Greater Christchurch Freight Infrastructure Statement

July 2014

aurecon


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Introduction

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

This partnership has collectively estimated freight growth forecasts for the Greater Christchurch region and 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.

As part of the wider package of works commissioned, a Freight Demand Statement was developed outlining the current and future freight demand in Greater Christchurch.

The Freight Infrastructure Statement provides the partnership with a view on the capacity of the freight movement infrastructure and its interaction with the current or future supply chains.

Finally, a Freight Management Directions Statement will identify interventions and improvements to optimise the capability and resilience of the existing freight infrastructure.

The importance of freight in Canterbury

This report considers the impact of freight growth on the transport network and supply chain capability. A key driver in assessing the impact of freight growth is the increase in volume of freight being moved. However, this takes no account of the unit value of freight being moved through the network. We have estimated the value of freight and compared this to volume carried by mode. This is represented in Table 1.

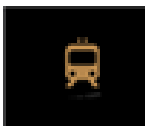
Mode	Volume (tonnes)	% of total Volume	Value	% of total Value
	25,000	0.1%	$2.39bn	4.0%
	5,297,579	31.0%	$18.9bn	31.6%
	3,251,447	19.0%	$8.3bn	13.7%
	8,524,026	49.9%	$30.4bn	50.8%

Table 1 - Approximate volume and value of freight moved through Greater Christchurch by mode

Overview of Current Infrastructure Use

Aurecon has considered transport infrastructure associated with four modes, namely: sea, rail, road and air.

Sea Freight – Lyttelton Port

Over half of all freight moved through Christchurch is moved through Lyttelton Port, with dairy related products and coal forming a large component of the volume.

Lyttelton Port has identified land as a constraint on freight growth and accordingly is currently undertaking reclamation works to address this. The port has commenced a reclamation programme in Te Awaparahi Bay to provide additional space for their container terminal. The Port's current resource consent allows for 10 hectares of reclamation. This work forms part of the Port's Master Development Plan.

Our assessment indicates that the 10 hectare reclamation underway will provide sufficient space for container storage to meet the lower bound growth estimate, assuming technology used in the future remains as per that used currently. Considering the upper bound growth and including the 10 hectare reclamation underway, there may be insufficient storage at both LPC and City Depot (Woolston) by around 2022, which would require the 20 hectare reclamation brought forward to meet this constraint. Under the upper bound growth scenario, container storage would reach capacity around 2031 with both the 10 hectare consented reclamation, and 20 hectare planned reclamation.

In terms of additional storage space there are a number of possible options:

- Reclamation at the existing Port to create more land for storing containers.
- Technical improvements supporting more efficient operation.
- Increase the land available at CityDepot, which already happening with expansion towards Curries Road.
- Provide additional storage space at a second inland port with good road and rail connectivity.

Based on current GCTS projections, additional reclamation beyond the 10 hectares consented will be required by around 2030, when we forecast (using existing stacking technology) that the port will exceed its current planned (and consented) reclamation for container storage purposes.

Increasing requirements for container storage land and growth in the use of rail associated with the dairy industry results in CityDepot operating near capacity. In terms of expansion, this site is constrained by both various land owners and the current configuration of the rail siding and is therefore unlikely to expand beyond its current footprint.

Rail Freight

Rail transports approximately 19% of all freight moved though Christchurch

Three lines converge in the vicinity of Christchurch:

- The Main South line, connecting LPC to Invercargill via Christchurch and Rolleston;
- The Main North Line, commencing at Addington, and connecting to Picton; and,
- The Midland Line, connecting the West Coast to the Main South Line at Rolleston.

Major movements include dairy product for export from Fonterra processing plants in Clandeboye (via Temuka) and Darfield; Synlait and Westland Milk via Rolleston. This product is either moved directly to LPC for export, or staged at City Depot and transferred to LPC via road, through Lyttelton road tunnel.

Middleton Yard is an important location for KiwiRail and is used to stage freight from the north carrying domestic freight for local and regional distribution, and export product to Lyttelton. There is also a coal wagon maintenance facility located here. Import/Export (IMEX) product staged at Middleton and travelling to and from LPC is typically transported via road.

- The trains moving domestic freight are typically broken up at Middleton 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 with a probable impact on local level crossings (particularly Whiteleigh Avenue and Annex Road).

- Freight trains destined for export typically travel straight through the Yard (and higher speed than those associated with shunting, etc.), and as such have a reduced impact of level crossings.

KiwiRail has identified that the current configuration of Middleton Yard will reach capacity in the next five to ten years under current freight growth trends. However, additional land is available in close proximity to the site should there be a desire to develop Middleton Yard to meet growth in freight volumes carried by rail for container transfer.

Consolidation of services supporting IMEX where efficient container transfer can take place, supporting local and regional distribution would improve both the efficiency of movement between Lyttelton and the Main South Line through Christchurch and limit the impact of increased train paths on level crossings along the corridor.

Air Freight – Christchurch International Airport

Christchurch International Airport (CIAL) provides import and export services for high value and time sensitive freight; and also operates as an air base for New Zealand and international governments to supply food and materials for Antarctic scientific research. Peak summer movements for the export of stone fruit frequently results in this product filling all available air freight capacity. However (and a key problem for airlines and dedicated freighter services) at other times of the year there would typically be excess capacity on aircraft.

The majority of the constraints to growth are a direct result of efficiency gains in the airline industry and the move towards single aisle aircraft on trans-Tasman routes (a key export destination for freight moving through the airport). Maximising the opportunities around passenger growth during the peak summer months to meet the demands of the peak produce export season as the two services are intrinsically linked. This would allow more freight to be moved through the airport using a regular passenger service on wide bodied aircraft, without the need for a specific freight service. Two additional areas of strength for Christchurch International Airport include:

- Continued support of all Antarctic support services located at CIAL which may also involve attracting other Countries to have a base managed out of Christchurch.
- Dakota Park is located in an ideal position to help consolidate operations of freight movement being well located in relation to the airport and strategic road network.

Road Freight

Whilst both Waimakariri and Selwyn Districts have freight origins in their respective districts, Selwyn is a particularly high producer of freight (including dairy, lamb and wool, seasonal produce and timber) which is predominately moved across their local road networks to the state highway network and then on to processing plants (‘farm gate’ to plant). Dairy production in the Greater Canterbury region is expected to double by the year 2025 and be almost 3.5 times its current production by the year 2041, with a corresponding increase in HCV movements from farm to processing plant supporting an increase in rail trips from processing plant to Port for export.

Aurecon has established the origins and destinations of freight by commodity based on point of production and have also estimated the mode of travel of freight for both imports and exports.

Based on origin/destination, we have been able to approximate the distribution of freight on the transport network. Using existing mode splits we are further able to distinguish between road and rail forecast increases in volumes (assuming a constant mode share between road and rail transport).

The completion of the Christchurch Southern Motorway Stage 1 (CSM1) has put additional pressures on Brougham Street (SH76), Shands Road and Springs Road during the peak periods. The opening of CSM stage 2 (CSM2) may have a relieving effect on Shands Road and Springs Road.

A constraint in the movement of freight during the day is Brougham Street. We have established that this corridor is used for export travelling towards LPC, while also being utilised extensively for the movement of local freight to and from distribution centres and customers in the greater Christchurch area. The route is particularly busy during peak times, with a large east/west movement and also significant cross movement with commuters travelling in to the CBD area.

Figure 1 – Approximate road container capacity - 2041

Figure 1 highlights the theoretical capacity of the road network on the approach to Lyttelton, through the road tunnel and indicates a TEU capacity significantly in excess of current volumes (and those predicted by Aurecon in 2041) assuming a move to 24 hour operation.

Road infrastructure is utilised at significantly different levels throughout the day and there appears to be significant gains from making more use of what we have, whilst getting more out of the supply chain. Soft measures use existing assets in the network and their implementation is only limited by the time taken to develop the measures.

Optimisation through soft measures may be achieved through such methods as:

- Shifting non time dependent goods outside peaks hours. This requires industry participation and the buy in from the customer.
- Using an interactive information sharing system to help relevant parties optimise freight movement across Christchurch.
- Introducing acknowledged freight corridors where goods can be moved outside peak hours.

Christchurch Re-Build

Significant volumes of material will be required for the re-build, representing approximately 760,000 HCV movements. A large proportion of this movement will be between the Port and City and as such, is likely to be concentrated on connections such as Brougham Street. It should also be noted that the construction industry uses a large and diverse range of commodities some of which will be delivered in bulk to sites, and some of which will be small scale local deliveries. This creates a broad range of vehicle movement.

Network Resilience

Lyttelton Tunnel currently represents a significant constraint in terms of overall network resilience with hazardous goods travelling through the tunnel. The desirable longer term option is for these goods to be transported over Evans Pass once the Sumner Road can be reopened. The level of remedial works to satisfy all road users on Sunmer Road will determine whether some operators will be comfortable using that road once it is reopened. The other alternative routes over Dyers Pass and Gebbies Pass are circuitous and incur greater costs and distances travelled along with the result being that they are less suitable for heavy vehicle transport. In the event that an incident occurred in the tunnel with a hazardous good vehicle, this could close the tunnel for a prolonged period, with significant impacts on Lyttelton. Furthermore, large volumes of both exports and imports travel through the tunnel, and a prolonged closure could have major effects on the economy of Canterbury.

Sumner Road and Causeway are areas that may have ongoing resilience issues when considering alternative access route from the port. Cliff face collapse at Peacocks Gallop (between Sumner and Redcliffs) is an example of the problems faced by this route.

Other resilience issues include:

- Stability of SH74 around the oxidation ponds on Dyers Road, were significantly damaged in the earthquakes and the risk remains.

- Bridge crossings of the Waimakariri River and Ashley River.
- Bridge crossings over the Heathcote and Avon Rivers within the Christchurch city area.

Supply Chain

The Christchurch supply chain system not only acts to service the Greater Christchurch region but also is heavily involved with the supply of freight throughout the entire South Island. As Christchurch has the largest Sea Port and Airport it is in the best position to service distribution of large number of stores throughout the Island. Our analysis of population, employment and land use suggests a growing demand for freight related activity in the south and west of Christchurch, reflecting the increase in population and employment in this location.

It has been identified that a significant amount of freight is either trucked or sent on rail from the North Island and this is a direct response to the use of established freight routes. Given the importance of Christchurch in local and regional distribution, and the size of the local market, a number of Distribution Centres and freight forwarders are located along the Main South Line corridor between Hornby and Middleton. From here, freight is distributed to end users in and around Christchurch, or transported to other locations in the south island, predominantly by road.

Section 1
Introduction

1. Introduction

1.1 Purpose of the study

The Greater Christchurch Transport Statement (GCTS) partnership was formed in 2012 and consists of members from New Zealand Transport Agency (NZTA), KiwiRail, Lyttelton Port Company Limited (LPC), 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 and 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 is included in the first of three reports, the Freight Demand Statement.

As part of the wider package of works commissioned, a Freight Infrastructure Statement is to be developed outlining the current and future freight demand in Greater Christchurch. The Freight Infrastructure Statement will lead on to the development of a Freight Management Directions Statement. This document will provide the partnership with a view on the capacity of the freight movement infrastructure and its interaction with the current or future supply chains. Finally, a Freight Management Directions Statement will identify interventions and improvements to optimise the capability and resilience of the existing freight infrastructure.

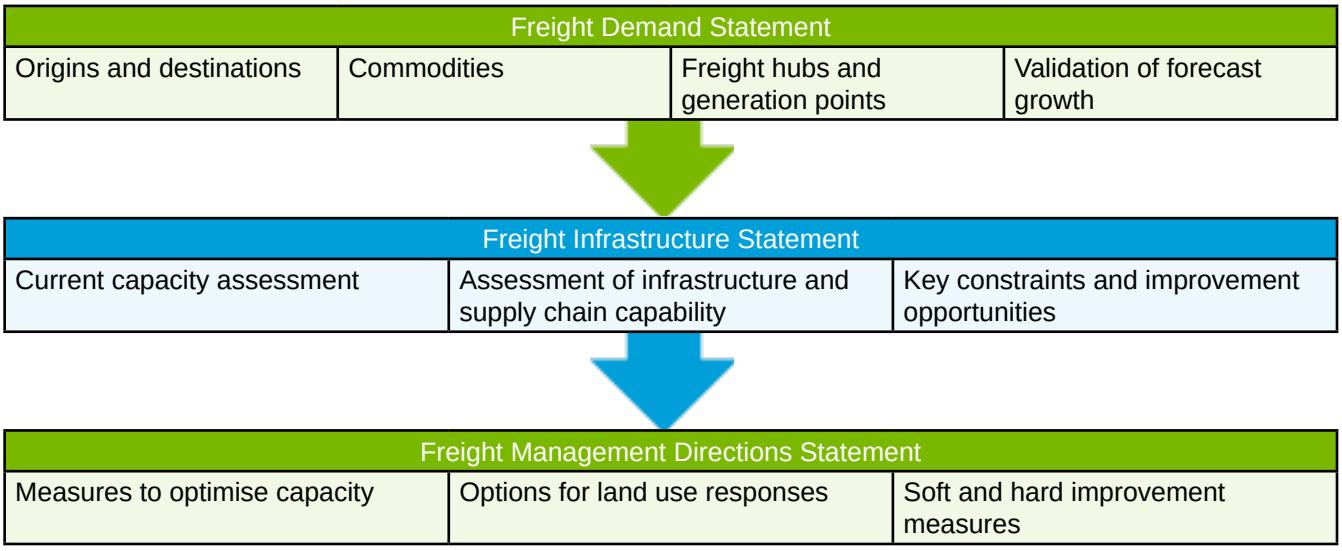


Figure 2 - Greater Christchurch Freight Study components

1.2 Aims of the Freight Infrastructure Statement

This document is known as the Freight Infrastructure Statement. It is a desktop review of information, data and forecasts from a variety of sources (some public and some private), together with an assessment of the impacts of projected growth in freight during the CGTS timeline up to 2041. While 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 that would focus actions to maximise the economic development of the region. The Freight Infrastructure Statement seeks to provide an understanding of the current capacity of the network and freight infrastructure and seeks to identify key constraints to meeting that growth whilst identifying improvement opportunities which will be taken forward in subsequent reports.

1.3 Report structure

The Freight Infrastructure Statement has the structure shown below. The structure is designed to describe and document current capacity of the freight system in Greater Christchurch together with an assessment of infrastructure and supply chain capability:

Section 2 Summary of Freight Forecasts. This section contains an overview of the Freight Demand Statement produced by analysing trends in commodity growth and population and employment data from Statistics New Zealand to provide context for the demand for import containers.

Section 3 Infrastructure, Land Use & Freight Movement. This section contains an overview of the existing freight-related infrastructure in the region, and provides a commentary of land use and its relevance in the context of freight.

Section 4 Sea Capacity Assessment. This section describes the current operational arrangement at LPC and the freight supply chain associated with the Port. An assessment of capacity has been undertaken which has been used to identify possible future constraints to meeting projected growth in the throughput of freight.

Section 5 Rail Capacity Assessment. This section contains considers the current and future rail related infrastructure and its ability to accommodate the future freight task.

Section 6 Air Capacity Assessment. This section assesses the impact of projected airport freight growth and the current infrastructure available to accommodate that growth. It describes opportunity to grow market share of freight handled by the Airport an

Section 7 Road Capacity Assessment. This section contains an analysis of current infrastructure, and considers the impact of the projected freight growth origin and destination on the local highway network. This section considers specifically freight related traffic on roads in Christchurch City, Selwyn District and Waimakariri District. The section also considers network resilience.

Section 8 Supply Chain Assessment. This section considers the current capacity restriction in the supply chain and looks at potential future development to the supply chain that would

Section 9 Concluding Remarks. This section summarises the information presented in Sections 3 to 8, in the context of providing a reliable set of overarching freight demands, to be used in subsequent project stages.

1.4 Volume and value of freight in Greater Christchurch

This report considers the impact of freight growth on the transport network and supply chain capability. A key driver in assessing the impact of freight growth is the increase in volume of freight being moved. However, this takes no account of the unit value of freight being moved through the network.

Table 2 below shows that whilst the volume of freight moved by air is relatively small in comparison to other modes, the value is high. Indeed, the value of exports is higher than other airports in New Zealand reflecting the high value stonefruits/seafood and gold/gems and other high value export products. In this case, the value of freight moved through the airport is approximately 40 times it's volume. Whilst this Statement considers the impact of increasing volumes of freight carried through Greater Christchurch, there is discussion in subsequent sections on the opportunities to increase the proportion of higher value freight transported through Christchurch International Airport

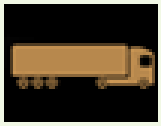
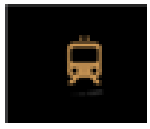
Mode	Volume (tonnes)	% of total Volume	Value	% of total Value
	25,000	0.1%	$2.39bn	4.0%
	5,297,579	31.0%	$18.9bn	31.6%
	3,251,447	19.0%	$8.3bn	13.7%
	8,524,026	49.9%	$30.4bn	50.8%

Table 2 - Approximate volume and value of freight moved through Greater Christchurch by mode


Timaru
Akaroa
West Coast
MACK

Section 2

Summary of freight forecasts

2. Summary of freight forecasts

2.1 Freight Demand Statement Summary

The Freight Demand Statement concluded that due to the large population and employment located in and around Greater Christchurch, as well as the production of export commodities throughout Canterbury, the region plays a critical role in the production of goods for domestic and international markets. As described in this statement, production of a number of major commodities is growing, particularly dairy 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 supply chains, in particular congestion issues relating to road, rail and port access, add costs to businesses and impact more broadly on overall productivity and the nation's economic health.

Current freight demand in the Greater Christchurch region is concentrated primarily on the export of a number of key commodities, including: dairy and milk products, meat products, coal, logs and 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).

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, all containers transported between the City Depot and LPC currently use road transport.

Imports from LPC through the Greater Christchurch region are commodities such as dry bulk and petroleum. General container freight used 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 this statement has been 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 forecast growth. Where significant differences were encountered for particular commodities, alternate data sources were interrogated and considered, to determine likely reasons for these 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 3 - Summary of projected growth by commodity (2010 to 2041).

30 Year Assumption			
Measure or commodity	**2010**	**2041**	**Growth**
Population	435,000	550,000	0.9%
Employment	200,000	244,000	0.7%
Containers (TEU) (lower)	290,000	**782,000**	**5.5%**
Containers (TEU) (upper)	290,000	1,500,000	*5.3%
Air Freight (tonnes)	**25,000**	**107,000**	**10.6%**
Dry bulk (tonnes)	660,000	1,200,000	2.6%
Petroleum (tonnes)	1,000,000	**1,371,000**	**1.2%**
Logs (tonnes)	250,000	**739,000**	**6.3%**
Coal (tonnes	2,300,000	**3,000,000**	**1.0%**

Table 3 - Summary of projected growth by commodity (2010 to 2041

* Compound Annual Growth Rate (all other growth rates are based on annual linear growth)

Bold numbers updated from the original GCTS values.

The Freight Demand Statement concluded that the GCTS growth forecasts appear significantly higher than indicated in historical information available for 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 is unlikely to be high enough to drive an overall container movement growth of approximately 5.3% compounding annually. However, the GCTS forecast may consider an increase in the South Island share of shipping due to the possibility of allowing larger ships, and this could help increase the overall total, although there remains competition within New Zealand given the relative proximity of ports to one another. Aurecon therefore have recommended in this case to provide a range of forecasts, a lower bound based on continued strong growth, and an upper bound based on compounding growth that considers these other factors.

It is worth noting that 2013 volumes are now available from LPC and are reproduced below.

