Deloitte.

Port Capacity Enhancement Program Cost Benefit Analysis

Port of Melbourne

Draft report | May 2024

Deloitte Access Economics

Contents

Charts

Tables

Figures

Glossary

Acronym	Full name
$PV	2023 present value in dollar terms
2050 PDS	2050 Port Development Strategy
2024-2053	30-year analysis period (Financial Year)
AAT	Australian Amalgamated Terminals Pty Ltd
ACCC	Australian Competition and Consumer Commission
ACFS	ACFS Port Logistics Pty Ltd
ARR	aggregate revenue requirement
AUD	Australian dollar
BCR	benefit cost ratio
CAPEX	capital expenditure
CBA	cost benefit analysis
CGE	computable general equilibrium
DCF	discounted cash flow
DTF	Department of Treasury and Finance
ESC	Essential Services Commission
ESC Act	Essential Services Commission Act 2001 (Vic)
HV	heavy vehicle
ICT	International Container Terminal
IMEX	import-export
LOA	length overall
NPV	Net present value
NSW	New South Wales
OPEX	operational expenditure
PCEP	Port Capacity Enhancement Program
PMA	Port Management Act 1995 (Vic)
PoM	Port of Melbourne Pty Ltd
PrixCar	PrixCar Services
PV	present value

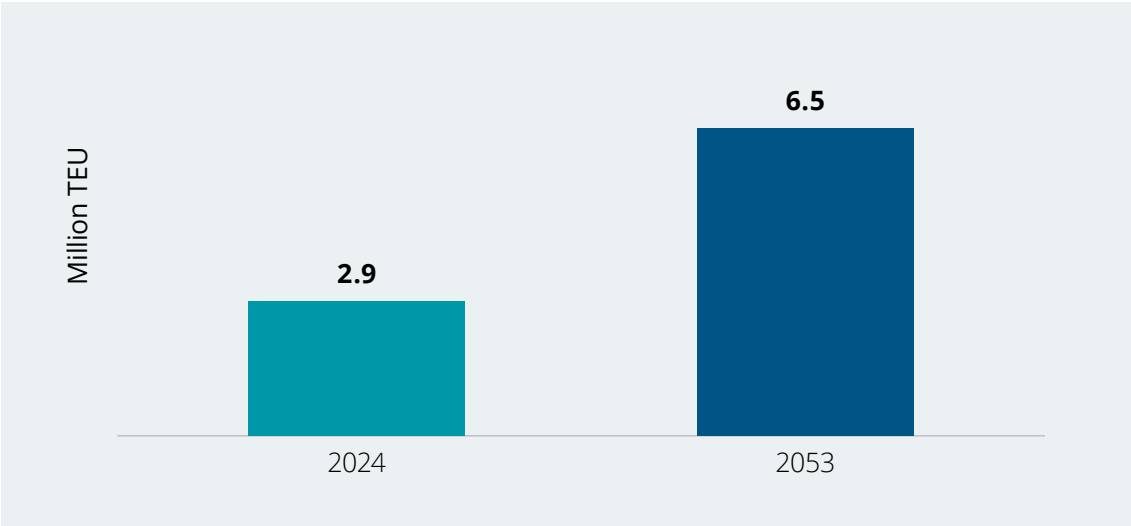
QLM	quay line metre
Qube	Qube Holdings LTD
RDD	Regression discontinuity design
SAV	Swanson Appleton Victoria
SDE	Swanson Dock East
SDW	Swanson Dock West
SQM	square metres
TEU	twenty-foot equivalent unit
The State	The State of Victoria
TTO	Tasmanian trade operators
USD	United States dollar
VICT	Victoria International Container Terminal Limited
VOC	Vehicle operating cost
WDE	Webb Dock East
WDN	Webb Dock North
WDN ICT	Webb Dock North International Container Terminal
WDW	Webb Dock West
WDW ICT	Webb Dock West International Container Terminal
WTT	Well-to-tank

Executive summary

Containerised trade at the Port of Melbourne (the Port) is forecast to more than double within the next thirty years (Chart i). Without a substantive change in capacity, based on the assumptions modelled in this report, the Port will be unable to accommodate the anticipated demand. Under the base case, capacity constraints are forecast to first arise at the Port in 2037 and the Port is forecast to reach capacity on a sustained basis from 2041 (Scenario B4 from the Black Quay – Port of Melbourne Container Capacity Review Final Report (Black Quay Report)), which would result in vessel congestion for a period of three years from 2041, and displacement of trade from 2044.[1] This vessel congestion and subsequent diverted trade would impact economic activity and increase supply chain costs which would likely be passed onto the consumer. To continue supporting the economic activities of Victoria and consumer requirements, it is important that, in accordance with Port of Melbourne's stewardship obligations, port capacity can meet the future demands of Victoria's growing economy.

Given the importance of accommodating future demand for the state of Victoria, the Port of Melbourne Operations Pty Ltd (PoM) has begun the process of planning for the next stage of port capacity: the Port Capacity Enhancement Program (PCEP). PCEP involves developing a new international container terminal and securing the long-term future for Tasmanian trade operators (TTO).

Chart i Forecast containerised trade



Source: Deloitte Access Economics Trade Forecast

[1] The model assumes that under base case vessel congestion would be experienced at the Port for three consecutive years, before trade is displaced.

To understand the potential economic, social, and environmental impacts of each possible option, PoM engaged Deloitte Access Economics (Deloitte) to conduct a cost benefit analysis (CBA) of potential options for PCEP. The analysis involved quantifying potential benefits and costs associated with a set of options. Two options have been assessed against a base case, at a high level, these are:

- **Base case**: under the 'base case' it has been assumed that Port activities would continue without significant capital expenditure by PoM, however this is assumed to include expenditure by existing stevedores, which enhances stevedore capacity and productivity.
- **Option 1**: under Option 1, it has been assumed that a two-berth container terminal would be built in Webb Dock North and TTOs would move from Webb Dock to Victoria Dock and an off-port logistics site. Capital expenditure (CAPEX) for Option 1 would begin in 2027.[2]
- **Option 2**: under Option 2, it has been assumed that a two-berth container terminal would be built in Webb Dock West and TTOs would move to Webb Dock West temporarily, prior to returning to the Eastern side of Webb Dock, automotive trades would move upriver to the SAV (Swanson, Appleton, Victoria Docks) precinct. CAPEX for Option 2 would begin in 2024.

The CBA has been undertaken in line with the Victorian Department of Treasury and Finance's (DTF) guidelines. Both options have been compared against the base case (outlined above). The results of the CBA indicate that future enhancement of the Port's capacity would have an overall net benefit for the Victorian economy. The result is driven by the fact that under the base case there is displacement of trade and vessel congestion, which is costly for the supply chain and the broader Victorian community. Sensitivity testing has been used to confirm that this result is robust to a range of input assumptions and delivery dates for new container capacity.

This CBA has been developed to consider the net economic impact of delivering additional container capacity at the Port, based on a comparison of the economic benefits and costs. The focus of the CBA is on all costs and benefits to society as a whole. This includes all benefits and costs, whether they are private, social or environmental. The CBA does not represent a commercial assessment of PCEP for PoM and therefore does not reflect a specific investment decision. The benefits and costs included in the CBA's net benefit calculation account for broader economic, societal and environmental considerations from the point of view of the Victorian economy. The CBA should not be interpreted as a commercial assessment of PCEP and therefore does not reflect a specific investment decision.

Table ii CBA Results - Net benefits to Victoria incremental to the base case ($PV millions)

	Option 1	Option 2
Costs	2,907	3,064
Benefits	7,902	7,682
NPV	4,995	4,618
BCR	2.72	2.51

Source: Deloitte Access Economics

[2] Option 1 and 2 have assumed start dates of 2027 and 2024 respectively, however, this is an assumption that underpins the modelling and is not a directive of when investment should commence. Further, the CBA is a summation of the costs and benefits related to the potential investment and any timelines or assumptions should not be understood as commitments by PoM.

Option 1 would provide greater capacity, and, as such, the analysis shows increased benefits relative to Option 2 with respect to increased economic activity and avoided land bridging[3] costs. Furthermore, Option 2 has greater CAPEX than Option 1, which also reduces the present value net benefit and benefit cost ratio (BCR).

Option 1 has lower CAPEX, OPEX, increased economic activity from the capacity uplift –both for PoM and tenants, avoided costs of land bridging from displaced trade and the residual value of land and new equipment, when compared directly with Option 2. Implementing Option 1 would result in additional supply chain costs relating to tenant movements and a new off-port logistics site for TTOs.

The results are robust to a series of sensitivity tests, with the net present value (NPV) from a state of Victoria perspective, remaining positive under conservative assumptions, such as delayed timing and low container demand. The sensitivities that have been tested and key impacts of the sensitivities are outlined below:

- **Base case:** The selection of the base case significantly impacts the results, as the benefits and costs of the options are measured against the base case. By increasing and decreasing capacity in the base case, the potentially realised net benefits may be reduced or increased respectively. For example, the current base case makes assumptions regarding stevedore investments in existing assets to improve productivity and continue to service forecast trade demand and service levels. These enhancements in the base case are also assumed to occur in the options. The assumed base case for this CBA has adopted Scenario B4 from the Black Quay Report.
- **Timing:** While there is a window of opportunity for delivery, delaying the timing of the Port's expansion beyond this period would reduce the net benefit that would be gained by Victoria.
- **Container forecast:** the projected trade for the Port influences the magnitude of the avoided displacement when PCEP would come online, as well as when capacity would be reached. If the actual trade is in fact higher than forecast trade, then there may be congestion before PCEP comes online, however, additional congestion and land bridging would be avoided once PCEP comes online. The increased benefits from PCEP coming online outweigh the costs of delay, and as such a higher containerised forecast increases the benefits of each option. The CBA has assumed the 'central' trade forecast from the Deloitte Access Economics Port of Melbourne Trade Forecasts Summary Report & Sensitivity Analysis (Deloitte Access Economics trade forecasts).

The forecasts that have been used as inputs to the CBA, indicate that current capacity at the Port would not be sufficient to meet forecast demand at the Port. Further, delivering increased capacity through PCEP would generate net benefits to the broader Victorian economy, than if PCEP did not proceed. Results also indicate that not increasing capacity would have significant impacts on the performance of Victorian supply chains and, ultimately, the Victorian consumer. Results from the CBA find that the Port configuration under Option 1 provides greater net benefits than Option 2, when compared to the base case. A number of qualitative considerations have been made to support the findings in the CBA which include competition effects of maintaining spare capacity, near-Port and network-wide landside congestion, risks of land-bridging to Victoria's supply chain, risks of interstate capacity not being made available and stevedore asset utilisation impact. These considerations are discussed in further detail in section 5.2.

[3] Land bridging refers to the movement of containers across land.

Outlined below are the five key findings resulting from the analysis:

01 The base case scenario is insufficient to meet forecast trade demand

Under the base case, stevedores are forecast to make investments which would increase the operational capacity and productivity of the Port. However, while this could meet demand in the short term, ultimately, capacity would still be reached sooner than when it would be reached under both options. As such, continuing a 'business as usual' scenario with investment undertaken by stevedores is insufficient to meet the trade demands of the next 30 years.

02 Proceeding with PCEP would create net benefits to Victoria

As additional capacity is delivered at the Port, there are several benefits to be gained by the Victorian economy, which would be greater than the benefits of the base case. Under PCEP, there would be greater economic activity at the Port, reduced overall supply chain costs due to avoided land bridging and vessel congestion, and larger ships accommodated at the Port, meaning economies of scale are experienced. As such, proceeding with PCEP would benefit the Victorian economy.

03 Option 1 (WDN ICT) has greater net benefits than Option 2 (WDW ICT)

While both options have net benefits, Option 1 (WDN ICT) has greater benefits relative to the base case. There is increased capacity compared to Option 2, which would result in greater benefits to be gained by the Victorian economy, through benefits to the Port, stevedores, and consumers. Option 1 also allows for greater optionality to expand capacity in the future, and has a lower CAPEX compared to Option 2.

04 Not proceeding with PCEP could have significant impacts on the supply chain and ultimately consumers

Without proceeding with PCEP, the Port would reach capacity earlier resulting in significant disruptions to the supply chain. As vessels are assumed to be diverted to Port Botany, containers would need to be transported by rail and road to Victoria. This would result in increased vehicle operating costs, road damage and negative externalities which is significantly more expensive than the vessel operating costs associated with arriving at PoM. Consumers and exporters in Victoria would face higher supply chain costs putting pressure on households and export business margins.

05 Delivering PCEP at an appropriate time can be beneficial to Victoria

There is a window of opportunity for when capacity uplift of the Port should be delivered (according to trade demand forecasts and capacity estimates). The analysis suggests there is a six-year[4] window in which PCEP could be delivered and yield a strong net benefit to the Victorian economy.

[4] This has been informed by the Black Quay capacity estimates compared with Deloitte trade forecasts, in the sensitivity analysis of delivering PCEP between 2034 and 2041, 3 years before and 3 years after the year capacity is temporarily exceeded in 2037.

01
Introduction

1.1 Background

The Port is a major business gateway for Victoria and South-eastern Australia and is Australia's largest container, automotive and general cargo port.[5] The Port is of significant economic importance for Victoria, handling over one-third of Australia's container trade, serving as a major source of employment and enabling trade, and acting as a gateway to the world. In 2021-22, PoM contributed $10.57 billion to the Victorian economy, comprising $3.77 billion directly from the Port-related activities (directly attributable income) and $6.8 billion indirectly from its flow-on effects.[6]

The Port has three international container terminals: Swanson Dock East (SDE), Swanson Dock West (SDW), and Webb Dock East (WDE). The Port will require additional container capacity to meet forecast increased container trade demand. Without intervention, the Port's operational efficiency will be impacted, leading to increased supply chain costs and reduced competitiveness of Victoria's freight dependent sectors.

PoM developed the 2050 Port Development Strategy (2050 PDS) in 2020. It outlines the high-level plans and approach for developing capacity and the efficiency of the Port over the next 30 years. PCEP has been outlined in the 2050 PDS, to support the growing needs of the Victorian container trade. The objectives of PCEP are to increase the Port's container capacity to accommodate expected trade growth and improve its ability to handle larger vessels with a capacity of up to 14,000 twenty-foot equivalent units (TEU) with a length overall (LOA) of 366m.

1.2 Scope

Deloitte has been engaged by PoM to undertake an independent CBA to understand the economic, social, and environmental impacts of PCEP.

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[5] Port of Melbourne (2020), 2050 Port Development Strategy. < https://www.portofmelbourne.com/wp-content/uploads/PoM-PDS-2020-Edition-For-Publication.pdf>

[6] ACIL ALLEN (2023), 2021-22 Economic contribution of the Port of Melbourne, <https://acilallen.com.au/projects/economic-modelling-and-analysis/2021-22-economic-contribution-of-the-port-of-melbourne>

The CBA compares the costs and benefits of two PCEP options against a 'base case' in which stevedores continue to make additional investments to increase operational capacity, without PoM proceeding with PCEP. The CBA assesses the merits of PCEP from a whole-of-Victoria point of view, identifies the need and timing for additional container capacity within the Port, and assesses the economic viability of potential options for providing additional container capacity.

The assumptions and inputs that underpin the CBA and underlying economic modelling and forecasts are estimates, and it is uncertain as to how they will be realised.[7] While the model uses the best available inputs, forecasts may be subject to change. As such, sensitivity testing is then used to analyse the impact of using different assumptions for the key inputs to the CBA. Individual modelled outcomes in the CBA are not determinative, but instead used to inform an overall assessment of the potential impacts of PCEP. Sensitivity testing confirms that the key results are robust to a range of input assumptions and modelled outcomes.

The CBA is not a comprehensive commercial assessment of PCEP for PoM and therefore does not reflect a specific investment decision. The CBA and economic analysis were undertaken as part of PoM's technical assessment of the costs and benefits of a future potential investment in the Port, from the point of view of the Victorian community as a whole. However, the CBA is not the sole determinant of whether PCEP is implemented or the timing of the expansion if it goes ahead. The investment decision will ultimately rest with PoM, subject to commercial, regulatory, risk, and other considerations that are outside the scope of the CBA.

The CBA follows the DTF guidelines.[8]

Key principles applied in a CBA include:

- Impacts must only be counted once (no double counting)
- Only direct effects are included (no second round or multiplier effects)
- Transfers, taxes or subsidies are excluded
- All effects are measured relative to the base case in incremental terms
- Victorian imports/exports and external port capacity are assumed to be exogenous
- All figures are in real terms using 2023 present value (PV) in $AUD

Key documents informing the development of the CBA include:

- Container Capacity Review by Black Quay (2023)
- Future Containership Fleet Analysis by GHD Advisory (2023)
- Long-Term Trade Forecast by Deloitte Access Economics (2023).

