# Cargo Centralisation in the Overseas Liner Trade

## Report

With the introduction of cellular container ships in the overseas liner trades, cargo which had traditionally been handled at many ports around Australia was centralised on a few major ports. This change had had a substantial impact on port activity, utilisation of existing facilities, waterside employment and land transport activity. This report presents the results of a study to determine whether existing cargo centralisation arrangements minimise total transport resource costs and to explore the potential for change.

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ISBN 0 644 01958 1

# FOREWORD

With the introduction to Australia in the late 1960s of the container method of handling cargo in the overseas trades, calls by container ships in these trades were restricted to a small number of major ports. Cargo which had traditionally been handled at smaller ports was centralised to these major ports. Consequent changes in port activity have been a matter of concern to the Marine and Ports Council of Australia. Because of this concern, the present study was proposed and terms of reference were provided by the Commonwealth Minister for Transport. Briefly stated, these are to examine the present cargo centralisation arrangements to determine whether they are efficient in terms of resource use and transport cost.

Early in the study progress was hampered by a lack of comprehensive information on container movements within Australia and a survey to estimate these movements was undertaken. At that stage it became clear that a comprehensive generalised analysis of alternatives to cargo centralisation procedures would not be feasible because of the complexity of the international liner trades and the paucity of reliable data. As a result, the findings in this report are based on a limited study of specific cases of alternative ship scheduling and centralisation arrangements involving increased ship calls at Adelaide and Brisbane. The alternatives considered were those which appeared likely to offer scope for increased efficiency.

For the purposes of the study a set of models was developed to estimate additional costs associated with ship diversion and to relate them to reductions in costs resulting from reduced centralisation flows. This approach was used to estimate the break even exchange of containers which would justify direct ship calls. The break even numbers were then compared with the numbers of containers available at the ports of Adelaide and Brisbane (as revealed by the 1976 Container Movements Study) to provide an indication of the probable economic and financial impact of changes in patterns of ship calls. Full details of the cost models and parameter values used in this study are contained in the report.

The report was prepared by R.J. Perkins with the assistance of G.P. Piko, under the direction of R.W.L. Wyers and R.H. Heacock.. Specialist advice was provided by A. Madge and F. Poldy and initial study work by A.J. Fitzpatrick is acknowledged. The container movement information reported here was collected by the Economic Research Unit under contract to the Bureau of Transport Economics.

Assistance during the preparation of this paper was provided by a number of shipping companies, terminal operators, rail authorities, government departments and other organisations. Their help in providing data and advice during the course of the study is gratefully acknowledged.

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Canberra 1982

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## SUMMARY

With the introduction of cellular container ships in the overseas liner trades, cargo which had traditionally been handled at many ports around Australia was centralised on a few major ports. This change had had a substantial impact on port activity, utilisation of existing facilities, waterside employment and land transport activity. This report presents the results of a study to determine whether existing cargo centralisation arrangements minimise total transport resource costs and to explore the potential for change.

The study was undertaken from a national perspective. Although it was concentrated upon overall changes in resource costs which would result from changes in ship calling patterns, it also explored the financial implications for various parties involved and the distribution of costs and benefits between participants and regions.

It was considered impracticable to attempt a model of the total system and so the study was confined to the corridors with the largest container flows, and to decentralisation alternatives that appeared most likely to return resource savings if they were to be adopted. Thus the bulk of the report covers a series of case studies relating to container centralisation in the Adelaide-Melbourne and Brisbane-Sydney corridors. The results of these case studies were then used to draw some general conclusions concerning the economics of cargo centralisation as presently practised.

The principal method of analysis used in the study was the computation of differences in short-run resource costs between present centralisation practices and selected alternatives. In each case cost differences considered were restricted to those directly attributable to changes in ship calling patterns, port and terminal activities and overland transfer of containers between ports. In each case, a 'break-even' transfer of containers was calculated such that the additional ship diversion and handling costs exactly balanced the cost savings in overland transport. This break-even volume was then compared with the volume of traffic prevailing during 1977-78 to provide an indication of the likelihood that the needed loadings could be achieved in practice. Taken together the results of these individual analyses were used as indicators of the general economic efficiency of the present arrangements and the potential for change in the direction of greater decentralisation.

The first step in the study was to conduct a detailed survey of container movements into, out of and between ports and regions in Australia. Data was obtained for 1977-78. No sufficiently detailed authorative information on an Australia-wide basis is available for a later period. However comment has been made where appropriate about major changes in container flows where these are thought to have occurred.

The second step was to consult the available data bases and to hold extensive discussions with terminal operators, shipowners, railways and port authorities to develop objective estimates of container handling rates at various ports, equipment and manning schedules, as well as other operating costs. Similarly, railway operating procedures and costs were estimated for both present operations and for changed ship calling patterns.

Since the fleet of ships serving any particular trade consists of various sizes and types, since each fleet is subject to a continuous process of change and since it is not feasible to predict which particular ship might be the one to change its pattern of port calls, ship costs used in the study were based on a 'representative' ship in each case. The approach adopted was to determine the median capacity (container numbers) of vessels in each trade and then synthesise typical specifications for a ship of that size

based on a previous regression analysis of cellular container ship characteristics.

Break-even container exchanges were then calculated for various trades. In each case the resulting break-even exchange was in the form of a range rather than a single value because of the uncertainties in the cost estimates. Because of the uncertainties in ship choice and ship costs, sensitivity testing was undertaken to ascertain the impact on break-even exchange rates of changes in ship size and fuel consumption.

The financial effects of changes in ship call patterns for shipowners, port and rail operators, and shippers were examined briefly in order to establish the likely pressures for change and the distribution of costs and benefits. In addition, the report contains some limited discussion on transfer of employment opportunities, etc though these impacts are judged to be small.

The major finding of the study is that total resource costs would be slightly reduced by some additional ship calls to Adelaide and Brisbane in some trades, and that such calls would produce both increased economic efficiency and improved financial returns to shipowners. The present system of centralisation appears not to produce any major economic distortion, but overall resource cost appears relatively insensitive to modest changes in ship calling patterns. Thus, while there does not appear to be any compelling argument, from a national resource standpoint, in favour of a significantly greater degree of decentralisation, further decentralisation going beyond the ship call patterns examined in this study would be unlikely to produce any major misallocation of resources. This means that if some modest extension of ship calls to Adelaide and Brisbane is judged to have significant benefits in relation to desired regional development then this could easily outweigh the associated increase in transport costs.

There are no marked divergences between economic and financial benefits for the cases examined in this study, and so shipowners can be expected to provide economically efficient services without the need for additional inducements. If they are slow to respond, either because of inertia or because of anticipated additional costs, local community pressures can be expected to quickly redress the balance.

As expected, costs and benefits arising from decentralisation would be distributed unevenly among participants. In the longer-term the costs of processing containers through Adelaide and Brisbane should not diverge appreciably from the savings achieved by not processing them through Sydney and Melbourne, and the additional revenue for one port should balance the losses for another. In fact, the gains to revenues in Adelaide and Brisbane would be a more significant part of their totals than would the losses to Sydney and Melbourne.

Depending on ship schedules, travel times for containers bound for Adelaide and Brisbane might be appreciably reduced, but at the cost of small delays to far more containers bound for Sydney and Melbourne.

Railways would experience a serious loss of revenue for each decentralisation option taken up. Since the impact of such options on the movement of empty containers is not certain, the magnitude of potential rail losses can be estimated only roughly. Additionally, the railways can be expected to act to minimise the financial effect on traffic reductions and so the final overall impact is uncertain.

Overall, the impact of changes in centralisation on shipping freight rates would be small since changes to only a small minority of voyages are envisaged and, even in those cases, the overall financial costs to the shipping line would be expected to change only slightly.

It must be emphasised that the analysis undertaken in this study was designed to provide guidance as to potential changes viewed from a national perspective. Thus the individual case studies were not undertaken in sufficient detail to provide a basis for decisions in individual cases. Such decisions would require a much more detailed analysis based on examination of specific operational changes and expected responses by individual people and organisations.

# CHAPTER 1—INTRODUCTION

## BACKGROUND TO THE STUDY

Traditionally, overseas liner vessels[1] have served a large number of ports in Australia. With the adoption of the container method of handling general cargo in these trades, shipowners claimed that it was necessary to limit the number of ports served because of the specialised capital-intensive terminals required to handle container vessels, and also to increase vessel utilisation by minimising time in port. Both moves were designed to achieve the scale economies available with this method of handling, and resulted in a reduction in the number of ports regularly served by overseas liner vessels. A number of other ports still receive direct calls by liner vessels, but on a much reduced basis.

Centralisation of cargo handling has had a substantial impact on port activity across Australia. Utilisation of existing port facilities, employment opportunities and the potential for further development at a large number of ports has been greatly affected by decisions over which the port authorities and State Governments have had little influence. As well as the impact on ports, cargo centralisation also affects utilisation of road and rail services and decentralisation policies of State Governments.

In general, the industry decisions relating to cargo centralisation (and the resulting pattern of freight movements) have not been subjected to scrutiny to determine whether they result in the most efficient use of Australia's transport resources. This report addresses itself to this question.

This study originated in discussions by the Marine and Ports Council of Australia (MPCA). The Council consists of Commonwealth, State and Northern Territory ministers responsible for port and marine affairs, and is chaired by the Commonwealth Minister for Transport. The MPCA expressed concern for the impact on port activity resulting from the introduction of cargo centralisation procedures in the overseas liner trades.

## TERMS OF REFERENCE

The terms of reference established for this study by the Commonwealth Minister for Transport provide for the following questions to be examined.

- Do the existing centralisation procedures minimise total transport costs?
- Are there alternatives which would give greater benefits for similar resource consumption?
- Are there alternatives which are likely to encourage more decentralisation development but which incur negligible transport resource cost penalties?
- If alternatives appear desirable, what measures may be effective in influencing shipowners to adopt shipping patterns more consistent with those alternatives?
- Can procedures be improved for the movement of container cargoes between Australian origin/destination and ship?

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1. A liner service employs vessels operated by shipping companies on a specified route and on a regular basis. This report is limited to consideration of containerised cargo liner services.

## SCOPE OF STUDY

The question of whether existing arrangements make the most effective use of transport resources is the primary issue and two alternative approaches might be adopted here. The first accepts the present range of ships and terminals as given, and examines optional service arrangements. The alternative is to consider the supply of shipping services, including the whole range of vessel and terminal types, and the port calling options available to each type.

Although the second approach would provide ultimate flexibility in examining resource utilisation, it was considered that an examination of the optimum use of presently committed resources would prove more useful in the immediate future and was thought to be more in line with the intent of the terms of reference. The study was based upon this approach, though some comment on the second approach is included in this report.

It became apparent early in the course of the study that it would not be feasible to adopt a generalised modelling approach to examine the total centralisation process. The Container Movements Study, undertaken as part of the overall Cargo Centralisation Study, revealed not only the very complex nature of the international liner trades and the associated container movements, but also a lack of accessible, definitive data. This necessitated a review of the study procedure and it was decided to focus on an assessment of cargo centralisation in the Melbourne-Adelaide and Sydney-Brisbane corridors.

The approach adopted was to examine in some detail the existing centralisation procedures in these corridors and alternative calling options using Adelaide or Brisbane. The analysis was based primarily on an examination of changes in resource costs, but some assessment was made also on the basis of financial costs—which are important in relation to the likely responses of parties involved in centralisation to proposals for change.

The results of this limited analysis have been used as a basis for drawing general inferences in respect of the terms of reference for the study. Such inferences are the proper focus of a study of this nature and it is emphasised that the analysis of individual changes in ship call schedules presented in this report are not definitive in the sense of establishing the desirability or otherwise of the particular change examined. The object of the study was to explore the probability that some changes would be beneficial in national terms and the analysis was pitched accordingly. A decision on changes to any specific service would require a much more detailed analysis of the specific changes involved based on particular ship movement and types, and on a detailed examination of current container movements.

The final term of reference, relating to methods for improving container cargo movement procedures, was passed on to the National Materials Handling Bureau (NMHB 1978), and is expected to form a separate report by the NMHB.

Appendix I contains the full text of the terms of reference, as provided by the Commonwealth Minister for Transport.

## STUDY CONDUCT

To examine the centralisation arrangements in the overseas liner trades, it was first necessary to gather information on cargo movements. The available statistical collections were not sufficiently detailed to allow necessary information on land flows of overseas containers to be determined. Initial effort was directed towards collection and interpretation of this information, from sources such as shipping companies, rail authorities, road operators, shipper groups and port authorities. A summary of the information collected is included in Chapter 4.

Visits were made to container terminals, shipping companies and rail authorities to hold discussions with their staff on operating practices and the likely effect of alternative centralisation arrangements.

The report is broadly laid out in two parts. Chapters 2 to 4 describe the history of containerisation and cargo centralisation in Australia, and give details of the shipping and handling of containers. They also give a summary of a survey of overseas container movements throughout Australia. The remaining five chapters make up the second part of the report and cover the analysis of centralisation alternatives and their effect on operators and shippers. Chapter 5 discusses the approach adopted in analysing alternative centralisation procedures. Chapter 6 develops operating cost information for ships, ports, container terminals and railways. This information is used in Chapter 7 to determine the differential cost of various alternatives to present centralisation arrangements which would include Adelaide and or Brisbane as ports of call. Chapter 8 considers the effects of these alternative arrangements on operator finances.

In Chapter 9 inferences are drawn with regard to the economic and financial efficiency of the centralisation process in accordance with the terms of reference for the study.

# CHAPTER 2—HISTORY OF CARGO CENTRALISATION AND CONTAINERISATION

## INTRODUCTION

Cargo centralisation in the overseas liner trades is defined as the movement of cargo generally in containers, between traditional, or feeder, ports and centralised, or major, ports at which container ships call. Prior to the late 1960s, many Australian ports had direct services from overseas cargo vessels. With the introduction of the container method of handling cargo in the overseas liner trades, port calls were rationalised to maximise utilisation of special port facilities and to minimise the in-port time of container ships.As a result, many ports lost their general cargo trade, which was centralised (mainly by rail) on major ports.

To help understand the effect of cargo centralisation, it is useful to place it in its historical and institutional framework. To this end, liner shipping conferences and shippers' organisations, which are the main bodies involved in the cargo centralisation process, are described in this chapter. The link between these organisations and the introduction of containers and cargo centralisation is also discussed. Finally, the current arrangement for cargo centralisation is described.

## SHIPPING SERVING AUSTRALIA

### Types of liner services

Liner shipping can be differentiated from tramp, bulk, tanker and passenger shipping by the provision of regular scheduled services, usually from named ports, and by carriage of all cargoes at pre-determined published freight rates. It can be divided into two parts: conference shipping, and independent liner or non-conference shipping.

Cargo liner conferences are a form of cartel, where a number of separate liner shipping firms join together in a formal trade sharing agreement. Conference arrangements normally include common freight rates and rationalised sailing schedules between each of the operators to ensure a regular service and equitable share of available cargoes to each member. The agreement may also include provisions for the pooling of revenue or cargo.

According to Deakin (1973), the first liner conferences were formed in England late in the nineteenth century as an attempt by shipowners to maintain freight rates at a time of growing excess capacity. In 1884, the first conference serving Australia was formed by a group of shipowners on the UK to Australia run. The Australian export trades remained conference-free until the introduction of refrigerated ships, when shipowners entered into agreement for the carriage of butter and fruit. By 1909, non-refrigerated export cargoes were also partially subject to conference agreement.

Independent or non-conference liner shipping firms are those which do not subscribe to conference agreements. They arrange their own sailing schedules and set their own freight rates. It is possible for a shipping line to be a conference member on one leg of a trade and an independent operator on the other. As conferences are formed on a directional basis for each trade, operators belong to separate conferences on inbound and outbound legs.

Conferences provide by far the greater part of liner shipping services, and are therefore of relevance to any study of centralisation in the liner trades[1]. A list of outbound conferences serving Australia is given in Appendix II.

**Conference characteristics**

Conference organisations can be classed as either closed or open. With a closed organisation, shipowners who wish to join the conference must apply for membership and have their application vetted by conference members and in some cases by government agencies. By contrast, open conferences, which are a product of US maritime law, can be joined by shipowners subject to US Federal Maritime Commission approval if they agree to charge the established freight rates. Conferences operating to and from Australia, with the exception of those linking Australia and the USA, have closed organisations. They are also usually referred to as deep-sea conferences because of their long, inter-continental routes.

It is essential for the continued existence of conferences that they should maintain shipper loyalty, regulate and secure conferences internally and limit outside competition. Conferences have a number of features to ensure these ends. These are:

- confidential criteria for conference admission;
- provisions for cargo and/or revenue sharing between members, the basis of which is usually confidential;
- sanctions against member lines which breach conference agreements;
- shipper loyalty rebates in a variety of forms;
- freight rate penalties for shippers who use non-conference carriers; and
- 'fighting ships' which offer freight rates below those of a non-conference competitor, if the need arises.

A characteristic associated with export conferences serving Australia is the uniform (or 'pan-Australia') freight rate system. Historically, freight rates for any cargo, with a few exceptions, have been uniform from all Australian ports of shipment to any given destination.

Similar arrangements exist for destination ports of the majority of inbound conferences.

**Freight rates—history of the negotiation process**

Overseas trade has always been an important element of Australia's economic prosperity. The export trades, in particular, have traditionally been at the forefront of Australian government policy, with successive Commonwealth Governments aware of the impact of overseas freight rates on Australia's export competitiveness. Thus, conference freight rates have long been of interest to Australian Governments, and of special concern to Australian shippers.

