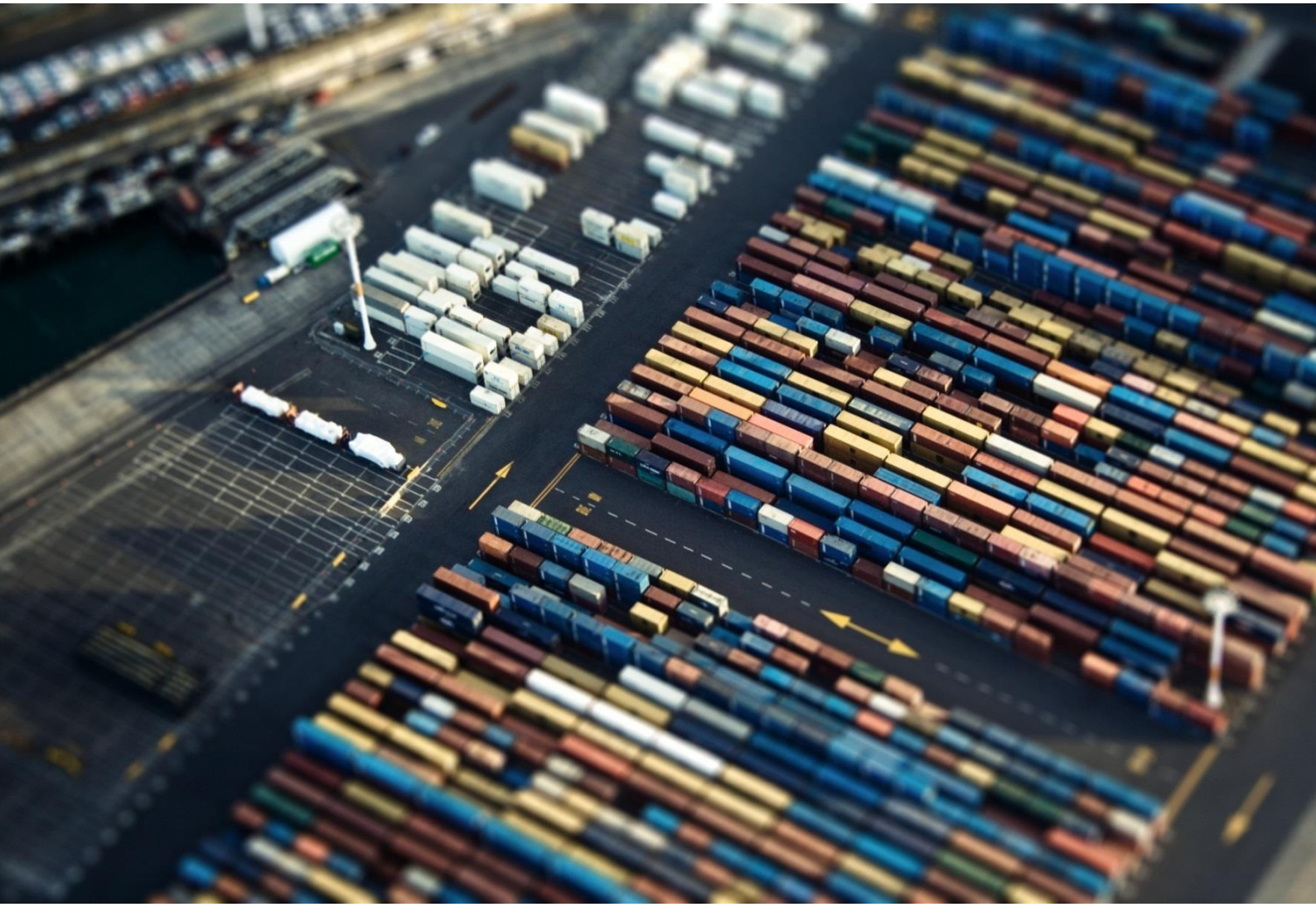

Port study 2

Final report

NZIER report to Auckland Council

3 February 2015

About NZIER

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Authorship

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Executive Summary

Introduction

Ports of Auckland Limited's (POAL's) main cargo wharves sit in a sensitive location adjoining Auckland's city centre and harbour front. Port expansion (particularly reclamation) and intensified use of port facilities and supporting road and rail links can have adverse amenity and environmental effects. Port activities have at times attracted significant public concern and debate.

Through their ownership interests, Auckland ratepayers benefit from a successful port operation as POAL dividends reduce the overall rates burden. POAL also provides employment and other economic benefits to the region through supporting Auckland exporters, importers and other businesses to grow.

In addition to its ownership interests, the Auckland Council acts as the Port Precinct regulator under the Resource Management Act 1991. The Council also has a place-shaper role. It invests to improve city amenity values, and is currently investigating options to improve the configuration of the central wharves adjacent to POAL's main site.

Purpose of port study

The purpose of this study is to inform Council decision making on the draft rule on port reclamation provided for in the Proposed Auckland Unitary Plan (PAUP). The draft rule, as notified by Council in September 2013, is that reclamation within the Port Precinct is a *non-complying* activity. Council also resolved to review this rule pending the conclusion of this port study. The study included consideration of the following issues:

- POAL's capacity to cope with increased throughput on its current footprint, without the need for further reclamation
- impacts of the growth in POAL's throughput on transport rail and road links
- the strategy for development of central city wharves to provide for improved public space and growth in cruise ship visits and ferry numbers.

We were asked not to make recommendations on the detail of any revised rule, but rather to discuss issues and options and to draw conclusions.

Port capacity and transport links

POAL's main site consists of a primary container terminal to the east (Fergusson and Freyberg east) and multi-cargo wharves to the west (Freyberg west, Jellicoe, Bledisloe, Marsden and Captain Cook) adjacent to the city centre.

- We project the container terminal will reach capacity around 2035, assuming incremental productivity gains and annual 3.2% container growth.
- General cargo wharves are reaching capacity constraints, driven by larger ships requiring longer berth lengths and more back-up wharf storage capacity – particularly for the temporary storage of vehicles.
- The Port has a recent record of productivity gains that have resulted in more efficient use of wharf space; however at this time it has not found a more effective solution for vehicle temporary storage and processing.

- We find there are no significant road or rail transport capacity constraints caused by port expansion or that are likely to constrain port expansion.

Central wharves redevelopment strategy

POAL's Captain Cook and Marsden multi-cargo wharves are adjacent to Queens Wharf, which is used as public space and to service cruise ships.

- An increase in cruise ship visits from 32 (2004) to nearly 90 (2014), and the increase in the length of cruise ships are putting pressure on wharf facilities and can conflict with transport ferry services, particularly as these grow in future.
- The City Centre Integration Group's draft strategy is to use Captain Cook Wharf for cruise ships and to remove Marsden Wharf. It notes that lost POAL cargo wharf capacity could potentially be addressed by reclamation at the end of Bledisloe Wharf.
- The strategy will produce public amenity gains through improved public transport facilities, greater public access to the water, and the removal of vehicles stored on Captain Cook Wharf visible from Queens Wharf.
- The strategy is at the planning stage; a business case is yet to be developed and no formal commitments have been made by any party to proceed.

Conclusions

- The container port can grow on its current footprint for approximately twenty years, assuming it continues to benefit from productivity improvements.
- General cargo operations are becoming constrained with respect to berth-capacity and on-wharf operations.
- Ultimately POAL will either lose business or need more land, structures or berth-capacity to allow for the future demand.
- For the proposed central wharves plan to proceed, the Port would need additional wharf capacity.
- The cruise ship, distribution and vehicle wholesaling industries generate significant economic benefits for Auckland, including employment in South Auckland.
- It is important that the regulatory rule applied should give effect to a regulatory regime which is appropriate, consistent and evidence-based. This removes the Council from any perceived conflict of interest between its port-ownership, regulatory and place- shaper roles.

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1. The Port, the problem and our brief

1.1. Ports of Auckland overview

Ports of Auckland Limited (POAL) is New Zealand's most significant port company by value of imports and exports traded in 2014. POAL's main port operations are located adjacent to the Auckland central business district. It also has a small port on the west coast in Onehunga and an inland port at Wiri, South Auckland.

Based on Statistics New Zealand, POAL and other data used in this report, POAL:

- handled close to one million container TEUs[1] in 2014, accounting for 36% of total container movements in New Zealand
- is the dominant port for consumer and capital goods imports for the New Zealand market, i.e. motor vehicles, machinery and electrical goods
- is a hub for other transport modes; 7% of TEUs are moved by rail, 72% by road on trucks and the remaining 21% are trans-shipped internally
- enabled 200,000 cruise passengers to experience Auckland and New Zealand
- declared $66 million paid in dividends to Auckland Council in 2014
- is the most efficient port in Australasia on some productivity measures.

POAL's total impact on the Auckland economy (POAL employment in addition to employment supported by POAL's activity) was $247.6 million in value-added[2] or 2,027 employees in 2010.[3]

1.2. Port of Auckland layout

The Port consists of a primary container terminal to the east (**Fergusson and Freyberg east**) and multi-cargo wharves to the west (**Freyberg west**, **Jellicoe**, **Bledisloe**, **Marsden** and **Captain Cook**) (see Figure 1).

The Port has 10 main cargo berths, as well as a number of secondary berths for tugs, workboats and barges and 80 hectares of yard space inside the Port Precinct. The Port also manages cruise ship visits using central wharves owned by the Auckland Council, in particular Queens Wharf[4] located on its western side adjacent to the Captain Cook Wharf.

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1 Twenty foot equivalent unit.

2 'Value-added' is a measure of economic activity that is expressed as the sum of labour, capital and tax minus subsidies and intermediate consumption.

3 Market Economics, Economic Impacts of the Ports of Auckland Limited 2010, 2012 and 2013.

4 Jointly owned by Auckland Council/Waterfront Auckland and the Crown.

Figure 1 Port of Auckland layout

Source: Statement of Evidence – Alistair Graeme Kirk, 17 October 2014

Bledisloe Wharf acts as a secondary and back-up container terminal when required to manage peak container volumes. Hence the multi-cargo and container terminal capacity issues are inter-dependent.

1.3. The problem

The problem before the Council is to resolve its regulatory approach to managing real and perceived conflicts over the competing future uses of the Waitemata Harbour space in and around the Port Precinct. In September 2013, the Council made a new Proposed Auckland Unitary Plan (PAUP) rule that reclamation inside the Port Precinct is a non-complying activity. The stated PAUP Port Precinct policy is to:

> "Avoid further reclamation within the precinct until the results of a study on the future operation and development of the port clearly identifies whether and when further reclamation is required to enable that future operation."

The rule increases uncertainty for POAL in obtaining a reclamation resource consent. This produces regulatory uncertainty for port planning and POAL's ability to use reclamation to increase capacity for projected increases in freight. It also potentially creates a competitive disadvantage vis-à-vis the Port of Tauranga.[5]

On the other hand there is public concern about the effects of reclamation activity. This includes concerns about negative impacts of reclamation on harbour amenity functions and values, such as recreational boating use, and potential adverse environmental effects.

The question before the Council is whether to confirm its draft rule or to opt for a less stringent regulatory setting such as making reclamation a 'discretionary' activity. This would still require a resource consent which might not be granted for any

[5] In the Bay of Plenty, reclamation is classified as a non-notified restricted discretionary activity for specified wharf extensions or otherwise provided for as a discretionary activity for the Port Zone in the Regional Coastal Environment Plan (as updated 2011) and in the Proposed Plan (2014). See http://www.boprc.govt.nz/media/30953/Plan-030701-RegionalCoastalEnvironmentPlanPart6.pdf

proposed reclamation. A discretionary activity rule may have lower compliance costs and provide a more certain environment for port planning and operations.

1.4. The study purpose and scope

The purpose of this study is to help *inform* Auckland Council decision making on the rule and policies on port reclamation provided for in the PAUP. We were not asked to recommend any regulatory setting for reclamation.

An objective of the study is to assess to what extent POAL can continue to operate within its current footprint without further significant reclamation or major investment in external transport infrastructure. This includes taking account of how transport links to and from the Port may be affected by increased port activity.

We also were asked to take into account the work being done by the City Centre Integration Group on the berthage strategy for the central wharves.

The following issues were outside scope:

- forming a view on the long term (30-50 year) location of the Port, or the scope of port operations
- undertaking an analysis of impacts (economic, social, environmental) of the Port's activities versus any alternative use of the port land
- providing a Section 32 Resource Management Act analysis of the proposed PAUP policies, plans and rules covering reclamation.

We were not asked to make recommendations as to the form of any rules to be applied within the Port Precinct.

2. Port capacity and transport links

We estimate when capacity constraints are likely to be reached at the Fergusson Container Terminal, given both projected container freight demand increases, and the scope for long-term efficiency gains at the Port. We project that the container terminal capacity of 2 million TEUs per annum is likely to be reached within its current footprint at around 2035, assuming current technology.

Unlike the Fergusson Container Terminal, the capacity of the multi-cargo wharves is difficult to assess/optimise primarily due to the non-homogenous nature of the cargo. The key constraints we have identified are the need for longer berths to service larger ships and more wharf space to manage cargo, in particular for temporary vehicle storage. Capacity pressures would become unmanageable if the Port was to give up the use of Captain Cook and Marsden wharves, as envisaged by the plans for the central wharves, without somehow offsetting this loss of wharf space.

2.1. Container terminal capacity

POAL estimates its ultimate container terminal capacity to be at least 2.0 million TEUs[6] per annum, compared to the throughput for the year ending June 2014 of 873,529[7] TEUs. Using projections of container throughput growth by Market Economics, POAL expects it will able to manage through to 2044 without the need to further expand the Terminal's consented footprint.

POAL's capacity estimate depends on assumptions of future terminal capacity improvements and Market Economics' container throughput (exports and imports) projections. We discuss the capacity issue first, before providing our own projections on the likely timing of potential terminal capacity constraints.

Rather than a hard constraint, container terminal capacity is dynamic – it depends on labour productivity, and capital and technology choices

POAL have calculated container terminal capacity taking into account:

1. **berth capacity** (space for ships) – this is a function of berth length, berth occupancy and ship exchange productivity[8]
2. **back-up land capacity** for storage and handling[9]
3. the outlook for **productivity gains**[10] that lead to increased capacity.

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6 Twenty foot equivalent unit – a standardised measure of containers.

7 Note this figure excludes 95,212 containers moved through the general cargo wharves.

8 Number of berths x hours per annum (8,760) x berth occupancy (%) x average crane intensity (cranes per vessel) x average crane productivity (moves per hour per crane) = total annual throughput capacity.

9 Number of ground slots x average stack height x (365/dwell time) = total back-up land capacity.

Berth and back-up land capacity depend on the productivity of port operations. So, for example, POAL reports that improving labour productivity effectively increased berth capacity at the Terminal by around 300,000 TEUs per year.[11] Most of this productivity improvement, discussed further below, occurred since 2012. This is a large improvement equivalent to 34% of total annual terminal throughput.

A consequence of this productivity improvement is that completion of the approved terminal reclamation may proceed more slowly than otherwise planned. Productivity initiatives have also helped reduce berth occupancy from close to 67% to 52%, which is now within the 50% to 60% benchmark regarded in the industry as a reasonable berth occupancy (providing flexibility to efficiently service ships without significant delays). The reclamation progressing at Fergusson is planned to add another berth somewhere between 2018 and 2020.

At this point the terminal is not constrained by storage and handling back-up land capacity. Full container stacks are currently 2 to 3 high, and could go as high as 6 by using different technology. The previously consented Fergusson reclamation will also add more storage capacity (3ha).

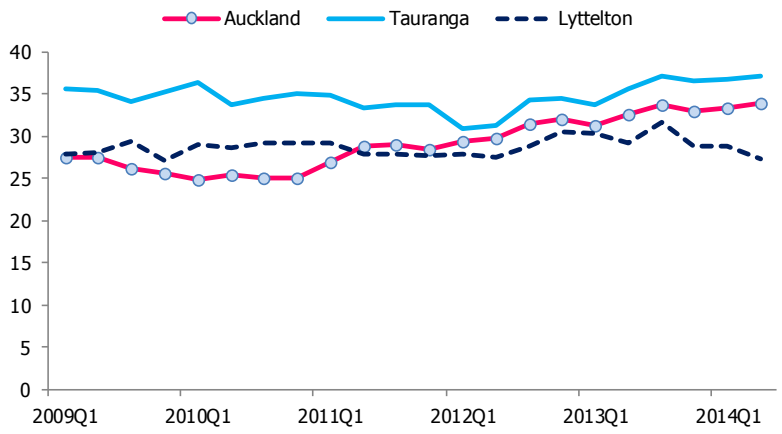
While POAL has made substantial productivity gains in recent times it is prudent to assume more modest productivity growth in the future

The crane rate is the number of containers a wharf-side crane loads and unloads in an hour. An increasing crane rate over time is a key performance indicator of port productivity. It supports improved ship turnaround times and hence can increase berth capacity. It makes the port more competitive.

