CONFIDENTIAL

Future of New Zealand's vehicle supply chain

The role of the Ports of Auckland

NZIER report to Auckland Council Investments Limited

7th September 2017

About NZIER

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NZIER is also known for its long-established Quarterly Survey of Business Opinion and Quarterly Predictions.

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Each year NZIER devotes resources to undertake and make freely available economic research and thinking aimed at promoting a better understanding of New Zealand's important economic challenges.

NZIER was established in 1958.

Authorship

This paper was prepared at NZIER by Laurence Kubiak, Nick Allison and Killian Destremau.

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The assistance of John Yeabsley, Peter Clough and Sarah Spring of NZIER, and of Geoff Lewis of the Productivity Commission is gratefully acknowledged.

Summary

Auckland Council Investments Ltd (ACIL) has asked NZIER to evaluate the costs and benefits of moving the vehicle import operations, which currently take place at Ports of Auckland's Limited (POAL's) port in downtown Auckland, to another location.

Background

Large and increasing numbers of vehicles are landed at the Auckland port, but the yard space devoted to it (mainly Bledisloe, Captain Cook and Marsden wharves) is limited. At present, the yard space devoted to vehicles is congested for five or six days a month, a phenomenon which will only intensify as the volume of imported vehicles grows. Minimising the time that vehicles spend on the wharves is a commercial and operational imperative for the Port, and the constrained yard space and associated berth space has knock-on effects for other port operations, including berth availability for cruise vessels.

To alleviate these pressures, the POAL plans to invest in a vehicle processing building which will manage current vehicle imports more efficiently and provide the additional capacity required to service growth. This development will necessitate an extension to Bledisloe Wharf and the vehicle processing building will include mixed use spaces.

Current operations

Auckland is currently the port of entry for more than two-thirds of New Zealand's vehicle imports (76% of light vehicles and 68% of heavy vehicles). Auckland is also the largest market for light vehicles, making up 37% of national demand, while nearby Waikato accounts for a further 9% of national demand. Thus, 61% of the light vehicles landed at Auckland are destined to be used ether in Auckland or the Waikato.

Effects of current operations

The Port of Auckland occupies a prime site in Auckland's CDB. Whether port operations are the best use of the land is a widely-debated issue in Auckland: redevelopment as stadium or pleasure centre (shops, restaurants, entertainment venues) are frequently cited as preferable alternatives. It is in this context that Auckland's mayor, Phil Goff has asked Auckland Council Investment Limited (ACIL) to:

> *Investigate, with the Ports and any other relevant parties, how the adverse impacts of motor vehicles stored on the wharves can be reduced or eliminated*

This is the reason why we have been commissioned to undertake this analysis.

Economic context

The total value of light vehicle imports was $4.8 billion in 2016 (December year), which was about 9% of New Zealand's total imports. The supply chain processes and related compliance activities to ready vehicles for the New Zealand market is therefore one of the most important in our economy. Our overall competitiveness partly relies on the efficiency of the vehicle import supply chain.

The World Economic Forum ranks New Zealand's overall competitiveness, based on several indicators, 13th in the world. For the 2nd pillar, infrastructure, a basic requirement, we ranked 27th. The survey of executives as part of the review by the World Economic Forum reveals that the supply of infrastructure is one of the main hindrances to New Zealand improving its competitiveness.

New Zealand's overall competitiveness, the provision of infrastructure and the efficiency of the vehicle supply chain are intimately linked. New Zealand does not currently fare well in the adequate provision of infrastructure or in the overall efficiency of its supply chain relative to other developed nations.

New Zealand is a small economy, far from the rest of the world. Openness to trade and competitiveness on the world stage is one of the key engines of the New Zealand economy. The efficiency of our logistics supply chain exerts an important effect on our overall economic performance.

Alternative

There is an alternative to making the current operations more efficient, and that is to move the vehicle handling facilities to another location.

Two possible alternatives to Auckland are: Northport (Whangarei) and the Port of Tauranga. Northport and Port of Tauranga are the only ports in proximity to Ports of Auckland likely to be able to cope with the volume of vehicle imports processed at Ports of Auckland today and in the future, although significant infrastructure investments would be required to allow the scale of operations at Auckland to move to either port.

We have not considered the alternative of a new port catering just for vehicles being established somewhere closer to the current port. Nor have we considered the option of relocating all the Port's cargo operations (containers and breakbulk) to an existing or new port facilities.[1]

[1] These options were considered in the Port Future Study.

Figure 1 Possible alternative locations

Source:

All vehicles or just cars?

Ships bringing vehicles to New Zealand carry both light and heavy vehicles.

The cost of importing heavy vehicles, particularly to cart heavy vehicles across New Zealand, is significantly above that of light vehicles on a per vehicle basis. The trucking requirements as well as the demands on infrastructure, would be significant. The heavy vehicle supply chain, given the much wider range of vehicle type and size, is more complex and would require significant investment.

In a typical shipment from Europe, cars are about 84% of the number of cargo items carried by the ship, but heavy vehicles/breakbulk was 42% of the volume. This heavy/breakbulk volume does not conform to a standard shape or size and is often difficult to transport long distances by land.

We have investigated the costs of moving all vehicle importation operations out of Auckland, as this is required to free up all the land current used to handle vehicle imports at the Port. We note, however, that it is the cost of transporting heavy vehicles to their intended use that is a major driver of the costs of the alternatives.

The research question

The question confronting ACIL is: does either of these options present a better means of managing adverse amenity impacts than POAL continuing to invest in its vehicle processing capability at Auckland's downtown port?

Framing the issues

NZIER has used a national welfare analysis framework to evaluate the alternatives. Using this framework, we calculate the costs and the benefits of moving the vehicle import operation to another port and establish from a national perspective (i.e. we take an NZ Inc perspective) a net result for each alternative.

The trade-off a cost-benefit analysis needs to weigh is

- the economic costs (transport and infrastructure) and social costs (fatalities, injuries, emissions) to divert vehicle imports from Ports of Auckland to Northport or Port of Tauranga, versus
- the amenity, largely visual, benefits of the change of Ports of Auckland's land use from vehicle handling to another use (other than port operations).

We have not attempted to specify the alternative use that would realise the benefits that would justify diverting vehicle imports to another port. Instead we have calculated the value that the change of land use would need to realise for such diversion to be justified.

We therefore estimate the total economic and social costs of diverting the vehicle imports, and then back calculate from this value that would need to be placed on the visual amenity benefits to compensate for these costs. This sets the hurdle that any alternative use would need to pass for the alternative use to improve national welfare.

Cost Benefit Components

We have set out the cost-benefit components in Table 1. The first column sets out the problem statement: a 'Do Nothing' scenario in which POAL does not continue to invest in vehicle processing activities. This is unlikely to be a practical option in the medium term as under this scenario the current problems will continue to grow and no benefits are delivered.

Table 1 The problem and the associated national cost benefit components

<Subheading>

Problem statement: Do Nothing	Base case: Investing in POAL's vehicle terminal development	Alternatives to the base case: Northport and Port of Tauranga
Over the next 5-10 years, peak congestion at the Port will increase significantly from 6 days a month to perhaps double this	Bledisloe wharf development of a vehicle processing building, with associated mixed use spaces Investment provides POAL with extra capacity to avoid	12.5 hectares of POAL land available for an alternative and perhaps higher value use Adverse amenity impacts are eliminated at Auckland. Possible adverse amenity

Additional costs and waiting times for ships, road transport operators and final vehicle customers Wharf configuration constrains options for mooring cruise ships If costs become too high for importers some vehicle imports might be shifted to other ports Local adverse amenity effects grow (more vehicles visible to the public held for longer on the wharf) Continued public concern and political questions as to whether vehicle imports is the highest value use of the land	wharf congestion problems and to efficiently manage increasing vehicle volumes Screening to mitigate visual impacts of vehicles moving across wharves. Depending on location aspect; not all activity would be screened and hence some Port operations are still visible. For example, visitors to Queens Wharf would see vehicles on Bledisloe	impacts at Northport or Tauranga Substantially increased cartage costs as vehicles are transported to the Auckland market from either Whangarei or Tauranga Significant volume of trucks required for cartage Associated with cartage: increased emissions, accidents, and traffic delays where trucks platoon in traffic Auckland congestion avoided Costs passed onto final vehicle consumer

Source: NZIER

The second column sets out the base case for the cost benefit analysis: POAL's planned response to the problem statemen, an investment which is assumed to have a financial benefit-cost ratio equal to or greater than 1, relative to column 1. This option generates some amenity benefits while maintaining the per vehicle cartage cost constant as future vehicle imports are handled at Ports of Auckland rather than Northport or Port of Tauranga. In a previous study (NZIER, 2015a) NZIER established that the connection from the port to Grafton Gully (the most constrained element in the surrounding transport infrastructure) has an annual average daily traffic volume (AADT) of 44,500 vehicles. Of these, only 7.9% are heavy commercial vehicles, not all of which will relate to port activities.

The incremental costs and benefits of moving vehicle imports to an alternative port – Tauranga or Whangarei – are listed in the third column. This would involve a major change to the supply chain.

It follows that it is the effect on the vehicle supply chain that needs to be considered when evaluating alternative ports to Auckland. At present, cartage, storage, inventory management, vehicle modification and other processing activities for vehicles destined for the North Island are concentrated in the Auckland region, close to the landing point. Some of these costs will change if the port of entry alters, and these cost changes are primary drivers of the cost benefit analysis result.

Other costs include building new port infrastructure in Tauranga or Whangarei to manage vehicle imports, upgrading transport infrastructure, and increased emissions and road accidents.

While there are real costs to the economy of shifting vehicle imports to another port, there are also benefits. POAL land previously used for processing vehicles could be made available for alternative uses and concerns about the adverse visual amenity of vehicles on the waterfront would be addressed.

Structure of the analysis

Our study takes as its starting point the future national demand for vehicle imports; considering known demand drivers such as the advent of electric vehicles. We then examine the supply chain which connects vehicles landed at the port with consumers in New Zealand, asking which costs would change if Northport or Tauranga were to become the North Island import port for vehicles. We then back calculate the visual amenity benefits required to make up for the estimated total economic and social costs as well as the amenity benefits which are captured by the uplift in the value of Ports of Auckland's land (which is only a subset of the total visual amenity benefits).

The scenarios investigated

The POAL investment scenario assumes that the Port of Auckland continues to operate within its current footprint, but invests in the vehicle terminal to increase throughput, screens some of the vehicles from the public view and thus mitigates some of the adverse amenity impacts.

The Northport and Tauranga scenarios assume POAL progressively exits the vehicle import market completely over seven years, allowing time for the acquisition of an expanded fleet of vehicle transporters and expanded facilities (berth and yard space construction) at these ports to be carted back to Auckland (if the vehicle is ultimately destined to Gisborne for example), those gains are currently possible and the supply chain has not reallocated to allow for these benefits to be accrued.

It is efficient for these services to be located where they are best able to accommodate the bulk delivery of vehicles, and as close as possible to the customer. Most vehicles would need to be carted back to Auckland anyway, creating significant additional transport and infrastructure costs to the economy.

Accordingly, our modelling assumption in the cost benefit analysis is that the vehicle supply chain remains in Auckland. We have not estimated the costs of moving parts of the supply chain to other locations.

Economic costs of alternative use of port land

The transport costs from the Port of Auckland to processing, wholesale and retail activities in Auckland (largely in the Penrose/Mount Wellington and Wiri/Drury areas of Auckland) are lower than the transport costs from Northport or Port of Tauranga to the Auckland market because the distances involved are much shorter. Thus, the journey time from alternative ports will be longer and fewer journeys will be able to be made in the day. Sustaining the flow of imported cars to Auckland will therefore require a significant increase in the trucking fleet to cart vehicles from other ports to Auckland.

The increase in vehicle prices from increased transport costs will ultimately be passed on to the consumer. This will lead to a decrease in vehicle imports over time and an ageing of the fleet. The increase in the truck kilometres travelled (13-17 million kms/year), will in turn increase the number of road crashes, injuries, deaths, and CO2 emissions. We have quantified these costs.

Our cost estimates are conservative. We have estimated a small demand response to the increase in the price of vehicles, as increased supply chain costs are passed on to buyers (assuming a very inelastic long run demand curve).

The value of alternative uses of POAL land does not materially offset the costs of moving vehicle imports to another port

The benefits that could offset the economic, environment and social costs of shifting vehicle imports to another port, are difficult to assess because they depend on:

- The precise form of the alternative land use, which is at present unknown, – Options include public spaces, residential, office, mixed uses, and the development of public facilities such as stadia
- The ability of POAL to unbundle the 12.5 hectares for vehicle imports from other general cargo and trans-shipment operations
- How the release of land is staged over time and conditions in the property market at the time of sale
- Whether the tenure is freehold (if politically achievable) or leasehold
- Extent to which the wharf and breastwork structures can be developed
- The impact of the neighbouring port operations on the desirability of the land, particularly as the port operates 24/7
- Public reaction and planning regulation to any proposed development, in particular the number of open spaces and the height of buildings that may be acceptable to the community.

The market value of the land

Two estimates of alternative POAL have been undertaken in recent years. Both these estimates covered the entire POAL site, not just the land used for vehicle imports. In 2013 CBRE Limited, engaged by POAL, estimated an alternative use value of between $300 to $600 million. A report commissioned from JLL for the EY consultants' report to the Port Future Study (2016) estimated a total value of just over $1.0 billion. Both reports followed a similar methodology of working back from a future notional development, and benchmarking CBD property values, to estimate their land values.

Why such a large difference in the estimated values?

EY assumed a total developable area of the land of 46%, which was significantly lower than CBRE's 56%, but EY assumed a gross floor area 32% higher than CBRE – a significantly higher site density and more property to place on the market.

Whether a higher density can be achieved depends on planning rules. CBRE assume relevant planning policies and height rules are similar to the waterside developments of the Wynyard Quarter and the Viaduct Harbour sites, whereas EYs benchmark is not defined. A fraught public dialogue over appropriate planning rules for any development on POAL's vacated land could be expected. If the Wellington CBD waterfront redevelopment history is a relevant benchmark, even the building heights CBRE assumed might be hard to achieve. Our tentative conclusion is that the EY estimate is likely to be towards the upper end of the market value that might be achieved.

The economic value of the land

From a national CBA perspective, we are interested in the *change* of the economic value of the land today, if it was put into another use. The change in the economic value is the difference between its value today (asset in POAL's accounts based on its earnings as part of the vehicle import process), in its current use, and its value in an alternative use. This is the "uplift" in its economic value; once the 12.5 hectares of land is re-zoned and transferred to its higher value use.

For estimating the CBA uplift value, we have chosen to use the EY estimate. We do not endorse this assessment, but it is independent of POAL's estimate, and has been accepted by the Auckland Council as the reference point for future work on port development. This estimate enables us to test whether the higher estimated value of an alternative land use would provide a material benefit stream for offsetting the economic, social and environment costs of the alternative port scenarios.

Using EY's estimate we get an economic gain of $115 million today for the 12.5 hectares used for vehicle imports. This does not provide material offsetting benefits to the national costs of moving vehicle imports to another port.

Amenity and environmental benefits were not estimated – they must make up the remaining difference to total estimated costs

We have not estimated the value of external benefits to people who no longer view vehicles on the waterfront. Rather we infer the value that New Zealanders and Aucklanders would need to place on the change in land use to justify the diversion of vehicle imports away from Ports of Auckland.

It is difficult to unbundle and value amenity benefits and costs for the POAL's proposed development in the absence of a masterplan. What we can say is that benefits will principally be visual amenity benefits, as follows:

- There will now be office like buildings on Quay Street frontage adjacent to the Bledsoe Wharf. We assume these will be designed to fit with the existing local urban landscape
- There would be some additional screening of wharf activities from viewpoints such as Queen's wharf, however the Bledsoe extension would make more wharf visible to visitors on Queen's Wharf
- The change in visual amenity from the water or viewed from the North Shore would be negligible. Residents of the North Shore will continue to see port activities largely as they were before the POAL investment, although some of the vehicle import activities will be screened from view by the vehicle processing building.

A useful framework within which to consider these issues is to assess the degree to which the environment is modified and the sensitivity of the changes – how many people are affected and to what degree? This presents a useful way of considering these questions.

The main groups of people who are impacted by the visual amenity are residents and workers who can see the vehicle import operations from two vantage points: the eastern part of the North Shore of Auckland (Northcote to Devonport), the area

surrounding the port (Quay Street, the wharves, and certain high rise buildings in the CBD), and travellers to and from these locations.

Table 2 indicates that these people will enjoy at best a moderately beneficial impact from any improvement in visual amenity caused by moving vehicle activities to another port.

Table 2 Sensitivity and scope of visual amenity impacts

		Sensitivity			
Degree of Modification		**National sensitivity**	**Regional sensitivity**	**Local sensitivity**	**Neighbourhood sensitivity**
	Considerable reduction	Very high adverse	High adverse	Moderate adverse	Minor adverse
	Noticeable reduction	High	Moderate adverse	Minor	Negligible
	No perceived change	Negligible	Negligible	Negligible	Negligible
	Noticeable improvement	High beneficial	Moderate beneficial	Minor beneficial	Negligible
	Considerable improvement	Very high beneficial	High beneficial	Moderate beneficial	Minor beneficial

Source: Based on UK Landscape Institute Guidelines 2013

Unquantified national welfare costs and benefits

We have not quantified a number of costs and benefits because they are unlikely to be material or because the data is such that it would have been difficult to produce a robust estimation within the scope of the project. These main items are:

- Environmental and amenity impacts of development and expansion of facilities at Tauranga and Northport to manage the import vehicles and associated heavy freight
- Social impacts from noise and community severance caused by an increase in vehicle transport truck volumes on roads
- Commuting time delays on arising from the platooning of large loaded trucks on route from the alternative ports to Auckland
- Management of high and heavy loads (e.g. cartage of oversize loads) that require escort services for safety and substantially slow traffic
- Dynamic productivity loses associated with the reconfiguration of the vehicle supply and higher costs that will have knock-on effects in a wide range of industries dependent on transport equipment and particularly at Northport and Port of Tauranga themselves
- Ageing of the vehicle fleet as people respond to higher vehicle prices by holding vehicles longer incurring higher maintenance costs.

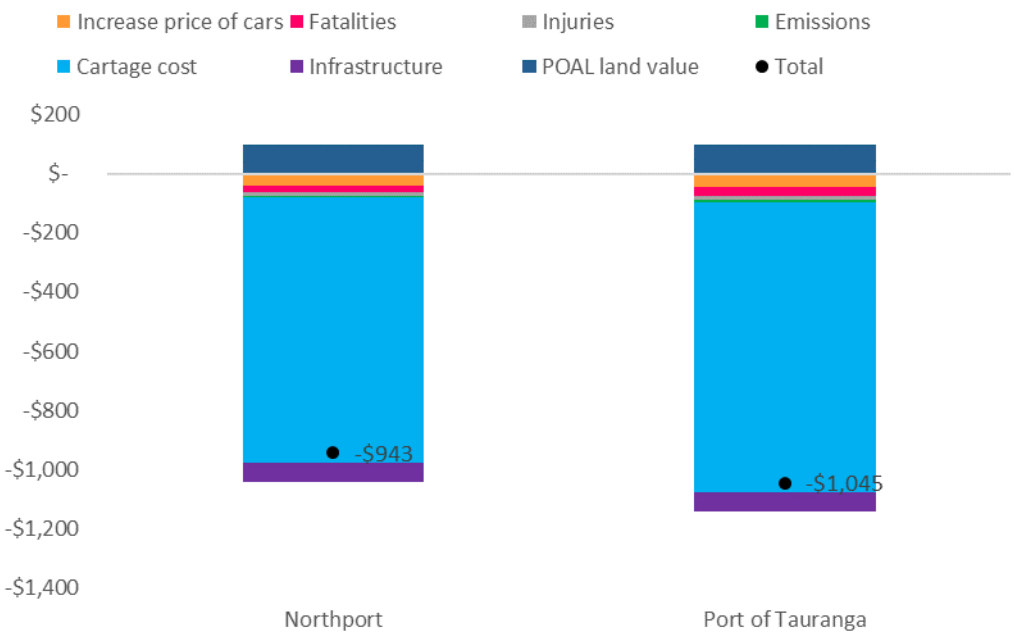
Overall results and considerations

The estimated required visual amenity impacts that would justify no change or an improvement to national welfare would respectively need to be equal to or greater than

- $943 million if Auckland's car trade is diverted to Northport, or
- $1.05 billion if Auckland's car trade is diverted to the Port of Tauranga.[2]

Figure 2 Summary of CBA national cost estimates of alternative port use

Central scenario; $ millions; Net present value of costs and benefits out to 2049



Source: NZIER

We are not surprised by these results. Vehicle importers have options as to where they land their vehicles and have chosen Auckland as their preferred destination in the upper North Island. It is hardly surprising that maintaining the importation facility in its current location represents the least-cost option.

Most of the demand for imported vehicles will remain in Auckland

Under present arrangements, most of the supply of vehicles into the North Island is located close to the demand for them. The other port options are further from the main market, and inherently less efficient as most vehicles, once landed in Tauranga

[2] The increase in the cost to transport vehicles to the final consumer is the largest loss in national welfare, so it is sensible to undertake a sensitivity analysis around it. We allow for uncertainty around the cost to cart such high volumes of vehicles from Northport and the Port of Tauranga to Auckland. Cartage prices are driven by a range of factors, not only the distance to be covered but also overnight stay and backloading opportunities. The cost to cart a light vehicle from both Northport and Tauranga to Auckland could range from $250 to $385. Our central scenario for this CBA is the mid-point of this range, $318 per vehicle.

or Whangarei, would have to be transported to Auckland, as that is where the majority will be bought by consumers.

Conclusion

At the heart of this analysis is the trade-off between the cost to New Zealand's competitiveness by reallocating the port of entry for the bulk of New Zealand's vehicle imports, raising the demand for resources from the transport sector to be drawn from other parts of the economy, against the visual amenity benefit from a change in POAL's land into an alternative use.

The estimated value of the amenity benefits required to offset the loss in competitiveness are significant and accrue largely to a small proportion of the Auckland population while the costs will be borne across the upper North Island.

Our analysis concludes that the willingness to accept the loss in competitiveness can only be justified on the basis that Auckland places an extremely high value (approximately ten times the land value uplift itself) on the visual amenity benefits to a change in the use of Ports of Auckland's land.

It is difficult to justify moving the vehicle imports from Auckland on either competitive or efficiency grounds. Markets constantly act to shape the vehicle supply chain to its natural most efficient structure across the North Island. The current situation is inherently efficient, as most vehicles are landed in the same city in which they will be bought by end-users. Departing from this situation by landing vehicles at ports at not less than 200 km away from Auckland, and then transporting the majority of vehicles back to Auckland (New Zealand's largest market) is less efficient. The benefit stream needed to offset these costs would need to be high and certain: our analysis, which rests upon independent assessments of the benefits, shows that these conditions are unlikely to be met.

Contents

Appendices

Figures

Tables

1. Introduction

1.1. Background

Auckland Council Investments Ltd (ACIL) has asked NZIER to carry out an analysis of vehicle imports into New Zealand to establish whether a net national benefit could arise from moving vehicle imports from the Port of Auckland to another port.

