Sea Freight Council of NSW Inc.

Regional Intermodal Terminals - Indicators for Sustainability

Sydney
March 2004

Strategic design + Development

Strategic design + Development Pty Ltd
ABN 51 103 363 257

Suite 105, 51 Rawson Street Epping NSW 2121
PO Box 1075 Epping NSW 1710 Australia
Telephone: +61 2 9868 2590
www.strategicdesign.com.au

Offices in Sydney, Melbourne, Adelaide, and Canberra

The Sea Freight Council of NSW is an industry driven forum, bringing together a wide membership of supply chain and logistics industry representatives engaged throughout the sea freight transport chain. The Council pursues work programmes aimed at collectively identifying and removing impediments to efficient freight logistics, thereby improving Australia's export competitiveness.

The Council is funded by the Commonwealth, the New South Wales Government and by industry in New South Wales. Stakeholders include:

- Commonwealth Department of Transport and Regional Services
- New South Wales Department of State and Regional Development
- New South Wales Ministry of Transport
- Ports Corporations of Sydney, Newcastle and Port Kembla
- Australian Institute of Export (NSW) Ltd
- State Chamber of Commerce (NSW

CONTENTS

FIGURES

TABLES

GLOSSARY OF TERMS

Brownfield	Site redevelopment of an existing site
BTRE	Bureau of Transport and Regional Economics
CSO	Community Service Obligation payments
Dwell time	Down time for train awaiting access to a terminal or network path
FDC	Fully Distributed Cost - includes all costs such as depreciation and overheads
FEU	Container dimension means forty-foot equivalent unit (or 12 metres in length)
FreightCorp	NSW-owned rail operator, Freight Rail Corporation, privatised in 2002
Greenfield	Site development of new site
Intermodal	Transport movement using both road and rail modes via a terminal interface
LRAC	Long Run Avoidable Cost - includes fixed and variable costs
Path	Time tabled movement of train through a network
RoI	Return on investment
Safe working load	Rail operating rules that specify locomotive power against a trailing load and inclines/declines
SRAC	Short Run Avoidable Cost - includes variable costs only, such as fuel
Sunk cost	Capital costs already written down
TEU	Container dimension means twenty-foot equivalent unit (or 6 metres in length)
Trailing load	Aggregate weight of rail wagons and payload, used to calculate locomotive power
NTK	Net-tonne kilometres

1. Background and Executive Summary

Strategic design + Development were engaged by the NSW Sea Freight Council to undertake an assessment of intermodal terminals within regional NSW to identify the key attributes behind commercially viable terminals. In particular the study seeks to:

- *Develop generic criteria for assessing the broad economic viability and defining infrastructure requirements of further regional terminal developments*
- *Form the basis of an educational handbook for regional communities and exporters exploring the potential to attract or develop and operate intermodal terminals as freight interchange points*

The study is intended as a guide to indicate volume thresholds and other operational and market characteristics; the methodologies used to formulate the cost models contain some **averaging within the classification bands**, and therefore total and unit costs must be considered **indicative only**, and prospective terminal developers or operators must develop site and operational specific cost models.

To initiate the study, the NSW Sea Freight Council included a number of **key characteristics** in the project brief that it considered relevant to the economic and viable terminal operation. Whilst the brief required that the analysis not be merely restricted to characteristics nominated by the council, the following characteristics are considered mandatory.

- *Trade characteristics and catchment area*
- *Freight Volumes*
- *Location and access to existing road and rail infrastructure*

a) Focus of the report

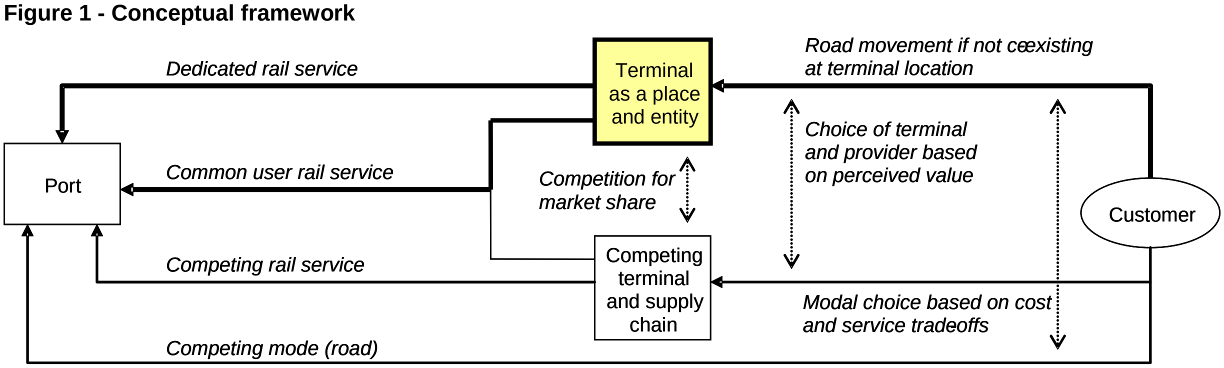
The report focuses solely on **rural and regional intermodal terminals**, which are predominantly export oriented, as the volume of imports moving direct from port to rural locations is limited, and rail movements cannot generally compete with road for domestic/intrastate movements to/from a metropolitan location.

Cost analysis of the terminal as a commercial entity and as an element within a supply chain is undertaken. The objective of the analysis is to understand the basis for commercial and economic sustainability in a de-regulated and privatised rail environment.

b) Wider perspectives on terminals

Rural intermodal terminals must be considered as *elements* within land-based supply chains which connect customers to key port locations. The terminal is a *place* and a *business entity* which must be commercially sustainable for the investor/operator, perform its operations in a socially and environmentally acceptable manner, and yield a perceived or real value for customers, who make modal choices about moving their products to/from the port.

Figure 1 - Conceptual framework



c) Critical conditions for sustainability

The following table summarises the strategic findings of the study expressed against the key perspectives considered relevant to a rural based intermodal terminal.

Table 1 - Terminals as places, entities and elements in chains

Perspective	Condition
Terminals as places	The terminal must have proximity to substantial and appropriate freight volumes, where there is a requirement to move products towards a market (and/or port). Proximity to existing road and rail infrastructure is also imperative. Typically, dense export-based rural commodities tend to favour an intermodal (rail/road) path to port, particularly where the rail journey is significantly greater than the road journey linking the customer to the terminal.
Terminals as entities	The terminal must be "fit for purpose" and ensure commercial sustainability for the investor and operator. Volume remains the key determinant for commercial success, followed by rail service regularity, and a level of investment commensurate with the size and complexity of the task. Terminals may also yield benefits for external stakeholders (e.g. community or government) which avoid externality costs such as greenhouse gas emission, road trauma, road maintenance, and noise emissions[1]
Terminals as elements in chains	Intermodal terminals are only sustainable to the extent that they exist as elements in supply chains that provide low cost transport paths to markets or ports, and these chains will compete with other supply chains for market share; therefore, not only must the terminal itself be efficient, it must exist within an efficient chain where the total cost of the elements is lower than the cost of competing chains for a comparable level of service.

d) Key observations about terminals

The increase in the number of rural intermodal terminals over the last 5 to 7 years has created an impression of a larger market for investment than is the case[2]. This is an erroneous notion. Substantial volume in nearby catchments is the critical driver for financial and operational sustainability. Operating three terminals in a catchment area where volumes are sufficient to sustain only two, for example, can dilute individual terminal volumes to a point where none of the three is viable.

- Whilst an importer or exporter may generate reasonable daily volumes – say up to 15 loaded TEU's per day (or 3,500 loaded TEU's per annum[3]) – this is insufficient for investment in a stand-alone intermodal terminal. Exporters are to be encouraged to consolidate with other users to ensure that an economic and viable volume is achieved as an intermodal terminal generally only becomes viable at around 10,000 loaded TEU's per annum, and preferably operates at more than 15,000 loaded TEU's per annum.
- Rural intermodal terminals emerged during the early phases of rail deregulation, and initial investment was partially subsidised through land vested to the government-owned rail operator, FreightCorp. Rail linehaul rates were supported by an above rail subsidy by Government to FreightCorp, to achieve an outcome where overall intermodal costs could compete with road.
  - … *Under a privatised rail environment, cross-subsidisation of terminal investment and rail linehaul costs has been discontinued*
  - … *Moreover, a rail operator with terminal investments can secure a greater revenue base and has the ability to spread overheads, whereas an operator with terminal investments only is likely to be at a cost disadvantage*

[1] Externality costs are covered in the Appendix in Section 8.10
[2] Refer to Markets and Service in Section 3.
[3] A TEU refers to "twenty-foot equivalent unit" and is the common industry measure for shipping containers. One TEU is a 6 metre container, whereas 12-metre containers are often referred to as a FEU, or "forty-foot equivalent unit". Container measures are standardised to TEU's.

… *Terminals developed in today's privatised environment are subject to quite different cost drivers and thresholds from those established under the previous regulated environment; benchmarking new projects against terminals established under the regulated environment is flawed in the current de-regulated environment where competition policy exists*

- Demand for rural based transport including intermodal terminals is essentially static over the medium term, with rural production (mainly commodities) growing at less than 3% per annum. Moreover, there are issues such as seasonality and drought which further impact on commercial sustainability.
- Any new investment which creates excess capacity at a local or regionalised level will cause unit costs to rise, owing to market fragmentation and the "step function"[4] of capacity and investment; this may cause an existing terminal to become unviable and limit the opportunities of the new terminal.
- Intermodal supply chains are not efficient across all distances, volumes and service levels, and where insufficient volume exists or service flexibility is necessary, road-based transport offers a superior economic alternative.
- Stakeholder surveys conducted in the project research phase of the study identified direct cash costs to the exporter/importer as the primary basis for modal choice.
- Transferring volumes from road to rail will yield marginal savings in externality costs (as mentioned above), however such savings are limited to $25-50 per TEU, depending on distance. Whilst externality costs are socialised and relevant to government, they are not immediately relevant to the choice of transport mode for the exporter/importer and/or fall outside the transaction with transport provider(s)[5]
- Whilst some interviewees expressed the need for a viable rail and terminal network, as a basis of addressing externality issues such as greenhouse emission, road trauma, road maintenance costs, and so on, transport costs remained the one relevant criterion influencing modal choice.
- Rural terminals do not represent a significant means of directly stimulating employment, as even large terminals (>25,000 TEU pa) employ less than 20-30 direct staff.
- The terminal may stimulate secondary employment opportunities by co-locating secondary and tertiary processes nearby, however the initial terminal development can only be considered viable where there are substantial start-up volumes or where volumes build quickly in the early stages of the terminal's life
- Ancillary services provide a marginal benefit for terminal revenues and the overall benefit depends on the type/nature of the terminal owner and their capacity to more broadly apportion overhead costs over other activities such as rail operations.

e) Logistics processes

Intermodal terminals are only sustainable to the extent that they exist as elements in supply chains that provide low cost paths to markets or ports. Consequently, these chains will compete with other supply chains for market share. Therefore, not only must the terminal itself be efficient, it must exist within an efficient chain where the total cost of the elements is lower than the cost of competing chains for a comparable level of service.

In the main, NSW rural-based intermodal terminals have a predominant focus on export movements to the ports of Sydney. Rail-based transport is able to compete in the export chains owing to its ability to deliver the consignment direct to port and obviate the need for additional handling and road movements from a secondary terminal. By contrast, the movement of "domestic" freight to/from the Sydney market is dominated by direct road movements, due to freight time demands and rail terminal infrastructure constraints in the Sydney Basin.

[4] Investments in capital equipment do not tend to be "linear", rather follow discrete "step functions" in cost that precedes capacity
[5] Refer to Appendix page 55 for further analysis on externality costs and implications

The cost of operating the additional modal interfaces for domestic freight is not offset by freight density or distance. Other factors relating to inventory management and consignment size favour direct road-based movements over intermodal channels

f) Summary of indicators for sustainability

From the analysis, the key factors that must be considered before investing and establishing a regional intermodal terminal are volume, investment levels, distance and proximity of customers, seasonality, terminal capacity and equipment levels, and the threat of competing supply channels, whether from another terminal or by road-direct services

Table 2 - Summary of key indicators for sustainability

Criteria	**Condition**
Volume	**Volume is the most critical driver for commercial sustainability.** **A threshold of 10,000 loaded TEU's is generally considered the minimum volume required to cover terminal "cash" costs and attract a viable and regular rail service**. This volume however is unlikely to make any substantial contribution to depreciation, overheads or profit.
Distance – particularly rail	**After allowing for the optimal power-to-weight arrangement, rail operating cost is a function of distance, travel speed and dwell time (for loading and unloading).** Where the distance travelled is comparatively short relative to the time to load and unload, the unit operating cost per TEU rises significantly, with distances around 300 kms being at the lowest end of the range[6]. Given the type of market demand, the train normally travels loaded in the export direction, and therefore, the operating cost of the journey from port to rural terminal must be offset by an efficient return (loaded journey). Distance then represents the most effective driver. **Road-based movements are more cost effective over shorter distances and provide greater flexibility in markets not accessible by rail.**
Brownfield versus Greenfield site investment	The level of initial investment will influence the viability of the terminal, especially in the initial "sunrise" volumes before the critical mass is assembled. **Most terminals today are a result of upgrades to existing rail infrastructure, allowing the terminal investor/operator cost relief in the early stages of operation.**
Import/threat of competing channels	Intermodal terminals and their related rail movements exist in a competitive environment, with the road sector seeking to maintain or improve modal share. The transport market is highly elastic - slight fluctuations in transport pricing can attract or lose freight volumes. **The intermodal transport option (via terminal and rail) must provide a lower aggregate cost than the direct road movement, plus an "allowance" that reflects a lower service or time-based outcome.**
Terminal capacity and capital equipment	**Terminal capacity is derived by investing in capital items such as land, infrastructure & forklifts. As such it is generally not linear and precedes demand.** Asset utilisation has a significant impact on operating cost, particularly relative to heavy forklift equipment and hardstand development.
Seasonality	Recognising the comparatively high level of fixed costs, a smooth volume profile is preferable across the year, to optimise operating costs. Where export commodities are seasonal, (such as cotton, horticulture, etc) then complementary product flows are necessary to offset fixed costs.

[6] Generally, a distance of 250-300 kilometres represents the shortest viable distance to port, to adequately compete with road services, however other factors which may relate to geography and infrastructure may favour rail over road below this range

g) An overview on price and cost

The following comments are drawn from the financial analysis in Section 7 commencing on page 38.

- "Small" terminals with a volume threshold less than 5,000 TEU's per annum (consisting of 2,500 loaded export containers and 2,500 inbound empty containers) are not economically viable as a stand alone investment/operation at any distance from port; road provides a more cost effective route to port as volume is insufficient to offset terminal and train operating costs.
- "Medium" sized terminals handling up to 5,000 to 20,000 TEU's pa (loaded and empty) similarly have difficulty competing with road direct services however collaboration amongst nearby terminals may allow sharing of train operating costs[7].
- "Large" or "Super" sized terminals which exceed 20,000 TEU's are economically viable beyond 400-500 kms from port and across all reasonable investment levels. Volumes are sufficient to assemble efficient train sizes and terminal fixed costs are offset.
- Terminal which are located less than 250-300 kilometres from port will generally not compete with road-direct services, however "Super" sized terminals with total volume exceeding 40,000 TEU's per annum may exceed "cash" costs however not make an adequate contribution to investment or overheads. Some specific geographic instances however may favour rail over road in locations which are closer to port, albeit limited.

The following table summarises the overall findings of the analysis. A more detailed analysis for varying investment levels and local haulage[8] is shown in Table 17 on page 42.

Table 3 – Overall summary classification by size and distance

Terminal Size	Overall container volumes pa			Distance to port (one-way)			
	Loaded TEU's (export)	Empty TEU's (inbound)	Total TEU's	300 kms	500 kms	650 kms	800 kms
Small	<2,500	<2,500	5,000	☒	☒	☒	☒
Medium	2,500 to 10,000	2,500 to 10,000	5,000 to 20,000	☒	☒	☒	☐
Large	10,000 to 20,000	10,000 to 20,000	20,000 to 40,000	☒	☑	☑	☑
Super	>20,000	>20,000	>40,000	☐	☑	☑	☑

☒ Not sustainable ☐ Marginal ☑ Sustainable

[7] A number of cotton exporters in the Narrabri and Wee Waa area generally collaborate to share train resources, even though their individual terminal output is described as "Medium" having less than 20,000 TEU's per annum

[8] "Local haulage" refers to the road-based movement to/from the factory or farm gate and the nearby terminal; the road movement is generally less than 50 kms, however in some instances it extends to 150 kms

h) Methodology

The information contained in this report is derived from detailed rail and other operational cost modelling within the developed framework, and reflects nominal investment returns under typical corporate governance, with the focus on commercial sustainability.

The analysis has not modelled market entry strategies fostered on loss-leadership pricing assumptions or any practice of cross-subsidising terminal operations with other external activities.

i) Qualification in this report

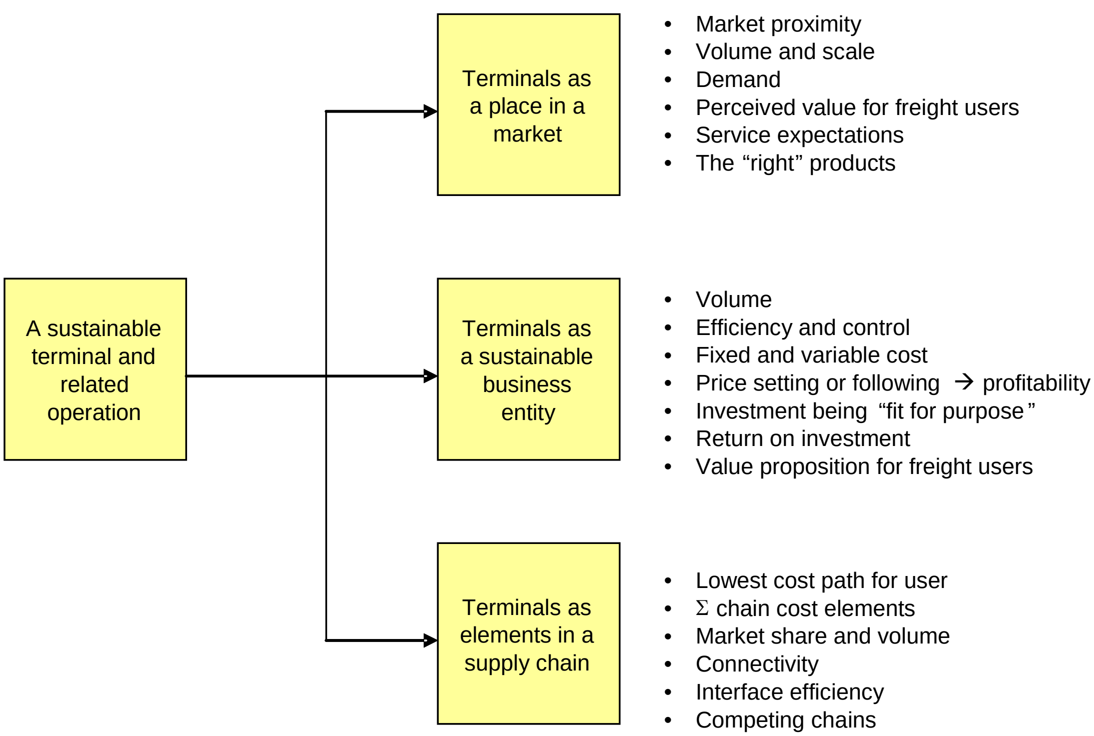
This report outlines the general conditions and drivers that support a commercially viable rural intermodal terminal, however it is acknowledged that there are current terminal operations in NSW which may fall outside the framework described herein.

The criteria outlined in this report relate to NSW and may not immediately be applicable to other states or territories.

2. A conceptual framework

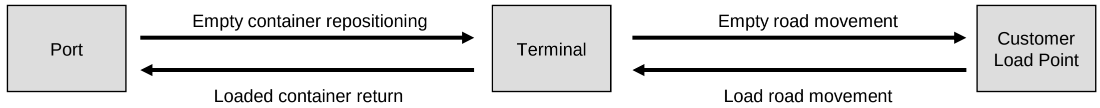
An intermodal terminal whether located in a metropolitan or rural setting should be considered from each of three equally important perspectives: (a) market relevance, (b) delivered value within a chain context, and (c) achieving competitive advantage. Notions that intermodal terminals exist at arms length from a dynamic set of chain processes are unsustainable

Figure 2 - Arrangement of key drivers



For the purpose of this report and analysis, terminal capacity has been classified into four discrete levels. Terminal size will be referred to using these categories throughout the remainder of the report.