Auckland's crane rate productivity improvement since 2009 is equivalent to a 3.9% annual increase. This is above the national average of 2.3%. Tauranga's crane rate increase has averaged 0.8% annually, and is still just above Auckland's (See Figure 2).

Figure 2 Crane rate

Container movements per hour



Source: Ministry of Transport 2014a

[10] Berth and back-up land capacity depend on the productivity of port operations. Productivity measures include crane rate productivity, container dwell times, container stack heights and labour productivity. Productivity also depends on the mix of capital technologies and labour used – to what degree operations are automated.

[11] Statement of Evidence of Alistair Graeme Kirk for Ports of Auckland Limited in Relation to Topic 005 – RPS, paragraph 3.21.

While Tauranga maintains the highest crane rate, POAL has the highest labour, ship and vessel productivity rates of Australian and New Zealand ports (See Appendix A).

It is important to note as seen in Figure 2 that most of the crane rate gains have occurred since 2011/12. This is also true of other measures of productivity.[12] For this reason, and being at the top-of-class in Australia and New Zealand, we expect more moderate productivity gains in future and hence more incremental increases in terminal capacity going forward. That is, the 'low-hanging fruit' has been picked, and future productivity gains will require more expensive investment in new technology.

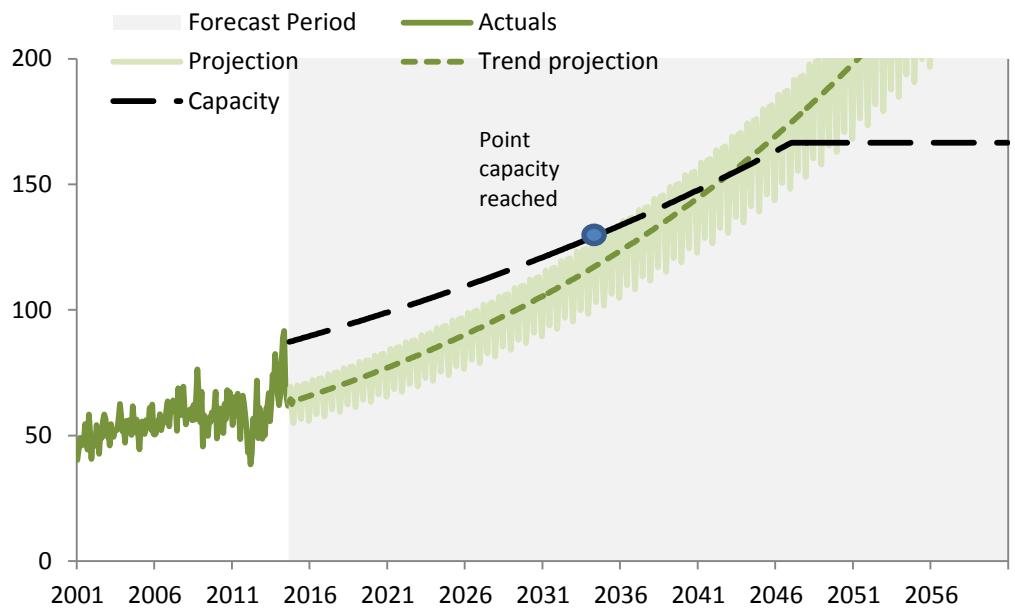
POAL's projected terminal capacity of at least 2.0 million TEU by 2044[13] implies an annual capacity increase of 2%, below the gains we have described above. It assumes ongoing incremental productivity improvements using existing or planned technologies. To be prudent, in our study we also make the same capacity increase assumption, and evaluate an upside risk that capacity can grow at 2.5% per annum.

2.1.1. Projected timing of capacity constraints

The Port needs capacity to manage demand peaks. Taking account of these (rather than using an annual average which masks these seasonal spikes) brings forward any capacity constraint by 5 years. We project that the container terminal capacity of 2 million TEUs per annum is likely to be reached within the Port's consented footprint at around 2035 (See Figure 3), taking into account demand peaks.

Figure 3 Projected container demand and supply capacities

Port of Auckland, TEU throughput by month (000s)



Source: NZIER, Statistics New Zealand

[12] So for example, labour productivity per container has improved faster over the last seven years, much more so than the previous seven years. The staff hours per container (the labour rate) decreased by an annual average of 3.7% between 2007 and 2014. Whereas, it only decreased by an annual average of 0.2% between 2000 and 2007. So the long run average annual labour productivity per container is closer to 2%.

[13] Statement of Evidence of Alistair Graeme Kirk for POAL in relation to topic 005 – RPS Issues. Paragraph 4.32.

Our base case forecast is for there to be capacity constraints in 2035, 9 years sooner than the POAL's projection based on Fairgray (2014).[14] The forecast difference arises from different assessments of likely container trade growth rates (see Table 1).

Table 1 Container volume forecast comparisons

Provider	Growth rate of container throughput	Time period	Port
NZIER	3.2%	2015-2060	Auckland
Fairgray	2.1-2.6%	2015-2041	Auckland
PwC	2.0-2.5%	2014-2041	Auckland
Deutsche Bank	6.9%	2014-2028	Tauranga
Credit Suisse	3.2% - 7.0%	2014-2028	Tauranga

Source: NZIER, Fairgray (2014), Deutsche Bank (2014), Credit Suisse (2014), PwC (2012b)

NZIER's projected TEU growth has been informed by an analysis of likely global trade growth trends

In our projections, container throughput is estimated to grow at around 3.2% per annum, under-pinned by two robust trends:

1. Increasing global GDP levels and increasing trade as a share of GDP, particularly in the Asia region, which is the most important contributor to increases in global trade flows. This will lift export demand.
2. Increasing population levels in Auckland and the upper North Island, due to both net migration inflows and high fertility rates in the Auckland region. This will boost import demand.

Table 2 summarises these drivers of growth historically and over our projection timeframe. The TEU growth of 3.2% is weaker than the 4.7% growth experienced over the past two decades. This is due to a weaker global and domestic growth outlook (primarily due to the short term lingering effects of the global financial crisis and then demographic change further out), but is in line with the historic relationship between TEU growth and the underlying population and GDP growth drivers.

[14] Statement of Evidence of Alistair Graeme Kirk for Ports of Auckland Limited in Relation to Topic 005 – RPS Issues 17 October 2014 – clause 4.32.

Table 2 Historic and projected key growth trends

Factor	History (1990-2014)	NZIER projections (2014-2060)	Long-term risk
World real GDP growth	3.5%	2.7%[1]	Upside – OECD forecasts are conservative as they do not factor in potentially more rapid market growth due to further trade liberalisation
World imports as a share of world GDP	20% in 2014	33%[1] by 2060	Upside – given potential for further trade liberalisation
NZ real GDP growth	2.6%	2.1%[4]	Balanced
NZ imports as a share of NZ GDP	30% in 2014	43% by 2060	Upside – given global risk
NZ real trade growth	4.8%	3.1%[6]	Upside – given global risk
Auckland population growth	2.2%	1.2%[5]	Balanced
Auckland GDP growth	3.4%[2]	2.5%[4]	Balanced
NZ per-capita income growth	1.4%	1.5%	Balanced
Container volume (TEU) growth	4.7%[3]	3.2%	Upside – given global risk

Source: NZIER

Notes: 1. OECD projections. 2. NZIER estimate based on historic Auckland population growth and NZ-wide per-capita income growth. 3. Rockpoint 2010 and Ports of Auckland Annual Review 2014. 4. NZ and Auckland GDP growth projections are based on Treasury's long-term per-capita income growth assumptions and Statistics New Zealand's median population growth forecasts. 5. Statistics New Zealand's median population growth forecasts for Auckland to 2031 and NZIER's population estimate for 2031-2061 that maintains the trend increase in Auckland's share of NZ population. 6. Estimated trade growth assumes export/import to GDP ratios will continue to rise in line with the historic trend and OECD forecasts.

The timing of the capacity constraint is sensitive to model assumptions

The timing of potential capacity constraints is sensitive to small, quite plausible changes in container growth and the capacity increase assumptions (see Table 3).

Table 3 Key sensitivities: year capacity reached

Scenario	Capacity increase 1.5% p.a. and 2 million TEU limit	**Base case 2% p.a. capacity increase**	Capacity increase 2.5% p.a. and 4 million TEU limit
Base case estimate	2028	**2035**	2078
Higher global demand and population growth (TEU growth 0.5% p.a. higher)	2024	2028	2037
Loss of market share to Port of Tauranga (TEU growth 0.3% p.a. lower)	2031	2041	+2100

Source: NZIER

Small capacity and throughput increases *compound* over the long term, leading to wide variations as to when a capacity constraint may be met – moving the capacity constraint out beyond 2100 in the most optimistic case. What is more relevant for planning is the near-term worst-case scenario that growth currently being experienced continues and under modest capacity growth assumptions capacity is approached in 2024.

A "least regrets" approach would be sensible for planning purposes

The balance of risks is probably skewed towards capacity constraints being reached earlier rather than later (see long term risks in Table 2), assuming only moderate capacity increases. A "least regrets" approach to managing this uncertainty would be to plan for expanding capacity sooner, rather than later. Long lead times are required to expand capacity through reclamation, which tends to be a slow process.

If container volumes continue to grow at the rate we project, POAL can bring forward planned container terminal capacity enhancements (e.g. the rate of the Fergusson reclamation).

This issue is not only important for terminal planning, but also important for the cargo terminal that currently manages overflow from the container terminal. It managed 95,212 or 10% of POAL's total TEU throughput for 2013/14 on the Bledisloe Wharf and as discussed below is seeing emerging capacity constraints.

2.2. The general cargo operation

The multi-cargo wharves handled over 5.6 million freight tonnes[15] of non-containerised cargo in 2013/14 (including over 207,000 vehicles), an increase of 29% over the previous financial year. This was 47% above the peak of 3.8 million freight tonnes recorded in 2006/07 prior to the recession.[16] This rapid increase in freight is putting pressure on wharf capacity.

Most of the general cargo operations manage imports. Imports outnumber export weights by a ratio of 10:1. We have accordingly focused our consideration of wharf capacity issues on imports.

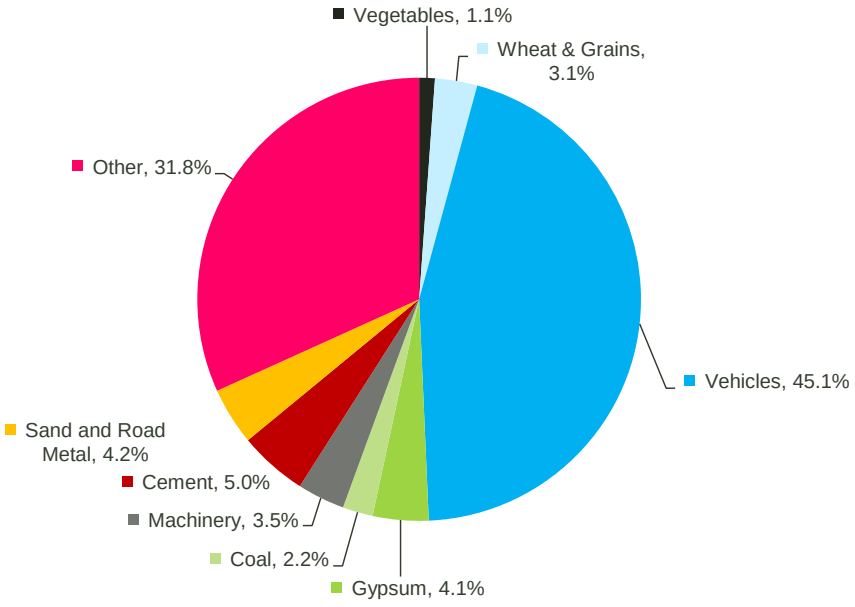
Between 2006/07 and 2013/14 vehicles were by far the most important cargo, accounting for 45% of imports. Other notable goods include cement, sand, gypsum, machinery, and coal (See Figure 4).

[15] A freight tonne is the greater of the weight in kilograms or the volume in m^3 of the goods.

[16] Source: POAL data provided.

Figure 4 Cargo wharves' imports

Freight tonnes for 7 year period from June 2006/07 to June 2013/14



Source: POAL

The non-homogenous nature of the cargo makes it difficult to measure the capacity of the multi-cargo operations generally. However, the dominance of vehicle imports for POAL is suggestive that these are a key driver of any capacity constraints. A product such as cement is pumped to specialised storage towers and other products such coal or grains can loaded directly onto trucks and transported from the wharves. Vehicles, however, need to be temporarily parked for processing using wharf space.

2.2.1. Assessing capacity of the cargo wharves

To assess the general cargo wharves' capacity we considered the following:

- berth length and berth occupancy
- back-up land storage capacity
- peak loads on capacity
- other factors, including the potential for productivity gains.

We briefly discuss the principal sources of pressures on the general cargo wharves before assessing capacity constraints.

2.2.2. The sources of the capacity pressures

Growing pressures on capacity in the cargo wharves come from:

- the need for the Bledisloe Wharf to act as a back-up for the container terminal during peaks, although this has been significantly mitigated with productivity gains in the container terminal

- the loss of Queens Wharf in 2009 (purchased by the Government and Auckland Regional Council for the Rugby World Cup) and its subsequent development as Auckland's primary cruise terminal, limiting the area available for other general cargo
- Golden Bay Cement shifting its import and storage facilities in 2010 facilitating the revitalisation of the Wynyard Quarter
- Holcim Cement's planned relocation to Jellicoe Wharf from the Port of Onehunga, enabling it to use larger ships (not suitable for the Manukau Harbour)[17]
- growth in local imports of building and road materials (sand and aggregates), now taken by barge rather than road due to constrained local quarry sites and high road transport costs
- rapid growth in cruise ship visits, which include the occasional use of Jellicoe Wharf for very large cruise ships (currently 1 visit every 2 years)
- rapid growth of vehicle imports that account for the majority of imports handled in the general cargo wharves.

Volumes of many of the products, such as vehicles, cement, sand, and aggregates, are driven by Auckland's population growth, are largely consumed within the Auckland region, and are expected to grow as Auckland grows.

2.2.3. The capacity constraint drivers

The PwC upper North Island port study (2012b) concluded that the bulk storage space is nearly fully utilised. We consider below the emerging constraints, their drivers and potential solutions.

Capacity constraints come from increased ship size putting pressure on back-up land storage and berth space

Multi-cargo ships such as vehicle ships, container ships and bulk carriers have been getting longer and wider over the last decade. While there has been a steady increase in cargo processed at the Port, the number of ship visits has dropped from 1,808 (2004) to 1,463 (2013) i.e. 20%. Multi-cargo container ships previously were 140m in length (900 TEU) but are now up to 200m in length (2,000 TEU).

Longer ships require longer berths. It is not uncommon for ships berthed at Bledisloe Wharf to extend past the wharf end, and in high winds be stabilised using a tug. Larger ships also require more back-up storage space for cargo that cannot be put directly onto trucks and removed immediately from the wharf.

Table 4 compares the ratios of back-up storage space to berth length for the three upper North Island ports. POAL has only 25% of the back-up area per metre of berth length of the other ports.

[17] This was driven by the closure of their Westport manufacturing facility and the need to import cement rather than manufacture in New Zealand. This then drove the ship size to 30,000 tonne bulk shipments. These future ships will draw 10m – 11m of water and these can only be handled at the Waitemata seaport (the Manukau is limited to about 5m draft).

