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

Figure 54: Northport

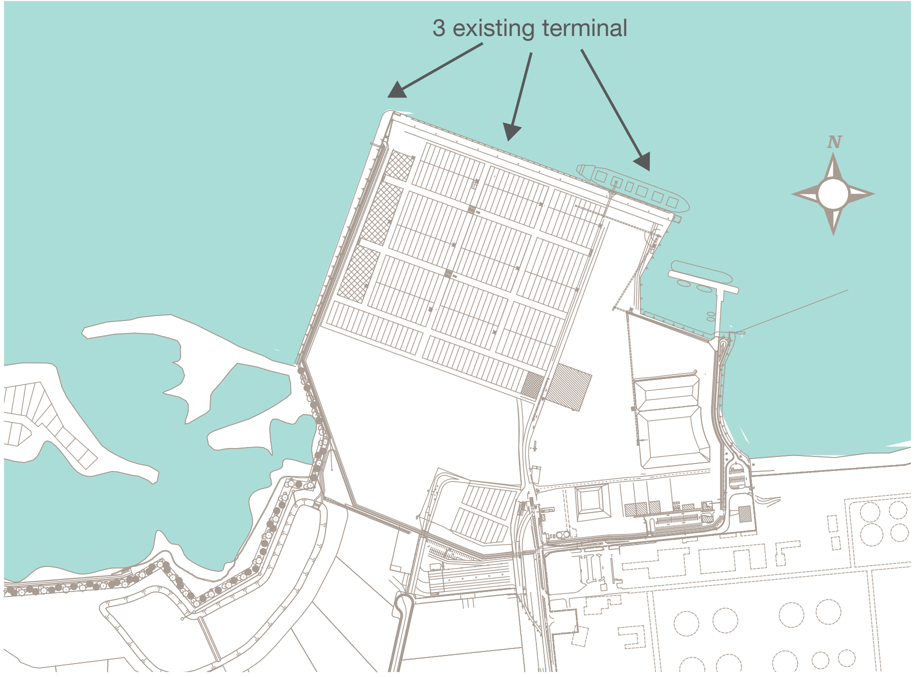


Figure 55: Ports of Auckland

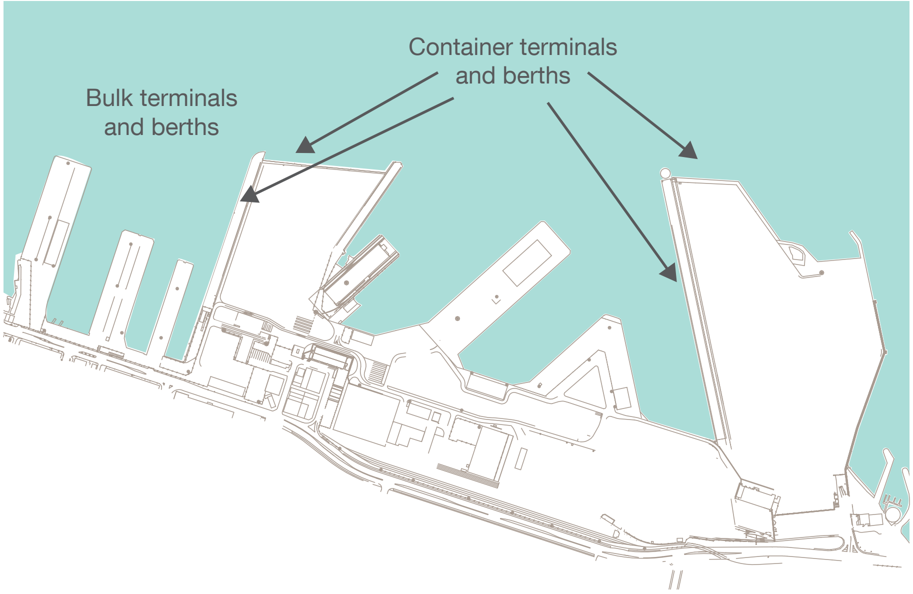
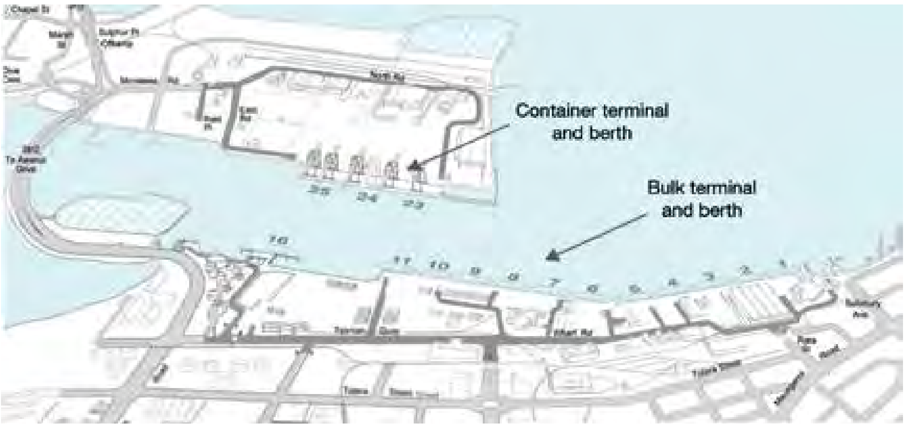


