How can we meet increasing demand for ports in the Upper North Island?

A report for the Upper North Island Strategic Alliance

November 2012

A technical study of the supply and demand for ports and port-related infrastructure in the Upper North Island

27 November 2012

pwc

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27 November 2012

Upper North Island port and port-related infrastructure supply and demand study

Dear Harvey,

We are pleased to provide our final report on the supply and demand of port and port-related infrastructure in the Upper North Island. Our key findings are detailed in the executive summary of the report.

This report is provided in accordance with the terms of our Contract for Professional Services, reference ACPN_8320, and is subject to the restrictions set out in Appendix D of this report.

Yours sincerely

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Glossary

Term	Definition
Categories of cargo movement	
Merchandise trade	Trade that moves between regions in physical form, including manufactured goods and products of agricultural and extractive industries.
Throughput	The total amount of cargo that is loaded or discharged at a port. Includes both outside-port cargo and port exchanges.
Outside-port cargo	Cargo moves into the port from sea and out by land, or vice versa. Includes imports, exports, and domestic coastal cargo.
Port exchanges	Cargo that both enters and exits the port by sea. Includes import and export transhipment and international transhipment cargo.
Imports	Cargo that enters a New Zealand port from another country.
Exports	Cargo that leaves a New Zealand port bound for another country.
Domestic coastal	Cargo that leaves a New Zealand port bound for another New Zealand port, or vice versa.
Import transhipment	Cargo that enters a New Zealand port from another country and is loaded on another ship to its final destination in New Zealand without leaving the port gate.
Export transhipment	Cargo that moves from one New Zealand port to another and is loaded on a ship bound for another country without leaving the port gate.
International transhipment	Cargo that enters a New Zealand port from another country and is loaded on another ship bound for a final destination in another country without leaving the port gate. Also called 're-exports'.

Shipping market terms	
Container cargo	Any merchandise that is loaded into and shipped in an intermodal shipping container.
Bulk cargo	Strictly speaking, bulk cargo is cargo that is transported unpackaged in large quantities. It refers to material in either liquid or granular form such as petroleum, grains, or coal typically dropped or poured directly into a bulk ship's hold. Smaller quantities can be boxed (or drummed) and palletised. Bulk cargo is classified as liquid or dry. In this report, we use the term 'bulk cargo' loosely to describe any merchandise that is not moved by container. As we have used it, the term includes a range of cargoes, including bulk liquids (eg crude oil), unprocessed logs, and cars.
Breakbulk cargo	Strictly speaking, breakbulk (or general) cargo covers the variety of goods that must be loaded individually, and not in containers nor in bulk as with oil or grain. In this report, we refer to it as 'Bulk cargo' more generally.
Upper North Island Ports	For the purposes of this study, the UNI ports are defined as: Ports of Auckland (POA), Port of Tauranga (POT), Northport, and the docks near Whangarei at Refining NZ's refinery and Portland cement plant.
Post-Panamax ships	Ships that are too large to navigate the locks in the Panama Canal. Currently, Panamax container ships have a capacity of 5,000 TEU. After an expansion programme is completed in 2014, the Canal will be able to handle 12,000 TEU container ships.

Term	*Definition*
Intermodal container	A standardised shipping container that can be moved between different freight modes (sea freight, road, rail) without having to unload and re-load its contents.
TEU	A standard measure of intermodal container cargo volume that allows for conversion between containers of different sizes. Stands for 'Twenty-foot Equivalent Unit'.
Inland port	A cargo consolidation and distribution facility located inland of a port and generally linked to it via a rail line. Examples in New Zealand include Metroport and Wiri Inland Port in Auckland.

Categories of infrastructure	
Port infrastructure	The capital assets of a port, including the port access channels, berthage, and storage facilities.
Land transport infrastructure	The distribution networks that move cargo between the port and its final origins or destinations inland of the port.
Port access	The depth of a port's channel and berths.
Berthage	The number, length, and configuration of a port's container and bulk berth spaces.
Storage	The container and bulk storage capacity of a port, including the total area of storage yards and the technology used to store and move cargo.
Distribution network	The land transport infrastructure, and associated inland ports and distribution facilities, that service a port. Includes both road and rail networks but not coastal shipping.

Executive summary

Executive summary

Introduction

This report was commissioned by the Upper North Island Strategic Alliance (UNISA) to determine trends in demand for merchandise trade through the Upper North Island (UNI) ports, the capacity of key port and port related infrastructure to manage this demand, and to form a view of potential infrastructure investment requirements.

This report examines future freight demand and infrastructure supply at the Ports of Auckland, Port of Tauranga, and Whangarei seaports[1] over a study period of 30 years. It includes projections of future freight to 2041 based on analysis of trade patterns and port throughput over the last ten years, supplemented by: qualitative information from industry participants; high level forecasts of economic growth in the UNI, New Zealand and amongst key trading partners; expected demographic changes; and physical constraints in respect of agricultural production in New Zealand.

Our primary historical data source is Customs/Statistics New Zealand data on export and import weights and volumes, by product, by port and by origin-destination between 2002 and 2012. We have also relied heavily on data compiled by the ports, particularly with respect to domestic coastal shipping, domestic and international transhipping – none of which are discernible from the Customs/Statistics New Zealand data.

In making our projections we have separately considered two components of total throughput: 'port exchanges' and 'outside-port' volume. Port exchanges include domestic and international transhipping, which involves the unloading and loading of ships at the port, but where products do not leave (or enter from outside) the port gates. Outside-port volume involves inward or outward movement of goods, which leave or arrive from outside of the port gates. Importantly, outside-port volume has an impact on both land transport and port infrastructure, while port exchanges impact port infrastructure only.

Our projections cover the next
30 years

1. The Whangarei ports are: Northport, the New Zealand Refining Company's Marsden Point wharf, and Golden Bay Cement's Portland wharf. Airports have not been included in the study, as they service a low volume of high-value or time-sensitive cargo that would not otherwise move through the ports.

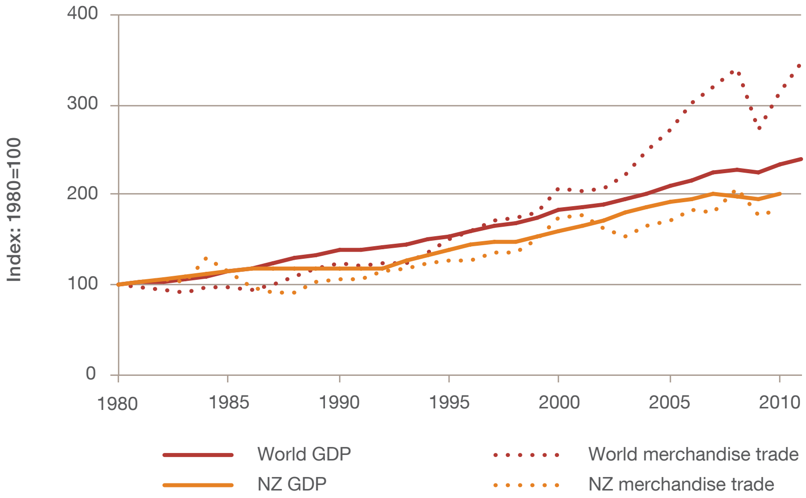
Context

World trade has grown markedly over the last 30 years as the impact of globalisation has re-shaped the way the world has structured itself economically. This is a consequence of a number of underlying drivers including:

- the removal of trade barriers
- relatively stable political environments the mobility of capital
- the emergence of China and other emerging nations as sources of cheap labour (and the subsequent shift of lower skilled manufacturing into these countries
- technological advances in shipping, including containerisation, which have significantly reduced the costs of trade.

Overseas trade plays a critical role in the New Zealand economy. As a small, remote nation with limited domestic markets and significant agricultural capacity, trade underpins our economy. It opens up overseas consumers and supply chains for New Zealand businesses. This enables us to specialise in agricultural products, which serve as the backbone of our exports and provide the income to purchase the manufactured and consumer products we import. It also enables New Zealand businesses to specialise in innovation-intensive market niches in the global economy.

NZ and world growth in GDP, merchandise trade value, 1980-2011



Source: World Bank

In terms of economic growth, exports are fundamental to our future prosperity, and export growth has been identified as a key priority both at a national and local government level (see the UNI local governments' economic development strategies and the government's Business Growth Agenda).

To support these aspirations, ensuring the country has a robust transport and distribution network is key, and the country's port and port related infrastructure represents an important component of this supply chain. The UNI will continue to play an important role in all of these aspects, as it accounts for a large and growing share of New Zealand's overall GDP, population and international merchandise trade.

At the same time, there is a perception of growing pressure on these infrastructure assets, particularly in Auckland, where concerns have been raised in relation to increasing competition with other users on the road and rail networks. In addition, there are growing questions about the appropriateness of having a port in central Auckland, and whether this is the best use of downtown waterfront land given the city's aspiration to be the world's most liveable and the fact that most of Auckland's manufacturing and distribution facilities are in south Auckland.

This report seeks to develop a better understanding of the demand for ports and port related infrastructure in the UNI over the next 30 years. It also investigates the constraints on the ability of this infrastructure to cope with projected demand, and the kind of infrastructure investments likely to be required to meet growth.

Recent trade growth

Over the last decade the UNI has experienced strong growth in both imports and exports, and even faster growth (at least since 2007) in port exchanges.

Growth in trade

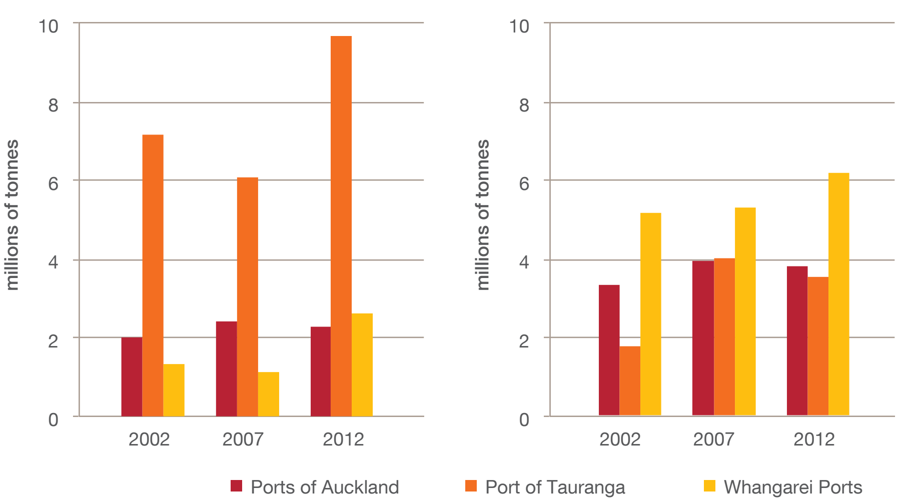
Over the last decade, the weight of UNI exports grew at an average rate of 3.4% per annum, increasing from 10.5m tonnes to 14.6m tonnes. About half of this growth was in log exports which grew by 2.1m tonnes. Over the same period, UNI imports grew at an average rate of 2.8% per annum, increasing from 10.0m tonnes to 13.2m tonnes. Import growth was dominated by 2.1m tonnes of growth in mineral fuels and 1.0m tonnes of growth in animal feed & pet food (ie palm kernels for cow feed).

The role of the three ports varies. Ports of Auckland (POA) handles a relatively more diverse range of exports compared with the Port of Tauranga (POT) and Northport, which are more focussed on bulk agricultural products. Dairy products account for the largest portion of exports through Auckland - 21% of total exports, or 473,000 tonnes, in 2012 - followed by wood, iron and steel, and beverages. There are also significant exports of a variety of other commodities.

Exports from Tauranga and Northport are dominated by a few major commodities. Nearly 90% of export weights through Northport (2.26 million tonnes) are of wood products, along with 56% of exports through Tauranga (5.43 million tonnes). Dairy plays a far smaller role in Tauranga, while Northport also exports significant quantities of fuels.

Export weights

Import weights



Source: Statistics NZ, PwC analysis

Comparing our measures of port task with government and council objectives

Central government and councils have set strategies for driving economic development through export growth (see eg the Government's Business Growth Agenda and the Auckland Plan).

1. our analysis is based on weight not value
2. we exclude all exports through airports, which accounted for 17% of export value in 2012
3. we consider merchandise trade only and exclude service exports, which accounted for 21% of exports in 2011 according to World Bank statistics
4. the relationship between trade weights and trade values may change over time, as trade in high-value/low-weight products grows.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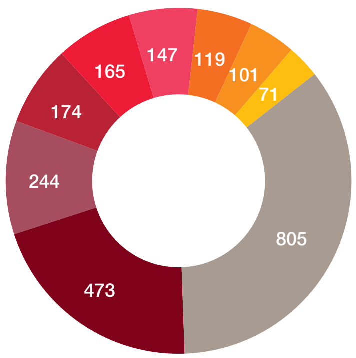
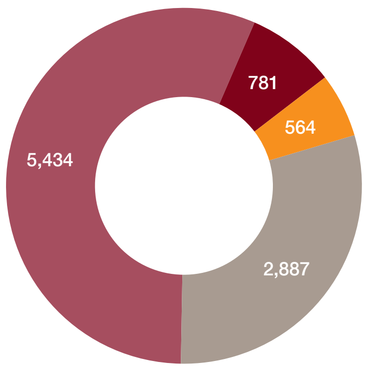
The Upper North Island ports have varied export profiles

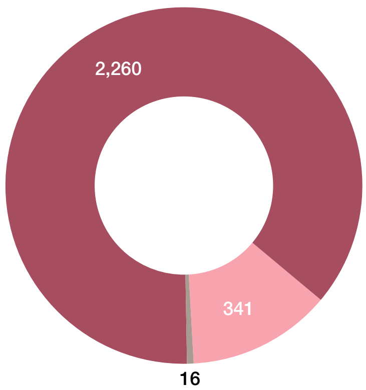
Ports of Auckland Exports, 000 tonnes, (2012)



Port of Tauranga Exports, 000 tonnes, (2012)



Whangarei Ports Exports, 000 tonnes, (2012)



- Other products
- Dairy products
- Wood and articles of wood
- Iron and steel
- Beverages, spirits and vinegar
- Mineral fuels and oils
- Salt, lime, stones, cement
- Meat and edible meat offal
- Pulp of wood
- Fruit and nuts

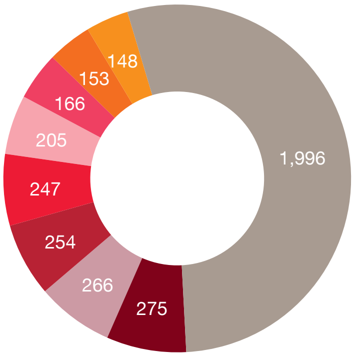
Source: Statistics NZ, PwC analysis

Similarly, POA handles a far wider range of imported products than the other ports. The eight most important import products, in terms of weight, account for just 46% of Auckland's total imports (1.72 million tonnes). In Tauranga, on the other hand, animal feed and pet food alone account for one-quarter of import weights (838,000 tonnes), followed by salt and building materials, fuels, fertilisers, and cereals, collectively weighing 1.55 million tonnes.

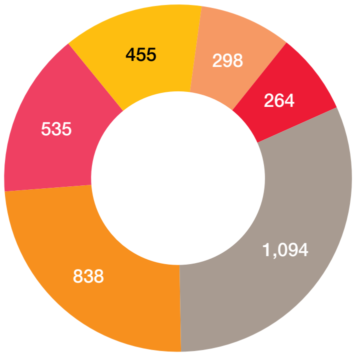
In Whangarei, mineral fuel (crude oil) imports to the Marsden Point refinery account for nearly all imports. Marsden Point, which is distinct from Northport, handles 5.87 million tonnes of fuel imports, which account for 44% of all import weights through the UNI ports. Building materials such as gypsum, which are mostly imported directly to the Golden Bay cement factory at Portland, account for much of the remainder of Whangarei's imports.

Tauranga and Auckland have more varied import profiles

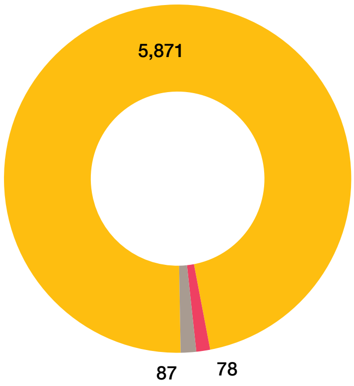
Ports of Auckland Imports, 000 tonnes, (2012)



Port of Tauranga Imports, 000 tonnes, (2012)



Whangarei Ports Imports, 000 tonnes, (2012)



- Other products
- Paper, paper pulp and paperboard
- Sugars and sugar confectionery
- Vehicles (excl railway or tramway)
- Plastics and articles thereof
- Cereals
- Salt, lime, stones, cement
- Iron and steel
- Fertilizers
- Animal feed & pet food
- Mineral fuels and oils

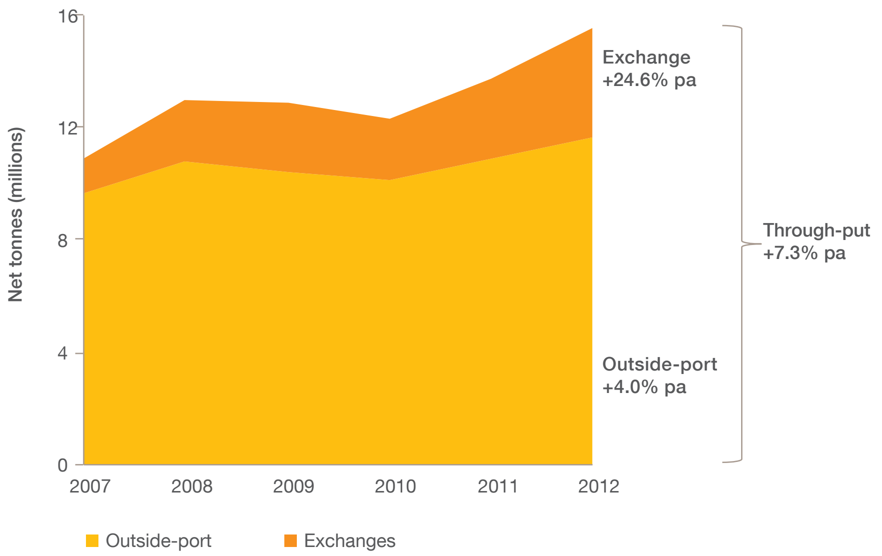
Source: Statistics NZ, PwC analysis

Growth in transhipping

Growth in total throughput at POA and POT has been significantly faster than growth in outside-port volumes, and this has been driven by dramatic increases in port exchange activity (international and domestic transhipping). This probably reflects the growing trend toward port hubbing, and the use of larger ships to extract economies of scale. While New Zealand still has a relatively large number of container ports for its size, regional ports such as Timaru and Wellington are losing traffic to their larger competitors. This trend is evident in both the data on average number of port calls and on import and export transhipment.

While transhipments are still small compared with overall international trade, New Zealand's ports appear to be moving towards a hub and spoke model. If this trend continues as expected, it is likely to reduce the role of regional ports (particularly for container trade) and concentrate overseas trade through a few major ports. The deployment of larger container ships on NZ shipping lines will accelerate this trend as only a few ports will have the trade volumes needed to justify the required investment required to host these ships.

2007-2012 Growth in UNI container volumes



Source: POAL, PoT data

Exogenous influences on infrastructure demand

Aside from growth in trade, demand for infrastructure at ports is being shaped by other influences.

The impact of larger ships

There is an international trend towards larger container ships due to the cost efficiencies they offer. Post-Panamax[2] container ships with a capacity of 8,000 TEUs or more are the fastest-growing category in shipping fleets. By comparison, the largest ships currently serving the New Zealand market can carry 4,100 TEU.

Increases to maximum ship size on major sea routes appear to be having a 'cascade effect' on other routes. Larger ships will be deployed on routes where there is sufficient container demand. However, smaller ships will continue to serve other routes at a higher cost.

There is a clear consensus that New Zealand will need infrastructure capacity to manage up to 6,000 TEU ships in the short to medium term, and perhaps up to 8,000 TEU ships in the medium to longer term. In the process, 3 or 4 hub ports will emerge, with regional ports acting as feeders. However, there is less of a consensus on the timing of these changes, which will be affected by growth in demand for overseas trade, developments in the shipping market, and infrastructure decisions made in New Zealand.

There is also a trend toward larger non-container ships. As with container ships, shipping lines will choose bulk cargo ships that best suit the products and ports that they serve. This trend is less likely to have a material impact on ports than the trend towards larger container ships. Unlike for containerised cargo, larger bulk ships will not lead to an increase in transhipment cargo due to the amount of time needed to load and unload bulk cargoes.

In terms of the UNI container ports, POT is actively preparing to host larger ships. They have recently been granted resource consent for further harbour dredging, which would ultimately provide capacity for ships up to about 8,000 TEU (though they are planning to develop this capacity in two stages).

POA's strategy is to manage larger ships more progressively. They are planning some minor additional dredging, and planning to manage larger ships through tidal windows. POA also note that the draught of ships coming into Auckland tends to be less, due to the lighter imported products they carry.

It is unlikely that this trend will result in a large share of New Zealand's international trade being 'hubbed' through Australian ports. Australian ports also lack the capacity to handle larger ships at present, although Brisbane and Sydney are addressing this shortfall. In addition, container volumes and cargo handling infrastructure at Australian ports are not significantly larger than those in the UNI region. Consequently, UNI trade could not be routed through Australian ports without considerable investment by those ports.

We discuss the impact of larger ships further into this report in the context of the ports' existing and planned infrastructure.

2. Post-Panamax describes the range of ships larger than the capacity of the Panama canal.

Domestic freight costs

Land transport freight costs are a significant component of total freight costs in New Zealand. This has implications for the economics of port configuration options, which rely on considerable land transport legs.

The cost to ship a container to or from Singapore, via Auckland, for various New Zealand cities is estimated below.

For example, a company exporting a container from Napier to Singapore via Auckland would spend:

- $1,520 on shipping line costs
- $407 on fixed costs at POA (including container loading, customs duties, etc)
- $1,529 on road freight from Napier to Auckland, $1,090 on rail freight plus an estimated $210 for container cartage to the rail depot, or $1,054 on coastal freight.[3]

In other words, depending upon the domestic freight mode chosen, between 35% and 44% of the total cost of shipping from Napier would be spent on domestic transport alone. Estimates for other New Zealand cities suggest that domestic freight costs will increase considerably as the distance to the port of export/import grows.

Supply chain analysis - total cost of shipping one TEU on the Singapore-Auckland route

		Importing			Exporting	
International freight costs						
Shipping line costs		$1,373			$1,520	
Port, customs, and biosecurity costs		$456			$407	
Domestic freight costs						
Origin/destination	**Road**	**Rail**	**Coastal**	**Road**	**Rail**	**Coastal**
Whangarei	$581	$602	NA	$581	$602	NA
Auckland	$210			$210		
Hamilton	$463	$400	NA	$463	$400	NA
Mt Maunganui	$746	$602	$699	$746	$602	$669
New Plymouth	$1,319	$1,151	$1,376	$1,319	$907	$1,260
Palmerston North	$1,889	$1,272	NA	$1,889	$1,144	NA
Napier	$1,529	$1,334	$1,139	$1,529	$1,090	$1,054
Wellington	$2,363	$1,394	$1,469	$2,363	$1,278	$1,341
Blenheim	$2,815	$1,413	$1,598	$2,815	$1,685	$1,454
Christchurch	$3,954	$1,618	$1,703	$3,954	$1,820	$1,515
Dunedin	$5,252	$1,887	$1,981	$5,252	$2,089	$1,789
Container cartage		**$210**			**$210**	

Source: Productivity Commission, Ministry of Transport, PwC calculations

3. Domestic freight costs are estimates based on data compiled by the Ministry of Transport for road and coastal freight, and KiwiRail's stated prices for 'walk-up' customers. We would expect a shipper with significant volumes or a consolidated customer such as an inland port to be able to negotiate significantly lower costs, especially for rail.

Developing Northport as a container terminal is likely to be uneconomic due to the additional cost of shipping containers from Whangarei to other UNI locations. Auckland and Tauranga are located much closer to main population centres and export-producing regions, meaning that any additional costs for importers-exporters at the port (eg higher charges to compensate for higher land prices) is offset by lower domestic freight costs. Road and rail costs may fall significantly as a result of investment in infrastructure upgrades. However, their magnitude compared with port and sea freight costs means that significant efficiencies and cost reductions would be needed across the board before a container port at Whangarei would make economic sense.

Inland ports

Inland ports are intended to exploit the cost advantages of cargo handling at an inland location. They can potentially serve two purposes. First, they can reduce dwell times at the port by allowing customs clearance (etc) for containers to be completed at an inland location. This can reduce the total cost of port operations if the difference between land prices at the port and inland locations is large enough to offset any double handling.

Second, inland ports can lower costs for importers and exporters by exploiting the cost efficiencies available when moving large volumes of containers by rail. They allow importers and exporters to avoid the costs of road freight (and, in particular, congestion in Auckland's road network) by consolidating freight at a closer location and moving it by rail to a port.

From an infrastructure perspective, the key impact of inland ports is likely to be changes in the distribution pattern of the trade task, in terms of modal shifts (from road to rail) and/or changes to the port of destination or origin. Of these, only changes in the port of destination or origin will have an impact on the projected task for each port. We do not expect inland ports to alter the projected trade task for the UNI as a whole.

Inland ports are likely to reinforce competition between POT and POA. Metroport, an inland port established by POT in Auckland, has enabled POT to actively compete in the Auckland market due to its proximity to manufacturers and distribution centres in south Auckland. We expect that the proposal for an inland port at Ruakura near Hamilton would reinforce this trend.

Inland ports are primarily a commercial proposition and should be evaluated as such. However, they do have some public policy implications for land-use and infrastructure planning. If inland ports provide a commercially viable proposition to shippers – ie if they reduce supply chain costs by consolidating sufficient volumes of freight and moving it to and from a seaport by rail – they may have an impact on land uses in the surrounding area. For example, they may strengthen incentives for production or distribution facilities to locate close to the inland port.

The effects may not necessarily be immediate. The experiences of Metroport and Wiri Inland Port suggest that inland ports will be slow to reach capacity – Metroport reached 55% utilisation in 2011, more than a decade after opening, while Wiri continues to struggle to achieve significant volume. Growth at Wiri has been limited as the convenience, speed and cost of road transport has proven superior to potential cost efficiencies from rail. Consequently, it is likely that their effects on land use and distribution network capacity will occur only in the medium term or beyond. This should be taken into account when assessing future inland port developments.

Key success factors for inland ports

Inland ports succeed or fail as commercial propositions. A 2012 report to the Waikato Regional Council lays out some factors affecting inland ports' effectiveness:

1. size of catchment area
2. location within a freight precinct or industrial centre
3. reliable road and rail access links
4. ability to operate 24/7
5. efficient design to maximise reliability of vehicle and container movements
6. appropriate types of container handling equipment
7. on-site Customs and Biosecurity services
8. storage and repositioning of empty containers

Source: Draft Aurecon report (2012)

Projections of future freight through the Upper North Island ports

We have constructed long-term projections of future freight through the UNI ports. They include high and low scenarios that provide a range of potential outcomes. Our projections to 2041 indicate significant growth in both trade and throughput.

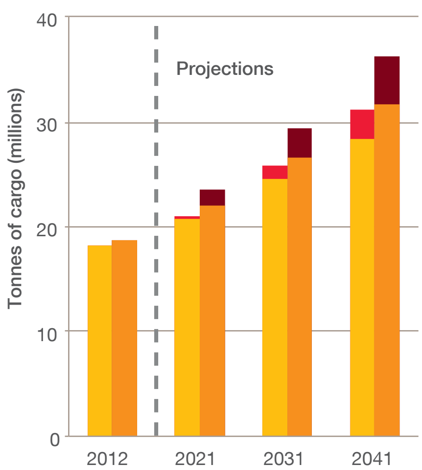
Throughput is expected to grow faster on the back of increased transhipment and domestic coastal freight. Key projections include:

- Throughput growth of 1.7%-2.3% pa, to 22m-32m tonnes, consisting of:
  - Outward growth of 1.8%-2.3%
  - Inward growth of 1.6%-2.3%.
- Outside-port volume growth of 1.4%-1.8% pa, or an additional 17m-22m tonnes, consisting of:
  - Exports of 28m-31m tonnes in 2041, reflecting growth of 1.6%-1.9% per annum
  - Imports of 21m-24m tonnes in 2041, reflecting growth of 1.2%-1.7% per annum.

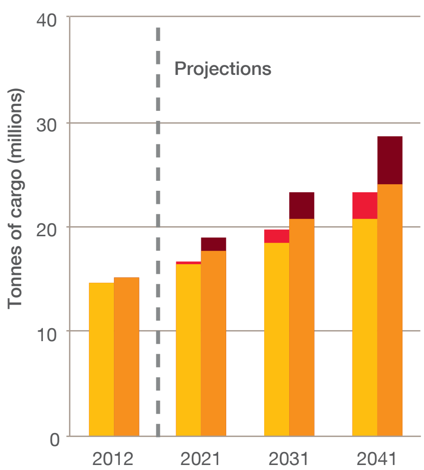
Overseas merchandise trade is the main component of the UNI port task, and hence the most significant driver of change. We expect growth in this area to be driven by, and in some cases constrained by, patterns of production, consumption, and overseas demand.

These include dairy and log production capacity in the UNI, regional population growth and future demand for petroleum products, and rapid growth in emerging Asian economies.

UNI outward cargo movements: outside-port and throughput



UNI inward cargo movements: outside-port and throughput



Outside-port - high
Outside-port - low
Throughput - high
Throughput - low

Source: Statistics NZ, PwC analysis

Overseas merchandise trade is the main component of the UNI port task, and hence the most significant driver of change.

Projections by port, and between container and bulk cargoes

Our main projections of the future port task have been made for the UNI region as a whole. However, we recognise breaking down these projections to individual ports is important in the context of understanding the constraints faced by these ports.

- At POA, container throughput is expected to grow by between 2.3% and 3.2% per annum over the period, while bulk throughput is projected to grow at between 1.9% and 2.2% per annum.
- At POT, container throughput is expected to grow by between 2.5% and 3.1% per annum over the period. Bulk throughput will also grow, but at a slower projected rate of between 1.7% and 2.3%.
- Growth at Northport and Marsden Point is expected to be slow relative to the other UNI ports. This is because the faster growing transhipping element is not expected to be a feature for the Whangarei ports due to the dominance of bulk cargo. Furthermore, growth in Northport's main cargo, unprocessed logs, is expected to be flat after 2020 due to the fact that log availability is projected to level off. Northport may be able to grow more rapidly if it is able to attract other types of cargo.

The table below summarises our projections to 2041, for each port by cargo and throughput type.

2012-2041 growth projections by port and type of cargo

Categories		Northport	Whangarei ports	POA	POT	Total UNI
Outside-port growth:						
Container	Per annum	-	-	2.0% to 2.5%	1.7% to 2.0%	1.8% to 2.2%
	Total	-	-	77% to 105%	62% to 76%	68% to 89%
Bulk	Per annum	1.0% to 1.0%	0.7% to 0.8%	1.7% to 1.9%	1.7% to 2.3%	1.7% to 2.2%
	Total	33% to 33%	22% to 26%	61% to 74%	62% to 91%	62% to 88%
Total	Per annum	1.0% to 1.0%	0.7% to 0.8%	1.9% to 2.4%	1.7% to 2.1%	1.4% to 1.8%
	Total	33% to 33%	22% to 26%	73% to 98%	62% to 84%	50% to 67%
Exchange growth						
Container (2021-2041)	Per annum	-	-	3.3% to 3.3%	5.0% to 5.1%	4.2% to 4.2%
	Total	-	-	90% to 91%	167% to 171%	126% to 128%
Bulk (2021-2041)	Per annum	-	-	6.2%	6.3%	6.3%
	Total	-	-	236%	240%	237%
Total (2021-2041)	Per annum	-	-	3.4% to 3.4%	5.1% to 5.1%	4.2% to 4.3%
	Total	-	-	94% to 95%	168% to 172%	128% to 131%
Total throughput growth						
Container	Per annum	-	-	2.3% to 3.2%	2.5% to 3.1%	2.4% to 3.2%
	Total	-	-	95% to 151%	104% to 146%	100% to 148%
Bulk	Per annum	1.0% to 1.0%	0.7% to 0.8%	1.9% to 2.2%	1.7% to 2.3%	1.7% to 2.3%
	Total	33% to 33%	29% to 33%	71% to 88%	62% to 92%	64% to 92%
Total	Per annum	1.0% to 1.0%	0.7% to 0.8%	2.2% to 3.0%	2.1% to 2.7%	1.7% to 2.3%
	Total	33% to 33%	29% to 33%	90% to 138%	82% to 117%	64% to 91%

Source: PwC analysis

In developing these estimates we have assumed that each port's share of overall UNI growth within each category of cargo movement will be similar to their historical shares, and that the share of cargo weight moving in containers will remain constant at 2012 levels.

With the obvious exception of heavy bulk cargoes such as logs and petroleum products, POA and POT compete for much of the freight task of the Upper North Island. This is especially true for (dry) containerised cargo. Although land transport costs will factor into importers' and exporters' decisions about which port to use, the two container ports are close substitutes for container cargo.

As a consequence, the shares of cargo carried through Auckland and Tauranga are likely to depend upon the ports' capacity to move additional containers, and the marginal cost of doing so. If, for example, POA reaches capacity while POT still has spare capacity, it is likely that POA will have to raise its prices. This will, in turn, encourage some shippers to divert cargo to POT. As long as spare capacity exists within the UNI ports, changing prices will encourage shippers to shift traffic away from congested ports.

Comments on these projections

We understand that these projections may be considered conservative. In particular, both POA and POT have experienced periods of growth in recent years (in container trade especially) that have been considerably higher than our projections. We make the following points in this regard:

- We are forecasting average growth to 2041 – we expect growth to be considerably higher (and lower) in certain years.
- As noted earlier, a considerable portion of recent growth has been driven by growth in port exchanges (over 30% per annum since 2007). While transhipping is expected to continue to grow, it is not realistic for it to grow at these sorts of rates beyond the short term.
- In weight terms, the UNIs key export products are forestry and dairy. While growth is expected to continue in these products, it is ultimately constrained by available forestry stocks, land for dairy farms and limited productivity opportunities.
- UNI population growth is projected to slow to an average of 1.3% per annum over the study period, and we expect imports to slow to reflect this. In addition, our major single import (oil) is expected to grow at an even slower rate as a consequence of supply constraints and more fuel efficient vehicles.

A considerable portion of recent growth has been driven by growth in transhipping.

Existing infrastructure at the Upper North Island ports

In considering existing port and port related infrastructure we have distinguished the following elements:

- ***Port access*** – the depth of each port's channel and berths
- ***Berthage*** – the number, length and configuration of container and bulk berth space at each port
- ***Storage*** – the container and bulk storage capacity of each port
- ***Distribution*** – primarily the land transport infrastructure servicing the port.

Ports also own significant operational infrastructure, such as cranes, straddles (for stacking containers), reefer slots (power points for refrigerated containers), buildings and operational technology. These types of assets are discussed in the context of options for improving port efficiencies.

Port	Access	Berthage	Storage	Distribution
Northport	Channel depth: 14.8m chart datum Berth depth: 2 x 13m, 1 x 14.5m Turning room limits vessels to 275-300m	3 berths totalling 570m	48 hectares reclaimed, 34 hectares of formed storage	Primarily road from the north and west Some domestic coastal shipping
Refining NZ, Marsden Point	Deep water access for both channel and berths, though there is a 14.8m shoal patch on the approach	2 jetties totalling 134m, which can accommodate ships of up to 275m and 200m, respectively	Some bulk liquid storage at refinery	Wiri pipeline to Auckland Coastal shipping Road transport north
POA – container	Channel depth: 12.5m chart datum, 13.9m at high tide Berth depth: 12.5m, 13m and 13.5m	3 berths totalling 870m	46 hectares, with a further 15 hectares at Wiri inland port	Road primarily through Grafton Gully and heading south Rail on North Island Main Trunk (NIMT) south, North Auckland Line (NAL) to Northland
POA – bulk	Range of berth depths	1,637m in total	25.3 hectares	Road, primarily through Grafton Gully to south Rail on NIMT south, NAL to Northland
POT - container	Channel depth: 12.9m chart datum Berth depth: 14.5m	3 container berths totalling 600m, with berthage currently being extended to 770m in total	72 hectares of which 41 is currently used. An additional 3.5 hectares at Metroport.	Road from various locations Rail, on East Coast Main Trunk (ECMT), primarily from/to Metroport in Auckland
POT – bulk	Berth depth: various up to 12.9m	Bulk berths totalling 2,055m plus one cement dolphin berth	112 hectares	Road primarily from the south Rail from central North island forests, and from Auckland
TOTAL UNI - container	-	1,470m or 1,946m including berths being developed at POT and POA	118 hectares, with 18.5 hectares of inland port container storage	-
TOTAL UNI - bulk	-	4,626m	171 hectares	-

The ability of the Upper North Island ports to cater for our projected growth

Overview

The capacity of the infrastructure discussed previous in this report is generally not fixed, and it is therefore difficult to give a strict view on technical limits.

For example, storage requirements depend on many elements including the length of time the containers are stored at the port (the dwell time), the type of straddle technology, the layout of the storage area, the seasonality of the port's activity and the space available. Many of these components depend on different operational parameters.

Similarly, the capacity of berth infrastructure is affected by the length and configuration of the berthage, and by the speed that ships are serviced. This in turn depends on the numbers and quality of cranes servicing vessels, the size of the ships (bigger ships can be serviced relatively faster), the extent of transhipping, and the ability of the port to deploy the appropriate crews to process the ships.

Our approach has been to estimate capacity on the basis of international benchmarks. These give us an indication of the maximum throughput per hectare of storage space or metre of berth space, which the most intensely used ports of similar size to the UNI ports are achieving.

Projected infrastructure limits

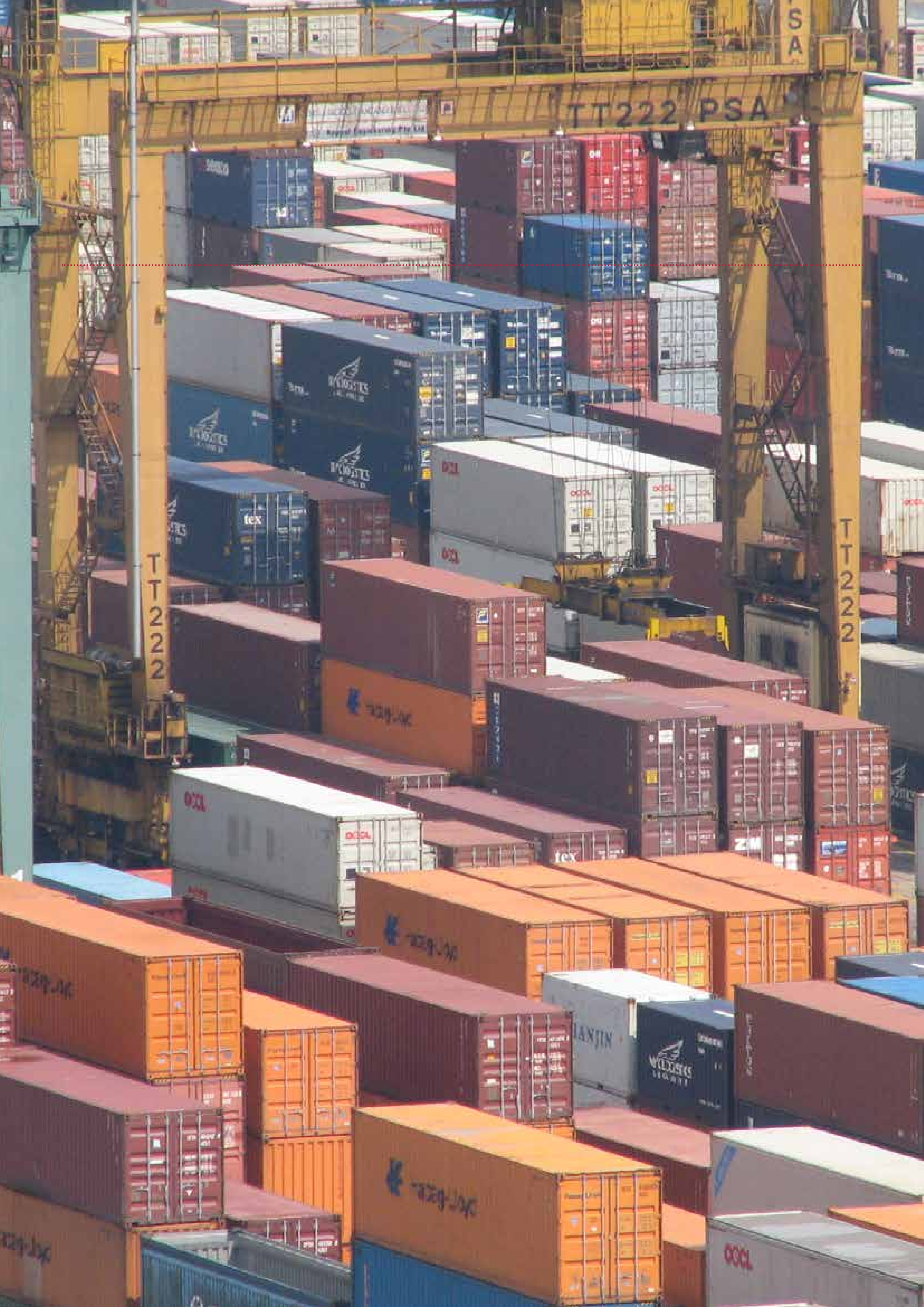
Notwithstanding the comments above, the table opposite outlines the elements of the current port and port-related infrastructure where the current infrastructure appears unlikely to be sufficient to cater to our projected future growth. It also presents options for addressing these limits.

This is an organic or incremental view, in that we are addressing limits and constraints as they are expected to arise, given the current UNI port and distribution system. The next section considers transformational or system changes.

Storage requirements depend on many elements including the length of time the containers are stored at the port (the dwell time), the type of straddle technology, the layout of the storage area, the seasonality of the port's activity and the space available.

Infrastructure issue	Options	Viable?
Berth depth at POA	Increase the depth of the container berths by dredging	Yes, subject to consent and being warranted commercially
	Do nothing, and be unable to cater for ships above a certain size	Yes, though may limit POA's ability to operate as a hub port, and/or increase costs for importers and exporters (compared with the other option)
Berth depth at POT	Increase the depth of the container berths by dredging	Yes, POT has recently received resource consent for channel and berth dredging
	Do nothing, and be unable to cater for ships above a certain size	Yes. As POT has consents, this is likely to be based on commercial decision as to the return on investment in dredging
Container berthage at POA	Develop additional consented container berth. POA have consent to develop a 306m 4th container berth	Yes, but to fully cater for growth further berths or efficiencies will be required
	Develop further additional berthage elsewhere at the port	Probably scope for limited additions, subject to resource consent and potential community sensitivity
	Increase ship handling speeds, through using more or better cranes, increased labour flexibility, handling larger ships, better berthage and storage alignment	Yes, but to reach potential, likely to require some reconfigurations or additional berth length as well
	Re-purpose bulk berthage	Technically viable, but would impact bulk capacity which is also likely to be stretched
Container berthage at POT	Complete full container berth extension	Yes, POT has longer term plans for a 285 metre berth extension. This will likely require an upgrade of air traffic control systems at Tauranga airport, due to flight path conflicts
	Develop further additional berthage elsewhere at the port	Would probably require re-purposing existing bulk berthage, placing pressure on bulk operations. Likely to depend on the relative values to the port of the cargoes
	Increase ship handling speeds	Yes, though POT is already operating at relatively high levels of efficiency
Container storage at POA	Complete the development of the additional 3.6ha of consented reclamation at the north-eastern tip of Fergusson terminal	Yes, being progressively reclaimed currently
	Reclamations	Technical scope, but would require resource consent and this is likely to be affected by community sensitivity
	Improve stacking technology	Yes, POA are currently planning to move from 2+1 to 3+1 stacking technology
	Other efficiencies	Likely to be able to make incremental improvements to dwell times (though imports already have very low dwell times)
	Re-purpose bulk storage	Probably not due to space pressure on bulk cargo

Infrastructure issue	Options	Viable?
Bulk berthage at POA **(particularly if Captain Cook and Marsden wharfs are lost)**	Reconfiguration	Yes, but likely to require some reclamations which are likely to be constrained by community sensitivity There may be a need for additional car storage facilities – eg a low-level car park building
Bulk storage at POA **(particularly if Captain Cook and Marsden wharfs are lost)**	Car stacker	Yes, based on cost relative to other storage options
	Reconfigurations	Yes, but likely to require some reclamations which would need resource consent, which are likely to be affected by community sensitivity
Storage at Northport	Currently unformed land could be developed.	Yes. Could undertake further reclamations or use adjacent land owned by Northland Port Corporation.
	Shorter dwell times of bulk cargo	Yes, but likely to be difficult due to the way logs are shipped
	Higher stack heights for bulk cargo	Yes, but physical constraints mean that benefits are limited
Grafton Gully **Although future congestion likely to be driven by non-port traffic growth, and/or land use pressure that impact existing routes (as opposed to port growth)**	A range of possible corridor improvements, including major work options like grade separation at Grafton Gully	Yes, but investment not likely to be induced by port traffic. General traffic congestion, and land-use changes on Quay street are the primary drivers
	Greater use of off-peak times	Yes, though would require changes in the operational hours of receiving distribution centres
	Modal shift to rail	There is significant technical capacity on rail, but growth likely to be limited due to increasing commuter traffic. Also not cost effective for majority of Auckland based customers
Auckland sections of North Island main trunk	Construct a 3rd line for freight	Construction may be affected by KiwiRail's ability to finance it in their turnaround plan While funding has not been fully agreed, work is currently underway to advance the construction of sections of this line between Southdown and Wiri prior to the introduction of the planned intensive passenger train timetable in 2014 While present-day mode shares would make it difficult to justify, the Auckland Plan includes the construction of a full third track for freight between the port and Papakura between 2021 and 2030. This project may be constrained by community sensitivity
Tauranga rail (including east coast main trunk)	Increasing passing loops, signalling improvements, and ultimately double tracking	Yes, likely to be progressive, based on commercial arrangements between KiwiRail and POT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The role of prices

In conjunction with decisions to invest in infrastructure, relative prices will play a key role in extracting and allocating capacity across the UNI port network, particularly where there are alternatives or substitutes. For example, costs and prices[4] will help determine:

- Whether a port invests in additional physical infrastructure (eg reclamations) or operational efficiencies (eg more cranes, automated stacking technology)
- How freight is distributed (eg by road or rail)
- The types of products that ports cater for – eg if physical space becomes a premium we would expect them to focus on products for which they can charge the most per square metre of storage space. Or put differently, as they start charging more because space is tight, exporters and importers will start considering whether it would be more cost effective for them to use a different port
- Where exporters/importers send or source their products (which is already happening in the container trade competition between POT and POA).

The ability of port customers to choose between ports reinforces the role of price in allocating capacity. While there will continue to be limitations to the extent that ports can be substitutes (especially for bulk products) Metroport has demonstrated that under the right conditions, POT can compete in the Auckland market. We expect that, if successful, the proposed inland port at Ruakura would provide further opportunities to allocate latent capacity, both in the regional rail network and in its ports, though the rate of take-up may be slow given the experience of Metroport and Wiri.

In conjunction with decisions to invest in infrastructure, relative prices will play a key role in extracting and allocating capacity across the UNI port network, particularly where there are alternatives or substitutes.

4. These may be direct costs, or indirect costs such as the costs associated with congestion, or the uncertainty associated with obtaining resource consents.

So what does this all mean?

In summary:

- There is considerable capacity that can be accessed through improved operational efficiencies, most notably for containers and container storage in particular.
- Completion of consented reclamations at Northport and POA and berth developments at all three ports will also provide significant additional capacity.
- Projecting the impact of growth in bulk cargo is much more difficult, due to the lack of uniformity. With a few exceptions (storage for cars and logs) we have conservatively assumed that opportunities for operational efficiencies for these types of cargoes are more limited.
- If each port is to manage their share of trade as projected, we expect each port will need to develop further capacity over the study period (even with assumed operational efficiencies):
  - For Northport this would probably include development of the planned fourth berth and deployment of additional storage area.
  - o For POT this would include the additional 285 metres of container berthage at Sulphur Point. (There is also likely to be some additional bulk infrastructure – but this will likely be managed by reconfigurations rather than substantial development.)
  - For POA, further reclamation and berth developments will probably be necessary, especially if Marsden and Captain Cook wharfs cease to be used. However, with the required operational efficiencies, we expect these requirements to be less substantial than the preferred reclamation options in the 2008 Port Development Plan.
- Relative prices and costs will largely determine which specific options are chosen, including what combination of new infrastructure and efficiencies is utilised.

Potential system changes to manage growth

There has been public commentary on systemic change in the ports systems as an alternative to incrementally adding capacity. We have summarised at a high level the pros, cons and implications of the three potential options. We note that these options would involve a relatively large-scale intervention in the market by government agencies – well over and above their current role.

While these options are not considered in detail in this report, they are provided as a summary to help inform further technical analysis. The options are focused on constraining growth at POA, as this is the port under the most significant pressure in terms of competing land uses, environmental concerns that limit growth capacity, and conflict with other transport uses.

Our options are focused on constraining growth at POA, as this is the port under the most significant pressure.

System change	Impacts/requirements	Comments
Option 1: **Establishing a container terminal at Northport, to incrementally take over POA operations**	Potential to re-purpose elements of Auckland's waterfront Investment at Northport – cranes, berthage, reclamation Rail spur to Northport Investment in Northern rail line Avondale to Southdown line to avoid Newmarket Managing Northland's existing bulk task Additional traffic right through Auckland to the South Auckland distribution network Ongoing increased costs across value chain (land transport costs exceed port costs) Need to re-establish distribution centres	Likely to be very expensive, relative to the incremental approach Likely to have negative economic implications for both Northland and Auckland. The forestry industry would face competition for space, land transport between Auckland and Whangarei would be far more congested. These costs may be partially offset by reduced shipping costs for other Northland importers and exporters. The UNI's trade supply chain would be more expensive, impacting competitiveness for importers and exporters May however provide reserve capacity and network resilience
Option 2: **Manage Auckland's growth elsewhere.** **In effect implying that POT takes container growth and POT and Northport take bulk growth.**	As POA becomes more efficient, potential for footprint to be reduced Increased costs across the value chain for diverted products (and probably a bigger impact for bulk products) Double tracking of Tauranga to Auckland line Increased pressure on freight routes between Auckland and Tauranga and Whangarei Capacity issues may develop in Tauranga, especially in relation to berth length Potential for reverse sensitivity issues in Tauranga, related to increased freight traffic, including trains Northport likely to require 5th berth earlier, and prices for existing bulk trade likely to increase	Given the ability of (container) exporters and importers to choose between the ports it is likely to be more efficient and effective for the market to allocate this growth. If it is relatively cheaper to deploy capacity at POT and Northport, then this should come through in prices The UNI's trade supply chain would be more expensive, impacting competitiveness for importers and exporters
Option 3: **A new UNI port**	Potential to re-purpose elements of Auckland's waterfront Massive infrastructure investment, not only in port infrastructure but also in road and rail links Significant stranded assets Considerable environmental impacts, depending on site selected Transformational change across the supply chain	Given projections, it seems unlikely that this option would make economic sense over the term of this study Benefits of repurposing current POA land seems, alone, insufficient to outweigh large costs for the foreseeable future

Beyond 2041

While our projections provide an indication of the port task and infrastructure requirements out to 2041, there is likely to be further growth thereafter. It may therefore be the case that even if a given amount of infrastructure can cater for the projected trade task in 2041, it may not fully be able to at some point after that.

This suggests a couple of questions:

- ***Is 30 years the right projection period, why not a 50 or 100 year timeframe?***
- ***Surely at some point ports will reach capacity. Shouldn't we be making decisions and plans to provide for this?***

While there are a number of perspectives as to the appropriate period for the planning of long-term infrastructure, we believe a 30-year horizon is a sensible time frame in this context, as:

- It coincides with the longest planning periods used by many public sector entities including NZTA, Auckland Council and Auckland Transport.
- Projections over long time periods become increasingly undermined by transformative changes. If we reflect on changes over the last 30 years for example, we have observed geopolitical changes (the collapse of the Soviet Bloc, the emergence of the Asian economies), massive technological innovation, removal of trade barriers and the globalisation of world trade, and the emergence of environmental concerns into the mainstream. None of these changes would have been easily predicted in 1980, but they have all had significant impacts on international trade.
- As well as transformative change, there is also potential for major system shocks. This could include a major oil shock, natural disaster or some form of conflict that significantly undermines trade.

Given what we currently know or can reasonably assume, if we take our projections out far enough, we will reach serious constraints in our trade supply chain. However, practically reacting or providing for this is probably limited to ensuring planning is flexible, and provides or retains options for future policy makers to react to major changes and constraints as they become more certain.

In this respect, we note that the UNI is actually well served by three ports. This currently provides strong competition to the benefit of exporters and importers, and also operational flexibility and resilience in the UNI's trade and logistics supply chains.

There are benefits in retaining flexibility to adapt to future circumstances, even where there is a financial cost in doing so, and if the option is never exercised. For example, while we do not consider that Northport will be required to manage significant freight from outside of the Northland region, we do believe that retaining capacity for it to take a larger role provides valuable flexibility and resilience across the port network in the UNI.

Conclusions

The UNI ports are projected to experience strong growth over the next 30 years, underpinned by continued growth in the trade of primary products, and the ongoing development of transhipping at POA and POT.

We expect that cargo throughput will grow more rapidly than outside-port cargo, and that containerised cargo will grow more rapidly than bulk cargo – in line with recent trends. As a consequence, more pressure will be placed on port infrastructure, which must handle growing volumes of exchange cargo, than on distribution networks and land transport infrastructure to the port. Likewise, container handling facilities are expected to handle more growth than bulk cargo facilities.

Overall, our projections suggest the UNI port network has capacity to meet the freight task over the next 30 years. But this will require substantial operational efficiencies as well as incremental investment in infrastructure including the uptake of consented berth developments, reclamations, and channel and berth deepening.

If the task is to be managed with broadly the same share and configuration of ports, POA will most likely require further storage and berth capacity. When this is required will depend on the timing of any operating efficiencies, the timing of any release of Captain Cook and Marsden wharfs, and spikes in demand. If POA can make substantial operational efficiencies, we expect these requirements for additional infrastructure to be smaller in scale than the preferred reclamation options in the 2008 Port Development Plan. Whether further reclamation is achievable will depend on the ability to obtain resource consents, which in turn will depend on consideration of the wider costs and benefits (social, economic, environmental and cultural) of the proposals.

If POA is unable to gain approval for an expanded footprint, then some of the projected growth will need to be accommodated at other UNI ports. In our view this is achievable given the capacity across the network. Relative prices will play an important role in reallocating freight - as constraints at one port increase, the cost of handling freight will increase, encouraging importers and exporters to move freight through the alternative port. This however, like any supply side constraint, will have economic consequences in terms of additional supply chain costs for exporters and importers.