The first Commonwealth involvement in the rate determination process occurred in 1906 to curb rebate payment schemes by conferences, which were designed to ensure shipper loyalty. In 1928, the Commonwealth Government supported the formation of the Australian Overseas Transport Association (AOTA), whose aim was to ensure that a regular liner service was provided that was acceptable to both shippers and shipowners. The AOTA method of setting freight rates involved negotiations between commodity groups within AOTA but with final consultation with State committees of producers, exporters, importers and the AOTA council. This method remained in operation until 1939. The requisition of British merchant ships for the Second World War effectively brought conferences arrangements to an end until the 1950s. In 1955, freight rate rises proposed by the Australia to UK/Europe conference resulted in

1. Australian Bureau of Statistics (1980) figures indicate that for 1979-80, 73 per cent of the export liner tonnage and 80 per cent of import liner tonnage was carried by conference operators.

intervention by the Commonwealth Government on behalf of shippers. This intervention resulted in an agreement that future freight rate increases were to be arranged through a formula based on voyage costs. This formula approach to setting freight rates lasted with minor modifications until 1968.

In 1966, the Commonwealth Government passed the *Trade Practices Act* which was designed to preserve and encourage competition in Australian trade and commerce. Collusive tendering and bidding were outlawed. Other agreements and practices which fell within the Act were examinable by the Trade Practices Tribunal. In 1967, the Act was amended to permit liner companies serving Australia to form conferences, and required these conferences to negotiate the terms and conditions applicable to export cargoes with a designated shippers' body. This legislation has since become the Commonwealth Government's main instrument for implementing overseas liner shipping policy.

Under the 1967 Amendment, Australian shippers on the UK/Europe route formed themselves into the Australia/Europe Shippers' Association (AESA), replacing AOTA. Similar developments also occurred in the Australia to Singapore/West Malaysia trade. However, in the majority of trades, shipper bodies were not formed.

In 1972, the *Trade Practices Act* was further amended to bring all export trades under formal shipper-conference consultations. The Commonwealth Government also supported the formation and operation of the Australian Shippers' Council (ASC), which subsequently became the body designated to represent shippers. Since its formation, the ASC has conducted most negotiations on behalf of Australian shippers although some commodity groups, most notably those associated with wool and meat, have chosen to negotiate separately with conferences. These negotiations between a conference and the ASC generally involve a presentation of conference accounts based on operating costs averaged across all conference members. These operating costs then form the basis of negotiations for changes in the freight rate.

Since 1972, the shipping clauses of the Trade Practices Act have been further extended. Under Part X of the *Trade Practices Act* 1974, liner cargo shipping was exempted from the competitive provisions of the main body of the Act. In keeping with traditional Commonwealth policy, Part X places reliance on shipper-shipowner negotiations under the supervision of a designated shipper body, to provide adequate, economical and efficient export shipping services.
Part X provides (inter alia) for the following:

- filing of conference agreements, the details of which are not publicly available; and
- intervention and ultimately sanctions, where agreement cannot be reached by shipowners and shippers.

## THE INTRODUCTION OF CONTAINERISATION

### Background

According to Tabak (1970) the use of containers to unitise freight shipment is an old concept. However the adoption of practical reusable steel containers for carrying cargo dates from the late 1950s. This concept was largely ignored by shipping lines until the International Standards Organisation (ISO) reached agreement in 1966 on standard shipping container sizes, based on an 8 foot[1] square external end area with lengths varying in 10 foot multiples from 10 to 40 feet[2] and incorporating standard fastening and lifting points. These containers, or ISO boxes as they became known, were quickly adopted by all operators, with the 20 foot length (representing one twenty foot equivalent or TEU) being the most common. A more recent development has been the introduction of the 8 foot 6 inch high ISO container. which is used extensively in the Australian trade.

1. Container sizes are defined in imperial units. For conversion 1 foot = 0.3048 metres.
2. Metric dimensions for the standard 20 foot ISO container are 6.07 metres long with a 2.44 metre square external end areas. The internal volume is 30.4 cubic metres.

The first container services in Australia were introduced by Associated Steamships Pty Ltd, who commenced operations with the *Kooringa* between Melbourne and Fremantle in 1964. The first regular overseas container shipping services to Australia followed in 1969, and were operated by two consortia, Overseas Containers (Australia) Ltd (OCAL) and Associated Containers Transportation's (ACT) Australian subsidiary, Trans-Ocean Containers Ltd (TOC, now known as ACTA). In late 1969, the Australian National Line (ANL) also introduced container services to Japan and Britain.

The main advantage of the new method of handling cargo was increased throughput per man-hour while in port. The best cargo handling rate in Australian ports for break-bulk cargoes was approximately 400 tons per day, according to Stonham (1970). Container ships, by comparison, could typically achieve some 1200 tons of cargo per day. This allowed a reduction in ship turn-around time[1], with consequent savings in capital and labour. A further advantage to shipowners lay in the increased capital barriers to entry associated with containerisation. These barriers tend to discourage potential competition, and are also a major reason behind the formation of consortia to operate container vessels and terminals.

The advantages to shipowners of containerisation were more than sufficient to offset the increased capital costs associated with container vessels. A disadvantage, in addition to increased capital costs, is that cellular container vessels are unsuitable for other cargoes and thus may be forced to backhaul with little cargo.

**Senate Select Committee on the Container Method of Handling Cargoes**

The general concern of successive Commonwealth Governments with Australian export competitiveness, coupled with a dearth of information on the likely impact of containerisation prior to its introduction in the overseas trades, led the Commonwealth to establish a Senate Select Committee in April 1967 to enquire into containerisation.

The Senate Select Committee (1968) noted in its report that two of the consortia (OCAL and TOC) formed specifically to handle container traffic, planned to establish three centralised container ports in Australia: Sydney, Melbourne and Fremantle. It also noted that overseas cargo moving to and from traditional ports was to be shipped by road, rail or coastal sea services, with liner conferences meeting the cost of transporting cargo from these ports to the centralised or major ports.

These shipments are known as feeder movements. The undertaking by the conference to meet the cost of feeder movements was applicable to existing cargoes and customers only. New cargoes and customers were to be subject to commercial negotiation, and would not necessarily have their centralisation costs paid. In practice, some new cargoes and customers do have their feeder movement costs met by conference lines.

**Present arrangements for cargo centralisation**

At the time of introduction, centralisation arrangements were guided by the principle that no existing shipper or shipper group should have to pay more as a result of cargo centralisation. In response to this principle, the centralisation system has evolved with the following characteristics:

- Sydney, Melbourne, and Fremantle, and to a lesser extent, Brisbane have developed as the main centralised ports for handling containers;
- sea feeder services to centralised ports have been largely discontinued (except for Tasmania) and rail is the predominant feeder mode;
- the cost of feeder movements for overseas containers is largely met by conference liner shipping companies; and

1. According to Stonham (1970), the Australia-UK round trip took 146 days prior to containerisation and has now been reduced to approximately 90 days.

- some other ports, most notably Adelaide and Townsville, have invested in container handling facilities in an attempt to attract regular liner services.

As centralisation evolved, sections of the community perceived some disadvantages:

- Sydney and Melbourne shippers received more frequent liner services than shippers at other ports;
- shippers not established at the time of containerisation did not necessarily receive the same conditions as established shippers;
- new export commodities are not necessarily covered by the initial conference centralisation undertaking;
- Port Authorities at feeder ports have become concerned about the effect centralisation has on the long term development of their ports; and
- State Governments and regional authorities have become concerned about the impact of centralisation on regional and State development.

Perceived disadvantages such as these formed the impetus for the conduct of this study, and provided the basis for its concentration on conference container shipping services.

# CHAPTER 3—THE SHIPPING AND HANDLING OF CONTAINERS

## INTRODUCTION

As the majority of the Australian container trade is handled by conference liner services, the discussion in this chapter will consider only conference services. The non-conference services which handle the remainder of the container trade make a greater number of direct calls and do not, in general, centralise containers or pay for feeder movements.

In terms of the number of container movements, Australia's major trade areas are United Kingdom/Europe, Japan/Korea, East Asia, and East Coast North America (ECNA). These areas and the routes sailed are shown in Figure 3.1. For each of these trade routes, the conference liner services provide a regular sailing schedule to specified ports both in Australia and overseas. In general, each conference operates to Sydney and Melbourne, with additional calls in some trades at Fremantle or Brisbane.

The trade in overseas containers is largely handled by fully cellular container ships with some ro-ro[1] vessels also in use. To handle the cellular vessels, specialised container terminals have been established in the ports that receive regular calls. Many of the these terminals can also accommodate ro-ro vessels.

## CONTAINER SHIPPING SERVICES

Since the introduction of containerisation in the Australia-UK/Europe trade in 1969, general cargo for all trades serving Australia has progressively been containerised. Table 3.1 shows the container movements by trade area for 1976-77 and for 1978-79[2]. During 1976-77 the four major trades (UK/Europe, Japan/East Asia and ECNA) accounted for 88 per cent of the total (ie import and export) overseas container movements[3]. By 1978-79 the equivalent figure was 75 per cent. In 1979-80 area definitions were changed and later statistics are not directly comparable.

As conferences are organised on a leg basis, each trade generally has conferences relating to the inward and outward directions. For Australia, most operators sail both legs and belong to the conference in both directions[4]. The following discussion describes the operators and the services offered (for inward and outward legs) on the UK/Europe, Japan/Korea, East Asian and ECNA trades. The service description is indicative of the shipping services currently provided by the conference operators, and does not imply that there is a fixed schedule to which operators adhere rigidly. In practice, the conferences employ a flexible approach to scheduling which enables them to respond to changes in trade levels by altering the sailing schedule of vessels on a given route, or in many cases by taking vessels off one trade and putting them on another. This latter alternative is possible if individual shipowners operate in more than one trade.

1. Formally called 'roll on, roll off' or 'vehicle deck' ships.

2 1976-77 was the year of the Container Movements study which provided the detailed data on container flows within Australia and for the discussion of centralisation alternatives. 1978-79 data is provided to indicate the changing overall pattern of trade since that time. Details of internal movements for years since 1976-77 are not available.

3. Container movements and the capacity of container vessels are measured in units of twenty-foot ISO containers or 'twenty foot equivalent units' (TEU).

4. For the UK/Europe to Australia leg, separate UK-Australia and Outward Continent-Australia conferences exist, although a large number of operators belong to both. For the return leg Australia to Europe (including the UK service), all operators belong to the Australia-Europe Shipping Conference.

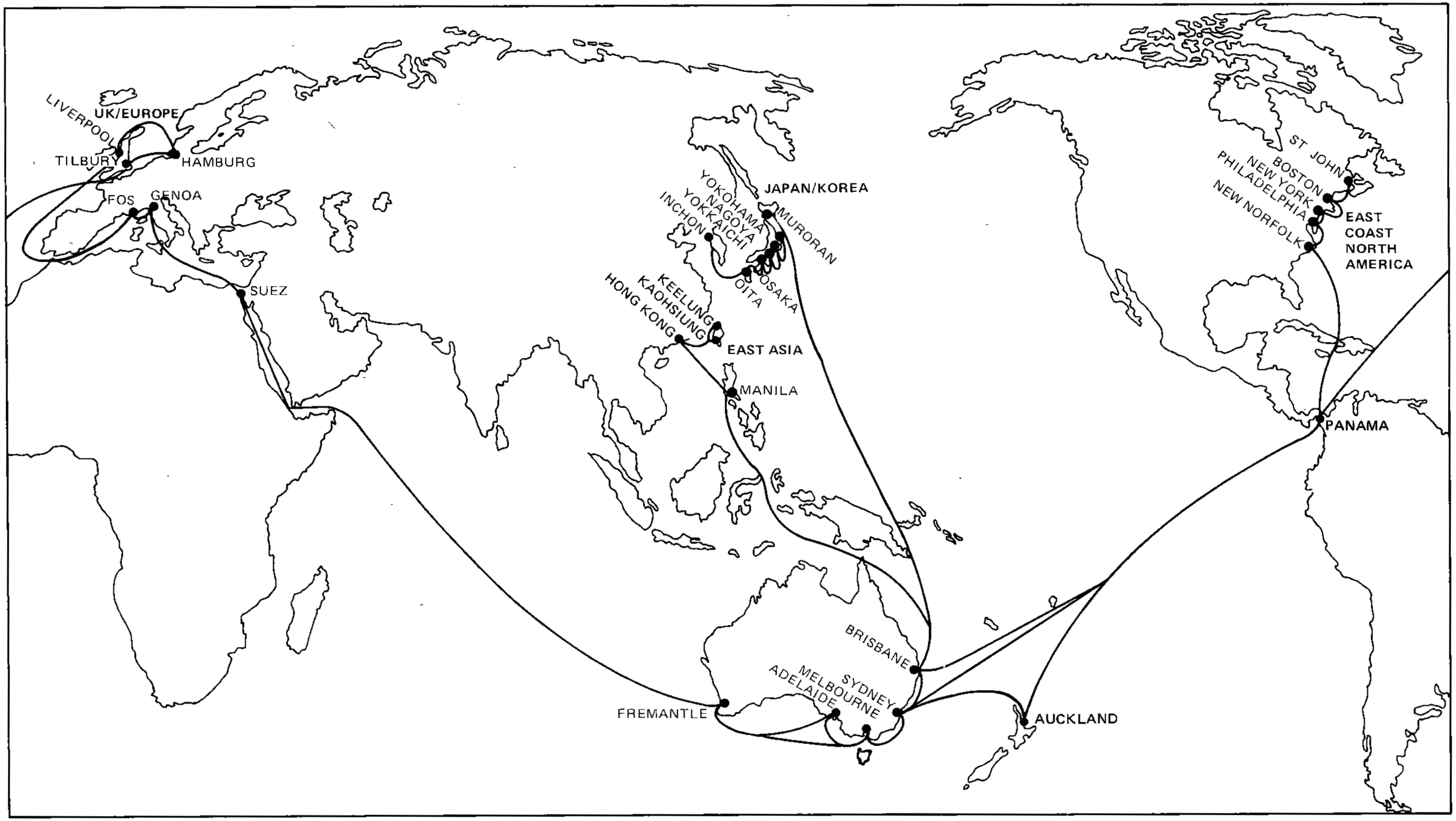


**Figure 3.1**
**Typical routes sailed by ships of the UK/Europe, Japan/Korea, East Asia and ECNA trades**

TABLE 3.1—CONTAINER MOVEMENTS BY TRADE AREA, 1976-77 AND 1978-79

*(TEUs)*

| Trade area | 1976-77 Movements | 1976-77 Proportion of total (per cent) | 1978-79 Movements | 1978-79 Proportion of total (per cent) |
|---|---|---|---|---|
| UK/Europe | 215 608 | 32 | 200 727 | 26 |
| Japan/East Asia[a] | 293 702 | 43 | 265 470 | 34 |
| ECNA[b] | 86 196 | 13 | 116 524 | 15 |
| WCNA[c] | 37 792 | 6 | 57 293 | 7 |
| Malaysia | 15 065 | 2 | — | — |
| South East Asia[d] | — | — | 51 789 | 7 |
| Pacific[e] | 14 053 | 2 | 51 616 | 7 |
| Other[f] | 13 425 | 2 | 28 531 | 4 |
| *Total* | *675 841* | *100* | *771 950* | *100* |

a. East Asia trade primarily Hong Kong, Philippines and Taiwan.
b. East Coast North America.
c. West Coast North America.
d. Malaysia included in South East Asia Statistics in 1978-79
e. Pacific includes Papua New Guinea and the Pacific Islands.
f. Others include Persian Gulf, Central Asia, Africa and Central and South America.

*Sources:* Australian Stevedoring Industry Authority and Department of Transport.

## UK/Europe trade

Vessels operating within the Australia-Europe and UK/Europe-Australia conferences handle most of the container movements between these two areas. Typical pure cellular and ro-ro vessels operated by these conferences are listed in Table 3.2[1]. The ANZECS and ACTA/ANL consortia listed in the table operate 20 of the 27 container/ro-ro vessels, and concentrate their port calls on Sydney and Melbourne with alternate calls at Fremantle. Containers carried by these operators are centralised on those three ports. Scan Carriers operate the remaining 7 vessels, all of which are ro-ros. These vessels call regularly at a large number of Australian ports such as Newcastle, Burnie, Townsville and Adelaide.

The European conferences' sailing schedules are flexible and respond to changes in the demand for shipping. The conferences currently operate the following sailing patterns to Australia:

- Europe to Fremantle (optional), Melbourne and Sydney via Suez, return to Europe via Suez;
- Europe to Fremantle (optional), Melbourne, Sydney and New Zealand via Suez, return to Europe via Suez;
- Europe to Fremantle (optional), Melbourne and Sydney via Suez, return to Europe via Panama; and
- Europe to Sydney, Melbourne and Fremantle (optional) via Panama, return to Europe via Suez.

Analysis of Lloyd's voyage records (Lloyd's 1980) for the first six months of 1980 showed that ANZECS and ACTA/ANL vessels made a total of thirty-four calls at each of Melbourne and Sydney. This gave a call frequency of one vessel every 5.4 days.

1. These conferences also operate a small number of conventional general cargo vessels. These vessels have been ignored by this report as their container-carrying capacity is insignificant, compared with purpose-built container vessels, and they are not involved in the centralisation process.

