**Stakeholder engagement**	**Tue 5/06/18**	**Mon 3/12/18**



Next steps

Task Name	Start
Context workshop	Tue 5/06/18
PWG workshop: issues confirmation	Tue 7/08/18
PWG meeting: progress review	Tue 25/09/18
PWG workshop: case studies agreement	Fri 19/10/18
PWG workshop: action plan review	Mon 19/11/18
Stakeholder workshop: action plan review	Mon 19/11/18
PWG meeting: study outcomes	Mon 3/12/18
Stakeholder presentation: study outcomes	Mon 3/12/18

Appendix B Examples of Fuel Change Commitments

The table below summarises a range of commitments by various jurisdictions around the World to incentivise more sustainable transport energy use.

(Source Quartz Research (https://qz.com/about/)

Table B-1: Summary of Juridictions

Jurisdiction	What's Restricted?	Source
Copenhagen, Denmark	Ban new diesel cars from entering the Danish capital	Copenhagen's mayor said last year he will introduce legislation to ban diesel cars registered after 2018. "It's not a human right to pollute the air for others. That's why diesel cars must be phased out," he told Danish newspaper *Politiken*
Rome, Italy	Ban diesel vehicles from city centre by 2024	Mayor Virginia Raggi announced a plan to ban diesel cars from city centre by 2024. "If we want to intervene seriously, we have to have the courage to adopt strong measures," she wrote on Feb. 27 on her Facebook page.
Norway	Target of no new gasoline or diesel vehicle sales by 2025	In 2016, Norwegian politicians agreed to an ambitious goal of phasing out all conventional cars: "There is an agreement on a target of zero new fossil-fuel cars sold as from 2025. No outright ban, but strong actions required," tweeted Norway's then-Environment and Climate Change minister Vidar Helgesen in 2016. Today, nearly 40% of all cars sold in Norway are electric or hybrid.
Athens, Paris, Madrid, Mexico City	End use of all diesel vehicles by 2025	At a 2016 conference, city leaders committed to "stop the use of all diesel-powered cars and trucks by the middle of the next decade" and incentivize electric, hydrogen and hybrid vehicles.
Paris	Ban on diesel in city by 2025. Ban on all internal combustion vehicles by 2030.	Paris pledged to ban diesel engines by 2025 and phase out all combustion-engine cars by 2030. "This is about planning for the long term with a strategy that will reduce greenhouse gases, "said Christophe Najdovski, head of Paris transport policy in October 2017. "Transport is one of the main greenhouse gas producers ... so we are planning an exit from combustion engine vehicles, or fossil-energy vehicles, by 2030."
India	No new gasoline or diesel vehicles by 2030 (if economical)	In 2017, the Indian government announced the "ambition, that by 2030, all vehicles sold in India may be electric-powered." The energy department's plan will depend on the costs of electric cars falling far enough to make it economical.
Ireland	No new gasoline or diesel vehicle by 2030	The country will ban sales of all gasoline and diesel vehicles by 2030. Cities such as Dublin are required to only buy electric buses after 2018.
Israel	Ban import of all gasoline and diesel fuel cars by 2030. Only natural gas and	Energy Minister Yuval Steinitz told a conference last February that "from 2030 onwards, the State of Israel will create alternatives and will no longer allow the import of cars that run on gasoline and diesel fuel. ... We intend to reach a situation in which Israel's industry

Jurisdiction	What's Restricted?	Source
	electric vehicles permitted.	will be based on natural gas, and most importantly, transportation in Israel will be based on natural gas or electricity."
Brussels, Belgium	Diesel ban in Belgian capital by 2030	The government of Brussels agreed to introduce a diesel ban in Belgium's capital by 2030. Restrictions on gasoline cars are being considered.
Netherlands	All vehicles emission free by 2030	A Dutch parliamentary coalition agreement stated in October 2017 that "the aim is for all new cars to be emission-free by 2030. Phasing out the tax incentives for zero-emission cars will be brought into line with this ambition." (page 39, document in Dutch)
France	No new gasoline or diesel vehicle sales by 2030	The French government's 2017 Climate Plan, pledges to "take greenhouse gas-emitting vehicles off the market by 2040: stopping sales of petrol or diesel cars will encourage car manufacturers to innovate and take the lead on this market."
United Kingdom	No sales of conventional petrol and diesel cars and vans by 2040. Reduce national vehicle emissions to zero by 2050.	The UK government committed to end sales of new conventional petrol and diesel cars and vans by 2040. Instead of completely banning petrol and diesel vehicles, it states (paywall) the "majority" of new cars and vans sold by 2040 should be zero emissions, and all should have zero emissions "capability" (such as hybrids). By 2050, the UK says it will reduce vehicle emissions to virtually zero by 2050 with "almost every car and van" zero-emissions by 2050. Scotland's Parliament announced more ambitious plans to phase out petrol and diesel cars by 2032.
Taiwan	No new non-electric motorcycles by 2035 and four-wheel vehicles by 2040	The country's Environmental Protection Administration plan would ban all sales of nonelectric motorcycles and four-wheel vehicles by 2035 and 2040, respectively.
China	No date given on phase-out of combustion engines	China is developing a long-term plan to phase out combustion engines, according to Xin Guobin, a government official from the Ministry of Industry and Information Technology. "Some countries have made a timeline for when to stop the production and sales of traditional fuel cars," he told Chinese state media last September, noting the ministry had started "relevant research" to finalize a timeline. "Those measures will certainly bring profound changes for our car industry's development." Experts anticipate (paywall) the country will impose the phase-out ban alongside carbon controls expected around 2030.
Germany	Ban on sale of new diesel cars expected. Considering ban on all internal combustion engines by 2040 in line with Britain and France.	Germany has not set a timeline, but chancellor Angela Merkel said in Aug. 2017 that the country must eventually join other European countries banning new diesel cars." She called plans by Britain and France to phase out fossil-fuel powered cars by 2040 "the right approach," while adding, "I don't want to name an exact year." German cities are already pushing for their own diesel bans.

Jurisdiction	What's Restricted?	Source
US states: California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, and Vermont. Canadian provinces: Québec	Reduce national vehicle emissions to zero by 2050.	"We will strive to make all passenger vehicle sales in our jurisdictions ZEVs as fast as possible, and no later than 2050."

Appendix C Case Studies

Case studies are presented below and have been prepared for the following:

- Stillwater logs
- Milton/Milburn Logging terminal
- Garnet
- Water
- Greymouth terminal
- Waste
- Port Chalmers Inland Port
- Technology change.

C.1 Stillwater Logs (Logs from the West Coast to Lyttelton)

C.1.1 Introduction

Logs are currently moved from the Stillwater area of the West Coast to Lyttelton part by road and part by rail. There is a desire to increase the share by rail, but this is currently constrained by a lack of rolling stock capable of handling the logs. The flows are forced to travel by road because of the shortage of rail capacity while fluctuating over time are currently estimated at about 4-5 truck movements per day, equivalent to about 120-150 tonnes per day, or about 30,000-50,000 tonnes per year.

Overall the volumes of logs transported by rail between the West Coast and Canterbury has amounted to just over 50,000 tonnes per year. This grew rapidly over the period from 2012/13 to 2015/16 but has since dropped slightly. This is set out in Figure C-1.

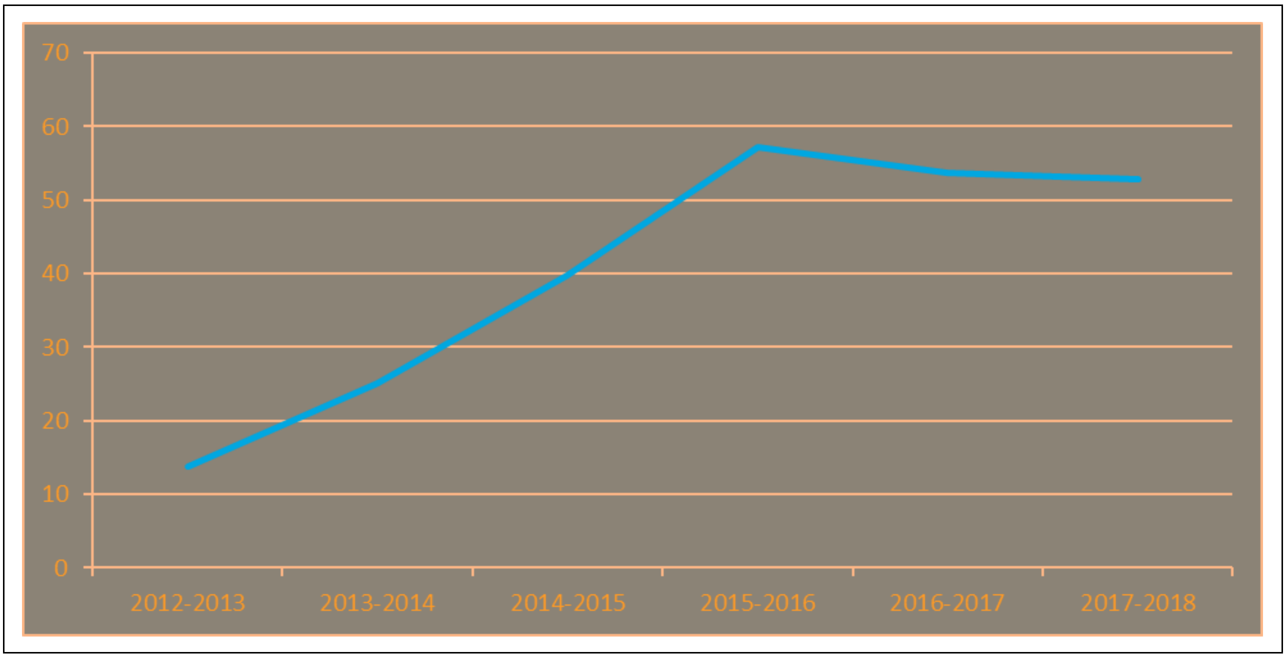


Figure C-1: Movement of logs and timber products by Rail between the West Coast and Canterbury (50,000 tonnes pa)

While the figures are not entirely consistent, MPI reports roundwood harvesting in the West Coast growing from about 160,000 tonnes in 2012 to 185,000 tonnes in 2017, with the rail share increasing from about 9 per cent to 28 per cent.

C.1.2 Volumes to be transported and method of transport

The volumes that might potentially be diverted to rail from road are estimated at about 30-50,000 tonnes per year.

It is likely that this level of demand would be sustained for a substantial period, with the forecasts of log flows between the West Coast and Canterbury forecast to grow over at least the next 10-15 years.

The logs would be transported in bulk and if moved by rail would be transferred at the existing facility at Stillwater. This should have the capacity to accommodate the increased traffic.

C.1.3 Total distances for goods transported

Road	Stillwater-Lyttelton	244 kms
Rail	Stillwater-Lyttelton	229 kms

C.1.4 State of play with the proposal

Currently KiwiRail are in the process of modifying the existing logging fleet to allow higher volumes of logs to be carried. It is not certain the extent that this additional capacity would be made available to move additional logs from Stillwater.

C.1.5 Potential for increased rail use

In principle the scheme promoters are keen to use rail primarily for the transport cost savings that this would generate.

C.1.6 Possible issues

The main issues that need to be resolved if the traffic is to be transferred to rail is the availability of suitable rolling stock.

C.1.7 Benefits of transfer to rail

C.1.7.1 Transport Impacts

The benefits of transfer to rail would include: -

- Reduction in environmental externalities imposed on the general community
- A reduction in road wear costs balanced against the loss of road user charges.

Using the modelling developed during the course of the study these are estimated at about: -

- $5 per tonne environmental externality benefits
- $2 per tonne net road wear costs.

On the basis of 30,000 tonnes per year the transfer to rail would generate benefits of about $0.2m per year. On the basis of a 20-year evaluation period, the discounted value of these would amount to about $2.0m and even over a 10-year period they would amount to about $1.3m.

C.1.8 Wider Economic Impacts

The reduction in the costs of transporting logs to the port may potentially result in an increased share of the available timber being harvested. Trees typically mature at about 30 years with increases in value as they get older being small. For the West Coast the proportion of trees aged over 30 years is relatively high by national standards, suggesting that for some of these older trees it is not economic too fell these because of the relatively high harvesting and transport costs. Reducing the transport costs may result in some expansion of the volumes harvested and not left to grow indefinitely. While recognising this as potential benefits this however has not been evaluated as part of this study.

C.1.9 Overall benefits

The possible transport benefits are set out in Table C-1.

Table C-1: Total Benefits of Rail Transport of Logs from Stillwater to Lyttelton ($m NPV)

Potential Impact	Evaluation Period		
	10 years	20 years	30 years
Movement of 30,000 tonnes per year			
Transport benefits	1.2	1.9	2.3

It can therefore be seen that that the transport benefits of increased movement of logs from are reasonably substantial.

C.1.10 Next steps and action plan

- Confirm the interest of the log producers in making additional use of rail and the scale of the additional traffic that might be transferred.
- Identify the potential for KiwiRail to provide additional capacity to accommodate this increased demand and any potential bottlenecks that might arise.
- If additional funding is required, identify potential sources for this and build a business case if appropriate potentially using the figures estimated above.

C.2 Milton/Milburn Logging Terminal

C.2.1 Introduction

There are substantial movements of logs by road to Port Chalmers and to Bluff, some of which move long distances. While KiwiRail does not currently carry significant volumes off logs by rail, the potential exists at least in principle for diverting at least some of this traffic away from road. This has been recognised and funds have been obtained from the PGF to examine this in more detail, including a detailed examination of the locations of the potential sources of logs. This work is currently being undertaken on behalf of Environment Southland.

For the current study we have not made detailed estimates of the flows which might be diverted but have considered the impact for possible rail flows that might be achieved with a log interchange facility in Southern Otago. For this we have assumed a facility at Milburn close to Milton. This would be used to transfer logs to rail either to Port Chalmers or to Bluff. The analysis therefore compares the impacts on externality costs of the movements by road or rail on these routes. A site at Milburn might also be used for the export of processed timber but this has not been considered at this stage. A site at Milton itself would have similar characteristics to the notional site at Milburn.

C.2.2 Total size of the market

Estimates of the total volumes of logs moved from Otago to Southland or harvested in Southland and transported within the region have been developed as part of the updated freight forecasts. These give the growth estimates and forecasts set out in Table C-2 and Figure C-2.

Table C-2: Total Forecast Log Flows to and Within Southland (m tonnes pa)

Year	Otago-Southland	Movements Within Southland	Total Southland flows
2017	0.24	0.97	1.21
2022	0.31	1.29	1.60
2032	0.30	1.67	1.97
2042	0.17	1.14	1.31

Source: Consultant's estimates from updated freight forecasts.

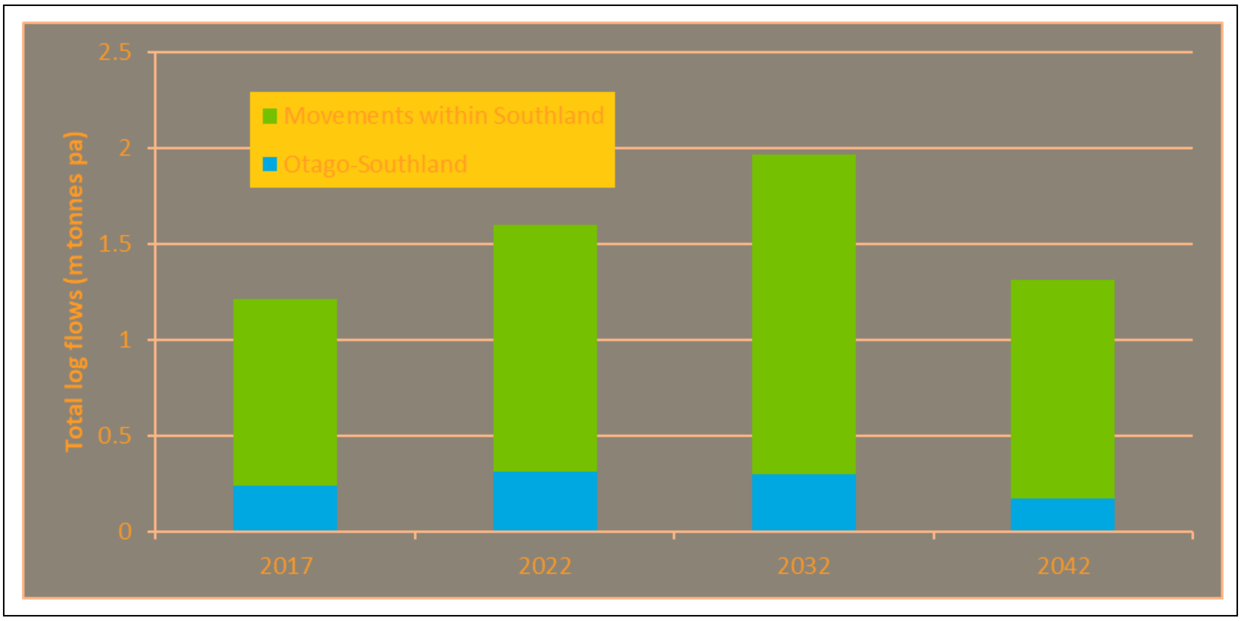


Figure C-2: Forecast log flows into and within Southland

Much of this traffic is exported as logs through Bluff with the volumes set out in Figure C-2. These have been growing steadily over recent years and are likely to continue growing over the future as the figures in Figure C-3 indicate.