Table 4 - Terminal classification scale to aid analysis

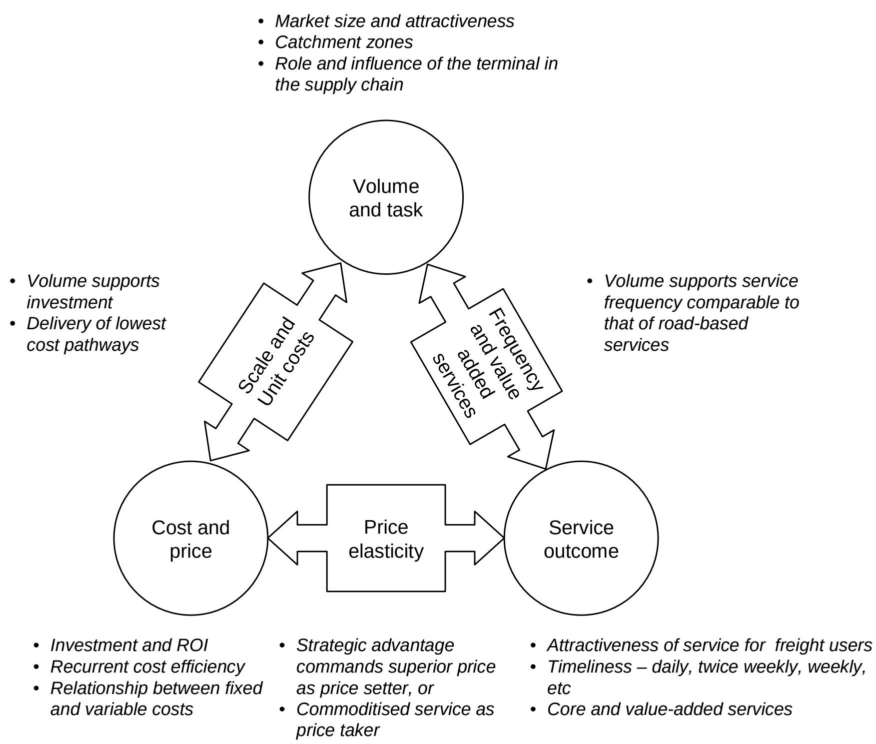


TERMINAL CLASSIFICATION	INBOUND (TEU's)	OUTBOUND (TEU's)	TOTAL THROUGHPUT (TEU's)
SMALL	< 2,500	< 2,500	< 5,000
MEDIUM	2,500 – 10,000	2,500 – 10,000	5,000 – 20,000
LARGE	10,000 – 20,000	10,000 – 20,000	20,000 – 40,000
SUPER	> 20,000	> 20,000	> 40,000

- Typically, the inbound TEU's represent the inflow of empty containers, which are repositioned from Port Botany or other metropolitan container terminals. Outbound TEU's generally represent the movement of the loaded container towards the port
- Inclusion of the "small" and "medium" sized terminal in this classification does not infer that such terminals are commercially viable, but are included for analytical comparison

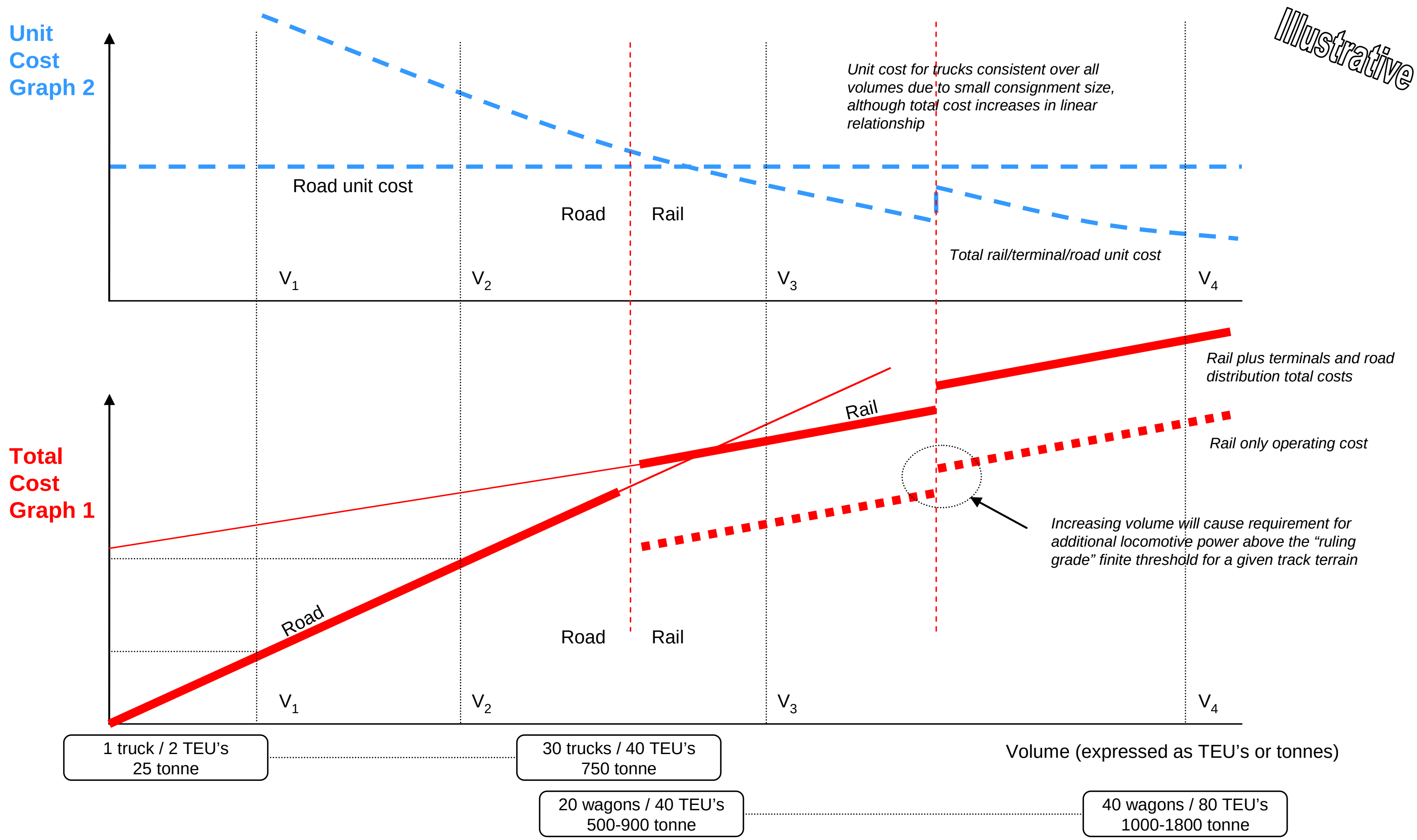
The determinants of sustainability for rural intermodal terminals exist as *trade-offs* between volume, investment in infrastructure, equitable cost/price arrangements, and service outcomes that meet a user's expectation. Secondly, price will not necessarily reflect cost and margin over all volumes, and will depend on the pricing impacts from competing chains available to the freight consignee.

Figure 3 - Relationship between determinants of sustainability



- Volume drives an intermodal (rail/road) system to achieve optimal unit costs for a nominated service level
- Volume also allows the terminal and rail operator to offer a more frequent service (in aggregate) for movement of goods to port
  - … *Whilst weekly rail services allow for the assembly of economic train movements, a weekly service may not align with shipping services or port cut-off times*
  - … *Low service frequency will cause an increase in supply chain inventory levels, with a corresponding increase in working capital costs*
- The relationship between price, and fixed and variable costs will mean that the terminal operation will only be profitable over a critical threshold volume for a given investment level and operating cost.
  - … *A competing road "direct" path achieves a linear relationship between volume and cost, as the unit size (typically 25 tonne per consignment) avoids the need for substantial infrastructure and carries the same fixed costs for 1 or 1000 TEU's per unit time*
- Whilst the terminal investor/operator is attracted to volume, customers (as buyers of freight services) will make modal choices based on the perceived value of the terminal
  - … *Is the terminal (and associated rail service) strategically important to the customer, extending to a point where higher prices for the provider are extracted over the short to medium term?*
  - … *Is there surplus capacity and infrastructure that allows low barriers to entry for competing operators within a common catchment area?*
  - … *A sustainable terminal operation must appreciate market elasticity and its effects on profit, cash and return on investment.*
- The most importance criterion for a sustainable terminal and an intermodal transport operation is the aggregation of volume to achieve lowest unit cost outcomes. Depending on key factors such as price and level of investment, a "stand-alone" terminal will ideally need to handle a minimum of 10,000 loaded TEU's to achieve the right economic framework. Below that volume threshold, freight users will need to aggregate their volumes with other like users.
- The operation of economic train-based quantities is also important, with train size above 20 wagons (40 TEU's) considered a minimum requirement, although sizes up to 40 wagons are more likely to be provided - and to be sustainable
  - … *Servicing a number of terminal sidings may provide an economic aggregation, within strict limits affected by train cycle and/or dwell times*
  - … *Additional information about train operating characteristics is provided in the Appendix from page 44.*
- Holding service expectations, delivery requirements and origin/destination point as constants, road-based movements are more efficient (in unit cost terms) for smaller volumes (V_1, V_2), whereas rail-based movements are more efficient over larger volumes (V_3, V_4) refer to Figure 4.
- Rail operations have very high fixed costs, which are only offset with sufficient volume to achieve a lower unit cost, whereas road-based movements with the unit size limited to 25-40 tonnes have low fixed costs and uniform unit costs over all volumes
- The graphs on the next page demonstrate total cost and unit cost relationships over a wide volume range
  - … *Graph 1 (lower) shows total cost for each mode*
  - … *Graph 2 (upper) shows unit cost behaviour for the same volume range*
- The rail-based movement must also factor in the cost of terminals and additional road movements to/from the terminal location and customer facility
- Rail unit costs also have step increases due to variations in power-to-weight ratios between the locomotives and the trailing load (wagons and payload)

Figure 4 - Generic volume, total cost and unit cost relationships for road and rail



3. Markets and Service

3.1 History of terminal development

The restructure of the NSW freight rail sector and the open access environment led to a revival of rail-based land transport within the import/export container trade.

- The corporatisation of the NSW State Rail Authority in the mid 1990's and the development of a separate freight arm – FreightCorp – renewed interest in the movement of containerised cargo by rail to NSW Ports.
- When FreightCorp was established in 1996, less than 10% of import and export container cargo was handled by rail and a major proportion of the containers moved by rail were from regional areas. By 2003, the share of rail volume had reached around 25%, in a market, which is growing at 6-7% per annum, driven largely by the recent growth in cross-metropolitan rail movements, rather than growth in rural export by rail
- At the same time the growth in cargo volumes being transported by road was causing costly congestion problems at Port and heightened community concerns about the increasing numbers of heavy trucks delivering containers through metropolitan areas.
- While there was widespread use of rail to deliver regional containers to Port, the system wherein the containers were delivered to and from customers via local rail yards or customer sidings was operationally inefficient and costly in terms of poor wagon utilisation and poor port productivity.
- In seeking to address the inefficiencies and to increase rail's share of the container transport task it became obvious that major changes to existing practices would be essential. Included in these changes was the development of inland ports to consolidate cargo into train loads for delivery direct to Port without the need for expensive sorting and shunting.
- The early development of rural intermodal terminals was largely based on the major NSW cargo catchment areas including Griffith, Narrabri, Moree and Blayney. All terminals except Narrabri were Brownfield sites i.e. used existing infrastructure

3.2 Current market volume

The ports of Sydney presently handle around 1.25 million TEU's per annum, and volume is growing at an average rate of 7% per annum. While the 2002-3 drought has had an impact on regional exports, with nominal volumes totalling around 180,000 TEU's per annum, rail achieved approximately 60% share of rural imports/exports.

- Regional intermodal terminals handle very little in the way of import volume, which is largely focussed on the import of metals and chemicals (Newcastle) and manufactured goods (mid-West)
- Exports mainly comprise agricultural commodities (cereals, cotton, hay), wine, horticulture, and animal foods.
- Due to geographic proximity, northern NSW cotton exports are contestable with the Port of Brisbane, whereas Riverina wine and horticulture is contestable with the Port of Melbourne

Table 5 - Composition of 2003-4 port volumes by origin/destinations and mode

Nominal volumes (2003-4 Projected)	Import Rail	Import Road	Import Total	Exports Rail	Exports Road	Exports Total	Totals Rail	Totals Road	Totals Total	
	000 teus	*000 teus*	*000 teus*	*000 teus*	*000 teus*	*000 teus*	*000 teus*	*000 teus*	*000 teus*	
Metro	-	*10*	*10*	-	*270*	*270*	-	*280*	*280*	*24%*
Rural	-	-	-	-	-	-	-	-	-	*0%*
Empty Containers	**-**	**10**	**10**	**-**	**270**	**270**	**-**	**280**	**280**	**24%**
Metro	*50*	*490*	*540*	*90*	*60*	*150*	*140*	*550*	*690*	*60%*
Rural	*20*	*20*	*40*	*90*	*50*	*140*	*110*	*70*	*180*	*16%*
Full Containers	**70**	**510**	**580**	**180**	**110**	**290**	**250**	**620**	**870**	**76%**
Subtotal	**70**	**520**	**590**	**180**	**380**	**560**	**250**	**900**	**1,150**	*100%*
	6%	45%	51%	16%	33%	49%	22%	78%	100%	
Other/Transhipment/etc									**100**	
Total									**1,250**	

Determinants for the placement of intermodal terminals have historically varied, yet access to the rail network, the ability to leverage "sunk cost" and confidence in market growth are dominant. Less attention has been paid to network quality, eg track class, and more has been paid to minimising the end-truck movement from customer to terminal, which has a significant bearing on cost.

Figure 5 - Road and rail networks and location of key rural terminals

- Over the last 10 years, intermodal terminals have emerged throughout the State, concurrent with the commercialisation of rail and vertical integration strategies
  - *Terminal development has generally sought to leverage existing infrastructure (as a sunk cost) with "new" terminal development limited to Narrabri, Moree and Parkes.*
  - *Other terminal developments mainly involved "Brownfield site" development of former shunting yards and freight depots, generally located in close proximity to the town centre, which in itself has caused social concerns around the movement of heavy vehicles to/from the intermodal terminal*

- *Many of these terminal developments would not have occurred under "Greenfield site" processes, as the initial investment would have been difficult to justify, given the "sunrise" volumes*

- Pre-deregulation, terminal developments where generally of two types:
  - *Customer-specific terminals to service single commodity exports such as cotton and cereals; e.g. Namoi Cotton at Wee Waa*
  - *Multi-purpose terminals owned by the dominant rail operator and managed under agreement with a nominated terminal operator; e.g. FCL at Blayney*

3.3 Market composition

An intermodal terminal must have a direct relationship with the served market. This market is dominated by rural export commodities and offers few opportunities for import movements. The major activity associated with inbound movements is handling and positioning empty containers to service the outbound export movements, and this is effectively carried as a "free backload" on most routes.

Figure 6 - Commodity clusters in rural NSW

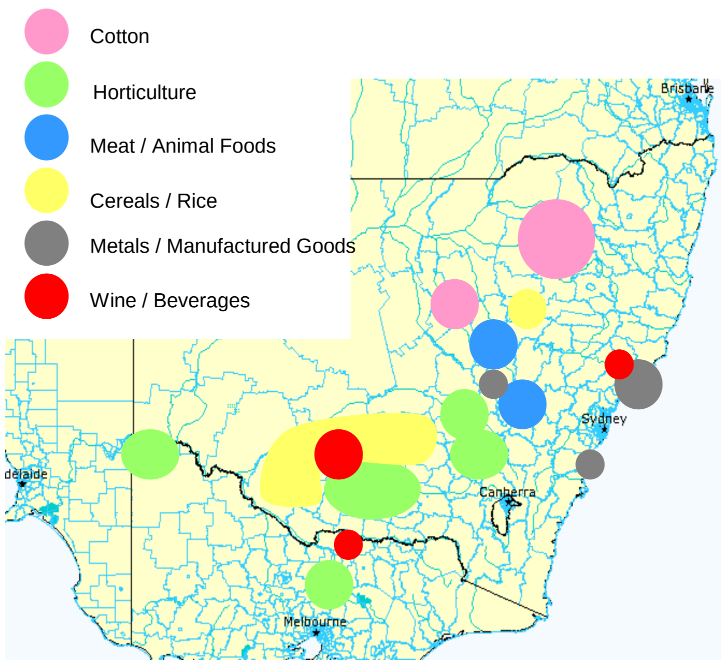


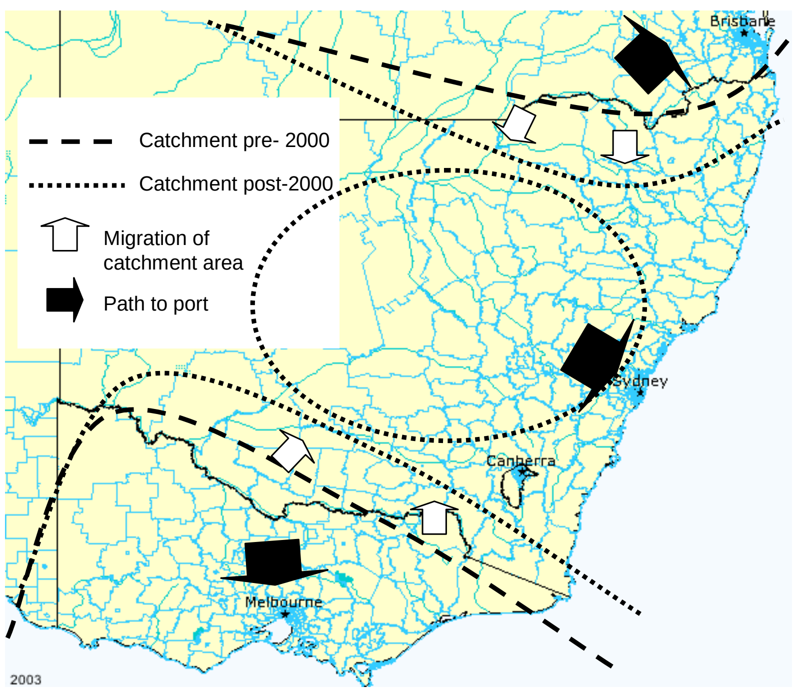
Table 6 - Nominal volumes by commodity

Rural volumes (nominal)	Import		Export	
	Rail '000 TEU's	Road '000 TEU's	Rail '000 TEU's	Road '000 TEU's
Cotton	-	-	20	-
Animal Foods	-	-	15	-
Cereals/Rice	-	-	15	-
Metals	5	-	15	5
Meat	-	-	5	-
Wine	-	-	10	5
Manufactured Goods	5	10	10	10
Other	10	10	20	20
Totals	**20**	**20**	**110**	**40**

Exporting ports have natural spheres of influence over rural catchment areas, and changes in freight demographics, re-regulation of rail, and the trend towards vertical integration of the supply chain are re-defining the boundaries of these catchments over time. This remains a fluid process.

- Historically, NSW rural terminals have had a firm relationship with the ports of Sydney, however following competition policy reform in the late 1990's, changes in freight demographics and logistics methods have caused an adjustment in the catchment area
- The establishment of cotton packing sheds in the Port of Brisbane have seen Narrabri and Moree volumes move by road to Brisbane, to coincide with shipping services having Brisbane as last port of call
  - *Example of a competing supply chain which diverts volume away from the intermodal terminals in northern NSW*
- The Riverina area is increasingly exporting wine and cereal products through Melbourne rather than Sydney
  - *Changes in provision of third party service providers and terminal managers in Griffith have demonstrated a preference for Melbourne*
  - *Marginal pricing of road and rail freight generally favours the southbound journey to Melbourne*
  - *Metropolitan road and rail congestion has hampered Sydney's capacity*
  - *Port rotations based on last port visit of shipping services; many ships call at Brisbane or Melbourne as last call before leaving Australia*

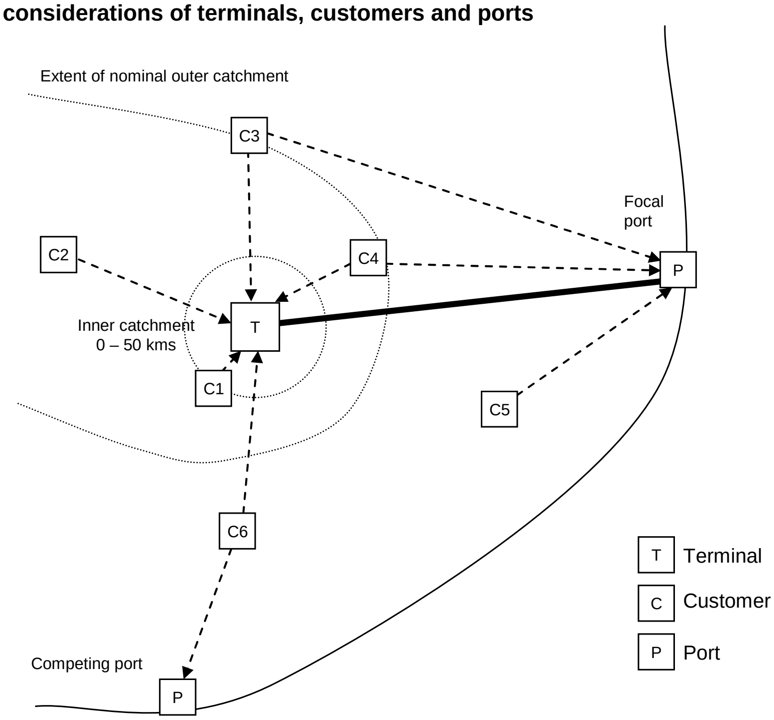
Figure 7 - Changing port catchment areas



3.4 Spatial considerations

There are important spatial relationships that arise when considering the relative position of the terminal to its market and the exporting port. A more generalised classification of these relationships is provided on the next page.

