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Greater Christchurch Freight Study

Freight Management Directions Statement

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1. Introduction

1.1 Purpose of the study

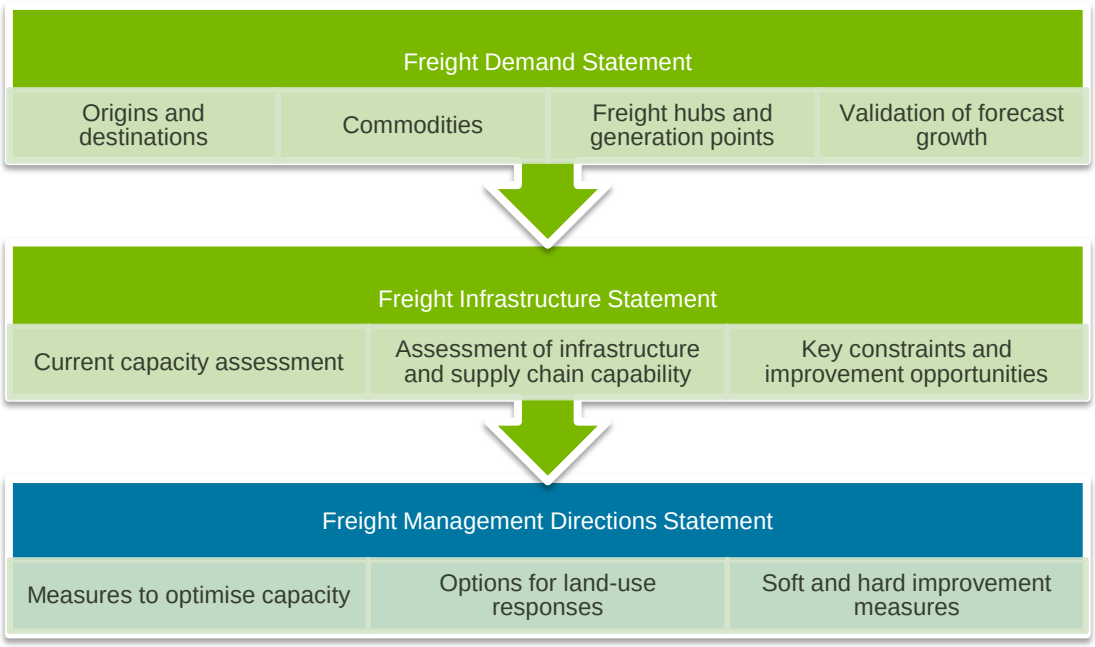
The Greater Christchurch Transport Statement (GCTS) partnership was formed in 2012 and consists of members from the New Zealand Transport Agency (NZTA), KiwiRail, Lyttelton Port Company Limited, Christchurch International Airport Limited (CIAL), Christchurch City Council (CCC), Selwyn and Waimakariri District Councils, Environment Canterbury and the Canterbury Earthquake Recovery Authority (CERA).

This partnership has collectively estimated freight growth forecasts for the Greater Christchurch region. It has commissioned Aurecon to validate these forecasts and explore options to improve and increase the resilience of freight logistics across Greater Christchurch, to respond to this growth.

The growth forecasts, together with an assessment of freight origins and destinations, are included in the first of three reports, the *Freight Demand Statement*.

As part of the wider package of works commissioned, a *Freight Infrastructure Statement* has been developed (considering the forecasts for commodity demands) assessing the capacity of the freight movement infrastructure and its interaction with the current or future supply chains. The *Freight Infrastructure Statement* leads on to the development of a *Freight Management Directions Statement*. This document will identify interventions and improvements needed to optimise the capability and resilience of the existing freight infrastructure and suggest future improvements.

Figure 1 - Greater Christchurch Freight Study components



1.2 Aims of the Freight Management Directions Statement

This document is known as the *Freight Management Directions Statement*. It identifies possible improvements, to optimise the current capacity of the freight network, and further measures and opportunities to meet future demands for the CGTS timeline up to 2041.

The overall Greater Christchurch Freight Study will seek to develop options to improve infrastructure and capacity, remove bottlenecks in supply chain efficiency and propose measures to focus actions aimed at maximising the economic development of the region. The *Freight Management Directions Statement* seeks to identify improvement opportunities, which can be taken forward to help inform the Christchurch Network Management Plan and implement the GCTS.

A critical point highlighted in the *Freight Demand Statement* is that the growth rates in freight demand for different commodities and freight types are interdependent***. Positive growth in one commodity may impose constraints on the broader supply chain; just as negative growth will provide added capacity***. For example, growth in container freight and the related train and truck movements to and from Lyttelton Port of Christchurch (LPC), is likely to constrain access for other trains and heavy vehicles moving coal and bulk goods.

The *Freight Management Directions Statement* considers how to address growth in freight demand and its impact on the overall system of freight movement in Greater Christchurch. Proposed solutions and recommendations are specifically designed to meet the following objectives:

- Ensure that sufficient capacity is available for freight growth (ports, inland ports, road and rail networks).
- Improve or maintain supply chain efficiency, by lowering supply chain costs and improving transit times.
- Allow efficient and rational capital investment to optimise future investment, minimise duplication and obtain efficiency gains through the achievement of greater scale.
- Minimise the impact on the environment, and carbon emissions in particular, by optimising freight movements and increasing the use of rail and coastal shipping, where appropriate.
- Ensure that Greater Christchurch remains competitive on a national and international scale.

1.3 Report structure

The *Freight Management Directions Statement* has the structure shown below. It is designed to describe and document recommendations for each element of the freight system in Greater Christchurch, together with an assessment of overall network resilience and supply chain management:

Section 2 **Summary of freight forecasts and capacity**. This section contains an overview of the strengths and weakness identified in the *Freight Demand* and *Freight Infrastructure Statements.*

Section 3 **State of the freight network**. This section evaluates what currently works well in the context of freight movement and identifies areas that do not work well. It assesses the areas under threat and considers the likely impact of projected growth in freight demand.

Section 4 **Strategies and actions**. This section presents a series of freight management actions, based on outcomes designed to address current and future movements of freight and the resulting impact on the network.

Section 5 **Recommendations**. This section summarises the information presented in Section 4. It provides a recommended set of actions (focusing on the short- to medium-term) to both address current impediments to efficiency and cater for future growth.

2. Summary of Freight Forecasts and Capacity

2.1 Freight Demand Statement Summary

The *Freight Demand Statement* concluded that the region plays a critical role in the production of goods for both domestic and international markets. This is due to the large population and extensive employment opportunities in the production of export commodities, throughout Canterbury.

As described in this statement, production of a number of major commodities is increasing, particularly dairy products and other agriculture. Producers are heavily reliant on the efficient movement of their freight from the point of production, through the manufacturing process, to the port for export. Inefficiencies in these logistics chains, in particular congestion issues relating to road, rail and port access, adds to the costs for individual businesses and negatively impacts on overall productivity and the economy of the region.

Current freight demand in the Greater Christchurch region is concentrated primarily on the export of a number of key commodities, including: dairy products, meat products, coal, logs and other timber products. Increasingly, these products are transported to LPC by rail, particularly dairy products (transported by rail from Clandeboye, Darfield and Rolleston) and coal (transported by rail from the West Coast region).

This is putting increasing pressure on existing rail infrastructure and adding to congestion in the Woolston area, around LPC's City Depot site. Currently, however, the majority of containers transported between the City Depot and LPC still use road transport.