Our base case (POAL investment scenario) assumes that the Port of Auckland continues to operate within its current footprint, but invests to increase throughput, screen the vehicles from the public view and thus mitigate some of the adverse amenity impacts. We then compare this scenario to two possible alternative port scenarios: Northport (Whangarei) and the Port of Tauranga.

NZIER used a national welfare framework to construct a cost benefit analysis (CBA) of each scenario. The alternative port scenarios assumed that vehicle imports would move entirely from Auckland to one of the alternative ports over a seven-year period to allow for the construction of additional berths and yard space at other ports.

1.2. Methodology

Our starting point is that the current situation – where more than two-thirds of New Zealand's vehicle are imported through the Port of Auckland – is efficient. That is, it already represents the least cost alternative, compared to landing vehicles at other ports, due to the operation of competition between ports. However, the costs that importers consider are the private costs to them – what they have to pay to land a vehicle and then transport it to its first land-based destination somewhere in Auckland or the Waikato. They will not consider things like the visual impact of having a vehicle-handling facility on the Port which is often full of vehicles in plain view, the effects of transporters on other motorists, pollution or all the costs of motor-vehicle accidents (these are termed 'social costs' and removing them involves a social benefit).

Using another port like Tauranga or Northport would involve increase private costs to importers, which would be passed on to consumers.

What our methodology involves is looking for social benefits from moving the port that would offset the private costs, meaning that from a national perspective, New Zealand would be better off.

One material impact of moving the Port would be that it would free-up the land currently used by the Ports of Auckland for vehicle handling for an alternative use. Depending on what they use was, the amenity effects of the current Port location might be reduced.

Calculating those amenity effects is not easy using the data that is currently available. Some of it would be captured in the price of land if it were sold into an alternative use and we can estimate that.

To overcome these limitations, we have applied a "backward-calculation" approach. This involves determining what level of social impacts moving the vehicle operation would need to produce to overcome the private costs.

In making these calculations, we have been careful to construct both a base-case and alternative scenario that are realistic.

The base case, which is leaving vehicle handling at the current Port, we have included the investment plans that the Ports of Auckland Limited are currently considering, which involves building a new a new vehicle processing facility, which will both increase efficiency and reduce the visual impact of the Port.

1.3. Structure of this study

Our study takes as its starting point the future national demand for vehicle imports over the next thirty years, taking into account known future demand drivers such as the advent of electric vehicles.

We then examine the supply chain which connects vehicles landed at the port with consumers in New Zealand, asking which costs would change under the scenarios set out above.

To estimate the benefits that would arise from moving the port activities to an alternative location, we consider the value that would be realised by releasing the port land for alternative uses.

1.4. Scenario not considered

NZIER did not consider the possibility of moving vehicle import activities currently undertaken at the Ports of Auckland to another location in Auckland. The project and supporting infrastructure costing required would be a very substantial undertaking and far beyond the scope of this study.

2. Demand for vehicle imports

POAL plans to invest in capacity to accommodate the demand for vehicle imports over the coming decades. This planned investment forms the base case for this study. Our analysis therefore starts with an examination of these demand trends which we use to produce a forecast that will allow a common basis of comparison between Auckland and the alternative ports.

2.1. Elements within the demand for vehicle imports

For the purposes of this study we constructed separate forecasts for the light fleet (vehicle sizes are based on engine cc rating) and the heavy fleet. Two main elements comprise the light fleet: new and used.

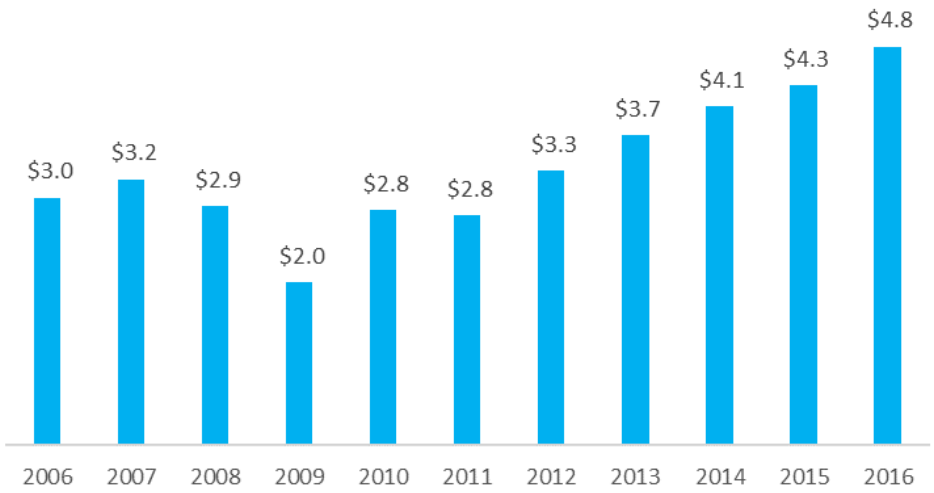
The heavy fleet is composed of a very broad range of items. Buses, tractors, trucks and items of heavy equipment are all classified as heavy fleet. Heavy items are more complex and costly to transport between the port and the eventual consumer, in contrast to the light fleet which benefits from a high degree of standardisation.

Light fleet: Current national demand

By 2016 New Zealand's demand for light vehicles had recovered from the dip that followed the global financial crisis (GFC). In the 2016 December year, the total value of vehicles imported, both new and used, was $4.8 billion: 9% of the New Zealand's total imports. Volumes imported have returned to pre-GFC levels, reaching 250,000 in 2015.

Figure 3 Total annual imports of light vehicles

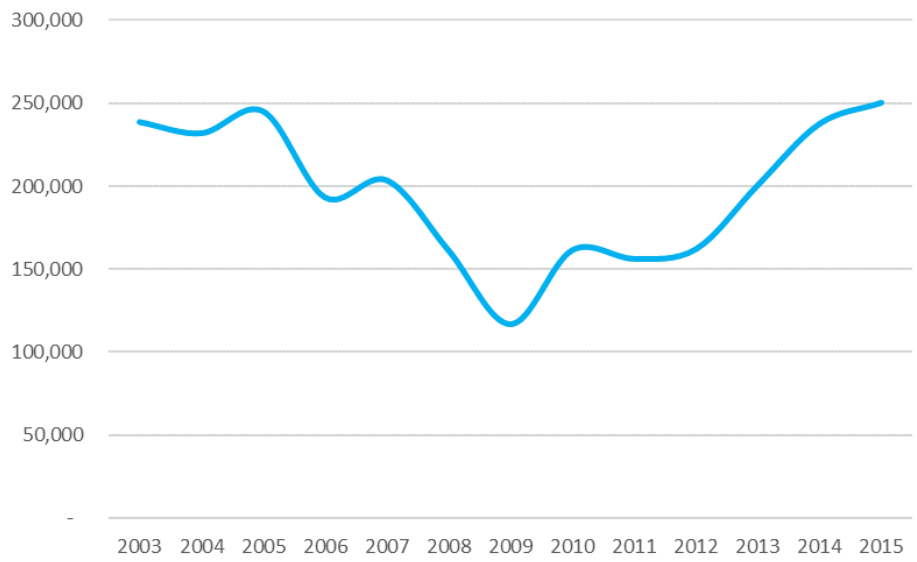
December year, Motor cars and other motor vehicles; principally designed for the transport of persons, including station wagons and racing cars; Cost including insurance and freight



Source: Statistics New Zealand

Figure 4 Total light vehicle imports

Count

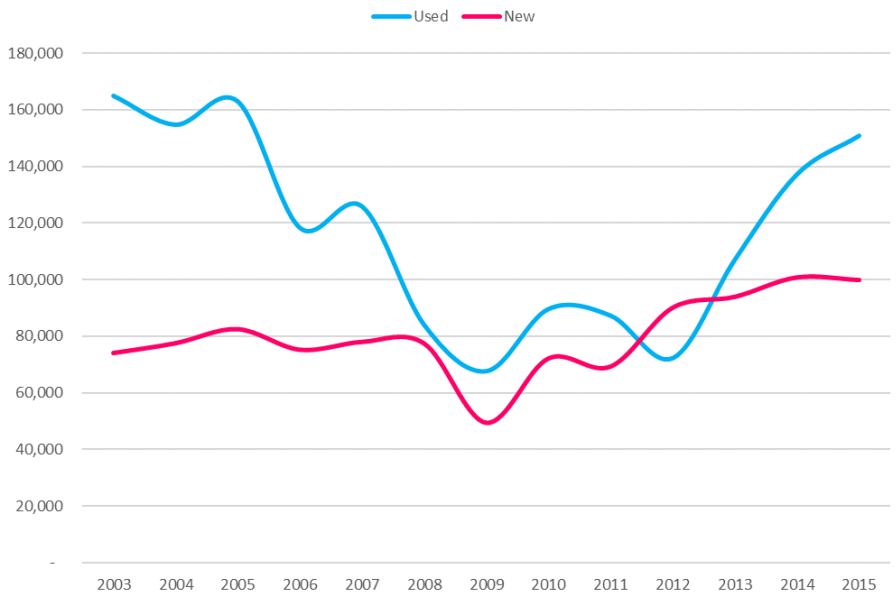


Source: NZIER personal communication with industry

The recovery has been driven by a surge in imports of used cars which have doubled since 2012.

Figure 5 Used and new light vehicle import volumes

Count



Source: NZIER personal communication with industry

At present the fleet is undergoing a faster replacement rate than over the last decade as a larger than usual cohort of vehicles is reaching replacement age. Our fleet projection assumes that this higher than usual replacement rate is temporary.

Light vehicle future demand

To forecast the growth in New Zealand's light and heavy vehicle fleet registrations we use NZIER/NZTA national vehicle fleet model, the Regional Land Transport Demand Model (RLTDM) (Stephenson, 2016). An outline of the structure of the model is provided in Appendix E.

NZIER's projection model uses registrations as a proxy for total vehicle imports. Projection of vehicle import volumes are based on registration projections which are equal to the projected growth in the size of the fleet, but which takes account of the number of vehicles retired or scrapped. Scrappage rates are projected based on scrappage rates observed over the past 10 years.

The principal purpose of the model is to forecast travel demand across different modes (private transport, public transport, etc.). Based on travel demand forecasts, we can project registrations for light private and commercial vehicles as well as heavy vehicles. The model structure is very detailed, and takes into account:

- Household composition and income and the relationship between these and vehicle ownership
- The ageing of the light vehicle fleet, including scrapping or retirement of vehicles
- Population growth, including net migration projections (Statistics NZ)
- The propensity of different age cohorts to purchase vehicles (based on revealed preferences of households)
- City density and public transport use (these can reduce car use, and potentially car ownership in some instances) (Stephenson, 2016).

Two-thirds of the projected growth in travel demand (and therefore the increase in demand for light and heavy vehicles) is due to population growth. Income growth is the strongest factor in the remaining third (Stephenson & Zheng, 2013).

The model accounts for population composition effects. The number of households is predicted to grow more quickly than the working-age population due to aging and households becoming smaller. Demand for freight transport is projected to grow roughly 1 percentage point faster than real GDP growth (Stephenson & Zheng, 2013).

Vehicle ownerships is less variable than travel demand hence vehicle import forecasts have higher certainty. Travel demand is more uncertainty due to the variability in fuel prices and travel costs (Stephenson & Zheng, 2013).

In the model, neither of these are especially sensitive to price.

- Freight demand is an integral part of economic activity and is connected to growth in the economy, not to the price of vehicles.
- Vehicle ownership is taken to be the result of people purchasing an option to drive a vehicle, rather than actually driving the vehicle. Thus, it was not heavily affected by price compared with actual travel behaviour (Stephenson & Zheng, 2013).

The model has been regionalised, so we can forecast regional demand for vehicles. This is an important consideration in forecasting North Island port shares in the base case (Stephenson, 2016).

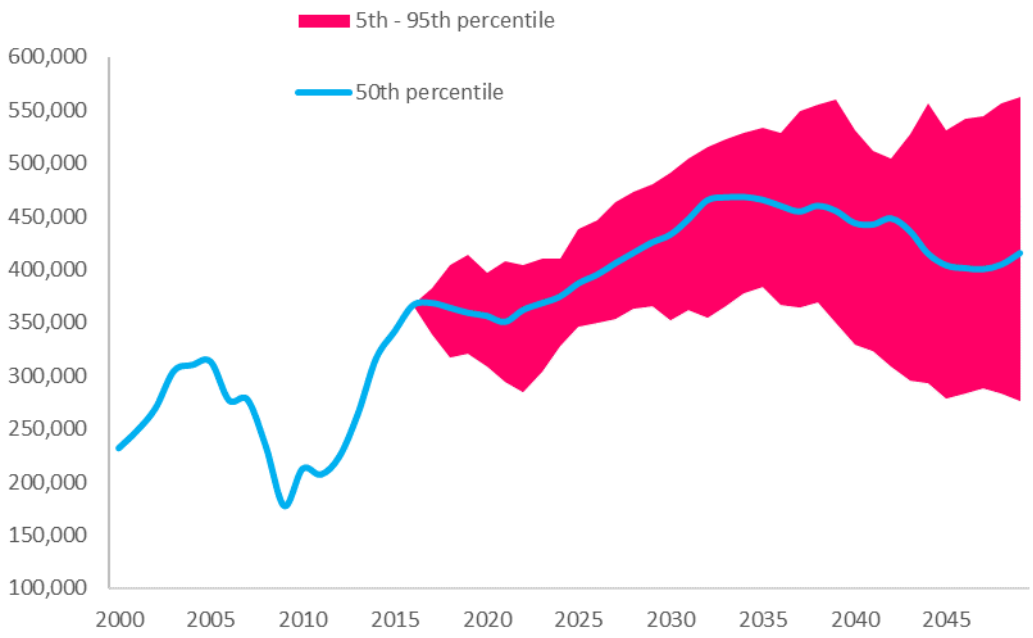
Our projection model identified the following as the primary drivers of vehicle registrations:

- The ageing of the fleet and demand from vehicle replacement
- A marginal increase in demand for more rapid refresh of the fleet as people move increasingly to electric vehicles over the next 30 years (with 90% of light vehicles registered in 20 years assumed to be electric – with growth in registrations modelled on a logistic growth curve, so rapidly rising after 2020)
- household demand for vehicles based on household type, region and income level.

The year-on-year fluctuations of the registration forecasts is largely driven by year on year fluctuations in:

- Migration and population growth
- Productivity and GDP growth
- Household income growth and unemployment.

Figure 6 Light vehicles' registration growth forecast



Source: NZIER

The projections fall into three distinct phases:

- 2017 to 2021 – annual registration is expected to ease as the size of vehicle cohort to be replaced shrinks compared to the 2010 to 2017 period (fewer

vehicles need to be replaced over that period as the size of the vehicle cohorts to be replaced falls)

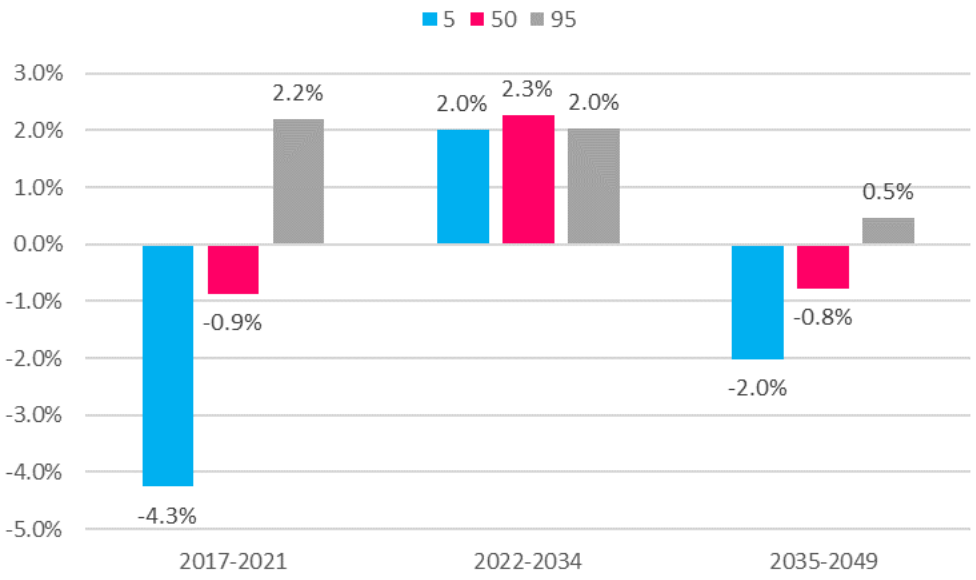
- 2022 to 2034 – electrical vehicle imports, population growth and ageing (older cohorts have higher ownerships per capita than younger cohorts) drive an increase in annual registration up to 2033
- 2035 to 2049 – 2033 onwards annual new registration begin to ease largely due to slower population growth and longer life of electric vehicles which reduces the vehicle replacement rate and finally vehicle imports.

Total annual registrations peak in 2034 at 470,000 and will be the largest annual import volume over the next 30 years. The average annual registration over the projection period is about 365,000 a year. The small volatility across the registration forecast is due to composition of the population (some cohorts are larger than others and they get older create demand shocks for vehicles) as well as variation in immigration and volatility in income growth over the projection horizon.

This cost benefit analysis is based on the 50th percentile projection. The uncertainty around the 50th percentile grows over the projection horizon. At the peak of the projections in 2033, (and any infrastructure must be built to accommodate peak rather than average demand), we project more than 450,000 light vehicle imports while at the 95th percentile we would expect over 500,000 imports and over 350,000 at the 5th percentile.

This uncertainty does not materially affect the results of this cost benefit analysis as the volume of vehicles imported is assumed to remain constant across the different scenarios (which port the vehicles are imported into).

Figure 7 Light vehicle registrations, annual growth rate



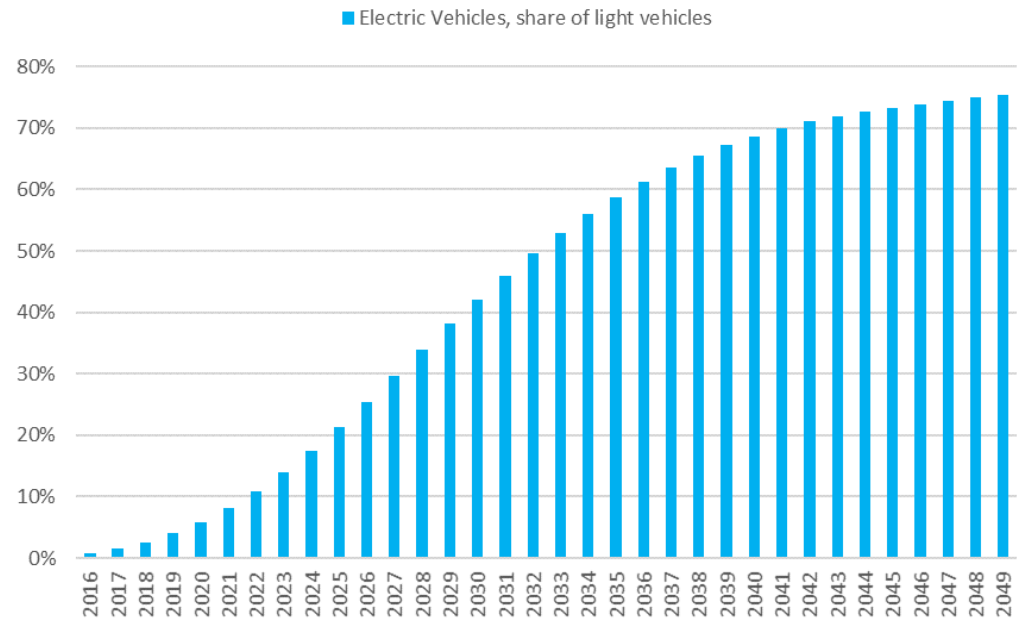
Source: NZIER

We project that electric vehicles as a share of the total fleet will reach 75% in 2049, from near 0% in 2016. We assume that electric vehicle uptake will lift overall vehicle

import when the adoption takes off between 2022 and 2034, but that this will not substantially increase the projected growth in registrations, as most of the demand for electric vehicles will be substitutional, not incremental: few people will require an electric vehicle as well as fuelled vehicle. The key drivers will remain population and income growth.

Figure 8 Electric vehicle fleet penetration

March year



Source: NZIER

2.2. Heavy

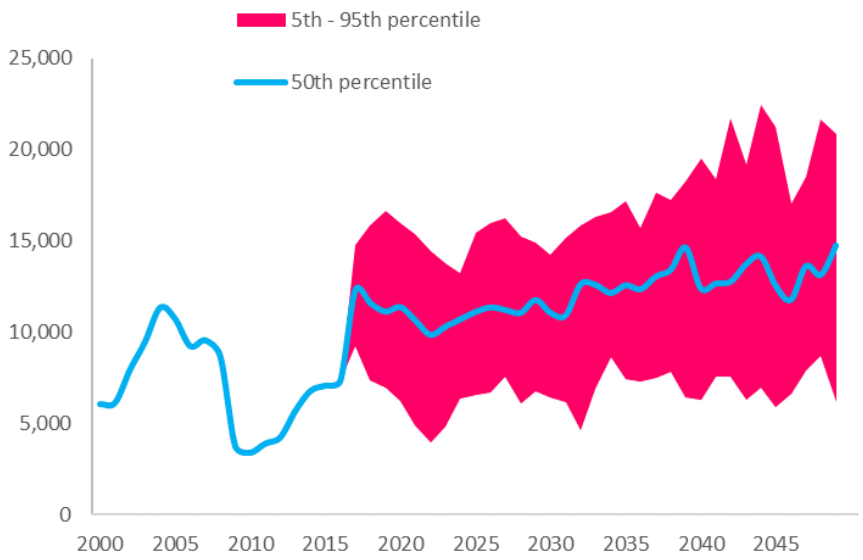
Current national demand

Heavy vehicle imports consist mainly of trucks, tractors, high and heavy (such as buses) vehicles and other very large vehicles. NZIER's projection, which also uses registrations as a proxy for imports, rests upon the following assumptions:

- Demand for buses grows in line with expectation of public transport demand
- Demand for heavy commercial vehicles grows in line with freight demand growth (roughly with GDP).

The projections are for a relatively constant but slow growth of total heavy vehicle registrations and therefore imports post 2018. In the first two years of the forecast, heavy vehicle registrations grow strongly, followed by a long period of slow growth throughout the rest of the projection horizon.

