

Perth Freight Link:

Making the right

Investment

In Perth's

Freight Task

A position paper for
the City of Fremantle

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Aims, Goals, Objectives & Methodology of this paper

The aim of this report is to demonstrate alternative options to the Perth Freight Link (PFL) in a fair and balanced manner. It is obvious that the PFL as a freight movement link to serve the wider economy is a good idea, but this particular proposal will damage the long term viability of Fremantle as a living and working destination renowned for its inner-city living opportunities, heritage, tourism, and sustainable transport opportunities. The PFL, in this light, seems a sub-optimal solution for freight transport.

The goals - as per the project scope - of this report are:

- i. To understand the existing capacity and future demand requirements for Port freight;
- ii. Find opportunities and infrastructure alternatives for improving links to the Port across the river and through North Fremantle;
- iii. Describe the potential to share freight rail line with passenger rail through south Fremantle;
- iv. Outline the impacts of PFL on wetlands, bushland, green space and significant treed areas;
- v. Outline the impacts of PFL limited access reserves and cuttings on visual amenity and pedestrian and cyclist connections;
- vi. Outline the impact on access to and economic activity in the Fremantle CBD; and,
- vii. Outline access to existing facilities adjacent to proposed infrastructure reserves.

This report will expand on these issues and suggest some options.

The objectives are to demonstrate through text, charts, analysis of available data and specific design illustration the impacts of, and alternatives to, the PFL.

The Methodology employed: define the scope of the project; explore the available documents from original sources; select those quotes and planning principles being expressed; analyze the meaning and potential outcomes of the source documents as they relate to long range planning for freight movements in the Perth metropolitan region and report the findings in this paper. This paper will then consider future options with some data and visualisation to assess the risks of the proposed PFL and to outline several alternatives that could be considered.

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I. ABSTRACT

The Perth Freight Link (PFL) is designed to speed trucks carrying containerised freight to the Port of Fremantle's Inner Harbour. In reality it seems mostly to be designed to take trucks off Leach Highway in the City of Melville and the seat of Riverton. As a tollway it is likely to undermine rail (now 14% of total containers) and the development of the Outer Harbour in the Kwinana area of Cockburn Sound. Both an increase in rail (to 30%) and an Outer Harbour have been long term bipartisan plans for freight movements.

The paper has calculated a potential fourfold increase in truck traffic through the City of Fremantle leading to severe impacts such as: the potential planned freight system in the Kwinana area such as Latitude 32; the economy of Fremantle as an activity centre; the liveability of people along the proposed cutting as well as businesses such as D'Orsogna; the flow of traffic at intersections with the PFL; the environment and attraction of East Fremantle and North Fremantle where there will be a significant increase in trucks idling in the bottleneck created; the Western Suburbs as there will be many more trucks that take Curtin Avenue and Stirling Highway coming from the north; the environmental qualities of the Beeliar Wetlands; and, the health of people in adjacent suburbs through an increase in diesel particulate pollution along the route.

The PFL will also hasten the capacity issues in the Inner Harbour within 5 years and if built could undermine the value of privatising the Port of Fremantle when the PFL should have been providing access to the Outer Harbour in Kwinana.

Alternative options are considered including: **Transport Demand Management** (which should be an ongoing practice) to help the freight transport operate in non-peak times, a **road tunnel** under White Gum Valley as an expensive option to a harbour nearing capacity; a **rail tunnel** under Fremantle to the Inner Harbour also an expensive option to a harbour reaching capacity; and **increasing rail's** capacity through electrification and double stacking via a second freight rail bridge which will require significant added costs to build the required intermodal hubs to accommodate an increase from 5 trains per day to possibly over 100.

An option for freight rail improvements combined with road based Transport Demand Management will offer gains in logistics in the short term, but the issue of freight movements encircling and invading Fremantle - by road or rail - is a challenging position for a city and suburbs trying to develop as a people-oriented activity centre. An investment in a long term strategy is required.

The best option is to redirect the PFL to Kwinana and use the Cap and Transition scenario to enable the building of the Outer Harbour as originally planned. The privatisation of the Port of Fremantle can include this requirement and the value of the sale would be considerably improved by having access provided to the long term container port. It generates various benefits: it removes the need for the PFL and shifts the capital investment where it is most beneficial for the next 50 years of growth as road and rail connections to the Outer Harbour; it saves North Fremantle and the Western Suburbs from 'bottlenecks' created by an influx of heavy trucks; it allows the urban areas of Fremantle, East Fremantle and Melville to continue to grow into their envisaged promise of human-oriented, knowledge-economy based, higher-density urban areas; it removes pollution such as harmful diesel particulates and noise from the populated urbanised area; it maintains the access to the highly popular Port and Leighton beaches inclusive of the anticipated real-estate properties; and, it creates the potential for the Outer Harbour to become an asset to be leased as a part of the freight transport logistics long into the future.

The final costs of the PFL will be much higher than the initial phases as it will necessitate further investments in bridges, interchanges and improvements in other parts of the logistics chain, especially in the final route through East Fremantle and North Fremantle. At what price-point does a different strategy, such as a Cap and Transition strategy make more social, economic and logistics sense?

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I. EXECUTIVE SUMMARY

1. Context

There are several key contextual points for consideration in the following report:

- i. There will be growth in both population and import/export trade;
- ii. The freight transport tasks ahead for the Metro region are daunting once the numbers are calculated - the State or a private enterprise will have to make investments soon;
- iii. The options for highways, trains, or other modes of transport all have negatives and positives but some are more realistic than others;
- iv. There has been a long-range bipartisan strategic plan to manage the growth in freight involving a transition to the Outer Harbour;
- v. The recent announcements of the Perth Freight Link and the privatisation of the Fremantle Port Authority need to be assessed as both are sudden decisions, largely politically driven, and many inadvertent impacts are possible as well as potential opportunities.

2. Understanding the Future Trends

The following future trends are calculated using data in Table i on the following page.

- i. The future as it has been planned: The Fremantle Inner Harbour now takes 700k TEU containers a year (in 2014) with 100k of these coming by rail. This was planned to move in 2050 to be 3 Million TEU containers with half going to the Inner Harbour and half to the Outer Harbour. 900k of these were anticipated to be on rail (30% is the goal for rail). If split equally this would mean 1,050,000 TEU on trucks going to each Harbour. Thus the Inner Harbour would only have gone from 600k TEU containers on trucks in 2014 to 1,050k TEU in 2050, an increase of 57% but a substantially managed increase.
- ii. The future with the PFL: With no clear future for the Outer Harbour and decreased rail for the Inner Harbour (undermined by the need for trucks on the toll-road) there will be by 2050 3 million TEU containers travelling by truck through Fremantle instead of 1,050,000. This will be felt immediately and grow to impossible truck traffic well before 2050. What the PFL means in terms of trucks is that instead of around 3000 trucks per day on a weekday in 2014 entering the Fremantle container port area, there would be 12-13,000 trucks per day by 2050 - a four fold increase. The consequences of such growth are going to be substantial on Fremantle and its surrounding local communities.

3. Impacts of the Perth Freight Link

The following are the first 11 unforeseen impacts of the Perth Freight Link:

- i. Undermine the operational capacity of the Inner Harbour due to rapidly increasing truck traffic to a port nearing land-side capacity instead of towards transport links better suited to long term freight growth;
- ii. Reducing the opportunity to develop the Outer Harbour as a part of the mid to long term public infrastructure strategy due to the need to make the PFL pay-back its

Table i: The Maths		
Under PFL:		
Current: circa 700,000 TEUs in 2014	100,000 on train 14% of TEUs	5 trains per day @ 80 TEUs per train
	3000 trucks per work day x 250 working days per year (as observed in North Quay Truck Survey 2014)	750,000 trucks per year or 1.1 trucks per TEU
Future: 3,000,000 TEU in 2050	14% maintained = 420,000 TEU on train as currently configured and no second bridge 30% = stated goal	= 23 trains per day; one every 64 minutes =45 trains per day at 32 minute intervals
	50% = 1,500,000 TEU on train	= 75 trains per day; one every 19 minutes
	1.1 trucks per TEU	3,300,000 trucks per year or ~13,000 per 250 working days
With Rail Tunnel:		
Total		
Airport Rail Tunnel = 8.5 km	\$260 million /km	\$2.21 billion
Proposed Freight Tunnel = 9 km	\$260 million/km	\$2.34 billion
Marshalling yards for trains	Unknown, but certainly expensive and expansive	Melbourne has Dynon Intermodal hub at ~86 hectares for 3 million TEU
Number of Trains per day	50% of 3 million TEU at 80 TEU per train 50% of 3 million at 160 TEU per train double stacked	75 trains per day 38 trains per day
Under Cap and Transition to 2050:		
Inner Harbour	30% on rail of 700,000= 210,000 TEU	11 trains a day @ 80 TEU per train
700,000	70% on truck of 700,000 = 420,000 TEU	539,000 trucks per year or 2156 per working day (250 days per year)
Outer Harbour 2,300,000	30% on rail = 690,000 TEUs to move	35 trains per day @ 80 TEU per train
	70% by truck = 1,610,00 TEU to move	1,771,000 trucks per year or 7084 per working day (250 days per year)

Table i outlines the dramatic changes in freight volume which will be the Perth Metro Region's task to transport within its urbanised area in the coming decades. Where and how it can be managed is the focus of this report.

- investment (as it is a toll-road);
- iii. Undermining time frames for investments in access alternatives (road and rail) to the Outer Harbour;
- iv. Closing rail to the Inner Harbour. Rail freight movement will be far less competitive due to the need to put as much of the containers as possible through the tollway;
- v. Increasing diesel particulates with its damaging long term health effects;
- vi. Fracturing North Fremantle and causing congestion at the port's landside entrance;
- vii. Impacting the Beeliar Wetlands and Banksia woodlands;
- viii. Severing the suburbs with the proposed cutting in Fremantle, East Fremantle and Melville;
- ix. Severely limiting the work the Council has done to reinvigorate the City of Fremantle over the last decades as trucks and people-intensive city centres do not mix;
- x. Driving away tourists and local beach users from the North Fremantle area due to the increase in trucks;
- xi. Increasing truck flows down Port Beach Road and Curtin Avenue through the high value Western Suburbs as the loss of rail and an Outer Harbour will drive increased north-bound truck traffic to run via the built up area road network: this will reinforce the long standing plan to build the Stephenson Highway from Mitchell Freeway, a long standing unpopular project with communities and councils in the Western Suburbs.

4. Options for the Port of Fremantle's Freight Task

The impacts and benefits of each option assessed are summarised as follows.

A. Transport Options

If the port remains where it is and is expanded to meet the growth in demand, then a highway, such as the proposed PFL, is well suited though it has impacts outlined above. Other options are road and rail tunnels and an upgraded rail service with a second bridge. All of these options are listed in Table i and have positives and negatives such as:

- i. PFL Freeway:
 - a. Pos: deals with the freight, increases effective capacity of the Inner Harbour;
 - b. Neg: noise and air pollution; severance of urban fabric with decreased property values; and high capital and political expense.
- ii. Road Tunnel
 - a. Pos: deals with the freight, increases effective capacity of the Inner Harbour becomes an asset to sell or lease;
 - b. Neg: noise and air pollution; high capital expense; doesn't alleviate the North Fremantle bottleneck or the ultimate Inner Harbour capacity issues.
- iii. Rail Bridge:
 - a. Pos: extends capacity of the Inner Harbour, is better than trucks, enables electrification and double stacking of containers;
 - b. Neg: noise and discomfort of increased freight train movements through Esplanade to North Coogee and beyond; expense.

iv. Rail Tunnel:

- a. Pos: moves larger portion of freight by rail; extends capacity of Port, increases land values along foreshore;
- b. Neg: large expense; needs additional land for intermodal hubs to manage loading and unloading differently from current operations.

None of these options assist with the value of the Port of Fremantle privatisation as the Outer Harbour needs to be developed quite soon and the PFL would increase the sale value if it was redirected to provide access in Kwinana. Lastly, as the freight rail lines have been privatised any public investment in rail will be to private benefit.

B. Outer Harbour Option

i. Cap and Transition

- a. Pos: freight is handled much more efficiently at places like Latitude 32 and with less negative impacts on existing urban residential and commercial areas;
- b. Neg: the Inner Harbour may be left with many question marks as to its future function, but this can be actively avoided with foresight as the container port is phased out.

ii. Outer Harbour alone

- a. Pos: Freight transport will no longer negatively affect Fremantle or other suburban areas like Melville and the Western Suburbs; redevelopment of Inner Harbour becomes a major development opportunity;
- b. Neg: The transition of the Port lands may be decades away leaving a gap in the urban fabric unless proactive planning starts today.

5. Conclusion

The Perth Freight Link is not helping with the long term movement of freight in Perth as it is simply shifting truck impacts away from one area (City of Melville)¹ and creating multiple impacts on the Beeliar Wetlands and the City of Fremantle. The long term strategy of developing a new container port in Kwinana needs to be reinstated with a cap on trucks entering Fremantle at around 700,000 TEUs per year. This can be incorporated into the Public Private Partnership procedures for the Fremantle Port Authority privatisation and the PFL shifted as a capital expenditure to provide road and rail access for the new Kwinana container port. This can enable the City of Fremantle to continue to grow as a people-intensive economy and the Kwinana region to continue as a freight-intensive economy.

The second best option, described in the paper, is to upgrade the rail system using electrification and double stacking which will require a dedicated rail bridge. Third best, though very expensive, is a rail tunnel from the Inner Harbour under the Swan River emerging in Spearwood on the current freight rail alignment as there are multiple co-benefits in addition to it having the required throughput. Fourth best is to have a road tunnel from High and Leach to dive under White Gum Valley and Clontarf Hill emerge onto the Roe 9 RoW though many issue related to the North Fremantle 'bottle-neck' and the Beeliar wetlands remain. The PFL, as proposed, is among the poorest of options due to its risks as well as financial, environmental and social costs.

All these options, other than the Outer Harbour, do not increase the value of the sale of Port of

¹ Apart from the 77 homes in Melville's Palmyra as reported in the West Australian. May 18, 2015. "Residents Fight Road Plan" <https://au.news.yahoo.com/thewest/wa/a/28061049/residents-fight-road-plan/>

Fremantle as the PFL and the other options are not helping in the long-term strategy of shifting to the Outer Harbour and allowing better - denser and more liveable - development in the urban areas of Fremantle, East Fremantle, Melville and the Western Suburbs as global best practices would indicate.

The following main body of the paper will look more closely at the planning context, the rationale and impacts of the Perth Freight Link and strategic alternatives to achieve better outcomes in the task of freight movements in the Perth metropolitan region.

Table ii: Options Summary						
Options/ Benefit	<u>Low Impact</u>	<u>High Capacity</u>	<u>Expense</u>	<u>Ease of Implementation</u>	<u>Net Positive for Urban Area</u>	<u>Likely to be Part of Privatisation</u>
Tunnel - Rail	Yes	Moderate, limited by logistics of loading and unloading	High, in the \$2 billion range	Feasible and possible, grades can work with protected areas untouched	Frees up the current freight ROW for public transit to Cockburn Coast and value capture from land redevelopment	No, but could be added to lease
Tunnel - Road	No, only reduces severance	Moderate, limited by volume of trucks increased as port remains where is	High, in the \$2 billion range if not higher due to safety for drivers and dangerous cargo	Feasible and possible, grades can work, protected areas untouched	Saves White Gum Valley, but the diesel exhaust and vibrations may be a problem	No
Upgraded rail	Yes	Moderate, limited by volume of trains increased as port remains where it is	Low, compared to other options. \$0.5 billion for new bridge and other works	High, but the higher volume of freight trains may cause issues along foreshore and in South Fremantle and Cockburn Coast	May cause political issues along foreshore and in South Fremantle and Cockburn Coast as the number of trains increases	No
Perth Freight Link	No	Moderate, limited by volume of trucks increased as port remains where is	High, with \$1.6 billion for first phase and following works likely another \$1.5 billion	Moderate, the engineering is feasible but the political costs may be high	Very damaging to property values, liveability, air quality, urban redevelopment	No
Transport Demand Management	Yes	Moderate, spreads the timing of transport	Low	High, but truck drivers, loaders, warehousing will need to change hours of operation	Moderate, with more trucks running at night there will be issues	Yes
Cap and Transition	Yes	Very efficient use of existing and new assets	High, new port and roads to be built with upgrades to existing roads & rail	High, has been planned for over 40 years	High as it reduces impact on City of Fremantle	Yes
Outer Harbour	Yes	Most efficient logistics with custom built 21st C freight transport	High, new port and roads to be built but with fewer upgrades to existing roads & rail	High, has been planned for over 40 years	Highest of all. Increased property values, higher pre-sale sales, no negative air pollution or highways	Yes

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II. INTRODUCTION

1. Fremantle: A Small Port with a Big Future

Fremantle is a mixed use port handling containers, 10 Mtpa² of bulk liquids (crude and refined oil imports and exports) and 9.3 Mtpa of mixed bulk. Fremantle's annual container capacity is 1.2-1.4 million twenty foot equivalent units (TEU), only 50 per cent of which was utilised in 2011. It is forecast to have the strongest growth rate in the country, apart from the bulk commodity Pilbara ports.³

The citizens of Fremantle enjoy the Port of Fremantle as an ever changing backdrop to their daily lives - and to many it remains the place of their daily earnings. To accommodate the growth of the port, as a function of a growing economy, the Perth Freight Link (PFL) has been planned to match the dock-side capacity with a road-based freight transport supply commensurate to moving containers for import or export from the Inner Harbour.

Moving freight in cities is mostly done by trucks as they can deliver from multiple origins to multiple destinations. However trucks do impact on cities due to their noise, diesel pollution, and disruption to traffic. This is especially apparent where the economy of the metropolitan region and wider economic hinterland focus at the point of trade: the tide-water ports. To overcome the issues and to create a smoother flow of goods, most cities in the developed world – and developing - have created strategies to deal with excessive truck movements. Two key strategies are involved:

1. Shift the container port away from the main urban area where freight-related economic activity can thrive without disturbing the more productive parts of the city involved in knowledge and services-oriented economic activity; and
2. Increase the use of freight on rail by creating freight terminals where trucks can feed containers onto highly efficient, intermodal, rail systems. This approach is outlined and accepted across Australia in Infrastructure Australia's National Port Strategy⁴.

In the developed world there are no major cities that have left their container port in the centre of major urban activity. By shifting the ports to a better site it is possible to improve road and rail connections and thus greater freight efficiencies are created. As well, new technologies are utilised in the new container and shipping operations. Thus freight-intensive productivity is increased as well as people-intensive urban productivity is increased in areas freed up from trucks.

Fremantle's Inner Harbour is a little different to other cities as it was always away from the centre of Perth (unlike Melbourne, Sydney and Singapore for example) and thus the pressure to move the port has not been so great. However it is in the centre of Fremantle. As Fremantle's Inner Harbour grew in trucks and the Fremantle CBD transformed into a knowledge and services centre, the need to reconsider the site of the container terminal has grown. The pressure to begin building a new Outer Harbour container facility has thus been on the agenda for several decades as has the need to increase the proportion of freight going to rail.

2 Million tonnes per annum

3 IA. 2015. "Australian Infrastructure Audit: Our Infrastructure Challenges Report – Volume 2" April 2015 <http://www.infrastructureaustralia.gov.au/policy-publications/publications/files/Australian-Infrastructure-Audit-Volume-2.pdf>

4 IA. 2011. "National Ports Strategy — 2011" <http://www.infrastructureaustralia.gov.au/policy-publications/publications/National-Ports-Strategy-2011.aspx>

2. Fremantle's Future: Change

The Fremantle Port Authority in their most recent Annual Report (2014)⁵ made the following comment:

'Fremantle Port's Inner Harbour container trade is expected to reach optimal capacity within the next 10 to 15 years, with the timing dependent on trade trends and other factors. When this occurs, additional facilities will be needed to cater for further growth. Significant planning for these has been undertaken over many years and the WA Planning Commission has been tasked subsequently with assessing and making recommendations to State Cabinet on the optimal location and design'. (p28)

The expected transition is set out in the planning scenario in Figure 1 showing the growth in containers to the Fremantle Inner Harbour being capped at around 1 million TEU⁶ and the transition to an Outer Harbour container terminal commencing in 2022.

At the same time the number of containers transferred from trucks to trains was expected to increase as has been the case in recent years. See Figure 2 from the Fremantle Port Authority Annual Report in 2014.

The proportion has been increasing very slowly but the total number of containers on rail has been growing steadily and was expected to increase further as the rail access at North Fremantle has recently been improved. Ultimately the freight strategy was designed to take 30% of trucks with containers off the road and replace them with highly efficient train freight.

Thus despite the Inner Harbour being a constrained site it appeared that the Outer Harbour and increased use of rail would mean that truck numbers could be managed despite there being issues in the approaches along Leach Highway and especially in North Fremantle where the trucks are focussed.

5 Fremantle Port Authority. 2014. "FPA Annual Report"

6 TEU: twenty foot equivalent units - a universal measure for freight movements based on the size one size of a standard container

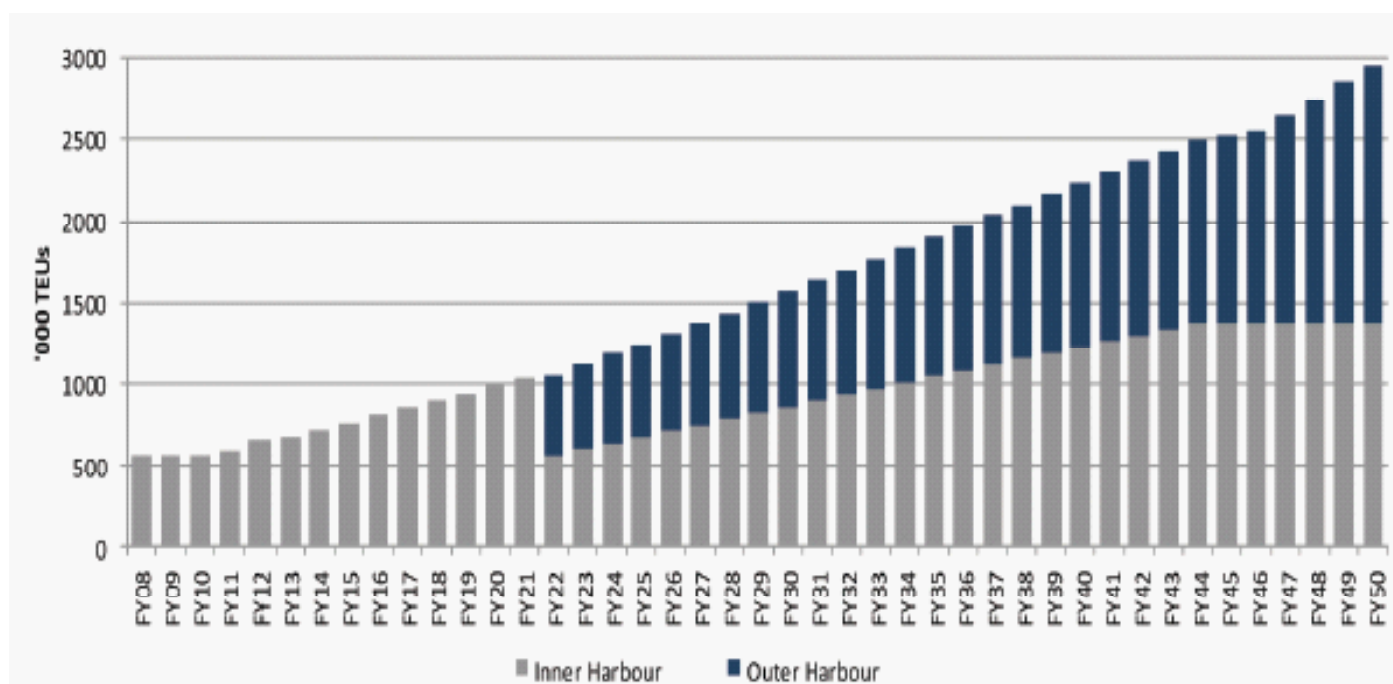


Figure 1. Indicative scenario for the Inner and Outer Harbour transition arrangements. Source: Perth Freight Link, Business Case Executive Summary

However this has now been subverted by the announcement of the \$1.6 billion Perth Freight Link (PFL) that was brought into the transport planning system in February 2015. For the State of Western Australia (WA) it is hard to react negatively to a substantial Federal Grant when the state is struggling financially. However, this particular project has many inadvertent and serious impacts outlined below.

