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Abstract:

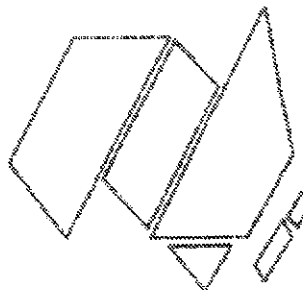
Having defined intermodal as the transfer of cargo from one mode to another (or others), the authors identify the different areas in cargo transportation which affect the efficiency of intermodal transport. The importance of investigating alternatives to truck transport in the intermodal link is discussed in view of the central position of the Port of Melbourne and the consequent congestion and pollution caused by trucks. The rail network would provide a viable alternative for large quantities of cargo to be transported over long distances.

The use of computer technology to simplify and speed up the numerous steps in the intermodal chain is also discussed.

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INTERMODAL INTEGRATION

(Study of the Transport Network in Port of Melbourne)

1. INTRODUCTION

The term of "Intermodal" is used to describe a combination of sea, land and/or air transport

A single modal movement involves a carrier or carriers of a single mode, for example, a truck/trucks which deliver cargo from the origin to the destination(s). An intermodal movement involves transfer of cargo from one mode to another, as in the truck/rail combinations. A multi modal movement involves transfer of cargo more than once to a third (or more) mode(s), such as the ship, truck and rail combinations. Intermodal can also describe a multimodal movement.

Intermodality can be observed from viewpoints of mode, type of cargo, condition of cargo, category of terminal or combinations and permutations of these viewpoints. Sea ports, rail road sidings and pipeline terminals are also the province of intermodality. Intermodal movement of cargo in Australia is part of two larger subjects - domestic and international transportation. Intermodal movement of cargo has always been and will be a current and lively subject as it changes constantly, along with the relationship among the transportation modes and with technical and conceptual improvements in its practice.

An intermodal terminal should provide access for and co-ordinate the interface of two or more different transportation systems. This is not easily achievable because access routes, working areas, techniques and equipment can be quite different for different modes. Unfortunately, most intermodal terminals today do not provide equal and satisfactory access for all modes they serve as seen at two major international container terminals in the Port of Melbourne. These two terminals were built to solve the problems of an individual mode, without a great deal of concern for requirements or future growth of intermodality. As a result, most terminal improvements involving intermodality have come as a second wave.

Coastal and river transport played an important role in the early development of Victoria. However, during the latter part of the nineteenth century, much of the coastal and river trade was replaced by the rapidly developing railway system. By the 1930's, the remaining coastal and river trade was further reduced by motor transport.

2. LAND TRANSPORT

The Port of Melbourne is situated at the hub of major Victorian road and rail networks which provide good accessibility to metropolitan, country and interstate regions. The interface between the port and the road and rail networks is a crucial element in overall transport chain efficiency and can have a significant effect on the ultimate productivity of the port.

Exports and imports through the Port of Melbourne are serviced by intermodal transport. Table 1 shows the percentage of general cargo and containers carried by different modes in 1991/92.

Table 1: Transportation Mode Ratios

	Percentage
General Cargo	
Truck	73
Rail	11
Pipeline	14
Containers	
Road	82
Rail	15

Source: Trade and Transport Review (PMA) 1993

Due to the reduction in the usage of rail sidings in the port and the further closure of sidings in the port surrounds, rail transport declined from 18 to 15 percent, giving way to a greater number of short haul truck movements between the South Dynon Rail Terminal and the port.

2.1 The Port; A Vital Link in Australia's Economy

Melbourne is Australia's major general cargo port and the largest container port in the Southern Hemisphere. Melbourne has the largest container throughput in Australia with 668,000 twenty foot equivalent units (TEU's) per annum (PMA report)¹¹ In international terms, Melbourne is among the top 25 container ports in the world. Table 2 shows the major trade by sector in the Port of Melbourne and compares the volume of trade for 1990/91 and 1991/92. The only significant variation volume is the 12.2% decrease of coastal imports, which is contrasted by a 6.5% increase in overseas exports.