Figure 9 Heavy vehicles' registration growth forecast



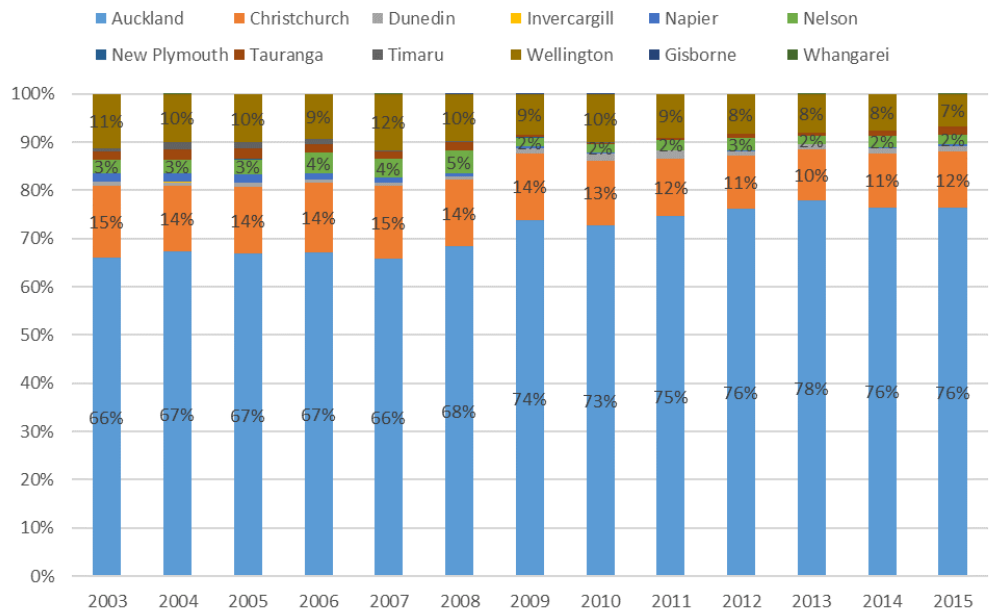
Source: NZIER

2.3. Market share of ports

Auckland is currently New Zealand's largest import port for vehicles, commanding 76% of the light vehicle imports in 2015. Auckland's market share has grown steadily over the previous decade: in 2003 its market share stood at 66%.

Figure 10 Total light vehicle imports by port

Percentage of import volumes by count



Source: NZIER personal communication with industry

Auckland's market share of new vehicle imports has increased to 84% while Nelson's and Wellington's have shrunk.. Auckland's used vehicle market share has increased also by 10%, mostly at the expense of Christchurch and Tauranga.

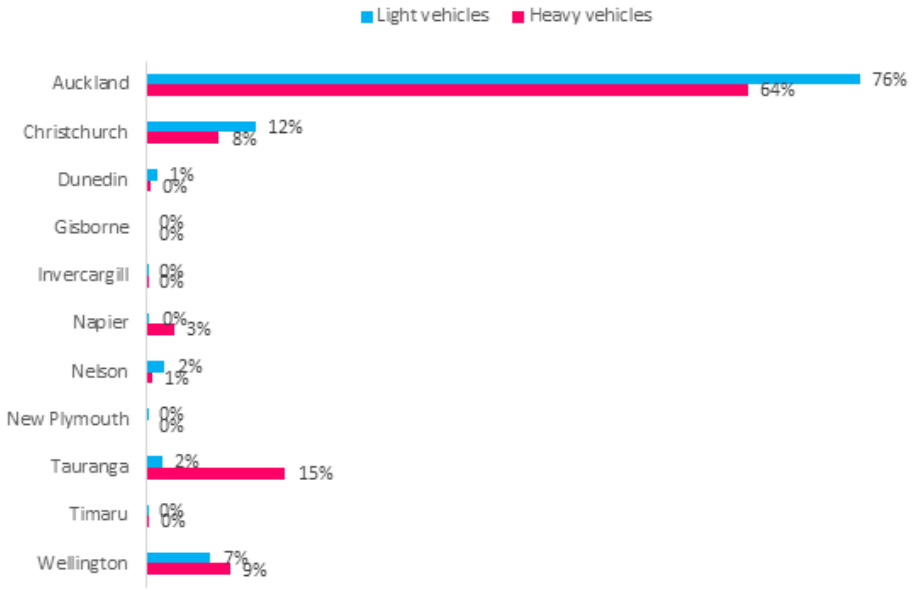
Among the factors which explain both POAL's higher and increasing in market share over the last decade, the following are most relevant:

- Most of the demand for vehicle import comes from the upper North Island, and particularly from Auckland (37%). Locating the main point of supply so close to the bulk of the demand confers efficiency benefits which we shall examine in greater depth in the following chapter.
- Car importers advised us that they import many variants of the same make and landing these in the largest market helps minimise holding and national distribution costs
- The local supply chain has evolved to be able to process high volumes of imports
- Auckland is home to a large number of company head offices which often undertake procurement and modification or branding of company vehicles centrally
- The majority of tourists arrive via Auckland airport: this drives demand for rental vehicle procurement

The current share of light and heavy vehicles is illustrated in the following figure.

Figure 11 Total light (2015) and heavy (2016) vehicles' market shares by port

New and used counts



Source: NZIER

Port volume forecast

For the base case, we have used the assumption that the current port market shares remain constant.

From our industry engagement, we understand that POAL's capacity to process vehicle imports reaches capacity at present around 6 or 7 days a month. Ports of Auckland has a daily holding capacity of approximately 5,000 units. At peak times it has held over 7,000 units on port, requiring the use of other areas on the port.

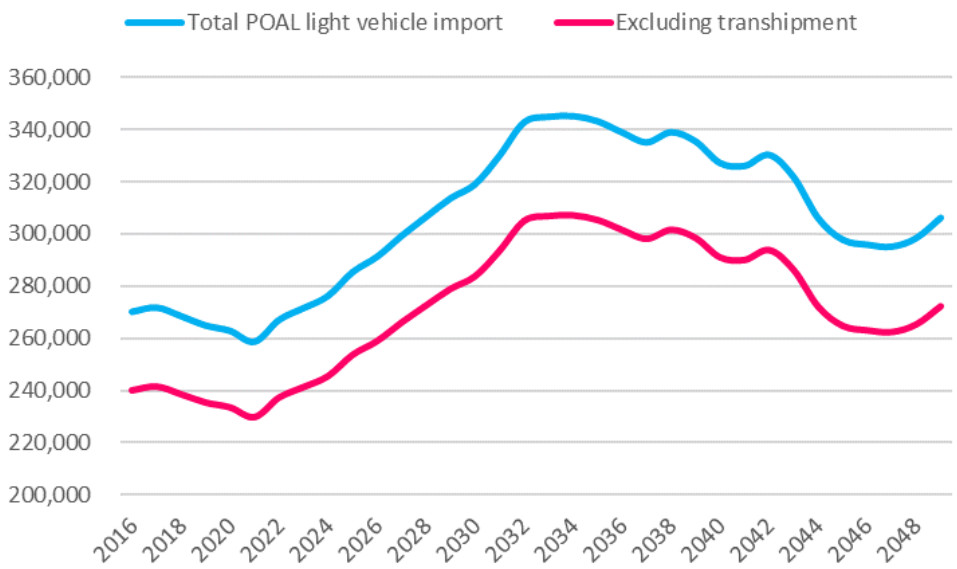
Based on the facts outlined above, we assume that the Port of Auckland will continue to expand capacity to serve growing import volumes, although this comes at increasing marginal cost of congestion. This means that we also assume that the Port of Auckland will maintain its market share, as do the other ports, unless extreme congestion emerges (extending dwell times out to 6-9 days over our forecast period and importers having to pay increased port charges $65/day after three days).

Applying this assumption to the forecasts outlined above produces the following forecast, in which Auckland's light vehicle imports peak at 345,000 (excluding transhipment) in 2033.

About 30,000 light vehicles are transhipped out of POAL and are not carted into the Auckland region for compliance.

Figure 12 POAL's total light vehicle imports

Vehicle count

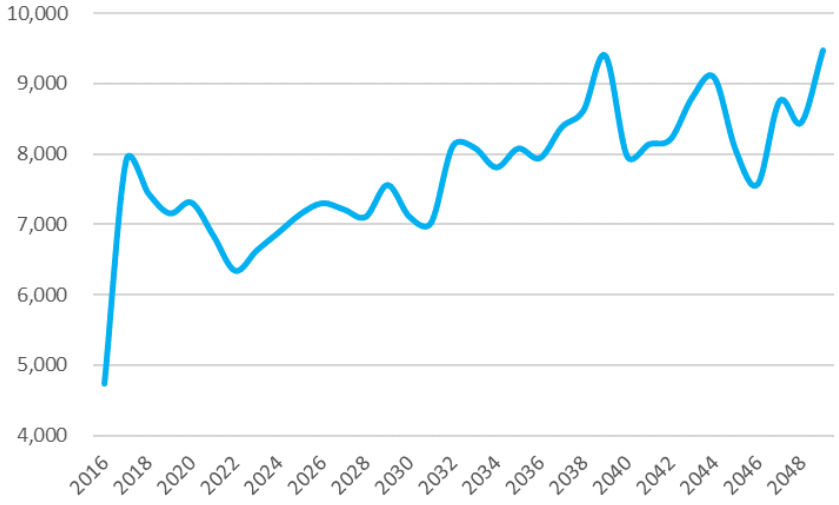


Source: NZIER

Figure 13 summarises the projected Auckland heavy vehicle import volumes Auckland's total heavy vehicle imports average about 7,500 until the end of the 2020s, then increase to about 8,500 a year until 2050.

Figure 13 POAL's total heavy vehicle imports

Vehicle count



Source: NZIER

3. The structure of the vehicle supply chain

The landing of vehicles is the start of a chain of processes that leads to the eventual delivery of the imported vehicle to its final owner: vehicles are not simply driven off the ship and given to an owner on the dock, who drivers it away. Vehicles arriving are not registered and have to be transported by truck.

What those processes are and how vehicles are transported between them is a key driver of the cost of delivery. In this section, we outline the stages in the supply chain, what they cost and how they are affected by location of the port.

The fundamental reason for this is that the current situation is inherently efficient, as most vehicles are landed in the same city in which they will be bought by end-users. Departing from this situation by landing vehicles at ports at not less than 200 km away from Auckland, and then transporting the majority of vehicles back to Auckland (New Zealand's largest market) is less efficient. The benefit stream needed to offset these costs would need to be high and certain: our analysis, which rests upon independent assessments of the benefits, shows that these conditions are unlikely to be met.

The vehicle import industry is accustomed to referring to the supply chain for the light fleet as two separate supply chains: one for used vehicles and one for new. It is true that these supply chains do indeed differ at several steps, but these differences do not bear significantly on the questions this study seeks to address: which costs within the supply chain are variable and which elements of the vehicle supply chain are likely to change location if the port of entry changes?

3.1. Overview of the supply chain

Figure 14 summarises the supply chain and places indicative costs per light vehicle against each of the stages. Almost all the costs are fixed with respect to the port of landing. The only costs that vary with respect to the port of landing are costs of transporting the vehicle from the port through the intervening compliance stages to its eventual point of sale to the end-consumer.

Figure 14 Light vehicle imports supply chain cost stack

Source: NZIER

The supply chain is represented as a cost stack in figure 13, read from bottom to top. Upon arrival at the foreign port, a vehicle destined for the New Zealand market is subjected to regulatory compliance and MPI biosecurity checks. It is then shipped and unloaded at the New Zealand port. Port handling cost is circa $50. While on the wharf it undergoes the safety inspections associated with first time registration and further biosecurity checks.

From there it is removed to storage facilities, most of which are in the Penrose-Mount Wellington or the Wiri-Drury areas. When the space becomes available for the vehicle at the showroom it is taken from the storage facility to a compliance centre for a further series of checks, warrant of fitness, and any customisation. Customisation includes in-market refits (fitting mud-guards, floor-mats, tow-bars, roof-racks) and repurposing of vehicles prior to sale, such as building specific trailers for trucks, converting large vans into mini-buses or modifying cars into sports versions.

Other costs associated with the supply include brokerage insurance and cost of holding inventories of vehicles.

The vehicle supply chain for vehicles destined to be sold in the upper North Island is concentrated in the Auckland region – because at present all the cars enter the market via POAL. Wellington and Canterbury have comparable supply chains at a scale commensurate with their lower market share of imports.

Some of the elements in the supply chain merit further discussion and are considered below.

3.2. Yard handling

Port wharfage fees are comparable across Ports of Auckland, Port of Tauranga and, they all charge on average $50 per day. Northport prices are not listed due to the low vehicle volume processed currently.

Table 3 Wharfage price for vehicles up to 20m3

Port	Wharfage price
Ports of Auckland	$52.61
Port of Tauranga	$53.27
Centreport	$47.77

Source: Port personal communication

3.3. Brokerage insurance

Brokerage insurance costs on average $50 per vehicle.

3.4. Transport from port to the compliance centre

The vehicle supply chain in Auckland requires cartage at three stages, from the port to the processing or compliance stages, and again after the vehicle is registered and then to the final retail or wholesale centres.

Two firms (Autohub and Nitsibo) transport 80% of the used vehicle imports up to the compliance stage. The two main operators apply a fixed-price model to all cartage around the wider Auckland region. In this study, however, we have treated this as a variable cost as it would change if the port of landing were changed. The current business model is possible only because the large majority of vehicle cartages are predictable and cover only a short distance (i.e. from Auckland's waterfront to Penrose or Wiri).

If vehicles were to be carted from another port the current model would not be sustainable. Effectively, Auckland customers would face a surcharge relative to current prices, and the increase in delays and time to cart will put pressure on the working capital to be held to purchase and re sell the car.

3.5. Compliance

Entry certification, known as 'compliance', ensures that every vehicle imported into New Zealand complies with safety and environmental standards. Compliance is carried out by Service Delivery Agents (SDAs) which are AA, VINZ and VTNZ.

The physical inspection of used vehicle is labour intensive and involves partial disassembly of the vehicle for checking. This stage also includes minor repairs. If larger structural repairs are required, these must be provided by independent NZTA Certified Repairers to ensure the integrity the compliance system.

The compliance industry in New Zealand is worth an estimated $50 million a year but it is also highly integrated with other industries which support the compliance activity, such vehicle parts, tyres, etc.

There are many commercial arrangements between different players of the supply chain and import dealers work closely with SDAs and certified repair shops. Compliance costs of models new to New Zealand can be in the order of $600 per vehicle, but compliance for existing models are much lower (Figure 15 summarises the cost stack for used light vehicles). Once the vehicle has complied with all standards, it is registered and carted to wholesale and retail distribution centres.

3.6. The light and heavy vehicles supply chains are intertwined

Some vehicles are transported in Roll on Roll off (RoRo) ships. RoRo ships also carry breakbulk, which are the high and heavy items (larger than 20m3) described in section 2. Examples include large four-wheel drive vehicles, large vans, tractors, trucks, buses, construction machinery, boats and specialist machinery. The costs vary greatly depending on the dimensions and shape to be transported. For example, a trip from Auckland to Wellington by road for:

- A 12m long bus would cost $1,200
- Two trucks piggy-backed would cost about $1,200
- A boat 3.5m wide, 5m high and 16m long weighing 15 tonne would cost about $3,000
- A large bulldozer could cost from $5,000 to $15,000 depending on blade, tracks and width[3].

By way of example the following table summarises the composition of different vehicles by volume of a typical vessel from Europe delivering vehicles to the Port of Auckland. While the number of vehicles up to 20m3 (a common cut-off point for differentiating light to heavy vehicles) varies it is rare that ships would only carry light vehicles.

In this example, taken from the ship's manifest, 16% of the goods are 'non cars', i.e. high and heavy (over 20m3). However, heavy vehicles account for almost half of the total volume that the vessel carries.

Table 4 Composition of vehicles for a typical vessel from Europe and UK

Vehicle volume	Number of vehicles	Share of number vehicles	Total volume	Share of total volume

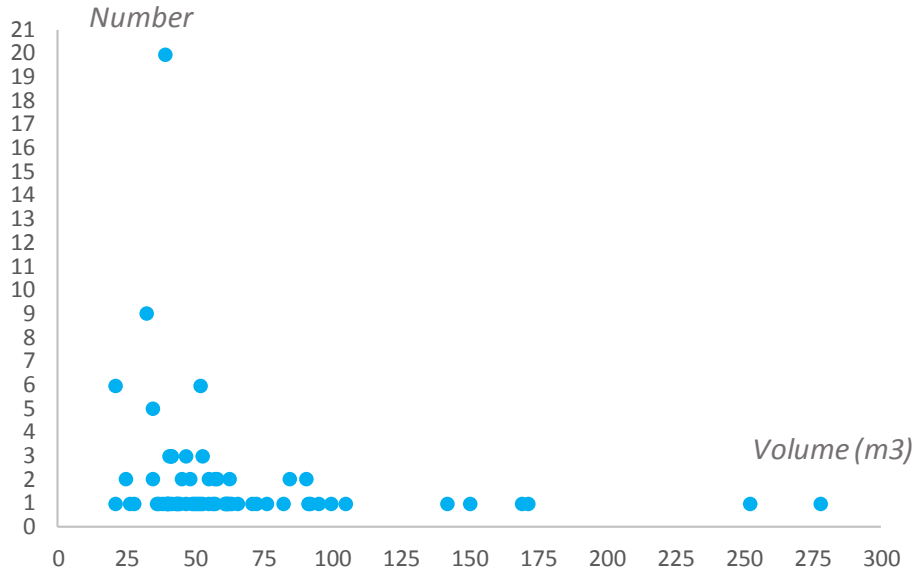
[3] Industry personal communication

Up to 20m3	697	84%	9,529	58%
Over to 20m3	128	16%	6,877	42%
Total	825	100%	16,406	100%

Source: POAL personal communication

Furthermore, the range of heavy vehicles that a typical vessel carries varies significantly in volume. The following chart summarises the number of vehicles by size (volume in cubic metre) which shows the wide range, particularly very large vehicles of 250 cubic metres or more.

Figure 15 Number of heavy vehicles by volume for a typical vessel from Europe



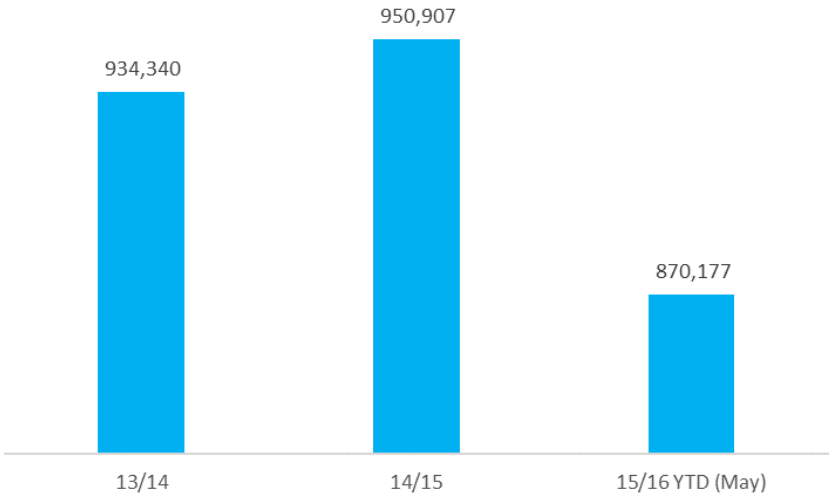
Source: POAL personal communication

The large breakbulk vehicles often require specialist transporters and sometimes escorts for the road journey from the port. They are usually outsize – over width, height or weight – and can only be transported two or three per truck.

In this cost benefit analysis, we do not consider the variations of the vehicle supply chain to deal with breakbulk, other than the variable cost associated with road cartage.

Figure 16 Port of Auckland RoRo breakbulk volumes

Tonnes; June Year



Source: POAL personal communication

Some particularly large heavy vehicles can be very expensive to transport, and given the current structure of the supply chain and the composition of vehicles a typical PCC or RoRo vessel carries it is not possible to separate them.

3.7. Cartage across New Zealand

After the compliance stage the vehicle is transported from the compliance centre to the point of sale by road or by rail. The large majority of vehicles are transported by road on a truck.

3.7.1. Road cartage

The New Zealand market is dominated by four freight forwarders. Indicative rates for vehicle cartage between the main North Island urban centres are shown in Figure 17.

Figure 17 Cartage costs between major city centres

Exclusive of GST

	Whangarei	Auckland	Hamilton	Tauranga	Napier	New Plymouth	Palmerston North
Whangarei							
Auckland	$ 275						
Hamilton	$ 417	$ 141					
Tauranga	$ 493	$ 217	$ 134				
Napier	$ 646	$ 370	$ 322	$ 349			
New Plymouth	$ 606	$ 331	$ 236	$ 336	$ 349		
Palmerston North	$ 656	$ 380	$ 322	$ 349	$ 188	$ 236	
Wellington	$ 669	$ 393	$ 383	$ 393	$ 322	$ 337	$ 167

Source: http://www.haulplus.co.nz/index.aspx; http://www.jeffs.co.nz/default.asp

In our cost benefit analysis, we assume that a truck can carry on average five vehicles per trip. A truck can carry between three and eight vehicles depending on the model being transported and the type of transporter. Some vehicles however can only be carried by specialised trucks.

To estimate heavy vehicles cartage costs, we could not rely on available sources to price the cartage between the different major North Island cities. Our approach was to scale light vehicle cartage costs for the different heavy vehicle types. The scalar used are summarised in the table below.

Table 5 Heavy vehicle cartage cost relative to light vehicles

Heavy vehicle type	Light vehicle cartage cost multiple
Tractor	2.5
Truck	4.5
High and Heavy (Buses, etc.)	10

Source: Industry personal communication

3.8. Employment impacts

Port employment

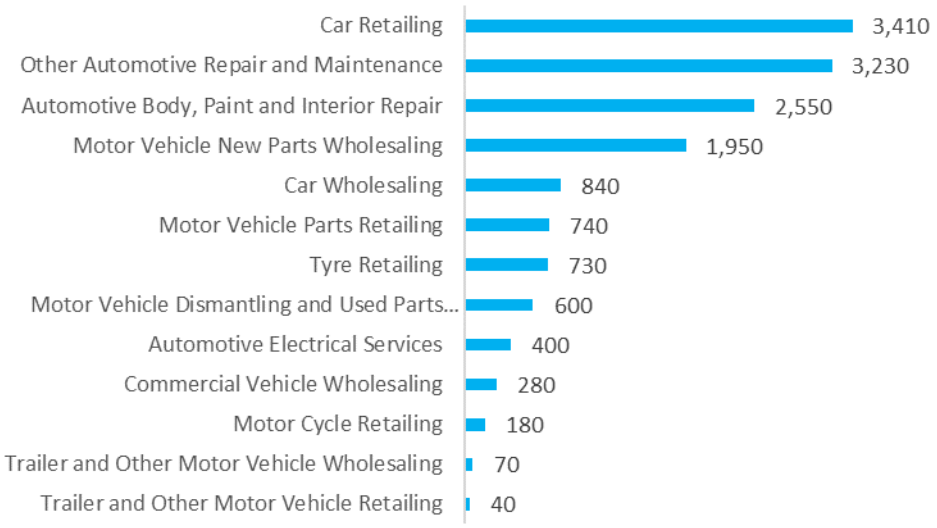
To handle the car trade at POAL includes POAL staff, Customs, Ministry for Primary Industries staff, cleaning contractors, stevedores, pilots and marine crew. The port employs 12 full-time on port positions (across several organisations) plus 70-100 personnel per ship visit (mainly stevedores).

Wider supply chain employment

The following figures summarise the impact of the vehicle supply chain on Auckland's economy in terms of employment. While not all industries in the supply chain will be affected to the same extent, almost 10,000 jobs would be lost from Auckland if the vehicle supply chain were to be transferred to another port. This is not a national loss in the CBA as the jobs lost in Auckland would be created elsewhere.