TABLE 3.2—CONTAINER SHIPS OPERATED BY THE AUSTRALIA-EUROPE AND EUROPE-AUSTRALIA SHIPPING CONFERENCES[a]

| *Name* | *Ship type* | *DWT capacity (tonnes)* | *TEU capacity (TEUs)* | *Operator* | | *Consortium* |
|---|---|---|---|---|---|---|
| Encounter Bay | Container | 29 262 | 1 530 | OCL[b] | | ANZECS[c] |
| Jervis Bay | Container | 29 262 | 1 530 | OCL | | ANZECS |
| Flinders Bay | Container | 29 262 | 1 530 | OCL | | ANZECS |
| Botany Bay | Container | 29 262 | 1 530 | OCL | | ANZECS |
| Resolution Bay | Container | 38 757 | 1 823 | OCL | | ANZECS |
| Mairangi Bay | Container | 38 757 | 1 823 | OCL | | ANZECS |
| Remeura Bay | Container | 32 753 | 1 655 | OCL | | ANZECS |
| Melbourne Express | Container | 32 117 | 1 614 | Hapag Lloyd | | ANZECS |
| Sydney | Express Container | 33 350 | 1 589 | Hapag Lloyd | | ANZECS |
| Nedlloyd Tasman | Container | 33 733 | 1 589 | Nedlloyd | Seabridge | ANZECS |
| Nedlloyd Houtman | Container | 49 262 | 2 714 | Nedlloyd | | ANZECS |
| Kangourou | Container | 44 060 | 1 490 | CGM[d] | | ANZECS |
| Lloydianna | Container | 32 502 | 1 590 | Lloyd Triestino | | ANZECS |
| New Zealand Pacific | Container | 38 642 | 1 822 | SCNZ[e] | | ANZECS |
| Act 1 | Container | 26 844 | 1 414 | ACTA[f] | | ACTA/ANL |
| Act 2 | Container | 26 844 | 1 414 | ACTA | | ACTA/ANL |
| Act 3 | Container | 26 940 | 1 294 | ACTA | | ACTA/ANL |
| Act 7 | Container | 39 710 | 1 822 | ACTA | | ACTA/ANL |
| Australian Venture | Container | 39 290 | 2 002 | ANL[g] | | ACTA/ANL |
| Australian Endeavour | Container | 26 844 | 1 223 | ANL | | ACTA/ANL |
| Lalandia | Ro-ro | 21 900 | 1 420 | Scan Carriers | | — |
| Tombarra | Ro-ro | 21 997 | 1 420 | Scan Carriers | | — |
| Tricolor | Ro-ro | 22 160 | 1 420 | Scan Carriers | | — |
| Barranduna | Ro-ro | 23 725 | 1 420 | Scan Carriers | | — |
| Tarago | Ro-ro | 22 170 | 1 420 | Scan Carriers | | — |
| Boogabilla | Ro-ro/cont | 32 500 | 1 700 | Scan Carriers | | — |
| Tourcoing | Ro-ro/cont | 32 500 | 1 711 | Scan Carriers | | — |

a. These ships are representative of vessels employed in this trade during 1980. Baltic Shipping and Jadranska Slobadna Plovidba (JSP) operate a small number of conventional general cargo (13-14 000 tons) vessels which can each carry approximately 100 TEUs.
b. Overseas Containers Limited.
c. Australia, New Zealand to Europe Container Service.
d. Compagnie Generale Maritime.
e. Shipping Corporation of New Zealand.
f. Associated Container Transportation (Australia).
g. Australian National Line.

*Source:* Lloyd's Voyage Record, Lloyd's Register of Shipping 1979-80.

TABLE 3.3—CONTAINER SHIPS OPERATED BY THE JAPAN/KOREA SECTION OF THE AUSTRALIA NORTHBOUND SHIPPING CONFERENCE[a]

| *Name* | *Ship type* | *DWT capacity (tonnes)* | *TEU capacity (TEUs)* | *Operator* | *Consortium* |
|---|---|---|---|---|---|
| Arafura | Container | 23 009 | 1 148 | OCL[b] | AJCL[c] |
| Ariake | Container | 34 346 | 2 000 | OCL | AJCL |
| Nichigoh Maru | Container | 32 023 | 1 576 | MOL[d] | AJCL |
| Canberra Maru | Container | 29 888 | 1 570 | NYK[e] | AJCL |
| Hakuba Maru | Container | 29 701 | 1 584 | YSL[f] | AJCL |
| Australian Emblem | Ro-ro/cont | 23 481 | 1 453 | ANL[g] | ESS[h] |
| Australian Escort | Ro-ro/cont | 23 629 | 1 453 | ANL | ESS |
| Australian Searoader | Ro-ro | 14 299 | 890 | K Line[i] | ESS |
| Fremantle Venture[j] | Container | 8 513 | 500 | K Line | ESS |
| Fremantle Enterprise[j] | Container | 8 502 | 430 | K Line | ESS |
| Hyogo Maru | Ro-ro | 14 059 | 673 | MOL, NYK, YSL | ESS |

a. These ships are representative of vessels employed in this trade during 1980. K Line and Knutsen Line also operate 3 and 8 conventional general cargo vessels respectively which can carry a small number of containers on these routes. Cho Yang Shipping Co started operating with ESS in 1981.
b. Overseas Containers Limited.
c. Australia Japan Container Line.
d. Mitsui OSK Lines Limited.
e. Nippon Yusen Kaisha Line.
f. Yamashita-Shinnihon Steamship Co Ltd.
g. Australian National Line.
h. Eastern Searoad Service and Korean Australian Searoad Service.
i. Kawasaki Kisen Kaisha Line.
j. Serves the west coast of Australia only.

*Source:* Lloyd's Voyage Record, Lloyd's Register of Shipping 1979-80, Department of Transport Australia.

Seventeen of these vessels also called at Fremantle, providing a call frequency of 10.8 days. In addition, the Australia to Europe Shipping Conference (AESCON) introduced a trial export call of approximate monthly frequency at Adelaide from March 1981.

**Japan/Korea trade**

Table 3.3 lists 11 container vessels operating on the Japan/Korea section of the Australia Northbound Shipping Conference. The nine vessels that serve the east coast of Australia are operated by two consortia, Australia-Japan Container Line and Eastern Searoad Service. All of these vessels call at Sydney, Melbourne and Brisbane, in that order, although occasionally the Sydney or Brisbane call is omitted. Containers from other centres such as Adelaide are centralised on the nearest port of call.

Lloyd's voyage records show that for the first six months of 1980 there were forty calls at Melbourne, giving a call frequency of one vessel every 4.6 days. Of these forty vessel calls, thirty-eight also called at Brisbane and thirty-four called at Sydney. This implies a call frequency of 5.4 days between calls for Sydney and 4.8 days for Brisbane.

**East Asia trade**

Vessels operating on the East Asia section of the Australia Northbound Shipping Conference (which includes Hong Kong, the Philippines and Taiwan) are listed in Table 3.4. The ANLINE consortium, which is a rationalised service offered by AAE, OOCL and ANL, operates 6 vessels with two other groups operating a further 7 vessels. The calling patterns of these vessels are quite varied:

- ANLINE vessels call at Sydney, Melbourne and Brisbane on a regular basis;
- the *Andros* and *Advara* operated by the Australian West Pacific Line (AWPL) usually call at Sydney, Melbourne, Burnie and Adelaide;
- the *Bunga Angsana* and *Bunga Teratai* (which are also operated by AWPL) usually sail from west to east around Australia, calling at Fremantle, Adelaide, Burnie, Melbourne, Sydney and Brisbane; and
- the *Tamara, Nagara* and *Malmros Monsoon* (operated by Atlanttrafik Express Service) sail east to west, calling at Brisbane, Sydney, Melbourne and Fremantle.

In total these vessels provide the average calling frequencies shown in Table 3.5. These vary from one vessel call every 4.3 days at Melbourne to almost 23 days between calls at Adelaide. Although some vessels operating on this trade make direct calls in each State, container centralisation is still carried out by some operators. For example, Adelaide containers for ANLINE vessels are centralised in Melbourne, because these ships only call at ports on the east coast of Australia. AWPL vessels calling at Adelaide serve both the South East Asian and East Asian trade regions and are therefore not considered to offer a direct service to the East Asian region.

TABLE 3.4—CONTAINER SHIPS OPERATED BY THE EAST ASIA SECTION OF THE AUSTRALIA NORTHBOUND SHIPPING CONFERENCE[a]

| *Name* | *Ship type* | *DWT capacity (tonnes)* | *TEU capacity (TEUs)* | *Operator* | *Consortium* |
|---|---|---|---|---|---|
| Australian Explorer | Ro-ro/cont | 18 411 | 1 000 | ANL[b] | ANLINE |
| Australian Enterprise | Ro-ro/cont | 18 590 | 1 000 | ANL | ANLINE |
| Asian Jade | Container | 19 800 | 1 176 | AAE[c] | ANLINE |
| Asian Pearl | Container | 19 600 | 1 176 | AAE | ANLINE |
| Oriental Ambassador | Container | 24 037 | 1 288 | OOCL[d] | ANLINE |
| Oriental Expert | Container | 23 991 | 1 288 | OOCL | ANLINE |
| Andros | Gen.Cargo/cont | 26 204 | 948 | AWPL[e] | — |
| Advara | Gen.Cargo/cont | 26 368 | 948 | AWPL | — |
| Bunga Angsana[f] | Container | 12 580 | 500 | AWPL | — |
| Bunga Teratai[f] | Container | 12 528 | 500 | AWPL | — |
| Tamara | Gen.Cargo/cont | 21 103 | 1 002 | AES[g] (AWPL operated) | — |
| Nagara | Gen.Cargo/cont | 21 103 | 1 002 | AES (AWPL operated) | — |
| Malmros Monsoon | Gen.Cargo/cont | 21 103 | 1 002 | AES (AWPL operated) | — |

a. These ships are representative of vessels employed in this trade during 1980. Knutsen line also operate 8 conventional general cargo vessels which carry containers and serve the west coast of Australia only.
b. Australian National Line.
c. Asia Australia Express.
d. Orient Overseas Container Line.
e. Australia West Pacific Line. This company also operates 3 conventional general cargo vessels (14000 tons).
f. Serves the west coast of Australia only.
g. Atlanttrafik Express Service.

*Source:* Lloyd's Voyage Record, Lloyd's Register of Shipping 1979-80, Department of Transport Australia.

TABLE 3.5—CALL FREQUENCIES AT AUSTRALIAN PORTS FOR EAST ASIA TRADE CONFERENCE VESSELS

| Port | Number of calls Jan-June 1980 | Call frequency (days) |
|---|---|---|
| Brisbane | 25 | 7.3 |
| Sydney | 38 | 4.8 |
| Melbourne | 43 | 4.3 |
| Burnie | 9 | 20.3 |
| Adelaide | 8 | 22.9 |
| Fremantle | 12 | 15.3 |

*Source:* Lloyd's Voyage Record, January-June 1980.

### East Coast North America (ECNA) trade

Container vessels operated by the Australia to East Coast North America (ECNA) Shipping Conference are listed in Table 3.6. There are three major operators and one consortium consisting of ACTA and ANL, known as Pacific America Container Express Service (PACE). A total of 17 container ships are operated by these four operators. The calling patterns of these ships are:

- Columbus vessels call at Sydney, Melbourne and Brisbane in that order;
- Farrell vessels call at Brisbane, Sydney and Melbourne;
- PACE vessels call at Melbourne, Sydney and Brisbane; and
- AES vessels call at Brisbane, Sydney, Melbourne and Fremantle.

In total, these vessels provide call frequencies varying from 4.7 days at Melbourne and Sydney and 5.9 days at Brisbane to around 23 days between calls at Fremantle. The export service provided by the AES vessels is less frequent than that provided by the other lines, because the former sail from Fremantle to the east coast of North America via Asia (which takes about six weeks). The other vessels in this service take about four weeks to sail direct from the east coast of Australia to the east coast of North America.

## CONTAINER TERMINAL FACILITIES

Containers are handled by a number of different methods, depending on the type of ship used to transport them and the gear available to load and unload them. For ro-ro vessels, a minimum of specialised facilities[1] is generally required if they carry their own ramps. The exceptions to this are stern-door vessels of the type operated by ANL, which can only be served at berths that provide a shore-based stern ramp.

Fully cellular container vessels carry the majority of containers between Australia and overseas and are usually handled at purpose-built container terminals. These terminals generally include a gantry crane capable of lifting containers from the vessels' holds to shore, as well as equipment for performing the shore movements.

The remainder of this report assumes that containers are handled at these specialised container terminals. It is also assumed that they are shipped aboard modern fully-cellular container vessels or ro-ro ships. Appendix III describes the physical characteristics of the major terminals used by conference shipping lines at Melbourne, Sydney, Brisbane, Fremantle and Adelaide.

In addition to the terminals already operating in Australia and described in Appendix III, further container facilities are being developed in Melbourne, Sydney and Brisbane. In Melbourne, ANL is developing a fifth berth at Webb Dock which is to be used by

1. Deck strengthening is sometimes required at berths which have not been built to withstand heavy wheel loads or ramp loads from ro-ro vessels.

TABLE 3.6—CONTAINER SHIPS OPERATED BY THE AUSTRALIA TO EAST COAST NORTH AMERICA SHIPPING CONFERENCE[a]

| *Name* | *Ship type* | *DWT capacity (tonnes)* | *TEU capacity (TEUs)* | *Operator* | *Consortium* |
|---|---|---|---|---|---|
| Columbus America | Container | 22 002 | 1 187 | Columbus | — |
| Columbus Australia | Container | 22 002 | 1 187 | Columbus | — |
| Columbus New Zealand | Container | 22 002 | 1 187 | Columbus | — |
| Columbus Queensland | Container | 24 400 | 1 211 | Columbus | — |
| Columbus Louisiana | Container | 20 100 | 1 211 | Columbus | — |
| Columbus Canterbury | Container | 20 100 | 1 211 | Columbus | — |
| Austral Entente | Container | 19 813 | 1 708 | Farrell | — |
| Austral Envoy | Container | 19 842 | 1 708 | Farrell | — |
| Austral Endurance | Container | 19 842 | 1 708 | Farrell | — |
| Austral Ensign | Container | 19 842 | 1 708 | Farrell | — |
| Act 3 | Container | 26 940 | 1 294 | ACTA[b] | PACE[c] |
| Act 4 | Container | 26 940 | 1 294 | ACTA | PACE |
| Act 5 | Container | 26 940 | 1 294 | ACTA | PACE |
| Australian Exporter | Container | 28 080 | 1 294 | ANL[d] | PACE |
| Tamara | Gen.Cargo/cont | 21 103 | 1 002 | AES[e] | — |
| Nagara | Gen.Cargo/cont | 21 103 | 1 002 | AES | — |
| Malmros Monsoon | Gen.Cargo/cont | 21 103 | 1 002 | AES | — |
| Helen | Bulk/container | 42 000 | 1 097 | ABC[f] | — |
| Deloris | Bulk/container | 42 000 | 1 097 | ABC | — |
| Sneland | Bulk/container | 23 743 | 672 | ABC | — |
| Prestigious | Bulk/container | 23 200 | 670 | ABS | — |
| Antwerper | Bulk/container | 42 000 | 1 482 | ABC | — |
| Brussell | Bulk/container | 42 000 | 1 482 | ABC | — |

a. These ships are representative of vessels employed in this trade during 1980.
b. Associated Container Transportation (Australia).
c. Pacific America Container Express Service.
d. Australian National Line.
e. Atlanttrafik Express Service.
f. ABC Container Line.

*Source:* Daily Commercial News, Lloyd's Register of Shipping 1979-80, Department of Transport Australia.

overseas container vessels. In Sydney, Container Terminal Australia Limited (CTAL) has a new facility at Port Botany scheduled to open in late 1981. This is a major complex which is 51 per cent owned by OCAL, with four other organisations having a share in the remainder. In Brisbane, Seatainer Terminals Ltd is to develop a terminal at Fisherman Islands Berth No 2.

The large container facilities being developed at Port Botany in Sydney and Fisherman Islands in Brisbane constitute a considerable increase in the capacity of these ports to handle containers. Once these terminals are fully operational, the capacity at both Sydney and Brisbane will be well in excess of the present trade, and it is possible that some of the less efficient terminals at these ports may eventually close down.

## CONTAINER HANDLING OPERATIONS

This section describes the major operations performed at container terminals, including the ship-to-shore, shore-to-stack, stack-to-land transport and depot functions. The level and type of manning at terminals is also discussed and a description given of rail transport arrangements for containers in the Melbourne-Adelaide and Sydney-Brisbane corridors.

### Container terminal operations

Container terminals are defined in this report as facilities which are capable of serving fully cellular ships (including the loading, unloading and storage of containers). In some instances these terminals can also serve ro-ro vessels. The operations at these terminals can be divided into four separate activity areas: ship-to-shore handling, shore-to-stack handling, stack-to-land transport handling, and depot activities. Each of these functions is generally performed by specific sets of machinery and gangs of men.

The ship-to-shore task (or loading-unloading function) is performed using a gantry crane, which is the single most expensive piece of machinery at terminals. Performance of these gantries is highly variable and largely dependent on the ship type being served, the type of crane in use and often the state of industrial relations at the port. For modern container ships which do not carry derrick cranes, and which have no major obstructions to cargo handling, performance can range from 12-15 TEUs per berth hour for single-lift cranes and 16.5-25 TEUs per berth hour for double-lift cranes. In some situations, the double-lift capacity is not able to be used because of stowage or other factors.