	Year		
Measure or commodity	**2010**	**Year to 30 June 2013**	**Percentage change**
Containers (TEU)	290,000	351,217	+21%
Dry Bulk (tonnes)	660,000	649,365	-1.6%
Petroleum (tonnes)	1,000,000	1,111,189	+11.1%
Logs (tonnes)	250,000	369,657	+47.9%
Coal (tonnes)	2,300,333	2,049,949	-10.9%

Table 4 - Updated measure (containers) or commodity through Lyttelton Port

Section 3

Infrastructure, Land use and freight movement

3. Infrastructure, land use and freight movement

3.1 Location of transport infrastructure

The GCTS aims to provide a basis for the development of a transport system that will support the efficient movement of people and freight across the region. To illustrate the current movement of freight, this section contains an overview of the existing freight-related infrastructure in the region.

Each area of freight activity will be further described below:

1. Lyttelton Port of Christchurch (LPC). The Canterbury region is a major producer of primary produce; consequently, LPC is the primary export hub for freight leaving the region but also handles a significant proportion of the imports. For example, high volumes of milk and dairy products, logs and timber products, livestock, meat and coal are produced in Canterbury. Much of this output is sent through Christchurch to LPC for export to international markets [50-60].
2. Christchurch International Airport. Operated by Christchurch International Airport Limited (CIAL), this is the major gateway airport for the South Island. It plays an important role in imports and exports of various commodities produced in Greater Christchurch and also in the wider South Island region. Data indicates that CIAL is primarily an export hub [20], with approximately 25,500 tonnes moving through CIAL in the year to April 2011. Of this volume, only 7,500 tonnes were imported (30%), with the remainder being exported through CIAL (70%). The major commodities exported through CIAL include: seafood, minerals and precious stones, meat and dairy products [20].
3. CityDepot. LPC operates an off-port container operation called CityDepot. This site is located in Chapmans Road in Woolston and provides a centralised point in Christchurch for the collation of (primarily) export maritime containers and the re-positioning of empty containers for major producers [50-60].
4. Middleton Rail Terminal. KiwiRail operates an intermodal terminal in Middleton, Christchurch. This location is linked to the KiwiRail network and plays an important role in transporting general containerised domestic freight between Christchurch and the North Island (Auckland in particular) . [1-4].
5. On-site rail sidings. Examples of dedicated sidings on the South Island that are of relevance to Greater Christchurch, are Fonterra's Temuka and Darfield sites (not shown on map), where export containers are packed, loaded onto trains and moved to LPC for export. Similarly, Westland Milk's Rolleston plant uses a rail siding to consolidate its containers onto rail for export through LPC. Dedicated on-site rail sidings also exist on the West Coast, for the loading of coal trains for transport to LPC for export.
6. Distribution Centres. Distribution centres in Greater Christchurch include: Countdown's Christchurch Regional Distribution Centre in Hornby; Kathmandu's National Distribution Centre in PortLink and Croxley Distribution Centre in Hornby. The Warehouse South Island Distribution Centre is located at Rolleston.
7. Izone. Located in Rolleston, Izone business hub is an 8 minute drive from the nearby Hornby industrial area in south-west Christchurch. Half of the 180 hectare greenfield industrial development is complete. Izone is owned by Selwyn District Council; and is located in close proximity to road and rail infrastructure.

Within Greater Christchurch, there are other areas with significant commercial activity (such as Belfast). While these have been excluded from the list above, they are important for transport in Christchurch, but discussion of this type of area on an individual basis, is beyond the scope of the statement.

Figure 3– Greater Christchurch transport infrastructure

While all arterial roads are important for the movement of freight, the current key road linkages are those that allow primary access into, or through, Greater Christchurch from their origin to destination. These are described in more detail below:

A. Lyttelton Tunnel / Tunnel Road (SH74). Lyttelton Tunnel provides a tunnel with one lane in each direction, from Heathcote Valley (southeast of Christchurch) through to Lyttelton. Due to the closure of Sumner Road following the 2011 earthquakes, it provides the only viable road connection between Christchurch and LPC for the movement of freight. As a result, all hazardous goods must use the tunnel; and special restrictions are in place to minimise the risk of damage and collision (further discussed in Section 7.9).

Lyttelton Rail Tunnel. With a similar alignment to Lyttelton Tunnel, this rail tunnel connects Lyttelton and Christchurch, and facilitates the transport of some freight between LPC and its markets. This includes the transport of containers (a large proportion being export dairy products), as well as coal from the west coast of the South Island. Each of these is discussed in later sections of this statement.

B. Sumner Road. Sumner Road provides an alternative road network link between Lyttelton and Christchurch, and used to be the route taken for trucks carrying hazardous goods, including fuel from the storage facility at LPC. It was severely damaged in the 2011 earthquakes, and has not re-opened to traffic, although there are several different proposals (and associated costs) being put forward to reconstruct the link.

C. Christchurch Northern Motorway (SH1S). This link provides the main connection between Christchurch and northern areas of the South Island. It runs adjacent to the river crossing via the Main North Road and the Main North Trunk Line. The only other alternative is Waimakariri Gorge Road (which is Route 72) a further 50 kilometres to the west.

   Main North Trunk Line. This is the main rail line that connects Christchurch through to the northern areas of the South Island including Blenheim and eventually Picton. This line then joins up with the Interisland Ferry to transport freight (and passengers) to and from the North Island of New Zealand.

D. Russley Road (SH1S). This road link provides bypass functionality for vehicles travelling through Greater Christchurch from the southwest to the north (and vice-versa), as well as connecting outlying and regional areas to Christchurch International Airport, without the need to enter Christchurch itself.

E. West Coast Road (SH73). As the name suggests, this road link connects Christchurch with the West Coast (via Arthurs Pass) and is a considerably shorter route to Greymouth compared to the northern alternative (State Highway 7). This road also provides a link between western areas of Canterbury and Christchurch.

F. Midland Line. The Midland Line provides the rail connection between Greymouth on the west coast of the South Island, through to Rolleston, southwest of Christchurch, where it connects with the Main South Trunk

Line, and through to Christchurch. For freight, it is used to transport coal between areas on the west coast to be exported at LPC.

G. Main South Road (SH1S). This road provides the main link between Christchurch and southern regions of the South Island. Further south, it crosses the Rakaia River, whose only other crossing location is approximately 40 kilometres to the west at the Rakaia Gorge on SH77.

Main South Trunk Line. This line provides the only rail access to the southern regions of the South Island. In connects from Invercargill in the south, through to Rolleston (connecting with the Midland Line), to Christchurch (connecting to the Main North Trunk Line), and eventually through to LPC at Lyttelton.

Brougham Street (SH76). Brougham Street serves several purposes, including the main line to transport freight between LPC and markets southwest of Christchurch, as well as being adjacent to a hub of major commercial activity that stretches from Woolston in the east through to Middleton in the west (where Brougham Street becomes the Christchurch Southern Motorway); approximately 8 kilometres from one end to the other.

3.2 Freight Movement in the Network

As we presented in the Freight Demand Statement, information on freight movements within the Greater Christchurch region, or, more broadly, movements across the South Island, is limited in the public domain. The only publicly available information on these movements is the historical data contained in the NFDS (2014); however, this information is broken down to a Regional Council level, meaning that the finest detail possible for this report is to show movements into, out of and within Canterbury.

We have analysed available data, and passed on location of population, estimated the destination of imports by mode. This has been completed for imports and exports, with the corresponding distribution and tonnage shown below. The key element of distribution infrastructure for imports is road based, with destinations within greater Christchurch and the south west accounting for the majority of movement. This is an important consideration as the movement of, and growth in freight supporting imports is closely aligned to population.

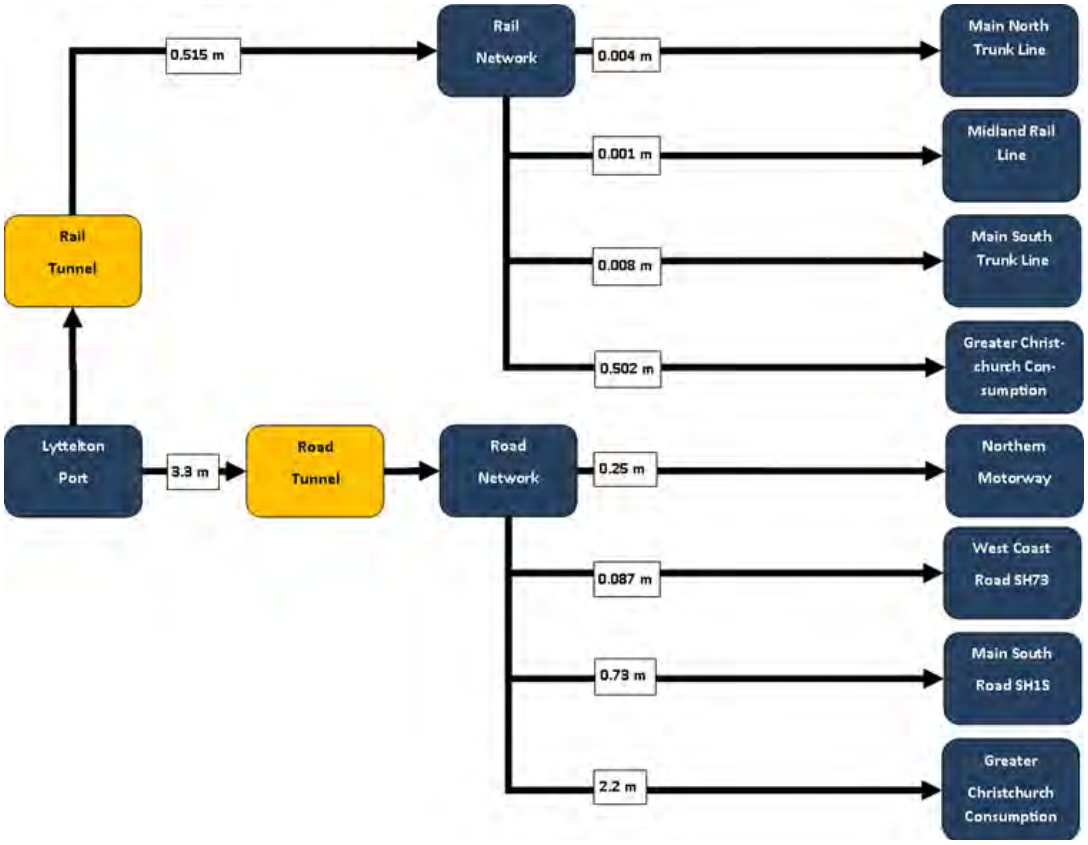


Figure 4 - Lyttelton Port – Import distribution network and tonnage (2010 values)

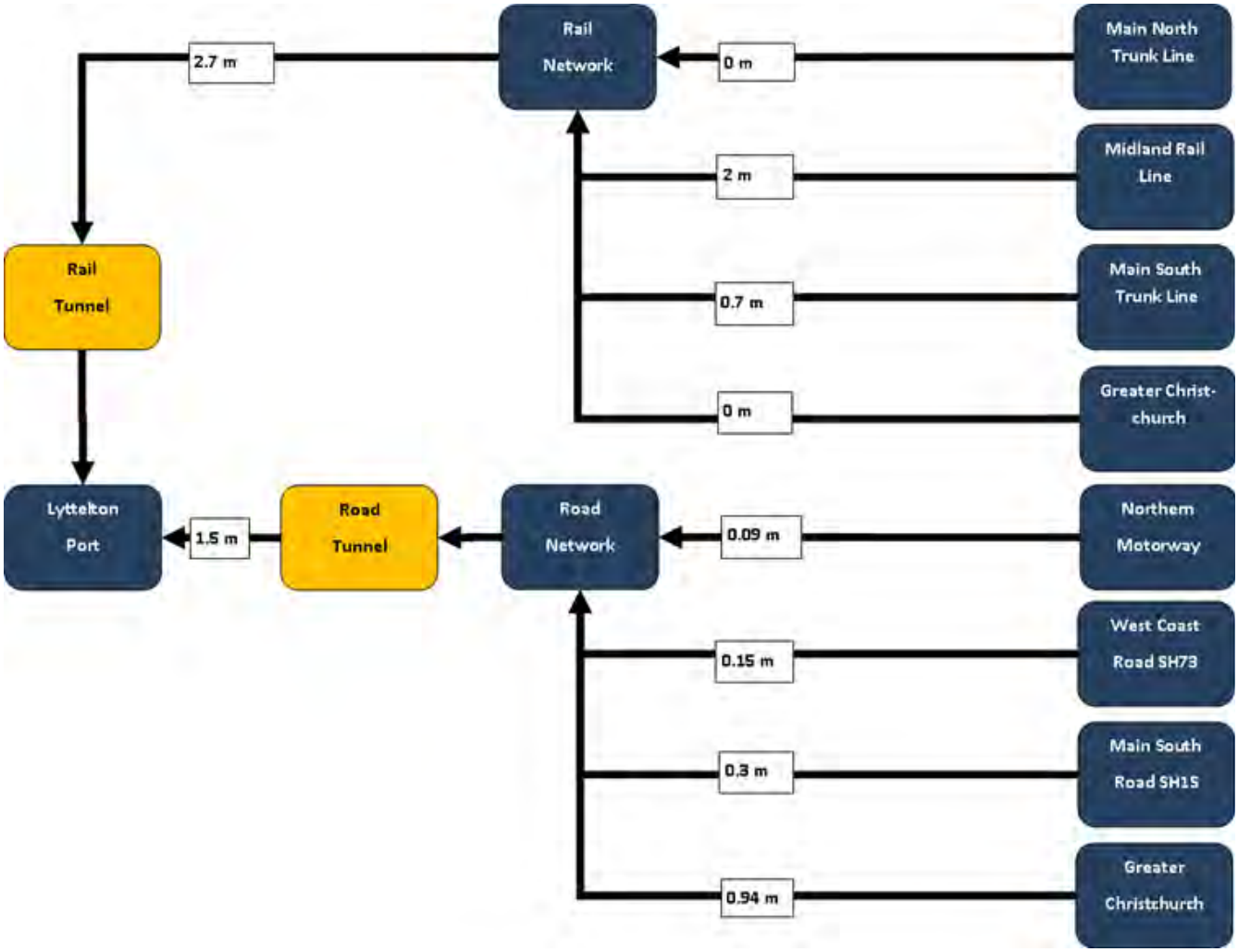


Figure 5 - Lyttelton Port – Export distribution network and tonnage (2010 values)

In terms of tonnage, movement of export freight through greater Christchurch is dominated by the use of rail, reflecting the trend in the coal and dairy industries to use rail between processing points and export. Accordingly, rail moves significant volumes as presented in Figure 5. The distribution reflects the location of dairy industry processing plants towards the west and south of Canterbury. The above distribution is shown graphically in Figure 6 - Export distribution by commodity and tonnage (2010 values) and Figure 7 - Import distribution by commodity and tonnage (2010 values)

Figure 6 - Export distribution by commodity and tonnage (2010 values)

Figure 7 - Import distribution by commodity and tonnage (2010 values)

Section 4

Sea Capacity Assessment

4. Sea Capacity assessment

4.1 Background

This section contains the validation of employment forecasts for the background.

Lyttelton Port of Christchurch is the South Island's major commercial deep water port, located in the Christchurch suburb of Lyttelton, on the northern shores of Lyttelton Harbour. Established as a Port in 1849, Lyttelton has developed in to a container trade hub port for the South Island.

The Port caters for containers as well as the loading and unloading of bulk products including petroleum, fertiliser, gypsum, cement, logs, conventional break-bulk, imported vehicles and fishing. It also has one of the largest coal export facilities in New Zealand. A breakdown of commodities moved through the Port is contained in the Freight Demand Statement.

The Port currently handles approximately 50% of the South Island's container cargo; however, there is competition from both Port Otago Ltd. and PrimePort Timaru (part owned by Port Tauranga). It is noted that Lyttelton is the export port for the West Coast while imports travel via Nelson.

As discussed in the Freight Demand Statement, the Canterbury region is a major producer of primary produce; consequently, LPC is the primary export hub for freight leaving the region. For example, high volumes of milk and dairy products, logs and timber products and meat are produced in Canterbury for export from LPC.

Figure 8 provides an overview of Lyttelton Port of Christchurch's quay side operations. The Container Terminal is located at the western end of Cashin Quay on the outer harbour reclamation. Quay side facilities are supported by CityDepot, an inland container storage and repair facility. Petroleum facilities are located on the western side of the outer harbour.

The inner harbour wharves and facilities cater for the unloading and loading of bulk products including petroleum, fertiliser, gypsum, cement, logs, conventional break-bulk, imported vehicles and fishing.

Following discussion, a detailed breakdown of the port infrastructure is provided below in Table 5 - Current facilities at Lyttelton Port. It is worth noting that Lyttelton Port has continued to operate following the earthquakes of 2010 and 2011. We have identified two key risks to the freight volumes, and hence infrastructure requirements associated with LPC:

- Whilst LPC is the largest Port in the South Island, we have not considered the impact of increased port competition and the resulting effects on freight volume forecast changes on the requirement for infrastructure investment.
- We understand a Port Consolidation Study is currently being undertaken by the Ministry of Transport following on from the updated National Freight Demand Study.

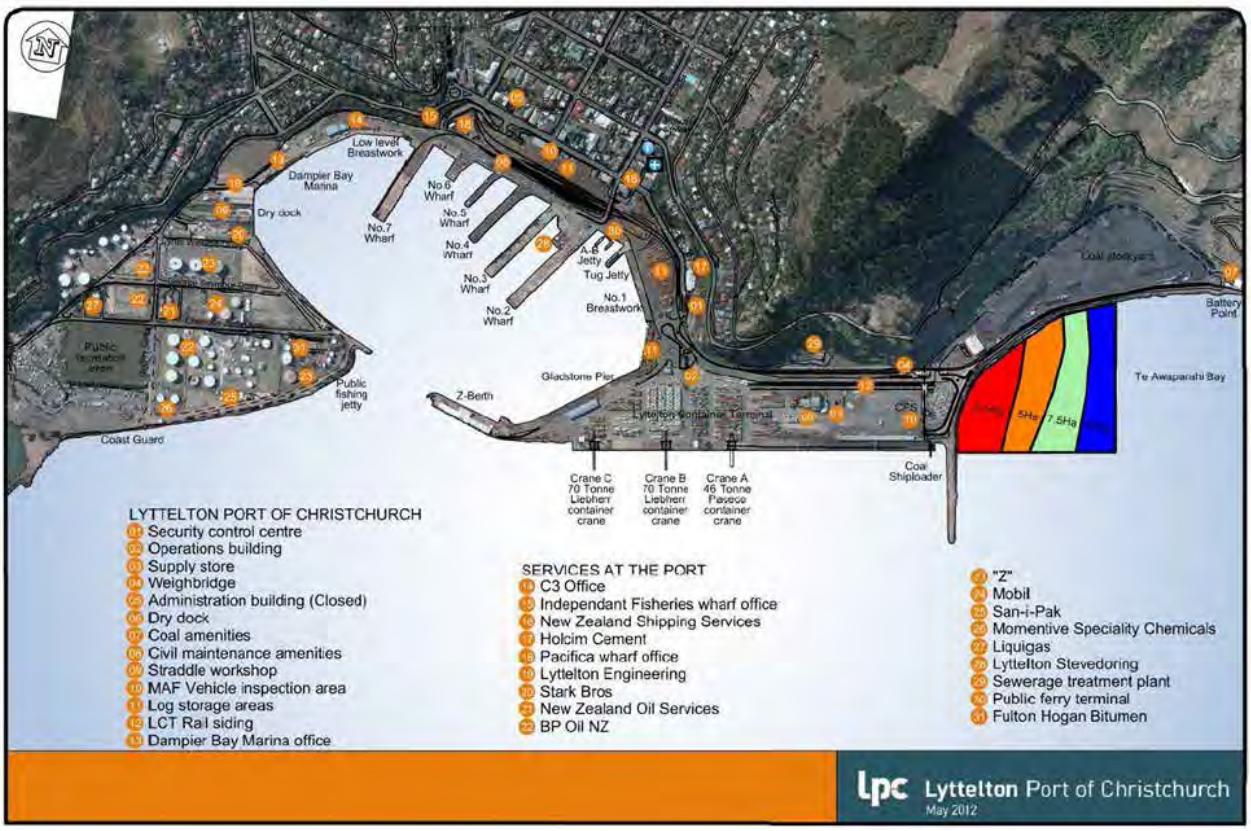


Figure 8 - Lyttelton Port of Christchurch layout . Source: LPC website.