The development of inland ports and improvements to transport and distribution networks may partially offset these cost increases, as evidenced by the ability of POT to compete with POA for many types of Auckland cargo, through its presence at Metroport.

We would expect that any transfer of growth to the other ports would occur slowly, but be punctuated by step changes as exporters and importers reconfigure their supply chains.

POT and Northport are also expected to need further infrastructure over the study period. While this would also require resource consent, there are less apparent impediments to these proceeding than at POA.

We do not forecast significant issues for land transport infrastructure to arise as a result of increasing port demand. In Auckland growth is likely to be dominated by non-port demand. Tauranga and Whangarei are generally not under the same land transport congestion pressures. However, improvements to the East Coast Main Trunk line between Auckland and Tauranga will most likely be required, including possible double tracking. We expect these changes to be progressive, based on commercial arrangements between KiwiRail and POT.

In summary, the most efficient and cost effective options are likely to be based around incremental growth at each port, complemented by changes in relative prices that help allocate latent capacity. The public sector will continue to play a key role in:

- balancing the wider costs and benefits of infrastructure investment through decisions around resource consents
- providing additional land transport infrastructure as appropriate
- monitoring the effectiveness of the UNI's logistics supply chain
- retaining flexibility and options across the network, both to provide network resilience and capacity to manage change.

It does not appear, based on current projections, that the benefits of substantial changes to the UNI port system, such as establishing a new container port, currently outweigh the costs involved.

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Thank you

for your time

1

Introduction

Introduction

This report was commissioned by the Upper North Island Strategic Alliance (UNISA) to determine trends in demand for merchandise trade through the Upper North Island (UNI) ports, the capacity of key port and port related infrastructure to manage this demand, and to form a view of potential infrastructure investment requirements. The study period of this report is 30 years.

The report is broken into two main parts. In the first (Sections 2, 3, and 4) we consider trends affecting demand for freight through the UNI ports and make projections of future freight task out to 2041. These projections are based on analysis of trade patterns and port throughput over the last ten years, supplemented by: qualitative information from industry participants; high level forecasts of economic growth in the UNI, New Zealand and amongst key trading partners; expected demographic changes; and physical constraints in respect of agricultural production in New Zealand. In the second part of the report (Sections 5 and 6) we examine the existing infrastructure at the UNI ports, the ability of this infrastructure to cater for projected growth, and options for meeting future demand.

The area of analysis is illustrated in Figure 1. It contains the seven district and regional council areas that comprise UNISA: Northland, Whangarei, Auckland, Waikato, Hamilton, Bay of Plenty, and Tauranga.

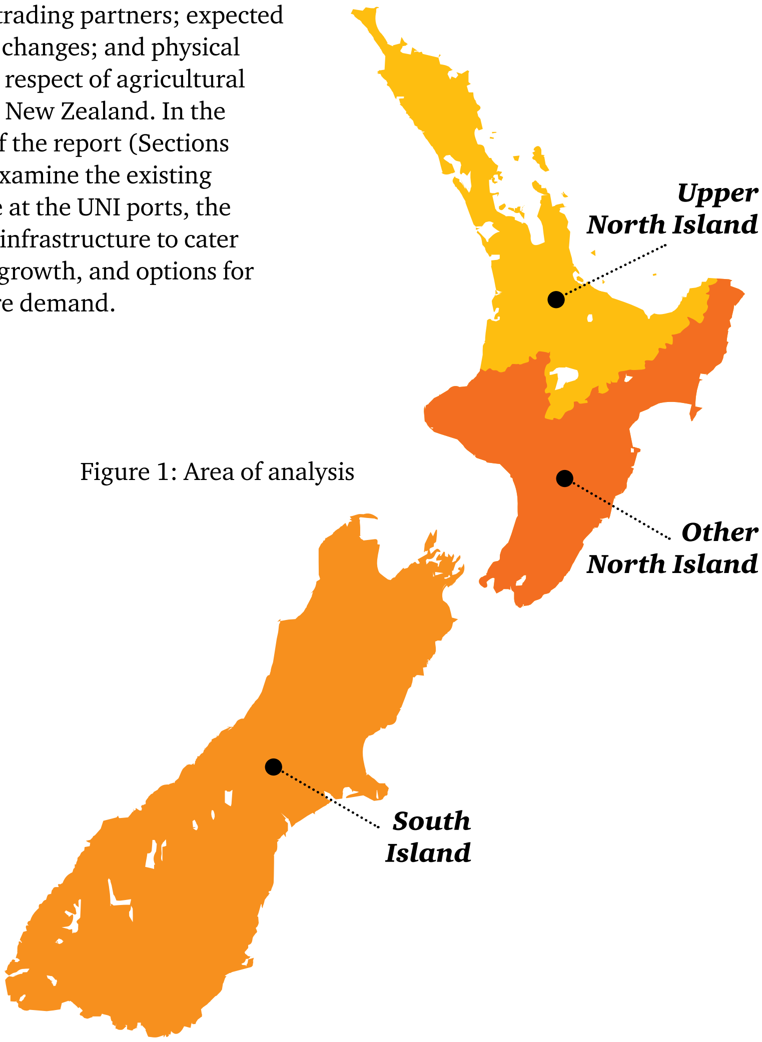


Figure 1: Area of analysis

Figure 2: Ports and railways in the UNI

There are ports in three cities within the UNI – Whangarei, Auckland, and Tauranga – and road and rail networks connecting main freight servicing locations. Figure 2 here shows the locations of the ports, railway lines, and main freight servicing locations in the study area[5]. We discuss the role of these ports, and the linkages between them, in more depth in the following sections.

5. Not all of the rail lines shown in this figure are currently active. For example, branch lines to Rotorua and Taneatua (in the eastern Bay of Plenty) are currently inactive.

2

Context for this study

Context for this study

In this section, we discuss some of the global and macroeconomic trends that shape demand for freight in the UNI region.

First, we consider the significance of ports to regional and national economies in the abstract before discussing the role of trade in the New Zealand economy. Following that, we discuss trends in world trade before a more in-depth discussion of recent trends in economic growth, population, and trade in the UNI region. This information serves as a backdrop to our projections of future port growth and our discussion of the future of freight in the region.

2.1 The role of ports in an economy

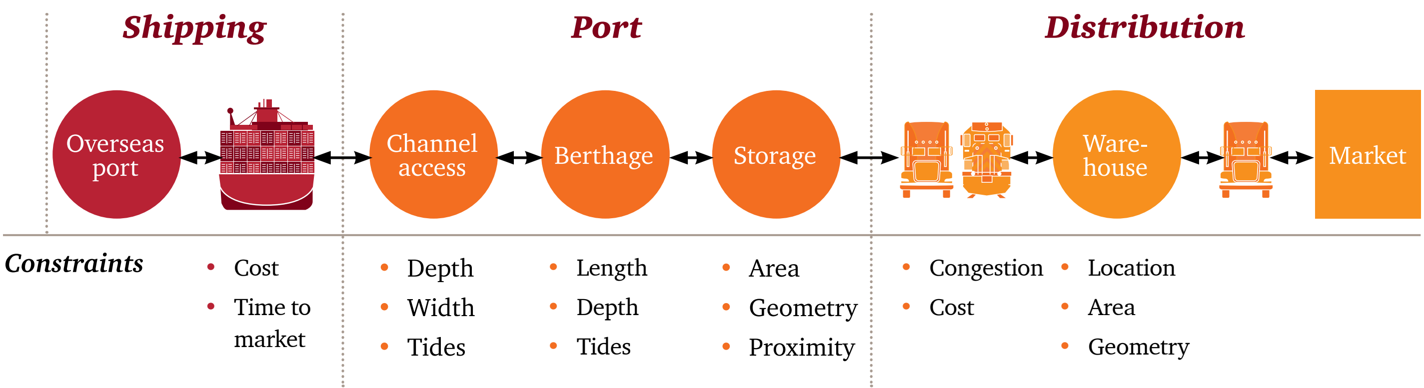
The role of a port is to enable sea trade between different regions and countries. The existence of a facility for moving freight between land transport and oceangoing vessels allows producers of physical goods to reach distant markets at a relatively low cost.

Ports are merely single nodes – albeit important ones – in broader supply chains. Their function is crucial for enabling trade but they cannot exist on their own. Demand for a port is related to underlying economic activity – production and consumption – and in turn can foster increased activity. (This is an important part of the economic literature on gains to trade and specialisation.)

Figure 3 below shows the position of a port vis-à-vis other components of the supply chain. There are a number of activities that occur within a port, including:

- loading and unloading of cargo from ships – ie what we typically think of when we picture a port
- border management functions such as customs and biosecurity clearance
- loading and unloading of cargo from land transport modes such as road and rail.

Figure 3: The role of a port in an international supply chain



Ports often serve as significant pieces of economic infrastructure for cities, regions, and nations. First and foremost, ports allow local producers to reach larger markets overseas, and local consumers to access goods produced elsewhere. The presence or absence of a port in a region can therefore have a significant effect on the cost of doing business and the cost of living within a region.

Second, ports may make a significant economic contribution to a region in their own right[6]. They are important employers and, in the case of most New Zealand ports, sources of revenue for councils, and, under the right circumstances, can anchor or attract additional economic activity. For example, Singapore's economic development over the past 50 years has been deeply linked to its role as a major hub port for the Asia-Pacific region. It was able to benefit twice – first, from revenues earned from trade passing through the city, and second, from additional manufacturing and warehousing activity that sprung up as a result of its relatively low transport costs.

6. See eg Market Economics (2011), Economic Impacts of the Ports of Auckland Limited: 2010, 2021 and 2031.

2.2 The role of trade in the New Zealand economy

Overseas trade plays a critical role in the New Zealand economy. As a small, remote nation with limited domestic markets and significant agricultural capacity, trade underpins our economy. It opens up overseas consumers and supply chains for New Zealand businesses. This enables us to specialise in agricultural products, which serve as the backbone of our exports and provide the income to purchase the manufactured and consumer products we import. It also enables New Zealand businesses to specialise in innovation-intensive market niches in the global economy.

In terms of economic growth, exports are fundamental to our future prosperity, and export growth has been identified as a key priority both at a national and local government level (see the UNI local governments' economic development strategies and the government's Business Growth Agenda). The UNI region plays, and will continue to play, an important role in New Zealand's prosperity due to its a large and growing share of New Zealand's overall GDP, population and international merchandise trade.

To support these aspirations, ensuring the country has a robust transport and distribution network is key, and the country's port and port related infrastructure represents an important component of this supply chain.

At the same time, there is a perception of growing pressure on these infrastructure assets, particularly in Auckland, where concerns have been raised in relation to increasing competition with other users on the road and rail networks. In addition, there are growing questions about the appropriateness of having a port in central Auckland, and whether this is the best use of downtown waterfront land given the city's aspiration to be the world's most liveable and the fact that most of Auckland's manufacturing and distribution facilities are in south Auckland.

As a small, remote nation with limited domestic markets and significant agricultural capacity, trade underpins our economy.

2.3 Growth in world trade

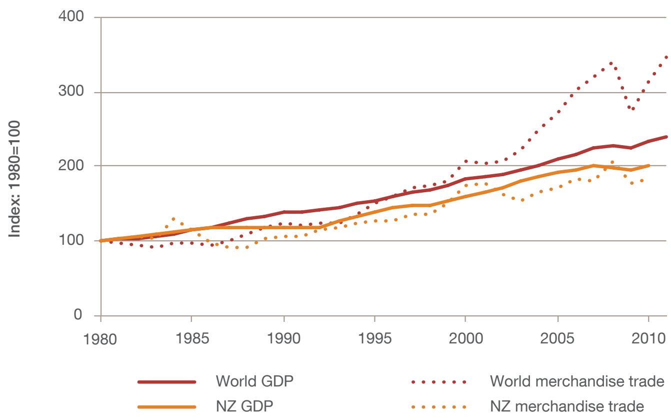
World trade has grown markedly over the last 30 years as the impact of globalisation has re-shaped the way the world has structured itself economically. Figure 4 compares GDP and merchandise trade value growth over the past three decades. Global trade growth has outpaced global economic growth significantly over the past decade. Merchandise trade growth in New Zealand has been less dramatic, however – it has generally kept pace with overall economic growth in recent decades[7].

Growth in trade over the last three decades, and in particular over the last decade, is a consequence of a number of underlying drivers including:

- the removal of trade barriers
- relatively stable political environments
- the mobility of capital
- the emergence of China and other emerging nations as sources of cheap labour (and the subsequent shift of lower skilled manufacturing into these countries)
- technological advances in shipping, including containerisation, which have significantly reduced the costs of trade.

Figure 4: Growth in GDP and merchandise trade value, NZ and world

NZ and world growth in GDP, merchandise trade value, 1980-2011



Source: World Bank

7. Note, however, that these figures do not account for trade in services, which has risen more rapidly than merchandise trade, albeit from a lower base.

2.4 Recent economic and population trends in the UNI

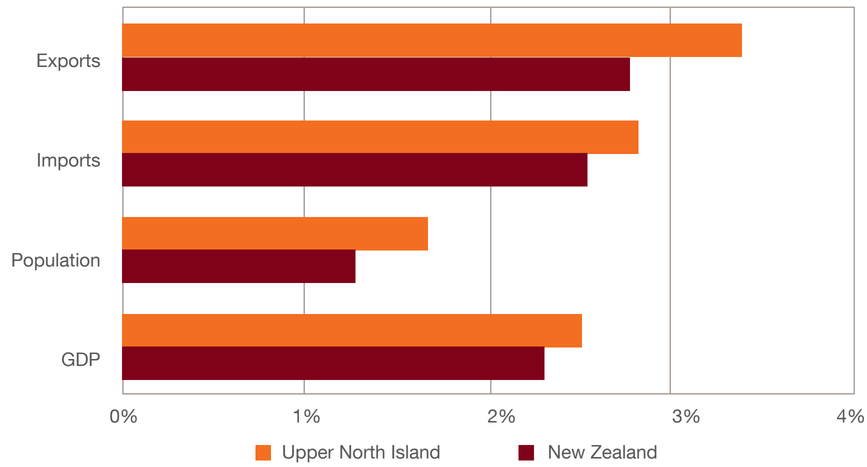
The UNI accounts for a large and growing share of New Zealand's overall GDP, population and international merchandise trade. As shown in Figure 5, the UNI's growth exceeded that of New Zealand as a whole from 2002 to 2012. This is expected to continue in the medium to long-term.

GDP, population and merchandise trade have grown faster in the Upper North Island:

- Both import and export weights have grown faster than GDP
- Exports have grown at double the population growth rate
- Imports have grown at 1.7 times the population growth rate

Figure 5: Recent trends in trends, population and GDP

Trends in trade, population and GDP in the last 10 years



Source: Statistics NZ, PwC analysis

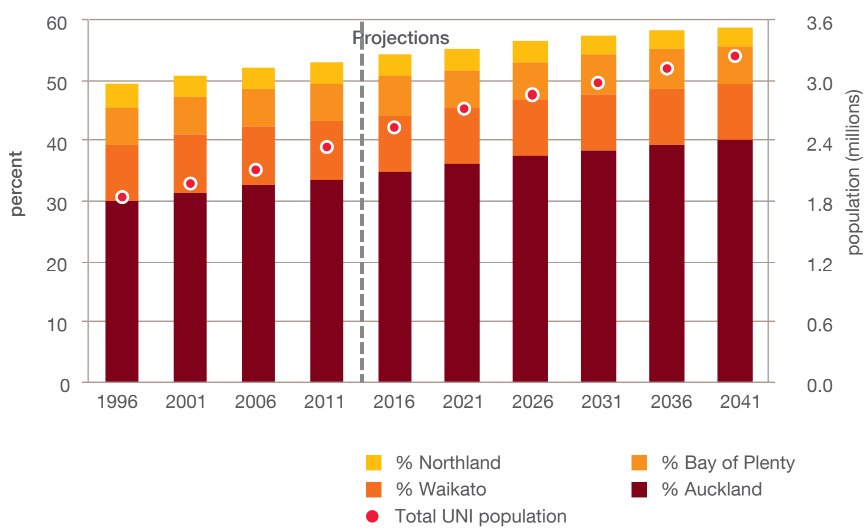
Current and future UNI Population

The UNI accounted for 53% of New Zealand residents in 2011. Its share of national population will increase in the future, as a majority of future NZ population growth is expected to occur in the region. Figure 6 presents historical and projected population growth of the UNI from 1996 to 2041. The growth projections are based on Statistics New Zealand projections of growth at a national level to 2061, and at a regional level to 2031.

The total population of the UNI is expected to grow from around 2.3m in 2011, to 3.3m in 2041. Auckland will dominate population growth in New Zealand, and is expected to account for around 40% of the country's population by 2041. In total, the UNI is expected to represent 59% of the New Zealand population by 2041, up from 53% today.

Figure 6: The Upper North Island will drive New Zealand population growth

NZ and world growth in GDP, merchandise trade value, 1980-2011



Source: Statistics NZ, PwC analysis

Context for this study continued

The Upper North Island economy

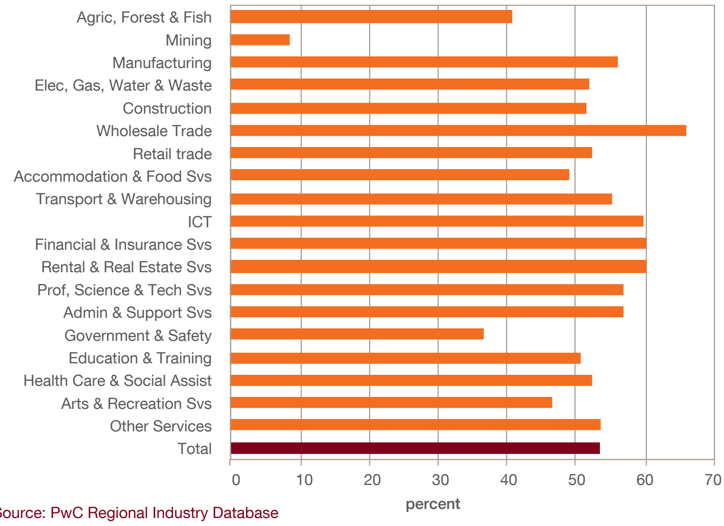
The UNI generated an estimated 53% of New Zealand GDP in the year to March 2011. In some industries, such as the wholesale trade sector, the UNI is even more important, with as much as 66% of GDP. These proportions emphasise the crucial role of the UNI in the New Zealand economy, and highlight the fact that throughput in the UNI ports is likely to continue to account for a larger than proportionate share (based on population) of New Zealand's total exports and imports.

Figure 7 shows the UNI share of national activity within 19 major industries, in terms of GDP, and displays average annual industry growth rates over the 2001-2011 period. We expect the UNI to continue to make up a large share of national GDP in most industries.

Over the last ten years, the fastest growing sectors in the UNI have been Information and Communications Technology (ICT), where GDP has increased 7.2% a year, doubling the sector's contribution since 2001. At the other end of the spectrum, primary production and manufacturing have not seen strong GDP growth despite strong growth in export weights. These facts probably hide a story of strong dairy farming and dairy manufacturing growth at the expense of sheep and beef; a wood sector that battled for several years and is only now recovering; and a long-term trend of manufacturing moving to countries with lower labour costs that has been exacerbated in recent years by a high exchange rate and global downturn.

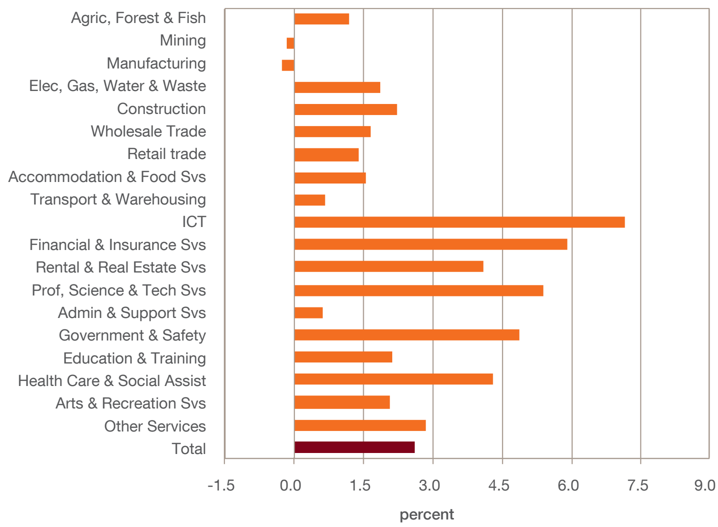
Figure 7: The upper North Island dominates New Zealand GDP, and has grown strongly since 2001

Upper North Island share of New Zealand GDP by industry



Source: PwC Regional Industry Database

Upper North Island GDP growth by industry (2001 to 2011)



Source: PwC Regional Industry Database

Major Upper North Island industries

Another factor that will affect demand for trade through the UNI ports is the composition of the local economy, which requires imports to produce some of its products for domestic consumption, and which exports large weights of mostly primary products and processed primary products.

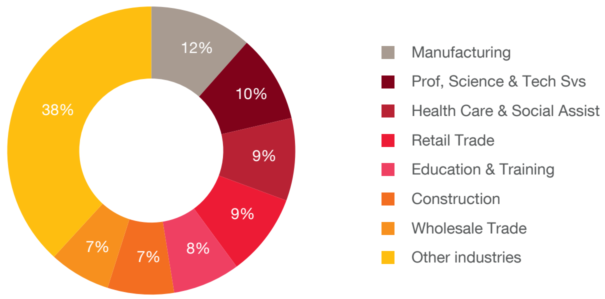
Given the dominant role Auckland plays in the UNI and the New Zealand economy, it is unsurprising that primary industries (such as forestry) do not appear among the largest eight industries. However, manufacturing (which includes manufacturing of dairy, beverage, timber and pulp products) is the most important single sector, with 12% of employment.

Other industries typically associated with urban centres, such as professional, scientific and technical services; health care and social assistance; retail trade; education and training; and wholesale trade dominate the employment picture. Some of these industries account for significant import demand. In particular, the retail and wholesale trade sectors are major importers of a variety of products that rely on the UNI ports.

As discussed in more depth in Section 4, a large share of international trade in the UNI is accounted for by three industries: wood, dairy, and petroleum refining. Wood and dairy also account for a significant proportion of freight within the region.

Figure 8: The Upper North Island has a wide mix of major industries

Upper North Island major industries (FTEs)



Source: PwC Regional Industry Database

Manufacturing is the most important single sector, with 12% of employment.

3

Background to projections

Background to projections

This section provides an in-depth background to our projections of future demand for the UNI ports.

3.1 Definitions

To measure current port task and make projections for future port task growth, it was necessary to choose appropriate and relevant measures and definitions of the port task. Here, we describe our key measures:

- We measure cargo in terms of weight rather than value, as weight of cargo is a better indicator of the size and number of vessels, trucks, trains, wharfs, cranes, and other infrastructure required
- We define three categories of cargo passing through UNI ports: outside-port cargo, which leaves the port gate to the surrounding region (or vice versa), exchanges, which transit through the port without leaving it, and throughput, which includes both outside-port and exchange cargo.

Weight versus value

Freight is commonly measured in one of three ways:

- According to the dollar value of the cargo. This is a commonly-reported measure as it enables comparisons to be made between the size of a nation's economy and its overseas trade (eg export-to-GDP ratios). However, it does not provide an accurate picture of the port task due to the fact that two commodities of an equal weight may have very different values.
- According to the weight (in tonnes) of the cargo. For many classes of cargo (eg bulk and breakbulk commodities that can easily be measured by weight), ports charge according to the weight of the cargo. We have used this measure in our calculations as it enables us to compare quantities across different types of commodities and cargoes. Statistics New Zealand publishes data on import and export cargo weights, based on Customs lodgement forms.
- According to the volume of the cargo. Ports charge according to volume for many classes of cargo, and trade data is occasionally published in terms of volumes. For example, containerised cargo is usually reported in terms of twenty-foot equivalent unit (TEU) containers, and log exports are usually reported in cubic metres. Volume data is less comparable between different cargoes.

Comparing our measures of port task with government and council objectives

Central government and councils have set strategies for driving economic development through export growth (see eg the Government's Business Growth Agenda and the Auckland Plan). The analysis in this report does not reflect upon these policy objectives for three reasons:

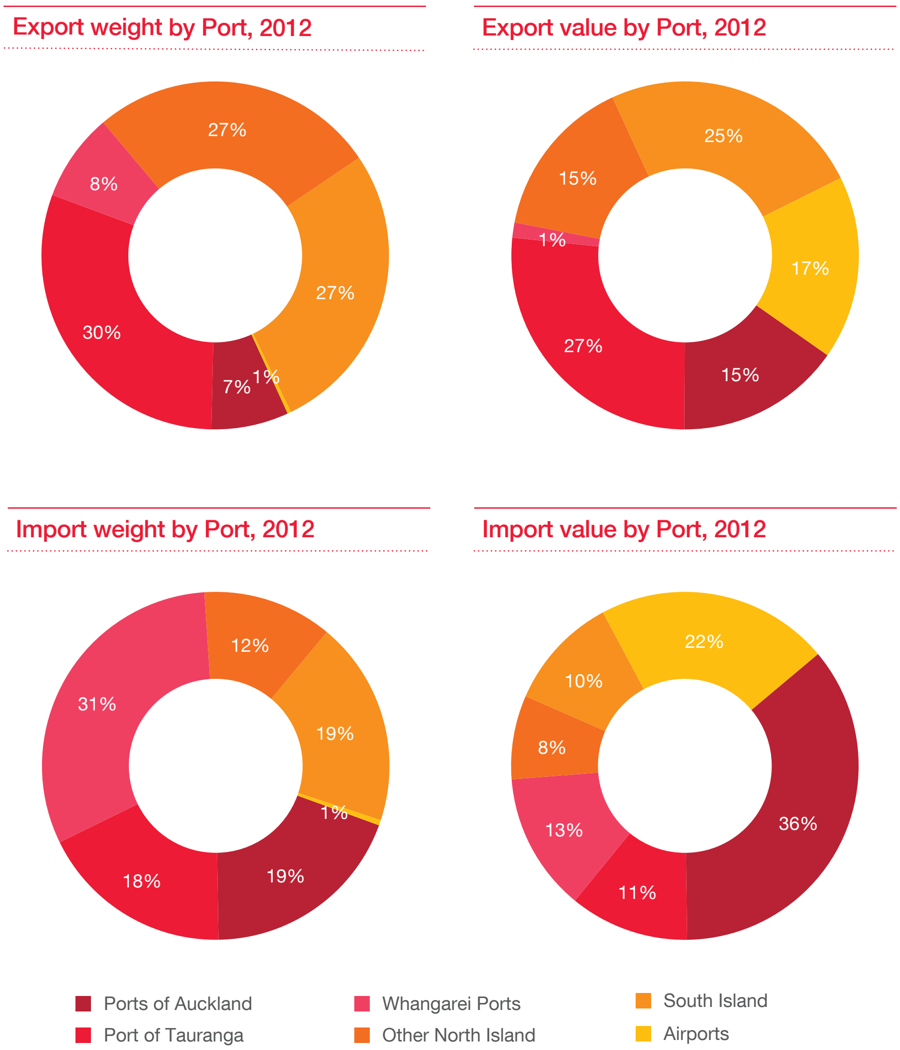
1. our analysis is based on weight not value
2. we exclude all exports through airports, which accounted for 17% of export value in 2012
3. we consider merchandise trade only and exclude service exports, which accounted for 21% of exports in 2011 according to World Bank statistics
4. we expect the relationship between trade weights and trade values to change over time, as trade in high-value/low-weight products is likely to grow.

Our projections of future port demand are based on freight weight due to the fact that it is a comparable measure that captures the total quantity of goods that must be moved through ports. While we expect the relationship between trade weight and value may change over time if and as New Zealand exports more higher value products, we do not believe this has a readily predictable impact on the weight-based freight task.

Comparing weight and value measures

Because different commodities differ in value, trade weight and trade value are not always correlated. For example, the following charts show that New Zealand's airports account for a significant share of the total value of exports and imports in spite of the fact that they account for less than one percent of the weight of imports and exports. Conversely, the ports at Whangarei account for a larger share of New Zealand's total trade weight than trade value due to the fact that they specialise in relatively heavy, low-value commodities.

Figure 9: Trade weights and values by port, 2012



Source: Statistics NZ, PwC analysis

While UNI ports still account for a large share of export and import trade weights, the role of airports in particular in facilitating trade in high value items means the share of trade accounted for by the UNI ports in value terms is lower. The three ports account for 43% of export values and 60% of import values, compared with 45% of export weights and 68% of import weights. The role of Northport in particular is far lower for trade values than for weights, given the lower dollar per tonne value of wood and oil products.

Furthermore, the average value of a kilogram of overseas cargo varies considerably between ports. Figure 10 shows the average value per tonne of product imported or exported through the UNI ports, the lower North Island and the South Island. Auckland has the highest value per kilogram for both exported and imported commodities, at nearly $3.40 a kilogram and $4.30 a kilogram respectively. Exports through Whangarei, which are predominantly wood products, average around $0.30 a kilogram, while imports (mainly of fuel products) average around $1.00[8]. The other ports fall somewhere in the middle.

Goods transported by air tend to be far more valuable per kilogram. The average value of air freight exports is around $84 a kilogram, and $101 for imports. Air freight offers faster service at a higher cost and as a result tends to get used for more expensive, time-sensitive goods.

Outside-port cargo, exchanges, and throughput

The function of a port is to load and discharge cargo from oceangoing ships. Depending upon the origin and destination of the cargo, there are several ways in which cargo can move through a port. We define three broad categories of cargo movements:

- ***Outside-port cargo*** moves into the port from sea and out by land, or vice versa. It is the weight of goods that have final origins or destinations inland of the port.

  Outside-port volume is the best measure of infrastructure requirements inland of the port, such as the rail and road capacity required to move cargo to and from its final destination.

- ***Cargo exchanges*** enter and exit the port by sea. They transit through the port without leaving the port gate.

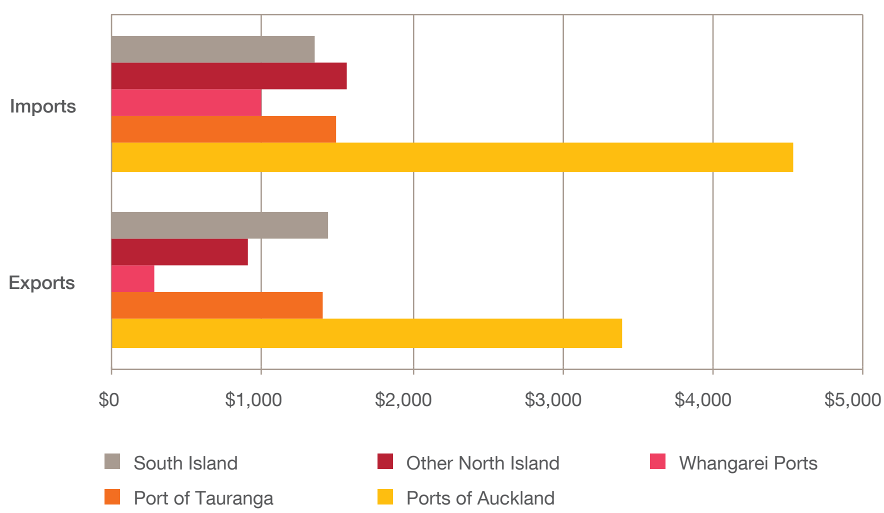
  Exchanges have an impact on port infrastructure requirements but have no effect on land transport infrastructure.

- ***Throughput*** includes both outside-port cargo and exchanges. It measures the total amount of cargo that is loaded or discharged at a port.

  Throughput is the best measure of infrastructure requirements at the port itself, including the number of cranes required to move containers on and off ships, the amount of port land required to store cargo, etc.

Figure 10: Average value per tonne is highest through POA

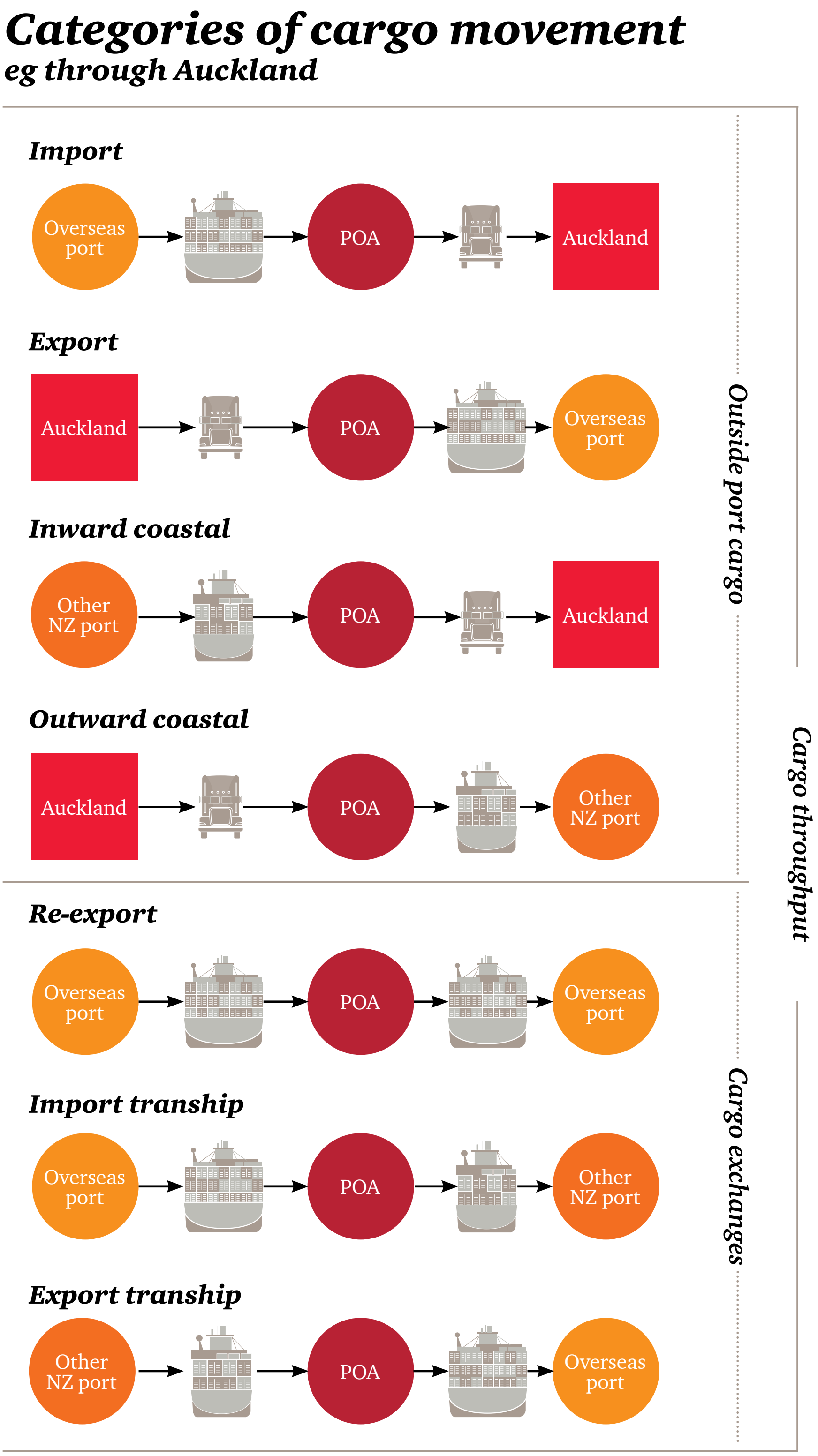
Value per tonne (NZ$), imports and exports



Source: Statistics NZ, PwC analysis

8. This value is almost identical to the 2012 price of crude oil.

Figure 11: Categories of cargo movement



Not all of these cargo movements will have the same impact on port and port-related infrastructure. For example, re-exports require no infrastructure outside of the port gate, as they are moved off one international cargo ship and transferred to another without leaving the port. On the other hand, imports will have an impact on land transport infrastructure, as they pass through the port to the local market.

The impacts of various types of cargo movement on port and land transport infrastructure are summarised in Table 1 overleaf. Only two categories – international trade (imports and exports) and domestic coastal movements (inward and outward) – require both port and inland infrastructure within the region of the port. The other categories of movement take place entirely within the port.

Table 1: Infrastructure requirements of different cargo movements

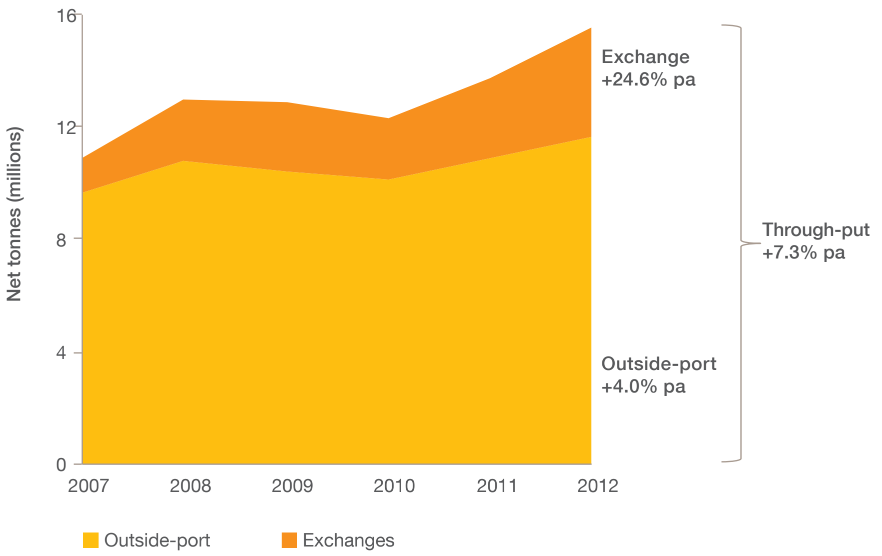
Inward	Outward	Infrastructure
Imports	Exports	Port and land transport
Domestic coastal inward	Domestic coastal outward	Port and land transport
Import tranships	Export tranships	Port only
Domestic leg of export tranships	Domestic leg of import tranships	Port only
International tranships	International tranships	Port only

Recent growth in outside-port container cargo and container throughput

In recent years, cargo exchanges appear to have grown considerably more rapidly than outside-port cargo. Based on data on container volumes from POA and POT, outside-port container cargo grew at a rate of 4.0% per annum from 2007 to 2012. However, container exchanges grew at a rate of 24.6% per annum over this period. As a consequence, container throughput grew at an average rate of 7.3% per annum – considerably more rapidly than outside-port volumes.

Figure 12: Growth in container volumes at POA and POT, 2007-2012

2007-2012 Growth in UNI container volumes



Source: POA, POT

3.2 Current trends in UNI international trade

Figure 13 summarises recent growth in export and import weights through New Zealand ports, including the UNI ports. National and UNI export weights have fluctuated over the last decade, falling between 2002 and 2007 before growing significantly in the five years to 2012. During this time, the UNI ports' share of national exports ranged from 42% to 46%. Import weights, on the other hand, have grown more steadily, in part because they are linked to population growth. The UNI ports have dominated national import weights – their share ranged from 67% to 71% of the total.

In 2002, New Zealand ports exported just under 25 million tonnes. Of this, around 43% passed through the UNI ports. Export weights declined over the five years to 2007, led by declines in the UNI, which saw the area's share of exports fall to a little under 42%. By 2012, export trade had rebounded on the back of improved wood and dairy exports, reaching nearly 32m tonnes, of which nearly 46% was through the UNI ports.

National import weights have grown from just over 15m tonnes in 2002 to over 19m tonnes in 2012. UNI import weights have grown in line with this overall trend. However, the UNI's share of total import weights has fluctuated from year to year. In 2002, the UNI ports accounted for two-thirds of import weights. This share rose to 71% in 2007, before declining slightly to 68%.

Over the last decade, UNI exports weights have grown from 10.5m tonnes to 14.6m tonnes. This represents growth of 3.4% per annum. Half of the total growth – 2.1m tonnes – was accounted for by increased log exports. UNI imports grew less rapidly over this period, from 10.0m tonnes to 13.2m tonnes. This represents growth of 2.8% per annum. The majority of this growth was accounted for by imported mineral fuels (an additional 1.2 million tonnes) and animal feed & pet food (an additional 1.0m tonnes).

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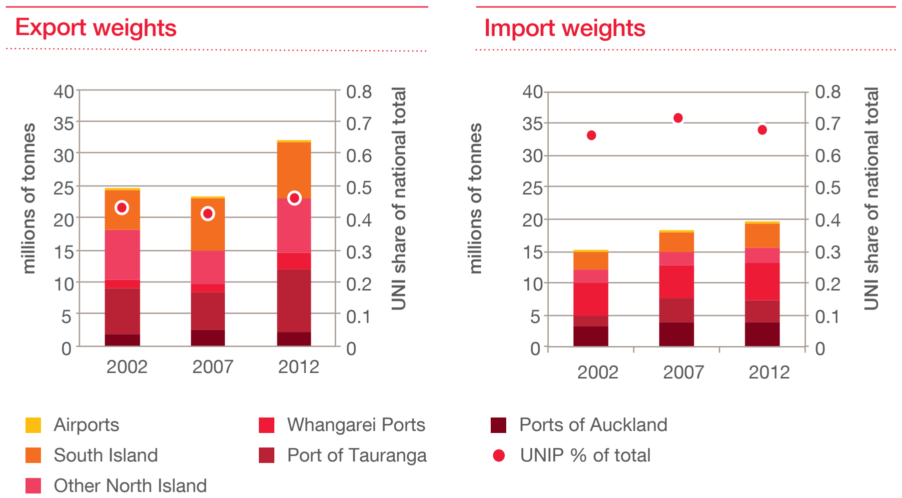
Figure 13: Recent growth in UNI export and import weights



Source: Statistics NZ, PwC analysis

3.2.1 The role of the UNI ports

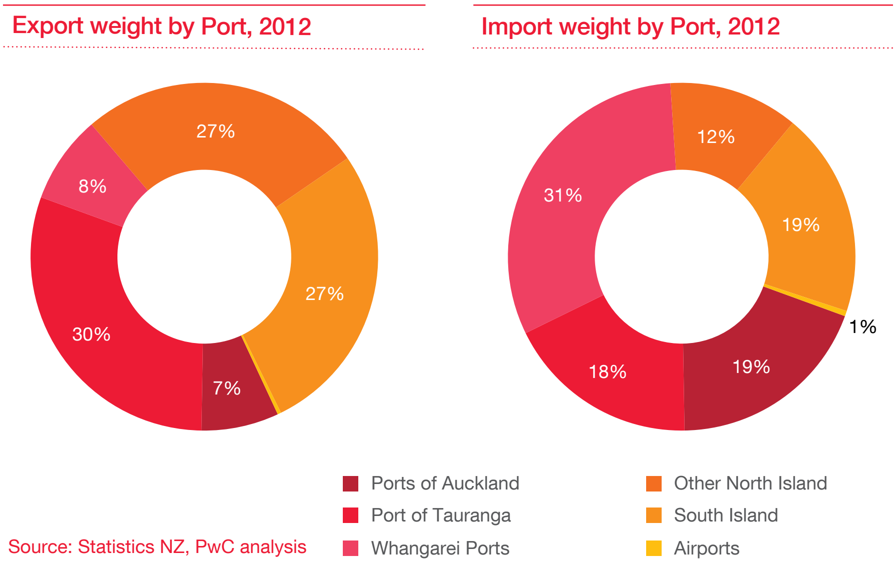
Share of freight exports and imports

Figure 14 shows the distribution of export and import weights across the UNI ports, the Lower North Island and the South Island.

The three UNI ports accounted for 45% of New Zealand's total freight export weights in 2012. 30% of national export weights were shipped through POT alone. The three UNI ports are even more important to national imports, with 68% of total weights in 2012. The Whangarei ports, which include the Marsden Point refinery's oil terminal, accounted for 31% of import weights on their own. This reflects Whangarei's national role in oil refining and distribution.

Only 1% of export and import weights are transported by air. The majority of the country's air freight moves through Auckland International Airport.

Figure 14: Upper North Island ports dominate import weights



Source: Statistics NZ, PwC analysis

Seasonality

Figure 15 illustrates the extent to which UNI ports' freight weights are affected by seasonality. It shows the average monthly deviation from annual average freight weights from 2000 to 2011.

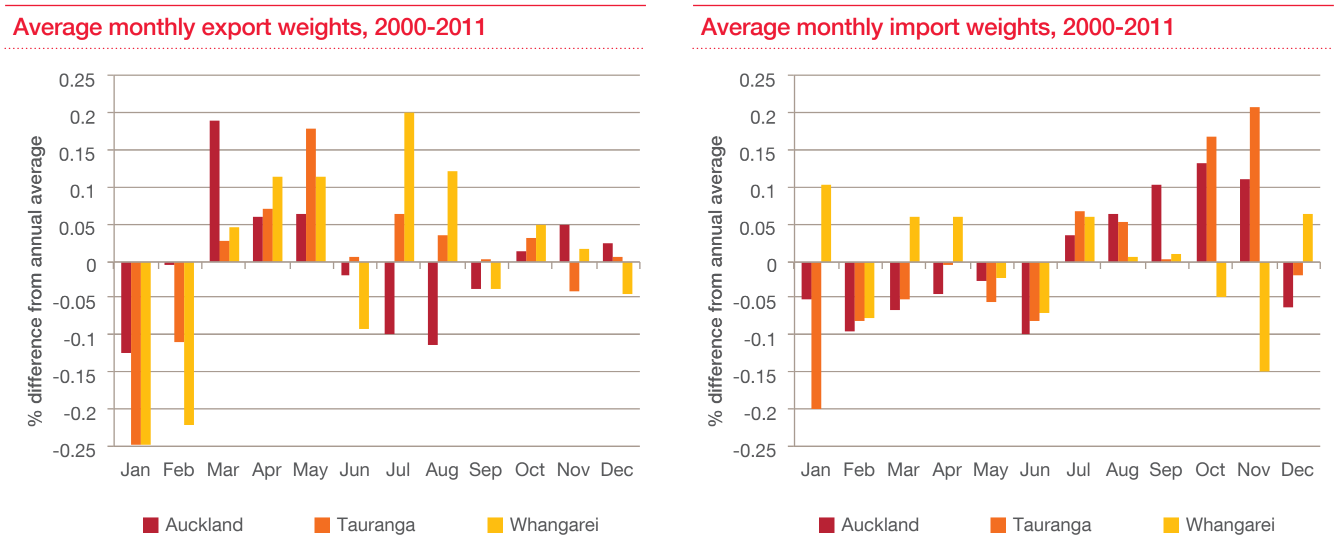
There is some degree of seasonality in import and export weights passing through Upper North Island ports. Exports from the UNI region peak between the months of March and May. This is likely to be driven by seasonal patterns in agricultural production. While there are variations between the ports, January and February tend to be trough months. Average export weights in peak months tend to be roughly 20% higher than annual average export weights.

Import weights are more consistent year-round. Imports to Auckland and Tauranga peak between the months of September and November. This is likely to be driven by retail importers stocking up inventory prior to the Christmas shopping season. Imports to Whangarei have a slight peak in January, likely in response to summer demand for fuel. Troughs in monthly import weight are less pronounced.

Overall, it appears to be the case that UNI imports and exports experience some regular seasonality. In the busiest months, demand for port facilities may be as much as 20% above average in months of peak demand and 20% below average in the troughs. This is likely to affect estimates of infrastructure requirements at and inland of the UNI ports.

According to analysis from the NZ Shippers Council, New Zealand's containerised trade experiences similar seasonal variation to the UNI's overall trade[9]. Peak container export volumes during the summer months (February-April) were approximately 17% higher than the annual weekly average. Seasonality in container import volumes was less pronounced, with peaks of up to 15% higher than the annual weekly average in the months leading up to Christmas (September to November).

Figure 15: Seasonality in freight weights through Upper North Island ports



Source: Statistics NZ

9. New Zealand Shippers Council (2010), "The Question of Bigger Ships".

3.2.2 Key products

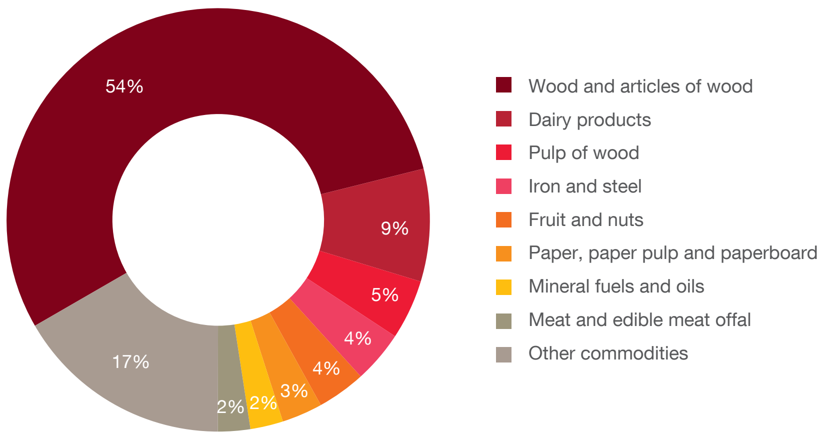
Figure 16 presents the main products exported through the UNI ports in the year to March 2012. Export weights were concentrated in a small number of product categories. The top three categories alone - wood products, dairy products, and wood pulp – accounted for more than two-thirds of the UNI's total. The top eight categories made up 83% of UNI export weights.

Wood products – largely bulk log exports – were the largest single category, with 7.9m tonnes of exports, or 54% of total UNI exports. Dairy products were the second-largest category, with a further 8.6% of exports, and wood pulp products accounted for a further 4.6% of exports.

Figure 17 shows the products imported through the UNI ports in the year to March 2012. The region's import weights are spread across a wider range of products than its exports. The top eight product categories accounted for 76% of total import weights. Mineral fuels were the single largest category, with 6.4m tonnes of imports, or 49% of total UNI import weights. Animal feed and pet food was the second-largest category, accounting for 8% of import weights (1.1m tonnes). Animal feed imports are linked with strong dairy farming growth, which has pushed up the demand for palm kernel extract feed.

Figure 16: Wood dominates export weights

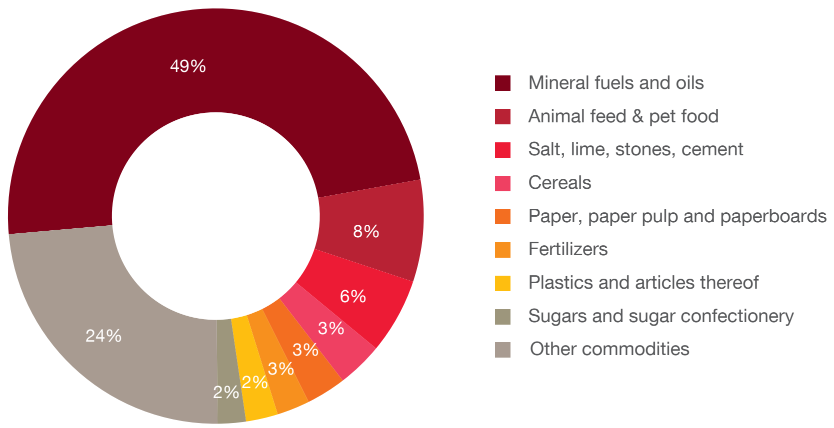
UNI Ports major export commodities 2012



Source: Statistics NZ, PwC analysis

Figure 17: Mineral fuels dominate import weights

UNI Ports major import commodities 2012



Source: Statistics NZ, PwC analysis

Major commodities by port

Figure 18 shows the major commodities exported through each of the three Upper North Island ports[10].

Dairy products provide the largest portion of exports through POA, at 21% in 2012 (473,000 tonnes), followed by wood, iron and steel, and beverages. A variety of other commodities are also exported in large quantities.

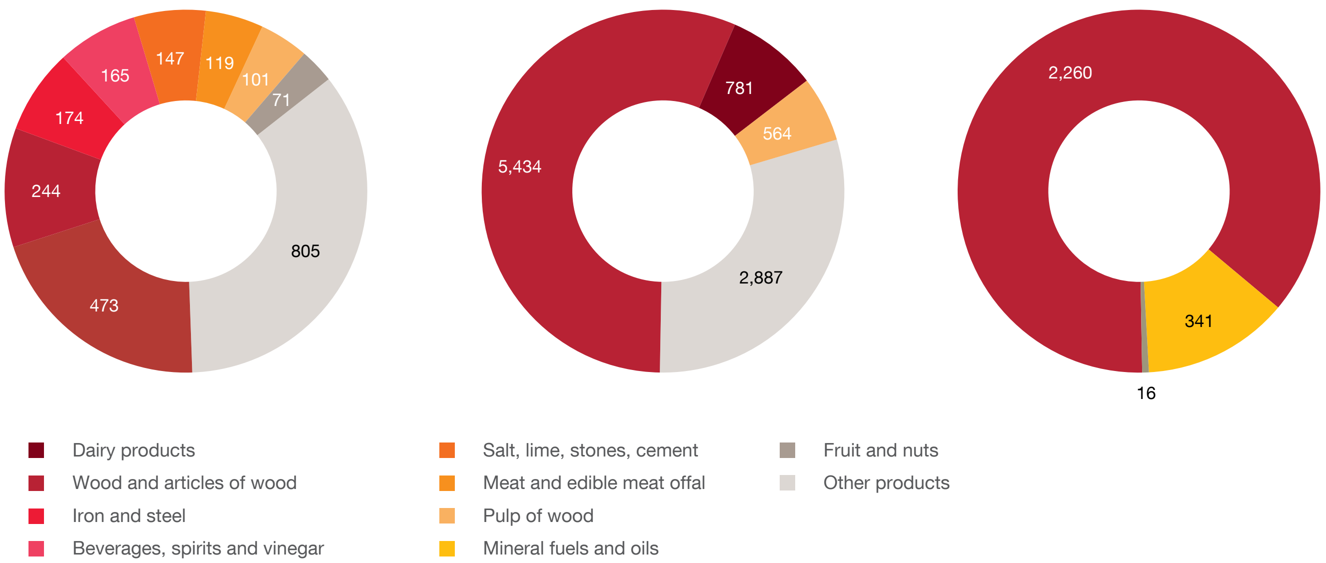
POT and the Whangarei ports, on the other hand, are dominated by a few major commodities. Nearly 90% of export weights through Whangarei (2.3m tonnes) are of wood products, along with 56% of exports through POT (5.4m tonnes). Dairy plays a far smaller role in POT, while fuel exports are also an important part of exports through Whangarei.