Where two cranes are available to serve the one vessel, increases of up to 70 per cent in lifting rates have been achieved. From discussions with operators, it appears that performance is highly variable and is often inexplicably so. The rates quoted above are considered to be those achievable under normal Australian operating conditions.

The shore-to-stack operation involves the movement of containers from the ship's side to the terminal's storage area for imports and the reverse for exports. This operation is performed by a variety of container handling equipment. Each terminal operator tends to specialise in one or more types of equipment. ANL terminals such as Newstead and BATL (part owned by ANL) in Brisbane, as well as Botany in Sydney and Webb Dock in Melbourne, all use fork-lift trucks for the transfer of containers within the terminal. Seatainer Terminals in Sydney use a combination of 'internal transfer vehicles' (ITVs) for moving containers to and from the ship's side, with front-loading and top-loading fork-lift trucks performing the loading and unloading operations on the stack. In Melbourne, Seatainers use straddle carriers to perform the loading and unloading of ITVs at the stack. Trans Ocean Terminals (TOT) at Adelaide and Melbourne use straddle carriers for the shore-stack transfer with some assistance from fork-lift trucks.

Three to four machines are usually allocated to each gantry crane to handle the shore-stack movement for container vessels. A similar number of fork-lift trucks are also used for working ro-ro vessels.

Stack-to-land transport operations involve transferring containers between the terminal storage area and rail wagons or road transport. A number of different types of equipment are in use, including fixed overhead travelling gantries (often referred to as 'transtainers'), fork-lift trucks and straddle carriers, with no one system dominating.

Container depots or decentralised container parks (DCPs) are used for packing and unpacking of less-than-container load (LCL) cargoes as well as providing additional storage area for containers. Some depots (such as Briswharves at Hamilton and Seatainers at West Swanson in Melbourne) are located within or adjacent to the terminal, but the scarcity of port-side land has meant that most depots are situated away from the terminal. Recently constructed terminals at Botany and Fisherman Islands are both planned to have depots on site.

## Manning at terminals

The number of workers permanently employed at container terminals ranges from under 30 at the TOT terminal in Adelaide to over 400 at large terminals such as ANL's Botany complex. Of these employees, around 50 to 60 per cent are members of the Waterside Workers Federation (WWF), with a further 20 per cent (and up to 30 per cent at one terminal) members of the Federated Clerks Union (FCU). Other employees are members of the Australian Foreman Stevedores Association (AFSA), Amalgamated Metal Workers and Shipwrights Union (AMWSU), Electrical Trades Union (ETU) and the Wharf Superintendents and Supervisors Association (WSSA) as well as a handful of other unions. At the ANL Botany terminal, workers from ten separate unions are employed, compared with seven at TOT in Melbourne and six at BATL in Brisbane.

The size of the workforce is largely determined by the throughput of the terminal and the type of roster system operated. Terminals which require the ability to work a continuous three-shift operation (such as Seatainers Melbourne and Sydney, ANL Botany and Briswharves) employ a 5/3 roster system, with employees working five days on and three days off over an eight-day cycle. For terminals which work only an occasional third shift, a 5/2 roster is used with employees working 5 days on and two days off every week. In general workers employed under a 5/3 roster work eight-hour shifts compared with a typical seven-hour shift for 5/2 roster workers.

As the loading and unloading of vessels is performed by specific gangs of waterside workers, their activities can be considered separately from those employees engaged in yard duties (reefer maintenance, receival and despatch, etc). For each vessel, 9 to 16 employees per shift are required to work the ship. As the working rules are on a 'one up-one down' basis for most heavy machinery (such as gantry cranes and container handling machinery), two employees per shift are required for each machine operated during the shift. Hence, for a single-gantry crane operation, at least nine employees are required, including 1 foreman, 2 gantry crane drivers, and 6 machinery drivers for 3 machines. Workers who are 'down' during the shift can be used for hatch and gangway work or other tasks as required. At some terminals a fourth machine is used to handle containers, requiring an additional two employees per shift. For ro-ro vessels, where simultaneous working of the crane deck and stern door occurs, 16 or more employees can be required for loading and unloading operations.

An additional task in the loading-unloading operation is lashing and unlashing containers, both on the weather deck and below decks (on ro-ro ships). This operation is performed by the crew onboard Australian flag ro-ro ships. All other vessels have their containers lashed and unlashed by waterside workers.

The manning requirements for lashing and unlashing varies between terminals. At terminals operated by ANL, gangs of 3 to 6 workers are employed solely to perform this task. Other terminals use normal gang labour (such as 'down' workers) for this operation. As a result, gang sizes at ANL terminals can be larger by up to 6 workers compared with those employed by other operators. Although these practices should affect costs, the actual effect on productivity is not well documented.

**Land transport of containers**

For long-haul feeder movements[1] of containers, such as those between capital cities, rail transport is the dominant mode. In the Sydney-Brisbane and Melbourne-Adelaide corridors, almost all feeder movements are performed by rail, with shipping companies usually having contract rate agreements with the railways for the carriage of their containers. The rail operation in each of these corridors is discussed below.

The broad-gauge service between Melbourne and Adelaide is operated by VicRail between the Dynon yards in Melbourne and Serviceton on the South Australian border. Loaded wagons are handed over at Serviceton to Australian National to complete the journey into Gillman or Mile End yards at Adelaide. A total of five express trains carrying a mix of containers and general goods leave Melbourne every day (Monday to Friday) for Adelaide, with five trains also departing each weekend. From Adelaide, four goods trains a day depart for Melbourne with two trains running during the weekend. The first two trains each day carry mainly overseas containers, with the remaining trains carrying a mixture of domestic and overseas freight.

Express trains take approximately 17 hours to complete the 778 kilometre journey between Adelaide and Melbourne, with typical trailing loads of 1000 to 1200 tonnes gross. Each train has around 19 wagons loaded with two or three containers per wagon. Container traffic, based on BTE estimates for 1976-77 on this route, is approximately 20 000 loaded containers per annum in each direction, with a further 3000 empty positioning movements also moving each way.

The standard-gauge service between Sydney and Brisbane is operated by the State Rail Authority (SRA) of NSW between Sydney and Acacia Ridge or Clapham in Brisbane, with five express goods trains per day in each direction. Containers travelling on the narrow-gauge Queensland system must be gauge-exchanged at these terminals. At present, all containers travelling between Sydney and Brisbane must pass through Brisbane's Hamilton container terminal, regardless of their origin or final destination in Brisbane.

Trains take approximately 25 hours to complete the 1000 kilometre journey. Typical trailing loads are 750 to 1000 tonnes gross, carried on 15 wagons with two or three containers per wagon. Approximately 10 000 loaded containers were carried southbound and almost 12 000 loaded and 13 000 empty containers travelled northbound in 1976-77, according to BTE estimates. Further discussion of these container movements is given in Chapter 4.

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1. Feeder movements are defined as movements of containers between central or major ports, and traditional or feeder ports which received direct calls prior to the introduction of centralisation. Traditional ports include Adelaide and Brisbane (for Europe trade).

# CHAPTER 4—SURVEY OF THE MOVEMENT OF OVERSEAS CONTAINERS THROUGHOUT AUSTRALIA

## BACKGROUND

An understanding of both the level of imports and exports, and of the movement of overseas containers within Australia is necessary in order to assess the effects of container centralisation procedures. At the commencement of this study, little was known of the size of the total container movement task, nor was there a good understanding of the pattern of container flows within Australia. To overcome this problem, the BTE employed the services of a consultant to conduct a study of container movements throughout Australia.

The terms of reference required the consultant to report on the following tasks which were seen as fundamental to an understanding of Australian container movements:

- estimation of the numbers of overseas containers arriving at and leaving each major Australian port, including a separate identification of loaded and empty containers, with movements to be identified by overseas trade region;
- indication of trends in the container transportation task over time;
- identification of the major domestic corridors along which container movements occur; the corridors to be identified included both those relevant to shorter distance movements (intra-city) and longer distance movements (inter-city) with an estimate of flows by type of container and mode for each major corridor;
- preparation of a report on the interaction between companies involved in the container trade, the role of each company and the availability of data on container flows within each organisation; and
- identification of topics requiring additional study.

The conduct and results of the survey of container movements are described in detail in this chapter, as they are of interest in their own right and have not been published elsewhere. The survey (BTE 1981, unpublished) contains data on container movements for the years 1975-76 and 1976-77.

In the following discussion (and throughout this report), the term 'transhipment' has been used to describe the movement of containers loaded with overseas cargo within Australia. The term 'positioning movement' has been used where empty overseas containers are transported within Australia. In some situations these containers, which are classified as 'empty' by shipping companies, are used to carry domestic cargo when being positioned.

## DATA COLLECTION

The data collection procedure employed in the study was to contact those organisations involved in the handling of overseas containers in Australia and request that they complete a detailed questionnaire on their involvement in container handling. The questionnaires were designed to determine the volume of container movements by trade area, the types of containers used, and the number of positioning and transhipment movements as well as the number of containers moved into and out of storage, by mode.

A major difficulty encountered during the study was that of record-keeping. Most organisations collect information for their own accounting and management purposes, and this information is often not suited to the needs of studies such as this. This meant that extraction of data was in many instances a very time-consuming task.

As no single organisation holds information on all facets of the container movement task, it was necessary to approach a wide range of organisations. Port authorities and the Australian Stevedoring Industry Authority (ASIA)[1] represent comprehensive sources of information on total movements of containers into and out of Australia, while the rail authorities are the major data source for movements within Australia. The total picture of container transhipments and positioning movements was assembled from information supplied by a large number of operators, which made it very difficult to cross-check all of the data collected. The results represent a valuable description of the container handling task, but fail to meet some of the original goals where disaggregate data was required.

## SUMMARY OF ESTIMATED CONTAINER MOVEMENTS THROUGH AUSTRALIAN PORTS

The consultant's report contained estimates of the container movements for 1975-76 and 1976-77. The discussion in this section concentrates on a description of the 1976-77 estimates.

Table 4.1 presents a summary of the total container movement task for 1976-77, and shows that an estimated 660 000 to 675 000 TEUs passed through Australian ports in that year. Two sets of estimates, based on port authority data and ASIA-supplied data, are presented and show a fair degree of variance between estimates.

Figures 4.1 to 4.6 present estimates of the total number of overseas containers handled at major Australian container ports. The diagrams describe the container task by trade area, differentiating between imports and exports as well as loaded and empty containers. A detailed tabulation of the container task at these ports, and for Australia as a whole, is given in Appendix IV, together with a definition of the trade areas described in this report.

The data presented in Table 4.1 and Figures 4.1 to 4.6 have been derived from port authority and Australian Stevedoring Industry Authority (ASIA) estimates, and both sets of data are depicted in each case. Comparison of the two sets of figures shows that, although in many instances there is close agreement, on some occasions large discrepancies exist between the estimates. The UK/Europe trade through the Port of Melbourne (shown in Figure 4.2) is a notable example. In this instance, the ASIA estimate is twice that of the port authority figure.

Notwithstanding these unresolved discrepancies, close examination of the data shows that the two data sources are in agreement as to the major characteristics of the container movement task. For example, it is clear from Figure 4.1 that (whichever data source is considered) the largest trade area, in terms of number of containers, for Australia as a whole is Japan/East Asia followed by UK/Europe. Furthermore, (from Table IV.2 in Appendix IV) the figure of 85 000 empty containers exported (about 25 per cent of total container exports) during 1976-77 was well above the 15 000 empty containers imported (about 5 per cent of total imports) for that year.

1. The Australian Stevedoring Industry Authority was disbanded on 1 July 1977. Responsibility for the collection and dissemination of stevedoring and port-related statistics now rests with the Department of Transport Australia.

TABLE 4.1—SUMMARY OF CONTAINER MOVEMENTS THROUGH AUSTRALIAN PORTS, BY TRADE AREA 1976-77

(TEUs)

| Trade area | Data source | Total[a] imports | Total[a] exports | Total movements | Percentage of total |
|---|---|---|---|---|---|
| UK/Europe | PA[b] | 83 601 | 81 818 | 165 419 | 25.1 |
| | ASIA[c] | 112 132 | 103 476 | 215 608 | 32.0 |
| Japan/East Asia | PA | 136 592 | 144 192 | 280 784 | 42.6 |
| | ASIA | 142 672 | 151 030 | 293 702 | 43.5 |
| ECNA[d] | PA | 55 501 | 38 524 | 94 025 | 14.3 |
| | ASIA | 45 226 | 40 970 | 86 196 | 12.8 |
| Other | PA | 54 037 | 64 269 | 118 306 | 18.0 |
| | ASIA | 36 730 | 43 605 | 80 335 | 11.9 |
| TOTAL | PA | 329 731 | 328 803 | 658 534 | 100.0 |
| | ASIA | 336 760 | 339 081 | 675 841 | 100.0 |

a. Includes loaded and empty containers.
b. Port Authorities.
c. Australian Stevedoring Industry Authority.
d. East Coast North America.

*Source:* BTE estimates (1981, unpublished).

## SUMMARY OF CONTAINER MOVEMENTS WITHIN AUSTRALIA

Figure 4.7 illustrates the transhipment[1] of loaded containers throughout Australia for 1976-77. The Melbourne-Adelaide and Sydney-Brisbane corridors carry the largest volumes of transhipment traffic, involving movements of:

- 20 200 TEUs Adelaide to Melbourne:
- 19 000 TEUs Melbourne to Adelaide;
- 11 700 TEUs Sydney to Brisbane; and
- 10 000 TEUs Brisbane to Sydney.

1. In the context of this report the word 'transhipment' is used for the movement of loaded international containers between a centralised port and their origin or destination within Australia.

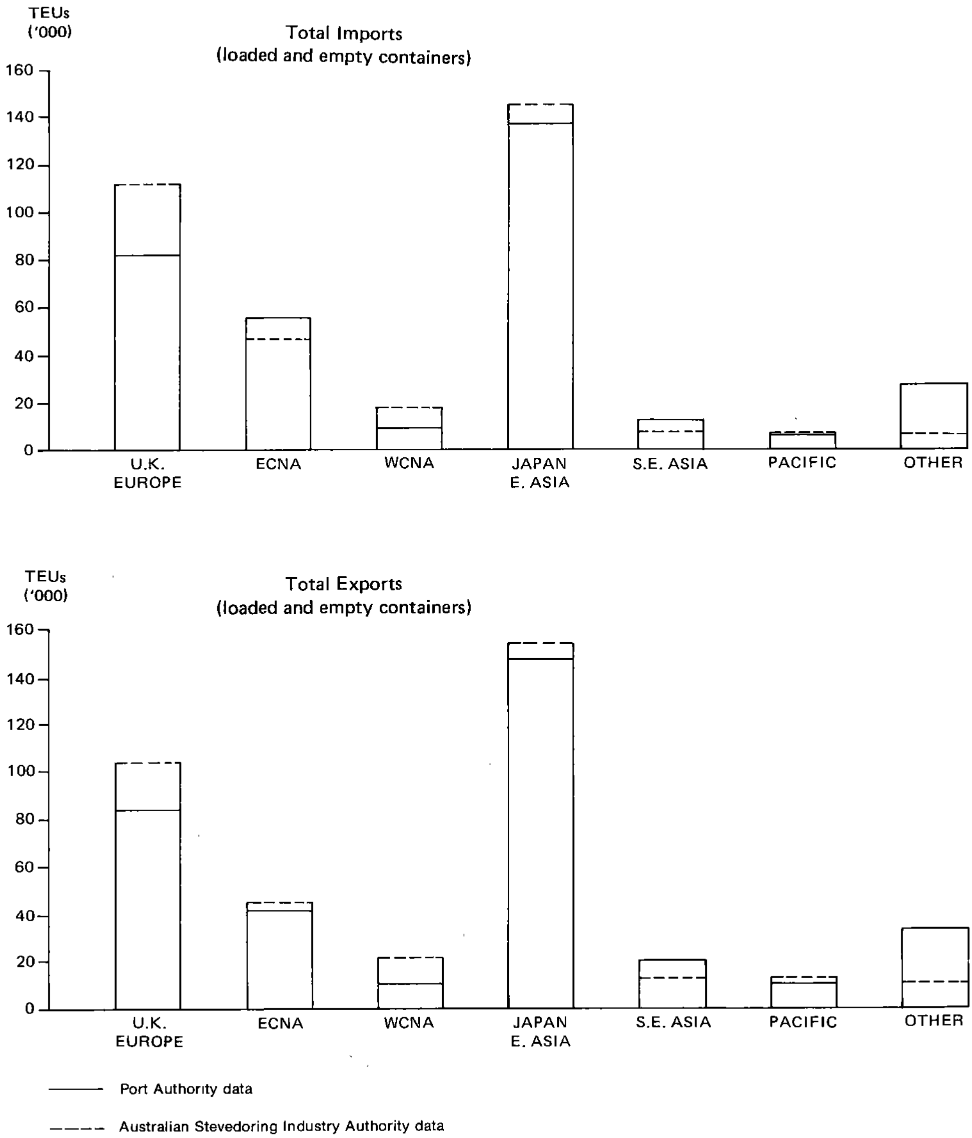
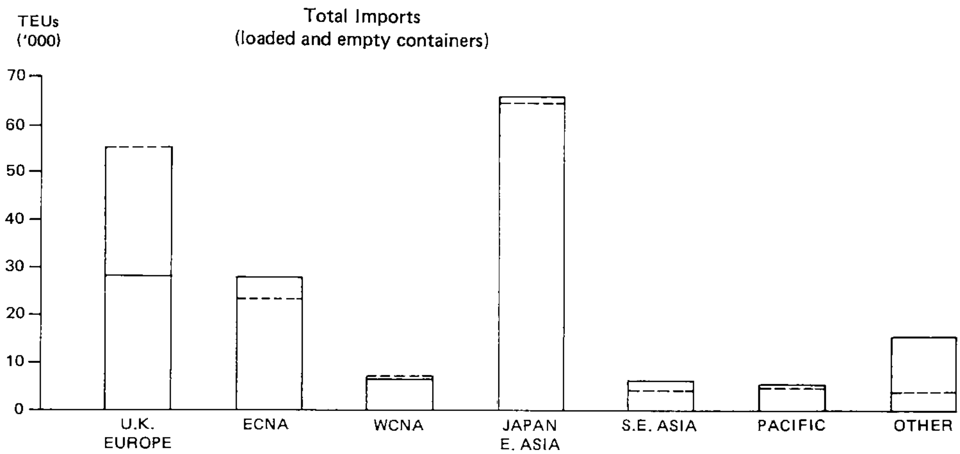