Table 5 - Current facilities at Lyttelton Port

Structure	Description
Cashin Quay Berths	CQ1 (coal), CQ2 (currently being re-built) and CQ3 and CQ4. Full cargo handling facilities with container cranes.
No.2 Wharf	A finger wharf, concrete decked to class one highway standard, for discharge of dry bulk import and general cargoes, and export of logs. - No.2 East is 270m long, 11.8m deep - No.2 West is 169m long, 9.3m deep - Four mobile discharge hoppers - 60 to 90 tonne capacity (can be relocated to other berths) - Wood faced fender piles
No.3 Wharf	A finger wharf, concrete decked to class one highway standard for discharge of dry bulk import and general cargoes, and export of logs. Also available for lay up and ship repair. - No.3 East is 195m long, 9.5m deep - No.3 West is 223m long, 10.6m deep - D-formed rubber fenders running the full length of the berth face
No.7 Wharf	A concrete decked wharf maintained to heavy duty standard and equipped with a heavy duty pad at No.7 East for quarter ramp vessels and stern roll-on/roll-off vessels. - No.7 East is 217m long, 10.3m deep - No.7 West is 187m long, 8.5m deep - 32 reefer points
Oil Wharf	A steel four-berthing dolphin structure, concrete service deck and shore based bollards suitable for vessels up to 225m long. Used for loading and unloading liquid bulk cargoes and bunkering. - 202m long, 12.6m deep
Z Berth	Earthquake damaged
No.1 Breastwork	A general cargo berth, 159m long, 9m deep, regularly used for the discharge of bulk cement. - Heavy duty 30m long pad in centre of berth.

In the year ended 30 June 2013, 588 general cargo vessels called at Lyttelton Port.

4.2 Containers

The Port's 13.5 hectare container terminal (as of April 2014) is located on the eastern side of the port, and provides container storage for approximately 4,000 containers, stacked up to a maximum of three containers high. However, we note that current stacking is lower to optimise operational efficiency which results in a maximum container storage of approximately 3700 TEU. The berth depth is currently 13.1m, which, at zero tide, will allow ships of up to 10.8m draft to berth (with a maximum permissible draught of 12.4m, at high tide).

The container grid is divided into a number of 'areas' by a central 'east-west' access road and a series of 'north-south' cross road all of which provide access to the grid for straddles.

Designated areas are provided for refrigerated (reefer), imports, exports, general and empty containers as well as dangerous goods. The reefer area of the container terminal is equipped with electrical points to handle approximately 720 integral refrigerated containers.

Infrastructure to assist in the unloading and loading of containers includes:

- 3x Container Cranes on approximately 360m of container rails, with a fourth crane expected to become operational in July 2014.
- 22x Straddle Carriers, with four under construction
- 7x Forklifts

The Container Terminal currently operates Monday to Saturday for manual transactions in addition to Sunday with kiosk transactions, with restricted hours for all manual transactions. The coal stockyard and marine services can operate 24 hours a day, seven days a week. Vessels are serviced 24 hours per day, 7 days per week.

The Port provides for containers being received by both road and rail. Truck access is provided at the eastern end of Norwich / Gladstone Quay (at the end of SH74) directly in to the container terminal. There are seven truck lanes within the terminal for loading / unloading; with 10 off-road parkup spaces provided at the Cashin Quay Backroad to allow documents to be completed prior to loading.

In peak periods, trucks have been reported to wait along Cashin Quay Backroad. The Port is currently considering proposals for an internet based truck booking system which will smooth demands, and therefore increase certainty over arrival times whilst increasing efficiency at the port entrance.

Separate gate access is provided to the empty container yard (ECY) located at the eastern end of the Port adjacent to the reclamation being undertaken.

The KiwiRail siding accommodates one 24-wagon train (48 TEU). On average 5 container trains are received at the container terminal per day. Fonterra's milk powder exports are received by LPC by rail directly from their plant in Darfield. The Clandeboye plant operates in a similar way to Darfield, with staging taking place at CityDepot prior to reaching the Port. Fonterra pack all containers at point of processing to maintain control of strict quality measures. In general, the proportion of imports and export containers is well balanced at Lyttelton, and empty containers are also transported via rail to CityDepot and then back to Fonterra's Darfield and Clandeboye plants. The turnaround (unload) on each train is approximately 2 hours.

Average length of time a container remains at the Port is 1.9 days for an import container, and 4 days for an export container.

The Container Terminal has suffered significant damage as a result of the 2011 earthquake including outward movements of the seawalls and deformation of the pavement. Temporary repairs have allowed the terminal to maintain operational but significant works will have to be undertaken over the next ten years to repair the terminal and wharf structures which may impact on port operations. Cashin Quay number 2 will be converted for use as part of the Container Terminal, having previously been used for general cargo and the cruise ships. The wharf demolition and stabilisation project on Cashin Quay number 2 is programmed to commence early 2014, noting that this wharf is currently not operational due to the extent of damage. Once completed during 2015, we understand the container berth length available will be approximately 600m.

Table 6 - Freight Breakdown Summary

Freight %	Type
Top four Commodities	Are dairy, meat products, coal/fuel and logs and timber products
Approximately 28% of containers moved	Are empty containers
70% of containers moved	Are full
Origin	Diary related products are a significant and growing market in Canterbury. Whilst there are dairy farms throughout Canterbury, there are large dairy processing plants in Darfield and Clandeboye

4.2.1 Actual Container Volumes

Actual container throughput in the year to 30 June 2013, provided by LPC, was 351,217 TEU, an increase of 140,000 containers over seven years.

Full container movements contribute to approximately 70% of the total container throughput, split equally between export and import. Empty container movements contribute to approximately 28% of the total container throughput, with slightly more containers being imported. Other movements, such as deliver, load, restow, shift on board and outside container terminal, make up the remainder of the terminals container movements.

Empty containers are de-hired at one of three depots in Christchurch (including CityDepot located in Woolston) and if they are to be repositioned (exported empty) are transported to the Empty Container Yard (ECY) at the Port. Import empty containers discharged from vessels are collected from the ECY, which has capacity for 870TEUs, with 1200TEU storage available from April 2014.

New development planned for completion in March/April 2014 will result in the ECY moving slightly eastwards and will increase the ECY capacity to approximately 1,500 TEU (an additional Container terminal capacity of 400-500 TEUs).

4.2.2 Forecasted Container Growth

As presented and discussed in the Freight Demand Statement, LPC's forecast for container throughput in 2041 is currently around 1.5 million TEU, which reflects a compound average growth rate of 5.3% over a 30 year period. LPC's growth assumptions are outlined in the Freight Demand Statement, together with alternative growth forecasts provided by Aurecon.

A major contributor to this growth is Fonterra's Darfield Plant, opened in 2012 (with stage 2 completed in 2013). The first drier produces 85,000 MT of milk powder a year; which equates to approximately 5,000 TEU. When fully operational, the plant will process 7.2 million litres of milk per day. LPC expect to receive approximately 15, 000 TEU from Darfield in the year to June 2014.

As domestic freight increases (with freight originating from the North Island coming into Christchurch for the earthquake rebuild), this will lead to an increase in coastal shipping and an increase in the movement of material from Lyttelton to various construction sites throughout Christchurch.

4.2.3 CityDepot

In addition to the quayside facilities Lyttelton Port of Christchurch operates CityDepot, an off- port container facility located at Chapmans Road in Woolston, approximately 10 minutes' drive from Lyttelton through Lyttelton Tunnel.

The 16 hectare site (comprising 9 hectares at CityDepot and 7 hectares at Curries Road site), primarily a storage facility for empty containers, is one of three empty container depots in Christchurch, and the only facility owned by LPC. Currently, approximately 9 hectares is set aside exclusively for the storage of empty containers.

This site, of which some is still under development, currently has capacity for approximately 9,000 TEUs which can be stacked up to between 5 - 7 containers high within the depot. The facility also provides a full range of container services, such as container repairs, pre-tripping and maintenance.

The depot is serviced by road and rail; with a 24-wagon KiwiRail siding located in the depot. The depot is nearing capacity and the Port is in the process of expanding its operations into an adjoining site with additional access off Curries Road.

4.3 Fuel

The Lyttelton Port Tank Farm, located at the western end of the inner harbour, has storage capacity for approximately 105 million litres of petroleum product including petrol (91, 95, 96 and 98), Diesel, Jet Fuel, and Bitumen products.

Approximately 1 million tonnes of bulk fuel product was moved through Lyttelton Port during the year ended 30 June 2013. The Tank Farm facilities / and capacity is as follows:

- Two 250mm nominal bore marine discharge units for white products - 1,100 tonnes per hour capacity
- One 250mm nominal bore marine discharge unit for black products - 420 tonnes per hour capacity
- LPG marine unloading arm
- Maximum bunkering rates:
  Light fuel oil - 90 tonnes per hour
  Marine diesel - 85 tonnes per hour.

The Tank Farm is operated by NZ Oil Services Ltd (NZOSL) with Mobil Oil New Zealand, BP New Zealand, Z Energy, and Fulton Hogan Bitumen having their own bulk fuel storage tanks within the facility. Additional storage facilities are provided in Woolston (15 million litres); Christchurch Airport (3 million litres, all jet fuel); and Timaru (40 million litres). The majority of the fuel is destined for Christchurch; followed by Timaru and Ashburton.

Prior to the Christchurch Earthquakes, petrol was either pumped from the port through a Mobil's 6.4km pipeline through the Port Hills down to a depot in Woolston; or transported by tanker across Sumner Road / Evans Pass. Diesel and jet fuel can only be transported by tanker.

Since the earthquakes the Evans Pass route has been closed, and NZ Transport Agency (NZTA) have permitted dangerous goods to pass through the Lyttelton Tunnel at night (7pm – 6am), unaccompanied, which is causing delays to other traffic using the tunnel.

The current procedure is as follows:

- When a tanker (or dangerous good vehicle) is leaving the Tank Farm (west Lyttelton) they advise the Lyttelton Tunnel Control they are leaving the Port. Tankers arriving from Christchurch typically arrive at the Heathcote Portal unannounced, and wait in the portal layby.
- The Tunnel Control Centre will then clear the tunnel, which takes approximately four minutes.
- Once given the all clear by the Tunnel Control Centre the tankers will pass through the tunnel unaccompanied.
- Once the tanker is clear of the tunnel, it will be reopened to all other traffic.

Between eight and 30 dangerous good vehicles can pass through the tunnel a night. In May 2013 NZTA signalled that temporary arrangement will end when Evans Pass reopens, following requests from BP New Zealand and Z Energy to transport fuel through the tunnel permanently. A second pipeline has also been discussed previously; however it is not possible for this to pass through the tunnel.

4.4 Timber

Timber (logs) exports to the year ended 30 June 2013 was approximately 370,000 tonnes. However, following the large storms in Canterbury in September 2013, the port is currently experiencing a spike in volume due to the export of windblown trees.

Logs are typically brought to the port by road, with some arriving by rail (predominately from the West Coast). Currently 6-12 wagons per day, typically with 30 logs per wagon. Ships typically take in the order of 48 hours to load, and are loaded 24 hours a day.

4.5 Coal

Lyttelton's coal terminal is one of the largest facilities in New Zealand, with approximately 2 million tonnes exported each year.

Coal arrives by rail from the West Coast, and is collected in the coal yard prior being loaded onto coal ships. Currently 5 trains arrive on a daily basis from the West Coast, comprising 30x 50-tonne bottom dump railway wagons. KiwiRail note there is capacity in the network for up to 8 trains per day, with up to 45 wagons per train if demand requires.

Up to 335,000 tonnes of coal can be stockpiled in the 6ha yard in 6 stockpiles. However coal operations tend to be 'just in time'.

The coal is loaded onto ships via a bucket-wheel reclaimer and mobile plant, which together feed a series of conveyor belts connected to a ship loader. During the year ended 30 June 2013, 37 coal ships visited the Port, less than one a week.

4.6 Fertiliser and cement

Approximately 325,000 tonnes of fertiliser was imported into the port in the year ended 30 June 2013. This material is transferred by road through to Christchurch and beyond.

Holcim New Zealand own and operate a cement depot at the eastern end of Gladstone Quay, with capacity to store 11,000 tonnes of cement in four silos. This was increased from 7,000 tonnes in 2012, to meet the demands of the Christchurch rebuild. Holcim ships currently berth at the No. 1 Breastworks which has underground facilities connecting it to their storage facility. Cement is then transferred by road to Christchurch and beyond.

In mid-2013 Holcim announced plans to shut its cement manufacturing plant in Westport and switch to importing cement. It was announced in December 2013 that Holcim would switch its cement import terminal to PrimePort Timaru. The estimated $50m investment will provide the capacity to handle up to one million tonnes of cement a year. Imports of cement to Lyttelton will be unaffected. The only difference is that imports will be via Timarie instead of West Port.

4.7 Port constraints

Aurecon have considered the impact of increasing freight volumes passing through LPC in three main categories:

- Impact in relation to the operation of the port
- Impact in relation to port access and transport network impacts
- Temporary impacts associated with the closure of Sumner Road (Evans Pass) for the transport of dangerous goods

The following outlines the infrastructure constraints identified for LPC.

4.7.1 Rail constraints

The number of sidings within the terminal (the quayside Container Terminal has one 24 wagon siding for container trade) constrains the number of rail movements and therefore impacts the number of containers that are able to arrive by rail.

Additionally, there is only one 24-wagon siding at CityDepot, and the number of trains per day is limited by the time required to unload / load the train (although there exists the possibility of providing an additional siding at the site which is constrained given land ownership issues). Extension of the container grid adjacent to the siding may assist in loading rates, although this has not been considered in detail as part of the Freight Infrastructure Statement.

In other words, in terms of rail constraints, the determining factor is not capacity of the line serving the port, it is the capacity of the sidings serving the line. This and the consequence of increasing use of capacity constrained sidings are discussed in more detail in Section 5.

KiwiRail have stated there is capacity for another three coal trains a day, to take the total number from five to eight. Should the need arise there is capacity within the site at LPC to build another siding.

4.7.2 Road constraints

The most direct road route from Lyttelton to Christchurch is through the Lyttelton Tunnel, operated by NZTA. Prior to the Christchurch earthquakes dangerous good and oversized vehicles were prohibited from the tunnel and used the alternative route of Sumner Road / Evan's Pass Road. However, this route has been closed since February 2011 and the NZ Transport Agency has permitted dangerous goods (including Petroleum) through the tunnel at night unaccompanied. However, and in addition to increased risk presented by the movement of hazardous substances through the tunnel, this leads to delays to both passenger and freight traffic who have to sit at either end of the tunnel waiting for the dangerous goods vehicles to pass through. Additionally, this requires a balance between ongoing tunnel maintenance and the passage of essential goods through the tunnel. It is a situation that is untenable in the medium term given the importance of the tunnel in the movement and distribution of experts and imports,

Currently Christchurch City Council, who maintain Sumner Road / Evans Pass, have not confirmed plans for the route, which requires significant repairs and stabilisation works to bring it back to a pre-earthquake standards. Whilst a question mark remains over the future use of the Sumner Road / Evans Pass route to (pre Earthquake conditions) use by general traffic, there will remain a significant concern over the lack of a secure resilient, alternative route to the port by road.

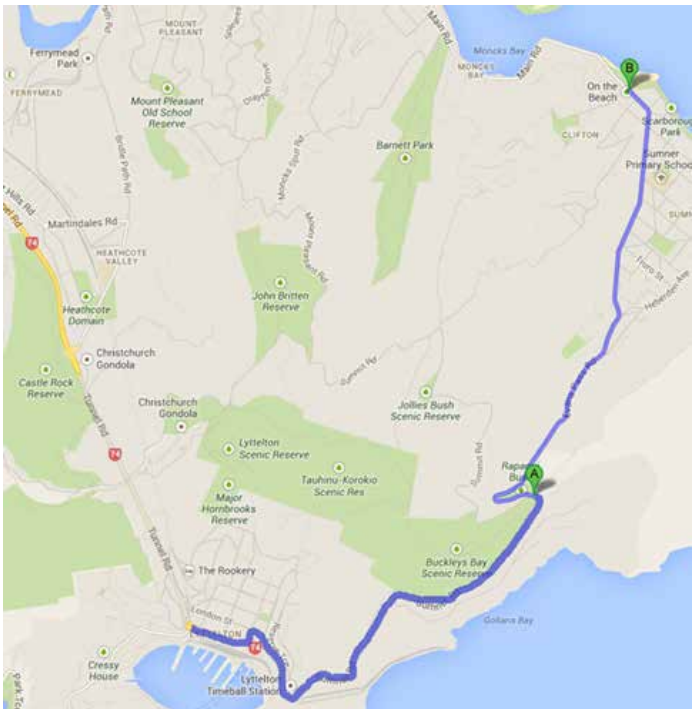


Figure 9 - Evans Pass route

In additional to the Evans Pass route there are two alternative surface routes from Lyttelton Port to Christchurch via Dyers Pass and Gebbies Pass; however, both are problematic to trucks as noted below.
Dyers Pass is approximately 25km between the port and Curletts Road interchange with an elevation gain of approximately 400m. The route also includes challenging horizontal alignment and a long descent through noise sensitive suburbs. Accordingly, this is not considered a long term viable access to the port. This was confirmed when a truck carrying a crane from the port overturned.

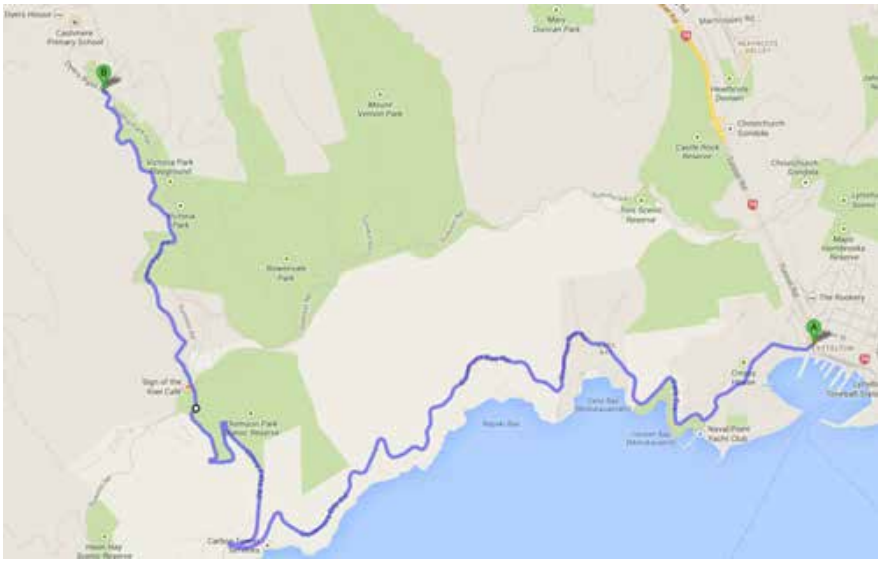


Figure 10 - Dyers Pass route

Gebbies Pass is approximately 50km between port and Curletts Road interchange, a significant increase in time and vehicle operating costs. Furthermore, the route also has no shoulders challenging horizontal alignment. Accordingly, this is not considered a long term viable alternative route to the port.