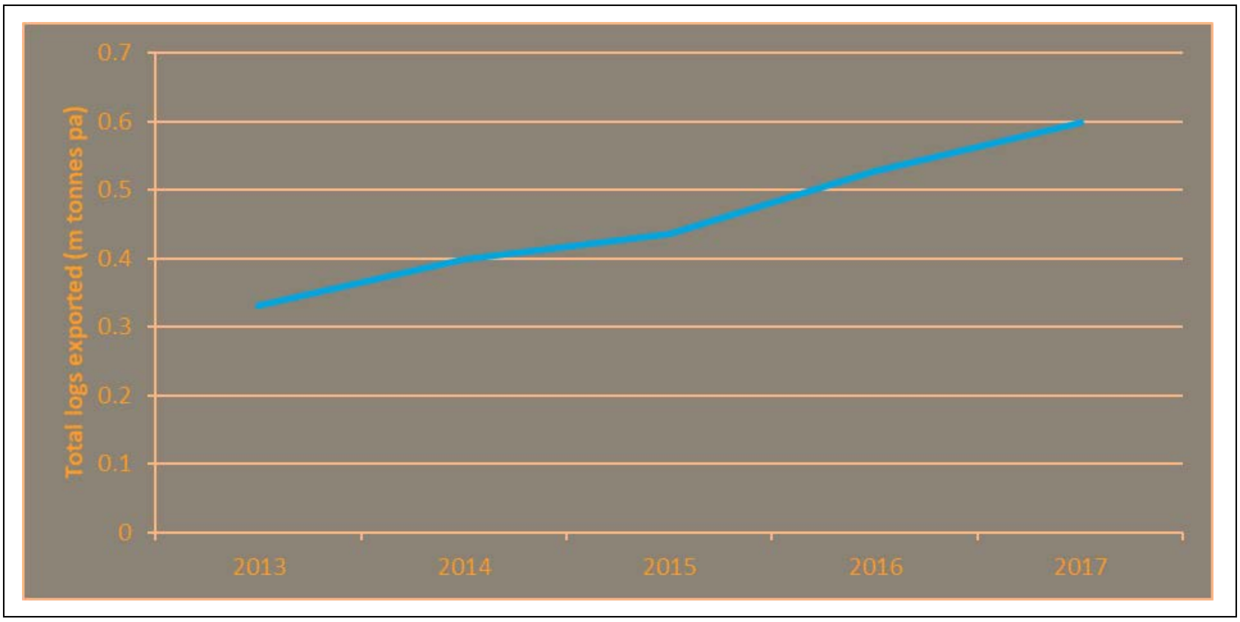


Figure C-3: Exports of logs from Bluff (m tonnes pa)

In addition to the export of logs there are also substantial exports of wood chips and processed timber, but these would be handled in a different manner to the logs and so are outside the immediate scope of this case study.

C.2.3 Possible diversion to rail

For this case study given the size of the potential market it has been assumed that either 50,000 or 100,000 tonnes of logs would be diverted to rail from road movements to Bluff or Dunedin. These figures which have been used to demonstrate the potential impacts of a shift to rail are within the likely forecasts of movement identified in the previous section of 0.2 - 0.3 m tonnes over the foreseeable future.

C.2.4 Total externalities costs for road and rail movements

The total externalities costs have been estimated using the approaches developed for the study. The annual costs which result are set out in Table C-3 and Figure C-4.

Table C-3: Externality Costs for Movements between Milburn and Bluff or Port Chalmers by Road and Rail ($000 per 50000 tonnes)

	Road		Local Road Plus Rail	
	Milburn	Milburn	Milburn	Milburn
	Bluff	Port Chalmers	Bluff	Port Chalmers
Distance	180	62	199	64
GHG	22	7	8	4
Other emissions	13	14	1	2
Other environmental costs	13	8	2	3
Total environmental costs	47	29	11	8
Accidents	134	46	23	15
Impacts on other road users	23	22	2	2
Total externality costs	204	120	36	25
Unmet road wear costs	86	30	7	7
Total	290	149	44	33
Cost/tonne ($)	**5.8**	**3.0**	**0.8**	**0.7**

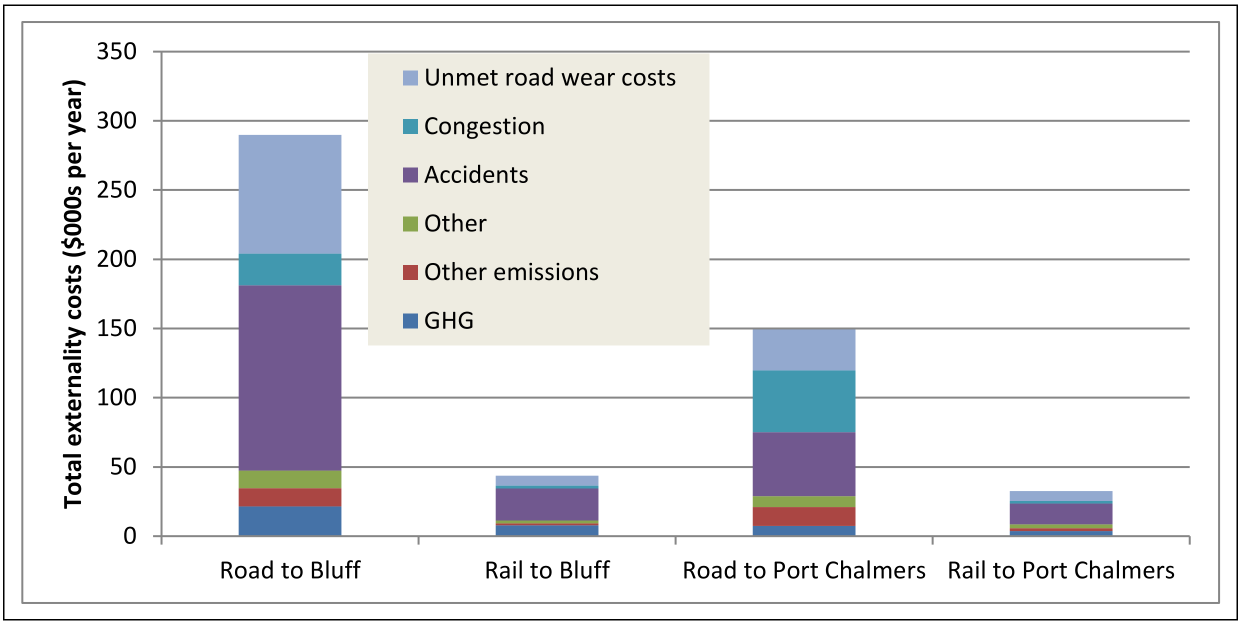


Figure C-4: Possible Milburn log hub: Total externality costs for road and rail for annual movement of 50,000 tonnes

For a movement of 50,000 tonnes there would be a total saving of $0.17m per year in terms of environmental, congestion and accident costs for the movement from Milburn to Bluff. If unmet road wear costs were included the difference in costs would increase to about $0.25 m per year. If logs were diverted for the movement to Port Chalmers the differences would be much smaller amounting to about $0.09m per year for the environmental, congestions and accident costs and $0.12m if all externality costs were included. These latter figures reflect the fairly long distance through the Dunedin urban area that would be required, giving particularly large environmental benefits.

These savings amount to about $4.9 or $2.3 per tonne for the routes to Bluff and Port Chalmers respectively.

The material in Section 2 suggests that these flows should be sustainable over considerable periods. The total discounted benefits assuming a flow of 50,000 and 100,000 tonnes per year over different evaluation periods are set out in Table C-4.

Table C-4: Total Discounted Externality Cost Benefits ($m NPV)

Evaluation Period (years)	50,000 tonnes pa		100,000 tonnes pa	
	Milburn-Bluff	Milburn-Port Chalmers	Milburn-Bluff	Milburn-Port Chalmers
10	1.60	0.80	3.20	1.50
20	2.50	1.20	5.00	2.40
30	3.00	1.40	6.00	2.90
40	3.30	1.60	6.60	3.10

Over an evaluation period of 20 years with 50,000 tonnes diverted the benefits would amount to somewhere between $1.2m and $2.5m with about a third representing unmet road wear costs and the balance the other externality costs. For 100,000 tonnes pa these figures would be doubled to between $2.4m and $5m.

C.2.5 Costs of a transfer point

The costs of a simple log transfer point would include those associated with the provision of a suitable siding and the provision of suitable space for storing and loading logs. We have not made any detailed costs of the provision of new facilities but have provisionally assumed that these would amount to about $2.1m for a new siding and limited hardstanding or $1.9m when discounted. It is possible that these facilities could be used for other transport flows, but these have not been investigated or considered in the analysis.

C.2.6 Overall assessment

Taking into account the costs of the terminal and the reduction in externality and unmet road wear costs for movements between Milburn and Bluff, the outline BCRs that result is set out in Table C-5.

Table C-5: Total BCR's From Development of Logging Terminal at Milburn (Benefits Based on Savings of Externality Costs and Unmet Road Wear Costs for Logging Traffic Only

Evaluation Period (years)	50,000 tonnes pa		100,000 tonnes pa	
	Milburn-Bluff	Milburn-Port Chalmers	Milburn-Bluff	Milburn-Port Chalmers
10	0.8	0.4	1.7	0.80
20	1.3	0.6	2.6	1.2
30	1.6	0.7	3.2	1.5
40	1.7	0.8	3.5	1.6

For movements diverted from Milburn to Bluff, the BCR of the logging terminal would exceed one for all evaluation periods for a flow of 100,000 tonnes and for all except 10 years for a flow of 50,000 tonnes. For traffic diverted from Port Chalmers the BCR would exceed one for movements of 100,000 tonnes per year for the evaluation periods greater than 10 years , but for the lower flow of 50,000 tonnes per year this would be below one for all evaluation periods. , Our analysis of the potential demand suggests that the lower flows should be sustainable over a longer-term future, so all options except the lower flows travelling to Port Chalmers should be able to generate a BCR in excess of one..

C.2.7 Next Steps

C.2.7.1 Proposed action plan

Given that there appears to be a reasonable case for progressing the development of a log transfer station at Milburn, serving either movements to Bluff or Port Chalmers the next steps would include: -

- Identification in more detail of the potential demand for movement of logs by rail within the area served by the proposed logging terminal.
- Confirmation that KiwiRail can provide sufficient rolling stock to provide the service.
- Review of the potential use of the interchange for other movements, particularly of processed timber and the implications that this would have for the design of the interchange.
- Confirmation of the costs of the interchange facilities required to handle the likely flows.
- Identification of any issues associated with the development of the transport interchange including land ownership, consenting and access issues and any associated costs.
- Assessment of the extent to which funding from outside KiwiRail would be required to develop the terminal.
- Development of a business case for the development of the terminal and any other necessary support that would be required and identification of potential sources of finance.

C.2.7.2 KiwiRail response

KiwiRail are investigating the commercial viability of new logging hubs in Southland and also at Milton/Milburn. This is being undertaken with support from Southland Regional Council, Clutha District Council, PanPac Forest Products and MBIE as part of a comprehensive feasibility study in the Otago and Southland Regions to:

(i) identify any potential opportunities to convey export log volumes to South Port on rail, thus avoiding truck trips on roads, lowering carbon emissions and delivering on the Government's Provincial Growth Fund objectives and

(ii) for a multi-modal port neutral freight hub on Otago's Tokomairiro Plain supporting PanPac Forest Products as well as future developments anticipated in the Joint Otago/Southland Regional Land Transport Plan

The study will be undertaken by KiwiRail, who will co-ordinate the work to deliver a feasibility report to MBIE outlining the potential opportunities. KiwiRail will be the lead agency for this predominantly MBIE funded study.

Key stakeholders who will be directly consulted in the development of the feasibility Study include:

- Environment Southland and Otago Regional Council Joint Land Transport Committee
- PanPac Forest Products
- South Port
- Port of Otago Limited
- Calder Stewart/Doug Hall (as landowners on Otago's Tokomairiro Plain)
- Clutha District Council
- NZTA

Methodologies developed in the South Island freight study looking into freight mode shift opportunities (this report) to support the assessment the forestry sector in the Southland / South Otago regions and commercial viability of new road/rail hubs with particular emphasis upon: -

1. Forward demand / harvest & processing projections:
   - Where are the forest blocks in Southland / South Otago, when are they predicted to come 'on-stream,' what is the estimated annualised harvest volumes over what duration and where are processing assets in relation to this?
2. Stakeholder Identification and Engagement

- Identify key stakeholders for export log volumes and multi-modal freight hub and where necessary / appropriate facilitate a stakeholder interest and issues identification process.

3. Network Modelling / Mode Competitiveness

   - Use network modelling tools (utilising existing land use linked network models held by Southland Regional Council and Clutha District Council) and forward demand profiles (utilising National Freight Demand Study outputs currently being updated) to identify if there are any rail served locations where log and freight aggregation facilities could / should logically be established including Otago's Tokomairiro Plain.
   - Assess relative road transport costings to, in conjunction with KiwiRail, determine whether it can be commercially viable to establish log yards to facilitate logs being moved to South Port.
   - Port Neutral freight aggregated on Otago's Tokomairiro Plain.

4. Opportunity Identification

   - Via stakeholder engagement and wider market assessment identify opportunities that would facilitate the required outcomes Size each opportunity and perform a ranking of each (ranking criteria to be established)

5. Develop a combined network and system model across Southern Otago and the Southland Region (building on existing models and utilising methodologies developed in the South Island freight study looking into mode shift opportunities – covered in this report) to assist in quantifying the size and impact of each opportunity - including:

   - Is there scope to transfer volume onto rail
   - Implications for intra Southland/Otago road networks
   - how many truck trips can be avoided or made more efficient?
   - Opportunities for aggregation facilities that could be / should be established including assessment of a port neutral multi modal freight hub on Otago's Tokomairiro Plain? Where else? Are there any barriers to establishment? e.g. environmental, resources consent, congestion, other?
   - Identify what level of investment might be required

   The process will be aligned with the Otago/Southland Joint Regional Land Transport Plan.

6. Opportunities will be assessed for alignment with Government's Provincial Growth Fund criteria of:

   - lifting the productivity potential of a region or regions and contribute to other objectives. These include jobs, community benefits, improved use of Māori assets, sustainability of natural assets, and mitigating and adapting to climate change.
   - adding value by building on what is there already and not duplicating existing efforts. The project also needs to generate clear public benefit.
   - Connecting to regional stakeholders and frameworks – Projects must align with regional priorities. They will need to have been discussed and agreed with relevant local stakeholders.
   - Governance, risk management and project execution – Projects will need to be supported by good project processes and those involved should have the capacity and capability to deliver the project. Projects need to be sustainable in the longer term beyond the Fund's life.

7. Recommendations and next steps

A full written report will be delivered outlining:

- Approach to Feasibility Study - including modelling methodology
- Stakeholder engagement
- Alignment with Provincial Growth Fund criteria
- Opportunity identification
- Recommendation for next steps

It is expected that the output of this study will be an investment decision to either invest in new road/rail hubs(s) in the Clutha District/Southland Region, or not. The timing of the study and decision is anticipated to be by the end of 2019 with the study commencing June 2019.

C.2.8 Extending the analysis

The analysis set out here has considered the case for developing logging hubs based on the benefits from the reduction of externality and road wear costs resulting from the diversion of traffic from road to rail. While the exact circumstances will vary from location to location, including the distances within the urban area on the approach to the port, these suggest that on the basis of savings in externality costs there is potentially a case for investing in rail interchange hubs where the distances to be transported are in excess of 60-80 kms and the flows are likely to be sustained for 15-20 years or more. On this basis we have considered the extent to which these results may have more general applicability across the South Island as a whole. This is based on a more detailed examination of the volumes of logs harvested at a district level and the options for movement by rail from these areas.

Estimates have been made of the volumes of logs harvested by district across the South Island in 2017, with forecasts for 2027 and 2037 based on the age of the forests. These are set out in Figure C-5.