Figure 18: The Upper North Island ports have varied export profiles

Ports of Auckland Exports, 000 tonnes, (2012)

Ports of Tauranga Exports, 000 tonnes, (2012)

Ports of Whangarei Exports, 000 tonnes, (2012)



Source: Statistics NZ, PwC analysis

10. Note again that weights for the Whangarei ports include those passing through Portland and Marsden Point.

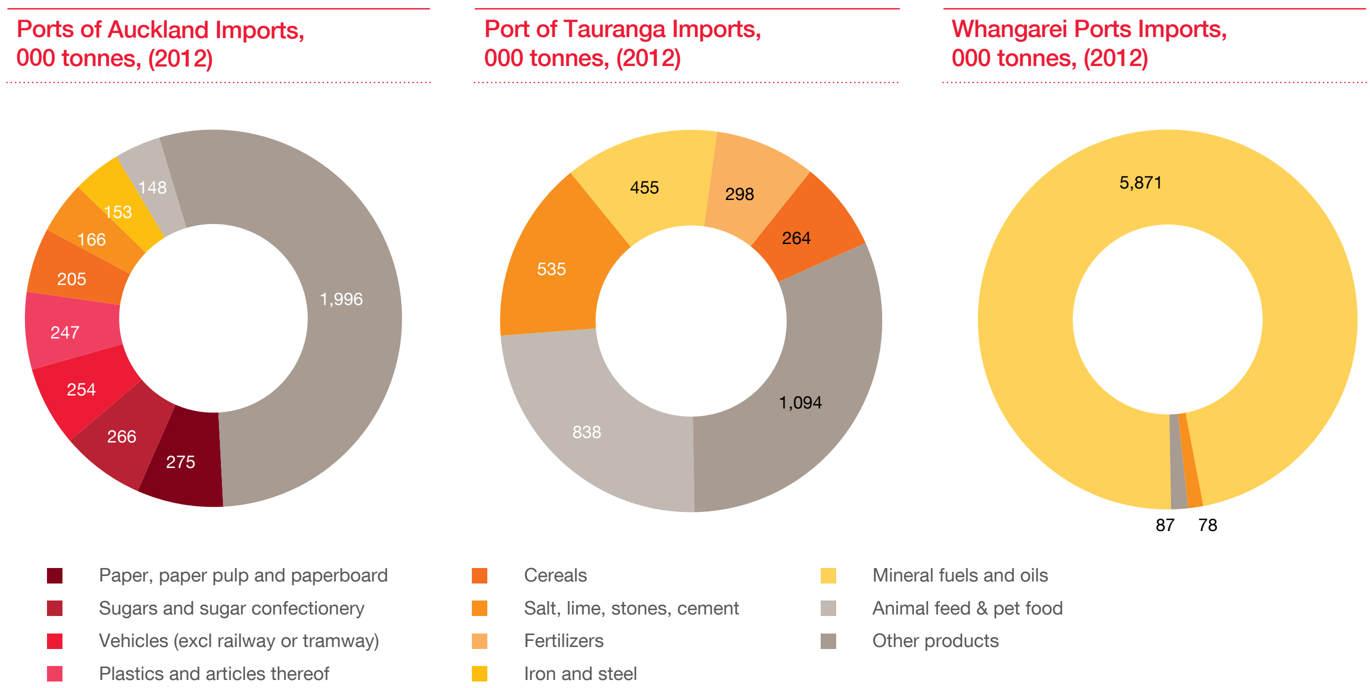
Background to projections continued

Figure 19 shows the import profile of each of the three UNI ports in 2012.

Once again, the variety of products imported through POA is far wider than through the other ports. The eight most important import products in weight terms account for just 46% of imports at POA (1.7m tonnes). At POT, on the other hand, animal feed and pet food alone account for one-quarter of import weights (838,000 tonnes), followed by salt and building materials, fuels, fertilisers, and cereals, together weighing 1.6m tonnes.

Nearly all imports to Whangarei are mineral fuels coming through New Zealand Refining Company's Marsden Point wharf. The 5.87 million tonnes of crude oil imports handled at Marsden Point in 2012 accounted for 44% of all import weights through the UNI ports. Building materials such as gypsum shipped to Golden Bay Cement at Portland account for much of the remaining imports to Whangarei.

Figure 19: POA and POT have more varied import profiles than Northport



Source: Statistics NZ, PwC analysis

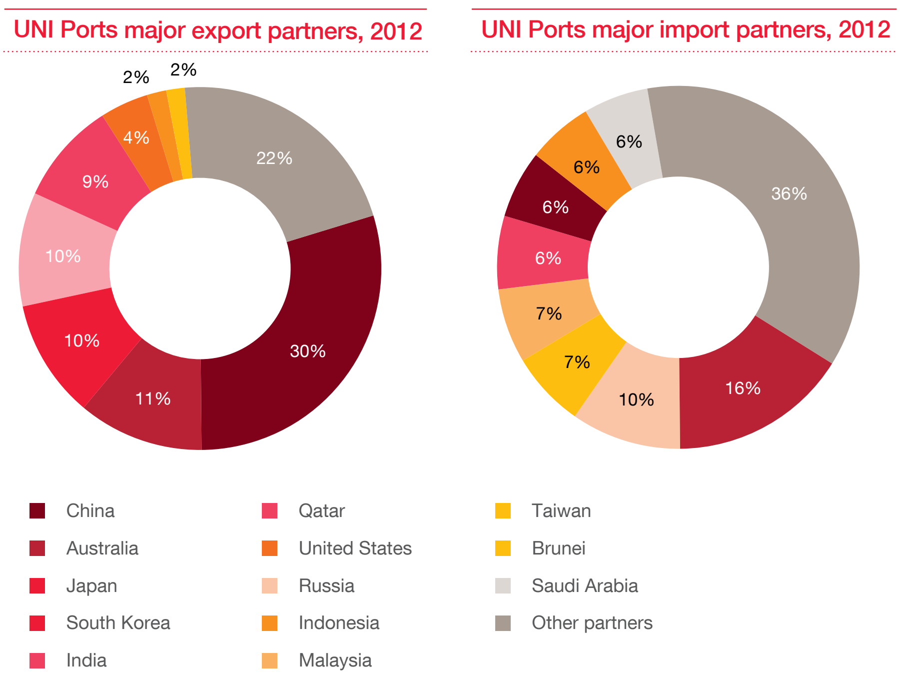
3.2.3 Key trading partners

Figure 20 shows the major trading partners for UNI ports in the year to March 2012. The majority of the UNI's trade, by weight, now takes place with other countries in the Asia-Pacific region. None of our top eight import or export partners are European[11]. Although our main trade partners are now closer to us, they are still distant: only Australia is located within 3,000 kilometres.

Export trade partners, by weight, were relatively concentrated compared with import trade partners. The UNI's top five export partners accounted for 70% of export weights in the year to March 2012. China alone accounted for nearly one-third of UNI ports export weights, followed by Australia, Japan, South Korea and India.

Import weights came from a considerably wider range of sources. The top five import partners accounted for 46% of import weights in the year to March 2012, and no country dominated to the same extent as China did on the exports side. Several of New Zealand's major import partners in 2012 – Russia, Brunei, Qatar and Saudi Arabia – were primarily fuel exporters to New Zealand. We do not expect these countries to remain the same from year to year, as crude oil is imported from different locations depending upon price.

Figure 20: The UNI exports to a small group of trading partners and imports from more diverse sources



Source: Statistics NZ, PwC analysis

11. While we import large volumes of mineral fuel from Russia, we consider it to fall within Asia.

3.2.4 Trading partner-commodity pairs

Table 2 shows the major trading partner-commodity pairs for Upper North Island port exports in 2012. The ten largest pairs are shaded orange.

Given the key role played by wood exports, it is unsurprising that several cells in the wood articles row are shaded orange. Wood exports to China account for almost one quarter of all export weights on their own. Japan, South Korea and India wood exports account for a further quarter. This suggests that growth in a large share of New Zealand's future export weights will be linked to economic growth in Asia.

Table 2: Export weights are dominated by wood products

Upper North Island Ports Exports 2012 (000 tonnes)	China	Aust -ralia	Japan	South Korea	India	United States	Indo -nesia	Taiwan	Thai-land	Other coun-tries	Grand Total
Wood and articles of wood	3,566	180	1,218	1,181	1,169	105	41	81	88	309	**7,938**
Dairy products	214	55	58	25	9	18	42	38	34	760	**1,254**
Pulp of wood	253	77	3	114	22	0	72	20	34	68	**665**
Iron and steel	9	159	23	19	16	121	19	9	2	202	**581**
Fruit and nuts	37	40	71	28	5	45	4	33	8	269	**540**
Paper, paper pulp and paperboard	54	185	0	21	8	20	7	16	9	134	**454**
Mineral fuels and oils	0	322	20	0	0	0	-	-	0	23	**365**
Meat and edible meat offal	12	4	13	25	-	122	15	14	1	153	**360**
Beverages, spirits and vinegar	3	138	2	5	0	72	0	0	0	124	**344**
NZ miscellaneous provisions	5	104	1	4	85	1	2	9	1	92	**305**
Salt, lime, stones, cement	1	17	0	6	1	4	1	2	2	228	**262**
Vegetables and certain roots (edible)	1	18	21	6	-	5	3	2	0	108	**163**
Fish & aquatic invertebrates	24	5	7	5	0	13	0	1	3	70	**127**
Animal feed & pet food	11	2	1	1	0	14	29	5	3	28	**94**
Cereals, flour, starch & milk preparations	16	32	1	2	0	0	2	5	8	23	**89**
Other products	109	299	99	39	19	91	13	5	9	357	**1,041**
Grand Total	**4,314**	**1,636**	**1,539**	**1,482**	**1,334**	**631**	**252**	**241**	**203**	**2,949**	**14,581**

Source: Statistics NZ, PwC analysis

Table 3 shows the major trading partner-commodity pairs for UNI port imports in 2012. The ten largest pairs are shaded orange.

With nearly 50% of import weights, mineral fuel-related pairings are key. As mentioned previously, there is significant fluctuation in mineral fuel import weights by country over time; oil is imported from a variety of countries based on needs, with one source easily replaceable by another. As a result, not too much should be read into the fact that Russia is currently a major import partner. As much as 99.9% of all imports from Russia are mineral fuels, which could be imported from a different trading partner in future.

Table 3: Import weights are dominated by fuel imports

Upper North Island Ports Exports 2012 (000 tonnes)	Aust -ralia	Russia	Brunei	Mala -ysia	Qatar	China	Indo -nesia	Saudi Arabia	Oman	Other coun-tries	Grand Total
Mineral fuels and oils	61	1,299	893	348	801	1	253	717	538	1,515	**6,425**
Animal feed & pet food	150	-	-	389	-	1	386	-	-	125	**1,050**
Salt, lime, stones, cement	290	-	-	2	-	41	10	1	-	435	**778**
Cereals	443	-	-	0	-	0	-	0	-	26	**470**
Paper, paper pulp and paperboard	166	0	-	8	-	52	30	-	-	152	**408**
Fertilizers	45	1	-	0	58	35	29	23	16	130	**338**
Plastics and articles thereof	55	-	-	18	4	43	4	14	-	189	**329**
Sugars and sugar confectionery	180	0	-	4	-	7	0	0	0	99	**291**
Vehicles (excl railway or tramway)	20	0	-	0	-	15	0	0	-	228	**264**
Iron and steel	61	0	-	1	-	17	6	0	-	112	**197**
NZ miscellaneous provisions	57	0	-	9	0	17	4	-	-	86	**173**
Appliances, agri & industrial machinery	9	0	-	3	-	41	1	0	-	111	**165**
Beverages, spirits and vinegar	75	0	-	1	-	3	0	0	-	79	**159**
Glass and glassware	26	-	-	1	-	30	6	5	-	82	**149**
Iron or steel articles	27	0	-	3	-	73	0	6	-	36	**146**
Other Products	444	0	0	89	0	423	42	1	0	889	**1,889**
Grand Total	**2,111**	**1,300**	**893**	**878**	**864**	**799**	**772**	**768**	**554**	**4,293**	**13,230**

Source: Statistics NZ, PwC analysis

3.3 Current port and shipping trends and their effects

In this subsection, we consider trends in international shipping and ports, including the deployment of larger ships, port hubbing, and changes to port technology.

3.3.1 How does freight move in and out?

New Zealand's international shipping market

New Zealand's overseas sea freight is heavily concentrated. As of 2009, five international shipping lines handled approximately 77 percent of total freight[12]. Maersk was the largest single shipper, moving 30% of New Zealand's trade, followed by Hamburg Sud (17%), MSC (12%), ANL/CMA CGM (10%), and Hapag Lloyd (8%).

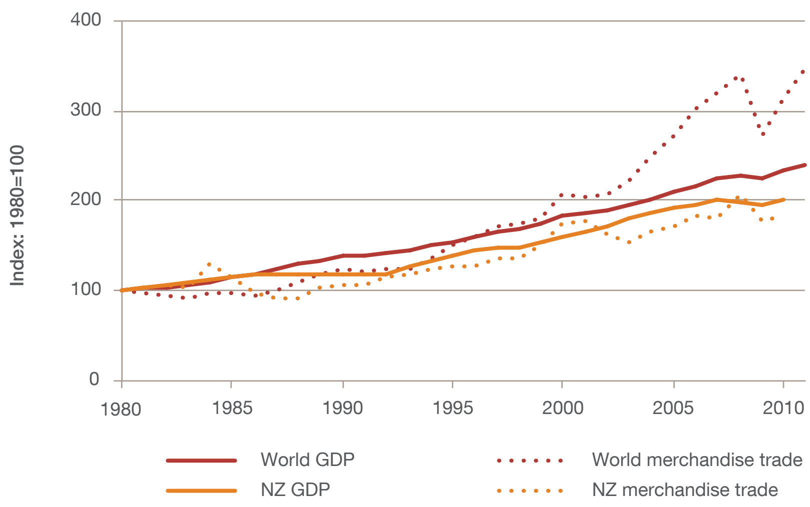
The shipping lines operate in a competitive environment and face commercial incentives to provide capacity in response to demand. While they are permitted by the Commerce Act and Shipping Act to cooperate in a limited fashion through discussion agreements and operational cooperation[13], they must compete with each other for cargo. Opportunities for collusion on price or line capacity are limited by this competition[14].

The supply of shipping is relatively inelastic, as capacity cannot be added or removed from the market without significant time and expense. As a result, small changes in global shipping demand can produce large shifts in the fortunes of shipping lines. This was illustrated in the wake of the 2008 global financial crisis.

As shown in Figure 21, global trade volumes grew rapidly in the 1990s and 2000s, outpacing global GDP growth. During this period, shipping lines aggressively invested in new capacity. However, global trade volumes fell sharply in 2008 and 2009 as a result of the global financial crisis before rebounding in subsequent years.

Figure 21: NZ and world growth in GDP and merchandise trade

NZ and world growth in GDP, merchandise trade value, 1980-2011



Source: World Bank

12. Auckland Regional Holdings, "Long-term Optimisation of the New Zealand Port Sector", October 2009
13. Discussion agreements allow shipping lines to exchange information on their current cargo capacity and prices but do not allow them to collectively set prices or capacity. The operational cooperation permitted by the Acts allows one shipping line to move cargo on a boat owned by another shipping line at market rates.
14. For a more in-depth discussion, see Productivity Commission (2012), "International freight transport services inquiry final report".

Shipping lines were adversely affected by the crash in trade volumes and have since undertaken consolidations and restructuring of shipping capacity in order to restore profitability. Shipping lines appear to have responded relatively quickly to the challenges posed by the global financial crisis. This is especially apparent in comparison with the shipping industry's slow response to a similar fall in trade volumes in the early 1970s[15]. Shipping lines have rationalised via mergers, decommissioning of older, smaller, and more expensive ships, slow steaming to increase utilisation and cut costs. This has led to a quick return to profitability – after losing US$19.5bn worldwide in 2009, shipping lines earned US$17bn in 2010 and an estimated US$8bn in 2011[16]. In spite of this, the full effects will take a number of years to be felt.

Although shipping lines are currently cutting smaller container ships, such as those currently serving New Zealand trade routes, in favour of larger, more cost-effective ships, this does not mean that New Zealand will lose cargo capacity. If one shipping company cuts services, others are likely to add capacity in response to the commercial opportunity. These effects are discussed more below.

The trend toward larger ships

Shipping lines will deploy larger ships on New Zealand trade routes if and when demand warrants it. As container volumes are expected to continue growing strongly, this is likely to occur in the short to medium term. At this point, ports will need to invest in order to accommodate larger ships.

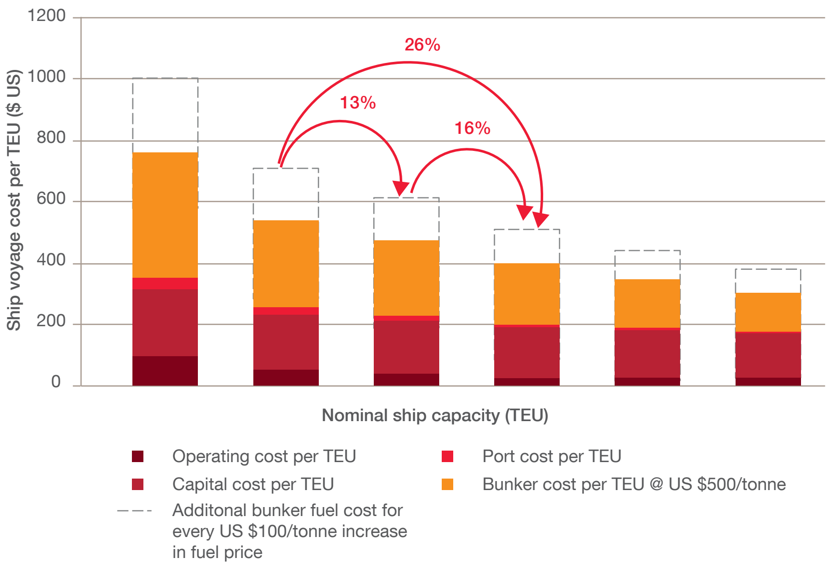
Conversely, however, shipping lines are expected to continue serving NZ directly with smaller ships in the interim. As long as there is strong demand from New Zealand importers and exporters – which will continue to be the case – there will be a commercial rationale for direct services. As a result, NZ importers and exporters do not face any significant risks associated with the timing of ports' investment in larger ships.

15. See NZIER (2010), "Freight futures" for a more in-depth discussion of long-term trends in the shipping market.
16. United Nations Conference on Trade and Development (2011), "Review of Maritime Transport".

Background to projections continued

Figure 22: Cost reductions form larger ships

Ship voyage cost per TEU for various ship sizes for a weekly New Zealand to Singapore services



Analysis based on:

- Average sailing speed of 20 knots for all ship sizes except the 1200 TEU ship (which is assumed to sail at its maximum design speed of 18.3 knots
- Current bunker fuel price of approximately US $500 per tonner;
- Shipping companies owning their own ships, rather than chartering ships; and
- Average inbound ship utilisation (based on full payig containers) of 60%, and outbound utilisation of 86%

Source: NZ Shippers' Council

There is an international trend towards larger container ships due to the cost efficiencies they offer. Larger ships can move containers more cheaply and more efficiently (as measured by fuel consumption per tonne-kilometre) than smaller vessels. Adopting larger ships can result in a decrease in vessel operating costs of up to 26% from size and efficient fuel consumption[17].

As shown by Figure 23, the size of container ships has been steadily increasing since their introduction. This trend is likely to continue, as Post-Panamax container ships with a capacity of 8,000 TEUs or more account for the overwhelming majority of current container ship orders[18]. At present, the largest container ships currently in service on Europe-Southeast Asia routes have a capacity of 14-18,000 TEU. By comparison, the largest ships regularly serving the New Zealand market can carry 4,100 TEU.

Increases to maximum ship size on major sea routes appear to be having a 'cascade effect' on other routes. In short, the small (and more costly) ships that currently serve minor routes are being gradually displaced by larger ships that are no longer required on major routes. As discussed above, shipping line rationalisation since the global financial crisis has accelerated this trend.

It is likely that larger ships will be deployed on New Zealand routes in the medium term future, although the timing may be affected by demand growth for international freight, developments in the shipping market, and infrastructure decisions made in New Zealand. As discussed in more depth in Section 5, the UNI ports will need to invest in order to accommodate larger ships, or manage them through restricted tidal windows.

There is a clear consensus that New Zealand will need infrastructure capacity to manage 6,000 TEU ships in the short to medium term, and perhaps 8,000 TEU ships in the medium to longer term. In the process, 3 or 4 hub ports will emerge, with regional ports acting as feeders. However, there is no consensus about the optimal timing for the necessary investments.

17. The New Zealand Shippers Council (2010), "The Question of Bigger Ships"
18. There are some physical limits to ship sizes as a result of the size of canals and maritime channels. Vessel size on routes between the Atlantic and Pacific Oceans is constrained by the locks in the Panama Canal – a 'Panamax' ship has a draft of 12m and carries no more than 5,000 TEU. Most of the new ships being commissioned today are Post-Panamax, or larger than 5,000 TEU. However, there is considerable room for container ship size growth on most other routes. (And the Panama Canal is currently being expanded.)

Figure 23: Container ship sizes and current order book

Container ship order book as % of existing fleet			Length	Draft	TEU
P-P 8K+ TEU 92.4%	First (1956-1970)	Converted cargo vessel Converted tanker	135m 200m	<9m < 30ft	500 800
P-P 3-8K TEU 26.3%	Second (1970-1980)	Cellular containership	215m	10m 33ft	1,000-2,500
Panamax 6.3%	Third (1980-1988)	Panamax class	250m 290m	11-12m 36-40ft	3,000 4,000
Sub-Panmax 5.1%	Fourth (1988- 2000)	Post Panamax	275m-305m	11-13m 43-45m	4,000-5,000
Handy 6.6%	Fifth (2000-2005)	Post Panamax Plus	335m	13m-14m 43-45ft	5,000-8,000
Feeder/Max 3.4%	Sixth (2006-)	New Panamax	397m	15.5m 50ft	11,000-14,500

Source: Clarksons Research, cited in internal PwC report, “Shipping Industry Developments H1 2011”

It is likely that demand from the UNI will be sufficient to require 7,000 TEU ships in the short-to-medium term. Analysis by the NZ Shippers Council[19] suggests that volumes on the Southeast Asia trade routes are large enough at present to be served by 7,000 TEU ships. However, shipping lines may be unwilling to deploy larger ships at present, as it would require them to consolidate their capacity and, in the process, reduce the operational independence of individual shipping lines.

Discussions with importers, exporters, and others within the port and shipping industry suggest that New Zealand is unlikely to be adversely affected by the trend towards larger container ships. Some commentary has focused on the risk of New Zealand's trade being transhipped through Australian ports, potentially adding cost and delays for importers and exporters[20]. However, this risk is likely to be overstated for two reasons.

First, Australian ports also lack the capacity to handle larger ships at present, although Brisbane and Sydney are addressing this shortfall. In addition, container volumes and cargo handling infrastructure at Australian ports are not significantly larger than those in the UNI region. Consequently, UNI trade could not be routed through Australian ports without considerable investment by those ports.

In the short term, the competitiveness of the shipping market means that New Zealand is likely to be served directly by smaller ships unless transhipment through Australia offers significant cost savings.

Second, shipping lines operate in a competitive market and as a result face a commercial incentive to add capacity to serve demand. This has been demonstrated in recent years. For example, after shipping lines Maersk and Hamburg Sud ceased services to Timaru's PrimePort in July 2012, MSC began a (smaller) container service to pick up demand from that area[21]. Similarly, when Maersk shifted its UNI container services from Tauranga to Auckland in 2006, Hamburg Sud and CMA CGM reorganised their schedules to make Tauranga their main port of call[22]. In other words, loss of capacity as a result of decisions made by an individual shipping line are likely to be offset by a market response from other lines.

In the short term, the competitiveness of the shipping market means that New Zealand is likely to be served directly by smaller ships unless transhipment through Australia offers significant cost savings. In the medium and long term, it means that shipping lines will seek to add larger ships if and when demand grows to a sufficient level. The main implication of this is that the key to handling larger ships is not necessarily for ports to invest as soon as possible but for them to avoid foreclosing on that possibility and be prepared to invest when it makes commercial sense.

19. The New Zealand Shippers Council (2010)
20. See for example Otago Daily Times (2010), "Aust ports could become hubs for NZ: industry leader", http://www.odt.co.nz/news/business/90100/aust-ports-could-become-hubs-nz-industry-leader; Stuff (2012), "Potential threat to ports' future ", http://www.stuff.co.nz/auckland/local-news/7281596/Potential-threat-to-ports-future.
21. http://www.stuff.co.nz/timaru-herald/features/7840116/Global-storm-buffets-port
22. NZIER (2010).

Oil price increases will drive increases to shipping costs

Fuel costs account for the largest single share of shipping lines' operating costs and as a consequence will have a significant impact on the shipping markets. Over the last decade, oil prices have risen considerably, although not without some major fluctuations in price related to global economic conditions. They are likely to continue rising throughout the study period.

Price increases will raise costs for importers and exporters unless increased shipping efficiency offsets it. This is likely to affect overseas trade demand. While the expected effects of oil price increases on shipping demand are likely to be priced into our projections, high oil price scenarios pose a downside risk for port demand growth.

Fuel oil is the largest single cost for ocean shipping; according to the United Nations Conference on Trade and Development (UNCTAD) (2011:26) it makes up roughly 60% of the operating costs for a containership. Increases in oil prices, driven by constrained supply and growing demand from rapidly-growing developing countries (eg China, India), are therefore likely to be the most significant factor pushing up the cost of ocean shipping. This may in turn reduce demand for shipping unless ship efficiency increases enough to offset any increases in cost.

The impact of higher oil prices may be partly mitigated by other decisions, such as:

- continued use of slow-steaming to conserve fuel (however, this costs time and may be resisted by importers and exporters)
- development and use of alternative fuels (eg biofuels)
- increased use of larger ships, which are more fuel-efficient per tonne-kilometre.

There may be a significant downside risk that is not captured within the consensus estimates reported here, as they indicate that oil prices will rise considerably more slowly in real terms than they have done over the last decade. Higher increases will tend to have a greater impact on demand for imports and exports.

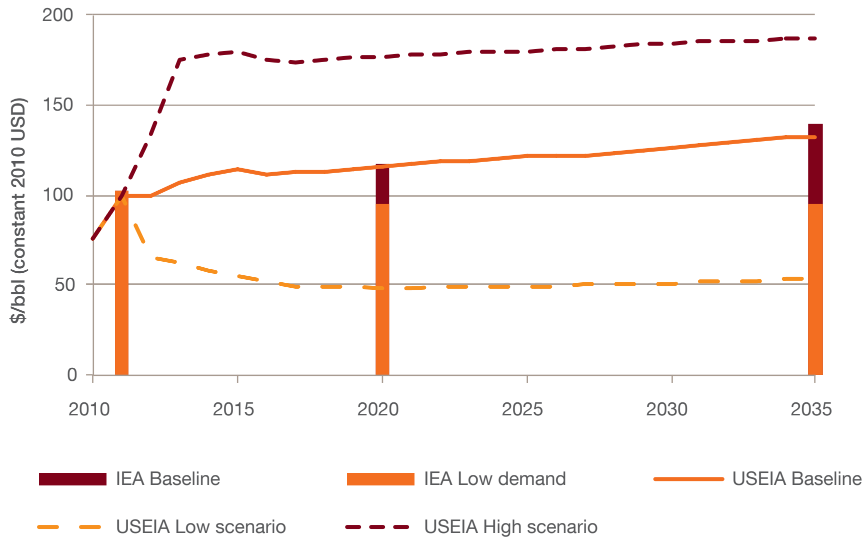
Background to projections continued

Base case oil price forecasts for the study period, compiled from several forecasting agencies, suggest that oil prices will rise in real terms over the upcoming decades. The International Energy Agency (IEA) and United States Energy Information Agency (USEIA) project that real oil prices will rise 16% by 2020 and 33% to 37% by 2035[23]. These agencies baseline forecasts are summarised in Figure 24. Forecasts provided by New Zealand's Ministry of Business, Innovation, and Employment (MBIE)[24] suggest that retail diesel prices will increase more rapidly within New Zealand, possibly as a result of exchange rate movements or refining and transport costs.

Note, however, that there is considerable uncertainty in these forecasts (as shown by the large range between high and low demand scenarios). While demand growth is currently forecast to outpace supply, new technologies may allow access to unconventional oil resources. While increased supply would moderate oil price increases, it would not necessarily reduce prices due to the high cost of extracting new resources.

Figure 24: IEA and USEIA crude oil import price forecasts

Crude oil import price forecasts to 2035



Source: IEA, USEIA

23. International Energy Agency (2011), "World Energy Outlook 2011"; United States Energy Information Administration (2012), "Annual Energy Outlook 2012, with Projections to 2035".
24. Ministry of Economic Development (2011), "New Zealand's Energy Outlook 2011", http://www.med.govt.nz/sectors-industries/energy/energy-modelling/modelling/new-zealands-energy-outlook.

3.3.2 Port hubbing

New Zealand is in the process of developing a domestic 'hub and spoke' model in which overseas cargo is predominantly routed through main ports before moving to regional ports on feeder services. This trend is related to the movement towards larger container ships. However, the same pattern is not likely to emerge on an international level – ie there is little risk of New Zealand trade being hubbed through Australian ports – due to the fact that container volumes to and from New Zealand are sufficient to justify direct services.

Port hubbing will have a material impact on projections of port demand. On the one hand, domestic port hubbing has led to significant increases in import and export transhipments through the UNI ports in recent years – a trend that we expect to continue. On the other hand, international transhipments through UNI ports have also grown rapidly, and we expect this to continue in the short to medium term. This will tend to increase growth in port throughput.

The main rationale for port hubbing is to improve economies of scale in the shipping market. In a 'hub and spoke' model, shipping lines consolidate direct routes through larger ports and serve smaller markets with feeder services. This enables larger ships to be deployed, decreasing operating costs, and port investment to be concentrated in the largest ports rather than duplicated across many locations.

While port hubbing will decrease costs for many importers and exporters, it could potentially have a negative effect on regions without a hub port. It is likely to increase the time to market for importers and exporters – a potential concern for New Zealand exporters of perishable agricultural products. However, costs would not necessarily increase as greater economies of scale could offset any increases related to feeder services and double handling of cargo at the hub port.

Port hubbing will have a material impact on projections of port demand.

Port hubbing on a national level

New Zealand's overseas container trade is increasingly being consolidated through the largest domestic ports – POA, POT, Christchurch and Dunedin. While New Zealand still has a relatively large number of container ports for its size, regional ports such as Timaru and Wellington are losing traffic to their larger competitors. This trend is related to a reduction in the average number of port calls made in New Zealand by international lines and to a recent increase in import and export transhipment.

The average number of port calls that an overseas container ship makes in New Zealand is declining and is likely to continue doing so in the near future. Rather than running services that stop at each regional port, shipping lines are providing overlapping services, each of which serves only a few ports. Because not all ports have direct service to all overseas trade partners, this trend will increase the share of cargo from regional ports that must be transhipped through the main ports.

Data from POA and POT suggests that transhipment of import and export cargo has risen substantially over the last half-decade. We expect developments in the shipping market, including the deployment of larger ships on New Zealand routes, to strengthen this trend and increase the relative importance of the UNI container ports to overall New Zealand trade. Although transhipment volumes in the UNI are still relatively small compared with overseas cargo volumes, it is likely that they will grow at a faster rate during the study period.

Port hubbing on an international level

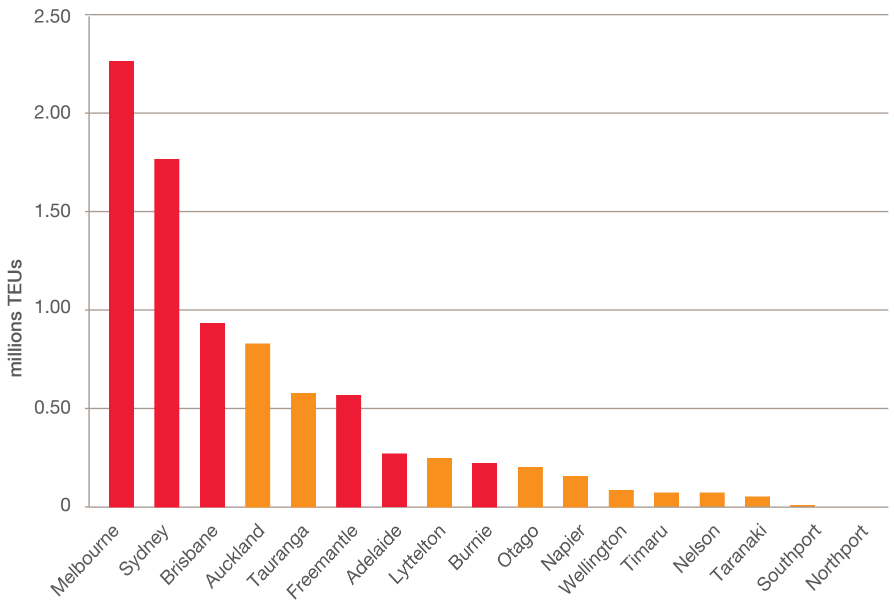
In our view, there is a clear trend towards port hubbing at a national level, but a similar pattern is not likely to emerge at an international level[25]. While some of New Zealand's international cargo will be transhipped through Australian ports, it is likely that this will take place on an opportunistic basis where cost advantages or travel time savings can be made. Conversely, some trade between Australia and the United States will be transhipped through the UNI ports. Most of New Zealand's international cargo will continue to travel on direct routes.

There are several factors that reduce the likelihood of New Zealand ports being relegated to 'spoke' status.

First and foremost, New Zealand has and will continue to have large enough trade volumes to justify direct routes with reasonably large ships. For example, analysis by the NZ Shippers Council found that container volumes between the UNI and Southeast Asia were, in theory, large enough to justify increasing ship size on these routes[26].

Figure 25: Australian port capacity and expansion plans

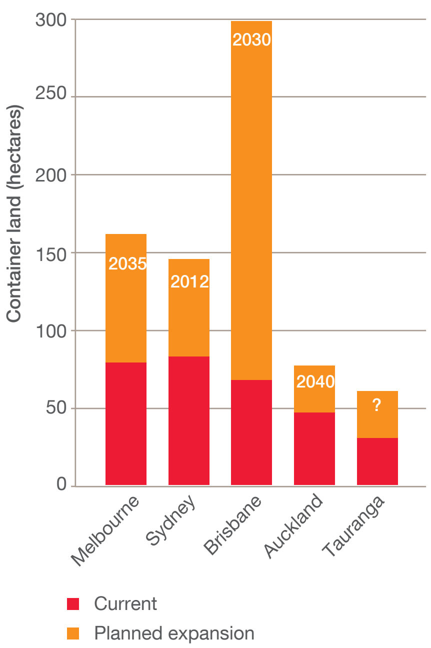
2008 Australian container port volumes (TEUs)



Source: Australian Competition and Consumer Comission (ACCC), Container Stevedoring Monitoring Report (October 2008), Ports of Auckland Limited

Australasian port infrastructure - current and planned expansion

Major australasian container ports - container land (hectares)



25. With the caveat that much of New Zealand's trade with Asia and Europe passes through Singapore, which serves as a regional transhipment hub.
26. NZ Shippers Council (2010).

The container shipping market is reasonably competitive. If one shipping line diverted container freight through an Australian port, resulting in increased costs or time to market for New Zealand importers and exporters, it is likely that another line would provide direct services instead. In other words, if port hubbing would raise New Zealand's supply chain costs, it would provoke a countervailing market response. Similarly, shipping lines are unlikely to drop direct services to New Zealand as a result of the trend towards larger ships.

Second, the largest Australian ports handle greater volumes than any New Zealand ports, but they do not have sufficient capacity to handle all New Zealand freight without considerable investment. This limits the scope for them to tranship more than a small share of UNI trade.

As shown in Figure 25, three of Australia's six large container ports – Melbourne, Sydney and Brisbane – handle larger container volumes than Auckland and Tauranga. According to ARH[27], each port is planning to invest in capacity to enable them to handle between four and seven million TEUs each by around 2030–2035.

The Australian ports' container traffic is not as large as could be expected given the population and size of economy in the areas that they serve. For example, POA handles almost as many containers as Brisbane, in spite of the fact that Brisbane's population is roughly 50% larger than Auckland's. Australia's economy is less trade-intensive than New Zealand's as measured by their ratio of trade to GDP. Furthermore, Australian exports are heavily concentrated in bulk minerals that don't move by container.

The largest Australian ports handle greater volumes than any New Zealand ports, but they do not have sufficient capacity to handle all New Zealand freight without considerable investment.

27. Auckland Regional Holdings (2009).

3.3.3 Port technology

New Zealand ports, including the UNI ports, are not at the forefront of technology or efficiency. On a number of measures of port efficiency, they lag behind international comparators, including Australian ports. (However, they move containers at a relatively low price compared with Australian ports.) This suggests that the UNI ports have scope to manage demand growth by increasing efficiency rather than increasing in size or undertaking expensive infrastructure upgrades. We discuss these options in more detail in later sections of the report.

Port technology has improved incrementally since the development and widespread adoption of containerised shipping in the 1960s and 1970s. Since then, larger ships and improvements to cranes and container stacking systems have driven increased port productivity. While port technology is unlikely to undergo a further transformational technology change along the lines of containerisation, there are a number of areas in which significant investments can be made. They include upgrading harbours and berths to accommodate larger ships, deploying automated container stacking (ACS) systems to increase container yard capacity, and developing inland ports to allow cargo to be consolidated and cleared through customs at a cheaper location. (We discuss inland ports more fully below.)

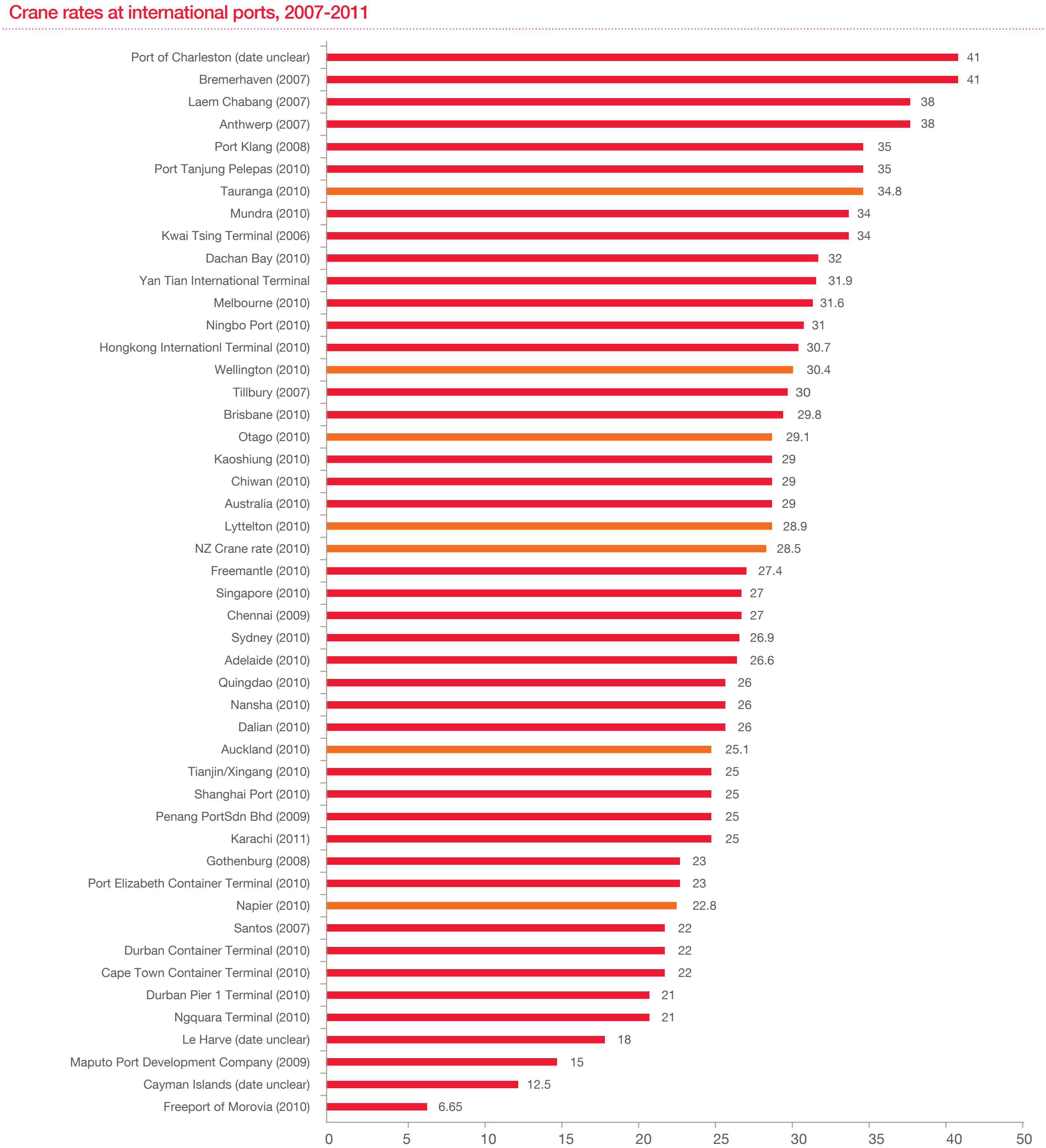
New Zealand ports are fully capable of handling containerised shipping but have not yet invested in all of the newest port technologies, such as ACS systems. Because New Zealand ports are behind the global 'technology frontier', there is scope for progressive upgrades to port equipment and productivity. POT performs better on most measures of port efficiency and productivity than POA. For example its crane rates are comparable with all but the most efficient international ports, as shown in Figure 26, while POA's performance is significantly lower. On other measures, such as yard utilisation, both ports are significantly below the best performing international ports.

Two common measures of container port efficiency are yard utilisation, defined as annual container throughput per hectare of storage area, and berth utilisation, defined as annual container throughput per metre of berth length[28]. Bulk cargo efficiency tends to be more difficult to measure due to considerable differences between various types of bulk cargo. (In other words, loading or discharging bulk liquids is a very different process than loading or unloading logs or cars.)

Another common, more comparable measure of container port efficiency is the crane rate, or number of containers moved per crane per hour. Figure 26 summarises available data on crane rates at international and New Zealand (in red) ports. It indicates that POT is the only New Zealand port in the upper tier of efficiency, while POA is below the New Zealand average.

28. Note, however, that both of these measures are affected by demand for port facilities. In other words, two ports may have similar technical capabilities, but higher demand at one port would mean that it had higher yard and berth utilisation figures in spite of the fact that it was not intrinsically any more efficient.

Figure 26: Crane rates at international ports, 2007-2011



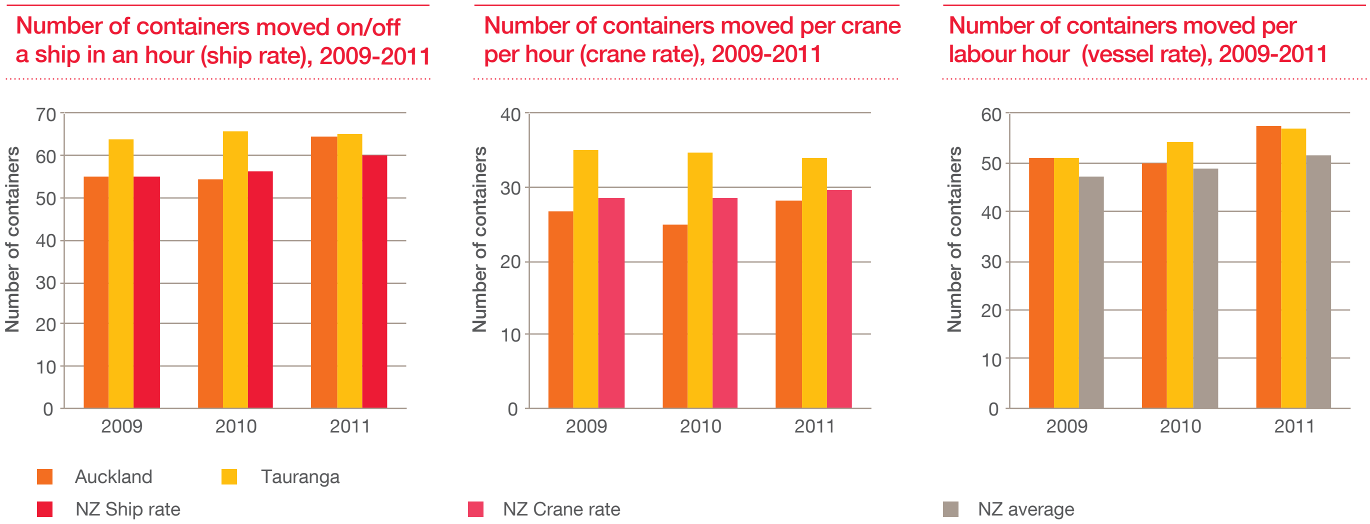
Source:Minitstry of Transport (2011), “Container Productivity at New Zealand Ports”

Background to projections continued

In addition, measures of port productivity compiled by the Ministry of Transport[29] suggest that POT is more efficient than POA in terms of moving containers. However, as shown in Figure 27, the gap between the ports has recently narrowed. POT remains New Zealand's best-performing port on most measures.

Increasing port efficiency may require significant investment in larger cranes, container stacking equipment – eg a computerised ACS system or larger straddle-carriers. (Currently, POA can stack three full containers or seven empty ones.) According to ARH[30], adopting automated stacking cranes could approximately double the capacity per hectare of POA and POT's container terminal by enabling increased stack heights.

Figure 27: Ministry of Transport measures of port efficiency, 2009-2011



Source: MoT

29. Available online at: http://www.transport.govt.nz/ourwork/TMIF/Pages/FT021.aspx.
30. Auckland Regional Holdings (2009).

3.3.4 How does freight move around?

(Distribution networks)

The UNI ports play a central role in national and international supply chains. Cargo entering through the ports must be transported to its ultimate destination, or vice versa. Consequently, it's necessary to consider the availability of transport and storage infrastructure and the efficiency of broader domestic distribution networks.

Here, we consider several features of New Zealand's domestic supply chains:

- the cost of shipping freight in and around New Zealand
- the role that coastal shipping plays in freight distribution
- the role that inland ports and distribution centres play in the Upper North Island, with a specific focus on the Auckland market
- potential changes to supply chain management that may impact on port demand or management.

Domestic freight costs

The cost of moving freight within New Zealand is high as a share of overall supply chain costs. Freight costs vary between different types of freight modes, reflecting the different advantages and limitations of each mode. Road freight provides greater speed and flexibility at a higher cost, while rail and coastal shipping are better suited for bulk goods, long-distance freight, and less time-sensitive shipments.

In many cases, it is cheaper to move freight between Auckland and Southeast Asia than it is to move it between locations within New Zealand. While this does not affect our demand forecasts, we expect it to influence decisions about future infrastructure investment or changes to the UNI port system. High domestic freight costs place a premium on having ports located close to population centres and export production locations. This constrains options to make system changes or consolidate cargo at a single port, as doing so may entail prohibitive increases to freight costs.

We estimated domestic transport costs, port costs, and overseas cargo costs using data from several sources[31]. The basis for these estimates is discussed in detail in Appendix B, "Domestic freight costs". Table 4 summarises the cost to ship a container to or from Singapore, via Auckland, for various New Zealand cities. It can be used to calculate the breakdown of transport costs for New Zealand regions[32]. Tables for other shipping routes (between Shanghai and POA and Long Beach and POA) are presented in Appendix B. While data on the cost to ship a dry container to and from POT is not readily available, it is likely to be similar to the cost of shipping through POA.

31. Ministry of Transport (2011), Productivity Commission (2012), Castalia Advisors (2010), "Ruakura Intermodal Terminal". While MoT and the Productivity Commission have previously presented similar figures, they have not consolidated them and discussed the implications for proposals to route increasing amounts of freight through the UNI ports.
32. Domestic freight costs are estimates based on data compiled by the Ministry of Transport for road and coastal freight, and KiwiRail's stated prices for 'walk-up' customers. We would expect a shipper with significant volumes or a consolidated customer such as an inland port to be able to negotiate significantly lower costs, especially for rail. These prices reflect the direct cost to freight customers, rather than the indirect costs to society resulting from road maintenance costs, vehicle emissions, etc. However, some of these costs are 'internalised' through mechanisms such as fuel taxes, road user charges, and the emissions trading scheme.

Background to projections continued

Table 4: Supply chain analysis – Singapore-Auckland route

		Importing			Exporting		
International freight costs							
Shipping line costs			$1,373			$1,520	
Port, customs, and biosecurity costs			$456			$407	
Domestic freight costs							
		Road	**Rail**	**Coastal**	**Road**	**Rail**	**Coastal**
Origin/destination	Whangarei	$581	$602	NA	$581	$602	NA
	Auckland	$210			$210		
	Hamilton	$463	$400	NA	$463	$400	NA
	Mt Maunganui	$746	$602	$699	$746	$602	$669
	New Plymouth	$1,319	$1,151	$1,376	$1,319	$907	$1,260
	Palmerston North	$1,889	$1,272	NA	$1,889	$1,144	NA
	Napier	$1,529	$1,334	$1,139	$1,529	$1,090	$1,054
	Wellington	$2,363	$1,394	$1,469	$2,363	$1,278	$1,341
	Blenheim	$2,815	$1,413	$1,598	$2,815	$1,685	$1,454
	Christchurch	$3,954	$1,618	$1,703	$3,954	$1,820	$1,515
	Dunedin	$5,252	$1,887	$1,981	$5,252	$2,089	$1,789
	Container cartage		**$210**			**$210**	

Source: Productivity Commission, Ministry of Transport, PwC calculations

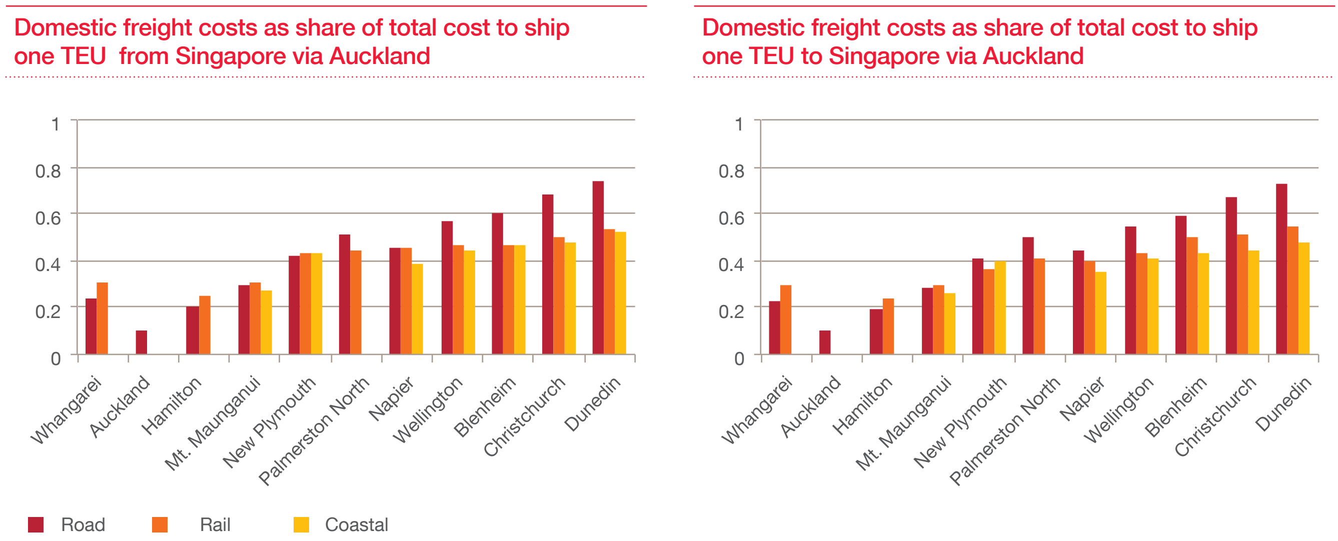
These calculations suggest that for many imports and exports, a large share of total supply chain costs are incurred within New Zealand rather than for sea freight.

For example, a company exporting a container from Napier to Singapore via Auckland would spend:

- $1,520 on shipping line costs
- $407 on fixed costs at POA (including container loading, customs duties, etc)
- $1,529 on road freight from Napier to Auckland, $1,090 on rail freight plus an estimated $210 for container cartage to the rail depot, or $1,054 on coastal freight
- Estimated coastal shipping costs are similar to rail freight costs, reflecting the fact that both modes compete in the long-distance, bulk cargo market.

In other words, depending upon the domestic freight mode chosen, between 35% and 44% of the total cost of shipping from Napier would be spent on domestic transport alone. Estimates for other New Zealand cities are summarised in Figure 28. They suggest that domestic freight costs will increase considerably as the distance to the port of export/import grows.

Figure 28: Domestic freight costs as a share of total supply chain costs



Source: PwC analysis

There is relatively little comparable international evidence on shipping costs along the supply chain, but given the quality of New Zealand's transport infrastructure it is likely that New Zealand's domestic freight sector is relatively high-cost. Because domestic freight costs are large relative to sea freight costs, changes to the New Zealand port sector that require increased domestic cargo movements may have a large impact on importers and exporters from more distant regions.

These estimates of domestic freight costs suggest several implications for our analysis of options for meeting future port demand. First, transport costs from Whangarei to Auckland and other UNI locations are likely to make it uneconomic to develop Northport to handle containerised cargo unless significant investments were made in land transport infrastructure and inland ports. Second, they suggest that current port locations in Auckland and Tauranga are efficient in terms of meeting freight demand from those regions.

One important caveat to this analysis is that consolidating freight volumes on rail may increase the cost-effectiveness of moving freight domestically. Rail provides increasing returns to scale for large volumes of freight. For example, Castalia (2010)[33a] estimated that two-way container traffic of 35,000 TEUs per year would reduce per-container rail costs by almost 70% relative to the prices for a single container quoted here. Consequently, inland ports or other means of consolidating freight from high-volume shippers may reduce the costs to distance significantly. This is apparent in the case of Metroport, which, as we discuss below, has enabled POT to compete for freight in the Auckland market.

33a. Castalia (2010), "Ruakura Intermodal Terminal", Report to Tainui Group Holdings.

Transport costs between Whangarei and other UNI locations

Developing Northport as a container terminal is likely to be uneconomic due to the additional cost of shipping containers between Whangarei and other UNI locations. Auckland and Tauranga are located much closer to main population centres and export-producing regions, meaning that any additional costs at the port (eg higher land prices) are more than offset by lower domestic freight costs.

Based on our estimates of road and rail freight prices, shipping one TEU between Whangarei and Auckland would cost $602 by overnight rail service, or $581 by road. Shipping one TEU between Whangarei and Tauranga would cost $786 for next-day rail service or $1,323 by road. (The short distances involved mean that coastal shipping is not likely to be cost-effective.) These freight costs are higher than current per-container port, customs and biosecurity costs at POA, meaning that diverting freight from POA to Northport would increase total supply chain costs. (It would, however, significantly reduce costs for Northland importers and exporters, although the small size of Northland's economy and population relative to Auckland means that the local benefits would not outweigh the additional costs to the whole UNI.)

Road and rail costs may fall significantly as a result of investment in infrastructure upgrades, including inland ports in other parts of the UNI. However, their magnitude compared with port and sea freight costs means that significant efficiencies and cost reductions would be needed across the board before a container port at Whangarei would make economic sense for importers and exporters.