Figure 56: Port of Tauranga



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).

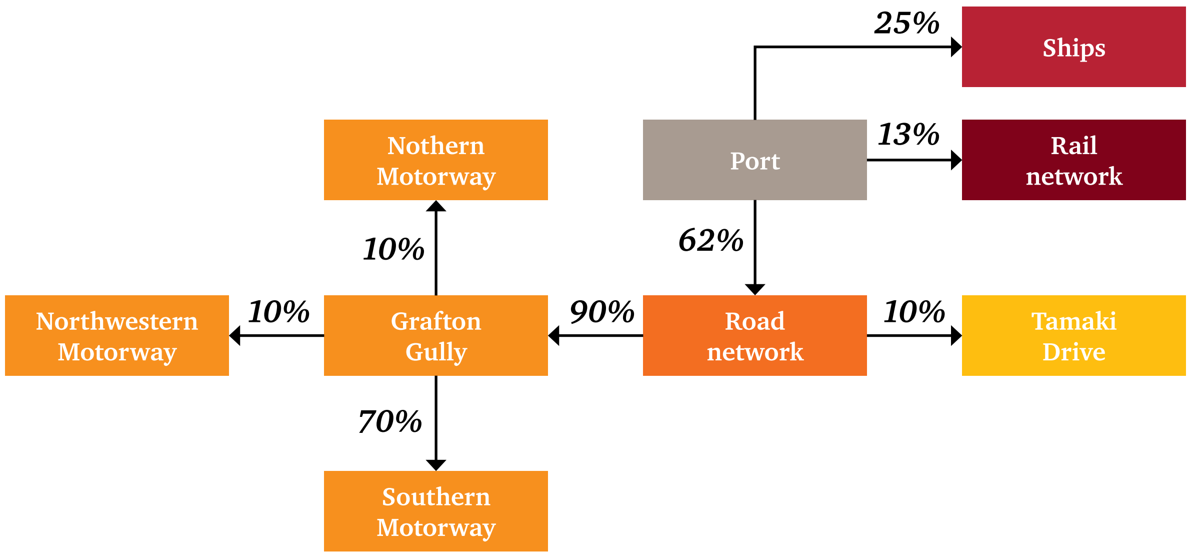
Figure 57 presents the routes which imports to POA use to reach their destination and exports from POA use to reach the port from their origin.[57]

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.