Figure 18 Auckland region's vehicle supply chain, numbers employed

Employment count, 2015

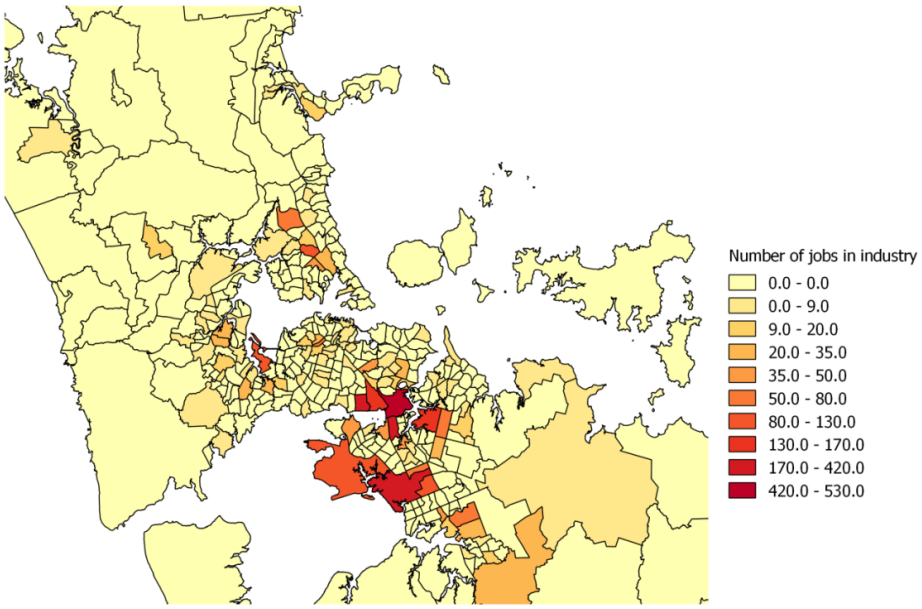


Source: Statistics New Zealand

Figure 19 shows that motor vehicle wholesale businesses (and jobs), one of the many industries in the supply chain, are concentrated around the residential suburbs in South Auckland creating employment opportunities in areas of socio-economic deprivation. As mentioned before, much of the supply chain is in the Penrose/Mount Wellington industrial area and draws its labour from South Auckland.

Figure 19 Employment in the wholesale car market across Auckland

Motor vehicle and motor vehicle parts wholesaling



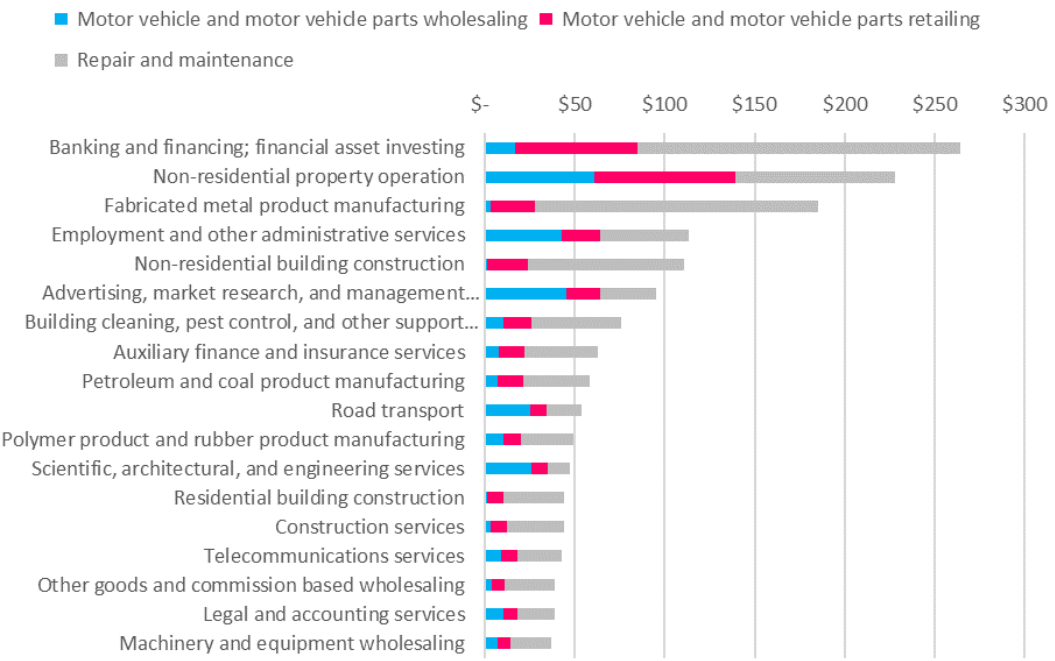
Source: NZIER based on Statistics NZ business demographics ANZSIC code F350

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

Furthermore, the vehicle supply chain is embedded into other supply chains and therefore any changes to the vehicle supply chain will adversely impact other industries at the Auckland regional level.

Figure 20 Indirect impact on other industries

$m; National vehicle supply chain inputs from other industries



Source: Statistics New Zealand

3.9. Auckland supply chain stickiness

Our modelling assumption in the cost benefit analysis is that the vehicle supply chain remains in Auckland. We have not estimated the costs of moving parts of the supply chain to other locations.

There is a large Auckland service sector supporting the vehicle industry. The sector's activities include storage, inventory management, compliance processing and undertaking modifications to new light and heavy vehicles. The location of the vehicle compliance industry (and the wider supply chain) is largely driven by the size of the fleet within their catchment rather than the share of vehicle imports.

Most of the Upper North Island demand is within the golden triangle (Auckland, Waikato and Tauranga. These regions combined represent 59% of total demand for light vehicles.

The remaining North Island regions that would benefit from their shorter distance to Port of Tauranga (relative to Ports of Auckland) are Hawkes-Bay and the residual

demand not met by Centreport for Wellington and Manawatu-Wanganui. The combined residual for the Wellington-Manawatu-Wanganui and the Gisborne is 9%.

The key implication is that the supply chain is not likely to entirely reallocate to Northport or Tauranga even though the vehicles themselves would be diverted away from Auckland.

In fact, while it is conceivable that a small volume of vehicles may be processed in Tauranga without having to be carted back to Auckland (if the vehicle is ultimately destined to Gisborne for example), those gains have been available for some time (if they existed) and the supply chain has not reallocated to allow for these benefits to be accrued. That is because there are costs to relocate resources away from Auckland to process vehicles in Tauranga. In fact, Ports of Auckland share of vehicle imports has been increasing in the last 10 years.

The vehicle supply chain is highly competitive. Businesses within it operate on tight margins, creating a strong incentive to find efficiencies. The supply chain has naturally grown around the main source of demand – Auckland. The current structure of the supply chain has been driven by the cost of onward transport and the economies of scale offered by aggregating associated processing activities at the location of highest demand.

It follows that Auckland is the most efficient location for these activities as cartage costs from the port of landing are minimised and the greater throughput of vehicles driven by Auckland's demand concentration confers economies of scale and scope on the Auckland supply that are not available elsewhere. Car dealers who import large volumes of cars hold the bulk of the inventory in Auckland.

If it were argued that the supply chain activities would move to a different area if the port of landing location was changed, this would not substantially affect the fundamental economics of vehicle importing in the North Island of New Zealand. It would remain the case that most of the vehicles landed would be bought in the Auckland and Waikato regions and they would have to be transported there eventually. The extra cost of the longer vehicle cartage would be incurred, and either passed on to consumers through higher prices or absorbed by car importers as lower profits relative to the current situation.

From a national welfare perspective, there are no major benefits to some or all of the supply chain relocating to a new port of call for vehicle imports, but there would be losses in economies of scale and reallocation costs. Our assumption that the supply chain activities remain in Auckland even if vehicle imports are diverted to Northport or Port of Tauranga, therefore neither underestimates the benefits or overestimates the costs of diverting vehicle imports.

4. Scenarios

In this section, we set out the main features of the cost benefit analysis, and what would change if the import of light vehicles were to be moved to Northport or Tauranga.

4.1. Market share under the alternative scenarios

Figure 21 summarises the difference between the demand for light vehicles across New Zealand and the share of imports by the ports around the country. About half of the vehicles imported through Ports of Auckland are eventually purchased in the Auckland (37%) and Waikato (9%) regions, the remaining being transported across the country.

Figure 21 Difference between regional demand and port share of light vehicles

Percentage; 2015; port share is exclusive of transhipment

Regional demand	Port	Demand share	Port share	Difference
Northland	Whangarei	4%	0%	-4%
Auckland & Waikato	Auckland	46%	76%	30%
Bay Of Plenty	Tauranga	7%	2%	-6%
Taranaki	New Plymouth	2%	0%	-2%
Wellington & Manawatu-Wanganui	Wellington	12%	7%	-5%
Canterbury	Christchurch & Timaru	15%	12%	-3%
Otago	Dunedin	4%	1%	-3%
Southland	Invercargill	2%	0%	-2%
Gisborne & Hawkes Bay	Napier	4%	0%	-4%
Upper South Island	Nelson	5%	2%	-3%

Source: NZIER, NZTA

Figure 22 Difference between regional demand and ports' import share of light vehicles

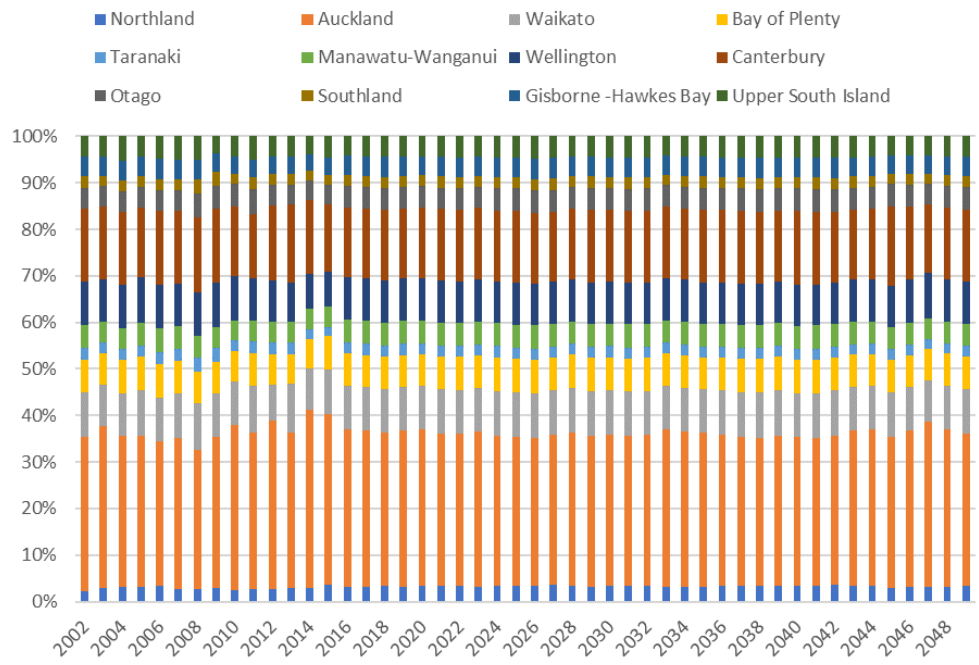
Count; 2015

Regional demand	Port	Demand volume	Port volume	Difference
Northland	Whangarei	10,373	12	- 10,361
Auckland & Waikato	Auckland	135,694	223,815	88,121
Bay of Plenty	Tauranga	21,222	5,055	- 16,166
Taranaki	New Plymouth	5,646	1	- 5,645
Wellington & Manawatu-Wanganui	Wellington	34,597	20,004	- 14,593
Canterbury	Christchurch & Timaru	42,531	34,176	- 8,355
Otago	Dunedin	12,304	3,242	- 9,062
Southland	Invercargill	5,934	6	- 5,928
Gisborne & Hawkes Bay	Napier	11,322	906	- 10,415
Upper South Island	Nelson	13,302	5,708	- 7,594

Source: NZIER, NZTA

Our projection of the light vehicle fleet by region and therefore demand for vehicles shows that the distribution of demand for vehicles will not change significantly over the next 30 years

Figure 23 Regional distribution of demand for light vehicles remains relatively constant over the projection period



Source: NZIER

4.2. Similar methodology for heavy vehicles

The NZIER fleet forecasting model does not provide regional registrations for heavy vehicles therefore we proxy the demand for heavy vehicles by region based on regional freight demand. The difference in the regional demand for freight and the distribution of heavy vehicle imports volume is summarised below. The differences are similar to the light vehicles difference between regional demand and port share.

Figure 24 Difference between regional demand and port market share of heavy vehicle imports

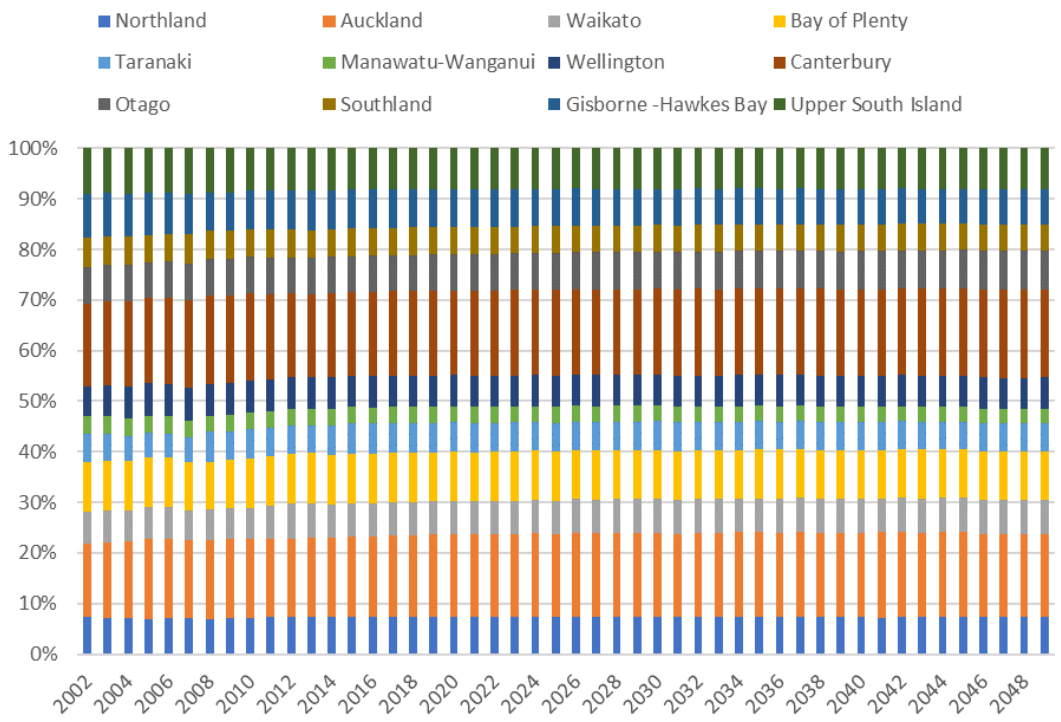
Percentage; 2016

Regional demand	Port	Demand share	Port share	Difference
Northland	Whangarei	7%	0%	-7%
Auckland & Waikato	Auckland	22%	68%	46%
Bay of Plenty	Tauranga	10%	13%	3%
Taranaki	New Plymouth	6%	0%	-6%
Wellington & Manawatu-Wanganui	Wellington	9%	7%	-2%
Canterbury	Christchurch & Timaru	17%	9%	-8%
Otago	Dunedin	7%	1%	-6%
Southland	Invercargill	5%	0%	-5%
Gisborne & Hawkes Bay	Napier	8%	2%	-6%
Upper South Island	Nelson	8%	0%	-8%

Source: NZIER, NZTA

As per the regional distribution of light vehicle demand, we use the distribution of the demand for freight as a proxy for demand by region for heavy vehicles, which we assume will remain constant over the forecast horizon.

Figure 25 Regional freight demand projections



Source: NZIER

4.3. Basic assumptions

The principal assumptions we made regarding the choice of port are as follows:

- Port capacity will adjust over time to meet demand, as it has done historically, and is planned to do in the scenario where POAL invests in the new vehicle terminal

- The vehicle import industry will seek to minimise its supply chain costs from the point of purchase overseas to the final buyer of the vehicle in New Zealand
- In the scenarios in which Northport and Tauranga gain Auckland's vehicle import volumes, most of the vehicles imported will be transported back to Auckland to the main market and, where they will undergo modification (where required) and compliance servicing. From there they will be transported around the central North Island to the final consumer
- The least cost option is taken for cartage, which is a function of the travel distance and travel time by road.

To construct the demand scenarios for Northport and Tauranga we progressively transfer the Auckland volumes to the substitute ports over a period of seven years.

This assumption is based on communications with the industry which estimates that a fast-tracked consenting process and construction of a berth would take about 3 years. Our assessment is that Northport and Port of Tauranga would need to build two berths each to process future vehicle imports if it was diverted away from Ports of Auckland.

We therefore assume a 7-year transition to allow for the construction of two operational berths, each taking 3 years to be consented and built, and allowing an extra year for the adjustment of other trade port operations at Northport or Port of Tauranga as well as the supply chain response (i.e. the increase in trucking fleet and hiring of truck drivers).

The cost of shipping to Northport, Ports of Auckland or Ports of Tauranga does not vary much. Port side regulatory clearance costs are considered fixed: what is of value to importers is the speed of regulatory clearance. Ports' charges themselves are small compared to other costs, particularly the cost of vehicle cartage.

As noted in the previous chapter, vehicle cartage is the cost which varies with the port of landing. Vehicle importers naturally prefer ports close to population centres, subject to wanting to minimise vehicle modification and repurposing costs for buyers. It follows that the choice of port for vehicles importers is primarily driven by two considerations:

- The need to minimise cartage costs by landing as many vehicles as close as their end-consumers, and
- The depth and strength of the in-market vehicle service, inspection and compliance industries. This is particularly so for heavy vehicles, but light vehicle inspections and clearances also benefit from the economies of scale associated with larger vehicle volumes.

Transhipped vehicles tend to be bundled with vehicles to be processed at the port of call. The significant number transhipped vehicles coming into Ports of Auckland is simply as a result of the large share of vehicles handled at Ports of Auckland in the first place.

These rates include input costs such as the cost of capital for vehicle-moving trucks, driver labour and accommodation.

4.4. Cartage costs

Current cartage cost (rack rates) for transporting light vehicles to and from Northport and Port of Tauranga are $275 and $217 per vehicle, respectively. These costs were sourced from two online public sources (Jeffs and Haulplus[4]) which provide cartage cost quotes for light vehicles between New Zealand's major town centres.

These rates include input costs such as the cost of capital for vehicle-moving trucks, driver labour and accommodation. These rates also take into account backloading probabilities that vary with destination. Vehicle movers represent highly specific assets that cannot easily carry other goods on return trips, and thus the probability of backloads represents a significant element of cartage costs to the buyer.

These rack rates currently enjoy the efficiency benefits which arise from the fact that so many of the vehicles are landed and processed very near their end-user demand. If the vehicles were landed at other ports and the majority then transported into Auckland, the rack rates would have to rise. The reasons for this include:

- The difficulty in completing more than one return journeys in a single shift due to the combination of distance and congestion
- Higher overnighting costs incurred
- The need to purchase additional equipment to accommodate the slower throughput caused by landing at ports further from the end-user
- Limited backloading opportunities (i.e. the trucks return empty, and for a greater distance, current rack rates reflect the fact that non-imported second-hand vehicles still need to be carted).

NZIER approached the vehicle distribution industry for an estimate of the effect of adjusting for these relative inefficiencies on the rack rates. The industry informed us that the cost to cart a light vehicle from both Northport and Tauranga to Auckland could range from $250 to $385. We have adopted the mid-point of this range – $318 per vehicle – as the cartage cost assumption for this CBA.

Table 6 Scenario cartage cost increases

Travel from (to Auckland)	Current rack rates	Adjusted cartage cost (range)	Mid-point
Northport	$275	$250-$385	$318
Port of Tauranga	$217	$250-$385	$318

Source: NZIER informed by industry personal communication

The cartage for the Northport scenario is then updated to take account of the Pūhoi to Warkworth extension which will reduce travel time and allow saving $8 per vehicle transported (NZTA, 2016a). We assume vehicles transported from Port of Tauranga will not be carted through Hamilton and therefore not benefit from the Waikato Expressway when it is finished At present, the majority of trucks carrying cargo from the Port of Tauranga use State Highway 2 to reach Auckland and Hamilton, joining SH1

[4] http://www.haulplus.co.nz/index.aspx; http://www.jeffs.co.nz/default.asp

at Pokeno, north of the Waikato Expressway. The direct route to Hamilton from Tauranga (SH29) winds over the Kaimai ranges and is more difficult for trucks to negotiate.

Cartage cost is the largest component of this CBA, so it is sensible to show the range provided by the industry. Table 7 shows the rates multiplied by the travel distance between Auckland and the alternative ports.

Table 7 CBA sensitivity analysis results

$ millions

Scenario	Lower bound	Central scenario	Higher bound
Northport	-$699	-$943	-$1,188
Port of Tauranga	-$789	-$1,045	-$1,300

Source: NZIER

A truck transporting vehicles from the Port of Auckland to Penrose can complete up to seven return trips per day carrying up to eight vehicles on each trip. From Northport, the same truck will only be able to make one to two return trips per day and one or less return trip from Tauranga. Overnighting – accommodating drivers in overnight accommodation – would also be likely to increase.

4.5. Infrastructure investment costs

POAL investment scenario

Under the base case the Port of Auckland continues to process vehicle imports and continues to invest to improve its effectiveness.

The port infrastructure currently used for car trade (PCC and RoRo vessels) consists of the following at POAL:

- Two dedicated berths for 200m and 265m PCC and RoRo vessels. Allowing for ship ramps, total berth length is around 600m
- A third overflow berth for 200m PCC – which is shared with other port vessels. Total berth length is around 280m allowing for ramps and clearance to other ships
- Total berth length at POAL for the trade is 880m
- 16ha of dedicated yard for handling/cargo off/on PCC and RoRo vessels
- Overflow yard of around 1ha to 4ha – which is shared with the rest of the port, and used at peak times.

POAL's long term plan is to increase the number of dedicated RoRo/PCC berths from two to three to accommodate future vehicle import growth. At present, POAL's ability to process vehicle imports reaches capacity for 5 or 6 days a month.

POAL's port infrastructure investment over the forecast horizon of the CBA does not need to be estimated as POAL's plans to expand its vehicle handling capability are known.

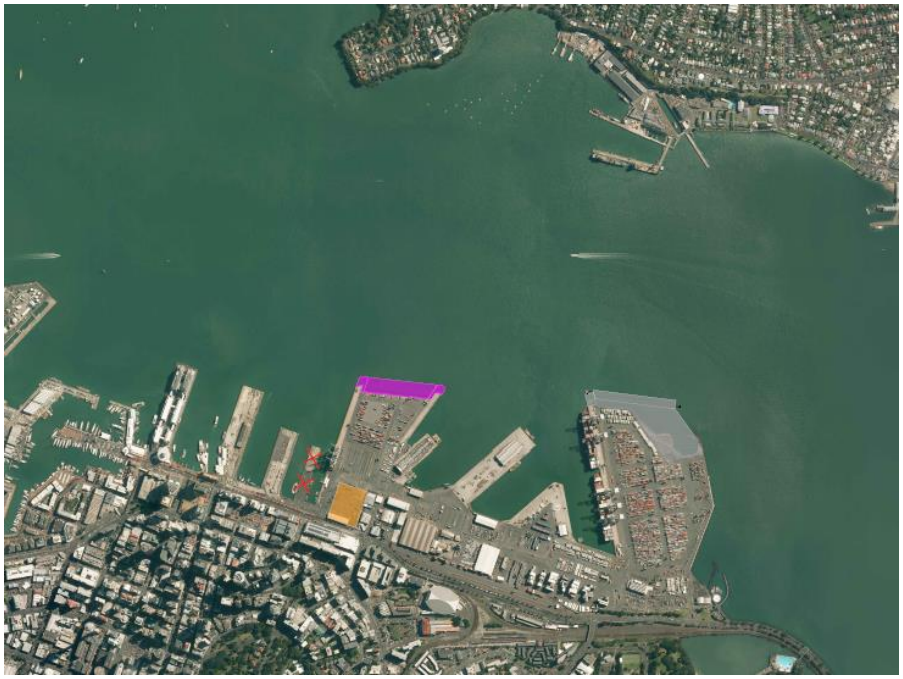
The Port Future Study (Consensus Working Group, 2016) recommended that POAL should increase its capacity to cater for projected growth. POAL has developed a concept in line with the Port Future Study which is illustrated in the following figure.