Inland ports

Inland ports are cargo-handling facilities designed to serve some port functions, such as the agglomeration of cargo and some customs and biosecurity clearance functions, at a location away from the port itself. They are generally located on cheaper land with better access to manufacturing and distribution facilities and linked to ports by a rail line.

Inland ports are intended to exploit the cost advantages of cargo handling at an inland location. They can potentially serve two purposes. First, they can reduce dwell times at the port by allowing customs clearance (etc) for containers to be completed at an inland location. This can reduce the total cost of port operations if the difference between land prices at the port and inland locations is large enough to offset any double handling.

Second, and more importantly, inland ports can lower costs for importers and exporters by exploiting the cost efficiencies available when moving large volumes of containers by rail. The basic idea is to allow importers and exporters to avoid the costs of road freight (and, in particular, congestion in Auckland's road network) by consolidating freight at a closer location and moving it by rail to a port. This is typically the main rationale for developing inland ports (see eg Castalia's business case for Ruakura Inland Port[33b]) and as a consequence will be our main focus when considering the role of inland ports.

In addition, inland ports can affect importers' and exporters' choice of ports. POT developed Metroport in order to enable it to compete for a share of Auckland's international trade. As a result, POT has become a viable substitute for POA for many categories of cargo. A recent econometric study found that the development of Metroport enabled some exporters to route cargo through POT, although most continued using POA as well[34].

The proposed development of a freight hub at Ruakura in Hamilton may have a similar effect within that region. As a result, inland ports (and similar improvements to domestic freight and distribution networks) will increase the scope to manage UNI freight demand across the system rather than at individual ports.

It is likely that the primary impacts of inland ports will be on demand for different freight modes and on the efficiency of distribution networks. First, the successful development of inland ports is likely to result in a mode shift in traffic to and from the port – away from road freight and towards rail freight. Due to the capacity of inland ports, this is likely to be an incremental change. Second, inland ports could have an effect on the ports through which overseas cargo enters and exits the country. For example, the development of MetroPort in Auckland has made it easier for South Auckland manufacturers to export through Tauranga. This will, not, however, affect the growth of cargo moving through the UNI ports.

Key success factors for inland ports

Inland ports succeed or fail as commercial propositions. A 2012 report to the Waikato Regional Council lays out some factors affecting inland ports' effectiveness:

1. size of catchment area
2. location within a freight precinct or industrial centre
3. reliable road and rail access links
4. ability to operate 24/7
5. efficient design to maximise reliability of vehicle and container movements
6. appropriate types of container handling equipment
7. on-site Customs and Biosecurity services
8. storage and repositioning of empty containers

Source: Draft Aurecon report (2012)

33b. Castalia (2010), "Ruakura Intermodal Terminal", Report to Tainui Group Holdings.
34. Fabling, Grimes and Sanderson (2011), "Any port in a storm? The impact of new port infrastructure on exporter behaviour".

Current inland port facilities and utilisation

Metroport was the first inland port facility in New Zealand. It was established in 1999 by POT (in conjunction with the future KiwiRail) to allow POT to compete for business from Auckland-based importers and exporters. It has a direct rail connection to the North Island Main Trunk (NIMT) and an area of five hectares, with an additional eight hectares at the adjacent MetroBox facility. Metroport is located in Penrose, close to much of Auckland's manufacturing capacity and many of its warehouses and distribution centres.

Metroport's annual throughput increased from 32,000 TEUs in its first year of operation to 138,000 TEUs in the year ending June 2011[35]. This represents 55 percent capacity utilisation. 23 percent of POT's container throughput is currently routed through Metroport.

Wiri Inland Port was developed by the POA in 2005 as a road-only terminal; a rail link to the NIMT was opened early in 2010. There are currently four rail services a week between POA and Wiri Inland Port. It has an area of 15 hectares. Wiri Inland Port is located 25 kilometres from the port, reportedly within a ten kilometre radius of the origin or destination of about 70 percent of POA's container trade[36]. (Note, however, that locations ten kilometres north of Wiri Inland Port are almost as close to the port as they are to Wiri, reducing the rationale for consolidating freight at that location.) The area around Wiri contains some manufacturing and distribution facilities but is considerably less developed than the area around Metroport.

In the year ended 2010, Wiri handled 30,000 TEU, or 20 percent of its capacity[37]. Only three percent of POA's total container throughput was routed through Wiri; this share would have to increase substantially in order for the inland port to reach capacity during the study period.

The Ruakura Intermodal Terminal is a proposed inland port located approximately three kilometres east of Hamilton City. It is currently under study by landowners Tainui Group Holdings and Chedworth Park Ltd. It would be situated on a planned 500 hectare commercial and industrial development with links to the East Coast Main Trunk (ECMT) rail line and the proposed Waikato Expressway.

The Ruakura Intermodal Terminal is a proposal for an inland port located approximately three kilometres east of Hamilton City. It is currently under study by landowners Tainui Group Holdings and Chedworth Park Ltd. It would be situated on a planned 500 hectare commercial and industrial development with links to the East Coast Main Trunk (ECMT) rail line and the proposed Waikato Expressway.

The potential volume of freight routed through Ruakura has not been modelled and is likely to depend upon a number of factors, including the scope of development in the surrounding area. However, a 2010 Castalia business case estimates that an annual throughput of approximately 12,000 TEU per year between Ruakura and Auckland would be required for the inland port to provide a cost advantage over direct road freight[38]. This is roughly equivalent to ten percent of the existing contestable domestic freight task in the region. This would reflect a change in freight movement patterns and modes rather than an increase in the region's freight task.

In addition, Fonterra has developed a freight hub at Te Rapa, Hamilton. This facility includes a cool store and direct access to the road and rail networks. Fonterra uses this site to consolidate manufactured dairy products from across the UNI region before shipping them by rail to the port.

35. Port of Tauranga 2011 Annual Report, cited in Castalia (2011), "Cost Benefit Analysis of the Waikato Expressway: Incorporating the Impact of the Ruakura Hub", Report to Tainui Group Holdings.
36. Cited in Castalia (2011).
37. Ports of Auckland Limited (December 2010), Interconnect – The Magazine for our Customers, cited in Castalia (2011).
38. Castalia (2010).

Inland ports and land use

Inland ports are primarily a commercial proposition and should be evaluated as such. However, they do have some public policy implications for land-use and infrastructure planning. If inland ports provide a commercially viable proposition to shippers – ie if they reduce supply chain costs by consolidating sufficient volumes of freight and moving it to and from a seaport by rail – they may have an impact on land uses in the surrounding area. For example, they may strengthen incentives for production or distribution facilities to locate close to the inland port.

The effects may not necessarily be immediate. The experiences of Metroport and Wiri Inland Port suggest that inland ports will be slow to reach capacity – Metroport reached 55 percent utilisation in 2011, more than a decade after opening, while Wiri was at 20 percent of capacity in its first year of rail operation and has not achieved significantly higher volumes since then. Consequently, it is likely that their effects on land use and distribution network capacity will occur only in the medium term or beyond. This should be taken into account when assessing future inland port developments.

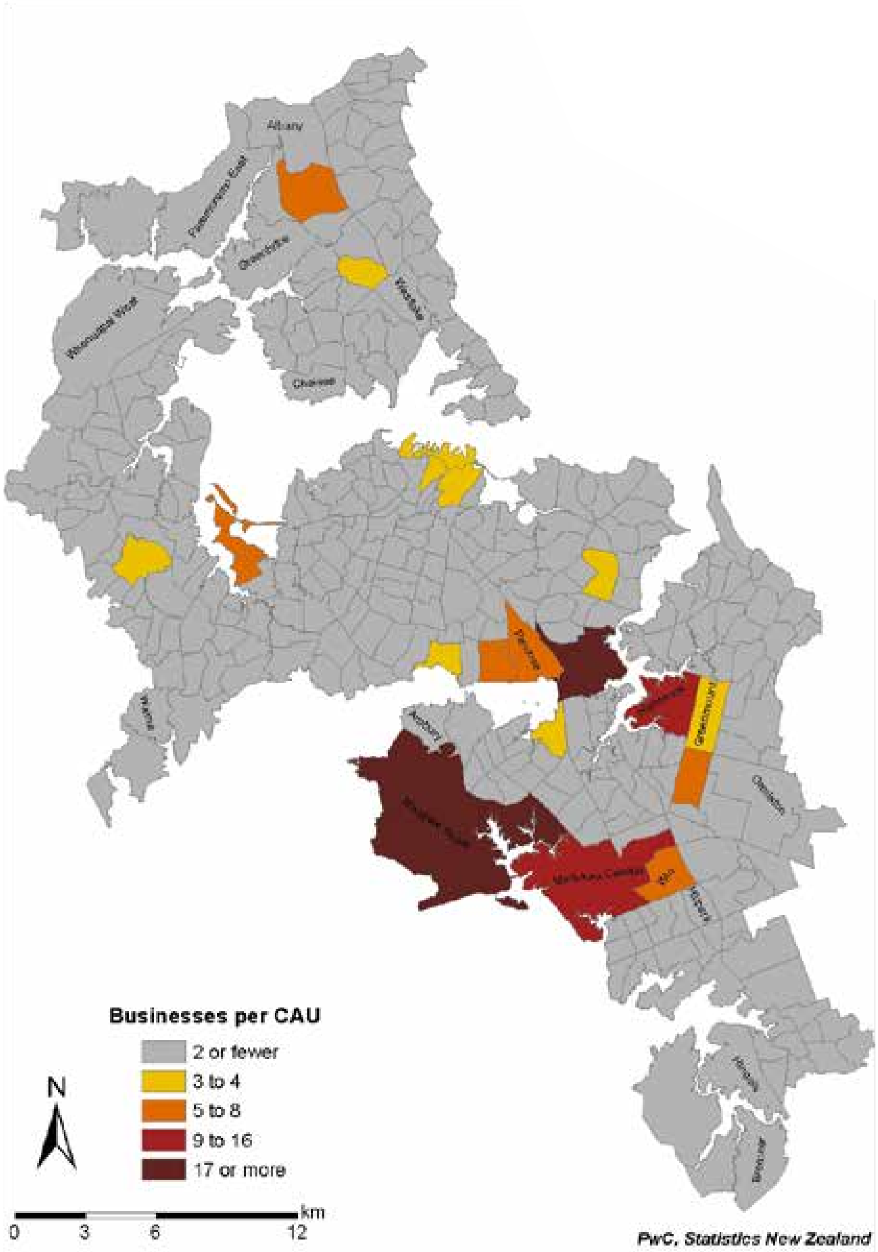
Location of warehousing, wholesaling, and road transport businesses in Auckland

Auckland plays an important role in distributing imported goods throughout the country. POA handles the largest share of New Zealand's non-oil imports and a wider variety of import commodities than any other New Zealand port. These goods are often moved to warehouses or wholesalers in Auckland before being distributed to other parts of the country.

Warehousing and distribution businesses within Auckland require access to the ports – either directly or via inland ports – and to land transport networks. Consequently, their location will influence the ports and transport modes that they choose to use.

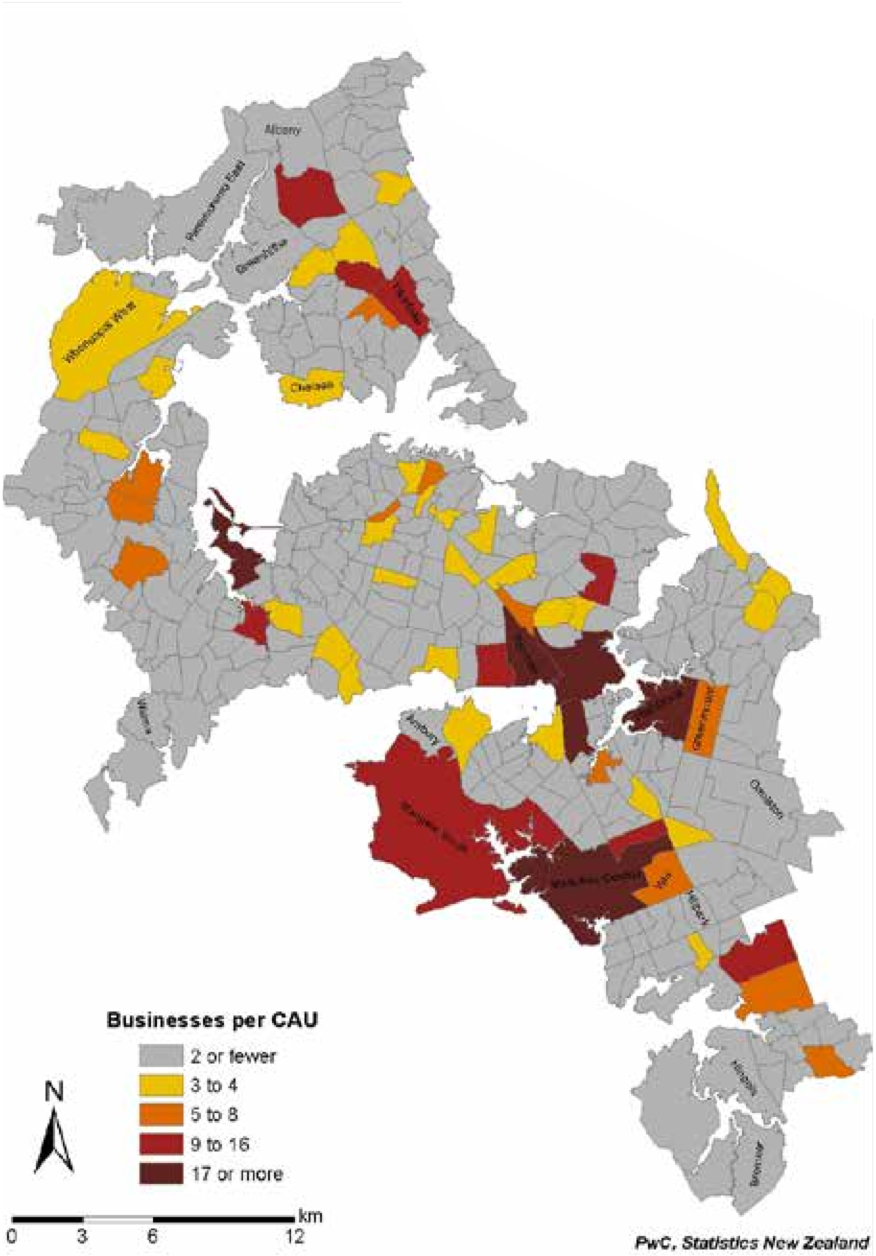
As shown in Figure 29, a large share of warehousing and storage business units in Auckland are concentrated in South Auckland suburbs – in particular, the Mount Wellington-Penrose and Mangere areas. There is also a significant concentration further south, in the area around Auckland Airport and Wiri. Auckland's warehousing businesses are heavily concentrated in a few areas - 47% of the regional total are located in the top ten area units. The concentration of these businesses in South Auckland, and in particular in Mount Wellington-Penrose, suggests that they will be able to access both POA and POT (through Metroport) relatively easily. Future traffic congestion in Auckland may affect access to POA, although warehousing businesses closer to the Wiri inland port may be able to mitigate the effects by routing freight by rail.

Figure 29: Location of warehousing and storage businesses in Auckland, 2011



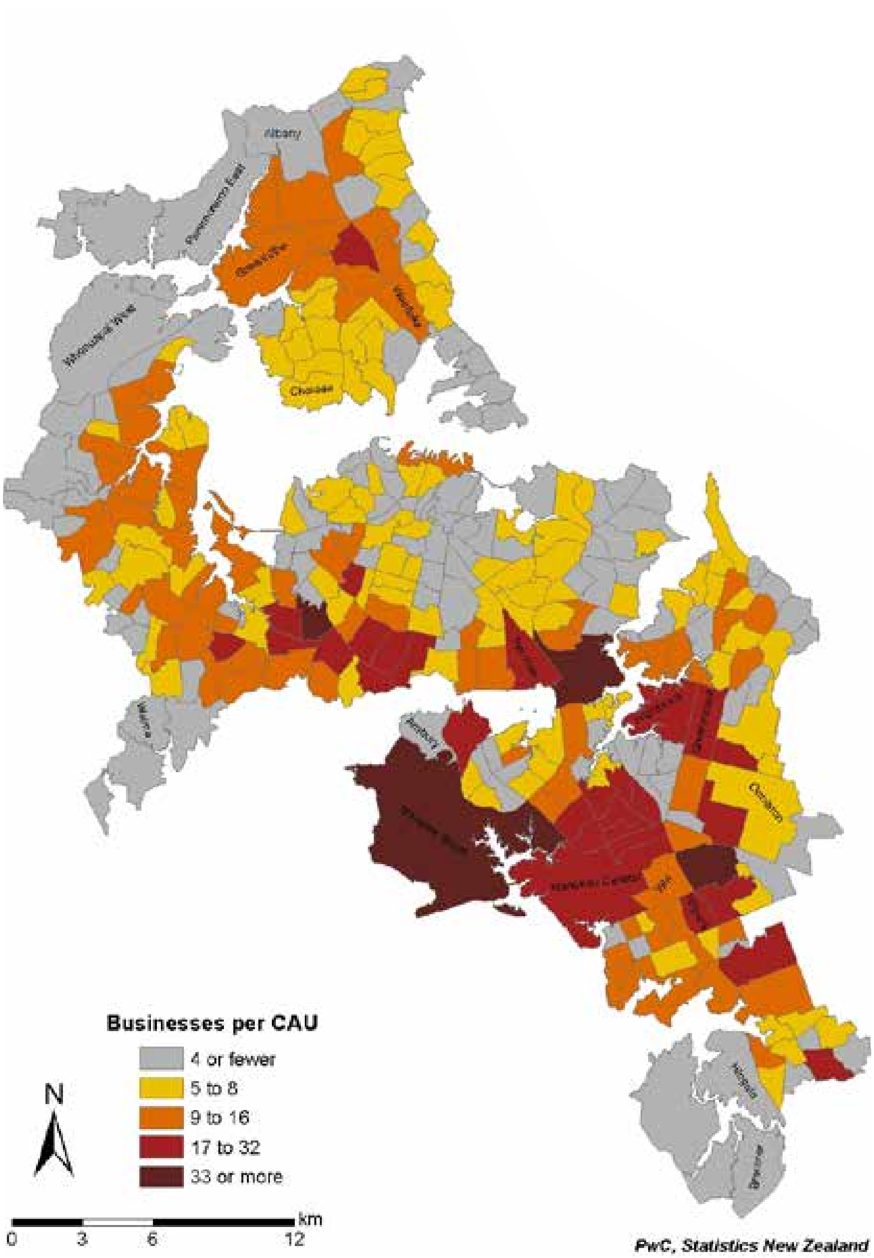
A similar pattern is apparent in the motor vehicle and motor vehicle parts wholesaling industry. A majority of the country's cars are imported through POA and received by Auckland-based wholesalers before distribution throughout the country. As shown in Figure 30, motor vehicle wholesaling businesses in Auckland are concentrated in South Auckland suburbs – in particular, the Mount Wellington-Penrose area. 31% of Auckland's motor vehicle wholesalers are concentrated in the top ten area units. At present, imported cars are moved by road freight, placing a premium on road network access between POA and these Auckland suburbs.

Figure 30: Location of motor vehicle wholesaling businesses in Auckland, 2011



Finally, Auckland's road transport businesses are also concentrated in south Auckland, and in particular around Auckland Airport and to the east of it. While road transport business units are more dispersed, and more numerous, than warehousing or motor vehicle wholesalers, there is still a definite pattern to their locations. It is likely that they have located in this area to take advantage of proximity to the main freight origins and destinations in the Auckland region. Figure 31 illustrates this pattern.

Figure 31: Location of road transport businesses in Auckland, 2011



Coastal shipping

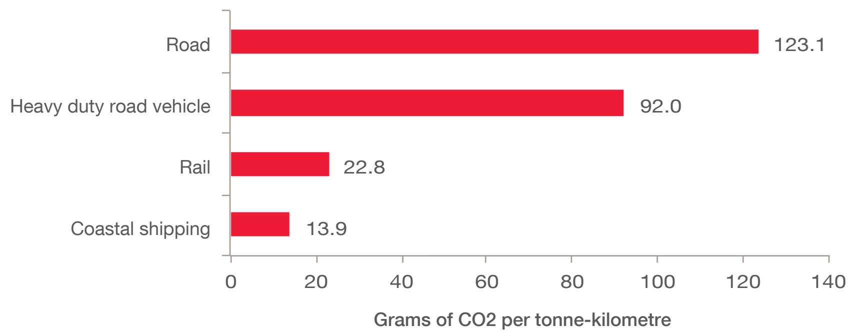
Coastal shipping accounted for 15% of total freight tonne-kilometres in New Zealand in 2006/07, and a smaller share of tonne-kilometres of general (containerised) cargo[39]. It also makes up a relatively small share of the overall port task.

However, it is important to understand the coastal shipping market. It is unique, compared with other domestic freight options, as its primary impact is on port facilities rather than land transport infrastructure. Moreover, coastal shipping offers a relatively cheap option for moving freight around the country. Depending upon trends in domestic freight costs and oil price increases, its current role may increase. We have accounted for this possibility in our high growth scenario for domestic coastal freight.

Coastal shipping tends to serve the bulk, long-distance market, competing, to a certain extent, with rail freight but less against road freight, which is more suited to shorter, more time-dependent routes. Future demand for coastal shipping is likely to depend upon government policy decisions, such as investments in alternative freight modes and carbon pricing decisions. Increasing fuel prices may also increase demand for coastal shipping as coastal shipping is more fuel efficient than land transport. Figure 29 displays this difference in terms of carbon emissions per tonne-kilometre, a measure which is closely related to consumption of fuel.

Figure 32: Carbon intensiveness of different freight modes

Carbon emissions of different freight modes



Source: MoT (2008) "Sea Change"

39. National Freight Demand Study (2008).

Background to projections continued

The 2008 National Freight Demand Study (NFDS) estimated, based on 2006/07 data, that bulk petroleum products from Marsden Point refinery and cement moved from the Portland cement plant in Whangarei accounted for 2.5 million tonnes out of the 4.3 million tonnes moved nationally. A smaller amount of coastal freight movements originated in Auckland (460,000 tonnes) and the Bay of Plenty/Tauranga (170,000 tonnes).

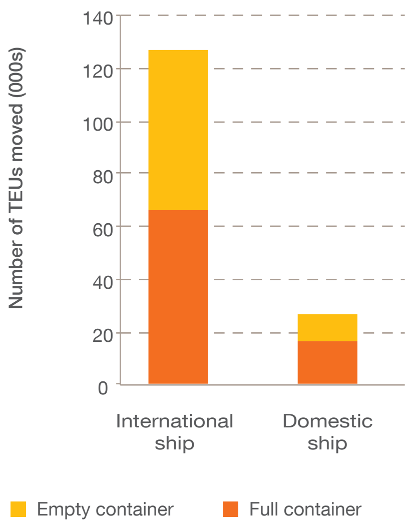
The bulk coastal freight market is unlikely to undergo any predictable changes due to the fact that many of the main routes are fairly stable and anchored by population concentrations and the location of major bulk product producers – the Marsden Point refinery and two cement plants in Whangarei and Westport. Containerised cargo has more potential for growth, albeit from a low base. Data from POA suggests that coastal shipping of containerised general cargo has grown significantly in recent years. Our projections for the coastal freight market reflect the dynamics and base demand estimated by the NFDS.

Growth in coastal shipping of containers will be affected by developments in the international shipping market. As shown in Figure 33, the majority of coastal shipping container capacity is provided by international shipping lines. The dominance of international shippers in the coastal market is likely to reflect the fact that they can move freight at relatively low marginal costs while making scheduled calls at multiple NZ ports. Pacifica Shipping is the only domestic firm in the market; it provides coastal shipping of containers on five routes[40]. Pacifica owns two coastal containerships with a combined capacity to move 1,500 full TEUs each week[41].

Coastal shipping of the main bulk products is generally provided by specialised ships either owned by the manufacturers of bulk products or exclusively supplied under contract. Bulk petroleum products, which make up a large share of coastal freight bulk tonnage, are moved exclusively by Silver Fern Shipping via two tankers. Another ship, the Awanuia, is used to supply bunker fuel directly to docked ships. Both cement manufacturers own and operate their own coastal ships to move their product around the country. Golden Bay Cement in Whangarei owns a barge and supply ship[42], while Holcim Cement in Westport owns two ships[43]. Cement is moved to specialised silos at ports.

Figure 33: Coastal shipping movement, January-June 2012

Coastal movements : January-June 2012



Source: MoT FIGS

40. Check figure – may have reduced.
41. Reference Pacifica's company profile, available online.
42. http://www.goldenbay.co.nz/mainmenu30/page71/Company+Profile.html.
43. http://www.holcim.co.nz/fileadmin/templates/NZ/doc/Weston/Newsletters/Sept_2008_Newsletter.pdf.

4

The future Upper North Island port task – our projections

The future Upper North Island port task – our projections

This section summarises our projections for port demand to 2041. As discussed in Section 3, we have developed projections of individual components of the port task that will allow us to examine separately the impact on the ports themselves and the impacts on the region's land transport infrastructure. In addition, we have considered what these projections may imply for demand at the individual ports in the region as well as for the system as a whole.

4.1 Revisiting definitions

Not all cargo movements will have the same impact on port and port-related infrastructure. In Section 3.1, we defined three broad categories of cargo movements:

- ***Outside-port cargo*** moves into the port from sea and out by land, or vice versa. It is the weight of goods that have final origins or destinations inland of the port. This category includes imports, exports, and domestic coastal entering or exiting the port.
- ***Cargo exchanges*** enter and exit the port by sea. They transit through the port without leaving the port gate. This category includes import and export transhipments and international transhipments (or re-exports).
- ***Throughput*** includes both outside-port cargo and exchanges. It measures the total amount of cargo that is loaded or discharged at a port. This category includes ***all*** types of cargo movement.

These categories of cargo movement and their impacts on port and land transport infrastructure are summarised in Table 5. The four categories of outside-port cargo are highlighted in light orange.

4.2 Summary of our projections

Overall trade and throughput

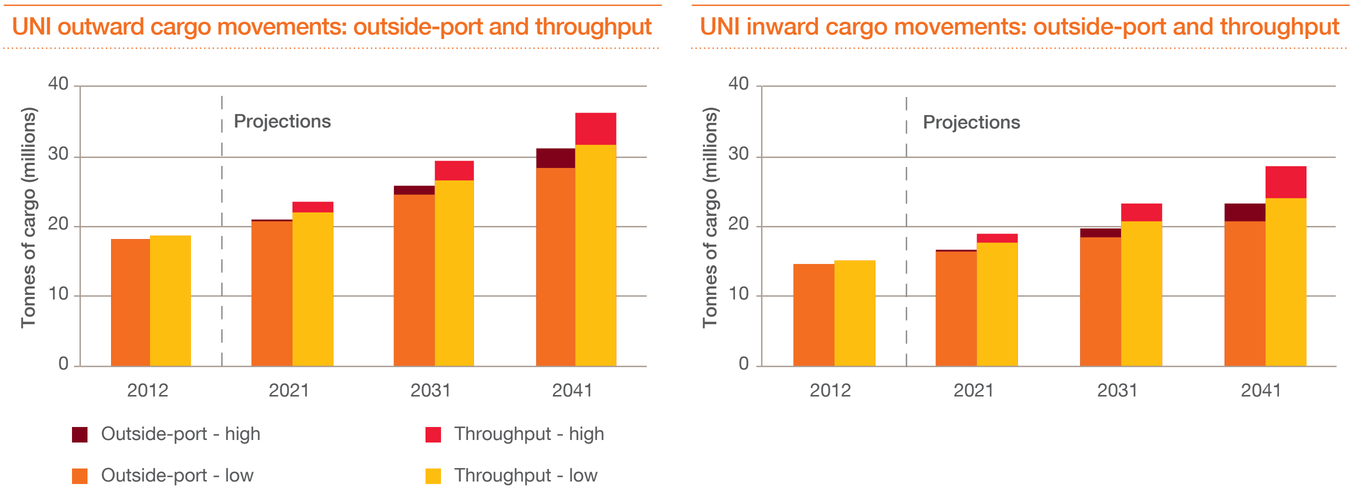
We have constructed long-term projections of future freight through the UNI ports. They include high and low scenarios that provide a range of potential outcomes. Our projections to 2041 indicate significant growth in both trade and throughput. Throughput is expected to grow faster on the back of increased transhipment and domestic coastal freight, as summarised in Figure 34 and Table 6.

Table 5: Infrastructure requirements of different cargo movements

Inward	Outward	Infrastructure
Imports	Exports	Port and land transport
Domestic coastal inward	Domestic coastal outward	Port and land transport
Import tranships	Export tranships	Port only
Domestic leg of export tranships	Domestic leg of import tranships	Port only
International tranships	International tranships	Port only

- Throughput growth of 1.7% to 2.3% per annum, or an additional 22m-31m tonnes
- Trade growth of 1.4% to 1.8% per annum, or an additional 16m-22m tonnes
- These estimates are subject to revision, particularly with respect to port cargo exchanges, due to the need to check some assumptions against the upcoming release of the Ministry of Transport's Quarterly Container Information Report for the June 2012 quarter.

Figure 34: Summary of outside port and throughout growth projections for the UNI



Source: PwC analysis

Table 6: Infrastructure requirements of different cargo movements Overall growth projections for the UNI

	Throughput	Outside-port
2012	34m tonnes	33m tonnes
2021	40m to 42m tonnes	37m to 38m tonnes
2031	47m to 53m tonnes	43m to 46m tonnes
2041	56m to 65m tonnes	49m to 54m tonnes
Absolute increase 2012-2041	22m to 31m tonnes	16m to 22m tonnes
% increase 2012-2041	64% to 91% over period	50% to 67% over period
CAGR 2012-2041	1.7% to 2.3% pa	1.4% to 1.8% pa

Source: PwC calculations

The future - our projections continued

Throughput projections

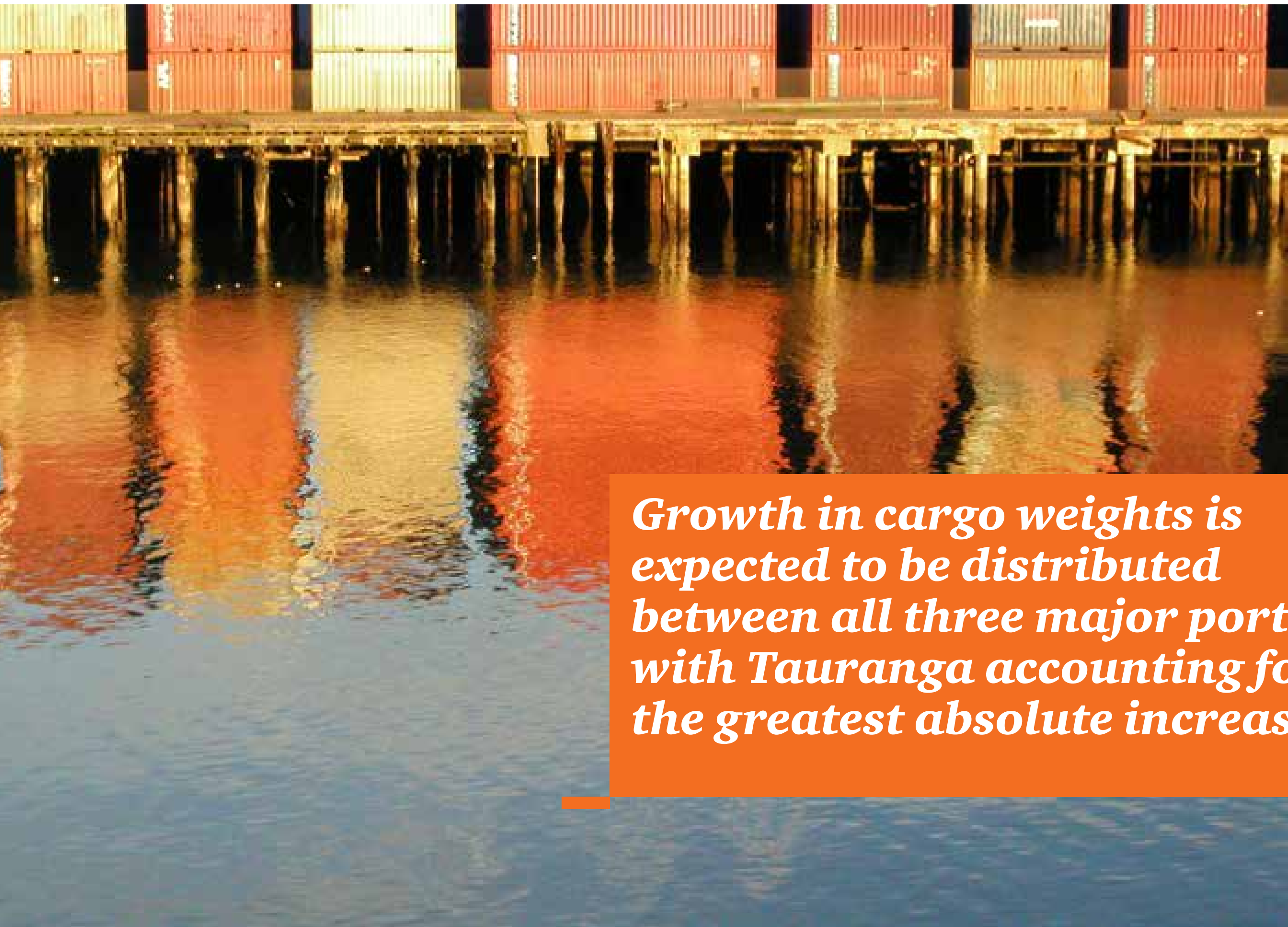
We project total throughput growth forecast to 2041 between 22m and 31m tonnes or 1.7% to 2.3% per annum. Growth in cargo weights is expected to be distributed between all three major ports, with Tauranga accounting for the greatest absolute increase.

Outside-port cargo projections

We project trade growth to 2041 of an extra 16m-22m tonnes or 1.4% to 1.8% per annum. This is expected to be lower than throughput growth due to the fact that international trade weights have grown less rapidly than other categories of cargo movement over the last decade, a trend we expect to continue.

The majority of trade volumes are comprised of international imports and exports. Domestic coastal freight makes up a smaller share of the total. We project international merchandise trade growth as follows:

- Exports 23.5m tonnes in 2041, reflecting total growth of 8.9m or 1.7% per annum
- Imports 18.8m tonnes in 2041, reflecting total growth of 5.5m, or 1.2% per annum.



Growth in cargo weights is expected to be distributed between all three major ports, with Tauranga accounting for the greatest absolute increases.

4.3 Key assumptions and drivers of demand

We have taken a long-term view that projects average growth over the study period rather than attempting to account for spikes in demand. We believe that this will be more reliable for three reasons. First, we expect much of the growth in cargo weights through the Upper North Island ports to be driven by a few key commodities – logs, dairy, and oil – for which production and demand patterns will be relatively predictable. Second, it is not possible to accurately predict when such spikes will take place, nor for which types of cargo. An attempt to pick the timing and magnitude of a spike in demand is not likely to provide a reliable basis for investment decisions.

Third, and perhaps most importantly, investments in port infrastructure and the associated land transport infrastructure are long-term propositions that must produce an economic return over a long period of time. As a result, investing in response to spikes in demand rather than in response to long-term growth rates may result in excess capacity or stranded assets.

We combined two different data sources to make our estimates:

- Statistics NZ/Customs data on weight of cargo imports and exports, by port
- Data from POA and POT on container movements (measured in weight and TEUs) and breakbulk movements (measured in revenue tonnes).

These two data series were not consistent with each other and as a result it was necessary to make some assumptions and adjustments to the data in order to ensure consistency between categories of cargo movements and units of measurement. These adjustments are explained in Appendix C, "Technical notes on trade task projections by port".

Our projections, and the assumptions and data we used to compile them are summarised in Table 9. We expect growth rates to vary between different categories of cargo movements. Because there is greater uncertainty about projections for domestic coastal movements and transhipments, we have included several scenarios for growth in each of those areas. Projections for international trade are relatively more robust and tested against the plans of major importers and exporters.

Table 7: Basis for port task projections

Cargo movement	Base data	Historical growth	High growth scenario	Low growth scenario
International trade (imports, exports)	Customs/Statistics NZ data on export and import weights and values, 2002-2012	3.1% per annum (2002-2012)	1.5% per annum; more rapid growth in first decades	(Single scenario only)
Domestic coastal (inward, outward)	POT/POA data on container and breakbulk movements, 2007-2012, plus some assumptions based on MoT container monitoring data	4.5% (Container cargo at POA, 2006-2012)	4.8% (NFDS + 50%)	1.6% (half NFDS)
Import/export tranships	Customs/Statistics NZ data on export and import weights and values, 2002-2012 Plus assumptions about share of LNI and SI trade moved through UNI	Above 10% (2008-2012; both domestic and international tranships of container cargo at POA and POT)	About 4% Based on assumption that UNI draws 60% of LNI and 20% of SI container-based trade	About 3% Based on assumption that UNI draws 40% of LNI and 13% of SI container based trade
International tranships	POA/PoT data on re-exports, plus some assumptions based on MoT container monitoring data	Above 10% (2008-2012; both domestic and international tranships of container cargo at POA and POT)	8% growth from 2012-21, then based on international trade projections	Based on international trade projections – 1.5% per annum over period

4.4 Import and export growth

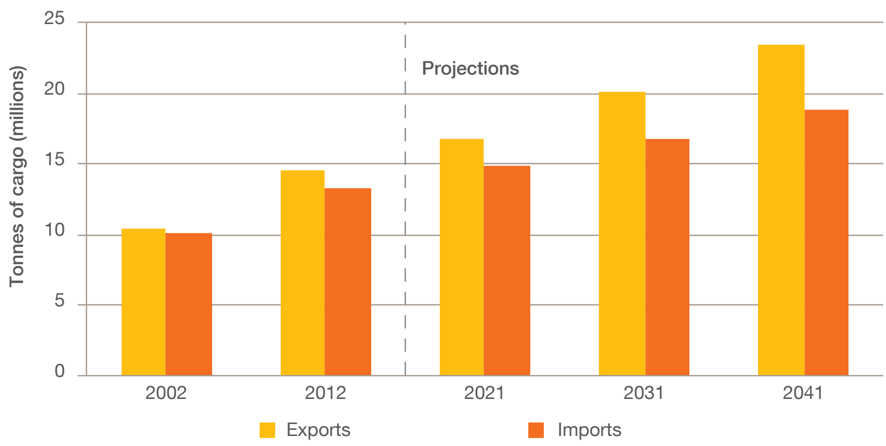
4.4.1 Summary of projections

Our projections for the UNI's international trade are summarised in Figure 36. We project exports to grow by 8.9m tonnes to total 23.5m tonnes in 2041. This equates to 1.7% growth per annum. Imports are projected to grow by 5.5m tonnes to total 18.8 million tonnes in 2041. This equates to 1.2% growth per annum. These projections are summarised in Figure 35.

As Figure 35 indicates, growth is expected to be fastest in the first decade before moderating in subsequent decades. This reflects slowing population growth (which will reduce growth in demand for imports) and constraints on further production of some of the main export commodities such as dairy and timber. Figure 36 breaks down international trade projections by port – showing that volumes through all three ports are expected to be considerable.

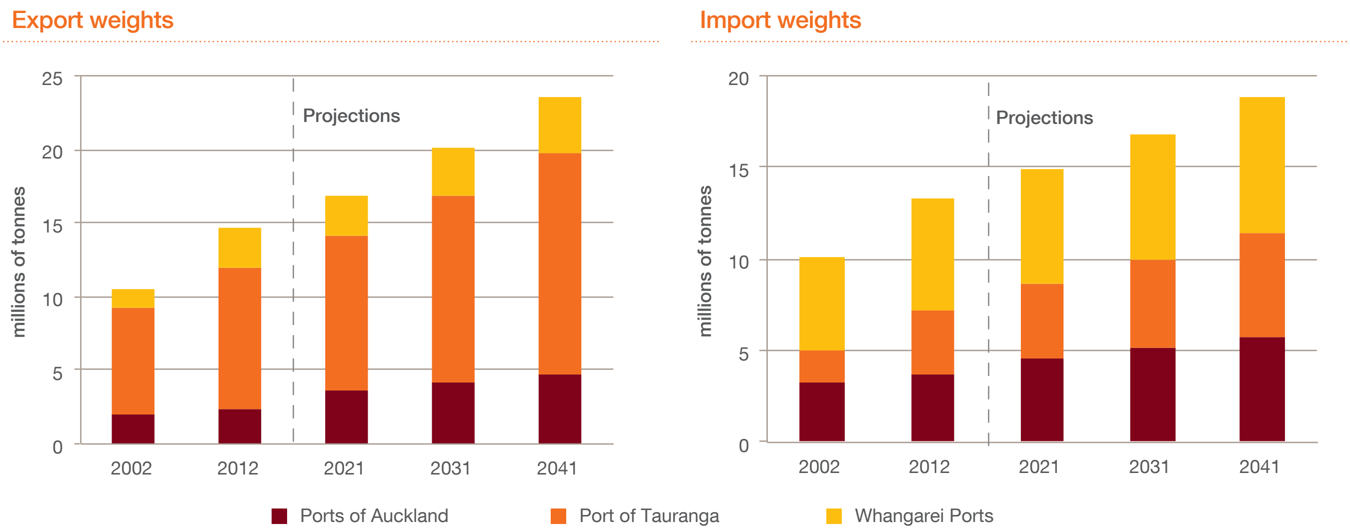
Figure 35: Projected import and export growth at UNI ports

UNI international trade movements: exports and imports



Source: PwC analysis

Figure 36: Import and export weight projections, by port



Source: PwC analysis

Projections for UNI imports and exports are more robust than projections for other categories of cargo movement. More and better information was available on which to base these projections, including Statistics New Zealand/Customs Service data and discussions with major importers and exporters. Due to the fact that overseas trade accounts for the most important component of port task – the 'backbone', so to speak – this is appropriate.

Projections for UNI imports and exports are more robust than projections for other categories of cargo movement.

4.4.2 Detailed projections

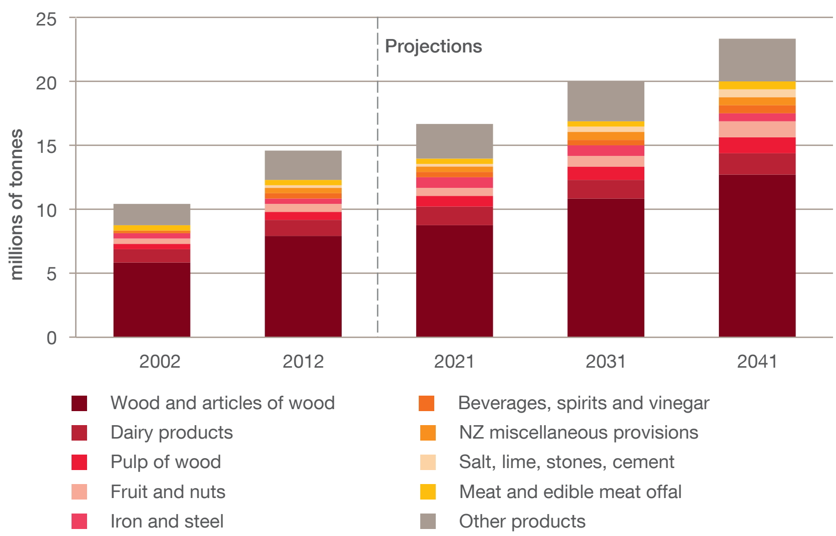
Figure 37 presents historical and projected changes in exports by commodity out to 2041.

Over the 29 years to 2041, exports are expected to grow by around 1.7% per year, reaching 23.5m tonnes. The composition of major products in weight terms is not expected to be dramatically different, with wood and pulp products continuing to dominate, and dairy products accounting for a further 7% of export weights.

We have cross-checked these projections with industry leaders and data on capacity for growth, particularly for wood and dairy products, to ensure they are realistic.

Figure 37: Exports wil continue to be dominated by wood products

UNI export weights



Source: PwC analysis

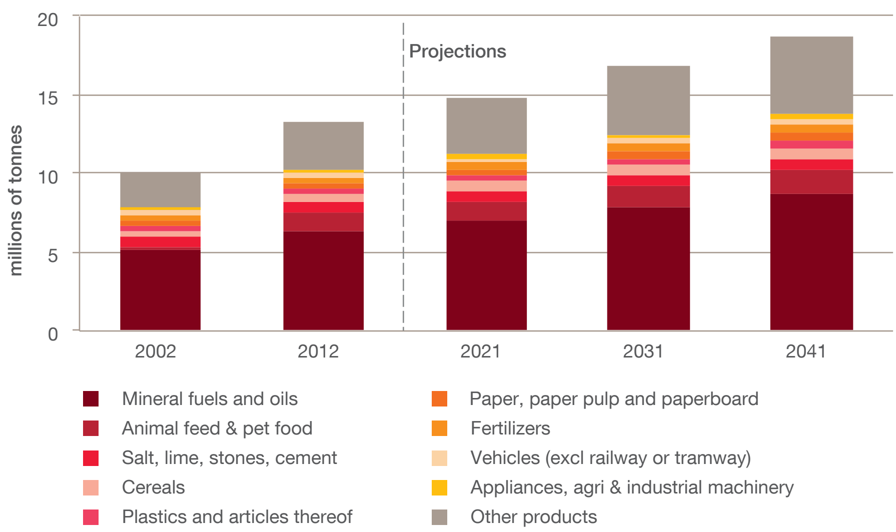
Figure 38 presents historical and projected changes in imports by commodity out to 2041.

Fuel will continue to be the most important import through the UNI. Since 2002, fuel imports into the UNI ports have grown at 2.1% a year, and while that trend is expected to moderate, overall fuel imports will remain strong.

Animal feed and cereals imports are expected to grow sharply as imports of Palm Kernel Extract (PKE) and other products for feeding to dairy cattle continues to rise sharply. These two categories are expected to be the second and fourth largest import categories by weight by 2041.

Figure 38: Imports will be dominated by fuel

UNI import weights



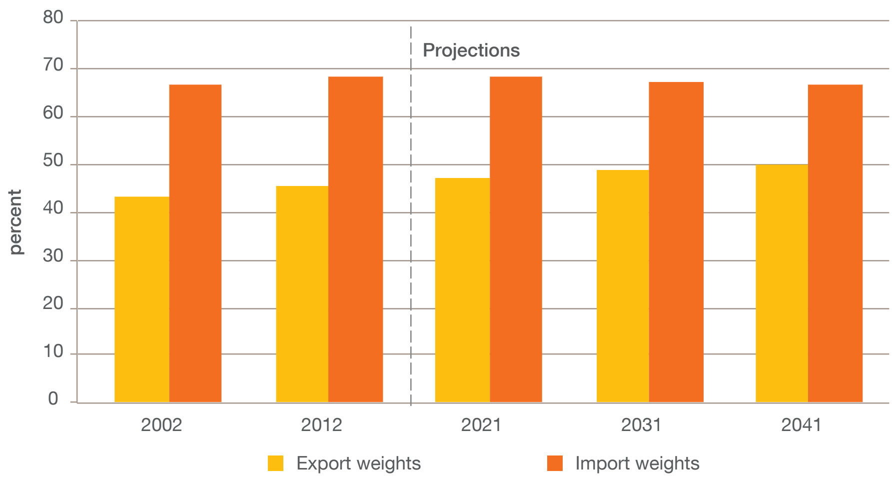
Source: PwC analysis

Figure 39 shows how the role of the UNI ports is expected to increase over time.

The UNI ports' share of New Zealand export weights is expected to grow to 50% from 46% in 2012 on the back of strong forestry and dairy growth. On the imports side, the UNI ports are expected to account for around 67% of weights in 2041, a similar value to the 68% in 2012.

Figure 39: The Upper North Island ports will play a larger role in exports

Upper North Island share of New Zealand trade weights



Source: PwC analysis

The UNI ports' share of New Zealand export weights is expected to grow to 50% from 46% in 2012.

Projections by key trading partners

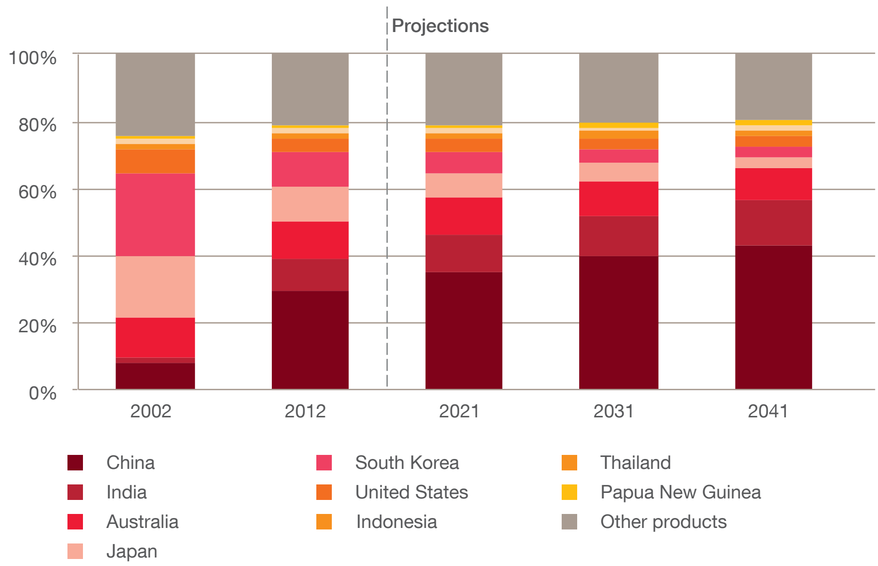
Figure 40 shows how the role played by major export trading partners is projected to change out to 2041.

Over the ten years to 2012, the share of exports through UNI ports bound for China has grown from 8.1% to 30%. Growth to 2041 is expected to be more moderate, but China is still expected to account for 43% of export weights by 2041, based on its strong demand for New Zealand wood and dairy products.

India, which took just 1.7% of UNI port export weights in 2002, and 9.2% in 2012, is expected to account for 14% by 2041, moving ahead of Australia, which will account for around 9.5% of export weights.

Figure 40: China and India are expected to be our main export partners

UNI export weights



Source: PwC analysis

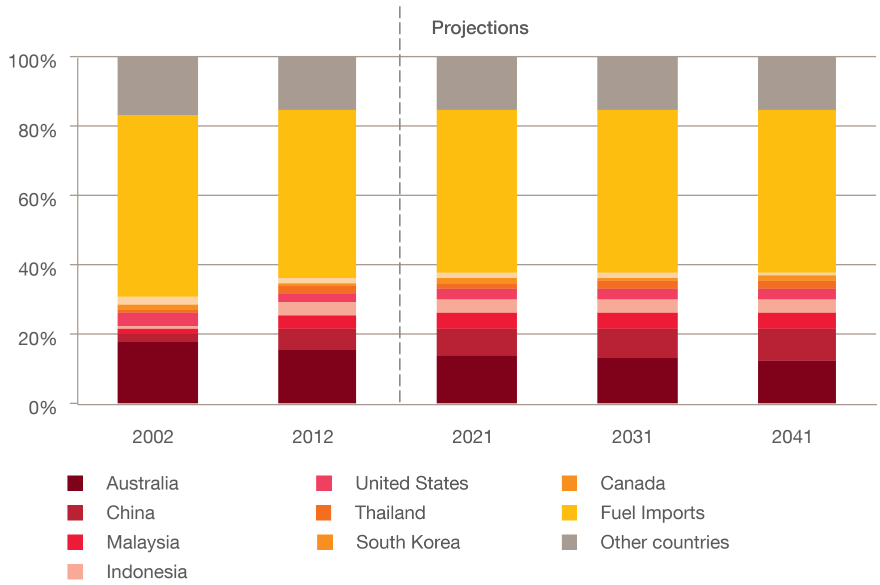
Figure 41 shows how the role played by major import trading partners is projected to change out to 2041.

New Zealand, with the UNI leading, will continue to import fuel from wherever the correct grades are available at the best price. Trade partners will vary from year to year, which is why rather than showing specific countries for fuel imports, we have grouped 'Fuel imports' together. Oil products will still account for 37% of import weights by 2041.

Animal feed is likely to be sourced mostly from Indonesia and Malaysia, while cereals will be sourced from Australia.

Figure 41: Oil exporters will dominate the list of import trading partners

UNI export weights



Source: PwC analysis

Animal feed is likely to be sourced mostly from Indonesia and Malaysia, while cereals will be sourced from Australia.

Trading partner-commodity pairs

Table 8 displays merchandise export projections for 2041 at the level of major export commodities and trading partners. Major exports are expected to be of wood and pulp to China and India; dairy products to China and a range of other countries; and fruit to Japan, South Korea and Hong Kong.

Table 9 displays merchandise import projections for 2041 at the level of major export commodities and trading partners. We have excluded mineral fuel imports from any of the countries listed in the table and lumped all mineral fuel imports together under 'Fuel imports', as the actual countries these come from will vary depending on where fuel can be sourced at the right price.

Animal feed will be the most important import other than fuel. Nearly 670,000 tonnes of cereals are likely to be imported from Australia each year by 2041.

Table 8: Half of all export weights are expected to be wood products to China and India

Upper North Island Ports Exports 2041 (000 tonnes)	China	India	Aust-ralia	Japan	South Korea	United States	Indo-nesia	Thai-land	PNG	Other coun-tries	Grand Total
Wood and articles of wood	8,499	2,786	112	475	178	16	98	119	3	504	**12,789**
Dairy products	380	17	97	43	44	5	13	26	8	1,009	**1,642**
Pulp of wood	602	52	15	0	240	0	172	81	0	96	**1,259**
Fruit and nuts	102	16	116	202	79	26	13	26	4	590	**1,174**
Iron and steel	2	23	217	8	27	162	5	3	35	225	**707**
Beverages, spirits and vinegar	6	0	278	3	9	135	0	0	4	227	**662**
NZ miscellaneous provisions	13	223	241	1	1	0	4	1	11	139	**635**
Salt, lime, stones, cement	1	3	30	0	18	12	3	5	177	310	**559**
Meat and edible meat offal	30	0	8	34	48	102	28	2	7	287	**546**
Paper, paper pulp and paperboard	24	18	82	0	36	47	16	23	0	279	**524**
Mineral fuels and oils	0	0	384	4	0	0	0	0	0	25	**414**
Cereals, flour, starch & milk preparations	44	0	107	0	5	0	6	21	0	72	**256**
Fish & aquatic invertebrates	79	0	1	4	4	10	0	2	3	124	**226**
Vegetables and certain roots (edible)	1	0	30	16	11	8	5	0	5	102	**177**
Plastics and articles thereof	33	5	27	0	2	2	0	3	5	97	**173**
Other products	227	47	483	91	62	135	56	19	68	579	**1,767**
Grand Total	**10,043**	**3,189**	**2,225**	**881**	**762**	**659**	**421**	**332**	**329**	**4,667**	**23,509**

Source: PwC analysis

Major exports are expected to be of wood and pulp to China and India; dairy products to China and a range of other countries; and fruit to Japan, South Korea and Hong Kong.