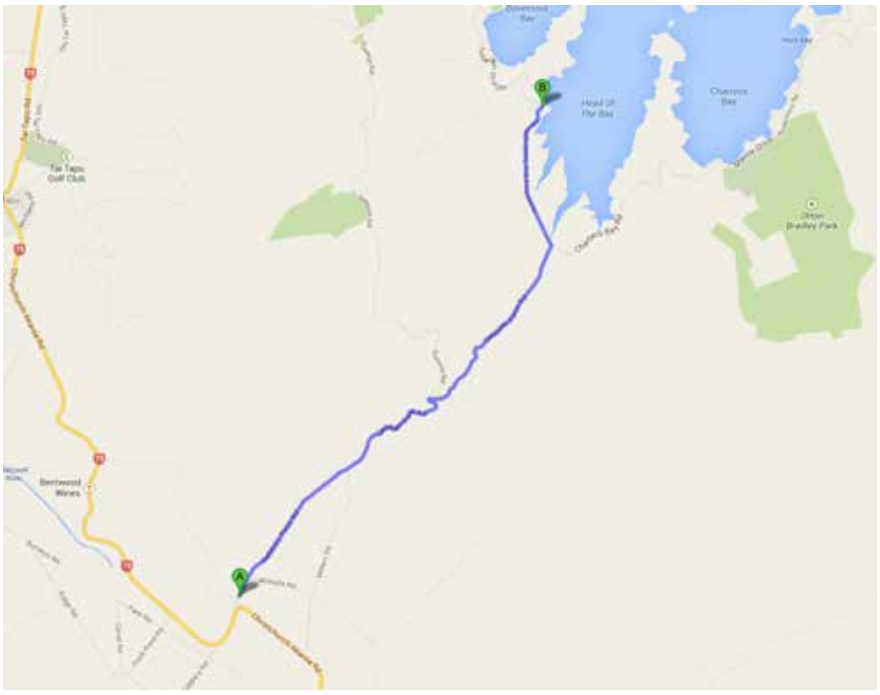


Figure 11 - Gebbies Pass route

The lack of a secure route and condition of the fuel pipeline post-earthquake are concerns for the transfer of fuel and other hazardous goods from Lyttelton Port to Christchurch.

4.7.3 Land constraints

Lyttelton Port has identified land as a constraint on freight growth and accordingly is currently undertaking reclamation works to address this. In April 2011, following the Christchurch earthquakes, the port commenced a reclamation programme in Te Awaparahi Bay, at the east end of the port, to provide additional space for their container terminal. The Port's current resource consent allows for 10 hectares of reclamation, to date approximately 5 hectares has been partially completed. It is worth noting that with the reclamation currently underway and forecast for completion in around 2016, container storage capacity and slots available will have increased by approximately 40% between 2013 and 2014. We understand that the Ports Master Development Plan aims for a thirty (30) hectare reclamation to cater for projected volumes through the Port.

Whilst problems with port access have been reported , LPC is generally managing to process containers in a timely manner, it is recognised that a sustainable longer term strategy is needed to meet the growing freight volumes through the port. Accordingly, LPC have commenced with a Master Planning exercise to optimise operations and planning going forward.

For logs and timber exports, storage space is carefully managed by the Port. Following the spike in exports following the September 2013 storms experienced in Canterbury, the port has temporarily expanded its operations into CityDepot for timber scaling and additional storage.

4.7.4 Operating hours

The port currently operates 5.5 days per week (Monday to Friday, and half a day on Saturday), 12 to 14 hours per day. Additional hours of operation are available to customers with prior arrangements or if vessels are operating. There are different hours for manual reception.

There would be more capacity for freight movements at the port and on the road network if the hours of operations were extended (potentially to a 24-hour, 7-day a week operation), as this would ease demand and peaks and spread the arrivals throughout the day or night.

Currently CityDepot only operates between 6.00am-10.00pm five days a week, and 7.00am-12 noon on a Saturday. However, these opening hours can be extended based on changes in demand and by arrangement. Additional hours would ease demand and peaks and spread the arrivals throughout the day or night.

Aurecon has undertaken extensive consultation as part of this study, and following discussion with freight forwarders, there does appear to be capacity in the existing supply chain to respond to longer port operating hours.

These extended hours would likely result in transport operators storing containers at their own depots overnight (referred to as hubbing or staging), as customers at this stage are resistant to longer hours because of the staffing costs.

4.8 Ability to accommodate projected growth

4.8.1 Port Operation

At the current rate of storage and berth utilisation, Lyttelton Port will not be able to accommodate the Aurecon or CGTS projected container throughput in 2041. As discussed previously, at the time of writing this report, LPC are developing a comprehensive Port's Master Development Plan to address the infrastructure requirements needed to meet this growth in a staged manner. Measures to improve port capacity including increasing container storage area and improvements to operating efficiency are discussed later in this report.

With container throughput at Lyttelton forecast to grow by between double (Aurecon) to more than quadruple (GCTS) between 2013 and 2041, one of the key constraints for the port operations is available land at the port and City Depot, and efficient links joining these two operations such that containers can be quickly and efficiently moved to or from the port.

Based on analysis of container storage, it is suggested that the container terminal storage facilities have been operating at or close to capacity however, recent reclamation has eased this situation considerably. Generally, large volume container terminals adopt conventional modes of operation which utilise portainer (gantry) cranes for vessel to shore loading and unloading, serviced by straddle carriers (SC) or rubber tired gantry cranes (RTGC).

Containers are stored in closely aligned single rows stacked 3 to 4 high for a SC operation whereas they could be stacked 6 high and 6 wide for an RTGC operation.

Increasingly in Australia and around the world, marine container terminals are being upgraded or designed for higher productivity using semi-automated rail mounted gantry cranes capable of efficiently sorting containers in stacks up to 6 high and 10 wide.

Typical indicators to measure performance of container terminals include TEU per hectare per year and TEU per metre of wharf per year.

Acceptable levels of performance at conventional container terminals range from 25,000 to 35,000 TEU per hectare per year and 1,200 to 1,700 TEU per metre of wharf per year based on the equipment currently in use at LPC. Forecast utilisation is shown below.

Take 7 - Actual and Forecast freight Breakdown Summary	2013	2015	Aurecon 2041	GCTS 2041
Containers Services (TEU's)	351,217 (actual)	389,432 (forecast)	752,161 (forecast)	1,500,000 (forecast)
Storage area (ha)	15	18	28	28
Wharf length (m)	360	600	600	600
Storage utilisation (TEU/ha/yr)	23,400	21,600	27,900	53,500
Berth Utilisation (TEU/m/yr)	975	585	1,250	2,500

Table 7– Actual and Forecast Freight Breakdown Summary

Assessing capacity associated with berths is more complex than for container storage. Accordingly, we have only estimated berth utilisation and expressed this as a percentage utilised per year, based on assumptions of days of operation.

A detailed assessment of port storage and berth utilisation, together with quay utilisation is included in Figure 12 and Figure 13. Analysis has been undertaken based on both the upper bound GCTS forecast and the alternative Aurecon GCTS lower bound forecast for container growth up to 2041. It is worth noting that the Port's Master Development Plan has specifically been developed to meet the demand presented in the Freight Demand Statement.

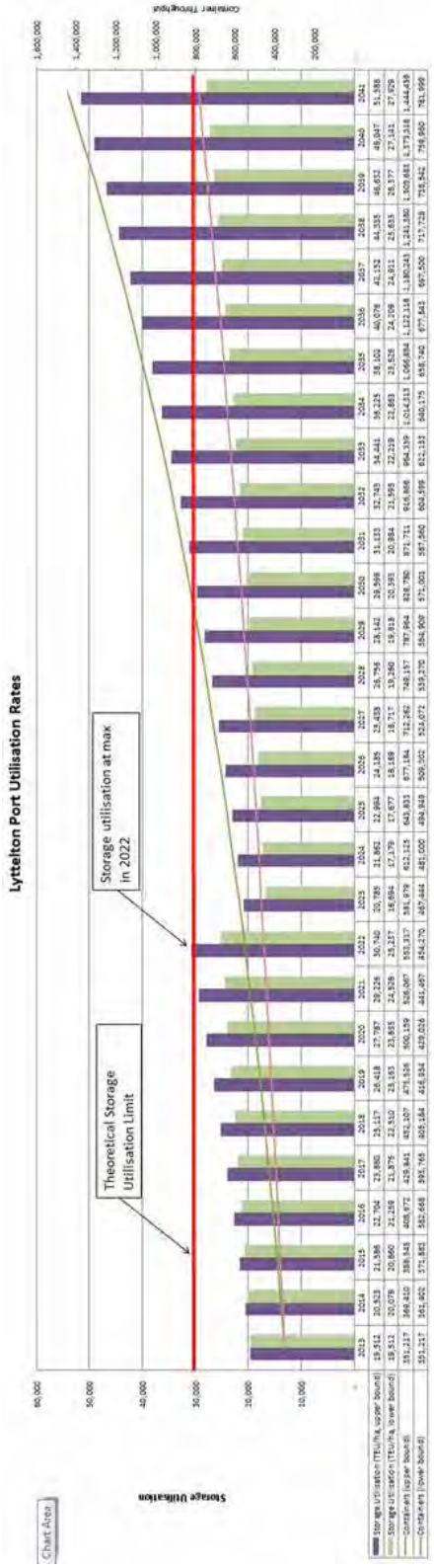


Figure 12 - Summary of Port storage utilisation metrics against time (shown against upper & lower bound container throughput)

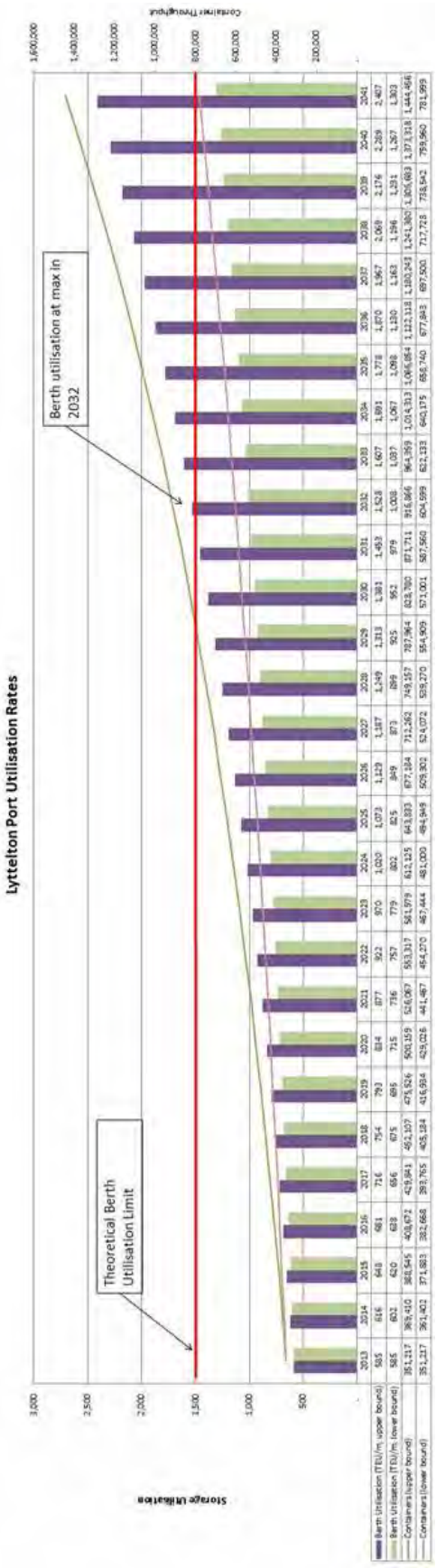


Figure 13 - Summary of Port berth utilisation metrics against time (shown against upper & lower bound container throughput)

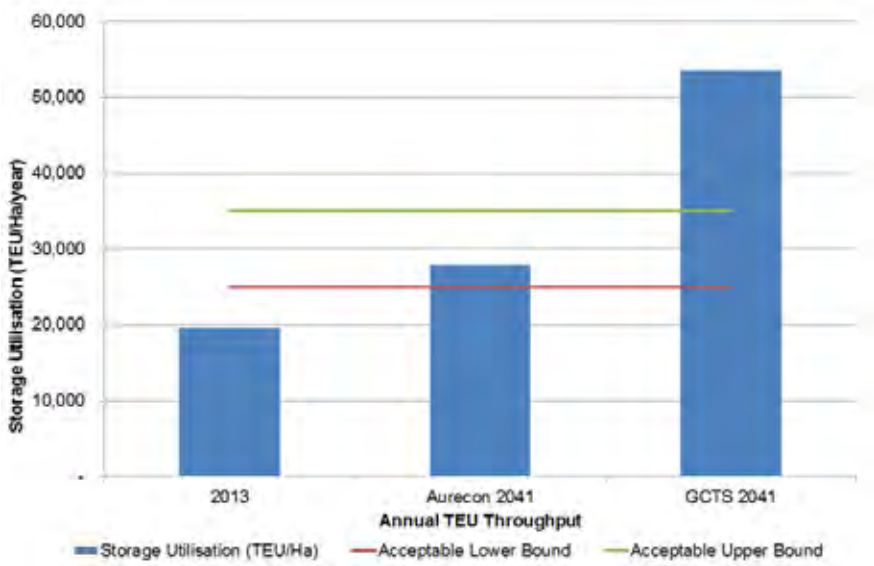


Figure 14 - Storage utilisation for 2013 and 2041

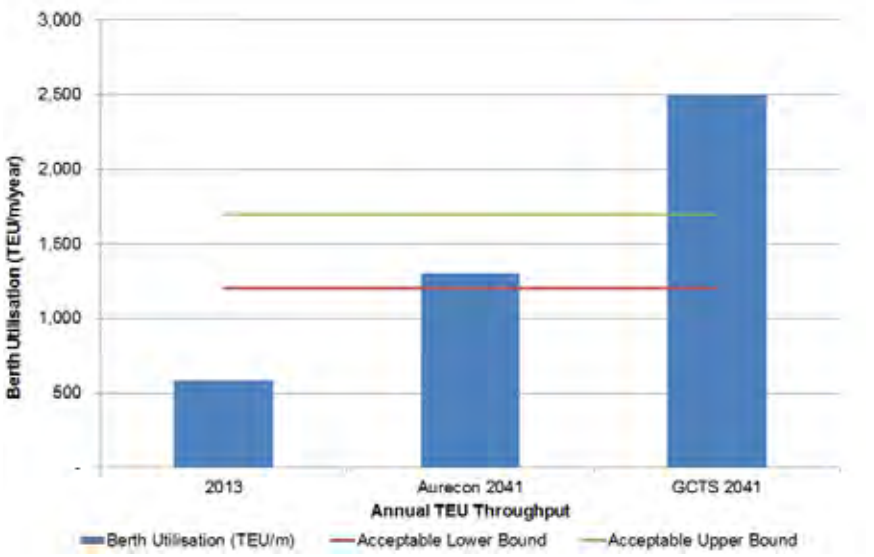


Figure 15 - Berth Utilisation for 2013 and 2041

As previously noted, maximising the efficiency of the storage capacity and utilisation of LPC container handling facility depends greatly on the stacking technology adopted at the port, the dwell time of each container and the proportion of transhipped containers. With automated stacking technology, storage utilisation of over 50,000 TEU/ha is possible and indeed, is seen in ports such as Singapore and Hong Kong where storage capacity of up to 60,000 and 70,000 TEU/ha respectively are observed.

Based on Aurecon analysis (and using upper bound forecasts for container growth), it is estimated using current port storage utilisation, berth utilisation and technology in use:

- Based on industry standard utilisation rates, and on the assumption that 30,000 TEU/ha per year is an acceptable upper limit for the technology currently in use, container storage at the port will become a critical issue approximately in the next three to five years.
- On the assumption that an acceptable berth utilisation is around 1,500 TEU/m of quay, berth utilisation will be a constraint in the next 4-8years.

In summary, to meet GCTS 2041 forecast volumes for the movement of containers through Lyttelton (assuming all other metrics remain constant).

Table 8 - Freight Breakdown Summary - Utilisation metrics

Increase in container storage area required to maintain 30,000 TEU ha	Approximately 22ha (over and above the 10ha consented)
Maintaining berth utilisation rates of 1,500 TEU/m	An extra 400m of quay will be required

Limited hardstand storage associated with LPC is considered a key constraint to accommodating the predicted growth in container volumes. One consideration here would be to introduce a fully automated option to maximise efficiency of container handling. Whilst this is an expensive option, it would greatly assist LPC towards meeting the throughput forecast by 2041.

4.8.2 Port access and transport network

As previously noted, assessing the capacity of the external transport network is more complex than the capacity limits imposed by the physical port infrastructure. Accordingly, we aim to establish the possible impacts on key transport routes in terms of additional traffic and provide commentary on the likely impact on congestion.

Aurecon has taken the freight origin and destination volumes calculated as part of the FDS and used these to estimate possible increases in freight movements on the road and rail network. This enables a summary of possible increases in vehicle movements associated with the increase in freight volumes to be superimposed on to the network for comparison with existing traffic. It is worth noting that these are dependent on agreed forecasts from the Freight Demand Statement.

Current Lyttelton Road Tunnel AADT is approximately 11,000 vehicles. Of this, approximately 10% are Heavy Commercial Vehicles (HCV) associated with port container traffic, with capacity to carry approximately 330,000 TEU (assuming vehicle loading of 1 TEU per vehicle). This is broadly in line with current LPC container volumes.

The following assumptions have been made regarding the capacity of the road network to transport containers in 2041:

- Tunnel Capacity: Assumed to be 18,000 AADT in 2041, and 20% of this is assumed to be HCV traffic.
- Vehicle Loading: Vehicle loading remains constant in the future (i.e. 1 TEU per vehicle are carried through the Tunnel).
- Days of operation: 300 days a year.

Given the above figures, the number of TEU carried to/from LPC via HCV is assumed to be approximately 1.08 million TEU in 2041 (Figure 16).

Figure 16 - Assumed road container capacity in 2041, Source GCTS supplementary documentation

A number of assumptions regarding the capacity of TEU carried by rail are also made. These include:

- Rail line capacity: 16 trains per day operating 300 days a year.
- Rail siding capacity: Each train consists of 48 wagons, each carrying two (2) TEU. This assumes that the current 24 wagon siding at LPC is increased to accommodate 48 wagons at some point in the future.
- Train utilisation: All trains are fully utilised (i.e. fully loaded and carrying two (2) TEU) in both directions.

The total rail capacity available for containers in 2041 is therefore approximately 460,000 TEU (Figure 17).

Figure 17 - Assumed rail container capacity in 2041. Source GCTS supplementary documentation.

When these two modes are added together, the total TEU capacity on the road and rail network is approximately 1.54 million TEU (Figure 15).

Figure 18 - Assumed total LPC container throughput 2041. Source GCTS supplementary documentation.

Commentary on assumptions

A number of these assumptions appear relatively conservative. For example, industry experience indicates that average vehicle loading of 1 TEU is low. For example, our recent work for the Port of Melbourne Corporation indicates that average vehicle loading at the port is closer to 2.0 TEU [5]. It is likely that vehicle loading for trips to and from LPC would be greater than 1, because of the mix between 20” and 40” containers in use.

As ports get busier and wait times for container delivery and receivals increase, trucking companies will try to increase the amount of backloading undertaken to increase efficiency. There are no backloading assumptions used to calculate total capacity of the infrastructure surrounding LPC. If backloading were considered, then the number of trucks required to transport these 1.5 million containers would be lower, and the theoretical capacity of the Tunnel in particular would increase.

These calculations assume that all containers being carried by road use the Lyttelton Tunnel. In reality, it is likely that some of these vehicles will use Sumner Road once it is reopened and in use for freight traffic associated with the port.

The assumed utilisation rate for all port shuttle trains is 100%. It is unlikely that every train will be completely full, indicating that the estimate of TEU transported to/from LPC may be on the high side. Nevertheless, it is considered that this utilisation is achievable. It is also assumed that the rail line capacity is capable of handling 16 container trains per day in addition to trains carrying coal.

Given that there are rail and road constraints at CityDepot and LPC, investment in port infrastructure is required to increase container capacity before the external transport network becomes the constraint in the movement of freight to and from the Port.