Table 2: Trade Comparative Figures in Port of Melbourne

	1991/92 VOLUMES	1990/91 VOLUMES	DIFFERENCES	RAIIOS
Total Throughput	23 117 579 T	23 029,690 T	+ 87 879 T	+ 0.38%
Overseas Exports	7 245 379 RT	6 805 014 RI	+ 440 365 RI	+ 6.5%
Overseas Imports	8 705,528 RI	8 498 750 RI	+ 206,778 RI	+ 6.1%
Container Traffic	668 152 IEU	647 724 IEU	+ 20 428 TEU	+ 3.2%
Commodity Trade	20 659 884 RT *	20 319 898 RT	+ 339 986 RT	+ 1.7%
Coastal Exports	3 613 855 RP	3 637 700 RP	- 23 845 RP	- 0.66%
Coastal Imports	3,558,033 RI	4,047,077 RI	- 494,044 RP	- 12.2%

Source: Trade & Transport Review 1991/92 (PMA)

T = Tonnes

RI = Revenue Tonnes (Equivalent 1m³ or 1 kilo litre)

* = Less Empty Containers

IEU = Twenty Foot Equivalent Units

2.2 Road Mode

The major roads providing access to the Port of Melbourne are Footscray Road, Sims Street, Dudley Street, Montague Street, the Westgate Freeway, Lorimer Street, Williamstown Road and Todd Road.

Road transport performs the major part of the inland transport task and in 1991/92 carried 73% by weight of the port's total traffic. It also accounted for about 78% of containers which passed through the port. Victoria's 160,000 km road network includes a good system of state highways and freeways which have been extensively upgraded in recent years, particularly under the Federal Government's road construction programme to mark the 1988 Bi-Centenary of Australia's European settlement.

Vic Roads has estimated that major but achievable gains in operational efficiency will reduce the number of truck trips required to handle a given volume of cargo by approximately 34%. In addition, it is expected that the proportion of port cargo handled by rail will increase.¹³

Vic Roads has analysed the impact of forecast port traffic on the road network surrounding the port in the year 2010.¹³ The network analysed included the port area and all surrounding municipalities. The effects of the construction of the Western Bypass and Southern Bypass were analysed.

In July 1990, the Department of Treasury made an investigation on the traffic generated by vehicles around the Port of Melbourne. The traffic forecasts show a 30% increase in total road travel in the area covered by the network over the period, with port truck traffic representing approximately 0.7% of total road travel.³ The impact of port traffic is therefore relatively small. However, the influence of port traffic varies considerably across the network.

The effect of the increase in traffic on the performance of the road network was also analysed. It was estimated that overall travel speeds would decrease in the area analysed by approximately 12% by the year 2010 if no major road improvements are carried out in the inner area.⁵

2.3 Environmental Impact of Land Transport

Overseas studies have shown that surface traffic (automobiles, buses, trucks, motor cycles) is the predominant and most widespread source of noise in cities. The Australian urban experience is no different and has been documented in reports prepared by the Bureau of Roads.⁷

The noise environment is dominated by the traffic volume, composition, speed and the nature of the pavement. The traffic stream is composed of two statistically independent components - cars and trucks (other vehicle types are considered insignificant in the traffic mix encountered in the Port of Melbourne).

As trucks are about 10 to 15 dB(A) noisier than cars,¹⁰ the peak noises will, in general, be due to passing trucks and consequently the L_{10} noise level will be dominated by the truck component of the traffic mix. (db - The decibel refers to a logarithmic ratio of sound pressure or of accoustical power).

2.4 **Economical Impact of Land Transport**

Apart from noise and air pollution, use of trucks to transport containers has a significant economical impact on Victorian consumers.

It costs \$418 million annually (1990 base) to move all containers along Melbourne's transport chain between ship and warehouses via stevedore and haulier.¹² The main components of the costs are summarised in Exhibit 2.4.