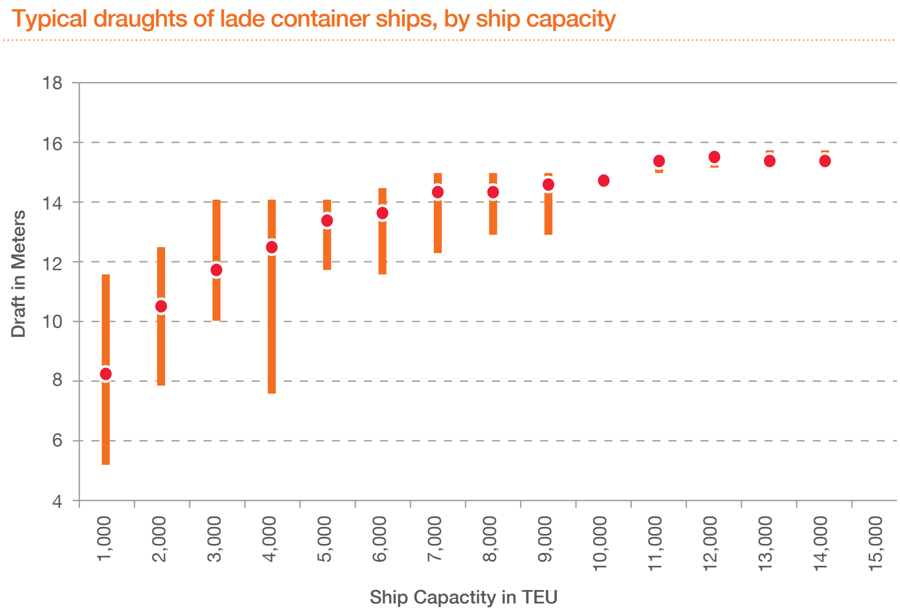
Where possible, our approach is to estimate the capacity of types of infrastructure on the basis of international benchmarks. These give us an indication of the maximum throughput, for a given berth length or amount of storage space, which the most intensely used and efficient ports of a similar size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

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

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.

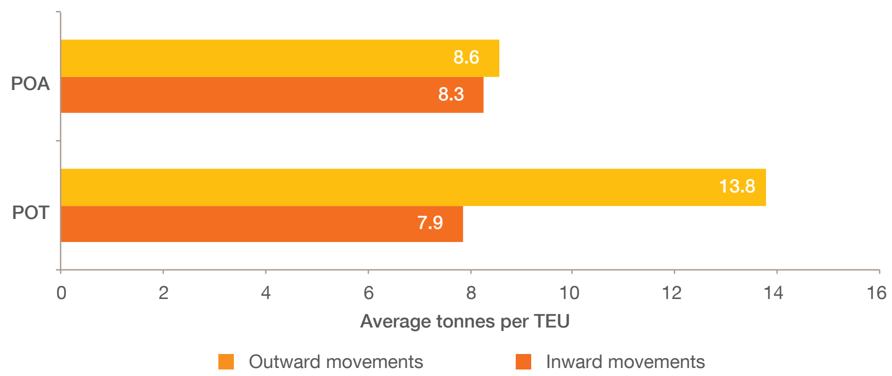
Table 16: POA tidal windows for different ship draughts

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.

The ability of the future trade task continued

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.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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 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.

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

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:

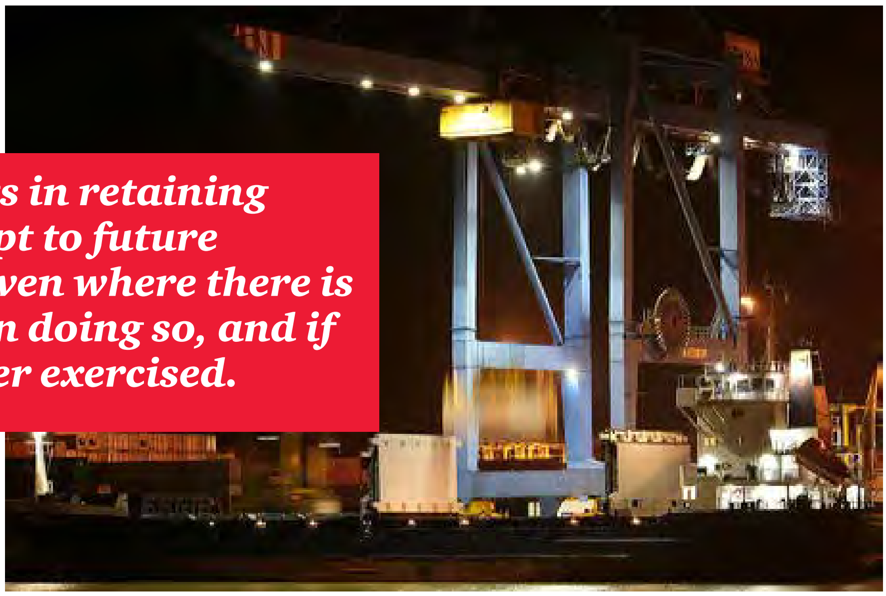
- It coincides with the longest planning periods used by many public sector entities including NZTA, Auckland Council and Auckland Transport.
- Projections over long time periods become increasingly undermined by transformative changes. If we reflect on changes over the last 30 years for example, we 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