4.9 Improvement opportunities

The possible improvement opportunities are summarised in Table 9 - Freight Breakdown Summary below. For each constraint identified in Section 4.8, a potential improvement is noted. Based on current projected growth in commodities taken from the Freight Demand Statement, this constraint has been plotted to show a staged implementation plan as to when the potential improvement would need to be triggered.

Constraint	Potential improvement	Stage	Comment
Hardstand storage at LPC potentially constraining the throughput of containers at LPC	Additional port storage through land reclamation New port infrastructure to increase stacking height for containers and software to optimise the storage location of individual containers Better rail and road links from LPC to off port storage facilities	Implement vehicle booking system for collection and delivery of containers at LPC – NOW Investment in equipment to enable containers to be stacked more than three high, and software to optimise container storage locations on port land – when TEU/Ha reaches 30,000 Increase rail siding capacity at LPC and CityDepot – when TEU/Ha approaches 25,000	
Demand at LPC gates impacting on vehicle wait times	Consider extending port gate hours of operation to manage port congestion	Extending hours of operation, particularly for periods of peak demand (for instance leading up to Christmas) – implement now Extending hours of operation to 24/7 – when TEU/Ha reaches 25,000	Whilst the Port have the ability to operate 24/7, importantly, this arrangement would need the backing of the wider freight industry.
Constraint	**Potential improvement**	**Stage**	**Comment**
Limited storage space for timber/logs		Increase storage capacity on port land Increase storage capacity at CityDepot Work with industry to increase the proportion of logs exported using containers	

Table 9 - Freight Breakdown Summary

4.10 Volume based intervention stages

Our assessment indicates that the reclamation underway and planned will allow sufficient space for container storage, assuming technology used in the future remains as per that used currently (which is unlikely as the Port have indicated a move to more efficient container handling technology). Assuming the higher rate of annual growth being predicted by LPC, there may be insufficient storage at both LPC and CityDepot before 2022, and LPC would need additional reclamation which has been consented (and we understand is 10 hectares). In terms of additional storage space there are a number of possible options:

- Reclamation at the existing Port to create more land for storing containers.
- Increase the land available at CityDepot.
- Provide additional storage space at a second inland port with good road and rail connectivity.

Based on current GCTS projections, additional reclamation beyond the 10 hectares consented will be required by around 2030, when we forecast (using existing stacking technology) that the port will exceed its current planned (and consented) reclamation for container storage purposes.

Section 5

Rail Capacity Assessment

5. Rail Capacity Assessment

5.1 Background

The rail network included in the Greater Christchurch study are is outlined in Figure 19 - KiwiRail rail lines (in RED) in the Greater Christchurch study area . In this network freight trains compete with passenger trains for network space. In addition, the movement of freight trains impacts on other transport modes (for instance road through level crossing delays).

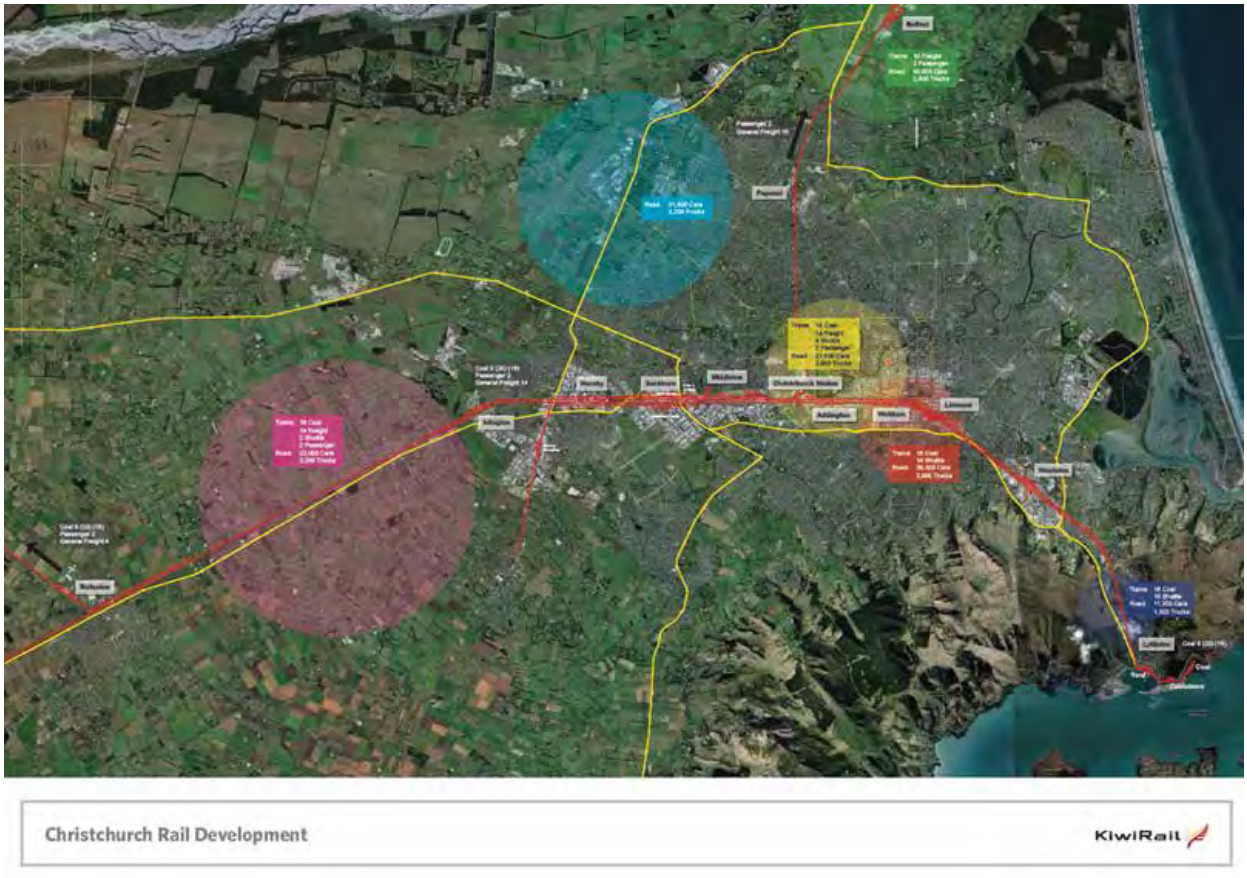


Figure 19 - KiwiRail rail lines (in RED) in the Greater Christchurch study area

Based on our discussions with KiwiRail, and our analysis of commodity origin and destination movements, the majority of product moved by rail originates from the South and West of Christchurch and moves through Christchurch to LPC. These movements are summarised below, broken down by specific rail line.

5.1.1 Midland Line (West Coast to Rolleston)

There is capacity for eight (8) trains loaded with coal per day each way (travelling between the West Coast and LPC). However, current demand only requires 5 coal trains per day each way. Each train consists of 30 wagons, however KiwiRail indicate that these wagons can be increased to 45 wagons in length if required. The space for coal stockpiles at the point of production and at LPC is limited so these trains and coal deliveries to the port operate using a 'just in time' delivery method, which is currently adequate given the volume of coal being exported. Train movements along this corridor are described in more detail below. One train carrying general freight runs between Christchurch and the West Coast each day as detailed below:

- One train completes a shuttle to Westland Dairy. The outbound movement from Christchurch takes liquid to the plant (for drying at Hokitika) and the inbound movement delivers milk powder to Rolleston, where it is packed for export at LPC. We understand this service will increase to two trains per day commencing next season.

- A similar service is operated between Fonterra's Darfield processing plant, however, the product is railed directly to the Port from Darfield. This is an important movement as it constitutes an area of significance for KiwiRail in the growth of containerised rail freight associated with the dairy industry.
- The majority of Fonterra's Clandeboye processed dairy product is received at CityDepot and trucked to the Port, having been staged at Middleton. Staging takes place at Middleton as the train is built up at Temuka with 40 wagons. The train is then split to 24 wagons maximum at Middleton where it continues to CityDepot (where the siding has a maximum capacity of 24 wagons).
- One extra freight train is required for boxed coal, gold and other general freight. These trains transport approximately 20 containers per day.
- Limited passenger trains also operate on this line, including the TransAlpine service, where passengers arriving from ocean liner are bused from Akaroa to Lyttelton to board the train service.

5.1.2 Main South Line (Lyttelton – Invercargill)

The main south line forms the backbone of the rail service south of Christchurch, correcting Christchurch with Dunedin and beyond. Currently, the main south line operates as follows:

- Two 40 wagon trains run from the Fonterra processing plant at Clandeboye (via Temuka) to Christchurch each day carrying dairy product. Fonterra pack each container on site to maintain strict quality control procedures for export.
- One train operates from Lyttelton to various markets every day which carries general freight. KiwiRail noted this as a growing production point for general freight rail traffic on this line.
- 14 trains travel each way south of Rolleston per day (4 travelling east/west to the west coast with an additional 5 each way north south, giving 14 in total. Discussions with KiwiRail indicate that the total could increase to 6-7 each way south).

5.1.3 Main North Line (Middleton to Picton)

The main train line to the north of Christchurch connects Christchurch to the north and Picton. From here, KiwiRail operate across the Cook Strait with connections north to Wellington and the remainder of the North Island. At the current time, this line primarily carries domestic freight and is a time sensitive route with trains required to keep to strict timetables to meet ferry crossing times at Picton.

Accordingly, in response to this time sensitivity, there are currently no freight service stops in Canterbury north of Middleton. Given the limited customer base north of Christchurch and the quantum of customers clustered in one area in the vicinity of the line it is unlikely to be cost effective for KiwiRail to implement a stop in the medium term at this stage. Therefore, the viability of a rail siding (and hence for some form of freight node) north of Christchurch appears very limited at this time.

In addition to freight, this line also carries two passenger scenic trains per day travelling between Lyttelton and Arthurs Pass.

However, there are a number of rail yards (sidings) within Christchurch operated by KiwiRail. These are described briefly in the Sections 5.2 and 5.3.

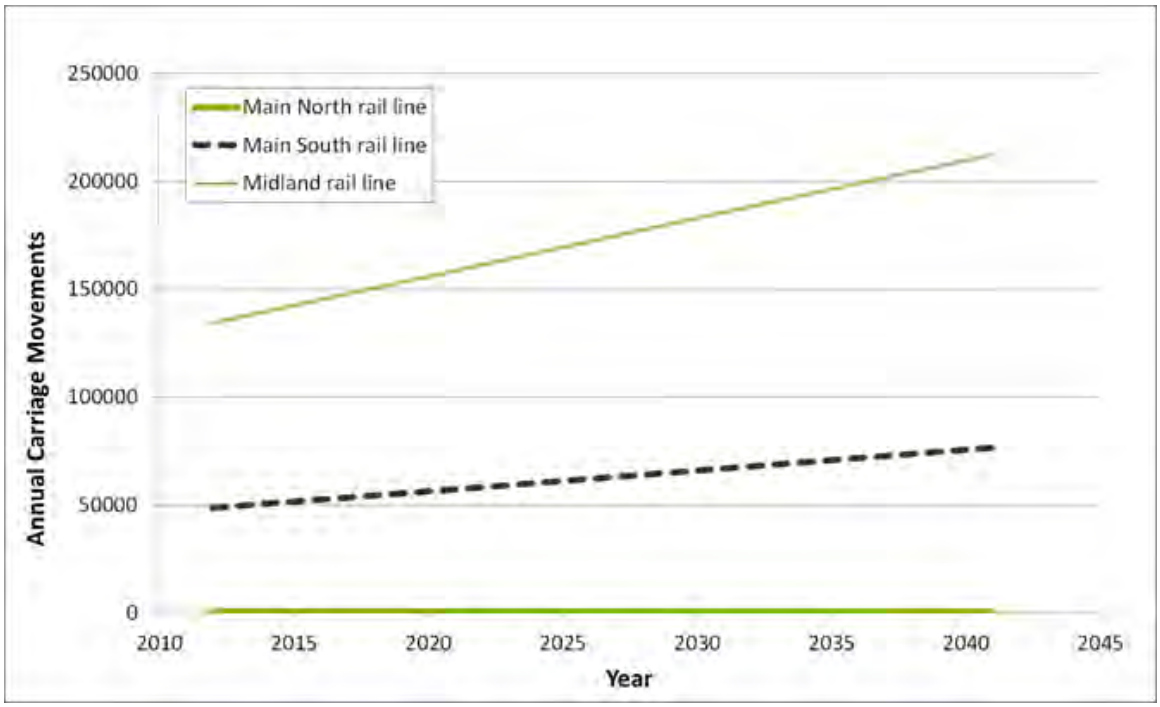


Figure 20 - Predicted growth in train movements by rail line around Christchurch

Through an analysis of current movements of freight and the origin destination analysis completed for the Freight Demand Statement, movements due to imports and exports at Lyttelton port have been accounted for.

Figure 20, the Midland rail line shows the largest number of carriage movements due coal movements from the West Coast in addition to processed goods for export being moved from relevant dairy processing plants.

As discussed with KiwiRail and as shown in our analysis in Section 5.4, capacities on the rail line in themselves are not likely to cause issues with the additional freight related traffic based on commodity growth predicted at this stage under the Aurecon or GCTS growth scenarios. The constraints appear to be located at transitional or nodal points on the rail system as discussed below. This presents a number of opportunities to KiwiRail, the efficient movement of freight through the Christchurch transport network and other users of the Christchurch road network, particularly in the vicinity of barrier controlled level crossings.

5.2 Woolston Yard

Woolston Yard is located at CityDepot, approximately at the western portal of the Lyttelton tunnel. Woolston provides for 24 rail wagon capacity in the siding and is also the site of CityDepot where LPC have their Inland Port operation including additional container storage facilities.

There are multiple landowners located in the Woolston site which is currently a constraint on expansion. This results in an inefficient layout of the rail sidings, further reducing the operational efficiency of the Yard.

Currently, the main land use associated with the Woolston Yard site is as a holding facility for the storage of empty containers, with some storage of logs and timber to manage a peak in exports following the large storms in Canterbury during 2013.

5.3 Middleton Yard

Middleton Yard is a container transfer facility located at the eastern end of the Midland Line, adjacent to Matipo Street. The Yard was built in 1980s when containers were less common for the movement of freight than today. The site is constrained in terms of siding length currently having approximately 1km of siding. However, the entire site is currently required to build up a standard 900m train. The site is flanked by Whiteleigh Avenue to the east and Annex Road to the west, both of which are controlled by level crossings.

This constraint is important in the context of freight distribution as the Yard handles primarily domestic freight, as evidenced by the large number of locally sited distributions centres. Export related freight such as processed milk product and coal travels straight through Middleton Yard to Woolston or LPC. Again, this is relevant for two key reasons:

- The trains moving domestic freight are typically broken up for to allow local distribution and consolidation of goods and freight. This means that trains will be shunting in the vicinity of Middleton Yard, reducing the capacity of the Yard with a probable impact on local level crossings (particularly Whiteleigh Avenue and Annex Road).
- Freight trains destined for export typically travel straight through the Yard (and higher speed than those associated with shunting, etc.), and as such have a reduced impact of level crossings.

KiwiRail have identified that Middleton Yard will reach capacity in the next five to ten years under current freight growth trends with the current configuration of sidings. However, additional land is available in close proximity to the site should there be a desire to develop Middleton Yard container transfer facility to meet growth in freight volumes carried by rail.

5.4 Rail Constraints

5.4.1 Rail Sidings

As identified in Section 4.2 and 4.3, key constraints associated with the movement of freight along the South Line between west Christchurch and Lyttelton include:

- Sidings/ change points, particularly located at the Middleton Yard. Notwithstanding the impact on level crossings, the constraint is considered unlikely to be main line capacity in the time horizon being considered as part of this study.
- It is generally accepted that using rail for short distances is not as economic as for longer distances. Following discussion with KiwiRail and based on Aurecon experience, the use of rail typically becomes more efficient for journeys over approximately 200km – 300km.

However, two key points need to be considered:

- The KiwiRail Turnaround Plan maximises the utilisation of existing train movements which is resulting in longer trains.
- Short distance ‘shuttles’ can operate successfully when there are a high number of wagons working between two points efficiently.

The majority of local Christchurch KiwiRail freight customers are located in and around Hornby, Stockburn and Middleton areas adjacent to the rail line.

At the Hornby siding and for train shunts only:

- There are generally two to three trains per day, generally at night.
- Main customers include Watties with overweight containers for distribution handled at Hornby.

Based on the train plans provided by KiwiRail, and following discussions between KiwiRail and Aurecon, speeds through Christchurch are permitted up to a maximum of 70km/h, with trains typically traveling at approximately 50km/h.

A maximum train length of 24 wagons is currently permitted east of the Middleton Yard due to constraints on siding length.

5.4.2 Rail Crossings

Level crossings have the potential to cause significant issues with the forecast growth in rail movements. With a growth level of 60% in train movements over the projected growth period, there will be a notable increase in the number of activations of level crossings. The Annex Road level crossing would see approximately 20 extra activations each day which approximates to an extra 10 minutes of traffic interruption, based on current train speeds.

Figure 21 - Annex Road level crossing and Middleton Yard

5.4.3 Operating Hours

A key operating constraint for railways is the nature of timely departures and arrivals. Often, the train schedule cannot be changed due to operational reasons (particularly in relation to the Main North Line and the need to meet Cook Strait ferry timetables). Through Christchurch, domestic freight tends to travel at peak hours and accordingly, the interaction with road traffic at level crossings becomes an important consideration as much of the increase in the delay will be focussed on peak hour traffic movements.

5.5 Ability to accommodate projected growth

We have established that the key constraints associated on the rail network are located at node points (or sidings), particularly Middleton and Woolston. Additional constraints imposed on the transport network are described below

5.5.1 Rail Crossings

It has been observed that rail level crossings with potential capacity constraints moving forward include:

- Annex Road (west of Middleton)
- Matipo Street (east of Middleton)
- Chapmans Road
- Curries Road
- Whiteleigh Avenue.

Barrier times vary between 15-25 seconds, with Annex Road level crossing being activated between 30 – 40 times daily. Whilst this is not a capacity constraint for KiwiRail, it will have delay effects on the Christchurch City road network.

Whilst the number of trains using this level crossing is significant the volume of movement does not represent a constraint on the rail network. However, this is an important link in the Christchurch city road network and is used by public transport, connecting the CBD to the southern suburbs.

Summary of key issues:

- Rail sidings have significant capacity constraints and are operating near to capacity.
- Land use changes to increase siding capacity are expensive, with competing demands such as the need to increase storage at CityDepot to meet the growing freight task.
- Increasingly, there will be significant deterioration in the delays experienced at level crossings by vehicular

traffic crossing the midland line between Middleton and Woolston.

- The movement of freight is generally uneconomic over short distances.
- Removing the need for shunting at yards along the midland line will increase the general speed of trains, reducing the impact on delays at level crossings.

5.6 Improvement opportunities

Considering the key constraints and the ability of the transport rail and road network to respond to these constraints, there are two key options available, described in more detail below.

- Removal of the need for significant shunting movements along the Midland Line between Middleton and CityDepot. Benefits to this would be twofold.

  - Operating speeds of trains would increase along the corridor (particularly around Middleton) as trains would be not be stopping/shunting and moving at slow speed along the corridor. This slow movement can significantly increase the travel time of a train across a level crossing, with a corresponding increase in delay for vehicular traffic.

  - Maximising the use of the existing asset, whilst delaying the need for significant infrastructure improvements such as grade separation and lengthening of sidings.