Table 4 Comparison of back-up storage to berth length

Port	Back-up area (m^2)	Berth length (m)	Ratio of wharf area per metre of berth length (m^2)
Northport	340,000	570	596
Port of Tauranga	1,120,000	2,055	545
Ports of Auckland	290,000	2,000	145

Source: NZIER, POAL data and PwC (2012b)

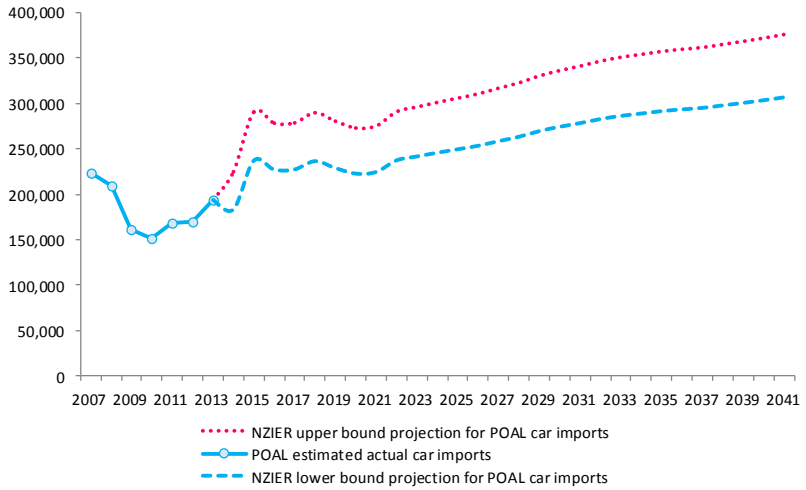
The low level of back-up capacity reflects legacy issues. The layout of the multi-cargo terminal was designed when ships were generally smaller and could fit at shorter wharves and in relatively narrow basins. Modern larger ships are designed to discharge cargo more rapidly, which then requires wider back-up areas to service these peaks in cargo volumes.

The peak carrying capacity constraint of the multi-cargo wharves is shaped by vehicle imports, which are growing rapidly

Large ship vehicle carriers rapidly off-load vehicles, spreading them out across wharf space for inspection and processing.

Light vehicle imports have grown rapidly since 2010. Growth has been supported by the replacement of ageing vehicles that some people deferred in the recession and a high exchange rate. Light vehicle imports have already exceeded the forecast for 2041 made in the PwC upper North Island port study (2012b). They are projected to increase by between 19% to 46% by 2025 and to continue to grow over our forecast period with ups and downs reflecting natural replacement cycles in the vehicle fleet (see Figure 5).

Figure 5 Light vehicle import forecasts (calendar years)



Source: NZIER, POAL, Ministry of Transport 2014b

The upper bound projection in Figure 5 assumes POAL maintains its current market share and the lower bound assumes its average market share since 2007. Vehicle imports are heavily concentrated in POAL (around 90% of vehicle imports).[18] This

[18] Estimate based on location of first vehicle registrations and Statistics New Zealand vehicle import weights.

reflects the fact that Auckland is New Zealand's major market and the focal point of vehicle wholesaling, refurbishment and distribution. This is unlikely to change in the foreseeable future.

POAL has around 7 days a month where near full temporary vehicle storage capacity constraints are being approached. As can be seen from the forecast in Figure 5, we expect continue rapid growth over next decade and this peaking problem will become increasing difficult to manage.

While peak vehicle loads can be managed presently, the rapid growth may mean the Port's throughput performance is compromised from time to time. Where such events cause delays in getting vehicles to customers, this could encourage importers to consider using the Port of Tauranga (POT). POAL needs to maintain flexibility to manage demand fluctuations, and it is prudent to retain and assess options for capacity expansion now, which POAL is doing. This is particularly so as a reclamation solution can take well over a decade to plan and implement.

Potential solutions

While further reclamation offers one solution, POAL has to consider the investment returns of this relative to other options to act in the interests of its shareholder (Auckland Council).

The use of wharf space for temporary vehicle storage is driven not only by quarantine inspection requirements, but also by inspection processes of vehicle importers and vehicle transporters. While POAL has investigated options to address this problem (larger vehicle transporters, vehicle stackers and car park buildings, for example), no feasible solution has been found to date.

POAL could potentially extend wharf structures, which is a permitted activity in the Port Precinct under the PAUP, to address berthage constraints, if reclamation proves too difficult. Structures are more expensive than reclamation and may not sufficiently address back-up capacity issues. Although, in combination with, for example, vehicle stackers, this might become feasible some time in future. However, detailed financial appraisal of options would need to be undertaken. In the interim, POAL is managing through a range of productivity initiatives, for example, reducing the use of Bledisloe Wharf for container traffic.

It is important to note it is difficult for POAL to manage peaks through rescheduling ship calls which are controlled by shipping companies. Increasing ship waiting times for a berth or ultimately turning away ships that are too large gives away competitive advantage to Tauranga.

While these are not attractive options for POAL, as some general cargo trade may shift to the Port of Tauranga or be carried by rail or road, it would be a way of managing through until capacity constraints are otherwise addressed.

2.3. Transport link capacity

Import and export TEUs are distributed from the Port by truck or by train. Of the total 968,741 TEUs moved through the Port (container and general cargo wharves), 69,585[19] of these were moved by rail. This equates to a transport distribution mode

[19] Source – Ports of Auckland 2014 Annual Review.

share of approximately 7% of TEUs moved by rail and 72% moved by road on trucks, with the remainder trans-shipped.

The road network has capacity for heavy traffic growth

POAL estimates that approximately 80% of Port-related freight, enters or leaves the Port via Grafton Gully. From Grafton Gully the majority of freight is distributed along the Southern Motorway with the remainder using the Northern and North-western Motorways.

The connection from the Port, along The Strand and Stanley Street to the commencement of SH16 at Grafton Gully, is considered the most significant bottleneck on the road network for freight as it services the highest volume of trucks. This section of road has an annual daily traffic volume (AADT) of 44,500 vehicles. However, only 7.9% of these are heavy commercial vehicles.[20] The potential capacity constraint is therefore growth in background traffic rather than increases in heavy vehicles coming from the Port.

It is likely that the level of background traffic growth will erode journey time reliability on The Strand and Stanley Street at SH16 for Port-related freight traffic in the foreseeable future.

Shifting greater volumes by rail network is feasible

There are currently 16 rail services per week operating in each direction between the Port and Wiri Inland Port. Each train currently carries approximately 88 TEUs therefore transporting around 1,400 TEUs in each direction per week.

POAL has confirmed an ambition to run up to 56 freight trains per week between Wiri Inland Port and the Port – amounting to 5,000 TEUs per week. Assuming no seasonal fluctuation, this would account for potential throughput of approximately 260,000 TEUs per year, assuming no changes in locomotive and wagon configuration.

POAL's longer term aim is to have up to 30% of freight from the Port carried by rail. The conflict of passenger and freight movements on the rail network in the longer term will be a challenge. Options are available to increase capacity including physical infrastructure improvements to the rail network and changes in the way freight services operate between the Port and Wiri Inland Port to, for example, a shorter, more frequent service. These kinds of options are being investigated by KiwiRail and POAL.

2.4. Conclusion

A port "capacity constraint" is dynamic. It depends on innovation and the rate of productivity improvement on the supply side, and global and domestic activity trends on the demand side, and actions of port competitors and customers.

We project the container terminal reaches capacity of 2 million TEUs around 2035, assuming only incremental productivity gains using current port technology and an annual 3.2% container growth. The timing of potential capacity constraints is sensitive to small, quite plausible changes in container growth and in the worst case scenario capacity could be reached in 2024. However, equally, relatively small

[20] Source: NZTA State Highway Traffic Volumes, 2013.

additional productivity improvements may address future container terminal capacity allowing the terminal to grow well beyond 2 million TEU.

General cargo space is more constrained; particularly berth space as ships get larger. The Port has a recent record of productivity gains that have resulted in more efficient use of wharf space. However, at this time it has not found a more effective solution for vehicle storage and processing. There are ways of continuing to manage emerging capacity constraints, before reclamation is undertaken, but they may not always be commercially attractive.

In light of long planning horizons involved in adding wharf capacity, a “least regrets” approach would be to investigate ways of adding capacity earlier rather than later.

3. Central wharves development proposal

Pressure on the POAL footprint is driven not only by increasing trade volumes, but also by the need to accommodate increasing cruise ship demand for the use of the central wharves adjacent to the POAL's multi-cargo wharves (Captain Cook, Marsden and Bledisloe). Pressure on the central wharves comes not only from increasing cruise ship visits, but also from larger ships which cannot be accommodated by the central wharves' structures.

The proposed solution includes the extension of Captain Cook Wharf to accommodate longer cruise ships. This will reduce the number of berths and the storage space for multi-cargo throughput, including that used for temporary vehicle storage. These industries are responsible for generating semi-skilled employment opportunities, including significant employment in vehicle warehousing and distribution in South Auckland. One solution may be to extend Bledisloe Wharf through reclamation to enable the continued expansion of cruise ship visits and multi-cargo throughput.

3.1. Existing capacity problems

The central wharves contain a mix of functions and activities (see Table 5) that at times can conflict or not function well together in peak demand periods. They include wharves owned or partly owned by the Auckland Council adjacent to the Captain Cook and Marsden wharves owned by POAL. Princes Wharf is owned by PoAL but leased to private parties.

Table 5 Central wharves' functions

Wharf	Functions and activities
Hobson Wharf	Downtown Marina and NZ Maritime Museum
Princes Wharf	Residential and commercial developments and secondary cruise terminal in front of the Hilton Hotel
Queens Wharf	Public access, water views, a place for events and the primary cruise terminal. Ferries berth between Queens and Princes wharves
Captain Cook, Marsden and Bledisloe wharves	These are working cargo terminals. Captain Cook is used for temporary vehicle storage. Tugs berth between Cook and Queens wharves.

Source: City Centre Integration Group, POAL

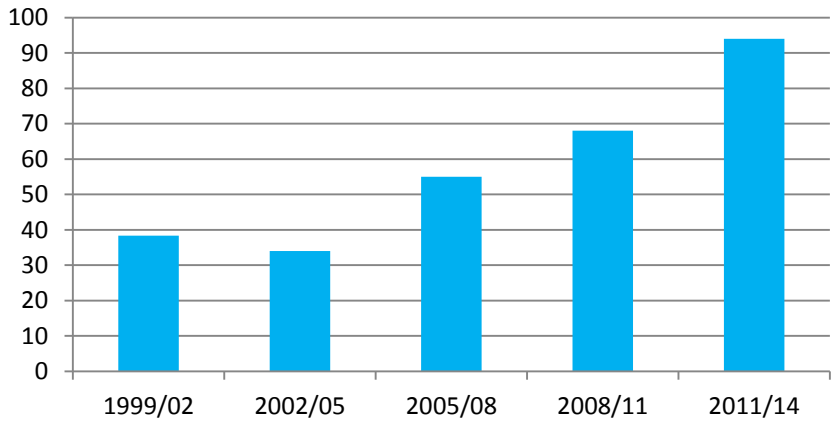
Growth is expected to make problems worse

Cruise and cargo ships are getting bigger and the frequency of visits is increasing. Figure 6 provides average per annum cruise ship visits between 1999 and 2014 in three year intervals, smoothing annual fluctuations numbers, thereby providing a clearer picture of the overall growth trend. Average annual visits have grown by 60

(176%) between 1999/02 and 2011/14. The number of passengers visiting Auckland has risen from 50,000 in 2004 to nearly 200,000.

Figure 6 Growth in cruise ship visits

Average per annum visits in three year periods between 1999 and 2014



Source: Auckland Tourism, Events and Economic Development

Auckland Tourism, Events and Economic Development (ATEED) see significant opportunities for further growth. They anticipate cruise ship visits will reach 120 per annum by 2020, with potential to reach 150 by 2030, bringing 375,000 tourists to Auckland.[21]

Along with this growth is an increasing number of visits by larger ships. Prior to June 2006, the largest cruise ships arriving at the Port were 294m long. Since then, five out of the last eight financial years have recorded visits by cruise ships of up to 345m in length, which suggests a trend towards the use of larger cruise ships.

Berths at central wharves cannot accommodate such large ships. These are berthed instead at Jellicoe Wharf, a multi-cargo wharf inside the Port Precinct. However, this wharf lacks visitor disembarkment facilities.

While Auckland is experiencing rapid growth in visits by cruise ships, there is also increasing demand for local ferry passenger services. Berths required for commuter ferries are expected to increase from 8 to 12 by 2025.

Table 6 Projected central wharves' requirements, 2025

Use	Current No. of berths	2025 No. of berths	Current Berth/ship length	2025 Berth length
Multi-cargo handling (Bledisloe)	No change	No change	Up to 170m (ship)	Up to 280m (ship)
Cruise ship	No change	No change	Up to 320m (berth)	Up to 350m (berth)
Ferry	8 (+4 layover)	12 (+5 layover)	No change	No change

Source: City Centre Integration Group

[21] Auckland Tourism, Events and Economic Development: Cruise Industry Action Plan, November 2014.

3.2. Proposed solution

The City Centre Integration Group (CCIG), which is made up of chief executives from across the Auckland Council Group, has been investigating the central wharves' problems and is developing a strategy to address these.

The CCIG's proposed solution involves the extension of Captain Cook Wharf, the possible demolition of Marsden Wharf and the possible extension of Bledisloe Wharf to offset the Port for lost wharf capacity to manage cargoes. This may involve the Port reclaiming up to 5.3ha, and opening to the public between 2.5ha and 3.1ha of space for public use (depending on whether Marsden Wharf is demolished).

Captain Cook and Marsden wharves are currently used for the temporary parking of vehicles as discussed in Section 2.2.3. Based on current wharf uses, the reclamation envisaged in the CCIG's preferred option would accommodate the ongoing growth in visits by cruise ships, growth in vehicle imports and expansion of multi-cargo imports generally. It is useful to understand the value of these activities to Auckland.

3.3. Value of cruise ship visits and vehicle imports/wholesaling

Cruise ship industry

The 2013-14 season had 88 cruise ships visits which brought 186,200 visitors and 63,900 crew to New Zealand. Market Economics (ME) spatial estimate this resulted in over 1.08 million passenger port days and 455,100 crew port days across the country. They estimate the total value added by the industry across all New Zealand regions was $365.3 million, with Auckland accounting for over $159 million (44%) of the total. The ME spatial estimate is equivalent to a value added of $1.8 million per ship visit in Auckland. At the time of writing this report, 92 cruise ship visits were booked for the 2014-15 season.

Typically, cruise ships visit multiple New Zealand ports as part of a wider circuit including the South Pacific and Australia. Together with other Australian major ports, Auckland uniquely within New Zealand functions as an exchange port where passengers and crew start or end their journeys. Exchange ports generate additional economic value by providing services that support the exchange of passengers and crew, and the resupplying of cruise ships. Services include bunkering, providoring, hotel stays, airline bookings, airport activity and transportation.

If berth facilities are inadequate or unavailable in Auckland, the cruise ship industry will respond by either:

- continuing visits but with smaller ships, resulting in Auckland receiving fewer passengers per visit or an increased frequency of visits
- reducing ship visits as the size of ships increases by limiting visits to a port of call rather than an exchange of passengers or crew.

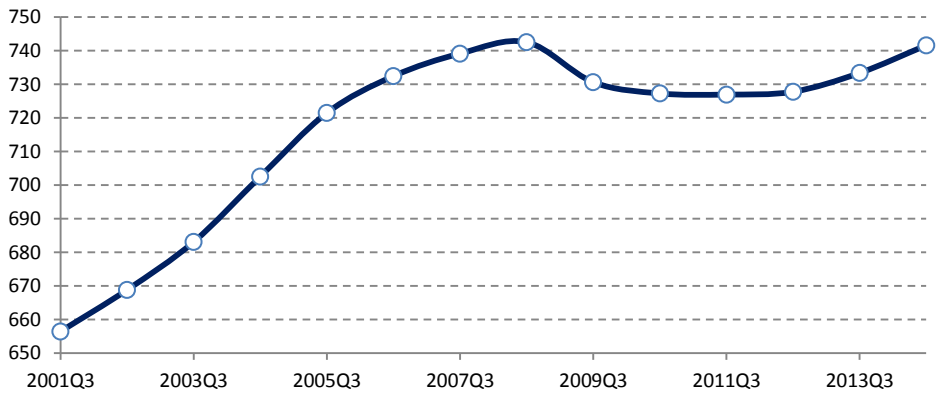
There is also the possibility that, if Auckland cannot accommodate larger ships, visits might be reduced nationally. It is beyond the scope of this report to examine these potential impacts.