Table 9: Energy and animal feed imports will determine our largest import partners

Upper North Island Ports Exports 2012 (000 tonnes)	Aust-ralia	China	Mala-ysia	Indo-nesia	United States	Thai-land	South Korea	Canada	Fuel imports	Other coun-tries	Grand Total
Mineral fuels and oils	0	0	0	0	0	0	0	0	8,793	0	**8,793**
Animal feed & pet food	215	1	558	553	3	6	0	9	0	138	**1,485**
Salt, lime, stones, cement	210	45	2	7	12	14	1	75	0	310	**676**
Cereals	636	0	0	0	7	17	0	0	0	13	**673**
Plastics and articles thereof	66	106	45	1	9	95	8	8	0	175	**513**
Paper, paper pulp and paperboard	167	84	14	17	42	3	35	6	0	139	**506**
Fertilizers	86	66	0	47	5	0	2	59	0	207	**472**
Vehicles (excl railway or tramway)	14	42	0	0	46	41	48	0	0	166	**357**
Appliances, agri & industrial machinery	2	112	8	2	71	30	28	1	0	70	**324**
Beverages, spirits and vinegar	111	8	3	0	36	3	8	1	0	123	**293**
Glass and glassware	41	65	0	13	3	1	0	0	0	164	**288**
Iron or steel articles	9	198	8	0	2	2	6	0	0	35	**260**
Cereals, flour, starch & milk preparations	145	17	6	8	5	23	6	1	0	37	**250**
Fruit and nuts	24	6	0	2	67	1	0	1	0	144	**245**
Iron and steel	15	46	0	16	0	23	4	7	0	110	**222**
Other products	581	1,016	180	69	236	192	136	72	0	949	**3,431**
Grand Total	**2,322**	**1,813**	**825**	**736**	**544**	**451**	**283**	**240**	**8,793**	**2,781**	**18,788**

Source: PwC analysis

4.4.3 Basis for projections

Projections of import and export growth were made on the basis of 2002 and 2012 weights of overseas cargo, by commodity and country. Growth rates over this period were projected into the future, with some adjustments made in order to correct for implausibly high growth rates.

The projections presented here are based on analysis that includes:

- Historical trends in product trade growth and in trading partner bilateral trade
- Capacity constraints for the production of New Zealand primary products such as wood and dairy
- High-level growth expectations for New Zealand's trading partners
- High-level economic growth trends in the UNI and New Zealand
- UNI and New Zealand population projections to 2041
- Discussions with more than 20 freight forwarders, shipping lines, and major industry leaders.

Headline drivers of growth

As discussed in Section 2.4, "Recent economic and population trends in the UNI", future trade in the region will be driven by population growth, economic growth, and industry composition. The UNI accounts for a large share of New Zealand's overall GDP, population and international merchandise trade. The UNI's growth exceeded that of New Zealand as a whole from 2002 to 2012. This is expected to continue in the medium- to long-term, meaning that the region will increase its share of national GDP, population, and international merchandise trade.

In 2012, the UNI accounted for 53 percent of New Zealand's GDP and population, 68 percent of import weights, and 46 percent of export weights. Based on Statistics New Zealand population projections, we expect it to grow to 59% of national population by 2041. Its shares of overall economic activity and trade are likely to increase along with population.

The UNI imports and exports a diverse range of goods. However, total trade weights are heavily affected by a few individual commodities: wood exports, dairy exports, and crude oil imports. These goods are relatively heavy and are moved in large quantities. Consequently, we provide a more in-depth analysis of their prospects for trade growth.

Likewise, a large and increasing share of New Zealand's trade is destined for or originated from rapidly-growing Asian economies. Trends in these markets will influence trade growth over the longer term. We will discuss the prospects for Asian economies in this report.

Future trade in the region will be driven by population growth, economic growth, and industry composition.


SHIPPING
&
RECEIVING

The UNI wood industry

The wood industry[44] plays a major role in New Zealand exports, currently representing over 62% of total exports by sea in weight terms. Therefore, changes in the production, productivity and capability to satisfy the international demand for wood will have a substantial impact on overall New Zealand exports.

As Figure 42 shows, over the last ten years, the industry has experienced average annual growth of 1.7%, with total growth of nearly 20% for the 10-year period. Moreover, wood industry production capacity is projected to continue to increase over the next 30 years. Our projections assume that wood exports will continue to be exported primarily as unprocessed logs. While this assumption may not continue to hold throughout the study period, any significant changes are likely to result from large investments in processing facilities, which are not possible to predict in advance.

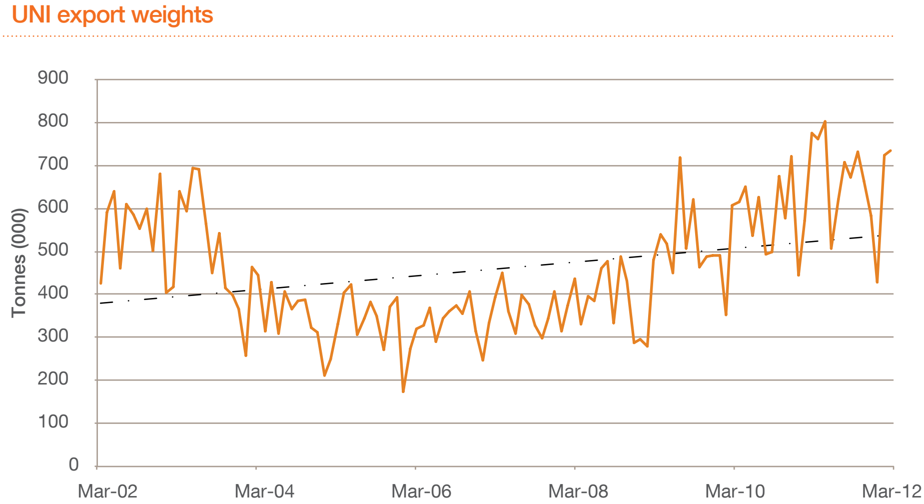
Moreover, increased domestic processing would raise the value of wood exports but not necessarily reduce their weight as sawn timber or pulp are comparable in weight to unprocessed logs. The main effect would be to increase the share of wood that is exported as containerised rather than bulk cargo.

According to the latest Forest Industry and Wood Availability Forecast Report produced by the Ministry for Primary Industries (MPI), wood availability is projected to continue to grow over the next several years.

The MPI modelled five different scenarios for each of New Zealand's Regions, depending on harvesting options and market conditions. For the purpose of analysing the natural catchment area of the UNI ports, we have used the estimates in their reports for the North Island Region only.

As Figure 43 shows, under a supply controlled scenario[45], wood availability is expected to grow from 17 million m^3 to 25 million m^3 in the next 10 years, representing an increase of 46% in wood availability. After 2021, volumes are modelled to stay constant.

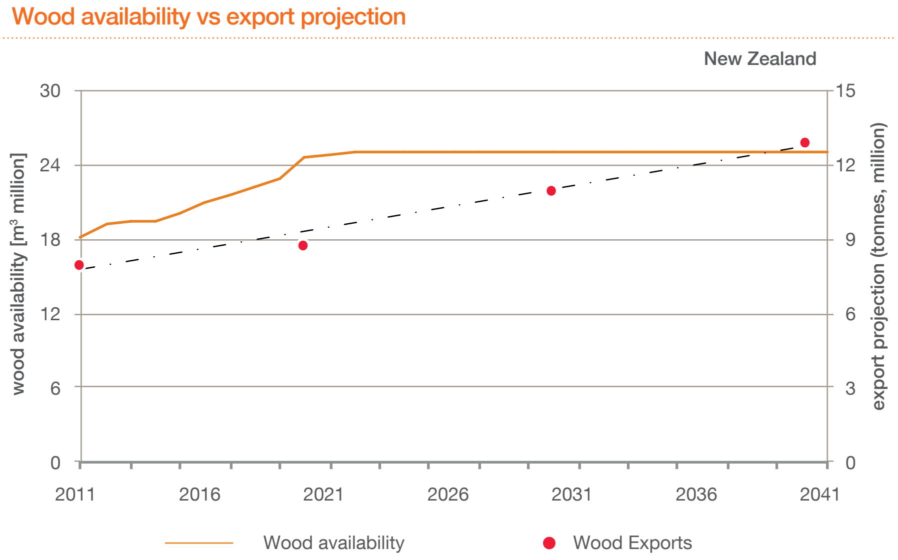
Figure 42: Wood industry exports, 2002-12



Source: MPI

44. The Wood industry is made of the industries of wood and articles of wood, cork, pulp, paper, printed books and other derivatives. In New Zealand, the majority of the exports (in weight terms) are wood and articles of wood such as wood in logs, chips, charcoal or rough shape.
45. Scenario modelled on radiata pine production. Out of the five proposed scenarios, we have selected the scenario where availability is controlled to reduce the volatility. Under all scenarios total growth is in similar ranges. For full report refer to http://www.mpi.govt.nz/news-resources/publications.aspx?title=Forest%20Industry%20and%20Wood%20Availability%20Forecasts.

Figure 43: Wood availability forecast vs PwC export projections, 2011-41



Source: MPI, PwC

The wood industry has experienced steady growth of 1.7% a year, with total growth of nearly 20% for the 10-year period.

North Island Dairy

New Zealand's Dairy exports have experienced remarkable growth over the last 10 years. In total, UNI ports' exports increased 27% for the period, and currently the industry represents the second largest export in weight terms with approximately 8.6% of the total in 2012.

According to the MPI[46], although the sector currently faces weakening international prices as a result of the European debt crisis, the long-term outlook is positive, with steady growth in domestic production and increasing prices as a result of good demand from emerging markets, and an economic recovery in developed countries.

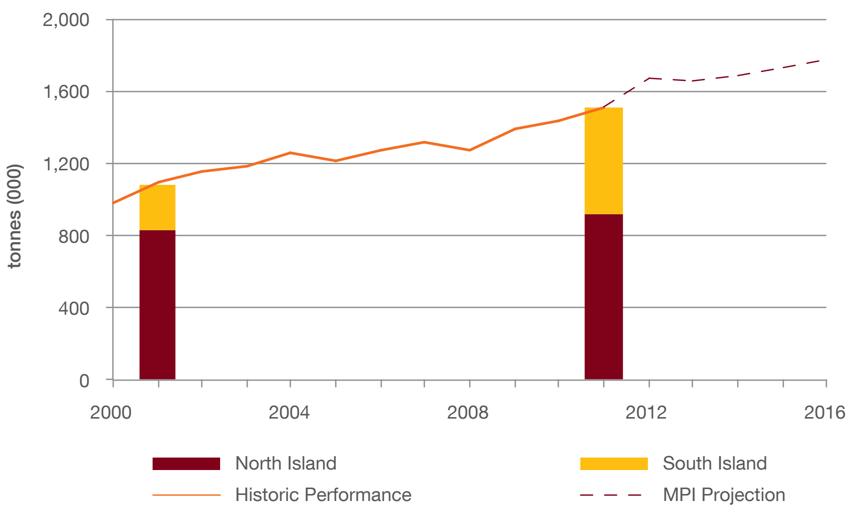
As shown in Figure 44, New Zealand's milk solids production has been consistently increasing in recent years and the trend is projected to continue. Total production increased from 1.1 million to over 1.5 million tonnes over the last 10 years, a 38% change in weight terms. In addition, MPI projects that total production will be in the order of 1.8 million tonnes by 2016, an average increase of 3.8% per annum over the 16 years.

However, most of this recent growth has taken place in the South Island. As shown in Figure 44, milk solids production in the region has boomed from 250,000 to near 590,000 tonnes over the last ten years, due to farm conversions and productivity gains.

Looking forward, dairy growth will predominantly be from increases in milk solids production rather than increase in productivity. This means we adopt a relatively conservative growth rate for the UNI ports, of 0.9% for the 2012-2041 period.

Figure 44: Milk solids production, 2000-16

New Zealand Milk Solids Production



Source: MPI

46. Situation and Outlook for Primary Industries. The Ministry for Primary Industries, 2012.

The last 10 years have experienced a remarkable growth in New Zealand's Dairy exports.

Mineral fuel imports

New Zealand's imports have historically been dominated by mineral fuels and oils and the trend is projected to continue. Currently, the industry represents 48% of the total weight imported through the UNI Ports, of which over 90% is imported through Marsden Point[47].

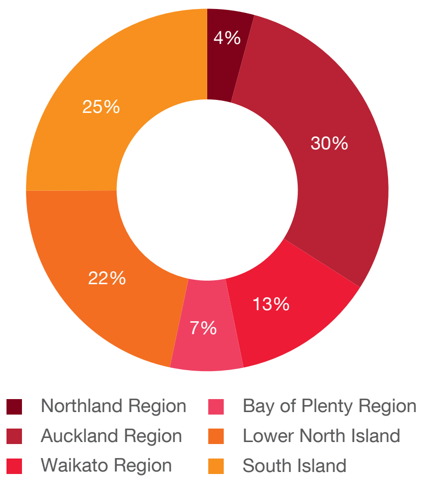
The country's mineral fuels imports are largely driven by the domestic consumption of petrol, which is dominated by household transport. However, diesel vehicles are becoming an increasingly popular choice, used heavily by the commercial transport sector, and in off-road applications such as primary industry and construction.

The UNI region plays an important role in both production and consumption of petroleum products. On the one hand, the Marsden Point refinery uses imported crude oil to meet the majority of the country's demand for petroleum, diesel, and other products. On the other hand, the UNI region consumes roughly half of the country's total petroleum products. For example, as shown in Figure 45, the UNI accounts for 53% of national vehicle kilometres travelled (VKT). Auckland alone accounted for 30% of national VKT. This is similar to its share of national population. Because oil consumption is closely related to land transport usage, it is likely that the UNI's share of total oil consumption will be similar to its share of national population, or slightly higher as a result of industrial uses.

As shown in Figure 46, domestic transport has driven the increase in the country's oil consumption for the past 20 years, representing 80% of total oil consumption. Consequently, it is the main driver of increased oil consumption. Consumption of oil for domestic transport increased at approximately 3% per annum between the years 1991 and 2006. However, consumption has stayed flat over the past five years.

vehicle kilometres travelled, 2010/11

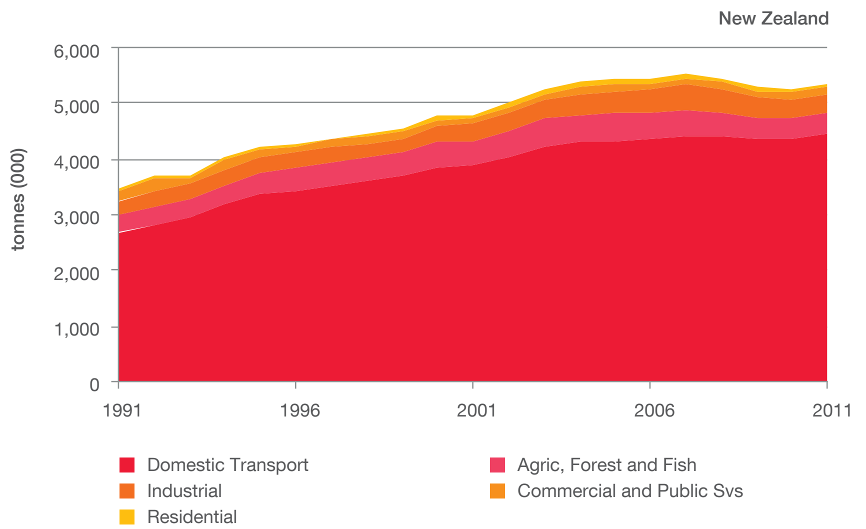
Regional share of national vehicle kilometres travelled



Source: MoT Transport Volume statistics

Figure 46: New Zealand's oil consumption, 1991-2011

Oil consumption



Source: MED

47. The Port of Whangarei currently imports over 75% of New Zealand's mineral fuels.

By contrast, growth in oil consumption for purposes other than land transportation has been negligible or immaterial to overall oil import projections. Total consumption for agriculture, industry, and other means of domestic transport has decreased slightly over the last decade.

The main drivers of domestic oil use are population growth, light passenger vehicle use, and road freight growth. New Zealand's domestic oil consumption rose by 18% from 2001 to 2011[48]. Over the same period, national population grew by 13%[49] and total VKT by road increased 14%[50]. However, oil use increased more rapidly on the back of faster growth in heavy vehicles, which are more fuel-intensive. VKT by diesel vehicles rose 38% from 2001 to 2011, while diesel consumption rose by 37% over the same period.

There are other factors that have affected domestic demand for oil, such as rapid oil price increases in the years leading up to 2008, increasing fuel efficiency in new cars, increasing engine sizes for new cars, an increase in the average age of New Zealand's vehicle fleet and increasing traffic congestion.

This analysis suggests that our projected total increase in mineral fuel imports of 37% for the period from 2011 to 2041 is reasonable given current trends. New Zealand's population is expected to be 27% larger by 2041[51], and it is likely that its oil use will continue to increase at a slightly faster rate.

New Zealand's population is expected to be 27% larger by 2041, and it is likely that its oil use will continue to increase at a slightly faster rate.

48. Ministry of Economic Development, Oil supply, transformation and demand tables.
49. Statistics New Zealand.
50. Ministry of Transport. Note that vehicle kilometres travelled per capita have been falling since 2005, contributing to flat overall traffic volumes.
51. Statistics New Zealand and PwC analysis.

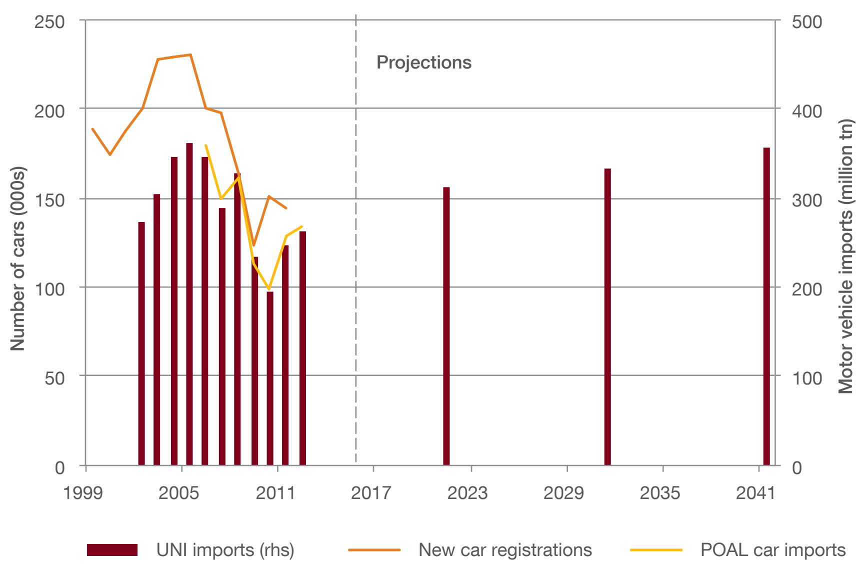
Motor vehicle imports

Imports of cars are an important driver of growth at POA. Motor vehicles are carried as breakbulk cargo and stored at the port while awaiting removal by wholesalers and vehicle refurbishers. As a result, they have significant space requirements.

As Figure 47 shows, new car registrations in New Zealand have fluctuated significantly over the last decade, rising to a peak in 2005 before falling considerably in subsequent years. Car imports through POA have followed a similar trend, reflecting the port's national role in the industry. The same pattern is apparent in motor vehicle import data from Statistics New Zealand.

Figure 47: Motor vehicle imports - historical and projected growth

Motor vehicle imports, historical and projected

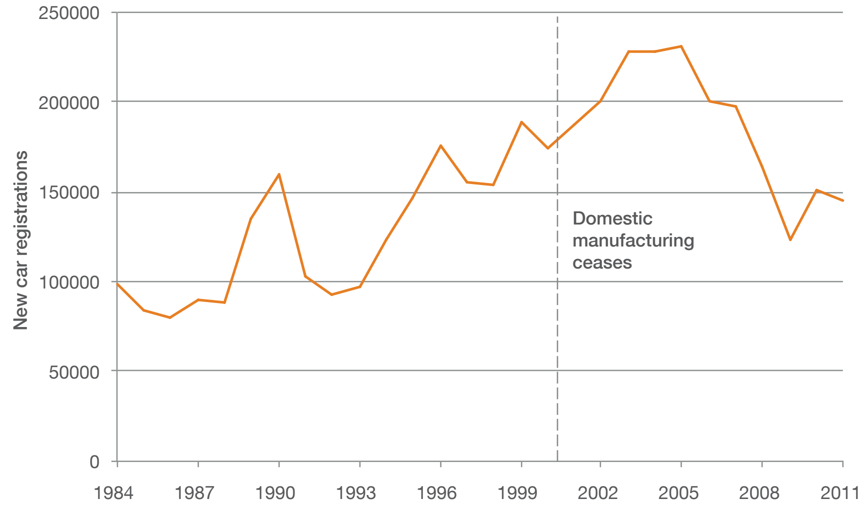


Source: NZTA, POAL, Stats NZ, PwC calculations

We project that motor vehicle import weights in the UNI will grow by a total of 8.8% over the study period. This is likely to be relatively conservative relative to Statistics New Zealand's forecast population growth of 27% over the same period. This is due to the fact that motor vehicle import weights fell over the 2002-2012 period. However, it is important to note that motor vehicle imports are likely to vary considerably from year to year. Recent fluctuations in demand for imported cars are illustrated in Figure 48, which shows new car registrations in New Zealand. Because New Zealand has no significant domestic car assembly capability, future spikes in demand may place short term pressures on port infrastructure above and beyond what is indicated by our projections.

Figure 48: New car registration in New Zealand, 1984-2011

New car registrations in NZ, 1984-2011



Source: NZTA

Future spikes in demand may place short term pressures on port infrastructure above and beyond what is indicated by our projections.

Emerging Asia

The emerging economies from Asia are driving New Zealand's export growth. Specifically, exports to China, India, Indonesia, Vietnam and Thailand have increased 410% in weight terms over the last ten years and currently account for 43% of total exports out of the UNI ports. The economic activity in these countries, supported by strategic trade agreements, will continue to play a key role in New Zealand's international trade.

The latest global economic prospects for the region show that growth is slowing slightly, partly reflecting an easing of stimulus in China and a shift toward domestic sources of demand.

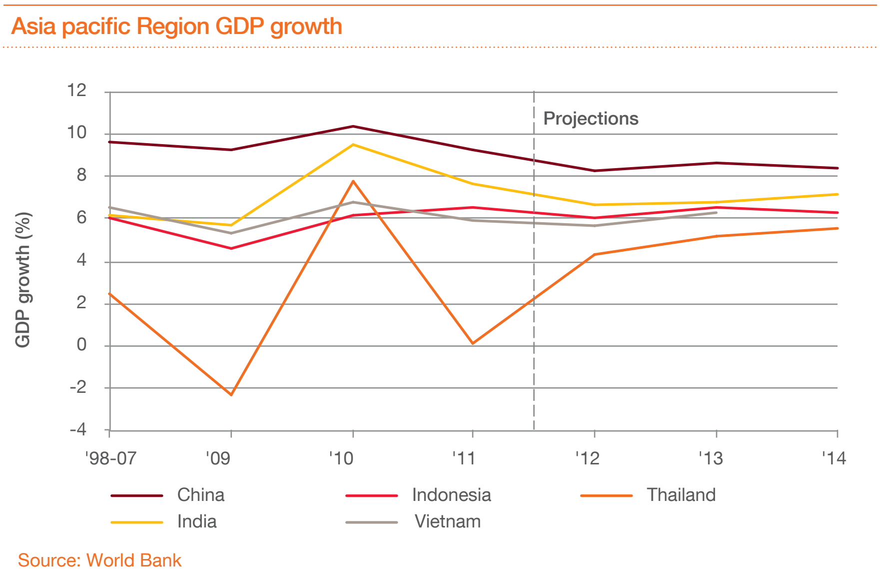
According to World Bank Reports[52], capital flows, which were resilient during the first half of 2011, slowed markedly in the second half of the year in response to increased risk aversion and new global banking regulations that accelerated deleveraging by Euro Area banks. Foreign direct investment (FDI) inflows increased by $45 billion (largely to China), partly offset by declines in portfolio equity flows (IPOs and fund investments in regional exchanges).

Nevertheless, relative to the stagnation in western economies, emerging Asia remains very strong, as highlighted by the forecast growth rates shown in Figure 49.

All these countries have maintained strong growth rates of over 6% with the exception of Thailand, which has experienced some volatility over recent years, linked to political changes there. Economic growth in the region, although slowing in China and India, is projected to remain strong. China is expected to grow at rates over 8% for the next several years, with India's growth rates positioned at just over 7%. Vietnam, Indonesia and Thailand are expected to grow at around 6% per year.

This means there is massive untapped potential for New Zealand to drive export trade growth with Asian emerging economies.

Figure 49: GDP growth for Asia emerging countries, 1998-2014



52. Global Economic Prospects June 2012, East Asia and the Pacific Annex. The World Bank.

There is massive untapped potential for New Zealand to grow trade with Asian emerging economies as a key driver of exports.

4.5 Domestic coastal freight

Domestic coastal shipping of containers to and from UNI ports has grown at a faster rate than overseas cargo over the past half-decade. We expect coastal freight to continue growing throughout the study period. We have defined scenarios in which it continues to grow at the rates experienced over the last half-decade and in which it grows at roughly the same rate as overseas trade.

These projections include both containerised coastal freight and bulk cargo. At present, bulk cargo – primarily petroleum products and cement – makes up the majority of cargo weights carried. However, this category of freight is likely to grow less rapidly than containerised cargo over the period.

4.5.1 Summary of projections

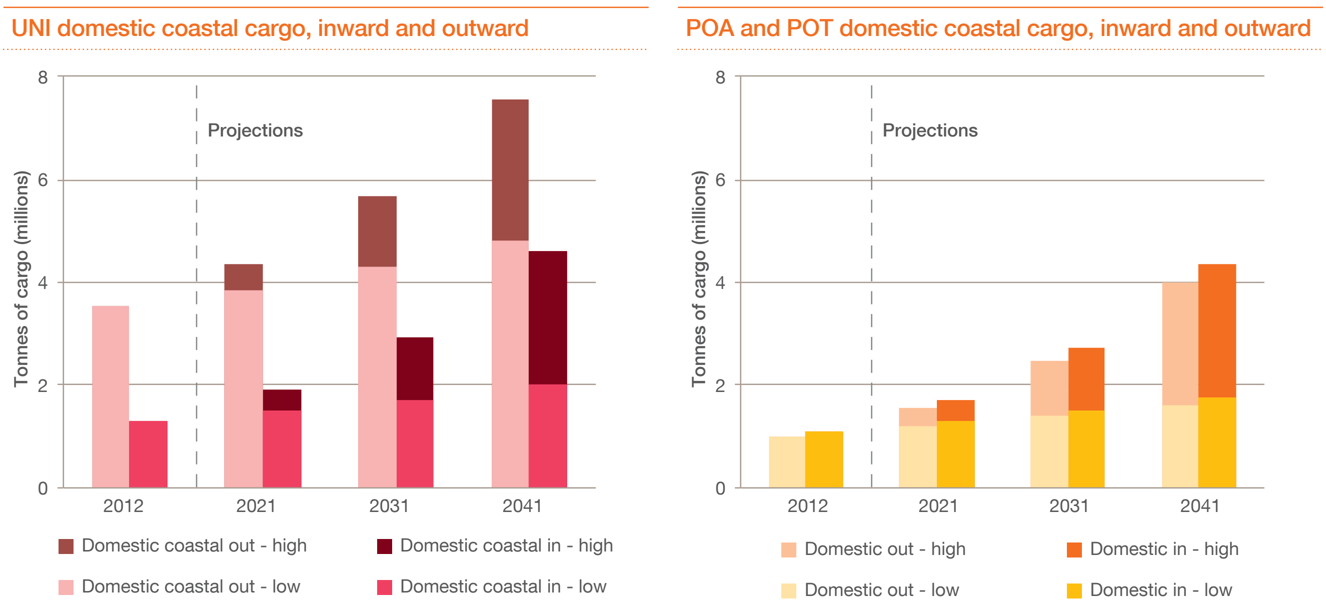
Our projections for domestic coastal freight are summarised in Figure 50. We expect that containerised cargo moving in and out of POA and POT will be the primary driver of demand over the study period. However, outward coastal freight from the region is dominated by movements of petroleum products and cement from Whangarei.

All in all, we expect domestic coastal cargo to grow at an annual rate of between 1.2% and 3.3% during the study period.

4.5.2 Basis for projections

We used three primary data sources to form our projections. First, we used data from POA and POT to estimate the magnitude of the domestic coastal freight task at those ports in 2012. Second, we used data from the 2008 NFDS to estimate the current magnitude of coastal shipping movements to and from Whangarei. Third, we used the National Freight Demand Study, which forecast 3.0% to 3.2% annual growth in coastal shipping over the 2007-2031 period, to develop scenarios for domestic coastal freight growth.

Figure 50: Growth projections for domestic coastal cargo



Source: PwC analysis

We considered several scenarios for domestic coastal freight growth at POA and POT. The base scenario was the NFDS forecast of 3.2% growth per annum. We added high and low growth scenarios of 4.8% growth and 1.6% growth, respectively.

Container freight is likely to grow faster than bulk cargo due to the fact that growth in shipments of the main bulk cargoes – petroleum products and cement – is constrained by production capacity at three sites (Marsden Point refinery and two cement plants). Consequently, we have made separate assumptions about growth rates for bulk cargo to and from the Whangarei ports. We assumed that coastal shipping of refined petroleum products from Whangarei would grow at the same rate as imports of mineral fuels (ie crude oil) to Whangarei – a reasonable assumption given the fact that Whangarei imports crude oil in order to refine it for domestic consumption. We assumed that coastal shipping of cement would either remain flat over the study period (in our low scenario) or increase at an annual rate of 1.6% (in our high scenario). These are likely to be reasonable assumptions due to the fact that significant increases to coastal shipping of cement from Whangarei would entail considerable investments in additional production capacity at Golden Bay Cement.

Finally, it is necessary to note that coastal shipping growth during the study period may be affected by policy changes, such as the emissions trading scheme and choices of land transport infrastructure investment. Because coastal shipping is a relatively minor transport mode, the impact of these changes may be large and is hard to predict.

4.6 Import and export transhipment

Over the last half-decade, POA and POT have handled an increasing amount of import and export transhipment cargo destined for or originated from other New Zealand regions. This has, in effect, meant that throughput at POA and PoT has increased without a corresponding increase in trade volumes.

We expect this trend to continue throughout the study period. There are some limits to the ability to tranship Lower North Island and South Island cargo through UNI ports – particularly for bulk cargoes (and in particular log exports) and time-sensitive refrigerated cargoes such as chilled meat. However, trends in the shipping market towards larger ships and fewer port calls in New Zealand make it likely that containerised cargo will increasingly be transhipped through the UNI.

Transhipment has some implications for the overall efficiency of NZ's port sector. Concentrating overseas shipments through the UNI ports may enable NZ to achieve greater returns to scale from larger ships. However, these efficiency gains may be partially offset by increased supply chain costs for regional importers and exporters, as transhipment may increase time to market or handling costs.

Over the last half-decade, POA and POT have handled an increasing amount of import and export transhipment cargo destined for or originated from other New Zealand regions.

4.6.1 Summary of projections

Our projections for import and export transhipment are summarised in Figure 51. We expect that the primary driver of growth in this category will be the increasing transhipment of Lower North Island (LNI) and South Island (SI) containerised imports and exports through POA and POT. As the LNI and SI export more cargo than they import, we expect overall export transhipments to be much higher than import transhipments. This does not have any bearing on the port task, however, as each transhipment entails both a load and a discharge of cargo regardless of its ultimate origin or destination.

As we do not have any comparable base year data for this category, it is not possible to provide projected growth rates over the whole period. However, these projections imply annual growth of 6% over the 2021-2041 period regardless of scenario, albeit from a higher starting point in the high growth scenario.

4.6.2 Basis for projections

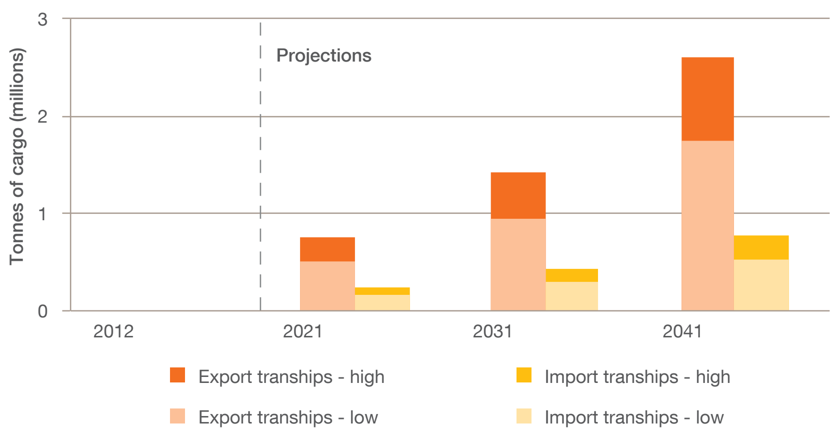
Our projections for import and export transhipment were based on projections for overseas cargo growth in the Lower North Island and South Island and assumptions about the share of this cargo that will be transhipped through the UNI in the future.

In order to project the overseas freight task of the Lower North Island and South Island, we used the same method as for the UNI trade projections. This involved projecting future growth on the basis of historical growth for individual commodity/country pairs over the 2002-2012 period. We moderated our growth forecasts on the basis of information from interviews with major importers and exporters and an analysis of supply or demand constraints in key markets.

We assumed that an increasing share of Lower North Island and South Island overseas freight would be transhipped through Auckland and Tauranga. We constructed two scenarios for transhipment growth. In the high growth scenario, the UNI ports will tranship 60% of the Lower North Island's cargo and 20% of the South Island's cargo by 2041. In the low growth scenario, 40% of Lower North Island cargo and 13% of South Island cargo will be transhipped through the UNI by 2041. We have excluded bulk cargoes such as logs and bulk liquids, as is it unlikely that it will be cost-effective to tranship them.

Figure 51: Growth projections for import and export transhipment

UNI import and export transhipments



Source: PwC analysis

4.7 International transhipment (re-exports)

Comprehensive and reliable data on international transhipments is not available. However, the available data from POA indicates that this category of cargo movement has grown rapidly over the last half-decade. Supplementary information from POT also indicates significant growth. International transhipments are predominantly if not entirely containerised cargo.

Based on information from shipping lines, UNI ports serve two main transhipment markets:

- Pacific Island trade, which is serviced through Auckland. Low cargo volumes on these routes mean that it is more efficient to operate feeder services from Auckland than to provide direct shipping lines. The long-term growth of these transhipments will be driven by economic and population growth in the Pacific Islands.
- Trade between Australia and the United States. Auckland currently handles some trade between Brisbane and the US, while Tauranga tranships wine exports from Australia to the US. Broadly speaking, transhipment of Australian trade will increase as a result of specific market opportunities rather than a longer-term trend. (Conversely, this means that some New Zealand trade may be transhipped through Australian ports when and if opportunities arise.)

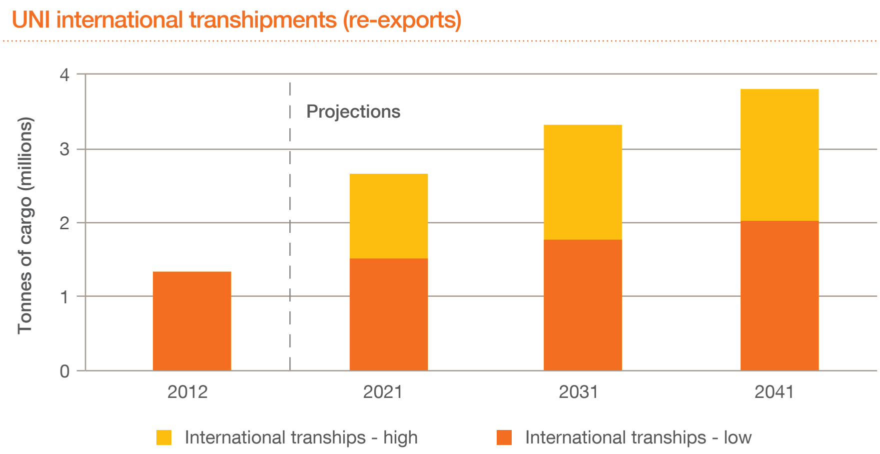
In the longer term, the scope for growth in international transhipments will be limited by growth in New Zealand's own overseas trade. If existing trade volumes are not large enough to justify service on a given shipping line, re-exports can easily move to different routes instead. In the short term, however, growth in this category of cargo movement can allow ports to increase their throughput more rapidly than trade.

4.7.1 Summary of projections

Our projections for international transhipment are summarised in Figure 52. We expect that the primary driver of growth in this category will be increases in transhipment of containerised trade to the Pacific Islands and between Australia and the United States.

We expect international transhipments to grow at an annual rate of between 1.5% and 3.7% over the study period. In the high growth scenario, however, we expect international transhipments to continue recent rapid growth rates over the next decade before slowing growth.

Figure 52: Growth projections for international transhipments



Source: PwC analysis

4.7.2 Basis for projections

Our projections for international transhipments were based on 2012 container movement data provided by POA and POT and assumptions about future growth. We assumed that no bulk cargo was re-exported through UNI ports, due to the fact that bulk carriers are more specialised and flexible in size and that bulk goods (eg logs) are often more complex to load and unload.

Based on data from POA, we expect that re-exports for the UNI as a whole will have grown rapidly over the last half-decade or decade. They are likely to continue growing rapidly in the near future. However, in the long run growth of re-exports is likely to be limited by overall international trade growth. If re-export growth exceeds international trade growth over a sustained period, re-exports will begin to either displace New Zealand's trade or require shipping lines to add capacity to service the re-export trade alone. It would make more sense for shipping lines to add direct routes instead.

We constructed two scenarios for re-export growth along these lines. In the low growth scenario, re-exports grow at the same rate as overall UNI imports and exports throughout the 2012-2041 period. In the high growth scenario, re-exports grow at 8% per annum from 2012-2021 before slowing down to match the growth rate of UNI imports and exports from 2021 to 2041.

We moderated our growth forecasts on the basis of information from interviews with major importers and exporters and an analysis of supply or demand constraints in key markets.

4.8 Allocating aggregate UNI growth by port and by container and non-container

Our main projections of future port task have been made for the UNI region as a whole. However, we recognise that there is some use to breaking down these projections to the level of individual ports. In this section, we provide indicative estimates of trade and throughput growth for Northport (and Whangarei ports more generally), POA, and POT. In addition, we provide indicative estimates of container cargo and breakbulk cargo growth at each port.

In order to break down projections for total cargo across the whole UNI region, we have had to make certain assumptions. Broadly speaking, we have assumed that the ports' share of overall UNI growth within each category of cargo movement will be similar to their historical shares, and that the share of cargo weight moving in containers will remain constant at 2012 levels. These assumptions will not necessarily hold true, but they were necessary in order to disaggregate our projections.

With the obvious exception of heavy bulk cargoes such as logs and petroleum products, POA and POT compete for much of the freight task of the UNI. This is especially true for (dry) containerised cargo. Although land transport costs will factor into importers' and exporters' decisions about which port to use, the two container ports are close substitutes for overseas cargo.

As a consequence, the shares of cargo carried through Auckland and Tauranga are likely to depend upon the ports' capacity to move additional containers, and the marginal cost of doing so. If, for example, POA reaches capacity while POT still has spare capacity, it is likely that POA will have to raise its prices. This will, in turn, encourage some shippers to divert cargo to POT instead. As long as spare capacity exists within the UNI ports, changing prices will encourage shippers to shift traffic away from congested ports.

4.8.1 Summary of projections

Our projections of the future port task for the UNI's individual ports are as follows:

- At POA, container throughput is expected to grow by between 2.3% and 3.2% per annum over the period, while bulk throughput is projected to grow at between 1.9% and 2.2% per annum.
- At POT, container throughput is expected to grow by between 2.5% and 3.1% per annum over the period. Bulk throughput will also grow, but at a slower projected rate of between 1.7% and 2.3% per annum.
- Trade growth at Northport (1.0% per annum) and the Whangarei ports in general (0.7% to 0.8% per annum) is expected to be slower than growth at the other UNI ports. This is because the faster growing transhipping element is not expected to be a feature for the Whangarei ports due to the dominance of bulk cargo. Furthermore, growth in Northport's main cargo, unprocessed logs, is expected to be flat after 2020 due to the fact that log availability is projected to level off[53]. Northport may be able to grow more rapidly if it is able to attract other types of cargo.

Table 10 summarises our projections to 2041, for each port by cargo type and category of cargo movement. These figures contained within should be considered to be indicative only as the underlying assumptions will not necessarily hold.

53. Forme Forest Industry Consultants (2012), "Desktop Review of Log Exporter and Processor Intentions March 2012", confidential report to Northport.

Table 10: UNI port task projections broken down by port and type of cargo 2012-2041 growth projections by port, container and breakbulk

Categories		Northport	Whangarei ports	POA	POT	Total UNI
Outside-port growth:						
Container	Per annum	-	-	2.0% to 2.5%	1.7% to 2.0%	1.8% to 2.2%
	Total	-	-	77% to 105%	62% to 76%	68% to 89%
Bulk	Per annum	1.0% to 1.0%	0.7% to 0.8%	1.7% to 1.9%	1.7% to 2.3%	1.7% to 2.2%
	Total	33% to 33%	22% to 26%	61% to 74%	62% to 91%	62% to 88%
Total	Per annum	1.0% to 1.0%	0.7% to 0.8%	1.9% to 2.4%	1.7% to 2.1%	1.4% to 1.8%
	Total	33% to 33%	22% to 26%	73% to 98%	62% to 84%	50% to 67%
Exchange growth						
Container (2021-2041)	Per annum	-	-	3.3% to 3.3%	5.0% to 5.1%	4.2% to 4.2%
	Total	-	-	90% to 91%	167% to 171%	126% to 128%
Bulk (2021-2041)	Per annum	-	-	6.2%	6.3%	6.3%
	Total	-	-	236%	240%	237%
Total (2021-2041)	Per annum	-	-	3.4% to 3.4%	5.1% to 5.1%	4.2% to 4.3%
	Total	-	-	94% to 95%	168% to 172%	128% to 131%
Total throughput growth						
Container	Per annum	-	-	2.3% to 3.2%	2.5% to 3.1%	2.4% to 3.2%
	Total	-	-	95% to 151%	104% to 146%	100% to 148%
Bulk	Per annum	1.0% to 1.0%	0.7% to 0.8%	1.9% to 2.2%	1.7% to 2.3%	1.7% to 2.3%
	Total	33% to 33%	29% to 33%	71% to 88%	62% to 92%	64% to 92%
Total	Per annum	1.0% to 1.0%	0.7% to 0.8%	2.2% to 3.0%	2.1% to 2.7%	1.7% to 2.3%
	Total	33% to 33%	29% to 33%	90% to 138%	82% to 117%	64% to 91%

Source: PwC analysis

4.8.2 Basis for allocations

Allocating UNI trade growth between ports

We made projections for the UNI as a whole and for individual ports. In order to do so, we had to make some assumptions about growth rates at individual ports. This was more salient for POA and POT than for Whangarei, as all categories of trade except international cargo were negligible at Northport.

In order to split out projections by individual ports, we had to make several assumptions. First, we allocated projected UNI import and export growth to individual ports. In order to do so, we used the method discussed in Section 4.4 to project growth for each individual port based on 2002 and 2011 data[54]. We then used these projections to allocate overall UNI growth to individual ports. The assumptions we made in order to do so – eg around maximum growth rates for individual commodity/country pairs – were consistent with those that we made in our main projections of overseas cargo growth.

We assumed that import and export tranships from the Lower North Island and South Island would be split between POA and POT according to those ports' 2012 share of UNI import/export tranships of containers. This was done under the assumptions that (a) most if not all tranships would be containerised (and hence best understood using data on container movements only) and that (b) the share of tranships going through POA and POT would not significantly change over the projection period. While the latter assumption may not hold throughout the projection period, we have no strong basis for making an alternative estimate.

We allocated international transhipment and domestic coastal shipping growth between POA and POT according to those ports' 2012 share of UNI international transhipment and domestic coastal shipping. In other words, we assumed that growth rates for POA and POT would be identical in these categories. We made separate estimates for the Whangarei ports based on the assumptions that (a) they would handle no re-export cargo and (b) all coastal shipping in and out of Whangarei would be related to oil and cement products. While these assumptions may not hold throughout the projection period, we have no strong basis for making an alternative estimate.

We recognise breaking down these projections to individual ports is important in the context of understanding the constraints faced by these ports.

54. We chose 2011 as an end year rather than 2012 due to the fact that an industrial dispute at POA diverted a large quantity of overseas trade from POA to POT.

Allocating growth by container and non-containerised cargo

Our high-level projections were made in terms of total cargo weight. In order to understand individual components of the port task, we needed to estimate the share of total cargo that would be containerised or moved as non-containerised cargo.

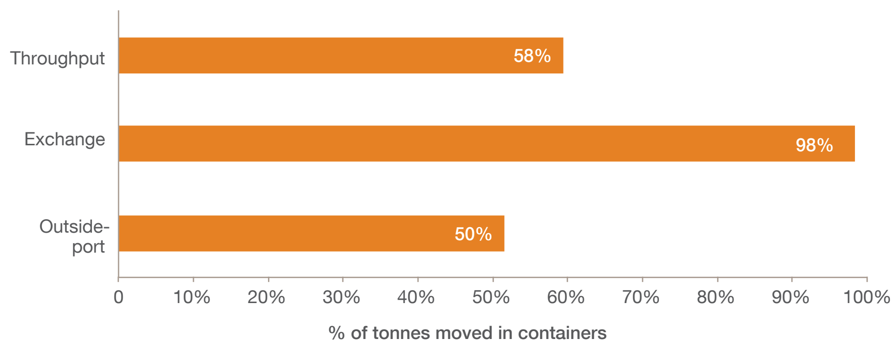
We assumed that the share of cargo moved in containers, within each category of cargo movement, would remain relatively constant over the 2012-2041 period. We used 2012 data from the ports in order to estimate the share of cargo weight that was containerised. We did so by comparing net weight of containerised cargo with estimated weight of bulk cargo within each category of cargo movement. Estimated container shares varied considerably – for example, in 2012 90% of POA's export weight was carried in containers, while only 47% of POT's export weight was containerised. (See Figure 53 for a summary of containerisation rates for traffic through POA and POT.)

The share of overall cargo carried in containers has not changed significantly in recent years. It is likely that most of the easy opportunities to containerise trade have now been taken up, meaning that container trade will increase its share of total cargo only incrementally. The ability of the ports to pursue further containerisation is likely to be constrained by the mix of products that they handle (eg log exports from Tauranga, car imports through Auckland).

After estimating projected container and bulk cargo weights, we used 2012 data from the ports to estimate total TEUs. We did so by calculating the ratio between the net weight of container cargo and total (full+empty) TEUs for each category of cargo movement. We then multiplied these ratios by the estimated weight of container trade to obtain an estimate of total TEUs.

Figure 53: Share of international trade cargo shipped in containers

Containerised cargo shares at POA and POT, 2012



Source: PwC analysis

4.8.3 An alternative allocation: Higher growth at POT

In our base case allocation, we project POT to grow at a similar rate as POA over the study period, or slightly slower. These estimates used 2002-2011 data on international cargo growth to estimate the share of growth that would occur at individual ports. We did not include 2012 to avoid picking up the temporary effects of the industrial action at POA. However, it is possible that the shifts that occurred in 2012 reflect an emerging long-term trend rather than a brief disruption. In this case, we may have under-predicted growth at POT.

As a result, we have constructed an alternative growth scenario on the basis of relative growth at these two ports from 2002 to 2012 data. We have not used these results in our analysis of future infrastructure needs. In this case, growth at POT is considerably greater than growth at POA. Overall growth forecasts are summarised in Table 11, which is comparable to Table 10 earlier in this section. In the base scenario, cargo throughput at POT was projected to grow 82% to 117% over the study period, with comparable or slightly higher growth at POA. In the alternative scenario, cargo throughput at POT is expected to grow 94% to 130% over the period – considerably higher than POA.

(This also has an impact on projected growth at Northport, reducing it due to the fact that trend growth was lower for 2002-2012 than for 2002-2011.)

It is possible that the shifts that occurred in 2012 reflect an emerging long-term trend rather than a brief disruption.

Table 11: 2012-2041 alternative growth projections by port and cargo type

Categories		Northport	Whangarei ports	POA	POT	Total UNI
UNI Outside-port growth:						
Container	Per annum	-	-	1.0% to 1.7%	2.0% to 2.2%	1.6% to 2.0%
	total	-	-	35% to 63%	76% to 90%	58% to 78%
Breakbulk	Per annum	0.4% to 0.4%	0.9% to 1.0%	1.0% to 1.3%	1.9% to 2.5%	1.8% to 2.3%
	total	14% to 14%	29% to 32%	35% to 47%	73% to 103%	67% to 94%
Total	Per annum	0.4% to 0.4%	0.9% to 1.0%	1.0% to 1.6%	1.9% to 2.4%	1.4% to 1.8%
	total	14% to 14%	29% to 32%	35% to 59%	75% to 97%	50% to 67%
Exchange growth						
Container (2021-2041)	Per annum	-	-	3.3% to 3.3%	5.0% to 5.1%	4.2% to 4.2%
	total	-	-	90% to 91%	167% to 171%	126% to 128%
Bulk (2021-2041)	Per annum	-	-	6.2%	6.3%	6.3%
	total	-	-	236%	240%	237%
Total (2021-2041)	Per annum	-	-	3.4% to 3.4%	5.1% to 5.1%	4.2% to 4.3%
	total	-	-	94% to 95%	168% to 172%	128% to 131%
Total throughput growth						
Container	Per annum	-	-	1.6% to 2.7%	2.7% to 3.3%	2.2% to 3.0%
	total	-	-	60% to 115%	117% to 159%	90% to 138%
Bulk	Per annum	0.4% to 0.4%	0.9% to 1.0%	1.3% to 1.7%	1.9% to 2.5%	1.8% to 2.4%
	total	14% to 14%	29% to 33%	44% to 62%	74% to 104%	69% to 97%
Total	Per annum	0.4% to 0.4%	0.9% to 1.0%	1.6% to 2.5%	2.3% to 2.9%	1.7% to 2.3%
	total	14% to 14%	29% to 33%	56% to 104%	94% to 130%	64% to 91%

Source: PwC analysis

The difference between the base scenario and this one is particularly significant for containerised cargo. In the base scenario, POA is expected to continue handling more containers than POT throughout the study period. In the alternative scenario, POT is likely to have considerably higher container growth than POA, reflecting the increasing role that it plays for handling cargo for the whole UNI region.

This alternative scenario should not have a significant impact on our analysis of infrastructure shortfalls and options for meeting that supply. The principal effect is to reduce the share of growth occurring at POA, where port and port-related infrastructure is most constrained, and reallocate it to POT, which has considerably more room to expand. If anything, POT's response to the industrial action at POA suggests that it is efficient enough and has enough spare capacity to handle rapid growth diverted from elsewhere in the UNI.

5

The ability of the Upper North Island ports to cater for the future trade task

The ability of the Upper North Island ports to cater for the future trade task

In this section, we analyse the ability of each UNI port to cater for our projected growth in volumes, firstly by using its current infrastructure, and then by either making operational efficiencies or investing in new infrastructure.

- ***In Section 5.1***, we outline the current UNI port and port-related infrastructure
- ***In Section 5.2***, we describe how we assess whether the current infrastructure can cater for a given level of growth
- ***In Sections 5.3 to 5.5***, going through each UNI port in turn, we consider each port's ability to cater for our projected growth in volumes – we assess the ability of current infrastructure to cope with growth, and where this is difficult, we outline options for addressing it
- ***In Section 5.6***, we discuss the role of markets and prices in allocating capacity.

A note on terminology

It should be noted that we loosely use the term 'bulk' throughout this report to describe all non-container cargo. Strictly speaking bulk cargo is cargo that is transported unpackaged in large quantities. It refers to material in either liquid or granular, form such as petroleum, grains, or coal typically dropped or poured, directly into a bulk ship's hold. Smaller quantities can be boxed (or drummed) and palletised. Bulk cargo is classified as liquid or dry. Break bulk (or general) cargo covers the variety of goods that must be loaded individually, and not in containers nor in bulk as with oil or grain[55].

55. Adapted from Wikipedia, see http://en.wikipedia.org/wiki/Bulk_cargo and http://en.wikipedia.org/wiki/Break_bulk_cargo.

5.1 The current infrastructure

We have looked at infrastructure across three categories:

- access for ships, including channel and berth depth
- port infrastructure, most importantly including berthage and storage capacity
- distribution, including road and rail access to or from the port.

5.1.1 Access arrangements

Table 12 outlines the current access arrangements across the UNI.

Table 12: Current access arrangements across the UNI

Port	Current arrangements	Consented or under development
Northport	• Berth depths of 13, 13, & 14.5 metres • Channel depth of 14.8 metres • Harbour can only accommodate 275-300 metre length vessels max, to allow sufficient room for turning	• Has consent for a new berth, which will have a depth of 14.5 metres • Ability to dredge to 14.5 metres at existing berths
Refining NZ	• Deep water berths • Approach is very deep, but limited by the 14.8 metre shoal patch	
Ports of Auckland	• Channel depth of 12.5 metres (chart datum) • Tides in channel allow for ships of up to 13.9 metres draught at high tides • Container berth depths of 12.5, 13, & 13.5 metres • Various bulk berth depths	• Container berth under development has consent for a depth of 13.5 metres • Consent for dredging of 1 existing berth to 15.5 metres
Port of Tauranga	• Channel depth of 12.9 metres (chart datum) inside harbour entrance; 14.1 metres outside • Various berth depths, of up to 14.5 metres for containers, and up to 12.9 metres for bulk • Tidal restrictions apply to larger ships at mid-tides due to the volume of water flowing through the entrance channel	• Consent for channel and berth dredging have recently been granted by the Environment Court[56]. These consents permit dredging of the outer channel to 17.4 metres, and inner channel and berths to 16 metres

56. The consents still need to be approved by the Minister of Conservation and they have been appealed to the Court of Appeal.

5.1.2 Port infrastructure

Table 13 outlines the current port infrastructure across the UNI ports.