In addition to Deloitte's desktop review, PoM provided data inputs and assumptions relating to vessel congestion, landside congestion (excluding network modelling), options capacity, the technical design of PCEP options, and key CAPEX. The scope of our work did not include any review of these inputs.

[7] Some inputs are inherently uncertain and subject to change (e.g., long-term trade forecasts); some assumptions are based on anticipated behaviour of third parties that is outside the control of PoM (e.g., stevedore investments); and/or there may be differing views from stakeholders (e.g., capacity forecasts).

[8] Department of Treasury and Finance (Vic) (2013), Economic Evaluation for Business Cases Technical guidelines, <https://www.dtf.vic.gov.au/sites/default/files/2018-03/Economic%20Evaluation%20-%20Technical%20Guide.doc>

02
Cost benefit analysis framework

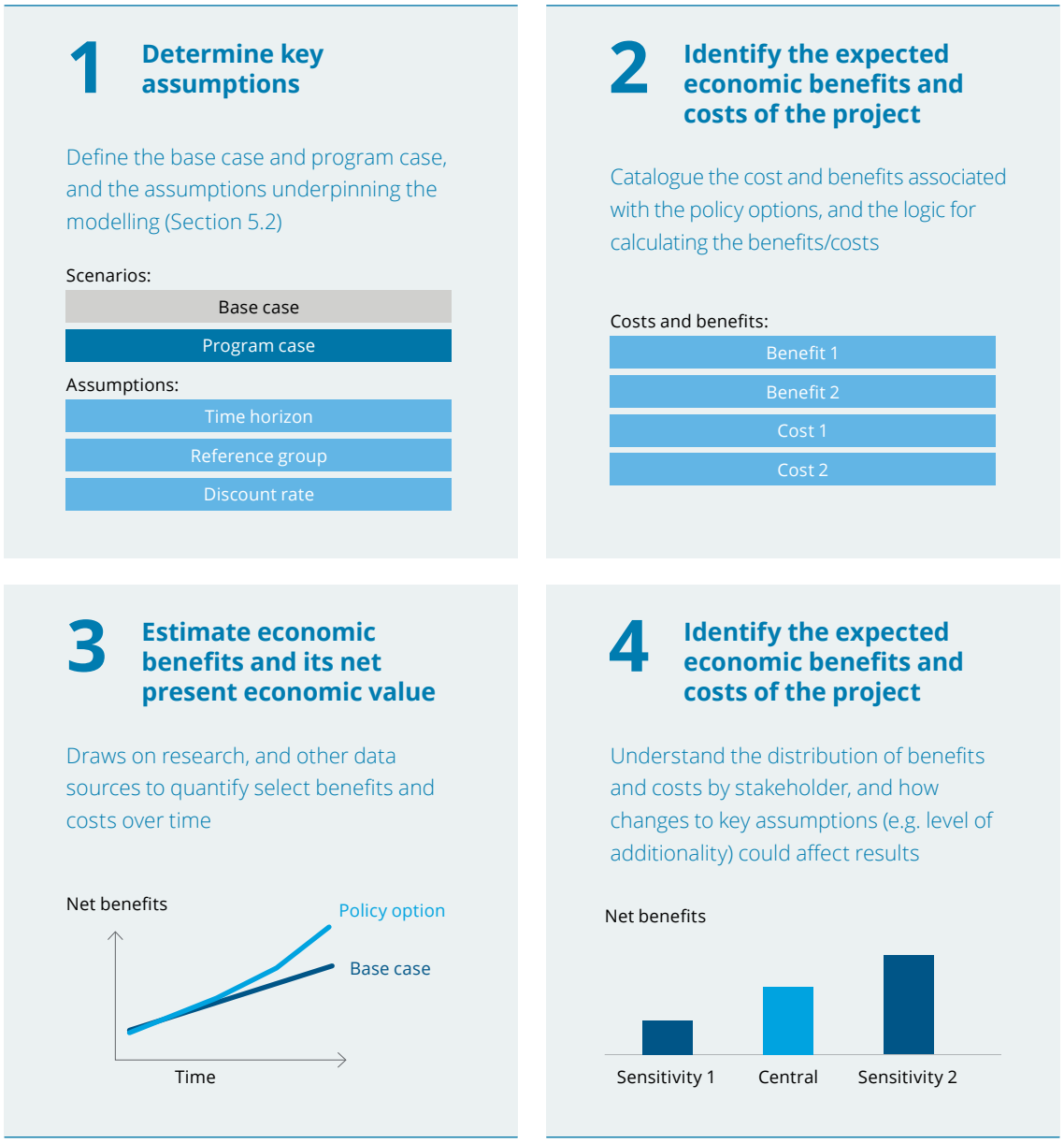
2.1 Cost Benefit Analysis Process

The CBA focusses on the impacts to the whole of Victoria, consistent with DTF guidelines. Any costs and benefits that occur outside Victoria are excluded from the analysis, unless the cost or benefit is expected to have a direct impact on Victorians (e.g., through the container supply chain). The CBA considers social, economic, and environmental costs and benefits which accrue to key participants in the supply chain.

The CBA process is outlined in Figure 2.1 and summarised below:

- **Step 1:** The base case and options are assessed and defined. The base case provides a reference against which any options considered, are measured. The assumptions underpinning the model are also defined at this stage of the analysis.
- **Step 2:** The costs and benefits of PCEP are then identified. Each cost and benefit has economic logic, which underpins the calculation.
- **Step 3:** The NPV of each cost and benefit, is then calculated in a discounted cash flow (DCF) model using economic research and modelling inputs to map the element over time.
- **Step 4:** The risks and sensitivities related to the costs and benefits are then investigated. This includes measuring the impact on the results when key assumptions change.

Figure 2.1 Cost benefit analysis process



Source: Deloitte Access Economics

The analysis assessed the capacity uplift created by each PCEP option, measured against the base case in which stevedores continue to make additional investments to increase operational capacity, without proceeding with PCEP. The primary objective is to measure the impact of each PCEP option in terms of costs and benefits to the Victorian community. This evaluation spanned 30 years from 2024 to 2053 (inclusive), with a 7% discount rate applied in line with DTF guidelines to calculate costs and benefits in 2024 present value (PV) terms.[9]

The CBA assesses the incremental economic, social and environmental costs and benefits to estimate the overall welfare impact to the State. This approach ensures that costs and benefits are not a transfer within Victoria (e.g., a payment from a Victorian consumer to a Victorian business) and avoids double counting of impacts (which could overstate the benefits).

[9] Department of Treasury and Finance (Vic) (2013), Economic Evaluation for Business Cases Technical guidelines, <https://www.dtf.vic.gov.au/sites/default/files/2018-03/Economic%20Evaluation%20-%20Technical%20Guide.doc>

2.2 Overview of Base Case and Options in the CBA

2.2.1 Base case (no PCEP scenario)

The base case is the scenario against which the benefits and costs of the options outlined in detail below will be measured.

The base case for this CBA assumes the Port remains unchanged for the most part. There is assumed to be no changes to tenant locations within the Port precinct under the base case. However, it is expected that stevedores will continue to invest in operational efficiency, increase productivity, and extend current capacity. This would include purchasing equipment such as cranes and straddles. Stevedore investment is an assumption in the modelling and may not necessarily occur in the manner assumed. PoM itself would not make any investments to enhance container capacity. With stevedore investments and enhanced productivity, it has been forecast that the Port would first temporarily face capacity constraints in 2037 and is consistently above capacity from 2041. Thereafter, it is assumed that vessel congestion would persist for three years, and subsequently there would be displacement of container trade to Port Botany in NSW, where land bridging would replace vessels calling at the Port.[10] The three years of vessel congestion is due to the expectation that cargo owners will choose to bear the congestion costs rather than incur the cost of land-bridging until three years have passed, which is aligned with the typical stevedoring contract length; after three years of sustained congestion, congestion fees and land-bridging costs broadly intersect.[11] Three years has been deemed a sufficient length of time to account for this transition period prior to displacement and this has been further extended to five years in the sensitivity analysis (with displacement occurring at the end of the five years) to provide added assurances as to the robustness of the CBA results to a longer congestion period.

2.2.2 Base case selection

A base case in a CBA, represents a scenario where there is no significant investment or intervention. It is often considered as a 'business as usual' or 'do-nothing' case. As per the DTF guidelines, it is accepted practice that the base case serves as a benchmark to evaluate potential options. The benefits and costs of options are measured incrementally against the outcomes of the base case. The selection of a base case is, therefore, important as it can significantly influence the results of a CBA.

Recently, the Ports of Hastings and Bay West have been considered as potential alternatives for a second container port in Victoria. The Port of Hastings in the Mornington Peninsula currently trades in oil, liquid petroleum gas, unleaded petrol and steel. Bay West, near Geelong, was identified by Infrastructure Victoria and confirmed in the Victorian Commercial Ports Strategy[12] as a preferred location for a new container terminal once PoM reaches capacity and exhausts all efficient expansion options.[13] In 2017, Infrastructure Victoria provided advice to the Victorian Government that the capacity of Victoria's existing ports should be optimised, having regard to social and environmental factors, before building a second major container port.

Specifically, the Victorian Government's 'Victorian Commercial Ports Strategy', outlines four objectives that guide the State's development over the next five years. As part of this strategy,[14] the State Government has committed to supporting the current ports in the State. This includes the support of the development of PoM's capacity to meet the growing demands of the economy. For these reasons, in line with prevailing State Government policy, significant investments at the Ports of Bay West and Hastings were ruled out as relevant base cases for this study.

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[10] For the purpose of the CBA it is assumed that trade would be displaced to Port Botany.

[11] ACCC (2019), Container stevedoring monitoring report (2018-19), <https://www.accc.gov.au/system/files/Container%20Stevedoring%20Monitoring%20Report%20-%202018-19.pdf>

[12] The Victorian Government (2023), Victorian Commercial Ports Strategy, <https://www.vic.gov.au/victorian-commercial-ports-strategy>

[13] Infrastructure Victoria (2017), Bay West preferred for Victoria's second container port, <https://www.infrastructurevictoria.com.au/2017/05/23/bay-west-preferred-for-victorias-second-container-port/>

[14] The Victorian Government (2023), Victorian Commercial Ports Strategy, <https://www.vic.gov.au/victorian-commercial-ports-strategy>

Given the context of this CBA, the selected base case was chosen from one of eight scenarios modelled by Black Quay in its capacity modelling for PoM. In line with DTF guidelines, a 'business as usual' base case has been selected, as to not overstate the benefits of PCEP and consider a realistic representation of the operational response (by stevedores investing and increasing productivity) that could transpire. A base case where no investment is being undertaken by PoM and stevedores do not invest in new equipment has not been considered appropriate for this CBA. The Black Quay study modelled eight scenarios relating to Port capacity, and Scenario B4 was chosen to reflect the capacity that could be achieved through stevedore investments in additional machinery and improvements in productivity (without proceeding with PCEP). Advice provided by Black Quay to PoM, suggests a TEU benchmark of 1,400 to 1,800 TEUs per quay line metre (QLM). This, therefore, implies that Scenario B4 is possibly only achievable if all productivity improvements assumed by Black Quay are achieved by the stevedores ahead of capacity being reached at the Port in 2037.

The results of the base case are underpinned by the Black Quay forecasts, which take into consideration several factors that may change. For example, the Black Quay study has incorporated assumptions around seasonal fluctuations and short-term disruptions. GHD vessel forecasts and Deloitte Access Economics trade forecasts are two of the key inputs to the economic modelling.

2.2.3 PCEP Options

PoM considered several potential engineering solutions that could be implemented as part of PCEP. PoM and its engineering team, then undertook an options selection process and identified three potential options. These were all consistent with the previous options that were explored in the 2050 PDS. These included:

- **Webb Dock North International Container Terminal (WDN ICT)** – two berth container terminal developed on the area north of WDE, on the eastern side of Webb Dock
- **Webb Dock West International Container Terminal (WDW ICT)** – two berth container terminal developed, on the western side of Webb Dock
- **River Berth at Swanson Dock East (SDE)** – transforming SDE by adding an additional one berth to the southern end of SDE, parallel with the Yarra River by demolishing part SDE Berth 1 and Appleton Berths B and C. This would mean that SDE would remain a 3-berth terminal long term and be able to service three 300 metre plus ships simultaneously, however this comes with a yard smaller than the current yard.

PoM separately commissioned work to determine the capital costs and capacity estimates of these options and found that the River Berth option was not suitable for CBA analysis. The River Berth option's capacity was decretive due to the reduction in yard capacity (from current yard capacity) and introducing the additional berth line to lift berth capacity, would be at the expense of yard storage, and therefore ruled out as an option under PCEP. The River Berth option also cuts off a potential pathway for relocating the auto trades upriver at some stage, to support long term Port growth.

Based on advice from PoM, and its internal review processes, WDN ICT and WDW ICT were the most appropriate options to be progressed to CBA. However, the selected options are subject to further design, refinement or change, which may result in a change in CAPEX assumptions. However, the sensitivity analysis shows that the BCR remains strong even with a 60% increase in CAPEX. For example, opportunities are being explored to expand or alter the proposed operations of TTOs in Victoria Dock, which are being considered as part of the progressive planning process and being tested through the appropriate decision gates. This is standard practice to ensure plans are refined with additional detail as they pass through each PoM planning decision gate.

In both PCEP options, Qube would be relocated further north in the SAV precinct, PrixCar would move off site, and the southern extension (extension of the quay line of Webb Dock to accommodate two 14,000 TEU vessels side by side by extending the wharf by approximately 70 metres) would be delivered at some stage as part of PCEP.

Under both options, a two-berth container terminal would be developed. The analysis remains agnostic as to the operator that might operate any new container terminal.

Option 1 – Webb Dock North (WDN)

WDN ICT includes changes to tenants and an enhancement to the Port. A two-berth container terminal would be developed in the area north of the existing VICT terminal, on the eastern side of Webb Dock. The dock would be extended northward to accommodate two 14,000 TEU vessels at berth simultaneously, providing the potential opportunity to implement WDW ICT in the future, if required.

Under this option, it is assumed TTOs loading and unloading would move from Webb Dock to Victoria Dock and off-port logistics within 15km. Auto trades would remain at Webb Dock. In this scenario, it is projected that container terminals area would increase, auto trades (as a whole) and Qube would have reduced land area, and general cargo would remain unchanged. Under Option 1, the space allocated for containers increases to around 2 million sqm at the expense of space for TTOs, auto trades and Qube.

Option 2 – Webb Dock West (WDW)

Similarly, WDW ICT includes changes to tenants and an enhancement to the Port. There would be a two-berth container terminal developed on the western side of Webb Dock. The dock would be extended north to 'future proof' the option and maintain the ability to implement WDN ICT in the future, when required.

Under this option, TTOs would temporarily relocate within Webb Dock to allow for berth realignment at WDN. Auto trades would move to Victoria Dock and Appleton Dock, sharing space with general cargo. Under Option 2, the space allocated for containers would increase. The area allocated for TTOs, auto trades, general cargo and Qube would decrease, with auto trades and general cargo/breakbulk sharing space within the SAV precinct. Based on discussions with PoM, it is assumed that break bulk (auto and general cargo) can accommodate future growth by utilising the space available in the Port.

Figure 2.2 Area across base case and PCEP options

Trade	Base case (sqm)	Option 1 (sqm)		Option 2 (sqm)	
Containers	1,497,727	2,017,727	↑	1,935,727	↑
Tasmanian	332,273	208,000 (ex. near port logistics)	↓	294,500	↓
Auto	422,228	392,582	↓	422,000 (auto and general cargo shared)	↓
General Cargo	80,000	80,000	–		
Auto + General Cargo	502,228	472,582		422,000	
Other (Qube)	140,386	approx. between 84,000 – 134,000	↓	approx. between 84,000 – 134,000	↓

Source: PoM

2.3 Costs and Benefits considered in the analysis

There are various costs and benefits associated with the base case and options that were considered as part of the CBA. Figure 2.3 and Figure 2.4 illustrate the scenarios using an import container supply chain example, and the details of each element quantified is described further in sections 2.3.2 and 2.3.3. This logic is also valid for exports. It should be noted, though not shown, empty container movements (including for land bridging) are included in the CBA.

The supply chain would be impacted differently under the base case and options. Under the base case, as capacity is forecasted to be reached, vessels would ultimately be diverted to Port Botany (after three years of vessel congestion), which would result in increased costs related to land bridging to transport the containers to/from Victoria. As such, consumers would experience increased supply chain costs. On the other hand, under both PCEP options, as capacity is expanded at the Port, costs associated with interstate land bridging would be avoided, along with vessel congestion. There are consumer/exporter savings also associated with economies of scale, as the Port would be able to accommodate larger ships. In addition, there would be increased economic activity for both the Port and stevedores. These savings and benefits would ultimately be passed onto the consumer, who would save due to the reduced costs in the supply chain.