Figure 8 - Spatial considerations of terminals, customers and ports



- *The inner catchment is focussed on the immediate township surrounding the terminal and may extend to 50 kms. Subject to price and service frequency, freight movements will generally be attracted to the terminal, for rail movement to the focal port. These customers are represented by* ***C1*** *in the diagram, with an example being the wine exporters at Griffith or Fletchers Meats at Dubbo*
- *The outer catchment will vary according to the relative position and distance of the focal port and competing ports*
- *Customer* ***C2*** *is likely to prefer the intermodal movement option, provided the road movement distance is less than the rail movement; an example is export hay from Forbes, which is moved by road to Blayney terminal*
- *Customer* ***C3*** *will make choices based on the comparative distance to the terminal and the port – the direct road option may provide a lower overall cost*
- *Customer* ***C4*** *is located more than 50 kilometres from the terminal, and modal choice will depend on the relative distances for road to the terminal and rail from the terminal to the port*
- *Customer* ***C5*** *will favour the direct road movement to port as the least cost path; an example is Hunter wine exports or Mudgee meat exports*
- *Customer* ***C6*** *has the opportunity to discriminate between export ports; an example is Coleambally Rice, which can move in either direction (i.e. Sydney or Melbourne)*

The positions and interval distances between customers and terminals relative to the port has a significant impact on modal choice by users, for road-based movements direct to port, or rail/road intermodal movement via the terminal. A number of scenarios need to be considered.

Table 7 - Relative advantages and disadvantages of terminal locations

Relative positions of terminal to customer and focal port		Road distance from customer to terminal	Rail distance to port		
			< 300 kms	301 - 500 kms	> 500 kms
Customer on near side of terminal to port	T — C — P	0 – 50 kms	☐	☑	☑
		> 51 kms	☒	☐	☐
Customer and terminal equidistant to port	T / C / P	0 – 50 kms	☐	☑	☑
		> 51 kms	☒	☐	☐
Customer on far - side of terminal from port	C — T — P	0 – 50 kms	☑	☑	☑
		> 51 kms	☐	☑	☑

T Terminal C Customer P Port

- ☑ Terminal has a competitive advantage over the direct road movement to port
- ☐ Terminal advantage is marginally diminished, and modal choice will depend on other factors such as lower unit cost through scale of value - added services
- ☒ Terminal is at a disadvantage and direct road represent least cost path to port

4. Terminals as places and entities

4.1 Existing terminal locations

Rural intermodal terminals vary significantly in scale and scope of services, ranging from less than 10 TEU per day to over 80 TEU per day, and a broad classification system is necessary to aid definition and analysis across the four assessment groups.

Development of the existing network of rural terminals occurred during the initial stages of rail de-regulation, when FreightCorp, the dominant rail operator, was operated as a government-owned trading entity. At that time, FreightCorp received a CSO which marginally subsidised rail activity. The cost/price analysis in this report varies from what might be observed in a number of existing terminals which were developed in a regulated environment, supported by CSO payments by government. These terminals may come under increased cost pressure where a deregulated and/or privatised rail environment exists.

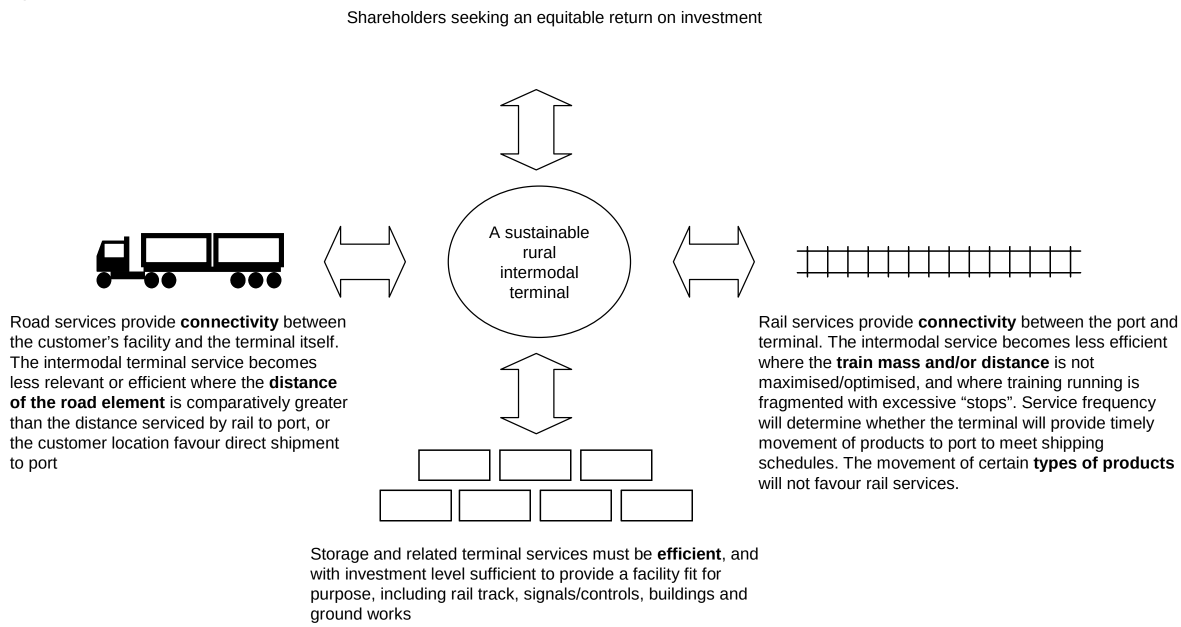
Table 8 - Size classification of existing terminals

Terminal Size	TEU handled pa (Loaded + empty)	TEU throughput per annum (Round trips)	Average loaded TEU's per day	Implications under full economic sustainability
Small	< 5,000	< 2,500	< 10	Volume is insufficient to sustain regular rail service or lead to optimal unit costs for terminal operations, unless co-existing with and highly complimentary to a larger nearby terminal. Terminal can only be justified if developed over existing infrastructure and it does not compete with any adjacent terminal. Typically, freight interests must be encouraged to use any existing terminals where located nearby (up to 20kms) as the (best case) marginal cost to provide additional shunting services is around $70-100 above the rail linehaul and terminal costs.
Medium	5,000 to 20,000	2,500 to 10,000	10 to 40	Volume may be marginal and financial sustainability will depend on the balance of service scope and resources employed – daily volume will need to be nearer 40 TEU's to be considered viable over the long term, with rail services every second day. Rail services are only justified on the basis that the site can be serviced within existing timetables (including dwell time) and no significant and marginal impact on rail operating cost is incurred. Sites in this classification will typically share rail services.
Large	20,000 to 40,000	10,000 to 20,000	40 to 80	Volume provides scale and opportunity to optimise terminal unit costs, with rail services approaching unit train time and cost performance. Service frequency may be less than daily (e.g. three times per week) and will impact on port delivery schedules.
Super	> 40,000	> 20,000	> 80	Optimal scale for a sustainable terminal, with sustainability generally impacted by proximity to port, and the specific relationship and proximity of customer, terminal and port.

4.2 Terminals act as a key interface

An intermodal terminal represents a strategic location between the freight user and a destination (usually a port) and must interface with, and provide a capability to access road and rail transport, and meet short-term storage demand. A freight user will only be inclined to use a terminal, where the interaction of the three functions yields a greater net value than direct services on road.

Figure 9 - Interfaces and terminal stakeholders

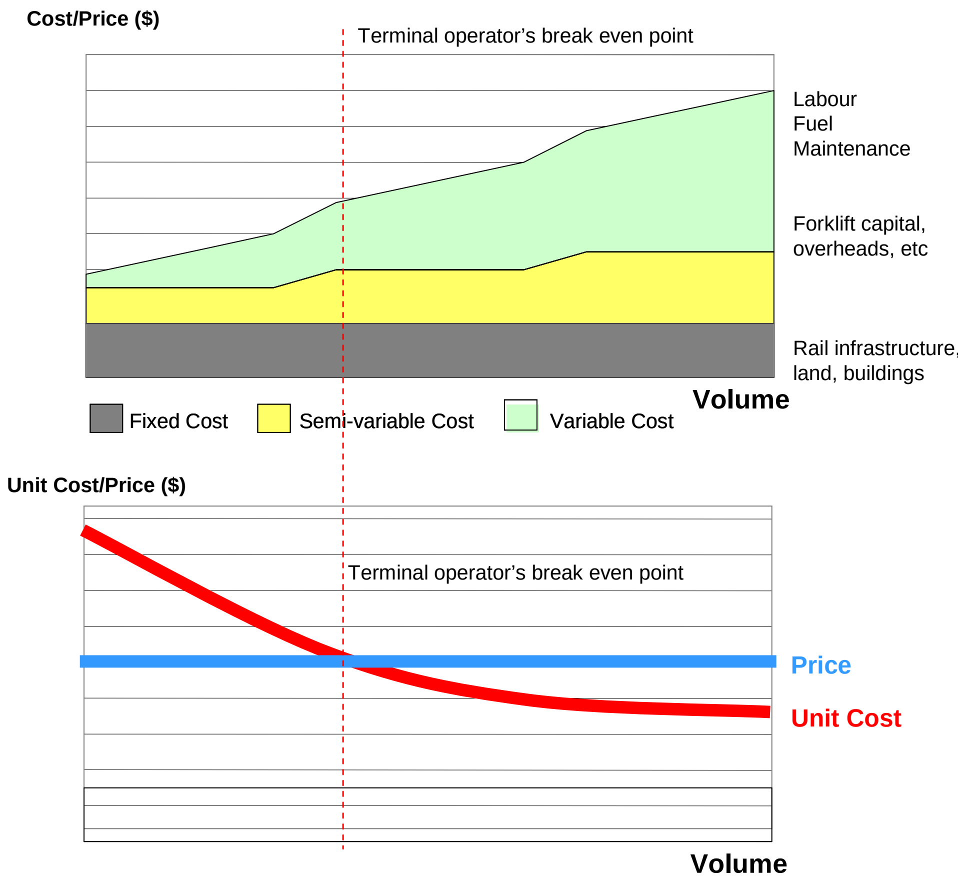


4.3 Terminal cost considerations

A sustainable terminal operation is one where revenue exceeds cost, and the profit margin provides an acceptable return on investment commensurate with the level of risk for the investor/operator

- Cost elements are a mix of fixed, semi-variable, and variable costs, which can yield high unit operating costs for terminals within minimal volume thresholds
- Terminal operations may exist in isolation from the provision of rail and road services, or such services may be vertically integrated with the terminal embedded within a single service offering by the operator
- The latter business model may provide an opportunity to operate the terminal as a "loss-leader" so as to attract marginal volume to existing (and underutilised) rail or road services
- This business model is the prevailing strategy of such organisations as Patrick, vertically integrated with Pacific National (as rail provider)

Figure 10 - Total cost and unit cost for an intermodal terminal

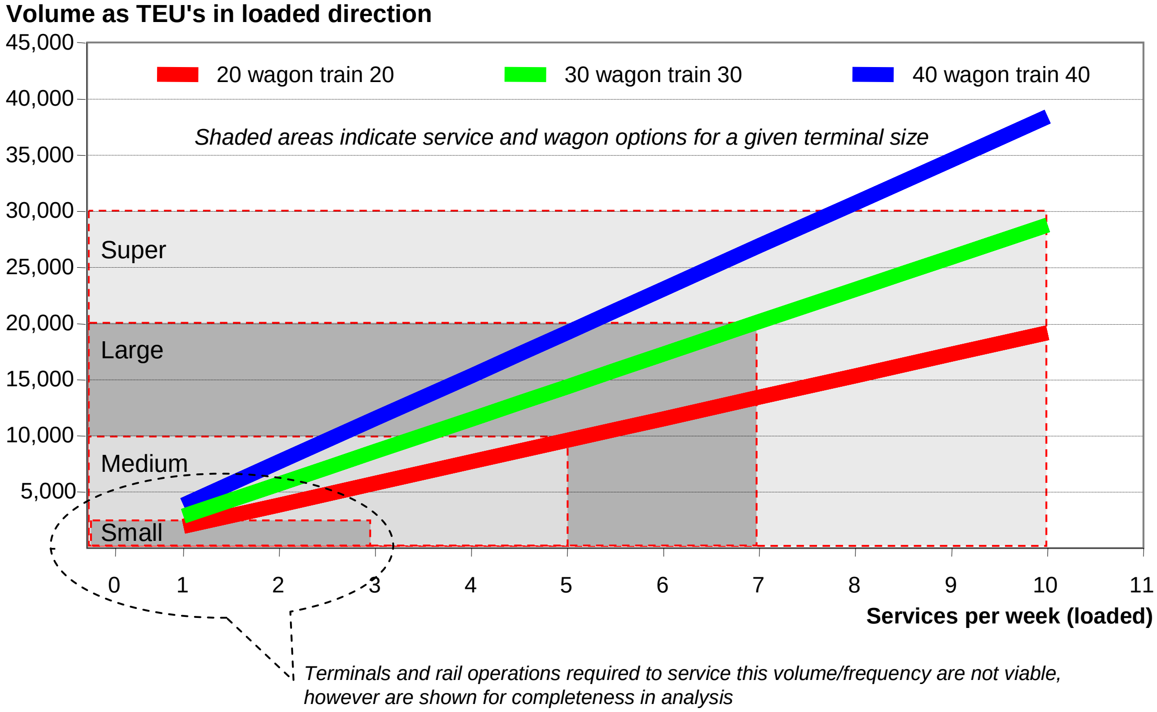


4.4 Relationship to rail services and infrastructure

A terminal operator will need to determine the required number of services per week and the optimal train size in order to meet average weekly demand volumes handled through the terminal. However, seasonality will alter the design criteria against a given volume and service frequency within a given timeframe

- The operator of a "Super" sized terminal will seek to move more than 20,000 loaded TEU's per annum, equivalent to around 625 TEU's per week. This is equivalent to operating 8 services per week using a 40 wagon train, with each wagon carrying 2 TEU's.
- For a "Large" sized terminal moving up to 20,000 loaded TEU's per annum, rail services would typically be based on a 5 services per week of 40 wagons and 80 TEU's
- Moderately viable, for a "Medium" sized terminal moving up to 10,000 loaded TEU's, the rail service would be based on 3 services per week using 30 wagons and 60 TEU's
- Although unviable, for a "Small" sized terminal moving up to 2,500 loaded TEU's, the rail service would be 2 services per week using 20 wagons and 40 TEU's

Figure 11 - Relationship between terminal size/volume, train configuration and service frequency



Subsequent rail cost modelling will utilise the assumptions derived here against each terminal specification.

Table 9 - Classification of train size and frequency to aid analysis

Train design and modelling criteria		
Terminal classification	Services per week	Wagons/TEU's per service
Small[9]	2	20
Medium	3	30
Large	5	40
Super	8	40

The analysis shows that as volumes increase through the terminal, the per TEU cost of terminal services falls. This is indicative of an operation that is high in upfront fixed costs and relatively low in variable (operating) costs.

Access to the existing rail networks and related infrastructure plays an obvious role in achieving a sustainable intermodal terminal. For the purpose of his study, three capital investment scenarios have been considered – "the **Greenfield** site, "the **Brownfield** site" and a site where **no additional rail capital** is employed (i.e. rail infrastructure is treated as a sunk cost).

[9] The "Small" and "Medium" sized terminals are not considered commercially viable, however inclusion here is for analytical comparison

- **<u>Greenfield</u>** (full investment) – assumes that all infrastructure is required at the site of the terminal, including rail siding, main line connection and signals, office and perimeter fences
- **<u>Brownfield</u>** (partial investment in rail facilities) – it is assumed that a new terminal will require minimal upgrade of the existing rail infrastructure (siding, connection, signals, etc) however full investment in terminal infrastructure
- **<u>No Rail Capital</u>** (no investment in rail) – No rail capital required, however terminal capital still required; rail capital considered "sunk" cost and is assumed to be in reasonable condition with remaining operational life.

Figure 13 (over page) shows the estimated terminal capital cost elements considered in each of three investment scenarios being super structure (offices, utilities, security/fences), hardstand, rail siding and controls (signals and points).

4.5 Overall unit cost for terminals under volume and investment criteria

Terminal investment and operational costs tend to fluctuate in the range of $30 to $40 per TEU for volumes equivalent to "Large" and "Super" sized terminals, however unit costs rise significantly with lower volumes. Investment levels have a less significant impact on sustainability at a higher volume range.

Figure 12 - Indicative terminal unit costs by volume and investment level

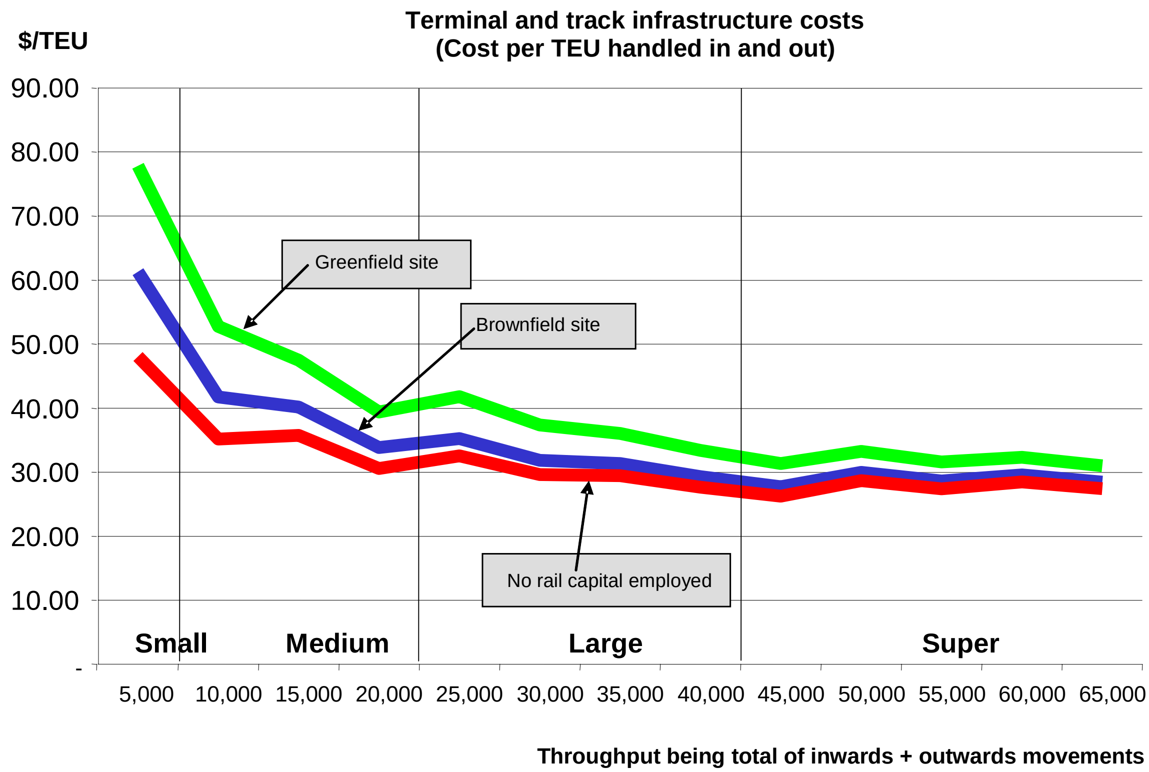
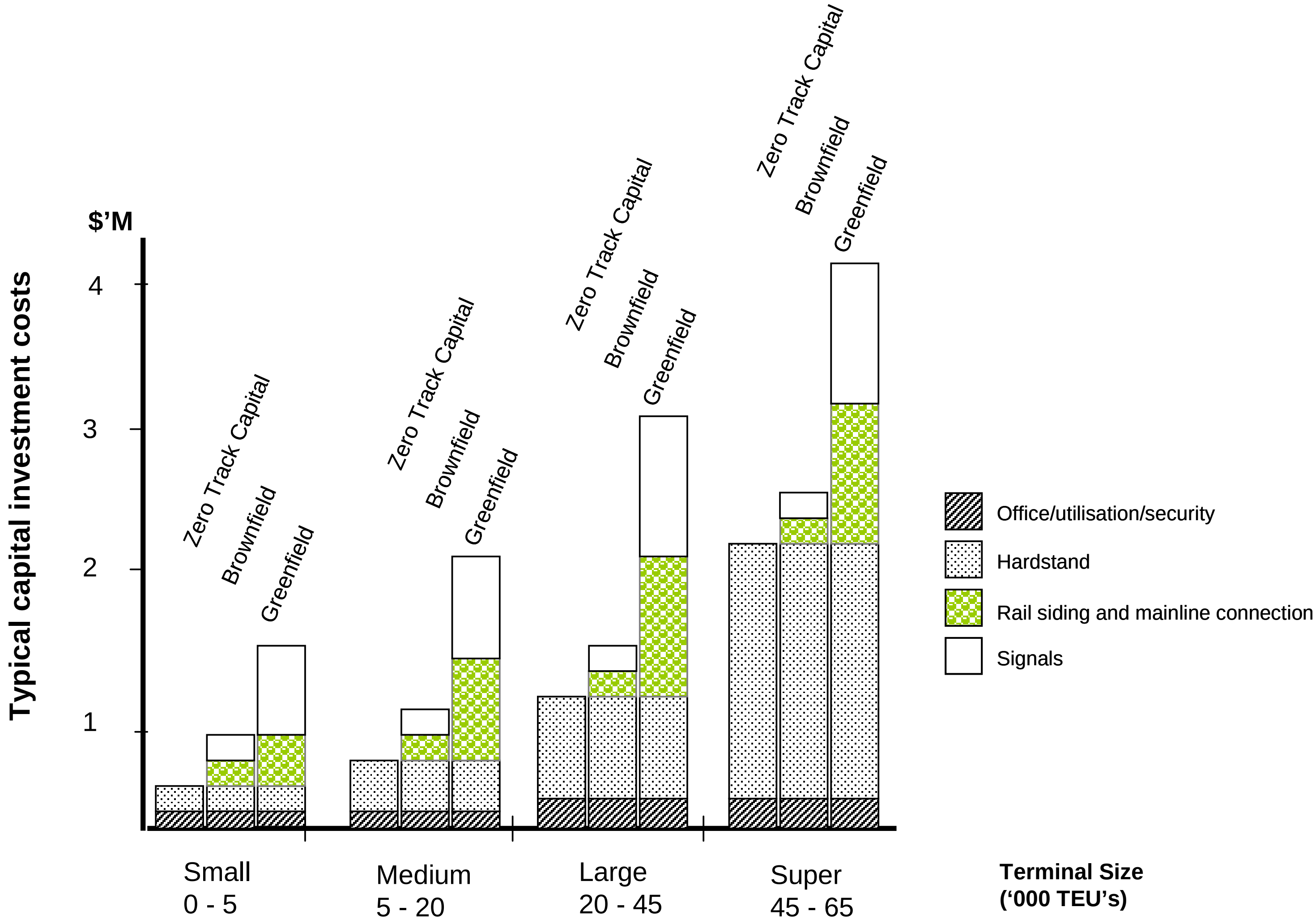