3. Perth Freight Link: Consequences

The PFL is likely to have a series of unforeseen consequences:

- i. Undermine the operational capacity of the Inner Harbour due to rapidly increasing truck traffic to a port nearing land-side capacity instead of towards transport links better suited to long term freight growth;
- ii. Reducing the opportunity to develop the Outer Harbour as a part of the mid to long term public infrastructure strategy due to the need to make the PFL pay-back its investment (as it is a toll-road);
- iii. Undermining investment time frames for investments in access alternatives (road and rail) to the Outer Harbour;
- iv. Reduction of rail to the Inner Harbour. Rail freight movement will be far less competitive due to the need to put as much of the containers as possible through the tollway;
- v. Increasing diesel particulates with its damaging long term health effects;
- vi. Fracturing North Fremantle and cause congestion at the port's landside entrance;
- vii. Impacting the Beeliar Wetlands;
- viii. Severing the suburbs with the proposed cutting in Fremantle;
- ix. Severely limiting the work the Council has done to reinvigorate the City of Fremantle over the last decades as trucks and people-intensive city centres do not mix;
- x. Driving away tourists and local beach users from the North Fremantle area due to the increase in trucks;
- xi. Increasing truck flows down Port Beach Road and Curtin Avenue through the high

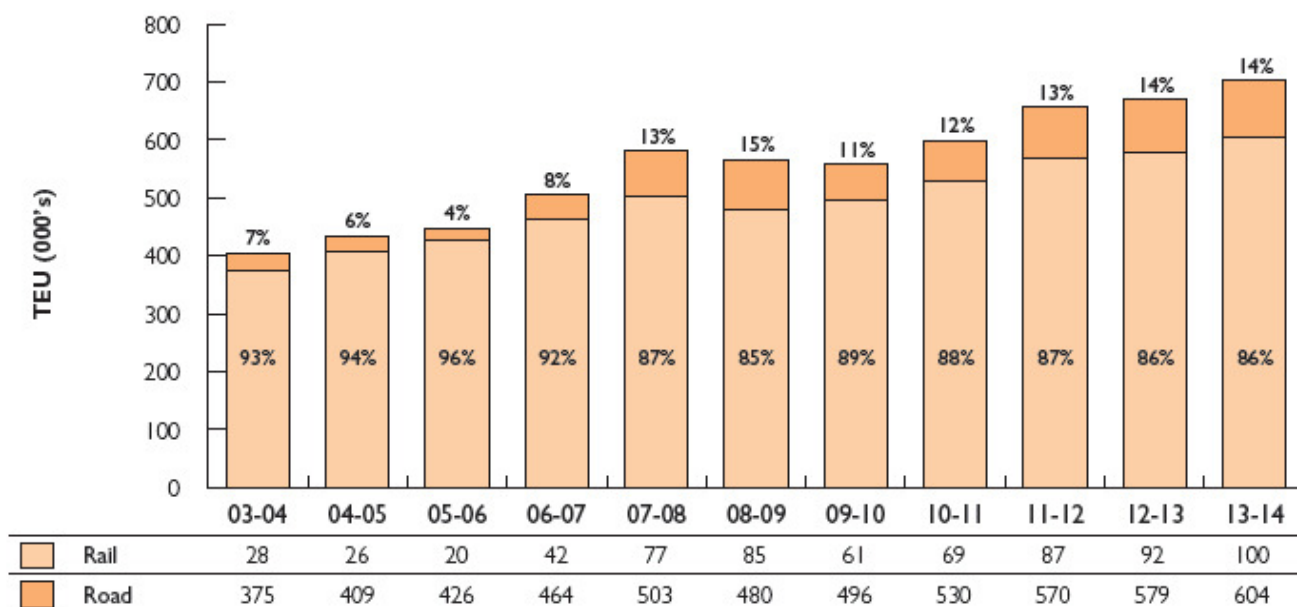


Figure 2. The number and proportion of containers on road and rail reaching the Inner Harbour, 2003/4 to 2013/14.
Source: Fremantle Port Authority Annual Report, 2014.

value Western Suburbs as the loss of rail and an Outer Harbour will drive increased north-bound truck traffic to run via the built up area road network: this will reinforce the long standing plan to build the Stephenson Highway from Mitchell Freeway, a much maligned concept.

- xii. There is also the chance that the congestion will not be resolved through the PFL as the heavy trucks may avoid using the toll-road and continue to use Leach (a much more direct) while the PFL may become overly popular with private automobile drivers were it to be not tolled. Effectively, with a toll there are negatives (avoidance) and without a toll there are negatives (overuse); neither of these options have been made public by the State of Western Australia.

All of these impacts will be expanded upon in Chapter IV: The PFL and Chapter V: Impacts.

4. Privatising the Fremantle Port Authority

The decision to privatise the Fremantle Port Authority (FPA) made in the State Budget on May 15th, follows the sale of the ports in Sydney, Brisbane, Melbourne, Newcastle, and Darwin. The rationale for such recycling “capital in mature assets into new infrastructure” was developed by Infrastructure Australia (IA) in the National Infrastructure Plan⁷. This was following an earlier IA report⁸ on the “potential benefits of transferring publicly held infrastructure to the private sector so that governments facing budgetary constraints can use the net proceeds to finance new infrastructure and overcome the infrastructure deficit.”

This decision can enable options that would help solve these issues outlined above or it could make the situation worse. Thus in each option the implications from privatising the FPA will be examined.

7 IA. 2013. “Report to COAG: National Infrastructure Plan June 2013” <http://www.infrastructureaustralia.gov.au/policy-publications/publications/Report-to-COAG-National-Infrastructure-Plan-June-2013.aspx>

8 IA. 2012. “Australia’s Public Infrastructure — Part of the Answer to Removing the Infrastructure Deficit” <http://www.infrastructureaustralia.gov.au/policy-publications/publications/Australias-Public-Infrastructure-Part-of-the-Answer-to-Removing-the-Infrastructure-Deficit.aspx>

III. THE ECONOMIC AND TRANSPORT CONTEXT

1. Introduction

The Perth Metropolitan region continues, despite a recent downturn in the iron ore prices, to grow in population, land area and economic diversity. Inherent within this growth are more consumers and needs of small and medium sized enterprises (SME) to access imports and create exports. Furthermore, as the agricultural sector diversifies its product and consumer base, the requirements to have a ready and open distribution system through containers becomes all the more apparent (e.g. Wheat) . The economy has grown from 1990's Gross State Product of \$76.9 Billion to \$265 Billion in 2013-14⁹. Perth and Peel is expected to reach a population of around 3.5 million by 2031¹⁰ and around 5 million by 2050¹¹. Hence freight is likely to continue to grow with some reduction in per capita freight movements due to dematerialization, the information technology revolution and logistics improvements.¹²

2. Current Freight Task

As will be seen on the following pages, Perth's freight task is to move large volumes of containers and other durable, perishable, and break-bulk goods (such as imported mining matériel) primarily through to inland ports at Kewdale, Henderson and O'Connor. Containers are by far the biggest part of the freight in the Inner Harbour at North Quay. The trend is likely to be continued and expanded within Fremantle and these freight focussed places. However, there is also reason to expect new warehousing to be developed in the outskirts of the urban area adjacent to any upgraded highway or rail access as the pressures to urbanise increase and companies find other areas to expand with fewer encumbrances and better logistics. This has been a typical pattern found throughout land-rich and automobile-dependent nations world-wide as such industries seek larger footprints with less cost and fewer constraints.

Kewdale / Welshpool leads the way as an inland port, warehousing and transshipping area from the port to the rest of the urban region, the state and across the nation.

3. Perth Freight Planning

There have been many plans and reports that include freight. The key reports are:

A. Old Plans, Evolving Plans

i. Stephenson Hepburn Plan

- a. In the era of Stephenson Hepburn Plan (SHP), cargo was dealt quite differently as the era of containers was not yet envisaged. It was much more labour intensive and required more smaller trucks to deliver the same loads. This is the reason the SHP forecasted foreshore highways to both quays of the inner harbour. These highways have been removed.

ii. MRS Updates

- a. The original Metropolitan Regional Scheme followed the SHP and forecast larger, bolder highways suited to a metropolis with the expectation that rail was not going to factor.

9 Committee for Perth "Factsheets 1-6" 2015. From: <http://www.committeeforperth.com.au/researchFactSheets.html>

10 WAPC, 2015. "Perth And Peel @ 3.5million" <http://www.planning.wa.gov.au/publications/3.5million.asp>

11 ABS. 2015. "Western Australia. Population Size" [http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/3222.0main+features112012%20\(base\)%20to%202101](http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/3222.0main+features112012%20(base)%20to%202101)

12 IPCC. 2014. "Methodological and Technological Issues in Technology Transfer. 3.1 Residential, Commercial, and Institutional Buildings Sector" <http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=523>

This scheme has been modified over the years as political and physical needs dictate.

iii. Freight Network Review

- a. The Freight Network Review of circa 2002 recognised the profound difficulty and inefficiency of the Inner Harbour and made many recommendations including: by 2008 “Planning approvals for Fremantle Port outer Harbour be finalised”; by 2012 “30% of containers moved by rail to and from Fremantle Inner Harbour; and by 2012 “Outer Harbour begins to accommodate overflow from Fremantle Inner Harbour”¹³

iv. The 6-point plan for moving freight in the south west Corridor, in 2008, was¹⁴:

- a. Extend Roe Highway to Kwinana Freeway;
- b. Put more freight on rail;
- c. Build inland container terminals;
- d. Make better use of roads;
- e. Plan now for the Outer Harbour at Fremantle; and
- f. Improve existing roads

13 Kewdale-Hazlemere Integrated Masterplan “Table 2.1 Freight Network Review implementation plan and recommendations” From: http://www.planning.wa.gov.au/dop_pub_pdf/KH_Chapter_Two.pdf

14 Lumsden, Eric. 2008. “Planning for the South West Corridor” Department for Planning and Infrastructure. Available at: <https://www.engineersaustralia.org.au/sites/default/files/shado/Divisions/Western%20Australia%20Division/Panels%20and%20Societies/Transport/South%20West%20Corridor%20Planning%20atCity%20of%20Melville%2024%20Apr%20-%20Final.pdf>

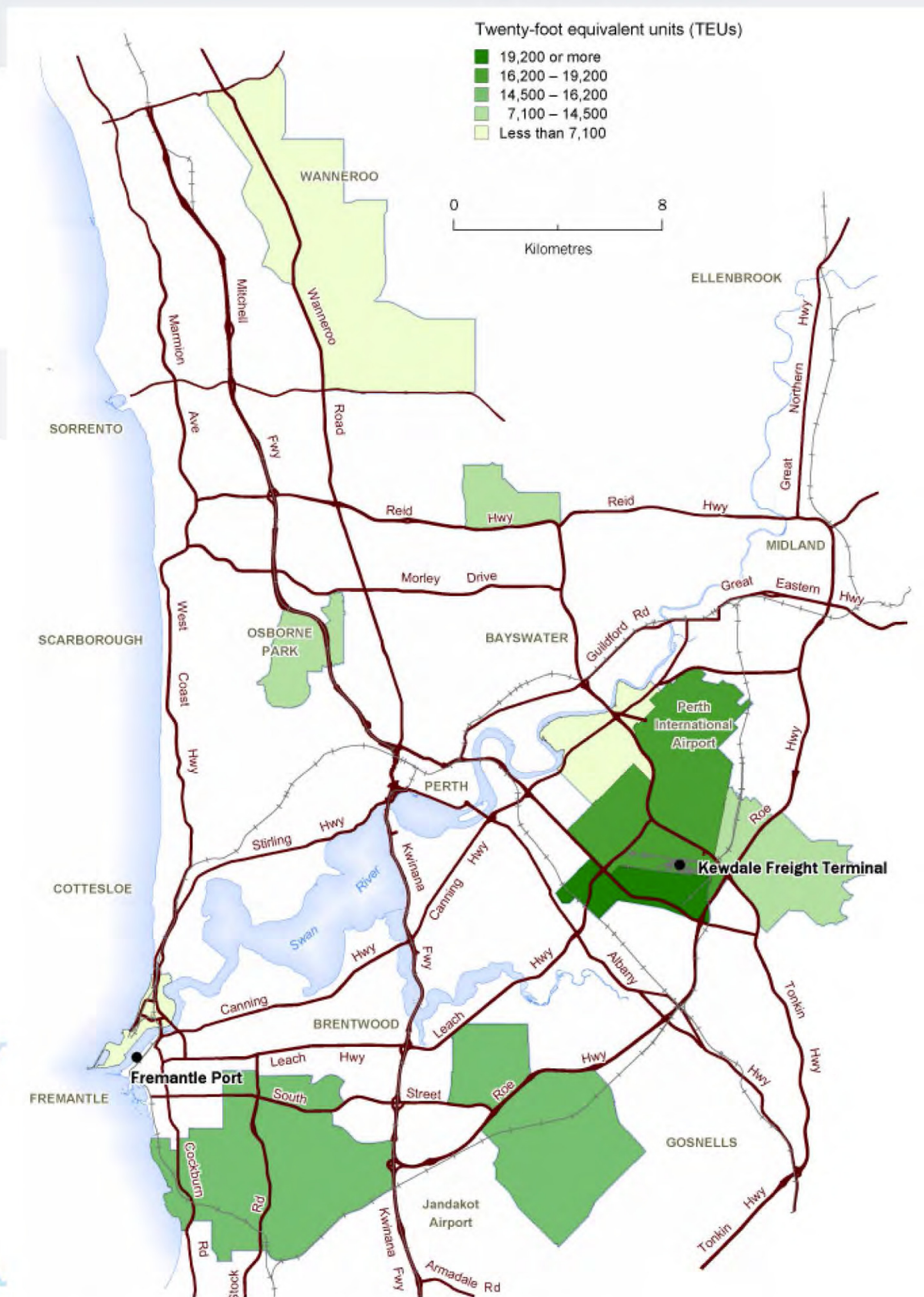


Figure 6: Container Movements in the Perth Metropolitan Area odities.

37

SOUTH WEST GROUP

www.southwestgroup.com.au

Figure 3. Freight Destinations around the Perth Metro. Source: South West Group. March 2015. "Review of South West Group Strategic Plan" www.southwestgroup.com.au

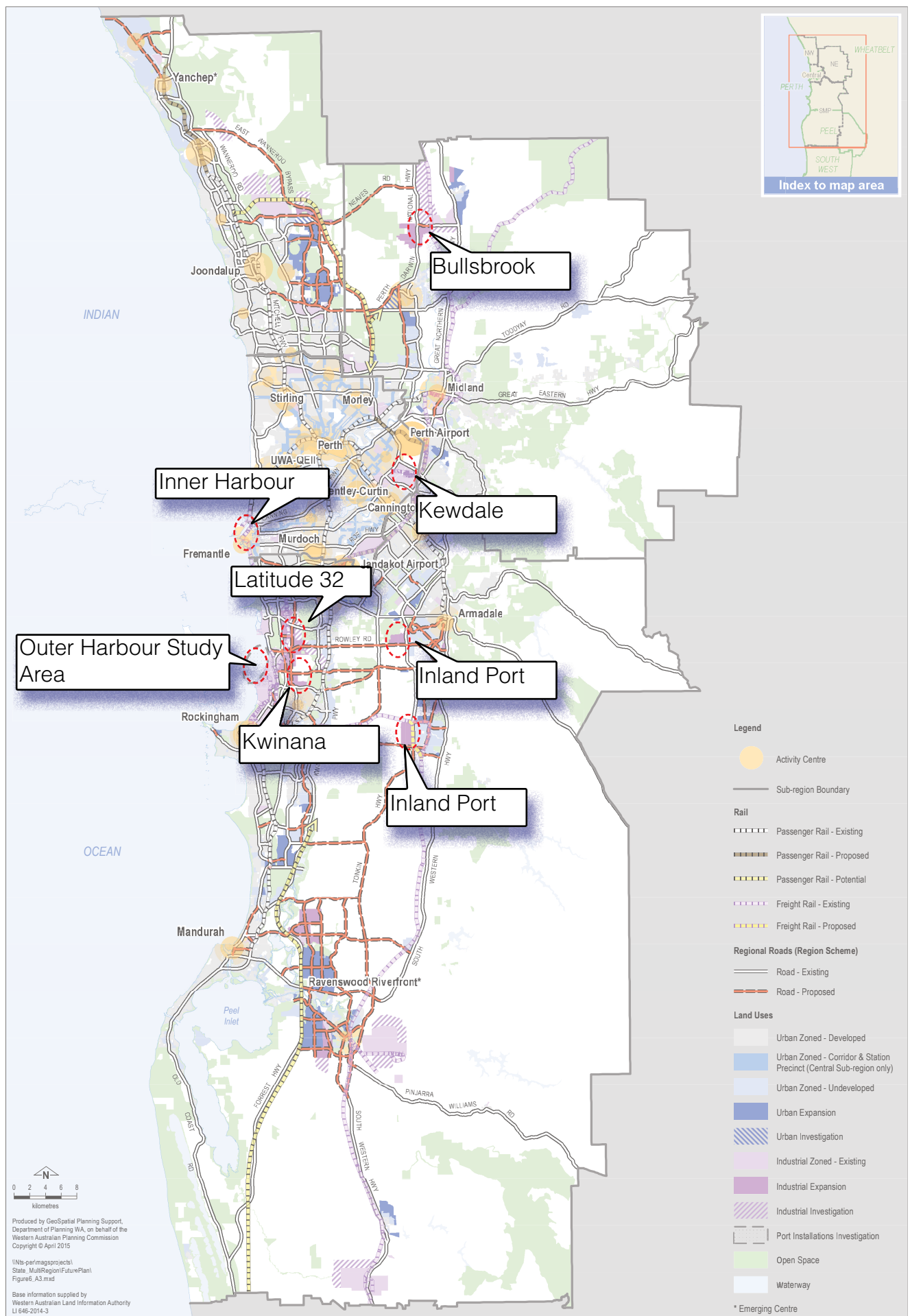


Figure 4. Perth and Peel @ 3.5 Million, Spatial Plan from Department of Planning, WA. http://www.planning.wa.gov.au/dop_pub_pdf/Spatial_Plan_A3.pdf Named freight handling sites.

Table 1 – Distribution of Unpack Locations

Location	2004	2011
Bayswater/Morley/Malaga	6%	8%
Inner Harbour	3%	6%
Kewdale/Forrestfield/Welshpool	39%	35%
Canning Vale (*note: 2003 totals included in Kewdale)	*	10%
Kwinana/Rockingham/Naval Base/Henderson	2%	3%
O'Connor/Spearwood/Bibra Lake	14%	16%
Outer Perth	5%	10%
Perth Central	11%	10%
Country	20%	2%
Total	100%	100%

Figure 5 – Full Container Delivery to Unpack Location - Time of Day

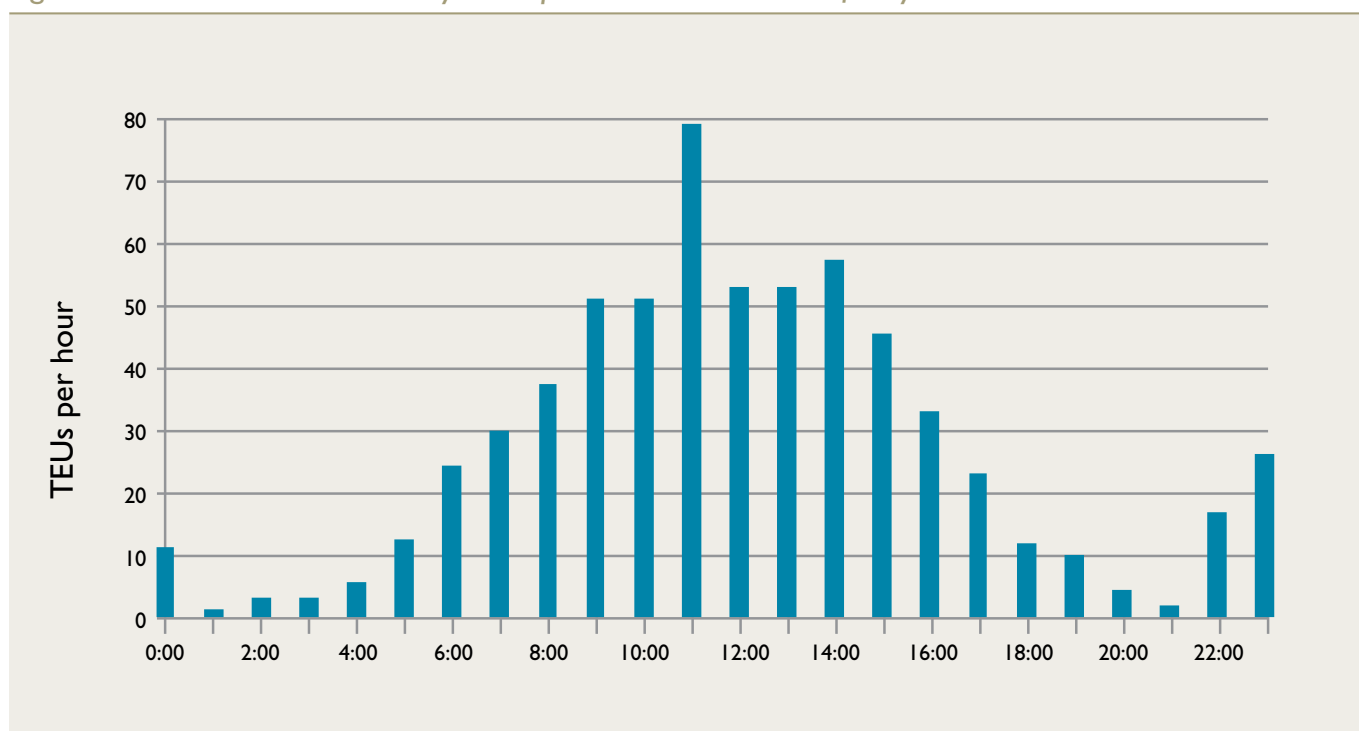


Figure 5. Freight Distribution and delivery times around the Perth Metro. Source: Port of Fremantle 2012 "Container Movement Study"

B. Latitude 32 and the industrial geography of Perth to 2050

Latitude 32 was born out of an acknowledged need to plan for the long term growth of appropriately located industrial lands. The site was chosen in the Hope Valley -Wattleup area as it was seen to have the best transport access to: the Perth CBD via the Kwinana Freeway, Perth's Airport precincts, the adjacent industrial complexes, Kewdale and the proposed Outer Harbour and Intermodal hub¹⁵ (Figure 6). As such, it does seem to be ready-made to send and receive a great deal of the cargo pressures the Inner Harbour is facing.