Figure 2.3 Import container supply chain under the base case once capacity is reached

Source: Deloitte Access Economics

Figure 2.4 Import container supply chain with PCEP options implemented

Source: Deloitte Access Economics

Table 2.1 PCEP cost and benefit framework

Costs	Benefits
PoM/Tenants	
• Capital expenditure by PoM and tenants (CAPEX) • Structural maintenance and renewal expenditure by PoM and tenants	• On-port direct economic activity from capacity uplift (net of OPEX) • Residual land value of new container terminals • Residual value of new equipment and wharf
Cargo owners/Victorian community	
• Tasmanian trade near-port logistics truck movements to and from PoM • PrixCar off-port relocation supply chain costs • Tasmanian trade vessel steaming costs from relocation up-river • Automotive trade vessel steaming costs from relocation up-river • Container vessel costs (calling at PoM)	• Avoided land-bridging VOC and externalities of displaced container trade (road and rail) • Avoided vessel congestion cost • Cargo owner savings from avoided land bridging (road and rail) • Cargo owner savings from economies of scale of larger vessels calling at PoM

Source: Deloitte Access Economics

2.3.2 Costs

There were several costs considered in the analysis; where the costs of each PCEP option were compared against the base case, to derive the incremental costs for each PCEP option.

- **CAPEX by PoM and tenants:** The assumed costs incurred by tenants and PoM to build, replace or improve assets, which includes expenditure on equipment within the Port, such as cranes, automated guided vehicles and straddles, as well as CAPEX to build the new container terminal wharves and yard. It should be noted that tenant relocation costs (investment required to develop the new site where the current tenant will move to) have also been included.
- **Structural maintenance and renewal expenditure by PoM and tenants:** The cost to maintain and replace the built asset CAPEX is based on quantity surveyor (QS) estimates provided by PoM. This item represents the additional resource costs used to maintain the equipment, terminal, and assets (regular and structural maintenance) under PCEP, over and above what is required under the base case. It should be noted that OPEX for operating the equipment (labour, rent, consumables, overheads etc) and terminals is captured separately on a per TEU basis as part of the producer surplus calculation included in benefits. Over the 30-year time period given by PoM this comes out to 0.66% of CAPEX/year for Option 1.
- **Tasmanian trade near-port logistics truck movements to and from PoM:** Costs associated with moving Tasmanian trade to a location nearby the Port assumed to be within a 15km radius. These are the vehicle operating costs (VOC) and the related social and environmental costs associated with the extra distance travelled to the logistics site. This is only relevant to Option 1 and applied to 25% of Tasmanian

trade, based on data from TTOs. Land acquisition or rental payments for a new site are excluded, as they would be a transfer between parties, and are offset between base case and options.

- **PrixCar off-port relocation supply chain costs:** PrixCar is a tenant of the Port that may be relocated off Port under PCEP. Landside vehicle operating, social and environmental costs of moving auto trades (PDI function) to Truganina (the assumed new location) are captured in the CBA. This allows land to be available for auto terminal trade under Option 1, and the new container terminal in Option 2.
- **Tasmanian trade vessel steaming costs from relocation up-river:** Under Option 1, TTOs would be located upriver (to SAV precinct) compared to the base case. There would be additional steaming and emissions (environmental) costs, from travelling up the Yarra River to Victoria Dock.
- **Automotive trade vessel steaming costs from relocation up-river:** Similarly, when auto trades relocate upriver under Option 2, there would be additional steaming and environmental costs from vessels travelling further to Appleton and Victoria Docks, relative to the base case.
- **Container vessel costs (calling at PoM):** Under the base case, trade above PoM capacity is assumed to be diverted to Sydney (Port Botany), after 3 years of vessel congestion.[15] Under PCEP, this trade is no longer displaced (no land bridging), so vessels from the Eastern trade routes, which travel down the East Coast of Australia must travel further to Melbourne (compared to the base case). This additional travel length results in higher steaming and environmental costs, which are then passed on to cargo owners.

2.3.3 Benefits

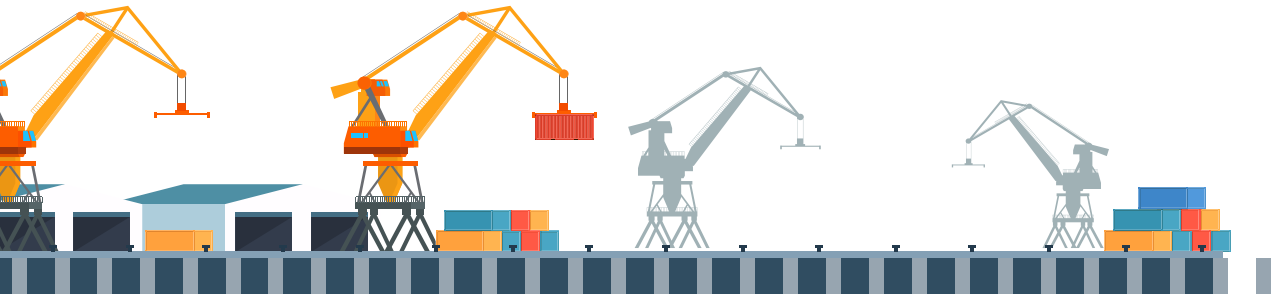
There were several benefits considered in the analysis, where the benefits of each PCEP option was compared with the base case, to derive the incremental benefits of each PCEP option.

- **On-port direct economic activity from capacity uplift (PoM/terminal operators):** Under PCEP, both PoM and terminal operators have increased operating profit summarily after PCEP has been implemented across the entire modelled period, due to increased capacity and activity at the Port. This reflects increased economic activity in Victoria which due to higher direct revenue (over and above the resource costs of additional operating costs), results in higher producer surplus in Victoria. The operating costs to both PoM and terminal operators capture labour, consumables, regular and ongoing maintenance, rent (cost to tenant, but revenue to PoM), and all OPEX relevant to the additional containers at the Port.
- **Avoided land bridging VOC and externalities of displaced container trade (road and rail):** Under the base case, when capacity is expected to be reached at PoM and after 3 years of vessel congestion, container trade is displaced to Sydney. Land bridging then takes place with road/rail moving displaced containers between Port Botany and Melbourne. This has associated VOC and social and environmental costs from the displaced container supply chain. These landside costs would be avoided under PCEP and are therefore treated as a saving to the Victorian import-export (IMEX) cargo owner. However, under PCEP, there would also be metro IMEX road/rail freight trips to/from PoM, which would be a landside cost under PCEP. This benefit item is reported as the net of these two effects.
- **Avoided vessel congestion cost:** Under the base case, when capacity is expected to be reached at PoM, it is assumed that there will be vessel congestion for a period of 3 years[16] (see 2.2.1). Under PCEP, with increased capacity, this vessel congestion would be avoided, and therefore treated as a saving passed on to the Victorian cargo owner. The additional vessel operating costs of calling at PoM are captured separately under costs (see 2.3.2). The vessel congestion is measured using a congestion charge and only applied to a share of total TEU (see section 3.1.3 for further details).

[15] Vessel congestion is assumed to persist at the Port for up to three years. This is based on the typical length of contractual arrangements of between two and five years, at which point containers are expected to be displaced. For instance, there is evidence to show that the typical contract period is three to five years (ACCC, Container stevedoring monitoring report (2018-19)).

[16] Vessel congestion can also appear temporarily under normal operating conditions for short periods.

- **Cargo owner savings from avoided land bridging (road and rail):** Under the base case, when capacity is expected to be reached at PoM and after 3 years of vessel congestion, container trade is displaced to Sydney. Land bridging then takes place with road/rail moving displaced containers between Port Botany and Melbourne. Under the base case, transport operators would then make a profit (revenue less costs). Under PCEP, this benefit item captures the savings to consumers from avoided land bridging (over and above the VOC savings). In effect, this is a switch of producer surplus from landside operators (under the base case) to cargo owners (under PCEP). Similar to the VOC benefit, this item is reported as net of the metro IMEX landside trip cost (to/from PoM) that occurs under PCEP.
- **Cargo owner savings from economies of scale of larger vessels calling at PoM:** Under PCEP, PoM would have increased capacity to handle larger vessels (over and above what is possible at Webb Dock under the base case). Using econometric modelling, it has been assumed that shipping lines would have reduced costs which will then be passed onto the consumer.
- **Residual value of new equipment and wharf:** This benefit captures the useful life of the equipment beyond the CBA horizon of 30 years, noting that regular and ongoing maintenance costs are included. Appendix B.1 has further information regarding the useful life assumed for equipment and the wharf.
- **Residual land value of new container terminals:** The expansion of the Port is assumed to have a longer life span beyond the CBA horizon of 30 years. As is typical in CBAs, this is measured as the discounted value of the future rental stream from the improvements of terminal land area (excluding the wharf), including the southern reclamation at Webb Dock, assuming a useful life of 50 years. These rents exclude the land value.



03
Base case analysis

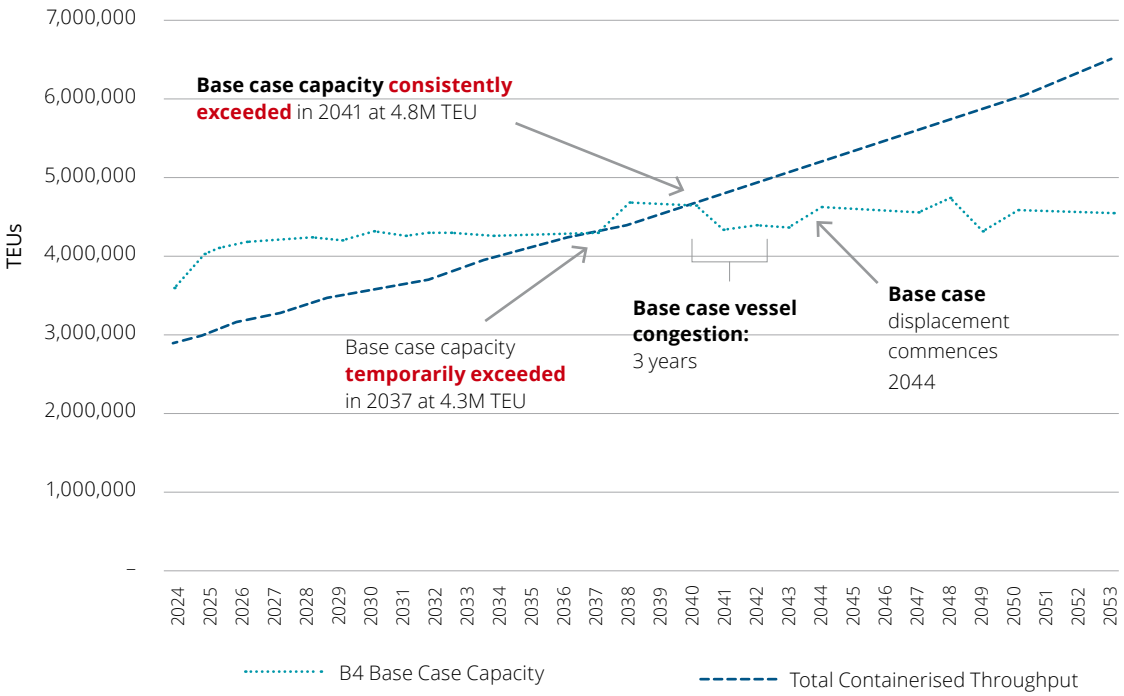
The base case used for the analysis is Scenario B4 modelled in the Black Quay Container Capacity Review. This scenario includes additional stevedore investment from 2025, as well as increased TEU ratio and crane rates, reflecting higher productivity.

3.1 Base Case Capacity

According to Scenario B4 in the Black Quay study, the base case capacity is not exceed by projected demand on a sustained basis until 2041 as shown in Chart 3.1 (4.8 million TEU). However, base case capacity is estimated to be temporarily exceeded in 2037 by a small margin. Due to changes in the forecast fleet composition incorporated in Black Quay estimates (sourced from GHD Ship Fleet Forecast), it is expected that there will be sufficient capacity to accommodate demand between 2038 and 2040. It is assumed that PoM will experience some vessel congestion in 2037 for one year.

The base case assumes that stevedores would undertake $321 million (PV terms) of CAPEX starting in 2025 (over a period of four years), in line with the capacity uplift assumed in Black Quay (Scenario B4) (see Chart B.1 for more details). PoM has not proceeded with PCEP under the base case. The base case capacity uplift (due to the associated equipment and productivity uplift) applies to the Swanson Dock and the current Webb Dock terminals, and therefore, is assumed to occur under PCEP options as well. The base case is dependent on stevedores making investments to improve container capacity at the Port. If stevedores don't make the investment and/or achieve the productivity assumptions under this scenario, capacity would be reached earlier leading to more displacement and an increase in relative net benefits of Option 1 and Option 2. That is, the net benefits of Option 1 and Option 2 may be understated if stevedores are not able to make the investments or deliver the productivity improvements as required under the base case (see 5.3.1 for more details).

Chart 3.1 Base Case Displacement of Container Trade



Source: Black Quay Consulting, Deloitte Access Economics

Once capacity is consistently reached,[17] estimated to be the forecast year of 2041, it has been assumed that vessel congestion would occur for 3 years after which container trade, which is no longer able to be accommodated, has been assumed to be displaced to Port Botany in Sydney. As a result, land bridging (road/rail freight) is required to service the needs of the Victorian consumers and exporters. In practice, the route for land bridging on rail is likely to involve several legs and points of handling. The route would include an initial movement on road or rail to an intermodal rail terminal in Sydney, capable of handling interstate freight (e.g., Moorebank). This is followed by a rail leg to at an intermodal terminal in Melbourne (e.g., Somerton), and a final movement by road to the cargo owner. Although there are several points of handling and mode changes which are required to practically achieve land bridging, a portion of these costs are also incurred in current operations of the supply chain without land bridging. As such, only the cost of the rail legs between Port Botany and Somerton Intermodal Terminal have been captured to avoid the risk of double counting.

The CBA modelling uses the Black Quay capacity estimates as a key input in the economic analysis. As noted, the volatility in the Black Quay estimates in the period between 2037 and 2041 is due to the incorporation of the GHD vessel forecasts, which has some variation in vessel sizes during that period. For further details, please refer to the Black Quay study.

3.1.2 Displacement

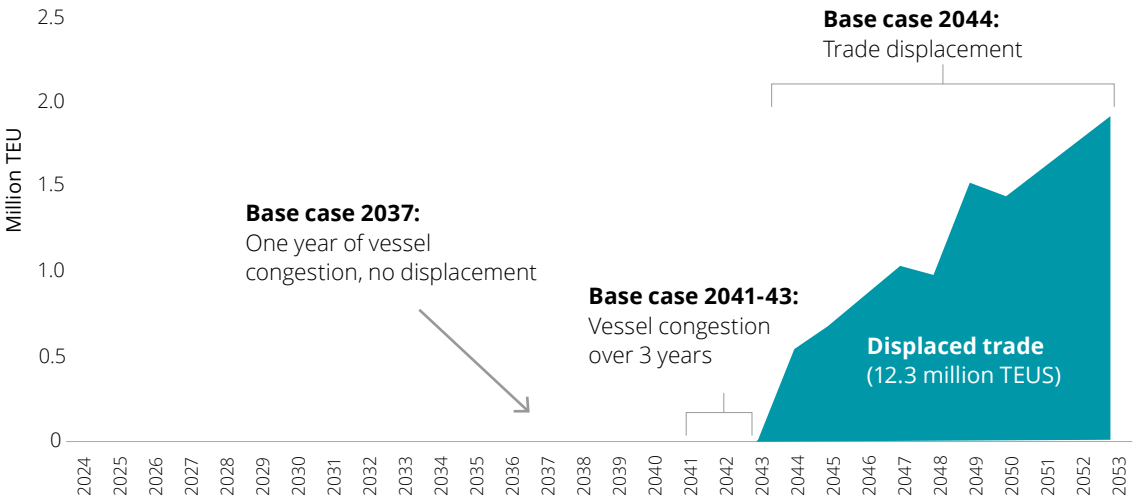
Displacement of containers under the base case would commence in 2044, rising to 1.91 million TEU by 2053 as shown in Chart 3.2 below.[18] Under the base case, capacity has been assumed to be reached on a sustained basis from 2041 which would then be followed by three years of vessel congestion. From 2044 onwards, containers would be displaced to Port Botany. It was assumed that Port Botany would create extra capacity to accommodate PoM container displacement and when required, expand capacity to continue to service

[17] While capacity is temporarily exceeded by forecast demand in 2037, for one year, capacity is only consistently reached from 2041. Thus displacement only occurs from three years after capacity is reached in 2041.