Figure 13 - Estimated capital costs for each investment level and volume consideration

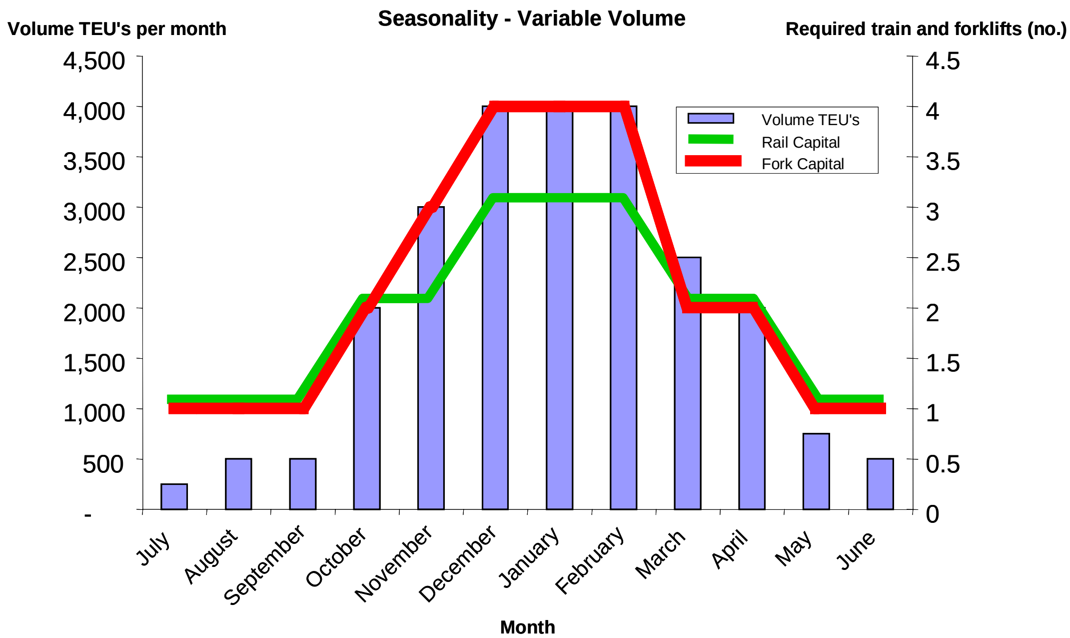


4.6 Seasonality impacts on terminal operations

An uneven volume distribution over a year will result in higher capital, space and equipment costs. Seasonality, such as low output, is the predominant driver of uneven terminal demand

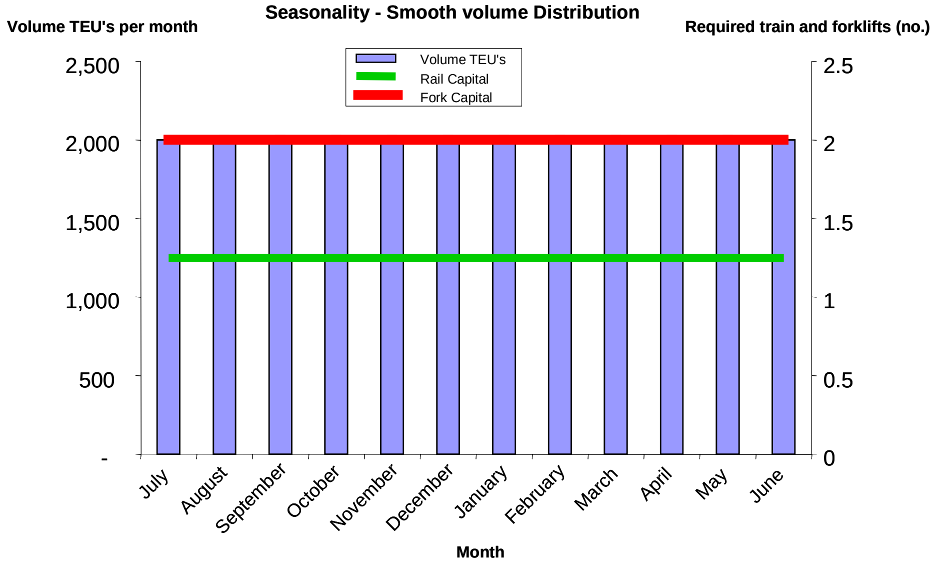
- The graphical examples in Figures 15 and 16 show a volume of 24,000 TEU distributed variably and smoothly across a 12 month period
- A variable distribution of TEU's across a year or even within a month can have a significant impact on the level of equipment required. In the example, a variable demand has doubled both the rail capital required and the fork lift capital required. An example of this type of product would be cotton or other agricultural products which have distinct seasonality in production

Figure 14 - Resource impacts arising from seasonal variances



- A smooth volume distribution allows for the most efficient use of resources and minimises the cost of capital. An example of this sort of product is animal foods or other manufactured products.
- Although it is difficult, if not impossible to have a completely smooth volume profile, the less seasonality experienced, the lower the cost of the terminal supply chain

Figure 15 - Resources for a smoothed volume task



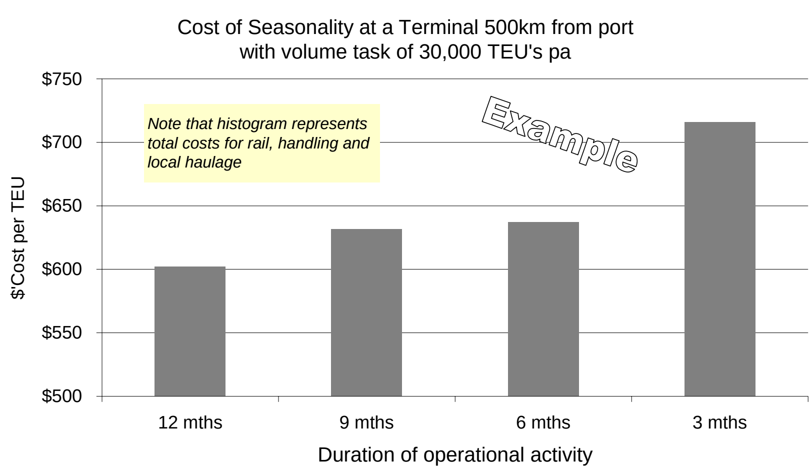
Historically, government rail operators absorbed the seasonal cost impacts through the provision of CSO by government, however with rail privatisation the seasonal risk is being transferred to the exporter assigning the goods.

One method of assessing the impact of seasonal peaks on total cost is to consider a hypothetical example of a terminal handling 30,000 TEU's over 3, 6, 9, and 12 months operational duration.

Here we assume some labour is casual, however there are limitations to the extent of train crew "casualisation", given the cost of training and route accreditation[10]. Terminal labour is considered casual and road haulage between farm/factory gate and terminal is fully variable. The predominant impact is on train operating costs, although at times there is an opportunity to re-allocate the rolling stock to other traffics.

The following example indicates that unit cost for the operators (in aggregate) can rise almost 25% over the optimal arrangement of a smooth workload.

Figure 16 - Seasonality and cost impacts

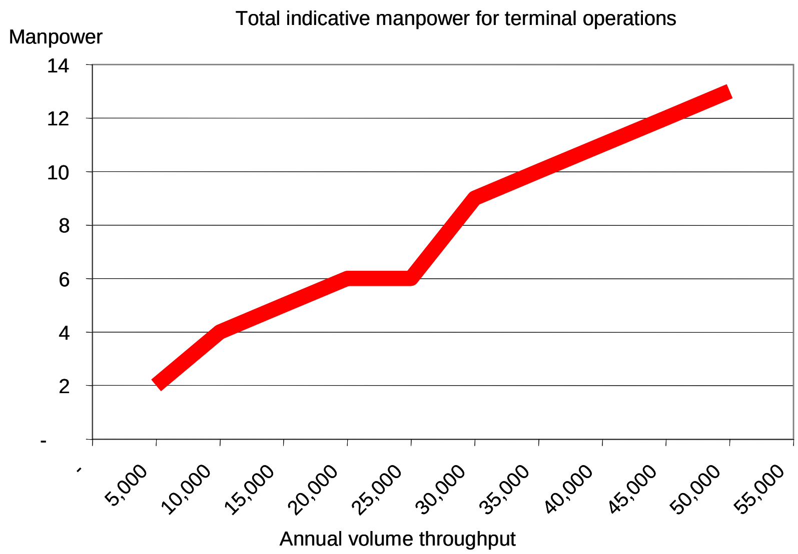


[10] This remains a critical issue for train crew involved in the movement of export grain, where the majority of train crew allocation occurs during the harvest clearance programs of November to February.

4.7 Employment and regional development

Investment in rural intermodal terminals has been erroneously promoted as a way of creating substantial employment, however even the largest of the existing terminal operations employ fewer than 15 terminal staff. Having achieved an initial volume throughput, terminals can provide an impetus for further investment in adjoining facilities and warehouses, which may have employment dividends. An example is Parle Foods, at Griffith, located approximately 5km from the intermodal terminal. Further investment is also being considered at Parkes, Dubbo, and Blayney.

Figure 17 - Nominal terminal manpower and volume relationships



- Terminal labour is a function of volume throughput, which is principally related to forklift operations involved in the loading and unloading of road and rail vehicles
    - … *Typical labour productivities and throughput levels yield the indicative manpower levels as shown in the table below*
- Ancillary staff, such as truck drivers, may be associated with the terminal, however these positions are essentially a reallocation of jobs that exist in alternative supply chains, such as road-based direct movements to port.

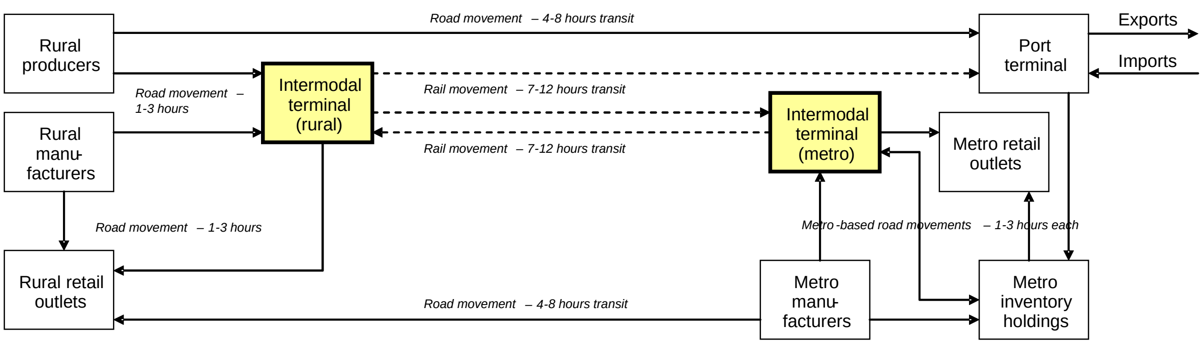
5. Terminals as elements in supply chains

Intermodal terminals are only sustainable to the extent that they exist as elements in supply chains that provide low cost paths to markets or ports.

Consequently, these chains will compete with other supply chains for market share. Therefore, not only must the terminal itself be efficient, it must exist within an efficient chain where the total cost of the elements is lower than the cost of competing chains for a comparable level of service.

The following diagram provides a generic structure of how the terminal fits into road and rail-based supply chains operating between ports and rural locations, and shows the complexity of links with capital city markets via metropolitan terminals.

Figure 18 - Generic intermodal supply chain structure



5.1 The logistics processes

a) Export chains

In the main, NSW rural-based intermodal terminals have a predominant focus on export movements to the ports of Sydney. The logistics activities associated with each type of supply chain are shown in Figure 19 on page 33. Rail-based transport is able to compete in the export chains owing to its ability to deliver the consignment direct to port and obviate the need for additional handling and road movements from a secondary terminal[11].

Greater detail of the rail and road costs for the export movements are provided in sections 5.2 and 5.3.

b) Domestic chains

Rural intermodal terminals have historically dealt with the export of commodities via the ports of Sydney. However an explanation of the competitive disadvantage of rail-based transport in domestic intrastate movements is warranted. By contrast, the movement of "domestic" freight to/from the Sydney market is dominated by direct road movements, due to freight time demands and rail terminal infrastructure constraints in the Sydney Basin.

The cost of operating the additional modal interfaces for domestic freight is not offset by freight density or distance. Other factors relating to inventory management and consignment size favour direct road-based movements over intermodal channels

[11] The need for secondary handling of export shipments arises when the rail capacity at the port terminal is exceeded, and contingent arrangements are made to transfer the export container via an alternative metropolitan terminal. This generally adds $30-$70 per TEU

- Within NSW, the movement of a domestic road-based consignment will generally take around 4-8 hours depending on distance. Comparable rail-based movements, with additional road movements at one or both ends, may take 9-18 hours depending on rail timetables and terminal operating hours
- "Domestic" inventories are consolidating and tend to be held in the major markets, such as Sydney and Melbourne. Exceptions do exist, however are generally in quantities which do not favour economic rail-based distribution processes
- Distribution to rural outlets tends to be in smaller consignment lots (up to 25 tonnes). In most circumstances an intermodal terminal will lack the capacity to influence domestic movements via two terminals and rail, given the dispersed geographic nature of origin and destination points

A cost analysis of domestic movements to/from rural locations demonstrates that multiple handling and truck journey places rail at a cost and time disadvantage

Table 10 - Comparable road and rail intermodal costs for domestic movement

Example

Griffith to Sydney Markets (horticulture products)			
ROAD movement		**RAIL intermodal movement**	
Activity	**Cost**	**Activity**	**Cost**
Semi trailer carrying load equivalent to 2 TEU's • 630 kms one way • 1260 kms round trip • Average cost $1.20 per km assuming no backload		Collect container in Sydney and transport to Sydney rail terminal	130.00
		Terminal handling costs to lad train	50.00
		Rail empty container to Griffith	Nil
		Transport container from Griffith rail terminal to load point and return to terminal	130.00
		Terminal handling costs at Griffith to load to train	50.00
		Rail line haul costs to Sydney (loaded) based on 2 TEU's	1000.00
		Handling costs at Sydney rail terminal	50.00
		Transport container to markets, unload and return	200.00
Total Cost	**$1,500 per load**	**Total Cost**	**$1,660 per load**
Loaded transit time	**7 hours**	**Loaded transit time**	**15 hours**

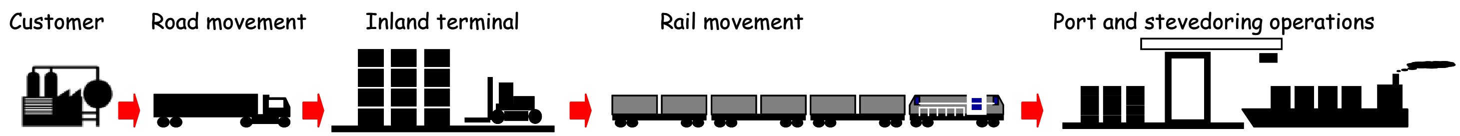
There are a number of methods by which rural-based movements can be transported to their destination. Each competes for market share, and modal choice is ultimately a function of total price (door-to-door), service quality, and timeliness. Each element within the chain must be efficient and low-cost, and the sum of the parts must achieve a lower overall cost than other competing chains.

Figure 19 - Logistics processes in various intermodal chains

DIRECT ROAD MOVEMENT TO PORT

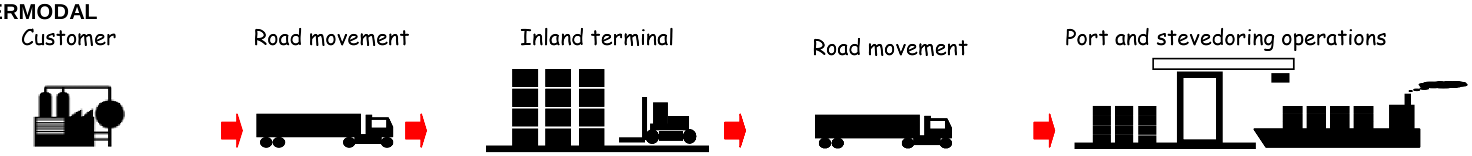
This option provides the quickest path to port, and is more cost effective where daily volumes are small, frequent delivery is necessary and journey distance is less than 300 kms

INTERMODAL/EXPORT



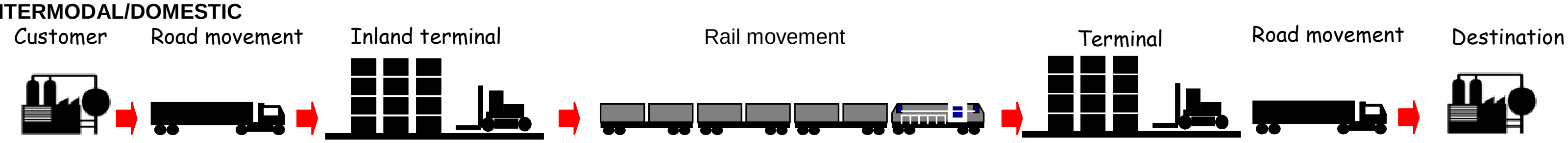
This option utilises the scale and economy benefits of rail combined with a local road based movement linking the customer to the terminal. The path to port is slower, and cost efficiency with full train volumes moving at a distance typically greater than 400 kms

INTERMODAL



This option is used where volumes are insufficient for efficient train movement, yet a staging task is required, such as seasonal movements of horticulture products.

INTERMODAL/DOMESTIC



This option demonstrates the movement of a domestic consignment from producer to customer

5.2 Rail transport costs

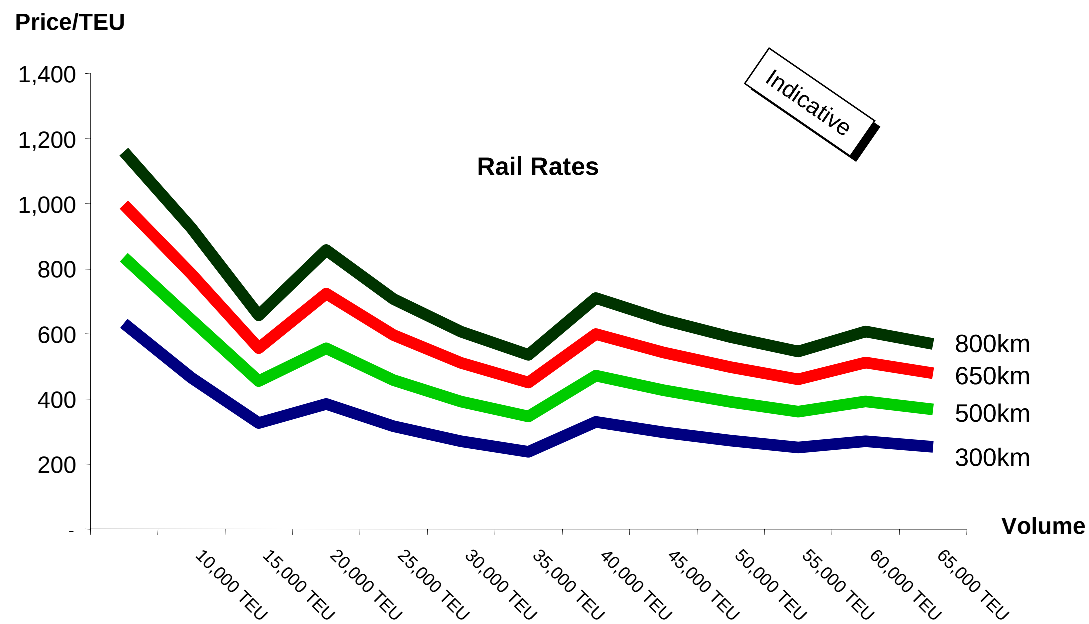
Recognising that rail transport is implied as the principal means of moving from a rural intermodal terminal, it is critical that the analysis exposes the underlying cost structure and drivers of rail operations. This section summarises the key points and further information is provided in the Appendix from page 44.