Table 13: Current port infrastructure across the UNI ports

Port	Current infrastructure	Infrastructure consented or under development
Northport – Berthage	• 3 berths, of 570 metres total	• Consent for 1 berth of 270 metres
Northport – Storage	• 34ha of formed storage landh	• An additional 14ha within port boundary • Consent for additional 2.3ha
Refining NZ – Berthage	• 2 jetties, of 134 metres total, which can accommodate ships of up to 275 and 200 metres length respectively	
Refining NZ – Storage	• Some storage at refinery	
Ports of Auckland – Berthage	• 3 container berths, of 870 metres total • Bulk berths of 1,637 metres total; in practice POA have 5 operable bulk berths	• 1 container berth of 306 meters consented (at edge of new storage) • Possible loss of 1 operable bulk berth if Captain Cook wharf is released
Ports of Auckland – Storage	• 46ha of container terminal land • 25.3ha of bulk storage land • Further 15ha storage area at Wiri inland port	• 3.6ha under development for container terminal • Possible loss of 3ha of land for bulk storage if Captain Cook and Marsden wharfs are released
Port of Tauranga – Berthage	• 3 container berths, of 600 metres total • Bulk berths of 2,055 metres total • 1 dolphin berth for cement and bulk liquids	• Container berth extension of 170 metres under development
Port of Tauranga – Storage	• 72ha of container terminal land, of which 41 is currently used • 112ha of bulk storage land • Further 3.5ha storage area at Metroport	
Total UNI – Berthage	• 6 container berths, of 1,470m total • Bulk berthage of 4,262m total	• 2 container berths of 476m under development • Possible loss of one bulk berth if Captain Cook and Marsden wharfs are released
Total UNI – Storage	• 118ha of container terminal land • 171ha of bulk storage land • 18.5ha container storage area at 2 inland ports	• 3.6ha under development for container storage • Possible loss of 3ha of land for bulk storage if Captain Cook and Marsden wharfs are released

Figure 54, Figure 55 and Figure 56 show the location of the port infrastructure at Northport, POA and POT, respectively.

Figure 54: Northport

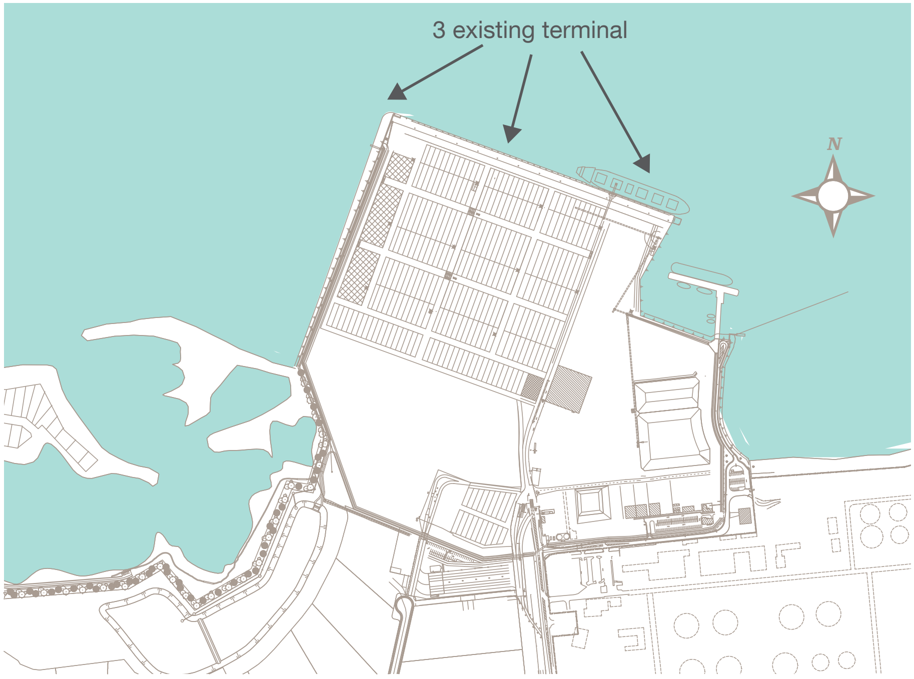


Figure 55: Ports of Auckland

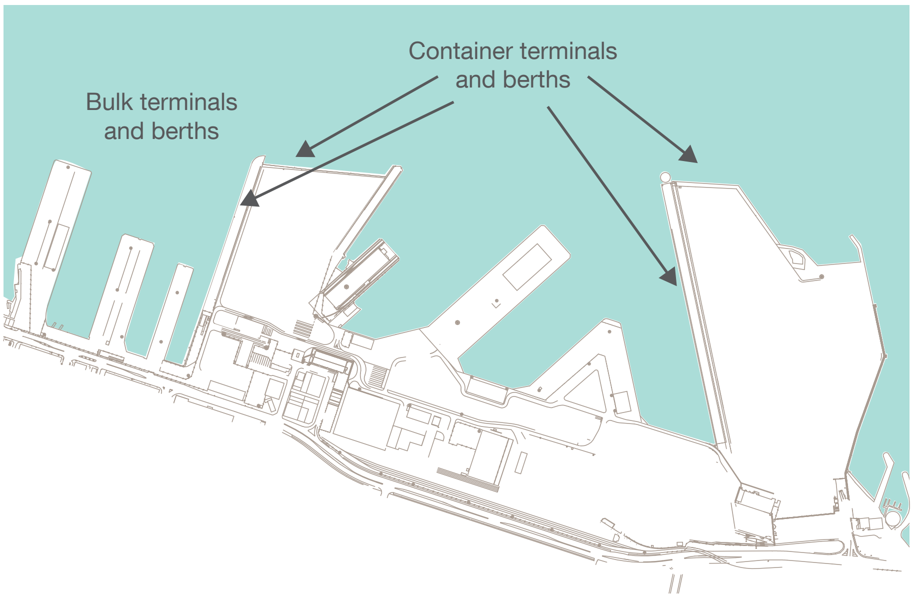
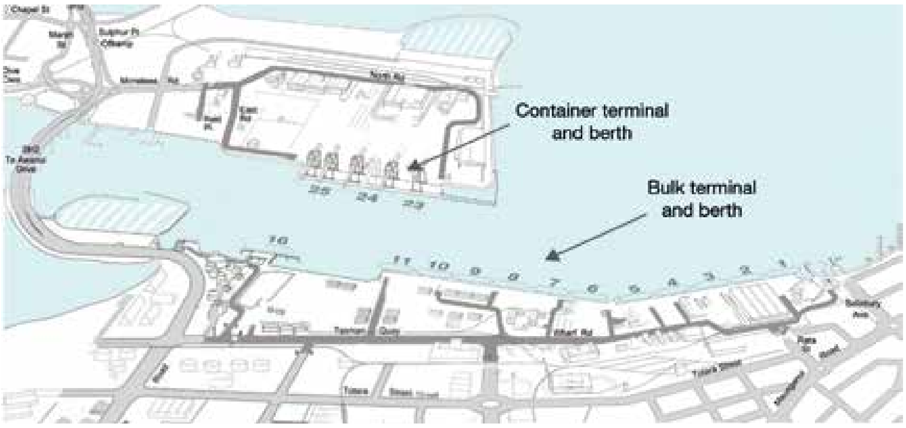


Figure 56: Port of Tauranga



5.1.3 Road and rail network

Northland

Northport cargo is distributed to and from the port by road. The primary road is state highway 1 north and south – and the predominance of log exports means the primary routes are from forests from Helensville to the far north.

Oil imported by Refining NZ is processed into fuels before being distributed using a combination of the Wiri pipeline (to Auckland), road (for Northland) and coastal shipping (to other New Zealand regions).

Auckland

The key pieces of distribution infrastructure within the Auckland area are the Grafton Gully road route, the other major Auckland motorways, and the Auckland rail network (specifically, the eastern branch of the main trunk line south from the port to Southdown and beyond).

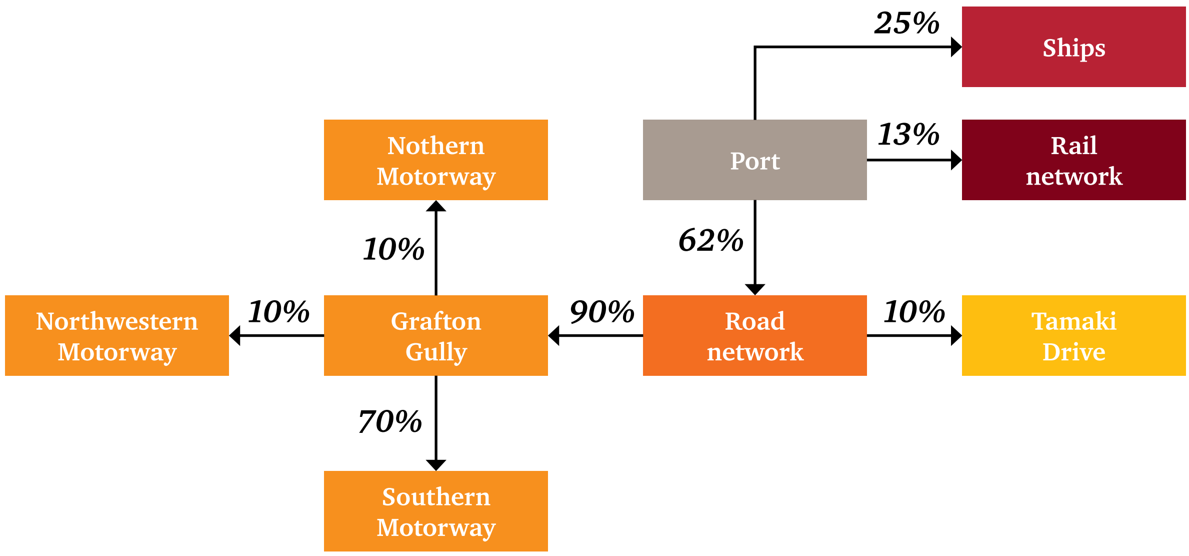
Figure 57 presents the routes which imports to POA use to reach their destination and exports from POA use to reach the port from their origin.[57]

Currently, around 62% of port trade volumes are distributed via the road network, 13% via the rail network, and 25% using coastal or international transhipping – meaning 75% of port trade uses the off-port distribution infrastructure.

Of the port traffic which uses the road network, around 90% travels to/from the port using Grafton Gully, 70% also using the Southern Motorway and 10% using each of the Northern and Northwestern motorways. 10% of the port traffic uses Tamaki Drive.

57. Derived from a combination of eROAD data (2012) and from Beca (2009), "Port Truck Survey Report", report prepared for Ports of Auckland Ltd.

Figure 57: Ports of Auckland distribution network, with current usage proportions



The port traffic using Grafton Gully represents only around 7% of the total traffic volume, despite being the single piece of distribution infrastructure which carries the most port traffic. Port traffic represents only 2% of traffic on the Southern Motorway.

The eastern rail line is also shared between port traffic and passenger services. As with roads, the passengers services greatly outnumber the freight services. There are currently up to eight port trains movements a day. But there are around this many passenger trains each hour at peak times.

Port road traffic is highest between 7am to 10am and around midday. There is little port traffic after 4pm. This is mainly driven by the optimal time for the cargo to reach its off-port destination or leave its origin.

Tauranga and Metroport

POT cargo is distributed to and from the port using a combination of road and rail. The primary roads used are state highway 2, both northwest to Auckland and southeast, and state highway 29 heading southwest. There is also a dedicated freight rail line, heading both northwest to connect with the North Island main trunk line at Hamilton and southeast. In 2009/10 about 40% of cargo was transported by rail[58], which includes the significant portion of logs which are transported to POT by rail from the Central North Island forests via Kawerau and Murupara.

Waikato

Road freight makes up a large share of traffic movements on some the key strategic corridors in and through the Waikato region. Traffic monitoring data from NZTA shows that heavy vehicles make up 10% to 15% of all traffic travelling through the urban area of Hamilton on SH1. This can be expected to drop when the Waikato Expressway is complete but clearly there will still be considerable demand for freight traffic to access the industry within the city. On SH29 between Hamilton and Tauranga the proportion of heavy traffic is reported to be around 15%. This will increase once the Expressway is complete if SH1 – SH29 becomes the preferred route between Auckland and Tauranga.

58. Bay of Plenty Regional Council, "Bay of Plenty Regional Land Transport Strategy Annual Report 2009/10".

5.2 How we assess whether current infrastructure can cope with greater volumes

The capacity of the infrastructure discussed above is generally not fixed. It is therefore difficult to give a strict view on technical limits, and hence on whether the current infrastructure can adequately cater for greater trade volumes.

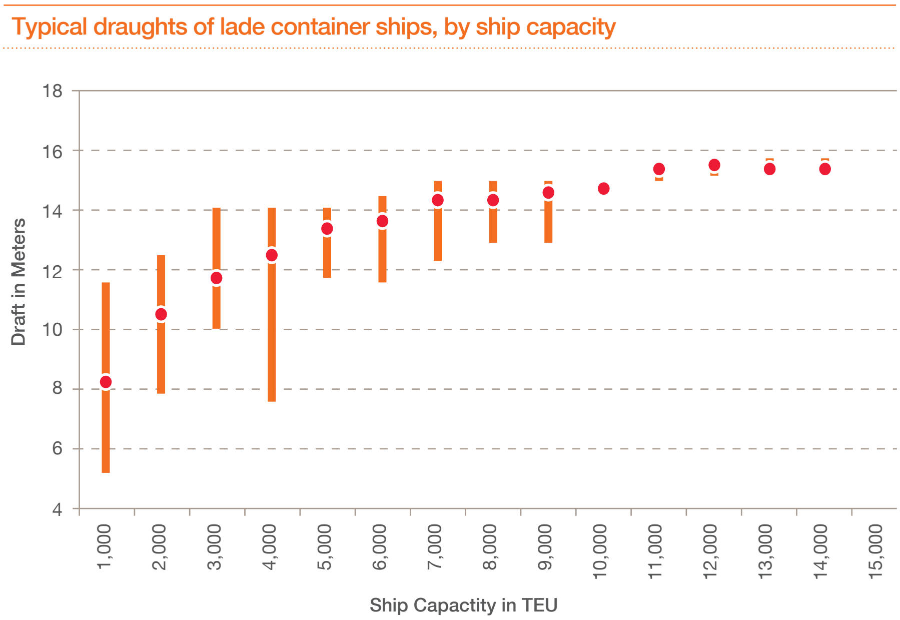
Where possible, our approach is to estimate the capacity of types of infrastructure on the basis of international benchmarks. These give us an indication of the maximum throughput, for a given berth length or amount of storage space, which the most intensely used and efficient ports of a similar size to the UNI ports are achieving.

5.2.1 Access arrangements

The average size of ships visiting the UNI ports is likely to increase in the future, at least to some extent. Larger ships typically have deeper draughts, and hence require deeper berths and channels.

Figure 58 presents the typical draughts of container ships of various sizes.

Figure 58: Typical draughts of laden container ships, by ship capacity



Source: Rodrigue, J-P et al. (2012) The Geography of Transport Systems, Hofstra University, Department of Global Studies & Geography, http://people.hofstra.edu/geotrans

While there is a relationship between increasing TEU capacity of ships and draught requirements, there is considerable variability stemming from ship design and the weight of product being carried. Many larger ships being built at the moment are wider and longer rather than deeper – partially in response to the fact that many ports worldwide have depth issues.

If we expect that ships of, say, 6,000 TEUs will want to call at a given port, then in order to cater for that, the port would need to provide capacity for ships of around 11.5-14.5 metre draughts, depending on the design of the ship and the extent to which it is laden. Assuming an under-keel clearance of about 10%[59], this suggests channel (at high tide) and berth (at all tides) depths of around 12.5-16 metres – and less to the extent the ship is not fully laden. Berths need to be deeper than the channel because ships need to sit at the berth for a whole tidal cycle, whereas they can enter and exit during tidal windows – although a deep channel is also advantageous as ships can enter across tidal windows.

We expect the size of ships to increase in increments. Currently the largest ships that visit New Zealand ports carry 4,000 to 4,600 TEU. We would expect this to move to 5,000-6,000 TEU in the short to medium term, and potentially up to 8,000 TEUs later in our projection period. This is most notably the case for container ships, but there may be some smaller increase in the average size of bulk ships too.

5.2.2 Container berthage

Total berth length

We analyse the capacity of container berthage space by using figures for 'berth utilisation' – the number of TEUs handled per metre of berth length per year. Berth utilisation is driven by three factors: 'berth occupancy', 'crane utilisation' and 'crane productivity'. This is described in Table 14.

We estimate that the technical capacity for berth utilisation, at a port around the size of POA and POT, is around 1,750 TEUs/metre. This is based on analysis by ARH[60] (and subsequently updated by Bestshore UAE), discussions with UNI ports, and analysis of the underlying influences of berth utilisation.

However, in order to achieve that level of berth utilisation, a port has to be very efficient in terms of the factors that influence berth utilisation.

Table 14: Metrics used to analyse technical capacity of container berthage

Primary metric for analysis	Definition		Technical capacity
Berth utilisation	Number of TEUs handled, per metre of berth length, per year		1,750
Factors which influence this primary metric	**Meaning**	**Influences**	**Technical capacity**
Berth occupancy	The proportion of time there is a ship at the berth being serviced	Has a natural ceiling, to avoid making ships wait	50% to 60%
Crane utilisation	The number of cranes servicing a given ship	Depends on the length of the ships, the number of cranes available, and the availability of operators	
Crane productivity	The speed at which cranes load and unload	Influenced by various operational issues Will naturally increase as ships get larger	

59. We note that the actual under-keel clearance that can be accommodated can differ between times and locations. More sheltered areas can accommodate smaller clearances, and improving technology is enabling ports to operate with smaller clearances. For example, the use of 'dynamic under-keel clearance' technology can allow clearance as a low as 25 or 30cm in certain conditions.
60. Auckland Regional Holdings, "Long-term Optimisation of the New Zealand Port Sector", October 2009.

Berth occupancy, for ports around the size of POA and POT, has a technical capacity of around 50%-60%[61,62]. Any more than that and the port is not flexible enough to accommodate uncertainties and unexpected scheduling changes. Typically, ports operating above this level can only do so for a short period, as shipping lines respond by reducing visits which naturally brings down the occupancy to a sustainable level.

If berth occupancy is below its technical capacity, then a port can increase its berth utilisation simply by handling more containers (ie being busier). However, once berth occupancy is maximised, a port can only increase its berth utilisation by improving crane utilisation and/or productivity – ie by making operational efficiencies.

Methods for improving crane utilisation include:

- Having more cranes available to use on each ship (which may require the purchase of more cranes)
- Ensuring labour availability to operate the cranes.

Methods for improving crane productivity include:

- Faster average loading speeds (which may require the purchase of better cranes)
- Improving various operational items, such as greater computerisation, better linkages between berths and storage areas, etc.

Individual berth length

In addition to considering whether the total berthage is sufficient, we also need to consider whether the configuration of those berths, and the lengths of individual berths, are sufficient to cater for the larger ships that we expect will call at some of the UNI ports in the future.

The current largest ships which call at UNI ports, which carry 4,000-4,600 TEUs, are typically around 250-270 metres long. Ships in the 5,000-6,000 TEU range are around 260-300 metres long, while those around 8,000 TEU may be up to 350 metres.

In order to cater for these ships, a port's berth configuration needs to accommodate these lengths.

If berth occupancy is below its technical capacity, then a port can increase its berth utilisation simply by handling more containers (ie being busier).

61. Agerschou et al (2004) state that the optimum container berth utilisation for a 3-berth port is 49%-52% and for a 4-berth port is 57%-60%. Agerschou, H. et al (2004), Planning and Design of Ports and Marine Terminals, 2nd ed, Thomas Telford.
62. Occupancy at higher levels than this would typically result in queuing, which involves significant costs to port users. We note that queuing is typical at many large ports overseas.

5.2.3 Container storage

We analyse the capacity of container storage space by using figures for 'storage utilisation' – the number of TEUs stored per hectare of storage space per year.

Storage utilisation is primarily based on the maximum number of TEUs that each hectare can store at one time (the 'stack density'). The stack density depends on the stacking technology being used. Table 15 shows our estimates of the stack density for four different technologies. These estimates are based on discussions with the UNI ports, and reflect factors such as the number of ground slots, average stack height, and accessibility requirements.

The stack density is multiplied by the average number of times the containers can be fully 'turned over' in a given year – 365 divided by the average number of days in which containers are stored at the port – to give a figure for the maximum number that can be stored in a year.

This figure is then adjusted by the peak-average storage ratio. The more variable the storage requirements at a port are, the more space that is required for a given number of TEUs in total over the year, and the lower the average utilisation of that space. We discussed seasonality at POA and POT earlier (section 3.2.1), and found that peak demand is around 20% higher than average demand. This was based on total trade (rather than just containers). The New Zealand Shippers Council[63] found similar results for container seasonality. We have estimated a peak-average ratio of 1.2 for the purposes of determining storage capacity.

The equation below shows how we determine the storage utilisation of a given area.

$$\textbf{Storage utilisation} = \frac{\text{Stack density (max TEUs per ha at once)} \times \left\{ \dfrac{365}{\text{average dwell time (days)}} \right\}}{\dfrac{\text{peak storage}}{\text{average storage}}}$$

Our understanding of international standards for dwell times suggests that ports struggle to achieve consistently lower dwell times than around 3-4 days for imports and 5-6 days for exports. However, what is technically possible at a given port depends heavily on the specific nature of the cargo and the port users – achievable technical capacity will differ from port to port. Nevertheless, we use an average dwell time of 4.5 days as our benchmark for this analysis.

Table 15 shows our estimates of the technical capacity for container storage utilisation, for different stacking technologies, for a port of the size of POA and POT.

Table 15: Storage utilisation technical capacity, for different stacking technologies

Straddle technology	Stack density (TEUs, estimate)	Stack density after peak factor adjustment (using peak factor of 1.2)	Storage utilisation (TEUs/ha) (using dwell time of 4.5 days)
2+1	360	300	25,000
3+1	520	430	35,000
Rubber tyred gantry	720	600	50,000
Automated stacking crane	720	600	50,000

5.2.4 Bulk berthage

The technical capacity of port infrastructure is much more difficult to analyse for bulk cargo than it is for containers – largely due to the fact that bulk trade includes a wide range of non-uniform products. It is therefore not feasible to use the same type of analysis as we use for containers.

Instead, we analyse berth occupancy rates (defined as above). This allows us to analyse the extent to which a port can expand the amount of time it has ships docked, and hence the ability of the current berthage to cope with future growth. However, it does not allow us to consider the amount of additional cargo that can be handled as a result of increased efficiencies.

The technical capacity of bulk berth occupancy for ports of the similar scale to the UNI ports is around 55%-65% (without queuing), slightly higher than for container berths[64]. However, this is a generalised estimate, as technical capacity for bulk berth occupancy will vary if the adjacent storage cannot be cleared to enable another ship to be hosted, or where berths are small or otherwise limited in their capacity to host a range of ships. We discuss these issues further as we work through the capacity of each of the ports.

63. The New Zealand Shippers Council (2010), "The Question of Bigger Ships".
64. Agerschou et al (2004) state that the optimum bulk berth utilisation for a 3-berth port is 54%-58% and for a 4-berth port is 61%-65%. Agerschou, H. et al (2004), Planning and Design of Ports and Marine Terminals, 2nd ed, Thomas Telford.

5.2.5 Bulk storage

As for berthage, bulk storage is more difficult to analyse than container storage. The UNI ports handle a range of different types of cargo, which have varying storage requirements.

While it is possible to analyse the amount of different types of cargo stored in a given hectare (ie storage utilisation), it is difficult to accurately assess the technical limit, particularly since the actual cargo being stored can vary from day-to-day.

This is less of an issue at Northport and POT where log storage dominates. However, POA has highly variable bulk cargo, each with different requirements.

5.2.6 Road and rail network

Firstly, as noted earlier, because some of the port trade comes both to and from the port by ship, the amount of trade which will use the off-port infrastructure is less than that which uses the port infrastructure.

The technical capacity of road and rail infrastructure is 'softer' than that for port infrastructure. That is, whereas port infrastructure has limits which cannot feasibly be broken, road and rail infrastructure can typically always cater for more usage, particularly outside of peak hours – it just comes at the cost of congestion, and potentially some associated social and environmental effects.

In addition, the ports are not the only users of the road and rail networks. In fact, for many of the elements of these networks, their usage is far outweighed by passenger traffic.

It is therefore difficult to establish whether the existing infrastructure can cater for future growth in port traffic.

Instead, we attempt to establish whether the current infrastructure can accommodate the projected growth in port traffic without a material increase in congestion as a consequence of the port traffic.

5.3 Northport and Refining NZ

In this section, we consider the ability of the infrastructure associated with Northport and Refining NZ to cater for these ports' share of projected growth in trade volumes.

5.3.1 Summary of ability to cater for projected growth

We are forecasting that Northport's trade task will grow by 33% by 2041. With the development of the additional consented berth, the berth space should be sufficient to cater for this growth. Similarly, Northport could handle the need for additional storage either by increasing its level of storage utilisation or developing currently unused port land.

Storage utilisation could potentially be increased by reducing the average dwell times or by higher average stack heights, though there are practical constraints around this. There are a range of options to access more storage space, including developing the currently reclaimed but unformed land, undertaking further reclamations to the east, and utilising adjacent land owned by Northland Port Corporation. Each of these options will come at a cost.

We are not anticipating any major transport congestion issues associated with Northport.

Refining NZ does not appear to have any issues catering to increased volumes of oil in the future.

5.3.2 Can the current access arrangements cope with the projected growth?

Northport currently services ships with draughts of up to around 12.6 metres. Northport does not currently have any problems, in terms of depths, servicing the ships that it receives. We are unaware of any shipping lines that wish to use larger ships at Northport which cannot.

We do not expect that Northport will need to cater for significantly larger ships in the future. While our projections include an increase in throughput at Northport, we expect that POA and POT will continue to be the main UNI container ports and that they will experience the primary increases in ship sizes. It also seems likely that bulk ships will not increase in size to the same extent as container ships.

If Northport's relative role within the UNI system changed markedly, for example in response to constraints on growth at POA, then it is possible that Northport would need to cater for larger ships than it does now. We consider whether berth depth would be sufficient in that scenario when we consider systemic changes to the UNI port system in Section 6.

As for Refining NZ, it is possible that larger oil tankers may wish to use the port in the future. The current depth arrangements are sufficient to cater for slightly larger ships, but if significantly larger and heavier ships are to be accommodated then the shoal patch on the approach will need to be removed. While this option has been considered, at this stage the benefits of larger vessels do not outweigh the costs.

5.3.3 Can the current port infrastructure cope with the projected growth?

Northport only handles a very small number of containers per year. To substantially expand its container operations would require considerable new infrastructure. We therefore ignore its container operations for the purposes of this section, but come back to the possibility of this when we discuss systemic changes to address UNI port trade growth in Section 6.

65. The new berthage involves an increase in berth length of 48%, and an increase in the number of berths of 33%, meaning required berth occupancy, assuming 33% growth, is 45%-50%.

Bulk berthage

Northport currently has a berth occupancy of around 50%, over its current berthage of 570 metres.

We are forecasting that Northport's trade task will grow by 33% by 2041. Once the consented berth is completed, total berthage will be 840m. With this new berth, Northport will need berth occupancy of around 45%-50%[65] if it is to cater for our forecast growth in volumes.

This required berth occupancy is below the 55%-65% benchmark range for a bulk port of Northport's size. Therefore, once the consented berth is constructed, the berthage infrastructure should be sufficient to cater for our projected growth to 2041.

If growth is higher than expected, or Northport finds itself unable to sustain berth occupancy rates at the required level, there are various options for addressing this. Most notably, Northport could continue the consented development further east (although this would require resource consent) – it has identified that an extra 270m of berthage is possible with 13.6ha reclaimed storage land. Further development west of the current port is more difficult, due to the sensitive nature of that land and the potential adverse environmental effects, though a piled berth may be an option with limited environmental impacts as it would not involve additional reclamations.

Bulk storage

Northport currently has storage utilisation of around 90,000 tonnes per hectare per annum, over its 34ha of formed storage land, which is predominantly driven by log storage. This is well below the utilisation levelof POT, who currently achieve utilisation rates around double those of Northport, across the 22ha of their bulk storage land which is used for logs.

The primary reason for Northport's lower levels of storage utilisation is its relatively long average dwell times. Compared to POT, Northport has a large number of smaller customers. Because of the variety of type and grade of log products and the number of different customers, Northport needs to be able to store many times more logs than would fill one ship. Each exporter delivers its logs to the port over a period of time, and the port is always storing logs which will be loaded onto a number of different future ships.

We are forecasting that Northport's trade task will grow by 33% by 2041. In order to accommodate this growth with its current storage land, Northport would need to increase its storage utilisation by the same amount. We discuss the options for achieving this below. Alternatively, Northport has 14 hectares of land that is not currently in use that it could make available for storage. If it developed this land, Northport would not need to increase storage utilisation in order to accommodate our projected growth.

Oil

Refining NZ is currently operating with a large amount of excess capacity, particularly in its berth arrangements. While we expect an increase in the volume of oil imported by Refining NZ in the future, we do not expect this to be sufficient to require additional berth space. We also do not expect the type of ships which call at this port to change materially. So it appears that the current berth arrangements are sufficient to cater for future oil volumes.

However it is possible that Refining NZ might need to expand its on-site refining capacity. We do not consider this issue further, as this is a commercial decision for NZRC, and is outside the scope of 'port-related infrastructure' that this report covers.

5.3.4 Options for addressing difficulties with port infrastructure

Northport will likely have difficulty catering for future throughput growth with its current storage land area (at least, at the current level of storage utilisation).

We consider there to be four main options for addressing these problems, two of which involve more storage space and two which involve increasing storage utilisation:

- reclaim more land
- utilise adjacent land owned by Northland Port Corporation
- stack logs higher on average reduce average dwell time.

Option 1 – expand east, undertaking reclamation to create new storage space

Northport has resource consent for a fourth 270m berth, east of the current berths, with 4.6ha of reclaimed storage. There is also the potential for Northport to continue this development further east, developing a fifth berth, with an extra 13.6ha of reclaimed storage land possible.

It is also potentially possible for Northport to develop berthage west of its current site. However, this is considered much more difficult, due to the sensitive nature of that land and the potential adverse environmental effects.

Main benefit

The additional space will allow Northport to store more cargo. The potential development should be sufficient to allow Northport to cater for future growth, although some efficiency improvements may also be required.

The reclamation will also allow Northport to construct an additional berth, although it appears that it should be able to cope without this. Ultimately Northport will determine whether it is more cost effective to make operational improvements to increase storage or berth capacity or seek resource consent to invest in the additional infrastructure associated with the fifth berth.

Other effects

The reclamation and berth development will involve considerable capital cost. The capital cost of reclamations and berth development to the consented conditions is in the order of $50m-$70m.

There may also be non-financial impacts associated with the port's increased footprint in the harbour. For the consented developments, these issues have already been addressed through the resource consent process. The broader impacts of the potential fifth berth and associated reclamations would be considered in depth through the consenting processes.

Further comments

Additional reclamation will require resource consent. The consent process would consider the wider costs and benefits of the development. Also, given the cost of reclamations, and the extent of unformed area already owned by the port, it seems likely that reclamations would be limited to those associated with increasing berth space.

Option 2 – utilise adjacent land owned by Northland Port Corporation

Northport could lease land from its 50% shareholder, Northland Port Corporation. As shown in Figure 59 below, Northland Port Corporation has significant freehold and leasehold interests adjacent to and nearby Northport.

Main benefit

This option could enable Northport to enlarge its storage capacity without undertaking reclamations or increasing storage utilisation. Whether this is commercially preferable will depend on the relative costs and operational requirements associated with managing cargo further from the berths.

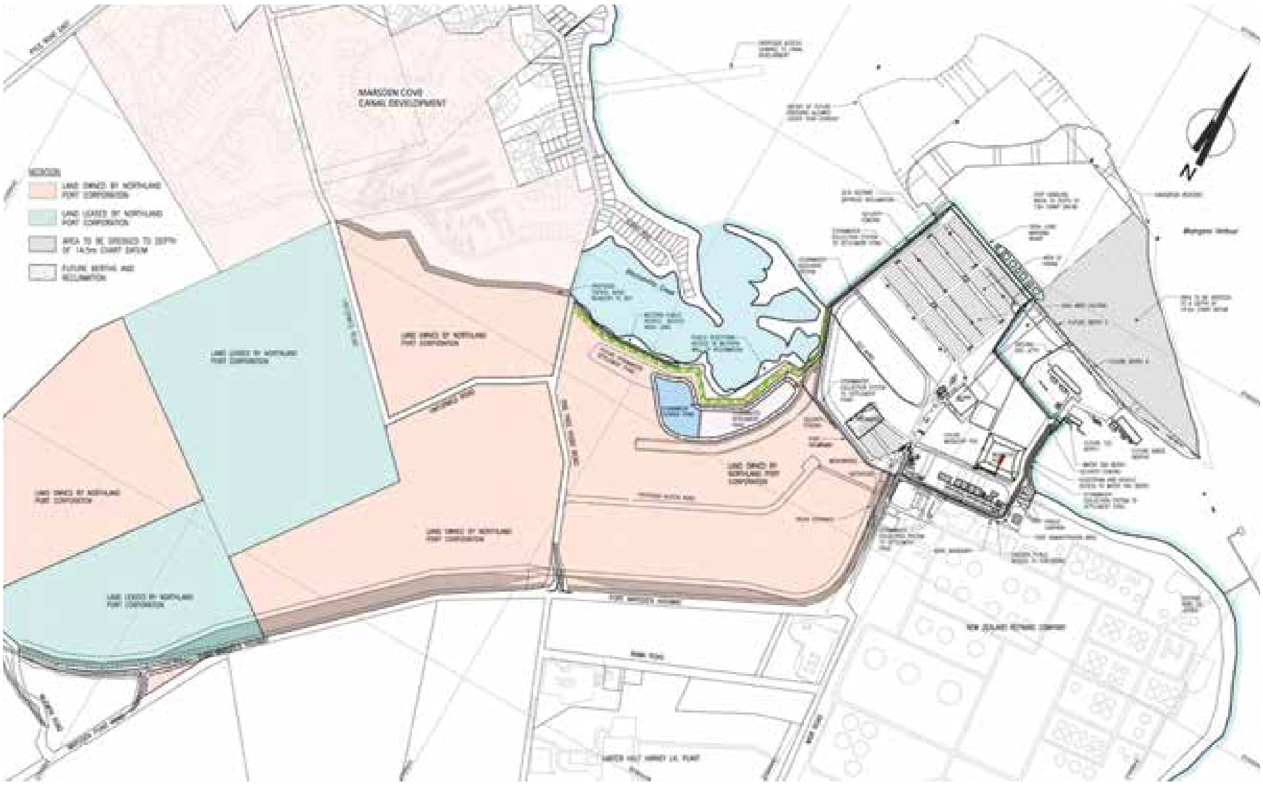
Other effects

This option would involve lease costs for Northport. Northland Port Corporation's website[66] outlines indicative lease costs of $60,000 -$80,000 per hectare per annum.

Further comments

It seems unlikely that this option would be preferable to commissioning further storage space within Northport's current landholdings due to its relative remoteness from the berths.

Figure 59: Northland Port Corporation land holdings



66. http://www.northlandportcorp.co.nz/landforlease.

Option 3 – stack logs higher on average

Northport could stack its logs higher than is currently the case.

Northport is currently trialling the introduction of 'bookends', which would allow stacking of logs up to 6 metres high – this should allow Northport to improve its stacking density by up to around 20%. Higher stacking than this is not practically feasible, due to the technical capacity of the loading equipment and fumigation requirements.

Main benefit

Greater stacking density allows higher levels of storage utilisation to be achieved. This allows more logs to be stored in a given area over a given time period, and makes it easier for Northport to cater for growth in throughput with its current storage space.

The increase in storage utilisation that could be achieved by this option may be sufficient to cater for future growth, without the need for additional space (beyond the use of the currently unformed land).

Other effects

The new bookends will have capital and possibly operational costs. Higher stacks may also impose higher usage costs on the port, if these are more difficult to handle when loading and unloading.

Option 4 – reduce dwell time

Northport could reduce the average time that logs are stored on the port. We note however this may be difficult.

The current dwell times are largely a function of the number and size of Northport's export customers, and the variety of products and export destinations. This seems unlikely to change significantly in the future.

It is possible that dwell times may reduce naturally as total volumes grow. If growth in volumes increases the amount of exports for each customer, this might increase the number of ships per year used by each customer, reducing the time between ships visits for each customer, and hence reducing the average dwell time.

It is also possible for Northport to incentivise lower dwell times through its charging arrangements. However, Northport already operates a tariff schedule where storage prices increase with storage length, so the opportunities to use this lever further may be limited.

Main benefit

Shorter average dwell times allows more logs to be stored in a given area over a given time period – ie it allows higher utilisation of storage space to be achieved. This makes it easier for Northport to cater for growth in throughput with its current storage space.

Other effects

Lower dwell times may involve increased costs for port users. For example, it may result in more off-port storage, require changes to the delivery schedules, or require changes to the way the port operates and configures its storage arrangements.

5.3.5 The distribution infrastructure

Road and rail

SH1 near the entrance to Marsden Point currently carries about 10,000 vehicles per day which is well within the capacity of that type of road. As with many other state highways the flow has changed little over recent years, indicating that there is unlikely to be large growth in future which could lead to capacity issues.

Within Whangarei typical daily flows are of the order of 22,000 – 25,000 vehicles and clearly there will be congestion due to the combination of local and through traffic. The current proportion of heavy vehicles is 5% – 7% which is around or below the state highway average; it is not known what proportion of this is Port traffic.

There is also significant land in the Marsden Point area zoned for commercial and residential development. If these developments proceed, additional pressure will be placed on the intersection with State Highway 1, and indeed the road to the port. However, we understand that as part of the consent approvals for these developments, contributions toward ameliorating transport works will be collected.

Northport is not directly serviced by rail and the main trunk rail line north of Auckland operates with substantial latent capacity.

Wiri oil pipeline

The Wiri oil pipeline currently transports around half of the oil that is refined by Refining NZ directly to south Auckland. Depending on the future volumes of oil, and the amount that is transported by road, it is possible that the pipeline may reach capacity by 2041. However, discussions with Refining NZ suggest that the Marsden Point refinery will reach capacity before the pipeline does.

In the event that the pipeline reaches capacity, it would be possible to increase capacity on the pipeline would involve increasing pressure (eg by introducing further or more powerful pumps) and/or pipe treatment that reduces friction and increases the speed at which fuel products pass through the pipe.

Another option would be to construct an additional pipe. This would increase capacity, possibly substantially, but would come at a considerable cost.

Decisions about whether or not to expand the refinery and the Wiri pipeline are likely to be made on a commercial basis by Refining NZ. In the event that they do not invest in additional capacity, demand for petroleum products could be handled by importing more refined products directly through ports in other regions.

Alternatively, if Refining NZ decides to increase refinery capacity but not pipeline capacity, we expect that users in other regions could respond by increasing the proportion of product transported by other modes, such as road or coastal shipping.

5.4 Ports of Auckland

In this section, we consider the ability of the infrastructure associated with POA to cater for POA's share of projected growth in trade volumes.

5.4.1 Summary of ability to cater for projected growth

At the current level of port utilisation and productivity, POA will not be able to cope with our projected throughput growth with its current infrastructure, within the timeframe considered. All areas of the port infrastructure will come under pressure. The extent to which POA can achieve operational efficiencies will determine whether it requires additional infrastructure to cater to future demand before 2041, and when such infrastructure is needed.

POA appears to have considerable scope to make operational efficiencies in the use of container berths and container storage space. Both areas are currently operating well below our estimate of their technical capacity. If POA can achieve substantial operational efficiencies in container berth usage and productivity, and upgrade its container stacking technology, the current container infrastructure should be sufficient to cater to future growth out to 2041 (though only just).

For bulk cargo, it appears likely to be much more difficult for the current infrastructure to cater for future growth. This is largely because it appears more difficult for POA to make considerable efficiencies in this area. The key issue is storage space. At the current level of productivity, POA is almost fully utilising its storage space, and this usage is also constraining POA's ability to increase its bulk berth occupancy. In order to cater for our projected growth in bulk cargo, POA would need to make extensive efficiencies in bulk storage utilisation – most likely through either more dense storage arrangements, or reduced dwell times. It is unclear to what extent efficiencies of this size are possible, and we note that achieving efficiencies in bulk storage may be quite difficult.

Any reduction in the current berth and storage space at POA – for example, if Captain Cook and Marsden wharfs are released for non-port use – will exacerbate these issues. If Captain Cook and Marsden wharfs are released, this will reduce the number of operable bulk berths from 5 to 4, and reduce the bulk storage land by around 3 ha. In addition to making it even more difficult for the already stretched bulk infrastructure to cope, we expect that this will impact the container terminal as well, as POA optimally reconfigures its land area to free up some container storage and berth space for bulk use. The level of efficiencies required, before more infrastructure is needed, will be proportionally higher.

To summarise the above, it is possible that the current port infrastructure could cater for our projected growth to 2041. However, if it is to do so, this would require substantial operational efficiencies. The required efficiencies in container operations appear achievable, but this is considerably less certain for bulk operations, which would require a substantial increase in the productivity of storage arrangements if the current space is to cope with growth of around 80%. If Captain Cook and Marsden wharfs are released, this will put even more pressure on the current infrastructure. The loss of bulk storage space will mean even more storage efficiencies are required, to such an extent that this seems very unlikely to be achievable, and any transfer of container berth and storage space to bulk usage will make it difficult for the container infrastructure to cope, even with substantial efficiencies.

So it seems likely that, even with very significant operational efficiencies, POA will still require additional berth and storage space before 2041 if it is to cater to our projected trade task. This will most likely involve additional reclamations. We do not think that the reclamations would need to be as substantial as the preferred reclamation options in the 2008 POA Development Plan[67].

67. Ports of Auckland (2008), Port Development Plan, pages 10-11.

Whether additional reclamation and berth development of sufficient size is ultimately achievable depends on the ability of POA to obtain resource consent. The consent process would consider the wider costs and benefits of the development in depth. If non-financial effects were deemed to be significant, obtaining resource consent for large scale reclamations with significant impacts on the harbour may be difficult – although small scale developments may be more feasible.

If POA is unable to gain consent for an expanded footprint, then some of the projected growth at POA will need to be accommodated at other UNI ports.

5.4.2 Can the current access arrangements cope with the projected growth?

We expect that shipping lines will want to service POA with incrementally larger container ships in the future. In the short to medium terms, we expect the largest ships will be around 5,000-6,000 TEU, increasing to perhaps 8,000 TEU in the longer term.

As noted earlier ship size in terms of TEU does not easily translate to draught, as the width and length of the ship, as well as the weight of the products it is carrying are also important factors. However, POA's container berths are currently not deep enough to cater for all 6,000 TEU ships, and certainly not for 8,000 TEU ships.

As for the channel, the current depth is sufficient to allow most of the current ships to use it at all tides. The deepest draughts of current ships are around 12.3m and these ships can use the channel around 70% of the time. Ships of 6,000 TEUs, and some of 8,000 TEUs, can pass through the channel at high tides. So the current channel is sufficiently deep to cater for larger ships, although tidal restrictions would need to be used to allow them. Table 15 below outlines the tidal windows for ships of different draughts at POA.

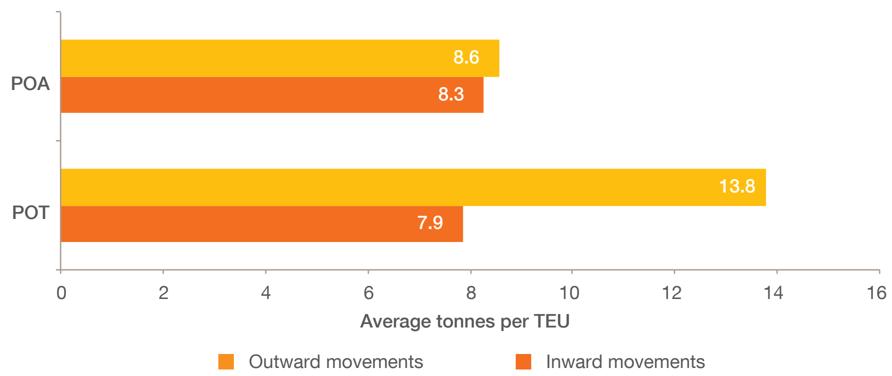
Table 16: POA tidal windows for different ship draughts

Vessel Draught (metres)	Open Window (%)
11.50	94.9
11.75	86.6
12.00	81.4
12.25	71.6
12.50	58.8
12.75	50.4
13.00	42.9
13.25	35.4

In addition ships docking at POA tend to operate at much lower than their maximum draught. The majority of containers coming into POA are filled with low-weight consumer items (eg clothes), while they often leave POA less than full because of POA lower export volumes (relative to imports). They can sit up to one metre higher in the water as a result. So ships can operate at shallower depths at POA than they could at, say, POT (which exports heavier dairy products and the like). This is illustrated in Figure 60 below which shows that the average weight of exports outside of exports out of POT is considerably higher than imports or exports for POA.

Figure 60: Projected import and export growth at UNI ports

Container weights at POA and POT, 2012



Source: POA, POT

5.4.3 Options for addressing difficulties with access arrangements

Channel depth

We consider there to be two main options for addressing the issue of channel depth:

- increase the depth of the channel by dredging
- operate restricted tidal windows for entry and exit of the largest ships.

Option 1 – dredge to increase the depth of the channel

POA could undertake dredging to increase the depth in its channel. It is likely that any additional capacity would be undertaken progressively, with POA indicating that the next dredging stage would likely be an additional 0.5 metres.

Main benefit

Increased channel depth will increase the maximum size of ship which can enter and exit POA at all tides. This makes it easier to cater to the expected desire of the shipping lines to send larger ships to POA in the future.

Other effects

The 0.5 metre dredging operation currently being considered by POA will cost in the order of $10m-$20m. Further dredging beyond this is expected to cost proportionately more.

There may be some effects on tidal currents and the like, depending on the depth, but these will likely be minor.

Further comments

POA will require resource consent before it can undertake this option. This process will, among other things, consider the wider costs and benefits of dredging.

Option 2 – operate tidal restrictions for large ships

POA would not alter the current channel depth. Instead, POA would operate a system of tidal restrictions, based on the draught of the ship.

Ships with shallower draughts (like those which currently call at POA) would be able to use the channel in all tides, while those with much deeper draughts would only be able to enter and exit the port at certain tidal windows.

Main benefit

This would avoid the capital expenditure involved in dredging the channel under Option 1.

Other effects

The use of tidal restrictions may make the shipping lines less willing to send ships to POA, but this is likely to be minor, depending on the length of the window.

Many large ports overseas operate tidal restrictions (as does POT). Furthermore, ships would not be forced to queue in the Hauraki Gulf until the tide was suitable – instead, they would set their speed from their previous port at the level required to arrive at Auckland at the start of their allowed tidal window (as they do with other ports which operate restrictions).

At worst, the shipping lines may levy relative higher charges to compensate for any disruptions to their ideal schedules. But any disruption is likely to be minor, and it seems reasonable that any effects of introducing tidal restrictions for the largest ships that will call at POA will be small.

Berth depths

There is only one option for addressing an inability to cater for larger ships at the berths – dredge to deepen the berths.

However, we also consider the option to not increase berth depth, and hence to choose not to cater for ships which cannot dock at the current berth depths.

Option 1 – dredge to increase the depth of the container berths

POA could undertake dredging to increase the depth at some or all of its container berths.

We note that POA is currently undertaking some incremental dredging at one of the Fergusson terminal wharfs, to increase the depth to 13.5 metres.

Main benefit

Increased berth depths will increase the maximum size of ship which can call at POA. This makes it easier to cater to the expected desire of the shipping lines to send larger ships to POA in the future.

This ability to cater for larger ships may lead to greater trade volumes at POA than would otherwise be the case. But it would also enable POA to share in the benefits of the increased efficiencies associated with larger ships.

Other effects

We expect there to be little, if any, environmental effects associated with berth dredging. Berth deepening is contained and has limited effect on the harbour, its flows, its ecosystem, or its other users. Historically POA have received consents for berth dredging on a non-notified basis.

Further comments

POA will require resource consent before it can undertake this option. This process will, among other things, consider the wider costs and benefits of dredging.

Option 2 – do nothing and not cater to bigger ships

POA could continue to operate with its current berths depths into the future, and not increase their depth.

This would likely mean that some of the ships that the shipping lines want to send to POA would be unable to come.

Main benefit

As the 'do nothing' option, the only benefit is the avoided costs of choosing one of the other options. Under this option, the costs of dredging are avoided.

Effects

The lack of ability to cater for larger ships will make the shipping lines less willing to send ships to POA. This will have one of two effects:

- The shipping lines use other ports for some trade that would otherwise use POA, as POA becomes more of a 'spoke' and less of a 'hub' than it otherwise would be
- The shipping lines continue to use POA at the same volumes, but NZ ports and users do not obtain any benefits from costs efficiencies associated with larger ships.

In practice, it seems likely that the end result will be a bit of both. But this will depend on the response of the port users, and how their demand is affected by the inability to share in the efficiency benefits of larger ships through price reductions.

5.4.4 Can the current port infrastructure cope with the projected growth?

Container berthage

As shown in Table 17, POA has a current berth utilisation of around 1,000 TEUs/metre.

Table 17: Current container berth utilisation at POA

Year	Berth length	TEUs serviced	Berth utilisation (TEUs/metre)
2011	870 metres	870,000	1000
2012	870 metres	818,000	940

Source: Ports of Auckland

Our demand projections indicate that it will need to service between 1.53 million and 2.07 million TEUs by 2041. Table 18 shows that, with the consented new berth at Fergusson wharf, the required berth utilisation is between 1,300 and 1,750 TEUs/metre.

Table 18: Berth utilisation required to meet projected future container trade task at POA

Future TEU requirements (2041)	With current berths		With consented 4th berth	
	Berth length	TEUs serviced	Berth utilisation (TEUs/metre)	Utilisation required
1.53m-2.07m TEUs	870 metres	1,750-2,400 TEUs/metre	1,176 metres	1,300-1,750 TEUs/metre

Source: PwC analysis

Our analysis (see Section 5.2.2) indicates that the technical capacity of a port of POA's size is around 1,750 TEUs/metre. However, in order to achieve this level of utilisation, POA would have to be operating very efficiently.

The current container berth occupancy rate at POA is around 55%. With a technical capacity for this metric of around 50%-60%, this gives POA minimal scope to increase berth utilisation without crane efficiencies.

Therefore, even with the consented additional berth, the current container berth infrastructure at POA and the current crane productivity looks insufficient to cater for our projected growth in container throughput. However if POA can make significant operating efficiencies, then the current berth space should be able to cater for our projected growth to 2041.

However, this ability to cater for the projected trade task will be compromised if there is any loss of bulk berths. If Captain Cook and Marsden wharfs are released, this is likely to lead to POA reconfiguring its land such that some of the container berth space is used for bulk cargo (at least in part). If this occurs, and usable container berth space is reduced to around its current level (870 metres), it seems likely that the current berth space will not be sufficient.

Container storage

As shown in Table 19, POA has a current storage utilisation of around 18,000-19,000 TEUs/ha.

Table 19: Current container storage utilisation at POA

Year	Hectares of storage	TEUs serviced	Storage utilisation
2011	46	870,000	19,000 TEUs/ha
2012	46	818,000	18,000 TEUs/ha

Source: Ports of Auckland

Table 20 shows that, with the additional storage space under development, POA will need storage utilisation of around 33,000-45,000 TEUs/ha in order to cater for projected throughput in 2041.

Table 20: Storage utilisation required to meet projected future container trade task at POA

Future TEU requirements (2041)	With current storage		With consented extra storage	
	Storage	Utilisation required	Storage	Utilisation required
1.53m-2.07m TEUs	46 ha	33,000-45,000 TEUs/ha	49.6 ha	31,000-42,000 TEUs/ha

Source: PwC analysis

With the current stacking technology and dwell times, our analysis estimates that the technical capacity of container storage at POA is around 25,000 TEUs/ha. Therefore, with the current stacking technology, the current storage space (including that under development) will not be sufficient to cater for future growth.

However, if POA moved to better stacking technologies, then the current storage space should be sufficient to cater for future growth. For example, the use of '3+1' straddles allow a technical capacity of around 35,000 TEUs/ha. We discuss this further, along with other options for catering to future demand, below.

The ability to cater for the projected trade task will be compromised if there is any loss of bulk storage space. If Captain Cook and Marsden wharfs are released, this is likely to lead to POA reconfiguring its land such that some of the container storage space is used for bulk cargo. If this occurs, POA will require even greater operational efficiencies, than moving to 3+1 straddles, for the current storage space to be sufficient to cater for future growth.

Bulk berthage

POA currently has bulk berth occupancy of around 30%, over its 5 usable bulk berths.

We are projecting that POA will increase its bulk throughput by 71%-88% by 2041. This implies that, without any efficiencies, berth occupancy will need to increase by the same proportion – ie to around 51%-56%. We note that car imports have been fairly volatile in the past, and may hence be so in the future, so POA may need to cater for even higher throughput than this for short periods.

The literature suggests the technical capacity of dedicated bulk berths is around 55%-65%[68], However, as noted earlier there are complicating factors that mean this kind of capacity is probably unachievable for POA, particularly in relation to the configuration and nature of POA's berths.

POA's ability to fully utilise its bulk berths is constrained by the length of berths which make them unusable for many ships, and because they are narrow finger wharfs with limited adjacent storage space. POA have stated that this lack of space means that berth utilisation is constrained by the time it takes to clear the products off the port as vacant berths cannot be used until the adjacent storage is also vacant. And this precludes it from achieving capacity much beyond current levels.

So, POA may not be able to increase its berth occupancy to sufficient levels to cater for future demand without achieving efficiencies with its use of bulk storage space.

If Captain Cook and Marsden wharfs are released, this will reduce the number of usable bulk berths from 5 to 4, and reduce total bulk berthage by around 230 metres. This will effectively mean that the current bulk berths cannot cater to future demand without efficiency improvements.

Bulk storage

As discussed above, it is very difficult to assess the technical capacity of bulk storage space, or how close the current use is to it.

POA staff have stated to us that in their view, they are currently operating close to capacity. This is difficult for us to confirm, but the fact that non-typical methods that POA has used to store bulk cargo during peak times (eg by storing cars on the rail sidings) and also that current storage arrangements are constraining the ability to increase berth occupancy, suggest that it is probably correct.

This means that the current bulk storage space cannot accommodate much more usage without making operating efficiencies – certainly not the 71%-88% increase in bulk throughput that we are projecting to 2041. We discuss operational efficiencies further below, although it is difficult to determine what improvements in utilisation are possible.

68. Agerschou et al (2004) state that the optimum bulk berth utilisation for a 3-berth port is 54%-58% and for a 4-berth port is 61%-65%. Agerschou, H. et al (2004), Planning and Design of Ports and Marine Terminals, 2nd ed, Thomas Telford.

If Captain Cook and Marsden wharfs are released, this will reduce bulk storage space by around 3 ha, and make it even more difficult for the bulk storage to cater for future growth.

Individual berth lengths

The current length of individual berths at POA is sufficient to cater for current ships. They should also be sufficient to cater for somewhat larger ships in the future.

However, there are some berths which are relatively short, and are not used as much as they would ideally be. For example, the berth on the eastern side of Bledisloe wharf is very rarely used due to its short length.

5.4.5 Options for addressing difficulties with port infrastructure

Both the berth space and the storage space at POA will have difficulty catering for future throughput growth.