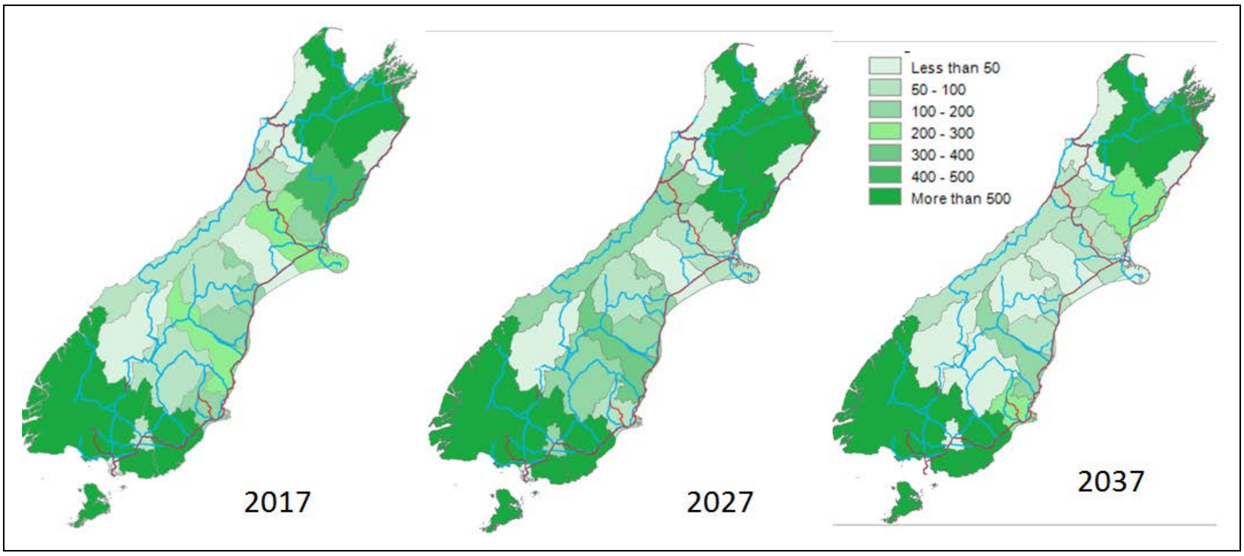


Figure C-5: South Island log forecasts by district 2017, 2027 and 2037 (000 tonnes)

These highlight the fairly stable pattern of log harvesting forecast for the next 20 years with high volumes in the South and the North. It should be noted that these are based on the potential supply of logs. The actual volumes harvested, especially for export logs will depend critically on market conditions and volumes may fluctuate substantially as these market conditions change.

We have also looked at the detail of the location of the forests based on the National Exotic Forest Description (NEFD) for 2016 and this is set out in Figure C-6. This also includes an indication of the areas that are approximately within 80 kms of the major rail connected logging ports including Picton.

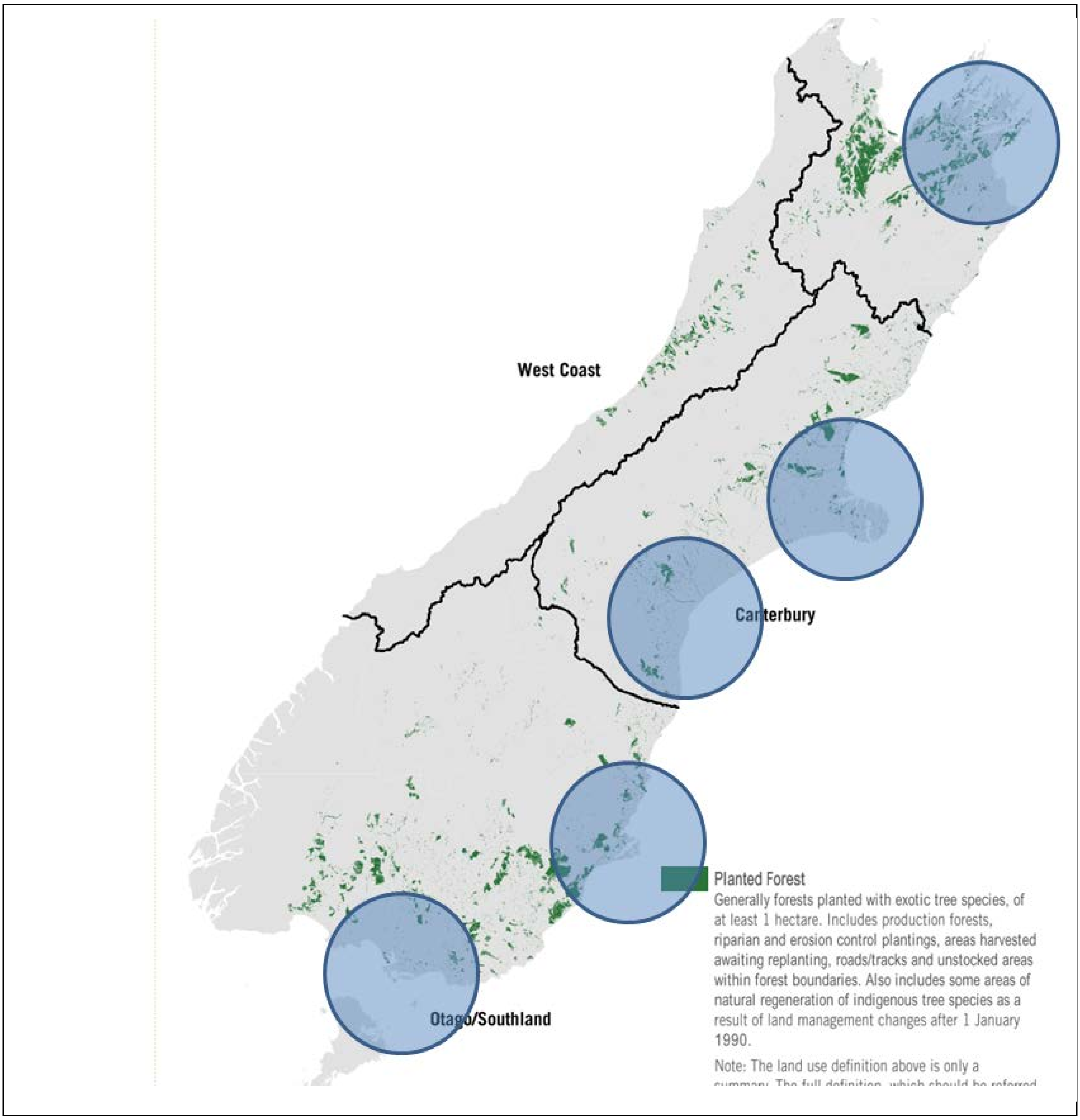


Figure C-6: Key forest areas (2016) and areas within 80kms of major rail served ports

The locations of the Railway lines are set out in red in Figure C-7.

Figure C-7: Key South Island transport links

Comparing the detailed locations of the commercial forested areas with the rail network suggests that particular opportunities exist for rail in west and northern Southland region (Southland and Clutha districts) and in the West Coast and possibly in Selwyn District. These are set out in Figure C-8.

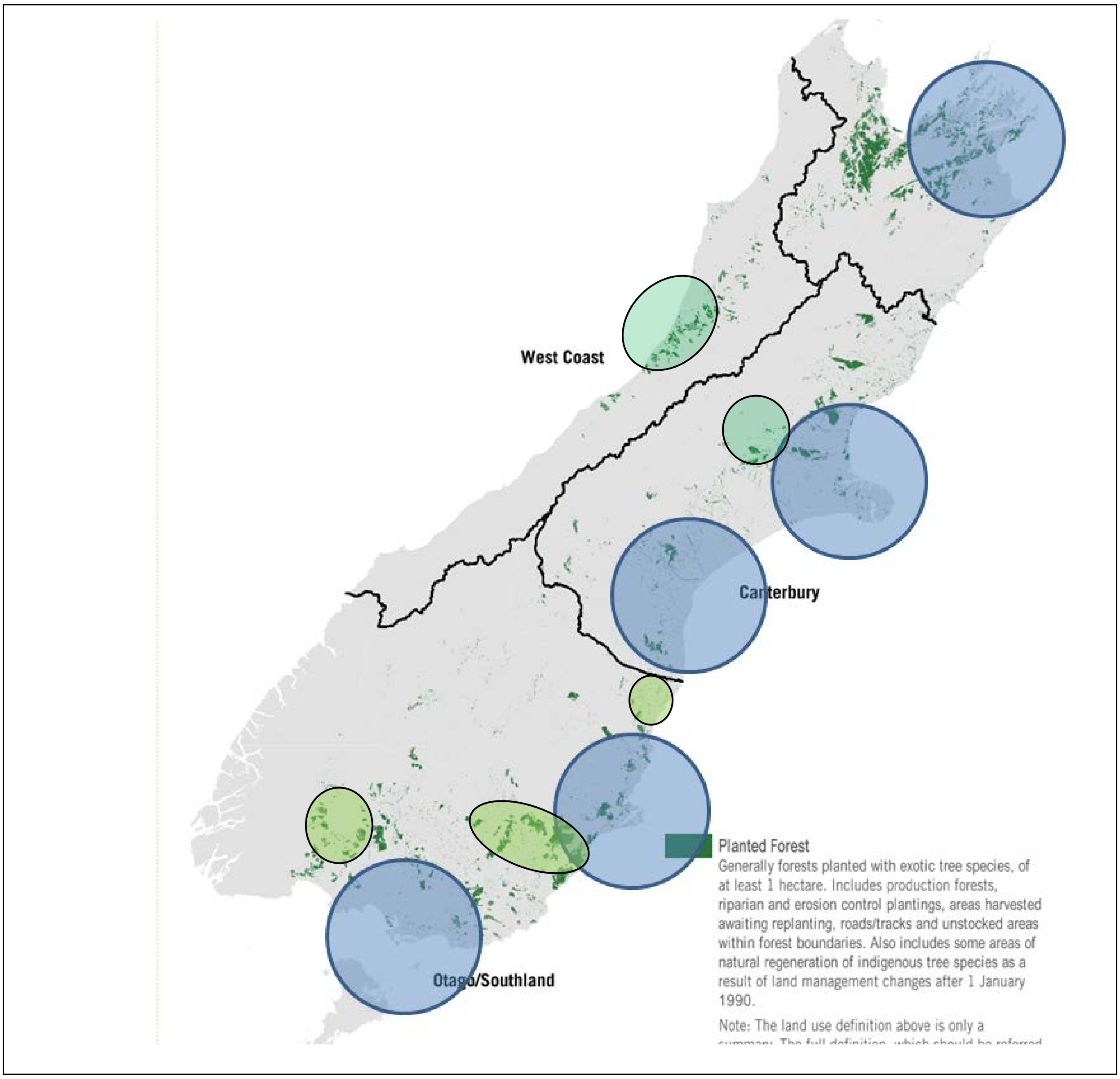


Figure C-8: Key potential rail opportunities

Sites in Southland region would tap into the particularly large volumes forecast for the future. To some extent the proposed site at Milburn would cover one of the potential areas but a new site at Wairio or Nightcaps would appear to have immediate potential. For the West Coast the proposed expansion at Stillwater (considered as a separate case study) may meet some of the demand but given the volumes there may be scope for further expansion at other sites.

There may also be scope for and benefits from rail terminals to serve forests further away from the rail line, if the road distances avoided are longer.

It should be emphasised however that although these sites have potential for investment based on the savings in externality costs, the volumes likely to be attracted to rail will depend on: -

- The balance of the costs to the shipper by road and rail which may be affected by more than just distance and also;
- The potential destinations of the logs, and in particular the extent to which they are moved to processing plants that are not rail served. The demands for logs for processing are likely to grow over the future, but it is anticipated that the volumes exported as logs while possibly falling will still remain substantial.

Overall there appears to be potential for generating significant externality benefits from the increased movement of logs by rail from a number of areas across the South Island, with the benefits typically exceeding the costs of provision of interchange terminals. However, the commercial viability and the scale of the operations which might result need to be confirmed.

C.3 Garnet

C.3.1 Introduction

Proposals are being developed for the production of garnet at a number of sites along the West Coast mainly from south of Hokitika to Barrytown to the north of Greymouth. The proposal for a site at Ruatapu just to the south of Hokitika is the most advanced. This would involve mining, separating the garnet from other material on site and then transporting the garnet to Timaru for further refining and processing before export. The export is anticipated to be in large 25,000 tonne vessels requiring the material to be stockpiled at the port and precluding the option of direct shipment from West Coast ports. It is understood that the application for Resource Consent for the necessary buildings for the processing and storage of the garnet at Timaru, are to be made shortly with production expected to start in early 2020.

Other deposits exist both south of those at Hokitika and to the north of Greymouth where a particularly large deposit combined with ilmenite is located at Barrytown. The resource to be exploited initially at Hokitika is estimated at about 3-5 million tonnes of garnet with substantially larger amounts available at the other locations which may be exploited later.

C.3.2 Volumes to be transported and method of transport

In the initial proposals for the development south of Hokitika the volumes to be transported are estimated to start at about 100 -150,000 tonnes per year. After investigation of different transport options, it is anticipated that the initial production would be transported by road vehicle direct from the production site to the processing plant at Timaru. The resource proposed to be exploited is large and is likely to be extended over time. As a result, it is likely that there are sufficient reserves to allow extraction over a considerable period. The owners of the operation Barton are understood to want to expand production to 300,000 tonnes per year after the operation has become established.

The garnet sand would be transported in bulk, and at 100-150,000 tonnes per year would take advantage of backloading opportunities from Timaru to the West Coast. At this point it would therefore make efficient use of the transport resources already being utilised and the additional costs would be limited. The movement of 100-150,000 tonnes per year would give rise to up to about 15-20 return truck movements per day. However, beyond 100-150,000 tonnes per year it is understood that backloading opportunities are no longer available and this could present an opportunity for rail. The use of rail would require an intermediate handling point at some stage along the route. Possible sites for this may be just to the north of Hokitika, at Kumara Junction or in Greymouth, possibly located in a common user terminal. For this analysis it has been assumed that if carried by rail the material would be transhipped in Greymouth possibly using the facilities at an upgraded Greymouth terminal although other options using a dedicated transfer facility and therefore possibly higher set-up costs may be available closer to Hokitika.

C.3.3 Total distances for goods transported

Road	Hokitika-Timaru	353 kms
Road/rail	Hokitika-Greymouth (road)	39 kms
	Greymouth - Timaru (rail)	400 kms

C.3.4 State of play with the proposal

It is understood that an application has been made for Resource Consent and it is expected that extraction and transport would start in early 2020. It appears that a fairly firm commitment has been made to transport the initial production of garnet by road, but with no definite plan for the movement of the expanded level of production, for which rail may be provide an alternative mode.

C.3.5 Potential for increased rail use

In principle the scheme promoters are keen to use rail to some degree primarily for the transport cost savings that this would generate and the environmental benefits that should result. It is also understood that there are constraints on the volumes that can be economically transported by road because of limited backloading opportunities. With a higher level of production additional jobs in Hokitika might be generated, and the proposers have suggested an increase in employment of 25.

C.3.6 Possible issues

The main issues that need to be resolved if at least some of the garnet traffic is to be transferred to rail are:

- The availability of suitable rolling stock and if appropriate containers to handle the flow between the West Coast and Canterbury and the desire of KiwiRail to handle this traffic.
- The costs to the shippers if a rail service could be provided and the comparison with the possible costs by road.
- The designation and if necessary, the financing and development of a site where the garnet can be transferred to rail. It is likely that some site development would be required.

C.3.7 Benefits of transfer to rail

C.3.7.1 Introduction

The benefits of increased rail use have been considered in two alternative scenarios: -

- **Scenario 1** Production would be expanded by 150,000 tonnes and either transported by road or rail.
- **Scenario 2** Production can only increase above 150,000 tonnes per year if rail is available to allow the additional output to be transported at a rate which makes the expansion economic. The expansion is therefore dependent on rail and would not occur if rail services cannot be provided.

At this stage we have considered the impacts of both these scenarios.

C.3.7.2 Scenario 1

With Scenario 1 there would be the potential to divert traffic from road to rail. The benefits of this transfer to rail would include: -

- Reduction in externalities imposed on the general community.
- A reduction in road wear costs partially balanced against the loss of road user charges.

Using the modelling developed during the course of the study these are estimated at about: -

- $5-6 per tonne externality benefits
- $0.5 per tonne net road wear costs.

This would give a saving of just over $6 per tonne.

On the basis of 150,000 tonnes per year, (the difference between the total production target of 150,000 tonnes per year and the longer-term desired output of 300,000 tonnes per year) the transfer to rail would generate externality and road wear cost benefits of about $0.9m per year. On the basis of a 10-year evaluation period, the discounted value of these would amount to about $6m and over a 20-year period if the operations were extended to other areas, they would increase to about $9m.

C.3.7.3 Scenario 2

Introduction

It has been reported that the use of rail increasing production by 150,000 tonnes per year would require the level of employment in Hokitika to be expanded from 40 to 65. If this were the case, there would be benefits to the local economy. There are a number of ways of measuring this including: -

- The increases in local GDP
- Increases in local wages
- Increases in tax take.

There may also be benefits at Timaru, but these have not been taken into account.