Under this concept, POAL's plans to increase capacity include a new vehicle processing building. This building is intended to improve the visual amenity of the port site by incorporating an attractive façade and possibly office and other mixed-use space in the design, and by screening away some of the port activities.

The proposed developments to provide the necessary capacity at Bledisloe (which handles vehicle imports) includes:

- Berthage infrastructure investment totalling $45 million:
  - Bledisloe north berth, coloured purple – costing $50 million but with only 50% devoted to vehicle import handling – $25 million
  - Removal of Marsden wharf, shown as red 'X' – costing $20 million the benefits being additional berths on Bledisloe devoted to vehicle imports and Captain Cook east possibly for cruise ships
- A development in line with the Port Future Study comprising of a vehicle processing building is intended to improve the visual amenity of the Port site by incorporating an attractive façade and office and other mixed-use space in the design, and by screening away some of the port activities. This is estimated to cost $40 million with possible enhancements such as roof top public access at an additional cost.

Figure 26 POAL's proposed Bledisloe development



Source: POAL personal communication

These investments are consistent with the Port Future Study plans led last year by Auckland Council. The above works, along with deepening of the Captain Cook and

Bledisloe basin will provide the required capacity for the processing of future vehicle import volumes and open the eastern side of Captain Cook wharf for possible cruise use.

We have not included these investments in the base case.

Alternatives to Auckland

If the entire car trade was relocated from Auckland to another port, the following would be required to provide the same level of service:

- 600m flexing to 1,000m berth length (and ideally 1,000m dedicated berth length in the long term)
- 16ha flexing to 20ha yard (we assume 18ha)
- Yard in proximity to berths. This enables vessels to be unloaded quickly due to the short distance between the ship ramp and the yard. This in turn enables vessels to be turned around quickly, significantly reducing vessel operator costs and decreasing berth demand.
- A clean and efficient bio-security area. Most other New Zealand process mixed cargo near the handling areas for vehicles, increasing the risk of contamination and damage.
-

The total port infrastructure can be broken into two major costs:

- Berthage – the construction cost of the wharf and dredging the berth pocket
- Storage – the construction cost of the yard space on a greenfield site which includes pavement, drainage, lighting and other items.

Our estimates of the construction costs are summarised below.

Table 8 Construction cost assumptions

Investment	Total cost	Description / comment
Berth	$60m per berth	PwC's 2012 report 'How can we meet increasing demand for ports in the Upper North Island' estimates the berth construction cost will be between $50m and $70m. This estimate is for Northport's already consented but yet to be built fourth berth. The consent was obtained for a 270m berth.
Storage	$36m (on Greenfields)	Ports of Auckland's devoted yard space to vehicle import operation is 12.5ha (this is an estimate due to overflow and other factors which complicate the exact assessment of the total yard space solely devoted to vehicles). We assume that 18ha would be required to accommodate future vehicle import volumes. We assume a construction cost per hectare of $2m. Note that if further reclamation was required, then there would be an additional cost of about $3m/ha.

Source: NZIER, industry personal communication

The following table summarises the total port infrastructure costs for Ports of Auckland, Northport and Port of Tauranga should the vehicle imports be diverted to them. The total (berth and storage) port infrastructure costs is $156 and 160 million, $71 and 75 million above that of POAL's proposed future investments.

Table 9 Total port infrastructure investment costs

In $ millions, total cost not NPV

Port scenario	Berthage	Storage[5]	Total
Ports of Auckland	$45	$40	***$85***
Northport	$120	$36	***$156***
Port of Tauranga	$120	$40	***$160***
Relative to Ports of Auckland (base case)			
Northport	$75	-$4	***$71***
Port of Tauranga	$75	$-0	***$75***

Source: NZIER

The following table summarises the timing of the investments which are cost items of the CBA alongside the timing of the benefits (uplift in the value of Ports of Auckland land).

Table 10 Timing of cost and benefit elements

<table>
<tr><th rowspan="3">Year</th><th>Benefits</th><th colspan="3">Costs</th></tr>
<tr><th rowspan="2">POAL land</th><th rowspan="2">Change in vehicle import port of call</th><th colspan="2">Infrastructure at alternative port</th></tr>
<tr><th>Berth</th><th>Storage</th></tr>
<tr><td>2018</td><td rowspan="6">Progressive land value uplift – as vehicles are diverted to another port</td><td>POAL's market share transfer begins</td><td rowspan="2">First berth construction</td><td rowspan="3">Storage development (either greenfield or parking terminal)</td></tr>
<tr><td>2019</td><td rowspan="4">Transfer taking place</td></tr>
<tr><td>2020</td><td rowspan="3">Second birth construction</td></tr>
<tr><td>2021</td><td rowspan="3"></td></tr>
<tr><td>2022</td></tr>
<tr><td>2023</td></tr>
<tr><td>2024</td><td colspan="3">POAL's market share transfer completed</td></tr>
<tr><td>2025 to 2049</td><td>In alternative land use</td><td colspan="3">Alternative port processing all of POAL's vehicle import volumes</td></tr>
</table>

[5] Excluding the cost of reclamation.

Source: NZIER

We make the following assumptions.

Northport

PWC's 2012 report predicted that Northport's own trade will increase by 33% by 2041, and concludes that existing and consented berth infrastructure should be sufficient to accommodate this growth. If the freight task is greater than projected, or berth occupancy cannot be sustained at required levels, berthage can be expanded further eastwards by an additional 270m beyond that already consented.

With respect to storage area, the report concluded that:

> *"Northport will likely have difficulty catering for future throughput growth with its current storage land area (at least at the current level of storage utilisation)" (PwC, 2012).*

If the vehicle import trade were to be diverted from Auckland to Northport, Northport would need to expand beyond its current plans. It would need to:

- Reclaim more land, near the berth
- Utilise adjacent land owned by Northland Port Corporation (NPC)
- Stack logs higher (over and above the modest increase in stack height currently being implemented)
- Reduce dwell times.

The feasibility of several of these options is questionable. The land owned by NPC is substantially further from the berth than is the case at Auckland, which would impact productivity and vehicle handling costs. Stacking logs higher and reducing dwell times would represent a substantial change in the logistics pattern at Northport which is characterised by larger numbers of small consignments. There is also a conflict between the log operation (which is dirty and dusty) and the requirement for a clean site for a car terminal to avoid dirt and contamination of cars which then must be cleaned. The feasible option is therefore to allow Northport to expand westwards across Blacksmiths Creek, in front of the adjacent developed residential areas.

We assume Northport invests in the construction of two berths with a total cost of $120 million, $60 million each. The 'How can we meet increasing demand for ports in the Upper North Island' report (henceforth the 'Upper North Island port study') states that (PwC, 2012):

> *Northport has resource consent for a fourth 270m berth, east of the current berths, with 4.6ha of reclaimed storage. There is also the potential for Northport to continue this development further east, developing a fifth berth, with an extra 13.6ha of reclaimed storage land possible (PwC, 2012).*

We assume Northport builds the already consented fourth berth as we all as a fifth berth. The report also notes with regards to a sixth berth:

> *It is also potentially possible for Northport to develop berthage west of its current site. However, this is considered much more difficult,*

> *due to the sensitive nature of that land and the potential adverse environmental effects (PwC, 2012).*

The assumption that Northport could build a sixth berth is debatable, we do not make that assumption in this analysis. It is unlikely that Northport will be able to provide three berths devoted to vehicle import handling. As Ports of Auckland's plans are to devote three berths to vehicle import handling, Northport's ongoing catering of other imports and exports is likely to be stressed by the vehicle import volumes. We do not quantify the potential impact of this constraint on Northport.

We assume that Northport invests in a storage space (yard space) to accommodate vehicle imports. We acknowledge that the consent for Northport's fourth berth includes a 4.6ha reclaimed storage space. However, the Upper North Island port study states that:

> *Northport will likely have difficulty catering for future throughput growth with its current storage land area, the construction of the fourth berth and additional storage space being one the solutions to this potential future constraint (PwC, 2012).*

Hence this space is not likely to be available for vehicle imports.

An additional 18ha would be required. This could be partially provided by the reclaimed storage space made available by the construction of the fifth berth (the total storage land provided being 13.6ha). But this space not being enough and that would require two separate yard space developments which is not economical. We therefore assume that Northport invests in greenfield development further away from the berth itself at a cost of $36 million.

We assume the construction of the storage space and first berth takes place immediately and construction of the second berth three years later.

4.5.1. Port of Tauranga

The Port of Tauranga (POT) occupies land at Mount Maunganui and Sulphur Point. The Sulphur Point site is used for containers, and multi cargo is handled at Mount Maunganui. We expect vehicle imports would be handled at Mount Maunganui.

The difficulty of establishing capacity for non-unitised mixed cargoes makes it difficult to estimate the total capacity of these wharves. The PwC report noted that Port of Tauranga would need to achieve average berth occupancy of 75% to accommodate all the projected bulk volume at its current infrastructure, which is beyond PWC's estimated maximum capability of 55-65% (PwC, 2012). If 65% berth occupancy was achievable and sustained, POT would require 15% more berthage to accommodate its bulk freight, or an additional 300m of berthage.

On the ability for Port of Tauranga to accommodate its projected future throughput, The 'Upper North Island port study' states:

> *Even with the available operating efficiencies, and the additional 170m of berth length currently being developed, POT's current berth length will not be sufficient to cater for our projected increase in throughput, both for containers and bulk cargo. POT will need to construct additional berthage. While resource consent will be*

> *required, POT's current plan to extend the current container berth 285 metres to the south, and to extend the current bulk berths by up to 1 ,000 metres to the south, will be sufficient to address this issue (PwC, 2012).*

We assume Port of Tauranga invests in two berths to accommodate POAL's vehicle import volumes. POT's current plan to develop a 285 metre berth to the south can be assumed to be only partially available for vehicle import handling. The total cost of berthage investment is the same as Northport's, $120 million.

As is the case at Northport, it is debatable that Port of Tauranga will be able to provide three berths devoted to vehicle import handling. Similarly, POT's ongoing handling of other imports and exports is likely to be stressed by the vehicle import volumes. We do not quantify the potential impact of this constraint on Port of Tauranga.

It is important to note that extending bulk berths to this extent may conflict with existing dolphin berths in the same area. The assumed 1,000m extension to the south would also extend across the front of a public road.

If POT future throughput growth is not strong, it may be possible to devote the additional 1,000m of berth length to vehicle imports only. However, such a development would be unsuitable for the storage of the vehicles, which are land hungry, as there is no suitable unoccupied land for an 18ha yard in proximity to the berth. The nearest available land is some distance away across public roads.

It is not obvious where Port of Tauranga would site an 18ha yard space greenfield development. We assume that Port of Tauranga would rather invest in car park building similar to POAL's development.

POT would have to decide its exact location but it is likely to be further away from the berth and a greater distance than the current arrangements in place at the Port of Auckland (increasing costs further which are not quantified in our CBA). Total investment cost in storage space for vehicles is therefore $40 million (same as POAL's development).

We assume the construction of the storage space and first berth takes place immediately and construction of the second berth three years later.

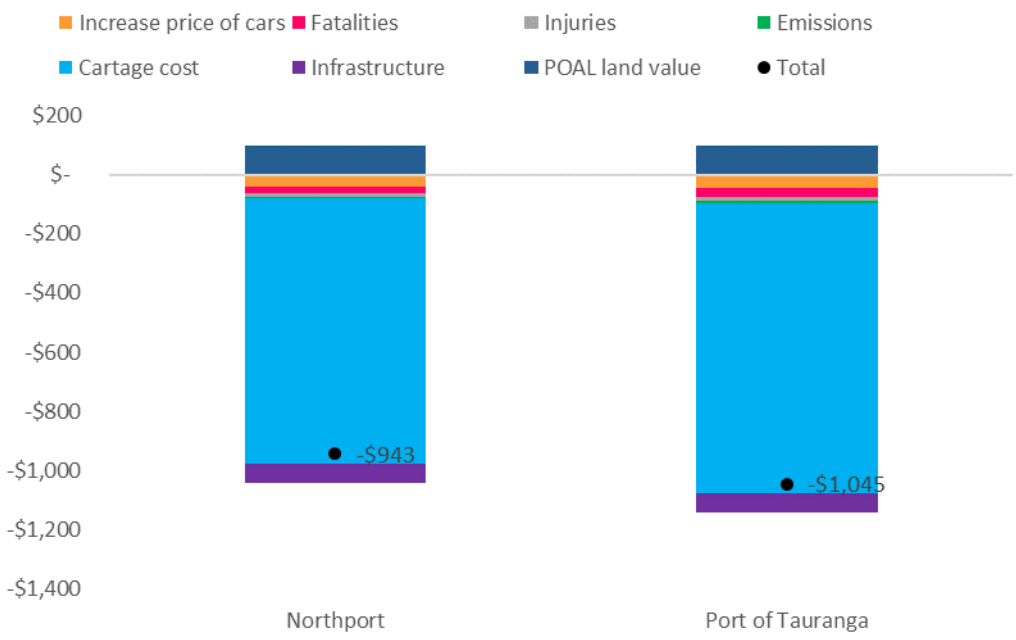
4.6. Summary: the costs of the scenarios

The national welfare CBA results are that the estimated required visual amenity impacts that would justify no change or an improvement to national welfare would respectively need to be equal to or greater than

- $943 million if Auckland's car trade is diverted to Northport, or
- $1.05 billion if Auckland's car trade is diverted to the Port of Tauranga.

Figure 27 Summary of CBA national cost estimates of alternative port use

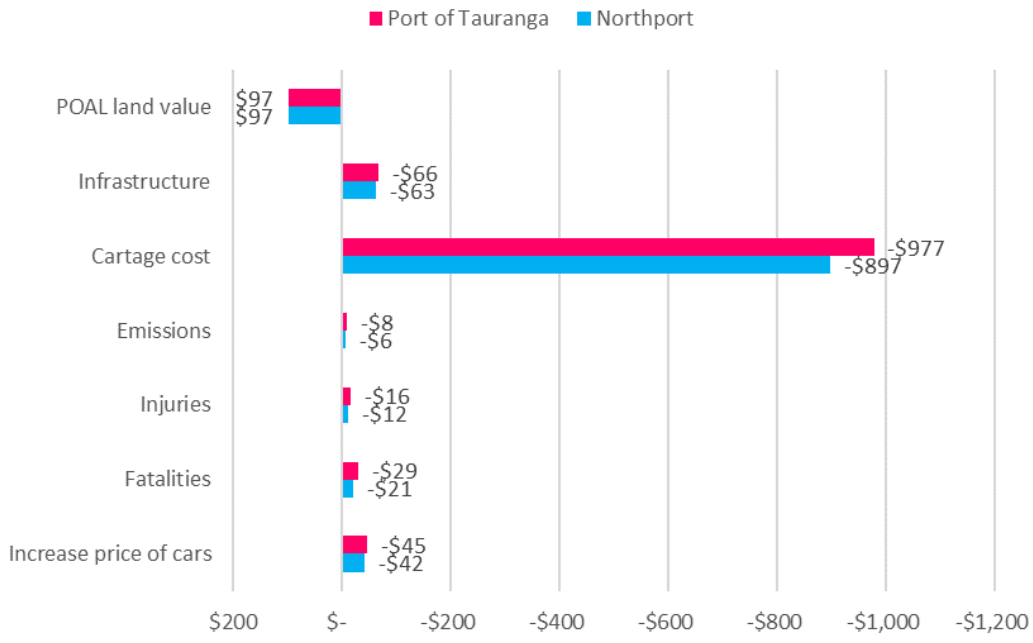
$ millions; Net present value of costs and benefits out to 2049



Source: NZIER

Figure 28 Summary results by cost

$ millions; Net present value



Source: NZIER

Table 11 Summary results by cost

$ millions; Net present value

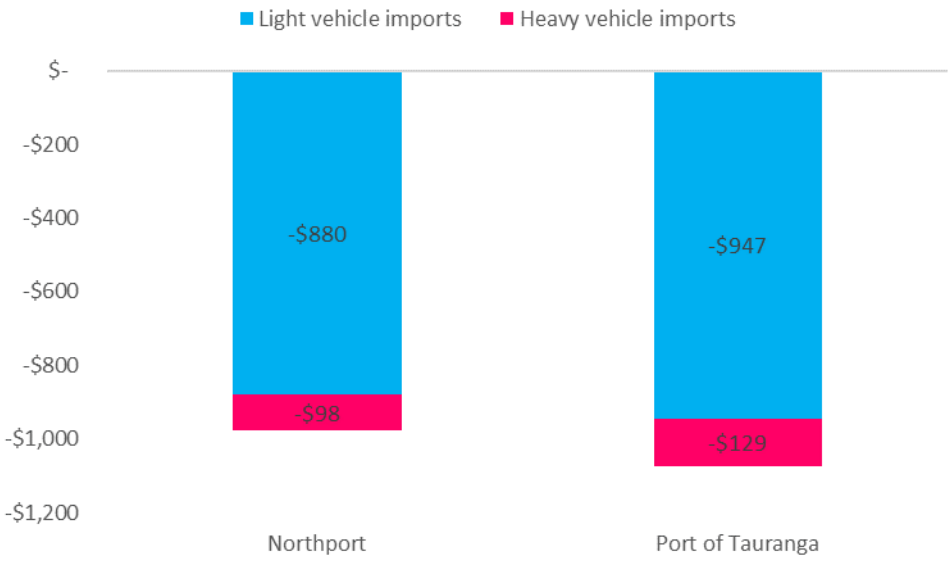
Cost	Northport	Port of Tauranga
Increase price of cars	-$42	-$45
Fatalities	-$21	-$29
Injuries	-$12	-$16
Emissions	-$6	-$8
Cartage cost	-$897	-$977
Infrastructure	-$63	-$66
Land uplift	$97	$97
Total	**-$943**	**-$1,045**

Source: NZIER

Light vehicles account for the bulk of the total cost of both scenarios in the CBA.

Figure 29 Light and heavy vehicles CBA results

$ millions; Net present value



Source: NZIER

5. Value of port land in alternative use

Benefits from shifting vehicle imports to another port include the mitigation of visual amenity impacts, of having vehicles temporary parked on the wharves, and the financial returns from the sale of the land.

The benefits from port land being in alternative use are captured in two ways

- Value uplift of the land – the change in land use from port operations to another use, predominantly a mix of residential and retail use, raises the economic value of the land. This benefit is captured by the market (as the land is sold to be redeveloped) and is estimated in this study
- Visual amenity benefits – those benefits arise from the preference of having POAL's land used for another use than port operations. It is the value that people place on having a better visual amenity from a residential development than on vehicle being processed on the same land.

In this study, we estimate an unimproved value of the land if put on the open market, which we compare to the current valuation of the land derived from POAL's published accounts. This 'uplift' value of land is in then put into the CBA as a benefit stream.

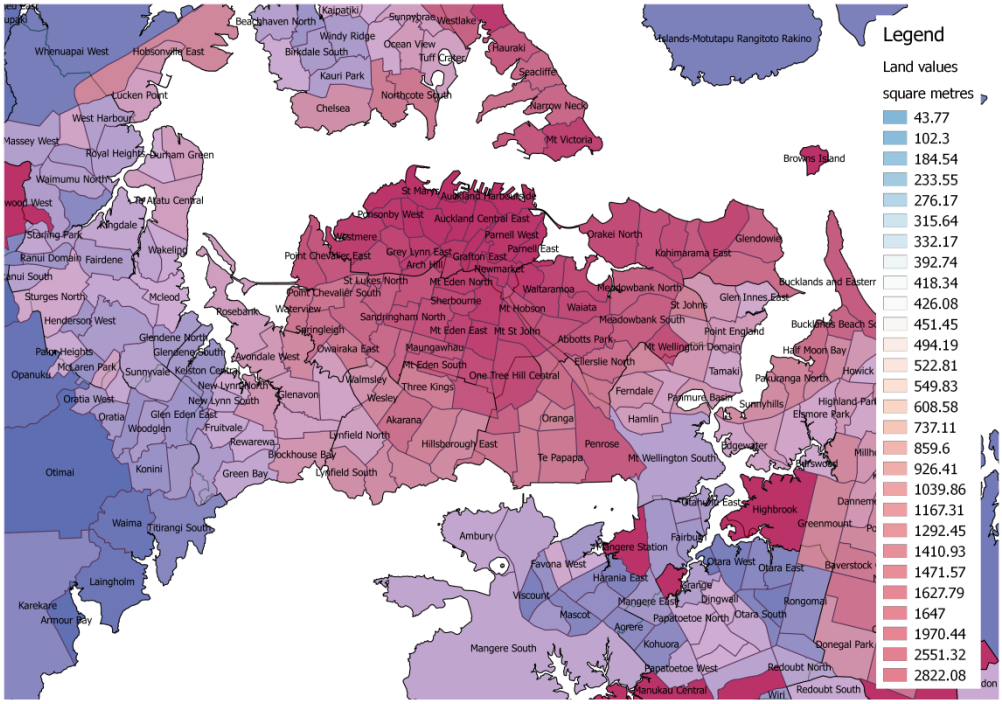
These benefits are difficult to assess because they depend on:

- The precise form of the alternative land use, which is at present unknown, – Options include public spaces, residential, office, mixed uses, and the development of public facilities such as stadia
- The ability of POAL to unbundle the 12.5 hectares for vehicle imports from other general cargo and trans-shipment operations
- How the release of land is staged over time and conditions in the property market at the time of sale
- Whether the tenure is freehold (if politically achievable) or leasehold
- Extent to which the wharf and breastwork structures can be developed
- The impact of the neighbouring port operations on the desirability of the land, particularly as the port operates 24/7
- Public reaction and planning regulation to any proposed development, in particular the number of open spaces and the height of buildings that may be acceptable to the community.

In this study, we estimate an unimproved value of the land if put on the open market, which we compare to the current valuation of the land derived from POAL's published accounts. This 'uplift' value of land is in then put into the CBA as a benefit stream.

5.1. Estimated market value of land released

Figure 30 Land price variations across Auckland



Source: NZIER, 2015

There is considerable variation in land values, both across Auckland, as we see from Figure 30, taken from a 2015 NZIER study, and even within urban precincts. Land price variations reflect a wide range of factors including:

- Availability of public transport
- Local amenity features e.g. parks and sea views
- Zoning rules for land use types e.g. industrial or residential
- Regulatory use constraints – historic places use restrictions
- School zone restrictions
- Number of legal land parcels that may need to be amalgamated
- The form of tenure, freehold or lease
- Building height, use and density restrictions
- The cost of demolition and land clearance costs required to release land to the market
- Tenure – freehold or leasehold.