The value of the vehicle imports and wholesaling industry

Around 90% of light vehicle imports in New Zealand come through the Ports of Auckland Ltd. Import data from Statistics New Zealand suggest that these vehicles were worth around $3.2 billion in 2013/14.

Figure 7 shows that vehicle ownership rates across New Zealand are back on the rise as the economy recovers. Ownership rates relative to the population fell during the global financial crisis as people put off major purchases, but have begun to grow again. Vehicle ownership trends are a good indicator of demand for vehicle imports and for businesses that manage vehicle wholesaling, warehousing and distribution in Auckland.

Figure 7 Light vehicle ownership per 1000 people

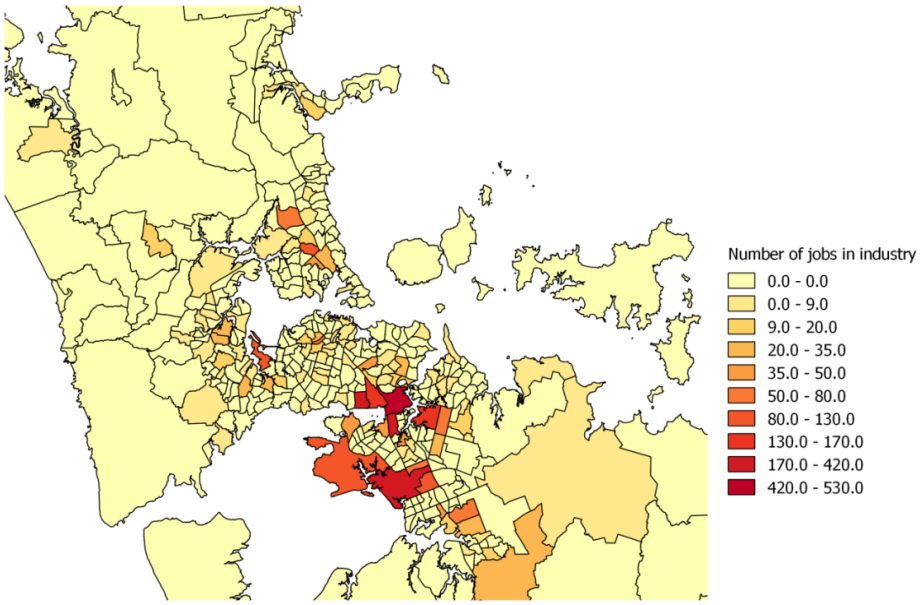


Source: NZIER based on Ministry of Transport quarterly vehicle fleet statistics

Auckland's motor vehicle wholesale industry stands to gain the most from the growing demand for vehicle imports. This industry employs about 3,500 people and accounts for 48% of total motor vehicle wholesale employment in New Zealand. Figure 8 shows that motor vehicle wholesale businesses (and jobs) are concentrated around the residential suburbs in South Auckland.

Figure 8 Employment in the wholesale car market across Auckland

Motor vehicle and motor vehicle parts wholesaling



Source: NZIER based on Statistics NZ business demographics ANZSIC code F350

Job creation is significant for South Auckland because it suffers higher unemployment rates than other parts of Auckland and New Zealand. For example, the unemployment rate in the Otara-Papatoetoe local board area was 14% according to the 2013 Census. Unemployment in the Auckland Region as a whole was 8%.

Our estimates suggest that, during the financial year April 2013 to March 2014, the motor vehicle wholesale industry contributed $380 million dollars to the Auckland's Regional Gross Value Added (RGVA).[22] Of this amount, $200 million was paid as wages/salaries.

Other bulk cargo

As noted above, the non-homogeneous nature of the balance of the cargo landed at the Port renders an analysis of the precise economic contribution made by each of the cargoes fragmentary and less valuable than the discussion of the dominant cargo (vehicles). Nonetheless, some general observations can be made. The largest discrete cargoes after vehicles are cement, sand, road metal and gypsum. It is reasonable to conjecture that the bulk of the consumption of these items will take place in the expanding Auckland region. It follows that there is value in landing such items near where they will be used, and that diverting the landing of such items to other ports is inefficient inasmuch as extra costs will then be incurred in transporting them to the Auckland region.

[22] This accounts for roughly 0.5% of Auckland RGVA. The GVA estimates were taken from NZIER's regional computable general equilibrium (CGE) database which is based on Statistics New Zealand's input-output table but updated to 2014 values using latest national accounts data.

Managing commercial risk and uncertainty

If POAL does not provide for the continued expansion of wharf capacity to service vehicle imports it would take on significant commercial risk. POT's capability to manage vehicle imports could be progressively built and erode POAL's competitive advantage and shareholder value. POT would need to make improvements to its port facilities to handle vehicle imports and adjustments would also need to occur in the vehicle transportation and warehousing industries. This change would be gradual and could plausibly start to happen over a 5 – 10 year period.

A more restrictive regulatory regime for reclamation for POAL, than is in place for POT, would facilitate the development of this competitive threat. A more restrictive regime creates uncertainty over POAL's ability to expand capacity. Vehicle logistics chain participants, such as shipping lines and vehicle importers might then work to secure alternative import routes to manage such a risk.

3.4. Conclusion

The central wharves strategy to try and service the growth in cruise ship visits involves the use and extension of Captain Cook Wharf. POAL would carry significant commercial risks releasing Captain Cook and Marsden Wharves, without a reasonable degree of certainty about the Bledisloe extension being possible.

The proposed central wharves strategy would enable continued growth and employment opportunities in the cruise ship, vehicle wholesaling and other industries the multi-cargo wharves service. In the case of the vehicle wholesaling and distribution industries, providing wharf capacity for their continued expansion may provide support for much needed employment in South Auckland.

Appendix A Fergusson Container Terminal capacity

In this Appendix we provide an assessment of when capacity constraints are likely to be reached at the Fergusson Container Terminal, given both projected container freight demand increases, and the scope for long-term efficiency gains at the Port. We project that the container terminal capacity of 2 million TEUs per annum is likely to be reached within its current footprint at around 2035, assuming current technology. This estimate incorporates the peak seasonal demands. If seasonal peaks could be smoothed, the capacity limit would occur around 5 years later, in 2041.

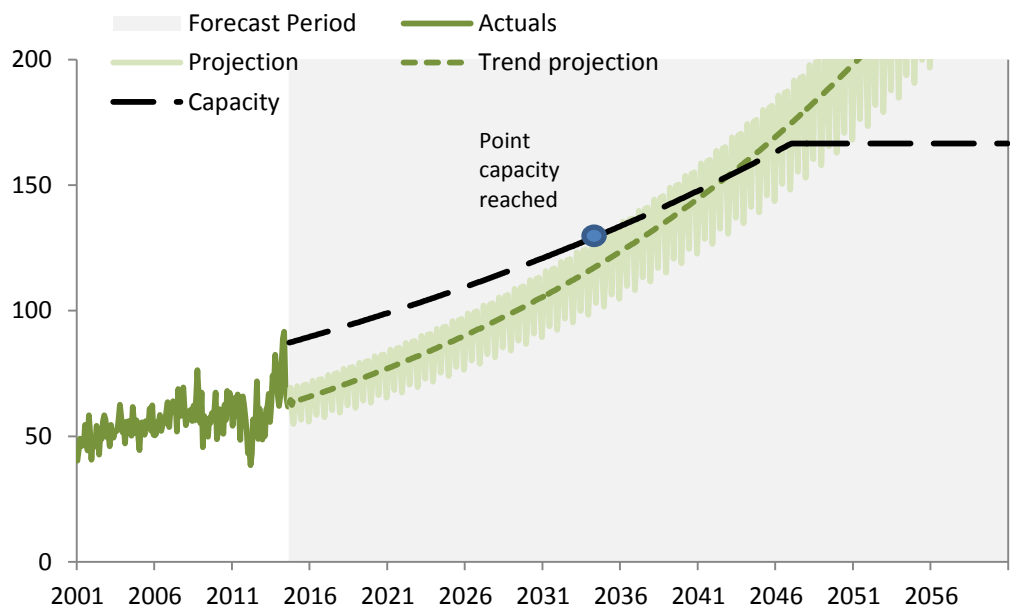
The range of uncertainty around this capacity estimate is very large, and POAL can respond to any emerging capacity constraint through investment in new technology and systems. Prudent management of this uncertainty suggests being prepared to invest in adding capacity earlier rather than later.

A.1 Overview of results

The Port needs capacity to manage demand peaks. Taking account of these (rather than using an annual average which masks these seasonal spikes) brings forward any capacity constraint by 5 years. We project that the container terminal capacity of 2 million TEUs per annum is likely to be reached within the Port's consented footprint at around 2035 (see Figure 9), taking into account demand peaks.

Figure 9 Projected container demand and supply capacities

Port of Auckland, TEU throughput by month (000s)



Source: NZIER, Statistics New Zealand

A.2 Basis of demand growth assumptions

A.2.1 Global trade growth context

Global GDP growth and global trade growth are strongly related over the economic cycle. When the global economy is booming global trade growth also tends to be strong, and conversely, as seen in the global financial crisis, global trade levels can fall precipitously when there is a global recession.

Of more importance for the port study are trend growth patterns. Over the past few decades growth in global, and New Zealand's, trade, including sea freight, has considerably outpaced global GDP growth. The main reasons the international literature offers for this include: reductions in tariff and non-tariff measures, faster productivity growth in the tradable than non-tradable sector (reducing the relative price of tradable goods), the internationalisation of production chains, reducing shipping and transport costs, rising incomes in developing countries (leading to demand for more internationally produced goods and services), and the opening up of new markets to international trade.[23]

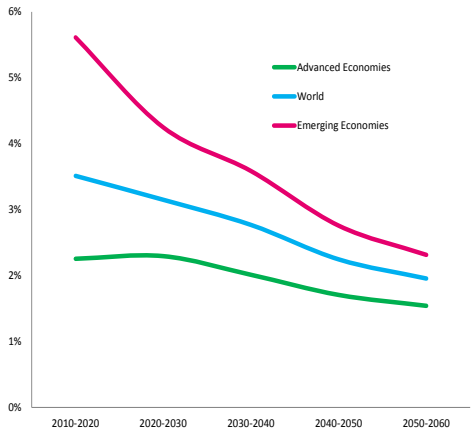
Looking forward over the next 50 years, we can expect global trend GDP growth to moderate as population growth in most of the OECD (and key emerging economies such as China) weakens, and as productivity catch-up in emerging markets tapers. The OECD, for example, projects trend global growth to decline from around 3.5% per annum to 2.7%, as seen in Figure 10.

Given many of the factors above driving increasing trade are likely to persist, the OECD still expects global trade growth to remain materially faster than GDP growth, at around 3.5% per annum, implying trade-to-GDP shares increase by around 60% on average compared to present levels.

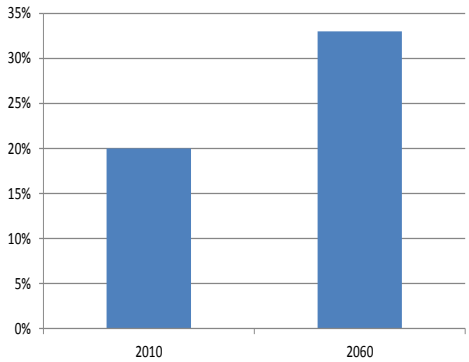
In line with the global experience, New Zealand's historic trade has also risen as a share of GDP. We project this to continue as shown in Figure 11.

Figure 10 Global growth and trade trends

OECD projections of global growth trends



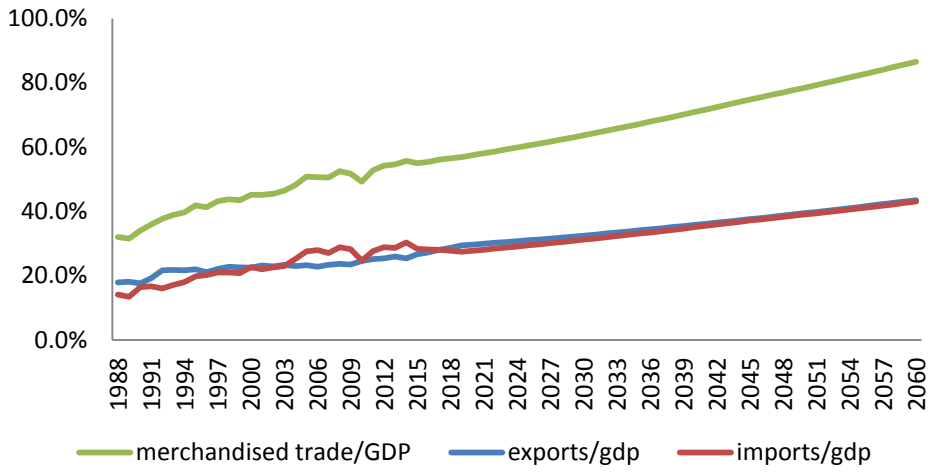
Global exports as a share of global GDP



Source: OECD

[23] See for example Johansson, A. and E. Olaberria (2014) "Global trade and specialisation patterns over the next 50 years", OECD Economic Policy paper No. 10. July 2014.

Figure 11 Historical and projected NZ trade as a share of GDP



Source: Statistics New Zealand, NZIER

A.2.2 Domestic growth context

Around two-thirds of container traffic at POAL is driven by domestic import demand, which over the long term is largely a function of population growth and increase in per-capita incomes. Our assumptions for these drivers of container traffic are shown in Table 7.

New Zealand's population is expected to increase from around 4.5 million to around 6 million by 2060 according to median or "base case" Statistics New Zealand (SNZ) projections. Approximately two-thirds of this increase, or 1 million people, is driven by an assumption that immigration will continue to outstrip emigration by around 12,000 people per annum.[24] We can expect that much of the increase in New Zealand's population will occur in the upper North Island. Auckland in particular will grow given both its pre-eminence as a destination for new immigrants, and its larger Pacifica population share, whose fertility rates are materially higher than non-Pacifica population groups.

Our assumed per-capita income growth of 1.5% per annum is around the rate achieved in New Zealand since the late 1980s, and is consistent with both New Zealand Treasury and OECD long-term expectations. This implies GDP growth in New Zealand of around 2.1% and the Auckland region of around 2.6%.

This, along with the solid global trade outlook, under-pins our trend port container demand growth projections, as next discussed.

24 In the absence of the net migration boost, we would expect New Zealand's population to peak in the 2050s, mildly decline over the 2030s to 2050s, and then stabilise. This pattern is due to the historic transition of fertility rates from the high levels seen in parents of the baby-boom generation to the moderate rates seen today (around 2.1 children per adult couple).

Table 7 Population and GDP projections – 2015-2060

	New Zealand	Auckland region
Base case population growth 2015-2060	0.6%[1]	1.1%[2]
GDP per-capita growth	1.5%[3]	1.5%[3]
NZIER estimate of long-term GDP growth	2.1%	2.6%
	2014	2060
Auckland's population level	1.5 million	2.6 million
Auckland's share of NZ population	33%	43%

Source: 1. Statistics New Zealand median population growth estimate. 2. Based on Statistics NZ median estimate for Auckland to 2031 and NZIER estimate 2031-60. 3. Based on New Zealand Treasury Long-Term Fiscal Model assumptions

A.2.3 Demand outlook

Methodology

We construct total container throughput from:

- a gross weight forecast for imports - under-pinned by the regional growth outlook discussed above
- a gross weight forecast for exports - under-pinned by the global trade growth outlook discussed above
- an assumption that the domestic trade share of throughput over the forecast period is the share observed over the period 2012Q1 to 2014Q2
- an assumption that trans-shipments maintains the same share of throughput over the same period, i.e. the same as 2012Q1 to 2014Q2
- an assumption that the seasonal patterns observed over history will occur going forward.