Increases in local GDP

On the basis of the estimated average GDP per worker for Westland of about $80,000 in 2017, 25 additional jobs would generate increased GDP of about $2m per year.

Increases in local wages

Average wage levels in Westland District in 2016 are estimated at $38,200 for all workers and $63,300 for workers in the mining industry[14]. Employment of an additional 25 workers would therefore give rise to increases in total wages of between $1.0m and $1.5m pa.

Total value over project lifetime

The total values of these increments to economic activity are set out in Table C-6.

Table C-6: Wider Economic Impacts of Additional Employment Creation in Hokitika ($m NPV)

Potential Impact	Evaluation Period		
	10 years	20 years	30 years
GDP growth	13	20	24
Increase in incomes - high	10	16	19
Increase in incomes low	6	10	12

An alternative approach

An alternative approach is to consider the value of the awards from the Provincial Growth Fund and the jobs that are reported to be created as a result of these. In two cases where the anticipated employment growth has been identified (Manawatū-Whanganui: Port and Rail boost and the Whakapapa high-speed ski field gondola[15]), the expenditure per job created is between $40,000 and $70,000. Applying these figures to the possible employment creation in Hokitika would give a value of between about $1m and $1.5m

Additional transport externalities

With the expanded production of garnet there would be some additional externality costs reflecting the additional transport by road and rail. These are typically small and would in particular reflect the distance from the production point to the rail loading point. On the assumptions made above with interchange in Greymouth, these additional costs would amount to about $0.3 per year or $2-3m when discounted over 10 or 20 years. These would need to be deducted from the employment benefits described above to get the overall net benefit.

C.3.8 Overall *benefits*

The possible transport and wider economic benefits for the two scenarios are set out in Table C-7.

[14] MBIE REAR website

[15] https://www.mbie.govt.nz/info-services/sectors-industries/regions-cities/provincial-development-unit/provincial-growth-fund/funding-announcements-old

Table C-7: Total Benefits of Rail Transport of Garnet ($m NPV)

Potential impact	Evaluation period		
	10 years	20 years	30 years
Scenario 1			
Transport benefits	6	9	11
Scenario 2			
Increase in GDP	13	20	24
Increase in incomes - high	10	16	19
Increase in incomes low	6	10	12
Less increased externality costs with increased output	(2)	(3)	(4)
Total benefits	4 - 11	7-17	8 - 20

It can therefore be seen that that the transport or wider economic benefits of using rail to transport the garnet in the two scenarios are substantial. The value of the externality benefits of transferring the proposed additional output to rail amount to about $13-20M over a 10- or 20-year evaluation period the impact on local GDP of increased employment less the additional externality costs are estimated to be similar at about $11-17m over 10 or 20 years. The cost of constructing the terminal would also need to be included in any business case.

C.3.9 Next steps and action plan

- Confirm interest of garnet producer in using rail and the scale of the operation that might be undertaken if rail is available.
- Confirm additional employment that might be generated if an increased output was available.
- Identify location for transfer of garnet to rail and potential use of a Greymouth terminal.
- Identify costs of any work required at the transfer point in respect of changes to the rail track or the construction of loading and storage facilities or access routes.
- Identify any other steps necessary to allow the transfer point to be developed (e.g. zoning and consent issues).
- Identify options for funding these and if appropriate develop business case for any public spending or other public actions required potentially using the figures estimated above.

C.3.10 Extending the analysis

The analysis of the benefits of transferring the movement of garnet (a low value primary product) from road to rail has shown that these can be substantial either in terms of reduced transport externality costs if it is possible to carry the product by road or in terms of economic development effects if the provision of rail transport allows output and the associated employment to be increased.

There are a number of possible similar mineral resources that could be exploited at different locations across the South Island. These include ilmenite on the West Coast and diatomite near Middlemarch in Otago. The analysis framework set out above could be broadly scaled to consider the externality and other benefits associated with these, although the results would depend on the particular routes to be used to transport the materials and if appropriate the level of employment creation that might be generated.

C.4 Bottled Water

C.4.1 Background

A company already producing bottle water from several sites across the country intends to add a West Coast source and bottling plant. There are a number of potential sites for this near Greymouth.

The project will employ 15 people, plus those involved in transport, potentially 30 extra jobs in total on the Coast.

C.4.2 Transport

The water will mainly be for export, in containers through Lyttelton. Output will start about 1800 containers per year (TEU), rising over 5-8 years to 20,000. This is equivalent to 80 containers per day. Rail is a clear option for transport[16], and the company is supportive of a rail solution for sustainability and efficiency reasons. The company and Development West Coast have discussed potential loading sites with KiwiRail. These include private sidings at existing minor railway yards in locations close to Greymouth, and through an upgraded terminal at Greymouth.

While a private siding would suit the company, they recognise that adding this traffic would strengthen the case for a Greymouth terminal, and would be happy to use such a facility. With the volumes planned in later years the terminal may have to be built at a larger than minimum size, or shunting capacity added to place and remove shorter rakes of wagons.

The traffic could be available within 2 - 2.5 years but is still under development and no firm date is available.

C.4.3 Road alternative

Water is a dense load and thus suitable for standard 8ft 6in high containers. The restriction on 9ft 6in containers on the rail line to the east coast should not be an issue. A 20ft container of water would likely weigh in the order of 17-23t, including tare.

Table C-8: Size and Distribution Weights

Bottle size	Bottles/carton	Cartons/TEU	Tonnes/TEU	Plus 2.5t tare
350ml	24	1692	14.2	16.7
500ml	24	1331	16.0	18.5
1.5 litres	10	1085	16.3	18.8
4 litres	4	1253	20.0	22.5

(Source: a bottling company website)

Two containers would thus exceed the legal load for a 50MAX truck, and higher weight HPMV are not permitted on SH 73 across the Alps. Each container would be thus making up one truckload, perhaps with some capacity for other loads if available.

Thus 80 extra trucks, each way, per day will be required, or 20,000 per year on a 5-day week basis. Rail can cope with containers of their weight, at the normal two per wagon. The volumes are such that the traffic could make up a train itself, equivalent to one of today's coal trains. In fact, if all were carried on a single train, it would be in excess of current single train load limits through the Otira Tunnel. Some of the containers would have to be carried on a general-purpose train, or the trains run six days per week.

C.4.4 Comparison of road and rail

Given the impact of the weight of a container, it is likely that rail will be more commercially attractive than road. Distances by road and rail are similar.

[16] It is noteworthy that a company in Belfast intends to rail water over the relatively short distance to Lyttelton.

Table C-9: Comparison between Road and Rail

Route	Road (SH only)	Rail
Site A - Lyttelton	231	263
Site A – Lyttelton via Greymouth rail		265
Incl Road from Site A		21
Rail from Greymouth		244
Site B - Lyttelton	267	230
Site B – Lyttelton via Greymouth rail		259
Incl road from Site B		15
Rail from Greymouth		244

There would in addition be substantial externality costs savings with the use of rail as set out below. This assumes that because of the weight of the loaded container the truck is used solely for the carriage of the water in 20 tonne consignments and that because of the volumes transported there are limited opportunities for backloading.

Table C-10: Externality Costs for Movements of Water between Greymouth and Lyttelton by Road and Rail ($m per 400,000 tonnes per year)

	Site A - Lyttelton			
	Road Throughout	Rail and Road Combined		
		Rail-Greymouth - Lyttelton	Road Site A-Greymouth	Total
Distance	231	244	21	268.0
GHG	0.33	0.06	0.03	0.09
Emissions	0.29	0.03	0.02	0.05
Other environmental costs	0.23	0.03	0.02	0.05
Total env	0.86	0.12	0.07	0.19
Accidents	2.06	0.24	0.19	0.42
Delays to other road users	0.51	0.00	0.03	0.03
Total	3.43	0.35	0.29	0.65
Road wear	0.44	0.00	0.04	0.04
Total	3.9	0.35	0.33	0.69
Total per tonne	9.7	0.9	0.8	1.7

At full production of 400,000 tonnes pa the use of rail would give externality savings of about $3.2m per year, reflecting the diversion of substantial volumes (80 return journeys per day) of potential heavy vehicle traffic from the road route across the Southern Alps.

When evaluated over the future the potential externality benefits are set out in the following table.

Table C-11: Total Discounted Externality Cost Benefits from Diversion of 20000 TEUs of Water from Road to Rail ($m NPV)

Evaluation Period (years)	Discounted Externality Cost Savings ($M NPV)
10	13.30
20	24.30
30	30.50
40	33.90

The benefits from transporting the water by rail rather than by road are therefore substantial.

C.4.5 Costs

The costs of establishing a terminal in Greymouth are included in that case study.

At full production the project will need about 40 dedicated container wagons (assuming a one-day return trip, as achieved by the coal traffic). As KiwiRail has no spare wagons, the 40 will have to be purchased at $160,000 each ($6.4m). The road option would also require a large fleet of trucks, at one container per truck and 80 loads per day, and assuming an 8-hour return journey, double shifted, this would also mean 40 trucks. 40 trucks at $350,000 each is $14m. The traffic may also need 1 or 2 extra locomotives in the fleet for the rail option. The exact number would depend on whether they could also be used outside the water traffic. A new locomotive cost in the order of $5m.

Both KiwiRail rolling stock and trucks would be likely to be charged for through the freight rate.

C.4.6 Overall Assessment

The water proposal is not yet active, but if it goes according to prediction, and is carried by rail, it will add substantially to the traffic hauled eastbound on the Midland line. It is likely to require an extra train to be run to cope with it. At present two trains per day run with non-coal traffic during the dairy season, and one during the off-season. The water traffic would add one train to these. At present there is capacity for this extra traffic through the Otira Tunnel.

The level of traffic predicted would potentially justify a private siding close to either alternative site for the bottling plant which would minimise the road feeder distances involved for a rail service and enhance the net externality benefits or using rail. But equally the traffic would make a good base load for a small transfer terminal in Greymouth, and it has been evaluated on this basis. This is a conservative approach in terms of assessing the benefits.

At present there is a significant level of exploration on the West Coast for minerals. Some of these may end up as bulk shipments, by truck, train or ship, and others (e.g. rare earths) may be in quantities that would benefit from a terminal. There are also a number of other water bottling prospects. While therefore the water considered in this case study is a useful catalyst for the establishment of a terminal, it may in future be necessary to provide a special siding for it.

C.4.7 Wider applicability

The case study could serve as a model for other potential water traffic elsewhere in the country, for example in the Bay of Plenty, southern Westland, and in Canterbury. However, the benefits would need to be adjusted for any increase in road feeder distance, and if trucks in excess of 50Max were permitted on the relevant highways.

As a base load for a freight terminal, it could be a model for other bulk traffics, like minerals, and for other freight terminal prospects. For further detail see the Greymouth terminal case study.

C.4.8 Key stakeholders

The key stakeholder is the promoting firm. KiwiRail as hauler of the freight and owner of rolling stick and terminal facilities is also a key stakeholder. In terms of widening the base of economic activity on the West Coast, and promotion of employment, stakeholders include the Regional Council. Grey and Westland District Councils, and Development West Coast.

The government either directly (vie Ministry of Transport) or through the Provincial Growth Fund (MBIE) may be sources of funding for the terminal and potentially rolling stock (see below).

C.4.9 Constraints on achievability

The project has to be proven and consented. While complications with overseas ownership will be absent from this specific proposal, this could still take time as well, the bottling plant itself would take 24 months before being in operation. There appears to be a large market for pure drinking water internationally, which could absorb the quantities involved.

KiwiRail will then have to carry out more detailed operational planning for the traffic.

KiwiRail will have to buy new wagons, and potentially new locomotives. These are built overseas and have a relatively short lead time, once approved. They would form part of KiwiRail's equipment planning once the project is committed to rail. The numbers involved are small compared with recent orders.

Nevertheless, the wagon and locomotive purchases will need external funding. At present KiwiRail's priorities for wagon and locomotive purchases are to replace life-expired equipment. The Government as shareholder has helped fund these purchases, as KiwiRail does not generate sufficient funds itself. Further such funding would be required for new wagons such as those involved in this traffic. In the truck case, this would come from normal lending institutions, which might also be used for rail. In either case, the water company itself could also fund the transport equipment.

The terminal in Tokoroa was part funded by the district council, and that model could be applied here, possibly with the assistance of the government sources mentioned above.

C.4.10 Next steps/action plan

As the project for water has not yet been firmed up, its progress needs to be monitored. We understand that greater clarity will be available in the near term. There needs to be liaison with the company to ensure its needs are met by rail. This currently is done by KiwiRail and Development West Coast.

- The implications of this case study on KiwiRail's forward equipment planning need to be taken into account by KiwiRail.
- Kiwirail will need to assess the commercial viability of the proposal, including risk and funding. Kiwirail therefore needs to be asked to make that viability assessment.
- A business case will then need to be developed for the capital investment and approved by the Board. Funding will need to be obtained.
- An operational plan needs to be developed by KiwiRail

Note: The action in terms of developing the Greymouth terminal is dealt with in that case study.

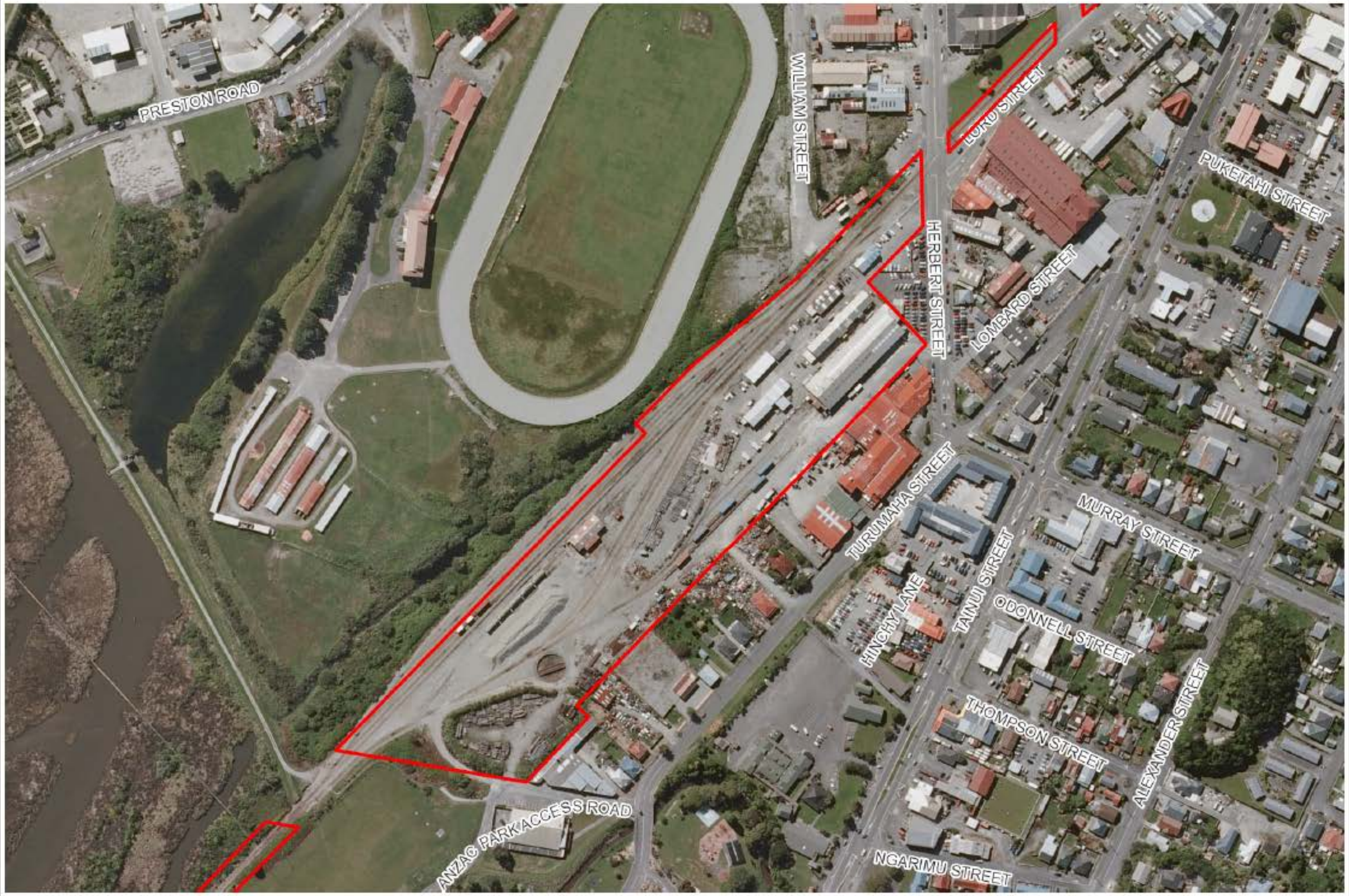
C.5 Greymouth Terminal

C.5.1 Background

There is a railway yard at Greymouth that handles wagon load freight, e.g. containers. If a modern simple terminal was built that could efficiently handle a higher volume of containers, this might attract more traffic, including traffic that currently moves by road.