- Separation of competing modes through grade separation. Grade separation of Annex Road and Whiteleigh Avenue. This option would clearly remove the delay associated with frequent calls of the level crossing at these locations. Grade separating Annex Road would allow a significant increase in space and permit KiwiRail to build up trains. However, this option would need four rail track clearance which may affect access to Lunns Road and adjacent land uses. This grade separation could only happen once the Wigram-Magdela link is constructed. Therefore rely on the new overbridge to be built so that traffic that would have used Lunns Road could use the Wigram-Magdela overbridge instead.
- It is worth noting that there are a number of potential sidings under investigation by KiwiRail. These include locations at Rolleston and Darfield in support of Stage 2 of Fonterra's development plan.

Section 6

Air Capacity Assessment

6. Air Capacity Assessment

6.1 Background

Christchurch International Airport (CIAL) provides import and export services for high value and time sensitive freight; and also operates as an air base for New Zealand and international governments to supply food and materials for Antarctic scientific research. The airport operates 24 hours a day, seven days per week with no current restrictions for aircraft take-off and landing.

Only a small percentage of freight is transported by air. However, given the type of goods transported and time constraints attached to these movements, the role air transport plays is important to both Christchurch's economy and the economy of the wider South Island. Refer to Section 1.4 for details of the value of freight passing through CIAL.

United States and NZ Antarctic operations take 90% of freight associated with Antarctic operations at the airport, although this component of air freight is expected to grow significantly in the future if further countried move their Antarctic logistics bases to Christchurch. This represents the continued advancement of Antarctic freight and research fracilities in Christchurch. It is noted that CIAL has no direct control over the Antarctic operations.

There has been a growing trend recently for trans-Tasman services to be provided using narrow (single isle) body aircraft such as the A320. This has a significant effect on the volume of freight available in the hold of aircraft as shown in Table 11, which compares the volume of freight (and percentage passenger baggage) for different aircraft configurations As can be seen, there is significantly more space available for freight in wide body aircraft (B767, B777 and A380).

Two airlines currently operate wide body aircraft services to Christchurch. Emirates Airlines operates a daily service between Dubai and Christchurch via Bangkok and Sydney utilising 777-300 series aircraft. Singapore Airlines operates a direct service to Singapore using a 777-200 series.

		Container Type	# on board	m3 per container	Capacity (#*m3)	Percentage Baggage	Capacity (#*m3)
Passenger Craft	A320	7LD3s	7	4.5	31.50	70%	9.34
	B763	30LD2s	30	3.4	102.00	30%	71.67
	B772	32LD3s	32	4.5	144.00	27%	104.60
	B77W	44LD3s	44	4.5	198.00	24%	150.83
	A380	38LD3s	38	4.5	171.00	37%	107.63
Freight Craft	B763F	n/a	n/a	n/a	438.00	0%	438.00

Table 11 - Comparison of various aircraft freight capacities (source: CIAL)

CIAL forecasts for freight growth in the short term are presented in Table 12.

		TOTALS m^3	% Increase (-Decrease)
Freight Capacity m^3	2014	244,789	
	2015	341,498	39.51%
	2016	355,846	4.20%
	2017	329,114	-7.51%
	2018	323,046	-1.84%

Table 12 - CIAL forecasts for changes in freight through the airport (source:CIAL)

6.1.1 Freight Forwarders and Dakota Park

Adjacent to the main terminal is an existing freight precinct, tenanted by large multi-national transport businesses, such as FedEx and DHL, as well as a number of local operators. A new specialist freight and logistics park area with an adjacent apron has been established within the airport called Dakota Park.

3rd Party logistics are also a large growth area. Outsourcing all warehousing, ordering and delivering to a company like this rather than having specific distribution centres. This reduces costs for companies and lets them focus on their core business areas. Examples include Icebreaker clothing.

6.1.2 Freight movements

Aurecon met a number of freight forwarders as part of an extensive consultation process in support of this study. One particular company Aurecon spoke to, with freight services covering the entire South Island stated that CIAL was the only major air freight mover in the South Island. It was stated that in periods of peak production of produce, resulting directly from capacity constraints on aircraft, goods, are usually trucked up to Auckland by road for export via Auckland Airport.

Peak summer movements (typically December to February) for the export of stone fruit and cherries alone frequently results these two products filling all available air freight capacity. However (and a key problem for airlines and dedicated freighter services) other times of the year there would typically be excess capacity on aircraft.

In terms of the supply chain, a number of responses are available for time sensitive, perishable and valuable goods. One option would be to attract freight movement through wide body aircraft into Christchurch by increasing the passenger numbers travelling to Christchurch, and the South Island. The introduction of new efficient wide body aircraft flying to international destinations such as Asia, the USA and Australia may present an opportunity for airlines. A second response would be to strengthen the network (whether road or rail or air) by sending freight via Auckland Airport.

Freight movements associated with Antarctica are described below.

- In terms of freight volumes associated with the combined Antarctic operation, the US is the largest operation, with its own dedicated supply ship to Antarctica via Lyttelton.
- The US base (McMurdo) has capacity for around 1000 people, with New Zealand's Scott Base having capacity for approximately 90.
- Antarctica NZ has a cargo warehouse and storage area on Corner of Orchard Road and Wairakei Road. They use this area to consolidate and repack cargo before sending to Antarctica. They also have their own chiller and freezer space to store perishables overnight before flying to Scott Base.
- The New Zealand operation supports many European scientists associated with research at Scott Base.
- In excess of 1000 containers support the combined services in Antarctica. US containers are transhipped at Lyttelton.
- CIAL supports approximately 100 flights per week to Antarctica during the peak season from October to February.
- Approximately 50% - 60% of air freight to Antarctica is scientific equipment, with the remainder being perishable foods, machinery and medical equipment.
- A number of aircraft are associated with the operation, including RNZAF 757 and Hercules, US C17 and occasionally Australian A319.

6.2 Air Constraints

The majority of the constraints to growth are as a result of changes in the airline industry with the move towards single isle aircraft on trans-Tasman routes (a key export destination for freight moving through the airport). Given the aeronautical growth assumptions provided by CIAL, it is estimated that the throughput of freight at the Airport will increase from 244,000 cubic metres in 2014 to 323,000 cubic metres in 2018, with the corresponding increase in freight handled. The growth in freight throughput is a direct result of the increased capacity from the

up-gauging of aircraft on certain routes from Christchurch.

- This is an identified area of opportunity for CIAL as there are currently large facilities being provided on the ice for storage and training activities which consume significant energy to heat and light. However it would be more beneficial to provide a facility in Christchurch for training scientists before they head to the Ice and hence reducing the resources required at the stations. There is also a need for "just in time" operations for flying supplies to Antarctica which, we understand, will require more warehousing in Christchurch.
- This is an opportunity to create an industry around the Antarctic operations by providing top class facilities that in turn attracts other countries such as China to have their base to the Ice from here. There are natural links to the University of Canterbury with the scientific endeavours which could be built on with this opportunity.
- The PricewaterhouseCoopers report titled Opening Up the Skies (completed in 2010 for Canterbury Development Corporation) indicates that freight capacity in the belly hold of aircraft is the main constraint to increasing air freight volume out of Christchurch.
- The limited space provided by narrow aircraft limits the freight that can move via air from Christchurch therefore the freight volumes are dictated by aircraft types, frequency of flights and routes. In other words, this constraint is driving the demand for freight at CIAL, and excess demand is forcing the industry to respond by finding alternative export routes. Wide bodied aircraft and increased flight numbers are expected in the near future as passenger demand continues to grow.
- Airlines will generally take on high yield freight such as perishables which can result in manufactured goods having to be trucked to Auckland to get a flight out therefore providing an inconsistent level of service.
- Airside apron available for large aircraft serving passenger growth is currently being planned with operational infrastructure already in place to allow for the effective sercvicing of all aircraft expected at CIAL in the short to medium term future. This will ease the potential conflict with Antarctic operations (particularly if this facility attracts other nations servicing Antarctic from Christchurch).

6.3 Growth in freight opportunities

A number of key opportunities have been identified and will be examined in more detail in the Freight Management Directions Statement.

- Maximising the opportunities around passenger growth during the peak summer months to meet the demands of the peak produce export season as the two services are intrinsically linked. This would allow more freight to be moved through the airport using a regular passenger service, without the need for a specific freight service thereby providing a cost effective alternative to a dedicated freighter service. This should also serve to provide certainty to the producers that an alternative regular, cost effective service is available by air directly from Christchurch.
- Increase the services provided in support of all Antarctic support services located at CIAL which may also involve attracting other Countries to have a base managed out of Christchurch.
- Airlines will be attracted to high yield freight such as perishables which can result in manufactured goods having to be trucked to Auckland to get a flight out therefore providing an inconsistent level of service.
- Dakota Park is located in an ideal position to help consolidate operations of freight movement being well located in relation to the airport and strategic road network. The introduction of chiller/freezer facilities that service a large number of freight forwarders would provide a consolidated facility with corresponding increase in efficiency. It was noted that a large number of small chiller operations are being proposed by individual freight forwarders.
- It was also noted that when the US Antarctic operations use commercial airlines to air freight goods to and from Christchurch, they typically fly to Los Angeles via Singapore. This is due to the ability of the airports (all three) ability to handle, securely, sensitive equipment and samples from Antarctic. It was also noted that staff associated with the operation (in the region of 3,000 in total) typically route via Australia to Los Angeles, and not Auckland (primarily) due to preferences in the use of specific Airlines by the US government. However, and irrespective of airline, there was a strong desire for a direct route from Christchurch to Los Angeles given the time saving presented by this service.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Section 7

Road capacity assessment

7. Road capacity assessment

7.1 Background

The Greater Christchurch Freight Study has considered freight movements and infrastructure within the Christchurch City Council, Waimakariri District Council and Selwyn District Council networks as well as the state highways within these networks.

The predominant freight movements through the region are across the State Highway Network, as show in the CAST model and detailed below:

- North South via SH1
- South to East (Port) via SH76
- West to East (Port) via SH73 /SH76
- North to East (Port) via SH74
- West to North via SH73 / SH1

Figure 22 - 2021 AM HCV Volume Plots

Figure 23 - 2021 PM HCV Volume Plots

Both the Waimakariri and Selwyn Districts are high producers of freight (including dairy, lamb and wool, seasonal produce, timber) which is predominately moved across their local road networks to the state highway network and then on to processing plants ('farm gate' to plant).

The majority of milk produced in the Project area is processed in Selwyn District at one of the three dairy processing plants located there (Fonterra at Darfield, Westland Milk at Rolleston and Synlait at Dunsandal); however the majority of other product travel via road or sea (Lyttelton Port) to other regions within New Zealand.

With the expansion of dairy in the last ten years, the impact of seasonal freight movements on the regional road network has been overshadowed by the daily movement of milk product.

The sections below outline the road networks under the control of Christchurch City Council, Waimakariri District Council and Selwyn District Councils and relevant constraints and bottlenecks.

It is important to note that the Freight Demand Statement highlighted clearly that increases in the volume of dairy product were significant, and even taking assuming Aurecon's estimate of 8.6% per annum, represents significant and ongoing growth in to the foreseeable future. This, as a minimum, brings a level of certainty to the planning associated with freight related infrastructure in the areas located in the vicinity of major dairy processing

plants in Canterbury.

7.2 Freight movement and distribution

Aurecon has developed a freight movement model spreadsheet which aims to:

- Establish the origins and destinations of freight by commodity based on point of production;
- Estimate the mode of travel of freight for both imports and exports

Based on origin/destination, we have been able to approximate the distribution of freight on the transport network. Using existing mode splits we are further able to distinguish between road and rail forecast increases in volumes (assuming a constant mode share between road and rail transport). This is important as it should allow a guide for understanding the traffic impact of freight moving forward throughout the timeline being considered.

It is important to note that when determining freight impact in terms of goods vehicle movements in this report the assumption that trucks are fully utilised has been used. There may be commercial reasons why all the capacity of the truck is not used. For example, in a hypothetical situation an exporter with a heavy product may load all 20 foot containers at approximately 27 tonnes. However, the gross mass limit for a tri axle truck is 42.5 tonnes, meaning that only one container is loaded on each truck so the utilisation of the truck can have a significant impact on the actual price of road transport.

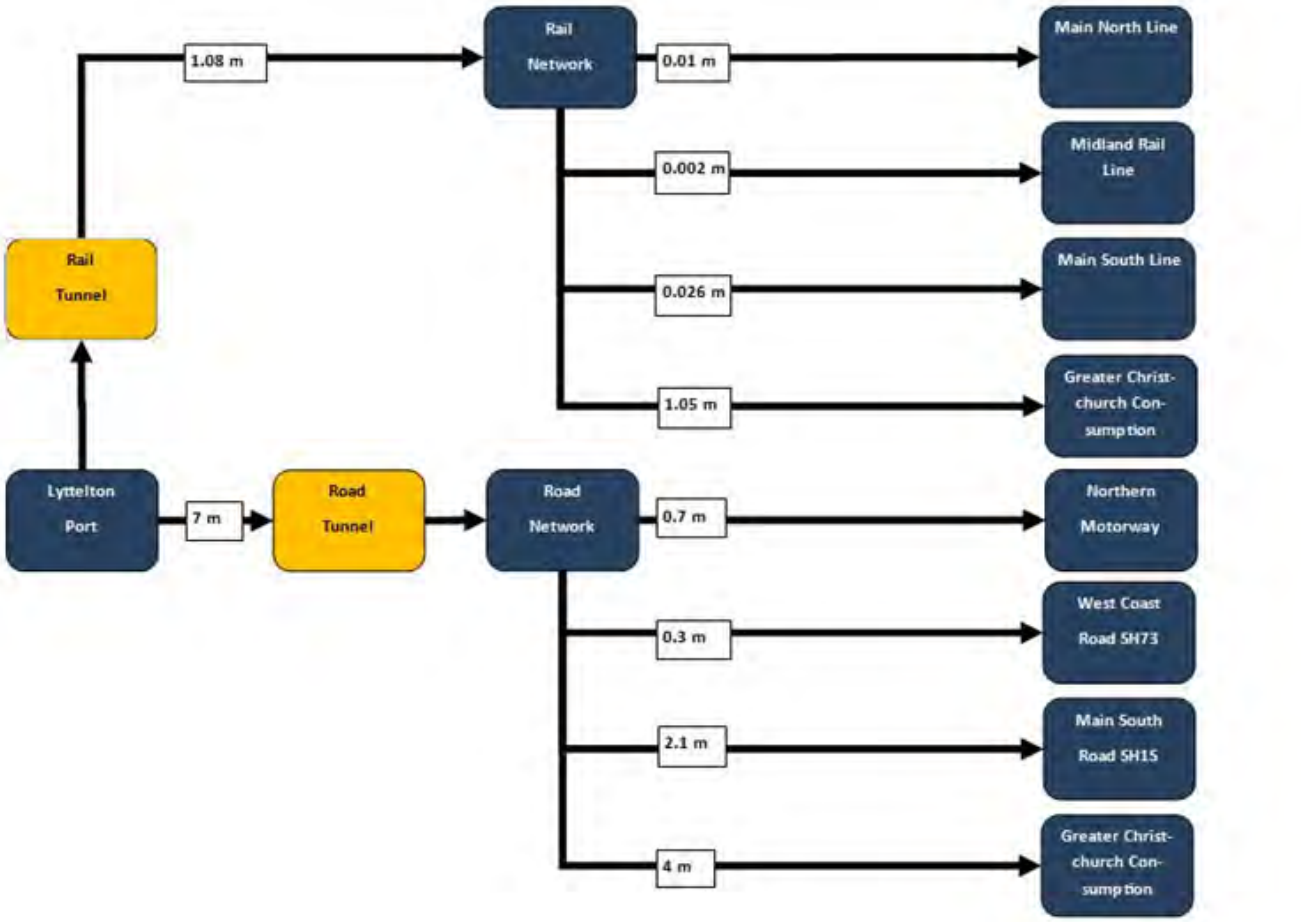

Figure 24 - Breakdown of tonnage movements on rail and road as a result of imports through Lyttelton Port

Using the origin destination model spreadsheet as discussed above, an approximate tonnage of freight moving on the strategic road and rail network has been established. Figure 24 breaks down the movement of freight created through imports forecast for 2041.

Based on current import mode split, up to 90% of the freight imported at Lyttelton is forecast to move through the Lyttelton road tunnel. Two thirds of this has a final destination within the Greater Christchurch region with the remainder destined for other areas of the South Island.

In terms of imports, the majority are consumed within the greater Christchurch area which is consistent with the distribution of main population. Based on our analysis, a growing region appears to be located to the south and west of the City, where around 25% of road freight is destined. On the basis of population growth and the distribution of freight and its connectivity to local and regional markets, this would support the development of corridor improvements in the south west by NZ Transport Agency.

Our analysis indicates that approximately 10% of road freight is destined for consumption in the north of Christchurch. Much of the freight traffic with a destination in greater Christchurch is sent to distribution centres located to the south of Moorhouse Avenue. This legacy location reflects the relative proximity to the main population centre of Christchurch and the proximity of good rail connections and good port access via SH76 to imports and exports. This is an important consideration as the distribution of local domestic freight is using the corridor together with the large volume of export freight destined for Lyttelton Port. Figure 25 illustrates the possible future distribution of import freight travelling through Lyttelton (based on 2041 forecasts).

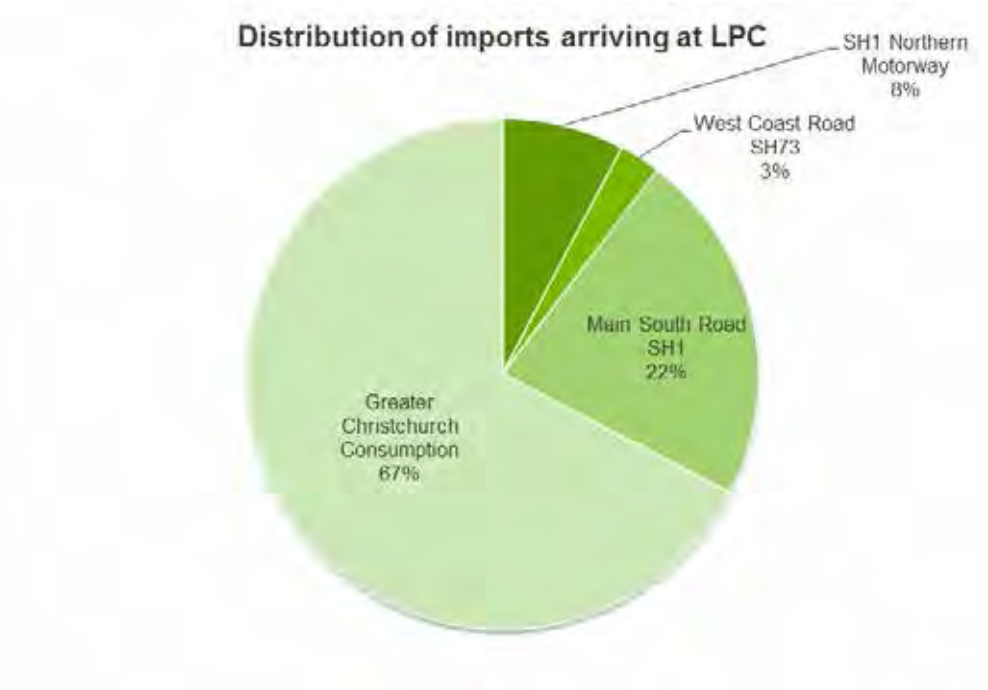

Figure 25 - Distribution of imports though Lyttelton

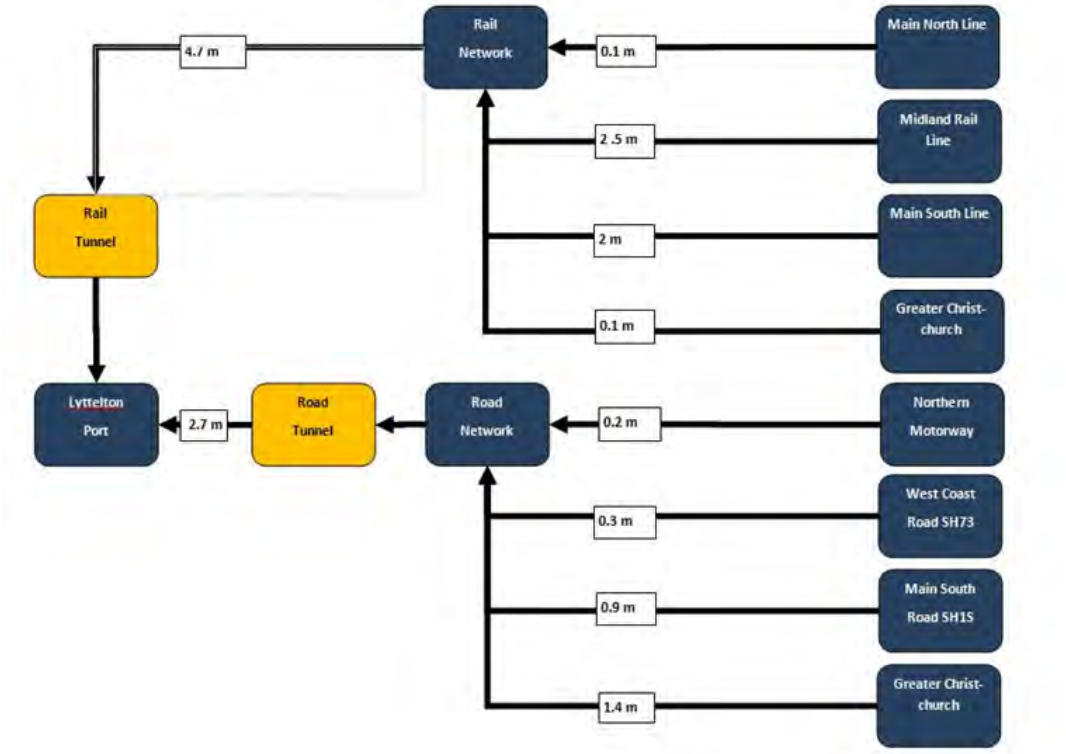

Figure 26 - Breakdown of tonnage movements on rail and road as a result of exports through Lyttelton Port

Figure 26 was also produced using the origin destination model spreadsheet developed for this study.