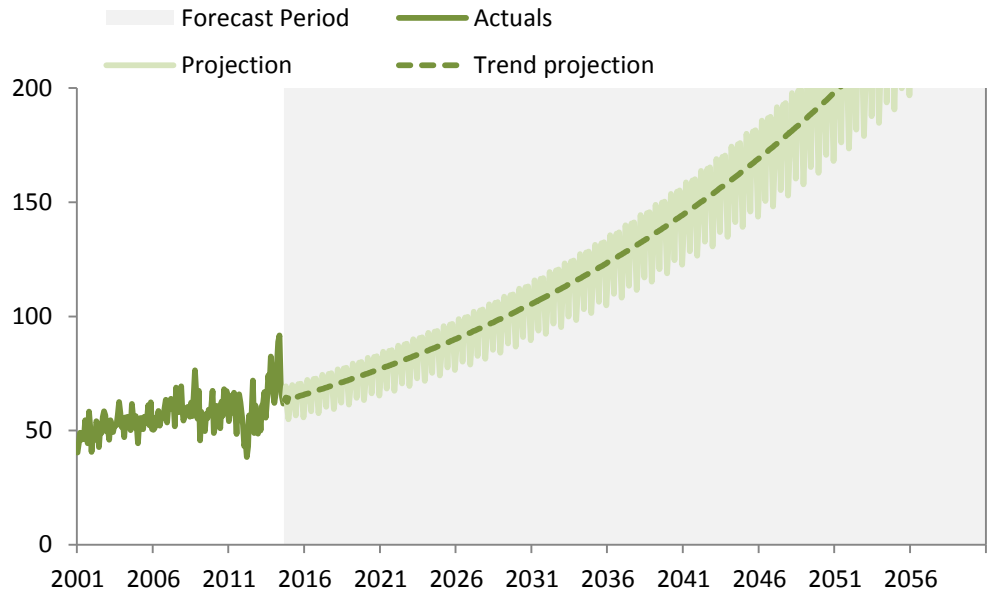
To estimate TEU throughput for the Port of Auckland we use in part a Factor-Augmented VAR model. This uses a broad range of data to capture common trends that drive demand for POAL and for New Zealand as a whole.

Base case results

We expect TEU throughput growth of 3.2% per annum, on average, out to around 2060 as depicted in Figure 12. This is based on export and import growth of around 3.2% per annum. For some particular months, throughput runs around 9% higher than trend. This rate of growth implies the Port of Auckland will process over 2 million TEUs a year by 2030, with imports the largest contributor to demand.

Figure 12 Base case TEU throughput

Port of Auckland, TEU throughput by month (000s)



Source: NZIER

Our projection for TEU growth is stronger than some recent long-term estimates from Fairgray and PwC, despite similar top-down methodological approaches and similar expectations for New Zealand and Auckland's population growth (see Table 8). The main differences are the input assumptions:

- our per-capita income growth assumption, which is in line with the historic data and based on the New Zealand Treasury's long-term modelling, is likely higher
- the extent to which trade as a share of GDP rises may also be stronger.

We provide as a sensitivity test the implication of weaker TEU growth in line with these studies in the following section.

In contrast, our estimates are significantly lower than the shorter-term (15 year ahead) container volume growth expectations we have been able to source for the Port of Tauranga (POT). Some of this stronger growth expectation is due to the Kotahi supply agreement, but it also appears to reflect a stronger growth expectation for upper North Island container demand in general.

Table 8 Container volume forecast comparisons

Provider	Growth rate of container throughput	Time period	Port
NZIER	3.2%	2015-2060	Auckland
Fairgray	2.1-2.6%	2015-2041	Auckland
PwC	2.0-2.5%	2014-2041	Auckland
Deutsche Bank	6.9%	2014-2028	Tauranga
Credit Suisse	3.2 - 7.0%	2014-2028	Tauranga

Source: NZIER

A.3 Capacity growth and constraints

The Port of Auckland's projected terminal capacity of at least 2.0 million TEU by 2044[25] implies an annual capacity increase of 2%. POAL takes into account:

1. **berth capacity** (space for ships) – a function of berth length, berth occupancy and ship exchange productivity[26]
2. **back-up land capacity** for storage and handling[27]
3. outlook for **productivity gains**[28] that lead to increased capacity.

Overall, rather than a hard constraint, container terminal capacity is better regarded as dynamic – it depends on labour productivity, and capital and technology choices. POAL's growth in capacity assumes:

- a range of productivity enhancing measures planned
- the current technology and capital mix, which implies capacity could in principle be expanded further with additional investment
- the Port's current starting maximum capacity is around 20% above present levels at Fergusson Container Terminal (i.e. around 1.05 million TEUs per annum).

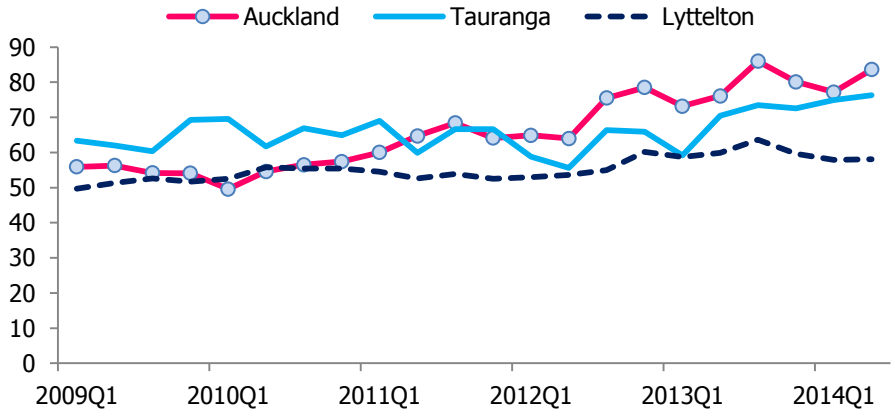
The projected increase in capacity, putting aside factors such as capital investment, depends heavily on continuing productivity improvements.

A.3.1 Recent productivity gains

Between 2009 and today POAL has moved from relatively poor performance, measured by its container labour productivity rate, to top-of-class (see Figure 13).

Figure 13 Container labour productivity 2009Q1-2014Q2

Container movements per labour hour



Source: Ministry of Transport

25 Statement of Evidence of Alistair Graeme Kirk for POAL in relation to topic 005 – RPS Issues. Paragraph 4.32.

26 Number of berths x hours per annum (8760) x berth occupancy (%) x average crane intensity (cranes per vessel) x average crane productivity (moves per hour per crane) = total annual throughput capacity.

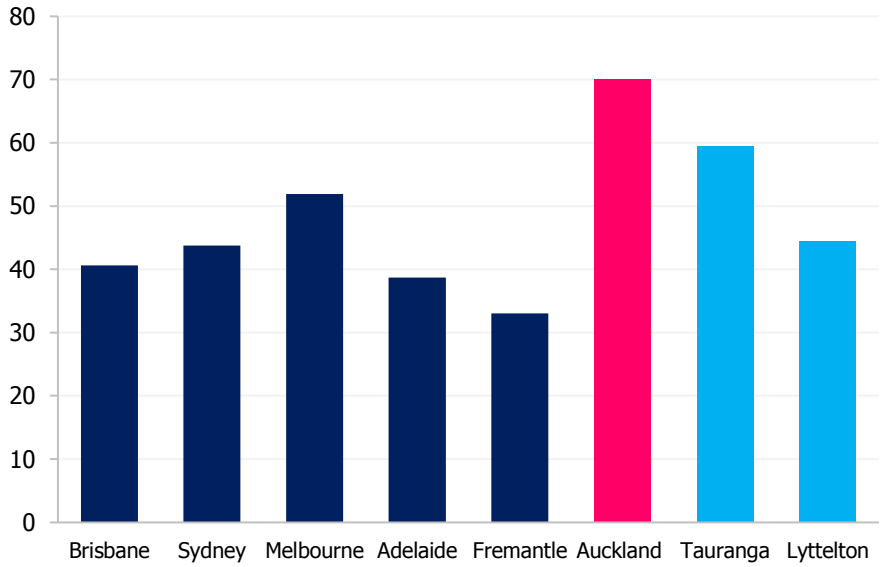
27 Number of ground slots x average stack height x (365/dwell time) = total back-up land capacity.

28 Berth and back-up land capacity depend on the productivity of port operations. Productivity measures include crane rate productivity, container dwell times, container stack heights and labour productivity. Productivity also depends on the mix of capital technologies and labour used – i.e., to what degree operations are automated.

Auckland's labour rate[29] performance during 2013 also compared well against the five largest ports in Australia (see Figure 14).

Figure 14 Benchmarking the labour rate in Australia and New Zealand

Average container movements per labour hour, calendar year 2013



Source: Ministry of Transport 2014a, BITRE 2014 Waterline 54, NZIER

Berth and back-up land capacity depend on the productivity of port operations. So for example, POAL reports that improving labour productivity effectively increased berth capacity at the Terminal by around 300,000 TEU per year. This is equivalent to 34% of total annual terminal throughput.

A consequence of this productivity improvement is that completion of the approved terminal reclamation may proceed more slowly than otherwise planned. Productivity initiatives have also helped reduce berth occupancy from around 67% to 52%, which is now within the 50% to 60% benchmark regarded in the industry as a reasonable berth occupancy (providing flexibility to efficiently service ships without significant delays). The reclamation progressing at Fergusson Container Terminal is planned to add another berth somewhere between 2018 and 2020.

A.3.2 Productivity outlook and expected capacity growth

Productivity growth at the Port has been very strong over recent years, but much weaker in the past. Historic labour productivity growth per container has been close to 2% per annum, although this reflects two very different periods of performance. Labour productivity per container has improved faster over the last seven years compared to the previous seven years. The staff hours per container (the labour rate) decreased by an annual average of 3.7% between 2007 and 2014. It decreased by an annual average of 0.2% between 2000 and 2007.[30]

[29] The labour rate is the number of containers loaded and unloaded from a ship divided by total hours of labour time.

[30] Based on POAL 2011 Interconnect September 2011 and POAL 2014 Annual Review 2014.

Most of POAL's improvement on container rate movement per hour occurred between 2012 and 2014 (see Table 9), seeing POAL catch up and pass POT and Lyttelton (see Figure 13).

Table 9 Labour productivity improvements

Growth in container movements per labour hour

Port	2009Q1-2014Q2	2012Q2-2014Q4
Auckland	43%	30%
Tauranga	22%	30%
Lyttelton	11%	3%

Source: Ministry of Transport 2014a, NZIER

These operational improvements have made POAL the most productive of the ports in Australasia. This leading position, and the fact that recent gains flowed from major restructuring, suggest future productivity will move at a more modest pace than the recent past, perhaps in line with the longer-term productivity growth rate of 2% per annum that the Port has achieved.

A.3.3 Expanding capacity beyond 2 million TEU

There is potential for further productivity gains through, for example, increased automation, stacking containers higher and improved logistics management through the supply chain as inland ports develop. In a future world where full containers are stacked 6 high (rather than 2 – 3 high as is the case presently), there is potential to maybe expand total capacity to 4 million TEU. This would require container volumes to justify the capital investment.

The text box below provides further discussion on inland ports and how they are likely to impact POAL, while in the following section implications of uncertainty around capacity limits are considered. We do not consider inland ports to have a material impact on capacity. POAL already has a very low container dwell time of 2 days, which compares to 3 – 5 days for OECD ports. In theory, a close by inland port can act as a capacity buffer, but in practice POAL can price its yard space to minimise dwell times, and exporters and importers can store containers elsewhere (either an inland port or in their own yards).

Box 1 Implications of inland ports

Inland ports (or inter-modal terminals) are of growing significance in the supply chain management of New Zealand shipping freight. Freight that comes into a sea port is transferred to an inland port by road or rail. Freight is then either processed and distributed to end users, or warehoused for future dispatch. Inland ports may also consolidate New Zealand produced goods for export, or process and consolidate in-bound sea freight for transhipment to other ports. The latter may be a particular benefit in the upper North Island, given the imbalance between export and import cargoes at the Port of Auckland and POT.

In the upper North Island the POAL's Wiri Inland Port processes and distributes in-bound containers, and consolidates standard container freight for export. It mainly acts as a consolidation point for freight where longer-term dwell times are not a significant commercial concern. In comparison Fonterra's facility at Te Rapa is mainly a consolidation point for its dairy exports, whilst POT's Metro Port facility acts as a shorter-term consolidation point for exports and imports through the Port of Tauranga.

Inland ports generally improve the efficiency of managing container and other freight traffic flows, which ultimately may increase export and imports flows. Container transfer time and handling space may also be reduced by transferring functions to inland sites. It is difficult to know how much their potential to ease capacity constraints may be offset by increased container traffic flows, but overall the development of inland ports also likely benefits POAL – more freight is processed through the Port with less delay than would otherwise be the case.

Distribution of freight may also be made more efficient by, for example, siting an inland port close to major road and rail routes terminating at the sea port (for example, Tainui Group Holdings proposed Ruakura inland port is situated near road and rail links to POAL facilities and POT). This potentially reduces the amount of time freight is held up in congested arterial roads.

It is beyond the scope of this report to consider the critical location, freight cost and service competiveness factors that matter for the commercial success of inland ports. We note, however, that scale is clearly an important consideration in this and that the development of large scale inland port processing and warehousing facilities potentially also frees up industrial and warehousing space in the Auckland isthmus (and Mount Maunganui) for other, potentially more valuable, land usages.

A.4 Sensitivity analysis

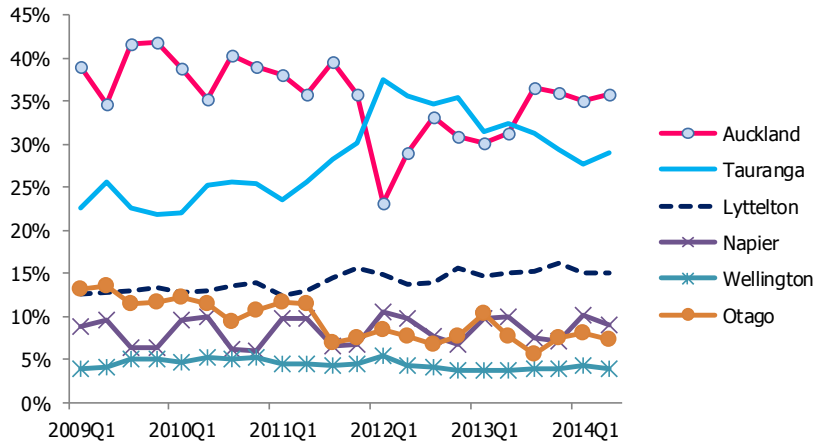
We assess sensitivity of our base case projection to scenarios of up and downside demand and capacity risks. The key finding of these scenarios is that the timing of potential constraints is highly sensitive to alternative growth assumptions.

1. Weaker demand growth due to competitive pressures

This scenario is motivated by the potential for POAL to lose market share to POT. Auckland has the largest share of the market of containers among the 6 ports shown in Figure 15. As at the end of the second quarter 2014, Auckland performed 36% of total container movements. Tauranga was next, with 29% of the market. Combined together Auckland and Tauranga handle 65% of the New Zealand import/export container market.

Figure 15 Container market share per quarter

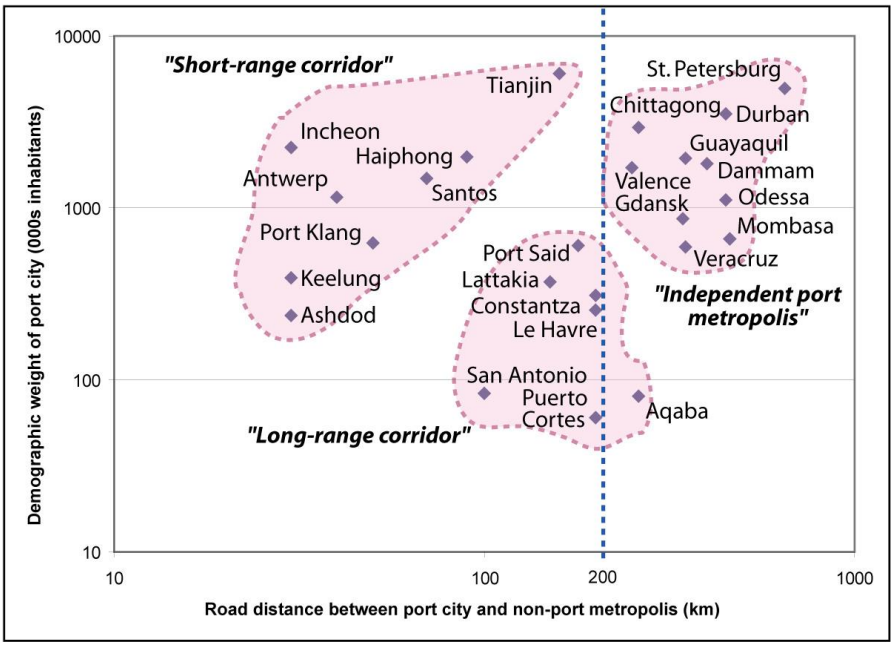
Containers (000s)



Source: Ministry of Transport 2014a

From a top-down level, while there is no doubt that the Port has the key advantage of being close to Auckland's large domestic market, international comparisons suggest that the Port of Tauranga (located approximately 200kms from Auckland) is close enough to also be a potential supplier of imports to the Auckland region. As seen in Figure 16, it is around the same distance as that from the busy port of Le Havre in Normandy to Paris.