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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)

Destination

Origin	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

Destination

Origin	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

Origin \ Destination	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)

Origin \ Destination	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

Origin \ Destination	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

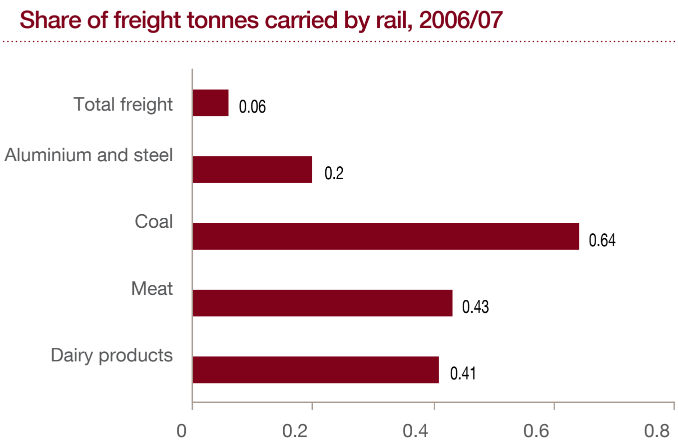
8.1.5 Cost reductions from large-volume rail traffic

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.

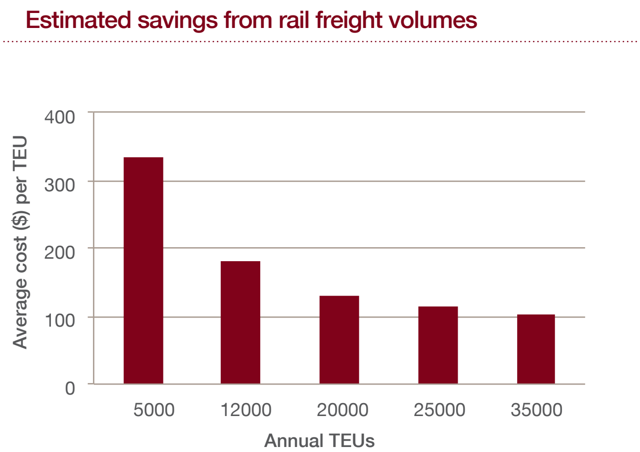
These estimates may not reflect actual prices offered by KiwiRail, which will be affected by market developments and input costs. Their modelling focuses on relatively low volumes compared with, say, Fonterra's dairy exports from the UNI or freight through Metroport. However, further cost reductions are likely to be relatively marginal.

Figure 62: Share of freight tonnes carried by rail in 2006/07, selected commodities



Source: NFDS (2008)

Figure 63: Estimated savings from large volumes of rail freight



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						
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 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.

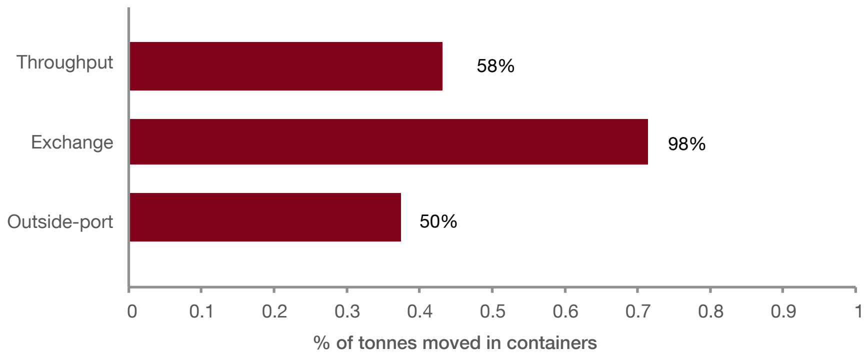
We assumed that the share of cargo moved in containers, within each category of cargo movement, would remain relatively constant over the 2012-2041 period. We used 2012 data from the ports in order to estimate the share of cargo weight that was containerised. We did so by comparing net weight of containerised 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).