The analysis also assumes that intermodal terminals are generally located adjacent to track with a minimum standard of Class 3, and that Class 4 or 5 rail track normally associated with low density grain branchlines will inhibit train running speed and axle loadings so as to represent a substantial cost impost relative to road. Class 3 rated track provides an average travel speed of around 60 kms per hour and axle loading capacity of 18 tonnes, providing an overall wagon capacity of 72-78 tonnes consistent[12].

Further, the cost of upgrade for a branch line to Class 3 and/or connection of a siding to the mainline or branchline has become the responsibility of the terminal operator, where the track owner and access provider is unable to fund the investment through normal commercial arrangements, and is underpinned by, or requires confidence in, the terminal's ability to reach substantial volumes.

The following diagram provides the indicative cost rate per TEU calculated for point-to-point journeys for varying distances on rail, however other factors such as additional shunting times can significantly vary the patterns and cost.

Figure 20 - Average rail-based unit costs for varying volumes and distance to port



- The graph describes the saw-toothed nature of train costs associated with incremental locomotive requirements. As volume per service increases, the cost per TEU falls significantly.
- As more services and capital are required, the cost per TEU spikes, until increasing volume brings the unit cost down again.
- Utilisation and the “power-to-weight ratio” drive this relationship between volume and cost.

The Appendix (from page 44) contains additional information and analysis relating to operating factors that influence rail costs.

[12] Further analysis is provided in the Appendix in section 8.3 on page 46.

5.3 Road transport costs

A summary of road costs has been produced using industry standard assumptions and a 50% mix of semi trailers and B-Doubles

The following diagram demonstrates the average costs of road movements as (a) short distance from terminal to factory or farm gate and (b) long distance intrastate movements direct to port. Note that minor fluctuations will occur from area to area due to seasonal demand/capacity for road vehicles, such as occurs at grain harvest (November-January) and forward and back-loading pricing.

Figure 21 - Indicative road rates

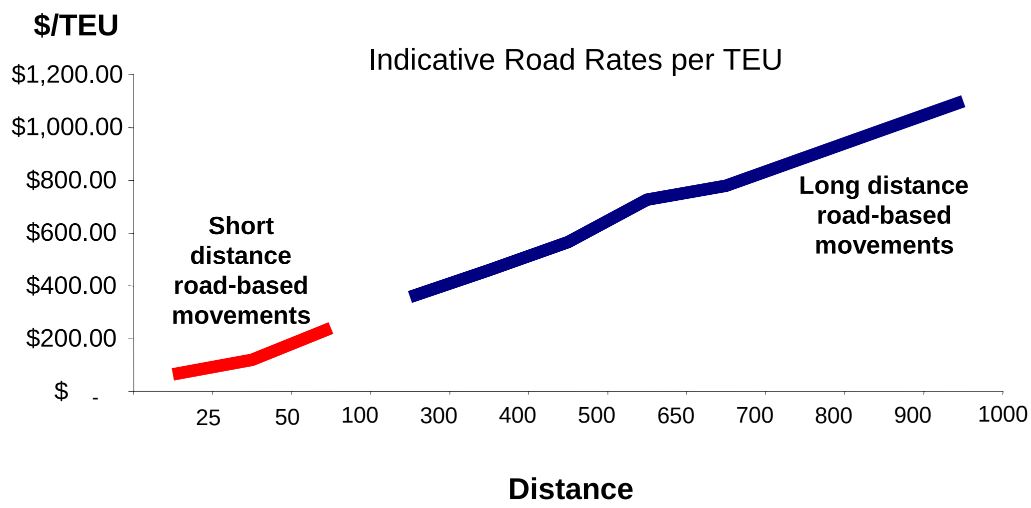


Table 11 – Indicative road rates showing lower and upper limits

Nominal Distance (km)	Road cost Per TEU Range ($)		
	Lower	Average	Upper
300	300	390	540
500	500	620	900
650	650	790	1170
800	800	960	1440

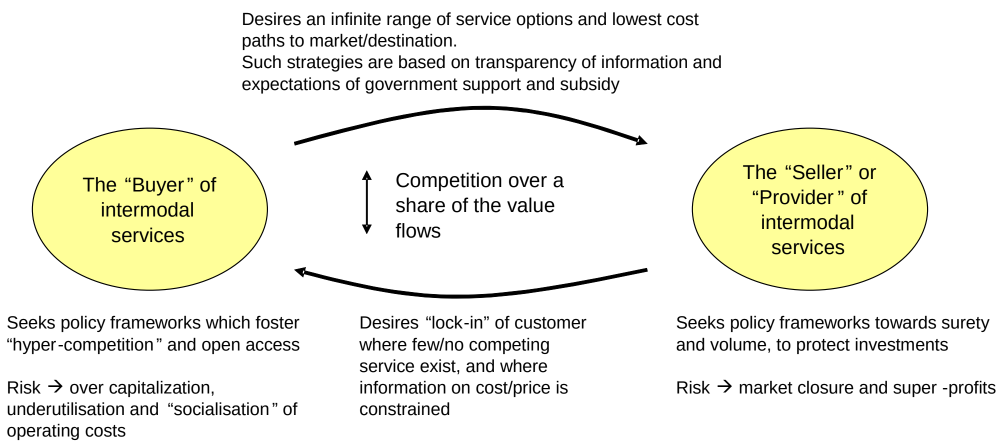
- The balance of TEU's on a truck has a major effect on the price per TEU. For heavy product it is unlikely that more than 2 boxes can be carried at a time; rail derives a competitive advantage over road for heavy materials
- The upper and lower truck costs shown in the table were calculated using industry information and assumptions in conjunction with some truck volume balancing calculations, which can be seen in the Appendix on page 51.

6. Impact of price and chain power on terminals

6.1 Power

Freight users are increasingly aware that vertical integration in a supply chain is decreasing supplier choice and a degree of contractual dependency. When freight users and developers advocate government investment and support for a user-specific terminal, it is often as part of a strategy to mitigate dependency on a single supplier and to take control over their own supply chains. Such strategies also seek to avoid the risk of excessive pricing by third party service providers.

Figure 22 - Buyer-supplier competition for share of value chain



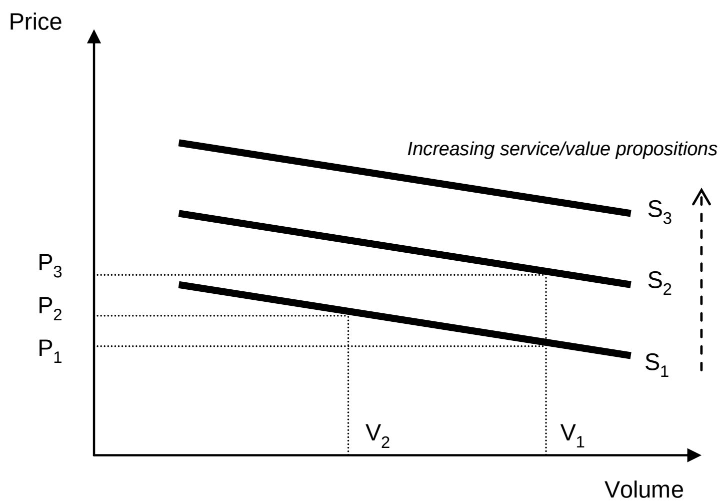
6.2 Price

Intermodal terminals generally operate in elastic markets. In an elastic market, minor fluctuation in price will erode the terminal's volumes. Where co-located terminals yield excess capacity relative to demand, freight users have the power to discriminate between terminal providers, however this may threaten the long term viability of the terminal operations.

a) Market with sensitive price characteristics

As shown in the diagram below, small movements in price ($P_1 \rightarrow P_2$) cause considerable volume erosion ($V_2 \rightarrow V_1$), which may be overcome by offering a higher level of service (S_2), which may in turn allow a price increase to P_3.

Figure 23 - Price sensitive market conditions



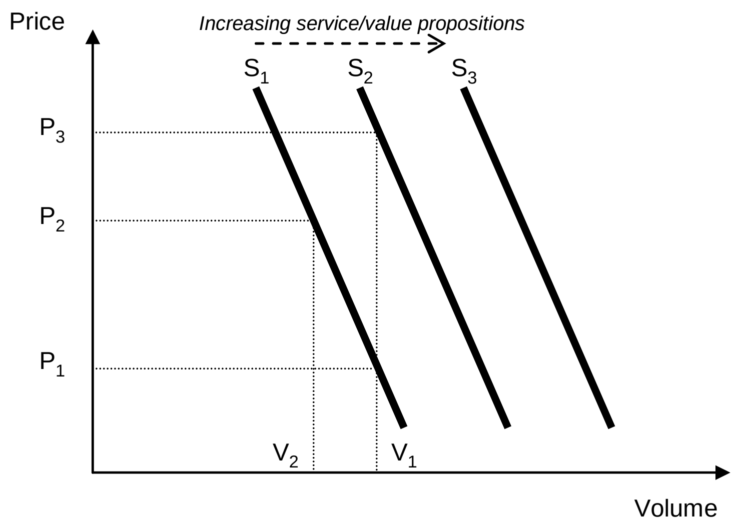
Conditions for Price Sensitivity

- High elasticity is the dominant scenario in the NSW intermodal market. While the prevailing road rate acts as a price cap, seasonal factors and the need to move large volumes quickly (e.g. export wine orders on a single vessel) will tend to create an inelastic market condition in the short term
- Short haul movements to port also tend to create an inelastic market, as trucks can achieve greater cycles through shorter distances and unrestricted 24-hour operations, whereas rail movements to the port are impacted by metropolitan passenger rail curfews
- Excess capacity arising from regional co-location of terminals will lead to a highly price sensitive market

b) Market with robust price characteristics

As shown in the following diagram, large movements in price ($P_1 \rightarrow P_2$) will not cause any significant erosion of volume ($V_2 \rightarrow V_1$). Inelastic markets may also provide an opportunity for value adding through provision of a higher level of service (S_2) at a higher price.

Figure 24 - Robust price market conditions



Conditions for robust pricing

- Not common in "road competitive" intermodal freight markets, however dense commodities which are located at distance from port will favour rail; e.g. cereal and cotton, at Griffith and Narrabri respectively
- Finite rail capacity and infrastructure, where roads are not to highway standard
- Planning consents which dictate the use of rail over road in new developments – typical in export coal licenses

7. The framework and financial results

a) Terminals which are 300 kms from port

Intermodal terminals within 300kms of port are generally at a cost disadvantage to direct road services, except in cases where high volumes exist, supplemented by back-loading revenue opportunities

- The figure and table immediately below compare the costs of a) direct trucking from production origin to delivery destination, and b) an intermodal chain from an origin point 300km from destination
- In the graph, the modeled direct truck cost, and maximum and minimum truck costs are shown and compared to total intermodal costs
- The modeled intermodal terminal is based on a Brownfield site, i.e., a site requiring limited rail capital upgrade, rather than full construction
- Road movement seems to be the most cost effective method of transport in the short distance case

Figure 25 – Nominal unit costs for Brownfield terminal 300kms from port

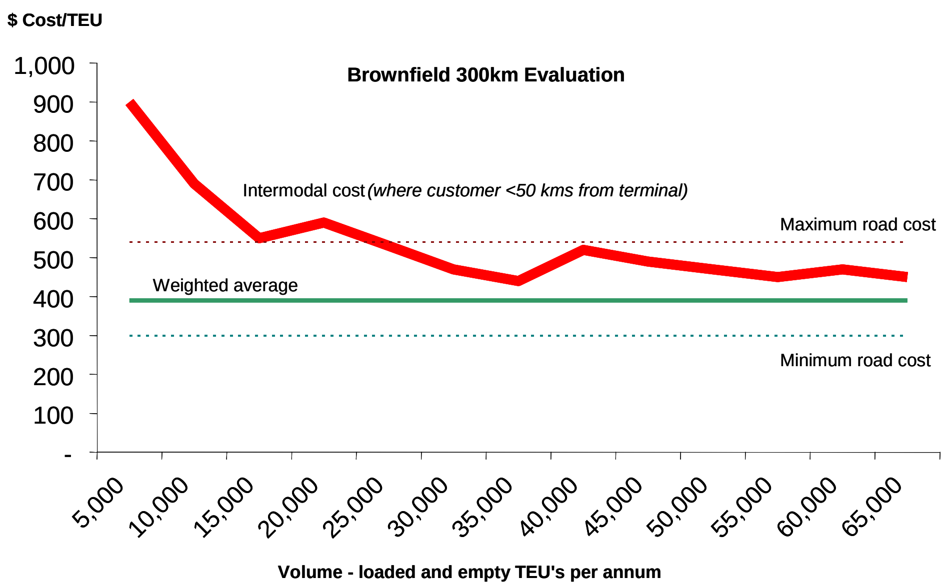


Table 12 - Modal and elemental cost comparison; 300kms from port

$ COST PER TEU						
TERMINAL DISTANCE	300 Km's					
	No Intermodal Terminal	Intermodal Terminal				Difference
Volume TEU's Annual	Truck Only	Truck	Terminal	Rail	TOTAL	
5,000	390	130	130	640	900	-510
10,000	390	130	90	470	690	-300
15,000	390	130	90	330	550	-160
20,000	390	130	70	390	590	-200
25,000	390	130	80	320	530	-140
30,000	390	130	70	270	470	-80
35,000	390	130	70	240	440	-50
40,000	390	130	60	330	520	-130
45,000	390	130	60	300	490	-100
50,000	390	130	60	280	470	-80
55,000	390	130	60	260	450	-60
60,000	390	130	60	280	470	-80
65,000	390	130	60	260	450	-60

b) Terminals which are 500 kms from port

For terminals located 500kms from port, the opportunity to generate marginal profit exists for discrete volume ranges above 30,000 TEU's, or 15,000 loaded TEU's per annum

- The figure and table immediately below compare the costs of a) direct trucking from production origin to delivery destination, and b) an intermodal chain from an origin point 500km from destination
- At the maximum throughput level analysed, the intermodal option is marginally better than direct road movements

Figure 26 - Nominal unit costs for Brownfield terminal 500kms from port

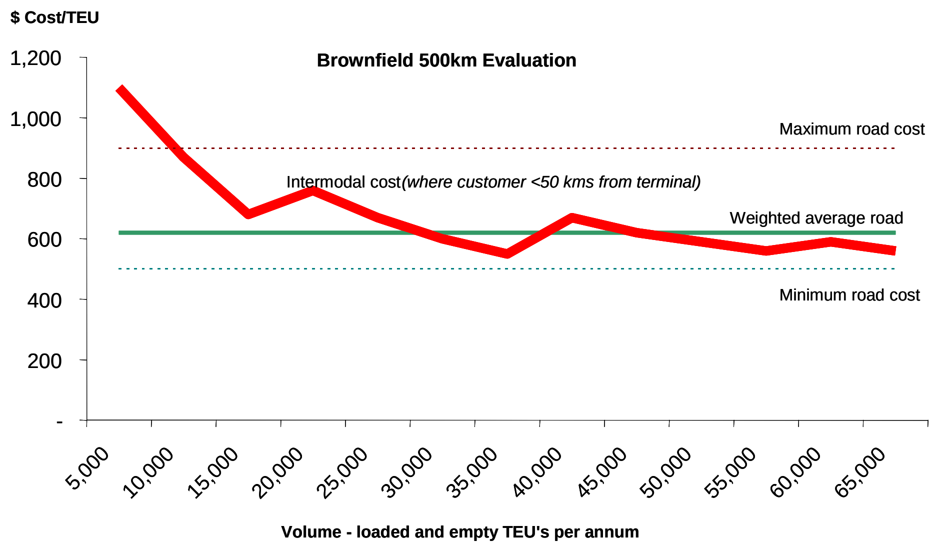


Table 13 - Modal and elemental cost comparison; 500kms from port

		$ COST PER TEU				
TERMINAL DISTANCE	**500 Km's**					
	No Intermodal Terminal	**Intermodal Terminal**				**Difference**
Volume TEU's Annual	**Truck Only**	**Truck**	**Terminal**	**Rail**	**TOTAL IM**	
5,000	620	130	130	840	1,100	-480
10,000	620	130	90	650	870	-250
15,000	620	130	90	460	680	-60
20,000	620	130	70	560	760	-140
25,000	620	130	80	460	670	-50
30,000	620	130	70	400	600	20
35,000	620	130	70	350	550	70
40,000	620	130	60	480	670	-50
45,000	620	130	60	430	620	-
50,000	620	130	60	400	590	30
55,000	620	130	60	370	560	60
60,000	620	130	60	400	590	30
65,000	620	130	60	370	560	60

c) Terminals which are 650 kms from port

At 650kms from port, an intermodal terminal service can compete on price for volumes in excess of 25,000 teu's per annum. This is equivalent to 12,500 loaded/export movements

- The figure and table immediately below compare the costs of a) direct trucking from production origin to delivery destination, and b) an intermodal chain from an origin point 650km from destination
- In most cases, the intermodal option yields a lower cost outcome

Figure 27 - Nominal unit costs for Brownfield terminal 650kms from port

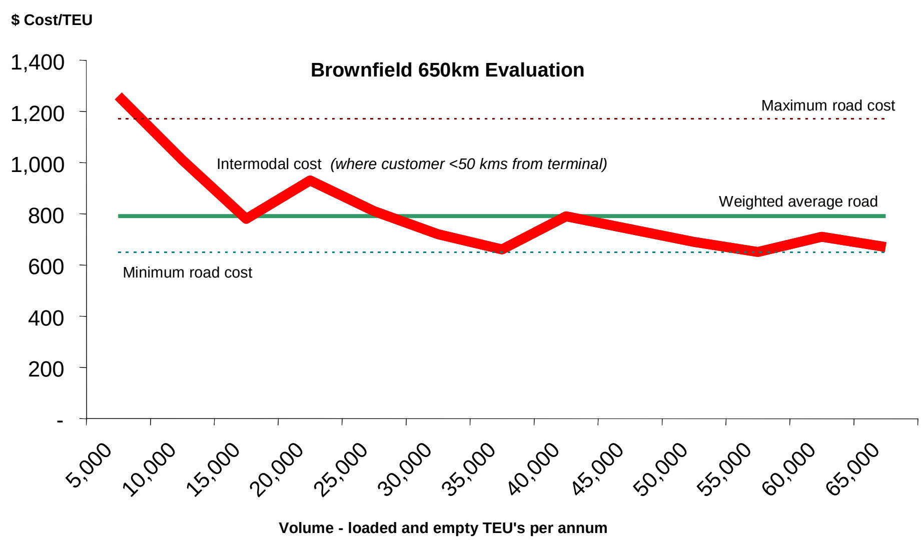


Table 14 - Modal and elemental cost comparison; 650kms from port

$ COST PER TEU						
TERMINAL DISTANCE	650 Km's					
	No Intermodal Terminal	Intermodal Terminal				Difference
Volume TEU's Annual	Truck Only	Truck	Terminal	Rail	TOTAL IM	
5,000	790	130	130	1,000	1,260	-470
10,000	790	130	90	790	1,010	-220
15,000	790	130	90	560	780	10
20,000	790	130	70	730	930	-140
25,000	790	130	80	600	810	-20
30,000	790	130	70	520	720	70
35,000	790	130	70	460	660	130
40,000	790	130	60	600	790	-
45,000	790	130	60	550	740	50
50,000	790	130	60	500	690	100
55,000	790	130	60	460	650	140
60,000	790	130	60	520	710	80
65,000	790	130	60	480	670	120

d) Terminals which are 800 kms from port

At 800kms to port, the intermodal service achieves a cost advantage over road above 15,000 teu's or 7,500 loaded teu's per annum, derived from the distance cost advantage of rail

- The figure and table immediately below compare the costs of a) direct trucking from production origin to delivery destination, and b) an intermodal chain from an origin point 800km from destination
- The increased requirement for capital assets is shown in the diagram as spikes in cost per TEU as volume increases
- The diagram and table show that with a distance of 800km to destination, the intermodal supply chain is highly competitive

Figure 28 - Nominal unit costs for Brownfield terminal 800kms from port

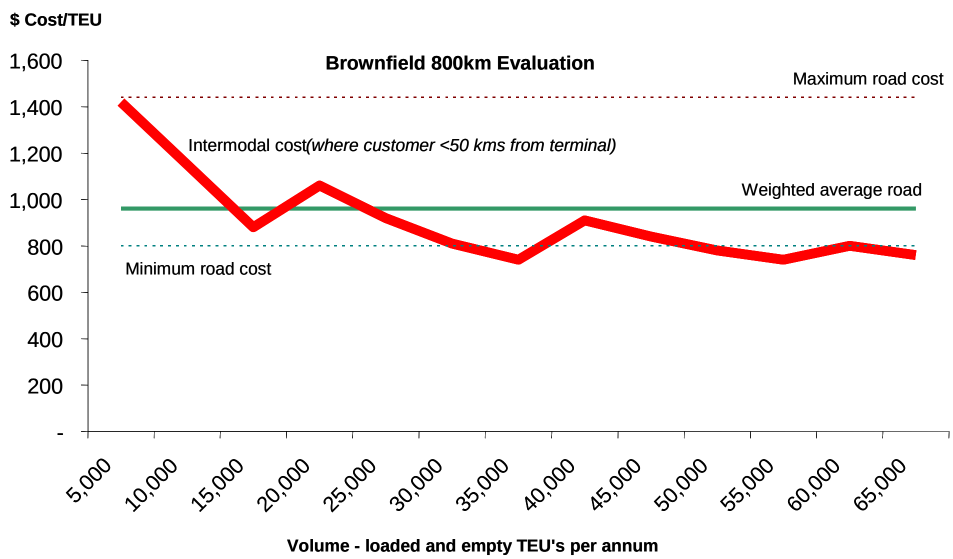


Table 15 - Modal and elemental cost comparison; 800kms from port

$ COST PER TEU						
TERMINAL DISTANCE	800 Km's					
	No Intermodal Terminal	Intermodal Terminal				Difference
Volume TEU's Annual	Truck Only	Truck	Terminal	Rail	TOTAL	
5,000	960	130	130	1,160	1,420	-460
10,000	960	130	90	930	1,150	-190
15,000	960	130	90	660	880	80
20,000	960	130	70	860	1,060	-100
25,000	960	130	80	710	920	40
30,000	960	130	70	610	810	150
35,000	960	130	70	540	740	220
40,000	960	130	60	720	910	50
45,000	960	130	60	650	840	120
50,000	960	130	60	590	780	180
55,000	960	130	60	550	740	220
60,000	960	130	60	610	800	160
65,000	960	130	60	570	760	200

e) Variations for rail infrastructure investment

The analysis so far has considered Brownfield terminal facilities where rail infrastructure already exists, but requires some additional capital investment for refurbishment and/or adjustment.