[18] Note that export trade originating in 'contestable' regions may switch to Sydney prior to three years (however this has not been modelled).

Melbourne volume. It is also assumed additional investment would also be required in the Sydney staging and empty container parks, as there would be more double handling of increased volumes in Port Botany. The cumulative displaced trade would be 12.3 million TEU between 2044 and 2053. It has been assumed that 8.1% of containers would be on rail in 2044, rising to 13% by 2053. Displacement of some containers to Adelaide has been considered, however, port capacity at Adelaide and shipping line preferences suggest that this would be an unrealistic assumption for the CBA and was excluded from the analysis.

Chart 3.2 Base Case Displacement of Container Trade



Source: Black Quay Consulting, Deloitte Access Economics

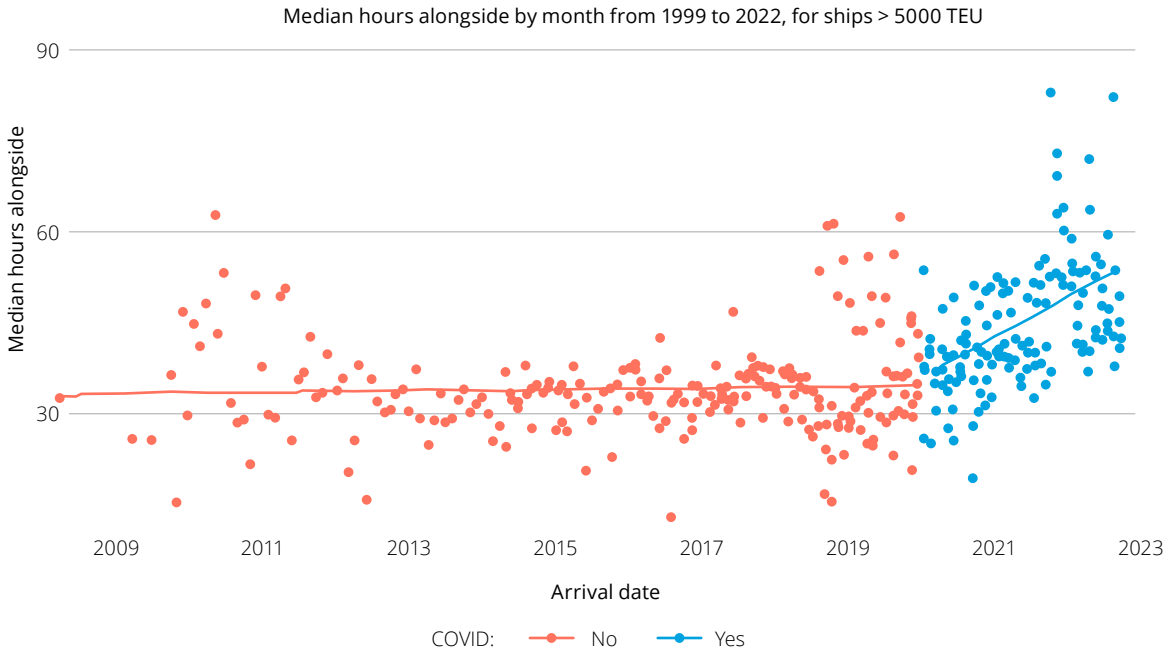
3.1.3 Economic approach to the cost of vessel congestion

To understand what happens to vessel delays (measured by 'alongside time') when operational capacity is not at optimal levels, PoM container vessel alongside time data was analysed in detail. Vessel data from 2009 onwards has been econometrically analysed, specifically focusing on the impact of the COVID pandemic on congestion as a representation of possible future congestion at the Port.

A regression discontinuity design (RDD) model was implemented to assess the impact of reaching capacity at the Port. It was found that while there was a positive trend over time of median hours alongside, leading up to the pandemic in relation to hours spent alongside; a significant change in wait times was experienced after 2020. Delays were experienced most intensely by larger ships, however, not all ships experienced longer than expected wait times. All results of this analysis were statistically significant.

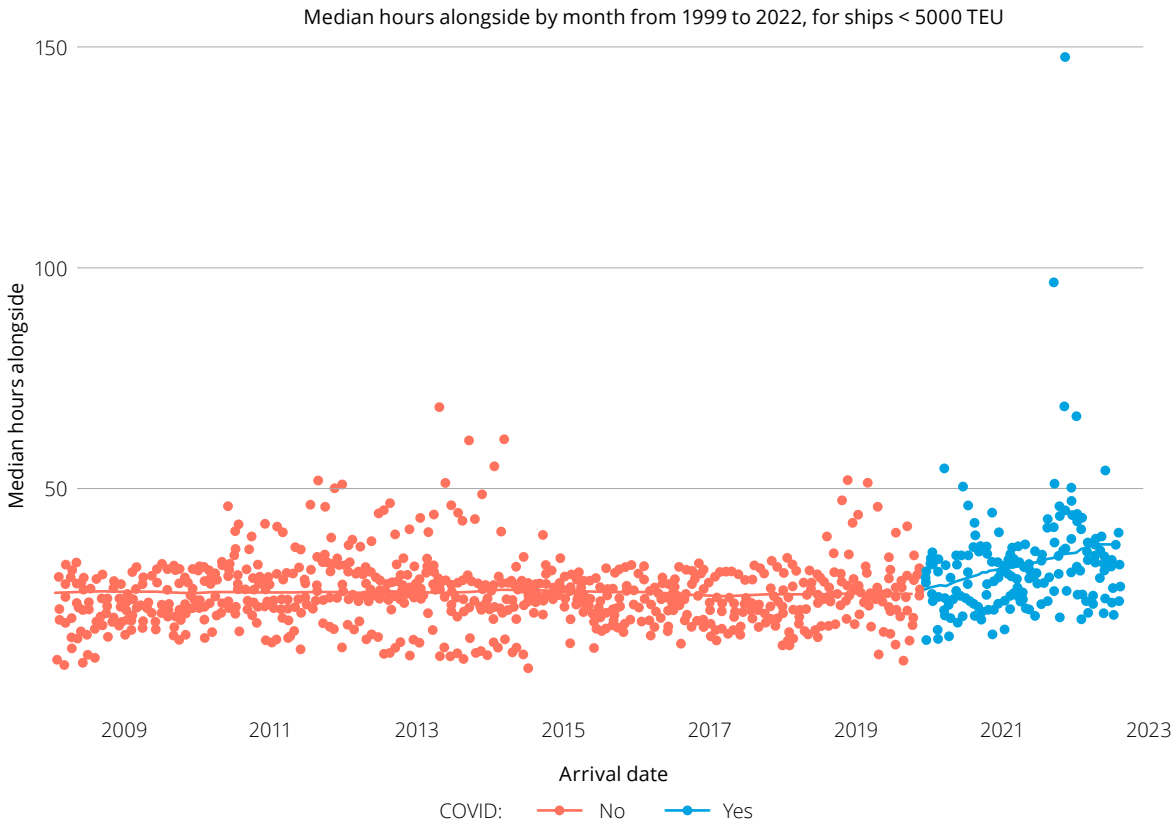
The analysis of wait times before and after the COVID period as per charts 3.3 and 3.4 below suggests that, when operational capacity (berth and yard) is reached, similar levels of congestion could be observed, particularly for larger vessels.

Chart 3.3 Vessel Delays Analysis for Over 5000 TEU ships



Source: Deloitte Access Economics and vessel data provided by PoM

Chart 3.4 Vessel Delays Analysis for Under 5000 TEU ships



Source: Deloitte Access Economics and vessel data provided by PoM

Vessel congestion charges

The insight from the PoM vessel congestion analysis was used to estimate the economic cost of vessel congestion during the 3-year period once capacity at the Port has been reached. Initially, some congestion may be tolerated at the Port, however as congestion worsens it would be addressed by diverting shipping lines and displacing trade. It may be the case that in practice, congestion costs would increase exponentially and would persist, even after land bridging starts. This may be considered an 'aggressive' or 'high' assumption in CBA terms. Instead, the applied approach is conservative, as it is possible that there could be increasing delays in the lead up to reaching capacity and as such, delays would be greater. It has been assumed that due to contractual obligations vessels would continue to call at PoM for 3 years.

Informed by charges imposed by major shipping lines, not PoM, Port congestion surcharges of approximately $471 per TEU (USD300) has been assumed in the CBA, which is the lowest level of congestion charges observed during the COVID period. It has been assumed that the Port congestion surcharge captures the productivity loss of vessel operations due to Port congestion which is then passed onto cargo owners. Based on desktop research of congestion charges (ranging from USD300[19] to 1000[20]), this is a conservative estimate. The congestion charge modelled in the CBA grows at 20% per year.[21] This means it reaches $682 per TEU in the third year of vessel congestion.

In practice, during COVID, all TEUs were subject to the congestion surcharge. However, for the purposes of this CBA, the surcharge was leveraged as a valuation approach to measure the market-based value of vessel congestion (representing lost productivity). During COVID, charges were applied to every TEU. However, it has been estimated that capacity will be reached gradually, rather than as a shock (like what occurred during COVID). For this reason, in the CBA, the charge has only been applied to a share of total throughput that experiences an above normal level of congestion. In practice, this could translate to the charge being seasonally applied during peaks to manage rising costs from cascading scheduling conflicts or for some shipping lines only. Over time, with congestion worsening, it is possible that in practice shipping lines would apply the charge to all TEUs, due to congestion having exponential effects on vessels. Part of this exponential nature is reflected by the 20% growth profile that is applied to the congestion charge.

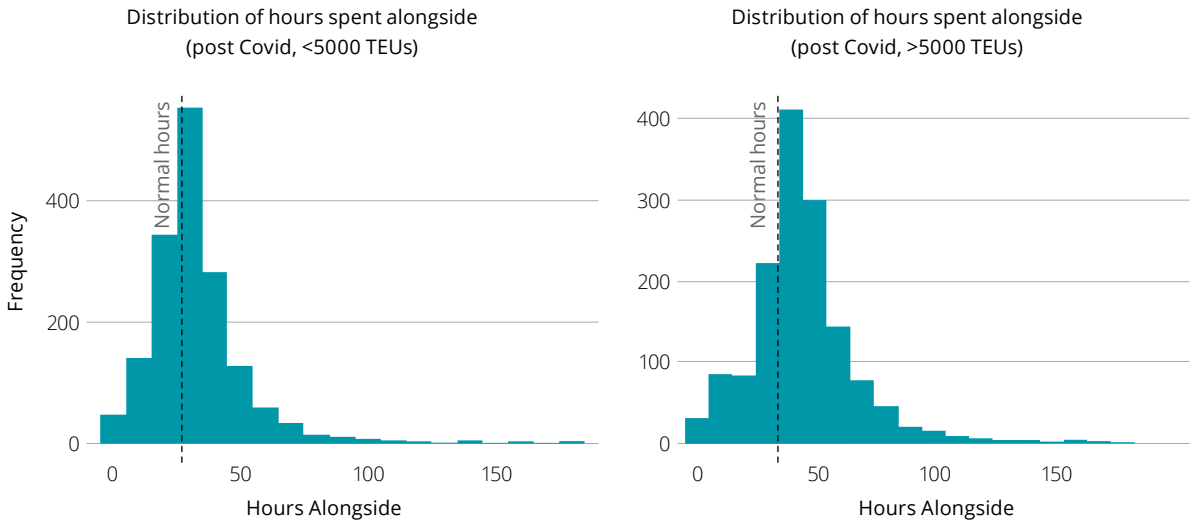
From the econometric analysis, 63.1% of ships with TEU capacity less than 5,000 and 75.6% with capacity greater than 5,000 TEUs experienced wait times greater than expected. For the CBA, the congestion surcharge has been applied as $471 x 75.6% for vessels with capacity over 5,000 TEU and $471 x 63.1% of vessels with TEU capacity less than 5,000, for 3 years, with an assumed 20% real growth in the charge each year, for three years. The scaling reflects the CBA valuation of congestion above nominal levels. In practice, however, as congestion worsens over time, with cascading scheduling conflicts, all vessels could face above nominal congestion – this effect is captured by the real growth in the congestion charge over time. The vessel congestion surcharge is applied over the duration of the three-year vessel congestion period. The share of vessels which the surcharge is applied to, is however, tested in the sensitivity analysis where all TEUs are subject to the congestion charge. This increases the vessel congestion savings (in PV terms) under Option 1 and Option 2, by $1,298 million and $749 million, respectively.

[19] Dieterle & Victory (2020), Melbourne/Brisbane Port Congestion Surcharge and other relevant updates, https://www.dieterle-victory.com/melbourne-brisbane-port-congestion-surcharge-and-other-relevant-updates/

[20] OOOCL (2020), Congestion Surcharge USD 1000 – Container, https://www.oocl.com/newzealand/eng/localinformation/localnews/2020/Pages/Congestion-Surcharge-USD-1000---Container-.aspx

[21] The rate of growth used is the same growth in vessel congestion that was seen during the first two years of COVID.

Chart 3.5 Distribution Analysis for ships above and below 5000 TEUs



Source: Deloitte Access Economics and vessel data provided by PoM

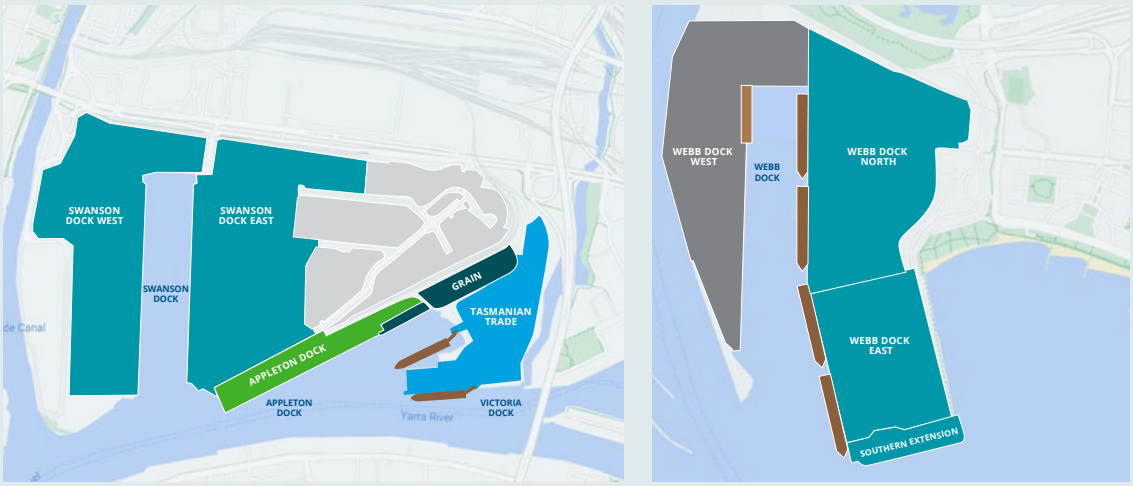
04
PCEP options analysis

4.1 Option 1 Webb Dock North International Container Terminal

Option 1 would provide for a two-berth container terminal developed on the area north of the existing VICT terminal, on the eastern side of Webb Dock. The dock would accommodate two 14,000 TEU vessels with LOA of 366m. Additional stevedore investments in cranes and straddles (as per the base case) would remain for existing terminals, and the capacity uplift under the base case is also assumed to persist.

Option 1 would involve TTOs moving from Webb Dock to Victoria Dock with off-port logistics. It was assumed PrixCar moves off-port to Truganina. Qube would re-locate further north in the SAV precinct, and Auto trades would remain in Webb Dock.