Bulk import commodities through LPC to the Greater Christchurch region, include dry-bulk and petroleum. General container freight for domestic consumption is also imported in significant quantities through LPC. The majority of this freight is transported through Greater Christchurch and the wider Canterbury region and South Island by road.

The primary aim of the Freight Demand Statement is to analyse and validate the growth forecasts, as outlined in the GCTS. Publicly available data has been used to compare trends in historical information to the growth forecasts. Where significant differences were encountered for particular commodities, alternate data sources were interrogated and considered, to determine likely reasons for the discrepancies and, if required, to formulate alternate forecasts.

A comparison of the forecasts outlined in the GCTS and the alternate forecasts provided in this report is shown in Table 1.

Table 1 - Summary of projected growth by commodity (2010 to 2041)

Measure or commodity	GCTS 2010	GCTS 2041 (growth)	Aurecon 2041 (growth)
Population	435,000	550,000 (0.9%)	
Employment	200,000	244,000 (0.7%)	
Containers (TEU)	290,000	1,500,000 (5.3%*)	Lower 782,000 (5.5%) Upper 1.5m (5.3%*)
Air freight (tonnes)	120,000^	400,000 (7.5%)	107,000 (10.6%)
Dry bulk (tonnes)	660,000	1,200,000 (2.6%)	
Petroleum (tonnes)	1,000,000	1,800,000 (2.6%)	1,371,000 (1.2%)
Logs (tonnes)	250,000	260,000 (0.1%)	739,000 (6.3%)
Coal (tonnes)	2,300,000	5,000,000 (3.8%)	3,000,000 (1.0%)

* Compound Annual Growth Rate (all other growth rates are based on annual linear growth)
^ Original figure was all tonnage coming into the airport, with some then road freighted to Auckland for export, Aurecon revised air freight in 2010 down to 25,000t, based on PwC and FIGS data

The *Freight Demand Statement* concluded that the GCTS growth forecasts appear significantly higher than historical projections in container trade, dry bulk, petroleum and coal.

For example, container volumes are driven primarily by dairy and meat exports and imports of consumer goods. Analysis of dairy and meat production does show that increases in exports of these products is likely, but it is unlikely to be high enough to drive an overall compound growth rate of 5.3% per annum in container movements.

However, the GCTS forecast considers an increase in the LPC market share of shipping, due to its capacity to allow the use of larger ships. This could help increase the overall total, but other South Island ports are also vying for greater market share through accepting larger ships. In this case, however, Aurecon provided a range of forecasts, a lower bound based on continued strong (linear) growth and an upper bound based on compounding growth, which considers these other factors. It is worth noting that 2013 and 2014 volumes are now available from LPC and are summarised in Table 2.

Table 2 - Updated commodity trade through LPC

Commodity	2010	Year to 30 June 2013	Year to 30 June 2014
Containers (TEU)	290,000	351,217	376,567
Dry Bulk (tonnes)	660,000	649,365	769,019
Petroleum (tonnes)	1,000,000	1,111,189	1,044,189
Logs (tonnes)	250,000	369,657	601,485
Coal (tonnes)	2,300,000	2,049,949	2,069,432

2.2 Freight Infrastructure Statement Summary

The *Freight Infrastructure Statement* considered the infrastructure associated with four modes: sea, rail, road and air, and the impact of freight growth on this network and the supply chain capability.

The approximate volume and value of freight moved through Greater Christchurch by each mode is shown in Table 3. Commentary on each of the modes is described below.

Table 3 - Estimated volume and value of freight moved through Greater Christchurch (2014)

Mode	Volume (tonnes)	% of total Volume	Value	% of total Value
	25,000	0.1%	$2.39bn	4.0%
	5,297,579	31.0%	$18.9bn	31.6%
	3,251,447	19.0%	$8.2bn	13.7%
	8,524,026	49.9%	$30.4bn	50.7%

Air freight

In peak summer months, all air freight capacity is filled by stone fruits. At other times of the year, there is typically an excess of capacity. Dakota Park is located in an ideal position for freight consolidation, close to the airport and to the strategic road network. The airport is currently well positioned to accommodate increased freight volumes but this requires greater airline capacity such as wide bodied planes. The the majority of the constraints to growth result from efficiency gains in the airline industry and the move towards single isle aircraft on trans-Tasman routes (a key export destination for freight moving through the airport).

Road freight

Completion of the Christchurch Southern Motorway Stage 1 has put additional pressure on a number of strategic intersections and routes during peak periods. Brougham Street is used extensively for local freight movements to and from distribution centres and customers; and it is also the main corridor for freight movements to and from LPC.

Optimisation of the freight network may relieve pressures on strategic roads during peak hours. Moving greater quantities of goods in off-peak hours would also help to achieve this.

At the present time, capacity issues are not a problem with the Lyttelton Tunnel over the planning horizon, although resilience and risk is a particular concern. In the event of an incident occurring during the transport of hazardous goods through Lyttelton Tunnel, the likely result would be closure of the tunnel for an extended period of time; this would have significant issues for the movement of freight to and from LPC.

Sumner Road may have ongoing resilience issues when it reopens (due to the unstable nature of the cliff face) but it is a vital alternative route for freight if the Lyttelton Tunnel were ever closed. The

limited number of bridges across the main rivers in the Greater Christchurch region also poses resilience concerns.

Rail freight

There is limited siding capacity at the City Depot inland port in Woolston that restricts capacity for increased IMEX rail freight movements through this site. Some products for export are therefore freighted by rail to the City Depot and transferred to LPC by road. This increases the number of trucks using the Lyttelton Tunnel; but does result in convenient positioning of empty containers and reduces export dwell time on the port which provides additional capacity.

Middleton Yard plays an important role in local and regional distribution, freight staging and consolidation. This process involves shunting, which negatively impacts road traffic at the level crossings on either side of the yard.

Middleton Yard will reach capacity in five to ten years under current growth trends. Service consolidation and expansion are necessary to improve its efficiency to meet this projected growth. The introduction of an inland port may alter trends and minimise capacity constraints on Middleton.