For a completely new "Greenfield" facility, the capital cost for new sidings will be greater, as will the operating cost per TEU. However, where the site does not require any rail capital, the operating cost will be lower than for the "Brownfield" site.

Table 16 - Nominal unit cost adjustment for differing rail capital investment

RAIL CAPITAL Assumptions and operating cost impacts					
		Small	**Medium**	**Large**	**Super**
Brownfield	$/TEU terminal costs	$130	$70 - $130	$60 - $70	$60
	Rail Capital $M	$0.5 m	$0.5 m	$0.5 m	$0.5 m
Greenfield	Differential $/TEU over Brownfield site	+ $30	+ $10 - $30	+ $10	+ $10
	Rail Capital $M	+ $1.25m	+ $1.5m	+ $2.0m	+ $2.0m
No Rail Capital	Differential $/TEU below Brownfield site	- $30	- $10 - $30	- $5 - $10	- $5
	Rail Capital $M	-	-	-	-

Depending on the infrastructure investment requirements, the rail investment costs per TEU for the "Greenfield site" will in the order of $60 - $130 per TEU greater than for the modelled "Brownfield site", and may not be commercially sustainable. Where no rail capital is required, as in most terminal developments to date, a reduction in investment cost of $5 to $30 per TEU is likely. This reinforces the observation that a sustainable terminal is only likely where it can access and utilise sunk capital, and where the market aggregates volumes in excess of 15,000 to 20,000 TEU's per annum

f) Summary

The following tables provide a summary of the analytical results, comparing the intermodal options across various terminal sizes, distances and capital levels, with the cost of direct road services. The shaded cells indicate where the terminal options derive a clear and sustainable advantage over the direct road options, however the road costs may fluctuate according to weight and back-loading situations. Detailed results are shown in the supplementary material section.

Table 17 - Summary of unit costs by investment level, volume/size, mode and distance to port

Brownfield Site - requiring minimal rail capital for siding upgrade

		Average Cost per TEU															
		Terminal @ 300km from port				Terminal @ 500km from port				Terminal @ 650km from port				Terminal @ 800km from port			
Terminal Size	**Terminal Size**	**Small**	**Medium**	**Large**	**Super**	**Small**	**Medium**	**Large**	**Super**	**Small**	**Medium**	**Large**	**Super**	**Small**	**Medium**	**Large**	**Super**
Intermodal	*Customer located within 50kms of terminal*	900	599	489	465	1,100	758	622	582	1,260	898	743	690	1,420	1,020	843	781
	Customer located more than 50kms of terminal	1,020	719	609	585	1,220	878	742	702	1,380	1,018	863	810	1,540	1,140	963	901
Road Direct	*All*	390	390	390	390	620	620	620	620	790	790	790	790	960	960	960	960

Greenfield Site - full investment including rail siding and connection to nearby mainline

		Average Cost per TEU															
		Terminal @ 300km from port				Terminal @ 500km from port				Terminal @ 650km from port				Terminal @ 800km from port			
Terminal Size	**Terminal Size**	**Small**	**Medium**	**Large**	**Super**	**Small**	**Medium**	**Large**	**Super**	**Small**	**Medium**	**Large**	**Super**	**Small**	**Medium**	**Large**	**Super**
Intermodal	*Customer located within 50kms of terminal*	922	606	497	467	1,126	765	625	586	1,288	905	747	696	1,450	1,029	848	789
	Customer located more than 50kms of terminal	1,042	726	617	587	1,246	885	745	706	1,408	1,025	867	816	1,570	1,149	968	909
Road Direct	*All*	390	390	390	390	620	620	620	620	790	790	790	790	960	960	960	960

No Rail Capital - terminal investment only

		Average Cost per TEU															
		Terminal @ 300km from port				Terminal @ 500km from port				Terminal @ 650km from port				Terminal @ 800km from port			
Terminal Size	**Terminal Size**	**Small**	**Medium**	**Large**	**Super**	**Small**	**Medium**	**Large**	**Super**	**Small**	**Medium**	**Large**	**Super**	**Small**	**Medium**	**Large**	**Super**
Intermodal	*Customer located within 50kms of terminal*	858	579	477	452	1,062	738	606	571	1,224	878	727	681	1,386	1,003	828	774
	Customer located more than 50kms of terminal	978	699	597	572	1,182	858	726	691	1,344	998	847	801	1,506	1,123	948	894
Road Direct	*All*	390	390	390	390	620	620	620	620	790	790	790	790	960	960	960	960

8. Appendices

8.1 Analysis of initial NSW SFC characteristics

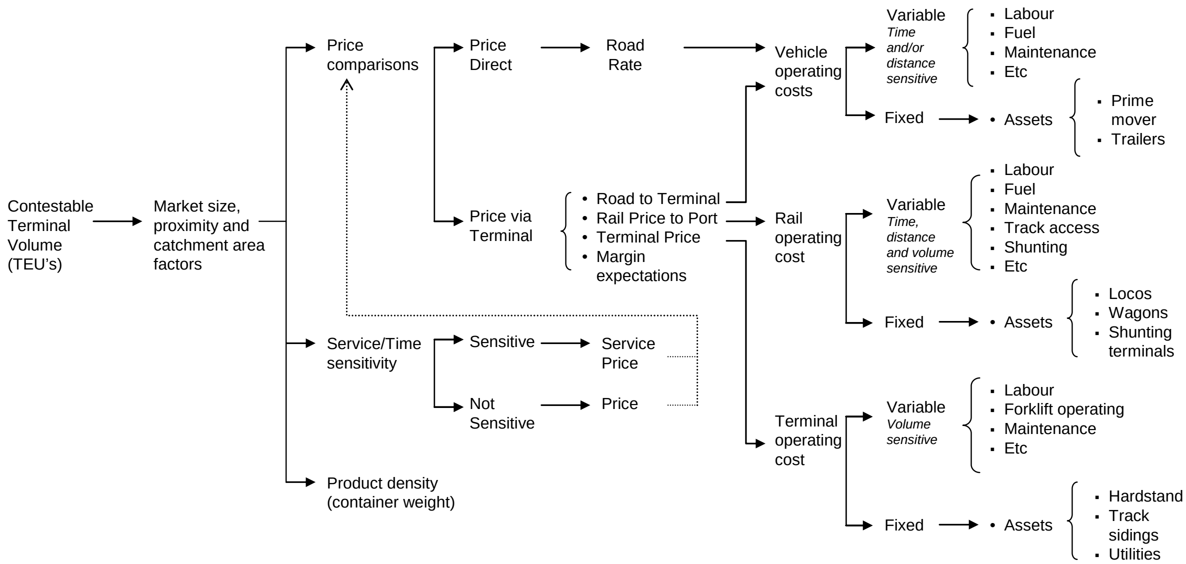
Table 18 - Assessment of preliminary criteria identified in initial brief

Characteristic identified in initial NSW SFC brief	Comments	Degree of importance for viable terminal (from report herein)		
		Critical; mandatory	Important	Moderate to Low
Trade characteristics and catchment area	Proximity to market; road distance must be minimal to rail distance. Product types must not be time sensitive	☑		
Freight Volumes	Scale of economy MOST critical factor to yield lower operating unit costs – annual volume must exceed 7,500 TEU's as an absolute minimum	☑		
Location and access to road and rail infrastructure	Start up volumes and costs exclude capacity for any significant capital costs, and existing terminals only viable to extent that they have accessed existing infrastructure or can be funded "off budget"	☑		
Rail Service frequency	Linkages between rail services and shipping services are important to shorten lead time for order fulfilment and delivery to port		☑	
Initial capital outlay/ equipment/ assets required	Refer to infrastructure comments. Operating cost minimisation is important given "price-taker" status of terminal		☑	
Maintenance costs	Relatively smaller cost item			☑
Existing efficiencies of terminal operation	Even an efficient terminal may not be viable due to the price setting factors of competing chains (eg road direct). The overall efficiency and cost of all of the chain elements must be considered			☑
Range of services offered	Demand for value added services (see page 61) will dictate those which are included in a terminals portfolio. Cost of these services will be primary consideration			☑
Relationship with metro terminals	Rural terminals have limited capacity to compete for intrastate domestic movements against road services			☑

8.2 Relationship between cost and revenue drivers

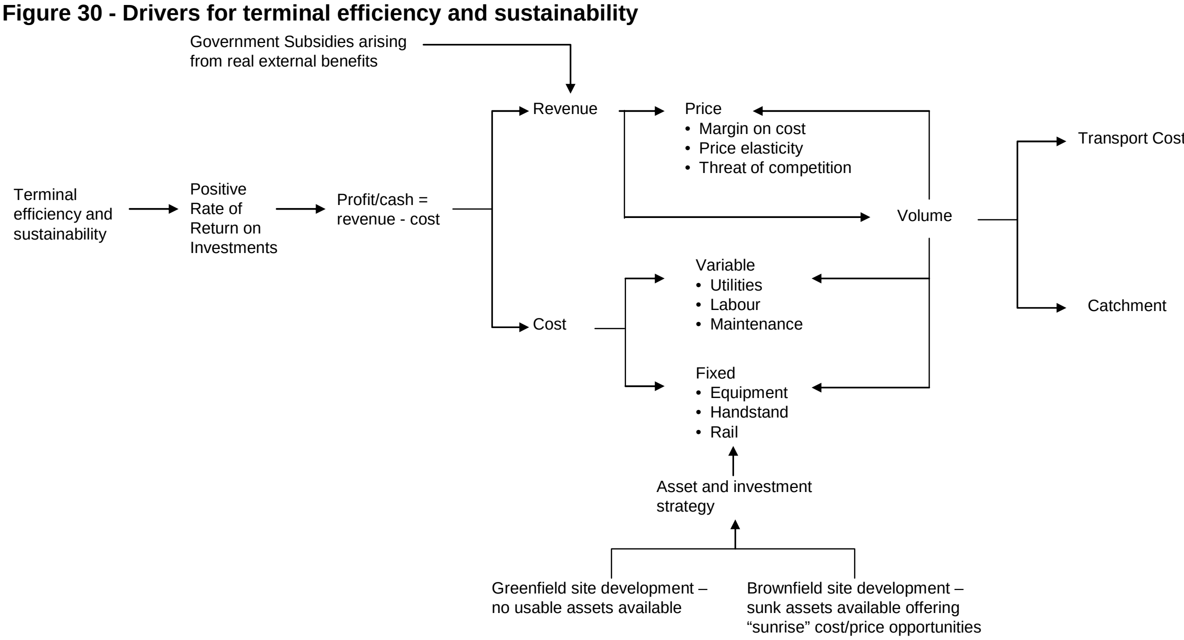
A sustainable terminal operation is highly dependent on both exogenous and endogenous factors that influence volume throughput. A direct relationship exists between volume, asset investment (fixed cost) which is fit for purpose, time/distance/volume factors which affect variable unit cost, price and service outcomes, and attracting the “right” cargo suitable for intermodal transport

Figure 29 - Drivers for contestable terminal volumes



A sustainable terminal MUST achieve a favourable economic outcome in its own right to justify investment, i.e. an outcome in which revenue exceeds cost and is sufficient to provide the investor/operator with an equitable return on investment

Figure 30 - Drivers for terminal efficiency and sustainability



8.3 Product density and time sensitivity

Intermodal supply chains are best suited to products that are heavy and not particularly time sensitive. Rail is able to carry more weight per vehicle journey than road movements. The multi handling activity of intermodal operations means that time sensitivity can be an important service issue, affecting the viability of rail for perishables and fast moving consumer goods to/from rural locations.

Figure 31 - Density and time considerations by mode

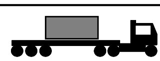
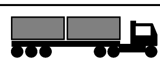
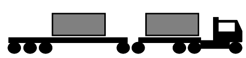
Conveying vehicle type	Weight considerations	Time sensitivity
A 	Over 50 tonne net weight capacity per journey, with product density exceeding 0.7 tonnes per cubic metre	Most rural based rail journeys exceed 7 hours, with transit time for 600kms plus distances in the order of 18 hours. Track quality and network density at key points impact average journey speed
B 	Increased cubic capacity marginally diminishes net weight due to additional container, with product density around 0.5 cubic metres to the tonne	
C 	Product density same as rail however overall net weight achieved is halved and unit cost increased	Ultimate flexibility and timeliness achieved with road vehicles, with point to point service specification. Minimal linkages and external dependencies
D 	Generally suited to fast moving consuming goods at 0.3 tonnes per cubic metre	
E 	Product density same as rail however overall net weight achieved is halved and unit cost increased	

Table 19 - Product density and vehicle mass limits

Gross weight (max)	Tare wieght of conveying vehicle	TEU's carried	Tare weight of containers *	Gross wieght of equipment	Tare wieght of product per vehicle	Cubic capacity (m3)	Allowable product density (tonne per m3)
78.00	24.00	2.00	3.80	27.80	50.20	66.00	0.76
78.00	24.00	3.00	5.70	29.70	48.30	99.00	0.49
42.50	14.70	1.00	1.90	16.60	25.90	33.00	0.78
42.50	14.70	2.00	3.80	18.50	24.00	66.00	0.36
65.00	21.00	2.00	3.80	24.80	40.20	66.00	0.61
* Based on 6m standard dry container @ 33 cu.m							

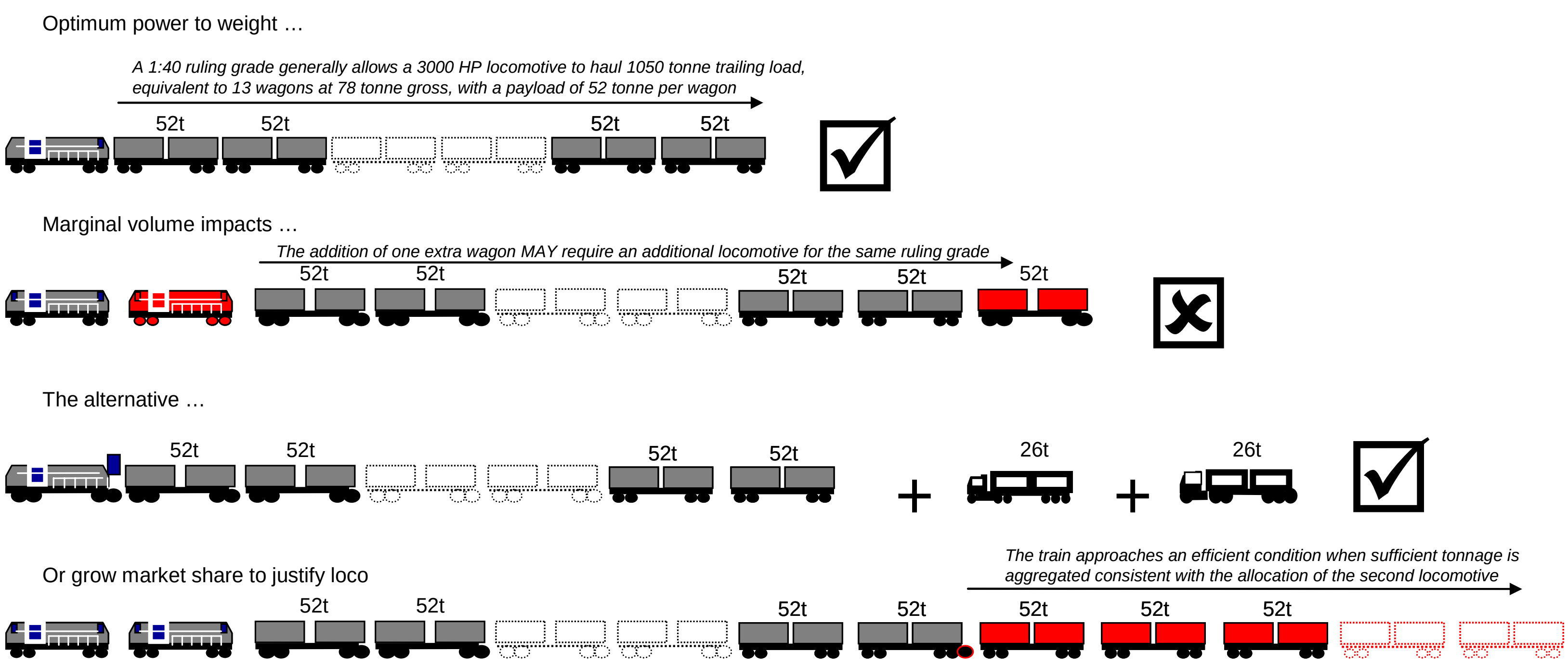
8.4 Key rail cost drivers

a) Cost impacts of payload, horsepower and topography

Efficiency and load utilisation for train-based movements are not constant over all volumes because of the relationship between locomotive power, the trailing load (of wagons and payload) and the topography.

- Rail operations (as defined by "safe-working rules") mandate minimum requirements for tractive effort (horsepower) for a given load over nominated track. This governs the number of locos required for a given task and location
- Failure to maximise the trailing load for a given number of locomotives will cause excessive locomotive power to be expended, with an impact on operating unit cost.

Figure 32 - Relationship between power, trailing weight, typography and efficiency



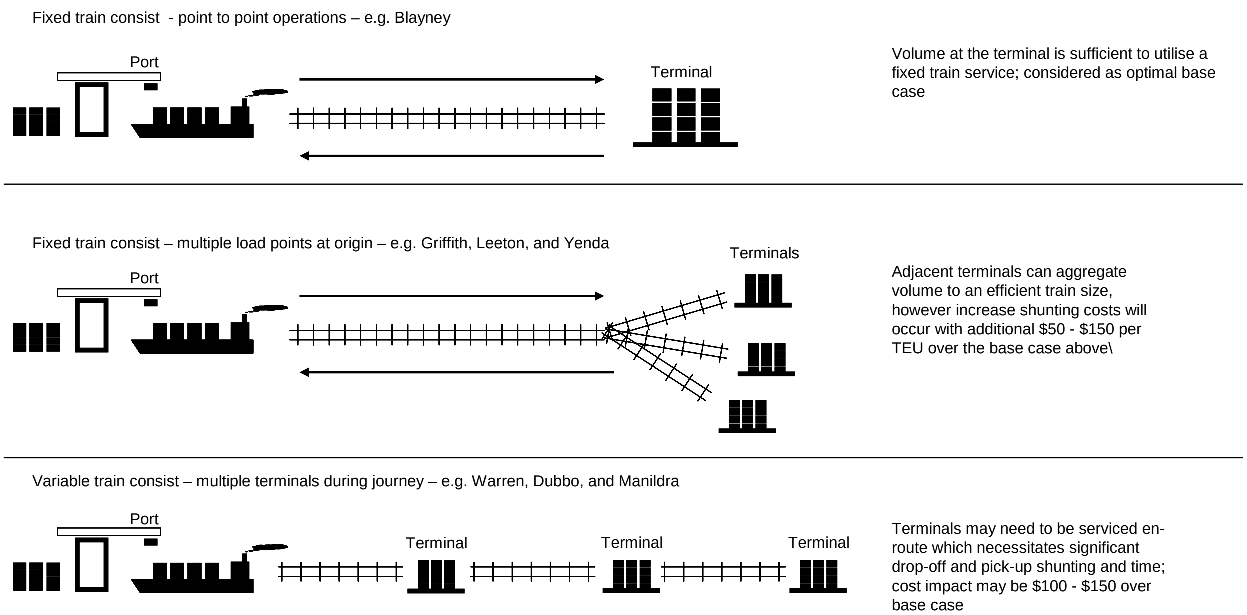
Example - Lithgow to Katoomba				
Locos	**Wagons**	**Horse power**	**Trailing tonnes ****	**HP per tonne**
1	13	3000	1014	2.96
2	14	6000	1092	5.49
2	19	6000	1482	4.05
2	26	6000	2028	2.96
3	39	9000	3042	2.96

*** based on 78 tonnes gross wight per wagon, or 52 tonnes payload (nominal)*

b) Single and multiple point loading impacts on rail costs

It is much easier and preferable for a rail operator to undertake single point-to-point service and achieve operational reliability. Complexity in the operation increases cost and service risk, and the incidence of missed train paths or access windows at port

Figure 33 - Various terminal and network configurations



c) Paths and delivery window cost impacts

Decisions to shunt to multiple terminals or drop off along the way should be based on whether marginal revenue from the additional volume is greater than marginal cost of providing the extra service/delivery/pick-up

- This revenue/cost decision needs to be made within the operational confines of maintaining operational consistency. Lack of operational consistency affects rail organisation profitability and therefore the organisation's ability to service a terminal
- Train paths are purchased from the below-rail owner / operator (in NSW, the Rail Infrastructure Corporation). This allows the rail operator to run its train along a section of track at a given time to a nominated timetable
- Windows at the port are arranged with stevedores and rail companies. The window dictates when a train service is allowed to access the port and be unloaded
- For a rail organisation with multiple train paths and windows at port, there is some flexibility in scheduling rail operations both up country and at the port. However, it is likely that all windows and most paths will have been allocated to other trains (and terminals).
- If a train service is delayed and misses its path or window, it is likely that it will be delayed for 24 hours until the service can return to timetable. This has an impact on crew, service reliability, volume delivery and profitability.