**Figure 4.1**
**Container movements through Australian ports 1976-77**

Source: BTE (1981, unpublished)



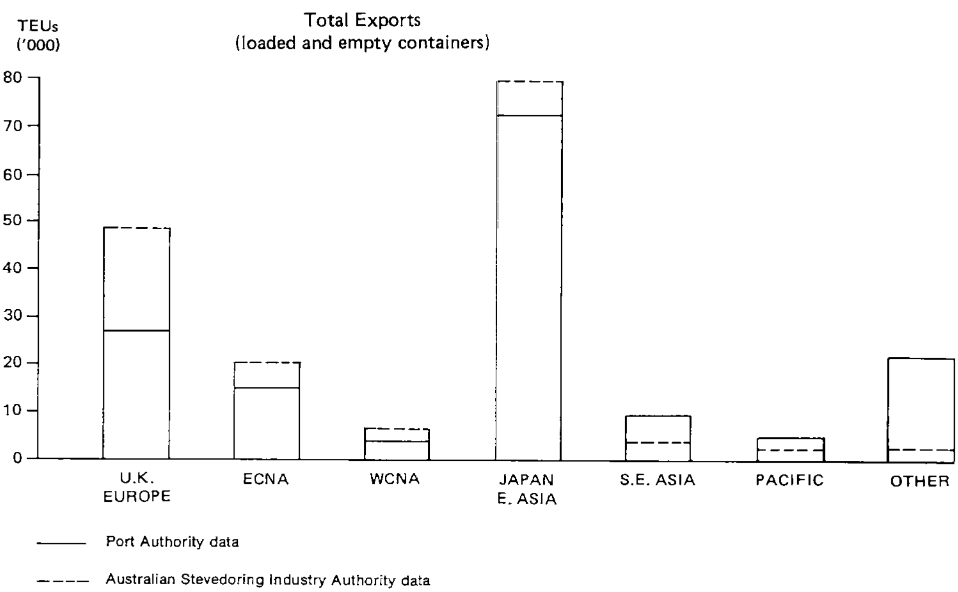




**Figure 4.2**
**Container movements through Port of Melbourne 1976-77**

Source: BTE (1981, unpublished)

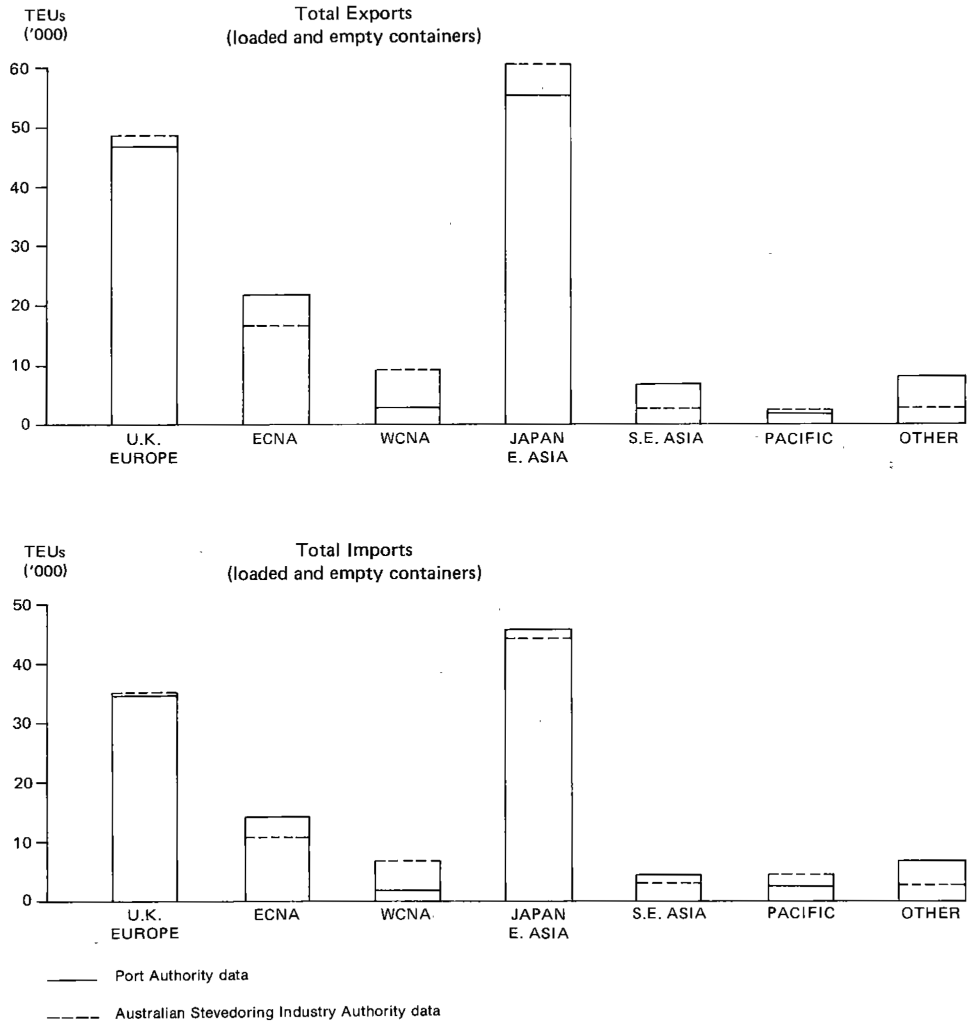



**Figure 4.3**
**Container movements through Port of Sydney 1976-77**

Source: BTE (1981, unpublished)

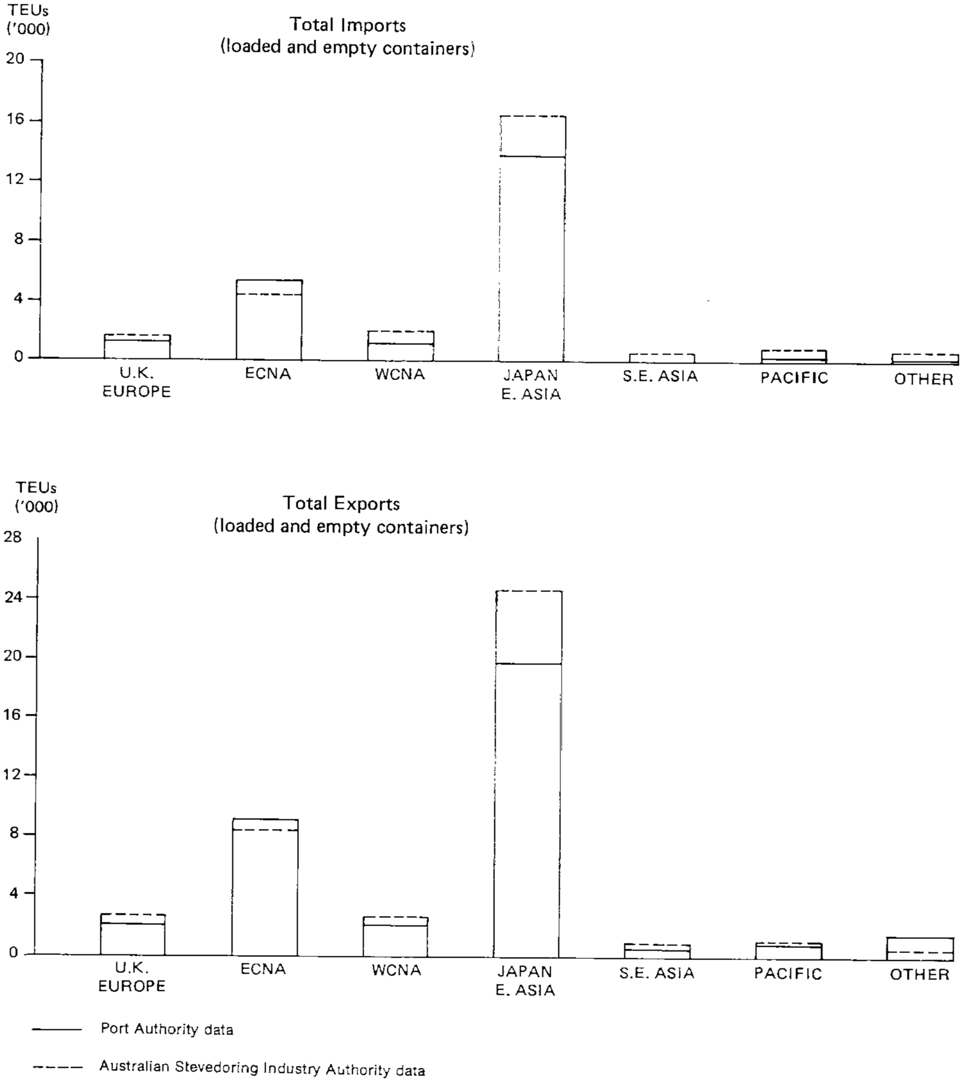



**Figure 4.4**
**Container movements through Port of Brisbane 1976-77**

Source: BTE (1981, unpublished)

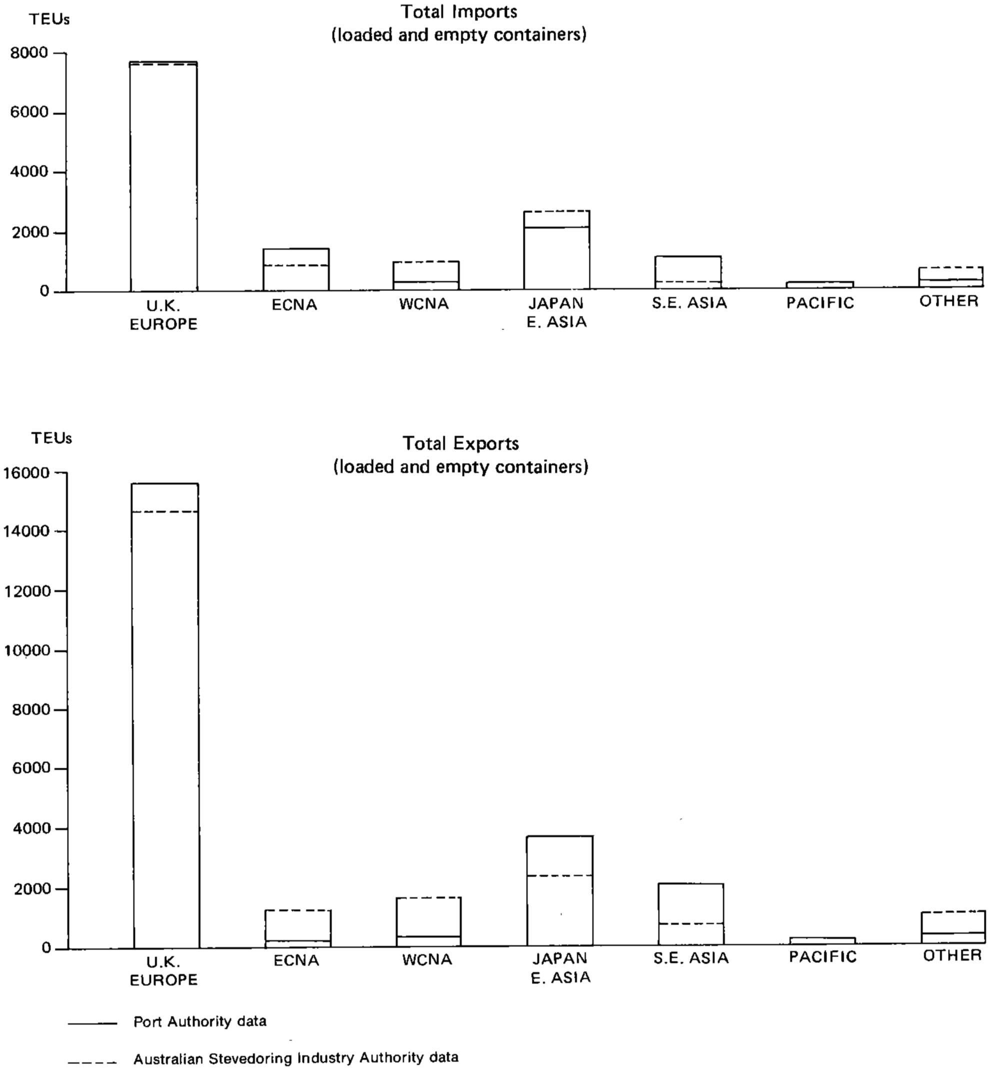



**Figure 4.5**
**Container movements through Port of Fremantle 1976-77**

Source: BTE (1981, unpublished)

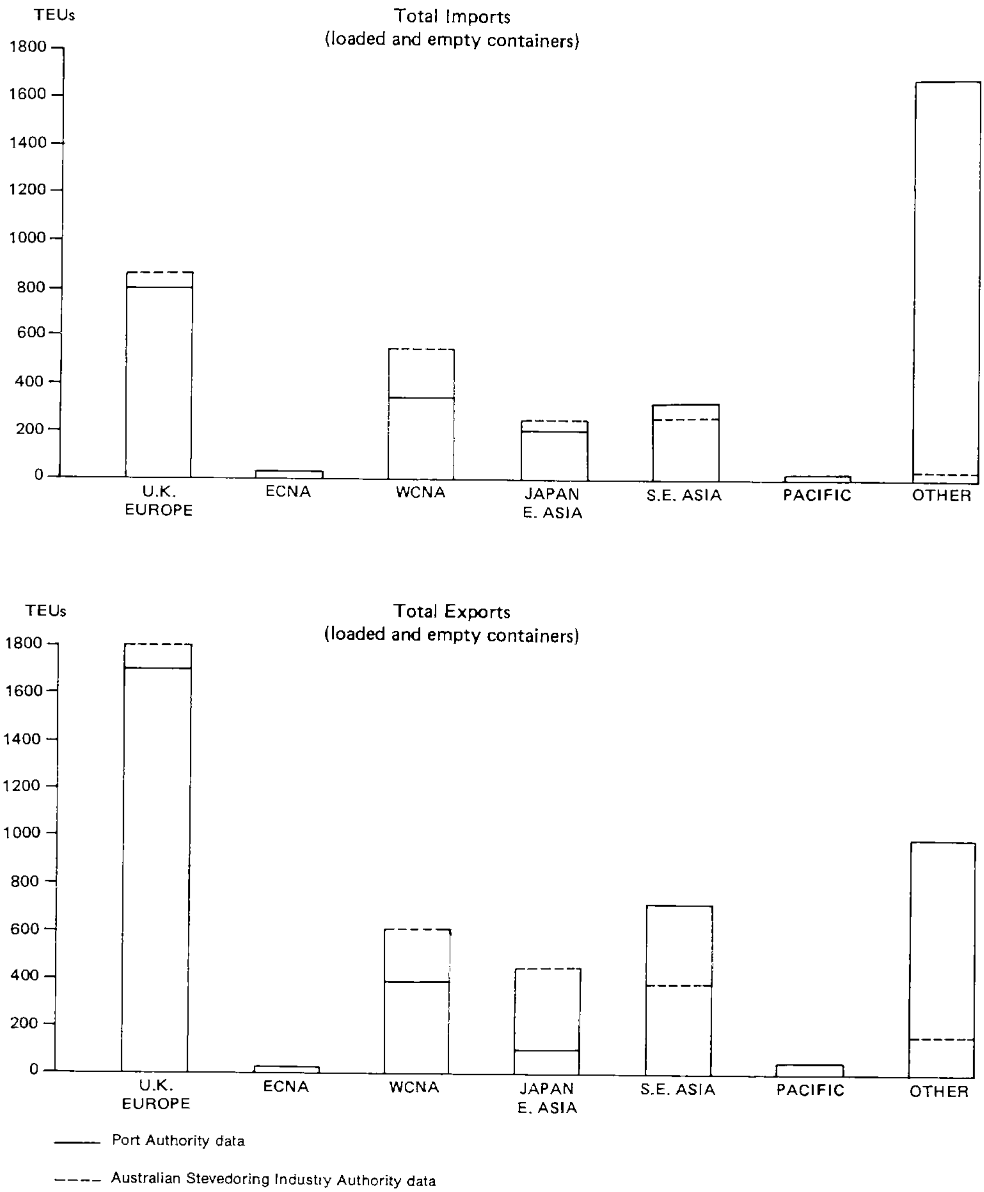



**Figure 4.6**
**Container movements through Port of Adelaide 1976-77**

Source: BTE (1981, unpublished)

An examination of the movements depicted in Figure 4.7 shows that an estimated 12 per cent of all containers passing through Australian ports during 1976-77 were transhipped to or from the hinterland of another port. The Melbourne-Adelaide and Sydney-Brisbane corridor movements accounted for 77 per cent of the containers transhipped during that year.