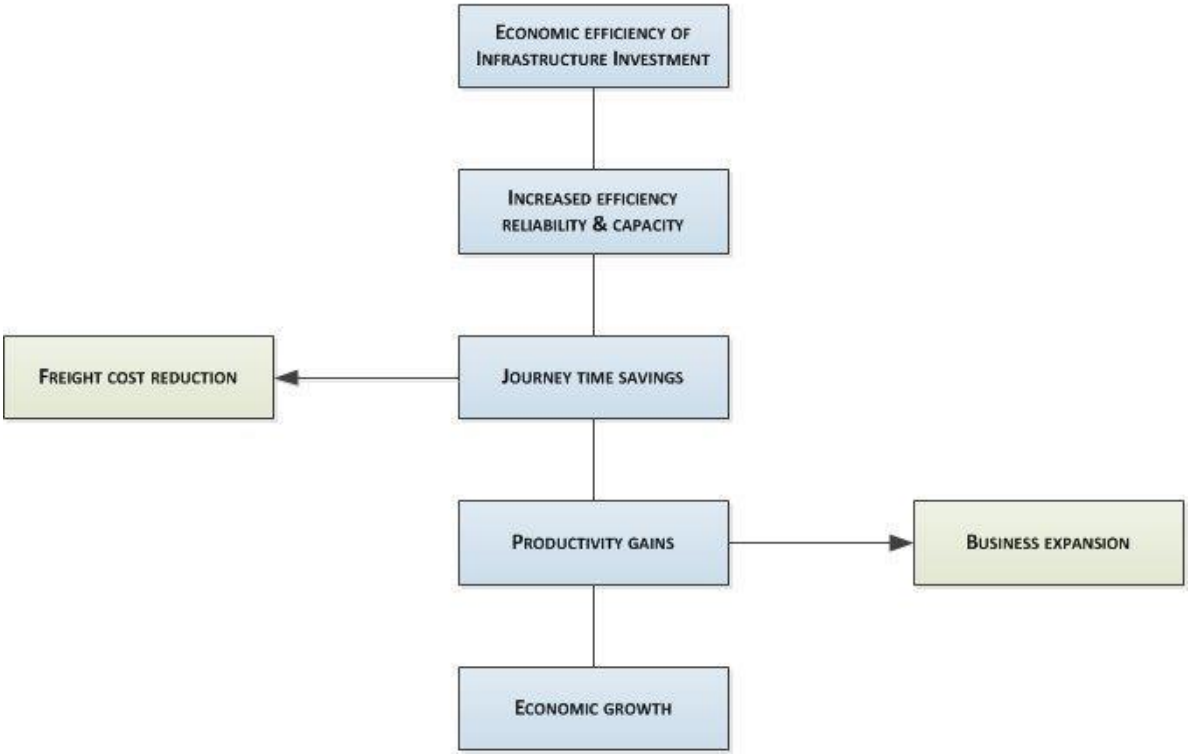
Sea freight

Additional container storage is required at LPC to increase the overall capacity of the port. Reclamation of 10 ha is currently underway to address this issue; however, if the higher (compound) annual growth rate of 5.3% predicted by LPC is achieved, the terminal may reach capacity at LPC and City Depot before 2022. In this case, additional remedial action will be required (including a combination of more storage space, an inland facility or different operational practices and equipment).

3. State of the freight network

There are a number of areas where the supply chain and supporting infrastructure facilitate the efficient movement of freight through Greater Christchurch to export destinations. The benefits of continued efficient investment are clear and is summarised in Figure 2. Effective planning to deliver adequate capacity to support the growth in exports is vital.

Figure 2 - Investment benefits



3.1 What currently works well - strengths in the freight network

The *Freight Infrastructure Statement* highlighted the current state of the infrastructure associated with the transport network in Greater Christchurch. It identified constraints in the network and supply chain, looking specifically at mode of travel by commodity, the role of the supply chain and associated land-use. This resulted in the identification of a number of areas that were considered to work well in the context of freight movement through and within the study area. These areas are described in more detail below.

1. **Key commodities**. Canterbury has established freight networks supporting key commodities, such as the export of coal, dairy products and logs. Recent growth in the dairy sector, based partly on conversion of land to support dairy production, has seen efficient movement of export freight, from farm to processing plant to port.

   The production certainty and large volumes of these commodities, combined with strict quality control measures at packing and processing plants, result in dairy products being particularly suited for transport by rail.

2. **High use of rail**. The mode split of rail as a proportion of the total freight volumes carried through Greater Christchurch, is significantly higher than the national average. Indeed, Aurecon estimates that approximately 20% of freight (tonnes) is moved by rail, compared to a national average of approximately 7%. Whilst recognising the large volumes of coal and dairy product moved by rail through Greater Christchurch, maintaining and supporting this trend should be a priority, given the expected increases production of dairy related products.

   The dairy industry in Canterbury has established freight networks linking production to processing plant to port for export. We previously concluded that over the past 5-10 years, higher yields of milk solids per cow and increased areas of irrigated land (for dairy farming have produced a steady increase in overall milk solid production. This equates to 3.8 times the milk solid production (with a doubling of the available irrigable land) between 2011 and 2041, if this growth continues.

3. **Capacity of rail network**. Despite large volumes of export related freight being moved by rail, there is still some spare capacity on the rail network.

   It is worth noting that the proportion of tonne-km moved by rail at a national level is higher, given the tendency for longer distance freight to be moved by rail. Importantly, the main South Line connecting Lyttelton with the southern regions of the South Island, has additional capacity to accommodate extra trains servicing the port. Based on maintaining existing mode splits, we expect the rail network to continue to be capable of carrying the forecast volumes of freight.

4. **Regional distribution**. Christchurch is well placed as a regional distribution centre, covering deliveries locally and to the rest of the South Island. This has allowed the emergence of Christchurch as the main population centre in the South Island, with sea and air ports of national importance. This, in turn, attracts people, skills and opportunities to the region, supported by good transport links.

   The Greater Christchurch area has good road and rail links to the remainder of the South Island. Many organisations use either Auckland or Christchurch as import distribution centres, in some cases resulting in the movement of freight between the two cities.

3.2 What currently doesn't work well - areas of weakness

The *Freight Infrastructure Statement* summarised how well the infrastructure network operates in Greater Christchurch, when considering the movement of freight associated with the four main modes: rail, air, sea and road. It also considered the operation of the supply chain for imports and exports moving through Christchurch and the associated distribution network in the region. Based on our analysis, there are a number of areas in both the network and the supply chain that do not operate as efficiently as they could. These are summarised below:

1. **Lyttelton Tunnel**. The importance of the LPC in importing and exporting goods, combined with role of Greater Christchurch in the collection and distribution of goods, places significant emphasis on Lyttelton Tunnel. The current lack of alternative routes for trucks, presents an undesirable position. The reliance on the tunnel for the movement of hazardous goods, represents a risk to the region if the tunnel becomes inoperable for any reason.

2. **Brougham Street (SH76)**. Brougham Street is a national, high volume state highway in the new national One Network Road Classification. It is an important link connecting SH1 (and the new Christchurch Southern Motorway Stages 1 and 2) to Lyttelton, towards the southern edge of the CBD. It is a route that is used for imports, exports and the distribution of goods to

Greater Christchurch and throughout the South Island. It is also used by commuter traffic between the southern suburbs and the CBD, and is a key link in the Christchurch public transport network.

According to NZTA, the introduction of Christchurch Southern Motorway Stage 1 has resulted in a 15% increase in traffic volumes and an additional 3 minutes travel time along Brougham Street. The significant positive that should be emphasised is that the Christchurch Southern Motorway Stage 1 has resulted in an overall saving of between four and nine minutes in travel time between Hornby and Lyttelton.

3. **LPC turnaround times**. Seasonal peak volumes and variable vessel arrivals can place the container yard over capacity and severely impact truck turnaround times. The reliability of LPC turnaround time for the delivery and collection of containers needs to be ensured. The use of booking systems to smooth out demand, using both short- and long-haul rail, and strategically located inland ports, are all recommendations to help improve this reliability. These measures will also improve traffic congestion in and around Lyttelton, boosting the amenity of the area.

4. **Air freight capacity**. Constrained air freight capacity, particularly at certain times of the year, limits growth in high value exports from Canterbury due to lack of wide bodied aircraft. This results in the adoption of alternative road options (including transport to Auckland Airport for export) by suppliers and freight forwarders.

5. **Hornby to Middleton corridor**. Including elements of Yaldhurst Road (SH73) and Main South Road (SH73A) and connecting to SH1 south, the corridor carries a large and diverse range of truck movements on the network, from port-related container traffic to local distribution of retail (e.g. Kathmandu at the eastern end, to Progressive Enterprises at Hornby towards the west). A number of freight forwarders are also located between these locations along the corridor, including Mainfreight and Toll, located at Middleton and Hornby respectively.