Table 20 - Path and timetable impacts

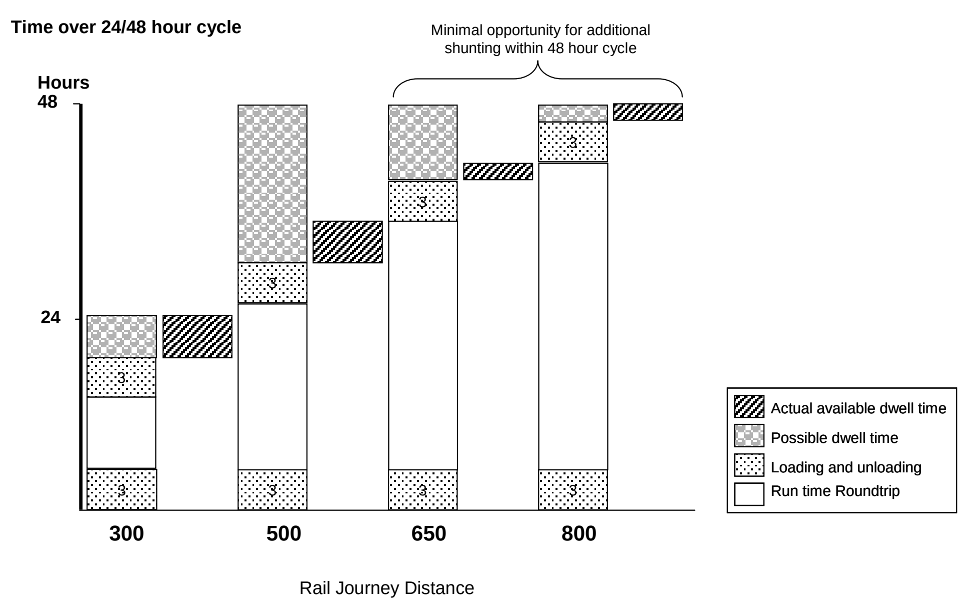
Results of Missing Timetable Path or Window				
	Single Booked	**Multiple Booked**	**Crew Cost**	**Volume**
Path	Wait for next available – may have to wait for other trains	Able to be flexible	Potential additional crew	May miss next service
Window	24hour delay @ port	May be able to add to existing	Additional crew	May miss opportunity to make next day task

d) Cost impact of fixed operating cycles and available dwell time

The marginal cost to service multiple terminals (at an end or intermediate point) will depend on the available dwell times within the cycle of paths and windows and the nature of the rail operations.

- Rail services tend to run on 24 or 48 hr cycles in order to maintain their mandatory paths[13] outbound to country and inbound to their windows at port
- This leads to possible dwell times at the up country end of the journey, shown in the diagram (“Possible dwell time”), which may be used to pick up volume from nearby terminals
- However, it is more likely that a rail operator will work to available crew shifts, every 8 hours in this case, and as such, we show the “Actual available dwell time”
- The level of resource for additional shunting to seek marginal revenue and volume must be offset against this marginal cost

Figure 34 - Relationship between daily train path cycles, and available dwell time

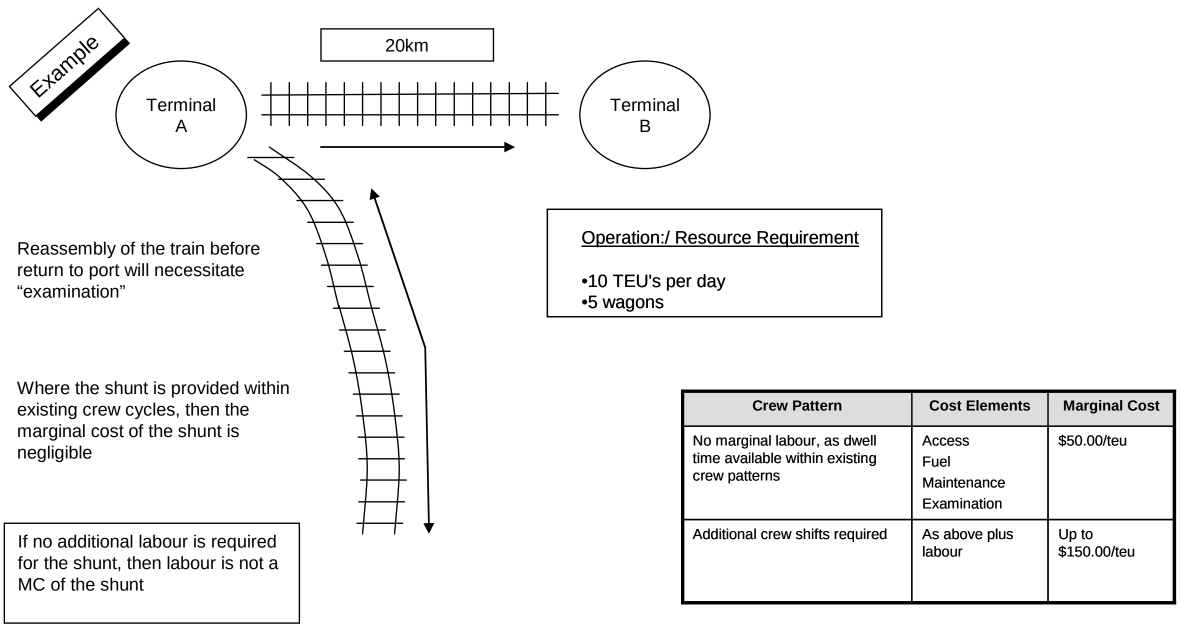


[13] Trains run according to fixed time tables which are considered “mandatory” and operated as standard services with high regularity, or “conditional” where the rail operator effectively operates the train on a “special” timetable which is not permanent.

e) Rail shunting cost impacts

An example of a shunt decision is shown below. For the shunt to terminal B to be undertaken, the marginal rail revenue must be greater than the marginal cost of the shunt.

Figure 35 - Additional shunting cost considerations



Crew Pattern	Cost Elements	Marginal Cost
No marginal labour, as dwell time available within existing crew patterns	Access Fuel Maintenance Examination	$50.00/teu
Additional crew shifts required	As above plus labour	Up to $150.00/teu

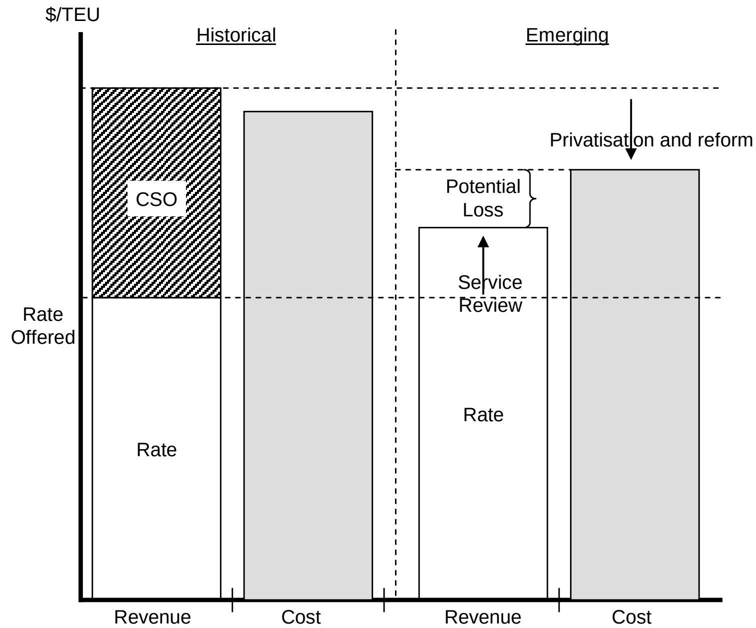
- Labour is not a marginal cost of undertaking a shunt option if it is available in existing crew patterns. It was previously shown that there is available dwell time up country within existing crew shifts to facilitate additional shunting
- From the example, if there is available dwell time and the operation can be undertaken within an existing crew shift, the marginal cost per TEU of this shunt is $50
- However, if an additional crew needs be engaged, the marginal cost of the operation can reach $150 per TEU
- In the case where labour is a marginal cost, i.e. where it is not available in existing crew patterns, it is often better to consolidate volume at a single terminal

8.5 Rail cost reform

Historically, government owned rail operations were subsidised via CSO's to meet key policy arrangements. Competition policy and rail privatisation of these rail entities have caused such subsidies to be removed, allowing a more transparent arrangement between cost and price.

The new privatised rail entities are required by regulation to re-evaluate service offerings, and pricing and other changes are presently occurring. Adverse costs arising from volume and seasonality risks are no longer being carried by the rail operator and the government. The following diagram demonstrates the fundamental changes that are occurring.

Figure 36 - Changes to rail pricing



Analysing the graph:

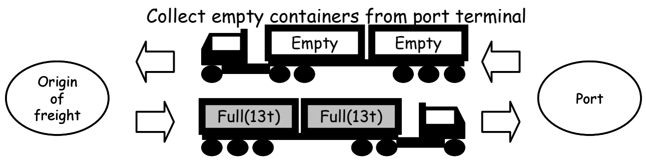
- In the historical case, rail operators charged a low rate in order to attract business off road and onto rail. Because of the negative perceptions to many railway services this rate had to be significantly lower than the market in order to entice producers to rail
- In the emerging case, NSW freight rail operators have been privatised and as such do not receive government subsidies. However rates for rail still need to be lower than competing modes of transport. It also takes time for rates to move upwards without resulting in loss of volume.
- Efficiency and cost savings are occurring, but again these take time to come into effect. Some railway services are therefore making a loss while this movement towards a sustainable equilibrium occurs – service rationalisation and contraction is evident at present.

8.6 Road vehicle configuration

The type of truck capital and box weights will determine the number of boxes that can be carried per journey and therefore the price per TEU that will be charged.

Figure 37 - Typical road vehicle configurations and nominal costs

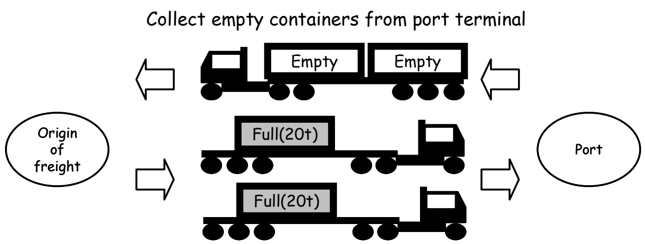
Semi-Trailers



Loaded movement conveys 2 TEU's within vehicle mass limits

Road "A" - Horticulture on Semi trailer

Distance		300	500	650	800
One-way journeys		2	2	2	2
$ per journey	$ 1.20	$ 360.00	$ 600.00	$ 780.00	$ 960.00
Transport costs		$ 720.00	$1,200.00	$1,560.00	$1,920.00
Loaded TEU's		2	2	2	2
Cost per TEU		$ 360.00	$ 600.00	$ 780.00	$ 960.00

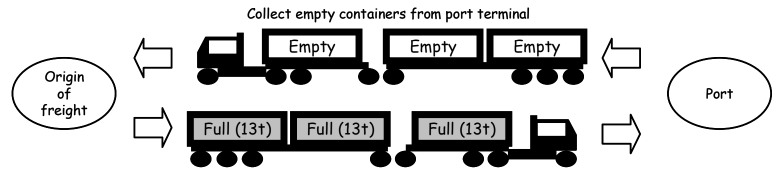


Loaded movement on two trucks due to vehicle mass

Road "B" - Wine, cereal, and cotton on Semi trailer

Distance		300	500	650	800
One-way journeys		3	3	3	3
$ per journey	$ 1.20	$ 360.00	$ 600.00	$ 780.00	$ 960.00
Transport costs		$1,080.00	$1,800.00	$2,340.00	$2,880.00
Loaded TEU's		2	2	2	2
Cost per TEU		$ 540.00	$ 900.00	$1,170.00	$1,440.00

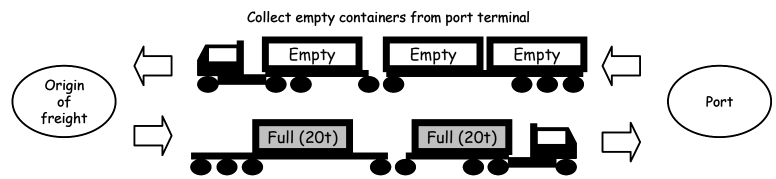
B-Doubles



Loaded movement can carry three TEU's within vehicle mass limits

Road "C" - Horticulture on B-Double

Distance		300	500	650	800
One-way journeys		2	2	2	2
$ per journey	$ 1.50	$ 450.00	$ 750.00	$ 975.00	$1,200.00
Transport costs		$ 900.00	$1,500.00	$1,950.00	$2,400.00
Loaded TEU's		3	3	3	3
Cost per TEU		$ 300.00	$ 500.00	$ 650.00	$ 800.00



Loaded movement limited to two TEU's due to vehicle mass limits

Road "D" - Wine, cereal, and cotton on B-Double

Distance		300	500	650	800
One-way journeys		2	2	2	2
$ per journey	$ 1.50	$ 450.00	$ 750.00	$ 975.00	$1,200.00
Transport costs		$ 900.00	$1,500.00	$1,950.00	$2,400.00
Loaded TEU's		2	2	2	2
Cost per TEU		$ 450.00	$ 750.00	$ 975.00	$1,200.00

8.7 Manpower

Nominal manpower levels can be determined for varying volume levels as shown in the following table.

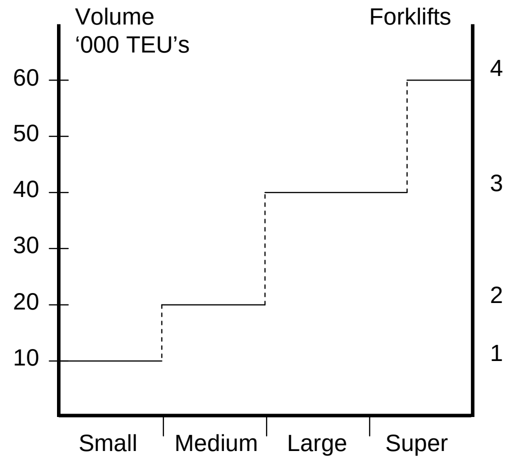
Table 21 - Calculated manpower levels and volume

Container throughput volume	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000
Average throughput per day	20	40	60	80	100	120	140	160	180	200
Upper daily limit with 25% surge capacity	25	50	75	100	125	150	175	200	225	250
Average lifts per container	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Average forklift time per lift (minutes)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Nominal lifting time per day (hours)	6.3	12.5	18.8	25.0	31.3	37.5	43.8	50.0	56.3	62.5
Equivalent manpower - Forklift personnel	1	2	3	4	4	5	6	7	8	9
Support personnel										
Supervisor	-	-	-	-	-	1	1	1	1	1
Administrative	-	1	1	1	1	1	1	1	1	1
Yard/support	1	1	1	1	1	2	2	2	2	2
Total indicative manpower for terminal operations	2	4	5	6	6	9	10	11	12	13

8.8 Forklifts

The number of forklifts affects the level of capital spend at a terminal and the level of manpower across one or multiple shifts – the ratio of TEU's handled to forklifts used is an important productivity measure.

Figure 38 - Relationship between forklifts and volume



- The greater the number of forklifts at a terminal, the higher the level of manpower
- The operating hours of a terminal affect the number of forklifts required to undertake the task – if demand can be smoothed over greater operating hours, fewer forklifts are required as volume and operating hours are scaleable
- It is often the case that more forklifts are required than would be suggested by volume to time equations because loading and unloading is typically done in activity blocks across a shift, (i.e. the arrival of a train) and contingency or urgency

8.9 Value-added services

Intermodal terminals must be able to handle all shipping container types and provide a base level of service on containers that move through the terminal (such as maintenance and cleaning).

Whilst value-added services provide supplementary revenues to the terminal operator, such revenues are considered marginal and ancillary to the core activity which is supported by strong volume throughput.

There are many types of value-added services that can be provided by intermodal terminals

- generally these include
  - … *Container pack / unpack*
  - … *Container cartage services*
  - … *Container customers/ LCL bonded areas*[14]
  - … *Warehousing services*
- and possibly
  - … *Australian Quarantine exports accreditation*
  - … *Electronic data linkages with other supply chain entities*

[14] LCL means cargo comprising small shipments, which are consolidated into full containers. As such, LCL cargo is generally bonded for customs inspection, whereas full container loads may move to/from destination under a bonded arrangement

Table 22 - Container types and services

Types of Container
o FCL Containers
o LCL Containers
o Liquid Tankers
o Refrigerated Containers

Basic Container Service
o Container Repairs
o Container Fumigation
o Empty Container Cleaning
o Container Storage
o DPI Inspections

8.10 Externality costs

In the analysis carried out to date, only the cash costs have been considered. However, there is a social cost or external cost that also must be considered, e.g., the cost of traffic accidents, congestion, pollution, and noise.

All of these costs fall outside of the transactional cost of the exporter, and are generally not considered by the exporter as a means of modal choice, however exist as a cost to government and the wider community.

Rail tends to be less costly in terms of externalities because it moves in bulk and as such requires fewer trips to complete a task. Parameters used for the costing of externalities under the terminal options were sourced from the Bureau of Transport Economics in their 1999 publication – "Competitive Neutrality between road and rail".

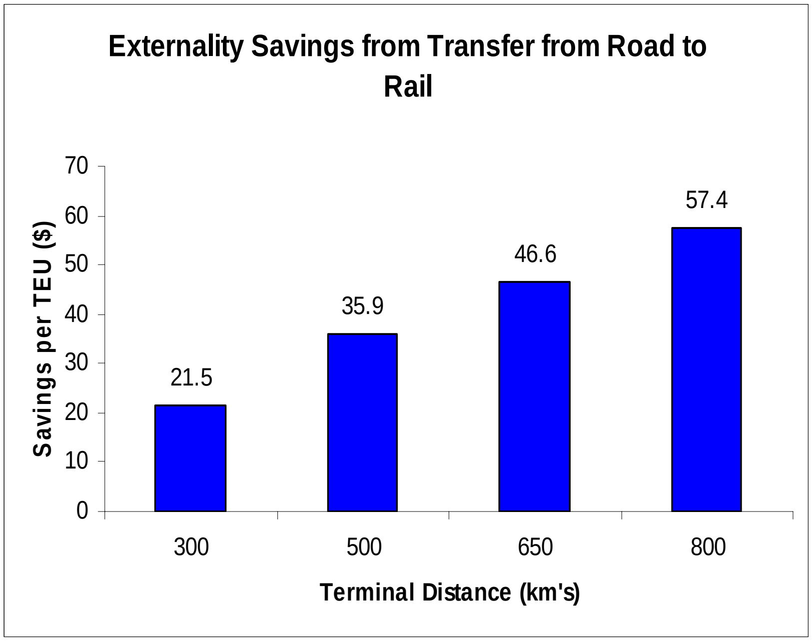
Table 23 - Nominal externality costs

Externality costs	**Cents per Net-tonne kilometre**	
	Rail	**Road**
Accident	0.03	0.32
Congestion	0	0.03
Pollution	0.004	0.01
Noise	0.02	0.034

Source: BTRE

The following graph demonstrates the nominal benefits/savings on a TEU basis arising from transferring the container to rail rather than moving the container directly to port.

Figure 39 - Nominal cost savings based on externality costs



8.11 Supporting cost models

The following tables provide the detailed analytical summaries that underpin the financial results in Section 7.