So, while the unimproved land values in the central CBD averages a value of close to $3,000/m2, there will be a wide variation around this average. It follows that estimates of the financial benefits from the sale of land for an alternative use are inherently uncertain. Land values will be very sensitive to planning restrictions such as building height limits and such planning policies cannot be known with certainty in advance of an alternative land use development of the port precinct.

The value of POAL land also depends on the ability of POAL to uncouple the space used for vehicle imports from other general cargo and trans-shipment operations. It is unlikely that the 12.5 hectares used for vehicle imports could be released in its entirety to the market. It is also unlikely that all the land released would be sold for development; pedestrian and road access would be required and some land would need to be set aside for public open spaces.

5.1.1. Estimates of alternative land use values

Two estimates of the alternative land use scenarios of POAL land have been undertaken in recent years.

CBRE

In 2013 POAL engaged CBRE Limited to estimate the alternative use for the 77ha POAL then occupied, largely close to the CBD. The CBRE approach was to work back from the sale value of a benchmark development. CBRE modelling assumed:

- The land would be available for mixed use, commercial and residential development, with investment of circa $450 million and with a 'built out' value likely to exceed $10 billion
- There would be a requirement for significant areas of public open space including an esplanade reserve along the water frontage
- 56% of the land would be available for property development
- A 40-year development period, releasing land in accord with market conditions
- Town planning policies and rules would reflect densities and height limits imposed by the zoning in adjacent Wynyard Quarter and the Viaduct Basin
- A gross floor area (GFA) of 1,612,500 m2 would be available for development
- A 4% long-term growth rate for land values in the Auckland CBD, based on the long-term growth rate of commercial land values in the Auckland CBD
- A seawall upgrade costing $120.6 million would be required
- Redevelopment works – demolition, roads, utilities, and open spaces etc. – would cost in order of $234 million.

CBRE estimated a total land value of between $300 to $600 million for the 77 hectares occupied by the Port. The mid-point of this estimated range is $584/m2.

EY and JLL

The most recent reference point for the land value is a report commissioned from JLL for EY's 2016 report to the Port Future Study.[6] This followed a similar approach to CBRE, working back from a notional development, the form of which was not specified in any detail. The land value estimate assumed:

- A value of $5,500 per m2 once the POAL land was developed, based on current sales of between $4,000 and $6,000 per m2 for similar sites on the periphery of the CBD adjacent to the Port
- The total developable area of the land was set at 45%, based on benchmark analysis of the other sites not specified
- A GFA of 2,126,250 m2 was assumed to be available for development. Building heights of up to 9 stories are assumed to be possible, although this is not clear from the information presented
- A 3% long-term growth rate for land values in the Auckland CBD, based on long-term growth rate of commercial land values in the Auckland CBD
- The staged release of land to avoid costly holding costs and maximise market sale value. This assumes POAL could continue some port operations on the land, but the practical challenges of doing this are not addressed.

JLL estimated an undeveloped land value of $1,400 per m2 for the full 75-77 hectare site, arriving at a total value of just over $1.0 billion for POAL land.

5.1.2. Why the big estimated difference in the alternative land use valuations?

While assumptions and scenarios can be challenged in both reports, the fact they have arrived at such different values demonstrates the speculative nature of guessing at future planning policies and rules for alternative land use. EY assumed a total developable area of the land of 46%, significantly lower than CBRE's 56%. EY assumed GFA was 32% higher than CBRE's. In other words, EY assumed a significantly higher site density and more property placed on the market, and this appears to have been a major factor driving the difference in valuation between the two studies. CBRE appear to have assumed a 5-storey development, and EY appear to have assumed a 9-storey development.

The use of higher building heights and associated density arguably makes the EY estimate more speculative than CBRE's. First, CBRE explicitly benchmark their assumed planning policies and rules to existing adjacent sites, whereas EYs benchmark is not defined. Second, any redevelopment scenario is likely to be a highly contested political process with considerable public engagement. We can look to the redevelopment of the Wellington CBD waterfront as useful comparator. There was fierce public resistance to intensification, and the result was wide open spaces; two-storey low rise

[6] EY Consultants Report to the Port Future Study 2016.

[7] The volume of land available for redevelopment has fluctuated as POAL has repurposed areas and hence the slight differences in the estimates of available land.

developments and retention of original port warehouses. Thus, it is far from clear that a re-development would achieve the GFA assumed by CBRE.

For purpose of the CBA we chosen to use the higher and possibly less likely EY estimate of the market value of POAL land. We have chosen this estimate because:

- It is independent of POAL's analysis and thus may be perceived as more credible
- It enables us to test whether the highest estimated value of an alternative land use would provide a benefit stream material enough to offset the economic, social and environment costs of shifting vehicle imports to another port
- The Port Future Study has been accepted by the Auckland Council as the reference point for future work on port development

In doing so NZIER is not endorsing the estimate as being any sounder than other estimates of the alternative land use values.

Assuming the full 12.5 hectares of land used for temporary vehicle parking and processing could be released in totality, this would yield a market value of $175 million using the Port Future Study estimate.

5.2. The economic value of the land

From a national CBA perspective, we are interested in the change of the economic value of the land today, if it was put into another use. The change in the economic value is the difference between its value today, in its current use, and its value in an alternative higher value use. This is the "uplift" in its economic value once the land is re-zoned and transferred into its higher value use. New Zealand already receives the value of the land today in its current use – we are interested in how much value can be added to the economy by changing its use in its next best use.

Currently POAL land appears to be achieving attractive investment returns of 11-12% for the port owner – Auckland Council.[8] Net yields on buildings in adjacent CBD precincts to the port are yielding 6-9%, however the land typically has significantly higher values and is principally used for CBD office space, retail and apartment dwelling.

POAL's asset valuation methodology, used for accounting purposes, also considers the highest value next use of the land. The rationale, from a business perspective, is to try and ensure management are focused on getting the best return on land holdings for shareholders (Auckland Council). Their valuation, prepared by Harcourts, however differs from the development based values developed by CBRE and JLL due to the use of more conservative site coverage and height assumptions for an alternative use.

The valuation is based on the amalgamation of land and staged subdivision from the CBRE report (CBRE, 2013). It updates this work by benchmarking 150 allotments with an average gross realisation of circa $4,500 per square metre. This generates a value of $387.3 million for 75 hectares of POAL land. This equates to a market value for the

[8] Measured as the ratio of EBITDA to total assets.

12.5 hectares of land, used for vehicle imports, of $59.8 million after adjusting for differences in land and wharf area (CBRE, 2013).[9]

As outlined above, we have chosen to use JLL's valuation from the 2016 report to the Port Future Study as the basis for the highest value the land could achieve in an alternative use. We are not suggesting this is the actual value of the alternative land use value. The summary calculation of the notional uplift in value is $115.2 million and is contained in the table below along with a comparison using the CBRE figure.

Table 12 Economic value of land released from exiting vehicle imports

Market value in alternative use (Port Future Study)	Less current POAL book value	Equals economic uplift value for CBA
$175 million	$59.8 million	$115.2 million

Source: NZIER 2017

5.3. Agglomeration benefits

The EY report applied a 12% land use uplift to reflect the net positive agglomeration benefits overall where all the port land is redeveloped (EY, 2016). In theory, agglomeration benefits, could arise where a substantial number of new workers come to the CBD, to live in residential developments on the former port land, and benefits arise from an increased density of businesses operating inside the CBD. Businesses gain benefit from working more closely together and attracting a larger pool of skilled labour to their support growth.

EY noted that while the port redevelopment would have a lower density and therefore agglomeration dis-benefits, it was assumed that the workers would move from less dense areas outside the CBD to more dense work locations, thus generating net positive agglomeration benefits overall. The 12% uplift was based on "a similar urban renewal project of an existing port site in Australia". EY is not specific as the development site they benchmarked, so it is difficult to comment on this estimate (EY, 2016).

However, we note that net agglomeration benefits will depend on the scale of the development at hand. The release of the land previously used for vehicles (12.5ha), is equivalent to only 16.5% of the land EY was assuming would be redeveloped. It is not clear that such a smaller scale development would reach a threshold where agglomeration effects are material enough to be estimated.

Agglomeration effects are not linear, they will disproportionately decline with the size of the development, so simply prorating the EY uplift to the land value, would overestimate any benefits. We note, even if we did apply a proportion of the uplift factor, say 10% ($17.5 million), this would not make a material contribution to offset

[9] In the case of the Bledisloe area, there is a higher portion of piled wharf structures (than for other parts of the port) some 4.2 ha of the total 12.5ha. The piled wharf structures (like Queens Wharf) are far costlier to develop for alternative uses, and tenure is limited by the length of occupation consents.

the economic, social and environmental costs we have quantified of shifting vehicles to another port.

5.4. POAL future development plan

Ideally, we then need to quantify the net benefits of the change in amenity values between the base case and the alternative land use scenario. This would involve subtracting the amenity benefits in the POAL base case investment, from the amenity benefits obtained from the land in an alternative use. However, we have no indicative value of amenity benefits associated with the base case scenario and hence can only qualitatively describe the possible development concept at POAL.

Figure 31 POAL's proposed Bledisloe development

Source: POAL personal communication

Figure 31 also shows the possible future developments consistent with the Port Future Study Consensus Working Group recommendation for "a northern east-west berth at Bledisloe Wharf"[10] and the car park building envisaged in the EY alternative option analysis:

- Extension of the Fergusson container terminal (underway)
- Bledisloe north berth, coloured purple – costing $50 million with only 50% devoted to vehicle import handling
- Car processing building – costing $40 million with possible enhancements such as roof top public access at an additional cost

[10] Page 24 Port Future Study.

- Removal of Marsden wharf, shown as red 'X' – costing $20 million, the benefits being additional berths on Bledisloe devoted to vehicle imports and Captain Cook east possibly for cruise ships.

The above investments, along with the deepening of the Captain Cook and Bledisloe basin, will provide the required capacity for the processing of future general cargo, containers and vehicle import volumes and will open-up the eastern side of Captain Cook wharf for possible cruise ship use.

5.5. Amenity benefits must 'make-up' for the estimated costs

The alternative land use scenarios provide for significant public and other amenity features and *these amenity benefits are likely to be captured* in the alternative land use property values. To illustrate, people are willing to pay more for downtown residential living associated with open park spaces, sea views, transit services (close to Britomart) and entertainment, than they are for other CBD sites without such amenity services.

While we cannot unbundle and estimate these amenity values from the alternative land value, they are in part embedded in the CBA economic uplift value of $115.2 million. This uplift equates to 66% of EY's estimated land value of $175 million. Thus, amenity values are significantly captured in the alternative port scenarios through the estimated land sale benefits.

It is not possible to estimate the net amenity benefits – the difference between that provided by the base case and the port scenarios we explore – with any degree of accuracy. To do so, we would have to account for detrimental effects on environmental and amenity values associated with developments at the Port of Tauranga or Northport. While we leave this unquantified, we note there is no obvious case to suggest that the adverse amenity effects of other port developments, to manage the vehicles, would be offset by residual amenity benefits not captured in the uplift land value.

5.5.1. Benefit shortfall – 'back-calculation'

We have estimated the quantified economic, social and environment costs of shifting vehicles as between $1.04 and $1.14 billion. The CBA model assumption is that the alternative land use value uplift of $115 million takes place progressively over the course of the 7 year transition where vehicle import are progressively diverted away from Ports of Auckland as land becomes available for alternative uses. The value grows by 3% per year to capture long run property appreciation and we then apply a 6% discount rate to this benefit stream.

The resulting benefits do not materially offset the scenario costs and leave an economic deficit of the alternative scenarios of $943 million and $1.05 billion – i.e. the shortfall in benefits required to achieve a benefit-cost ratio of 1 (the NPV of the uplift of the value of the land is $97 million). This is referred to as a 'back-calculation' of unquantifiable benefits in a CBA.

5.5.2. Land value uplift at Northport and Port of Tauranga

It could be argued that the diversion of the vehicle import trade would uplift the value of the land at Northport and Port of Tauranga and that this included in the CBA. From a national welfare perspective, however, an uplift in the value of any existing industrial land at alternative port sites simply reflects the fact these ports have now captured the cash flow that previously went to POAL. The same activity is now undertaken at an alternative site and hence reflected in the land value; it is not additive. Whereas, in the case of alternative POAL land use, land is transferred into a higher value use for country.

6. Cost benefit framework

6.1. National welfare analysis approach

Using a national welfare analysis approach we investigate costs and benefits from a national, rather than a regional perspective. We take this approach as the vehicles imported through POAL are distributed across the North Island and any changes in the price of vehicles ultimately flow through the entire market. The welfare considerations we consider include:

- National resource costs or productive efficiency – for example, these might arise for car importers and distributors through changed infrastructural costs e.g. the cost of additional berth facilities and transporter cartage costs for vehicles.
- Changes in producer surplus. Producer surplus is a measure of the difference between the amount a producer of a good, in this case importation of vehicles for sale, receives in the market and the minimum amount the producer is willing to accept in payment
- Changes in consumer surplus that might arise from changes in importation costs. Consumer surplus is defined as the difference between the total amount that consumers are willing to pay for vehicles (indicated by a demand curve) and the total amount that they do pay (i.e. the market price)
- Deadweight losses (also known as excess burden or allocative inefficiency) is a loss of economic efficiency that can occur when the optimal equilibrium for a good or service is not achieved or is not achievable. This could be due to poorly designed regulations or monopoly pricing
- Social and environmental costs and benefits – for example, the cost of an increased crash rate if vehicles need to be transported further, and environmental amenity benefits from an alternative use of port land
- Dynamic efficiency losses or gains as both producers and consumers' respond to the new price setting e.g. as higher prices decrease the demand for vehicles, the average age of the vehicle fleet will rise.

In this context, we also carefully consider the transfers – benefits and costs that while borne by one party in the economy, due to the change in import location, represent merely redistribution of costs and benefits. Our analysis also considers 'deadweight losses' which may arise from policy interventions. These are expanded upon further below. Figure 32 provides an overview of the cost benefit approach.

6.2. Benefits

The benefits that could arise from transferring vehicles to another port include the:

- Alternative land use of port facilities
- Associated environmental and amenity values from the next best use.

We consider the alternative land use of the port facilities as a large development to increase amenity value from shopping, offices complex entertainment and seaside apartment living.

Amenity values are reflected in society's willingness to pay for avoidance or mitigation of adverse environmental effects, and are often not reflected in market prices. Political decision-makers are then left to weigh up whether the unquantified value of amenity change is big enough to overturn an estimated net benefit from a CBA.

6.3. Transfers

From a national perspective, the costs and benefits of Auckland exiting the vehicle industry are mixed – some regions win, while others lose but they do not impact the national CBA results. For example, dividends from the POAL, that supplement household council rates, would be reduced; however other councils or other port shareholders, in the other regions (Bay of Plenty and Northland), would benefit from an increased flow of dividends. The CBA treats such items as transfers from a national perspective.

Annual total revenue from vehicle activity to Ports of Auckland was $15 million in 2016. The loss of the vehicle import business would also reduce the value of POAL (or Auckland Council's investment) by about $170 million.

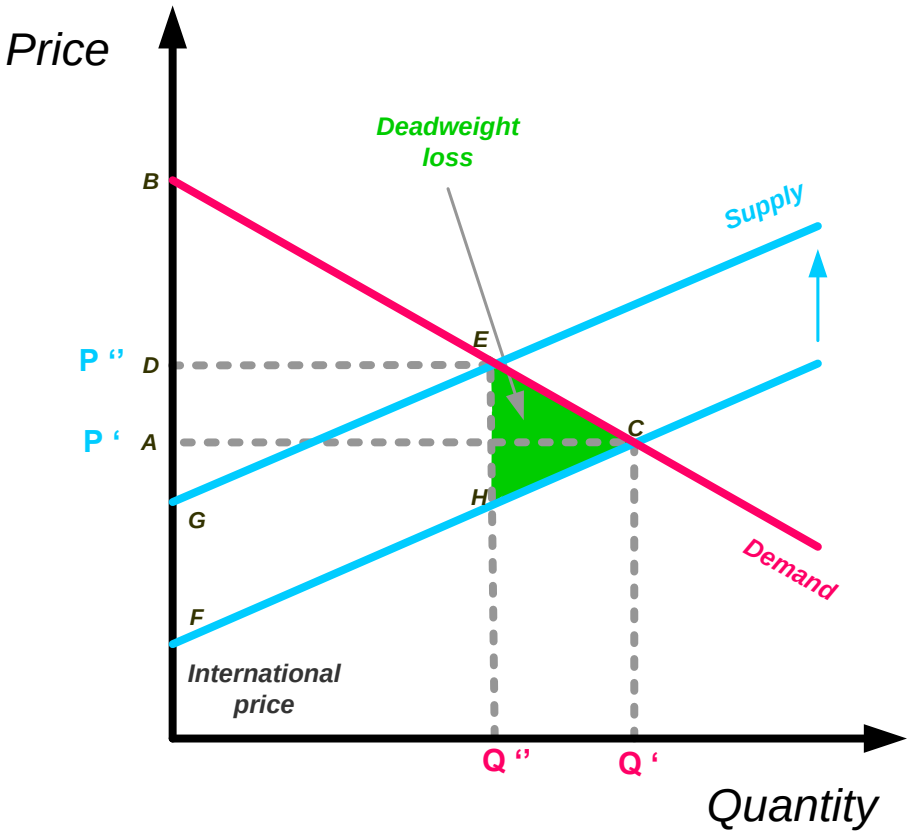
Whether such a loss eventuates depends on the value of the alternative use of the surplus port capacity (i.e. land) created by no longer importing vehicles. The idea of using surplus space for shopping and restaurant activities has been promoted by some as a higher value activity than importing vehicles. However, much of this may not add any significant value to the local economy. It may simply transfer such activities from adjacent shopping and restaurant precincts; in the absence of increased demand for these services.

6.4. Consumer and producer welfare analysis

New Zealand does not produce any light vehicles itself. It is a price taker of light vehicles produced by other nations, illustrated at point F in the graph in Figure 32. However, there are significant importer and distributor costs in landing vehicles, certifying road worthiness, modifying or refitting vehicles and moving them within Auckland (the main market) and to hinterland areas for sale to the final consumer. Thus we have drawn an upward sloping supply curve from point F representing New Zealand producers in the vehicle supply chain.

Our analysis below shows that importing vehicles through alternative ports substantially increases road cartage to the main market – Auckland. This is akin to putting a tariff on vehicles and moves the cost of domestic supply curve upward, now starting from point G in the graph. This increased cost is passed onto consumers, in the context of *long run* demand being reasonably inelastic. In turn, consumers demand fewer vehicles (they move back up the demand curve) and the volume of cars imported is reduced. As the price of light vehicle increases from point 'A' to 'D', the quantity imported falls, from Q' to Q'' in our framework.

Figure 32 National welfare framework



Source: NZIER

This reduction in demand is likely to be small as long-run demand for vehicles is inelastic. In the short term, the reduction in demand will be reflected in lower quality or smaller vehicle models being imported and in the longer term an ageing of the vehicle fleet. This movement from Q’ to Q’’ represents a deadweight loss to the economy, where both producers and consumers no longer benefit from vehicle imports and this is the shaded area ‘HEC’.

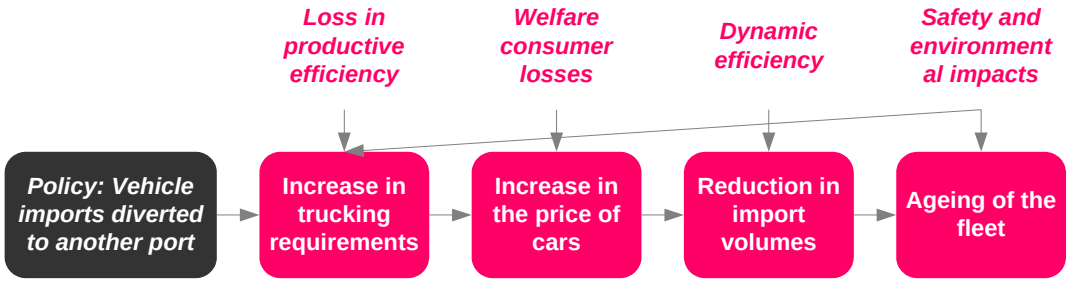
The resource cost for producers is the area below the supply curve and the cost of importing vehicles increases by the area ‘FGEH’, representing the increased cost of cartage. There are also reductions in consumer surplus – reduced from the area ‘ABC’ to the area DBE’ – and producer surplus – reduced from area ‘ACF’ to the area ‘GDE’.

A free, efficient market is unlikely to deliver such an outcome. For the result described above to come about (a) the owner (Council) would have to make the port move (either by using ownership rights, or re-zoning the land to force a move) and (b) the Council would have to be able to use the RMA to stop a new port being established by a different owner if the original port were moved.

Finally, it is worth noting that the increased cost of importing vehicles new to New Zealand affects the price of not only new but existing vehicles. Holders of existing vehicles see the value of their asset increase, but when they finally change vehicles

they are faced with a higher price. We do not include this as a welfare cost as it represents a transfer between buyers and sellers of the vehicles in the market.

Figure 33 Costs' summary and type



Source: NZIER

The approach to estimating each of the four costs outlined above are summarised below.

6.4.1. Loss in productive efficiency

The loss of productive efficiency in the economy comes from the extra cost of transporting cars from another port to Auckland and the cost of any changes to the car distribution supply chain in Auckland.

The transport fleet will grow to accommodate the greater transport task of carting vehicles from Northport and Port of Tauranga. While it may benefit the transport industry, it is a loss of productive efficiency to the economy from a welfare perspective (unless there is significant slack in the economy i.e. unmet capacity, which we do not assume in New Zealand over the long term). That is because the diversion of vehicle imports to a different port than Ports of Auckland draws resources to the transport industry that otherwise would be available for other uses and it is therefore a cost to the economy that would not have to be incurred otherwise. Backloading offers a good example. If vehicle imports move, trucks will be travelling longer distances while not carrying vehicles.

Another issue is the greater likelihood of damage to imported vehicles due to the greater distances covered. Any damages will need to be fixed before the vehicles are sold. We do not quantify the cost of those damages in this CBA.

Value of time

We use a value of time of $20.10 per hour for truck drivers from the NZTA Economic Evaluation Manual updated for 2016 prices (NZTA, 2016b).

There are a number of additional complications that are very challenging to estimate but could increase costs further around the potential adverse impact on predictability and timeliness in the supply chain. The main reason for this is being the increase in freight trucks carrying vehicles which may all need to be unloaded at the same time and the Auckland market may not be able to process them all at the same time.

The Auckland vehicle supply chain benefits currently from a small distance to travel from the Port to Penrose/Mount Wellington and a relatively constant flow of vehicles and predictable delivery timeframes which allow trucks to be unloaded one after the other.

Longer travel distances could potentially increase the platooning of trucks carrying vehicles. Platooning refers to the tendency for the transport system to work in such a way that vehicles arrive at their destination at the same time rather than spaced evenly. If platooning occurs, more trucks will need to be unloaded at the same time in Auckland, as opposed to the constant flow, which is obviously more efficient.

This means truck drivers risk either:

- Waiting for vehicles to be unloaded in Auckland and in Northport and Tauranga
- Unloading vehicles at a car park facility, which will then have to be double handled when there is enough capacity for the vehicle to be processed through the next stage of the supply chain.