Figure 16 Distance of ports from major urban areas



Source: OECD, Regional Development Working Paper 2011/07

Also mattering for competition is the composition of trade. To provide an indication, Table 10 summarises the top 7 imports by value for the Port of Auckland and POT. There is considerable overlap, in machinery, plastics, electrical goods and paper, and as such these markets (27% of POAL's imports) are probably quite contestable.

In contrast, we think vehicles, fuels, animal feed and fertilisers are probably much less contestable given the requirement for local supply chains or supporting infrastructure. Amongst these items, vehicles are probably the more contestable over a medium-term horizon, given that the marginal cost of shifting vehicles from Tauranga to Auckland is not prohibitive.[31] However, significant investment in expansion of the vehicle transporter fleet and changes in POT facilities, such as paving and maybe berth extensions, would be required to make this possible. While plausible over the longer term POT cannot immediately substitute for POAL's role in vehicle imports.

Table 10 POAL and POT import profiles

Top 7 commodities; 2013; Import value (CIF)

Commodity	POAL share	Commodity	POT share
Vehicles	23%	Fuels	9%
Machinery	12%	Machinery	9%
Electrical goods	7%	Animal feed	7%
Plastics	5%	Plastics	5%
Paper	3%	Electrical goods	4%
Iron & steel prod.	2%	Paper	4%
Furniture	2%	Fertilisers	3%

Source: NZIER, Statistics New Zealand

2. Weaker demand growth due to uncertainty

We also motivate weaker demand growth by uncertainty around key inputs into our trend demand growth assumptions. As discussed above, other consultants using a similar demand forecasting framework arrive at materially weaker long–term demand growth rates, given different views on trade growth. We show the implication of taking a long-term demand growth profile in line with their assumptions.

3. Stronger demand growth due to global conditions

The OECD projections for world growth and trade, and by implication our projections for New Zealand's trend trade growth, are made on the basis of present trade policies. They do not, for example, take into account the potential trade gains from the TPP trade-pact under negotiation, or from improvements in the efficiency levels of ports that New Zealand trades with.[32]

The OECD forecasts also do not entertain rapid growth in global trade that could occur should countries with large populations such as India and Indonesia embark on more ambitious reform programs. Finally, in addition to the global trend, we can

[31] The standard rack rate to transport a single vehicle is around $260 (GST inclusive) from Auckland City to Tauranga; significant discounts could be negotiated for a buyer moving large volumes of vehicles and for firms located in the South of Auckland.

[32] One OECD study found that doubling the port efficiency of two countries boosts their bilateral trade by around 30 per cent. See OECD Regional Development Working Paper 2013/13.

expect New Zealand's trade to be positively impacted by the centre of global trade continuing to shift from the Atlantic to the Pacific. China has of course been the driver of this change in global trade patterns over the past decade or so, but going forward other countries with large populations such as India, Indonesia, The Philippines and Vietnam could become at least as large an influence.

As discussed in the text box in the section above, we also think that the development of inland ports in the upper North Island is likely to be positive for demand growth given that it enables better supply chain management and export and import volumes. There is also potential for POAL to regain market share in exports from POT (particularly dairy) over the longer term as the Kotahi ten-year freight agreement comes to an end. Finally, a factor we don't consider to be as important for demand growth (positive or negative) is the influence of shipping (see Box 2).

Box 2 Influence of the shipping industry

Relative to Australia, the US and many parts of Asia, New Zealand is served by fewer shipping companies, market share is more concentrated, and capacity sharing arrangements are more common. This has led at times to perceptions that the ports and New Zealand's export and importers face competitive threats and high prices from the shipping companies. However, studies by the Productivity Commission and NZIER have not found evidence of this in fact occurring. This is because the global shipping industry is also highly competitive. Moves by one company to raise prices or reduce service levels would be met by other companies coming into the market.

The competitiveness of the global shipping industry in part reflects the fact that it has an enduring over-capacity problem, something that is set to continue as ultra-large container ships continue to enter commission over the next few years, whilst there are many decades of life left in the smaller vessels that service New Zealand waters (see "The hidden opportunity in container shipping", McKinsey, November 2014).

Shipping industry economics favour scale – large ships are more profitable for shipping companies than smaller given lower fuel, operating, port and capital costs per unit of cargo. The development of larger and larger ships historically has led to port consolidation in New Zealand and globally.

A logical extension of the trend to larger ships is that the upper North Island will evolve to a single or two hub configuration, with other ports acting as feeders or spokes. Arguably POT has increased the chances of this occurrence given their ability to handle larger vessels (6,500 TEUs compared with traditional 4,500 TEUs), and the Kotahi arrangement which secures export supply with the Maersk shipping line over the next decade to August 2024.

There are several reasons to discount the likelihood of a single hub export and import hub emerging. First is the requirement to fill the larger ships with cargo. Fonterra, Silver Fern Farms and the other suppliers in the Kotahi arrangement collectively manage the volume required, but it is not obvious that other export alliances could be of similar scale. Second, the Port of Auckland is still the natural location for an import hub, and it has the ability to handle the (lighter) larger import laden vessels at high tide. Relatively minor dredging could make this all tide. Third, as above, the shipping industry has a poor record of rationalising its capacity. Finally, the development of inland ports potentially facilitates increasing trans-shipments. This is very attractive to shipping companies (they make more money than they otherwise would have on the arrival or return leg) and on the margin favours moderate ship sizes which are easier to fill.

4. Weaker and stronger capacity motivated by uncertainty

POAL's projected terminal capacity of at least 2 million TEU by 2044 and implied productivity growth rate of around 2% per annum assumes ongoing incremental productivity improvements using existing technologies. Given the strong period of recent capacity performances, and the fact technology is not fixed, there is upside risk that capacity can grow at a faster pace, and that the 2 million TEU limit can be

pushed-out. We evaluate a 2.5% per annum capacity growth rate with a terminal capacity limit of 4 million TEUs.

On the other hand, some of the capacity developments are not fully within POAL's control and we note that our productivity growth assumption is higher than total economy measures (e.g. The Treasury assumes 1.5% for New Zealand over the long run). As such a scenario of weaker capacity growth is also considered.

A.5 Scenario results

Table 11 quantifies our growth assumptions for these scenarios. Note we consider the implications of weaker and stronger capacity for the three alternative demand growth scenarios. This is seen in Table 12 which presents the point at which a capacity limit is reached taking into consideration peak seasonal demand patterns.

Our sensitivity analysis suggests that the capacity constraints could be reached by the middle of the next decade, or as far out as the 2100s. This very wide range reflects the fact that there is considerable uncertainty around the long-term growth assumptions, and "small" differences in these assumptions cumulate to very large TEU level differences over a long-term horizon and hence the timing of when capacity constraints are reached.

Table 11 Scenario growth assumptions

Scenarios	Growth assumed
1. Weaker demand growth due to loss of market share	2.9% p.a. demand growth, -0.3% less than base case
2. Weaker demand growth due to alternative input assumptions	2.3% p.a. growth, -0.9% less than base case
3. Stronger demand growth due to better world conditions	3.7% p.a. growth, 0.5% higher than base case
4. Alternative capacity growth	-/+ 0.5% around base case growth of 2%

Source: NZIER

We think the balance of risks probably lie to the constraint occurring sooner rather than later given the stronger than forecast historic demand growth trends and our view that the OECD external demand forecasts are likely quite conservative. We suggest that a "least regrets" approach to managing this uncertainty would be to plan for capacity constraints occurring sooner rather than later.

Table 12 Key sensitivities: year capacity reached

Scenario	Capacity increase 1.5% p.a. and 2 million TEU limit	**Base case 2% p.a. capacity increase (2 million TEU)**	Capacity increase 2.5% p.a. and 4 million TEU limit
Base case estimate	2028	**2035**	2078
Higher global demand and population growth (TEU growth 0.5% p.a. higher)	2024	2028	2037
Loss of market share to Port of Tauranga (TEU growth 0.3% p.a. lower)	2031	2041	+2100

Source: NZIER

Appendix B Capacity of multi-cargo wharves

Unlike the Fergusson Container Terminal, the capacity of the multi-cargo wharves is difficult to assess/optimise primarily due to the non-homogenous nature of the cargo. This Appendix assesses the existing pressures and identifies key constraints to provide guidance on whether future demand can be accommodated without any further reclamation.

We find that the multi-cargo wharves are dominated by imports which are experiencing rapid growth. The key constraints we have identified are the need for longer berths to service larger ships and more wharf space to manage cargo, in particular temporary vehicle storage. Capacity pressures would become unmanageable if POAL was to give up the use of Captain Cook and Marsden wharves, as envisaged by the plans for the central wharves, without somehow offsetting this loss of wharf space.

B.1 Considerations for assessing wharf capacity

General principles and considerations which guide capacity requirements are outlined below.

Berth length and spacing

The total berth length for a port is a function of the number of berths and the length of each berth. However, consideration also needs to be given to the combination/layout of each berth as this can impact on the flexibility of the operations at the port. For instance, limited spacing between berths can potentially restrict the use of a berth when an adjacent berth is being used. Furthermore, the limited number of 'long' berths also limits the ability to process multiple large ships simultaneously, thereby reducing the flexibility of the multi-cargo wharves.

Back-up land (temporary storage) capacity

Back-up land capacity is a function of area available, stack height, and dwell time. Whilst stack height is in turn a function of stacking capability (plant) and peak (loading/discharging) factors, in the case of multi-cargo, it is also limited by the cargo's ability to be stacked (i.e. not all cargo can be stacked to similar heights/or even at all). Therefore, the combination of various cargo types also limits the extent of stacking, and therefore impacts on the available back-up land capacity.

Berth occupancy

Berth occupancy is defined as the percent of time a berth is occupied. It is understood that 55-65% is considered as the upper limit for practical berth occupancy. However, it is noted, that this efficiency range might not be practical for

the Port of Auckland which has a sub-optimal 'finger wharf' configuration with limited back-up land and short berth lengths.

Peak requirements

Different types of cargo have different loading/discharging requirements as well as dwell times. Cargo with small loading/discharging times and/or long dwell times can result in higher peak requirements in the multi-cargo terminal. So for example vehicles are discharged rapidly and take between 2 to 3 days dwell time to process, whereas cement can be pumped from ships directly into storage towers off the wharf.

In order to handle peaking requirements, sufficient back-up land is required to ensure that loading/discharging of goods remains unconstrained. As such, the combination of loading/discharging requirements and dwell times as well as the availability of back-up land impact on the time required to prepare a berth for the next ship.

Other considerations

Other considerations which impact on berth capacity for multi-cargo operations include the equipment, buildings, processes and labour efficiencies at the Port. However, the primary issue which forms the basis of this report is whether reclamation will be required. As such, the findings of this Appendix will focus on aspects of the multi-cargo wharves that are related to reclamation (i.e. the need for further expansion), irrespective of whether efficiency gains can/cannot be made with respect to these other considerations.

B.2 Import/export overview

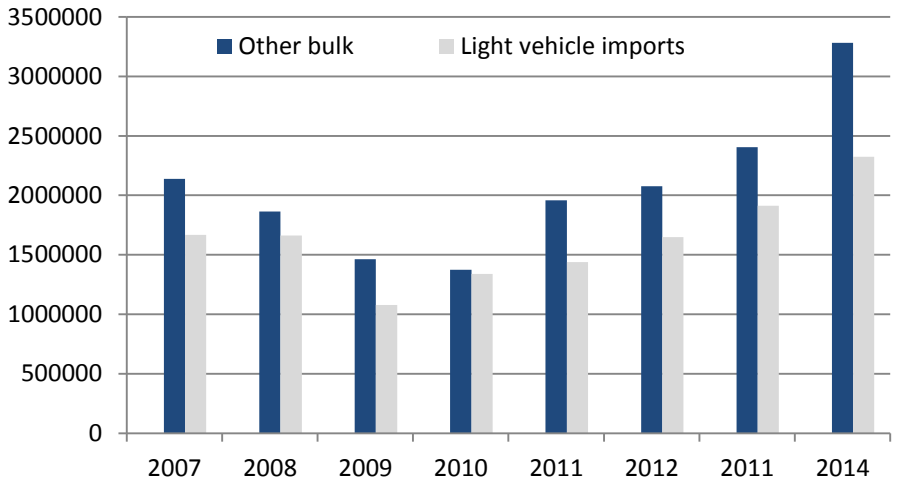
The multi-cargo wharves handled over 5.6 million freight tonnes[33] of non-containerised cargo in 2013/14 (including over 207,000 vehicles), an increase of 29% over the previous financial year. This was 47% above the peak of 3.8 million freight tonnes recorded in 2006/07 prior to the recession.[34] This rapid increase in freight shown in Figure 17 is putting pressure on wharf capacity.

[33] A freight tonne is the greater of the weight in kilograms or the volume in m^3 of the goods.

[34] Data provided by POAL.

Figure 17 Total throughput (exports and imports)

Freight tonnes for financial years ending June



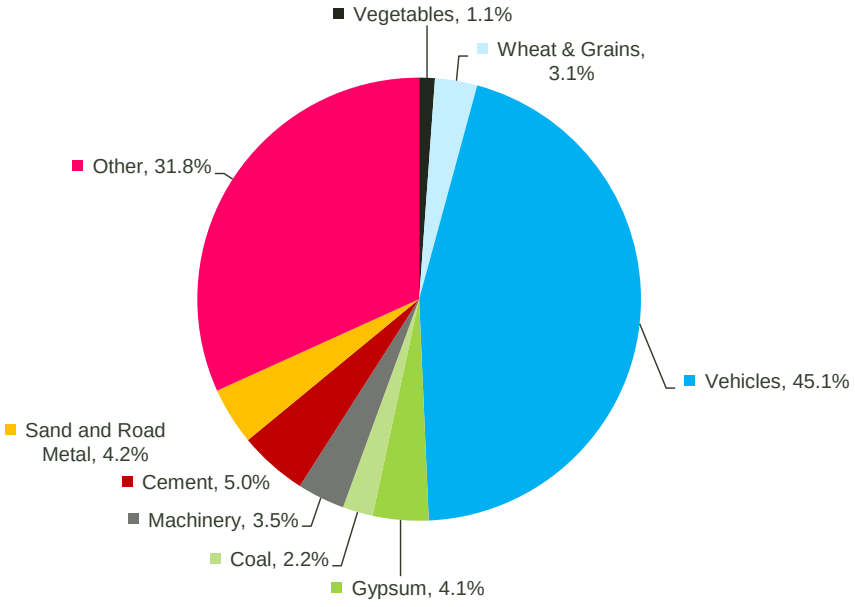
Source: POAL, NZIER analysis

The effect of the global financial crisis on the productivity of the multi-cargo terminal is evident with both the amount of vehicles and breakbulk reaching its lowest levels in 2008 and 2009. Since then, rapid growth has been experienced for the tonnage of light vehicles and breakbulk handled at the Port, with 2014 recording the highest tonnage for both.

Between the financial years of 2006 and 2013, cement, sand, gypsum, machinery and coal were the most imported cargo products (in freight tonnes) in that order (excluding vehicles). Vehicles were by far the most important cargo, accounting for 45% of imports (See Figure 18). To put that in perspective, there were approximately nine times more vehicles (which have increased dwell times as explained previously) in terms of freight tonnes of goods compared to the next highest product (cement).