The following points are directly from the Latitude 32 FAQ's section of their website¹⁶:

- i. "Main Roads WA has indicated 2026 for Rowley Road and the upgrade of Anketell Road and 2031 for the Fremantle Rockingham Controlled Access Highway."
- ii. "The proposed outer harbour is intended to handle overflow freight when Fremantle Port reaches capacity. Freight will be transferred from the harbour via either road or rail, possibly to an inland intermodal terminal located within Latitude 32. An intermodal freight terminal, usually located on a rail line, is a transfer point for cargo between one mode of transport to another."
- iii. "The Department of Transport is currently preparing a Metro Freight Network Strategy, which includes a number of proposed locations for an intermodal terminal. Latitude 32 is one of the proposed locations. The Metro Freight Network Strategy is anticipated to be released in early 2015."

Latitude 32, is an important new freight facility but it depends entirely on how quickly the Outer Harbour container facility can be constructed and proper access by road and rail completed. The PFL will not only divert investment to help this facility and its access, the analysis shows that it will be undermined.

However, in light of the privatisation of the Port of Fremantle, it is possible that a new lessee/ owner will acquire rights to use this area which may enable Latitude 32 to finally come to use. It may not come into play with a new lessee if the PFL is constructed as the flow of freight will be to Kewdale alone, leaving this entire area to sit unused for a second generation.

15 Latitude 32, Industry Zone. 2015. "Location" <http://latitude32.com.au/project-overview/location/>

16 Latitude 32, Industry Zone. 2015. "About the Project, FAQs" <http://latitude32.com.au/project-overview/frequently-asked-questions/>

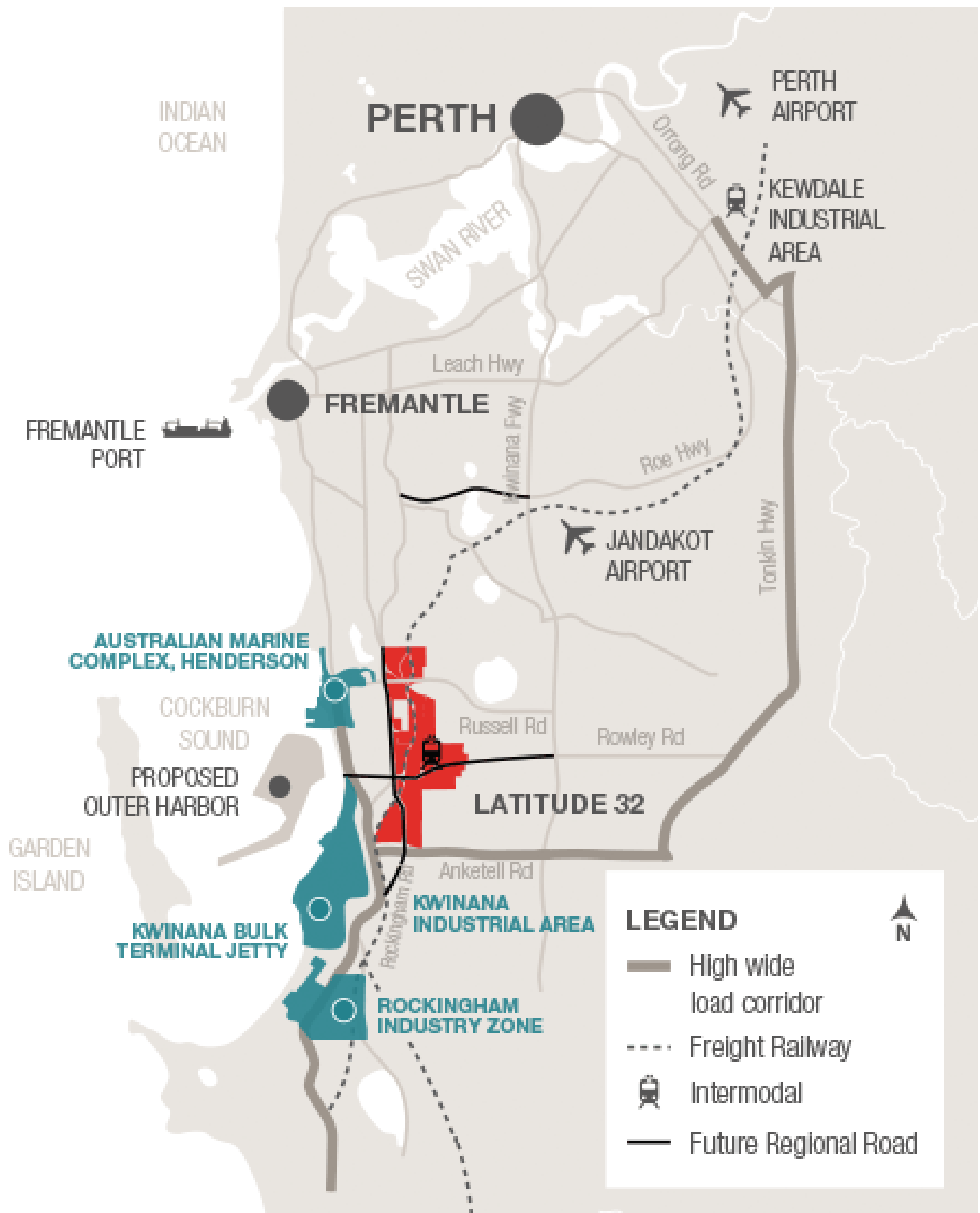


Figure 6. Latitude 32: "Location" showing the strategy which has been slowly unfolding for decades but is now being overwhelmed with a 'shovel-ready' electoral gamble. From <http://latitude32.com.au/project-overview/location/>

C. Kwinana Intermodal Terminal

The Kwinana Intermodal terminal, located adjacent to Latitude 32, is intended to relieve some of the congestion from the freight task currently at Kewdale. It was selected according to these criteria: “land area requirement, connections to the rail network, environmental impacts, distance from residential areas and impact of established infrastructure, such as the Dampier-Bunbury gas pipeline”¹⁷.

- i. “The demand for international intermodal services will be driven by a number of factors, in particular the acceleration of international container trade through the port of Fremantle and the Outer Harbour when it commences operation as a container terminal at some point around 2015.”¹⁸
- ii. Kwinana is a suitable location for a major intermodal terminal in the Perth Metropolitan area from a supply perspective as it meets the key locational drivers for a successful intermodal terminal which are:
 - a. proximity to the main freight rail lines and to road networks that can accommodate the volume of trucks
 - b. proximity to key cargo catchments such as ports and distribution centres
 - c. separation from residential or other sensitive and in some cases incompatible land uses
 - d. flat topography to allow for long trains such as 1500-1800m in length
 - e. adequate area of land for future growth and for complementary uses.
- iii. Kwinana also rates well from a demand perspective because of the:
 - a. importance of industrial and construction goods in the freight task
 - b. reasonably good accessibility to much of the metropolitan population base
 - c. strong growth prospects of the South West region
 - d. possibility of significantly supplementing domestic intermodal freight with import/export freight through the Outer Harbour.¹⁹

This facility, and the promise of a future well planned to accommodate growth in containerised intermodal freight, should be taken advantage of sooner rather than later. The PFL only delays the ambitions of this site as will be outlined below.

17 WAPC “Update on Planning for an Intermodal Terminal...”http://www.planning.wa.gov.au/dop_pub_pdf/Kwinana_brochure.pdf

18 Kwinana Intermodal Terminal Study. 2006. Page 1.

19 Kwinana Intermodal Terminal Study. 2006. Page 5

D. Inner Harbour - Capacity and new expansion

Although evidently dated by its projected schedule of 'capacity', the following quotes²⁰ from the Port of Fremantle are insightful.

Regarding a definition of Capacity:

"It is difficult to be completely definitive about how much cargo a port can handle. It is almost always possible to draw a little more out of a port facility, if the owner is prepared to invest enough capital or accept lower service standards. Capacity is also affected by the characteristics of the trade that is served."

This same, dated document, continues in stating that an Outer Harbour is expected by 2020.

"...supplementary facilities in the Outer Harbour to handle the overflow from Fremantle's Inner Harbour are not expected to be required on capacity grounds, until approximately 2020. Even after supplementary facilities are developed, it is planned that the Inner Harbour will continue in the longer term, throughout the twenty first century, as a major, dynamic container and general cargo port facility able to efficiently cater for the handling of container trade at more than three times current levels"

However, in 2011 a fresh report "Optimising our port infrastructure and planning for growth"²¹ was released in which it was stated, fully admitting, that the expansion of the port then already underway was about to create "transport challenges":

"Reclaimed land at Rous Head has provided an additional 27 hectares for port-related purposes and created an opportunity to improve landside access and efficiency.... The reclaimed land also allows planning for a truck marshalling area with communication and control systems to direct heavy vehicle flows. The result is Fremantle port will continue to grow over the next 10 years to its anticipated capacity of 1.2 million containers per year, and this is expected to present transport challenges."

Again, this document underlines that eventually the Inner Harbour will reach capacity and that an Outer Harbour will be required.

"Future growth in the bulk products trade is anticipated and this will continue to stimulate demand for additional Outer Harbour port facilities and associated transport logistics.....Additional container facilities will also be required once the Inner Harbour reaches capacity, and studies over time have shown the Outer Harbour is the best site for these."

20 Fremantle Port Authority "Inner Harbour Development" <http://www.fremantleports.com.au/SiteCollectionDocuments/Inner%20Harbour%20Port%20Development%20Plan.PDF>

21 Fremantle Ports 2011 "Optimising our port infrastructure and planning for growth" From <http://www.fremantleports.com.au/SiteCollectionDocuments/Port%20Infrastructure%20brochure%20June%202011.pdf>

Key Observations

Perth's Freight planning has been proceeding inexorably towards the development of an Outer Harbour container port with a series of intermodal terminal facilities being carefully planned in the Kwinana and Cockburn region. Various sites and access have been proposed but no detailed plan developed though work appears to have advanced within the Fremantle Port Authority (FPA) and Department of Transport on a Freight Strategy that would have enabled further progress towards this goal. Please see Figure 7 for an overview of the proposals.

This will all be now thrown into disarray due to the delivery of a totally unexpected and unplanned new road: The Perth Freight Link.

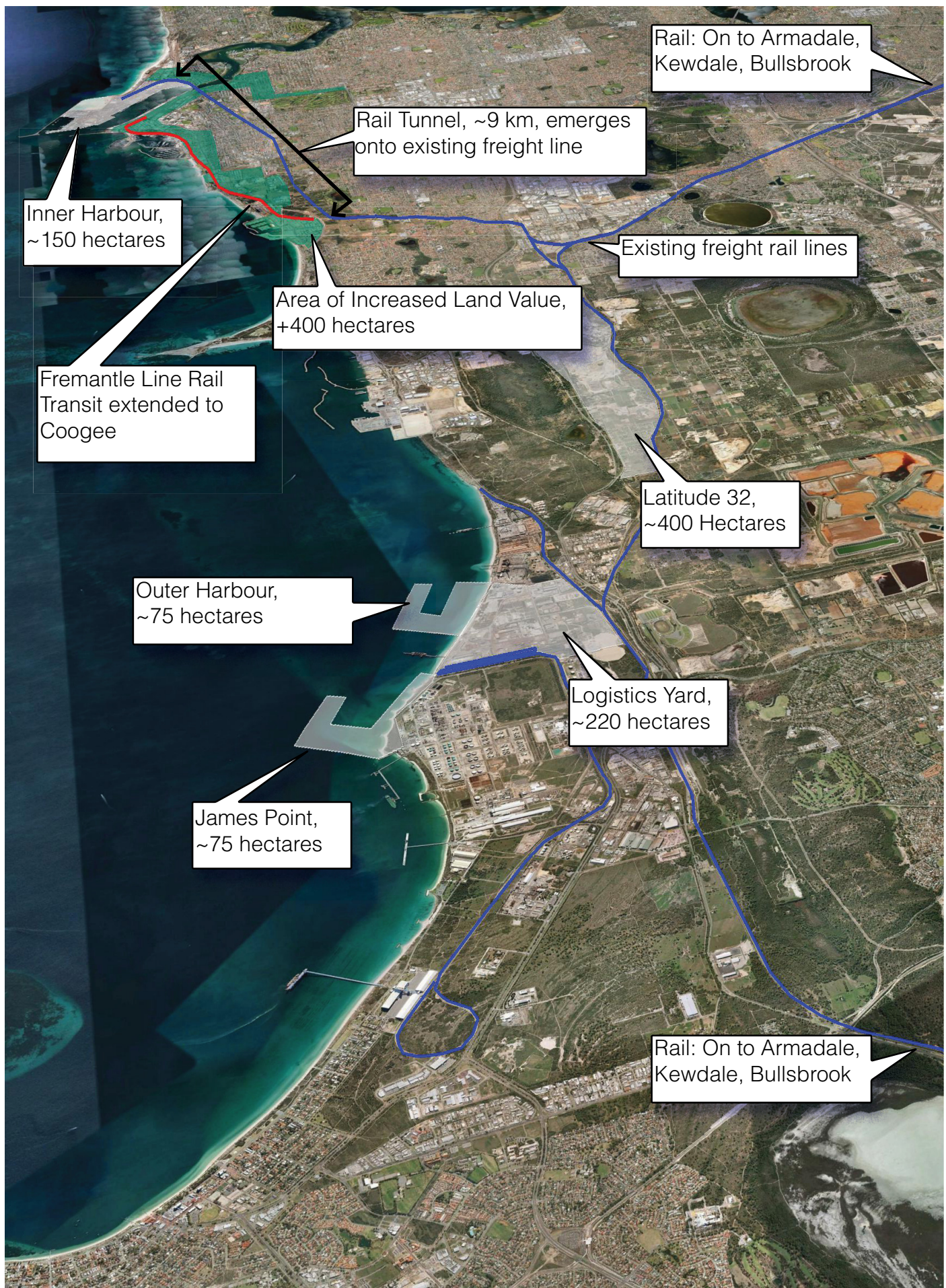


Figure 7. Outline of the Proposals. Blue lines indicate existing freight rail plus the tunnel portion, clearly marked. The red line is the proposed extension of the TransPerth passenger rail service to Coogee. White polygons are the proposed freight handling areas and the green area is the zone of highest land value increases from these changes.

IV. ABOUT PERTH FREIGHT LINK - ROUTES AND POLICY

1. Introduction

Perth has a need to bring container trucks to and from a variety of areas to a port with exports and imports. Mostly the trucks come to and from Kewdale, Osborne Park, Kwinana and Malaga as well as those that need to travel to the Pilbara via Northlink (see Figure 8). At present they move mostly along Leach Highway although there is also a significant proportion that come on other roads from the north, south and east.

2. Why the PFL?

The PFL was created to solve the problem of trucks going along Leach Highway. The solution to this issue had been sought for decades involving rail and an Outer Harbour as outlined above. However, a campaign by the City of Melville and the Member for Riverton, to take trucks around their city and electoral boundaries has changed this. A new strategy has been developed to extend Roe Highway to Stock Road and then through Fremantle's suburbs as set out in Figure 9 & 10. The PFL goes around the City of Melville adding 10 kms (26km to 36km) to a truck trip from Kewdale to Fremantle. The project is a toll road designed to provide time savings for containers and trucks of around 10 minutes due to a lack of traffic lights.

3. The Economics

There are three stages as set out in Figure 8. The first two stages are estimated to cost \$1.6 billion. The final stage to get through to North Fremantle has not been announced but is likely to cost at least \$0.5b extra as it will most likely involve doubling Stirling Bridge and providing large overpasses to miss lights around Tydeman Road. The total is thus more likely to be around \$2b, if not much more.

4. Stated Benefits

The Benefits of the PFL as enumerated on the Main Roads website are:

It will provide the 'missing link' in the Perth Urban Transport Corridor, through a dedicated, high productivity, east-west freight connection between Perth's heartland industrial areas, such as Kewdale and Welshpool, and Fremantle Port. Current stop-start traffic will be replaced with free-flowing vehicle movement.

The project will link with the \$1 billion Gateway WA project and the \$1.12 billion NorthLink WA (Perth to Darwin Highway) project to provide a free flowing 85km route from Muchea to Fremantle Port and Perth's southern industrial and trade centres – delivering significant benefits to the economy, industry, motorists and local communities.

The project will result in improved safety for all road users, reduced traffic congestion, fewer trucks on urban roads, lower emissions, reduced noise and significant freight industry productivity improvements.

Reading between the lines of the above quote we can see this is viewed as a fundamental part of a broader State and Nation building exercise. Such efforts are to be applauded. However, the impacts

of such projects must consider not only the wishes of the residents but also the ambitions of the urban areas through which they pass, the ecology of the places they are built atop, the preferences of the local economy to be more than a transshipment point and the impacts on the long term freight strategy as outlined above. The benefits as outlined by the state government are presented in Figure 8.

5. Benefit Cost Ratio

A Benefit Cost Ratio (BCR) for the PFL has been estimated at 2.8 which is a very good figure compared to many like the East-West Link in Melbourne which was going to only have a BCR of 0.4 and like the PFL was a Federal Government top-down project. However the BCR of 2.8 assumes a lot; most of the benefits are based on a 10 minute time savings by trucks, despite there being no solution to the traffic at North Fremantle yet. A faster route around the city may be possible but in the end it will not save time if trucks are stuck in truck jams in East Fremantle and North Fremantle. The benefit cost ratio is thus illusory and misleading.

The Impacts from the PFL therefore need to be assessed in more detail and the potential options reviewed.

6. Time savings reconsidered

Were the PFL constructed to Stock Road and then south to Roe 8, a distance of 36.5 km at an average 80 km per hour would be 27.4 minutes. ($\text{Distance/Speed} \times 60$). This compares to the current 26 kilometers of Leach Highway to Kewdale at around an average 60 km per hour at 26 minutes. The enormous time savings from this expensive proposition may be nil. The ramifications being that it may indeed be better to improve the intersections along the existing route to increase a more sustained speed via improved signalling and intersection upgrades.

These will be covered again under the discussions “Road Tunnel” in VII.2 and under “Transport Demand Management” in the Appendix 1.

V. THE IMPACTS OF THE PERTH FREIGHT LINK

There are many impacts likely to follow from the PFL as announced. The key infrastructure impacts will be that there will be: no commitment to the Outer Harbour and no improvement to rail to the Inner Harbour. This will mean the numbers of trucks becomes a serious exercise in logistics and impact assessment especially as they run through an increasingly liveable urban area.

To make the toll-road sell funding and to remove the possibility of over-use by private vehicles, causing delays and congestion to the trucks, that the toll will apply to all vehicles. It will have many other underrepresented negatives such as follows.

1. The Tollway Toll

The project is designed as a Tollway. This is a key element that has not been considered properly and is more than likely going to cause inadvertent issues which could undermine the whole port freight strategy. Instead of creating a more efficient port it is likely to reduce its overall functionality and at the same time create significant economic impacts on the city and suburbs of Fremantle as well as the Western Suburbs.

There are two major factors that are likely to cause these failures:

A. The Outer Harbour:

The Outer Harbour project is likely to be postponed as the \$1.575 billion assigned to this project would mean that the chances of a similar amount for the Outer Harbour sometime soon are next to zero. If the Outer Harbour was to begin taking containers in 2022 it would need to be fully planned

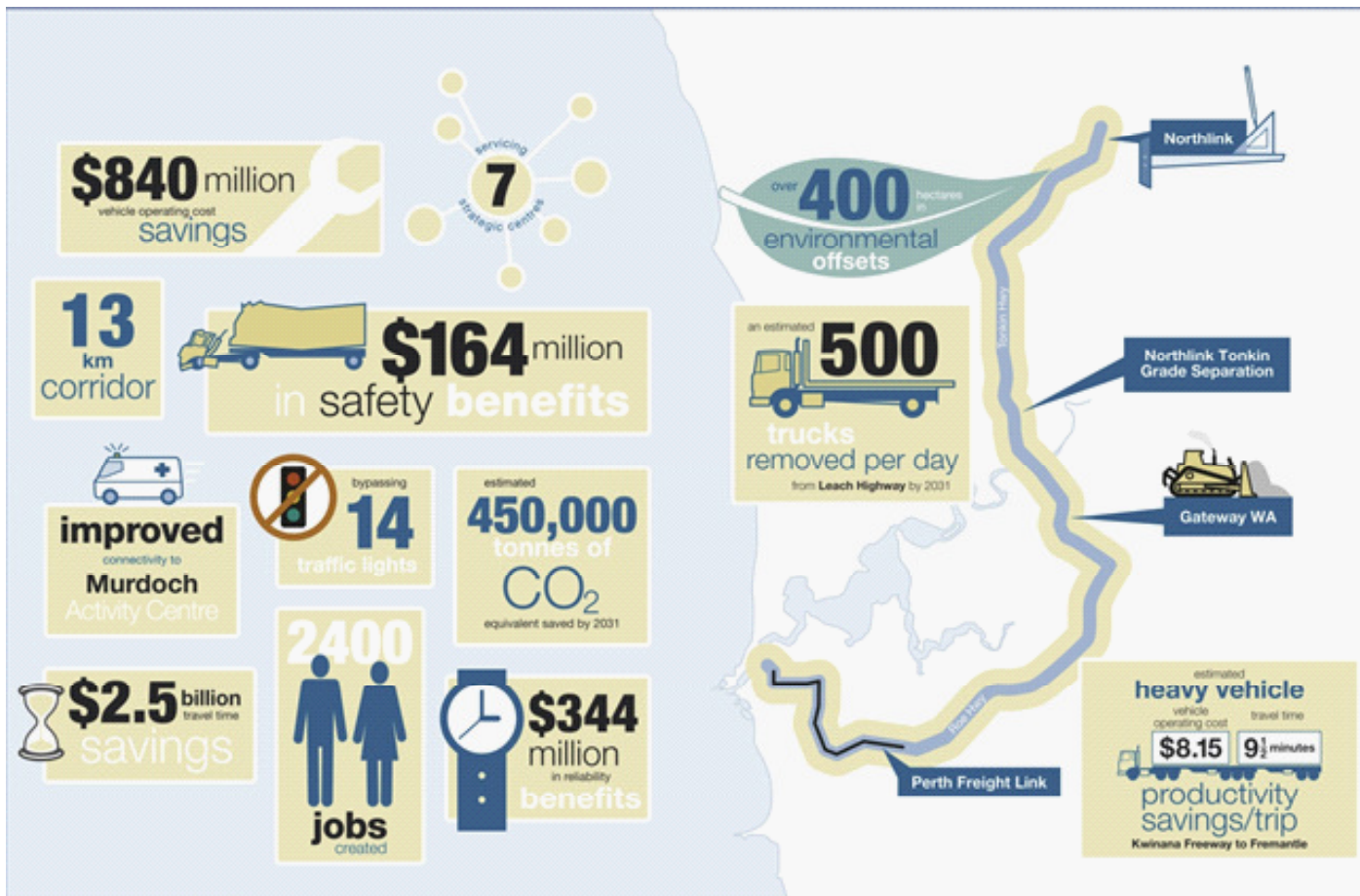


Figure 8. Map of PFL as it relates to other major freight links being built. Source: Perth Freight Link, Business Case Executive Summary