In contrast to the high proportion of freight moved by road for imports, approximately 35% of the freight exported in 2041 is forecast to be moved through the road tunnel. This is in large part due to the high volume of coal moved by rail from the West Coast over the Midland Rail line, and the volume of dairy product exported via rail.

Two thirds of the freight moved through the road tunnel has origins within the Greater Christchurch region.

7.3 Christchurch City transport impacts

7.3.1 Key routes and considerations

The key routes for freight around Christchurch are the state highway routes around the perimeter of the city; SH1, SH73, SH74 and SH76. However there are number of constraints to freight movement within this state highway network and the wider Christchurch City Council (CCC) road network especially in the peak period where freight is competing with commuter traffic for road space.

7.3.2 Freight Vehicle movements on key Greater Christchurch roads due to imports and exports

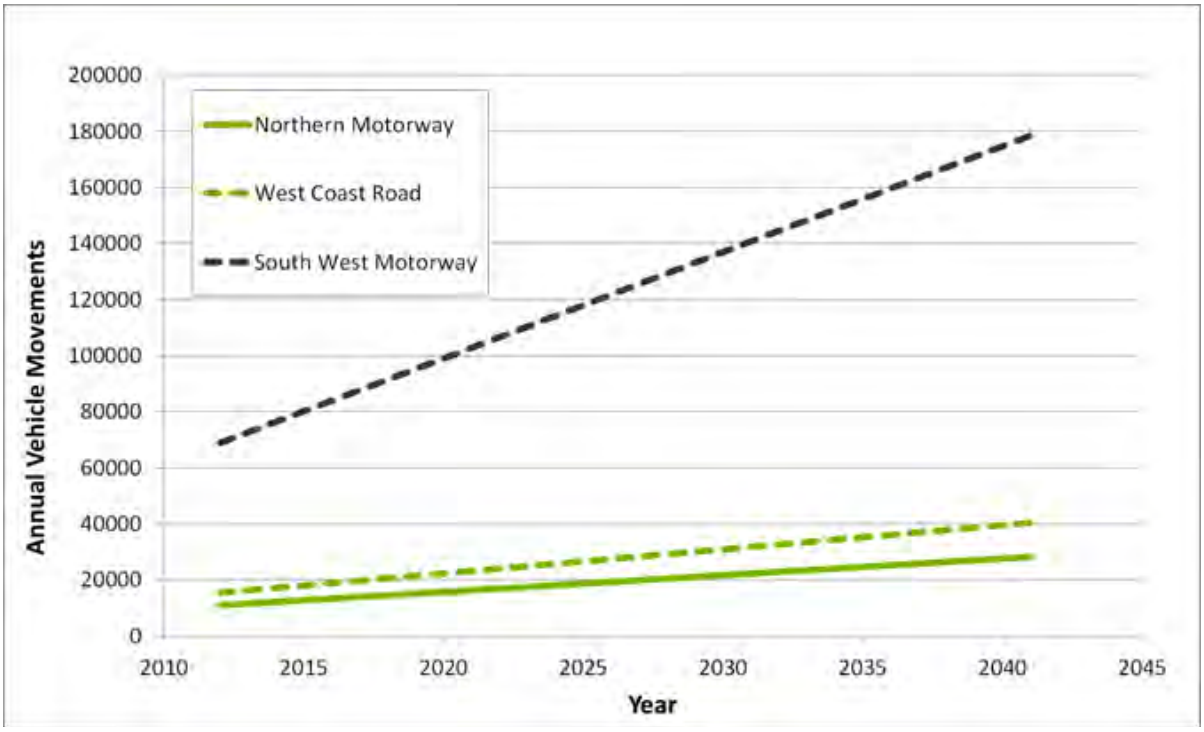

Figure 27 - Annual vehicle movements on key roads within the region due to import and exports

Figure 27 uses tonnages calculated tracked through the origin destination model along with the following assumptions surrounding vehicle carrying capacities;

- 15 tonnes per container
- 1.5 containers per vehicle

A figure in line with container growth of 5.5% (per annum) is used to extrapolate the likely vehicle movements from 2012 onwards.

These vehicle movements are only due to imports from and exports to Lyttelton Port and as a result do not represent total movements on these roads. What also must be considered in addition to these vehicle movements are the domestic movement of pre-manufactured goods and also internal domestic movement of freight for consumption.

To show the effect of theoretical capacity calculations on the transport network, Figure 16 has been reproduced below using slightly different assumptions.

- If we again assume a tunnel capacity of 18,000 vehicles per day.
- Given the forecast increase in freight traffic (over and above private vehicle traffic) assume a proportion of HCV's of 20%.
- Assume 1.5 TEU per HCV, reflecting the supply chain response to more efficient movement of goods, and that each TEU is loaded to 60% (in recognition that most TEU's are loaded in one direction only).

Figure 28 – Possible theoretical road container capacity through Lyttelton Tunnel in 2041.

The sensitivity highlights the impact of key assumptions such as backloading, hours of operation and number of TEU's per truck. It illustrates that the supply chain response to increasing freight volumes is an effective tool in accommodating growth in containers.

SH76 Brougham Street

The completion of the Christchurch Southern Motorway Stage 1 (CSMS1) has put additional pressures on Brougham Street (SH 76), Shands Road and Springs Road during the peak periods.

Critical locations along Brougham Street include:

- Eastern end of CSM1 where it joins Brougham Street due to the reduction of speed and the addition of local traffic.
- The intersection with Ensors Road where the number of lanes on Brougham Street, both east and westbound, reduces from two to one reducing the overall capacity of the entire route.
- Colombo Street intersection, in particular the impact on Colombo Street cross movements.

Durham Street and a key movement along Moorhouse Avenue to Gasson Street and Waltham Avenue.

Figure 29 - Brougham Street

The completion of CSM2 will provide additional connectivity between Lyttelton Port and the Izone industrial area and Rolleston; however it will further increase pressure on SH76 Brougham Street in the peak periods. This will be somewhat alleviated by optimisation works that the Christchurch Traffic Operation Centre (CTOC) are undertaking along Brougham Street. However there are concerns from ECAN with respect to the impact on bus routes along Colombo Street with longer delays given to the cross movements to accommodate the SH76

Brougham Street traffic.

Figure 30 - PM Saturn plot of Brougham Street

SH73 Curletts Road

SH73 Curletts Road (from Blenheim Road to Peer Street) currently has three temporary lanes operating through a residential area where the cone delineation has to be moved twice daily. With three schools in close proximity Curletts Road serves large volumes of pedestrians which are in direct conflict with the heavy vehicles utilising this route to head west via Yaldhurst Road.

Figure 31 - Curletts Road

Whiteleigh Avenue and Annex road

Figure 32 - Annex Road level crossing

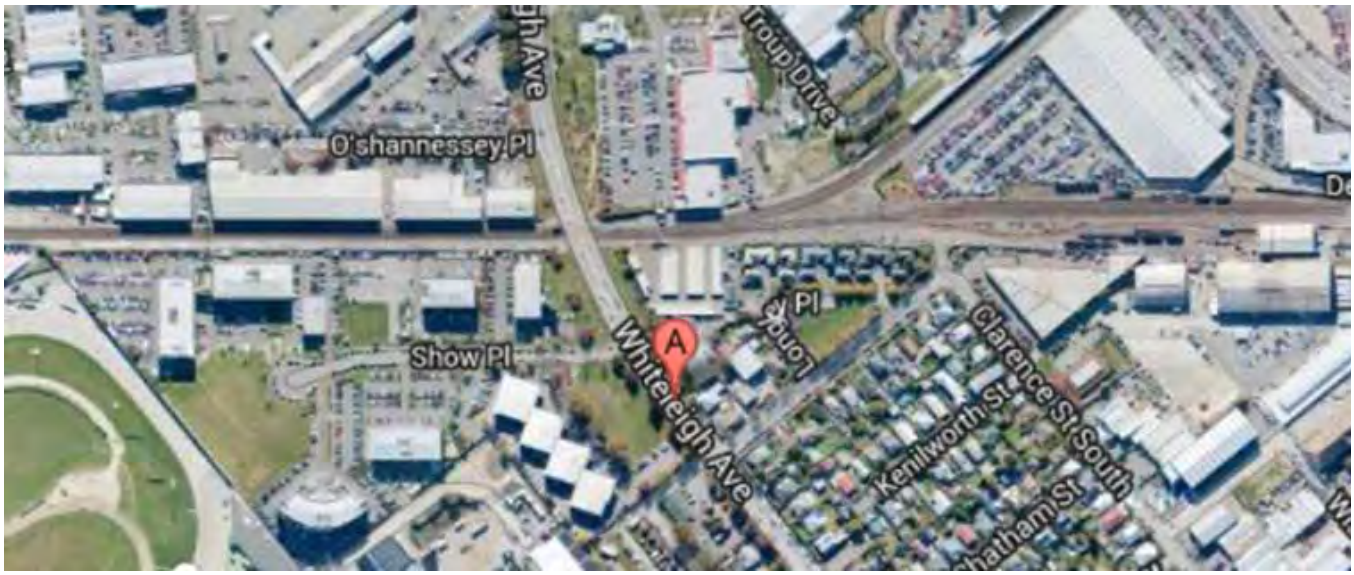

Figure 33 - Whiteleigh Avenue level crossing

The KiwiRail level crossings on Whiteleigh Avenue and Annex Road in Addington create significant congestion and delays on both routes when train movements close them during peak periods, with queues extending past Lincoln Road and Blenheim Road which both carry in excess of 21,000 vehicles per day. This can also be seen to a lesser extent on a number of the other level crossings along the route including Matipo Street.

Northern Christchurch

To the North of Christchurch the NZTA's Northern Arterial and Western Corridor Projects will alleviate pressures on the SH1 / SH74 Main South Road; and Marshlands Road which are currently operating at capacity in the peak periods. The Northern Arterial is currently being consented, while the sections of the Western Corridor are currently under construction with works south of the Airport due to be completed by 2014, and works north of the Airport in approximately 2 years.

SH74 around the eastern side of the city suffered significant damage as a result of the Christchurch Earthquake.

Current repair work is leading to a number of diversions however once completed the route will have adequate capacity to accommodate the freight being moved through this route.

We also understand that the Northern motorway currently experiences peak hour congestion with large volumes of commuters travelling between Waimakariri district and Christchurch.

Lyttelton Tunnel

As outlined previously, since the Christchurch earthquakes, the movement of freight to the Port has been constrained by the closure of Lyttelton Tunnel for the movement of hazardous goods during the hours of 7pm to 6am. Between 8 and 30 movements can occur any one evening, at any time, preventing freight companies from planning their movements around it.

NZTA has a future project for the Lyttelton Tunnel upgrading the deluge system. This will improve operation and safety of the tunnel once funding is secured for the design and construction, however, it will not remove the hazard from the tunnel.

Figure 34 - Lyttelton Tunnel

Earthquake Repairs

Earthquake repairs to services in the inner city are impacting on traffic movements within the four avenues, for this reason the Road Transport Association are minimising the number of heavy vehicles utilising Bealey and Fitzgerald Avenues at this time.

7.3.3 Level crossing impacts

Important level crossings are located on the following:

- Whiteleigh Avenue
- Lincoln Road
- Matipo Street

- Annex Road
- Chapmans Road
- Curries Road

Note there are also a number of level crossings in residential areas to the north of Christchurch, although based on the distribution of freight and its growth, these may be affected less as a result of the growing freight task.

7.4 Selwyn District Council transport impacts

The Selwyn District Council maintains and operates 2,400km of roads within their network, of which approximately 1100km are unsealed. The network provides for both the movement of rural freight in the region and also commuter traffic from the rapidly growing urban areas of Rolleston, Lincoln and Prebbleton close to Christchurch. Traffic volumes on the network have increased by over 50% over the last 10 years.

7.4.1 Dairy traffic

In the last decade large scale dairy conversions have occurred resulting in significant increases in the volume of heavy vehicles on the network across the wider plains area of the District. It is estimated that daily over 500 dairy tankers are on the Councils roading network collecting from dairy farms, and the subsequent transport of milk to the large processing plants located near Darfield, Dunsandel and Rolleston.

With the projected growth in dairy production within the Canterbury region and in particular Selwyn, dairy tanker numbers in the region 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. In most part this reflects the benefits of the Central Plans Water irrigation scheme by the lift of agricultural productivity over 60,000 ha of Selwyn district.

This growth in dairy production may result in approximately 1000 dairy tankers operating in the Selwyn district by 2025, a significant increase of HCV's on the districts roading network.

7.4.2 Other freight movements and HPVs

The rapid growth of Selwyn's Izone Industrial Park at Rolleston has increased pressures on the surrounding local network and State Highway 1. Currently zoned for 140ha of industrial development, it is being planned to expand further towards Christchurch. Recent news relating to the establishment of freight handling facilities at Rolleston by third party operators puts further emphasis on the need to ensure road and rail networks can respond to these expected demands going forward.

Recently the main entrance to Izone was moved to Hoskyns Road which was planned to improve direct access to SH1 and the planned motorway interchange at Weedons Rd via Jones Road. This is expected to be in place around 2020 as part of Stage 2 of the Christchurch Southern Motorway Extension. Furthermore SDC is investigating how access to and from residential and industrial areas of Rolleston can be improved with SH1 in an integrated manner.

In addition to the new Izone entrance on Hoskyns Road, SDC are proposing a number improvements to local roads around Izone and to join up with CSM2 as it comes on line to accommodate the additional traffic generated, including upgrades to Jones Road and an overbridge over SH1 that will improve local roading connectivity and access to the interchange.

Selwyn District Council have accommodated an increase in the extent of the High Productivity Motor Vehicles (HPMV) routes through the District in recent years. Focussing initially on arterial and collector routes these routes now cover key main collection routes following requests from dairy companies. Telegraph Road, a Council arterial route that connects SH1 to SH73 at Darfield, by way of example has had a rapid increase in heavy vehicle use increasing to over 25% in a very short period.

The amount of forestry over the District has declined markedly in recent years with only large plantations remaining in the hill and high country. The effects of milling operations are relatively sporadic and short lived, utilising the state highway network predominately.

The 50Max national initiative is something SDC are also preparing for that will increase efficiency and

productivity of the more standard heavy vehicle operating fleet over its network.

7.4.3 Urban growth and the conflict with freight vehicles

Rapid urban growth in Selwyn, influenced heavily by the change in settlement patterns post-earthquakes, has led to significant increases in the volume of traffic on the Shands and Springs Road arterials, both of which are approaching 10,000 vehicles per day. These roads form the main arterial connections to Christchurch from the district. With the recent opening of Stage 1 of the Christchurch Southern Motorway these roads are working much harder to cater for the demand to access to the new motorway.

Springs Road provides access to CSM1 for vehicles from Prebbleton and wider afield such as Lincoln, while Shands Road serves a higher proportion of heavy vehicles that includes access to the industrial areas of Hornby. Shands Road is a HPMV route for aggregate trucks from quarries in the area to serve the Christchurch Rebuild. Quarries around Rolleston are similarly being serviced in a similar ways with HPMV routes.

Many of the challenges faced by SDC in managing their roading network and moving freight results from the split of traffic on their network; with urban commuter traffic from the growing urban areas of Rolleston, Lincoln and Prebbleton and also Darfield utilising the same routes as freight traffic bound for dairy processing plants in the region and / or Lyttelton Port. SDC currently have a large network of traffic counters deployed around the District which they use to monitor traffic growth and to formulate strategies on how to manage the network.

The effects of these different types of growth on the network make maintaining an acceptable level of service a challenge due to increased maintenance needs from the accelerated deterioration of the network through increased wear and tear. This coupled with more constrained national funding in support of local roading activities presents difficulties going forward, not only for Selwyn, but all road controlling authorities.

7.5 Waimakariri District Council transport impacts

Waimakariri District Council (WDC) maintains and operates 1,500km of roading within their network, of which 630km is unsealed. The Waimakariri District is separated from Christchurch and Selwyn District by the Waimarkariri River. There are three existing bridge crossings of the river which provides a constraint to the total volume of traffic; the main crossing on SH1 Christchurch Northern Motorway just north of Belfast providing two lanes in each direction; the Old Waimakariri River Bridge located downstream of the highway bridge (one lane in each direction) and a second one-lane bridge crossing on route 72 Waimakariri Gorge Road near Sheffield. The Old Waimakariri River Bridge has experienced some issues with scour which results in the bridge being closed in high river flow events on a semi-regular basis which results in the traffic being diverted to the state highway bridge.

The predominant purpose of the local roading network is to move freight from the farm-gate to the state highway network and onwards to processing plants. In addition to this domestic freight is brought into the district (Rangioria) to support the predominately rural community.

A number of small manufacturers and processing plants (timber) are located within the region, however most product is processed out of region. The Daiken New Zealand Medium Density Fibreboard (MDF) plant located at Sefton creates a number of heavy vehicle movements through the District. There has been an increase in HPM applications for freight coming from the West Coast to supply the wood processing plant. However it is not considered to impact the network at this stage. It is difficult to work out exactly where the trucks are going, and WDC does not have a gauge on the exact volume.

The Ashley River Bridge at the northern extent of the Rangiora urban area provides a direct link to Loburn, Ashley and other settlements including the MDF plant. This bridge is currently unable to be trafficked when the Ashley River is in flood due to the piers scouring and failing in recent events. This results in regular closures and traffic being diverted to either the bridge upstream at the Ashley Gorge or the state highway bridge downstream. A new bridge is currently being designed in this location with construction to follow therefore improving resilience for freight and local traffic movements.

A number of small manufacturers and processing plants (timber) are located within the region however most product is processed out of region. Milk produced in the region is moved across the one-lane bridge on route 72 through to the processing plants in Darfield, Rolleston and Dunsandel.