An Ariel of that yard is attached below.

Greymouth



Legend

- Stations and Locations
- Spot Height
- Landholding
- Roads_noline

KiwiRail

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Date Printed: 7 Nov 2018

120 0 60 120
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C.5.2 Model terminal

There is a small, privately owned terminal at Tokoroa which could be used as a model. This terminal handles a variety of animal health-based products that are distributed by the terminal's owner. Third party cargoes have been handled also, and it continues to be open to them.

It has a double-ended siding off the main line, about 250m long and with an adjacent hardstand for loading and unloading of wagons/containers by forklift, about 15m wide along the whole length of the terminal. There is also a storage area for containers. The siding can accommodate about 15 standard container wagons at a time.

C.5.3 Proposal for Greymouth

Currently the large shed at the north-eastern end of the site is leased by Toll, and it handles road and rail freight forwarding traffic. There is a large expanse of land to the south west of that that could be redeveloped (in part) for a small freight terminal

C.5.4 Costs of building the terminal.

Indicative costs for building the terminal (as supplied by KiwiRail) are set out below. This assumes a siding 15 wagons long, plus a small margin, and a hardstand 15m wide. At this stage it Is assumed that containers needing to be stored will not require pavement. The costs assume all new materials as KiwiRail does not have secondhand materials available. However, it may be that existing tracks could be reused, even potentially in situ, which would reduce the costs. The table below assumes that KiwiRail will own the terminal and not charge for the use of the land. However, it is unlikely that its capital priorities will include funding it. It is thus a useful case to see if external funding can be justified in terms of the societal benefits it will bring.

Table C-12: Costs of Developing a Small Rail Freight Terminal

Item	Unit	Cost per unit	No. units	Cost
Track	m	$1500	270	$405,000
Turnouts	No.	$150,000	2	$300,000
Hardstand pavement	M^2	$250	4050	$1,012,500
Project management	10%			$172,000
Contingencies	15%			$258,000
Total cost				$2.15m

C.5.5 Current traffic levels

Most rail traffic from the West Coast is bulk commodities in some quantity, such as coal, dairy products, logs, and meat. The amount of other traffic is small, including traffic to the North Island. In the other direction the main commodity is bulk milk. There is again only a small amount of other traffic. None of the existing bulk traffic would use the terminal. The current "other" traffic probably would, but it is small and is already rail-borne, so should not be included when calculating the benefits.

C.5.6 Potential traffic

There are two types of traffic that could use the terminal, new traffic not yet developed, which might otherwise move by road; and traffic that moves already by road.

In terms of new traffic, there are numerous natural resource developments that could use the terminal. If they eventuate, they would be the base traffic for the terminal. They include garnet and possibly other minerals, and bulk water. The garnet and water are dealt with in separate case studies, set out above sections of. In the case of garnet, the first 150,000t are likely to move by road as there is a backload available. That is likely to exhaust the available backload, however, and for further quantities rail should be an attractive option – either the further amounts covered by the case study, or from another operator.

Water is dealt with in detail in the previous case study. As discussed below, there is only a small amount of general freight over all modes, and likely to be relatively little that can transfer to rail. So, the terminal needs a major user, an "anchor tenant", to make it viable. Water could be such a major use, with about 80 containers (40 wagons/day eventually. At that volume, it is likely that the proposed terminal would need to be double the size of that set out in the table above, and some shunting assistance introduced. A double sized terminal would be two parallel sidings with hard stand between them, and with room for 30 wagons. These would be unloaded (empty containers) and re-loaded continuously by road shuttle from the plant, and each rake moved when full. There is adequate existing capacity for full wagons to be stored until made into a train. The trade of between longer sidings and fewer shunt movements would need to be determined.

Once the garnet traffic exceeds the levels of available backload, this too could use the terminal. Again, there will be a trade-off between the length of sidings and movement of rakes. Meanwhile other mineral prospects could also yield significant amounts of traffic that is likely to be containerised, e.g. rare earths.

There will only be modest amounts of general freight traffic. Virtually all general retail and manufacturing traffic arrives in the region by road. While the population of the West Coast means the volumes are not great, the tourist market serves to increase them. A local road freight company has 3-4 trucks per day crossing the Alps, including those for Mainfreight. The company believes that this traffic could not be transferred to rail traffic because of its requirements for speed of delivery and reliability. The company does use rail however for some heavier loads (e.g. stone) and values the option of having rail available.

A further possibility for general freight is to use the proposed two-way service being developed for Westland Dairy products by Coda. Coda specialises in optimising two-way freight floes, and in this case is proposing to use the same equipment (curtainsider containers on rail) for both the output of the Westland Milk plant, and substantial inputs to it (e.g. packaging, lactose). However, the latter, westbound, flow is likely to be less than 10% of the eastbound flow of the factory outputs. The general freight movement has the opposite pattern, which may mean that the surplus capacity westbound could be used for general freight to Greymouth. This is not a straightforward proposition, as leaving a wagon with freight at Greymouth on the eastbound haul will delay it getting to Hokitika, possibly by a day (depending on train frequency). If there are numbers of such wagons, it will impact on the whole fleet and mean additional wagons are required in the circuit.

An estimate of the total demand for general freight travelling to and from the West Coast can be derived from the 2014 National Freight Demand Study. In the following table the NFDS numbers have been brought up to 2017-18 levels by using the forecasts in the Ministry of Transport's Freight Outlook Model, and interpolating (geometrically) for this year. The numbers are for the general freight retail and manufacturing commodity only.

Table C-13: General Freight to and from West Coast (t, m)

From	to	2012-13	2022-23	2017-18 (interpolated)
West Coast	Canterbury	0.053	0.061	0.057
Canterbury	West Coast	0.133	0.144	0.138
Otago, Southland	West Coast	0.009	0.009	0.009
West Coast	Otago, Southland	0.005	0.005	0.005
North Island	West Coast	0.013	0.014	0.013
West Coast	North Island	0.018	0.022	0.020
Total		**0.231**	**0.255**	**0.243**
% Westbound		**67%**	**65%**	**66%**

Currently then this shows that nearly a quarter of a million tonnes of general freight flow on road and rail across the Alps, and two-thirds is westbound, 160,000t in 2017-18. Only about 1000t of this is currently carried by rail. New facilities at Greymouth should encourage further traffic to transfer to rail, but the extent can only be estimated. If it was 25,000t (one eighth) then about 10 containers a day could use the terminal, on reasonable load assumptions of 10t/TEU. On the figures above, about half could find an eastbound load.

Rail traffic is at present heavily eastbound, so the general freight would add very little to the costs of running trains. While it is true that the dominant traffic, coal, uses wagons that are incompatible with most other uses, the actual trains can haul other commodities. KiwiRail uses 30 wagon coal trains loaded eastbound and has recently trialled returning the wagons in a 60-wagon train. This leaves train and track capacity for westbound loads. As noted above, the Coda proposal could use the same wagons in each direction. The water traffic could also absorb wagons and containers that have arrived at Greymouth with general freight.

C.5.7 Comparison of road and rail

The externality benefits of using a terminal for water and garnet have already been assessed, as separate case studies. For water, they could total $5.9m pa, or $63m NPV over 30 years. Garnet benefits could be of the order of $3-3.5m pa, and $8-20m NPV over 30 years. The externality benefits from either of these commodities would cover the costs of building the terminal.

For general traffic at the rate of 25000t pa and 10 containers per day the externality benefits are estimated as follows: -

Table C-14: Externality Costs for Movements of Containerised General Cargo between Lyttelton and Greymouth by Road and Rail ($m per 25000 tonnes per year)

		Rail with Road		
	Road	Rail	Road	Total
Distance	231	244	10.5	254.5
GHG	0.02	0.00	0.00	0.00
Emissions	0.02	0.00	0.00	0.00
Other environmental costs	0.02	0.00	0.00	0.00
Total environmental costs	0.06	0.01	0.00	0.01
Accidents	0.14	0.01	0.01	0.02
Delays to other road users	0.03	0.00	0.00	0.00
Total	0.23	0.02	0.01	0.03
Road wear	0.03	0.00	0.00	0.00
Total	0.26	0.02	0.01	0.03
Total per tonne	10.5	0.9	0.4	1.3

With a flow of 25,000 tonnes diverted from road, the use of rail is estimated to give externality savings of about $0.2m-0.25m per year.

When evaluated over the future the potential externality benefits are set out in the following table.

Table C-15: Total Discounted Externality Cost Benefits ($m NPV)

Evaluation Period (years)	Discounted Externality Cost Savings ($M NPV)
10	S1.40
20	$2.20
30	$2.70
40	$2.90

These benefits would need to be offset by the costs of developing the terminal, estimated above at about $2.4m for a basic terminal, or about $2.0m when discounted. On the assumptions made in the analysis, in particular about the availability of the traffic, the externality benefits for general freight as calculated would broadly cover the costs of the terminal, even when evaluated over a period of 20 years or more. The case would be improved if other traffics such as garnet or water used the terminal.

C.5.8 Overall assessment

There is a suitable site for a terminal on land already owned by KiwiRail. The costs of upgrading it into a small modern freight handling terminal are quite modest.

There is only limited general freight likely to be available, and it may be difficult to maintain long term flows at the levels postulated. However, given the length of the movement, the externality benefits of using rail over road from this freight are fairly substantial and are likely to be sufficient to broadly cover the costs of the terminal over an evaluation period of 20 years or more. The case would be improved, and in particular further certainty provided if an additional major user of the terminal with a longer-term commitment could be identified. This could be bottled water, garnet, or another mineral as yet undeveloped. It could also be a distribution operation like that at Tokoroa.

The development of a rail supported distribution terminal would provide an element of additional resilience in the event of disruption to the road links serving the West Coast.

C.5.9 Wider applicability

There are other South Island sites that could be considered for a similar terminal. These could include Ashburton (which already has a functioning rail transfer site) or Mataura or Gore or Kaikoura (which do not). The hurdle for the establishment of the style of terminal will be the availability of a major user "anchor tenant".

C.5.10 Key stakeholders

The key stakeholder is the major user or users. KiwiRail as hauler of the freight and owner of rolling stick and terminal facilities is also a key stakeholder. Local government stakeholders include the Regional Council. Grey and Westland District Councils, and Development West Coast, in terms of the economic development implications of the terminal and the commodities it would serve.

The government either directly (via Vote: Transport) or through the Provincial Growth Fund (MBIE) may be sources of funding for the terminal. So too could the National Land Transport Fund, given the savings that the increased use of rail would bring in terms of road maintenance.

C.5.11 Constraints on achievability

The major constraint is the availability of traffic, and thus of the major commodities that are required. Put simply, the terminal will depend on the successful development of these commodities.

There are constraints in terms of availability of rolling stock that are discussed in the water case study.

Given the priorities for and constraints on KiwiRail's capital expenditure, an external contribution needs to be made to enable it to be built. This could come from local or central sources, like the Provincial Growth fund. The terminal in Tokoroa was part funded by the district council, and that model could be applied here. The major users could also contribute, as with the terminal they avoid the costs of developing their own private sidings.

C.5.12 Next steps/Action plan

Liaise closely with the resource companies to monitor and encourage the development of their plans. The critical next step is to have proven traffic that could use the terminal.

Investigate in more depth the availability of other traffic that might use the terminal, including liaising with Coda about their potential use.

Confirm the availability of the site and the likely costs of developing the terminal with KiwiRail.

Assess other issues that may impact on the use of the site, such as road access.

Identify funding sources, including for the rolling stock required to carry the major traffics.

When there is a firm "anchor tenant", KiwiRail will need to approve the project and build it.

C.6 Waste to West Coast[17]

C.6.1 Introduction

Proposals have been developed for the establishment of a waste to energy plant to be located at Westport to be undertaken by Renew Energy Ltd. This would consume waste collected from a number of locations across the South Island and burn this creating electricity and hot water for possible industrial uses at the same time. As well as disposing of waste the project would therefore also help overcome energy issues on the West Coast and possibly avoid the need for investment in generating and transmission facilities serving the area.

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[17] It should be noted that this project appears to have been abandoned since the analysis was undertaken but which nevertheless provides useful insights into externality issues.

The project has been around for several years but in early 2018 a Chinese company China Tianying Inc, which operates similar plants in 25 countries, signed a $300 million deal to own and operate the Westport plant. This requires Renew Energy the scheme proposers to source enough waste to feed the plant and obtain consent. This process is ongoing but there is likely to be strong local and national opposition to the construction and operation of the plant which may mean that even if it does achieve consent, the details of its operations may be different to those currently planned by the project sponsors.

C.6.2 Volumes to be transported and method of transport

The plans for the waste plant call initially for 60-70,000 tonnes of waste to be transported by rail annually over a period from sometime in 2019 until 2021or 2022 when the plant is planned to become operational. This would be transported from a baling plant at Sockburn for storage on the West Coast at a location which has yet to be confirmed where the waste would be stockpiled until the plant starts operations. In the period immediately before the plant becomes operational this stockpile could be very substantial. It is intended that the movements from Sockburn would be supplemented by material from other baling stations located across the South Island generating about 250,000 tonnes of waste annually for the plant when it is fully operational.

When the plant is in operation it is assumed that in part the material would be supplied from the east coast for which a number of baling stations would be established. These would then be transported directly by rail. Material from the West Coast would be transported by road. Waste from Nelson would probably be transported by road but potentially could be transported by some form of coastal shipping or barging, although this would require works at Westport port to allow the vessels to use this. The flows through the port could possibly be supplemented by waste from the lower North Island. This is outside the scope of this study.

Because of concerns about possible contamination the waste would be transported in special containers which are currently about to be manufactured in China.

The choice of intermediate location is still under consideration. Renew Energy are looking for a site close to the possible plant location in Westport either in Westport itself or at Inangahua Junction which would minimise the onward transport costs to the waste to energy plant. KiwiRail are reported to favour a more remote site at Reefton to take advantage of existing sliding and land there. This would involve a longer onward haul and Renew Energy have concerns about the security of this site for long term storage.

C.6.3 Total distances for goods transported

For the alternative options for movement between Sockburn and Westport the alternative distances are as follows: -

Rail	Sockburn - Inangahua	295 kms
	Sockburn - Reefton	260 kms
	Sockburn - Westport	340 kms
Road	Inangahua - Westport	45kms
	Reefton - Westport	77kms

C.6.4 State of play with the proposal

As discussed above, while there are still a number of issues remaining with the development of the plant and consent has yet to be obtained, on the assumption that it is to go ahead, a number of elements associated with the transport of the waste have been broadly agreed. However, we understand that the location of the interchange point for the intermediate stockpile is still under discussion. This may be an area where there is scope for consideration of options which minimise the eternal costs of transport to the community. It is also possible that given the scale of the operation more than one stockpile location will be necessary to accommodate the proposed volumes.

For the purpose of the case study we have examined two aspects of the operation: -

- The benefits of transporting 60,000 tonnes of waste the full distance from Sockburn to Westport compared to transport by road.
- The impacts of alternative stockpile locations assuming that the main transport from the east coast is by rail with onward transport to Westport by road.

C.6.5 Possible issues

The main issues that need to be resolved with the stockpile locations are: -

- the operational issues associated with the alternative temporary storage locations
- the extent to which the existing facilities would need to be enhanced for what may be a short-term requirement. Although storage is only likely required for a relatively short time up to 2-3 years, the volumes to be stockpiled are likely to be very substantial, possibly up to 120,000 or possibly substantially more depending on the dates at which the various activities start, and the plant comes into full scale operation.

C.6.6 Benefits of transfer to rail

C.6.6.1 Costs for movements from the east coast

The environmental and other externality costs for movements by rail or by road from the east coast from Sockburn to Westport have been estimated as set down in Table C-16.

Table C-16: Waste to Energy: Externality costs for movements between Sockburn and Westport by Road and Rail ($000 per 60000 tonnes)

	Sockburn-Westport	
	Road	Rail
Distance	339	347
GHG	49	12
Emissions	32	2
Other environmental costs	30	5
Total env	110	19
Accidents	303	50
Congestion	64	0
Total	476	70
Road wear	65	0
Total	542	70
Total per tonne	9.0	1.2

Overall the use of rail for movements of 60,000 tonnes between Sockburn and Westport would give externality cost savings of about $7.8 per tonne or about $0.5m per year. Over different evaluation periods the total discounted benefits are as set out in Table C-17. This assumes that the movement starts taking place in mid-2019.

Table C-17: Waste to Energy: Total externality benefits of rail transport of waste from Sockburn to Westport ($m NPV)

Potential impact	Evaluation period			
	10 years	20 years	30 years	40 years
Total externality benefits	3.3	5.0	6.0	6.5

The externality benefits resulting from the movement by rail of 60,000 tonnes of waste from Sockburn to Westport range from about $3m if evaluated over 10 years to $6-7m if evaluated over 40 years.