Figure 4.1 Option 1, tenant locations



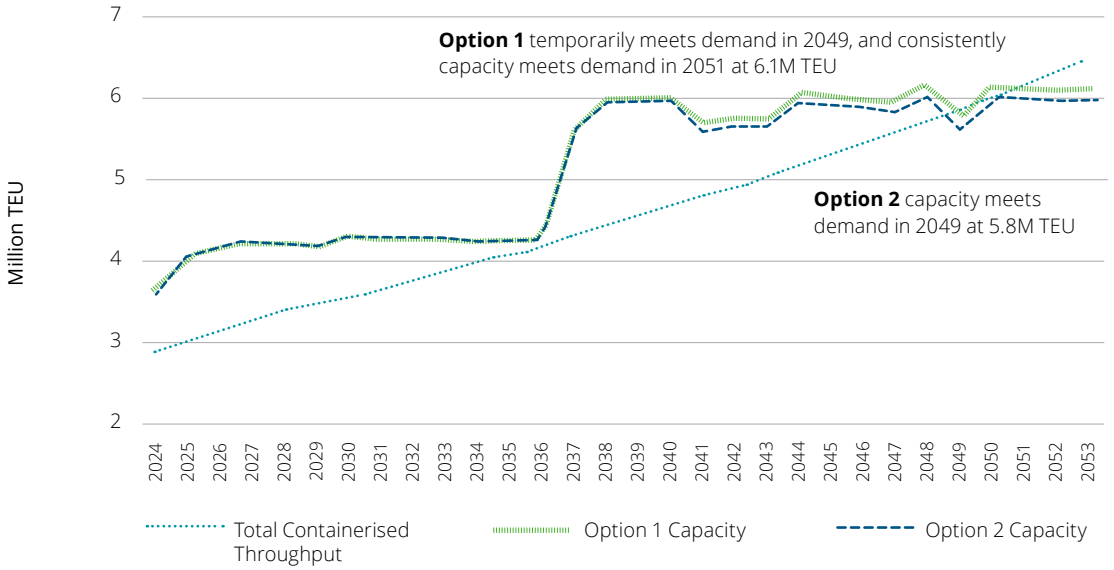
Source: PoM

4.1.1 Option 1 Capacity

Capacity under PCEP would increase significantly, compared to the base case. Under Option 1, PoM would be able to accommodate total containerised throughput until 2051 with a maximum of 6.1 million TEU as shown in Chart 4.1.

Capacity under Option 1 would follow the same trajectory as the base case until 2037. In 2037, when the ICT would go live, capacity under Option 1 would increase from 4.3 to 5.63 million TEUs. Under Option 1, PoM could continue to meet demand until 2051, thereafter, additional capacity would be required to avoid displacement of container trade.

Chart 4.1 Projected Capacity and Total Container Throughput



Source: Black Quay Consulting, Deloitte Access Economics

4.1.2 Displacement

Once capacity is expected to be reached, for 3 years it was assumed that vessel congestion would rise and then there would be displacement to Port Botany in Sydney. Given the trade forecasts, for Option 1 there was no displacement in the evaluation period of this analysis, however, displacement may occur once the 3-year vessel congestion ends, post-reaching capacity in 2051. Therefore, there would be vessel congestion from 2051-2053 and no trade displacement for this analysis period. The capacity uplift from Option 1 would avoid cumulative container displacement of 14.5 million TEU by 2053. It has been assumed that Victorian demand for imports and supply of exports are not impacted by supply chain costs, which is in line with CBA guidelines of holding consumer demand exogenous to the model. If imports and exports fell due to increased costs, then this would still lead to a loss of consumer and producer surplus.

PCEP would avoid the displacement that is modelled to occur from 2044 under the base case. Undertaking PCEP would avoid vessel congestion costs, which are calculated based on the additional freight costs imposed during COVID (see 3.1.3). This is the cost that is most sensitive to delays in implementing PCEP, as a delay of three years only causes an increase in vessel congestion costs and does not initially impact land-bridging. After the first three years, the benefits of reduced displaced trade are the reduced VOC, cargo owner, and social and environmental costs, due to less trucks and trains moving between Melbourne and Sydney.

The reduced landside costs will mean that exporters pay less to export their goods, and importers will see decreased prices. This will flow on to both Victorian consumers and producers in a variety of sectors. Conversely, displacement to Sydney comes with a small benefit of reduced vessel steaming costs on Eastern Trade Routes. As transporting a TEU by sea costs less than by land,[22] this cost is heavily outweighed by the costs of land-bridging.

4.1.3 Tasmanian Trade

The CBA assumes that TTO logistics would relocate to a suitable location within 15km of the Port under Option 1. When PCEP comes online, all movements (current and increased from PCEP) would incur increased vehicle operating, environmental and social costs from the increased distance travelled, as well as increased handling costs from moving off port.

Additionally, TTOs would relocate upriver to the SAV precinct. This has been forecast to add additional steaming time inbound and outbound for TTO vessels. Relocating TTOs, increases steaming costs from the vessel moving further, as well as increased costs due to increased carbon emissions. Section 5 provides a breakdown of the cost.

4.1.4 On-port direct economic activity from capacity uplift

An increase in capacity results in increased lifts. As much of the costs of container handing are fixed, incremental lifts have a profit margin. For tenants, this is $52.5/TEU, which is the revenue from each lift subtracting the costs (including labour, equipment, rent and others). As such, this can be multiplied by the increased number of TEUs processed by tenants to determine the forecast economic surplus. For PoM, costs and benefits per lift have been derived from the regulatory model. Each additional lift is expected to result in increased profit for PoM, and, as such, this represents a benefit in the CBA modelling.

4.1.5 Capital expenditure, structural maintenance and renewal

Option 1 would incur capital costs to PoM, as well as later structural maintenance and renewal costs to keep the capital running over time. It has been assumed that Option 1 has a capital expenditure of $2,384 million in NPV terms. The structural maintenance and renewal in Option 1 is $160 million in NPV terms.

Operational expenditure has not been included in the model, as operating expenditure due to PCEP is captured by on-port direct economic activity from capacity uplift. This has increased revenue, net of OPEX, so a further line-item for operational expenditure is not required. Structural maintenance and renewal is not included in the increased economic activity, and as such has been considered separately.

4.1.6 Preserving optionality for future port expansion

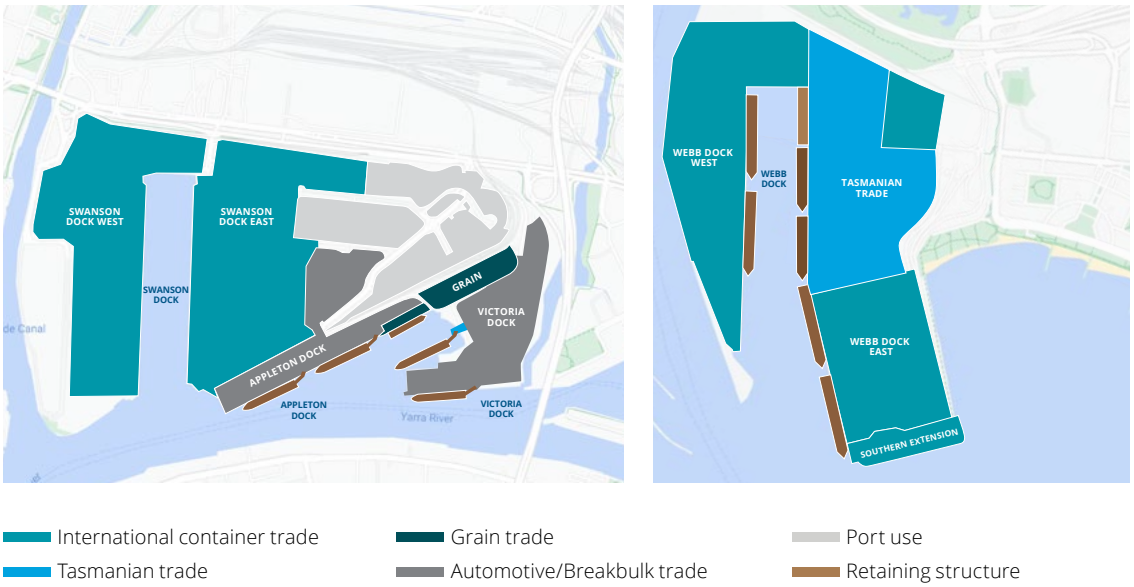
WDN would also allow for optionality and port expansion in the future, to continue container capacity growth. With TTOs relocated to the SAV precinct, WDN may have the option to gain more container space if required, from auto trades. With WDW, there would be no space to expand, unless TTOs are relocated. Therefore, WDN would provide better future optionality to accommodate for future container capacity.

[22] BITRE, 2017, 'Interstate Road, Rail and Sea Freight Rates', https://www.bitre.gov.au/sites/default/files/is_090.pdf

4.2 Option 2 Webb Dock West International Container Terminal

Option 2 would provide a two-berth container terminal developed on the western side of Webb Dock. The quayline would be extended north to future proof and maintain the ability to expand long term. The dock would accommodate two 14,000 TEU vessels with LOA 366m. Additional stevedore investments in cranes and straddles (as per base case) would remain for existing terminals. Option 2 would involve TTOs remaining at Webb Dock and auto trade moving to Victoria Dock and Appleton Dock sharing the space with break bulk. Like Option 1, PrixCar would move off-port assumed to Truganina and Qube will re-locate further north in the SAV precinct.

Figure 4.2 Option 2, tenant locations



Source: PoM

4.2.1 Option 2 Capacity

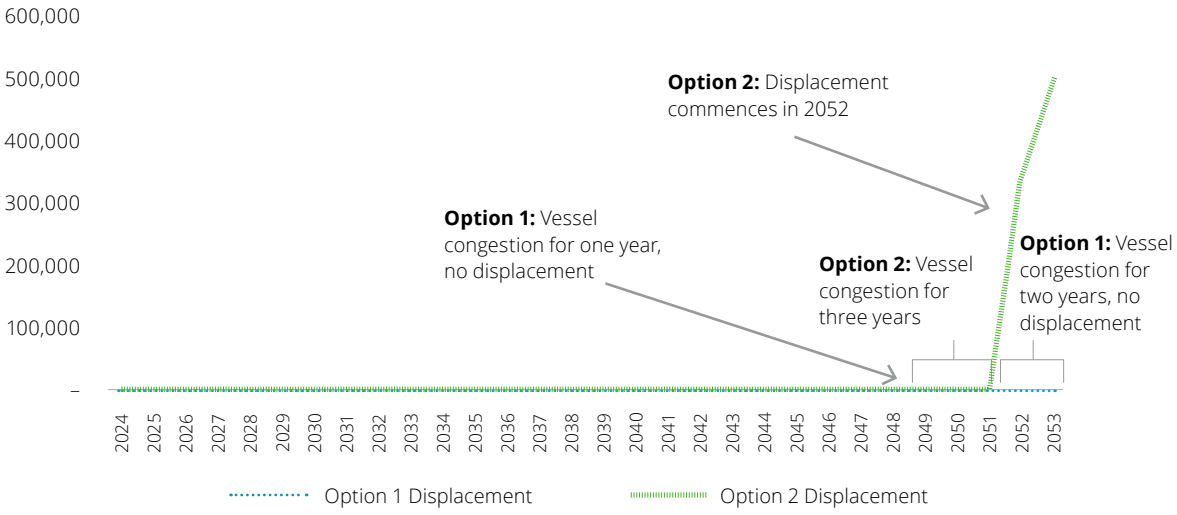
Option 2 would accommodate total containerised throughput until 2049 with a maximum of 5.8 million TEU as shown in Chart 4.1.

Similar to Option 1, capacity would grow at the same rate as under the base case until the ICT is completed, which would see an increase of capacity from 4.3 to 5.57 million TEU in 2037, just under the capacity in Option 1. By proceeding with Option 2, PoM could continue meeting demand until 2049, thereafter additional capacity would be required to avoid port congestion and displacement of container trade.

4.2.2 Displacement

Similar to Option 1, once capacity is reached, for 3 years, it has been assumed that vessel congestion would rise, and would therefore be displaced to Sydney. Under Option 2, there is vessel congestion from 2049-2051. From 2052, container trade would be displaced to Port Botany (Sydney), reaching 0.5 million TEU in 2053 using road and rail to/from Victoria as shown in Chart 4.2. The cumulative displacement is 0.7 million TEU. It has been assumed that Victorian demand for imports and supply of exports, would remain impervious to supply chain costs.

Chart 4.2 PCEP Options Container Trade Displacement



Source: Black Quay Consulting, Deloitte Access Economics

4.2.3 Automotive trade

Under Option 2, Automotive trade would move up the Yarra River from Webb Dock West to Appleton Dock and Victoria Dock. The timing of displacement and the method of calculating costs of displacement are assumed to be the same as for Tasmanian trade.

05
CBA Results

5.1 Summary

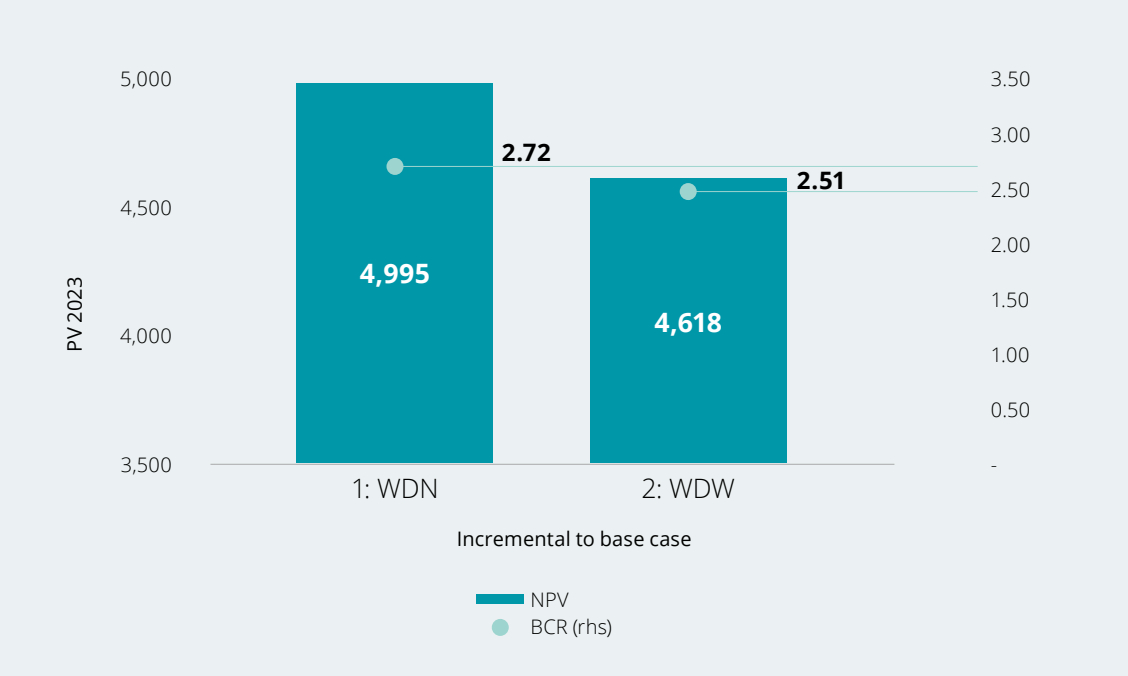
Results show that implementing PCEP would produce a net benefit of $5.0 billion (PV) under Option 1 (WDN), with a BCR of 2.72 relative to the base case. Option 2 (WDW) would generate $4.6 billion (PV) in net benefits, with a BCR of 2.51.

Table 5.1 Cost-benefit analysis 2024 to 2053 (PV $ millions), incremental to the base case

	Option 1 WDN	Option 2 WDW
Costs		
Capital expenditure by PoM and tenants (CAPEX)	2,384	2,744
Structural maintenance and renewal	160	173
Tasmanian trade near-port logistics truck movements to and from PoM	179	-
PrixCar off-port relocation supply chain costs	90	89
Tasmanian trade vessel steaming costs from relocation up-river	45	-
Automotive trade vessel steaming costs from relocation up-river	-	11
Container vessel costs (calling at PoM)	49	46
Benefits		
On-port direct economic activity from capacity uplift (net of OPEX)		
Port of Melbourne	561	444
Terminal Operators	121	116
Residual land value of new container terminals	133	110
Avoided land-bridging VOC and externalities of displaced container trade		
Road	2,626	2,484
Rail	53	50
Avoided vessel congestion cost	644	880
Cargo owner savings from avoided land bridging (road and rail)	2,572	2,432
Cargo owner savings from economies of scale of larger vessels at PoM	1,112	1,105
Residual value of new equipment and wharf	81	62
Total		
Costs	2,907	3,064
Benefits	7,902	7,682
NPV	**4,995**	**4,618**
BCR	**2.72**	**2.51**

Source: Deloitte Access Economics
Note: Results are incremental to the base case

Chart 5.1 CBA Results – Incremental to the base case ($PV, millions)



Source: Deloitte Access Economics
Note: Chart is truncated so should not be used to observe proportionality

5.1.2 Costs

- There would be **increased capital expenditure** by both PoM and tenants if PoM proceeds with PCEP. In the base case, investment is made by stevedores to improve operational efficiency. However, under the options, both stevedores and PoM would enhance the capacity and efficiency of the Port. Greater CAPEX would be made in Option 2, relative to Option 1 and the base case.
- **Structural maintenance expenditure is higher under both options** compared to the base case, as it refers to the additional structural assets (machinery, equipment, and fixed assets) under PCEP. As there is greater CAPEX in Option 2, the structural maintenance expenditure is higher than Option 1.
- In Option 1, TTOs would relocate upriver, and 25% of the trade would need to access an off-port logistics facility (assumed to be within 15kms of the Port), and there would be a cost associated with **increased truck movements for TTOs**. This would not occur in the base case or under Option 2.
- In both options, PrixCar is expected to be relocated off-port, it has been assumed, for the purposes of this analysis, to another location such as Truganina (16.4 Km distance). This would result in **increased supply chain costs for PrixCar customers**, were PrixCar relocated. Option 1 would have a greater cost as the relocation would occur one year earlier and would therefore have an extra year of costs associated with the relocation.
- Moving TTOs (Option 1) or automotive trade (Option 2) upriver would create increased vessel operating costs as vessels would be required to travel further upriver.
- **Container vessel costs would increase** under both options, as container capacity increases with PCEP, and more vessels would call at PoM (relative to the base case). Of course, these additional costs (both metro IMEX landside movements and vessel costs) offset against the savings from avoided land bridging.