Almost all such movements in Australia are carried out by rail, except those between Tasmania and the mainland. Road transport accounted for the transhipment of about 1000 TEUs on the Sydney to Brisbane route during 1976-77. A small proportion of containers were also moved by road on other routes, but detailed figures were not estimated.

Figure 4.8 illustrates the estimated number of positioning movements of empty containers throughout Australia for 1976-77. A number of corridors experienced a significant movement of empty containers, such as:

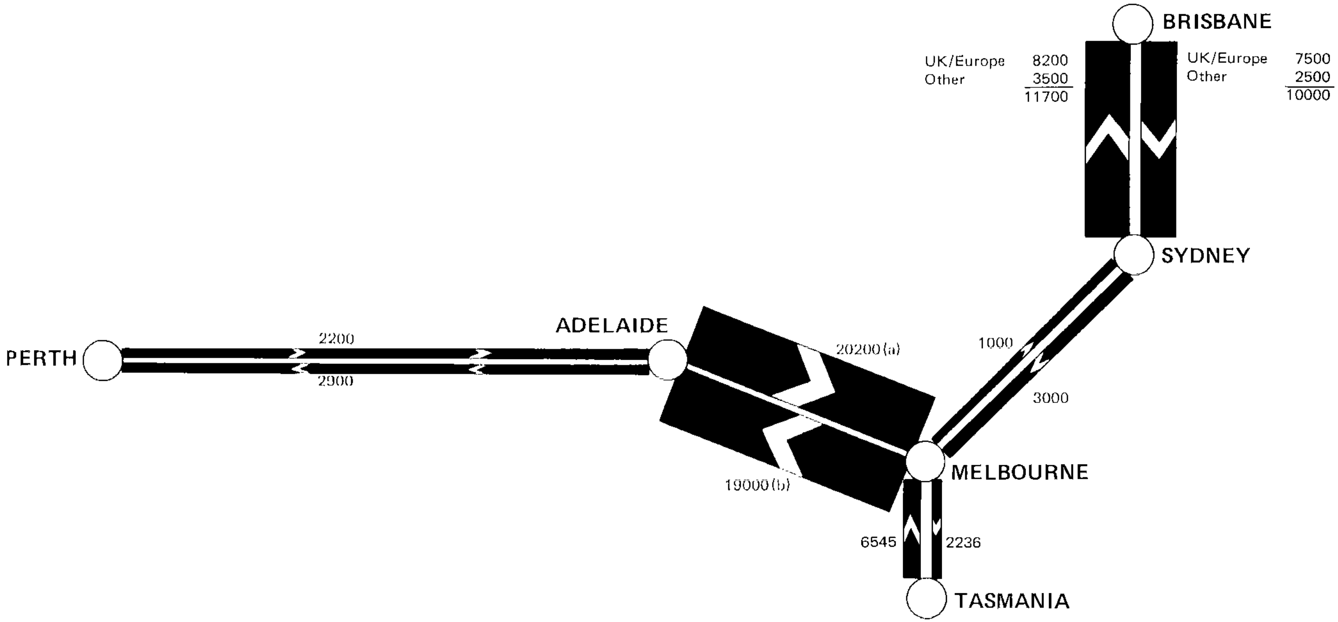
- 13 300 TEUs Sydney to Brisbane;
- 3250 TEUs Sydney to Melbourne;
- 3050 TEUs Sydney to Perth;
- 2500 TEUs Melbourne to Tasmania;
- 3300 TEUs Melbourne to Adelaide; and
- 2450 TEUs Adelaide to Melbourne.

Rail transport is the dominant mode for positioning of empty containers, as well as for the transhipment of loaded containers. Of the estimated 13 300 empty TEUs moved to Brisbane during 1976-77, about 11 000 were moved by rail and 2000 by road. The only routes where rail was not the dominant mode for carrying empty containers were Melbourne to Tasmania (sea), and Sydney to Melbourne (where road transport carried about 2000 TEUs and rail transport only 1000 TEUs during 1976-77).

Some overseas containers, which are classified as 'empty' by shipping companies, are loaded with domestic cargo while they are being positioned within Australia. This poses a data collection problem as many organisations record these movements as domestic cargo rather than as overseas container movements. NSW SRA was the only rail authority to separately identify these movements. It indicated that the use of empty overseas containers for transporting domestic cargo is common practice, with around 70 per cent of the empty containers positioned from Sydney to Brisbane being loaded with domestic cargo during 1976-77. The positioning movements shown in Figure 4.8 exclude those movements involving 'empty' overseas containers loaded with domestic cargo, with the exception of the Sydney-Brisbane corridor. The estimates shown are therefore less than the true positioning movement task.

Individual ports usually exhibit an imbalance in all container movements between imports and exports. For example, in 1976-77 the port of Sydney imported 140 000 TEUs but exported only 110 000 TEUs[1]. The difference is accounted for by transhipment of loaded containers and positioning of empty containers. In this case, containers were transhipped between Sydney and Brisbane and positioned from Sydney to Queensland and from Sydney to Western Australia.

1. Refer to Table IV.4 in Appendix IV.




(a) Trade breakdown - containers transhipped Adelaide to Melbourne:

| | |
|---|---|
| Europe | 3 900 |
| Japan | 2 400 |
| ECNA/WCNA | 700 |
| East Asia | 1 000 |
| South East Asia | 700 |
| Other | 300 |
| Unknown | 9 000 |
| Perth to Melbourne | 2 200 |
| | 20 200 |

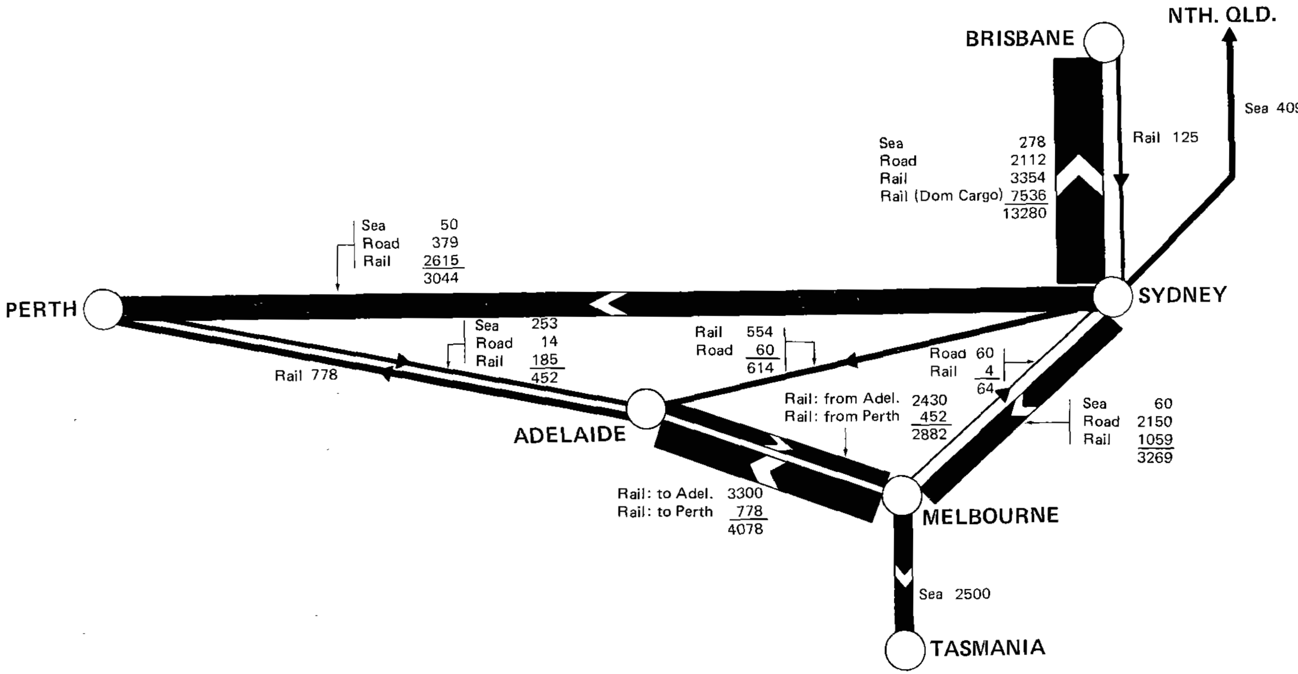
(b) Trade breakdown - containers transhipped Melbourne to Adelaide:

| | |
|---|---|
| Europe | 6 200 |
| Japan | 5 790 |
| ECNA/WCNA | 1 800 |
| East Asia | 1 430 |
| South East Asia | 740 |
| Other | 140 |
| Melbourne to Perth | 2 900 |
| | 19 000 |

(c) Term used to describe the movement within Australia of a container loaded with overseas cargo. Figure not to scale.

**Figure 4.7**
**Container transhipments (c) 1976-77 (TEUs)**

Source: BTE (1981, unpublished)




(a) Terms used to describe the movement within Australia of overseas containers that are not loaded with overseas cargo. Some of these containers are used for carrying domestic cargo during the repositioning movement. Not all movements involving domestic cargo have been included here. Figure not to scale.

**Figure 4.8**
**Container positioning movements (a) 1976-77 (TEUs)**

Source: BTE (1981, unpublished)

The total container movements for all modes into and out of a particular port will balance over a period of time, otherwise there will be a long-term build-up (or run-down) in the number of containers stored at that port. The estimates of container movements during one year, shown in Table 4.2, indicate that there was a reasonable balance of container movements for each of the major Australian ports during that year, excepting Fremantle and the Tasmanian ports, but it is not known what part of the discrepancy is due to data errors rather than container storage at a port.

TABLE 4.2—CONTAINER MOVEMENT BALANCE FOR MAJOR AUSTRALIAN PORTS (ALL MODES), 1976-77

*(TEUs)*

| *Port/area* | *Containers arriving*[a] | *Containers despatched*[a] | *Discrepancy (%)* |
|---|---|---|---|
| Melbourne | 189 600 | 190 100 | 0.3 |
| Sydney | 151 200 | 152 200[a] | 0.7 |
| Brisbane | 48 400 | 47 200 | 2.5 |
| Fremantle | 26 600[b] | 24 000 | 10.8 |
| Adelaide | 22 650 | 23 980 | 5.5 |
| Tasmania | 4 740 | 6 550 | 27.6 |
| Total | 443 190 | 444 030 | 0.2 |

a. Includes movements into and out of each port or area by road, rail and sea.
b. Includes the Westrail estimate of 7000 TEUs positioned to Perth loaded with domestic cargo.

*Source:* BTE (1981, unpublished).

## COMMENT ON USE OF THE RESULTS

In order to evaluate the feasibility of decentralised port calling patterns by liner services, it is necessary to estimate the number of containers which might be available at feeder ports. A preliminary estimate can be made by determining the number of containers for that trade which are currently transported by land between the feeder port and major ports receiving direct services.

Figure 4.7 presents some limited information on the origins and destinations of containers transhipped along the Melbourne-Adelaide and Sydney-Brisbane corridors. The data shown are not complete, and provide only an indication of the number of containers which could potentially have been shipped direct to/from the ports of Adelaide or Brisbane during 1976-77. Shortcomings of the data are that the destination is known for only half of the export containers transhipped from Adelaide to Melbourne, and only an approximate trade split is available for the Sydney-Brisbane corridor. In addition, it is known that export cargoes are sometimes transported between ports before being containerised at the export port. Cargo currently handled in this fashion could be available for shipment direct to/from a feeder port but would not appear in the container flows shown in Figure 4.7.

The container positioning movements for 1976-77 (shown in Figure 4.8) underestimate the number of containers handled during the year, because of movements involving domestic cargo. Expected increases in the containerisation of some export cargoes at feeder ports could also affect transhipment cargo. These shortfalls, together with an incomplete trade breakdown for transhipped containers, contribute to a general underestimate of the number of containers, or potential container cargo, originating or destined for feeder ports during 1976-77. The portions of the transhipments that have been allocated to particular trades have been used later in this report when examining alternative port-calling strategies involving direct calls by container ships at the ports of Adelaide and Brisbane. As a result of the shortfalls, it is expected that the outcome of an analysis based on the estimates from Figures 4.7 and 4.8 would be biased in favour of the present centralised calling situation.

Although transhipment and positioning traffic estimates for 1976-77 are used in Chapters 7 and 8 when discussing 'break-even' container numbers for direct port calls, it is emphasised that such estimnates are not a reliable guide to present (1981) conditions. Traffic in specific trades has changed significantly since the container movement study was conducted. Analysis of specific decentralisation proposals would require the collection of up to date information on traffic levels to compare with the 'break-even' container exchanges produced by the models presented in this report.

# CHAPTER 5—THE APPROACH TO THE EVALUATION OF CARGO CENTRALISATION

## APPROACH

The terms of reference for this study require the resource cost and financial consequences of present and alternative centralisation procedures to be examined. To do this, it is necessary to take account of the additional costs and benefits that would be incurred when introducing alternative procedures. This approach involves a summation of the incremental costs and benefits across all participants to give a net resource cost.

It is quite likely that changes in centralisation practices that are accompanied by resource savings will cause costs to rise for some participants in the transport system, while costs fall for others. In these instances, unless losers are compensated, change will be resisted by them. Thus, it is useful to examine the distribution of resource costs among participants, both to assess the likelihood of deleterious effects of proposals and to estimate the likely demand for intervention by government.

It is also possible that broadly beneficial changes in centralisation procedures will generate costs for groups outside the affected transport system. These costs are termed externalities and may take the form of environmental deterioration (traffic noise, estuarine damage, etc), loss of jobs (changed patterns of trade and transport activity) and increased costs of goods and services caused by levies imposed on uncompensated losers (for example, general increases in port charges to pay for new facilities serving particular trades).

There are a number of other factors which (although not taken into account in the resource analysis) are also of immediate concern to shippers. These include service quality aspects such as transit time and inventory costs, as well as pressure on freight rates resulting from changes to shipping costs.

Each of these factors can influence a participant's perception of relative advantage in the market place and bear on his decisions about shipping services.

Many of these factors are not easily quantifiable, nor in many instances is basic data available, so that they have not been evaluated in the present, broad based, study. The present work has focussed primarily on analysis of resource costs, although some financial analysis has been undertaken and some discussion of the other factors is included in Chapter 8.

The impact of industrial relations questions on total transport costs has not been specifically examined in this study since, in aggregate, the effect would be small and the direction of change uncertain. It is true that, over recent years, Brisbane and Adelaide have maintained a better record in relation to waterfront stoppages than have Melbourne and Sydney, but this does not imply that cost savings would necessarily result from the changes in ship call patterns examined in this study. Most of these changes involve calls at Adelaide or Brisbane in addition to calls at Melbourne or Sydney and so would increase the probability of a delay on the Australian coast. However, some changes involve substitution of calls at Adelaide or Brisbane for calls at Melbourne or Sydney which would decrease the probability of delay. In addition, the elimination of some land links in the centralisation process would reduce the probability of delays to Adelaide and Brisbane bound goods. Given the complexities of the interactions it is not possible, on the basis of the information available, to decide whether the expected changes in ship call patterns would produce an overall positive or negative effect with regard to this particular aspect.

The examination of cargo centralisation concentrates on the four trades which between them carry over 80 per cent of containers between Australia and overseas. These trades, and their proportion of total overseas container movements (based on port authority estimates for imports and exports during 1976-77) are: Australia-UK/Europe, 25.1 per cent; Australia-Japan and East Asia, 42.6 per cent; and Australia-ECNA, 14.3 per cent (for a total of 82 per cent)[1].

The analysis concentrates on the operators within each conference who centralise containers on the major container ports in this country. The remaining operators, who are either outside the various conferences or operate different types of vessels (such as Scan Carriers who operate 7 ro-ro vessels in the Australia-Europe trade), account for only a small percentage of the total trade and usually do not centralise cargoes on the major ports[2].

To assist in drawing general conclusions from various alternatives to present centralisation procedures, it was found useful to concentrate on the possibility of direct calls at Adelaide or additional direct calls at Brisbane. The study also examined the present calls at Brisbane to determine whether these calls are justified in resource cost terms. Alternatives based on Adelaide and Brisbane were studied because container transhipment estimates were available for each of the four trades considered and because these ports also have the largest number of container transhipment and positioning movements outside the centralised ports.

## METHODS OF ANALYSIS

### Short-run resource costs

The economic technique used for costing alternatives to centralisation is based on a short-run approach, where relevant costs are those which vary over the short-term, during which time the present stock of capital facilities (container terminals, ports, ships, railway rolling-stock) are considered adequate to meet the demands placed on them. Since capital facilities are now adequate for the present pattern of centralised calls, as well as for any of the alternatives examined in this study, their costs can be ignored in a short-run analysis. This approach provides a guide to the most appropriate use of resources for the short-run only, but, as the container handling facilities at Adelaide and Brisbane currently have considerable spare capacity, the approach may apply for a considerable period into the future.

To carry out the resource analysis, a differential costing approach has been adopted, so that only the additional costs (or benefits) of alternatives to present centralisation procedures are taken into account. Costs which are common to both the present and any proposed centralisation procedures have been excluded from the analysis.