C.6.6.2 Externality costs associated with alternative storage locations

We understand that the location of the temporary storage location for the waste has not yet been finalised, so the impacts of different locations have been assessed. These are set out in Table C-18. on the basis of a flow of 60,000 tonnes.

Table C-18: Waste to Energy: Annual externality costs of alternative transport options ($m)

Rail Component	Road Costs			Rail Costs	Total
	Environmental, Accident and Congestion costs	Unmet Road Wear	Total Road		
Sockburn - Reefton	0.11	0.02	0.12	0.05	0.17
Sockburn-Inangahua	0.06	0.01	0.07	0.06	0.13
Sockburn- Westport				0.07	0.07

A storage depot located in Westport would give the lowest externality costs with a saving of about $0.1 m per year compared to a location at Reefton and about half that compared to a location at Inangahua Junction. Over 2.5 years the discounted cost saving would amount to about $0.2m and $0.1m respectively.

While there are externality cost benefits from establishing a storage point close to Westport, the total of these over the two years or so until the plant is established are fairly small and would not by themselves warrant a high level of investment to achieve this.

C.6.7 Next steps and action plan

- Confirm that the waste to energy plant is to go ahead and identify the scale of the transport movements associated with this.
- Review options for an intermediate storage point or points and any necessary investment required to support these.
- Identify possible sources of funding for these and determine the need for any public finance.
- Develop business case for investment taking into account the broader impacts of any decision.

C.7 Port Chalmers Inland Port (using rail for all movements to and from Port Chalmers)

C.7.1 Background

Port Otago has previously expressed a desire to take all road traffic off the 13km State Highway 88 that runs from Dunedin to the port. The highway is narrow and winding and passes through residential areas. All traffic to and from the Port Chalmers port would be by rail; some existing traffic, notably logs, would be served at the city port. Substantial quantities of fertiliser and its raw materials would continue to be served by the Ravensbourne jetty.

In discussion with Port Otago they suggested that the proposal was on the back burner owing to lack of rail capacity. It is thus an ideal case study, to assess whether the societal benefits would give it greater priority than implied simply by the financial benefits.

C.7.2 Site

One proposed site is on rail land in the central city. This requires rail to move some maintenance facilities, at an unknown cost. We understand that Port Otago favours this site. It would however still involve road transport through Dunedin to the edge of the central city, albeit largely on a motorway. We have therefore included an alternative, hypothetical, site on the Taieri Plains, for example adjacent to the Fonterra store, or south of Mosgiel. Most port traffic is to or from south of the city. We have assumed an area of 1-2 hectares, based on the areas available at Dunedin and an assessment of the throughput.

C.7.3 Container volumes

In the calendar year 2017, the Ministry of Transport's FIGS data shows that the port exported some 62,000 full TEU of containerised freight, plus a further 4000 TEU of outward domestic freight. It imported 15,800TEU plus 6300 TEU of inward domestic traffic. The domestic volumes are likely to have been influenced by increased coastal movement following the Kaikoura earthquake, and are unlikely to be typical. In the four quarters to Q3 2016, immediately prior to the earthquake, the port handled 1600 outward and 4100 inwards domestic TEUs.

Significant numbers of empty containers were also handled, especially inwards. There were also a large number of containers transhipped. Tranships take place on the port and are not part of the landward freight task.

For this analysis we focus on the outward, export, traffic, as that is the dominant direction and will determine the size of the transport task.

Of the 66,000 TEU (export and domestic) outward in 2017, 38,500 were hauled to the port by rail. In addition, a major flow of panel products was carried by rail to the port in breakbulk form, and packed into containers at the port, estimated at 7800 TEU. So, in total rail already carries about 45,300 TEU, or 69% of the port's 2017 outward containers. There remain 20,700 TEU not currently carried by rail. Adjusting for the earthquake impact, by reducing the domestic from 4000 to 2000, reduces the task for the rail transfer proposal to 18,700, say 19,000 TEU.

19,000 TEU is of the order of 80 containers per day, on a 5-day week basis. The export traffic at the port is subject to peaks, especially for dairy and meat. However, most of this traffic is already on rail. The residual traffic is likely to be less peaked. Allowing for a 10% peak would mean about 90 containers a day (45 wagons or trucks) would be required to be moved. Peaks can also be accommodated by working extra days in the week or running more trains.

C.7.4 Size and cost of the terminal

The distance to the port is short, and 4-5 train round trips could be run in a day from the town site at least. To be conservative, we have assumed 3 trips per day. That implies a siding or sidings capable of handling 15 wagons at a time. Such a siding or pair of sidings would total 260m in length

We envisage an operation that would load trucks on to waiting wagons, without the need for other than incidental storage of containers. Inbound empty containers might need temporary storage, however. Thus, a site with the same track length of the basic terminal proposed for Greymouth would be adequate, but with about twice the paved area. That terminal would cost $3.2 m. Lifting gear would also have to be provided (at approximately $0.25m).

At least two sets of wagons would also be required. It is also assumed that a loaded train would wait at Port Chalmers while it is unloaded. Note that an uncertainty is the length of siding available at the port. The operation would thus be a full load would be taken from the Dunedin sidings, replaced with a set of empties, then the full load is taken to the port, unloaded and returned empty for the next cycle. Any imports and empty containers would be accommodated on the empty train legs. A cycle should take about two hours.

A number of variations are possible which would trade off frequency of service and number of wagons and amount of terminal space required.

C.7.5 Comparison of road and rail

The proposal should remove 9500 truck movements a year each way on SH 88 and through central Dunedin; and through the whole city for the Mosgiel site. The analysis of the benefits of using rail are as follows (for each site).

Inland port in central Dunedin

The distances between central Dunedin and Port Chalmers are similar at about 13km.

Table C-19: Externality Costs for Movements of Containerised Freight between Central Dunedin and Port Chalmers by Road and Rail ($m per 9500 trucks per year)

	Road	Rail
Distance	13	13
GHG	0.01	0.00
Emissions	0.04	0.02
Other environmental costs	0.02	0.01
Total environmental costs	0.07	0.03
Accidents	0.06	0.01
Delays to other road users	0.08	0.00
Total	0.20	0.04
Road wear	0.01	0.00
Total	0.21	0.04
Total per tonne ($)	0.7	0.2

With a flow of 9500 trucks diverted from road, the use of rail is estimated to give externality savings of about $0.17m per year. [18]

When evaluated over the future the potential externality benefits are set out in the following table

Table C-20: Total Discounted Externality Costs with Diversion of Freight Traffic to Rail with a Central Dunedin Inland Port

Evaluation Period (years)	Discounted Externality Cost Savings ($M NPV)
10	1.00
20	1.60
30	1.90
40	2.10

These benefits would need to be offset by the costs of developing the terminal, estimated above at about $3.45m or about $2.9m when discounted. As a result, although the externality benefits as calculated would contribute to the case for an inland port in central Dunedin, they would not be sufficient on their own to fully support the case for investment.

Mosgiel site

For a terminal at Mosgiel the distances involved by road or rail would be about 27km. It is assumed that there would also be a short additional road distance of 5 km associated with the rail movement. Using the same assumptions about diverted truck movements as for the central Dunedin terminal discussed above, the analysis of the benefits of using rail is as follows: -

[18] It should be noted that the parameters used for the evaluation of the externality costs for both sites represent general conditions on the South Island road network and when used for the appraisal of short distance routes in urban areas the results may be subject to a degree of uncertainty. SH 88 is likely to be more sensitive than these average figures suggest.

Table C-21: Externality Costs for Movements of Containerised Freight between Mosgiel and Port Chalmers by Road and Rail ($m per 9500 trucks per year)

	Road Throughout	Combined Rail and Road		
		Rail	Road	Road+Rail
Distance	27	28	5	33
GHG	0.02	0.00	0.00	0.01
Emissions	0.06	0.02	0.01	0.03
Other environmental costs	0.03	0.02	0.01	0.03
Total environmental costs	0.11	0.04	0.03	0.06
Accidents	0.11	0.02	0.02	0.04
Delays to other road users	0.12	0.00	0.02	0.02
Sub total	0.35	0.06	0.07	0.13
Road wear	0.02	0.00	0.00	0.00
Total	**0.37**	**0.06**	**0.07**	**0.13**
Total per tonne	1.3	0.2	0.3	0.5

With a flow of 9500 trucks diverted from road, the use of rail is estimated to give externality savings of about $0.2-0.3m per year.

When evaluated over the future the potential externality benefits are set out in the following table.

Table C-22: Total Discounted Externality Costs with Diversion of Freight Traffic to Rail with an Inland Port at Mosgiel

Evaluation Period (years)	Discounted Externality Cost Savings ($M NPV)
10	$1.5
20	$2.3
30	$2.8
40	$3.1

These benefits would need to be offset by the costs of developing the terminal, estimated above at about $3.45m or about $2.9m when discounted. While the externality benefits could contribute to the case for a new inland terminal, they would only match the broad costs of the inland terminal over an extended evaluation period of 30 or 40 years.

C.7.6 Overall assessment

The proposal will remove a substantial number of trucks from a narrow, winding urban highway. It will also simplify operations at the port and increase its efficiency. When measured against the costs of providing a terminal the externality benefits would exceed the costs after about 30 years for a site in Mosgiel. For a site in central Dunedin, while the externality benefits would contribute to the case for a new terminal but would not be sufficient on their own to justify this.

It requires land to be made available, and investment in a terminal. A fleet of wagons, probably 30, would also be required, as well as lifting equipment. The short haul and likely traffic should mean that this is a low-stress task for the wagons, and could perhaps use older pre-retirement wagons.

C.7.7 Wider applicability

" Inland ports" are relatively common. Lyttelton and Southport already have them, as do most North Island ports, where their primary purpose is traffic generation rather than relief of a tight port site. There is thus limited wider applicability directly, though might be relevant to Napier, which has a restricted site. But the proposal might be a model for exclusive use of rail in serving ports, and for use of short distance rail shuttles in other circumstances.

C.7.8 Key stakeholders

The key stakeholder is Port Otago Ltd. The operation would be designed for their needs and for their exclusive use. Clearly KiwiRail as operators are also a key stakeholder.

In terms of the environmental benefits the key beneficiary is the Dunedin City, and the residents along the SH88 route. Otago Regional Council may also be a stakeholder.

NZTA would have substantially less work to do in maintaining the highway, and may also be able to avoid substantial improvements to it.

The obvious source of funding is the port company. However, in view of the externality benefits gained, the city may have a role in contributing, as well as central government sources. In view of the savings likely on the highway, the National Land Transport Fund could also be a logical source of funding.

C.7.9 Constraints on achievability

The key constraint is the port wanting to pursue it, and it and KiwiRail coming to a commercial agreement.

This includes land availability, and any costs in making that land free to build the terminal on.

KiwiRail will have to provide locomotives and wagons, which are currently in short supply, but for a short, level journey it should be possible to use older equipment, at least for the town site.

C.7.10 Next steps/Action plan

KiwiRail and Port Otago have to agree to pursue the project.

A site needs to be decided on and made available (or purchased) for the terminal.

The length of track and amount of hardstanding needs to be determined.

An optimum operating plan needs to be developed, making the best use of the terminal, the wagons, the train movements, and the port site.

A finance plan will need to be developed, particularly if funding is required from third parties.

C.8 Urban Distribution

C.8.1 Introduction

In addition to considering the effects of schemes which result in the diversion of freight movements away from road transport we have also considered the possible effects of the transfer of freight movements from diesel powered vehicles to electric vehicles. For this we have developed a notional scheme, although based on the types of changes that are occurring within New Zealand. The proposal examined in this case study covers deliveries in a metro area.

C.8.2 Definition of the case study

The case study is based on a metro delivery round involving an MCV operating about 100 kms per day and compares the operating and externality costs of using a diesel or equivalent electric vehicle. The vehicles are assumed to be operated wholly within the urban area. The trucks are assumed to have a maximum load of 5 tonnes with an average load of half of this.

C.8.3 Identification of the potential benefits

The basic parameters for the assessment of environmental impacts are based on a heavy-duty vehicle taken to be equivalent to an HCVII as defined by NZTA in the EEM. No published data is available for the smaller vehicle types considered here, but material from the EEM suggests that an MCV has a fuel consumption of approximately 35 per cent of that of the heavy vehicles. The main components of the externality costs which are likely to vary between diesel and electric vehicles are assumed to be related to fuel consumption (greenhouse gas and other emissions) and so the externality parameters for large vehicles have been reduced by this factor. The values which result are set out in Table C-17.

Table C-23: Estimated Environmental Costs for Different Vehicle Types ($ per 1000 vkt)

Environmental Cost Item	HCV Costs	MCV Costs (Diesel)	MCV Costs Electric
Air pollution	155.7	54.2	0
Greenhouse	36.1	12.5	0
Noise	33.0	11.5	5.8 (1)
Soil and water	16.2	5.6	5.6
Biodiversity	11.0	3.8	3.8
Nature and landscape	1.2	0.4	0.4
Additional urban /barrier effects	10.5	3.7	3.7
Total	263.8	91.8	19.3

Notes (1) Assumed to be half the cost of a diesel vehicle

On the basis of these figures the use of electric vehicles would reduce the environmental costs of urban operation by MCVs by almost 80 per cent.

The operation being examined is assumed to involve 10 trucks typically travelling about 100 kms per day or 25,000 kms per year. On this basis the total annual environmental benefits would amount to about $18,000 per year or $1,800 per truck, mainly in terms of reductions in greenhouse gas and other emissions. At a carbon cost of $60 per tonne (the value assumed in the underlying cost parameters), the reductions in greenhouse gases would be the equivalent of about 5 tonnes per vehicle or 50 tonnes overall.

The changes in the environmental costs need to be considered alongside the differences in the costs facing the operator of the vehicles.

C.8.4 Actions to Enable or Accelerate MCV EV Take-Up

There are a number of national and local initiatives that can be undertaken to encourage MCV EV take-up.

- Provide certainly of cost structures through the retention of RUC Exemption for EVs as a proxy for the improved carbon footprint and environmental operation of the vehicle operations.
- Suspensory loans for the difference in purchase price for an EV versus a diesel vehicle or other subsidy for EV Purchase.
- Ensuring there is sufficient charging infrastructure including any network improvements.

Key Actions to initiate these would include;

- EC and Regional Councils should request MBIE or EECA to complete a business case assessing the merits of long-term support measures for EVs as a way to improve the carbon efficiency and sustainability of NZ's Transport Systems. This would include actions such as:
  - The retention of RUC Exemptions or other similar measures
  - The potential of loans or subsidies to further accelerate the adoption of EVs in the freight task.
- EECA completing a review of likely charging infrastructure needs for Heavy and MCV. This would need to address both network needs and charge station needs.

C.8.5 Enabling A More Efficient Urban Supply Chain

In addition to the electrification of the MCV fleet there are a number of other factors expected to impact Urban Distribution in the coming years.

- First, NZ, like many other jurisdictions, is seeing a steady rise in the take up of e commerce. This is expected to continue to increase as will customer's expectations around faster and or same day delivery. This has significant impacts on the end of the supply chain and many initiatives are expected to be undertaken to reduce the impact of this on the last mile network.

- Second, increasing analytic capability is allowing disruptive and sharing models to develop creating opportunities to share distribution hubs.

- Third, the development of personal mobility and drone delivery capability is allowing efficient delivery right into the suburbs. Some jurisdictions are implementing mobile and or micro-hubs in conjunction with electric cargo bikes and pick up locations to improve delivery service AND reduce trips.

In general, the technologies for all these are available now and take up will either be demand or regulation driven. Regulation could be motivated by either traffic management or environmental considerations.

The public infrastructure needed to facilitate this is not substantial and would generally include changes to physical infrastructure considering parking and operation of the micro-hubs to ensure safe and efficient operation.

It is recommended that EC and the South Island Regional Councils complete a review of global initiatives in this area and provide guidelines for cities to plan and prepare for likely changes in the urban freight delivery task. These guidelines could include both regulatory and infrastructure modification.

C.9 Barging Logs in the Marlborough Sounds

C.9.1 Background

Marlborough District Council is exploring the most appropriate way to shift logs from harvesting within the Marlborough Sounds to Port Marlborough in Picton. The transport modes being investigated are by road or by barge.

The project aim is to establish a transport system that allows for the safe and efficient transport of harvested logs to market from the Titirangi, South Hopai and South Crail Bay areas of the Marlborough Sounds over the next 50 years, being two harvest cycles.

C.9.2 Volume of logs

From the 25 February 2016 Council report, it is estimated that there will be 500,000 tonnes of logs to be transported out of the Kenepuru sounds area that is not currently serviced by barge sites, the majority over a 15-year period for the first harvest cycle.

C.9.3 Transport demand

The 18,000 laden truck and trailer loads that would be required to move the above volume of logs, equates to an average 1,200 truck movements per annum. If no logging operations are permitted over weekends or during December - January that then requires 6 laden trips out and 6 empty trips in per day, every week day, for 40 weeks a year, for 15 years. [This is based on HPMV – subsequent discussion is HPMV not approved therefore number of truck movements increases.]