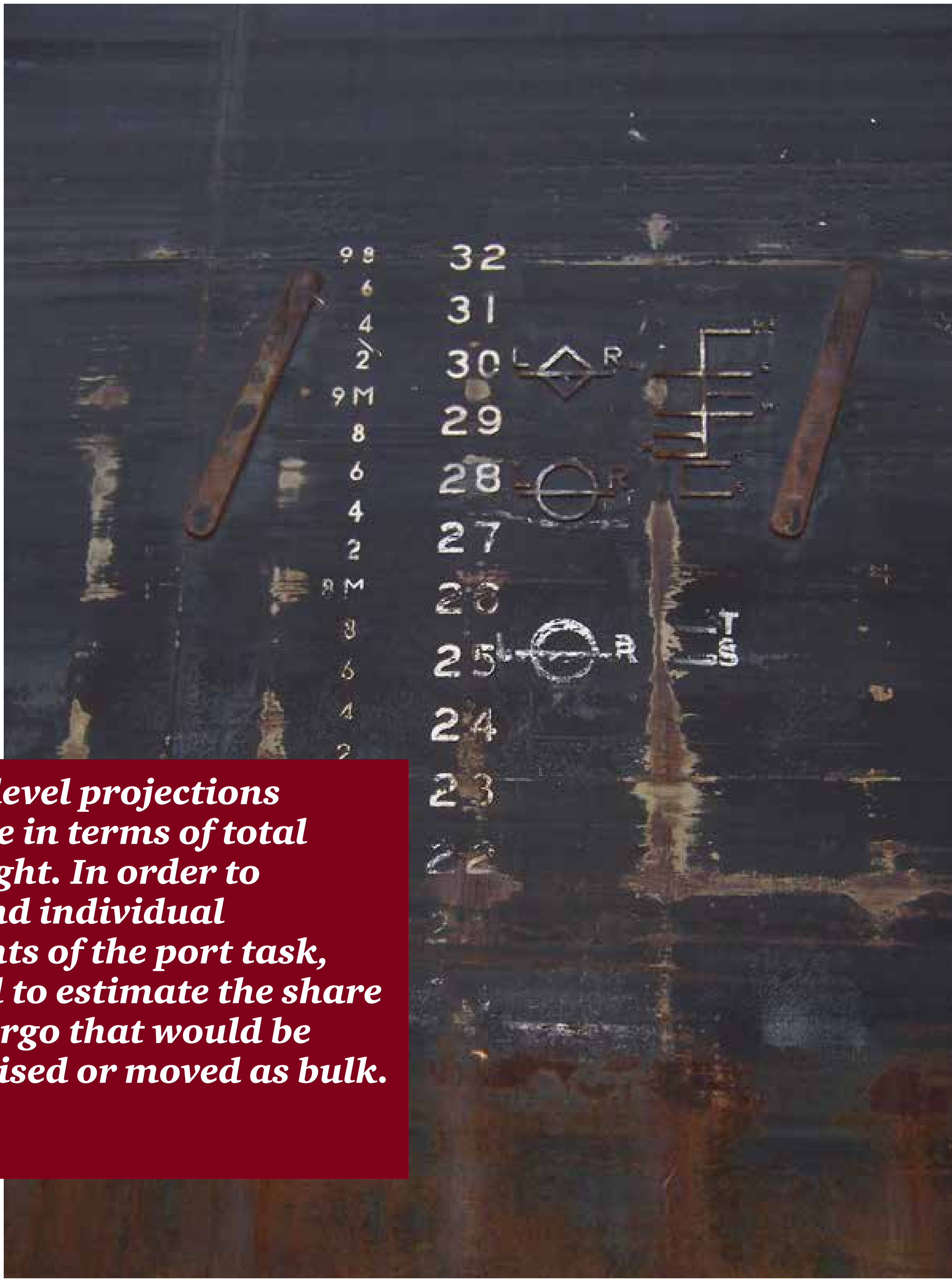
After estimating projected container and bulk weights, we used 2012 data from the ports to estimate total TEUs. We did so by calculating the ratio between the net weight of container cargo and total (full+empty) TEUs for each category of cargo movement. We then multiplied these ratios by the estimated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

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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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