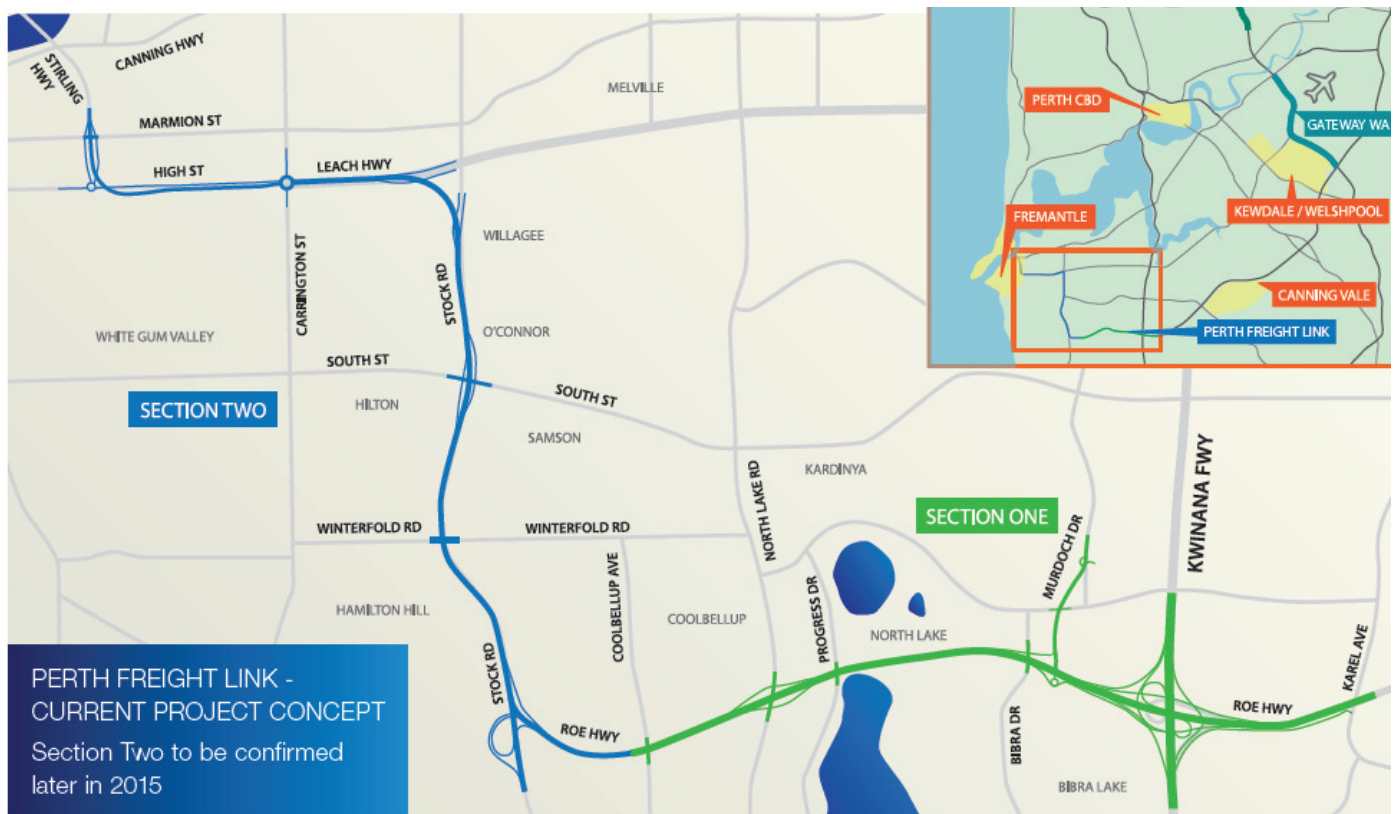


Figure 9. Image of proposed PFL from WA Main Roads May 2015 "Perth Freight Link A Free Flowing Freight Connection" available at <https://www.mainroads.wa.gov.au/Documents/Perth%20Freight%20Link-Information%20Sheet%20April%202015-web.RCN-D15%5E23197747.PDF>



Figure 10. The PFL avoiding the City of Melville and some sensitive state seats instead of running directly to the port down Leach Highway. Why would a heavy goods truck take a longer tolled route? Source: Perth Freight Link, Business Case Executive Summary

very quickly and earthworks begin within a few years. The Outer Harbour preparations for its road and rail access would need to be done in the period of the next few years as the PFL is being built. This is not happening and all of the State's resources will now be directed into the PFL. Thus the Outer Harbour will be postponed with no access road or rail budgeted for many years.

The following impacts can thus be calculated:

- i. The future as it has been planned: The Fremantle Inner Harbour now takes 700k TEU containers a year (in 2014) with 100k of these coming by rail. This was planned to move in 2050 to be 3000k TEU containers with half going to the Inner Harbour and half to the Outer Harbour. 900k of these were anticipated to be on rail (30% is the goal for rail). If split equally this would mean 1,050 TEU on trucks going to each Harbour. Thus the Inner Harbour would only have gone from 600k TEU containers on trucks in 2014 to 1,050k TEU in 2050, an increase of 57% but a substantially managed increase.
- ii. The future with the PFL: With no clear future for the Outer Harbour and reduced rail for the Inner Harbour there will be by 2050 3 million TEU containers travelling by truck through Fremantle instead of 1,050, 000. This will be felt immediately and grow to impossible truck traffic well before 2050. What the PFL means in terms of trucks per day is that instead of around 3000 trucks per day on a weekday in 2014 entering the Fremantle container port area, there would be 12,000 trucks per day by 2050 - a four fold increase. The consequences of such growth are going to be substantial on Fremantle and its surroundings.

B. More Trucks, Less Rail

The clear implication in establishing a toll on trucks using the PFL is that the route will need to have as many trucks using it as possible. This would mean decommissioning the rail to the Inner Harbour for freight as any assistance to them would undermine the toll revenue. Rail will be seen as non-competitive and inefficient once the special truck route is completed. It is more than likely that B-triples would be approved for the PFL further increasing the efficiency of trucking. This would completely remove the rail option for freight to the Inner Harbour.

Rail freight movement will be far less competitive due to the need to put as much of the containers as possible through the tollway. The toll road will have to pay for itself and it cannot be seen to be giving an unfair advantage to the competition, freight rail. Freight on rail will be seen to be enjoying a 'free-ride' and a continued subsidy. This will be especially the cases if the truck lobby groups push against the toll road and need arguments.

The effect of this will be to slow any expansion, delay maintenance and try to out-compete rail at every opportunity. The freight rail will become less competitive until it disappears.

One potential positive from this is that the disappearance of the freight train could leave the freight rail RoW running past the Fremantle Station available for passenger rail. Plans are already released for an extension of the Thornlie line around to Cockburn Central. The next stage could be built around freight rail RoW to Spearwood, Coogee, Cockburn Coast, South Beach and into Fremantle. Yet, unless this is properly planned for it will not be budgeted and be an awkward transition.

C. Conclusion:

There are clearly some inadvertent impacts from the PFL due to it being a tollway and being a large commitment of capital expense that rarely can be found for such truck routes. The implications of a fourfold increase in trucks can be followed through in the following issues.

2. Inner and Outer Harbour: Transport and Capacity Impacts

A. Undermining the operational capacity of the Inner Harbour

- i. This will arise due to rapidly increasing trucks with containers to a port nearing land-side capacity instead of towards transport links better suited to long term growth
- ii. The numbers of trucks coming to Fremantle are already over-stretching the transport system in Fremantle but are manageable within the Fremantle Inner Harbour operations. The port continues to improve its productivity.²² However its growth was always going to reach limits after its 'optimal capacity' was achieved when the number of containers reached around 1,400,000 TEU. This was expected sometime in the next 10 to 15 years.
- iii. This 'optimal capacity' was based on projections where rail kept increasing its load and then the Outer Harbour took over the extra growth. But as pointed out above both of these are now unlikely to happen: the rail will be closed down as it cannot be accepted competing with a toll road that is meant to pay off a State Government funding commitment; and the Outer Harbour will be shelved indefinitely as the possibility of funding another \$2b road and rail access system to the Outer Harbour is most unlikely.
- iv. The number of trucks going to the Inner Harbour are likely to be in the range of 12,000 per day, or 4 times the current number, if the Inner Harbour expands
- v. These inadvertent implications in the PFL will have serious repercussions for the operations in the Inner Harbour. More trucks will be arriving at the port much sooner than anticipated as the PFL is due to begin in 2018. But the problem will quickly spin out of control as the 'optimal capacity' of the port is breached. Is it possible to consider the arrival, on every working day, of 4 times the number of trucks that are now passing through the Inner Harbour port operations?

3. Truck Size and Road Geometry

- i. B-Doubles and Triples (heavy truck trailers) will be more common as the PFL design geometry will accommodate their specifications. This will be both positive and negative.
 - a. On the positive side this will lower the trucks to TEU ratio which also lowers the Diesel particulates per TEU. However with the increased volumes of TEUs shipping through North Quay the net effect will be adverse.
 - b. On the negative side the B-Doubles and Triples will require wider turning radii and faster lanes of greater width meaning the roads will be much more dangerous inside the urban area. The extra speed and longer trucks will then need to be funneled into the port's working areas through North Fremantle requiring prioritised signal lights for Tydeman Road but also a much higher incident of intersection failure when one or two trucks do

²² Fremantle Ports 2014 "Annual Report"

not clear an intersection.

- ii. How the 'time-savings' are continued to be saved at the entrance to the Port's North Quay needs to be resolved before the expenditure of the PFL is agreed upon or the cost savings are forfeited to delays and congestion at the port's entrance.

4. Human and Natural Environment Impacts

A. Increasing diesel particulates with damaging long term health effects

- i. The increased number of trucks traversing the route to Fremantle can be alleviated to some degree by the use of crossovers and underpasses and trenches but the total pollution caused by these trucks will be substantially increased. In particular diesel pollution (known as particulates) will be greatly increased and these fine particles are a growing concern in the global health community as they cause cancer as well as other breathing-related diseases like asthma²³.
- ii. The WHO have confirmed the link between diesel particulates and cancer. Speaking about this the director of New York's Clean Fuels and Vehicles Project, Rich Kassel said:

*"The pollution that we care about from diesel - buses, trucks and other diesel engines - is technically called particulate matter. We all know it is soot. It's fine particles that are small enough to get past our throat, past our lungs into the deepest part, the deepest of our lungs, where they trigger asthma attacks, bronchitis, emphysema, heart disease and now of course we've learned cancer."*²⁴

- iii. Fine particles of diesel smoke can travel some distance from their source and the route of the PFL through the suburbs of Perth and finally through highly adjacent housing in Fremantle is not a trivial issue. The number of trucks increasing five times would suggest that a proper assessment of health impacts should be considered.

B. Failing Intersections

The PFL is designed to reduce the need for intersections experienced by trucks along the tollway. However this will mean a number of intersections for residential and collector route car traffic will become much more difficult. For example:

- i. Access to North Fremantle's Port Beach and Curtin Avenue will be very limited with the stream of trucks passing by daily, figured to be in the range of 12,000 per 250 working days of the year if the TEUs do reach 3 million. This volume of trucks effectively blocks access to the beach amenity and the housing envisioned along this shore along with existing houses in the Western Suburbs.
- ii. Likewise, Queen Victoria Street will be blocked from its current throughput capacity of cars, cyclists and pedestrians as the signals will be prioritised for heavy trucks on Tydeman Road.
- iii. High Street - currently used to exit or enter Fremantle - will be avoided as an east/west

23 Ole Raaschou-Nielsen et al. 2013. "Air pollution and lung cancer incidence in 17 European cohorts: prospective analyses from the European Study of Cohorts for Air Pollution Effects (ESCAPE)". The Lancet Oncology 14 (9): 813–22.

24 In: Metherell L. 2012. 'WHO Confirms Diesel Fumes Carcinogenic', ABC News The World Today, 13 June, 2012

throughfare due to the PFL trench cutting across it. Marmion will be chosen as drivers will choose to make this their east/west connector creating congestion repercussions along the length of Marmion from East Street to Risley in Melville.

- iv. South Street, another major entrance point for the City of Fremantle, will be impacted as the intersection at Stock will be given priority to the north/south running heavy trucks meaning long phasing at the lights for the east/west travellers or a grade separated fly over will need to be built, as following.

The one sure way to avoid the intersection failures is to expand the capacity of the Perth Freight Link to include grade-separated 'diverging diamond' type interchanges at all these locations which include a) resuming more land and urban housing stock and b) spending a great deal more capital. These kind of impacts can only be avoided if there are fewer trucks going through the area. Read below under 'Costs'.

C. Setting back urban renewal

Though there hasn't been a great amount of detailed planning for the areas directly abutting the proposed PFL there would be a host of issues as they relate to significant proposed development and potential growth areas. Below will be listed a number of urban renewal issues associated with the Freight Link.

- i. North Fremantle will remain underachieving in its redevelopment and turn its economic base towards the western suburbs as the physical barriers - a major new highway causing yet more noise and diesel particulate pollution but also causing intersection failures - will discourage cross harbour traffic.
- ii. East Fremantle will also underachieve in its potential to support new housing as the new highway will be discordant, divide the city, and produce more pollution. None of these aspects have ever led to higher real-estate trends or increased liveability.
- iii. Amendment 49 planing area, the East End and Victoria Quay are three key precincts for the future of growth in the CBD on Fremantle proper. These will be negatively impacted if pedestrians, cyclists, bus riders or car drivers cannot easily access the city core due to the limits placed on their movements to the historic city. While it will not drive away all investment, it will certainly not encourage investors to try to make their way to the city of Fremantle as the PFL will be a physical and mental barrier. Such effects have noted in Australian cities as diverse as Port Hedland and Port Adelaide where large roads have divided the historic cores from the rest of the larger urbanised area leading to blight. People are attracted to Fremantle because of its inherited human-scaled, walkable fabric, not because of its highway infrastructure. Instead of being able to drive investment to, the PFL will more than likely drive investment away from the City of Fremantle.
- iv. Cockburn Coast is a State of Western Australia - Landcorp project underway which will also see diminished result from the PFL as envisaged. The main access from the rest to the Perth Metro Region will be from along South Street and, as with the rest of Fremantle, will be limited in its access by car or bus from this main artery due to priority being given to the heavy trucks. Limited, that is, unless a grade-separated interchange

is constructed at South and Stock.

- v. In sum total, the efforts at creating higher residential densities with globally significant Liveability, as measured by various means in global studies²⁵, and lowered air pollution will be overlooked and many opportunities lost.

D. Severing the suburbs with the proposed cutting in Fremantle

- i. Several suburban areas will be impacted removing homes while also removing the historic D'Orsogna factory, along with its 500 jobs, from Fremantle. Although it has been understood there could be a tunnel in this section of the alignment, the grading of a tunnel here - from Carrington to South Street - would necessitate a serious review of a tunneling option under the Fremantle Eastern Bypass instead of this entire alignment due to cost. Visualisation of the elevated viaduct is illustrated in the next section of this report.
- ii. The large convoy of trucks will cut a swathe through North Fremantle, East Fremantle and Melville as it swings down Stock Road, Leach Highway, Stirling Highway and Tydeman Road. There are some design elements of the PFL that have solved earlier suggested large scale overpasses in the Leach Highway section but little can be done about the sheer number of trucks and the presence of a largely impassable cutting that will divide the City of Fremantle from East Fremantle and Melville. This will cause issues in regards to air pollution, noise, vibration, and active transportation connectivity.
- iii. This is the kind of road that no city is building anymore through a heavily built up area²⁶. As Enrique Penalosa, the former Mayor of Bogota said at a Perth Symposium:

'New freeways are like poisonous rivers.. You can't live next to them, you can't walk alongside them – and they don't solve congestion problems they are meant to fix. It is so weird that you in Perth continue to build new roads and new freeways when the rest of the developed world has stopped'²⁷.

E. Fracturing North Fremantle and causing congestion at the port's landside entrance

- i. North Fremantle will be severely impacted in its redevelopment. Due to a major new highway - the PFL - causing yet more noise and diesel particulate pollution but also causing intersection failures at Queen Victoria and Tydeman Road, North Fremantle will not be able to grow in several of the key areas, most notably at Leighton Beach.
- ii. A higher volume of truck traffic will attempt to evade the toll-road - especially if the destination of the cargo is towards the north - by turning up Curtin Avenue or the Stirling Highway to travel through Mosman Park and the other Western Suburbs. This will cause further congestion on these roads and negatively impact on the street fronting businesses while also creating yet more political impetus to make the Stirling Highway into a wider 6 lane through-fare.
- iii. There has thus far been no release of the need or cost or process to twin the Stirling

25 Wikipedia. 2015. "World's most liveable cities" http://en.wikipedia.org/wiki/World%27s_most_liveable_cities None of the criteria listed are to have access to heavy truck routes in the midst of erstwhile walkable neighbourhoods.

26 Newman P and Kenworthy J. 2015. The End of Automobile Dependence: How Cities are Moving Beyond Car-Based Planning, Island Press, Washington DC.

27 Enrique Penalosa "Perth's road obsession weird" The West Australian, April 16th, p9. <https://au.news.yahoo.com/thewest/a/27141575/perths-road-obsession-weird/>

Highway Bridge into North Fremantle. This has either been an oversight or avoided to reduce the overall capital expense in this years budget; but it will eventually be needed.

F. Driving away tourists and local beach users from the North Fremantle area due to the increase in trucks

- i. Access to North Fremantle's Curtin Avenue will be very limited with the stream of trucks passing by daily, figured to be in the range of 13,000 per 250 working days of the year if the TEUs do reach 3 million in a land-side increase scenario. This volume of trucks effectively blocks access to the beach amenity and the housing envisioned along this shore along with existing houses in the Western Suburbs. Likewise, Queen Victoria Street will be blocked from its current throughput capacity of cars, cyclists and pedestrians as the signals will be prioritised for heavy trucks on Tydeman Road.

G. Increasing truck flows down Curtin Avenue

- i. Heavy trucks will begin to seek quicker routes to their delivery destinations and are unlikely to change northern destinations into a long trip south
- ii. This will drive more heavy freight trucks through the high value Western Suburbs as the loss of rail and an Outer Harbour will drive increased north-bound truck traffic to run via the built up area road network
- iii. This will reinforce the long standing plan for the Stephenson Highway to divert traffic from the Mitchell Freeway
- iv. A long standing plan to widen Curtin Avenue and Stirling Highway through the Western Suburbs is likely to be mooted once again

H. Impacting the Beeliar Wetland & Banksia Woodlands

- i. The construction of the Roe 8 through the Beeliar wetlands and Banksia woodland has been a controversial environmental issue for 40 years. It was once assessed by the EPA and rejected but has now been approved with the Main Roads new approach to constructing an elevated roadway. It remains deeply controversial as significant wetland chain in the south metropolitan region and remains an important ecological 'stepping stone' for many rare species such as Carnaby's Cockatoo which have lost over 50% of their remaining habitat over the last few decades. They are unique in that they have the wetland and the dry bushland in a contiguous chain, a rare remnant in the current urbanised Perth Metro Region. The Beeliar Wetlands also provide ongoing value to the community with high quality passive recreation opportunities.²⁸

28 Save The Beeliar Wetlands. 2015. "What are the Beeliar Wetland?" http://savebeeliarwetlands.com/wetlands/article/what_are_the_beeliar_wetlands

5. Liveability Factors and Economic Impacts

A. Severely limiting the work the Council has done to reinvigorate the City of Fremantle over the last decades as trucks and people-intensive cities do not mix

- i. After a period of slowdown in its economy Fremantle has been rapidly growing in recent years as a major activity centre with a particular emphasis on knowledge economy jobs, services and tourism²⁹. Over \$1b in new redevelopment projects are in the final stages of delivery ushering in a new era of urban productivity for the historic city³⁰.
- ii. Much of this future is placed under threat as it depends on Fremantle continuing to be a place people will want to visit. Fremantle with an increase in truck traffic of four times will not be a place that is easy to access. As is well known in Fremantle, container trucks use almost every road in the city as well as the main route of Leach Highway. This will increase every year with dispersed trucks impacting heavily on all aspects of the people-based urban economy.
- iii. The PFL will create a barrier around the city, particularly in the North Fremantle and East Fremantle area. This will eventually impact on investment in the city. It makes Fremantle a truck city not a people-oriented city.
- iv. It will also severely impact all the shops and businesses along Stock Road who may no longer have street frontage access from anywhere along Stock Road as all access will be via cul-de-sac access roads from elsewhere along South Street.

B. Economic Impacts on Planned Outer Harbour Precincts

- i. As described earlier, Latitude 32, Kwinana Intermodal and other planned upgrades to an Outer Harbour have all been slowly unfolding as the mid to long term plan for economic growth and regional freight logistics. As the PFL will be a toll-road, there will be no pressure to build any of the required infrastructure to fulfill this planned for mandate in the Cockburn Sound area as the toll-road will require all containers to pass through it to help pay down its costs. This will mean the resumed land of Wattleup and Hope Valley, the current site of Latitude 32 and the Kwinana Intermodal Port will languish. Fewer jobs will be produced in the Rockingham jobs catchment and an opportunity squandered.
- ii. Meanwhile, in Fremantle, land values in key locations will be affected with a slower redevelopment and fewer jobs created in the Fremantle CBD as a result of the PFL acting as a physical and social barrier as outlined above.

²⁹ City of Fremantle. 2011. Fremantle Economic Development Strategy, 2011-2015, City of Fremantle, Fremantle.

³⁰ City of Fremantle. 2015. Fremantle 2029, City of Fremantle, Fremantle.

Perth Freight Link Newman & Hendrigan

VI. COSTS, RISKS AND OTHER ISSUES OF THE PERTH FREIGHT LINK

Although the Perth Freight Link is intended to match the dock-side capacity with a transport supply to the Port of Fremantle, it has some serious drawbacks in its impacts and 'hidden' capital costs associated. These include the impacts on other streets and networks along its length but especially noticeable at the street network convergence on North Fremantle and bridge crossing at the Swan River, the potential cost of having to create a lengthy trench, the limits it places on urban renewal aspirations, its project risks as experienced in other Australian cities, and the barrier it creates to living and working, walking and cycling, bus and train riding to and from Fremantle.

To begin the list of items to be considered as potential risks and oversights:

1. The costs of Perth Freight Link

The costs to build the PFL are being touted at around \$1.6 billion.

The \$1.6 billion Perth Freight Link, officially launched on 19 May 2014 as part of the Federal Budget, is the largest road infrastructure project ever to be undertaken in Western Australia.

This cost stated is without knowing what the bidders will be able to provide for this price once detailed engineering of retaining walls, sound walls, large bore sump pumps, and viaduct building come in.

However if it is built it does trigger another wave of required investment to match the 'time savings' the PFL, ostensibly, is meant to provide. To maintain the value of the 80 km/h travel expected along this route, the investment of the PFL will require a further a) twinning of the Stirling Highway, b) improvement to the North Fremantle intersections of Stirling/Tydeman and Tydeman/Queen Victoria, and c) improvements to the access intersections into the port and an expansion of the truck marshalling yards within the port precinct as they wait to either load/unload or wait to avoid the peak rush hours on the freeway system.

Access points will also need upgrading such as at Stock/South into a grade-separated interchange along with another at the intersection of Stock and Roe 8/9. The \$1.6 billion is just the beginning of an expensive, land consuming, multi-phase, decade long infrastructure project to a port which will be reaching capacity at 1.2 million TEUs. Reaching capacity, that is, unless yet more expense is forthcoming as Port expansion seaward, for which then the PFL may not have sufficient capacity to move the expected 3 million TEUs annually. This investment in the PFL will call for yet more investment to match supply with demand in lock step, except with Fremantle and its surrounding urban areas receiving the brunt of the negative externalities.