The relevant costs for the resource cost analysis can be divided into four separate areas. These are ship-related costs, port-related costs, terminal costs, and land transport costs. Each includes fuel, variable repairs and maintenance expenditure, and some labour costs.

For the resource cost analysis, the additional costs attributable to a direct call are compared with resource savings which also accrue to the call, mainly through a reduction in the need to tranship containers. A break-even resource cost analysis then estimated the number of containers which need to be handled in order to justify a direct call. This analysis was performed by balancing the additional costs of ship diversion with the savings achieved by not transhipping containers between ports. Container

1. Asia statistics show a greater proportion of total traffic for these trades: see Tables 3.1 and 4.1.
2. Perhaps indicative of the operational possibilities of the more versatile ro-ro type of cargo vessel.

break-even numbers differ between various alternatives to centralisation because of differences in diversion distances for each combination of trade and port, because of differing ship types adopted for each trade and because of the differences in rail transhipment distance between ports. Since there is uncertainty in the calculation of some costs, break-even numbers are expressed in terms of an upper and lower estimate. The break-even container numbers for each alternative examined are compared with the estimated historical container transhipments for the particular trade to indicate whether sufficient containers might be available in the near future[1] to justify the direct call.

Resource costs are examined under ship, port, terminal and land transport headings in Chapter 6, before being drawn together in the examination of alternative centralisation options in Chapter 7.

### Long-run resource costs

Once capital items become due for replacement or require augmentation (due to changes in traffic level, resulting from alternative centralisation arrangements as well as long term trade changes), the short-run approach is no longer valid. In this case, the capital expended (or saved, in the case of deferral or non-replacement of assets) is a cost to the system in the long-run. To decide whether the alternative centralisation arrangements are desirable over a longer time horizon, estimates of capital replacement and their timing must be made. In addition, the effect of alternative centralisation arrangements must be separated from the underlying long-term trends in international trade and system productivity.

Ultimately, all costs become variable in the very long-term, but it is more realistic to consider horizons that are less than this, particularly as there is a large degree of uncertainty attached to most long-range forecasts. Therefore, a twenty year horizon has been adopted as a reasonable long run period for calculation purposes.

Selected long-run scenarios are examined in Chapter 7, for cases where they are expected to be important.

### Financial costs

Financial costs equate with prices paid for goods and services. Due to market distortions such as taxes, subsidies, profits and institutional constraints, financial costs do not generally correspond to resource costs. The distribution of financial costs among participants is likely to be different from the distribution of resource costs.

Changes to resource costs may indicate the efficient allocation of resources among alternative uses, under market conditions, but the financial consequences of proposals will have more impact on decision makers and their valuation of choices than will resource costs.

Since organisations do not always give top priority to profit per se, too much weight should not be given to financial analyses. Nevertheless, financial costs and their distribution, when contrasted with resource costs, form a useful picture of the likely responses of various groups affected by changes to present centralisation practices.

In general, the study aims to determine whether overall resource savings can be achieved as a result of alternative centralisation procedures. If it can be shown that resource savings might be achieved by adopting a particular centralisation option, then it is also useful to consider the financial consequences of that option.

If the financial analysis proves unfavourable (that is, a net cost results from the change) for cases where resource savings are available, it could be argued that in economic terms there may be a net benefit available by compensating the provider of the service to ensure that the alternative procedure is adopted. In this situation there would be a

1. Relative to 1976-77, the year for which traffic data was collected.

net economic improvement provided that there are economic gains sufficient to balance any needed financial compensation. This procedure may be impossible to carry out because of the difficulty of identifying and realising appropriate transfer payments between different groups. However, it is important to recognise that economic gains are potentially available through a trade-off of this sort.

In this study it was assumed that additional port calls have only a marginal effect on the operations of shipping companies and have no effect beyond the rescheduling of certain voyages. The financial consequences are assumed to be limited to the immediate short term cost changes occasioned by single rescheduling events. This assumption is justified by the very small changes to fleet productivity brought about by each additional port call.

Financial costs are calculated on a differential basis and include ship operating costs (such as capital and other long-run items), port charges, terminal charges and land transport charges.

Financial analyses have been carried out only for select cases to complement the resource cost calculations which form the core of this report.

## CALCULATION OF RESULTS

Calculation of resource costs for cargo centralisation alternatives follows the same general approach in all cases. It takes into account the four major components of ship, port, terminal and land transport costs. Each of the components is determined by variables such as ship size, engine size and type and diversion distances, handling rates at container terminals and land transport distances. These and other variables must be chosen for each option considered.

A general statement of the resource cost calculation is given in Appendix V. This method has been employed to analyse the cargo centralisation alternatives listed in Chapter 7, using cost data from Chapter 6. The results of the resource cost calculations for each alternative are then presented in Chapter 7.

# CHAPTER 6—EVALUATION OF COSTS AND BENEFITS

## INTRODUCTION

This chapter presents short-run resource cost estimates which are used in the examination of centralisation alternatives in Chapter 7. The costs have been divided into three sections covering ship and port, container terminal and land transport costs. The relevant short-run costs compiled are largely specific to the Melbourne-Adelaide and Sydney-Brisbane routes and the trade through these ports, and therefore cannot be generalised for the purposes of analysing other ports or trades.

All costs in this report are expressed in December Quarter 1980 prices, but it should be remembered that some factor prices (notably fuel costs and crew costs) are subject to rapid change in certain circumstances. Thus any specific proposals for decentralisation should be analysed using current data specific to the ship types, etc involved.

## SHIP AND PORT COSTS

The short-run ship and port cost components associated with the diversion of a ship to an additional port of call are estimated in this section. The magnitude of these costs is dependent on the size and type of ship assumed to be diverted. By examining the specifications of the vessels operating on the four major Australian trade routes[1], the median ship capacity (in TEUs) on each trade route was estimated and typical specifications for each size ship were then synthesized for the purpose of cost analysis. These typical vessels are described in Table 6.1. All short-run ship resource cost calculations are based on these typical vessels.

The effect on the results of variations in specifications of these typical vessels are considered in Chapter 7. Detailed calculations for all ship and port costs are given in Appendix VI.

TABLE 6.1—SPECIFICATIONS OF TYPICAL VESSELS BY TRADE

| *Ship characteristic* | *UK/Europe* | *Japan/Korea* | *East Asia* | *ECNA*[a] |
|---|---|---|---|---|
| Ship type | container | container | container | container |
| Deadweight tonnes | 30 000 | 28 000 | 20 000 | 23 000 |
| TEU capacity | 1 550 | 1 500 | 1 000 | 1 200 |
| Gross regist tonnes | 27 000 | 30 000 | 21 000 | 20 000 |
| Net regist tonnes | 15 000 | 17 000 | 11 000 | 11 000 |
| Engine type | steam turbine | diesel | diesel | steam turbine |
| Max power (hp) | 32 000 | 31 000 | 19 000 | 28 000 |
| Max speed (knots) | 21.5 | 22.0 | 19.0 | 22.0 |
| Overall length (m) | 235 | 230 | 200 | 200 |
| Launching date | 1970 | 1977 | 1974 | 1971 |

a. East Coast North America.

*Source:* Based on specifications for median capacity vessels operating on each of the four trade routes, 1980.

1. The container vessels operating on the UK/Europe, Japan/Korea, East Asia and ECNA trade routes are listed in Tables 3.2, 3.3, 3.4 and 3.6.

**Ship costs**

The diversion of a vessel to an additional port of call incurs short-run ship costs[1] due to the following factors:

- additional fuel used at sea;
- fuel used during pilotage at the additional port;
- fuel consumed while in the additional port minus the fuel saved due to a shorter time being spent in the major port; and
- marginal repairs and maintenance due to additional steaming.

All other costs associated with ship operation are considered to be fixed over the short-run time span. For example, servicing of capital has been excluded because it is assumed that the capacity of the present fleet of vessels is adequate to perform the additional port calls. This assumption was confirmed in discussions with a number of ship operators, for the trades covered by this report. Once shipping capacity becomes a constraint on the ability to perform additional calls, the costs associated with increasing that capacity to allow the calls to be made become relevant. The long-run analysis in Chapter 7 considers this situation.

Since shipping capacity is not significantly reduced by the additional steaming time implied by the alternatives examined, no additional ships are required and the same amount of labour will be employed on-board ship. Ships' crew costs are therefore excluded from the short-run analysis. Similar assumptions justify the exclusion of insurance charges and scheduled maintenance costs.

Fuel consumption at sea has been estimated using the information presented in Appendix VI for daily fuel consumption. All typical vessels are assumed to operate at 19 knots. A slow-steaming allowance has been made for those vessels shown in Table 6.1 which were designed to operate at maximum speeds above 19 knots.

The price assumed for marine fuel oil is based on an average of bunker prices at a number of major ports around the world, and has been multiplied by the fuel consumption rate to determine the cost of fuel used per hour. The cost of fuel for each typical vessel is shown in Table 6.2, and varies from $740 per hour for a typical diesel-engined East Asia trade vessel to $1300 per hour for a typical steam turbine-engined UK/Europe vessel (1980 costs).

The fuel consumed during pilotage is calculated in Appendix VI on the basis of consumption rates at sea for each typical vessel. Because of the different pilotage distances at each port, pilotage costs vary by ship type and port of call, and are tabulated in Table 6.2. These costs are estimated to vary from $550 for a typical East Asia trade vessel calling at Sydney or Adelaide to $7800 for a typical UK/Europe vessel calling at Brisbane.

The cost of fuel consumed while in port is calculated in Appendix VI and presented in Table 6.2. It is assumed that diesel-engined vessels draw auxiliary power from diesel generators while in port, whereas steam turbine vessels generate power by using their main boilers. Separate fuel consumption rates have therefore been used for each engine type. Diesel generators are assumed to use marine diesel oil, while steam generators use marine fuel oil for in-port power generation.

The estimated cost of the fuel consumed in port ranges from $85 to $168 per hour, depending on engine type. Note that the fuel saved at the major port must be subtracted from the fuel consumed at the additional port to give the net increase for port fuel costs.

As marginal repair and maintenance expenditure resulting from additional steaming is difficult to estimate, the repair and maintenance costs calculated in Appendix VI and

1. In this case, 'short-run' is a time period within which the ship is not given major alterations, or sold, scrapped or replaced by a more economical ship.

presented in Table 6.2 have been based on average repair and maintenance costs per day. This assumption tends to overstate these costs, but as repair and maintenance expenditure is small in comparison with fuel costs the error has a negligible effect on the results.

TABLE 6.2—SHIP AND PORT RESOURCE COSTS ASSOCIATED WITH AN ADDITIONAL PORT CALL

| *Cost item* | *UK/Europe trade* | *Japan/Korea trade* | *East Asia trade* | *ECNA trade* |
|---|---|---|---|---|
| Fuel consumption at sea ($/hr) | 1 304 | 933 | 743 | 958 |
| Fuel consumption during pilotage[a] ($/call) | | | | |
| Adelaide | 961 | 687 | 547 | 706 |
| Melbourne | 6 589 | 4 714 | 3 754 | 4 840 |
| Brisbane | 7 824 | 5 598 | 4 458 | 5 748 |
| Sydney | 961 | 687 | 547 | 706 |
| Fuel consumption in port[b] ($/hr) | 168 | 119 | 85 | 129 |
| Repairs and maintenance ($/hr) | 50 | 47 | 35 | 40 |
| Fuel consumption of tug boats all ports ($/call) | 750 | 750 | 750 | 750 |

a. The total fuel consumed during pilotage at the port.
b. When calculating the change in fuel consumed at port the saving at the major port must be subtracted from the cost at the additional port.

All prices are in December Quarter 1980 dollars.

*Source:* Based on calculations from Appendix VI.

### Port costs

The short-run resource costs incurred at a port when servicing an additional vessel call are:

- fuel consumed by tug boats;
- marginal repair and maintenance of the tug boats;
- fuel consumed by the pilot boat; and
- marginal repair and maintenance of the pilot boat.

All other costs associated with a port call are considered fixed in the short-term. For example, crew costs for tug boats have been excluded because it is assumed that the same amount of labour would be employed whether or not the additional port calls are made. The effect on the provision of port facilities such as wharves and gantry cranes of additional calls is assumed to be a long-run cost and has been considered under long-run consequences in Chapter 7.

The estimate of fuel consumption by tug boats is based on the use of three tugs to berth and unberth a container ship. The time to berth a vessel is assumed to be the same for all ports and vessels, giving a total fuel cost of $750 per port call, as shown in Table 6.2.

All other short-run port costs are expected to be small in magnitude. The cost of marginal repair and maintenance of tug and pilot boats attributable to serving an additional vessel call and the fuel costs for the pilot boat are expected to be sufficiently small to allow them to be ignored.

## CONTAINER TERMINAL AND DEPOT COSTS

The resource costs relevant to container terminal operations are assumed to be limited to those activities occurring inside the terminal gate. As the overall study technique involves a short-run costing approach, and is concerned only in the cost differences between the existing and alternative operating strategies, the relevant container terminal costs are:

- variable labour costs;
- fuel costs for machinery;
- marginal repairs and maintenance for machinery;
- rail wagon loading and unloading costs; and
- capital costs where additional facilities or equipment are immediately required as a result of the new operating strategy.

The approach adopted is applicable to established container terminals, where changes in throughput due to different port calling strategies are not expected to require an expansion of the existing container terminal, but could mean the purchase of additional items of machinery. This is expected to apply to the terminals at Adelaide, Melbourne, Sydney and Brisbane which are the subject of the centralisation alternatives considered in this study. In the longer term, all costs become variable and are therefore relevant. For such a situation it would be necessary to consider the change in the timing for construction of new facilities, brought about by changes to the present port calling pattern. These aspects are considered further under long-run consequences in Chapter 7.

Operations at container depots, which are sometimes conducted alongside the terminal, could be affected by the adoption of alternatives to present centralisation practices. Although the overall number of containers originating at or bound for a particular centre would remain unchanged (assuming that new traffic is not generated as a result of the alternative arrangements) some change to the container numbers passing through depots as well as the terminal could be expected. In many instances, the changes at depots may be merely a substitution of local pickup and delivery compared with the present interstate rail service. An increase in container packing and unpacking may also occur at ports such as Adelaide, as this is now generally performed at centralised ports prior to delivery of the cargo. The net effect across all container depots is expected to be small, and has therefore been excluded from the analysis.

### Labour costs

The approach adopted for labour costing assumes that the number of workers employed at container terminals is fixed in the short-run but that the number of hours worked per week can vary. Because of the present working rules, labour can be assumed to be employed on a shift basis. Once a shift is rostered and commences work, a full shift payment is made to those employees rostered to work, regardless of whether there is sufficient work available through to the end of the shift. Similarly, if work is not available for a particular shift, employees can either be rostered to work an alternative shift where work is available, or are advised that there is no work and are paid for that shift at the idle time rate.

This analysis assumes that, in resource terms, the cost of running an additional shift to serve a vessel is equivalent to the difference between the full shift payment and the idle time payment for the case where no work is available. Conversely, the saving which occurs from not rostering a shift is assumed equivalent in dollar terms to the cost of running an additional shift. This assumption implies that resource costs equal financial costs. Although this is not strictly correct, it is considered adequate for this analysis, particularly as labour costs comprise only a small proportion of overall resource costs for ship diversions.

Terminal costing in this section is concerned primarily with the loading and unloading of container ships. One other activity which is affected by direct calls is the rail wagon loading and unloading operation, due to the reduction in the number of containers which need to be transhipped by rail. This transhipment reduction means a labour saving in the rail loading-unloading operation at terminals and depots, primarily at centralised ports. Increases in road receival and delivery activity which can be expected at the newly-served port have been assumed to be directly balanced by the decrease in rail activity at the same port, and thus have been excluded[1]. Resource cost changes for labour have therefore been calculated only for those employees who are available for ship loading-unloading operations at terminals as well as employees at centralised ports who handle rail loading operations. All these tasks are performed by waterside workers.

Average wage and idle time payments for permanent waterside workers (employed under special agreement awards) at Adelaide, Melbourne, Sydney and Brisbane have been used to calculate a resource cost per shift for scheduling or cancelling a shift at each of the ports, given specified shift lengths, ship types and numbers of cranes available. These costs are presented in Table 6.3 and include allowances at Sydney and Melbourne for the reduction in rail loading operations. Further details on the derivation of these costs are given in Appendix VII.

TABLE 6.3—LABOUR RESOURCE COSTS FOR SCHEDULING OR CANCELLING A SHIFT, BY PORT

| *Port* | *Shift length (hrs)* | *Pure cellular vessel* | | *Vehicle deck vessel* |
|---|---|---|---|---|
| | | *Using one crane ($/shift)* | *Using two cranes ($/shift)* | *Using one crane ($/shift)* |
| Melbourne | 7 | 582 | 853- 931 | na |
| | 8 | 665 | 975-1 064 | 842-931 |
| Sydney | 7 | na | na | na |
| | 8 | 706 | 1 035-1 129 | 894-988 |
| Brisbane | 7 | 364 | 646- 727 | 525-606 |
| | 8 | 415 | 739- 831 | 600-692 |
| | 11 | na | na | 825-952 |
| Adelaide | 7 | 166 | na | na |

*Source:* BTE estimates based on information from Department of Transport Australia (1980a) and discussions with operators.