We consider there to be five main options for addressing these problems:

- undertake additional reclamations, to create additional berthage and storage space
- repurpose container berthage and/or storage space for bulk usage (or vice versa)
- improve the loading and unloading speed
- increase storage density, by improving stacking technology
- reduce average dwell times.

This set of options includes some which provide additional infrastructure, and others which involve more efficient use of infrastructure.

We note that these options are not mutually exclusive. All five can potentially be used to address capacity issues.

Option 1 – undertake additional reclamations, to create additional berthage and storage space

In addition to the reclamation currently under development, POA could reclaim further land, to increase storage space, extend existing berths and/or create new berths.

There are many potential reclamation and port configurations which could allow additional berthage and storage space. Two possibilities which were included as preferred options in the 2008 POA Development Plan are:[69]

- extending Bledisloe wharf northwards, increasing the length of the berths on either side, and creating a new berth across the north edge of the wharf
- 'filling in' the unreclaimed area between Fergusson and Bledisloe wharfs, and constructing new berths across the northern edge of the area.
- We understand that POA is currently investigating other development options, with reduced encroachment into the harbour compared to those included in the 2008 Development Plan.

69. Ports of Auckland (2008), Port Development Plan, pages 10-11.

Main benefit

Reclamations will create additional berthage and storage space. This will increase the amount of container and/or bulk throughput that POA can handle.

If reclamations were large enough, they could allow POA to cater for our projected future trade task without needing to achieve any operational efficiencies.

Other effects

Additional reclamations will have financial and non-financial costs, the size of which will be heavily dependent on the specifics of the development. POA have traditionally used essential capital and maintenance dredging to build reclamations. This is cost effective (as it does not use purchased fill) but limits the speed that reclamations can be progressed.

The capital cost of reclamations is likely to be significant. On top of that, each additional berth costs around $150,000 per lineal metre, with accompanying cranes for any container berths $10m-$15m each.

There are a number of potential non-financial effects, which all largely stem from any increased footprint in the harbour. These may include:

- a reduction in harbour space available for other purposes
- an effect on the currents in the harbour, which in turn may affect other harbour users and activities
- an effect on the ecosystem and wildlife
- a visual effect for people viewing the harbour.

The size of any non-financial effects depends on the size and location of the new berth, and any associated reclamations.

- The effect on other harbour users will increase as the size of the reclamation increases and as the port land moves further north and into the main harbour channel.
- The harbour current will only be materially affected if the developments extends beyond the current line between the north end of Fergusson wharf and the northern end of the Wynyard wharf.
- The visual impact will increase with the size of the new development, and is likely to be greatest the further west the development is and the further it extends the port land northwards.

Further comments

Additional reclamation will require resource consent. The consent process would consider the wider costs and benefits of the development. If non-financial effects were deemed to be significant, obtaining resource consent for large scale reclamations with significant impacts on the harbour may be difficult – although small scale developments may be more feasible, these impacts would be examined in depth during any resource consent process.

Option 2 – repurpose container berthage and/or storage space for bulk usage (or vice versa)

If POA had more difficulty accommodating growth in either containers or bulk cargo than it did in the other, it could repurpose some of its berth and/or storage space from one use to the other.

Since it appears that POA will have more difficulty catering for growth in bulk cargo than in containers, we consider here a repurposing of container space for bulk usage, but we note that it could be the other way around.

There are various ways in which the port could be reconfigured. Furthermore, instead of a simple transfer of some container space to bulk usage, POA could potentially reconfigure the entire port land in a new arrangement for container and bulk uses.

Main benefit

This would increase the berth and storage space for bulk cargo, without the need for reclamations.

Depending on the reconfiguration, it may also allow operational efficiencies to be more easily achieved. For example, the current container berths are spread across both Bledisloe and Fergusson wharfs, and a reconfiguration which groups them closer together may allow greater productivity.

Other effects

The repurposing will have some financial costs, but these are likely to be relatively small.

The key adverse impact of this option is that the amount of container berth and storage space is reduced, reducing the ability for POA to cater for future container volumes. Since it appears that the current container berth space is just enough to cater for our projected growth to 2041, with substantial operational efficiencies, if some berth space is repurposed as bulk berthage, this may directly lead to a need for more infrastructure before 2041.

Option 3 – improve the loading and unloading speed

If cargo can be loaded and unloaded faster, this will allow POA to increase its berth utilisation – more cargo can be handled for a given level of berth occupancy.

For containers, this involves increasing crane utilisation and/or crane productivity.

Methods for improving crane utilisation include:

- having more cranes available to use on each ship (which may require the purchase of more cranes)
- ensuring labour availability to operate the cranes.
- Methods for improving crane productivity include:
- faster average loading speeds (which may require the purchase of better cranes)
- improving various operational items, such as greater computerisation, better linkages between berths and storage areas, etc.

Given POA's current level of container berth utilisation, it seems that POA has scope to make considerable operational efficiencies in terms of its crane utilisation and productivity.

For bulk products, not all cargo requires cranes (eg cars) and hence the potential efficiencies are slightly different, but in general they involve the same type of improvements as those stated above.

We also note that faster handling speeds are easier to achieve on larger ships. Thus if the average ship size increases, this will naturally increase the speed at which cargo can be loaded and unloaded.

Main benefit

Operating efficiencies which increase the speed at which POA loads and unloads ships will increase the berth utilisation of POA (subject to storage constraints for bulk products – see below). This improves the ability to cater for a growth in throughput with the current berthage.

If POA can achieve significant improvements in container loading speeds, it may be able to cater for our projected growth to 2041 without requiring more berth space.

For bulk products, it is possible that improvements in loading speed do not actually provide any material benefit. We understand that, despite having a relatively low bulk berth occupancy rate, it cannot accommodate more bulk ships due to storage constraints – faster loading speeds only allow greater berth utilisation if the products can be moved off the wharf fast enough to allow for more ships to be serviced. Therefore, POA also needs to either increase its bulk storage space or make operational efficiencies in that area, if faster handling times are to actually lead to an improvement in berth utilisation.

Other effects

Some of these efficiencies will involve financial costs to POA. New cranes will involve a capital cost. New operational technology may involve higher capital and/or operational costs. The ongoing industrial dispute reflects costs associated with POA's drive to enhance labour flexibility.

In general, it seems likely that this option involves smaller costs and adverse effects than the options which involve investing in new berthage infrastructure.

Option 4 – increase storage density, by improving stacking technology

POA could increase the density of its storage arrangements – ie it could increase the average amount of cargo stored in a given area, on average over the year.

For containers, the main way to do this is to improve the stacking technology. POA currently uses '2+1' straddles. It could upgrade this to '3+1' straddles, which allow, on average, one extra container on each stack. '3+1' straddles allow a technical storage capacity of around 35,000 TEUs/ha, compared with 25,000 TEUs/ha under the current technology. Even better technologies, like rubber-tyred gantries or automatic stacking cranes, can achieve even higher utilisations.

Bulk cargo is naturally more difficult to stack. For cars, the primary options are the use of 'car-stacker' technologies, or to build a multi-storey car-park. Logs can be stacked higher than is the case currently. For other products, the options for multi-level storage arrangements appear more limited.

Main benefit

Greater storage density allows higher utilisation of storage space to be achieved. This makes it easier to cater for growth in throughput with the current storage space.

Other effects

Anything which involves new equipment or technology will have capital and operational costs.

Higher stacks - whether containers, logs, or car-parks – may have non-financial effects, in terms of an adverse visual impact. These impacts are governed by district plan rules[70] which reflect consideration of the visual impacts and set out height restrictions applying to POA, along with the surrounding area.

Option 5 – reduce average dwell times

POA can reduce the average dwell times of the cargo it stores – for either or both of containers and bulk.

This could be achieved in a number of ways, including:

- improving the scheduling alignment of export drop-offs and ships
- increasing the charges to users for each day of storage
- utilising more off-port storage, eg at Wiri.

The extent to which dwell times can be practically reduced is probably limited. We expect that POA could reduce current dwell times, particularly if the price for storage was set high enough. However, we understand that POA's current average dwell times (particularly for container imports) are at the top end internationally, and hence it may be difficult (or require a very high price) to reduce them materially. In addition, for certain products such as cars, there are practical limits based on the truck fleet that can be deployed to service arriving ships. The fleet size is determined by both the requirements at POA and also by their broader operating requirements. Increasing the fleet may be uneconomic if it means the trucks are idle outside concentrated periods of port servicing.

70. Soon to be replaced by the Auckland Unitary Plan.

The use of off-port storage is essentially a balance of reduced land costs, against the double-handling of cargo.

Main benefit

Lower average dwell times reduce the amount of storage space a port needs to cater for a given amount of annual throughput, and hence increases average storage utilisation. It therefore allows POA greater ability to cater for volume growth without needing more storage space.

Other effects

The primary adverse effect of reduced dwell times is that it is likely to result in increased off-port dwell times. This will increase non-port costs for port users. Firstly, port users need to store the items off-port for longer, which costs money in terms of land requirements. Secondly, if the products were not being stored off-port currently, a move to do so would increase the number of times the item has to get loaded and unloaded. Whether greater off-port storage is an improvement on the current arrangements depends on the storage costs at each location (likely to be higher off-port), the land values of the two storage areas (likely to be higher at the port), and the total loading cost (higher for off-port).

5.4.6 Can the current distribution infrastructure cope with the projected growth?

We are projecting that the volume of POAL's trade which uses off-port distribution networks will increase by 73%-98% by 2041.

Grafton Gully

The primary potential bottleneck is at Grafton Gully.

If the relative proportions of traffic using each route remain the same in the future as in Figure 57, and the amount of cargo per truck remains at current levels, then our projected increase in total port traffic would result in an increase in the total traffic at Grafton Gully of around 5%-7%. While Grafton Gully can be congested at certain times currently, it seems reasonable to expect it to be able to handle 5%-7% additional traffic without a substantial increase in congestion (although there would likely be a small effect).

More important for the future congestion at Grafton Gully is the growth of non-port traffic. Over recent years traffic growth in many parts of the New Zealand state highway network has been either flat or very low, and this phenomenon has also been observed in a number of other western countries. Looking further back, an average annual growth rate of around 2%-3% would be considered typical. On balance, it seems reasonable to expect general traffic on the Auckland motorway network to grow by around 1% p.a. over our projection period – about 35% in total over the 30-year period[71].

In addition, there are reasons why general traffic using Grafton Gully may grow faster than the average over the Auckland motorway network. In particular, current Auckland Council plans to reduce the volume of cars using parts of Quay Street would likely divert traffic onto Grafton Gully. Therefore, it seems reasonable to expect an increase in non-port traffic on Grafton Gully of around 35%-50% between now and 2041 – which equates to around 32%-45% of current total Grafton Gully traffic.

71. The modelling work done in relation to the Auckland Plan indicates that congestion will improve by 2021. However, beyond 2021 congestion is forecast to worsen as population growth outstrips infrastructure investments. Furthermore, interpeak congestion is forecast to increase at a more rapid rate.

An increase in total traffic using Grafton Gully of around 40%-50% is significant, and it seems likely that this would lead to a substantial increase in congestion. Therefore, it does not seem likely that the current Grafton Gully infrastructure will have the capacity to accommodate future traffic demand. However, it is the non-port traffic which is driving the future congestion – port traffic only represents a small proportion of the total growth.

Other motorways

Table 21 below outlines the current impact of POA traffic at various locations across the Auckland road network.

After Grafton Gully, the next most important piece of road infrastructure for port traffic is the Southern Motorway. Since port traffic represents about 2% of current traffic on the motorway, our projected increase in port traffic represents an increase in total motorway traffic of less than 2% of the current total traffic volumes. This is unlikely to result in a material increase in congestion.

As per the discussion above, we expect that the Southern Motorway will experience an increase of about 35% of total traffic by 2041. Therefore, there may be a significant increase in congestion on the Southern Motorway by 2041, if the current infrastructure is unchanged, but this will be driven by increases in general, rather than port, traffic.

Lastly, we note that no other element of the Auckland road network carries enough port traffic for there to be any material effect as a result of our projected growth in port traffic. The only possible exception is the corridor between SH20 and SH1, which encompasses the industrial areas of Onehunga / Southdown, East Tamaki / Highbrook, Auckland Airport / Wiri, and southern Mount Wellington. Metroport is located in Onehunga, meaning that congestion in this area will affect port traffic.

The Auckland Plan includes the construction of the East-West link to improve connectivity in this area between 2012 and 2020. The first phase will be to develop a sub-regional strategy based on a thorough understanding of the transport problems in the area, which include an anticipated increase in road freight in the corridor of 60% in the next 30 years.

Table 21: Traffic volume in Auckland

Estimated daily truck traffic 2012			Network impact		
Port	*100%*	*3,000*	Location	*All traffic*	*Port share*
Grafton Gully	90%	2,700	**Stanley Street**	42,800	6.3%
Southern motorway	70%	2,100	**Ellerslie - Panmure highway**	122,400	1.7%
Northern motorway	10%	300	**Esmonde Road**	99,700	0.3%
Northwestern motorway	10%	300	**St Lukes Interchange**	88,600	0.3%

Source: NZTA, Beca, EROAD

Eastern rail line

As with the road network, we expect an increase in rail traffic from POA of about 78%-94% by 2041. This will be accommodated through an increased number of trains and greater average cargo volumes per train.

The eastern rail currently operates well below its capacity, in terms of the number of trains it can accommodate throughout the day. An increase of this amount seems likely to be able to be accommodated with the current network – although port trains will need to be scheduled around passenger services.

However, as with the road network, we expect a large increase in passenger volumes using the eastern rail line. Following the introduction of electrified passenger services on the Auckland network around 2014, the headway on the main services will be 10 minutes during peak periods. This should be able to be accommodated on the eastern rail line, because this line operates at much higher latent capacity than the main southern line from Britomart to Southdown.

While there seems likely to be sufficient capacity on this line, the 'tighter' operation means that the effects of any delays will be worse. Passing is considerably more difficult on the urban rail network than the urban road network. If a freight train is delayed, the tight timetable will mean that the consequences for passengers could be considerable.

We also note that while the line can likely accommodate the additional traffic, this traffic may have significant social effects. There is an increasing unfavourable community opinion of port traffic, and additional freight trains through Auckland's eastern suburbs are likely to be seen unfavourably by many. We note that these issues are currently being factored into the design of new buildings around stations and tracks.

Southern rail line between Southdown and Wiri

The rail line between Southdown and Wiri runs the trains that use both the main southern line and the eastern line. It accommodates the port trains and the passenger trains on both lines. In addition, because POT's Metroport is located at Southdown, this rail line also caters for the POT-Metroport rail traffic.

So this line will have to accommodate increases in POA rail traffic, POT-Metroport traffic, and Auckland southern and eastern line passenger trains.

The expected growth in the number of trains, particularly passenger trains, is likely to lead to conflicts between passenger and freight services, especially as the latter are much longer and slower than the electric multiple units. Because of the intensive timetable, any disruptions to passenger services will have serious knock-on effects.


PIL
MOL

5.4.7 Options for addressing difficulties with distribution infrastructure

All the main pieces of road and rail infrastructure used by POA traffic will have difficulty accommodating port traffic by the end of our projection period. However, this is not due to increases in port traffic – it is driven by increases in non-port traffic that also uses the same corridors. While congestion in Auckland will affect port operations, it is not necessarily a problem that can be fully addressed by changes to port and port-related infrastructure. It is, rather, a symptom of a more general problem that requires a more general solution.

Congestion has several effects on port traffic. Delays on the road network increase the cost of moving freight to and from the port and add to the cost of doing business in Auckland. But in addition, congestion makes travel times to and from the port more unreliable, which will have a cost that is more difficult to quantify.

As in the case of port infrastructure, there are two general options for managing the challenges of congestion in the distribution network: provide more infrastructure, or use existing infrastructure more efficiently. Some of these options pertain directly to port operations or infrastructure directly related to the port, such as the state highway through Grafton Gully.

Due to the fact that general traffic is the main driver of congestion, many options that would have a significant effect on congestion costs for port traffic are beyond the scope of this study. For example, projects like the City Rail Link or the current redesign of Auckland's bus network may result in an increased public transport mode share in and around the city centre and thereby increase the road space available for port traffic.

Option 1 – more efficient use of trucks and trains

For trucks, there appear to be two main ways that they can carry more cargo on average:

- reduce the number of trips to the port for which the trucks only carry cargo in one direction
- increase the volume of cargo trucks can carry at one time.

A large proportion of trucks currently only carry cargo in one direction. While the current arrangements seem to be a function of the current preferences of port users in response to their costs (ie paying for more trips is justifiable to get the cargo at the optimum time), this could change in response to changes in congestion, port charges, fuel costs, and various other factors.

Increases in the number of TEUs per truck are also expected as a consequence of the use of larger trucks. High Productivity Vehicles are commonplace in other countries and recent legislative changes in New Zealand[72] are expected to see them deployed more in New Zealand too.

72. Land Transport Rule: Vehicle Dimension and Mass Rule Amendment 2010.

Current modelling for the Auckland East Waterfront Access Study[73] assumes an increase of TEUs per truck from the current 1.9 to 2.5 (due to improved productivity and the use of larger trucks). This would reduce the contribution of port traffic by around a quarter.

As well as trucks, some trains could potentially be lengthened, so that more cargo is carried on each train.

Additionally, there are opportunities to move freight outside of congested times. Much of the port traffic currently travels during the morning (including peak) and early afternoon. We understand that the current scheduling is primarily based around preferred times for customers (importers) to receive products at their distribution centres. There is scope to increase the amount of traffic at other times.

Main benefit

If the average amount of cargo carried on each truck and train could be increased, this would reduce the growth in port traffic to less than the projected growth in off-port cargo.

However, this will only have a small effect on the total amount of traffic using the road and rail routes, and hence on overall congestion. Making port traffic more efficient, while useful, does nothing to reduce the amount of non-port traffic, which will be the primary driver of congestion in the future.

If traffic travels at less congested times, this will shift vehicles out of peak times, offsetting the expected increase in peak traffic and reducing the need for infrastructure to cater for these peaks.

Other effects

While there will be fewer trucks and trains than otherwise, they will carry more cargo on average. This means that some of the trucks and trains will be longer. This may have an adverse visual impact – whether it is material is unclear.

Depending on how it occurs, a reduction in the proportion of trips for which trucks only carry cargo in one direction may add costs to port users.

Moving port traffic during off-peak periods, which are less congested than morning and evening peaks, will have flow-on costs to port users. We understand that the main driver of current travel timings is the optimal time for users (eg warehouses) to receive products. Consequently, managing port traffic in off-peak periods may have an implication for importers' and exporters' operating hours.

73. A current NZTA and Auckland Transport strategic study to investigate transport network options and the necessary staging to enable long term strategic land use outcomes for the eastern waterfront area.

Option 2 – more capacity on the road and rail network

More traffic capacity could be provided on each of Grafton Gully, the southern motorway and the southern rail line between Southdown and Wiri – although we note that this could be difficult.

We do not, in this report, analyse the merits of different options for adding capacity in these areas. We note that Auckland Transport and NZTA are currently investigating options to address concerns around future congestion on the Auckland traffic network.

In particular, we note the following points in relation to potential capacity additions:

- New Zealand Transport Agency and Auckland Transport are investigating the relative costs and benefits of various roading improvements along the SH16 corridor, including grade separation options, and their preferred timing and form in order to support Auckland Council land use planning.
- The Auckland Plan includes the development of a third rail line between Southdown and Wiri, to be dedicated solely to freight. It will connect trains leaving Southdown at the Otahuhu Junction to just south of Wiri. While funding has not been fully agreed, work is currently underway to advance the construction of sections of this line prior to the introduction of the planned intensive passenger train timetable in 2014. Some work has already been completed at the access point to Westfield and Southdown to reduce the time taken for freight trains to exit onto the rail network. This line is expected to cost around $60m, including the necessary work near the Wiri depot.

Main benefit

Increased capacity on these routes will reduce future congestion, and aid the transport of port cargo.

Other effects

Upgrading transport capacity will have substantial capital costs.

There may also be some visual and/or noise impact. Whether this is material will depend on various factors.

Further comments

We reiterate that this option has a much wider benefit than just for port users, and also that the costs are largely incurred as a response to issues other than port growth, and would be required whether the port continues to exist or not.

Increased rail freight could potentially come into conflict with passenger rail operations, which are expected to increase during the study period as a result of increased patronage stemming from factors such as scheduled rail electrification and the proposed City Rail Link. Signalling capabilities create theoretical minimum headways that are relatively close to being reached. As a result, rail freight may have to move at off-peak times or overnight, with uncertain impacts on the operations of POA and inland ports. Off-peak freight movements may, in turn, conflict with residential amenity or liveability along freight corridors.

5.5 Port of Tauranga

In this section, we consider the ability of the infrastructure associated with POT to cater for this port's share of projected growth in trade volumes.

5.5.1 Summary of the ability to cater for projected growth

Even with the available operating efficiencies, and the additional 170m of berth length currently being developed, POT's current berth length will not be sufficient to cater for our projected increase in throughput, both for containers and bulk cargo. POT will need to construct additional berthage. While resource consent will be required, POT's current plan to extend the current container berth 285 metres to the south, and to extend the current bulk berths by up to 1 ,000 metres to the south, will be sufficient to address this issue. (However, extending bulk berths to this extent may conflict with existing dolphin berths in the same area.) While it involves capital costs, it should come with minimal social and environmental impacts.

Container berthage is the only issue with port infrastructure. There appears to be enough bulk berthage and storage space to cater for our projected future volumes, although there may be the need for operational reconfigurations. POT also have the potential to develop an additional kilometre of berth space, and has recently required 8 hectares of land which they may deploy to provide greater operational flexibility.

Key elements of the rail network may suffer from congestion in the future. The dedicated rail line from POT to the main trunk line seems likely to reach maximum capacity before 2041. This growth will be managed incrementally by KiwiRail through additional passing loops, better signalling, and potentially double tracking if required. Previous studies[74] have also raised concern about the capacity of the rail connections to Murupara and Kawerau to manage the projected log traffic. We expect these issues to be resolvable commercially between the interested parties (POT, KiwiRail and the forestry companies) eg through deployment of increased rolling stock, passing loops or improved signalling.

In terms of roading, congestion issues are likely to emerge in Tauranga, but these are likely to be a consequence of general traffic rather than port traffic. Increased congestion is likely to lead to a decline in the level of performance for freight to and from the port. The Tauranga Urban Network Study report states that the effects on port traffic will be most acute at a small number of critical locations, ie Mirrilees Road /SH2, Totara Street / Hewletts Road (SH2) and Elizabeth St / SH2.

The Tauranga Eastern Link (TEL) will duplicate the existing SH2 south of Tauranga, including bypassing Te Puke. This will provide considerable additional capacity from the area which is the source of much of the logs and related product that are exported through POT.

74. Paling, Williamson and Sanderson (2011), "Bay of Plenty Economic Development and Transport Study".

5.5.2 Can the current access arrangements cope with the projected growth?

We expect that, as with POA, shipping lines will want to service POT with 5,000-6,000 TEU container ships in the near future. It seems possible that they may also want to use up to 8,000 TEU ships further into the future.

The current channel depth is sufficient to allow all current ships to use it at all tides – however, due to tidal flow speeds, many ships cannot enter the port at the middle of the tide. Depending on the precise draft, 6,000 TEU ships may be able to use the current channel, but may be restricted to doing so at high tides. It is unlikely that the largest future ships would be able to navigate the channel at its current depth.

However, if POT goes ahead with its recently consented[75] dredging programme, then they will be well placed to accommodate these ships.

5.5.3 Options for addressing difficulties with access arrangements

As discussed POT are actively pursuing this option with consent recently granted by the Environment Court (but subject to ratification and final appeals). This consent ultimately enables POT to dredge its berths to 16 metres and its channel to 17.1 metres. This would involve a staged dredging programme that enables them to cater to the ships being contemplated.

Given this process is so advanced we have not considered alternative approaches.

75. The consents still need to be approved by the Minister of Conservation and they have been appealed to the Court of Appeal.

5.5.4 Can the current port infrastructure cope with the projected growth?

Container berthage

As shown in Table 22, POT has a current berth utilisation of around 1,000-1,300 TEUs/metre.

Our demand projections indicate that POT will need to service between 1.48m and 1.78m TEUs by 2041. Table 23 shows that, with the currently consented berth extension, the required berth utilisation is between 1,900 and 2,300 TEUs/metre.

Our analysis (see Section 5.2.2) indicates that the technical capacity of a port of POT's size is around 1,750 TEUs/metre. However, in order to achieve this level of utilisation, POT would have to be operating very efficiently.

The current container berth occupancy rate at POT is around 43%[76]. With a technical capacity for this metric of around 50%-60%, this gives POT some scope to increase berth utilisation without crane efficiencies. The combination of POT's current berth occupancy and berth utilisation figures suggest that it is operating with relatively efficient levels of crane utilisation and crane productivity.

It appears that, even with the consented berth extension and improvements to berth occupancy, the current container berthage will not be sufficient to cater for our future growth out to 2041. Berth utilisation of 1,900-2,300 TEUs/metre is beyond even the most efficient ports of POT's size.

Table 22: Current container berth utilisation at POT

Year	Berth length	TEUs serviced	Berth utilisation (TEUs/metre)
2011	600 metres	580,000	967
2012	600 metres	780,000	1,300

Source: Ports of Tauranga

Table 23: Berth utilisation required to meet projected future container trade task at POT

Future TEU requirements (2041)	With current berths		With consented extension	
	Berth length	Utilisation required	Berth length	Utilisation required
1.48m-1.78m TEUs	600 metres	2,450-3,000 TEUs/metre	770 metres	1,900-2,300 TEUs/metre

Source: PwC analysis

Container storage

As shown in Table 24, POT has a current storage utilisation of around 18,000-19,000 TEUs/ha.

For the purposes of these calculations, we consider that the available but currently unused container storage land is part of the 'current storage infrastructure'.

Table 24: Current container storage utilisation at POT

Year	Hectares of storage	TEUs serviced	Storage utilisation
2011	72	580,000	8,055 TEUs/ha
2012	72	780,000	10,833 TEUs/ha

Source: Ports of Tauranga

Table 25: Storage utilisation required to meet projected future container trade task at POT

Future TEU requirements (2041)	With current storage	
	Storage	Utilisation required
1.48m-1.78m TEUs	72 ha	20,500-24,500 TEUs/ha

Source: PwC analysis

Table 25 shows that with the current storage, POT will need a storage utilisation of around 20,500-24,500 TEUs/ha in order to cater for future growth.

With the current stacking technology and dwell times, our analysis estimates that the technical capacity of container storage at POT is around 25,000 TEUs/ha. Therefore, the current storage space should be sufficient to cater for future growth, without any need to make operational efficiencies.

76. Ports of Tauranga website, http://www.port-tauranga.co.nz/images.php?oid=1188.

Bulk berthage

POT currently has a bulk berth occupancy of around 39%.[77]

We are projecting that POT will increase its bulk throughput by around 62%-92% by 2041. This implies that, without any efficiencies, berth occupancy will need to increase by the same proportion to accommodate this – ie to around 63%-75%.

We estimate that the technical capacity of bulk berths is around 55%-65%. However as we noted earlier, these estimates can vary materially depending on the characteristics of the port. POT have stated to us that they may be able to achieve slightly higher occupancy than this, due to their continuous quay and abundant adjacent storage space.

However, POT does have capacity to develop up to an additional 1,000 metres of bulk berth at the southern end of their existing berthage, which is earmarked for bulk and liquid cargoes[78]. However, extending bulk berths to this extent may conflict with existing dolphin berths in the same area. While they may have capacity to manage the projected task through efficiencies for a significant portion of the study period, its development would enhance operational flexibility.

Bulk storage

As discussed above with POA, it is very difficult to assess the technical capacity of bulk storage space, or how close the current use is to it.

Our understanding from POT is that the current bulk storage space comfortably accommodates their current needs, and that they could use it more efficiently if needed. This suggests that POT should be able to cater for the projected increase in bulk throughput of 62%-92% by 2041, although some operating efficiencies and reconfigurations may be required. For example POT currently has 22 hectares of land (within its bulk storage area) dedicated to log storage. They recently demolished a shed at the bulk terminal to create an additional 2.5 hectares of storage, and are progressively sealing the storage facility in Hewletts Road[79].

POT also has an 8 hectare site nearby which may be deployed. We understand that it is intended that this site would be used to accommodate bulk and liquid cargoes[80].

Individual berth lengths

POT's berths are all in a line. POT can accommodate very long ships. It should have no issues catering to longer ships in the future.

77. Ports of Tauranga website, http://www.port-tauranga.co.nz/images.php?oid=1188.
78. Ports of Tauranga website, http://www.port-tauranga.co.nz/images.php?oid=2744.
79. Ports of Tauranga website, http://www.port-tauranga.co.nz/images.php?oid=3816.
80. Ports of Tauranga website, http://www.port-tauranga.co.nz/images.php?oid=2744.

5.5.5 Options for addressing difficulties with port infrastructure

The current container berth space at POT will not be sufficient to cater for future growth without operational efficiencies.

We consider there to be two main options for addressing this:

- construct additional berth space at Sulphur Point
- repurpose some of the bulk berth space at Mount Maunganui for container use.

We do not include any option here related to achieving operational efficiencies. We expect that POT will naturally increase its container berth occupancy as the number of ships increases. Furthermore, we consider that it is already operating very efficiently in terms of its crane utilisation and crane productivity – while some small gains seem possible, we do not think that these could be large enough to warrant consideration against increasing berth space as a realistic option for addressing an infrastructure shortage.

Option 1 – construct additional berth space at Sulphur Point

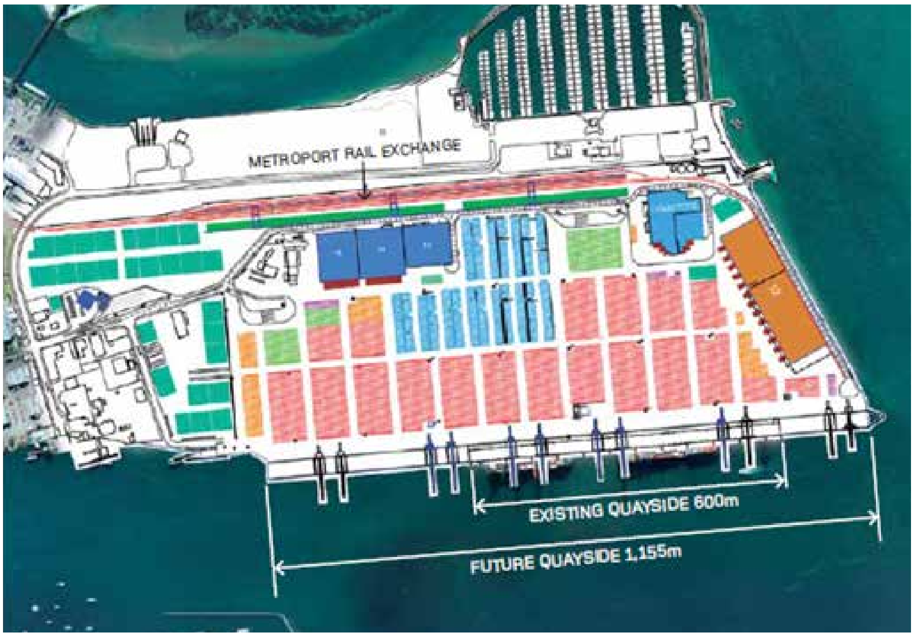
POT could construct additional berth space at Sulphur Point.

POT has developed a plan to extend the current container berths southward, along the edge of its existing storage space. There is around 385 metres of berthage space available, but due to potential conflicts with the flight paths of Tauranga airport, only around 285 metres of this can be used.

An extension of 285m would take total container berthage to 1,055 metres. POT does not have resource consent for this. Figure 61 shows this planned extension.

We also note that there is also some scope for additional berthage at the northern edge of Sulphur Point.

Figure 61. Planned extension of container berth at POT



Main benefit

Additional berth space will increase the amount of container throughput that POT can handle.

If large enough, this could allow POT to cater for our projected future trade task. With the planned 285 metre extension, future berth utilisation would need to be 1,400-1,700 TEUs/metre – much lower than the required level without the extension, and well within the range of utilisations able to be achieved.

Other effects

Additional berths cost around $150,000-$175,000 per lineal metre, so POT's planned 285 metre extension will cost around $43m-$50m. Accompanying cranes will cost $10m-$15m each.

There may also be some visual impact in terms of the increased berthage and cranes. While likely to be negative, this effect is likely to be minor given that the additional berthage is within the existing port footprint and alongside land already used for port operations.

Lastly, extending the current container berthage southward by even 285 metres would require an upgrade of the current air traffic signals at Tauranga Ai rport. POT and Tauranga Airport have already held discussions around this issue, and POT would pay the additional costs involved.

Further comments

POT will require resource consent to construct additional berthage. The consent process will consider the wider costs and benefits of the development, including the size and nature of any non-financial effects.

Option 2 – repurpose some bulk berthage at Mount Maunganui for container use

POT could repurpose some of its bulk berth space at Mount Maunganui for container uses. This would also require some repurposing of storage space from bulk to containers.

Main benefit

This would increase the berth space for containers, without the need for additional berth construction.

Other effects

The repurposing will have some financial costs, but these are likely to be fairly small.

The key adverse impact of this option is that the amount of bulk berth and storage space is reduced, reducing the ability for POT to cater for future bulk volumes. While it does not appear that this is very constrained at the moment, if the current amounts of berth and storage space were significantly reduced, there could potentially be an issue in the future. Ultimately this would be an operational and commercial decision based on the relative costs and benefits of the options for POT.

The current container berth space at POT will not be sufficient to cater for future growth without operational efficiencies.

5.5.6 Distribution infrastructure

We are projecting that the volume of POT's trade which uses off-port distribution networks will increase by around 62%-84% by 2041. If the average volume of cargo per truck/train remains constant, then this implies that total port traffic will increase by the same amount.

As with Auckland, congestion in Tauranga's road network will be largely driven by general traffic rather than port traffic. While road congestion will affect port operations, it is not necessarily a problem that can be fully addressed by changes to port and port-related infrastructure. However, capacity limits on the rail network around Tauranga will be driven entirely by freight growth.

Congestion has several effects on port traffic. Delays on the road network increase the cost of moving freight to and from the port and add to the cost of doing business. But in addition, congestion can make travel times to and from the port more unreliable, which will have a cost that is more difficult to quantify.

As in the case of port infrastructure, there are two general options for managing the challenges of congestion in the distribution network: provide more infrastructure, or use existing infrastructure more efficiently. Some of these options pertain directly to port operations or infrastructure directly related to the port, while others are beyond the scope of this study as they relate to general traffic.

State highway network

The current road network operates with considerable latent capacity, at least over the state highway routes used by port traffic. An increase in port traffic of 62%-84% across the routes would be unlikely to result in a significant increase in congestion. The Tauranga Eastern Link (TEL) will duplicate the existing SH2 south of Tauranga, including bypassing Te Puke. This will provide considerable additional capacity from the area which is the source of much of the logs and related product that is exported through POT. In addition, NZTA are actively considering upgrades to state highway 2 to improve safety and capacity, and we expect that these will limit any future congestion on the route.

Overall, the total road capacity between Auckland and Tauranga, outside the urban areas, is unlikely to be reached for many years. In addition, current Government policy is for SH1 – SH29 to become the main freight route between the two cities. This will provide additional capacity for inter-regional freight. The current Roads of National Significance programme is investing heavily in the SH1 Waikato Expressway and SH29 from Hamilton to Tauranga is identified in the current Government Policy Statement as a potential future RONS. SH2 to the north would however still be required for getting fruit and logs from the Coromandel to the Port.

Congestion issues are likely to emerge in Tauranga itself and increasing congestion will affect all vehicle types, meaning that there will be a decline in the level of performance for freight to and from the port. Specifically for port traffic, the Tauranga Urban Network Study report states that these effects will be most felt at a small number of critical locations, ie Mirrilees Road /SH2, Totara Street / Hewletts Road (SH2) and Elizabeth Street /SH2.

Rail network

The majority of POT rail traffic uses the line to the west of Tauranga which connects with the main trunk line. It has recently expanded capacity on the line by adding two passing loops, and a third is under construction. KiwiRail has resource consent for a fourth passing loop at Morrinsville, which it plans to construct when capacity is reached.

However, KiwiRail expects that this line will reach capacity again 10 years after construction of the Morrinsville loop. It therefore seems that the current infrastructure on the rail line west of POT, even with the consented additional passing loops, will not be able to cater for our projected growth in port traffic. This could lead to additional pressure on road freight transport.

Options for efficiency gains are limited, though there may be some incremental increases in the length and hence capacity of these trains. We expect that KiwiRail will continue to progressively improve signalling and add passing loops as required, on a path toward eventual complete double-tracking (with the possible exclusion of the Kaimai Tunnel).

Previous studies[81] have also raised concern about the capacity of the rail connections to Murupara and Kawerau to manage the projected log traffic. We expect these issues to be resolvable commercially between the interested parties (POT, KiwiRail and the forestry companies) eg through deployment of increased rolling stock, passing loops or improved signalling.

Lastly, we note that increased numbers of port trains may be seen unfavourably by some members of the Tauranga community. POT traffic heading to and from Auckland travels very close to the Otumoetai waterfront, and the bulk cargo also travels along the central city waterfront between The Strand and the harbour. Even if capacity upgrades are provided, there could be increasing community sensitivity to port operations in the future, as has been seen recently in Auckland.

81. Paling, Williamson and Sanderson (2011), "Bay of Plenty Economic Development and Transport Study".

5.6 The role of prices

As discussed above, there are various options to address the infrastructure difficulties we have identified. Which combination of options actually gets utilised, and the timing of the options, will be chosen by port companies and port users.

In conjunction with decisions to invest in infrastructure, relative prices will play a key role in extracting and allocating capacity across the UNI port network, particularly where there are alternatives or substitutes. Costs and prices[82] for example will help determine:

- Whether a port invests in additional physical infrastructure (eg reclamations) or operational efficiencies (eg more cranes, automated stacking technology)
- How freight is distributed (eg by road or rail)
- The types of products that ports cater for – eg if physical space becomes a premium we would expect them to focus on products for which they can charge the most per square metre of storage space. Or put differently, as they start charging more because space is tight, exporters and importers will start considering whether it would be more cost effective for them to use a different port
- Where exporters/importers send or source their products (which is already happening in the container trade competition between POT and POA).

The ability of port customers to choose between ports reinforces the role of price in allocating capacity. While there will continue to be limitations in the extent that ports can be substitutes (especially for bulk products) Metroport has demonstrated that under the right conditions, POT can compete in the Auckland market. We expect that, if successful, the proposed inland port at Ruakura would provide further opportunities to allocate latent capacity, both in the regional rail network and in its ports, though the rate of take-up may be slow given the experience of Metroport and Wiri.

Historically for example, expanding port capacity in New Zealand has typically been achieved through reclamations and increasing berthage, as opposed to driving more throughput from existing assets. Presumably, the costs associated with developing more port infrastructure have been less than the costs associated with increased operational efficiencies. As the costs of more infrastructure increases - say through increased physical works costs, environmental or social costs – we can expect ports to increase investment in operational efficiencies.

Similarly price plays a key role in allocating capacity. For example, if road congestion worsens, we can expect that there will be a shift of freight from road to rail. If storage capacity at POA gets particularly tight, we would anticipate prices going up, and customers using POT instead.

As the limits of infrastructure are tested going forward, we expect that a combination of these factors would play out. Ports will shape their strategies and investment choices around the relative costs and benefits of pursuing increased physical space versus investing in operational infrastructure that drives efficiencies. They will also make decisions around the relative value of the products they manage and cater to.

82. These may be direct costs, or indirect costs such as the costs associated with congestion, or the uncertainty associated with obtaining resource consents.

6

Potential changes to the Upper North Island ports system

Potential changes to the Upper North Island ports system

There has been public commentary on systemic change in the ports systems as an alternative to incrementally adding capacity. We have summarised at a high level the pros, cons and implications of three potential options. While these options are not considered in detail in this report, they are provided as a summary to help inform further technical analysis.

The options are focused on constraining growth at POA, as this is the port under the most significant pressure in terms of competing land uses, environmental concerns that limit growth capacity, and conflict with other transport uses.

These options are:

- Constraining POA's future throughput at the current levels, and managing POA's organic growth elsewhere
- Establishing a container terminal at Northport that would take over POA's container and possibly non-containerised cargo operations over time
- Establishing a new port in the UNI and removing POA over time.

While there are clearly other systemic options, these three allow consideration of key issues and implications.

We note that these options would involve a relatively large-scale intervention in the market by government agencies – well over and above their current role. This would need to be justified on the basis that one of these options (or similar) would represent an improvement over the outcome which would occur without this intervention, and that the benefits outweighed the costs of intervention. We note that there may be considerable unforeseen costs which get passed onto port users and other organisations down the value chain.

We note that there may be considerable unforeseen costs which get passed onto port users and other organisations down the value chain.

6.1 Establishing a container terminal at Northport

The option

Northport could establish a container terminal, and progressively take over all of POA's container operations.

We note that a potential limiting factor on the size of operation Northport could establish is the size of the harbour and the ability of ships to turn. Northport can currently only accommodate ships of 275-300 metres in length[83], because there is not sufficient space for longer ships to be able to turn around. To accommodate longer ships, the turning bay would need to be widened by digging out the banks of the harbour across from the port. 275-300 metres is sufficient to cater for almost all ships which currently call at POA and POT, but may not be sufficient to cater for larger ships in the future.

Main impact

In this option the physical footprint of POA could be reduced in size and redeveloped. This could lead to social and environmental benefits by reducing the port's impact on marine ecosystems, and opening up more of the Auckland waterfront to other uses.

The development would also provide additional network resilience – although this may only be a short-term effect if the POA container terminal is eventually decommissioned. This option could significantly reduce costs for Northland importers and exporters. However, the small size of Northland's economy and population relative to Auckland means that the local benefits would not outweigh the additional costs to the whole UNI.

Northport could establish a container terminal, and progressively take over all of POA's container operations.

83. While Northport's turning basin is 400m, experience from Northport pilot's suggest that it would be very difficult or unsafe to turn ships longer than 300m due to shifts from tidal movements.

Other effects

Establishing a container terminal at Northport would involve several different types of costs.

Firstly, this would involve considerable capital investment.

- Northport would need to construct a container terminal operation, with the necessary berths, storage area, dredging, cranes, etc.
- Northport's existing wharf facilities would need further investment to enable them to handle the weight of cranes etc associated with a container terminal.
- The road and rail links to Auckland would need to be upgraded, particularly since much of the container cargo would be destined for the Auckland market.
  - The North Auckland Line would require upgrading, probably including double tracking and reducing the number of tunnels, to make the journey faster. A new link would be required between Northport and the main trunk line.
  - The rail lines through the west of Auckland's urban area would need considerable investment. The line from Southdown to Avondale, that is included in Auckland Transport's long-term plan, would need to be constructed, to avoid all the freight travelling through Newmarket. The existing western line may also need to be upgraded.
  - State highway 1 between Whangarei and Auckland would require considerable upgrades. The Puhoi to Wellsford RONS would require construction, and further investment north of Wellsford would also likely be required.
  - The cost of the required investment in upgrading the road and rail links would likely dwarf the cost of the new container terminal.

Such a large expansion of Northport would require substantial additional reclamations to the west of the current location. This is relatively sensitive land, and a large expansion would likely cause significant environmental impacts.

As discussed above, a large container operation may (depending on the length of ships which may want to call at the port) also require widening of the turning bay, by digging out the banks of the harbour across from the port. This could potentially involve substantial environmental effects. Whether this is achievable would depend on the ability to obtain resource consent, and the consent process would involve detailed consideration of the size of any environmental effects.

In addition, port users would incur higher ongoing costs than they would if they could continue to use POA. Due to the additional distance between the new port and the majority of importers, port users would face higher distribution costs (either due to their own transit times, or higher port charges if the port transported the goods for them). Some port users have also installed substantial facilities near the existing POA, and would have stranded costs if the port was moved. Users could move their operations to be closer to the port, but this would take time and involve considerable expense.

Lastly, the new container terminal may make it more difficult for Northport to manage its future bulk cargo task.

Further comments

Establishing a container terminal at Northport would require resource consent – for various elements of the development. This process would consider the wider costs and benefits of the container terminal.

6.2 Limiting Ports of Auckland's growth

The option

Instead of POA catering for its organic growth, POA could continue to handle its current volumes of container and bulk traffic, and all its growth could be accommodated elsewhere.

In practice, this would most likely be the result of POA being unable to obtain resource consent for further reclamations, and Captain Cook and Marsden wharfs being released for other uses. Despite achieving operational efficiencies, the increased trade task becomes impossible on a smaller land area, with the result that POA can broadly handle not much more than its current volumes.

We expect that POT and Northport would share the future bulk growth, and POT would accommodate the container growth.

Main impact

The key benefit of this option is that POA would not require more infrastructure, and Captain Cook and Marsden wharfs could be released for other uses. It would avoid the increased social and environmental costs in some of the options for POA in Section 5.4.5.

Other effects

Both Northport and POT would have to cater for a larger future trade task than under our main projections, putting proportionally more stress on their infrastructure. This would mean either additional infrastructure or an acceleration of the need for infrastructure. This includes:

- Double tracking of the Tauranga to Auckland rail line
- Increased pressure on freight routes between Auckland and Tauranga and Whangarei
- Capacity issues may develop in Tauranga, especially in relation to berth length
- Increased potential for reverse sensitivity issues in Tauranga, related to increased freight traffic, including train
- Northport likely to require a fifth berth, and prices for Northport's existing bulk trade (ie the log industry) likely to increase

However, so long as POT and Northport were able to develop additional berth space in line with their current (unconsented) plans, these ports should be able to accommodate POA's growth.

The limit on POA volumes will also adversely affect port users. The capacity constraint will likely raise the charges levied by POA, with those least willing to pay being the users who transfer to another port. The remaining POA users pay higher charges, while those who switch incur higher distribution costs. This in effect means increased costs across the value chain for diverted products (with probably a bigger impact for bulk products that are more expensive to transport).

6.3 Establishing a new port in the UNI

The option

A new port could be established in the UNI. This would either become the main UNI hub port, or be one of two hub ports alongside POT.

The new port would incrementally take over POA's operation, eventually to such an extent that POA either ceased to exist in its current location or only operated with a small fraction of its current volumes and land area. The new port would also compete for trade volumes with Northport and POT, as part of a well-functioning market.

Various potential locations have been considered in previous studies. Most notably, a 1999 report by POA[84] considered the merits of several alternative port sites. This report broadly considers four different locations – in the Manukau harbour, in the area between Waiheke Island and the Firth of Thames, off the west coast beaches north of the Manukau harbour entrance, and on the north-eastern coast of the North Shore around Whangaparoa.

In this report we do not explicitly consider the relative merits of individual alternative sites. We consider this option as a group, with specific costs and benefits dependent on the specific location.

Main impact

In this option the physical footprint of POA could be reduced in size, or even eliminated, and the port land redeveloped. The other two systemic options we considered above are unlikely to be capable of achieving this – to drastically reduce the size of POA, a new UNI port is needed.

This avoids any additional infrastructure required at POA. It could also lead to social and environmental benefits by reducing the port's impact on marine ecosystems, and opening up more of the Auckland waterfront to other uses.

Other effects

Establishing a new UNI port would involve several different types of costs. Most notably, a new port would involve massive capital investment.

- All potential locations would require the construction of a container terminal operation, with the necessary berths, storage area, dredging, cranes, etc. These costs will depend on the location but are likely to be considerable.
- A new port either off the western beaches, off the northern North Shore, or towards the Firth of Thames would require new road and rail links. In the first and third case, these links would need to pass through mountain ranges to reach the Auckland urban area. While we have not estimated a cost for this we expect it would be very expensive.
- A new port in the Manukau harbour would require ongoing dredging, for the entire time that the port is in operation. Again, estimating the cost of this would be a significant exercise, but we expect it would be very expensive.

All of the alternative locations considered by other studies involved some form of adverse environmental effect – including continual dredging, port traffic passing through regional parks and DOC land, and substantial effects on the water area and nearby beaches.

Possibly with the exception of the Manukau site, port users would incur higher costs. This is due to the additional distance between the new port and the majority of importers, meaning higher distribution costs. There would also be costs associated with re-establishing supply chains to the new locations. For users with substantial facilities near the existing POA, this would involve stranded costs if the port was moved.

If the new port was well outside the urban area, it also seems likely that the average commute for workers would increase, or that they would have to move home in order to get the same commute.

84. Ports of Auckland (June 1999), Port Development Options for the Auckland Region.

When could it be justified?

A new port, if appropriately sited, could allow the provision of additional infrastructure to cater for growing trade, without the same social costs that POA imposes. However, a new port would involve massive costs – capital for those constructing it and its distribution links, increased operating costs for port users, and potentially large environmental costs.

To justify a new port, the benefits from POA reducing in size would have to be extremely large. It seems doubtful that the benefits are large enough at the current time.

However, if substantial additional investment was required at POA, including more reclamations, to such an extent that this was deemed to be unacceptable by the Auckland community, or if the other UNI ports ran into hard capacity constraints or increased community opposition, then a new UNI port may become a viable option.

Further comments

To establish a new port, a large number of resource consents would be required. Without considering the detail of this process, establishing a new UNI port is several orders of magnitude more complex and difficult than any of the other options considered in this report.

It seems reasonable that such a large project would have to be run by a government agency – either national or regional. Funding could come from a variety of potential sources, although it would seem likely that ratepayers from the UNI area would need to pay a significant amount of the upfront cost.

6.4 The value of retaining options

Notwithstanding our view that the UNI ports system has the capacity to manage the freight task over the next 30 years, we believe there is significant value in retaining options that provide system flexibility, adaptability and resilience.

Forecasting the future, particularly over long periods is inherently difficult, particularly in a sector that is subject to the vagaries of international trade policy, economic volatility and technological transformation, as well as natural disasters.

Consequently, there are benefits in retaining flexibility to adapt to future circumstances, even where there is a financial cost in doing so, and if the option is never exercised.

For example, even if it was decided that Northport does not need to grow significantly, there are benefits in leaving the existing rail capacity available, in case, for whatever reason, a much larger Northport operation was deemed viable in the future. Similarly, proposals to significantly restrict or remove Auckland's port – even if it was felt that the task could be managed elsewhere, would compromise resilience and flexibility in the future.

In our view, a key role public sector planning role going forward is to ensure flexibility and options are maintained.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The potential situation beyond the end of our study period

The potential situation beyond the end of our study period

While our projections provide an indication of the port task and infrastructure requirements out to 2041, there is likely to be further growth thereafter. It may therefore be the case that even if a given amount of infrastructure can cater for the projected trade task in 2041; it may not fully be able to at some point after that.

This suggests a couple of questions:

- ***Is 30 years the right projection period, why not a 50 or 100 year timeframe?***
- ***Surely at some point ports will reach capacity. Shouldn't we be making decisions and plans to provide for this?***

While there are a number of perspectives as to the appropriate period for the planning of long-term infrastructure, we believe a 30-year horizon is a sensible time frame in this context, as:

- It coincides with the longest planning periods used by many public sector entities including NZTA, Auckland Council and Auckland Transport.
- Projections over long time periods become increasingly undermined by transformative changes. If we reflect on changes over the last 30 years for example, we have observed geopolitical changes (the collapse of the Soviet Bloc, the emergence of the Asian economies), massive technological innovation, removal of trade barriers and the globalisation of world trade, and the emergence of environmental concerns into the mainstream. None of these changes would have been easily predicted in 1980, but they have all had significant impacts on international trade.
- As well as transformative change, there is also potential for major system shocks. This could include a major oil shock, natural disaster or some form of conflict that significantly undermines trade.

Projections over long time periods (30+ years) become increasingly undermined by transformative changes.

Given what we currently know or can reasonably assume, if we take our projections out far enough, we will reach serious constraints in our trade supply chain. However, practically reacting or providing for this is probably limited to ensuring planning is flexible, and provides or retains options for future policy makers to react to major changes and constraints as they become more certain.

In this respect, we note that the UNI is actually well served by three ports. The region's ports operate as a system in which individual ports play specialised roles within the context of overall regional and national trade. For example, POA handles a large share of the region's imports, while POT handles bulk exports from a large catchment area and Whangarei has a national role in the importing and refining of crude oil. In addition, the existing port structure provides strong competition to the benefit of exporters and importers, and also operational flexibility and resilience in the UNI's trade and logistics supply chains.

There are benefits in retaining flexibility to adapt to future circumstances, even where there is a financial cost in doing so, and if the option is never exercised. For example, while we do not consider that Northport will be necessary to manage significant freight from outside of the Northland region, we do believe that retaining capacity for it to take a larger role provides valuable flexibility and resilience across the port network in the UNI.

There are benefits in retaining flexibility to adapt to future circumstances, even where there is a financial cost in doing so, and if the option is never exercised.

8

Conclusions

Conclusions

The UNI ports are projected to experience strong growth over the next 30 years, underpinned by continued growth in the trade of primary products, and the ongoing development of transhipping at POA and POT.

We expect that cargo throughput will grow more rapidly than outside-port cargo, and that containerised cargo will grow more rapidly than bulk cargo – in line with recent trends. As a consequence, more pressure will be placed on port infrastructure, which must handle growing volumes of exchange cargo, than on distribution networks and land transport infrastructure to the port. Likewise, container handling facilities are expected to handle more growth than bulk cargo facilities.

Overall, our projections suggest the UNI port network has capacity to meet the freight task over the next 30 years. But this will require substantial operational efficiencies as well as incremental investment in infrastructure including the uptake of consented berth developments, reclamations, channel and berth deepening.

If the task is to be managed with broadly the same share and configuration of ports, POA will most likely require further storage and berth capacity. If POA can make substantial operational efficiencies, we expect these requirements to be smaller in scale than the preferred reclamation options in the 2008 Port Development Plan. Whether further reclamation is achievable will depend on the ability to obtain resource consents, which in turn will depend on consideration of the wider costs and benefits (social, economic, environmental and cultural) of the proposals.

If POA is unable to gain approval for an expanded footprint, then some of the projected growth will need to be accommodated at other UNI ports. In our view this is achievable given the capacity across the network. Relative prices will play an important role in reallocating freight - as constraints at one port increase, the cost of handling freight will increase, encouraging importers and exporters to move freight through the alternative port. This however, like any supply side constraint, will have economic consequences in terms of additional supply chain costs for exporters and importers.

The development of inland ports and improvements to transport and distribution networks may partially offset these cost increases, as evidenced by the ability of POT to compete with POA for many types of Auckland cargo, through its presence at Metroport.

We would expect that any transfer of growth to the other ports would occur slowly, but be punctuated by step changes as exporters and importers reconfigure their supply chains.

POT and Northport are also expected to need further infrastructure over the study period. While this would also require resource consent, there are less apparent impediments to these proceeding than at POA.

We are not forecasting significant issues for land transport infrastructure. In Auckland growth is likely to be dominated by non-port demand. Tauranga and Whangarei are generally not under the same land transport congestion pressures. However, improvements to the East Coast main trunk line between Auckland and Tauranga will most likely be required, including possible double tracking. We expect these changes to be progressive, based on commercial arrangements between KiwiRail and POT.