3.3 Possible future capacity constraints and threats

Based on forecast growth and considering the areas of weakness in the freight network, a list of possible future capacity constraints and threats to the efficiency of the freight network, is shown below.

1. **Brougham Street (SH76) capacity and corresponding delays to freight**. NZTA estimates that the Christchurch Southern Motorway Stage 1 has resulted in journey time improvements from Hornby to Lyttelton of 4-9 minutes, with a corresponding increase in traffic on Brougham Street of 15%.

   The opening of Christchurch Southern Motorway Stage 2, connecting Brougham Street (SH76) to SH1 south of Templeton, will put additional pressure on Brougham Street.

   Brougham Street also serves as a local commuter route, connecting communities to the south of Christchurch with the CBD.

   As more traffic uses this corridor, the travel time reliability of the route between Christchurch and Lyttelton may be further compromised. This problem must be considered in the context of the increased freight task on the route and the potential impacts on import and export efficiency. Brougham Street will be an important link in the movement of freight associated with the ongoing Christchurch rebuild.

2. **Port storage and berth utilisation constraints**. Based on both Aurecon's analysis and industry standard utilisation rates, and using the assumption that 30,000 TEU/ha per year is an acceptable upper limit for the technology currently in use by LPC, container storage at the

port will become a critical issue by around 2022. This recognises the 'Port Lyttelton Plan: Our Future' and the current 10 ha of reclamation taking place.

On the assumption that an acceptable berth utilisation is around 1,500 TEU/m of quay, berth utilisation will be a constraint by around 2030 in the upper bound growth scenario. It may be possible that improved terminal technologies could extend these timeframes.

3. **Rail siding capacity on the Main South Line**. This constraint is important for freight distribution, as sidings on the Main South Line handle primarily domestic freight, as evidenced by the large number of locally sited distribution centres.

   Trains moving *domestic* freight are typically broken up to allow local distribution and consolidation of freight. This means that trains will be shunting in the vicinity of Middleton Yard, reducing the capacity of the yard and with a probable impact on local level crossings (particularly Whiteleigh Avenue and Annex Road).

   KiwiRail has forecast that Middleton Yard will reach capacity in the next 5-10 years under current freight growth trends and with the current configuration of sidings. We understand that additional land is available in close proximity to the site, should there be a desire to develop Middleton Yard container transfer facility to meet the growth in rail freight volumes. At present, the impact of an inland port on the container transfer site at Middleton is unknown, but it would allow KiwiRail to operate more efficiently.

4. **Lyttelton Tunnel**. As the freight task grows, increasing pressure will be placed on Lyttelton Tunnel to transport goods between LPC and Greater Christchurch and beyond. Due to the closure of Sumner Road, following the 2011 earthquakes, it provides the most viable road connection between Christchurch and LPC for the movement of freight. As a result, all hazardous goods must use the tunnel; consequently, special restrictions are in place to minimise the risk of damage and collision.

5. **Air Freight at Christchurch International Airport**. As we have shown in the *Freight Demand Statement* and *Freight Infrastructure Statement*, the value of freight moved through the airport is significant. Typically, high value and time-sensitive exports are transported to the airport exclusively by road (compared to a combination of road and rail). This maintains additional control, while helping with the time-sensitivity of the freight.

   Ensuring good linkages to the transport network serving Christchurch International Airport is vital to securing future high value freight. Maintaining good levels of service through ongoing western corridor improvements will be important in the long-term.

6. **Port switching costs**. Given the relatively close proximity of other South Island ports (particularly PrimePort Timaru, located only 170km south of LPC), the costs to a major exporter or importer of switching between one port and another is relatively low. Failure to maintain an efficient means of transporting export freight through Christchurch (if it becomes increasingly expensive or difficult) may result in a transfer of volumes to alternative transport networks.

7. **Performance of the Rural Network**. With the projected growth in dairy production in Canterbury, dairy tanker numbers will continue to rise. Production in the Greater Canterbury region is expected to double by the year 2025 and will be almost 3.5 times its current production by the year 2041. Consideration should be given to accommodating the 'farm gate' to processing plant movement as part of an important link in the supply chain.

4. Strategies and Actions

As described in the previous sections, a number of issues already exist that are impacting efficient movement of freight within and through the Greater Christchurch region. In the future, with projected growth in many export commodities, infrastructure capacity and other impediments will restrict the region's ability to fully realise those growth opportunities.

We propose, in Table 4, a series of interventions and measures that *could* be undertaken. This list contains a combination of measures at either resolving existing issues, meeting future growth, providing resilience in freight transport, improving efficiency or developing opportunities to promote Greater Christchurch as a preferred place to do business.

Some of the interventions and measures are complementary (e.g. undertake grade separations on either side of Middleton Yard, expand Middleton Yard to increase capacity and encourage higher rail mode-share), while others are competing or achieve similar outcomes (e.g. increase LPC's capacity by reclamation of land for container storage, and develop an inland port to improve LPC's overall capacity).

The opportunity interventions provided in Table 4 are by-and-large aspirational, but are included to highlight some of the benefits in thinking more broadly than simply addressing existing and future growth needs.

The order of the interventions and measures is not important; however, we have put those measures that address existing issues earlier in the table and aspirational opportunities later. Aurecon recommendations are summarised in the last section of this report, but should only be read once the details of the proposed interventions are understood.

For each intervention or measure, the most appropriate timing, indicative cost and priority are proposed, but should be read with the knowledge that some outcomes could be realised using different measures.

Table 4 - Possible interventions and measures to implement

Measure	Reason(s)	Other
Implement vehicle booking system at LPC	Resolve existing issue The LPC currently does not have a vehicle booking system and, as a result, trucks arrive at the time of day most suited to either the transport operator or the customer. This results in certain times slots being busier than others, which causes congestion both inside and outside LPC. It can lead to longer turnaround times, and reduces reliability in both turnaround time and in travel time to and from LPC. The implementation of a vehicle booking system would enable a smoothing of the existing demand peaks within LPC, which, in turn, would reduce the number of vehicles in the terminal and on the surrounding road network. It will also improve the reliability of turnaround times at LPC, providing additional certainty to transport operators. Opportunity A vehicle booking system could provide priority to operators with containers being loaded in both directions (backloaded), to reduce the number of overall gate movements and free up capacity on the road network near LPC.	Timing Short (0-3 years) Cost $ Priority High

Measure	Reason(s)	Other
Brougham Street optimisation and capacity improvements	Resolve existing issue Brougham Street is already heavy congested at certain times of the day, because it is the national, high volume state highway connecting western and eastern suburbs of Christchurch, is near a major freight and industrial precincts to the south of Christchurch, links freight between LPC and its customers (both those located within Christchurch and elsewhere on the South Island) and has a high volumes of local traffic (vehicle, bus and cycle) crossing it to access the Central City business district. . Right turning traffic onto and from Brougham Street has a significant impact on the network efficiency of the corridor. Meet forecast growth / Resilience This situation is likely to get worse, as port import and export container volumes increase. This is likely to occur even if rail captures a higher market-share at the port, due to increased industrial activity and employment in the Woolston to Sydenham corridor. To tackle both 'existing issues' and to 'meet forecast growth', a minimum would be to identify the choke points and undertake remedial work to alleviate or reduce the issues and undertake travel demand management initiatives to encourage better utilisation of the existing network. In the short term a network operating plan can be implemented to optimise network performance such as by altering signal timing/coordination and improving lane utilisation. In the longer term further improvements may be required such as widening to 2 lanes for the entire length, localised clearways or intersection improvements with turning restrictions where appropriate. Opportunity Brougham Street will always attract a high proportion of freight vehicles, due to its location relative to the industrial precincts between Woolston and Sydenham, towards Middleton and the connection to the port. The port connection aside, widening the road to three lanes or grade separating key intersections to improve connectivity to other corridors would ensure the efficient distribution of freight and improve local access crossing of the corridor.	Timing Short (0-3 years) to Long term (4-10+ years) Cost $-$$$$ Priority High