Figure 18 Multi-cargo wharves' imports

Freight tonnes for 7 year period from June 2006/07 to June 2013/14



Source: POAL

The vast majority of the general cargo operations manage imports. Import weights outnumber export weights by a ratio of 10:1. Putting aside the issue of vehicle imports which are driven both national and local demand, the diversity in cargo demand appears to be driven by Auckland's growth. So for example, there has been consistent growth in bulk vegetables, grains, sand and aggregates.

Quarries have progressively closed in and around Auckland and road transport is expensive. The cost of aggregate typically doubles in price after the first 30km of cartage.[35] As such, it is reasonable to assume that it is increasingly desirable to satisfy some demand for sand and aggregate in Auckland through local trade at the Port rather than use of the inland road network.

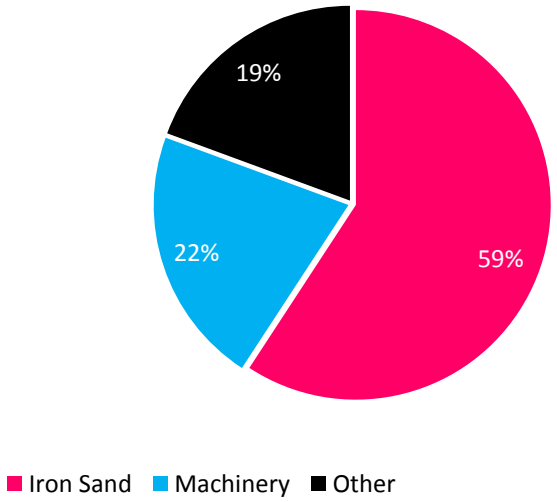
Exports

Between the financial years of 2006 and 2013, iron sand was by far the most exported product from the multi-cargo wharves, followed by machinery. All other exports were relatively small in comparison. Iron sand exports only started in 2011 and have grown to dominate exports (see Figure 19).

[35] Source: NZIER, 2013, Construction industry study: implications for cost escalation in road building, maintenance and operation.

Figure 19 Total exports June 2006 to June 2014

Freight tonnes for 7 year period ending 30 June 2006/07 to June 2013/14



Source: POAL, Aurecon and NZIER analysis

B.3 Port operational improvements

A number of incremental improvement initiatives have already been implemented to improve the efficiency of multi-cargo facilities

Since 1988, buildings on land immediately south of Jellicoe, Freyberg and Bledisloe wharves (previously leased) were demolished and paved to increase the available back-up area for multi-cargo facilities. Furthermore, areas adjacent to the multi-cargo berths have also been cleared and paved to increase the available back-up area.

A number of public roads have been secured/closed off and incorporated into the Port operational area. As part of this, Quay Street was also purchased and realigned to the south to increase the area available for the operational use of the multi-cargo facilities.

The multi-cargo operations were consolidated into a single area (with more flexible work practices and yard layouts) as part of the Port restructure after previously being fragmented across the Port. Recently, a more efficient truck grid has also been put in place which allows for an increase in capacity while minimising the overall footprint.

B.4 Sources of capacity pressures and key constraints

Future risk of continued overflow from the Fergusson Container Terminal

Appendix A provides projections of demand or throughput at the Fergusson Container Terminal. In the worst case scenario, the terminal could potentially reach full capacity by 2024. The multi-cargo Bledisloe Wharf handles around 10% of

containers, and there risk that rapid container growth could put more pressure on this wharf.

Legacy issues limit operating efficiency

Port of Auckland is a city port which has grown hand-in-hand with the community and was officially established in the 1840s. Therefore, the Port's layout at the western end (i.e. the multi-cargo wharves, which include Captain Cook, Marsden, Bledisloe and Jellicoe wharves) is largely a remnant of a different shipping era where ships were generally smaller and had the ability to fit at shorter wharves and in relatively narrow basins.

The shipping era in which these narrower 'finger wharves' were built involved long loading/unloading times for cargo (as operations then weren't as technically advanced as they are today). Today, modern, larger ships are designed to load/discharge cargo very rapidly and this activity requires wider back-up areas to service these rapid peaks and troughs in cargo movement.

Table 13 shows how unfavourably POAL's back-up capacity compares to Northport and the Port of Tauranga. POAL has only 25% of the back-up area per metre of berth length of the other ports.

Table 13 Comparison of back-up storage to berth length

Port	Back-up area (m^2)	Berth length (m)	Ratio of wharf area (m^2) per metre of berth length
Northport	340,000	570	596
Port of Tauranga	1,120,000	2,055	545
Ports of Auckland	290,000	2,000	145

Source: NZIER, POAL data and PwC (2012b)

There is also increased pressure on existing infrastructure (including the reduction in available berth lengths – see second bullet below) which has impacted on multi-cargo operations:

- Golden Bay Cement moved their operation site from Wynyard Quarter to the Port as part of the revitalisation of the Auckland Waterfront in 2010[36]
- Queens Wharf was purchased in 2009 for public/community related activities (for instance the Rugby World Cup Event in 2011) by the New Zealand Government and Auckland Regional Council. This resulted in a loss of approximately 600m of berth length and 30,000 m^2 area.[37]

Finally we note a 'finger wharf' layout is difficult use efficiently as the relatively narrow wharves have limited available back-up land, making it more vulnerable to peak capacity issues that lead to having to shift cargo between wharves.

Potentially, multi-cargo berth capacity can be measured by assessing berth occupancy. Generally, a berth occupancy of 55 to 65% is considered to be the maximum potential capacity for conventional multi-cargo berth configurations which have continuous berth lengths and associated back-up areas (such as can be found at the Port of Tauranga and Northport). However, the Port of Auckland has an old

[36] Source: Golden Bay Cement Relocation to the Eastern Port Questions and Answers for Port Neighbours – POAL.

[37] Source: http://www.queens-wharf.co.nz/queens-wharf/history/ date retrieved 27 November 2014.

'finger wharf' configuration which is likely to have been a contributing factor for the sub-par berth occupancy of 30% as stated in the PwC report (2012b). As such, it is not considered to be a relevant measure of the multi-cargo berth operation in this case.

Larger ships put pressure on berth availability

While there has been a steady increase in cargo processed at the Port, the number of ships visiting has dropped from 1,808 in 2004 to 1,463 in the 2012/13 financial year, a reduction of 22%. Larger and longer ships require longer berths and more space between berths for tugs to operate.

Prior to June 2006, the largest cruise ships arriving at the Port were 294m long. However, since then, five out of the last eight financial years have recorded visits by cruise ships of up to 345m in length which suggests a trend towards the arrival of larger cruise ships. An increase in the number of larger cruise ships berthing on Queens Wharf (east) is limiting the use of Captain Cook Wharf (west) due to constraints from the wider beams of these vessels, which limit simultaneously berthing at this location; this is effectively a loss of 250m of berth on Captain Cook Wharf (west) in this scenario.

Multi-cargo ships such as vehicle ships, container ships and bulk carriers are also getting longer and wider. For instance, multi-cargo container ships previously were 140m in length (900 TEUs) but are now up to 200m in length (2000 TEUs).

Consequences of larger ships on cargo operations and safety

It is expected that that the additional cargo which is transferred to/from these larger ships results in increased peak requirements for transit storage (larger loads of cargo to/from the larger ships during each visit). This is especially true for ships carrying imported vehicles which require temporary storage for processing on the wharf.

These larger ships are also taller (in addition to being longer and wider) and therefore will generally have a greater windage. It is understood that this can potentially require tugs to minimise the safety risks associated with the greater windage, where ships overhang the berth length, making fastening of the ship to the wharf more challenging. As such, they require wider basins to safely manoeuvre to/from the port as well as longer wharf structures.

POAL also suggest that there is a potential trend for new larger ships (with deeper drafts) to displace other sizeable ships (which have shallower drafts) from the northern hemisphere to less established markets such as New Zealand and Australia. This could potentially require deepening of existing berths, approaches and parts of the navigation channel of the Port of Auckland.

Larger ships are also seeing rationalisation of cement transport and relocation of storage facilities

Holcim Cement is expected to relocate their cement import facility from the Port of Onehunga to the Port of Auckland, more specifically the Jellicoe Wharf. It is understood that this consolidation of operations is driven by the use of larger ships (up to 30,000 tonnes) that require longer and deeper berths.

As such, POAL expects the occupancy of the western side of the Jellicoe Wharf to increase significantly in the next couple of years once this facility has been relocated. As part of this, it is noted that Holcim Cement intends to replace the local production

at the company's Westport cement plant with imported cement, once the import terminal at the Port of Auckland (and another terminal at Timaru) are fully operational.[38] This is likely to result in increased shipments at the multi-cargo wharves in the future.

B.4.1 Peak capacity constraints

Like road congestion, the use of wharf space can become congested when large volumes of goods are rapidly discharged from larger ships. The primary peaking requirement with respect to vehicles imports is when large vehicle carrier ships rapidly discharge vehicles spreading them out across wharf space for inspection and processing, which requires an adequate back-up area for optimal efficiency.

The use of wharf space for temporary vehicle storage is driven not only by quarantine inspection requirements, but also by inspection processes of vehicle importers and vehicle transporters. While options have been investigated to address this problem (vehicle stackers and buildings), no feasible solution has been found to date.

POAL has around seven days a month where near full temporary vehicle storage capacity constraints are being approached.

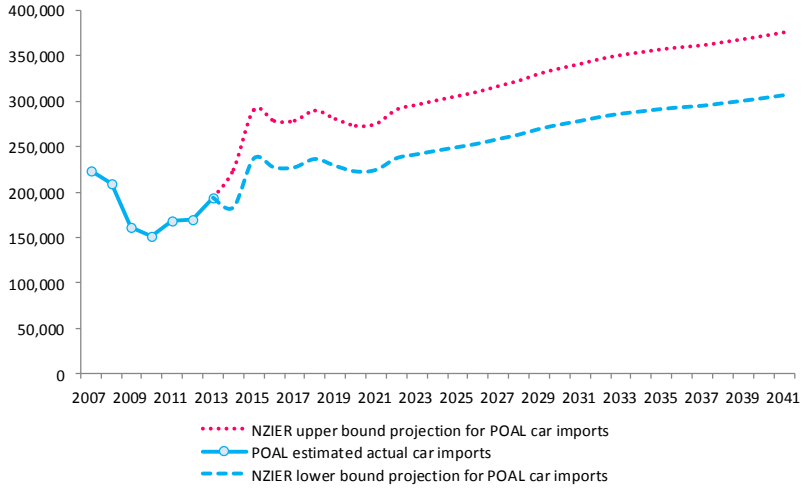
The peak carrying capacity constraint of the multi-cargo wharves is shaped by vehicle imports and these will become more frequent

Vehicle imports have grown rapidly since 2010. Growth has been supported by the replacement of ageing vehicles that some people deferred in the recession and a high exchange rate. Vehicle imports have already exceeded the forecast for 2041 made in the PwC upper North Island port study (2012b). They are projected to increase by between 19 and 46% by 2025 and continue to grow over our forecast period with ups and downs reflecting natural replacement cycles in the vehicle fleet (see Figure 5).

The upper bound projection in Figure 20 assumes POAL maintains its current market share and the lower bound assumes its average market share since 2007. Vehicle imports are heavily concentrated in POAL (up to 90% of vehicle imports). This reflects the fact that Auckland is New Zealand's major market and the focal point of vehicle wholesaling, refurbishment and distribution. This is unlikely to change in the foreseeable future.

[38] Source: http://www.stuff.co.nz/business/industries/9522997/Holcim-picks-Auckland-and-Timaru date retrieved 27 November 2014.

Figure 20 Light vehicle import forecasts (calendar years)



Source: NZIER, POAL, Ministry of Transport, 2014b

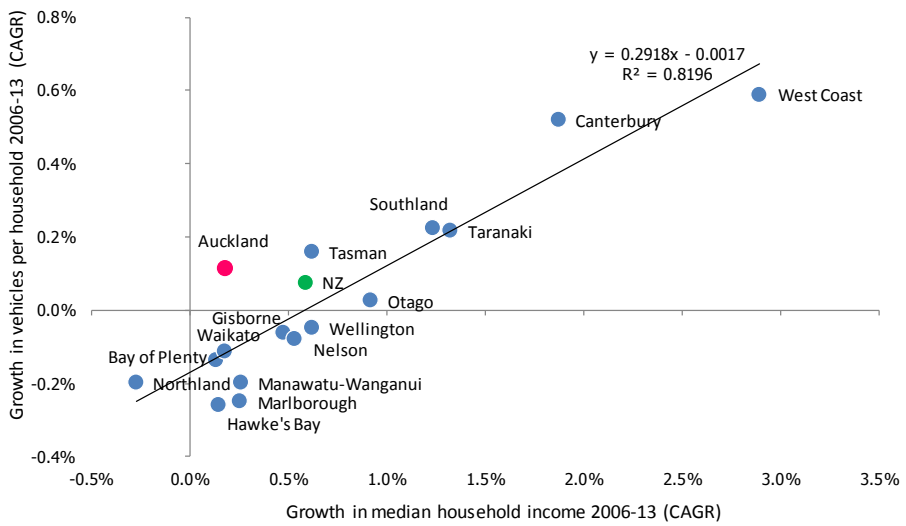
The econometric model used to create our forecast takes into account:

- the ageing of the light vehicle fleet, including scrapping or retirement of vehicles
- population growth, including taking into account net migration
- the propensity of different age cohorts to purchase vehicles (revealed preferences of households)
- the effect of increasing incomes as gross domestic product grows
- city density and public transport use (these can reduce car use, and potentially car ownership in some instances).

Vehicles per household increased 0.1% per annum between 2006 and 2013, despite a very sluggish economy and medium household income growth of only 0.6%.

Figure 21 Growth of car ownership and medium household incomes

Compound average growth rates (CAGR)



Source: Statistics New Zealand, NZIER

Redevelopment of the central wharves area (Princes, Queens, Captain Cook and Marsden wharves)

Pressure on Port of Auckland's footprint is driven not only by increasing trade volumes, but also by the need to accommodate increasing demand for the use of the central wharves adjacent to Port of Auckland's general cargo wharf (Bledisloe) for cruise ships. Cruise ships are getting larger and cannot always be accommodated in the central wharves. Occasionally Jellicoe Wharf is used by cruise ships.

The City Centre Integration Group proposed solution involves the extension of Captain Cook Wharf, the demolition of Marsden Wharf and the possible extension of Bledisloe Wharf to manage port cargo that previously used Captain Cook and Marsden wharves. This involves the Port reclaiming up to 5.3ha and opening to the public between 2.5ha and 3.1ha (depending on whether or not Marsden Wharf is demolished).

It is highly unlikely that the Port could continue to manage current multi-cargo volumes with the loss of Captain Cook Wharf, as it is often used for temporary vehicle storage.

B.5 Conclusion

Identifying the timing of capacity constraints is difficult to accurately determine, given the nature of bulk cargo and its interaction with the Port. The Port has inherited a legacy wharf design that limits it ability to operate multi-cargo operations efficiently. Given the growth in ship size and projections for vehicle imports, as well as other breakbulk commodities growing, the multi-cargo wharves will become progressively more constrained over next five to ten years. If the Port loses the use of Captain Cook Wharf, immediate action by way of reclamation or some other means of adding space would be required to manage present volumes of multi-cargoes.

Appendix C Transport links

This Appendix considers the projected Ports of Auckland Limited (POAL) growth and the ability of the surrounding land transport infrastructure to cope with the increasing throughput. The distribution of TEUs is the main focus of this assessment, however the effect of the growth of vehicle imports, bulk and breakbulk is also examined.

Bulk, breakbulk cargo and vehicles leave the Port via truck. Import and export TEUs are distributed from the Port by truck or by train. Of the 968,741 TEUs moved through the Port in the 13/14 financial year, 69,585 of these were moved by rail.[39] This equates to a transport distribution mode share of approximately 7% of TEUs moved by rail and 72% moved by road on trucks, with the remaining 21% trans-shipped internally. POAL has recently increased the number of rail services to and from the Port, and estimates that the annualised rail volume is now around 120,000 TEUs per year, or 12% of container throughput.

We find there is no significant transport capacity constraints caused by port expansion or that are likely to constrain port expansion.

The road network has capacity for Port-associated traffic growth

At present, POAL indicates that there are approximately 2,250 Port-associated truck movements per day on average (2500 per week day). As each truck visit accounts for two truck movements, the 2,250 truck movements account for only 1,125 trucks. This figure has recently decreased as the volume of TEUs transported by rail has increased. POAL estimates that approximately 80% of this freight enters or leaves the Port via Grafton Gully. From Grafton Gully the majority of freight is distributed along the Southern Motorway with the remainder using the Northern and North-Western Motorways.