5.1.3 Benefits

- There would be **increased economic activity** from the capacity uplift for both PoM and tenants, as the Port would be able to handle a larger number of TEUs per annum.
- As a result of building the new container terminals, there would be **increased residual land value** under both options. This reflects the value that tenants are able to generate from this land and the value that exists beyond the horizon of the CBA.
- Increasing port capacity would **avoid vehicle operating costs and externalities of land bridging** (rail and road) under both options.
- Increasing Port capacity would **decrease vessel congestion**. The avoided cost would be greater under Option 2, as under Option 1, there would be four years of congestion costs. This is because there is an additional year of vessel congestion which occurs in 2049 in option 1 which does not occur in option 2. Relative to the base case, this causes the avoided vessel congestion cost for Option 1 to be lower than Option 2.
- **Cargo owners would experience monetary savings from avoided land bridging**, which is significantly more expensive than transporting cargo and containers by ship.
- **Cargo owners would experience savings from economies of scale,** as increased capacity would allow for larger ships to arrive, which ultimately reduces their costs.
- There would be an **increased residual value** of new equipment at the Port under both options, relative to the base case.

Overall, the analysis shows that there is an increasing net welfare benefit to the State by delivering PCEP relative to the base case. There would be an advantage in the implementation of Option 1 (WDN ICT), when compared with Option 2 (WDW ICT). This is due to Option 1 allowing TTOs to retain long term tenure at the Port and provides the option to increase container capacity at WDW in the future. Further, Option 1 is no longer constrained by TTOs, which are instead located in the SAV precinct. Therefore, under Option 1, there would be a possibility to continue to grow container capacity further, which would not be possible in Option 2.

5.2 Qualitative considerations

In a CBA not all costs and benefits are necessarily quantifiable. As such, these could be considered outside of the modelling and assessed qualitatively. Effects of some qualitative considerations, such as competition or risk, could be ambiguous.

Competition effects

PCEP has two main competitive effects. Firstly, the effect of competition between the Ports of Melbourne and Botany, where the trade in northern Victoria and southern NSW is potentially contestable. The distance between these ports is quite large, and as such, expanding capacity is unlikely to have large effects on competition between these two ports in terms of container capacity. Secondly, there are the 'within port' competitive effects. Implementing PCEP could mean that stevedores may have more capacity for new trade, which may mean shipping lines then have the option to move between stevedores. PCEP is unlikely to have major effects on landside competition, where trucking and rail companies operate in broader container supply chain, of which, the Port is only one component. However, the landside constraints, which are external to PCEP, could then be binding upon both road and rail operators.

Given the height restrictions imposed by the West Gate bridge, the maximum vessel size that can be accommodated at Swanson dock is 10,000 TEU capacity vessels.[23] By contrast, there is no vessel size constraint

[23] Black Quay Consulting, Port of Melbourne – Container Capacity Review, (report commissioned by Port of Melbourne)

at Webb Dock. With PCEP, there would be two terminals at Webb Dock, which would be capable of accepting ships of approximately up to 14,000 TEU capacity. This suggests that there could be a difference in economies of scale from larger ships at Webb Dock. In the long run, as vessel sizes grow, this could result in bifurcation of trade between Swanson and Webb docks with larger vessels calling at Webb Dock. It should also be noted that this bifurcation risk already exists under the base case with one terminal at Webb Dock. Ultimately, the extent to which this competition effect transpires will, of course depend on shipping line contracts and commercial arrangements between parties.

However, it is not apparent that the competition question would be an immediate concern over the 30-year horizon of the economic analysis of this study. Based on vessel forecasts provided by PoM,[24] larger vessels in the 14,000 TEU class are not expected to become typical until 2046 (10% of vessel visits).

Near port and network landside congestion

The CBA has not captured near-port landside supply chain costs of increased congestion. Based on PoM advice, it has been assumed that landside and near-port congestion remain manageable, with the possibility of congestion post-2050. Near-port congestion is the congestion in the direct vicinity of the Port and would be measured with the increased travel time costs, VOC and environmental costs incurred by increased delay in travel times near the Port.

Near-port congestion could arise as a result of PCEP if the container throughput in the Port becomes greater than what is possible to accommodate with the current landside infrastructure (both road and rail). It is unlikely for there to be further increases to near-port landside congestion without PCEP, as lower capacity to handle shipping containers would mean road transport networks are not the binding constraint. Associated costs of this congestion in 2051 and beyond could be mitigated by further expenditure on near-port road and rail capacity, however, this is likely to have its own sets of costs and benefits, and therefore is outside the scope of this model.

There are also significant rail freight (port rail shuttle network (PRSN) and Webb Dock Rail) initiatives that are considered outside the scope of this CBA. Realising a greater rail mode share would rely on the success of these initiatives to reduce the number of trucks on the road and reduce potential congestion and other externalities. Congestion across the rest of Melbourne is likely to remain similar between the base case and options as diverted trade would still travel through Melbourne to reach the end customer.

Risk profile of land-bridging

Land bridging changes the risk profile of Victoria's supply chain, placing greater risks on landside disruptions and lower risks on marine-side disruptions. With increased pressure on roads, events such as natural disasters that impact roads between Sydney and Melbourne could increase risks in the supply chain. Conversely, risks at sea – such as storms, would be lower due to ships travelling a shorter distance to Sydney. This could impact the timing of cargo in Victoria and therefore consumption and industrial activity. If the risk profile of land-bridging outweighs the risk of addition sea-freight, then the CBA as modelled would underrepresent the benefits of PCEP.

Some of the risk caused by land bridging would be captured in the insurance of the vehicle or vessel, which is captured as part of vehicle operating costs. This could reflect greater risks to the overall supply chain, and this assumes that insurance is constant over the time period, meaning that increased landside movements does not affect the risk profile. Increased movements are likely to increase the probability of crashes, which, alongside the direct cost is captured in social costs. The additional movements could also create congestion, which is associated with increased costs of moving goods between Sydney and Melbourne.

[24] Port of Melbourne Future Containership Fleet Analysis, 2022-2050, <https://www.portofmelbourne.com/wp-content/uploads/GHD-PoM-Future-Containership-Fleet-Analysis-Tech-Paper_2050_Final_20220902.pdf>

Operating at maximum capacity

Operating the Port at maximum capacity for 30 years could further increase risk to cargo holders. This could increase the cost of disruptions caused by unexpected shutdowns or unexpected damage to port equipment. If the Port is fully utilised, then it means that any shutdowns require congestion of trade or land bridging. If the Port is not at full capacity, then trade may be able to be diverted to other stevedores at the Port, depending on contractual obligations, which may reduce the social costs. As such, a conservative approach has been taken in this CBA, as it assumes that capacity is constant, and does not model shutdowns, such as those that could occur during trade union negotiations. Short declines in capacity could be particularly costly compared to consistent delays, as congestion at the Port has a higher yearly cost than land bridging, which grows exponentially over the congestion period.

Increased risk could also have behavioural impacts on importers and exporters, which could adjust to the increased risk by relying more on warehousing. The possibility of this was highlighted during the COVID pandemic, where port users increased inventories in response to the increased risk from COVID delays and shutdowns.[25] The cost of increasing and holding inventory to respond to an increased risk, would be the increased cost of supplying warehousing, which would likely be passed onto the consumer, as well as any out-of-state warehousing profits, which would be less likely, as warehousing would be to serve Victorian consumers.

Interstate capacity

The CBA does not assess the viability of moving container trade interstate or the CAPEX that would be required to support this in Port Botany. Port Botany's forward-looking capacity, following considerable investment in productivity improvement, is estimated at over 7.2 million TEU, and current throughput is 2.8 million TEU.[26] Port Botany has a regulatory requirement to ensure that demand does not exceed capacity, so would likely be required to expand capacity if capacity was reached due to land bridging. Additional costs to upgrade Port Botany could flow through to the Victorian community through higher port interface costs, however, this has not been quantified. If Port Botany did not upgrade capacity, then this could have further flow-on effects. If the CBA is expanded to capture NSW, should there be upgrades required at Port Botany, these would also then be captured in the analysis, it has been assumed that this might be similar to those incurred under PCEP.

If Port Botany could not be utilised, then trade would have to travel to other Australian ports, such as Adelaide, Newcastle, or Brisbane, which could be associated with greater land bridging costs. Moving trade further than Port Botany, could also decrease vessel costs (savings to consumers), however, it is expected that landside costs would outweigh the savings from shorter vessel distances, as seen by landside costs outweighing vessel costs savings from the displacement to Port Botany in the CBA.

As such, it is expected that if Port Botany reached capacity, then the benefits of PCEP would be higher if displaced containers called at Brisbane (or Newcastle) instead, increasing the net benefit of PCEP.

Asset utilisation

The analysis accounted for additional revenue to stevedores from the uplift in capacity in the CBA, however the CBA does not measure the impacts of the redistribution of revenue between existing and new terminal operators, or potential underutilisation of assets. From a CBA point of view, the distribution of revenue between terminals is not an area of focus of the CBA as these are transfer payments which do not impact the overall costs or benefits within the State. It has also been assumed that, with growing demand, stevedores

[25] Johanson and Cummins (2022), From 'just in time' to 'just in case', supply chain crunch hits big sheds, Sydney Morning Herald, https://www.smh.com.au/business/companies/from-just-in-time-to-just-in-case-supply-chain-crunch-hits-big-sheds-20220905-p5bfi5.html

[26] NSW Ports (2015), 'Navigating the future: NSW Ports 30 year plan', https://www.nswports.com.au/sites/default/files/Uploads/Publications/NSW-Ports-Master-Plan-2015.pdf

would respond appropriately to increase investment, implying that asset utilisation would, in effect, be optimised.

Currently, the Port of Melbourne has excess capacity of 1.1 million TEU. Under PCEP Option 1, in the first year, spare capacity would rise to 1.3 million TEU, and fall between 2037 and 2051, when capacity would be reached. As such, PCEP does not result in a level of excess capacity that is materially different from what has been experienced in recent history and stevedores are unlikely to change behaviour due to increased excess capacity.

The minimum efficient scale is the point at which firms can produce where long run average costs are minimised. In economic literature, this is the point at which firms efficiently compete with each other. In the context of stevedoring, this requires stevedores to expand at a level where there is enough excess capacity to deliver goods without congestion costs, but with not so much excess capacity that costs increase to recover the costs of the excess. Assuming that the excess capacity currently falls within this threshold, which would be enabled by a competitive stevedoring market, then keeping capacity within this range with PCEP would likely keep costs low for consumers.

Social and environmental externalities during the construction phase

Construction undertaken for PCEP may have some un-costed environmental and social impacts, such as increased noise, congestion, port user disruption and emissions during construction. These have not been included in the modelling, as they are likely to be minor in scale compared to other costs and benefits in the CBA.

Any project that went ahead would go through a full statutory approvals process which would assess all environmental risks, including biodiversity risks. These would be mitigated using appropriate strategies as developed by the Port as required for the Environmental Impact Statement approval. The environmental externalities of the construction phase would be explored in detail in this assessment.

5.3 Sensitivity analysis

As part of this CBA, a sensitivity analysis was performed to understand how the results would change under different assumptions that underpin the model.

5.3.1 Black Quay capacity scenarios

The base case is a key factor that contributes to the analysis of the two options. Choosing the base case is integral to the outcomes of the CBA. The Black Quay scenario B4 has been selected for use in the analysis, the reasoning behind which is outlined in section 2.1.

Scenario D1 is a more optimistic scenario, compared to Scenario B4 and current conditions. With respect to current productivities, Scenario D1 has an increased TEU ratio, crane rate, no seasonal peaking and larger vessels at Swanson Dock. Scenario D1 increases the capacity of the Port, so PCEP is delivered later for both options. The impact of which means that Options 1 and 2 NPV and BCR decreases, due to a stronger base case, which mitigates the need for land-bridging and lowers the benefit in the options.

Scenario B1 is a relatively more conservative base case selection. It assumes an increased TEU ratio, while all other aspects remain the same as current productivities. This means that capacity is forecast to be reached sooner, which means that Option 1 is brought forward. Option 2 is modelled to start construction in FY24, and as such cannot be brought forward further, meaning PCEP is delivered after container capacity is reached. This would result in Option 1 and 2 NPV and BCR increasing, due to PCEP preventing more land bridging.

Table 5.2 Sensitivity analysis for Black Quay capacity scenarios keeping PCEP timing as per core scenario

		Option 1	Option 2
Core capacity (Scenario B4)	NPV	4,995	4,618
	BCR	2.72	2.51
High capacity (Scenario D1)	NPV	3,977	3,114
	BCR	2.38	2.03
Low capacity (Scenario B1)	NPV	6,771	6,121
	BCR	3.30	2.97

Source: Deloitte Access Economics

5.3.2 Containerised trade forecast

The trade forecast underpins when capacity will be reached, which impacts related displacement and congestion costs. Increasing the trade forecast would result in capacity being reached earlier in the base case and options. Similarly, a lower trade forecast would mean that displacement and congestion costs would begin later. The high and low scenarios shown below are based on the high and low scenarios in Deloitte's containerised trade scenarios.

Table 5.3 Sensitivity analysis for containerised trade forecast keeping PCEP timing as per core scenario

		Option 1	Option 2
Core demand	NPV	4,995	4,618
	BCR	2.72	2.51
High demand	NPV	7,604	7,033
	BCR	3.58	3.27
Low demand	NPV	3,534	3,168
	BCR	2.23	2.04

Source: Deloitte Access Economics

5.3.3 Timing of PCEP commencement

Core CBA timing for Options 1 and 2 are chosen so that PCEP comes online in 2037, when congestion is forecast to occur temporarily. In the CBA, it is assumed that PCEP construction would commence in 2027 under Option 1 and 2024 under Option 2. In this sensitivity, the start of PCEP construction is delayed by 3 years and brought forward by 3 years to test implications on the CBA. It should be noted that the start date for Option 2 cannot be brought forward as there would be insufficient time to undertake required planning, construction, and delivery of PCEP. The 30-year period of the cashflow remains unchanged and is as per the core scenario. In essence, the capacity uplift from changing the timing interacts with the trade demand forecasts and Black Quay Study capacity estimation to then alter the timing of costs and benefits relative to the core scenario. For further details see Appendix E.

Delaying PCEP (3 years after 2037) could reduce the infrastructure expenditure (to both PoM and tenants) in present value terms relative to the core scenario, however, it comes at the expense of additional vessel congestion costs and disrupted supply chains. Delaying PCEP also impacts the distribution of benefits between stakeholders. If PCEP is delayed, the Victorian community is expected to incur a higher share of the cost due to the land bridging implications and the cost pass-through to end consumers as well as the social & environmental impact.

If PCEP is brought forward (3 years earlier than 2037), it increases the present value of costs, as expenditure would occur earlier, without decreasing the amount of congestion or displacement. In other words, infrastructure costs are expended before they are required. In the core timing, additional capacity from PCEP is assumed to come online in 2037 when capacity is required to meet the core trade demand forecast. This results in a lower NPV and BCR for the low scenario of this sensitivity analysis when compared to the base case.

Table 5.4 Sensitivity analysis of PCEP timing

		Option 1	Option 2
Core (2037)	NPV	4,995	4,618
	BCR	2.72	2.51
Later (3 years later)	NPV	4,605	4,271
	BCR	2.98	2.70
Early (3 years earlier)*	NPV	4,805	NA
	BCR	2.34	NA

Source: Deloitte Access Economics
*Option 2 cannot be brought forward, as it requires CAPEX to begin earlier than FY24, which is not realistic or plausible.

5.3.4 Contingency CAPEX & structural maintenance and renewal

CAPEX is a key component of the CBA and the largest cost associated with the base case and options. As such, it has significant impacts on the net benefits and BCR. CAPEX sensitivity analysis is tested on 30% lower or 60% higher than the assumed costs as this is the estimated accuracy of the cost.