Measure	Reason(s)	Other
Rail improvements along rail corridor through Christchurch and at LPC	Resolve existing issue Improvements to the rail network in Christchurch and LPC would provide efficiencies in transport and could facilitate improved rail mode-share. This will result in a reduced number of truck trips on the road network, which will help reduce congestion. Meet forecast growth To be able to meet projected freight and container growth and reduce the reliance on the already congested road network, rail movements in and out of Christchurch and LPC need to at least keep pace with projected growth. Opportunity Ideally, the use of rail for import containers (in conjunction with an inland port, or demand elsewhere on the South Island) will allow trains to be better utilised in both directions. This, in turn, will improve efficiency and provide ongoing cost benefits. Improvements to the signalling system and duplication of the main trunk line from Islington to Rolleston, would increase capacity and allow Rolleston to capture higher rail mode-share around its growing freight precinct.	Timing Medium (4-10 years) Cost $$$ Priority Med
Increase backloading at LPC	Resolve existing issue Backloading increases efficiency in the movement of freight, as fewer empty vehicles are on the road network. This reduces the overall number of vehicles (in turn reducing congestion) and also reduces the overall distance travelled by transport operators to move freight (which increases efficiency). While these benefits are not restricted to road movements to and from LPC, the port is probably the ideal location to realise many of them: 1. Fewer vehicles in the terminal. 2. Fewer vehicles on the surrounding road network. 3. Lower kilometres travelled (given the distance between Lyttelton and Christchurch).	Timing Short (0-3 years) Cost $ Priority Med
Empty container storage arrangements	Resolve existing issue Storage of containers further away from LPC and closer to customers, would reduce overall transport costs and free up capacity on the road network near LPC. This will involve working with shipping lines to arrange container de-hire away from LPC, which will be a significant impediment to overcome. The use of rail to move empty containers in and out of LPC would be an ideal outcome. They have lower time sensitivity than full containers and movements can be planned in advance to make best use of spare rail capacity.	Timing Short (0-3 years) Cost $ Priority Med

Measure	Reason(s)	Other
Increase capacity of LPC, particularly to cope with projected container growth	Meet forecast growth The capacity of a maritime container terminal is generally determined by: the amount of land available for storing containers, the services provided within the terminal (e.g. Customs and Quarantine) and the length of time containers stay at the terminal. In LPC's case, the impact of transhipments also needs to be considered. Lyttelton Port Company (Limited) is currently undertaking reclamation works, to ensure that enough capacity is available to meet the forecast short- to medium-term growth. Ongoing expansion of capacity will need to consider constraints outside the terminal, such as the ability of the road network in Lyttelton and Christchurch to cope with the increased number of freight vehicles. Alternative solutions (e.g. inland ports), could be a method of increasing the effective capacity of LPC without increasing terminal storage space. This solution would be dependent on other factors, such as the cost of the (rail) operation and the time-sensitivity of the freight. Opportunity An efficient, higher capacity LPC may facilitate protection and expansion of the South Island's overall market share of imports and exports, so long as the freight transport can be undertaken efficiently. Another benefit would be the ability to capture an increased number of transhipments and attract coastal shipping, providing economic benefits and efficiencies in end-to-end transport in the region.	Timing Medium (4-10 years) Cost $$$ Priority High
Protection of freight corridors and land areas adjacent to freight activities	Meet forecast growth The ability to meet the challenge of increasing numbers of freight movements (both import/export-related and general freight produced and consumed in New Zealand), hinges on the ability to efficiently move freight between its origins and destinations. As freight volumes increase, the use of off-peak times (e.g. night) becomes more economically viable (customers able to receive freight later and better travel times). It is therefore extremely important to make provision for this future growth. In particular, the planning for the region should incorporate mechanisms to ensure: 1. No encroachment of residential dwellings into freight intensive areas. This will ensure that these areas are able to continue to work 24 hours per day. 2. Where possible, land provisions for future infrastructure upgrades along key freight corridors, in particular, Brougham Street industrial corridor. It is important to protect 24 hour operation in the region around the LPC, as it will be difficult to move to off-peak times if containers and other dry and liquid bulk freight cannot be transported to and from the terminal at night. Opportunity	Timing Short (0-3 years) Cost $-$$$ Priority High

Measure	Reason(s)	Other
	Protection must be retained to avoid operating curfews at the port, the airport and other industrial precincts, which will place Greater Christchurch in a very good position economically, compared to other regions where there are restrictions on either locations or on time.	
Development of an inland port and an associated freight precinct to facilitate the consolidation, deconsolidation and distribution of freight	Efficiency improvement While short-haul rail is not as economical as long-haul rail, the benefits of an inland port for the region include: freed up capacity in and around LPC; short road trips leading to better fleet utilisation; and, co-location of complementary businesses. The development of an inland port would realise these benefits, while also making better use of existing rail assets. The ideal location for an inland port is either a long way from Christchurch, to service the remainder of the South Island, or to the immediate southwest of Christchurch, to service both Christchurch and the remainder of the South Island. Given the population of the South Island and existing distribution centres located in the Hornby area and the growing freight precinct near Rolleston, a location between Islington and Rolleston[1] would probably be the most viable. A location near the Christchurch International Airport would be less suitable, because the airport is off the main rail trunk line, and the airport itself would not attract high volumes of rail freight. Meet forecast growth To meet forecast import and export container growth, supply chain improvements like inland ports would help get the containers out of the port as quickly and efficiently as possible, minimising storage requirements at LPC itself. Being able to undertake this line-haul leg (between LPC and the inland port) at quiet times on the road and rail network, would add to the efficiency gains to be realised. Opportunity The development of a master-plan for an integrated inland port would significantly reduce the freight-related traffic entering Christchurch (especially traffic between LPC and other parts of the South Island). This would free up existing road capacity and improve the amenity of Christchurch itself.	Timing Short (0-3 years) To Medium (4-10 years) Cost $$$ Priority Med

[1] Currently, the section between Islington and Rolleston contains single track only, which could restrict the number of port shuttles able to operate between LPC and Rolleston.