Exhibit 2.4 - Total Cost of Container Movement Along Transport Distribution Chain (By Road Only), Melbourne 1990

Position In Land Transport Chain	Average Time (Hours)	Annual Cost (\$ Million)
Ship in Port	55.0	\$150m
Port Infrastructure	N/A	\$ 40m
Craneage	0.1	\$ 25m
Straddle Forklift or Transtainer	0.3	\$100m
Dwell in Stacks	100.0	\$ 34m
Truck Movement To/From Warehouse	2.9	\$ 69m
Ship to Warehouse	158.3 Hrs. (6.6 Days)	\$418m

Source: Truck Management in the Port of Melbourne (1990)

Potential for reducing these costs is probably greatest for the large cost components of container dwell time in terminals and truck delays which account for 8% and 5% respectively of the \$418 million. Truck queuing contributes 65% of the annual truck delay costs in the port. (PMA Land Use Plan).

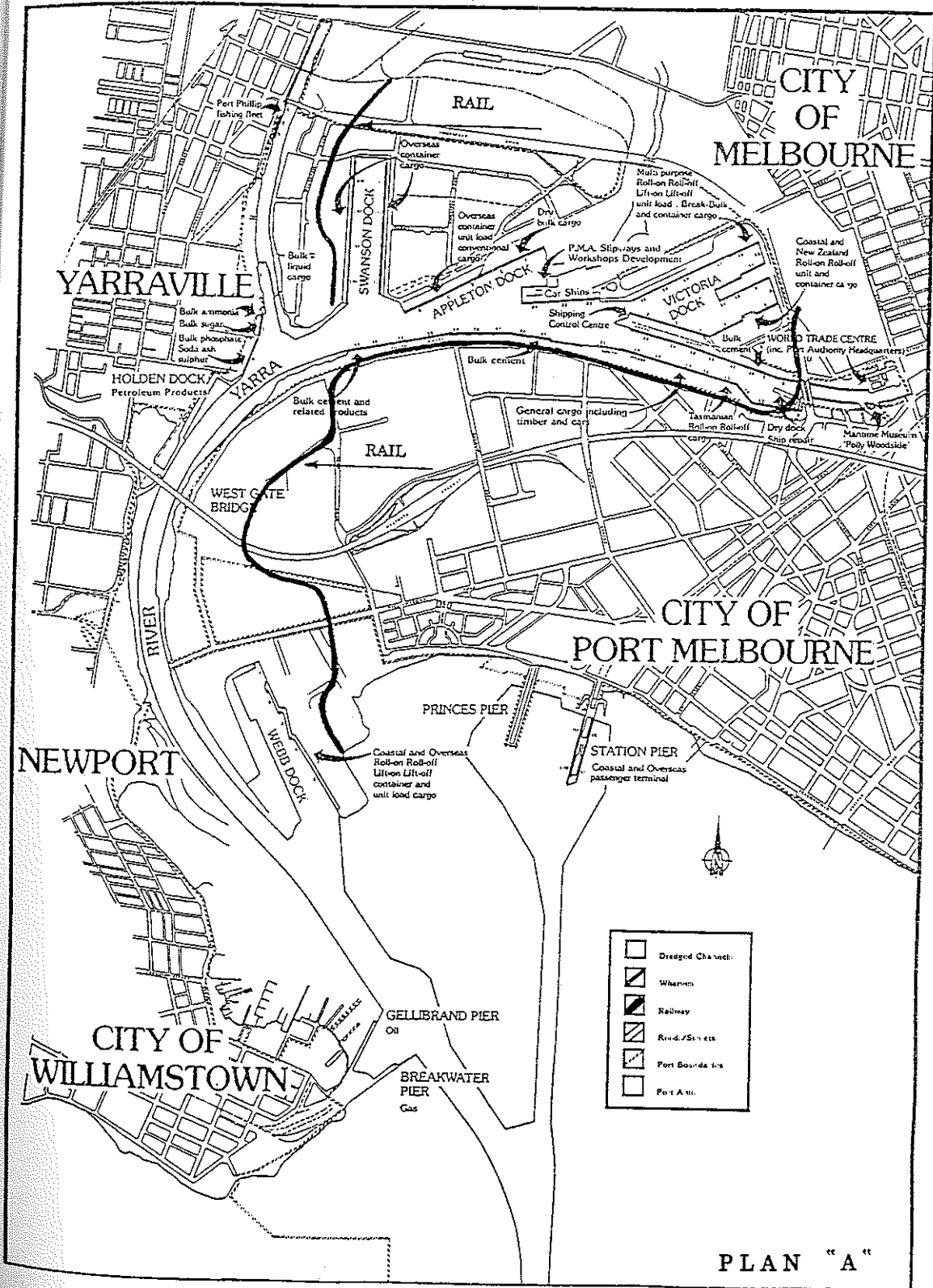
2.5 Rail Mode

V/Line, the Victorian member of the Railways of Australia, provides closely integrated rail container services with the Port of Melbourne, which enables quick and efficient rail transport of import and export shipping containers between the port and the Victorian country and interstate.

V/Line's rail distribution network provides the port's container terminal at Swanson, Appleton and Webb Docks with direct rail links system, in addition to which V/Line's main intermodal facility at South Dynon is located only 2km from the Swanson, Appleton and Victoria Dock area (see Plan A).

Rapid transit super freighter services (100 km/hr) operating from South Dynon provide the port with overnight express container rail services that can effect next morning delivery to Adelaide and Sydney, second morning delivery to Brisbane and third morning delivery to Perth.

Freight coming to the Port of Melbourne from these locations is provided the same level of express freight service by return super freighters. In 1991/92, only 11% of cargo was carried by rail. The containerised freight carried by rail declined from 18% to 15% during 1991/92. This reflects a reduction in the usage of rail sidings in the port and further closure of sidings in port surrounds, in favour of a greater number of short haul truck movements between the South Dynon rail terminal and the port.



Broad gauge rail sidings are located within the port area at Swanson Dock, Appleton Dock and Webb Dock. These sidings are used to transfer cargo between the port and the major rail facilities operated by the Public Transport Corporation (Melbourne Yard, Dynon, South Dynon and Tottenham yards) for consolidation. The present port rail sidings at Swanson and Appleton Docks are very short and operationally inefficient. It is expected that they will be withdrawn from operation in the medium term.