NSWSFC - Terminal Analysis -300km

TEU Volume	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000
Services p.w	2	3	3	5	5	5	5	8	8	8	8	10	10
Loco Consists	1	1	1	1	1	1	1	2	2	2	2	2	2
Wagon Consists	1	1	1	1	1	1	1	2	2	2	2	2	2
Loco Type													
3000 h.p	2	2	2	2	2	2	2	2	2	2	2	2	2
1500 h.p	-	-	-	-	-	-	-	-	-	-	-	-	-
Wagon Type													
40' Wagons (2xslots)	20	30	30	40	40	40	40	40	40	40	40	40	40
60' Wagons (2xslots)	-	-	-	-	-	-	-	-	-	-	-	-	-
60' Wagons (3xslots)	-	-	-	-	-	-	-	-	-	-	-	-	-
Distance (km)	300	300	300	300	300	300	300	300	300	300	300	300	300
Cycle Time (hrs)	21	21	21	21	21	21	21	21	21	21	21	21	21
Cost													
TEU RATE	632	465	326	384	316	270	237	329	297	272	251	270	252
TRAIN Rate	16,592	16,266	16,970	16,021	16,451	16,883	17,312	17,163	17,431	17,699	17,966	16,879	17,093

NSWSFC - Terminal Analysis -500km

TEU Volume	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000
Services p.w	2	3	3	5	5	5	5	8	8	8	8	10	10
Loco Consists	1	1	1	1	1	1	1	2	2	2	2	2	2
Wagon Consists	1	1	1	1	1	1	1	2	2	2	2	2	2
Loco Type													
3000 h.p	2	2	2	2	2	2	2	2	2	2	2	2	2
1500 h.p	-	-	-	-	-	-	-	-	-	-	-	-	-
Wagon Type													
40' Wagons (2xslots)	20	30	30	40	40	40	40	40	40	40	40	40	40
60' Wagons (2xslots)	-	-	-	-	-	-	-	-	-	-	-	-	-
60' Wagons (3xslots)	-	-	-	-	-	-	-	-	-	-	-	-	-
Distance (km)	500	500	500	500	500	500	500	500	500	500	500	500	500
Cycle Time (hrs)	32	32	32	32	32	32	32	32	32	32	32	32	32
Cost													
TEU RATE	836	644	455	555	458	392	346	471	426	391	361	393	368
TRAIN Rate	21,934	22,524	23,675	23,140	23,843	24,551	25,251	24,556	24,994	25,432	25,870	24,544	24,894

NSWSFC - Terminal Analysis -650km

TEU Volume	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000
Services p.w	2	3	3	5	5	5	5	8	8	8	8	10	10
Loco Consists	1	1	1	2	2	2	2	3	3	3	3	3	3
Wagon Consists	1	1	1	2	2	2	2	3	3	3	3	3	3
Loco Type													
3000 h.p	2	2	2	2	2	2	2	2	2	2	2	2	2
1500 h.p	-	-	-	-	-	-	-	-	-	-	-	-	-
Wagon Type													
40' Wagons (2xslots)	20	30	30	40	40	40	40	40	40	40	40	40	40
60' Wagons (2xslots)	-	-	-	-	-	-	-	-	-	-	-	-	-
60' Wagons (3xslots)	-	-	-	-	-	-	-	-	-	-	-	-	-
Distance (km)	650	650	650	650	650	650	650	650	650	650	650	650	650
Cycle Time (hrs)	39	39	39	39	39	39	39	39	39	39	39	39	39
Cost													
TEU RATE	998	785	556	724	596	511	450	599	543	497	460	511	479
TRAIN Rate	26,190	27,467	28,954	30,153	31,060	31,974	32,879	31,240	31,806	32,372	32,937	31,965	32,418

NSWSFC - Terminal Analysis -800km

TEU Volume	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000
Services p.w	2	3	3	5	5	5	5	8	8	8	8	10	10
Loco Consists	1	1	1	2	2	2	2	3	3	3	3	3	3
Wagon Consists	1	1	1	2	2	2	2	3	3	3	3	3	3
Loco Type													
3000 h.p	2	2	2	2	2	2	2	2	2	2	2	2	2
1500 h.p	-	-	-	-	-	-	-	-	-	-	-	-	-
Wagon Type													
40' Wagons (2xslots)	20	30	30	40	40	40	40	40	40	40	40	40	40
60' Wagons (2xslots)	-	-	-	-	-	-	-	-	-	-	-	-	-
60' Wagons (3xslots)	-	-	-	-	-	-	-	-	-	-	-	-	-
Distance (km)	800	800	800	800	800	800	800	800	800	800	800	800	800
Cycle Time (hrs)	46	46	46	46	46	46	46	46	46	46	46	46	46
Cost													
TEU RATE	1,160	926	657	858	707	607	535	711	644	590	546	607	569
TRAIN Rate	30,447	32,410	34,232	35,742	36,854	37,974	39,083	37,035	37,728	38,421	39,115	37,964	38,518

BROWNFIELD TERMINAL COST MODEL

TERMINAL OPTION	@5,000	@10,000	@ 15,000	@ 20,000	@ 25,000	@ 30,000	@ 35,000	@ 40,000	@ 45,000	@ 50,000	@ 55,000	@ 60,000	@ 65,000
TEU's													
In	2,500	5,000	7,500	10,000	12,500	15,000	17,500	20,000	22,500	25,000	27,500	30,000	32,500
Out	2,500	5,000	7,500	10,000	12,500	15,000	17,500	20,000	22,500	25,000	27,500	30,000	32,500
Total TEU's	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000
Terminal Size	SMALL	MEDIUM	MEDIUM	MEDIUM	LARGE	LARGE	LARGE	LARGE	LARGE	SUPER	SUPER	SUPER	SUPER
Operational Outputs													
Hours of Operations	8	8	12	12	12	18	18	18	18	18	18	18	18
Lifts p.a	15,000	30,000	45,000	60,000	75,000	90,000	105,000	120,000	135,000	150,000	165,000	180,000	195,000
Lift Time + Idle Time (hours)	1,100	2,200	3,300	4,400	5,500	6,600	7,700	8,800	9,900	11,000	12,100	13,200	14,300
Average Storage	83	167	250	333	417	500	583	667	750	833	917	1,000	1,083
Footprint (sq.m)	975	1,950	2,925	3,900	4,875	5,850	6,825	7,800	8,775	9,750	10,725	11,700	12,675
Total Site (sq.m)	1,950	3,900	5,850	7,800	9,750	11,700	13,650	15,600	17,550	19,500	21,450	23,400	25,350
Paved	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
Non Paved	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
Labour													
Yard Staff	0.5	0.9	1.4	1.8	2.3	2.8	3.2	3.7	4.1	4.6	5.0	5.5	6.0
Admin Staff	0.5	1	1	1	1	1	2	2	2	3	3	3	3
Management	0	0	1	1	1	1	1	1	1	2	2	2	2
Total Staff	1.0	1.9	3.4	3.8	4.3	4.8	6.2	6.7	7.1	9.6	10.0	10.5	11.0
Equipment													
Derived Forklifts	0.5	0.9	0.9	1.2	1.5	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6
Used Forklifts	1	1	1	1	2	2	2	2	2	2	2	3	3
Rail Capital													
Rail head	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING
Signals and points	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING
Costs													
Short-run avoidable costs (SRAC)	144,595	229,189	383,409	437,628	536,848	591,067	706,037	760,256	814,476	1,029,445	1,083,665	1,182,884	1,237,104
Long-run avoidable costs (LRAC)	278,450	379,379	547,444	615,508	800,073	868,137	996,952	1,065,016	1,133,081	1,361,895	1,429,960	1,613,024	1,681,089
Fully distributed costs (FDC)	306,294	417,317	602,188	677,059	880,080	954,951	1,096,647	1,171,518	1,246,389	1,498,085	1,572,955	1,774,326	1,849,197
Cost per TEU	61.26	41.73	40.15	33.85	35.20	31.83	31.33	29.29	27.70	29.96	28.60	29.57	28.45

GREENFIELD TERMINAL COST MODEL

TERMINAL OPTION	@5,000	@10,000	@ 15,000	@ 20,000	@ 25,000	@ 30,000	@ 35,000	@ 40,000	@ 45,000	@ 50,000	@ 55,000	@ 60,000	@ 65,000
TEU's													
In	2,500	5,000	7,500	10,000	12,500	15,000	17,500	20,000	22,500	25,000	27,500	30,000	32,500
Out	2,500	5,000	7,500	10,000	12,500	15,000	17,500	20,000	22,500	25,000	27,500	30,000	32,500
Total TEU's	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000
Terminal Size	SMALL	MEDIUM	MEDIUM	MEDIUM	LARGE	LARGE	LARGE	LARGE	LARGE	SUPER	SUPER	SUPER	SUPER
Operational Outputs													
Hours of Operations	8	8	12	12	12	18	18	18	18	18	18	18	18
Lifts p.a	15,000	30,000	45,000	60,000	75,000	90,000	105,000	120,000	135,000	150,000	165,000	180,000	195,000
Lift Time + Idle Time (hours)	1,100	2,200	3,300	4,400	5,500	6,600	7,700	8,800	9,900	11,000	12,100	13,200	14,300
Average Storage	83	167	250	333	417	500	583	667	750	833	917	1,000	1,083
Footprint (sq.m)	975	1,950	2,925	3,900	4,875	5,850	6,825	7,800	8,775	9,750	10,725	11,700	12,675
Total Site (sq.m)	1,950	3,900	5,850	7,800	9,750	11,700	13,650	15,600	17,550	19,500	21,450	23,400	25,350
Paved	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
Non Paved	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
Labour													
Yard Staff	0.5	0.9	1.4	1.8	2.3	2.8	3.2	3.7	4.1	4.6	5.0	5.5	6.0
Admin Staff	0.5	1	1	1	1	1	2	2	2	3	3	3	3
Management	0	0	1	1	1	1	1	1	1	2	2	2	2
Total Staff	1.0	1.9	3.4	3.8	4.3	4.8	6.2	6.7	7.1	9.6	10.0	10.5	11.0
Equipment													
Derived Forklifts	0.5	0.9	0.9	1.2	1.5	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6
Used Forklifts	1	1	1	1	2	2	2	2	2	2	2	3	3
Rail Capital													
Rail head	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW
Signals and points	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW
Costs													
Short-run avoidable costs (SRAC)	144,595	229,189	383,409	437,628	536,848	591,067	706,037	760,256	814,476	1,029,445	1,083,665	1,182,884	1,237,104
Long-run avoidable costs (LRAC)	353,450	479,379	647,444	715,508	950,073	1,018,137	1,146,952	1,215,016	1,283,081	1,511,895	1,579,960	1,763,024	1,831,089
Fully distributed costs (FDC)	388,794	527,317	712,188	787,059	1,045,080	1,119,951	1,261,647	1,336,518	1,411,389	1,663,085	1,737,955	1,939,326	2,014,197
Cost per TEU	77.76	52.73	47.48	39.35	41.80	37.33	36.05	33.41	31.36	33.26	31.60	32.32	30.99

ZERO RAIL CAPITAL TERMINAL COST MODEL

TERMINAL OPTION	@5,000	@10,000	@ 15,000	@ 20,000	@ 25,000	@ 30,000	@ 35,000	@ 40,000	@ 45,000	@ 50,000	@ 55,000	@ 60,000	@ 65,000
TEU's													
In	2,500	5,000	7,500	10,000	12,500	15,000	17,500	20,000	22,500	25,000	27,500	30,000	32,500
Out	2,500	5,000	7,500	10,000	12,500	15,000	17,500	20,000	22,500	25,000	27,500	30,000	32,500
Total TEU's	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000
Terminal Size	SMALL	MEDIUM	MEDIUM	MEDIUM	LARGE	LARGE	LARGE	LARGE	LARGE	SUPER	SUPER	SUPER	SUPER
Operational Outputs													
Hours of Operations	8	8	12	12	12	18	18	18	18	18	18	18	18
Lifts p.a	15,000	30,000	45,000	60,000	75,000	90,000	105,000	120,000	135,000	150,000	165,000	180,000	195,000
Lift Time + Idle Time (hours)	1,100	2,200	3,300	4,400	5,500	6,600	7,700	8,800	9,900	11,000	12,100	13,200	14,300
Average Storage	83	167	250	333	417	500	583	667	750	833	917	1,000	1,083
Footprint (sq.m)	975	1,950	2,925	3,900	4,875	5,850	6,825	7,800	8,775	9,750	10,725	11,700	12,675
Total Site (sq.m)	1,950	3,900	5,850	7,800	9,750	11,700	13,650	15,600	17,550	19,500	21,450	23,400	25,350
Paved	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
Non Paved	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
Labour													
Yard Staff	0.5	0.9	1.4	1.8	2.3	2.8	3.2	3.7	4.1	4.6	5.0	5.5	6.0
Admin Staff	0.5	1	1	1	1	1	2	2	2	3	3	3	3
Management	0	0	1	1	1	1	1	1	1	2	2	2	2
Total Staff	1.0	1.9	3.4	3.8	4.3	4.8	6.2	6.7	7.1	9.6	10.0	10.5	11.0
Equipment													
Derived Forklifts	0.5	0.9	0.9	1.2	1.5	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6
Used Forklifts	1	1	1	1	2	2	2	2	2	2	2	3	3
Rail Capital													
Rail head	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
Signals and points	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
Costs													
Short-run avoidable costs (SRAC)	134,595	219,189	373,409	427,628	526,848	581,067	696,037	750,256	804,476	1,019,445	1,073,665	1,172,884	1,227,104
Long-run avoidable costs (LRAC)	218,450	319,379	487,444	555,508	740,073	808,137	936,952	1,005,016	1,073,081	1,301,895	1,369,960	1,553,024	1,621,089
Fully distributed costs (FDC)	240,294	351,317	536,188	611,059	814,080	888,951	1,030,647	1,105,518	1,180,389	1,432,085	1,506,955	1,708,326	1,783,197
Cost per TEU	48.06	35.13	35.75	30.55	32.56	29.63	29.45	27.64	26.23	28.64	27.40	28.47	27.43

ROAD COST MODEL - TEU's ROUNDTRIP

ROAD MODEL											
DISTANCE	**25**	**50**	**100**	**300**	**400**	**500**	**650**	**700**	**800**	**900**	**1,000**
Costs											
Driving time per day	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**
% Road sealed	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Loading time	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**
Transit time (one way)	1	1	2	5	7	8	11	12	13	15	17
Cycle time	3	4	6	12	15	18	23	25	28	32	35
Kilometres/day	200	300	400	600	641	655	669	673	678	683	686
One way Truck Trips p.a	5,000	5,000	5,000	4,167	4,167	4,167	4,167	4,167	4,167	4,167	4,167
Truck days per year	1,250	1,667	2,500	4,000	4,991	6,102	7,769	8,324	9,436	10,547	11,658
% B-Doubles	**0%**	**0%**	**0%**	**50%**	**50%**	**50%**	**50%**	**50%**	**50%**	**50%**	**50%**
Total cost/TEU	**$ 79**	**$ 114**	**$ 180**	**$ 358**	**$ 460**	**$ 566**	**$ 726**	**$ 779**	**$ 886**	**$ 993**	**$ 1,099**
TRIP CHARGE MODEL	**$ 157**	**$ 227**	**$ 360**	**$ 894**	**$ 1,149**	**$ 1,416**	**$ 1,815**	**$ 1,949**	**$ 2,215**	**$ 2,482**	**$ 2,748**

EXTERNALITIES

JOURNEY DISTANCE 300

ROAD COSTS ($'000s)									RAIL COSTS ($'000s)					($'000s)	
Volume Each Way	Road Trips @ volume	Rail Trips @ volume	Total NTK's ('000s)	Accidents	Congestion	Pollution	Noise	ROAD TOTAL	Accidents	Congestion	Pollution	Noise	RAIL TOTAL	ANNUAL TOTAL SAVINGS	Savings per TEU
10,000	5,000	125	66,000	211	20	7	22	238	20	-	3	13	22	215	21.5
15,000	7,500	188	99,000	317	30	10	34	356	30	-	4	20	34	323	21.5
20,000	10,000	250	132,000	422	40	13	45	475	40	-	5	26	45	430	21.5
25,000	12,500	313	165,000	528	50	17	56	594	50	-	7	33	56	538	21.5
30,000	15,000	375	198,000	634	59	20	67	713	59	-	8	40	67	645	21.5
35,000	17,500	438	231,000	739	69	23	79	832	69	-	9	46	79	753	21.5
40,000	20,000	500	264,000	845	79	26	90	950	79	-	11	53	90	861	21.5
45,000	22,500	563	297,000	950	89	30	101	1,069	89	-	12	59	101	968	21.5
50,000	25,000	625	330,000	1,056	99	33	112	1,188	99	-	13	66	112	1,076	21.5
55,000	27,500	688	363,000	1,162	109	36	123	1,307	109	-	15	73	123	1,183	21.5
60,000	30,000	750	396,000	1,267	119	40	135	1,426	119	-	16	79	135	1,291	21.5
65,000	32,500	813	429,000	1,373	129	43	146	1,544	129	-	17	86	146	1,399	21.5

JOURNEY DISTANCE 500

ROAD COSTS ($'000s)									RAIL COSTS ($'000s)					($'000s)	
Volume Each Way	Road Trips @ volume	Rail Trips @ volume	Total NTK's ('000s)	Accidents	Congestion	Pollution	Noise	ROAD TOTAL	Accidents	Congestion	Pollution	Noise	RAIL TOTAL	ANNUAL TOTAL SAVINGS	Savings per TEU
10,000	5,000	125	110,000	352	33	11	37	396	33	-	4	22	37	359	35.9
15,000	7,500	188	165,000	528	50	17	56	594	50	-	7	33	56	538	35.9
20,000	10,000	250	220,000	704	66	22	75	792	66	-	9	44	75	717	35.9
25,000	12,500	313	275,000	880	83	28	94	990	83	-	11	55	94	897	35.9
30,000	15,000	375	330,000	1,056	99	33	112	1,188	99	-	13	66	112	1,076	35.9
35,000	17,500	438	385,000	1,232	116	39	131	1,386	116	-	15	77	131	1,255	35.9
40,000	20,000	500	440,000	1,408	132	44	150	1,584	132	-	18	88	150	1,434	35.9
45,000	22,500	563	495,000	1,584	149	50	168	1,782	149	-	20	99	168	1,614	35.9
50,000	25,000	625	550,000	1,760	165	55	187	1,980	165	-	22	110	187	1,793	35.9
55,000	27,500	688	605,000	1,936	182	61	206	2,178	182	-	24	121	206	1,972	35.9
60,000	30,000	750	660,000	2,112	198	66	224	2,376	198	-	26	132	224	2,152	35.9
65,000	32,500	813	715,000	2,288	215	72	243	2,574	215	-	29	143	243	2,331	35.9

EXTERNALITIES

JOURNEY DISTANCE 650

				ROAD COSTS ($'000s)					RAIL COSTS ($'000s)					($'000s)	
Volume Each Way	Road Trips @ volume	Rail Trips @ volume	Total NTK's ('000s)	Accidents	Congestion	Pollution	Noise	ROAD TOTAL	Accidents	Congestion	Pollution	Noise	RAIL TOTAL	ANNUAL TOTAL SAVINGS	Savings per TEU
10,000	5,000	125	143,000	458	43	14	49	515	43	-	6	29	49	466	46.6
15,000	7,500	188	214,500	686	64	21	73	772	64	-	9	43	73	699	46.6
20,000	10,000	250	286,000	915	86	29	97	1,030	86	-	11	57	97	932	46.6
25,000	12,500	313	357,500	1,144	107	36	122	1,287	107	-	14	72	122	1,165	46.6
30,000	15,000	375	429,000	1,373	129	43	146	1,544	129	-	17	86	146	1,399	46.6
35,000	17,500	438	500,500	1,602	150	50	170	1,802	150	-	20	100	170	1,632	46.6
40,000	20,000	500	572,000	1,830	172	57	194	2,059	172	-	23	114	194	1,865	46.6
45,000	22,500	563	643,500	2,059	193	64	219	2,317	193	-	26	129	219	2,098	46.6
50,000	25,000	625	715,000	2,288	215	72	243	2,574	215	-	29	143	243	2,331	46.6
55,000	27,500	688	786,500	2,517	236	79	267	2,831	236	-	31	157	267	2,564	46.6
60,000	30,000	750	858,000	2,746	257	86	292	3,089	257	-	34	172	292	2,797	46.6
65,000	32,500	813	929,500	2,974	279	93	316	3,346	279	-	37	186	316	3,030	46.6

JOURNEY DISTANCE 800

				ROAD COSTS ($'000s)					RAIL COSTS ($'000s)					($'000s)	
Volume Each Way	Road Trips @ volume	Rail Trips @ volume	Total NTK's ('000s)	Accidents	Congestion	Pollution	Noise	ROAD TOTAL	Accidents	Congestion	Pollution	Noise	RAIL TOTAL	ANNUAL TOTAL SAVINGS	Savings per TEU
10,000	5,000	125	176,000	563	53	18	60	634	53	-	7	35	60	574	57.4
15,000	7,500	188	264,000	845	79	26	90	950	79	-	11	53	90	861	57.4
20,000	10,000	250	352,000	1,126	106	35	120	1,267	106	-	14	70	120	1,148	57.4
25,000	12,500	313	440,000	1,408	132	44	150	1,584	132	-	18	88	150	1,434	57.4
30,000	15,000	375	528,000	1,690	158	53	180	1,901	158	-	21	106	180	1,721	57.4
35,000	17,500	438	616,000	1,971	185	62	209	2,218	185	-	25	123	209	2,008	57.4
40,000	20,000	500	704,000	2,253	211	70	239	2,534	211	-	28	141	239	2,295	57.4
45,000	22,500	563	792,000	2,534	238	79	269	2,851	238	-	32	158	269	2,582	57.4
50,000	25,000	625	880,000	2,816	264	88	299	3,168	264	-	35	176	299	2,869	57.4
55,000	27,500	688	968,000	3,098	290	97	329	3,485	290	-	39	194	329	3,156	57.4
60,000	30,000	750	1,056,000	3,379	317	106	359	3,802	317	-	42	211	359	3,443	57.4
65,000	32,500	813	1,144,000	3,661	343	114	389	4,118	343	-	46	229	389	3,729	57.4