C.9.4 The problem

The existing Kenepuru Sound Road from the head of the Sound through to Linkwater is not considered suitable for the amount of logging truck and trailer loads that future demand suggests would access this road.

C.9.5 Preferred option – Barge site

Rather than upgrading the road for logging truck demand the preferred option is to establish a single site for a barge operation within the Titirangi, South Hopai and South Crail Bay area.

This option itself presents additional challenges. There are a large number of mussel farms located throughout the Marlborough Sounds and recreational fishing is popular. Manoeuvring barges within some of these areas could prove difficult. Also, the proposed barges require a minimum water depth to operate.

Within the Kenepuru sounds there are several areas that have significant numbers of holiday homes. There are also a lot of private jetties providing boat access into these properties. Road access into all forested areas is limited with the main roads being the Kenepuru Road, Crail Bay Road and Manaroa Road. Much of the forestry is also on private land rather than large commercial plantations.

The development of a new barge site and associated operations can be noisy and dusty. With the Marlborough Sounds being an area that has high intrinsic value including aesthetics, marine, environmental etc. Controls will need to put in place to mitigate any potential effects.

C.9.6 Information to support design

The implementation of the solution will be an iterative process involving technical assessments, GIS mapping, stakeholder discussions, and on-site validation, with each stage informing the next step and potentially modifying a previous step.

- GIS Mapping has been undertaken to allow presentation of the following information
- Forestry Catchment – the only areas being Titirangi, South Hopai and South Crail Bay
- Total yields per sector/ planting cycle
- Annual tonnage per sector
- Road access available / extent of road upgrade marked up
- Suitable areas for adjacent landside operations available
- Barge navigation constraints including bathymetry – based on the largest proposed barge
- Marine farming activity – existing and proposed
- Residential intensity
- Identification of high value / high use areas for recreational / tourism purposes
- Overlays from the MEP
  - Coastal Natural Character
  - Outstanding Natural Features
  - Ecologically Significant Marine Sites

C.9.7 Project next steps

This is a project in progress. Steps to reach a conclusion include:

- assessment of the "consentability" of an area ranging from "permitted" to "prohibited"
- harvest mapping (which is based on a harvest year of 28 years after planting)
- select options and identify the number of truck movements on a daily basis
- Targeted stakeholder discussion to allow for some verification or correction of the various mapping.
- site proofing.
- dissemination of information, a meeting involving the stakeholders including residents' associations and formation of a working group to review and then undertake the MCA.
- compare the "No Barge" option to look at the truck movements on all parts of the network.
- Evaluate the advantages / disadvantages of several barge locations.

Appendix D PWG Workshop 3 Case Studies Presentation and Actions Discussion

D.1 Workshop Notes Final for Issue

D.2 Case Studies Final 1.0 - Workshop 3 Presentation November 2018

Workshop

Case Studies and Action Plan, South Island Freight Mode Shift Study

Location: Environment Canterbury, Tuam Street, Christchurch

Attendees:

Darren Fidler, Environment Canterbury
Lorraine Johns, Environment Canterbury
Stephen Bateman, Independent Advisor
Russell Hawkes, Environment Southland
Kevin Stratful, West Coast Regional Development
Ralph Samuelson, Ministry of Transport
Paul Dinnington, KiwiRail
Colette McCann, KiwiRail
Caroline Hutchinson, NZTA
Steve Higgs, NZTA
Murray King, Murray King & Francis Small
Richard Paling, Richard Paling Consulting
Andrew Maughan, Stantec
Mike Rudge, Stantec

November 22, 2018 at 1pm

Workshop Notes

Stakeholders introduced themselves, their organisation interests and Stantec presented against each of the case studies and themes. A discussion was held clarifying key points and identifying potential next steps. The discussions and focus of the workshop are summarised into the following tables:

- Case Study Outcomes organised by Theme
- Case study next steps
- Quantified benefits
- Draft action plan

Case Study Outcomes organised by theme

Opportunity Theme	Principle Benefits	Key Next Steps	Transferability to other NZ Opportunities
Logs	Transport benefits	BUSINESS CASE Identify locations, NZTA business case to look at funding of hubs and transport benefits to be realized.	YES. Forestry areas >80km from Port and close to existing railway line. Large areas of regional NZ.
Other commodities	Transport and /or economic benefits (safety, environmental, access employment, GDP)	BUSINESS CASE Explore public investment in infrastructure to unlock economic growth opportunity, MBIE PGF business cases, private sector funded opportunities.	YES. Driven by commercial and socio-economic opportunity.
Multi-user terminals	Transport and wider economic benefits (access, environmental, employment, GDP)	BUSINESS CASE Requires lead investment, could be combined PGF and NZTA funding, business case.	YES. Across NZ.
Inland port	As for multi user terminals	Seeking agreement from both KR and Port Otago, then business case.	Limited but might be a model for other ports on cramped sites.

Opportunity Theme	Principle Benefits	Key Next Steps	Transferability to other NZ Opportunities
Waste to West Coast	New commodity Economic benefit Future transport benefits	MARKET TO DECIDE (possible business case) Commercially driven opportunity, already focused on lowest net cost most efficient mode options development. No further action.	NO This is a standalone opportunity. However, it may act as a case study for how other standalone opportunities may be delivered elsewhere in the country if government investment is used to help enable (economic growth) as a next step.
Last mile urban distribution	Transport (reduced congestion, safety, environmental, access)	STUDY Study to quantify benefits of multi-user and mobile freight/parcel hubs. TLA driven and NZTA. This is a possible future problem, not a known existing problem.	MONITOR EXISTING INDUSTRY STUDY Probably Auckland, Christchurch, and possibly Wellington, Hamilton. Suggested also consider Queenstown.
	Environmental (noise and air pollution/emissions)	STUDY Quantify potential environmental benefits for Christchurch, identify. Problem is noise and air pollution (GHG) from ‘last mile’ small vehicle freight delivery in urban environments. Opportunity to reduce total environmental emissions by converting freight delivery for small vehicle last mile to electric vehicles. Scale the problem. Define who are the interested parties. Is it a value for money proposition? Determine what is needed.	YES Would have an impact primarily in higher density urban areas such as Auckland, and possibly Wellington, Christchurch and Hamilton.

Case Study Next Steps

Case Study	Actions/Next Steps
Stillwater logs	• Confirm the interest of the log producers in making additional use of rail and the scale of the additional traffic that might be transferred. • Identify the potential for KiwiRail to provide additional rolling stock capacity to accommodate this increased demands and any potential bottlenecks that might arise. • Identify any changes needed to the Stillwater site. • Assess the need for additional public funding. • Assess externality benefits. • If additional funding required, identify potential sources for this and build business case if appropriate potentially using the figures estimated above.
Milton/Milburn logging terminal	• Identification in more detail of the potential demand for movement of logs within the area served by the proposed logging terminal. • Assessment of the potential market for movement by rail. • Identification of any other traffics which might use a new interchange terminal. • Confirmation that KiwiRail has sufficient rolling stock and is willing to provide the service. • Identification of possible sites for the terminal. • Confirmation of the costs of the interchange facilities required to handle the likely flows. • Identification of any issues associated with the development of the transport interchange including land ownership, consenting and access issues and any associated costs. • Assessment of externality benefits. • Assessment of the extent to which funding from outside KiwiRail would be required to develop the terminal. • Development of a business case for the development of the terminal and any other necessary support that would be required and identification of potential sources of finance.
Bottled water from the West Coast	• As the project for water has not yet been firmed up, its progress needs to be monitored. • There needs to be liaison with the company to ensure its needs are met by rail. This currently is done by KiwiRail and Development West Coast. • The implications of this case study on KiwiRail's forward equipment planning need to be taken into account by KiwiRail. • KiwiRail will need to assess the commercial viability of the proposal, including risk and funding. KiwiRail therefore needs to be asked to make that viability assessment. • A business case will then need to be developed for the capital investment and approved by the Board. Funding will need to be obtained. • Assess externality benefits. • An operational plan needs to be developed by KiwiRail. • The action in terms of developing the Greymouth terminal is dealt with in that case study.
Garnet from West Coast	• Confirm interest of garnet producer in using rail and the scale of the operation that might be undertaken over time if rail is available. • Confirm KiwiRail capacity to handle the additional traffic. • Confirm additional employment that might be generated if output increased if rail was available. • Identify location for transfer of garnet to rail and potential use of a Greymouth terminal.

Case Study	Actions/Next Steps
	• Identify costs of any work required at the transfer point in respect of changes to the rail track or the construction of loading and storage facilities or access routes. • Identify any other steps necessary to allow the transfer point to be developed (eg zoning and consent issues). • Identify externality benefits. • Identify options for funding these and if appropriate develop business case for any public spending or other public actions required.
Greymouth Freight Terminal	• Liaise closely with the resource companies to monitor and encourage the development of their plans. The critical next step is to have proven traffic that could use the terminal. • Investigate in more depth the availability of other traffic that might use the terminal, including liaising with Coda about their potential use. • Confirm the availability of the site and the likely costs of developing the terminal with KiwiRail. • Assess other issues that may impact on the use of the site, such as road access. • Identify externality benefits associated with the increased use of rail. • Identify potential funding sources, including for the rolling stock required to carry the major traffics. • When there is a firm "anchor tenant", KiwiRail will need to approve the project and build it.
Port Chalmers: exclusively using rail to serve Port	• KiwiRail and Port Otago have to agree to pursue the project. • A site needs to be decided on and made available (or purchased) for the terminal. • The length of track and amount of hardstanding needs to be determined. • An optimum operating plan needs to be developed, making the best use of the terminal, the wagons, the train movements, and the port site. • Assess externality benefits. • A finance plan will need to be developed, particularly if funding is required from third parties.
Waste to West Coast	• Confirm that the waste to energy plant is to go ahead and identify the scale of the transport movements associated with this. • Review options for an intermediate storage point or points and any necessary investment required to support these. • Assess the externality benefits. • Identify possible sources of funding for these and determine the need for any public finance. • Develop business case for investment taking into account the broader impacts of any decision.
Electric vehicles	• Assess implications of use of electric vehicles rather than diesel /petrol vehicles in terms of whole life costs to operator and externality benefits • Assess need for funding and identify potential funders. • Develop business case if additional funding from private sector required • Complete a review of global initiatives in this area. • provide guidelines for cities to plan and prepare for likely changes in the urban freight delivery task. • guidelines could include both regulatory and infrastructure modification.
Urban distribution	

Quantified benefits

Case Study	Product	Annual Volumes (tonnes)	Total Annual Externality Benefits ($m pa)	Unmet Road Wear Costs ($m pa)
Stillwater logs	Logs	30,000	0.3	0.2
Milton/Milburn Logging terminal	Logs	50,000	0.4 for movements to Bluff	0.2
Garnet	Industrial materials	150,000	2.0	1.2
Water	Consumer products	400,000	5.9	3.2
Greymouth terminal	General freight	25,000	0.4	0.2
Waste	Waste	60,000	0.1-0.2 for alternative storage points 0.9 for movement from Christchurch	0.1 0.5
Port Chalmers Inland Port	General freight	200,000	0.3 - 0.4	0.1 - 0.2
Electric vehicles (urban) – Christchurch*	Consumer goods	TBC	TBC	0
Urban distribution – Christchurch*	Consumer goods	TBC	TBC	TBC
Total		915,000	9.4-10.3	5.2 - 5.7

*** added to table post workshop***

Draft Action Plan

Reference	What	Who	When

Action 1:	• SI Chairs to identify lead agency.
	• Lead agency to complete point of entry document
	• Have point of entry discussion with NZ Transport. Agency and / or MBIE (PGF) relevant to opportunity
	• Projects (possible lead agency):
	  o Stillwater (West Coast Regional Council)
	  o Milton/Milburn (Southland / Otago Regional Council / NZ Transport Agency)
	  o Bottled water from the West Coast (West Coast Regional Council)
	  o Garnet from the West Coast (West Coast Regional Council)
	  o Greymouth freight terminal (West Coast Regional Council)
	  o Port Chalmers (NZ Transport Agency / Port Chalmers / KiwiRail).
	• Undertake business case to confirm next steps for these opportunities.
		SI Chairs	January 2019

Action 2:	• Undertake a study to identify and prioritise (with quantified transport and economic benefits) a comprehensive long list of road to rail opportunities. across the South Island. • Undertake preliminary evaluation (modelled on the approach taken with case studies for the SI freight mode shift study) of the potential benefits of each of the opportunities. • Have point of entry discussions with NZTA/MBIE by regional priority.	SI Chairs	January 2019

Reference	What	Who	When
Action 3:	• Propose research to NZ Transport Agency / MoT: o Complete study on impacts in cities of electric vehicle uptake: o Complete study on impacts in cities of increased online shopping and increased volume of door to door deliveries in urban environment. • (if need) Develop infrastructure planning and design guidelines for electric vehicles and for increasing urban distribution for Christchurch in consultation with industry (such as Foodstuffs and Courier companies).	SI Chairs	January 2019
Action 4:	• West Coast Regional Council to facilitate agreement between KiwiRail and Developers on waste transport • If agreement in principle is reached, undertake a study to understand transport impacts and likely waste storage points. • Have point of entry discussion with NZ Transport Agency and / or MBIE (PGF). • Undertake business case to confirm next steps	West Coast Regional Council	Now
Action 5:	• Explore alternatives to road capital investment funding.	NZ Transport Agency	Now

Stantec

Workshop 3
22 November 2018

Environment Canterbury South Island Freight Study

In association with

Richard Paling Consulting and

Murray King & Francis Small

Agenda

1. Context
2. Workshop activity (case study discussions)
3. Summary
4. Next steps

1. Context
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1.1 Context

- Background and rationale for case studies
  - “Better” mode split in South Island
  - Measured in terms of reduced impact on community
    - primarily- reduced externality costs
  - Primarily looking at opportunities to transfer to rail

1.2

Externality Costs

- Assessment of relevant externality costs for different modes
- These include:-
  - GHG
  - Other emissions
  - Noise
  - Soil and water
  - Biodiversity
  - Nature and landscape
  - Additional urban/barrier effects
  - Accidents
  - Impacts on other road users
  - Unmet road wear costs
- Take into account whether roads are rural or urban and for urban areas whether traffic is in the peak or not

Agenda

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2.1

Bundle 1 – Logging Options

2.1.1

Stillwater Logs

- Shortage of rail capacity to carry logs from West Coast means more expensive road routes have to be used
- Increased heavy vehicles crossing the difficult routes across the Alps.
- Immediate potential for increased use of rail using existing facilities, possibly removing 20-30 return truck trips per week
- This would increase rail's share of the total volumes of logs transported to Canterbury from the West Coast substantially
- Externality benefits of shift to rail fairly substantial $2m-$3m over 10 or 20 years.
- Next steps to clarify possible increases in KR capacity