Table 5.5 Sensitivity analysis for contingency CAPEX & structural maintenance and renewal

		Option 1	Option 2
Core (100%)	NPV	4,995	4,618
	BCR	2.72	2.51
High (+60%)	NPV	3,565	2,972
	BCR	1.82	1.63
Low (-30%)	NPV	5,711	5,441
	BCR	3.61	3.43

Source: Deloitte Access Economics

The results from all sensitivity analyses are detailed in Appendix E.

06
Key findings

Outlined below are five key findings resulting from the analysis:

01 The base case scenario is insufficient to meet forecast trade demand

Under the base case, stevedores would make investments which would increase the operational capacity and productivity of the Port. However, while this could meet demand in the short term, ultimately capacity would still be reached sooner than when it would be reached under both options. As such, continuing a 'business as usual' scenario with investment undertaken by stevedores is insufficient to meet the trade demands of the next 30 years.

02 Proceeding with PCEP would create net benefits to Victoria

As additional capacity is delivered at the Port, there are several benefits to be gained by the Victorian economy, which would be greater than the benefits of the base case. Under PCEP, there would be greater economic activity at the Port, reduced overall supply chain costs due to avoided land bridging and vessel congestion, and larger ships accommodated at the Port, meaning economies of scale are experienced. As such, proceeding with PCEP would benefit the Victorian economy.

03 Option 1 (WDN ICT) has greater net benefits than Option 2 (WDW ICT)

While both options have net benefits, Option 1 (WDN ICT) has greater benefits relative to the base case. There is increased capacity compared to Option 2, which would result in greater benefits to be gained by the Victorian economy, through benefits to the Port, stevedores, and consumers. Option 1 also allows for greater optionality to expand capacity in the future, and has a lower CAPEX compared to Option 2.

04 Not proceeding with PCEP could have significant impacts on the supply chain and ultimately consumers

Without proceeding with PCEP, the Port would reach capacity earlier resulting in significant disruptions to the supply chain. As vessels are assumed to be diverted to Port Botany, containers would need to be transported by rail and road to Victoria. This would result in increased vehicle operating costs, road damage and negative externalities which is significantly more expensive than the vessel operating costs associated with arriving at PoM. Consumers and exporters in Victoria would face higher supply chain costs putting pressure on households and export business margins.

05 Delivering PCEP at an appropriate time can be beneficial to Victoria

There is a window of opportunity for when capacity uplift of the Port should be delivered (according to trade demand forecasts and capacity estimates). The analysis suggests there is a six-year[27] window in which PCEP could be delivered and yield a strong net benefit to the Victorian economy.

[27] This has been informed by the Black Quay capacity estimates compared with Deloitte trade forecasts, in the sensitivity analysis of delivering PCEP between 2034 and 2041, 3 years before and 3 years after the year capacity is temporarily exceeded in 2037.

Appendix A
CBA Overview

A.1. Introduction

A CBA examines the economic costs and benefits of a project or policy proposal to society. It is a tool for determining whether the societal benefits of a project (or policy) are outweighed by the societal costs, and, if so, to what extent.

This CBA has been undertaken in line with the following government guidance:
- Office of Best Practice Regulation: Cost-benefit analysis guidance note
- Victorian DTF: Economic Evaluation for Business Cases Technical guidelines.

A.2. Methodology

The CBA considers costs and benefits directly attributable to PCEP (capital expenditure, operating expenditure and revenue).

Undertaking a CBA in accordance with these guidelines involves five key steps.

Step 1: Defining a base case and project case and, as relevant, project delivery options
A CBA only considers costs and benefits that can be attributed to the reform in question. The total benefits and costs of a given proposal (the 'project case/s') are compared to those that would have otherwise occurred in the absence of the reform (the 'base case'). Only incremental costs and benefits of project cases are considered, relative to the base case.

In many cases, there are different options for delivering the project. In these circumstances, the costs and benefits of each project option are compared to the base case. The analysis can therefore be a useful tool for ranking options (including the base case) according to the extent to which benefits outweigh costs.

In the context of PCEP, the base case is the scenario in which no projects are developed, and stevedores make necessary investments in machinery to increase capacity.

Step 2: Identifying the costs and benefits of the project
All reasonable costs and benefits of the project should be identified, including both tangible and intangible impacts. Common categories of stakeholders affected by a proposal, for which the relevant costs and benefits incurred or accrued should be incorporated, include households or residents, businesses, the environment, government, and non-government organisations. This includes governments at the federal, state, and local level.

Step 3: Quantifying the time series path of each cost and benefit, wherever possible, or qualitatively acknowledging costs and benefits that cannot be quantified
Each cost and benefit is quantified in monetary terms by using market values and prices. These estimates are extended throughout the modelled period to obtain costs and benefits over the life of the project.

Step 4: Ascertaining the net present value (NPV) of the time series path for each cost and benefit
As some impacts of a proposal are often immediate (such as upfront establishment costs), while others tend

to occur over longer periods of time (such as the ongoing market benefits), costs and benefits are compared in NPV terms. Comparing the impacts that occur over different time periods to arrive at an overall project evaluation requires a method of comparing impacts in the present versus those in the future: a discounted cash-flow analysis. This approach provides an estimate of the NPV of all costs and benefits, and therefore, whether the benefits exceed the costs in present value terms.

The net return (discounted benefit over discounted costs) is expressed in the form of a ratio, referred to as the benefit cost ratio (BCR). A BCR greater than one indicates that net benefits related to the proposal are greater than net costs (or for every $1.00 in costs, a return greater than $1.00 is achieved). The reverse is true for a BCR of less than one.

Step 5: Interpreting and testing the results

The central BCR figure of the CBA should be supported by further analysis by way of sensitivity and distributional analysis to guide government decision-making.

Sensitivity analysis shows the sensitivity of results to key assumptions and other factors, which can reasonably be expected to impact the level of costs and benefits. Sensitivity analysis is most useful when there is a meaningful testing of such factors, rather than arbitrary contingencies. However, this depends on the information available. The sensitivity analysis undertaken for this project is presented together with the results.

Distributional analysis is used to understand how a policy impacts different stakeholders and considers to whom the benefits accrue and by whom the costs are incurred. It is based on the premise that not all agents within the economy will benefit equally from government decisions, and in some cases, depending on the objectives of the decision being made, the allocation of resources within the community can be more, or just as important, as the overall BCR. Where possible, the distributional impacts of this proposal have been noted.

Finally, to support the analysis, all assumptions, data or information sources, and the basis for calculations must be documented. This has been carried out throughout the report.

Appendix B
CBA Calculations

B.1. Costs

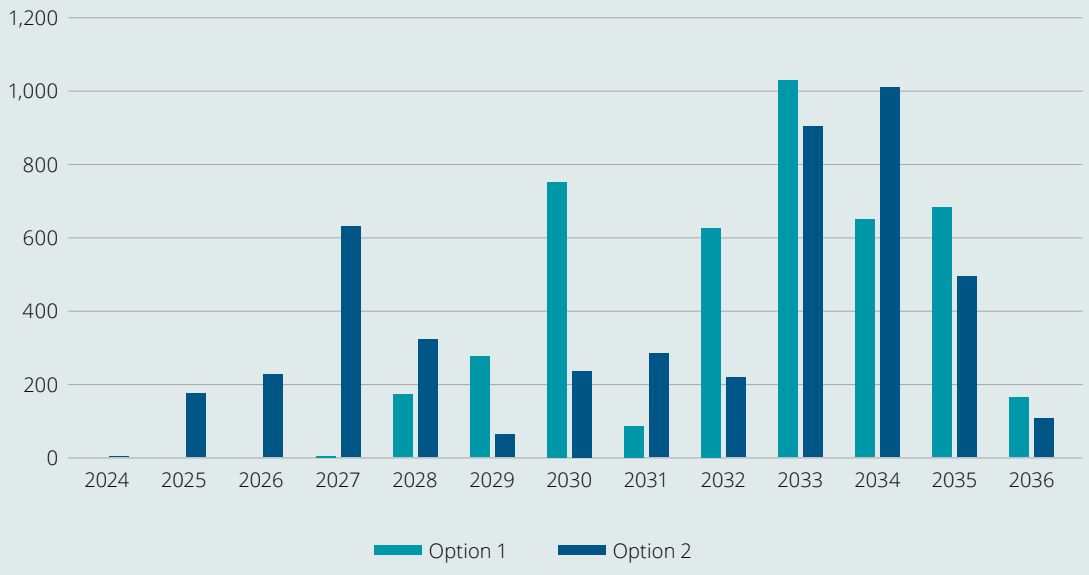
Capital expenditure

For the base case, CAPEX is based on the amount of equipment required in Scenario D4 in Black Quay. To determine the capital expenditure, only the costs of additional equipment have been measured and assumed to be spent over 4 years. In the base case, it is assumed that equipment would be renewed at the end of its useful life, where useful lives are provided by PoM. An approximate equation for base case capex is:

CAPEX = Amount of additional equipment × cost of additional equipment

In Options 1 and 2, CAPEX is provided by PoM. It is assumed that CAPEX for Option 1 would begin in 2027 and that Option 2 CAPEX would begin in 2024.

Chart B.1 PoM and Stevedore CAPEX over time for Options 1 and 2, incremental to the base case

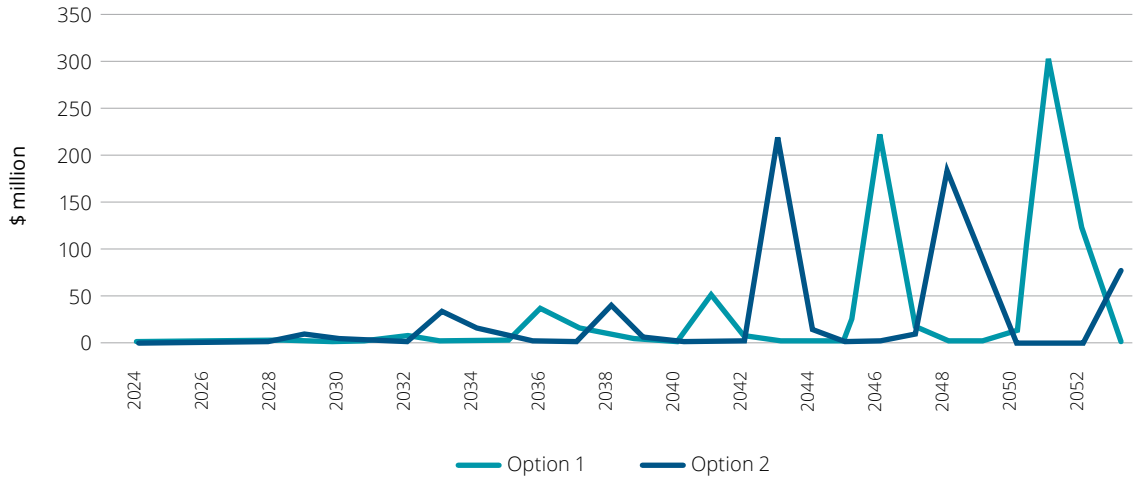


Source: Deloitte Access Economics based on PoM estimates

Structural maintenance and renewal

Estimates for structural maintenance and renewal were given from PoM. Their costs over time are shown below:

Chart B.2 Structural maintenance and renewal costs over time



Source: Deloitte Access Economics based on PoM estimates

Tasmanian trade near-port logistics truck movements

This cost measures the increased vehicle operating, environmental and social costs of trucks from on-port logistics facilities to moving near-port logistics facilities. Further details on costs of heavy vehicle movements for Tasmanian trade are given in avoided land bridging, and further details on Tasmanian trade relocation are given in 4.1.3.

PrixCar off-port relocation supply chain costs

Further details on the calculation to find the costs of heavy vehicle movements for PrixCar relocation are for vehicle operating costs for road and rail, an approximate equation for this is:

Avoided land bridging = The number of TEUs that are displaced × the proportion of freight on land × the distance on road between PoM and off-port locationPort Botany × vehicle operating costs

Tasmanian trade vessel steaming costs

An approximate formula for the increased Tasmanian trade vessel steaming costs is:

Increased steaming costs = Increased time from moving upriver × (steaming cost per minute per TEU + emissions cost per minute per TEU) × number of TEU that are diverted upriver

Automotive trade vessel steaming costs

The additional vessel operating costs and carbon emissions are estimated in the same way as for Tasmanian trade movement up-river in Option 1 with vehicles instead of TEU.

Container vessel costs

This assumes that there is an additional cost per TEU of $32 for large vessels and $38 for small vessels making the trip between Sydney and Melbourne. The approximate equation for this is:

Vessel costs = Steaming and environmental cost per TEU × proportion of trade coming from Asia × number of TEUs diverted to Port Botany

B.2. Benefits

On-port direct economic activity

Increased on-port direct economic activity are based on the increased TEU throughput, multiplied by the operating profit per TEU in ACCC container stevedoring monitoring report 2021-22[28] and increased rent for PoM. An approximate equation for the direct economic activity for stevedores is:

Stevedore economic activity = Revenue per TEU × TEUs that are not diverted to Port Botany – cost per TEU × TEUs that are not diverted to Port Botany

The approximate equation for direct economic activity for PoM is:

PoM economic activity = Channel and wharfage fees per TEU × number of TEUs + increased rental rates from PCEP – cost per TEU processed to PoM

Residual land value of new container terminal

The value of this is the present value of the rental flow in 2053. For Option 1 the residual land value in 2053 is $1,013 million and for Option 2 the residual land value in 2053 is $840 million. The equation for present value is:

$$PV = \frac{rental\ flow}{(1+discount\ rate)^{remaining\ years}}$$

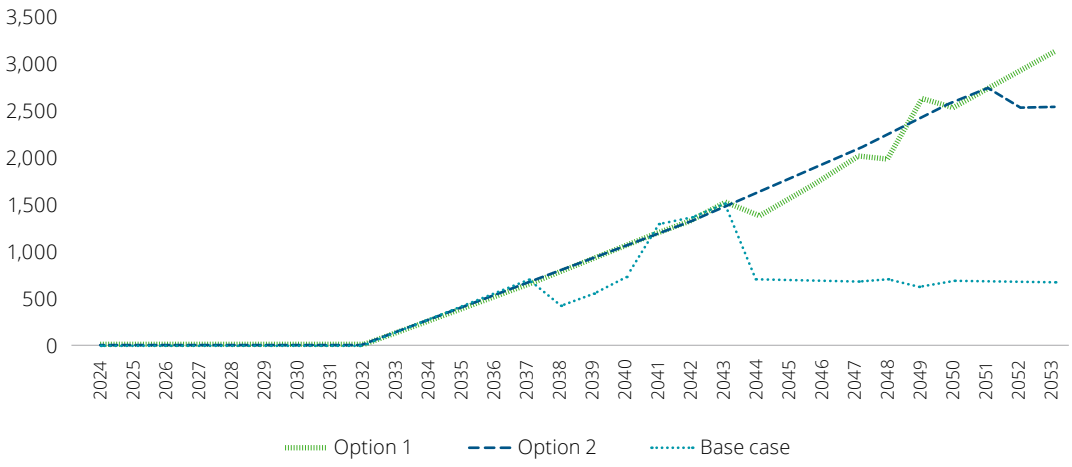
Avoided land bridging

For vehicle operating costs for road and rail, an approximate equation for this is:

Avoided land bridging = The number of TEUs that are displaced × the proportion of freight on land × the distance on road between PoM and Port Botany × vehicle operating costs

Further details on these costs are given in 3.1.2. The costs over time are given below in Chart B.3.

Chart B.3 Avoided land bridging vehicle operating, social and environmental costs over time



Source: Deloitte Access Economics

[28] ACCC (December 2022), Container stevedoring monitoring report 2021-22, <https://www.accc.gov.au/system/files/Container%20stevedoring%20monitoring%20report%202021-22.pdf>.