Approximately half the port cargo which is currently transported by rail is transferred between the port and the South Dynon rail terminal by road. When the existing port sidings at Swanson/Appleton Dock are closed, all rail cargo from this area will need to be transferred to South Dynon by road.

Although the Port of Melbourne is strategically placed with respect to road and rail infrastructure, there are significant community concerns about the ability of the existing road and rail system to cope with the traffic which will be generated by forecast increases in trade and the effect of port traffic on neighbouring residential areas. The close proximity of the Melbourne Central Activities District exacerbates these concerns.

It is estimated that major but achievable gains in operational efficiency will reduce the number of truck trips required to handle a given volume of cargo by approximately 34% (PMA Land Use Plan). In addition, it is expected that the proportion of port cargo handled by rail will increase.

The ability of road transport to deliver flexible door to door delivery services to or from virtually any origin or destination is difficult for rail to match, except where high volumes of cargo are to be carried over relatively long distances.

Recommendations

The major market for rail for port cargo is containerised trade over relatively long-haul country and interstate routes. On these routes rail can compete very effectively with road transport provided the following broad parameters are satisfied:-

- Sufficient volumes of cargo are generated to warrant the use of block trains. A block train (at least 30 wagons) can be moved as a unit from origin to destination without the need for disconnection and reconnection with other trains, thus avoiding delays associated with shunting of individual or small groups of wagons.

- Transport distances are more than 200 kilometres unless particularly high volumes over specific shorter routes are involved.
- Rail terminal facilities are located as close as possible to the marine terminals the service, preferably with direct access for Internal Transfer Vehicles (ITV's).
- Rail terminal facilities are of adequate dimensions and are equipped to handle block trains.