The final costs of the PFL will much higher than the initial phases as it will necessitate further investments in bridges, interchanges and improvements in other parts of the logistics chain. At what price-point does a different strategy, such as one of two tunnel configurations (Road or Rail) and/or a Cap and Transition strategy make more social, economic and logistics sense?

A. Stirling Bridge and Canning Highway

As touched on above, but expanded here, there will have to be a duplication of existing Stirling bridge and use the full extents of the existing road reserve, with intersection improvements, to access the port. If there are to be timesaving and greater capacity built into the highway system for

heavy goods vehicles, these time savings will have to remove all choke-points between origins and destination to be equal all along the length. This will, therefore, require a twinning of the Stirling Bridge at unaccounted cost, disruption and project risk such as timing and cost blow-out.

Access to the Port might be controlled through integrated traffic signal control from the Canning Highway junction. This would mean that instead of the pleasant riverside walks alongside market-led residential and commercial office space, Fremantle and East Fremantle will have traffic congestion with idling trucks siting on the newly twinned bridge waiting their turn to deposit their containers.

The intersection of Canning Highway will likely need to be either a clover-leaf or diverging-diamond to permit the traffic to flow onto the Stirling Highway bridge. However, there will be insufficient space for such a structure unless yet more land and buildings are resumed, at elevated cost and political capital. This will be an enormous eye-sore, driving down local property prices along the East Fremantle and North Fremantle shore as rarely has a view onto an industrial zones freight access lead to higher land values.

The intersections at Tydeman and Queen Victoria in North Fremantle will be sorely impacted as the priority of signaling will have to be given to the movement of heavy trucks to, again, maintain their time-savings. This will be exacerbated by the increase in truck traffic over the coming years. While Fremantle grows as a preferred investment destination, this intersections will need to be very free flowing to permit cars, cyclists and walkers access to the city; with the intersections constrained by truck priority this will be severely hampered.

B. Review of all required grade-separated overpasses

- i. In North Fremantle, to manage the volume of vehicles having saved all their time to Tydeman to then be halted at the lights
- ii. In East Fremantle, to allow traffic to enter into the PFL from Canning Highway and Marmion Street - 2 overpasses - so that these two roads do not congest all east /west and north/south bound traffic entering into Fremantle.
- iii. At Carrington and Leach there will need to be some accommodation of local traffic wanting to access the PFL lest all drivers go to South or Canning Highway to enter the PFL. This would compound the issues on either road.
- iv. At Leach and Stock will be required a very limited-access overpass, fly-over, to carry the traffic over the grade differences at this intersection.
- v. At South Street and Stock, likely to be of the 'diverging diamond' type to allow South Street to operate as one of the principle entrances to Fremantle

The construction of the PFL will require many, thus far unaccounted for, interchange and intersection improvements to allow the PFL to flow congestion free as designed and for the existing urban fabric to have modest amounts of traffic increases.

2. Logistics of Construction

If the PFL is constructed as described, a long trench from under Marmion Street in East Fremantle extending to east of Carrington Street in the Leach Highway RoW to then fly over the Stock Road intersection, there will be enormous construction works required and closure of the RoW as currently travelled. For a regular arterial this causes uncomfortable delays and organised detours, but as this route carries the freight trucks these will need a new route for years: where will the heavy trucks go? Canning Highway to Stock Road and then south to rejoin Leach is unworkable as the north end of Stock is in fact a residential street acting as a collector. Another option would be to Hampton through to South Street and then east to North Lake and to rejoin Leach is unworkable as the Fremantle Traffic Bridge already needs replacement and Ord/Hampton is already near peak-hour capacity and has several traffic lights. Were the heavy trucks to head north on Curtin Avenue or Stirling Highway this too will cause further congestion on roads and neighbourhoods ill equipped to handle the imposition of 3,000 heavy trucks per day over the two years, or more, of the construction phases.

The PFL may mean rerouting of the heavy trucks through neighbourhoods over the years of its construction.

3. The Risks of Perth Freight Link

There are certain risks inherent with any sort of construction. Weather, labour force availability, material procurement, progress payments, and so forth all militate against timely delivery of any project. However with this project these will be significant political risk.

As we have seen in the recent Victorian election, what used to be a given i.e. 'road building is good for the economy' has now shifted to be a better informed debate. The debate in the Victoria State election was between a car-based future in which free-flowing truck and vehicle traffic could be quickly moved around inner Melbourne or another vision in which future capital expenditures are focussed on public transit and freight train networks. The debate was beyond different versions of how to transport goods and people around a city. Rather, what was debated was competing visions of how the city will look and operate into the future; in fact it was a debate about how Australians will live and work.

It would seem that public discourse on freeway building in Australia will remain a controversial topic at the higher levels and at the grass-roots of citizens concern. The risks to any government proposing this level of investment may face, in a general election, the same issues and a potential loss of majority. The risks to contractors and the state-level project team may well be low level picketing of work sites, causing safety concerns and site shut-downs, at a minimum or even cancellation of contracts if the government changes with a mandate to redirect funding priorities.

The political climate in Australia has now galvanised around several key positions regarding liveability, public transport, quality of investments and the ways in which Australians view their cities. It is incumbent of governments to respond with responsible infrastructure investments.

4. Impacts Visualised

The following pages will comprise a set of images taken from three-dimensional modelling work undertaken by the co-author, Cole Hendrigan. They are only intended to show the outline - sketch - of the impacts. They are not based off engineering documents, but rather a combination of conceptual drawings presented online from Main Roads or the Port of Fremantle.

As to the depth of the tunnel: grading of the trench to go under Marmion and Carrington to then rise towards a rased viaduct will require significant cuts to maintain a level. In a trench, it is relatively important to not have series of crests, as this adds undue risk, therefore we will expect that once a grade is established under Marmion and High, that this will continue for the distance until required to rise to exit the trench. The current ground level rises significantly along the Golf Course and when cut into will necessitates a very deep trench at this point.



Figure 12. Two images of the intersection of High/Leach and Stirling from the original proposal of 2014.



Figure 13. The new proposal for the High/Leach and Stirling intersection. Leach is lowered into an open trench to slide under Carrington, High and Marmion Street.



Figure 14. The new proposal for Leach Highway at the Golf Course. At this point the trench is 30 meters deep.



Figure 15. The new proposal for Stirling Highway as it passes under Marmion Street. at this point it is 6.5 meters deep.

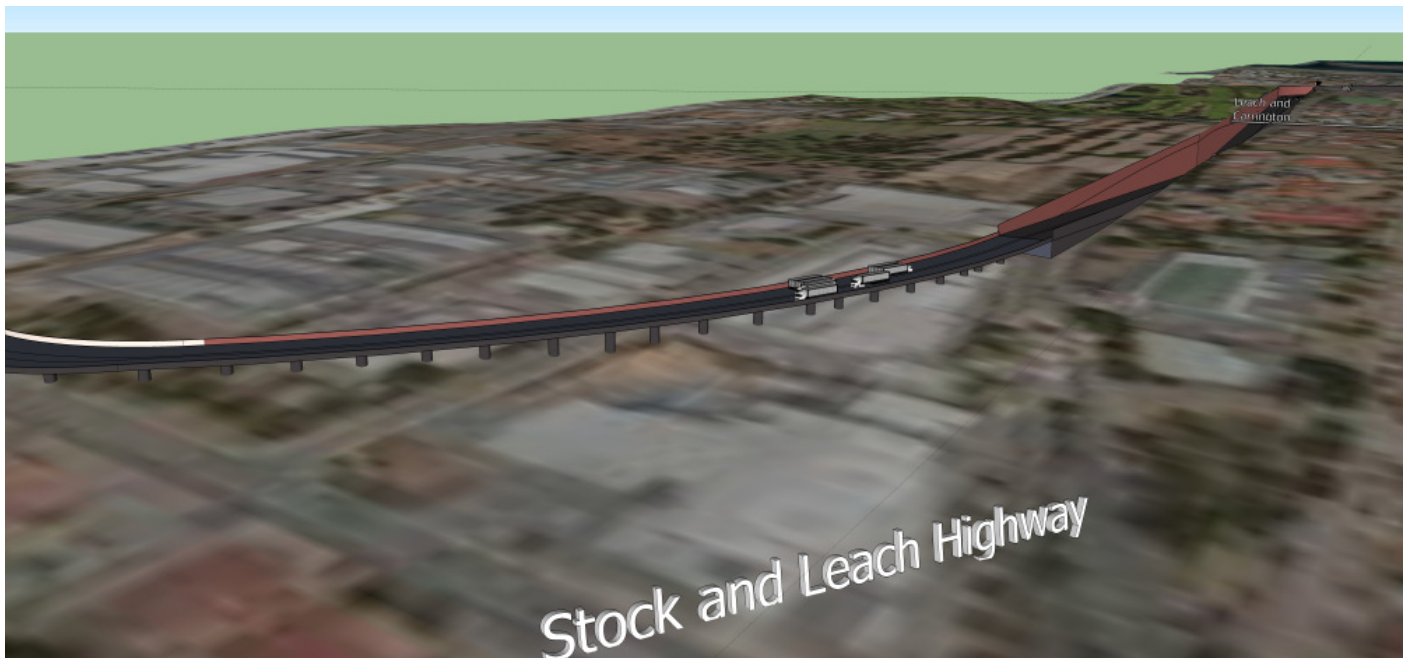


Figure 16. The fly over - an arching viaduct - necessary to maintain speed and capacity at Stock Road and Leach.

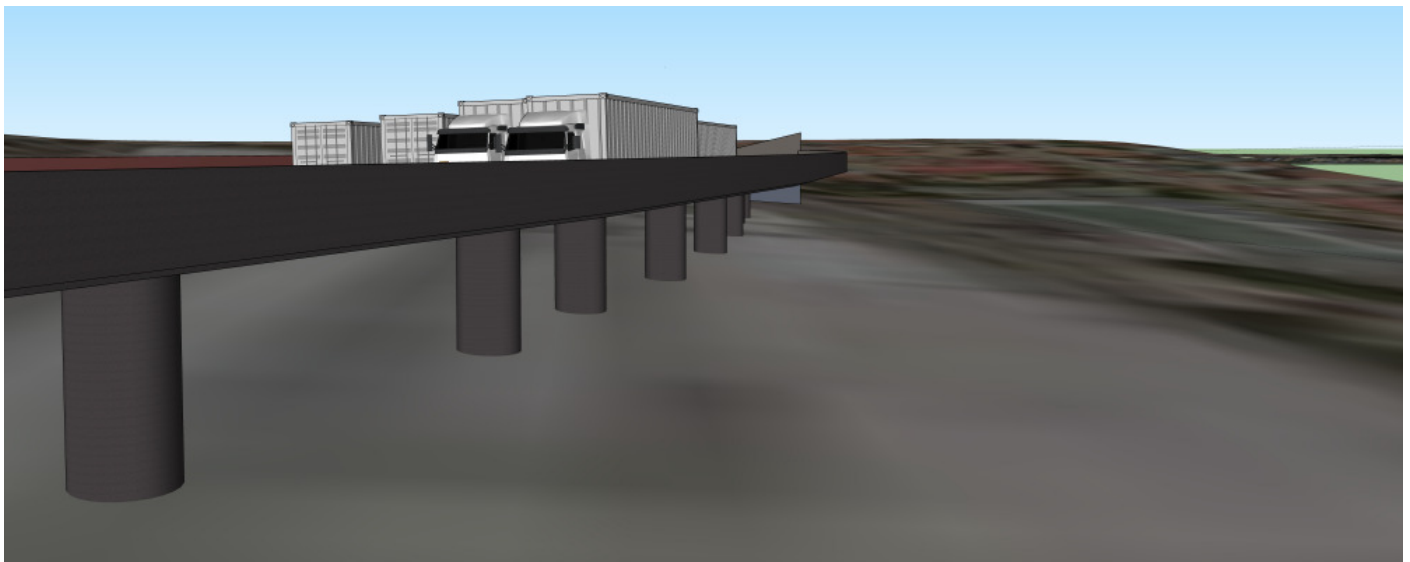


Figure 17. The fly over from up close. At this point it is 10 meters above existing grade and through D'Orsogna.



Figure 18. A before and after shot of the intersection of Tydeman and Stirling in North Fremantle. High sounds walls and wide turning radii allow 80 km per hour truck movements with light priority through this narrow urban area.

VII. STRATEGIC ALTERNATIVES TO THE PERTH FREIGHT LINK

1. Introduction

In casting about for alternative freight management systems there are really only a few tried and proven means to convey containerised freight. These are large ships, intermodal truck and train, and barges. Other alternatives such as conveyor belts, freight trams, barges, aerial gondolas and others are all possible and will be given a few paragraphs of consideration in the Appendix 1.

A few facts to keep in mind:

- i. The Australian Bureau of Statistics (ABS) states that Perth is currently at 2 million persons. At the projected rate of increase, 5 million person are expected to call Perth home by the 2050's³¹ although the State of Western Australia is forecasting 3.5 million³²; the State is growing and so will economic activity.
- ii. The PFL business case states that overall the Port of Fremantle will need to have capacity to send and receive close to 3,000,000 TEU by 2050 up from 700,000 in 2014.³³
- iii. Currently, an average of 3,000 trucks are observed per day arriving and departing over the hours of 5am -7pm on the 250 working days of the year.³⁴
- iv. The rail system currently carries about 14% of this 700,000 or an estimated 100,000 TEU.³⁵
- v. Reportedly, the Inner Harbour's rail loop could handle 320,000 TEU per year if so tasked.
- vi. The State Government is asking the three bidding consortia to look at alternatives to the PFL with special look at design and construction of a road tunnel.

The alternative route extends Roe Highway west of Stock Road along the Roe Highway road reserve in Hamilton Hill. It then heads north as a tunnel, starting just before Clontarf Hill and running underground to join Stirling Highway near High Street.

The feasibility of this alternative route will be considered against environmental, economic and social impact measures.³⁶

It is entirely possible that an alternative strategy to the planned PFL will save in capital expenditure - when all and alleviate community concerns while moving a similar volume of freight. This will lead us into a discussion on the possible alternative of 'cap and transition' of the Inner Harbour. However, first will be a review an idea to tunnel under the Fremantle Eastern Bypass for a freight road and of the options for rail to deliver higher freight yields under various scenarios.

Most of these alternative options need not be mutually exclusive and may work well together as will be presented in Table 2 in the Concluding Remarks.

31 ABS 2015 "Western Australia. Population Size" [http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/3222.0main+features112012%20\(base\)%20to%202101](http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/3222.0main+features112012%20(base)%20to%202101)

32 Government of Western Australia. 2015. 'Perth and Peel @3.5 Million' http://www.planning.wa.gov.au/dop_pub_pdf/pp_summary.pdf

33 Main Roads Western Australia "Perth Freight Link, Business case Executive Summary" 2015 <https://www.mainroads.wa.gov.au/Documents/Perth%20Freight%20Link%20Business%20Case%20Summary%20Version%20-%20FINAL.RCN-D14%5E23688714.PPTX>.

34 Freight Logistics Council " North Quay Truck Survey, 2014" <http://freightandlogisticscouncil.wa.gov.au/documents/reports/WAPOTF-Truck-Survey-2014-Presentation-December.pdf>

35 Fremantle Ports 2014 "Annual Report"

36 Main Roads, WA. 2015. 'Perth Freight Link' <https://www.mainroads.wa.gov.au/BuildingRoads/Projects/UrbanProjects/Pages/Perth-Freight-Link.aspx#news>

2. Road Tunnel along the Fremantle Eastern Bypass

As being explored by the consortia, quoted from Mainroads WA above, an option for the Roe Highway is to extend west past Stock Road to the base of Clontarf Hill and under the extinguished Fremantle Eastern Bypass (FEB). The PFL would then enter a tunnel that would go under the city and emerge either at Stirling Highway in East Fremantle or go under the Swan River and enter North Quay directly. If built as a tunnel from south of Hilton's Clontarf Hill to North Quay, a distance of over 5 km of tunnel (600 meters under Clontarf Hill and 4.4 km from Lefroy Road to North Quay), would cost around \$1.5 billion if the Airport Link tunnel is used as a guide in this matter. However, as it will likely have to be configured as 4 - 6 lane road tunnel (3.6m per lane x 6=21.6) plus a separate emergency tunnel for the hundreds of drivers in a road tunnel at any given time it may cost much more than the Airport Link per kilometer.

This would solve some of the severance and truck impacts in the urbanised suburbs surrounding Fremantle, however:

- i. It does not resolve the Beeliar Wetland impacts,
- ii. It does not solve the problem of many trucks opting to take Curtin Avenue for north bound deliveries to avoid the toll,
- iii. It does not solve the problem of the North Fremantle bottleneck or the Inner Harbour capacity issues over the long term and the dock-side truck marshaling yard will need to grow significantly were it to approach satisfying this demand,
- iv. It continues to cause a problem with the Inner Harbour rail becoming un-competitive and Outer Harbour being further delayed,
- v. Also, the many issues regarding diesel particulates, stemming from the fuel choice in the truck engines, are now becoming more well known as a leading cause of respiratory disease. Having large vents extrude from the tunnel sending plumes of diesel particulate mater in the range of PM 0.1 which, once inhaled, can penetrate deep into the lungs contributing to a host of issues from headaches to lung cancer³⁷. That the vents would be expelling such fumes and particulates directly into an established neighbourhood and near schools should be seriously considered in a negative light. Scrubbers on the vents could remove a great deal of the particles, but these are very tiny and will be difficult to clean.

At an average 80 km per hour, the time required to transport a container from the Port to Kewdale, a 35.2 km route through a tunnel, the trip would be 26.4 minutes. This compares to the current 26 kilometers of Leach Highway to Kewdale at around an average 60 km per hour at also 26 minutes. The enormous time savings from this expensive proposition may be nil. The ramifications being that it may indeed be better to improve the intersections along the existing route to increase this sustained speed via improved signalling. To compare, were the PFL constructed to Stock Road and then south to Roe 8, 36.5 km at an average 80 km per hour would be 27.4 minutes. (Distance/SpeedX60)

Therefore, all considered, it is advisable to look at another option: Freight Rail improvements with a second bridge and/ or a Rail Tunnel to Spearwood.

37 Ole Raaschou-Nielsen et al. (July 10, 2013). "Air pollution and lung cancer incidence in 17 European cohorts: prospective analyses from the European Study of Cohorts for Air Pollution Effects (ESCAPE)". *The Lancet Oncology* 14 (9): 813–22. doi:10.1016/S1470-2045(13)70279-1. PMID 23849838. Retrieved July 10, 2013.



Figure 19. The Road Tunnel option as an extension of the Roe 8 and Roe 9. In red are the likely tunnels, under Clontarf Hill and White Gum Valley and in yellow will be the 'at grade' highways. What is also apparent is the degree to which the width and speed of the Roe Highway will be reduced once it arrives into a tunnel to then enter the Port of Fremantle where truck congestion awaits.

3. Rail expansion for the Inner Harbour

The following are three scenarios for increasing the volume transported by freight train. They will illustrate, in numbers, the freight task ahead and asks if we are willing to tolerate the imposition of increased freight rail traffic though Fremantle's foreshore. 3,000,000 TEU will have very adverse effects not only on the road and rail operations, but also on the entire locality of North Fremantle as this would necessitate an overall doubling of the footprint with more land reclamation and a quadrupling of the current impact. At a certain point, the reasoning for this increase of industrial activity in an urban area, with myriad impacts and constraints, is contradictory to good governance, long-range planning or economic sense.

To further confound efforts in this enquiry, it important to know the entire freight line is now privately owned and any public investment will benefit a private enterprise³⁸.

A. Scenario 1

3 million TEUs arriving and departing from the wharves at the Port of Fremantle with 600,000 of these being delivered by truck to destinations not on a rail route. This will leave 2,400,000 TEU to be moved by rail. The inland area required to marshal and unload the trains would be an enormous total. Luckily, Perth does have several large contiguous areas set aside for warehousing and shipping of containers already, notably at Kewdale (17 Hectares) but also Latitude 32's (+200 Hectares) ready to be pressed into service.

Marshalling and loading docks aside, were the trains to run at 80 TEUs per train this would require 30,000 trains per 250 working day years, 120 trains per day or 5 trains per hour every hour of the day. This is equal to one train every 12 minutes. This would be a world-leading freight logistic facility were it to exist. However, were the trains to be a little longer and double stacked (implying both a new train bridge and electrification {to reduce local air pollution} on new catenary) so to achieve 160 TEU per train this would still require 60 trains, or one such train every 20 minutes every hour of every day.

B. Scenario 2

The outer harbour is built and the inner harbour is capped at 700,000 TEUs with over half, 400,000 TEU, of this is conveyed by train. This freight rail percentage is decided as an ideal number to match the desires of the City of Fremantle to be as carbon-free as possible and to avoid having to contend with the construction of the PFL. Running the same numbers as above in Scenario 1 yields: 80 TEU trains= 35 trains per day or one every 40 minutes and 160 TEU double-stacked trains (implying both a new train bridge and electrification on new catenary) = 18 trains per day or one every 82 minutes (read below).

C. Scenario 3

Rail freight is tripled from its current 100,000 TEU to its reported land-side capacity of 320,000 with no other changes to the track, bridge, overhead electric current carrying catenary of the passenger train or double-stack train cars. 320,000 TEUs will require 16 trains a day passing by the Round House, along the Esplanade and South Beach to points further inland every 90 minutes. Were the bridge doubled and catenary lifted to allow double-stacked trains, this would be in the range of 8 trains a day or close to the current 5 trains per day at 180 minute intervals.

³⁸ Brookfield. 2015. 'Our Network' <http://www.brookfieldrail.com/about-us/our-network/>

D. Results of above Three Scenarios

What should be clear is that if the Port of Fremantle is to transport a larger share of containers and other break-bulk good by train from the Port of Fremantle there will have to be significant investments in double-stack train cars, electrification of the trains and raising the catenary, a second bridge to support more trains and a great deal of tolerance of the visitors and residents in the West End of Fremantle. Otherwise, we there may need to be a dedicated rail freight tunnel to move the volume of freight we are expected to handle over the coming years: this will be reviewed after a brief discussion on a new bridge.

Scenarios	Year	TEU Task for Rail	TEU per train	Trains per year (250 days)	Trains per day	Trains per 24 hour (th)	Trains intervals (th/60)
Scen. 1	2050	2,400,000	80	30,000	120	5	12
Scen. 1	2050	2,400,000	160	15,000	60	3	20
Scen. 2	2020?	400,000	80	5000	20	0.8	72
Scen. 2	2020	400,000	160	2500	10	0.4	144
Scen. 3	2020	320,000	80	4000	16	.7	90
Scen. 3	2020	320,000	160	2000	8	.3	180

E. Twinning the Train Bridge Scenario

Although this has been touched on above, this scenario is to have the current shared train bridge separated and twinned. What this would achieve is two fold: the freight trains could then run as often as necessary without conflict with the passenger train schedule and the current passenger catenary (rail electric current support) which is currently an obstacle to double-stack train car operations. While this would make almost no difference to the passenger rail - as it will remain almost exactly as is - it would remove major bottlenecks to the efficient operations of current freight rail. More trains could pass, each train carrying more TEUs and fewer heavy trucks, or their accompanying grade separated freeways, would be required. This may cost in the order of \$400 million AUD.