The connection from the Port, along The Strand and Stanley Street to the commencement of SH16 at Grafton Gully is considered a bottleneck for freight as it services the highest volume of Port-associated trucks. This section of road has an annual average daily traffic volume (AADT) of 44,500 vehicles, with 7.9% of these heavy commercial vehicles.[40] The potential capacity constraint is continued growth in background traffic rather than increases exclusively in heavy vehicles coming from the Port. As a result, it is likely that even with growth in Port traffic, the actual proportion of POAL-associated traffic using Grafton Gully will not change significantly.

The City East West Transport Study, endorsed/adopted by Auckland Transport sets the preferred direction for traffic in the CBD (see Figure 22). This includes maximising the use of the state highway network as an alternative to through travel through the city centre. This will increase the proportion of non-Port-related traffic using Grafton Gully in the future.

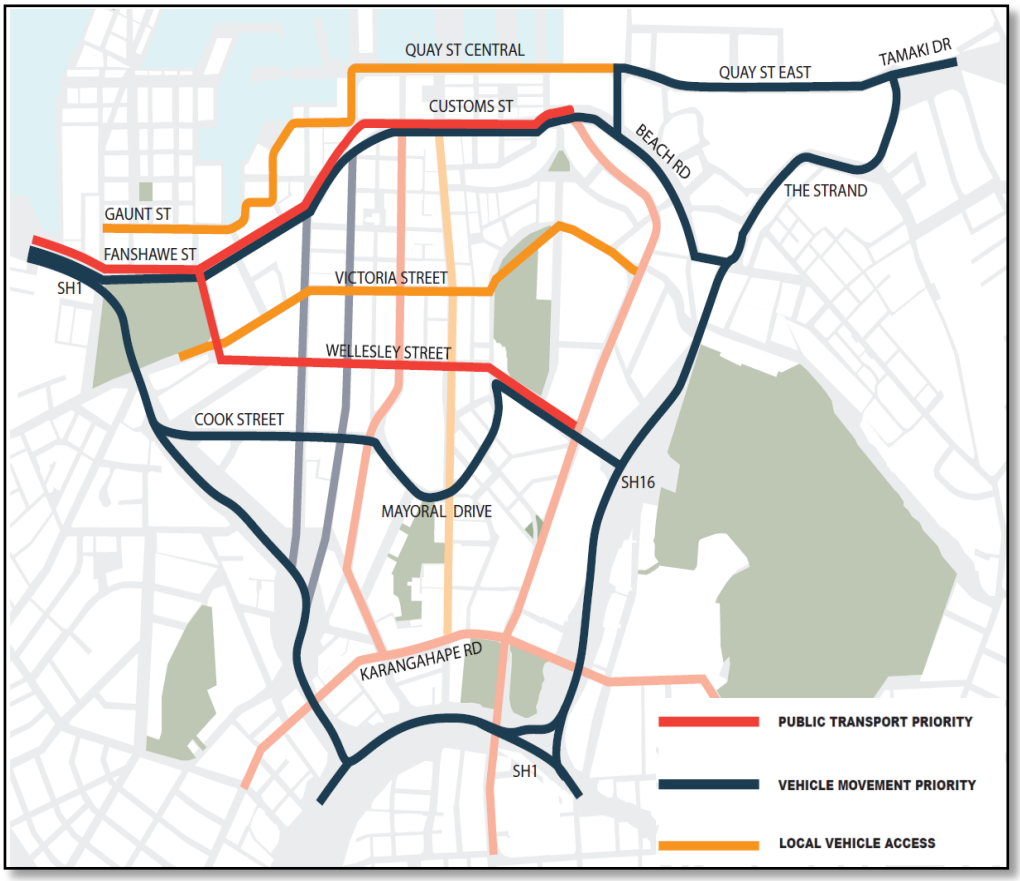
[39] Ports of Auckland Limited 2014 Annual Review.

[40] NZTA State Highway Traffic Volumes, 2013.

The potential redevelopment of the western end of Quay Street involves reducing traffic (perhaps by restricting vehicles to local traffic only) and encouraging the use of active modes of transport. The likely effect of such measures is an increase in the general traffic volumes using Tangihua Street, The Strand and hence Grafton Gully. This level of background traffic is likely to erode journey time reliability through The Strand and Stanley Street at SH16 for Port-related freight traffic. We understand that NZTA and Auckland Transport are considering the need for increased capacity between the Port and SH16 Grafton Gully through investigations such as the East Waterfront Access Study.

Trucks currently operate with an average of 1.9 TEUs[41] per truck, however POAL indicate that with more certainty around TEU weights and a better ability to mix and match truck loads, this is likely to increase to 2.5 TEUs per truck in the future. As a consequence, truck movements would decrease by around 20% (all else equal).

Figure 22 Planned priority vehicle movement network



Source: City East West Transport Study, Aurecon 2014

Shifting greater volumes by the rail network is feasible

POAL estimates there are currently 25 rail services operating per week to and from the Port. Of these services, approximately 16 are shuttle services operating each way between the Port of Auckland and Wiri Inland Port. Each train is made up of 50ft

[41] Source – Upper North Island Strategic Alliance Report, PWC, 2012, Auckland East Waterfront Access Study.

wagons and can carry two TEUs, therefore leaving a 10ft un-occupied space per wagon. Each train can carry up to 112 TEUs; however they currently operate at around 70-80% capacity carrying an average of 88 TEUs in each direction.

POAL have confirmed an ambition to run up to 56 freight trains per week between Wiri Inland Port and the Port of Auckland – handling approximately 6,300 TEUs per week. Assuming no seasonal fluctuation, this would account for the throughput of approximately 327,600 TEUs per year. This could be increased if 60ft wagons were utilised, thereby allowing more efficient transport of 3 TEUs per wagon without wasted space.

Further rail capacity improvements are being investigated

A longer term aim is to have up to 30% of freight from the Port carried by rail. The potential conflict between passenger and freight movements on the rail network in the future will be a challenge. Options are available to increase capacity as mentioned above, including physical infrastructure improvements to the rail network and changes in the way freight services operate between the Port and Wiri Inland Port. Possible capacity improvements may include, for example, a shorter, more frequent (possibly hybrid) train service. Infrastructure improvements may include minor changes to network signalling and to the internal rail network including the length of sidings at both POAL ports and the inland facility. These kinds of options are being investigated by Auckland Transport, KiwiRail and POAL.

If the passenger network becomes a constraint on the operation of the Port, POAL has the ability to respond through efficiency improvements such as using shorter, faster trains during peak periods and longer, slower trains off-peak, as well as increasing the efficiency and capacity of the wagons.

C.1 Existing TEU transport situation

Of the 968,741 TEUs moved through the Port of Auckland in the 2013-2014 period, approximately 7% of these were moved by rail, 72% by truck and 21% were trans-shipped (see Table 14).

Table 14 2014 TEU movements by transport mode

2014 TEUs	Rail	Truck	Trans-shipped
968,741	69,585	695,720	203,436
	7%	72%	21%

Source: Aurecon, POAL

The number of trucks required to transport this 695,720 TEU throughput is approximately 370,000. Assuming each truck only transports TEUs in one direction, this equates to an average of 2,250 truck movements per day or 2,500 per week-day. Of these around 1,600 – 1,700 trucks are associated with the Container Terminal and the remaining 500 - 600 are truck movements associated with the transportation of bulk, breakbulk and vehicles.

Assuming each train operates at 75% capacity, the total number of trains used for transporting containers was 828, equating to approximately 15 rail services per week.

C.2 Future TEU scenarios

C.2.1 Status quo

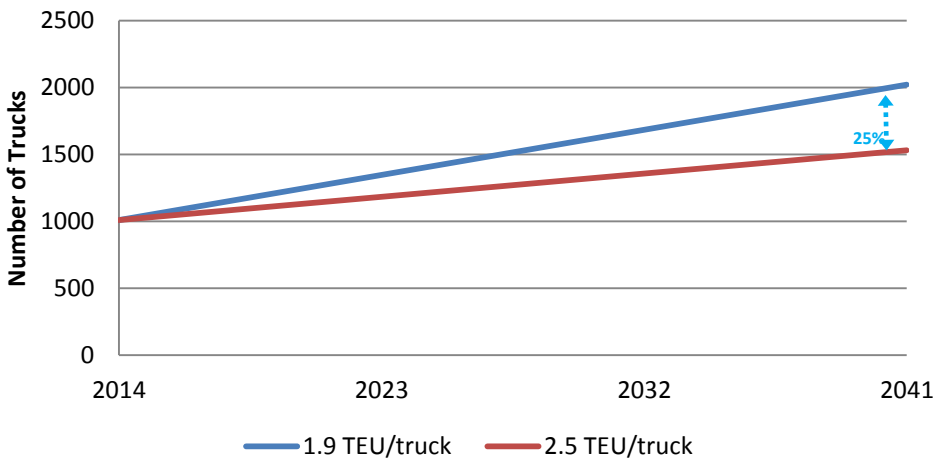
The 'status quo' scenario results in all TEU growth being absorbed by the road network, with the number of trains servicing the Port remaining constant at 16 per week in each direction (32 in total). This assumes that each service operates fully utilised moving 112 TEUs in each direction and that the proportion of trans-shipped containers remains at 21%. Under this scenario the volume of TEUs transported by truck in 2041 will increase by 100% (see Table 15).

Table 15 Status quo growth forecast

Estimate	2041 TEUs	Rail	Truck (% increase)	Trans-shipped
POAL	2,000,000	186,368	1,393,632 (100%)	420,000

In terms of truck traffic, there would be another 370,000 Port-associated trucks entering and leaving the Port each year assuming 1.9 TEUs per truck is maintained. This equates to an additional 1,010 trucks per day, as shown in Figure 23.

Figure 23 Container Terminal daily truck traffic volumes



Source: Aurecon

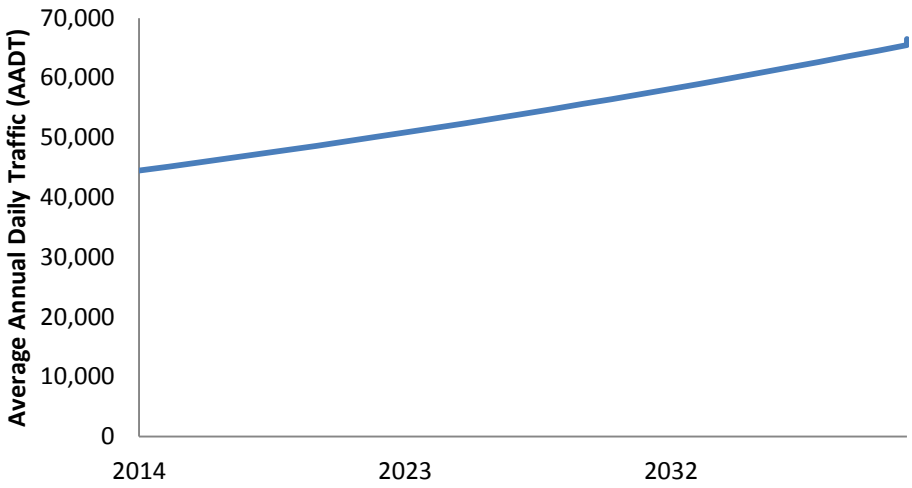
However if the average TEUs per truck increases from 1.9 to 2.5, there would only be an additional 190,000 trucks required in 2041, equating to another 520 Container Terminal trucks per day. This improved productivity would reduce the number of daily Container Terminal-associated trucks by almost 25%. This saving can be improved further if each truck transports TEUs both to and from the Port.

The road network could absorb TEU growth if rail capacity is not increased

This increase in POAL container truck volumes over the next 27 years may have an impact on congestion of the road network. However the significant growth in general

traffic over this period, shown in Figure 24, is more likely to generate increases in congestion which may affect the reliability and accessibility of Port-related traffic. In this Figure the projected general traffic growth is based on a 1.5% yearly increase[42] which is in accordance with the actual growth that has occurred over the last 10 years.

Figure 24 Projected daily Stanley Street traffic growth



Source: Aurecon

The proportion of TEUs transported by truck is the highest in this scenario of all the future scenarios modelled, yet even so, the additional number of trucks required is not significant. As a result, the daily increase in TEU trucks alone is unlikely to result in increased congestion through Grafton Gully.

C.2.2 Rail volumes of 56 trains per week

If the throughput of trains was to increase up to 56 per week in each direction, there would still be an increase in the volume of TEUs transported by trucks, however this would only increase by 33% as shown in Table 16. This assumes that each train service operates fully utilised moving 112 TEUs in each direction and that the proportion of trans-shipped containers remains at 21%.

Table 16 56 trains per week forecast

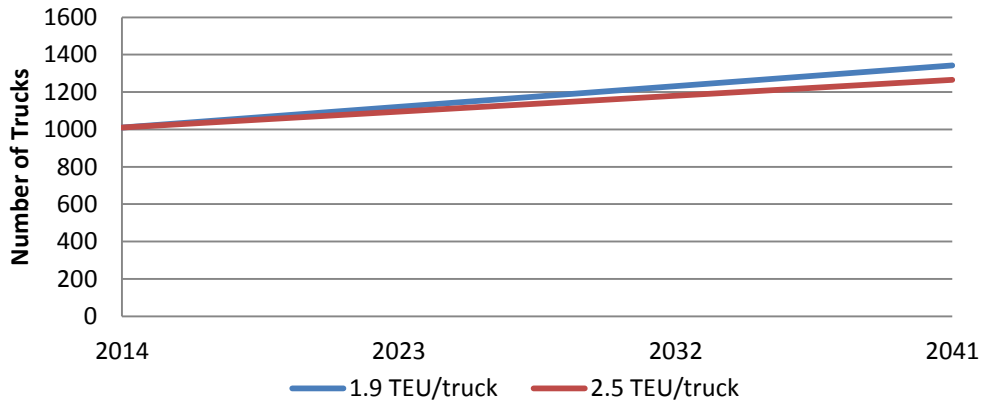
2041 TEUs	Rail	Truck (% increase)	Trans-shipped
2,000,000	652,288	927,712 (33%)	420,000

In terms of truck traffic, there would be another 122,000 POAL-associated trucks entering and leaving the Port each year, assuming 1.9 TEUs per truck is maintained. This equates to an additional 334 trucks per day.

[42] Source – Economic Evaluation Manual, NZTA, 2010

However if the average TEUs per truck increases to 2.5, there would only be an additional 93,000 trucks per year required by 2041, equating to 255 extra trucks per day. In 2041 these trucks will make up only 3.8% of the daily traffic through Grafton Gully. The effect of these different truck sizes on daily volumes is shown in Figure 25.

Figure 25 Container Terminal daily truck traffic



Source: Aurecon

Improving the TEU capacity per truck, in this scenario, has a lesser impact and would only reduce the number of daily container terminal trips associated with trucks by 6%. The POAL target to increase rail throughput to 30% over the next 5-10 years would be achieved for the transport distribution of TEUs under this scenario.

C.3 Vehicle import projections

The remaining daily POAL-associated truck trips that cannot be attributed to TEU distribution are likely to be generated by bulk and breakbulk cargo. As vehicles make up around half of this bulk volume, the majority of the remaining trucks may be attributed to vehicle transporters.

Light vehicle transporters can carry a varying number of vehicles depending on their size and the size of the imported fleet. In the 2013/14 financial year, 207,591 vehicles were imported through the Port of Auckland, which equates to an average of 569 vehicles per day, ignoring the effects of seasonal fluctuations. For the purposes of this report, we estimate that each vehicle transporter can carry on average 5 light vehicles.

Forecast growth patterns suggest that in 2041 the number of vehicles imported per year will equal approximately 341,000, based on a medium growth scenario. This equates to an additional 70 trucks per day assuming the average number of vehicles transported by each truck remains constant. While this is a 65% increase from the existing daily number of vehicle transporters, they account for a small proportion of daily truck movements discussed in the above scenarios.

C.4 Conclusion

The effects of POAL's forecast growth may have an impact on the road and rail networks. However, the expected growth of general traffic and passenger train services are likely to be a more significant cause of any congestion.

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