Measure	Reason(s)	Other
Increase Middleton Yard capacity, or provide alternative rail facilities in Greater Christchurch	Meet forecast growth As Middleton Yard will reach capacity in the next 5 to 10 years, it is important to put in place expansion plans or provisions, alternative locations or remedial actions to meet the forecast growth. Failure to take action will result in less overall freight on rail and an increased number of freight vehicles on the road network. This will compound existing congestion issues on the existing road network and place higher reliance on trucks to move freight within the South Island. The increased use of trucks on regional roads will cause increased wear and tear and higher maintenance costs.	Timing Medium (4-10 years) Cost $$-$$$ Priority High
Grade separations at Annex Road, Matipo Street and Whiteleigh Avenue	Meet forecast growth The locations of these crossings relative to Middleton Yard, mean that they are already affected by (in particular) trains either travelling through Middleton Yard to Woolston or LPC. More significant, is the effect from domestic trains arriving at Middleton Yard to be broken up for local distribution and consolidation of goods and freight. Annex Road, in particular, is a significant connector between the Christchurch South Motorway (from Brougham Road) to the western region of Christchurch, and will be detrimental to movements of freight and other vehicles if remedial action is not undertaken.	Timing Long (10+ years) Cost $$$ Priority High
Re-opening of Sumner Road to freight traffic (in particular)	Resilience As discussed previously, the closure of Sumner Road, following the 2011 earthquakes, has meant that hazardous goods (under certain conditions) and other road-based freight uses Lyttelton Tunnel. This current arrangement poses two significant risks: 1. Trucks carrying hazardous goods through the Lyttelton Tunnel may be involved in an incident/crash; and 2. Another earthquake could cause damage the Lyttelton Tunnel. In either case, any type of Lyttelton Tunnel damage that closed the tunnel for any length of time (anything longer than a few days), with no viable surface alternative, would mean that LPC (in particular) would cease to function as a viable port. Any prolonged closure of the Lyttelton Tunnel is likely to cause a significant shift of freight to other ports (e.g. PrimePort Timaru), which might not be recoverable when the Lyttelton Tunnel reopened. This scenario could have economic consequences for the Greater Christchurch region.	Timing Short (0-3 years) Cost $$-$$$ Priority High

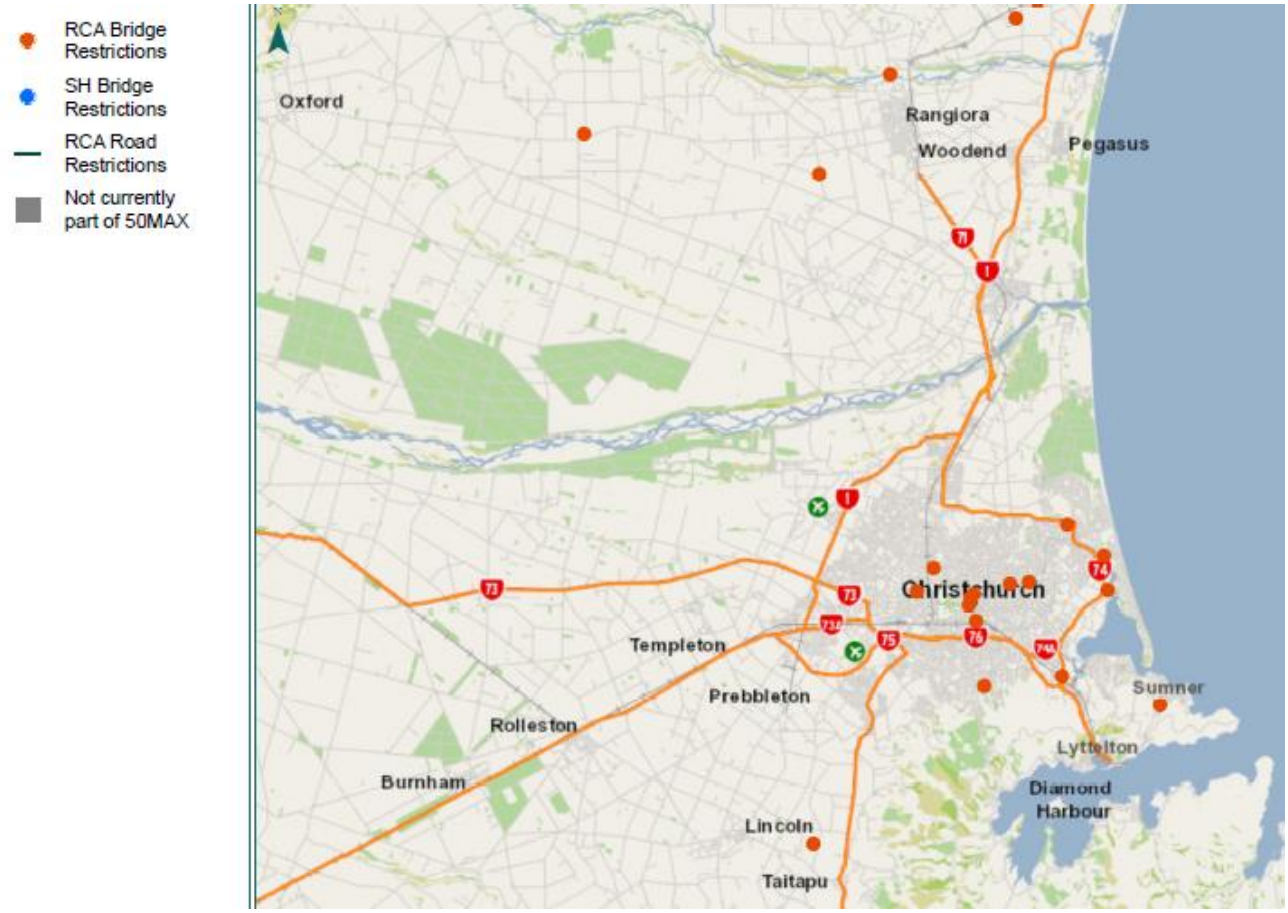
Measure	Reason(s)	Other
Lyttelton Tunnel duplication	Resilience / Opportunity Lyttelton Tunnel is the main (and really the only freight-viable) road connecting Lyttelton and LPC to the remainder of Christchurch. As discussed previously, an incident/crash or earthquake damage would severely impact LPC imports and exports and the ongoing economic conditions of the region. A duplication of the tunnel (to form two tunnels, each with two lanes) would mitigate some of the risks from either of these two events. In addition, additional capacity may stimulate growth in the region.	Timing Long (10+ years) Cost $$$$ Priority Med
Common user unpack and pack facilities, adjacent to the port or inland port	Efficiency improvement Existing logistics chains tend to make use of efficient *container* handling and transport systems. However, one of the perverse outcomes of this system is often a long trip back with an empty container. Efficiencies can be realised, for example, if the import containers are unpacked close to the port (or inland port) and the freight transported to the customer using a general purpose vehicle (curtainsider or tautliner). Another benefit is the ability to load freight to the volume and load capacity of the vehicle, which is often more than standard maritime containers. Development of a common-user facility would remove the need for transport operators to invest in individual facilities that require substantial economies of scale to be commercially viable.	Timing Medium (4-10 years) Cost $$ Priority Low
Encourage off-peak movements of freight	Efficiency improvement This change is easy to recommend but known to be difficult to implement due to requiring changes in behaviour of both customers and freight operators, however, transporting freight in off-peak (night) times has significant efficiency benefits. It frees up road capacity during the peak times for other road users, it makes travel faster (as it is less congested) and therefore deliveries are faster. It also makes better use of the transport fleet, e.g. deliveries can occur during both the day and night. The biggest impediment to wide-spread use is that the customer must be able to receive the freight (or have the freight collected) at night, when they would not normally have staff working. The 'low hanging fruit' for off-peak freight movements are between transport depots, ports (and inland ports) and large 24/7 distribution centres. These centres are more likely to either already work at night, or be more easily able to change or expand shift times. Encouragement of off-peak port collection times could be applied through pricing policies (more expensive to collect during peak times and less expensive during off-peak times). Transport operators are less able to apply the same method to their customers, as with the competitive nature of transport, the customer would just go to one of their competitors.	Timing Medium (4-10 years) Cost $ Priority Med