Avoided vessel congestion

Further details on how this is calculated is available in 3.1.3. An approximate equation for this is:

Avoided vessel congestion = Containerised throughput at PoM (capped at capacity) × port congestion surcharge × share of throughput surcharge is applied to

Cargo owner savings from land bridging

The calculation of cargo owner savings uses the market rate of land bridging, subtract the vehicle operating costs. An approximate equation for this is:

Cargo owner savings from land bridging= (Quoted cost of shipping a TEU from Sydney - vehicle operating costs per TEU) × number of TEUs that are diverted to Port Botany

Cargo owner savings from economies of scale

It is assumed that economies of scale from larger ships cause a reduction of freight rates in the options. An approximate equation for this is:

Cargo owner savings from economies of scale = Reduction in freight rate from larger ships being able to dock × number of containers

Residual value of new equipment and wharf

The residual value is the remainder of their capital expenditure depending on their useful life assuming linear depreciation and a 20% scrap value. An approximate equation of how this is calculated is below:

Residual value = (CAPEX-scrap value)/Useful life) × remaining life at end of model+ scrap value

Appendix C
Assumptions

A crucial step of the CBA is to outline any assumptions used in the analysis. It is important to recognise and address the inherent uncertainties that exists in the intricate world of economic evaluations. Assumptions play a pivotal role in navigating these uncertainties and shape the outcome of the results. It is important to note, there were assumptions made from the inputs which have been reviewed and deemed reasonable by Deloitte including:

- Capacity Forecasts[29]
  - Black Quay – Scenario B4 for base case, Scenario D1 & B1 for upper and lower capacity sensitivity scenarios
  - PoM advice on options capacity.

- Fleet Forecast (GHD)
  - Throughput by vessel size by dock
  - Vessel visits by vessel size.

- Containerised Trade Forecast (Deloitte Access Economics).

For PCEP CBA, assumptions used in the model have been outlined in Table C.1 to provide a straightforward explanation and the origin of the assumptions.

Table C.1 CBA Model assumptions

Benefit/Cost	Assumption	Description	Source	Assumption values
Port machinery costs (relates to capital expenditure by tenants in base case)	Useful life	Number of years the equipment is expected to remain operational	PoM	STS: 20 years ASC: 25 years AGV: 10 years Straddle: 12.5 years
	Numbers of STS cranes	Number of units in operations, and the number of units in each Black Quay scenario	PoM, Black Quay	Base = 27 Option 1/2 = 37
	Numbers of ASC cranes	Number of units in operations, and the number of units in each Black Quay scenario	PoM, Black Quay	Base = 30 Option 1 = 74 Option 2 = 46
	Equipment purchase costs	Cost to purchase an additional piece of machinery	PoM	STS: $20m ASC: $5.4m AGV: $1.5m Straddle: $1.9m

[29] Black Quay assumptions for base case (Scenario B4): Gross crane rate – 27 gmph (WDE) 30 gmph (SDE & SDW), TEU ratio – 1.60 to 1.70 by 2030, SD Terminal operators to invest in 1 over 3 straddles.

Options capacity input provided by PoM assumes 1.7 TEU ratio and 30 gmph across Option 1 and Option 2.

Benefit/Cost	Assumption	Description	Source	Assumption values
Yarra Channel vessel costs (relates to Auto & Tasmanian trade vessel steaming costs from relocation up-river)	Change in transit time	Change in vessel transit time due to relocation between Breakwater Pier and Appleton Berth	OPX Yarra Channel Study	Inbound: 24 min Outbound: 31.5 min
	Tasmanian trade TEU throughput	Forecasted TEU throughput of Tasmanian trade	Deloitte Access Economics Trade Forecast	Time series
	Yarra Channel – Tasmanian trade deadweight tonnage	Weight of Tasmanian trade	PoM	13,000 tonnes/ship
	Auto trade tonnage	Weight of Auto trade	PoM	Time series from DAE trade forecast
	Vessel operating cost	Cost to operate a vessel, measured in $/minute/TEU	Deloitte internal modelling, based on various sources and quoted container rates on coastal shipping	$0.3/minute/TEU
Vessel congestion (relates to avoided vessel congestion cost)	Port congestion surcharge	Lower bound of the surcharge that was applied to containers going through PoM during COVID	Dieterle & Victory	$471 AUD ($300 USD) scaled by 20% per year
	Vessels experiencing above nominal congestion	Share of vessels experiencing above nominal congestion	GHD Fleet forecast	Time series
Tasmanian trade near-port logistics truck movements to and from PoM	Distance between logistics and shipping	Distance between new Tasmanian trade logistics and shipping	PoM estimates	15km
	Share of Tasmanian trade movements, which move between shipping and logistics	Share of Tasmanian trade movements, between new logistics facility and shipping	PoM	25%
Producer surplus **(relates to on-port direct economic activity from capacity uplift, net of OPEX)**	Operating profit per TEU	Revenue gained by stevedores per TEU (handling – cost of handling)	ACCC Container Stevedoring Monitoring Report 2021-22	$52.5
	Port cost of handling container trade per TEU	Costs to PoM for handling an extra TEU	Acil Allen	$17

Benefit/Cost	Assumption	Description	Source	Assumption values
Consumer surplus (relates to Cargo owner savings from avoided land bridging (road and rail)	Freight rates between Port Botany and Melbourne	Cost to a cargo holder to ship a container between Sydney and Melbourne by road and rail	Deloitte research	Road: $2,415 (including VoC) Rail: $1,197 (including VoC)
PoM tenant profile (relates to residual land value of new container terminals and direct economic activity from capacity uplift)	Square metre (sqm)	Square metres of land for tenants of the Port	PoM	See Figure 2.2
	Rental rate	Rental rate of tenant's land of the Port ($/sqm)	PoM	Confidential
Landside parameters (relates to avoided land bridging VOC and externalities of displaced container trade)	Vehicle operating costs	Cost to operate a truck and/or train between Port Botany and Port of Melbourne	Deloitte internal VOC model (refer to Appendix D for further breakdown)	Road: $1,333/TEU (entire journey) $1.6/TEU/km Rail: $655/TEU (entire journey) $0.6/TEU/km
	Social and environment cost	External costs to society and the environment from increased road/rail travel for a trip between Port Botany and PoM	ATAP (Australian Transport Assessment and Planning) Guidelines, NSW DPE	Road: $299/TEU (entire journey) Rail: $93/TEU (entire journey)
	Rail and road productivity (metro/ interstate)	Number of TEU a truck and/or train carries on average between Port Botany and PoM	WSP Memo, PoM Container Logistics Chain Study	Road: 1.7 TEU Rail: 84 TEU
	Distances (kms)	Distances between Port Botany and Melbourne	Deloitte research	Road: 836 km Rail: 1,044 km

Benefit/Cost	Assumption	Description	Source	Assumption values
Vessel alongside time and stevedore productivity (relates to on-port direct economic activity from capacity uplift, net of OPEX)	Median vessel time at berth	Median time a vessel spent at berth during COVID	Deloitte analysis of PoM data	<5k TEU: 32.2 hours 5k to 10k TEU: 46.9 hours
	Increase in hours spent post COVID	Average increase in hours spent at the Port following March 2020	Deloitte analysis of PoM data	<5k TEU: 7.5 hours 5k to 10k TEU: 11.6 hours
Economies of saving from larger vessels (relates to Cargo owner savings from economies of scale of larger vessels calling at PoM)	Ratio of freight rate to average vessel size	Percentage change of freight rate when average vessel size increases by 1%	Lin, Y. H., & Tseng, P. (2017). The impact of vessel size on freight rates: A panel data analysis. Journal of Transport Economics and Policy, 51(4), 439-457.	-2.7%
	Freight rate	Average cost of shipping freight between Asia and Melbourne	Drewry Container ship fleet forecast and maritime economic assessment (2017)	$1,335
	Change in average vessel size	Predicted change in average vessel sizes due to PCEP	Drewry Container ship fleet forecast and maritime economic assessment (2017)	Base case: 0.5% Options: 2%

Appendix D
Landside vehicle operating cost parameters

After capacity is reached under the base case, it has been assumed that trade would be diverted to other ports in Australia. In the base case, the cumulative displaced trade between 2044 and 2053 is 12.3 million TEU. For container trade, Deloitte has assumed that all containers are diverted to Port Botany.

The trade will then either be required to travel by road or rail to Melbourne, typically going to a distribution centre. Deloitte has assumed that 8.1% of this displaced trade will travel by rail in 2044, which will rise to 13.0% of trade in 2053. Each of these travel modes are associated with vehicle operating costs and external costs which are shown in Table D.1.

The external costs for travel are shown below:

Table D.1 External costs of travel

Item	Road (% of cost)	Rail (% of cost)
Noise	7.8%	32.6%
Air pollution	12.4%	10.8%
Climate change	7.7%	4.6%
WTT emissions	2.3%	21.5%
Soil and water	5.4%	7.5%
Nature and landscape	0.7%	2.7%
Urban effects	4.0%	4.5%
Biodiversity	1.9%	0.2%
Road/track wear	44.5%	15.6%
Crash risk	13.2%	-

Source: ATAP (2020) & Transport for NSW (2020)

Inter-city trips are associated with a cost to Victoria, as Deloitte has assumed that economic activity associated with interstate shipping is attributed interstate.

Table D.2 Vehicle operating costs components of a road trip to Port of Melbourne

Item	Cost (%) Somerton	Rail (% of cost) Port Botany
Depot Handling cost	31.1%	4.1%
Crew costs	27.0%	20.9%
Capital cost	7.9%	5.9%
Insurance and registration costs	1.6%	1.2%
Fuel costs	6.2%	43.2%
Maintenance costs	1.2%	1.0%
Consumables and other costs	1.4%	8.6%
Tolls	4.6%	2.1%
Margin	12.2%	13.1%
Extra costs	0.0%	0.0%

Source: Deloitte Access Economics
Note: There may be additional handling costs however this has been excluded to prevent any potential double counting or transfer effects

Table D.3 Vehicle operating costs components of a rail trip from Port Botany to Port of Melbourne

Item	Cost (%)
Fuel costs	28.0%
Crew costs	9.2%
Maintenance costs	12.0%
Capital cost	12.5%
Track access charge	17.1%
Rail terminal service cost	6.5%
Rail terminal access cost	1.7%
Margin	13.0%

Source: Deloitte Access Economics
Note: There may be additional handling costs however this has been excluded to prevent any potential double counting or transfer effects

Appendix E
Sensitivity Analysis

E.1. Discount rates

Discount rates are used to calculate the present value of future cashflows so that different benefits and costs can be compared. In alignment with DTF guidelines, this CBA applies a discount rate of 7%. Changing the discount rate does not affect the overall outcome of the CBA, rather it changes the magnitude of the present value of net benefits.

Table E.1 Sensitivity analysis for discount rates

		Option 1	Option 2
Core (7%)	NPV	4,995	4,618
	BCR	2.72	2.51
Low (4%)	NPV	11,276	10,921
	BCR	3.81	3.74
High (10%)	NPV	2,079	1,693
	BCR	1.96	1.70

Source: Deloitte Access Economics.

E.2. Probability of benefit realisation

In the core analysis, it was assumed that all benefits would be realised. However, it may not be the case that all benefits are realised, in which case understanding the impacts on the overall results is key for decision making.

Table E.2 Sensitivity analysis for probability of benefit realisation

		Option 1	Option 2
Core (100%)	NPV	4,995	4,618
	BCR	2.72	2.51
Low (80%)	NPV	3,468	3,125
	BCR	2.20	2.02
High (120%)	NPV	6,523	6,111
	BCR	3.24	2.99

Source: Deloitte Access Economics.

E.3. Landside costs

Landside costs and land bridging have significant impacts on the results of the CBA and drive a large portion of the net benefits associated with either option as this cost is avoided with PCEP.

Table E.3 Sensitivity analysis for landside costs

		Option 1	Option 2
Core (100%)	NPV	4,995	4,618
	BCR	2.72	2.51
Low (90%)	NPV	4,754	4,365
	BCR	2.65	2.42
High (110%)	NPV	5,236	4,871
	BCR	2.79	2.59

Source: Deloitte Access Economics.

E.4. Rail share for displaced containers in 2053

Rail is a relatively cheaper mode of transport on a per-TEU basis for displaced containers compared to road and therefore have consequences on land bridging related benefits in the CBA. By increasing forecast rail share, the cost of land bridging would consequently decrease.

Table E.4 Sensitivity analysis for rail share for displaced containers in 2053

		Option 1	Option 2
Core (13%)	NPV	4,995	4,618
	BCR	2.72	2.51
Low (8%)	NPV	5,151	4,764
	BCR	2.77	2.55
High (20%)	NPV	4,778	4,414
	BCR	2.64	2.44

Source: Deloitte Access Economics.

E.5. Vessel congestion period prior to displacement

Under the core assumptions, vessel congestion is expected to be experienced for three years, before displacement begins. It is assumed that the Port experiences congestion after capacity is reached as contractual agreements between shipping lines and the Port prevent them from immediately moving to a different port for land bridging. Decreasing the vessel congestion period in the modelling causes land-bridging to commence sooner, and land-bridging is assumed to carry a lower cost than congestion in the early years of the modelling horizon. This is due, in part, to the assumption that a congestion charge is applied to 71.9% of the Port's overall throughput when capacity is exceeded. Whereas land-bridging is applied only to the excess demand (above the estimated capacity at a given point in time) that cannot be handled by the Port which grows gradually over time. Shipping lines could anticipate congestion and divert trade ahead of the assumed timing of the congestion charge. This is captured by the 'no congestion charge' scenario below.

Table E.5 Sensitivity analysis for vessel congestion period

		Option 1	Option 2
Core (3 years)	NPV	4,995	4,618
	BCR	2.72	2.51
No congestion charge (0 years)	NPV	5,367	4,782
	BCR	2.85	2.56
Longer congestion charge period (5 years)[30]	NPV	4,862	4,540
	BCR	2.67	2.48

Source: Deloitte Access Economics.

Tasmanian near-port logistics location

Under Option 1, there is a cost associated with the truck movements between PoM and a near-port logistics location. By increasing the distance, the cost associated with the truck movements would rise due to greater vehicle operating costs and social and environmental impacts. Similarly, decreasing the distance would reduce this cost.

Table E.6 Sensitivity analysis for Tasmanian near-port logistics location

		Option 1	Option 2
Core (15km)	NPV	4,995	4,618
	BCR	2.72	2.51
Low (10km)	NPV	5,055	4,618
	BCR	2.78	2.51
High (20km)	NPV	4,936	4,618
	BCR	2.66	2.51

Source: Deloitte Access Economics
Note: Tasmanian trade is not moved to a near-port logistics location under Option 2, so there is no change experienced

[30] Analysis period for Option 1, 5-year congestion charge, has been extended by 3 years to capture the full duration for this sensitivity test, this treatment was not required for Option 2.

E.6. Vessel congestion cost

Vessel congestion costs occur when the port's capacity is reached and is considered as an avoided cost under the options. Changing the cost of vessel congestion would not impact overall results, rather the magnitude of the benefits and net present value of benefits. Two sensitivities are tested for vessel congestion cost, the magnitude of the cost (Table E.7) and the proportion of the vessels that the charge is applied to (Table E.8).

Table E.7 Sensitivity analysis for increasing and decreasing vessel congestion costs

		Option 1	Option 2
Core (100%)	NPV	4,995	4,618
	BCR	2.72	2.51
Low (80%)	NPV	4,867	4,442
	BCR	2.67	2.45
High (120%)	NPV	5,124	4,794
	BCR	2.76	2.56

Source: Deloitte Access Economics.

Table E.8 Sensitivity analysis for applying vessel congestion costs to more vessels

		Option 1	Option 2
Core (72%)	NPV	4,995	4,618
	BCR	2.72	2.51
High (100%)	NPV	5,247	4,962
	BCR	2.81	2.62

Source: Deloitte Access Economics.

Appendix F
Key Limitations and Exclusions

Key limitations are a key component of a CBA, according to the guidelines. Key limitations assist in identifying any crucial steps and/or work which have been excluded from the analysis.

Outlined below are the key limitations of the CBA. These inputs are not included in the CBA due to lack of availability. It has been determined however that the impacts on the core CBA results would be minimal:

- Network wide traffic modelling
- More detailed landside and vessel congestion modelling
- On-port competition effects
- Changes outside of the Port that might be required outside Victoria (e.g., Port Botany)
- Import demand and export supply responses to capacity limitations.

The key limitations outlined above are outside of this CBA's scope and require further external analysis where required. It is assumed they would not materially impact the overall results.

Other Considerations relating to PCEP

Webb Dock Freight Link

From a CBA point of view, the analysis only considers projects related to PCEP. It is noted however, that the development of Webb Dock Freight Link would alleviate land-side congestion in the near-port and the broader road network around Webb Dock. Without a rail connection, there is a possibility for road congestion to occur beyond 2045 in the outer years of the CBA's scope of 30 years.

Innovation in road and rail

Mode share and vehicle productivity assumptions used in this analysis have been based on existing technologies used by road and rail operators. Specifically, there is no consideration of the potential impact of high-productivity vehicles, electric trucks, double stacking on rail, or other innovations that might impact the cost of land bridging on operators or on the environment. There is considerable uncertainty of these future scenarios which is not the focus of this study. However, as part of the sensitivity analysis, the impact of a higher or lower forecast rail mode share is assessed, which is a key driver of the avoided land bridging benefits.

Limitation of our work

General use restriction

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