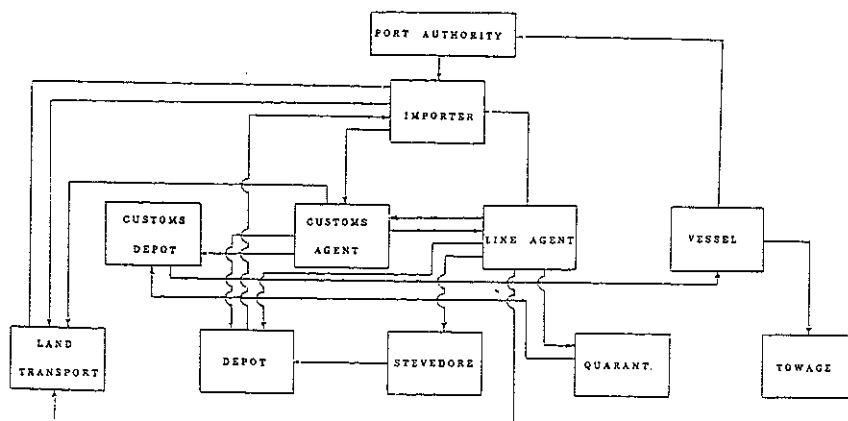
3. INTERMODALISM AND COMPUTER TECHNOLOGY

The adoption of highly sophisticated computerised communications systems in the shipping industry should assist in reducing transport delay costs due to paper based communication systems. These systems would increase the general level of awareness of operating conditions throughout the industry, resulting in more informed decision-making by the various participants, including the importers and exporters.

Sophisticated intermodal management information systems have been developed which tie the various intermodal system links together in terms of information hook up and transfer. These are usually tied together by satellite communications systems to provide real time data transfer which, in turn, allows identification of the location of any piece of cargo or unit of equipment at any period of time.

Delays are immediately recorded and alternate routings, equipment or space assignments are then made. For effective use of such a system, all intermodal links must be operationally integrated, their intermodal use cost pre-determined and intermodal systems management override be incorporated to allow intermodal management to super-impose its requirements over and above those of individual modes and their operators.

The below schematic describes the complexity of the existing "paper based activities" communication which have created operational delays for decades, causing ships queuing due to berth unavailability, long dwell time of containers and delays in container movement from origin to destination.



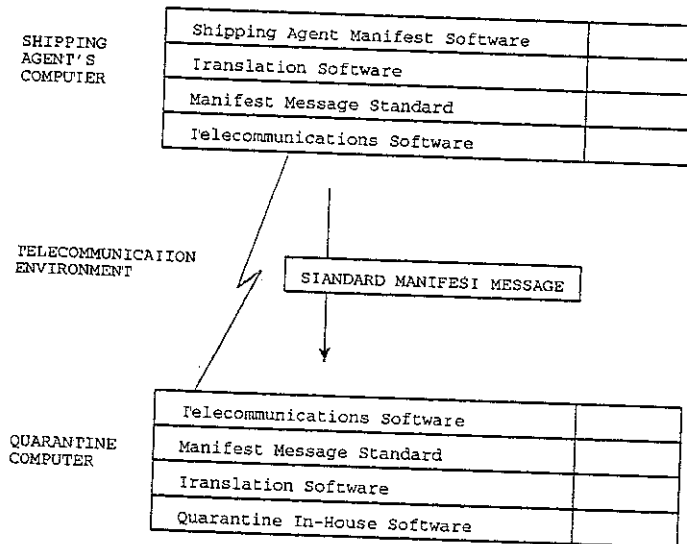
COMMUNICATION FLOW
"EXISTING PAPER BASED ACTIVITIES"

Electronic Data Interchange is computer-to-computer exchange of information using international standards. It uses the existing technologies of telecommunications and computing. Information are sent in an international standard format which are known to specific broad-based industries (such as transportation).