As explored in Scenario 2, above, if the bridge were twinned and electric catenary raised to allow double-stacked rail cars then we could look at a 50% of 1,400,000 TEUs (current land-side capacity) freight on rail with 4375 trains per 250 working day year or 18 trains per 24 hour day. Again, that is 18 trains per day running past the Esplanade and the Round House, cutting off residents to access to South Beach and backing up traffic on South and Marine Terrace not to mention keeping residents in North Coogee awake. All of these negative externalities would be alleviated by a tunnel.

F. Train Tunnel Scenario

The train tunnel idea has some validity. A siding and a tunnel could be built within the current land area of the port and descend at a 1% grade for 2.5 km, with a bend, to arrive 25 meters below datum under the Swan River slightly upriver from the current rail bridge. From this point the tunnel could stay at this level, - 25m, or rise slightly towards a level for which access to Tunnel Boring Machine (TBM) launch pads are more readily set. The sites of the old tank farm on Knutsford Street and/or the old quarry (tip site) at Lefroy Road can be construction yards and on the alignment. This tunnel would then run under Clontarf Hill and Manning Park, west of Davilak Lake and emerge just to the south of Spearwood Avenue on the existing rail line. The rail freight then moves on to Latitude 32, Kewdale, Bullsbrook or other.

The tunnel's alignment would be direct and travel a large distance southwards before emerging on the east/west running portion of the current freight line near Spearwood. By this means the train tunnel is worthwhile in terms of removing the train's impact away from the foreshore with its



Figure 20. The Rail Tunnel option, in blue, beginning a long slow grade down at 1 to 2 % to arrive 25 meters under to surface of the Swan River to then travel underground until arriving in Spearwood. The red line is the least expensive extension to the TransPerth network to date - merely extending operations along an existing RoW - dropping off passengers on new platforms at the Esplanade, South Beach, Cockburn Coast and Coogee.



Figure 21. Rail Tunnel entrance at Port of Fremantle. Running at 1-2% grade it arrives under the river and then under Cantonment and Clontarf Hill to emerge on current rail freight corridor

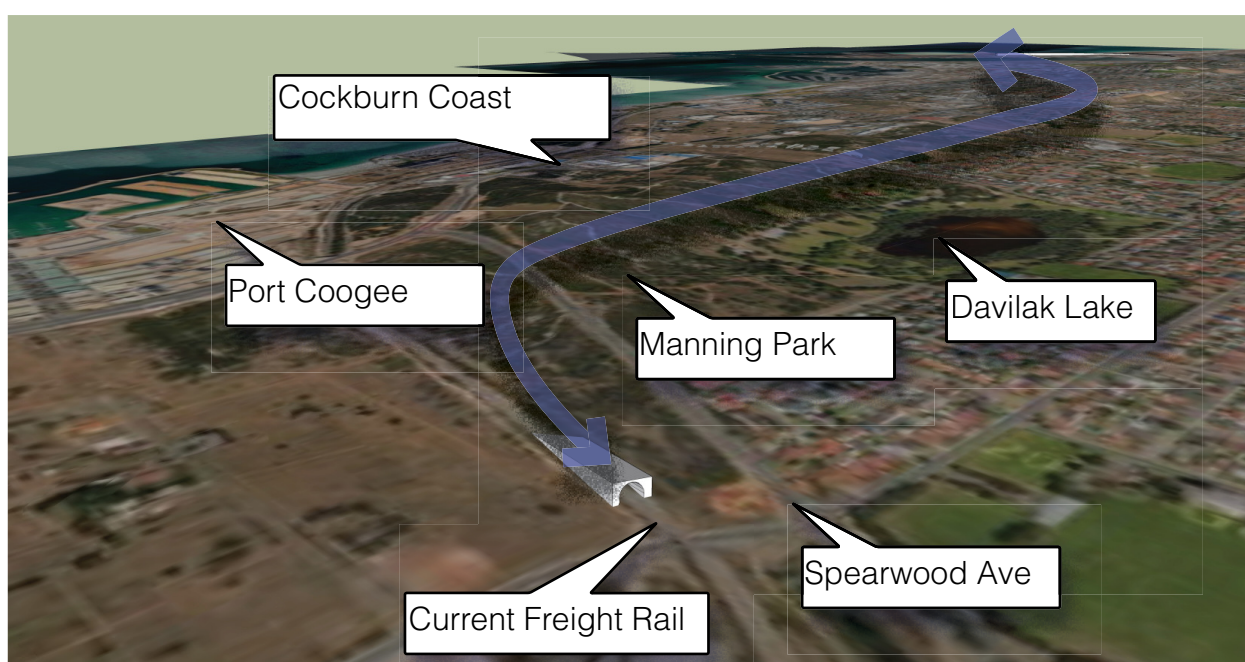


Figure 22. Rail tunnel exit at current rail freight corridor to the east of Coogee and south of Manning Park. This tunnel releases the foreshore rail corridor to public transit increasing access, land values and value capture while managing a large step-change in rail freight.

overlapping priorities for transportation, recreation, living, and working. Though expensive, there could be positive externalities of flowing tax and rate moneys back into budgets from the impact on land values in Fremantle. This tunnel would likely be in the \$2 billion dollar range being slightly longer than the currently planned Airport Link and likely costing a similar per kilometer figure.

Though longer, the rail tunnel may also be less expensive per kilometer than a road tunnel as it will only need to be 7-10 meters wide with only emergency rooms for the 2-4 humans in the tunnel at any given time. This contrasts with a 4 - 6 lane road tunnel (3.6m per lane x 6=21.6m) plus a separate emergency tunnel for the hundreds of drivers in a road tunnel at any given time.

- i. Co Benefit of Public Transit and Captured Value
 - a. By moving the freight on train via a tunnel to Spearwood - as per above - this frees up the current right-of-way from Fremantle Station to Cockburn Coast to be used for public transit. In such a scenario the existing commuter rail service of the TransPerth Fremantle Line could be operated to Cockburn Coast - once there is a population there to serve - and Coogee/Spearwood. Or, this could be a RoW in which one segment of a Light Rail Transit service could be placed. As LRT is a shorter-braking technology (can stop quickly) it operates in separated RoWs *or* in narrow shared-use carriage ways with pedestrians and other vehicles. Were this segment to be a part of a broader LRT loop or network stretching inland to South Terrace or Hampton before returning to the CBD there would be vast changes to a) how the residents of Fremantle travelled and b) the density gradients currently stuck at a mediocre level.
 - b. The flow on effect of this service would be large on the South Fremantle side as higher quality transit service access tends to increase property values, increases viability of denser residential projects (townhouses, stacked townhouses, condominiums) in pre-sale offers, and this created more places of employment, retail, shops, cafe and overall conviviality and an active economic life. The real-estate market is ready for this type of development in Fremantle generally and rail transit would help to support any such efforts to regenerate what is, globally, an outstanding urban location latent with potential.

G. Summary of Rail Expansion

Though a freight tunnel has apparent appeal, it is felt that other improvements to the rail system, such as a second dedicated freight rail bridge, would be less expensive and help considerably in the moving of freight. However, substantially increased rail movements - commensurate to such investments - will have large negative impacts on the quality of life in the West End, South Beach, Cockburn Coast, Coogee and Spearwood. Furthermore, as much of the rail line is already leased to Brookfield, public investments will be to private benefit. Therefore, the best option is to press the Federal and State governments to improve road and rail access to an Outer Harbour in Kwinana as a long-term strategy to handle freight. These Outer Harbour links will prove beneficial to both a) overall logistics and b) the liability of having excessive freight movements - by road or rail - encircling and invading Fremantle and its surrounding urban areas.

4. Outer Harbour Only

There is a scenario in which the Outer Harbour is constructed by the year 2020. All container traffic is moved to this part of the Port leaving the Inner Harbour to deal with break-bulk, scrap metal, machinery, livestock and automobiles. However, this will leave very large questions as to the purpose of the Inner Harbour's vast container handling area and likely contrary to the potential new lessees of the Inner Harbour. Likewise, after the last round of investments in dredging, land reclamation and new cranes by the stevedoring companies, this option - at this point in time - appears limited.

5. Cap and Transition

Mr Nahan (WA State Treasurer) said the sale of Fremantle Port would solve the government's future problem of having to expand capacity in 10 to 15 years, which would require a \$2 billion to \$4 billion investment.

"There is a need to build an outer harbour, logically in Kwinana, and a lot of work has been done on that," he said.

"This lease also will look at not only recycling assets from the Port of Fremantle but also to solve the issue of how you fund and build the overflow replacement port."³⁹

By taking a few measures to manage, rather than squeeze, an asset - being the Port of Fremantle - there is another vision to be evaluated. In this scenario there is a reduction of TEU import and export in the inner harbour as the transport supply cannot accommodate the transport demands placed on it. Future growth in trade is redirected to a custom built an outer harbour which is built with appropriate transportation links. At the inner harbour - the current Port of Fremantle's North Quay - a much higher rate of trade is freighted via rail (see Rail Alternatives) and what trucking does move freight is achieved on much the same route as today but with improved intersections to points inland. This option is called the Cap and Transition option.

The Cap and Transition to an Outer Harbour is envisioned as a transition of some or even the majority of trade traffic through a harbour other than the North Quay. This is not a particularly unusual position. Long range planning has been anticipating an Outer Harbour in Cockburn sound for decades to complete the Cap and Transition process. This is even represented in Figure 8 from the Perth Freight Link Business Case.

Without growth in containerised trade traffic elsewhere Fremantle will always be negatively impacted by trucks to its east and/or by trains on its western foreshore. Ideally the optimal number may be to cap the growth to roughly today's number of TEUs, 700,000, with the remainder handled in the Outer Harbour. This will need continued growth in the proportion and total number of containers reaching the Inner Harbour and by accelerating the transition to the Outer Harbour.

The following figures set out the Cap and Transition Strategy. It will need a rapid planning process to complete the preferred siting and access for the Outer Harbour. It will need funding of the access to link it into a Perth Freight Link that goes right around the city with both road and rail systems optimised. Such a system would be a much better use of the Federal Government grant.

39 Australian Financial Review "WA budget 2015: Fremantle Port part of WA \$5b sell-off " May 14, 2015 from <http://www.afr.com/news/policy/budget/wa-budget-2015-fremantle-port-part-of-wa-5b-selloff-20150514-gh1c0c>

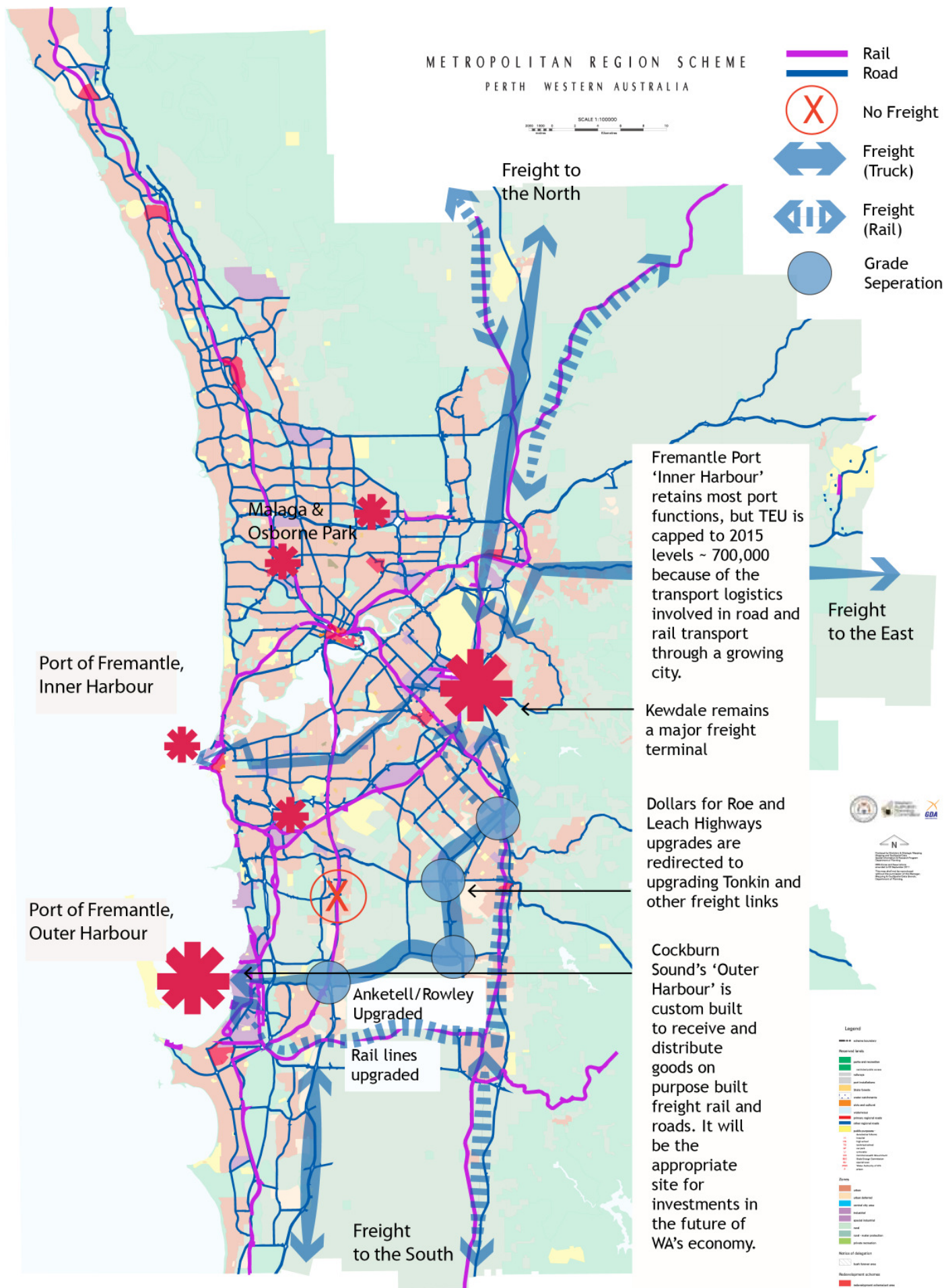


Figure 23. A Cap and Transition scenario with the Outer Harbour built along with road and rail upgrades leading away from two major ports and several inland ports.

A. Variations of Cap and Transition

Several of the following are very similar to the above “Rail Expansion for Inner Harbour” discussion but are expanded on forthwith under a slightly different rubric considering the flow of goods with an Outer Harbour added into the freight handling capacity of the metro region.

- i. As the Inner Harbour reaches 1.4 million TEU handled per year, 320,000 TEU travel by train from the Inner Harbour via a twinned bridge and the remaining 1,080,000 TEU to be evenly split between the two ports (540,000 each) and moved by heavy truck - along the existing Leach Highway and an upgraded Rolwley or Anketell Road to Tonkin Hlghway - but with sophisticated Transport Demand Management (TDM) (see Appendix 1). The TDM employed will be to improve signaling and intersection capacity, reduce peak hour flow via 24/7 operations spreading the impacts longitudinally and on-board real-time information about congestion and capacity at all points along the freight routes.
- ii. As the Inner Harbour reaches 1.4 million TEU handled per year, 320,000 TEU travel by train from the Inner Harbour via a twinned bridge and the remaining 1,080,000 TEU are moved by heavy truck in a dedicated freight road tunnel under the extinguished Fremantle Eastern Bypass to join the Roe 8 and Roe 9 extensions at Rockingham Road south of Clontarf Hill. In this instance the tunnel could be leased separately or bundled with the Port and the proceeds going towards either the Outer Harbour construction or Public Transit initiatives.
- iii. As the Inner Harbour reaches 1.4 million TEU handled per year, 320,000 TEU travel by train from the Inner Harbour via a dedicated freight rail tunnel which links the Inner and Outer harbour together and to a suite of well located inland ports. The tunnel is leased to a third party, potentially the new lessees of the Port of Fremantle, and the proceeds are put towards public transit. The first key public transit upgrade will be to the Cockburn Coast and Coogee via South Fremantle on the vacant freight RoW. This act alone raises multiples of millions of dollars in land value increases of which the local, state and federal governments reap millions of dollars in *passive* taxes, rates and duties from the real-estate market or in *actively* selling, leasing or developing outright government-owned land to the market.
- iv. A stand alone tunnel is carved from the sand and limestone under the extinguished Eastern Fremantle Bypass which is initially built for heavy trucks but which eventually transitions to rail. This will ink to the Outer Harbour via Rockingham Road initially but the rail will travel by its own RoW from just south of Spearwood Avenue. There are dedicated lanes for cars which emerge at Canning Highway in East Fremantle while the main tunnel extends under the Swan River and directly into the North Quay of the Inner Harbour.

B. Privatisation

The State Government announcement of the privatisation of the Fremantle Port Authority needs to be considered as part of the PFL. The Premier and Treasurer have announced that the Outer Harbour container port at Kwinana “could be built as part of the lease terms”⁴⁰. Bipartisan support for this is likely as Alannah MacTiernan said she “had no in-principle objection to Fremantle Port being privatised” but said “the money raised should be hypothecated to new public transport projects not used to pay down debt”⁴¹. This coincides with what Infrastructure Australia saw as the main rationale for selling public assets.⁴² That was the outcome from the sale of the Port of Botany which raised \$5 billion and the New South Wales Government immediately funded three new rail projects worth \$4 billion.

Building a new container terminal to utilise the best of modern technology in freight logistics is likely to be an incentive for private bidders looking at the mid to long term future of acquiring a lease on the Port of Fremantle and its land. The potential for redeveloping the Fremantle Port Inner Harbour area in the long term for residential, tourism, commercial and recreation uses would also be a major incentive for private bidders based on the success of Darling Harbour and Barangaroo (Sydney), Docklands (Melbourne) and Honeysuckle (Newcastle) as well as many other similar projects around the world - see Appendix 2.

However, the PFL is not helpful for private bidders as it muddies the waters over the future of the Inner Harbour and Outer Harbour in the following ways:

- i. \$1.575 - 2 billion for access to the Inner Harbour will now defer any State Government investments in the Outer harbour access which will be a precursor for any action to build a new Kwinana container terminal;
- ii. Being a tollway the PFL undermines the Inner Harbour rail access and create a dramatic increase in trucks going to the Inner Harbour, damaging plans for the Inner and Outer Harbour coping with the capacity limits already projected for the Fremantle area;
- iii. If a tunnel was built for road or rail to the Inner Harbour what would happen to such a facility when the North Quay area is redeveloped? The importance of linking people intensive activity to the centre of Fremantle would be undermined as well as damaging the potential for redevelopment if a freight tunnel was created in the middle of the North Quay.

In Table 1, below, the options discussed for the PFL are outlines and their suitability for being included in a new public/private partnership bid for the Fremantle Port are suggested.

Anything that largely increases the cost of the PFL with alternative technology - as per above - or a new tunnel (road or rail) are most unlikely to receive serious consideration by government or by private bidders.

The only real options for both public interests and private investors in the Port will be: a) Transport Demand Management (see Appendix 1) as these have obvious efficiency gains, and b) the Cap and Transition strategy with benefits for both and the ultimate movement of the main port logistics to the

40 West Australian. May 15th, page 7

41 West Australian. May 16th, page 6

42 IA. 2012. “Australia’s Public Infrastructure — Part of the Answer to Removing the Infrastructure Deficit” <http://www.infrastructureaustralia.gov.au/policy-publications/publications/Australias-Public-Infrastructure-Part-of-the-Answer-to-Removing-the-Infrastructure-Deficit.aspx>

Outer Harbour and redevelopment of the Inner Harbour to replace containers.

The PFL is thus the right strategy to link dock-side capacity with a road-based transport supply, but to the wrong port.

If the State Government was to make the most of the privatisation opportunity it should immediately review the PFL. It should redirect the capital expenditure to the Outer Harbour and begin the Cap and Transition strategy following long term planning policy and action.

C. Timing

A Cap and Transition plan as outlined can be made part of the privatisation proposal. If it is included as a requirement it will need the State and Federal Governments to agree to the PFL being transferred to the Outer Harbour. This means that the best option for the port site and access plan would need to be considered as part of the privatisation bidding process with a State Government agreement to build the access roads and rail connections.

Planning for the Outer Harbour would have to be announced within the current year, 2015, to be able to be ready to accommodate the first containers by year 2020. In that financial year, 5 years forward, the Port of Fremantle is expected to ship 1,000,000 million TEU over its wharves.

Ideally the time frame to construct a new port would be shorter, but the land needs to be secured from current owners and users, environmental impacts assessed and mitigated, traffic impact assessed and other measures. All of this occupies great amounts of time, consulting fees and physical asset design and construction. A four to five year window is very short in such an appropriately legislated climate. Luckily, however, the outer port has been a part of the planning process for over forty years in a formal manner, so there is a great deal of work already accomplished on this front.

As stated in a 2004 report⁴³, available from the WAPC website:

43 WAPC, 2004, "Fremantle Ports: Outer Harbour Project" http://www.planning.wa.gov.au/dop_pub_pdf/Fremantle_Ports.pdf

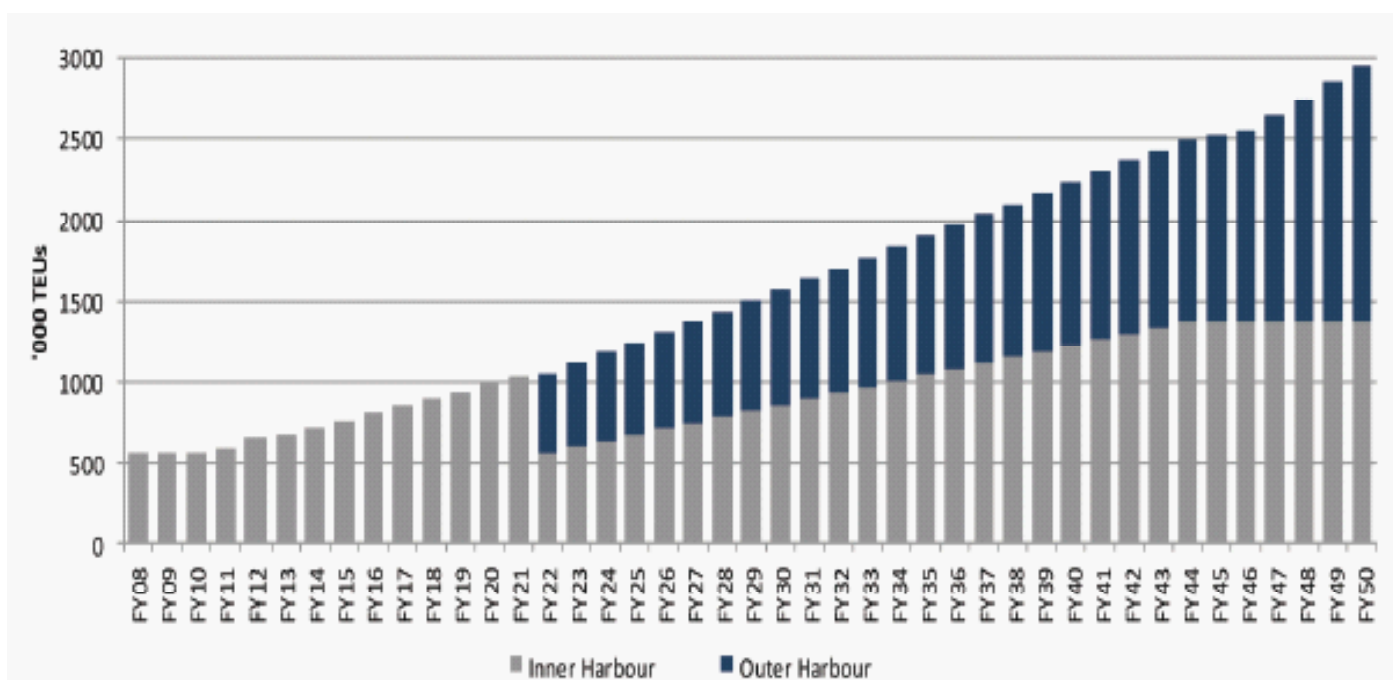


Figure 24. Indicative scenario for the Inner and Outer Harbour transition arrangements. Source: Perth Freight Link, Business Case Executive Summary

The first container and general cargo plan for the Outer Harbour was put forward in the 1960s, and the idea was considered again by State Governments in 1982 and 1989. In 1996, following Future Port Options studies in 1991 and 1994, Cabinet endorsed the appropriateness of Naval Base/Kwinana for the development of additional port facilities to handle container and general cargo trade expansion beyond the capacity of the existing Fremantle Inner Harbour. (p. 3)

The 2000 Fremantle Inner Harbour Port Development Plan, which was developed with the help of national and international port and transport planning experts, incorporates land use initiatives which, together with productivity trends, would enable trade handled in the Inner Harbour to reach 1.2 million containers annually. Based on trade trends, Fremantle Port's Inner Harbour is expected to reach capacity by around the year 2017.