Measure	Reason(s)	Other
Increasing Air freight capacity	Opportunity Air transport is best suited to high value, time-sensitive freight. At certain times of the year, however, there is insufficient capacity to handle the demand. Road transport from the South Island to Auckland Airport then becomes a stop gap measure to ensure the freight can be exported to its final destination. While this solution is scalable to meet future growth in high value, time-sensitive freight, it is hardly ideal, as it adds considerably to the transport costs of exporters, erodes profit and may reduce the overall amount that can be exported. Aurecon understands that the re-introduction of wide-body aircraft to Christchurch International Airport will greatly increase the freight capacity. This will help the cost efficiency of exports and therefore the region.	Timing Short (0-3 years) Cost $ Priority Med
High Productivity Motor Vehicle improvements to the network	Opportunity High Productivity Motor Vehicles, or large trucks, have the ability to reduce the number of trips required to transport a particular amount of freight from its origin to destination. The state highway through Christchurch is currently fully HPMV capable through to LPC. Freight operators are encouraged to make use of this capability. An expanded HPMV local road network for connection to any inland port would allow efficient linehaul movements, as well as supplementing and complementing rail freight movements to and from LPC.	Timing Medium (4-10 years) Cost $$ Priority Low
Improvement of north and west highway corridors	Opportunity SH1 between Belfast in the north and Hornby in the south, provides two important functions: 1. For the movement of people and freight to and from Christchurch International Airport and Hornby area, particularly from areas to the north and south of Christchurch; and 2. As the main freight corridor for road freight between the northern regions of the South Island (including freight from the North Island) to the southern regions of the South Island. Currently, this corridor is being upgraded to be two lanes in each direction (as part of the Roads of National Importance programme). Once this is complete there do not seem to be any serious issues in the immediate area, but further bypass improvements would future-proof the area. It would also facilitate ongoing efficient access for high value, time-sensitive freight to the airport.	Timing Ongoing Cost $$$$ Priority Low

Measure	Reason(s)	Other
One Network Road Classification implementation	Network connectivity Freight journeys start and end at specific locations that are usually accessed via the local authority road network. The first and last kilometre of such journeys needs to be enabled to ensure freight connectivity is delivered effectively. The provision, maintenance and operational requirements for these networks will be considered through the implementation of the new One Network Road Classification system.	Timing Short (0-3 years) Cost $ Priority Medium

A map of the current '50Max' HPMV SH network and local bridge restrictions is shown in Figure 3, relating to the opportunity to build a more robust, connected network to allow the use of high productivity vehicles and realise the associated efficiency benefits.

Figure 3 - HPMV Routes



5. Recommendations

While it would be desirable to undertake all possible interventions and measures (shown in Table 4), with limited resources it is necessary to determine the combination of measures that provide the most benefit to the region. Table 5 summarises the interventions and measures described in Section 4, giving their category or the reason for their inclusion in this master list.

Aurecon has shaded those rows which it believes provide the most benefit to Greater Christchurch. This is a subjective assessment and likely to be different from individual stakeholders that have their own areas of influence and interest.

The selection of the recommended measures necessarily has first focussed on the high priority items; those items aimed to reducing congestion at certain times, increasing capacity to meet current or short-term expected growth and those that add needed resilience to the transport network. Not surprisingly, these items are mostly short-term actions, clearly identified, and, in some cases, already being worked on or investigated.

Of the medium-priority measures recommended by Aurecon in the above list, those selected are the measures that provide for the efficiency and capacity to cater for expected growth in domestic and import and export freight traffic. These measures make greater use of rail (where sensible to do so) and therefore have lower reliance on road transport for freight movements. This will help the road network cope with the ever increasing movement of other freight vehicles, public transport and private vehicles.

In each case, the timing for these medium-priority recommendations has been identified as 5+ years; however, we should note that planning, financing and construction will take a considerable amount of time. Consequently, the reality of their realisation is likely to be considerable longer than 5 years, even if concepts and high level planning have already begun.

Two other measures require individual discussion, one for its inclusion and one for its exclusion. The first of these is the inclusion of increasing air freight capacity, where identified as an opportunity (because in reality, the current stop-gap method for dealing with capacity by using Auckland Airport, is working and likely to be scalable).

We have included this one to reflect the high value export product and the economic benefit to the region. Inefficiencies influencing transport costs and competitiveness with global markets should not be underestimated. While it is worthwhile, changing the current situation to attract wide-body aircraft is not as simple as financing and building infrastructure, as it is more closely aligned with market forces beyond the influence of individual stakeholders.

In addition to this inclusion, we have decided to exclude encouraging off-peak freight movements. While no doubt a very worthwhile improvement, the size of the Greater Christchurch market is currently too small for this to become a viable solution. That said, encouraging freight activities at night (e.g. container hubbing at transport operators' depots) is still a worthwhile endeavour.

And finally, the list of interventions and measures for improvement, efficiency, resilience and opportunity is constantly changing, based on emerging trends, changing commercial relationships, increases and decreases in the prices of individual commodities, market circumstances and changing priorities. What is low or no priority today, may become high-priority should circumstances change.

Table 5 - Summary of suggested interventions and measures

GCFMDS Table 5 (Page 1 of 2)	Contribution to GCTS OUTCOMES High ● Medium ◉ Low ○															
Suggested Measure	Journey					Safety	Environment		Implementation Risk	Potential Funding Partners			Indicative Timeframes √ early planning work **√** main implementation (*) large infrastructure require business case confirmation			Indicative Cost $0-$5 million = **$** $5-$50 million = **$$** $50-$100million = **$$$** $100+ million = **$$$$**
	Travel Choice (road freight mode shift)	Connect-edness	Reliability	Efficiency	Resilience											
	Optimising across modes	Connectedness Land Use Integration - Aligning Land Use	Optimising existing Infrastructure	Infrastructure improvement investment	Future Proofing - Resilience	Safe Journeys	Liveable Communities	Low Environmental Impacts		Lead Agency	Supporting Agency	Priority	Short (0 - 3 years)	Medium (4 - 10 years)	Long-term (10+ years)	
1. Implement vehicle booking system at LPC			●				○	○	Low	LPC		High	**√**			$
2. Brougham Street optimisation	○	○	●		○	○	○	○	Low	CTOC	CCC, NZTA, ECan	High	**√**			$$
3. Brougham Street capacity improvements	○	◉	○	●	●	◉	◉	◉	Community consultation and competing objectives.	NZTA	CCC, ECan, CTOC	High	√		**√ (*)**	$$$
4. Rail improvements along the rail corridor through Greater Christchurch and at LPC	●		●	●	●	○	◉	◉		KiwiRail	LPC	Med	√	**√**		$$$
5. Increase backloading at LPC			●				○	○	Freight logistics and customer engagement	LPC		Med	√			$
6. Empty container storage arrangements			●				○	○	Requires the buy-in of shipping lines and transport operators.	LPC		Med	√			$
7. Increase capacity of LPC, particularly to cope with projected container growth	●	◉	○	●	●		◉	◉		LPC	CCC, SDC	High	√	**√**		$$$
8. Protection of freight corridors and land areas adjacent to freight activities	●	●	●	●	●	●	●	●	Community consultation and competing objectives.	ALL		High	**√**			$-$$$
9. Development of an inland port and associated freight precinct at Rolleston	●	●	●	●	●	◉	◉	◉	Multi-party buy-in and collaboration	LPC, SDC, Kiwirail, NZTA		Med	√	**√**		$$$
10. Increase Middleton Yard or rail capacity	◉		●	●	◉	○	○	○		KiwiRail		High	√	**√**		$$-$$$
11. Grade separations of rail and road at key locations	●	◉		●	◉	●	◉	○	Community consultation and competing objectives.	CCC	NZTA, KiwiRail	High			**√ (*)**	$$$$