The costs from having truck drivers restricted in the number of trips they will be able to undertake would be significant. The required trucking capacity if those issues arise would be above the increased need for a greater trucking fleet resulting from the greater distances to be covered.

6.4.2. Consumer welfare loss

Consumer welfare loss is the deadweight loss in our CBA framework, that is the increase in vehicle prices which reduces demand.

The deadweight loss arises from the reduction in vehicle imports. In practice, rather than a fall in quantity imported, it is likely that consumers will purchase cheaper or older vehicles rather than not purchase imported vehicles, or delay the purchase of a more recent vehicle. We equate the loss of welfare from importing older vehicles to the reduction in the volume of exports as a proxy.

In either case, the loss in welfare resulting from purchasing cheaper vehicles than they would otherwise have is a national welfare loss paid by no one to no one in the economy, it is a deadweight loss.

The increased revenue to the producer is used to pay for the increase in the number of drivers, the cost of investment in the larger required trucking fleet as well as lower backloading opportunities.

Based on total value of imports and import volumes we estimate the average light vehicle price at $15,300 in 2016.

6.4.3. Dynamic efficiency

The national welfare loss from an increase in the price of vehicles also includes the long-term impact of the price increases of light vehicles, which is a dynamic efficiency impact:

If older vehicles are purchased or purchase is delayed – the long-term impact includes a potential decrease in fuel efficiency across the fleet as older cars lead to increased carbon emissions.

We use the same approach to estimate both impacts and assume that estimating the value of the reduction in import volumes is a proxy for the total welfare loss which would take place in practice.

We summarise the research on the responsiveness of consumers to higher or lower prices for vehicles, i.e. the price elasticity of demand. Our review of the research suggests an inelastic demand (i.e. little change in demand due to a change in price) and some reported an elastic demand (i.e. a greater change in demand due to a change in price). But estimates of an inelastic demand for vehicles were more common than elastic demand findings.

A comprehensive study of the UK demand for light vehicles reported a very inelastic demand response from changes in prices not only for ownership costs (purchase price) based on different approaches, but also for running costs (which is closely related to the price of oil and fuel costs) (Whelan, circa 2003).

The international literature suggests demand for cars is inelastic, i.e. changes in price does not have a substantial impact on the quantity of vehicles demanded. However, given the large volumes of imported vehicles and the time span of the cost benefit analysis, small changes in price can have large welfare consequences.

In New Zealand, NZIER's research for NZTA aligns with the international literature. Our research found that a 10% increase in average costs of travel (dollars per km) was associated with a 0.3% reduction in travel demand, though this value varies according to shares of costs in household budgets (incomes) and over time as costs rise and fall (Stephenson, 2016). While the cost of travel is not equal to the purchase cost, it underlines the low sensitivity of demand for travel with respect to changes in prices (See Appendix C).

We have similar findings from our research of the elasticity of demand for a particular transport mode, i.e. driving against taking the bus. The results in Table 18 (Appendix C) are elasticities of mode share use, averaged across all New Zealand regions. The elasticities are percentage changes in mode share for a proportionate percentage change in the variable we use to understand the choice for different modes of transport.

Both the increase in the cost of driving and a reduction in income are inelastic and therefore would not lead to large shifts in demand for imported vehicles.

6.4.4. Social and environmental costs and benefits

Congestion

Transferring vehicle imports to another port is likely to somewhat increase congestion as the trucking fleet must increase to deal with the greater distances to be covered from Northport and Tauranga. However, in the Waikato and Bay of Plenty regions, freight traffic already accounts for a larger share of total vehicles travelled so the increase will not be material in those regions. Furthermore, road infrastructure

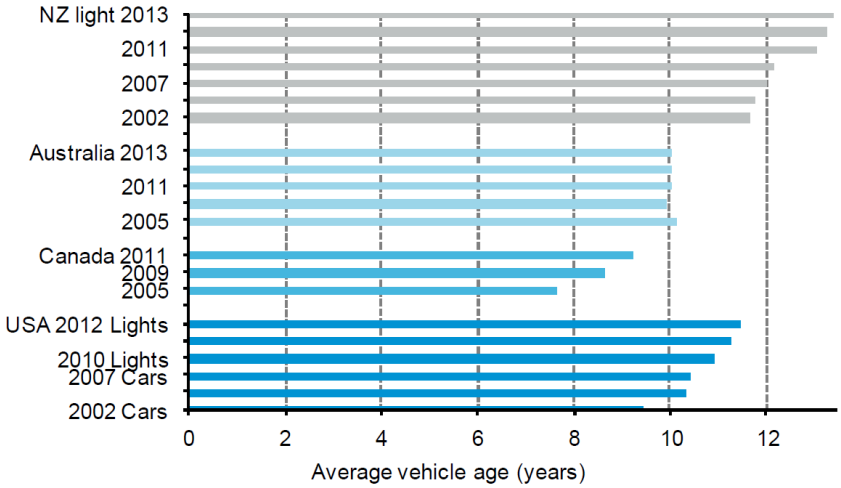
projects both in Northland and Waikato over the CBA period will mitigate this risk to some extent.

Ageing of the fleet

Vehicle age is important as it is a proxy for a range of vehicle attributes, especially the use of safety technology features and the vehicle's level of harmful emissions. An older fleet will be less safe and have higher harmful emissions than a younger fleet.

New Zealand's average age of the vehicles in the light fleet is already high by international standards (see Figure 34).

Figure 34 Average fleet age



Source: MOT, 2015

The Ministry of Transport states that there are possible issues associated with an ageing light vehicle fleet:

- New technologies (safety and environmental technologies) will not be taken up as quickly as they could be
- Delayed benefits to society from technologies that require a critical mass of vehicles to be using the technology before they become viable (the most obvious being intelligent transport systems) (MOT, 2011).

The ageing of the fleet is an impact we anticipate from this policy but we expect the cost in terms of safety and environmental costs to be much smaller than the large increase in costs from the increase in the trucking fleet to transport vehicles.

Hence, we only estimate the safety and environmental costs from the increase in trucking vehicle kilometres travelled in our CBA.

Safety impact

The value of statistical life at June 2015 prices, and adding the other social cost components gives an updated average social cost per fatality of $4,094,500 (then inflated to 2016 prices) (MOT, 2015a) (NZTA, 2016b).

For non-fatal injuries, the average social cost after scaling up the estimates to account for non-reported cases, are $760,000 per reported serious injury and $75,000 per reported minor injury (then inflated to 2017 prices) (MOT, 2015a) (NZTA, 2016b).

Environmental impacts

The cost of emissions for our CBA at 2004 prices is $40 per tonne of CO2 emitted (NZTA, 2016b).

6.5. Discount rate

We have used a discount rate of 6% (The Treasury, 2016). This is the rate recommended by Treasury and NZTA for major infrastructure projects with an asset life of greater than 25 years.

7. Sensitivity analysis

The sensitivity analysis of our CBA results includes a lower and upper bound of the cost of road cartag, and how the results would change if the cars were transported by rail rather than by road

7.1. Road cartage: upper and lower bounds

The important sensitivity is the lower bound sensitivity as it assumes a lower cartage cost to cart vehicles from Northport and Port of Tauranga than the central scenario. But the lower bound sensitivity does not suggest a positive impact of shifting the vehicle imports to Northport and Port of Tauranga either – it remains a net welfare loss.

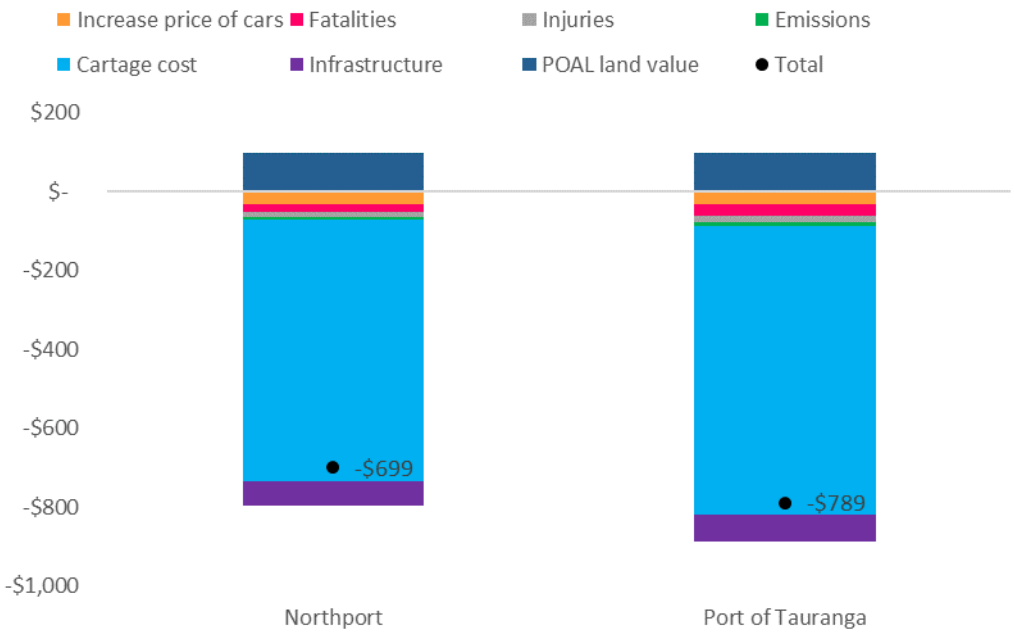
Lower bound

The lower bound CBA results are for a cost of cartage of $250 per vehicle (the central scenario being $318).

The national welfare CBA results are for the lower bound sensitivity analysis that the estimated required visual amenity impacts that would justify no change or an improvement to national welfare would respectively need to be equal to or greater than

- $699 million if Auckland's car trade is diverted to Northport, or a
- $789 million if Auckland's car trade is diverted to the Port of Tauranga.

Figure 35 Lower bound CBA results



Source: NZIER

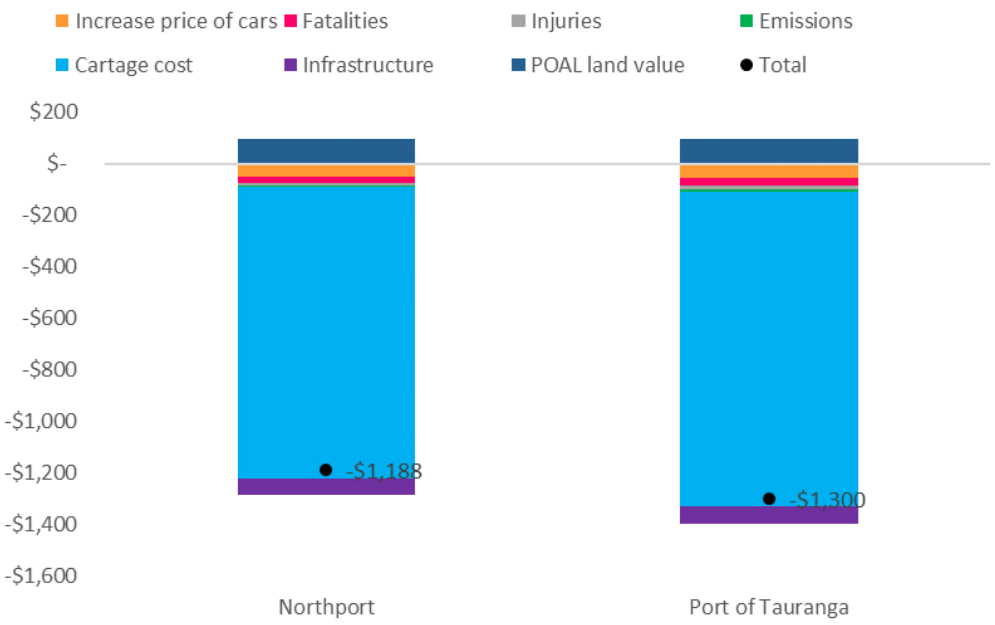
Upper bound

The higher bound CBA results are for a cost of cartage of $385 per vehicle (the central scenario being $318).

The national welfare CBA results are for the higher bound sensitivity analysis are that the estimated required visual amenity impacts that would justify no change or an improvement to national welfare would respectively need to be equal to or greater than

- $1.2 billion if Auckland's car trade is diverted to Northport, or a
- $1.3 billion if Auckland's car trade is diverted to the Port of Tauranga.

Figure 36 Upper bound CBA results



Source: NZIER

7.2. Rail cartage

Rail cartage for vehicles is much rarer than road and mostly from the Port of Tauranga. While there is scope to increase rail transport of the container trade (particularly for POAL) there is little infrastructure to transport vehicles by rail in New Zealand:

Ports of Auckland

Ports of Auckland benefits from an extensive rail network which has scope for a greater role in Auckland's logistics chain. At present, it is not used for carrying vehicles. POAL would face as many challenges distributing vehicles by rail as any other port.

Northport

Northport has an existing rail network, but it would require significant investment to support volumes of the order that go through to the Port of Auckland (Taylor, 2012). Estimates of the cost of upgrading the rail infrastructure to carry vehicles from Whangarei to Auckland is in the order of $3 to $4 billion. If the rail line were redeveloped, businesses outside Northland would still be better served by the Ports of Auckland or Tauranga (Taylor, 2012).

Port of Tauranga

The Bay of Plenty has over a third of New Zealand's rail traffic. The region's rail network is the most densely utilised sector of the national rail network. Rail plays a significant freight role in the region with a principal focus on the Port of Tauranga. Increasingly, the Port of Tauranga is being used as a gateway for the Auckland market, with shipping containers being railed to and from POAL's inland terminal at South Auckland (Environment Bay of Plenty, 2007).

Some vehicles landing at Port of Tauranga are moved by rail to Auckland, mostly in refers (refrigerated) containers, but they represent only a small volume. Our industry engagement indicates that rail is a problematic option for moving cars from the Port of Tauranga due to lack of rail car/wagon capacity, lack of consolidating facilities at Port of Tauranga and in Auckland, and pressure on the Kaimai Tunnel.

7.2.1. The costs of using rail for cartage

Expanding the rail network to accommodate the future growth in vehicle imports is unlikely to be commercially viable or welfare maximising as the cost of rail cartage is similar to the cost of road cartage, and diverting vehicles to Northport or Tauranga would incur a number of additional costs:

- Double handling if vehicles must be loaded and unloaded on several occasions prior to reaching their destination. Rail networks are point to point networks, and therefore much less flexible than road networks. For example, vehicles landing at Northport will first need to be transported to Whangarei from Marsden Point, loaded on to the rail network at a railhead, and then unloaded at another railhead in Auckland for onward distribution
- The current rolling stock to carry cars will need to be upgraded or procured
- Rail cannot carry all types of vehicles, mostly only light vehicles up to a certain size. Heavy vehicles will still need to be transported by trucks.

Kiwirail has provided NZIER with indicative rail costs per light vehicle. These costs include handling costs, but exclude infrastructure investment costs, and are summarised in the table below. Kiwirail has made the following assumptions is estimating these costs:

- Two light vehicles per wagon
- $22 per wagon for loading
- $22 per wagon for unloading
- $0.11 per tonne per kilometre for transport between Tauranga or Whangarei and Auckland
- Average weight of a light vehicle is 2 tonnes
- Cost per locomotive $4.5 million (The class recently purchased cannot run on the North Auckland line)
- Cost per wagon is $120,000

Table 13 Cartage cost comparison between rail and road to Auckland

Inclusive of handling; exclusive of infrastructure investment

Scenario	Rail	Road	Difference
Northport	$277	$309	$32
Port of Tauranga	$260	$318	$58

Source: Kiwirail personal communication

The estimated cost difference for Northport is $32 and $58 for Tauranga per vehicle. These cost differences are exclusive of infrastructure investment. The estimated infrastructure investment cost for the respective scenarios are

- Northport to Auckland
  - $600m capital cost for upgrade of Northport link
  - Avondale-Southdown rail link to mitigate scheduling freight trains through Newmarket is estimated at $2-3 billion
- Port of Tauranga to Auckland
  - Increasing capacity on the Auckland rail network. Planning is advanced for a third main line between Wiri and Westfield to increase train scheduling flexibility at an estimated cost of $65m.
  - Increasing capacity in the Kaimai tunnel . The Kaimai tunnel currently accommodates 33 trains per day. No estimate is available for this.

We can first conclude for the Northport scenario that the rail option is less economical than the road option to transport vehicles.

There are capacity constraints on the Tauranga to Auckland rail network but the investment in infrastructure required is less than Northport where an estimate is available.

Those cost comparisons do not account for:

- double handling at each railhead (both at Port of Tauranga and again in Auckland)
- the flexibility that the road cartage offers to deliver vehicles at different locations without double handling
- potential cost incurred by delays due to the lack of coordination between rail and the trucks to cart vehicles from to the railhead at each end of the rail line
- infrastructure investments in the rail network capacity which are not all costed but will still need to be incurred
- the cost to transport vehicle by rail is priced by weight and therefore heavy vehicles would cost disproportionately more on a per vehicle basis than light vehicles as well as require specific investments over and above that required for light vehicles.

While there are small benefits to using rail over road to transport vehicles, such as no increases in injuries and fatalities from crashes, these benefits are relatively small compared to the substantial infrastructure and other costs which would be incurred for rail to be used to transport imported vehicles.

Our modelling assumption has been that all vehicles imported through Northport or the Port of Tauranga will be transported by road.

8. Conclusion

NZIER concludes that the benefits realised by moving the importation of vehicles from the Port of Auckland to another port are unlikely to outweigh the additional costs incurred. The assumptions we have used to arrive at this conclusion are conservative, particularly in that we have identified a number of costs which we have not included in the CBA.

The fundamental reason for this is that the current situation is inherently efficient, as most vehicles are landed in the same city in which they will be bought by end-users. Departing from this situation by landing vehicles at ports at not less than 200 km away from Auckland, and then transporting the majority of vehicles back to Auckland (New Zealand's largest market) is less efficient. The benefit stream needed to offset these costs would need to be high and certain: our analysis, which rests upon independent assessments of the benefits, shows that these conditions are unlikely to be met.

Appendix A Policy considerations

A.1 Infrastructure and logistics are critical for New Zealand's competitiveness

High performing logistic systems are vital to New Zealand. As an isolated economy, an efficient logistic infrastructure reduces the effects of the long supply chains which terminate in New Zealand and cuts transaction costs. A large body of literature shows the influence that transaction costs have on a country's performance, particularly for economies reliant on international trade.

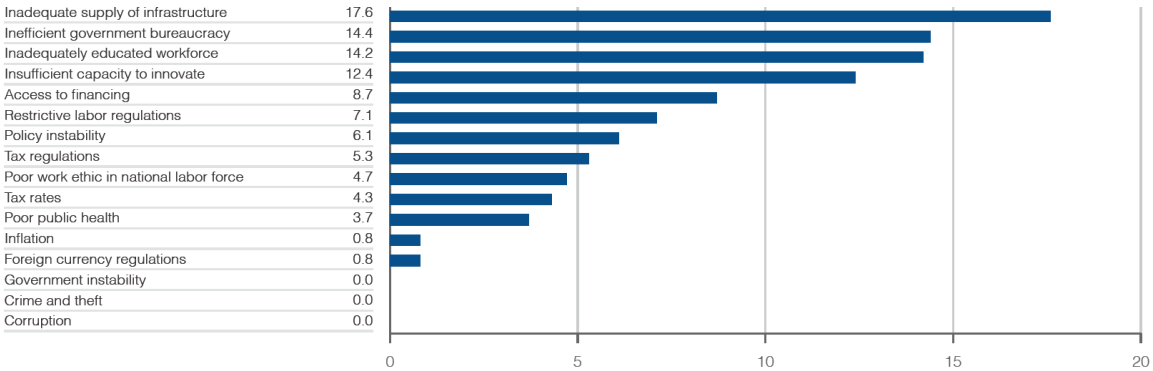
The World Economic Forum (2013) estimates that improving logistics performance could increase GDP by nearly 5% and trade by 15% globally, compared to less than 1% and 10%, respectively, for a complete tariff removal (Cattaneo et al., 2013).

The World Economic Forum ranks New Zealand's overall competitiveness, based on a number of indicators, 13th in the world. For the 2nd pillar, infrastructure, a basic requirement, we ranked 27th (WEF, 2016).

The survey of executives as part of the New Zealand's competitiveness review by the World Economic Forum reveals that the supply of infrastructure is one of the most problematic factors in New Zealand to improving competitiveness.

Figure 37 Factors that hinder New Zealand business activity

Executive Opinion Survey



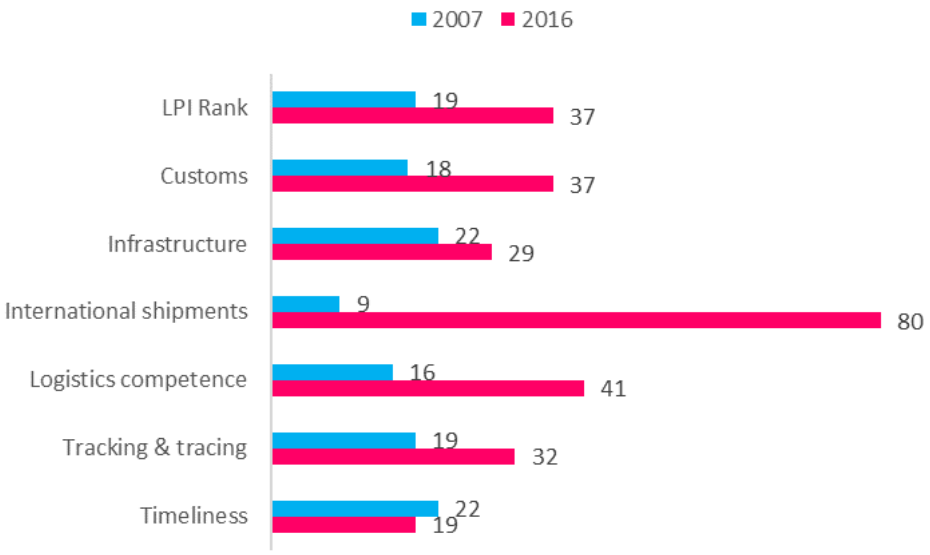
Source: World Economic Forum, 2016

World Bank data suggests New Zealand performs relatively poorly (compared to best practice) in four logistic areas:

- Infrastructure – the quality of trade and transport infrastructure
- Logistics quality and competence – the competence and quality of logistics services such as trucking, forwarding, and customs brokerage
- Tracking and tracing – the ability to track and trace consignments
- Timeliness – the frequency with which shipments reach consignees within scheduled or expected delivery times (World Bank, 2016).

Figure 38 New Zealand's logistics performance

International ranking



Source: World Bank, 2016

A.2 Infrastructure, logistics and transport policy directives

The most recent comprehensive study on New Zealand's logistics systems was the New Zealand Productivity Commission's (NZPC) (2012) international freight transport services report. It made five key recommendations:

- Ports could enhance their abilities to meet the future freight needs of the country if improvements were made to the governance framework for council-controlled port companies
- There is scope for a significant lift in workplace productivity at a number of ports. Most New Zealand port companies, their employees and unions have some work to do to fully achieve these benefits
- Current exemptions for shipping companies from the Commerce Act should be removed so that normal competition laws apply
- Better coordination of investment in freight infrastructure is needed. Greater use should be made of 'facilitated discussion' models, such as the Upper North Island Freight Plan

- More information on freight in New Zealand should be collected and made available on a regular basis. This would have considerable value and help freight organisations make better individual and joint decisions (NZPC, 2012).