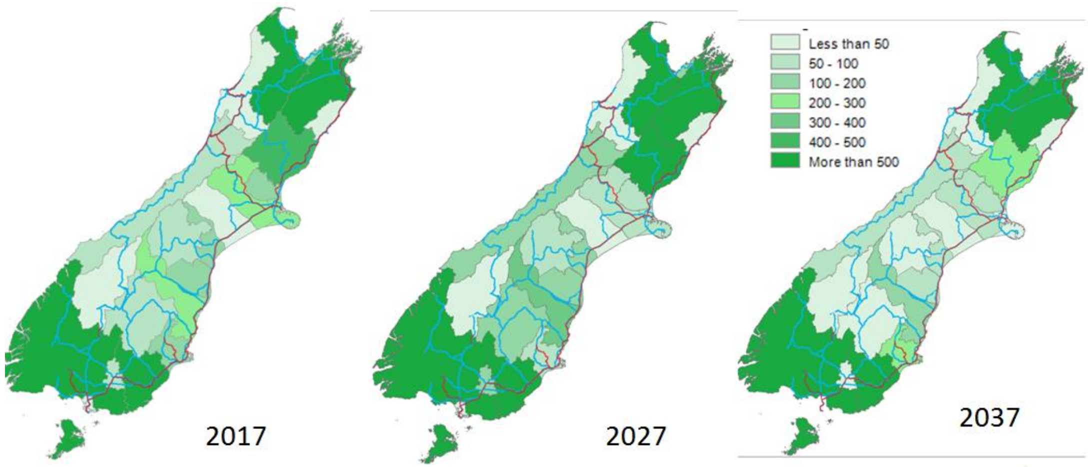
2.1.2

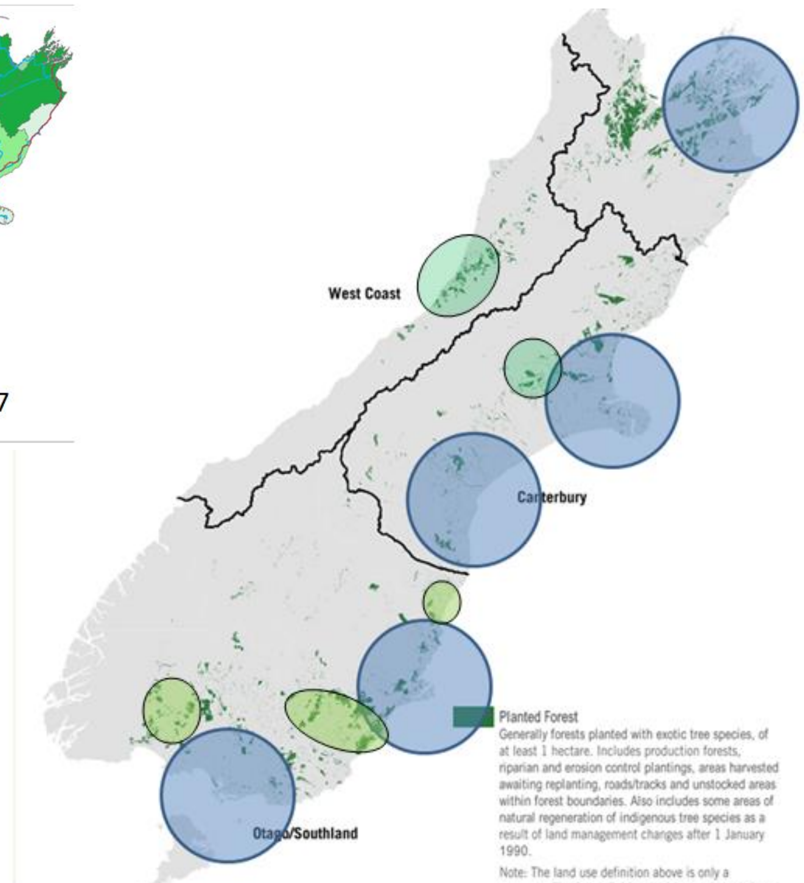
Milton/Milburn logging terminal

- Increasing volumes of logs from South Otago and Southland
- Potential for logging terminal serving movements from Milton or Milburn
- Volumes not known in detail so have developed plans on basis of flow of 50,000 tonnes per year switched from road to Bluff, a distance of xx km.
- Potential good because of reduced costs of transport by rail
- Would shift about 30-40 return trips per week by heavy vehicle to rail.
- Externality benefits of the order of $3-5m over 20-40 years compared to costs of about $2m
- Benefits would be improved if could be combined with other traffic – wood products at Milburn
- Potentially could be scaled to other locations across the South Island
- Next steps
  - Clarify KiwiRail capacity
  - Identify potential demand in more detail
  - Identify and progress potential sites

2.1.3

Forecast logging production and potential interchange areas





2.2

Bundle 2 – Commodity movements

2.2.1

Bottled Water from West Coast

- Proposal to bottle water near Greymouth; up to 20,000 TEU pa
- To be railed to Lyttelton
- Could be handled via a private siding;
- Or through a common user terminal in Greymouth
- Would be a necessary “anchor tenant”
- Benefits measured against road haulage (1 truck/TEU)
- $5.9m pa; $57NPV over 30 years
- Would require large investment in rail rolling stock
- Could apply to other water projects, though the benefits will vary
- Next steps: firm up proposal; KiwiRail to develop business case for rolling stock

2.2.2

Garnet from West Coast - 1

- Proposal to exploit large reserves of garnet near Hokitika
- 100-150,000 tonnes in Phase 1 – could increase to 300,000 tonnes pa in Phase 2
- After treatment transported to Timaru for processing and shipment in large vessels
- Phase 1 material to be transported by road using backloading capacity to Timaru
  - Initial movements in bulk but could potentially be shipped by container
- Future expansion potentially constrained by lack of economic transport capacity
- Possibility of rail interchange site near Hokitika or possibly shipped by Greymouth
- Benefits measured in two ways –
  - externality benefits of transfer from road or
  - local economic benefits if rail unlocks transport constraint and allows increased employment
- On basis of Phase 2 150,000 tonnes
  - Transport externality benefits $15-25m over 10-30 years
  - Local economic benefits of $4-$20m over 10-30 years

2.2.3

Garnet from West Coast - 2

- Would require large investment in rail rolling stock and either a dedicated terminal or space at Greymouth
- Could apply to other mineral projects (more garnet, ilmenite, diatomite), though the scale of these and potential benefits will vary
- Next steps
  - Confirm interest of garnet producer in using rail and the scale of the operation that might be undertaken and demand for transport over time if rail is available
  - Confirm additional employment that might be generated if an increased output was available.
  - Identify location for transfer of garnet to rail and potential use of a Greymouth terminal and associated costs
  - Identify any other steps necessary to allow the transfer point to be developed (eg zoning and consent issues).
  - Identify options for funding

2.3

Bundle 3 – Multi-user terminals

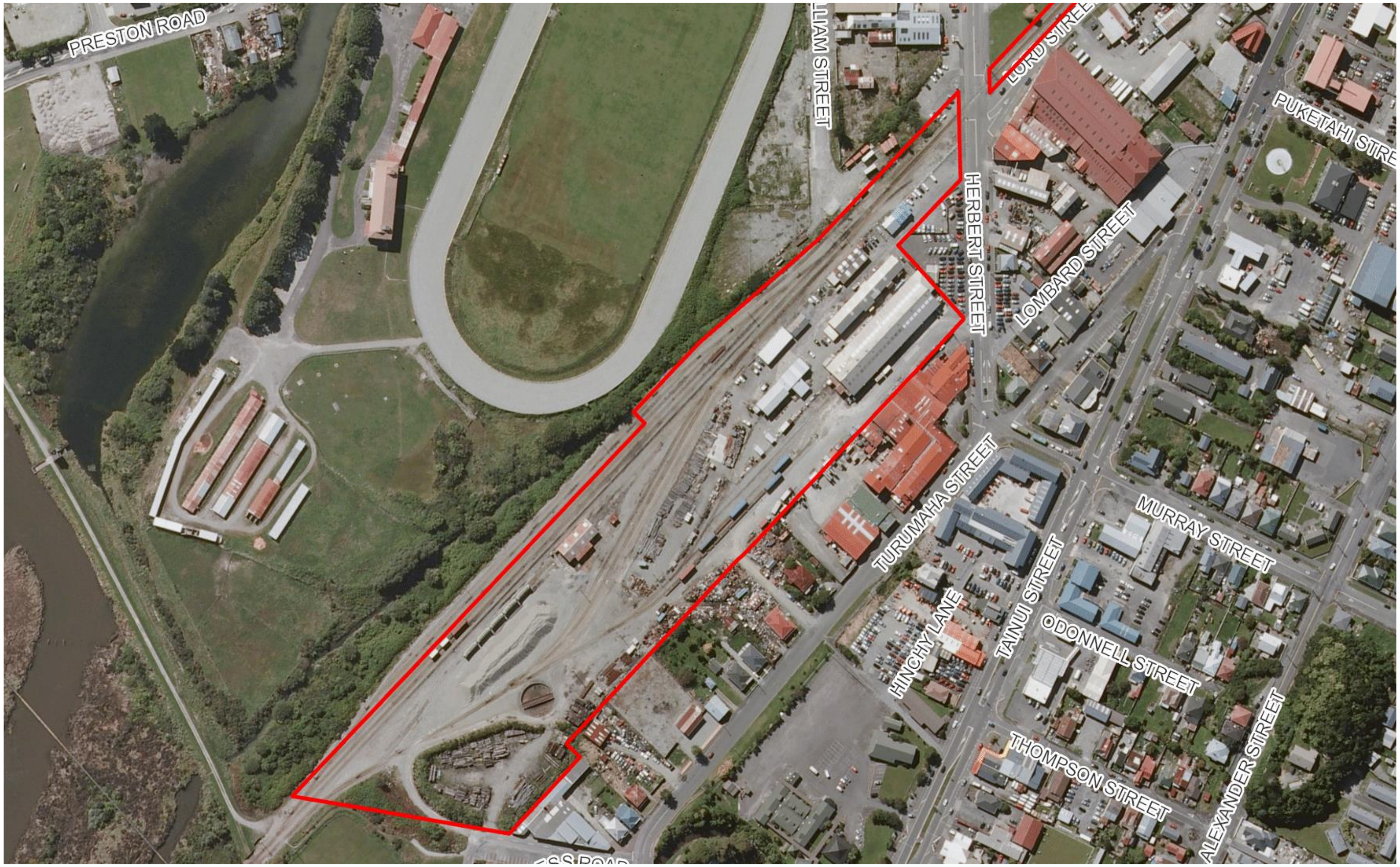
2.3.1

Greymouth Freight Terminal

- On existing KiwiRail site
- Basic terminal about $2.1m
  - Modelled on Tokoroa
- Would serve general goods market –but that is thin
  - Needs a major user as “anchor tenant”
- If water was an anchor tenant then terminal would be twice as large
- Garnet and other minerals could also be significant users
- Potentially also a distribution centre like Tokoroa
- Externality benefits as for water, plus garnet and general freight, $0.4m pa, NPV $3-5m
- Potential case for investment by local and central government
- Could be a model for terminals in other small communities in SI
  - Eg Gore, Kaikoura
- Next steps:
  - Confirm with KR the availability of the site.
  - firm up a major user; and also general traffic levels.

2.3.2

Greymouth site



2.3.3

Exclusively using rail to serve Port Chalmers

- Rail already carries c 70% of all exports to the port
- The remainder use narrow and windy SH88
- Estimated at 19,000 TEU per year
- Proposal is to build a terminal off port and rail these TEU also
- 2 sites, on railway land in Dunedin, or near Mosgiel
- More substantial than Greymouth, cost about $3m
- Also needs rolling stock
- Externality benefits NPV $2-3m for central Dunedin, $2-5m for Mosgiel
- Could be model for serving ports only by rail
- Especially if they have restricted sites.
- Next steps: KR and port to agree on project, site and operating issues

2.4

Bundle 4 – Waste

2.4.1

Waste to West Coast

- Potential for new waste to energy plant on West Coast at Westport
- Would bring in waste for burning initially from baling plant in Christchurch
  - but planned to expand to other SI locations some of which could be rail served
- Waste from Christchurch would be transported by rail and accumulated on West Coast for 2-3 years until plant constructed
- Location of storage site not yet finalised although space required is extensive.
  - Considered externality costs of alternative locations
  - Because only required for a relatively short time externality cost differences between alternative locations relatively small
  - Would not by themselves justify major investment
- Also considered benefits of rail for longer distance movements from Christchurch
  - Externality benefits much more substantial $7-13m over 10-40 years.
- Scheme has particular characteristics which make extension elsewhere limited

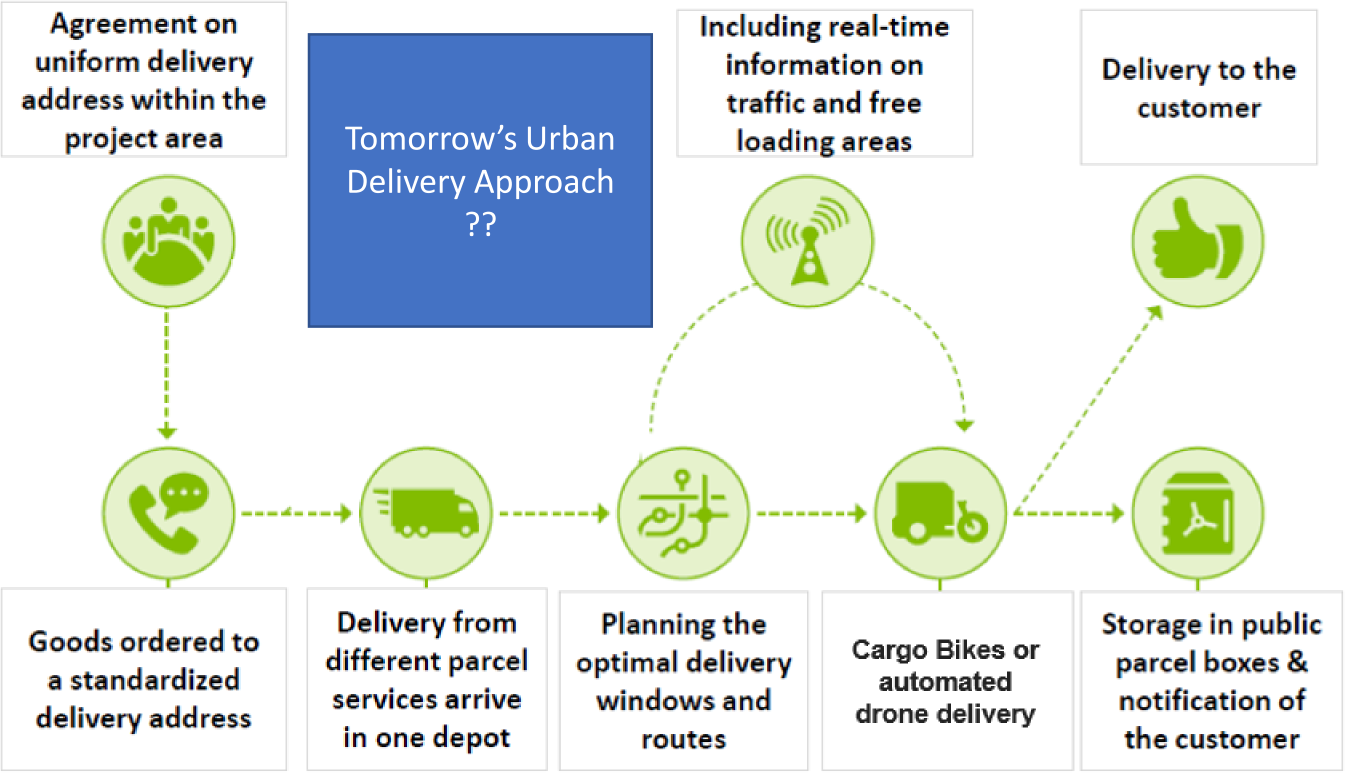
2.5

Bundle 5 – Urban distribution

2.5.1

Bundle 5 – Urban distribution

The combination of demand changes, logistics 4 approaches and innovation in last mile delivery is likely to drive changes that need to be anticipated and considered proactively



Need to avoid being the victim of change and be its partner instead

2.5.2

Bundle 5 – Urban distribution

- Suggested that the options and implications be considered now and appropriate responses be developed including:
  - Consider local regulatory and policy needs around controlling delivery traffic, locations of pick up points to manage congestion and safety issues
  - Consider design standards for pick up points (mobile and fixed)
  - Consider trials with courier operators

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3.1

Constraints and scalability

Case study	Scalability of benefits	Constraints - in addition to availability rolling stock
1. Logs from West Coast	Single site but scalability discussed below for Milton logs	Probably none
2. Port Otago		Availability of site Funding for development
3. Greymouth (This could potentially include water and garnet which possibly could be consolidated at a Greymouth hub.	Other locations discussed briefly	Availability of site Funding for development
4. Milton (logging hub) go ahead because industry wants trucks off road - probably need for funding for new wagons	Scalability across SI discussed	Availability of site Funding for development
5. Waste to WC plant industry	Probably one-off project	
6. Water (potentially consolidated through proposed Greymouth terminal)	Scalability discussed	Availability of site Funding for development
7. Garnet (potentially consolidated through proposed Greymouth terminal)	Scalability to other minerals discussed	Availability of site Funding for development
Change in distribution methods		
8. Urban distribution with electric vehicles, incl serving railheads		Economic viability

3.2

Case study key benefits comparison

Case study	Product	Annual Volumes (tonnes)	Total Annual Externality Benefits ($m pa)	Unmet road wear costs ($m pa)
Stillwater logs	Logs	30,000	0.3	0.2
Milton/Milburn Logging terminal	Logs	50,000	0.4 for movements to Bluff	0.2
Garnet	Industrial materials	150,000	2.0	1.2
Water	Consumer products	400,000	5.9	3.2
Greymouth terminal	General freight	25,000	0.4	0.2
Waste	Waste	60,000	0.1-0.2 for alternative storage points 0.9 for movement from Christchurch	0.1 0.5
Port Chalmers Inland Port	General freight	200,000	0.3 - 0.4	0.1 - 0.2
Total		915,000	9.4-10.3	5.2 - 5.7

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6.2

Next steps

Task Name	Start
Context workshop	Tue 5/06/18
PWG workshop: issues confirmation	Tue 7/08/18
PWG meeting: progress review	Tue 25/09/18
PWG workshop: case studies agreement	Wed 24/10/18
PWG workshop: action plan review	~~Mon 19/11/18~~ Thu 22/11/18
Stakeholder workshop: action plan review	~~Mon 19/11/18~~ Thu 22/11/18
PWG meeting: study outcomes	Mon 3/12/18
Stakeholder presentation: study outcomes	Mon 3/12/18

Christchurch

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