When capacity is reached, the Inner Harbour, which is a well designed, deep draught port, will continue to operate at the increased level of trade, but additional port facilities will need to be built to cater for container trade and associated general cargo growth beyond that level. (p.1)

What has transpired, since 2004, is both a reduction in the estimated TEU to 2017 and an expansion in the land-side availability at North Quay making the 2004 report inaccurate in some projections but not in overall extent. The current projections show the eventual need for a new outer harbour, as seen in the figure from the PFL Business Case, to take the growth plus draw down on the transport task associated with the inner harbour's inefficient location.

There is a strong case to build a new Outer Harbour commensurate to the needs of today and tomorrow in a less constrained location, with 21st Century transport links and logistics handling.

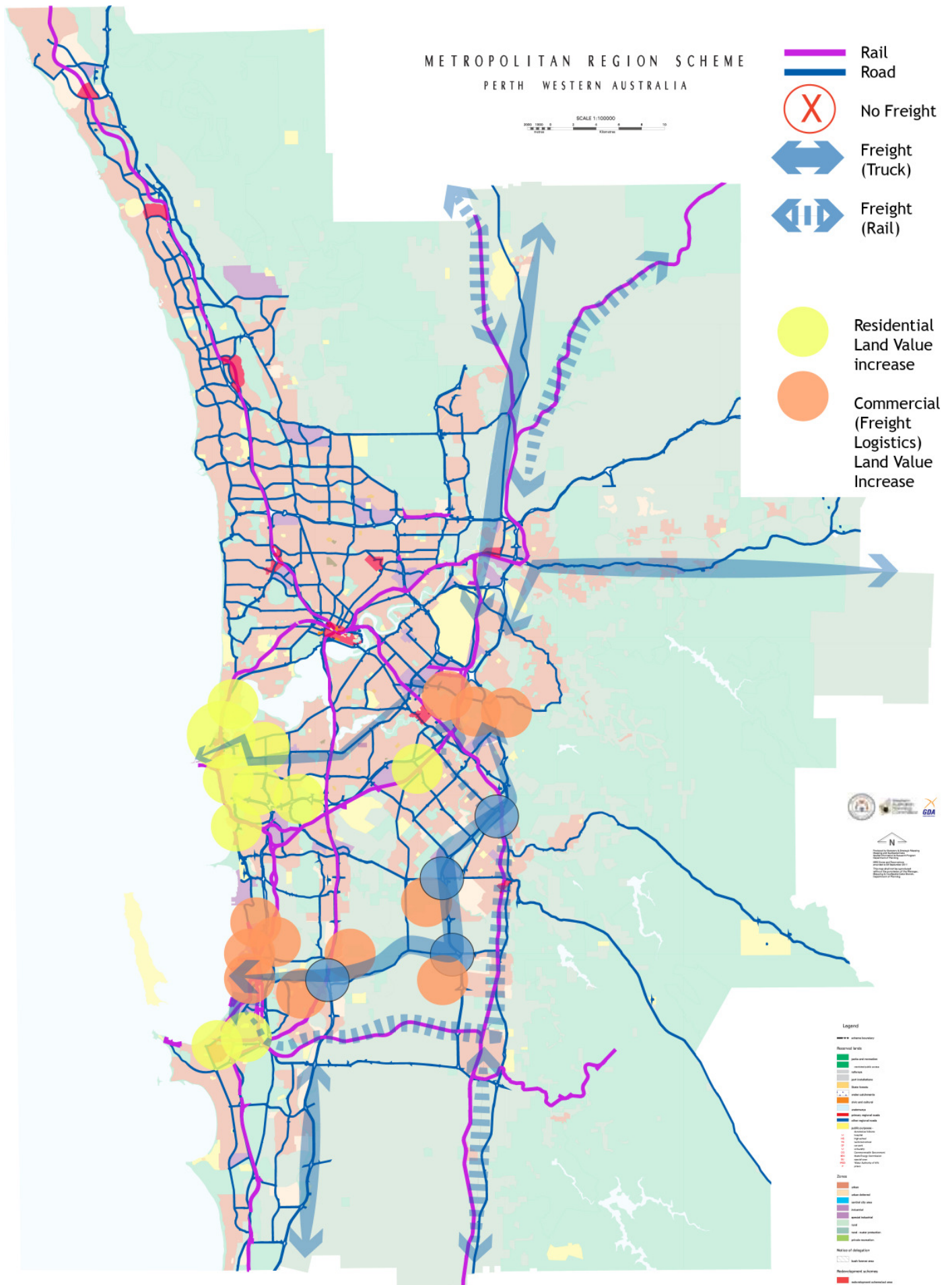
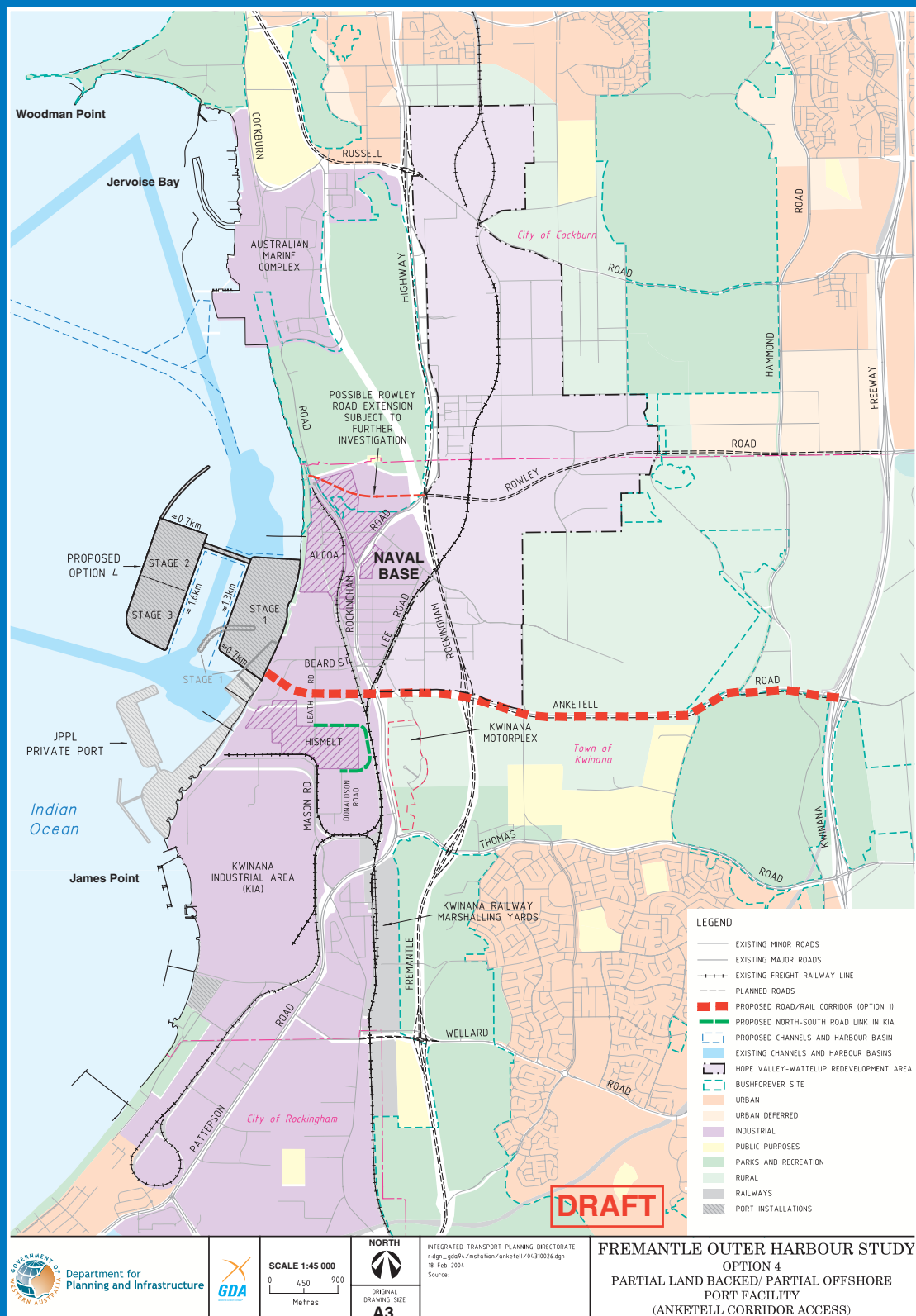


Figure 25. A Cap and Transition scenario will have vast increases in residential and commercial land values



Option 4

A partial land-backed, partial offshore facility in the area from Alcoa to Fremantle Port's Kwinana Bulk Terminal, with berths constructed parallel to the shoreline.

Figure 26. Draft "Option 4" from Fremantle Outer Harbour Study, circa 2004. From http://www.planning.wa.gov.au/dop_pub_pdf/draftFreoOptions.pdf Shown in light grey is a hypothetical James Point Port.

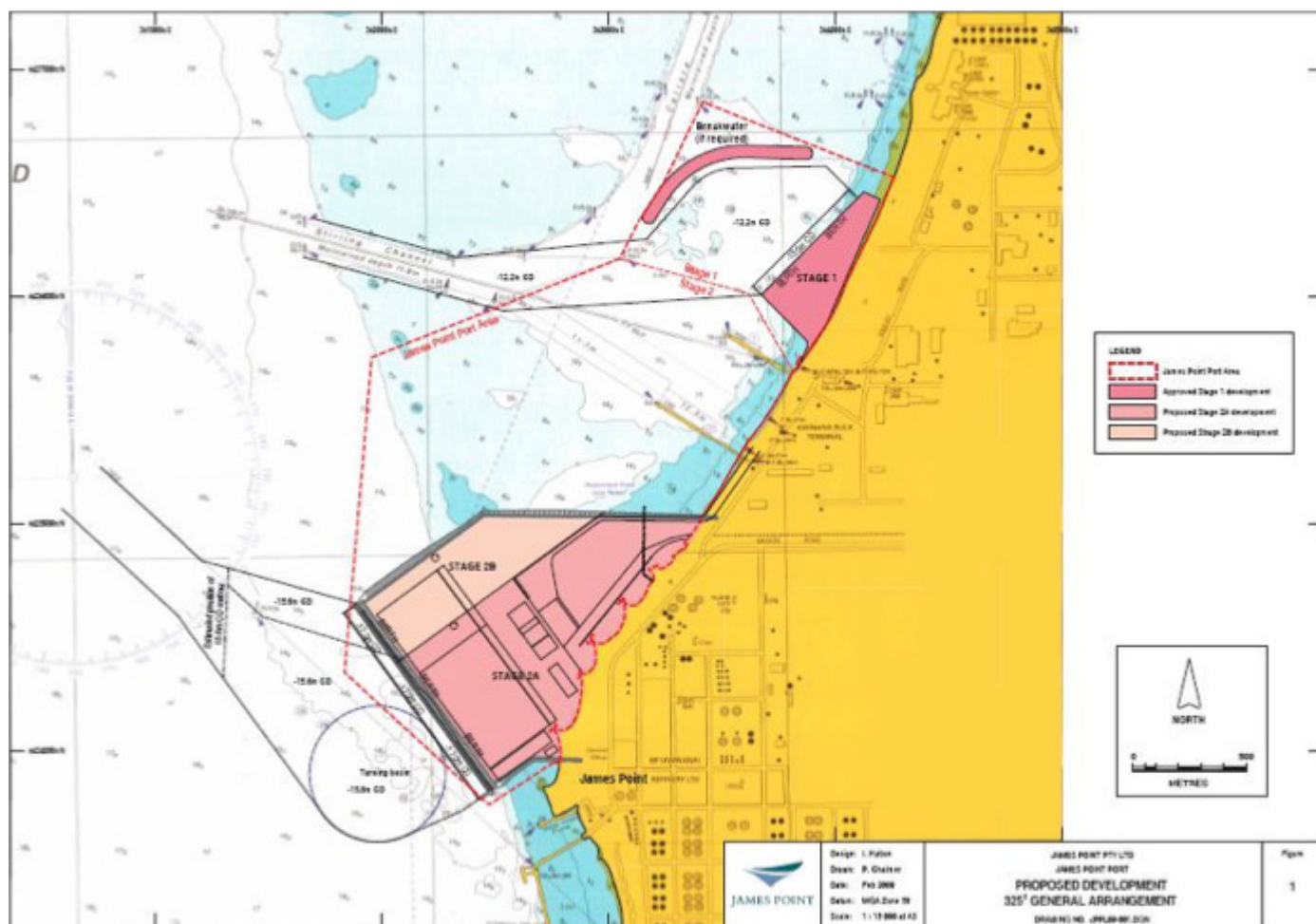


Figure 27. Image of the planned privately operated James Point Port option. Image via: http://maritimeintel.com/wp-content/uploads/2013/11/Oct_09James_Point_Presentation-copy.jpg

Status of the James Point Port as of 18 December 2013

“...The Board has determined that the James Point Port will not now proceed, and has directed that all work on the James Point Port proposal cease immediately.

... it is therefore a matter of profound regret and disappointment to JPPL that its vision for an essential piece of port infrastructure will not now be delivered, to the considerable detriment of the State's economy and the importers and exporters who wanted to use the James Point Port.” <http://www.jamespoint.com.au/>

Table 1: Options Summary						
Options/ Benefit	<u>Low Impact</u>	<u>High Capacity</u>	<u>Expense</u>	<u>Ease of Implementation</u>	<u>Net Positive for Urban Area</u>	<u>Likely to be Part of Privatisation</u>
Barges	Yes	Moderate	Low	High, but no destinations	Positive	No
Trams	Yes	Low	Moderate, once a tram network exists	Moderate, once a tram network exists	Moderate	No
Gondolas	Yes	Low - moderate	Moderate	Low due to local political uncertainty	Moderate, if passenger service included	No
Conveyor Belt	Yes	High	Moderate - High	Low to the cooperation between industries and retraining required	High if it removes the cargo from the street and is quiet	No
Tunnel - Rail	Yes	Moderate, limited by logistics of loading and unloading	High, in the \$2 billion range	Feasible and possible, grades can work with protected areas untouched	Frees up the current freight ROW for public transit to Cockburn Coast and value capture from land redevelopment	No
Tunnel - Road	No, only reduces severance	Moderate, limited by volume of trucks increased as port remains where it is	High, in the \$2 billion range if not higher due to safety for drivers and dangerous cargo	Feasible and possible, grades can work, protected areas untouched	Saves White Gum Valley, but the diesel exhaust and vibrations may be a problem	No
Upgraded rail	Yes	Moderate, limited by volume of trains increased as port remains where it is	Low, compared to other options. \$0.5 billion for new bridge and other works	High, but the higher volume of freight trains may cause issues along foreshore and in South Fremantle and Cockburn Coast	May cause political issues along foreshore and in South Fremantle and Cockburn Coast as the number of trains increases	No
Perth Freight Link	No	Moderate, limited by volume of trucks increased as port remains where it is	High, with \$1.6 billion for first phase and following works likely another \$1.5 billion	Moderate, the engineering is feasible but the political costs may be high	Very damaging to property values, liveability, air quality, urban redevelopment	No
Transport Demand Management	Yes	Moderate, spreads the timing of transport	Low	High, but truck drivers, loaders, warehousing will need to change hours of operation	Moderate, with more trucks running at night there will be issues	Yes
Cap and Transition	Yes	Very efficient use of existing and new assets	High, new port and roads to be built with upgrades to existing roads & rail	High, has been planned for over 40 years	High as it reduces impact on City of Fremantle	Yes
Outer Harbour	Yes	Most efficient logistics with custom built 21st C freight transport	High, new port and roads to be built but with fewer upgrades to existing roads & rail	High, has been planned for over 40 years	Highest of all. Increased property values, higher pre-sale sales, no negative air pollution or highways	Yes

VIII. CONCLUDING REMARKS

There are many options to handle the freight task. While the Port has been - and always will be - a significant backdrop to the sense of place, its growth in TEUs per annum has to be dealt with appropriately and with certainty: either it grows while Fremantle becomes overwhelmed by the trucks or the freight is transitioned elsewhere and Fremantle grows into its role as a Strategic Centre.

1. Review of the options

A. Options

If the port remains where it is and is expanded to meet the growth in demand, then either a highway, rail upgrades, tunnels or a cap on TEU handling and transition to an Outer Harbour will be required. All of these options have positives and negatives such as:

- i. Freeway:
 - a. Pos: deals with the freight, increases capacity of the Port;
 - b. Neg: Noise, Air pollution, severance of urban fabric, decreased property values, and enormous capital and political expense
- ii. Road Tunnel
 - a. Pos: deals with the freight, increases effective capacity of the Inner Harbour becomes an asset to sell or lease;
 - b. Neg: noise and air pollution; high capital expense.
- iii. Rail Bridge:
 - a. Pos: Extends capacity of port, is better than trucks;
 - b. Neg Noise and discomfort of increased freight train movements through Esplanade to North Coogee, private beneficiary, expense.
- iv. Rail Tunnel:
 - a. Pos: Moves larger portion of freight by rail, extends capacity of Port, increase land values along foreshore;
 - b. Neg: expense, private beneficiary, need additional land to manage loading and unloading different from current operations.

B. Outer Harbour option

- i. Cap and transition
 - a. Pos: Freight is handled much more efficiently and with less negative impacts on existing urban residential and commercial areas;
 - b. Neg: The Inner Harbour may be left with many question marks as to its future function, but this can be actively avoided with foresight.
- ii. Outer Harbour alone
 - a. Pos: Freight transport will no longer negatively affect Fremantle;
 - b. Neg: The transition of the Port lands may be decades away leaving a gap in the urban fabric unless proactive planning starts today.

C. Alternatives as in Appendix 1

Additionally there are other options such as trams, barges, conveyor belts and aerial gondolas each with opportunities but with outweighing constraints.

- i. Trams:
 - a. Opportunity: Could move some volume of freight to key locations;
 - b. Constraint: There is no tram network existing to optimise to this end, low capacity to move any significant volume, significant cost impacts.
- ii. Barges:
 - a. Opportunity: Perth has many rivers and industrial waterfronts which could be used to send and receive barges;
 - b. Constraint: The rivers are of uncertain draught and overhead clearances, all industrial lands on the river have been turned to housing or parkland.
- iii. Conveyor Belts:
 - a. Opportunity: Could move great volumes of cargo at low cost and low carbon in a 'hidden' utility out of sight and causing no congestion;
 - b. Constraint: Likely as expensive as a rail tunnel of similar length, requires high level of coordination of unloading docks on the inland port side, operating speed will likely be much slower than by rail or truck equating lower throughput capacity, significant cost.
- iv. Gondolas:
 - a. Opportunity: Mature technology used worldwide in ski-fields and for sight-seeing and even public transit;
 - b. Constraint: Public acceptance of towers in the 'view-shed', significant cost.

2. Conclusion

The PFL is a clear subversion of the planning process which has been bipartisan for many years, each government adding to the process to eventually support the building of a new Outer Harbour and reduce the impacts of the Inner Harbour truck convoys. The Perth Freight Link has been foisted onto the agenda in a rush to a) sole a highly partisan political position on trucking in one part of the city (Melville) over another (Fremantle) and b) secure 'shovel-ready' projects for short-term economic activity by a Federal government unaware of the local conditions and extensive planning - and building - towards a gradual shift of port facilities. It portrays the worst of current political theater but with real world consequences.

However, what the PFL does illustrate is that the Port of Fremantle, which has already undergone extensive changes through its history, will need to change again or it will grow to negatively dominate the City of Fremantle with its freight containers, cars, sheep and mining matériel as a continuous convoy. By bringing forth the proposal for the PFL the Federal Government has shortened the time-frame in which Fremantle has to ask itself some hard questions about its relationship to its iconic industrial landscape, the working port.

Of all the options reviewed the following can be concluded:

The rail tunnel is a good contender but the very high cost of it will mean a long-range dedication to the Port of Fremantle remaining as is, where is. It will also mean a reorganization of the inland port

network with large sets of loading and marshalling yards purchased and developed to accommodate the rail borne containers. The rail tunnel also removes the current freight task from the Fremantle foreshore which allows for the right-of-way to be used for public transit to South Fremantle, North Coogee and Cockburn Coast all of which will gain in homes and jobs activity and overall land values, of which the three tiers of government will passively 'capture value'. All in all, the rail tunnel is an option weighed in the paper despite a cost in the \$2 billion range - which puts it proximate to the current PFL price tag. As the freight rail system is leased⁴⁴ already there would be many issues to resolve in the leasing arrangements for such a project.

An improved rail service may offer a much higher per-day throughput, conveying a greater portion of the freight task than currently over a dedicated freight bridge, but with large political concerns attached. The number of trains cutting through the Victoria Quay, West End, Esplanade, South Beach, Cockburn Coast, Coogee and Spearwood - all high value real-estate - will be in the range of 16 per day on a three-fold increase or up to 20 on a four-fold increase (see VII.3.D) from a current 5. This will, in effect, surround and invade Fremantle in freight movements, decrease liveability and increase political cost.

The 'Cap and Transition' is the most acceptable in the medium term, 5 - 7 years, of all the options. It allows enough time to make small, discreet, improvement at some of the more problematic road intersections - such as at High and Leach which will be of benefit to all drivers - while a new Outer Harbour is under construction. It also allows time for the recent land expansion of the Port of Fremantle to have had a useful decade of use before having some of the older infrastructure phased out while the new harbour takes up the growth in TEU tonnage. It also gives credence to the ideals of rail based freight as specific upgrades - such as a second rail bridge - can be brought forward to help with current and future freight obligations as possibly the majority of freight coming through the North Quay can travel by rail once the overall majority is being handled at the Outer Harbour. This also allows enough time for the purchasing of land, planning, environmental approvals, dredging and road upgrades to happen in a step-by-step process at the Kwinana Industrial complex in the Cockburn Sound for the long-awaited Outer Harbour. All in all, this option will make the best use of: the Latitude 32 sites, the Kwinana Intermodal site, the existing rail network to Cockburn Sound, the road right-of-ways already dedicated to supporting an Outer Harbour and the expectation of the Port of Fremantle to have an outer harbour at some point in the near future.

The Cap and Transition is the ideal scenario in which an 'almost-shovel-ready' project can be funded and activated to the best of Fremantle's, Rockingham's, Melville's and Cockburn's long term interests in liveability, jobs and homes in a growing metro region. This would be heightened by the privatisation bids which would have improved value for the public and private interests.