The most relevant finding to this study, is the need to better coordinate investment in freight infrastructure. Investment needs to be made to increase port capacity to handle increasing vehicle imports. This investment needs to be planned and coordinated. Uncertainty over whether Ports of Auckland will invest in additional capacity creates uncertainty for investors throughout the supply chain. It also risks a scenario of uncoordinated investment; where multiple ports invest in facilities that are then underutilised.

A.3 Central and local government economic policies

Infrastructure provision and its impact of logistics and supply chain structures have regional and national ramifications. Central and local government economic objectives rely on efficient port infrastructure and supply chains to fulfil their agendas and improve the lives of New Zealanders.

A.3.1 Central government economic policies

The Business Growth Agenda (BGA) is the overarching policy guiding policymaking at the central government level. The BGA's headline objective is to increase New Zealand's international trade as measured by its exports to GDP ratio target, to reach 40% of GDP by 2025. Further it sets out to increase the added value to our exports and reduce our reliance on commodities through increased innovation and skills.

In order to work towards the delivery of the "building a more productive and competitive economy" priority the Government has identified six key areas under a business growth agenda. These are building:

- Export markets
- Investment
- Innovation
- Skilled and safe workplaces
- Natural resources
- Infrastructure (MBIE, 2015).

A.3.2 Local government economic policies

Auckland Council's ambition is to make Auckland the world's most liveable city. Auckland's economic development goals are aligned to the BGA and its objectives. It sets out five priorities:

- Grow a business-friendly and well-functioning city
- Develop an innovation hub of the Asia-Pacific rim
- Become internationally connected and export-driven
- Enhance investment in people to grow skills and a local workforce
- Develop a vibrant, creative international city (Auckland Council, 2016).

Based on these goals Auckland Council set a number of targets which include:

- Improve Auckland's OECD city rank (GDP per capita) from 69th place in 2011 by 20 places by 2031
- Increase annual average productivity growth from 1 % p.a. in the last decade to 2 % p.a. for the next 30 year
- Increase annual average export growth from 3 % p.a. in the last decade to 6 % p.a. for the next 30 years
- Increase annual average real GDP growth from 3 % in the last decade to 5 % p.a. for the next 30 years
- Ongoing provision of planned and serviced capacity for Group 1 business land, including large lots, to meet five yearly demand, as assessed by annual surveys (Wilson & Bishop, 2015).

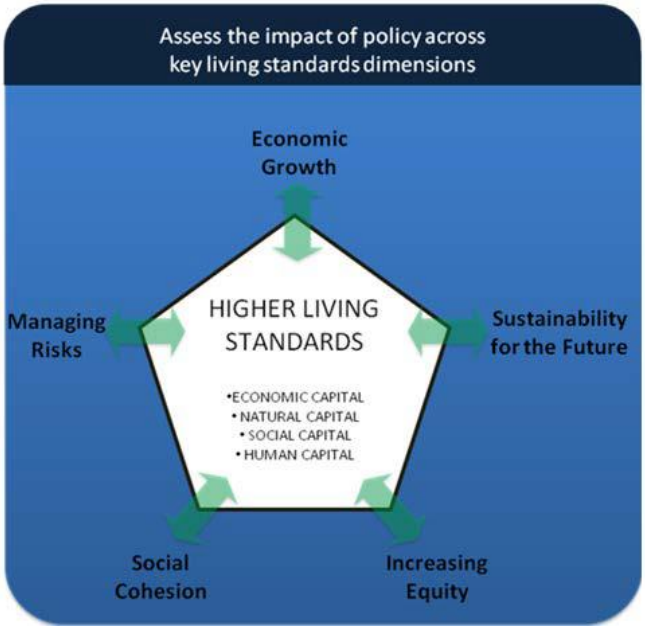
A.4 Framing the impact of the policy – Treasury's living standards framework

Infrastructure provision requires an understanding of the trade-offs (costs and benefits) and must be provided in a way that increases the welfare of all New Zealanders. Furthermore, economic growth cannot be the sole measure of welfare.

By welfare or "living standards" means more than income. High living standards mean people have greater opportunities, capabilities and incentives to live a life that they value (The Treasury, 2015).

The Treasury's living standards framework is a useful framework to understand the issue of infrastructure provision and therefore the policy in question around the vehicle import market, its distribution across ports and its impact on supply chains.

Figure 39 Living standards framework



Source: The Treasury, 2015

When thinking of the different "points" of the living standards framework it is important to understand about their impact on each of the capitals (economic, natural, social and human):

- Sustainability for the future – is about the future of human, social and physical/ financial capital as well as natural capital
- Increasing equity – is not just about income distribution but the distribution of everything of value but also whether there are fair processes
- Managing risk is not just about economic or natural hazard risk; it is also about risks to social outcomes and people
- Economic growth is not just about lifting people's incomes, but also the resources available to spend on community assets, like schools, hospitals, welfare, and roads
- Social cohesion is not just about lifting social connectedness. It is also about the role of things like the rule of law in promoting economic growth, and the fairness of government's processes in promoting equity (The Treasury, 2015).

The trade-offs from this policy are the amenity benefits from the next best use of port land either in the form of residential or commercial developments against the increase in price for vehicles, the cost of cartage, the safety and environmental risks.

The costs estimated of the policy are significant and fall disproportionately on lower income households both in the form of job losses in Auckland if the supply chain is relocated closer to another port and in the form of higher vehicle prices across the North Island. Finally, the spatial distribution of the benefits is very localised to downtown Auckland, to the surrounding residential areas and tourists, while the costs are spread throughout the Golden Triangle (Auckland, Waikato and Bay of Plenty) and Northland.

A.5 The impact of the policy on living standards and government targets

Treasury's living standards framework is a useful tool show the trade-offs and synergies of policies. We summarise the CBA results at the local, regional and national level across the framework's five 'points'. While the policy does have potential to boost local amenity benefits, those must be weighed against a decrease in living standards at the national level.

Table 14 Policy impact on New Zealanders' living standards

Treasury's living standards	Policy impact		
	Increase in living standards	Transfer (no change in living standards)	Decrease in living standards
Sustainability for the future			Increased carbon emissions
Equity			Inequality due to higher vehicle prices (particularly for lower income households)

Treasury's living standards	Policy impact		
	Increase in living standards	Transfer (no change in living standards)	Decrease in living standards
Managing risk			Regulatory certainty and predictability of return on investment Increase in road deaths and injuries from trucks
Economic growth	Next best land use opportunity (combination of residential, entertainment and retail activities)	Shift of economic activity to the regions (support regional development)	Risk to supply chain structure and efficiency (risk to export performance) Adequate provision of infrastructure Consumer deadweight loss Resource reallocation – Increase in trucking fleet to cart cars which is captured by carting firms in the form of greater vehicle prices
Social cohesion	Increased amenity from port land in downtown Auckland		Lower purchasing power (particularly for lower income households)

Source: NZIER, The Treasury (2015)

Our analysis concludes that this policy will not raise the living standards for New Zealanders.

Finally, the policy conflicts with the Auckland Council's economic development goals and the government's Business Growth Agenda's socio-economic target. The risk to the Auckland economy from this policy is that the transfer of activity to the regions will negatively affect the growth of the Auckland economy. At the national level, there are the potential negative impacts on the efficient provision of infrastructure and the productivity of logistic supply chains, which will adversely affect GDP, productivity and export growth.

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Appendix C Supplementary information

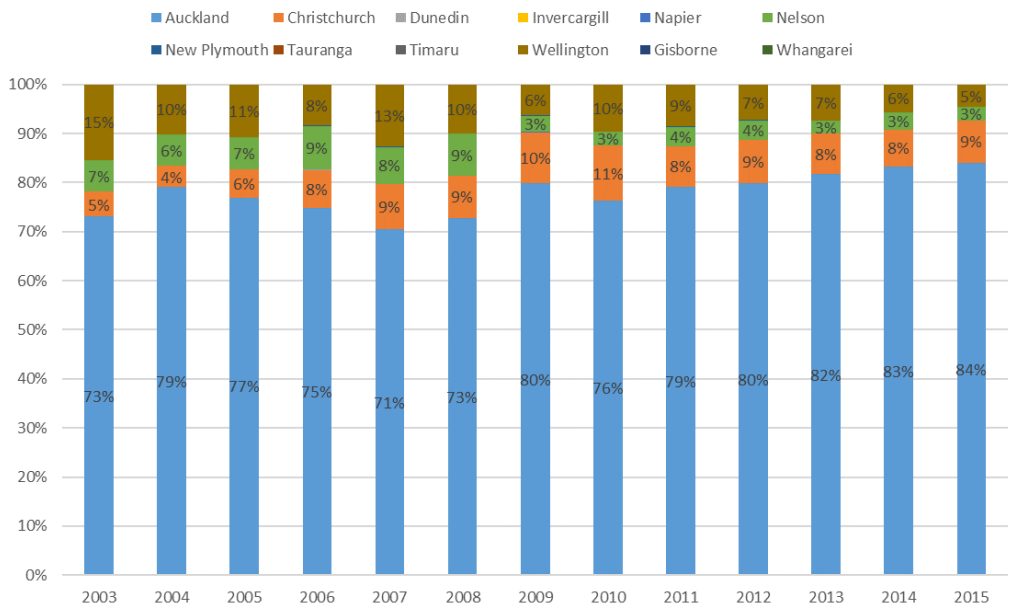
Figure 40 New Zealand's competitiveness performance overview

Global Competitiveness Index	13
Subindex A: Basic requirements	8
1st pillar: Institutions	3
2nd pillar: Infrastructure	27
3rd pillar: Macroeconomic environment	17
4th pillar: Health and primary education	6
Subindex B: Efficiency enhancers	8
5th pillar: Higher education and training	10
6th pillar: Goods market efficiency	10
7th pillar: Labor market efficiency	6
8th pillar: Financial market development	1
9th pillar: Technological readiness	13
10th pillar: Market size	64
Subindex C: Innovation and sophistication factors	26
11th pillar: Business sophistication	26
12th pillar: Innovation	23

Source: World Economic Forum, 2016

Figure 41 New light vehicle imports, port market share

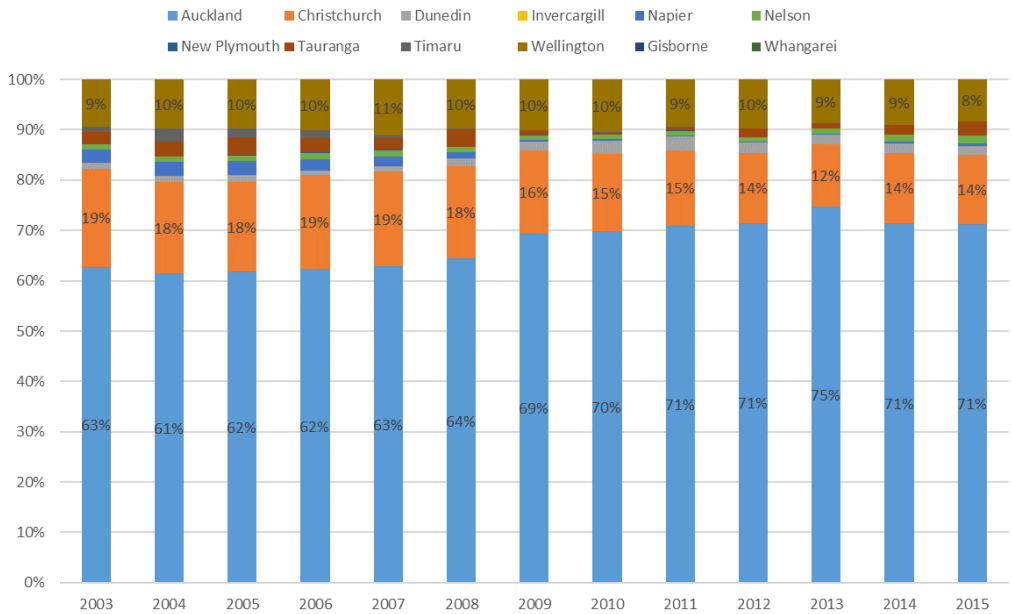
Percentage of import volumes by count



Source: NZIER personal communication with industry

Figure 42 Used light vehicle imports by port

Percentage of import volumes by count



Source: NZIER personal communication with industry

Table 15 summarises our review of elasticity findings from our review of the international literature.

Table 15 List of elasticity estimates, international literature

Source	Estimate	Type (Long run / Short run)	Link
Hess (1977)	-1.63, 0.26	Respectively price elasticity and income elasticity	From McCarthy (1996) http://www.jstor.org/stable/2109802
Whelan (circa 2003)	-0.02 to -0.06	For purchase costs	http://www.wctrs.leeds.ac.uk/wp/wp-content/uploads/abstracts/lisbon/general/03249.pdf
Johansson and Schipper (1997)	-0.2	Long run Vehicle Travel Price Sensitivity Studies Summary of various previous studies International	From Litman (2017) http://www.vtpi.org/elasticities.pdf
Dargay and Vythoulkas (1999)	0.27, -0.44 and -0.28	Respectively short run elasticities of demand to income, purchase and running costs	From Whelan (circa 2003) http://www.wctrs.leeds.ac.uk/wp/wp-content/uploads/abstracts/lisbon/general/03249.pdf
Hanly and Dargay (2000)	0.42 and -0.07.	Respectively short run income elasticity and car purchase cost elasticity	From Whelan (circa 2003) http://www.wctrs.leeds.ac.uk/wp/wp-content/uploads/abstracts/lisbon/general/03249.pdf

Source: Various sources

Table 16 UK vehicle elasticities

Estimation disaggregated at the household level

Model	Year	MNL	Dogit	Mixed Logit
Household Income	1985	0.445	0.453	0.441
	1990	0.387	0.396	0.415
	1995	0.372	0.378	0.392
	1998	0.329	0.329	0.349
Ownership Costs	1985	-0.083	-0.085	-0.083
	1990	-0.063	-0.065	-0.064
	1995	-0.057	-0.059	-0.058
	1998	-0.050	-0.053	-0.050
Running Costs	1985	-0.045	-0.045	-0.047
	1990	-0.039	-0.036	-0.035
	1995	-0.036	-0.036	-0.037
	1998	-0.035	-0.035	-0.036

Source: Whelan, circa 2003

Table 17 summarises the elasticities for different types of households, the elasticities very across households but remain inelastic across the board.

Table 17 Summary results of model predicting total travel demand

Results of a panel model based on 11 years (2004–2014) and 72 cross-sections and data from the NZHTS. Level values are averages for 2004–2011.

Group	Percent change in travel demand given a 10% increase in dollars per km, given household income
Alone	-0.52
Couple, no kids	-0.27
Two parent family	-0.21
One parent family	-0.47
Multi-person household	-0.25
Multi-family household	-0.19

Source: Stephenson, 2016

Table 18 Mode share elasticities

Percent change in mode share divided by percent change in explanatory factor

Explanatory factors	Drive
Increase in cost of driving	-0.02
Reduction in income	-0.004

Source: Stephenson, 2016

Appendix D Organisations interviewed

- Aracup Ltd
- Auto Logistics
- Autohub
- Car Distribution Group
- Carr & Haslam
- Enviro-Mark Solutions
- Independent Motor Vehicle Industry Association
- Kiwirail
- McCullough Ltd
- Motor Industry Association
- Ports of Auckland Ltd
- The Productivity Commission
- Toyota Ltd

Appendix E Regional National Land Transport Demand Model structure

This section draws heavily from Stephenson & Zheng (2013) and Stephenson (2016).

NZIER built the National Long-term Land Transport Demand Model (NLTDM) to allow NZTA to evaluate transport demand scenarios. The model takes account of trends in in:

- Population growth dynamics
- Spatial demographic trends
- Technology trends
- Income and economic growth
- Industrial composition
- Policy and prices, for example:
  - Environmental policy changes
  - Fuel price escalation and volatility (Stephenson & Zheng, 2013).

The NLTDM features:

- Top-down macro-forecasting methods with sufficient behavioural and spatial detail to account for structural change in transport demand
- A reasonably high degree of regional disaggregation (12 regions) to capture trends in urbanisation, effects of density, and regional differences in economic growth prospects and industrial composition
- A stochastic mode that provides a sense of the degree of uncertainty that exists around how demand will evolve in coming decades (Stephenson & Zheng, 2013).

The principal purpose of the model is to forecast travel demand across different modes (private transport, public transport, etc.). Based on travel demand forecasts, the model can be used to project registrations for light private and commercial vehicles as well as heavy vehicles. The model structure is very detailed and the projections take into account:

- Household composition as well as income and how this is related to vehicle ownership
- The ageing of the light vehicle fleet, including scrapping or retirement of vehicles
- Population growth, including taking account of net migration projections (Statistics NZ)
- The propensity of different age cohorts to purchase vehicles (based on revealed preferences of households)

- City density and public transport use (these can reduce car use, and potentially car ownership in some instances) (Stephenson & Zheng, 2013).

The general approach is to break transport demands down into three different components:

- Trends and patterns due to path dependencies, such as:
  - Population growth, age structure and location
  - Economic growth
- Deviations from trend path dependencies due to relative price and income effects, such as:
  - Fuel price shocks
  - Income effects
- Temporal interdependencies, such as:
  - Co-movement of industry growth
  - Transmission of shocks over time (Stephenson & Zheng, 2013).

Figure 43 NLTDM model dimensions

Population	Regional population	Growth and incomes	HH vehicle demand	Freight demand	Prices	Vehicle fleet	VKT and cost	HH travel
Outputs Population by age and sex Households, by type Average age of households Number of people per household Labour force Long-run employment **Scope** Ages 0 to 90 years 6 Household types: alone, one parent, two parent, couple, multi-person, multi-family 12 regions: Northland, Auckland, Waikato, Bay of Plenty, Gisborne-Hawke's Bay, Taranaki, Manawatu-Wanganui, Wellington, Upper South Island, Canterbury, Otago, Southland **Input assumptions and key statistical models** Net migration (ARIMA(1,0,1)) Age-specific mortality and fertility Living arrangement type rates (LATRs) Labour force participation rates Long-run unemployment rates		**Outputs** GDP by industry and region HH incomes by type and region **Scope** As for population plus 8 industries: agriculture and food; forestry and wood manufacturing; mining and chemicals; other manufacturing; construction and utilities; trade and transport; other services; public administration **Input assumptions and key statistical models** National and industry multifactor productivity growth Trend growth in industry GDP Historical covariance between industries in economic activity (VAR model) Relationship between GDP per capita and HH incomes	**Outputs** Vehicles per household by region and HH type **Scope** As for population plus forecast probability a HH will own 0, 1, 2, 3 or more vehicles **Input assumptions and key statistical models** Generalised linear model (logistic) of conditional probabilities (by HH type) of vehicle ownership based on income, average age, population density and a Wellington dummy	**Outputs** Freight volumes by mode, industry, and region Road freight tonne-kilometres **Scope** 8 industries and 12 regions and three modes: rail, sea, road **Input assumptions and key statistical models** Trends in freight intensity (value of freight input per unit of GDP by industry) Regional industrial comparative advantage based on historical employment shares Freight mode share by industry by region	**Outputs** Taxes Fuel price at pump Vehicle price trends **Scope** NZ **Input assumptions** Long-run exchange rate Inflation (CPI) ETS costs Oil prices	**Outputs** Number of vehicles by age, type, technology, and size **Scope** Ages 0 to 30 Types: light passenger, light commercial, motorcycle, heavy commercial, bus Technology: Petrol, diesel, hybrid, electric, and plug-in hybrid Sizes based on engine cc rating: 5 light sizes, 2 motorcycle sizes, 9 heavy sizes and 3 bus sizes **Input assumptions and key statistical models** Fuel efficiency Age of import Registrations of alternative fuel vehicles Number of registrations that are new vehicles Scrappage rates	**Outputs** VKT by non-private passenger vehicles by vehicle type and age Emissions by vehicle type and age Cost per kilometre of travel, by vehicle type Tax revenue from transport **Scope** As for vehicle fleet **Input assumptions and key statistical models** VKT by vehicle age Travel behaviour and congestion impacts on fuel consumption Emissions factors	**Outputs** Passenger kilometres by public transport and private passenger vehicle Passenger vehicle VKT **Scope** Regions Passenger transport mode **Input assumptions and key statistical models** Regional distributions of VKT Regional vehicle ocupancy trends Age distributions in propensity to use public transport VKT cost and income elasticities PT fuel price and income elasticities

16

Source: Stephenson & Zheng, 2013

Two-thirds of the projected growth in travel demand (and in turn increase in registration from the increase in demand for light and heavy vehicles) is due to population growth.

The model also takes into account the population composition effect. With the population getting older and households becoming smaller, the number of households is predicted to grow more quickly than the working-age population.

The remaining third which drives travel demand includes various factors but is mostly as a result of income growth.

Demand for freight transport was projected by the model to grow roughly 1 percentage point faster than real GDP growth. However, demand growth would be slower than in the past decade as the services sector is expected to be the fastest-growing sector in the economy.

An increase in supply conditions related to public transport, such as an increase in accessibility can potentially change this outlook. But it would take a large change to reverse the general trend towards declining PT use as incomes grow.

Slowing population growth and an ageing population have significant effects on the projections in terms of keeping a lid on transport demand.

There is currently a small bulge in the population that is entering working age. In 30 years' time, these people will enter a phase of life where they would be likely to live in households of couples without children. At this stage of life, they would be likely to purchase a second car, simply because they have more disposable income than at most other points in their adult life. This would result in a lift in demand for private passenger vehicles.

On the other hand, the younger (say under 20 years) portion of the population would be a much smaller than it is today and consequently demand for public transport would be proportionately lower than it is today, relative to overall travel demand.

Fuel prices and travel costs are the largest single sources of uncertainty. The reason for the very high degree of variation in the fuel price is that it reflects the combined effects of uncertainty in the international price of oil and the exchange rate.

But the variability or uncertainty in travel demands contrasts with vehicle ownership and freight demand results and hence provides greater certainty in the projection of heavy and light vehicle registration. In the model, neither of these are especially sensitive to price.

- Freight demand is an integral part of economic activity and is connected to growth in the economy, not to prices.
- Vehicle ownership is taken to be the result of people purchasing an option to drive a vehicle, rather than actually driving the vehicle. Thus, it was not heavily affected by price compared with actual travel behaviour.

At the same time, there is limited upside potential for vehicle ownership even when income growth is very high. This is because there is a non-linear (declining) relationship between income growth and vehicle ownership rates at the household level – not everyone needs or wants multiple vehicles.

Note that while this does not look to be a major difference in relative growth rates, strong growth in the economy was partly connected to higher-than-average inward net migration and a consequent increase in the number of people in the population of working age and more likely to own a vehicle or multiple vehicles.

The projection model identified the following as the primary drivers of vehicle registrations:

- The ageing of the fleet and demand from vehicle replacement
- A marginal increase in demand for more rapid refresh of the fleet as people move increasingly to electric vehicles over the next 30 years (with 90% of light vehicles registered in 20 years assumed to be electric – with growth in registrations modelled on a logistic growth curve, so rapidly rising after 2020)
- Additional household demand for vehicles (above replacement) based on discrete choice models of vehicle ownership (number of vehicles) by household type and region and income level.

The year-on-year fluctuations of the registration forecasts are largely driven by year-on-year fluctuations in:

- Migration and population growth
- Productivity and GDP growth
- Household income growth and unemployment (Stephenson, 2016).