Electronic Data Interchange has three main components:-

- a. Transaction Message Standard: A standard way of representing the data in each transaction.
- b. Translation Software: Software which interfaces with the in-house computer and which allows in-house data to be converted to a standard message (a transaction message standard) or a standard message to be converted to an in-house file or record format.
- c. Telecommunications: A method of transmitting the standard messages from one computer to another.

The schematic below shows the three main EDI components.



3.2 The Existing and the Future Comparison

In the electronic world, all transport communication flows are carried out by computers. The instructions are transmitted electronically and provide coordinations in import/export system and transportation.

This paperless system provides information for:-

- Customs/Customs Agent.
- Quarantine/Depot.
- Importer/Exporter.
- Port Authorities.

- Ship's Agent.
- Road/Rail Transport.
- Freight Forwarder.
- Stevedores/Terminals.
- Banks.
- And Others.

The EDI synchronises the activities within the system which does not exist in the paper based operations.

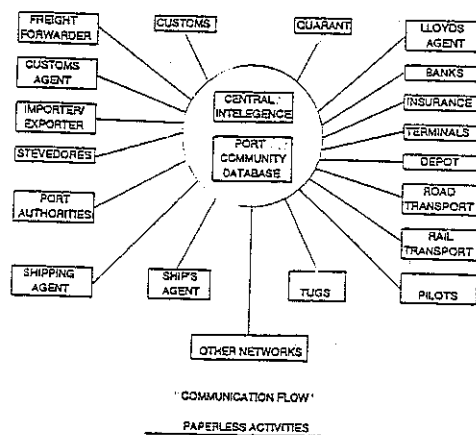
Today, most advanced terminals around the world are equipped with EDI (paperless communication system). Some terminals have allocated large sums of money to establish or upgrade their existing systems. For example, the Port of Singapore Authority spent 1.2 billion dollars in 1991/92 to upgrade their terminal communication system. Singapore Ports have achieved the world's most productive terminal operators in container handling (Cargo Systems - 92).

To maximise the benefits of EDI and information databases other technologies could be considered. For example, truck deliverers could use Smart Cards at terminals to identify themselves and the container they are delivering or picking up. The information on the Smart Card could be generated from the Road Transport Operators from the Port Community database.

Also to complete the cycle the telecommunications environment of the Port Community must be able to access banking networks so that Electronic Funds Transfer (EFT) can be used. Many delays are currently caused while payments are made (e.g. Customs duty and levies).

Operations in the future could be and look a lot simpler.

Schematic below represents the more ordered electronic world. Sitting in the midst of the Port Community Telecommunications Network is a central intelligence which knows that if a Manifest Message comes from a Shipping Agent it must go to Customs, Quarantine, a depot, a terminal and the Port Authority. It knows which depots and which terminals. It can either leave the message waiting there ready for receipt to be activated or it can send the messages directly to the computers belonging to these organisations. Data from internal systems can selectively be used to update a Port Community Database and then any member of the Port community, if the security system in the central intelligence allows it, can access the Port Community database.



4. CONCLUSION

Rapid changes in the technological environment of marine transportation and increasing integration of waterborne and land transport systems have fostered a revolution in the design and operation of transport vehicles, cargo handling technology and terminal facilities.

Transport technology usually lags behind shipping and terminal technology by a few years, making it difficult for transport modes to maintain effective services for users who are able to change technology much more quickly.

Ports have become complex intermodal transfer and processing facilities that must respond quickly and efficiently to changes in trade, volume, form and type of commodities traded, modal technology, operating procedures, and more.

Whereas in the past, these intermodal developments were mainly due to technological advances, future developments will require impulse from the commercial sector. Road transport has proved successful over the past decade as it offers an adaptable solution to many intermodal problems. However, increasing road transport links to a central port such as the Port of Melbourne will entail environmental disadvantages (increase in accidents, air and noise pollution, etc.). Consideration should therefore be given to investigating alternative land transport forms for seaborne cargo such as upgrading the existing rail tracks to accommodate the block train with no need for disconnection/reconnection with other trains. The high costs of road transport compared with rail should also be taken into account.

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