Global best practices in container ports is to shift then to new sites away from the constrained logistics of people-intensive parts of the city. This will be the ultimate situation with the Cap and Transition strategy and will create a new residential, commercial, and tourist precinct on the Inner Harbour generating billions in economic activity, land sales and low-carbon living (Appendix 2). This will increase the value of the sale of the Port of Fremantle whilst improving the productivity of both freight-intensive and people-intensive activity in the southern region of Perth.

Thus it is recommended that the Cap and Transition strategy be adopted with an immediate review of the PFL to shift it, as a funded capital expense, to support the transport tasks of road and rail to the Outer Harbour.

44 Brookfield. 2015. 'Our Network' <http://www.brookfieldrail.com/about-us/our-network/>

Table 2: Options Matrix - mixing options							
Options	Tunnel - Rail	Tunnel - Road	Upgraded Rail	Perth Freight Link	Transport Demand Management	Cap and Transition	Outer Harbour alone
Tunnel - Rail		No, cancel each other out in different RoW	No, cancel each other out in different RoW	Possibly can do both, most expensive	Yes, and least expensive	Yes, and a very good long term strategy	No, improved rail will be via a southern route
Tunnel - Road	No, cancel each other out in different RoW		No, cancel each other out in different RoW	Yes, a very good option replacing PFL alignment	Yes, possible but an expensive option to reduce trips	Yes, can move trucks south to Latitude 32 and Outer Harbour	No, improved freight road will be via a souther route to Tonkin Hwy
Upgraded rail	No, cancel each other out in different RoW	No, cancel each other out in different RoW		Yes, a good option if the only one	Yes, mutually beneficial	Yes, and a very good long term strategy	No, all new rail expense will be to the south
Perth Freight Link	Possibly can do both, most expensive	Yes, a very good option replacing PFL alignment	Yes, a good option if the only one		Yes, mutually beneficial	No, PFL would be vastly oversized	No, PFL will be redundant
Transport Demand Management	Yes, and least expensive	Yes, possible but an expensive option to reduce trips	Yes, mutually beneficial	Yes, mutually beneficial		Yes, mutually beneficial	Yes, mutually beneficial
Cap and Transition	Yes, and a very good long term strategy	Yes, can move trucks south to Latitude 32 and Outer Harbour	Yes, and a very good long term strategy	No, PFL would be vastly oversized	Yes, mutually beneficial		Yes, mutually beneficial
Outer Harbour	No, improved rail will be via a southern route	No, improved freight road will be via a souther route to Tonkin Hwy	No, all new rail expense will be to the south	No, PFL will be redundant	Yes, mutually beneficial	Yes, mutually beneficial	

Table 2 - Options Matrix is intended to demonstrate how no one option may be best, but that many options are mutually beneficial and may be used together in managing the future freight tasks.

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X. APPENDIX 1: ALTERNATIVE TECHNOLOGIES

Alternative technologies for freight is being considered in parts of the world - revealing the best of new and old technologies - which are worth exploring as options to help cope with the freight task.

A. Conveyor Belts

According to a proprietary website from DENYS⁴⁵:

To meet the market requirements with regard to container movements within the port , additional intraport transport facilities will have to be foreseen in addition of the existing transport infrastructure such as motorways, roads, railways...

The transport system UCM (Underground Container Mover) has a large number of advantages:

- *Independent of the existing transport infrastructure*
- *No influence of weather conditions*
- *24 h on 24 h*
- *Almost unlimited transport capacities*
- *Inexpensive and reliable*
- *Durable technological development*

This particular technology out of Belgium anticipates a need for such a radical rethink arising out the immense road congestion of the heavily urbanised Hamburg to Antwerp corridor. Although the technology is based on a concrete tunnel with guided trailers, this same traction system could operate a conveyor belt with scanners and shunts which operate just as cargo and luggage do at airports, just on a much longer trajectory and with much larger objects.

More than 20 computer-controlled perpendicular shafts would drop the containers from the wharf to the underground, 22 to 28 metres below. The slow moving conveyor belt (travelling at a speed of just 7 kilometres per hour) will not even be stopped while loading and unloading the containers.⁴⁶

It would require the shipping and the stevedoring companies to agree to retrain their labour force and invest in the equipment. It would then be another step altogether to agree on a location for a depot from which trucks would pick up the pre-sorted containers for delivery to their respective warehouses or delivery doors. The prospects of the needs being so pressing as to force this level of cooperation appear limited, but not without merit.

The biggest restriction is the need for a large tunnel to take either the driverless rail carriages or the conveyor belt from the port to the intermodal terminal. The rail tunnel option outlined below for a conventional system would be far cheaper as it does not require the entire system to be underground and make use of an existing - and proven - mode of freight transport.

B. Barges

Barges have a long standing as a respected and still widely used means of transporting bulk and break-bulk materials in North American, European and Asian canals and river networks. Recently there have been movements to harmonise the movements of large numbers of shipping containers directly from the ocean-going ship onto a barge for distribution further inland. In this way the large

⁴⁵ DENYS "Underground Container Mover" from <http://www.denys.be/en/projecten/index/1/Underground-Container-Mover/1/dream-works>

⁴⁶ Low Tech Magazine "A world without trucks: underground freight networks: Underground Conveyor Belts" <http://www.lowtechmagazine.com/2008/02/a-world-without.html>

volumes of containers and intermodal units do not face the severe congestion faced on the roads and rail⁴⁷ and are instead floated to their destination.

The practicable application of this in Perth is that though the concept of moving the containers onto a barge is acceptable, as is the pulling of them with tugs (this is done already to the North West Shelf of Western Australia) there is no destination for the containers other than Cockburn Sound. Arriving by barge in Cockburn Sound, the container will have to be triple handled, if not more, to finally arrive at its destination. This is inefficient. Were that an inland port be available along the

47 South Eastern Ohio Port Authority "Container-on Barge Port Concept Paper" from: https://towmasters.files.wordpress.com/2011/03/cob_port_concept_paper_seohiopa_2008.pdf

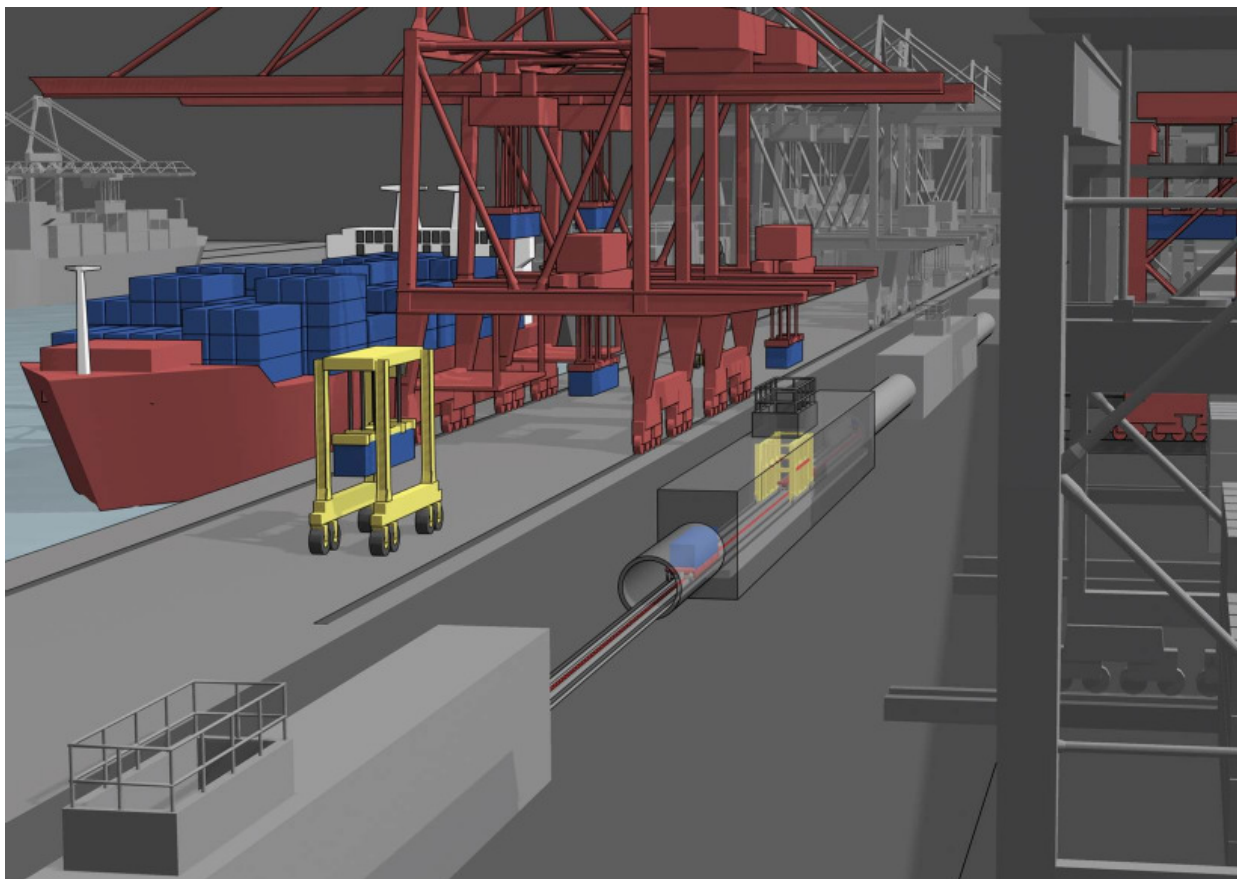


Figure 28. Unloading from the ship directly onto the UCM



Figure 29. Underground Container Mover. Images of the UCM from Denys.be

river and that the river were of sufficient draft and overhead clearance of bridges this may be an option, but this is not the case. Furthermore, all industrial lands along the Swan River have long been rendered into housing estates, horse racing tracks or parkland making the likelihood of barges as a significant option dim.

C. Freight Tram

Trams have been around for centuries and cargo has been around for millennia. Why the two have never been properly paired is obvious as trams were developed for people intensive activity, not freight activity. Yet, there are a few proposals and one prototype in Europe.

Paris has plans to use the current tram routes, and those under construction, to be link the movement of goods as a small-scale delivery system directly to the door of receivers, especially grocers. An added encouragement will be a pollution tax on heavy trucks which will place an onus on carbon free delivery options. Such trams could carry the equivalent of four truck loads of goods indicating dozens of trains to supply the ongoing daily needs of the grocery stores. On the mainlines the cargo trams will be zippered-in, running between passenger trams, but with their origins and destinations requiring a unique siding where fork-lifts can load or unload the cargo containers. This will make good use of the track during off-peak hours when the passenger trams run less frequently. In congested highway settings, such as Perth, a cargo tram eliminates a great deal of wasted truck labour costs spent idling in traffic, reduces the traffic congestion with fewer cargo movements, reduces the costs of fuel and the negative externalities of diesel particulates.

Also of note is a Volkswagon factory in Dresden uses part of the passenger tram line to help shift parts between a logistics site and a factory. This is a (locally) carbon free means to transport good from one site to another on a dedicated right of way. According to a paper on the topic:

Two 60 metre long trams each with 60 tons capacity run 16 hours a day 6 days a week under a 15 year contract. The system is reported to be both profitable and competitive with road.

Concluding that:

... those with a specific objective and few stakeholders have succeeded, suggesting that for urban deliveries systems organisational challenges may pose the largest barrier to its implementation.⁴⁸

The main problem with freight trams an option to move large volumes of freight instead of the PFL is that so far no application to the movement of containers due to their size and weight. Even if developed for containers the limitations are sever. Due to the trams running in the street network they cannot be long, more than 8-10 containers, or many crossing intersections will be affected by the slow moving tram. Most importantly, the volume of TEUs to be transported is daunting currently for an unprepared networks and with only 8-10 TEUs per trams there would have to be an unending stream of trams to make any impressionable difference. At the current rate of 15% of rail based transport of 700,000 TEUs this would require 36 such trams per day. If the Inner Harbour grows to receive 1.2 million TEUs, 15% of the capacity would require 62 such trams per day; 3 million TEUs, over 130 such trams. While a great idea for removing four or five trucks per tram, the scale issue will limit this from being a superior option for moving freight in the Perth Metro Region.

48 Regue, Robert & Bristo Abigail L. "Exploring Scenarios for the Introduction of Freight Trams in Barcelona" TRB 2012 Annual Meeting. <http://docs.trb.org/prp/12-0952.pdf>

D. Freight Gondola

According to a website devoted to low carbon transport:

It would be perfectly possible to construct (ropeway gondola) lines all over the place and get most cargo traffic off the road ...A cargo tramway could be built from a train station or parking lot outside the city to a shopping mall, or along the motorway between two towns or cities.

...There would be no delays due to gridlocks or traffic accidents. Noise and vibration would be minimal. The low energy requirements could easily be met by renewable, stationary energy sources. In short, a ropeway offers all the benefits of an underground freight network without the enormous capital costs.

...Doppelmayr (a major gondola manufacturer) now offers cargo tramways with capacities of up to 1,500 tonnes per hour, which would be more than enough to get all trucks off the road again.

... even on flat ground (as in Perth) a cargo ropeway could be a more sustainable option than most other alternatives. The only motorized transport option that seems to be able to compete with the ropeway in terms of both capacity, efficiency and cost is canal transport ...

And what about those trucks? They are so twentieth century.⁴⁹

How well such a system would work in Perth with a cultural aversion to tall towers or anything 'out-of-character' on the skyline, or physically over the terrain to the first inland port, would have to be measured carefully before proposing such a technology. The technology is proven in ski-fields world wide and as public transit in Medellin, Colombia, so it is not without merit as a technology but for containers it remains untested.

E. Improved Transport Demand Management

There is a strong case to be made for managing the flow of containerised trucks with either pulses and/or extending the port operation hours. This would involve staggering the trucks so they can both travel in 'green waves' of signal lights all tuning for them in unison or, at least, travel in off-peak hours. This is likely already in effect to some degree in peak hour traffic, however it is noticed that almost all trucking is done between 5am and 7pm, Monday to Friday, 250 days a week. Indeed, we can read in the "North Quay Truck Survey 2014", page 7 that: "91% of trucks appear between 5am and 7pm"⁵⁰ with the highest peak at 8:30 in the morning.

Likewise, the "Truck Productivity Study" of 2014 notes:

Transport operations at the port remain concentrated in daylight hours, Monday to Friday. This creates pressure on services and facilities during these periods, and will not be sustainable as port volumes grow in the future.

One (truck) operator said that '... evening operations are a more cost-efficient way

49 "Aerial ropeways: automatic cargo transport for a bargain " <http://www.lowtechmagazine.com/2011/01/aerial-ropeways-automatic-cargo-transport.html>

50 Freight Logistics Council "North Quay Truck Survey 2014 " Accessed from Fremantle Port: <http://www.fremantleports.com.au/SiteCollectionDocuments/North%20Quay%20Truck%20Survey%202014.pdf>

to operate as they avoid a lot of the inefficiencies seen during the day due to the various parties in the supply chain not working in a unified manner.' The operator found that double the volume could be handled compared to daylight operations.⁵¹

Were this managed differently the trucks could be running before and after the peak hours with large convoys in the evening. Of course, this would mean operating the port and receiving destinations differently than current: this is the rise of Perth as a 24 hour city, as most global cities are. The proposal to build a \$1.6 -2 billion dollar highway seems a very expensive option in light of simply changing operating hours. It would, of course, mean increased noise impacts in those areas near the truck routes.

F. Improved transport supply through design and technology

The design of the intersections - as found - could be improved to the highest standards of turning radius and super-elevation. Significantly bad intersections such as High/Stirling and Leach/Stock should be upgraded as they operate at a standard - from casual observations - in highly problematic manners.

It could be wise to revert to the 2014 proposal from Main Roads as illustrated on page 26 in which sound walls and at-grade access was still present along with turning radii suited to efficient throughput of heavy vehicles with signal priority. Such an arrangement, though not satisfying to everyone, may be more acceptable than a cut trench running through the front door of Fremantle.

Another example of what is available, in the technology side, to increase supply without actually laying more asphalt are Intelligent Transport Systems (ITS)⁵² in which such items as 'smart boards' are positioned road-side to give account and advice for the traffic conditions ahead and an optimal speed to have the smoothest drive. Such a device can also be made as a part of a dash-board mounted GPS. Though this may cost to install, it will certainly be less expensive than \$1.6 billion and put the onus on the drivers who choose to drive at peak hours to judge their best travel times. It doesn't, however, reduce the trucks in total numbers but for perhaps at peak hours.

G. Conclusion to Alternative Technologies

In reviewing all these technologies or transport modes it is safe to say there is no one which has the capacity to move the sheer volume per day at a cost which is competitive to looking at other options. If the logistics are so dire that one or several of these options must be considered, it will likely be found less expensive to merely follow up on the original strategy of an Outer Harbour and the required roads and rail to move goods from a new, custom made, location.

51 Fremantle Ports "Truck Productivity Study" July 2014

52 A good description of all the available technologies is available on Wikipedia "Intelligent transportation system" http://en.wikipedia.org/wiki/Intelligent_transportation_system

XI. APPENDIX 2: PORTS TO PORTALS

Although there are many 19th and 20th century ports are moving away from the city centre, it is difficult to comprehensively view the scale of the urban projects taking their place. Likewise it is difficult to view these changes in a like comparison which is easily understood. This following chart is not a complete compendium, but it does represent a fairly wide swath from South Africa, Argentina, Canada, UK, Germany, Norway, Sweden, Finland, Denmark and Australia. All of these countries rely, notably, on the market to send signals to the housing sector and long-ranged rational planning to arrange for high quality livability and urban design outcomes.

The freight transferring ports themselves are relocating to better locations where the loading and unloading are not constrained by existing land uses, where the noxious and dangerous goods pose no harm to local residents or businesses, and with rail and road connections which are not slowed by, and do not congest, urban arterials as they move the freight regionally.

When they do move, what they leave behind are vast tracts of ready to repurpose land with, sometimes, only limited remediation required compared to heavy-industry brown-fields. Typically, most ports areas are flat terrains, making levels and underground utilities easy to insert, with an existing rail or road infrastructure easily adapted, with sun and wind aspects to be used to advantage if properly considered and with a much desired 'tabula rasa' (or clean slate) ready for any preferred building programme.

In many global cities many home buyers and workers prefer the inner city's amenity rich, transport option laden and walkability. Typically, adjacent to most older inner cities are the original ports with concomitant, if on the market, very high land values and with a great ease to redevelop from the aspects of infrastructure, housing and public open space. Luckily, this is desirable land as the global market for waterside living, shopping, working and recreating appears to be unlimited. The water's edge continues to holds great appeal.

The following chart is arranged in descending order by hectares of land.

A lengthier report on this topic is available from authors upon request.

Ports to Portals: Changing post-industrial waterfronts to active sustainable urban infill											
Port	Owner	Previous Use	New Use	Hectares	m2 Floor Space	Public Open Space	Jobs	Residents	Transport	Year Finished	Source
Nordhaven, Copenhagen, Denmark	Copenhagen City and Port Development	Port	Residential, Office, Retail, POS	360	4,000,000		40,000	40,000	Metro, Bus, Walking, Bicycle	2050	http://www.cobe.dk/rdhaven
West Harbour, Helsinki, Finland	City of Helsinki?	Main Cargo port	Residential, Schools, Office, Retail, POS	200			20,000	30,000	Tram, Metro, Walking, Cycling	2030	http://www.uutahelsinki/default/files/legacsisatama_eng_265x86
Docklands Melbourne, Australia	VicUrban, City of Melbourne	Port	Residential, Office, Hotel, Retail, POS	190			60,000	20,000	Tram, Rail, Road, Walking	2025	http://www.places.vic/recincts-and-development/docklands
Kalasatama, Helsinki, Finland	City of Helsinki?	Fish port	Residential, Office, Retail, POS	175			8,000	20,000	Metro, Tram, Bus, Walking	2035	http://www.uutahelsinki/default/files/inline-attachments/2014-02/kalasatama_esite
Puerto Madero, Buenos Aires, Argentina	Corporación Antiguo Puerto Madero	Docks	Residential, Retail, POS	170				6,629	Subte Metro nearby, bus, walking, car		http://en.wikipedia.org/erto_Madero
Hafencity, Hamburg, Germany	City of Hamburg?	Docks, Warehouse	Retail, Hotel, Entertainment, POS, Residential	157	2,320,000	28 hectares	45,000	6,000	Walking, Cycling, Metro, Bus	2025	http://www.hafencity
Lower Don Lands, Toronto, Canada	City of Toronto via Waterfront Toronto	Post-industrial, port	Retail, Entertainment, POS, Residential	125	278,709 of commercial and retail space	53		12,500	20 minute walk to downtown, bus,		http://www.waterfronttoronto.ca/lowerdonlands
Victoria Waterfront, Cape Town, South Africa	Cape Town ?	Port	Retail, Hotel, Entertainment, POS, Residential	123					Bus, car, walking	2007	http://capeinfo.com/links/history/115-waterfront-development.html

Ports to Portals: Changing post-industrial waterfronts to active sustainable urban infill

<u>Port</u>	<u>Owner</u>	<u>Previous Use</u>	<u>New Use</u>	<u>Hectares</u>	<u>m2 Floor Space</u>	<u>Public Open Space</u>	<u>Jobs</u>	<u>Residents</u>	<u>Transport</u>	<u>Year Finished</u>	<u>Source</u>
Sodra Hammarby, Stockholm, Sweden	City of Stockholm?	Port and Industrial area	Residential, Office, Retail, POS	48			35,000	25,000	Metro, bus, Tram, cycling walking	2015	http://www.hammarby.se/henglist/pdf/HSE_eng_ny.pdf
Canary Wharf, London, UK	London Docklands Development Corporation	Isle of Dogs Port	Residential, Office, Retail, POS	34.8	1,300,000		100,500	12,500	DLR Train, Walking, Cycling		http://www.towerham.uk/docashx?docid=2318e-4a-50-a842-9dd8caf3f59&version=1
Tjuvholmen, Oslo, Norway	Selvaag/Aspelin Ramm, Oslo Port	Shipyard, Warehouse	Residential, Institutional, Retail, POS	33	140,000	0.9 Hectares		900 dwellings	Bus, Tram, Ferry	2014	http://www.prosjekt-fjordbyen.oslo.kommune.no/fjordbykonto/ORDBYEN/Internett%20BYEN/Dokumenter/Gfc-2008.pdf
Barangaroo, Sydney, Australia	State of NSW, Barangaroo Delivery Authority	Darling Harbour, Port	Residential, Office, Hotel, Retail, POS	22	535,000 - 681,000		23,000	2,000	Ferry, Bus Walking, Cycling, Tram	2023	http://www.barangaroo.aspx
SE False Creek, Vancouver, Canada	City of Vancouver	Light and heavy industry	Residential, Office, Hotel, Retail, POS	20	196,954	8			Car, bus, train, walking, cycling		http://www.via-architecture.com/pro-east-false-creek-mast
Granville Island, Vancouver, Canada	Canada Mortgage and Housing Corp	Shipyard, Warehouse	Retail, Hotel, Light Industrial, University, POS	15	84,111		2,500	0	Bus, Walking, Bicycle, Car	1979	http://granvilleisland.com
Marineholmen, Bergen, Norway	City of Bergen?	Shipyard, Naval base, Warehouse	Retail, Schools, University, POS	10	45,000 for Commercial		2000 -4000		Tram (to be reinstated), Metro, Walking, Cycling		http://www.marineholmen.no/prosjekt/4289/prosjekt
Fremantle, Australia	Port Authority	Active Port		150							