The local network is considered to operate within capacity, including the one-lane bridge crossing on Route 72. WDC have, however, implemented an extensive network of traffic counters within the district to enable them to monitor growth on the network. The High Productivity Motor Vehicle (HPMV) route through the District is via SH1.

7.6 Ability to accommodate projected growth

A major constraint in the freight network is Brougham Street. We have established that this corridor is used for both export trade travelling towards LPC, it is also used extensively for the movement of local freight to and from distribution centres and customers in the greater Christchurch area. The route is particularly busy during peak times, with a large east/west movement and also significant cross movement with commuters travelling in to the CBD area.

7.7 Improvement opportunities

There are a number of options currently being developed within the Canterbury region that consider hard infrastructure improvements or developments.

Whilst considering the data available, it becomes clear that infrastructure is utilised at significantly different levels through the day. Indeed, considering the practical impacts of the example in Figure 23, there does appear to be significant efficiency gains from making more use of what we have, whilst getting more out of this supply chain. This particular subject is discussed in more detail in Section 7. Soft measures use existing assets in the network and implementation is only limited by the time taken to develop the measures.

Optimisation through soft measures may be achieved through such methods as:

- Shifting non time dependent goods outside peaks hours. This requires industry participation and the buy in of the customer.
- Using an interactive information sharing system to help relevant parties optimise freight movement across Christchurch.
- Introducing acknowledged freight corridors where good can be moved outside peak hours.
- De-stuffing containers.

A more detailed understanding of localised freight movement by working with CTOC to improve efficiencies during the peak and off peak periods is one example.

‘Sweating the asset’ is a key principle in making the most of what we have. This would look at ways road controlling authorities (RTAs) could maximise capacity out of their existing network without significant capital expenditure. An analysis of current traffic volumes by hour along key routes would determine the ‘spare capacity’ which could be prioritised for freight moving to and from the Port.

Additionally, planning processes could be put in place to identify suitable strategic and arterial roads within the networks with the purpose of freight movement, hence reducing the demand on lower volume roads. This then focuses the RTAs on where to spend maintenance money, for example where to put heavy duty pavements. This leads to reviewing these roads using the Safe System approach to ensure that intersections and mid-blocks can cope with the growth in heavy vehicle numbers whilst maintaining a high level of safety for all road users.

Review freight movement operating times to reduce demand at peak hours when heavy vehicles are in direct conflict with commuter traffic.

7.8 Volume based intervention stages

There are key constraints on the highway network. SH76 Brougham Street is congested at peak times and has a number of conflicts. It is used extensively by commuters along its length, is fronted in sections by residential properties, light industrial and is bounded by the railway to the south, and forms the southern boundary of the CBD to the north. As a result of its position relative to the CBD, there are a number of ‘Z’ movements along its

length as traffic moves to and from the CBD. This creates pressure at key signal controlled intersections

7.9 The value of network resilience

Lyttelton Tunnel currently represents a significant issue in terms of overall network resilience with hazardous goods currently travelling through the tunnel. However the desirable scenario is for these goods to be transported over Evans Pass once the Sumner Road can be reopened. The level of remedial works to satisfy all road users on Sunmer Road will determine whether some operators will be comfortable using that road once it is reopened. The other alternative routes over Dyers Pass and Gebbies Pass are circuitous and incur greater costs and distances travelled along with the result being that they are less suitable for heavy vehicle transport. In the unlikely event that an incident occurred in the tunnel with a hazardous good vehicle, this could close the tunnel for a prolonged period, with significant impacts on Lyttelton.

Sumner Road and Causeway are areas that may have ongoing resilience issues when considering alternative access route from the port. Cliff face collapse at Peacocks Gallop (between Sumner and Redcliffs) is an example of the problems faced by this route.

Other resilience issues include:

- Stability of SH74 around the oxidation pons on Dyers Road, were significantly damaged in the earthquakes and the risk remains.
- Bridge crossings of the Waimakariri River and Ashley River.
- Bridge crossings over the Heathcote and Avon Rivers within the Christchurch city area.

Whilst LPC may have capacity to accommodate the freight volumes presented in the Freight Demand Statement up to approximately 2030, there is significant value in maintaining options to accommodate predicted growth in the freight task. Forecasting and planning for infrastructure associated with a growing export trade is subject to many variables (both domestic and international) many of which are out-with the control of Government. Accordingly, it is prudent to maintain the ability to respond to likely changes over the forecast horizon of the GCTS in a flexible way.

7.10 Christchurch Re-build

Whilst the impact of the Christchurch re-build on import of material and movement of material locally is depended on the rate of build, it forms an important factor in the short to medium term effects on local infrastructure. We reported in the Freight Demand Statement that significant volumes of material will be required for the re-build, representing approximately 760,000 HCV movements. A large proportion of this movement will be between the Port and City and as such, is likely to be concentrated on connections such as SH76 Brougham Street. It should also be noted that the construction industry uses a large and diverse range of commodities some of which will be delivered in bulk to sites, and some of which will be small scale local deliveries. This creates a broad range of vehicle movement.

Comparing the above HCV movements daily (assuming a seven year build period with 250 days of construction per year), it is worth noting that the number of HCV's represents approximately 30% of the current movements through Lyttelton Tunnel. In other words, the effect of the re-build is such that it represents approximately 10 years of HCV (commodity) growth and is similar to forecast flows associated with the freight task in around 2024 (estimated using lower bound growth forecast).

The possible effects of the Christchurch re-build is illustrated below which summarises the effect of the increase in HCV's through Lyttelton tunnel in the context of overall freight forecasts determined as part of the Freight Demand Statement. It shows that due to the import of build related materials over the short term, the 2030 forecast volumes (without the re-build) could be reached as soon as 2020. In other words (based on the lower bound forecast), the re-build represents approximately 10 years worth of background growth.

Figure 35 - Possible effects of the Christchurch rebuild (HCV's per day)

Given the short term impact of the re-build, a freight management plan should be implemented at a local level to maintain efficient freight accessibility in to the CBD area. A freight management plan may include measures such as:

- Identify area construction management plans to co-ordinate construction activity at a wider geographic level.
- Identified routes to and from the Port that have a freight priority.
- Staging delivery to avoid traffic peak periods.
- Demonstrate that waste material can be removed from CBD sites, and that material can be delivered in a safe and efficient way.
- Manage the impacts on local residents and businesses.

It is therefore recommended that specific construction management plans are adopted for areas of re-build such that:

- Road Controlling Authorities can influence and improve construction related freight efficiency.
- There is an improvement in overall network efficiency by actively managing construction related freight resulting in reduced congestion.

7.11 HPMV Routes

The current route for High Productivity Motor Vehicles (HPMV's) through Canterbury is via State Highway 1 to both the north and south of Christchurch. It is worth noting that the route to the north is currently under investigation, and the route to the south is subject to a number of restrictions on SH1 at Rangitata North bridge and Rakaia River bridge. There is no current plan to provide high productivity motor vehicle access between the Port and inland Ports used by LPC.

Section 8

Supply Chain Assessment

8. Supply Chain Assessment

8.1 The importance of the supply chain

We presented predicted growth in the Greater Christchurch freight task up to 2041 in the Freight Demand Statement. This indicated a need to plan for the movement of between 782,000 and 1.5m TEU's per annum (from approximately 350,000 handled by LPC in 2013) in addition to an increase in bulk goods carried such as logs.

It is important to adopt a network wide, multi-modal approach to respond to the growing freight task. Accordingly, the whole supply chain must be considered when planning infrastructure investment to avoid a mis-match between the capability of ports to accommodate predicted growth, and the capability of the inland domestic transport network to serve this freight volume increase. This section provides commentary on the operation of the current supply chain in Christchurch, and considers capacity restrictions and improvements moving forward.

8.2 Background and current operations

A supply chain is a system of organisations, people, technology, activities, information and resources involved in moving a product from supplier to customer. Supply chains transform natural resources, raw materials and components into a finished product that is delivered to the end customer. Supply chains move products from input materials, through processing, through distribution, and ultimately to customers. Each company has its particular supply chains and many options around these.

Supply chain management is a broad concept with multiple levels. The art of supply chain management for any business is determining their most efficient supply chain position (balancing cost, service and quality) for servicing their market. In this study we consider the transport and logistics flows of companies in the context of the Greater Christchurch freight system.

Through determining the Greater Christchurch freight origin and destinations, we have mapped, at a high level, the steps in supply chains – capturing the transition points or nodes and the transport links between them. This is important, as it is at the node where the risk of failure increases. At a node a product may be delayed, incorrectly stored or constrained. Problems arise at nodes because there is:

- a handover of responsibility
- some loss of information
- a change in the capacity of the system from one process to another
- a change from a continuous process to a batch process or vice versa

Freight users make their transport choices based on the time, price and reliability of the different options freight suppliers provide. Different industries have different supply chains, for example, consumer goods generally require a greater level of reliability and responsiveness and complexity than primary industry, mining or forestry.

The Christchurch supply chain system not only acts to service the Greater Christchurch region but also is heavily involved with the supply of freight throughout the entire South Island. As Christchurch has the largest sea port and airport it is in the best position to service distribution of large number of stores throughout the Island.

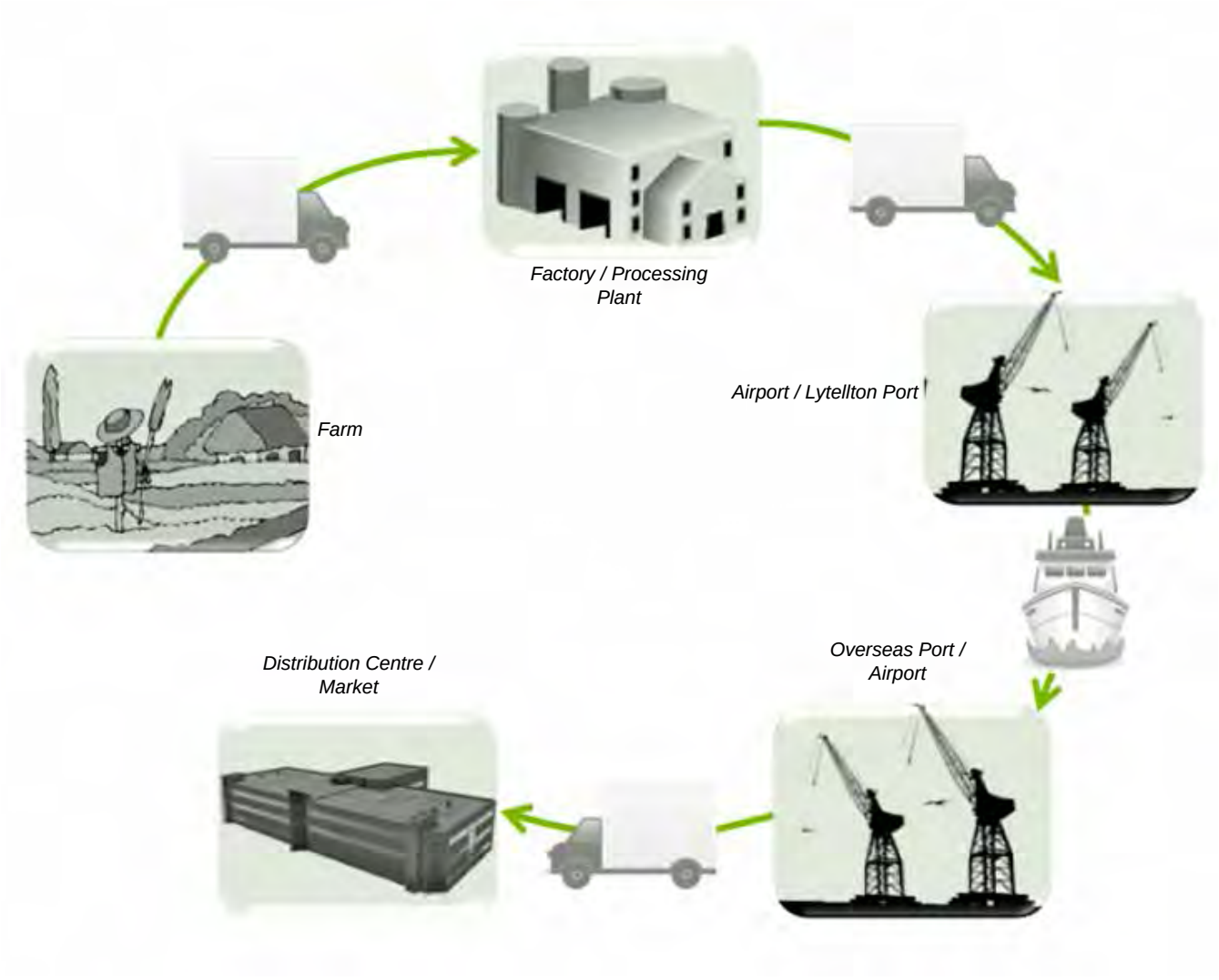

Figure 36 – Typical Canterbury Supply Chain

Goods received by road from the Airport or Lyttelton port are unpacked, organised and sent out to areas around Christchurch from key distribution hubs around Middleton and Rolleston, where The Warehouse has located its South Island distribution hub. This is an important distinction for The Warehouse as their distribution centre is located in a position with excellent connectivity to the local, regional and South Island road and rail network.

It has been identified that a significant amount of freight is either trucked or sent on rail from the North Island and this is a direct response to the use of established freight routes.

Through speaking to various haulage companies with trucking operations, a number of conclusions regarding common practice of supply chain could be found. In terms of imports, most containers are de-stuffed at either distribution centres or at the owners. From the distributions centres, containers are then moved to empty container yards such at Waltham Road where they are de-hired.

8.3 Current issues in the supply chain

The supply chain is complex and in the context of imports, has evolved to respond to specific needs of numerous customers over long periods of time.

In terms of imports, containerised goods are typically received at the Port by a truck (assuming by road) and either:

- The container is taken straight to the customer to be emptied (de-stuffed). Once emptied, the container is collected and taken to an empty container yard and de-hired.
- The container is taken to a warehouse or distribution centre and de-stuffed, where goods are stored awaiting distribution to customers. Once the container is de-stuffed, it is taken to the empty container yard for cleaning/repair and storage.

The process of de-stuffing a container at its destination may be inefficient as the unit carrying the container may have significantly more capacity – in other words, the container may not be full and the truck carrying the container may be capable of taking significantly more freight. By de-stuffing closer to the Port, and combining loads, more efficient use of a truck can be made whereby loads can be combined before delivery to customers. Depending on how close de-stuffing can be done to the Port, this process also avoids an empty container journey. Improving the efficiency of container movement in this way would involve industry co-operation, but it is possible with the trend in logistics to be outsourced to bigger companies.


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Section 9

Concluding Remarks

9. Concluding Remarks

9.1 Freight movement in Christchurch

This report considers the impact of freight growth on the transport network and supply chain capability. A key driver in assessing the impact of freight growth is the increase in volume of freight being moved.

In terms of land use, key points of freight activity, and their role in the distribution network have been identified. The distribution networks for imports and exports, by commodity, have been identified, where it was shown some two-thirds of imports are consumed in the greater Christchurch area. The growing importance in Christchurch as a South Island centre for distribution was evident.

Aurecon considered transport infrastructure associated with four modes, namely: sea, rail, road and air. It was found that imports are predominantly carried by road, and distributed by truck to various distribution centres where they are forwarded on to various local regional South Island destinations. In terms of exports, rail carries around one-fifth of freight which is dominated by freight associated with dairy, dairy product and coal from the west coast.

9.2 Infrastructure

Aurecon considered transport infrastructure associated with four modes, namely: sea, rail, road and air. It was found that imports are predominantly carried by road, and distributed by truck to various distribution centres where they are forwarded on to various local regional South Island destinations. In terms of exports, rail carries around one-fifth of freight which is dominated by freight associated with dairy and dairy product and coal from the West Coast.

9.2.1 Port Infrastructure

Lyttelton Port has identified land as a constraint on freight growth and accordingly is currently undertaking reclamation works to address this. The port has commenced a reclamation programme in Te Awaparahi Bay to provide additional space for their container terminal. The Port's current resource consent allows for 10 hectares of reclamation. This work forms part of the Port's Master Development Plan.

Our assessment indicates that the reclamation underway (and future planned 10 hectare reclamation) will allow sufficient space for container storage to meet the lower bound (Aurecon) growth estimate, assuming technology used in the future remains as per that used currently. Assuming the upper bound growth, there may be insufficient storage at both LPC and City Depot (Woolston) before 2022, which would require the 10 hectare reclamation brought forward to meet this constraint.

Based on current upper bound (GCTS) growth projections, additional reclamation beyond the 10 hectares consented will be required by around 2030, when we forecast (using existing stacking technology) that the port will exceed its current planned (and consented) reclamation for container storage purposes.

There are a number of initiatives being undertaken by the Port to improve the vehicle booking system (VBS).

9.2.2 Road Infrastructure

In terms of road infrastructure, the completion of the Christchurch Southern Motorway Stage 1 (CSM1) has put additional pressures on Brougham Street (SH76), Shands Road and Springs Road during the peak periods. The majority of the freight task in passing through Christchurch is transported along this corridor (whether by road or rail), and as such the corridor attracts a large number of distribution centres and freight forwarders. This in turn places more pressure on the corridor at peak times.

Transport impacts on Christchurch City and surrounding District councils were identified, using the origins and destinations of freight determined in the Freight Demand Study.

Whilst relatively small volumes of air freight pass through Christchurch Airport International Airport, its importance as a national and regional airport is significant. Time sensitive, high value freight requires reliable access to the airport and strong roads links are important to grow this high value freight business.

9.2.3 Airport

CIAL provides import and export services for high value and time sensitive freight; and also operates as an air base for New Zealand and international governments to supply food and materials for Antarctic scientific research. Peak summer movements for the export of stone fruit frequently results in this product filling all available air freight capacity. However (and a key problem for airlines and dedicated freighter services) at other times of the year there would typically be excess capacity on aircraft. Given the value of time sensitive freight passing through the airport, it is important that there are reliable transport routes serving the airport and the businesses supporting airport and air freight services.

9.2.4 Rail Infrastructure

Middleton Yard is an important location for KiwiRail and is used to stage freight from the north carrying domestic freight for local and regional distribution, and export product to Lyttelton. There is also a coal wagon maintenance facility located here. Import/Export (IMEX) product staged at Middleton and travelling to and from LPC is typically transported via road.

KiwiRail have identified that the current configuration of Middleton Yard will reach capacity in the next five to ten years under current freight growth trends. However, additional land is available in close proximity to the site should there be a desire to develop Middleton Yard to meet growth in freight volumes carried by rail for container transfer.

Consolidation of services supporting IMEX where efficient container transfer can take place, supporting local and regional distribution would improve both the efficiency of movement between Lyttelton and the Main South Line through Christchurch and limit the impact of increased train paths on level crossings along the corridor.

9.2.5 Network Resilience and the Christchurch re-build

Since the Christchurch earthquakes, the movement of freight to the Port has been constrained by the closure of Lyttelton Tunnel for the movement of hazardous goods during the hours of 7pm to 6am. Between 8 and 30 movements can occur any one evening, at any time, preventing freight companies from planning their movements around it.

NZTA has a future project for the Lyttelton Tunnel upgrading the deluge system. This will improve operation and safety of the tunnel once funding is secured for the design and construction, however, it will not remove the hazard from the tunnel.

Significant volumes of material will be required for the Christchurch re-build, representing approximately 760,000 HCV movements. A large proportion of this movement will be between the Port and City and as such, is likely to be concentrated on connections such as SH76 Brougham Street. It should also be noted that the construction industry uses a large and diverse range of commodities some of which will be delivered in bulk to sites, and some of which will be small scale local deliveries. This creates a broad range of vehicle movement with local impacts.

Section 10
Glossary

10. 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	Forklift capable of carrying a fully loaded 20 foot or 40 foot container. 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	Lyttelton 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 and 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 rows.
TEU	Twenty Foot Equivalent Unit, 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.

Table 13 - Glossary

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