GCFMDS Table 5 (Page 2 of 2)	Contribution to GCTS OUTCOMES High ● Medium ◎ Low ○																
Suggested Measure	Journey					Safety	Environment		Implementation Risk	Potential Funding Partners			Indicative Timeframes √ early planning work **√** main implementation (*) large infrastructure require business case confirmation			Indicative Cost $0-$5 million = **$** $5-$50 million = **$$** $50-$100million = **$$$** $100+ million = **$$$$**
	Travel Choice (road freight mode shift)	Connect-edness	Reliability	Efficiency	Resilience											
	Optimising across modes	Connectedness Land Use Integration - Aligning Land Use	Optimising existing Infrastructure	Infrastructure improvement investment	Future Proofing - Resilience	Safe Journeys	Liveable Communities	Low Environmental Impacts		Lead Agency	Supporting Agency	Priority	Short (0 - 3 years)	Medium (4 - 10 years)	Long-term (10+ years)	
12. Re-opening of Sumner Road to freight traffic		○	●	◎	●	●	○	○	Requires agreement between stakeholders on the level of resilience to be provided along the route.	CCC	NZTA, LPC	High	**√**			$$-$$$
13. Lyttelton Tunnel duplication		◎		●	●	●	●	○	Major consultation and environmental impacts	NZTA		Med			**√ (*)**	$$$$
14. Common user unpack and pack facilities adjacent to the port or inland port	●		◎	◎	○	○	○	○	Requires buy-in of developers, freight forwarding companies, suppliers and receivers.	LPC	ALL as required	Low	√	**√**		$$
15. Encourage off-peak freight movements			●		○	◎	◎	○	Requires buy-in of transport operators, suppliers and receivers	ALL		Med	√	**√**		$
16. Increasing Air freight capacity	●		●		○	○	○	○	Requires buy-in of freight forwarding companies, airlines, receivers and suppliers.	CIAL		Med	√			$
17. HPMV improvements to the network			●	◎						NZTA	CCC,SDC, WDC	Low	√	**√**		$$
18. Improvement of north and west corridors		◎	○	●	●	◎	◎	◎		NZTA	CCC	Low	**√ (RoNS)**		**√ (*)**	$$$$
19. One Network Road Classification Implementation			●			○				NZTA, CCC, SDC, WDC		High	**√**			$

Key				
Contribution to outcome	**Symbol**		**Indicative Cost Range**	**Symbol**
High	●		$0-5million	$
Medium	◎		$5-50million	$$
Low	○		$50-100million	$$$
			$100million +	$$$$

6. Glossary

Term	Definition
3PL	Third party logistics providers - provide transport services for customers, including storage of freight.
Backloading	The practice where a container or non-container truck makes a delivery and a collection during the same trip, i.e. truck is laden in both directions.
CIAL	Christchurch International Airport Limited. Operators of Christchurch International Airport.
CHE	Container Handling Equipment. This may include gantry cranes, full and empty container handling forklifts, reach stackers and straddle carriers.
Consignee	A business receiving and unpacking a container for domestic rail movements (for the purposes of this study), equivalent to an importer for international shipping movements.
Consignor	A business packing and dispatching a container for domestic rail movements (for the purpose of this study), equivalent to an exporter for international shipping movements.
Container or shipping container	Steel boxes designed to carry freight. Maritime containers are often standardised: 20 feet or 40 feet long and 8 feet wide and high. Domestic containers are much more varied, with lengths including 30, 45, 48 and 53 feet.
Container movement	A container movement is the collection of a container from one location (e.g. an intermodal terminal) and transporting it to another location (e.g. an importer).
De-hire	The process of returning an empty container to an empty container park.
Empty container park	A handling, repair and storage facility for empty containers, usually located close to the port to minimise repositioning costs for shipping lines.
Export	For the purposes of this study, export refers to the dispatch of containers from a gateway port (e.g. Auckland or Tauranga) by a vessel to an international or mainland coastal destination.
Exporter	A business operated primarily for the purpose of exporting freight, or providing export-related services to other businesses.
Gantry crane	A large crane mounted on a platform that usually runs back and forth on parallel tracks (can be rubber tyred or rail-mounted) astride the container stacks. These cranes are generally used at a marine or intermodal terminal to load/unload containers from trains or trucks.
Hardstand	An open ground area with a prepared, hard wearing surface. For the purposes of this report, this includes all surfaced intermodal terminal land, including the container stacking area. Hardstand is normally built and rated to take a certain weight, which can dictate stack height.
Full container handling	Forklift capable of carrying a fully loaded 20 foot or 40 foot container.

Term	Definition
forklift	These forklifts are generally used to transfer fully loaded containers between the hardstand area and trucks or rail wagons.
Import	For the purposes of this study, import refers to the discharge of containers into a gateway port (e.g. Auckland or Tauranga) from an international, or mainland coastal vessel.
Importer	A business operated primarily for the purpose of importing freight, or providing import-related services to other companies.
Intermodal	Movement of containers interchangeably between transport modes (e.g. road and rail), where the equipment is compatible within the multiple systems.
Empty container handling forklift	Forklift capable of carrying an empty 20 foot or 40 foot container. These forklifts are generally used to transfer empty containers between trucks and empty container storage facilities. Some *empty container handling forklifts* are able to carry two 20 or 40 foot containers at the same time.
Logistics chain	A logistics management system that integrates the sequence of activities from delivery of raw materials to the manufacturer, through to the delivery of the finished product to the customer.
LPC	Port of Christchurch. Located in Lyttelton, this is the major gateway port in the Canterbury region and acts as a major trade gateway to the South Island of New Zealand.
Rail terminal operators	A business that engages in the loading and unloading of freight and containers on and off trains.
Reach Stacker	Reach stackers are able to transport containers (both 20 foot and 40 foot, full or empty) short distances very quickly and to stack them in various rows and heights, depending on its access and the weight of the container. Reach stackers usually have a higher stacking capacity than forklifts. Using reach stackers, container blocks can be kept 2–deep, due to the second row access. Reach stackers are generally used to transfer containers between the hardstand area and trucks or rail wagons.
Reefer	Refrigerated container designed to transport refrigerated or frozen freight. They have their own refrigeration equipment incorporated into the container design.
Repositioning	Movement of a normally empty container from one location where it is not needed, to another where it is. The export of an empty container is often referred to as repositioning.
Stevedore	A business that engages in the loading and unloading of cargo vessels at a port. For the purpose of this study, this relates to containerised freight.
Straddle carrier	A *straddle carrier* is a non-road going vehicle for use in gateway ports, intermodal terminals and transport yards. It is used for stacking and moving standard containers (both full and empty). Straddle carriers pick and carry containers while straddling their load and connect to the top lifting points of the container. Straddle carriers have the ability to stack containers up to 4-high; however, container stacks can only be one container wide with small gaps in between the rows.

Term	Definition
TEU	Twenty Foot Equivalent Unit: a container counting unit based on the International Standards Organisation, 20-foot by 8-foot container.
Transhipments	To transfer freight or a container from one ship, truck or freight vehicle to another. For the purposes of this study, a transhipment refers to the transfer of containerised freight from one train to another, e.g. maritime import container to a domestic train for delivery intrastate or interstate.
Transport operator	A business that transports containerised or non-containerised freight between two locations, e.g. port and import customer.

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