In summary, the most efficient and cost effective options are likely to be based around incremental growth at each port, complemented by changes in relative prices that help allocate latent capacity. The public sector will continue to play a key role in:

- balancing the wider costs and benefits of infrastructure investment through decisions around resource consents
- providing additional land transport infrastructure as appropriate
- monitoring the effectiveness of the UNI's logistics supply chain
- retaining flexibility and options across the network, both to provide network resilience and capacity to manage change.

It does not appear, based on current projections, that the benefits of substantial changes to the UNI port system, such as establishing a new port, currently outweigh the costs involved.

Appendices

Appendix A

References

Auckland State Highway Future Directions, NZ Transport Agency, July 2012

Bigger Ships: Meeting Shippers' Future Demands, NZ Freight Summit, May 2012

Break Bulk Shipping Study, Shipping Australia Ltd, 2012

City Ports – Ports of Auckland Annual Review, 2010/11

Coastal Shipping and Model Freight Choice, NZ Transport Agency, October 2009

Company Profile, Pacifica Shipping, 2011

Desktop Review of Log Exporter and Processor Intentions March 2012, confidential report to Northport, Forme Forest Industry Consultants, 2012

Developing an Integrated National Supply Chain, Transport NZ Summit 2012, Kotahi Logistics LP Ltd, May 2012

Development of NZ National Freight Matrix, Land Transport NZ Research Report, 2005

Development Plan for Auckland Report, POAL, 1989

Draft Auckland Plan – Auckland Ports and Airports, Auckland Council

Draft Auckland Plan, Auckland's Ports and Airports, Auckland Council, 2011

Economic Impact Report, POAL, 2011

Economic Impact Report, POAL, Covec, 2008

Freight Futures Report, NZIER, September 2010

Freight Information Gathering System and Port Productivity Study, April 2012

Freight Information Gathering System Report, Ministry of Transport, January 2012

Interim Report, Northland Port Corporation NZ Ltd, 2011Northport Booklet

International Freight Transport Services Inquiry, NZ Productivity Commission

International Freight Transport Services, January 2012

Land Use Policy – Present and Future Land Requirements of Logistical Activities, Alan McKinnon, August 2009

Long Term Optimisation of NZ Port Sector, Auckland Regional Holdings, October 2009

National Freight Demand Study, Richard Paling Consulting, 2008

National Freight Demand Study, September 2008

National Infrastructure Plan – National Infrastructure Unit, NZ, 2010

Northport Confidential Booklet, March 2012

NZPC's final report on International Freight Transport Services, Russell McVeagh, April 2012

Oil Prices and Maritime Freight Rates – An Empirical Investigation, UNCTAD, 2010

POAL's Capacity Report, Bestshore, 2012

POAL's Traffic Survey Report, Beca Infrastructure Ltd, April 2009

Port Development Options for the Auckland Region, POAL, June 1999

Port Development Options for the Auckland Region, POAL, June 1999

Port Development Plan, POAL, 2008

Port of Tauranga Annual Report, 2011

Port of Tauranga Economic Impacts for 2006, Dr W R Hughes, University of Waikato

Research into freight hub/inland port development in the Waikato Region. Draft report. Aurecon, August 2012

Review of Maritime Transport, UNCTAD, 2011

Rodrigue, J-P et al. (2012) The Geography of Transport Systems, Hofstra University, Department of Global Studies & Geography, http://people.hofstra.edu/geotrans

Sea Change – Strategy for Domestic Sea Freight, MoT, 2008

Shipping Statistics and Market Review, ISL, 2011

The KiwiRail Turnaround Plan, KiwiRail, 2009/10

The North Auckland Line SIA Main Report, Quigley & Watts Ltd, July 2012

The Question of Bigger Ships Report, NZ Shippers' Council, August 2010

The Question of Bigger Ships, NZ Shippers' Council, August 2010

Understanding Transport Costs and Charges – Transport Costs in Freight Logistics, MoT, 2010

Upper North Island Freight Study, Northland Regional Council, August 2010

Upper North Island Freight Study, Richard Paling Consulting, 2010

Appendix B
Domestic freight costs

In order to understand the distribution of freight costs throughout the supply chain, we have compiled or calculated estimates of overseas cargo costs, port costs, and domestic freight costs on different modes. These figures were used to analyse the potential effects of future infrastructure investment or changes to the UNI port system. New Zealand's high domestic freight costs place a premium on having ports located close to population centres and export production locations.

In this appendix, we discuss the data sources and assumptions that were used to generate estimates of freight costs.

8.1 Data sources

The Ministry of Transport[85] and Productivity Commission[86] have collected data on the costs of exporting or importing one TEU for selected origins and destinations. Their data breaks down different components of the overall shipping cost, including sea transport costs, domestic port costs, and transport costs within New Zealand. We have used this information in the first instance. However, we have had to supplement this information with other data sources and our own calculations.

8.1.1 Sea freight and port charges

In order to estimate international freight costs and port costs, we have used data compiled by the Productivity Commission[87]. They report costs to import and export on four major shipping routes: Singapore – Auckland, Long Beach (Los Angeles) – Auckland, Shanghai – Auckland, and Sydney – Auckland.

The Productivity Commission estimated the cost of moving a container between a New Zealand and an international port by gathering multiple quotes from shippers and freight forwarders in November 2011. The quotes were for a single shipment (one TEU), but made in the context of expected regular shipments of 12 to 30 TEUs per year. They presented figures for the quote with the lowest total price. These cost estimates are summarised in Table 26 and Table 27.

Table 26: Freight costs to import one TEU to Auckland

Origin	Singapore	Long Beach	Shanghai	Sydney
Distance (km)	**4,857**	**5,664**	**5,197**	**1,275**
Sea transport costs ($)	1,373	4,255	1,413	485
Destination costs ($)	456	466	439	428
Total ($)	**1,829**	**4,721**	**1,852**	**913**

Source: Productivity Commission

85. Ministry of Transport, 2011 Freight Charge Comparison Report, July 2011.
86. Productivity Commission, International freight transport services inquiry, April 2012.
87. Productivity Commission (2012).

Table 27: Freight costs to export one TEU from Auckland

Origin	Singapore	Long Beach	Shanghai	Sydney
Distance (km)	**4,857**	**5,664**	**5,197**	**1,275**
Origin costs ($)	407	407	412	
Sea transport costs ($)	1,520	2,773	1,580	605
Destination costs ($)	336	620	265	733
Total ($)	**2,293**	**3,760**	**2,256**	**1,338**

Source: Productivity Commission

We used Productivity Commission data as it is slightly more up-to-date than comparable data from the Ministry of Transport. However, the Ministry also provides some data on the costs of importing from Shanghai or Southampton (UK) to Wellington, and exporting refrigerated containers from Tauranga to Shanghai or Tilbury (UK)[88]. We have not discussed freight costs on these routes. It is likely that international freight costs to or from POT will be similar to those to or from POA.

8.1.2 Domestic road freight

We estimated road freight costs using (a) data on the distance, by road, between major cities[89] and (b) estimates of per-kilometre freight costs to move one TEU compiled by the Ministry of Transport. These estimates may not reflect actual prices offered by individual trucking companies, which may vary in response to market competition, input costs, and other factors.

We considered several estimates of per-kilometre road freight costs:

- The Ministry of Transport[90] calculated road freight costs between Christchurch and Auckland on the basis of a minimum breakeven cost of between $3 and $4 per kilometre travelled and an average fuel adjustment factor (FAF) of 5%.
- The Ministry's estimated road freight cost for shipping from Auckland to Christchurch equated to a per-kilometre cost of $4.70, indicating that fixed costs (eg those associated with the Cook Strait Ferry) may be a significant component of some road journeys.
- Castalia[91] estimated three prices to set an upper and lower bound for per-kilometre road freight costs: $2.20, $2.92, $4.50. They used the average of the three - $3.20 per kilometre – in their report.

We have made similar assumptions about per-kilometre road freight costs. We estimate that shipping one TEU will cost $3.50 per kilometre – the midpoint of the Ministry of Transport's estimates of minimum breakeven costs – plus a FAF of 5%. Because trucking companies typically include all fixed costs within their per-kilometre prices, we have assumed that there would be no additional fixed charges associated with picking up and dropping off containers at origin and destination (container cartage) or moving trucks across the Cook Strait. This may mean that we overestimate road freight prices for shorter journeys while underestimating prices for inter-island freight.

Actual road freight prices will differ from these estimates due to several factors. First, different trucking companies have different rate structures that depend upon their usual routes and the location of their freight depots, among other things. Second, road freight is cheaper on routes with higher freight volumes, which allow companies to spread fixed costs more widely, and on higher-quality roads, which reduce operating costs such as fuel and wear and tear on vehicles. This means that road freight along main routes between Auckland, Hamilton and Tauranga and up and down State Highway 1 will be cheaper than road freight to and from regional destinations such as Whangarei. Third, northbound road freight tends to be cheaper due to the fact that more freight is shipped southbound.

88. Ministry of Transport (2011).
89. Compiled using Google Maps, http://maps.google.co.nz/.
90. Ministry of Transport (2011).
91. Castalia Advisors (2010), "Ruakura Intermodal Terminal".

Appendix B – Appendix B Domestic freight costs *continued*

Estimated distances and prices for road freight are presented in Table 28 and Table 29.

Table 28: Distance between cities, by road (km)

Origin \ Destination	Whangarei	Auckland	Hamilton	Tauranga	New Plymouth	Palmerston North	Napier	Wellington	Blenheim	Christchurch	Dunedin
Whangarei		158	282	360	516	671	572	800	923	1,232	1,586
Auckland	158		126	203	359	514	416	643	766	1,076	1,429
Hamilton	282	126		103	240	388	290	517	640	949	1,302
Tauranga	360	203	103		310	392	288	521	645	954	1,307
New Plymouth	516	359	240	310							
Palmerston North	671	514	388	392							
Napier	572	416	290	288							
Wellington	800	643	517	521							
Blenheim	923	766	640	645							
Christchurch	1,232	1,076	949	954							
Dunedin	1,586	1,429	1,302	1,307							

Source: Google Maps, city to city distances

Table 29: Estimated cost to ship one TEU by road

Origin \ Destination	Whangarei	Auckland	Hamilton	Tauranga	New Plymouth	Palmerston North	Napier	Wellington	Blenheim	Christchurch	Dunedin
Whangarei		$581	$1,036	$1,323	$1,896	$2,466	$2,102	$2,940	$3,392	$4,528	$5,829
Auckland	$581		$463	$746	$1,319	$1,889	$1,529	$2,363	$2,815	$3,954	$5,252
Hamilton	$1,036	$463		$379	$882	$1,426	$1,066	$1,900	$2,352	$3,488	$4,785
Tauranga	$1,323	$746	$379		$1,139	$1,441	$1,058	$1,915	$2,370	$3,506	$4,803
New Plymouth	$1,896	$1,319	$882	$1,139							
Palmerston North	$2,466	$1,889	$1,426	$1,441							
Napier	$2,102	$1,529	$1,066	$1,058							
Wellington	$2,940	$2,363	$1,900	$1,915							
Blenheim	$3,392	$2,815	$2,352	$2,370							
Christchurch	$4,528	$3,954	$3,488	$3,506							
Dunedin	$5,829	$5,252	$4,785	$4,803							

Source: PwC estimates

Table 30: KiwiRail quoted rates to ship one TEU by rail between New Zealand cities

Destination

Origin	Whangarei	Auckland	Hamilton	Mt Maunganui	New Plymouth	Palmerston North	Napier	Wellington	Blenheim	Christchurch	Dunedin
Whangarei		$602	$603	$786	$1,151	$1,272	$1,334	$1,394	$1,955	$2,089	$2,361
Auckland	$602		$400	$602	$907	$1,144	$1,090	$1,278	$1,685	$1,820	$2,089
Hamilton	$603	$400		$400	$907	$1,144	$1,090	$1,278	$1,685	$1,820	$2,089
Mt Maunganui	$786	$602	$400		$907	$1,144	$1,090	$1,278	$1,685	$1,820	$2,089
New Plymouth	$1,151	$1,151	$907	$907							
Palmerston North	$1,272	$1,272	$1,144	$1,144							
Napier	$1,334	$1,334	$1,090	$1,090							
Wellington	$1,394	$1,394	$1,278	$1,278							
Blenheim	$1,685	$1,413	$1,413	$1,413							
Christchurch	$1,887	$1,618	$1,618	$1,618							
Dunedin	$2,159	$1,887	$1,887	$1,887							

Source: KiwiRail

8.1.3 Domestic rail freight

- We have compiled information on KiwiRail's freight rates for one TEU as at 31 August 2012[92]. These rates are available to KiwiRail's 'walk-up' customers – ie shippers seeking to move a small volume of cargo on a one-off rather than ongoing basis – on regularly scheduled rail services. Freight rates are considerably lower for large-volume customers due to the fact that rail freight offers increasing returns to scale. An estimate of cost reductions for large container volumes is discussed below.
- KiwiRail's freight rates and shipping times are summarised in Table 30 and Table 31. Costs are generally lower for northbound freight than for southbound freight, reflecting imbalanced flows on those routes. (More freight moves in a southbound direction than a northbound one, requiring KiwiRail to relocate empty wagons and containers.) Note, also, that the cost of shipping a container to or from South Island locations is equivalent for Auckland, Tauranga, and Hamilton, but significantly higher (and more time-intensive) for Whangarei.

Table 31: Fastest available rail delivery time to ship one TEU by rail between New Zealand cities

Origin \ Destination	Whangarei	Auckland	Hamilton	Mt Maunganui	New Plymouth	Palmerston North	Napier	Wellington	Blenheim	Christchurch	Dunedin
Whangarei		O/night to depot by 7:30am	Next day, 4pm	Next day, 4pm	Next day, 4pm	Next day, 4pm	Next day, 4pm	Next day, 4pm	2-3 days by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am
Auckland	O/night to depot by 7:30am		O/night to depot by 7:30am	O/night to depot by 7:30am	Next day, 4pm	O/night to depot by 7:30am	Next day, 4pm	O/night to depot by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am
Hamilton	Next day, 4pm	O/night to depot by 7:30am		O/night to depot by 7:30am	Next day, 4pm	O/night to depot by 7:30am	Next day, 4pm	O/night to depot by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am
Mt Maunganui	Next day, 4pm	O/night to depot by 7:30am	O/night to depot by 7:30am		Next day, 4pm	O/night to depot by 7:30am	Next day, 4pm	O/night to depot by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am
New Plymouth	Next day, 4pm	Next day, 4pm	Next day, 4pm	Next day, 4pm							
Palmerston North	Next day, 4pm	O/night to depot by 7:30am	O/night to depot by 7:30am	O/night to depot by 7:30am							
Napier	Next day, 4pm	Next day, 4pm	Next day, 4pm	Next day, 4pm							
Wellington	Next day, 4pm	O/night to depot by 7:30am	O/night to depot by 7:30am	O/night to depot by 7:30am							
Blenheim	2-3 days by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am							
Christchurch	2-3 days by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am							
Dunedin	2-3 days by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am	2-3 days by 7:30am							

Source: KiwiRail

92. Available online at http://www.KiwiRailfreight.co.nz/pricing.aspx.

8.1.4 Domestic coastal shipping

We estimated coastal shipping costs for one TEU on most routes using figures published by the Ministry of Transport[93] and information about sea distances between ports[94]. Domestic coastal shipping company Pacifica Shipping currently offers scheduled services to most domestic container ports either on its own vessels or on international shipping lines' conference vessels[95]. Due to commercial sensitivities, Pacifica and the international shipping lines that provide the majority of coastal freight capacity have only provided information on coastal shipping costs between Auckland and Christchurch. This is due in part to the fact that shippers offer variable rates depending upon the amount of cargo space they have free at a given time. Consequently, these estimates may not reflect actual prices offered by shipping companies.

The Ministry of Transport provided detailed information on the costs of shipping one TEU between Auckland and Christchurch. In order to estimate costs on other routes, we separated sea freight costs into fixed and variable costs and then calculated the per-kilometre variable cost of transporting one TEU from wharf to wharf.

We assumed that:

- Port and container cartage costs were roughly constant at all ports and freight servicing locations. We estimated these costs as $464 per container, a value that included port handling at both ends and container cartage.
- All of the sea freight costs vary based on the kilometres travelled – an unrealistic assumption but one that has to be made for simplicity. We estimated that it would cost $1.79 per kilometre to move one TEU south, and $1.56 per kilometre to move one TEU north. As with rail freight, it is cheaper to move freight north due to the fact that more northbound shipping capacity is available.

Actual coastal shipping prices will differ from estimates based on these figures for several reasons. First, shippers offer variable rates depending upon market conditions and free capacity on scheduled services. Second, coastal shipping is cheapest on high-volume routes, and in particular the Auckland-Christchurch route. Consequently, our calculations are likely to underestimate coastal shipping costs for other routes.

93. Ministry of Transport (2011).
94. Compiled from sea-distances.com.
95. http://www.pacship.co.nz/page1263521.aspx.

Sea distances between New Zealand ports are summarised in Table 32. Our estimates of coastal shipping costs are summarised in Table 33.

Table 32: Distances between cities, by sea (km)

Destination

Origin	Whangarei	Auckland	Hamilton	Tauranga	New Plymouth	Palmerston North	Napier	Wellington	Nelson	Christchurch	Dunedin
Whangarei		83		165	462		396	580	596	702	866
Auckland	83			131	509		377	561	633	683	847
Hamilton											
Tauranga	165	131			587		290	430	582	596	760
New Plymouth	462	509		587							
Palmerston North											
Napier	396	377		290							
Wellington	580	561		430							
Nelson	596	633		582							
Christchurch	702	683		596							
Dunedin	866	847		760							

Source: Sea-distances.com calculations of port-to-port distances

Table 33: Estimated cost to ship one TEU by coastal shipping

Destination

Origin	Whangarei	Auckland	Hamilton	Mt Maunganui	New Plymouth	Palmerston North	Napier	Wellington	Nelson	Christchurch	Dunedin
Whangarei		$613		$759	$1,291		$1,173	$1,503	$1,531	$1,721	$2,015
Auckland	$594			$699	$1,376		$1,139	$1,469	$1,598	$1,687	$1,981
Hamilton											
Mt Maunganui	$722	$669			$1,515		$983	$1,234	$1,506	$1,531	$1,825
New Plymouth	$1,187	$1,260		$1,382							
Palmerston North											
Napier	$1,083	$1,054		$918							
Wellington	$1,371	$1,341		$1,137							
Nelson	$1,396	$1,454		$1,374							
Christchurch	$1,562	$1,532		$1,396							
Dunedin	$1,819	$1,789		$1,653							

Source: PwC estimates

8.1.5 Cost reductions from large-volume rail traffic

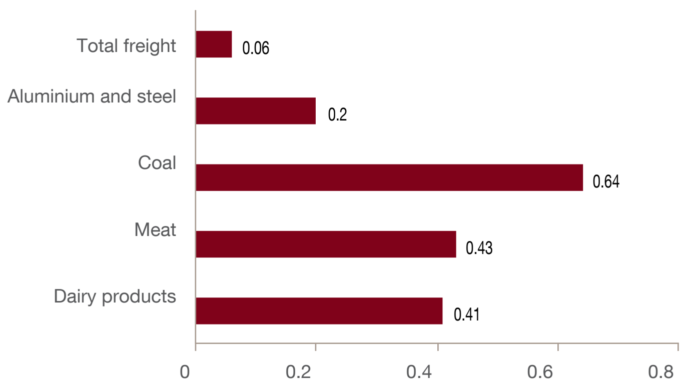
The cost advantage of rail freight over road freight increases over longer distances and for larger volumes of freight. This is one reason that large-volume shippers, such as Fonterra and Solid Energy, are more likely to move cargo by rail. This is illustrated in Figure 62, which shows that bulk commodities produced by single companies, or small groups of companies, are more likely to be carried by rail.

Inland ports can affect domestic supply chain costs by driving reductions in rail costs to and from seaports. Castalia modelled per-TEU savings from large volumes of rail freight between a proposed inland port at Ruakura (Hamilton) and either POA or POT[96]. Their estimates are summarised in Figure 63. They indicate that annual container throughput of 35,000 TEU at Ruakura would reduce the cost of rail freight to and from the ports by almost 70% relative to low volumes.

These estimates may not reflect actual prices offered by KiwiRail, which will be affected by market developments and input costs. Their modelling focuses on relatively low volumes compared with, say, Fonterra's dairy exports from the UNI or freight through Metroport. However, further cost reductions are likely to be relatively marginal.

Figure 62: Share of freight tonnes carried by rail in 2006/07, selected commodities

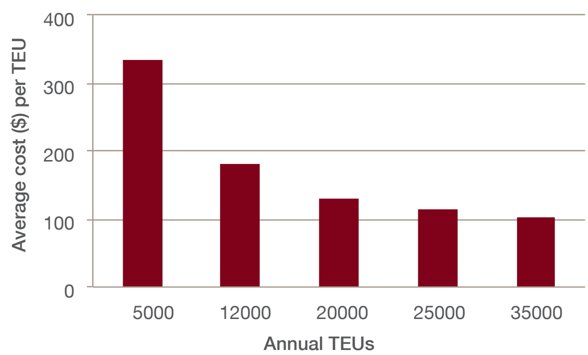
Share of freight tonnes carried by rail, 2006/07



Source: NFDS (2008)

Figure 63: Estimated savings from large volumes of rail freight

Estimated savings from rail freight volumes



Source: Castalia (2010)

96. Castalia Advisors (2010).

8.2 Detailed supply chain cost tables

Table 34, Table 35, and Table 36 compare domestic freight costs by road, rail, and coastal shipping with international freight costs (including shipping line costs and port charges) on three main shipping routes: Singapore – Auckland, Long Beach (Los Angeles) – Auckland, and Shanghai – Auckland. In all cases, domestic freight costs have remained the same.

We expect that a similar analysis of international trade passing through POT will show similar results.

Table 34: Supply chain analysis - total cost of shipping one TEU on the Singapore-Auckland route

		Importing			Exporting		
International freight costs							
	Shipping line costs		$1,373			$1,520	
	Port, customs, and biosecurity costs		$456			$407	
Domestic freight costs							
		Road	**Rail**	**Coastal**	**Road**	**Rail**	**Coastal**
Origin/destination	Whangarei	$581	$602	NA	$581	$602	NA
	Auckland	$210			$210		
	Hamilton	$463	$400	NA	$463	$400	NA
	Mt Maunganui	$746	$602	$699	$746	$602	$669
	New Plymouth	$1,319	$1,151	$1,376	$1,319	$907	$1,260
	Palmerston North	$1,889	$1,272	NA	$1,889	$1,144	NA
	Napier	$1,529	$1,334	$1,139	$1,529	$1,090	$1,054
	Wellington	$2,363	$1,394	$1,469	$2,363	$1,278	$1,341
	Blenheim	$2,815	$1,413	$1,598	$2,815	$1,685	$1,454
	Christchurch	$3,954	$1,618	$1,703	$3,954	$1,820	$1,515
	Dunedin	$5,252	$1,887	$1,981	$5,252	$2,089	$1,789
	Container cartage		**$210**			**$210**	

Source: Productivity Commission, Ministry of Transport, PwC calculations

Table 35: Supply chain analysis - total cost of shipping one TEU on the Long Beach-Auckland route

		Importing			Exporting	
International freight costs						
Shipping line costs		$4,255			$2,773	
Port, customs, and biosecurity costs		$466				
Domestic freight costs						
Origin/destination	**Road**	**Rail**	**Coastal**	**Road**	**Rail**	**Coastal**
Whangarei	$581	$602	NA	$581	$602	NA
Auckland	$210			$210		
Hamilton	$463	$400	NA	$463	$400	NA
Mt Maunganui	$746	$602	$699	$746	$602	$669
New Plymouth	$1,319	$1,151	$1,376	$1,319	$907	$1,260
Palmerston North	$1,889	$1,272	NA	$1,889	$1,144	NA
Napier	$1,529	$1,334	$1,139	$1,529	$1,090	$1,054
Wellington	$2,363	$1,394	$1,469	$2,363	$1,278	$1,341
Blenheim	$2,815	$1,413	$1,598	$2,815	$1,685	$1,454
Christchurch	$3,954	$1,618	$1,703	$3,954	$1,820	$1,515
Dunedin	$5,252	$1,887	$1,981	$5,252	$2,089	$1,789
Container cartage		**$210**			**$210**	

Source: Productivity Commission, Ministry of Transport, PwC calculations

Table 36: Supply chain analysis - total cost of shipping one TEU on the Shanghai-Auckland route

	Importing			Exporting		
International freight costs						
Shipping line costs	$1,413			$1,580		
Port, customs, and biosecurity costs	$439			$412		
Domestic freight costs						
	Road	**Rail**	**Coastal**	**Road**	**Rail**	**Coastal**
Whangarei	$581	$602	NA	$581	$602	NA
Auckland	$210			$210		
Hamilton	$463	$400	NA	$463	$400	NA
Mt Maunganui	$746	$602	$699	$746	$602	$669
New Plymouth	$1,319	$1,151	$1,376	$1,319	$907	$1,260
Palmerston North	$1,889	$1,272	NA	$1,889	$1,144	NA
Napier	$1,529	$1,334	$1,139	$1,529	$1,090	$1,054
Wellington	$2,363	$1,394	$1,469	$2,363	$1,278	$1,341
Blenheim	$2,815	$1,413	$1,598	$2,815	$1,685	$1,454
Christchurch	$3,954	$1,618	$1,703	$3,954	$1,820	$1,515
Dunedin	$5,252	$1,887	$1,981	$5,252	$2,089	$1,789
Container cartage	**$210**			**$210**		

Source: Productivity Commission, Ministry of Transport, PwC calculations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Appendix C

Technical notes on trade task projections by port

In this appendix, we provide a more in-depth discussion of the data and assumptions underlying our projections of the future port task. Our projections are based on available data on recent volumes of cargo moving through the UNI ports and information from a range of sources on likely future trends. However, this data is not necessarily complete or fully comparable and as a result some estimates and assumptions have been needed in order to make them usable. It is important to consider these assumptions as caveats to these projections.

8.3 Data sources

Data on the current port task and recent growth trends was available from three main sources:

- Statistics New Zealand data on the weight of cargo imports and exports, by port and commodity code
- Data on all types of container and bulk and breakbulk cargo movements provided by the port companies (POA/POT)
- The 2008 National Freight Demand Study (NFDS) report on domestic freight movements by mode.

These data sources were not consistent with each other – for example, POA and POT reported higher total import and export weights than Statistics New Zealand did – and as a result we have used them to estimate separate components of the overall port task[97].

Statistics New Zealand data, which is based on import and export lodgements received by the New Zealand Customs Service, is the most accurate measure of imports and exports passing through New Zealand's ports. Consequently, we have used it to make projections of (a) future import and export growth at the UNI ports and (b) growth in imports and exports at LNI and SI ports that may in the future be transhipped through the UNI ports. We collected overseas cargo data for years ended March in order to ensure consistency with Statistics New Zealand's national accounts reporting.

97. As discussed above, the overall port task includes imports, exports, international transhipments, import and export transhipments, and domestic coastal.

There are some caveats to note when using Statistics New Zealand overseas cargo data. First, Customs records exports at the final point of loading in New Zealand, and imports at the first port of discharge in New Zealand. As a result, goods that are transhipped through the UNI to or from other New Zealand ports will be recorded as imports or exports in the UNI. This is not likely to have a material impact on our projections due to the small role that transhipments play at present. In addition, there are some minor exclusions from published trade data related to minimum reporting thresholds for Customs, and application of confidentiality rules for trade items[98]. This is not likely to be material to our analysis.

However, Statistics New Zealand provides no data on domestic coastal shipping movements, international transhipments (or re-exports), or growth rates for import and export transhipment. As a result, we have used data from POA and POT to estimate current cargo volumes and potential future growth in these categories. We have supplemented this with information from the NFDS, which allows us to estimate domestic coastal movements in and out of the Whangarei ports and projected future growth for domestic coastal freight.

POA provided data for years ended March – consistent with the balance dates we used for data from Statistics New Zealand. However, POT provided data for years ended June. Due to the fact that POT attracted a significant amount of cargo from POA during the latter's industrial dispute, this may bias our starting-year estimates of port task. However, this is not likely to be hugely problematic due to the fact that the industrial action will have had a smaller effect on the categories of cargo for which we are using port data than it had on international trade. Furthermore, it will have primarily affected the allocation of cargo between the ports, rather than the overall amount of cargo handled in the UNI.

We have assumed that any inconsistencies between port and Statistics New Zealand import and export figures will not have any bearing upon the accuracy of the ports' figures on re-exports and domestic coastal shipping. In addition, we were required to make some assumptions to adjust for the reporting categories and units used by POA and POT. We discuss these in detail below.

8.4 Projected growth

Working with two distinct data sources required us to make separate projections of growth rates for different categories of cargo movement. The assumptions that went into each projection are detailed below.

8.4.1 Imports and exports

We have discussed our projections of import and export growth in much greater detail in the body of the main report. To summarise, we have projected growth rates for individual commodity/country pairs on the basis of overseas cargo growth rates between 2002 and 2012. In general, growth rates over this period were projected forward into the future, with some adjustments made in order to moderate implausibly high growth rates.

Projections for UNI imports and exports are more robust than projections for other categories of cargo movement. More and better information was available on which to base these projections, including Statistics New Zealand/Customs Service data and discussions with major importers and exporters. Due to the fact that overseas trade accounts for the most important component of port task – the 'backbone', so to speak – this is appropriate.

98. See http://www2.stats.govt.nz/domino/external/omni/omni.nsf/outputs/Overseas+Merchandise+Trade+%28Imports+and+Exports%29.

8.4.2 Domestic coastal freight

We expect that containerised cargo moving in and out of POA and POT will be the primary driver of demand over the study period. However, outward coastal freight from the region is dominated by movements of petroleum products and cement from Whangarei.

We used three primary data sources to form our projections. First, we used data from POA and POT to estimate the magnitude of the domestic coastal freight task at those ports in 2012. Second, we used data from the 2008 National Freight Demand Study to estimate the current magnitude of coastal shipping movements to and from Whangarei. Third, we used the National Freight Demand Study, which forecast 3.0% to 3.2% annual growth in coastal shipping over the 2007-2031 period, to develop scenarios for domestic coastal freight growth.

We considered several scenarios for domestic coastal freight growth at POA and POT. The base scenario was the NFDS forecast of 3.2% growth per annum. We added high and low growth scenarios of 4.8% growth and 1.6% growth, respectively.

Container freight is likely to grow faster than bulk cargo due to the fact that growth in shipments of the main bulk cargoes – petroleum products and cement – is constrained by production capacity at three sites (Refining NZ and two cement plants). Consequently, we have made separate assumptions about growth rates for bulk cargo to and from the Whangarei ports. We assumed that coastal shipping of refined petroleum products from Whangarei would grow at the same rate as imports of mineral fuels (ie crude oil) to Whangarei – a reasonable assumption given the fact that Whangarei imports crude oil in order to refine it for domestic consumption. We assumed that coastal shipping of cement would either remain flat over the study period (in our low scenario) or increase at an annual rate of 1.6% (in our high scenario). These are likely to be reasonable assumptions due to the fact that significant increases to coastal shipping of cement from Whangarei would entail considerable investments in additional production capacity at Golden Bay Cement.

Finally, it is necessary to note that coastal shipping growth during the study period may be affected by policy changes, such as the emissions trading scheme and choices of land transport infrastructure investment. Because coastal shipping is a relatively minor transport mode, the impact of these changes may be large and is hard to predict.

8.4.3 Import and export tranships

We expect that the primary driver of growth in this category will be the increasing transhipment of Lower North Island (LNI) and South Island (SI) containerised imports and exports through POA and POT. As the LNI and SI export more cargo than they import, we expect overall export transhipments to be much higher than import transhipments. This does not have any bearing on the port task, however, as each transhipment entails both a load and a discharge of cargo regardless of its ultimate origin or destination.

Our projections for import and export transhipment were based on projections for overseas cargo growth in the LNI and SI and assumptions about the share of this cargo that will be transhipped through the UNI in the future.

In order to project the overseas freight task of the Lower North Island and South Island, we used the same method as for the UNI trade projections. This involved projecting future growth on the basis of historical growth for individual commodity/country pairs over the 2002-2012 period. We moderated our growth forecasts on the basis of information from interviews with major importers and exporters and an analysis of supply or demand constraints in key markets.

We assumed that an increasing share of Lower North Island and South Island overseas freight would be transhipped through Auckland and Tauranga. We constructed two scenarios for transhipment growth. In the high growth scenario, the UNI ports will tranship 60% of the Lower North Island's cargo and 20% of the South Island's cargo by 2041. In the low growth scenario, 40% of Lower North Island cargo and 13% of South Island cargo will be transhipped through the UNI by 2041. We have excluded bulk cargoes such as logs and bulk liquids, as is it unlikely that it will be cost-effective to tranship them.

8.4.4 International transhipments (re-exports)

Our projections for international transhipments were based on 2012 container movement data provided by POA and POT and assumptions about future growth. We assumed that no bulk cargo was re-exported through UNI ports, due to the fact that bulk carriers are more specialised and flexible in size and that bulk goods (eg logs) are often more complex to load and unload. Based on information from shipping lines, UNI ports serve two main transhipment markets:

- Pacific Island trade, which is serviced through Auckland. Low cargo volumes on these routes mean that it is more efficient to operate feeder services from Auckland than to provide direct shipping lines. The long-term growth of these transhipments will be driven by economic and population growth in the Pacific Islands.
- Trade between Australia and the United States. Auckland currently handles some trade between Brisbane and the US, while Tauranga tranships wine exports from Australia to the US. Broadly speaking, transhipment of Australian trade will increase as a result of specific market opportunities rather than a longer-term trend. (Conversely, this means that some New Zealand trade may be transhipped through Australian ports when and if opportunities arise.)

In the longer term, the scope for growth in international transhipments will be limited by growth in New Zealand's own overseas trade. If existing trade volumes are not large enough to justify service on a given shipping line, re-exports can easily move to different routes instead. In the short term, however, growth in this category of cargo movement can allow ports to increase their throughput more rapidly than trade.

We expect that re-exports for the UNI as a whole will have grown rapidly over the last half-decade or decade. They are likely to continue growing rapidly in the near future. However, in the long run growth of re-exports is likely to be limited by overall international trade growth. If re-export growth exceeds international trade growth over a sustained period, re-exports will begin to either displace New Zealand's trade or require shipping lines to add capacity to service the re-export trade alone. It would make more sense for shipping lines to add direct routes instead.

We constructed two scenarios for re-export growth along these lines. In the low growth scenario, re-exports grow at the same rate as overall UNI imports and exports throughout the 2012-2041 period. In the high growth scenario, re-exports grow at 8% per annum from 2012-2021 before slowing down to match the growth rate of UNI imports and exports from 2021 to 2041.

8.5 Working with port data

Due to the fact that POA and POT used a variety of reporting categories and reporting units, some adjustments were necessary in order to ensure that base year (2012) data was consistent and comparable. These adjustments are described in detail below.

8.5.1 Inconsistent categories

The ports' data on cargo movements was not grouped into categories that were consistent with the categories used in this report. Our categories were based on those used in the Ministry of Transport's Freight Information Gathering System publications[99]- henceforth referred to as the FIGS categories. These categories are summarised in Table 37:

Table 37: Infrastructure requirements of different cargo movements

Inward	Outward	Infrastructure
Imports	Exports	Port and land transport
Domestic coastal inward	Domestic coastal outward	Port and land transport
Import tranships	Export tranships	Port only
Domestic leg of export tranships	Domestic leg of import tranships	Port only
International tranships	International tranships	Port only

The comparability of data reported by the ports varied considerably. POA's data on container movements were reported in the FIGS categories. However, POA's bulk data merged several categories together. For both container and non-container cargo, POT grouped together all transhipment movements into two categories, grouped together imports and inward domestic coastal freight, and grouped together exports and outward domestic coastal freight. We summarise ports' reporting categories, and how they map onto the categories of cargo movement used in this report, in Table 38, Table 39, and Table 40.

Table 38: Categories of container movements reported by POA

POA reporting category	Definition	Corresponds to...
International container movements		
Exports	Overseas-bound, NZ-originated cargo loaded on ships	Exports, plus loads of export transhipments
Imports	NZ-bound, overseas-originated cargo discharged from ships	Imports, plus discharges of import transhipments
Re-exports	Total loads plus discharges of overseas-bound, overseas-originated cargo; this cargo is not cleared by Customs and does not leave POA	International transhipments
Domestic container movements		
Export tranships	Discharges of cargo moved from other NZ ports to POA to be loaded on an overseas-bound ship for export	Export transhipments (discharges only)
Import tranships	Loads of overseas-originated cargo that was landed at POA prior to being coastally shipped to another NZ port	Import transhipments (loads only)
Domestic in	Auckland-bound, NZ-originated cargo discharged from coastal shipping	Domestic coastal in
Domestic out	NZ-bound, Auckland-originated cargo loaded on coastal shipping	Domestic coastal out
Unknown	Cargo with unknown origin/destination. This is not especially material – there were only 1200 'Unknown' TEUs in 2012, one third of which were full.	N/A

99. Ministry of Transport, Quarterly Container Information Reports. Available online at http://www.transport.govt.nz/ourwork/sea/figs/.

Appendix C – Technical notes on trade task projections by port *continued*

Table 39: Categories of bulk cargo movements reported by POA

POA reporting category	Definition	Corresponds to...
Import	NZ-bound, overseas-originated cargo discharged from ships	Imports
	Plus Auckland-bound, NZ-originated cargo discharged from coastal shipping (ie domestic coastal shipping)	Domestic coastal inward
Export	Overseas-bound, NZ-originated cargo loaded on ships	Exports
	Plus NZ-bound, Auckland-originated cargo loaded on coastal shipping (ie domestic coastal shipping)	Domestic coastal outward
Import transhipment	Loads of overseas-originated cargo that was landed at POA prior to being coastally shipped to another NZ port	Import transhipment
Export transhipment	Discharges of cargo moved from other NZ ports to POA to be loaded on an overseas-bound ship for export	Export transhipment

Table 40: Categories of container movements reported by POA

POA reporting category	Definition	Corresponds to...
Outward cargo movements		
Exports	Overseas- or NZ-bound, Tauranga-originated cargo loaded on international shipping lines	Exports Domestic coastal out
Tranships load	Includes three types of container movements: Overseas-bound cargo loaded on ships at Tauranga but originated from other NZ regions and shipped to Tauranga via coastal shipping. Overseas-originated containers loaded on ships at Tauranga and shipped to other NZ regions via coastal shipping. Loads of overseas-bound, overseas-originated cargo being transhipped through Tauranga. The number of 'tranship loads' should be equivalent to the number of 'tranship discharges'.	Export transhipments (loads only) Import transhipments (loads only) International transhipments (loads only)
Exports coastal	NZ-bound, Tauranga-originated cargo loaded on domestically-owned coastal shipping lines (ie Pacifica Shipping). Coastal freight carried by international shipping lines is captured within the 'exports' category.	Domestic coastal out
Inward cargo movements		
Imports	Tauranga-bound, overseas- or NZ-originated cargo discharged from international shipping lines.	Imports Domestic coastal in
Tranships discharge	Includes three types of container movements: Overseas-originated cargo discharged from ships at Tauranga but bound for other NZ regions via coastal shipping. NZ-originated cargo discharged from coastal shipping at Tauranga for transhipment to a final overseas destination. Discharges of overseas-bound, overseas-originated cargo being transhipped through Tauranga. The number of 'tranship discharges' should be equivalent to the number of 'tranship loads'.	Import transhipments (discharges only) Export transhipments (discharges only) International transhipments (discharges only)
Imports coastal	Tauranga-bound, NZ-originated cargo discharged from domestically-owned coastal shipping lines (ie Pacifica Shipping). Coastal freight carried by international shipping lines is captured within the 'imports' category.	Domestic coastal in
Cargo movements in the course of ordinary port operations		
Sundry	Loads or discharges of flatracks and ships gear – almost totally immaterial.	N/A
Restows	Discharges of cargo from ships done in order to gain access to cargo sitting beneath it underneath. Each restow is only counted once. Does not significantly impact on port task as restows are a normal part of port operation.	N/A
SOB	Shift on board – ie cargo restows that do not involve moving cargo to the dock on the dock. Tiny in number.	N/A

In order to convert the ports' data into a usable form, we had to make assumptions about the allocation of cargo within individual categories. As suggested by the tables above, data from POT required the most adjustment in order to fit the categories used in this report.

In particular, we had to:

- Disaggregate the 'tranship discharges' and 'tranship loads' categories into five FIGS categories: imports, exports, import tranships, export tranships, and re-exports.
- Estimate the share of cargo in the 'exports' and 'imports' categories that is domestic coastal cargo carried by international shipping lines.

Based on FIGS data, we broke down categories of container movement as shown in Table 41. We calibrated our assumptions against the Ministry of Transport's FIGS data, which covered container movements for the September 2011, December 2011, March 2012, and June 2012 quarters.

Table 41: Categories of container movements reported by POA

POT category	**Tranship discharges**	=	**Tranship loads**	**Share of total**
FIGS Categories	Import discharges	=	Import tranship loads	12%
	Export tranship discharges	=	Export loads	72%
	Re-export discharges	=	Re-export loads	16%
POT category	**Exports**			**Share of total**
FIGS Categories	Domestic out			5%
	International export			95%
POT category	**Imports**			**Share of total**
FIGS Categories	Domestic in			10%
	International import			90%

Source: PwC estimates

Similarly, we had to allocate POT bulk cargo data into the appropriate categories. However, in this case no other, more reliable data was available to calibrate our estimates. Consequently, we made assumptions based on our understanding that (a) most transhipment cargo handled at POT was destined for export, (b) international transhipments of bulk cargo are negligible or nonexistent, and (c) domestic coastal freight represents only a fraction of imports and exports. Our assumptions are summarised in Table 42.

Table 42: Breakbulk movements at POT

POT category	**Tranship discharges**	=	**Tranship loads**	**Share of total**
FIGS Categories	Import discharges	=	Export tranship loads	33%
	Import tranship discharges	=	Export loads	67%
	Re-export discharges	=	Re-export loads	0%
POT category	**Exports**			**Share of total**
FIGS Categories	Domestic out			5%
	International export			95%
POT category	**Imports**			**Share of total**
FIGS Categories	Domestic in			5%
	International import			95%

Source: PwC estimates

While POA's container reporting categories were compatible with the FIGS categories, we had to allocate their data on bulk cargo to the proper categories. As with POT, no other data was available to calibrate our assumptions, and as a result we allocated POA categories based on our understanding that domestic coastal freight represents only a fraction of imports and exports. Our assumptions are summarised in Table 43.

Table 43: Breakbulk movements at POA

POT category	**Exports**	**Share of total**
FIGS Categories	Import discharges	5%
	Export tranship discharges	95%
POT category	**Imports**	**Share of total**
FIGS Categories	Domestic in	5%
	International import	95%

Source: PwC estimates

One important thing to note about this exercise was that our assumptions are only valid for 2012 data due to the fact that we have calibrated them against 2011/2012 FIGS releases. Based on POA data, there are strong reasons to believe that domestic cargo, import/export transhipment, and re-exports have grown more rapidly than imports and exports. As a result, we cannot use these assumptions to construct a valid historical trend for PoT container cargo or bulk cargo at either port.

8.5.2 Units of measurement

Ports measure, and charge for, different commodities using different units, including tonnes, cubic metres, kilolitres, and other, more specific, metrics. As a result, POA and POT have reported data on bulk and breakbulk cargo in terms of revenue-tonnes (also described as manifest tonnes) rather than weight. As a result, they are not necessarily comparable with Statistics New Zealand data on import and export weights or ports' data on container cargo weights. Consequently, we have converted revenue-tonne measures into estimated weights to ensure that our estimates are comparable across reporting categories.

Conversion factors for selected commodities are summarised in Table 44.

Table 44: Revenue-tonne conversion factors for main bulk commodities

Commodity	Revenue-tonne unit	Conversion to tonnes	Notes
Oil products	kilolitre	0.75	Based on density of petrol (1)
	kilolitre	0.85	Based on density of diesel
Bulk liquid	kilolitre	1.00	Based on density of pure water, under the assumption that some liquids would weigh more and others less (1)
Kiwifruit (POT)	m^3	0.35	Based on weight and volume of kiwifruit trays (2)
Fruit and vegetables (POA)	m^3	0.43	Based on weight and volume of apple trays (3)
Cars (POA)	units	1.70	Based on comparison of POA car import numbers and Stats NZ import weights; assumes 10% of motor vehicle import weights are parts (4)
Cars (POT)	m^3	0.16	Based on assumption that the average car imported through NZ has a similar weight and volume as a Toyota Corolla (5)
Saw timber	m^3	0.48	Based on density of kiln-dried radiata pine logs (6)
Logs	JAS m^3 (7)	1.0	Based on discussion with Northport

Notes:

(1) http://www.aqua-calc.com/calculate/volume-to-weight

(2) US Department of Agriculture (1992), "Weights, Measures and Conversion Factors for Agricultural Products"

(3) http://www.enzafruit.be/en/new-zealand-pipfruit/packaging/

(4) POA / Statistics NZ data

(5) Manufacturer information

(6) http://www.eecabusiness.govt.nz/wood-energy-resources/biomass-converter

(7) JAS = Japanese Agricultural Standard for measuring logs

8.6 Allocating UNI trade growth between ports

We made projections for the UNI as a whole and for individual ports. In order to do so, we had to make some assumptions about growth rates at individual ports. This was more salient for POA and POT than for Whangarei, as all categories of trade except international cargo were negligible at Northport.

In order to split out projections by individual ports, we had to make several assumptions. First, we allocated projected UNI import and export growth to individual ports. In order to do so, we projected growth for each individual port based on 2002 and 2011 data and using the same method as we did for our overall UNI overseas cargo projections[100]. We then used these projections to allocate overall UNI growth to individual ports. The assumptions we made in order to do so – eg around maximum growth rates for individual commodity/country pairs – were consistent with those that we made in our main projections of overseas cargo growth.

We assumed that import and export tranships from the Lower North Island and South Island would be split between POA and POT according to those ports' 2012 share of UNI import/export tranships of containers. This was done under the assumptions that (a) most if not all tranships would be containerised (and hence best understood using data on container movements only) and that (b) the share of tranships going through POA and POT would not significantly change over the projection period. While the latter assumption may not hold throughout the projection period, we have no strong basis for making an alternative estimate.

We allocated international transhipment and domestic coastal shipping growth between POA and POT according to those ports' 2012 share of UNI international transhipment and domestic coastal shipping. In other words, we assumed that growth rates for POA and POT would be identical in these categories. We made separate estimates for the Whangarei ports based on the assumptions that (a) they would handle no re-export cargo and (b) all coastal shipping in and out of Whangarei would be related to oil and cement products. While these assumptions may not hold throughout the projection period, we have no strong basis for making an alternative estimate.

100. We chose 2011 as an end year rather than 2012 due to the fact that an industrial dispute at POA diverted a large quantity of overseas trade from POA to POT.

8.7 Allocating growth by container and bulk cargo

Our high-level projections were made in terms of total cargo weight. In order to understand individual components of the port task, we needed to estimate the share of total cargo that would be containerised or moved as bulk.

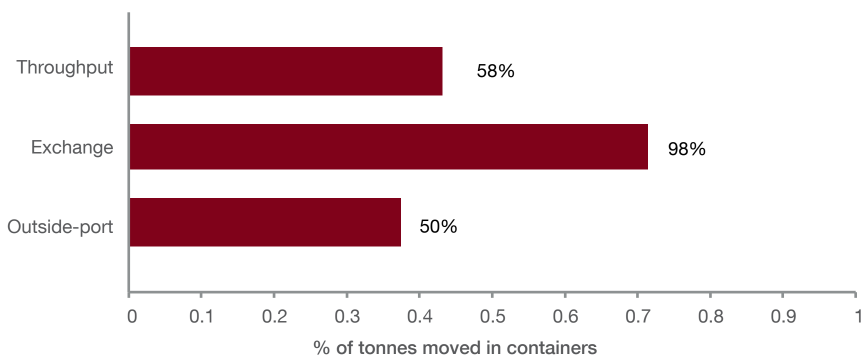
We assumed that the share of cargo moved in containers, within each category of cargo movement, would remain relatively constant over the 2012-2041 period. We used 2012 data from the ports in order to estimate the share of cargo weight that was containerised. We did so by comparing net weight of containerised cargo with estimated weight of bulk cargo within each category of cargo movement. Estimated container shares varied considerably – for example, in 2012 90% of Auckland's export weight was carried in containers, while only 47% of POT's export weight was containerised. Container cargo shares at POA and POT in 2012 are summarised in Figure 64.

The share of overall cargo carried in containers has not changed significantly in recent years. It is likely that most of the easy opportunities to containerise trade have now been taken up, meaning that container trade will increase its share of total cargo only incrementally. The ability of the ports to pursue further containerisation is likely to be constrained by the mix of products that they handle (eg log exports from Tauranga, car imports through Auckland).

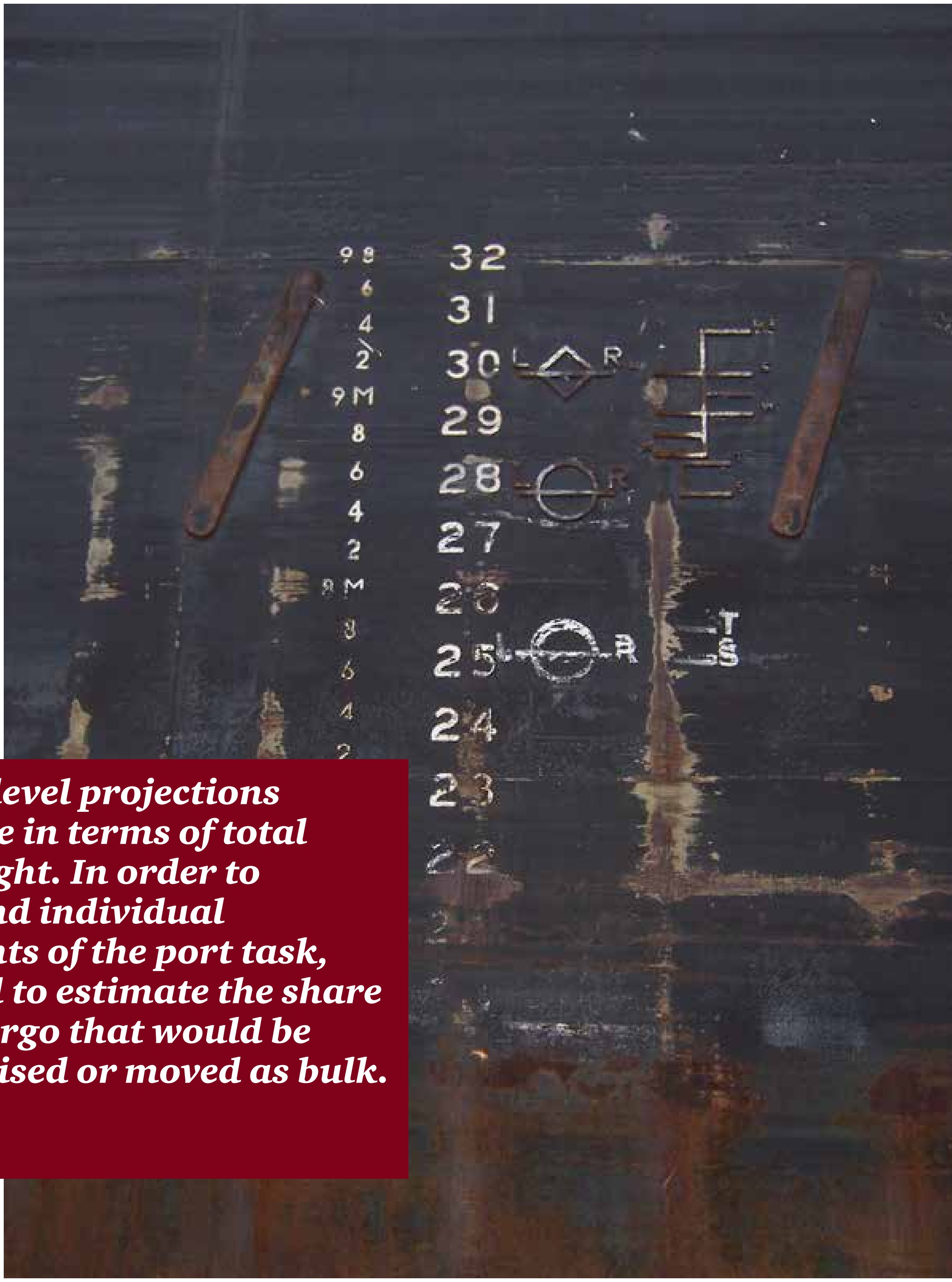
After estimating projected container and bulk weights, we used 2012 data from the ports to estimate total TEUs. We did so by calculating the ratio between the net weight of container cargo and total (full+empty) TEUs for each category of cargo movement. We then multiplied these ratios by the estimated weight of container trade to obtain an estimate of total TEUs.

Figure 64: Share of cargo at POTand POA moved in containers, 2012

Containerised cargo shares at POA and POT, 2012



Source: Castalia (2010)



Our high-level projections were made in terms of total cargo weight. In order to understand individual components of the port task, we needed to estimate the share of total cargo that would be containerised or moved as bulk.

Appendix D
Restrictions

This report has been prepared for the Upper North Island Strategic Alliance (UNISA) to determine trends in demand for merchandise trade through the Upper North Island (UNI) ports, the capacity of key port and port related infrastructure to manage this demand, and to form a view of potential infrastructure investment requirements. This report has been prepared solely for this purpose and should not be relied upon for any other purpose. We accept no liability to any party should it used for any purpose other than that for which it was prepared.

This report has been prepared solely for use by UNISA and may not be copied or distributed to third parties without our prior written consent.

To the fullest extent permitted by law, PwC accepts no duty of care to any third party in connection with the provision of this report and/or any related information or explanation (together, the 'Information"). Accordingly, regardless of the form of action, whether in contract, tort (including without limitation, negligence) or otherwise, and to the extent permitted by applicable law, PwC accepts no liability of any kind to any third party and disclaims all responsibility for the consequences of any third party acting or refraining to act in reliance on the Information.

We have not independently verified the accuracy of information provided to us, and have not conducted any form of audit in respect of that information. Accordingly, we express no opinion on the reliability, accuracy, or completeness of the information provided to us and upon which we have relied.

The statements and opinions expressed herein have been made in good faith, and on the basis that all information relied upon is true and accurate in all material respects, and not misleading by reason of omission or otherwise.

The statements and opinions expressed in this report are based on information available as at the date of the report.

We reserve the right, but will be under no obligation, to review or amend our report, if any additional information, which was in existence on the date of this report, was not brought to our attention, or subsequently comes to light.

This report is issued pursuant to the terms and conditions set out in our Contract for Professional Services, reference ACPN_8320.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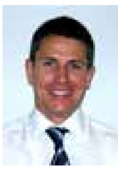

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