The rate at which containers are handled affects the cost of ship diversion, by influencing the length of time that any one ship spends loading and unloading its cargo. This in turn affects the number of labour shifts required to turn a vessel around. Factors which can determine the container handling rate, defined in this case as the gross number of containers exchanged per berth hour, include the type of equipment available and the ship type being served. The vessels assumed are typically of 20000 to 30000 deadweight tonne capacity (1000 to 1550 TEU) and have been purpose-built for the trade. A range of handling rates for these vessels compared with the various

1. Loading a container onto a truck involves an operation similar to loading a flat wagon, and since the increase in the number of containers distributed by road in the vicinity of the newly-served port should be similar to the decrease in containers previously transported by rail to and from a central port, the assumption should prove valid.

combinations of lifting equipment available to serve them is given in Table 6.4. All figures are considered to be realisable rates rather than the maxima achievable.

TABLE 6.4—RANGE OF HANDLING RATES FOR AUSTRALIAN CONTAINER TERMINALS

*(TEUs per berth hour)*

| *No of cranes* | *Crane type*[a] | *Ship type* | |
|---|---|---|---|
| | | Pure cellular | Vehicle deck |
| 1 | single lift | 12.5-15 | 16.7-25 |
| 1 | double lift | 16.5-25 | 25 -35 |
| 2 | double lift | 25 -27 | na |

a. Single and double lift refer to the number of 20 foot ISO containers which can be handled in one movement of the crane.

*Source:* BTE estimates based on information supplied by operators.

## Machinery costs

Machinery costs can be considered to be made up of short-run operating costs (such as fuel and marginal repairs and maintenance) and capital outlays for additional machinery which are immediately required as a result of the changed throughput.

The short-run operating costs are dependent on the type of machinery used to perform the shore-to-stack and stack-to-shore operations. As there is a large variety of equipment at Australian terminals performing this task, it is not possible to reliably determine the difference in short-run machinery operating costs. Vessels in the UK/Europe, Japan/Korea, East Asia and ECNA trades call at two or more terminals at Sydney and Melbourne. This is also the case for the Japan/Korea and East Asia trade vessels at Brisbane. Information from terminal operators suggest that machinery operating costs are low compared with other cost elements in the analysis[1]. Machinery operating costs as well as marginal repairs and maintenance expenditure have been excluded on this basis.

The number of container handling machines, such as straddle carriers, fork-lift trucks and ITVs may prove to be either inadequate or excessive as a result of changes in throughput at particular terminals. In situations where new machines need to be provided, the resource cost attributable to the new calling arrangement is equivalent to the annual capital charge for the machine multiplied by the number of years that the purchase has been advanced as a result of the new arrangements. If the new machine would never have been required under the original calling schedule, all machinery costs are attributable.

Savings can also be achieved if machinery is declared surplus as a result of the changes and can be sold off. In practical terms, sale of machinery is unlikely to occur, although retirement of old machinery may be advanced or the purchase of corresponding replacement machinery, now no longer immediately required, may be deferred. Because the major trades (UK/Europe, Japan/Korea, East Asia and ECNA) are usually shared by several terminals at the major ports, the overall effect on machinery at each terminal will be less than in the case where the entire trade is concentrated on the one terminal. For these reasons, short-run machinery costs at Melbourne and Sydney terminals have been assumed to be negligible.

The recently commissioned container terminal at Fisherman Islands in Brisbane has expanded the port's capacity to well above its former throughput. This excess capacity

1. *Machinery handling the shore-stack task for one vessel consumes approximately 50 litres of fuel per shift. In unit terms this represents the order of $0.13-0.16 per TEU handled.*

means that additional vessels can be served without incurring short-run machinery costs.

The machinery available at the Adelaide terminal, together with that available on short notice from the terminal's container depot, is expected to be adequate to cope with an additional regular call handling around 3000 TEUs per annum[1]. Machinery costs have therefore been excluded from the short-run analysis for this port.

If several additional regular calls were to be established at Adelaide, additional men and machinery may be required at the terminal. This situation is considered under long-run consequences in Chapter 7.

Table 6.5 presents costs for the major mobile equipment items used in the shore-stack transfer operation. These costs, together with labour costs derived in this section are used in Chapter 7 as a basis for assessing centralisation alternatives involving direct calls at Adelaide and Brisbane.

TABLE 6.5—COSTS FOR MOBILE EQUIPMENT USED AT TERMINALS

| *Equipment type* | *Capital cost[a] ($'000)* | *Expected life (years)* |
|---|---|---|
| Fork-lift truck (capacity 22-30 tonne) | 200-250 | 8-10 |
| Straddle carrier (capacity 22-30 tonne) | 385-450 | 10-12 |

a. *All costs at December Quarter 1980.*

*Source:* BTE estimates based on information supplied by operators.

## LAND TRANSPORT COSTS

Land transport costs for movement of containers to central ports within Australia have been based on rail operating costs, since the majority of containers are carried by that mode. A short-run approach has been used to estimate the operating costs and is concerned only with the cost differences between existing and alternative operating strategies. The relevant rail operating costs are:

- locomotive fuel;
- crew costs;
- marginal maintenance for rail track, locomotives, wagons and brake vans;
- shunting;
- rail terminal costs where appropriate; and
- capital costs where additional facilities or equipment are required immediately as a result of the new operating strategy.

In any rail system, costs will vary across rail lines and train-sets; thus, any costing exercise should be route and train-set specific. However, data disaggregated to this level are generally unavailable. In their absence, cost data made available by a number of operators have been used to estimate a range of short-run resource costs for the Melbourne-Adelaide and Sydney-Brisbane rail corridors.

The resource savings accruing to rail transport from the introduction of direct liner services at ports such as Adelaide or Brisbane will depend on the amount of container traffic diverted from rail and the operational response of rail authorities to such a

1. Based on National Ports Council (1978) design criteria of one machine for every 5000 TEUs handled per annum. At present there are 3 machines at the terminal with 3 more available at short notice. Throughput during 1979-80 was around 4000 TEUs but is believed to have exceeded 8000 TEUs for 1980-81.

change. Two possible changes which can occur are a reduction in the number of train journeys or a reduction in the number of wagons hauled by each train. This analysis assumes that rail authorities would respond to a downturn in traffic by reducing the number of train journeys.

A present shortage of locomotives and container flat wagons is believed to be sufficiently acute (according to shipping companies and rail authorities) to prevent the realisation of capital savings in the short-run as a result of any downturn in traffic. The short-run analysis has therefore excluded capital cost items. In the long-run, capital savings could be available from deferring the purchase of some locomotives and flat wagons. These long-run costs are considered further in Chapter 7.

Details of all resource cost calculations for rail operations are given in Appendix VIII.

**Melbourne-Adelaide rail costs**

Rail operations in this corridor involve a line haul between Swanson Dock or the Dynon rail yards in Melbourne and the Adelaide terminal or container depots. Marshalling is performed at Dynon yards in Melbourne and at Gillman or Mile End in Adelaide. The costs associated with loading and unloading rail wagons has been considered in the previous section on container terminals because this operation is performed at the terminals.

The estimated short-run cost of moving containers between Melbourne and Adelaide is shown in Table 6.6. Fuel costs for this operation have been estimated on the basis of a world price for diesel fuel, rather than on the lower contract rates generally paid by rail authorities. Crew costs have been included because of a reported shortage of train crews. This shortage means that cancellation of train journeys would allow redeployment of crew, with consequent savings in overtime normally paid to other crews. Maintenance cost figures were supplied by a number of authorities and include rail track, locomotive, wagon and brake van estimates. An allowance for the shunting of wagons has been included.

The total short-run resource cost of operating a train carrying containers between Melbourne and Adelaide is estimated to be $3047 to $3563 per journey (Table 6.6). On a unit basis this represents $69 to $81 per TEU for a train carrying 44 containers.

TABLE 6.6—SHORT-RUN RESOURCE COST OF MOVING CONTAINERS BETWEEN MELBOURNE AND ADELAIDE BY RAIL,[a] DECEMBER QUARTER 1980

*($)*

| *Cost item* | *Cost* | | | |
|---|---|---|---|---|
| | *Low* | | *High* | |
| | *per journey* | *per TEU* | *per journey* | *per TEU* |
| Fuel | 1 083 | 24.60 | 1 544 | 35.10 |
| Crew | 607 | 13.80 | 607 | 13.80 |
| Track maintenance | 552 | 12.55 | 552 | 12.55 |
| Locomotive maintenance | 249 | 5.65 | 304 | 6.90 |
| Wagon maintenance | 334 | 7.60 | 334 | 7.60 |
| Brake van maintenance | 66 | 1.50 | 66 | 1.50 |
| Shunting | 156 | 3.55 | 156 | 3.55 |
| Total | 3 047 | 69.25 | 3 563 | 81.00 |

a. Based on a 778 km rail journey with a 19-wagon train carrying 44 containers.

*Source:* Information supplied by various rail authorities.

**Sydney-Brisbane rail costs**

Containers carried on this route travel from Sydney via the standard gauge link to Acacia Ridge rail terminal on the outskirts of Brisbane. At Acacia Ridge, the containers are transferred by gantry crane to the narrow-gauge Queensland system and are delivered to the Hamilton terminal in Brisbane.

The estimated short-run cost of moving containers between Sydney and Brisbane is shown in Table 6.7. An estimate of the cost of performing the container transfer at Acacia Ridge has been included, as this operation would be avoided if containers were shipped directly through the port of Brisbane.

The total short-run resource cost of operating a single train is estimated to be $3695 to $3890 per journey (Table 6.7). This represents $103 to $108 per TEU for a train carrying 36 containers.

TABLE 6.7—SHORT-RUN RESOURCE COST OF MOVING CONTAINERS BETWEEN SYDNEY AND BRISBANE BY RAIL,[a] DECEMBER QUARTER 1980

($)

| *Cost item* | *Cost* | | | |
|---|---|---|---|---|
| | *Low* | | *High* | |
| | *per journey* | *per TEU* | *per journey* | *per TEU* |
| Fuel | 1 393 | 38.70 | 1 489 | 41.35 |
| Crew | 781 | 21.70 | 781 | 21.70 |
| Track maintenance | 533 | 14.80 | 533 | 14.80 |
| Locomotive maintenance | 241 | 6.70 | 340 | 9.45 |
| Wagon maintenance | 338 | 9.40 | 338 | 9.40 |
| Brake van maintenance | 83 | 2.30 | 83 | 2.30 |
| Shunting | 128 | 3.55 | 128 | 3.55 |
| Rail terminal costs | 198 | 5.50 | 198 | 5.50 |
| Total | 3 695 | 102.65 | 3 890 | 108.05 |

a. Based on a 1000 km rail journey with a 15-wagon train carrying 36 containers.

*Source:* Information supplied by various rail authorities.

# CHAPTER 7—RESULTS OF THE CENTRALISATION ANALYSIS

## CENTRALISATION ALTERNATIVES

Ten specific centralisation alternatives were examined in the course of this study to provide a basis for an assessment of the general economic and financial efficiency of present centralisation arrangements. The cases examined are listed in Table 7.1. Each alternative involves a ship diverting from its usual route to make an additional port call at either Adelaide or Brisbane, and then returning to its route. Three of the alternatives considered involve an examination of present services to Brisbane in the Japan/Korea, East Asia and ECNA trades, to see whether the number of containers handled during each visit is sufficient to justify the call *in resource cost terms*.

Analysis in this chapter is based on *resource cost* changes, since this is the primary focus of the present study, but it is recognised that *financial costs* are more relevant to decisions by shipping lines. Some financial analysis (reported here and in Chapter 8) indicates that direct calls which offer resource cost savings also offer financial savings to shipping companies, though they appear small in comparison to overall ship operating costs.

For each of the four trades considered, a range of alternatives allowing direct calls at Adelaide and Brisbane have been examined. In addition to the obvious diversion routes, consideration has been given to port-calling patterns which involve major changes to the routes currently sailed. One of these alternatives involves East Asia vessels adopting a round-Australia route. This route involves a much shorter diversion compared with the vessel sailing to Adelaide and returning to East Asia via its traditional route on the east coast.

Another alternative which has been considered involves a UK/Europe trade vessel calling at Fremantle, Adelaide and Melbourne and then returning to Europe via the Suez Canal. This alternative would involve the loss of one call at Sydney every time this diversion was performed. Provided that the reduction in service at Sydney can be achieved at little or no cost, there are resource savings to be gained from such an alternative.

Other options which were initially considered but have been rejected involved round-Australia routes for the UK/Europe and Japan/Korea trades. Both options involve considerable increases in route distances and were rejected on that basis.

The overall objective of this approach was to try to obtain an insight into the relationships between centralisation distances and volumes, ship diversion distances and overall resource and financial costs. Thus the individual 'case studies' are undertaken only to a degree of detail commensurate to this requirement and should not be regarded as appropriate for decision making in individual instances.

### Assumptions concerning alternatives to centralisation

The economic and financial analyses involved adoption of a number of simplifying assumptions, mainly to do with transport operations. In particular, it has been assumed that:

- ship calls are perfectly regular;
- seasonal variations in load are negligible;
- rail traffic is uniform; and
- stowage of containers is not affected by alternative calling arrangements.

TABLE 7.1—ROUTES AND DIVERSION DISTANCES FOR CENTRALISATION ALTERNATIVES

| Trade | Diversion port | Diversion route | Typical vessel size assumed for diversion[a] | | Total diversion distance (nautical miles |
|---|---|---|---|---|---|
| | | | Dead-weight tonnes | TEU | |
| UK/Europe | Adelaide | Fremantle-Adelaide-Melbourne[b] | 30000 | 1550 | +167 |
| | Adelaide | Fremantle-Adelaide-Melbourne and return to Europe (omit-Sydney call) | 30000 | 1550 | -895 |
| | Brisbane | Sydney-Brisbane-Europe via Panama | 30000 | 1550 | +501 |
| Japan/Korea | Adelaide | Melbourne-Adelaide-Melbourne | 28000 | 1500 | +908 |
| | Brisbane | Sydney-Brisbane-Japan[c] | 28000 | 1500 | +64 |
| East Asia | Adelaide | Melbourne-Adelaide-Melbourne | 20000 | 1000 | +908 |
| | Adelaide | Melbourne-Adelaide-East Asia[d] (round-Australia route) | 20000 | 1000 | +229 |
| | Brisbane | Sydney-Brisbane-East Asia[c] | 20000 | 1000 | +64 |
| ECNA | Adelaide | Melbourne-Adelaide-Melbourne | 23000 | 1200 | +908 |
| | Brisbane | Sydney-Brisbane-ECNA[c] | 23000 | 1200 | +501 |

a. Typical vessel sizes and specifications have been adopted for each trade. These vessels are detailed in Table 6.1.
b. Trial calls commenced in March 1981 on an approximately monthly basis.
c. Regular calls are currently made at Brisbane in these trades.
d. Two vessels operated by AWPL call at Adelaide using this route with an approximate 4 week frequency.

*Source:* Diversion distances estimated from Lloyd's Nautical Yearbook (1981).

As little information is available to suggest how the positioning movements of empty containers are generated, it has not been possible to predict what effect the introduction of additional ports of call would have on these movements. In practice, direct ship calls at Brisbane and Adelaide may provide some savings in the cost of moving empty containers, but in the absence of reliable information, positioning movements have been assumed to be unaffected.

Adoption of some of the centralisation alternatives described in this chapter may be constrained by a lack of appropriate facilities (such as reefer handling capacity) at some terminals. Imbalances in container flows may also arise, particularly if direct calls at a port are heavily import or export-oriented. This may impose additional adjustment costs, particularly on railways. No allowance has been made in the analysis for the possibility of these circumstances arising.

Throughout the analysis, it has been assumed that ships will make calls at alternative ports at least once a month. Although, in principle, less frequent calls would allow for a greater accumulation of containers, shippers are likely to find calls at longer intervals less satisfactory than present arrangements.

As a considerable number of vessels operate in each of the four trades examined by this report (UK/Europe trade has 20 cellular ships in operation and the Japan/Korea, East Asia and ECNA trades operate 11, 13 and 17 ships respectively), the introduction of (say) monthly calls at a port such as Adelaide or Brisbane would affect voyage arrangements of partiuclar vessels, on average, once a year (or even less frequently).

Resource costs calculated for the various centralisation alternatives are therefore considered to reflect marginal changes only.

Changes to port calling patterns can be expected to affect the load factors of particular vessels, as well as the accumulation overseas and in Australia of cargo to be shipped through the newly served port. These system-effects are assumed to be sufficiently marginal when compared with the total shipping task to allow them to be ignored.

## RESULTS

Container break-even numbers for each of the centralisation alternatives are presented in Table 7.2, together with a comparison of the relevant container feeder movement estimates for 1976-77[1]. The break-even numbers are based on resource costs and are expressed in terms of a range of TEUs. This range reflects the uncertainty in estimating some elements such as railway operating costs and the additional time in port for direct-calling ships.

TABLE 7.2—CONTAINER BREAK-EVEN NUMBERS FOR CENTRALISATION ALTERNATIVES

| *Trade* | *Diversion port* | *Diversion route* | *Range of container break-even numbers (total TEUs handled per call)* | *Estimated loaded containers available during 1976-77[a] (TEUs per month)* |
|---|---|---|---|---|
| UK/Europe | Adelaide | Fremantle-Adelaide-Melbourne | 165-225 | 840[b] |
| | Adelaide | Fremantle-Adelaide-Melbourne and return to Europe (omit-Sydney call) | 0[c] | 840[b] |
| | Brisbane | Sydney-Brisbane-Europe via Panama | 385-450 | 1300 |
| Japan/Korea | Adelaide | Melbourne-Adelaide-Melbourne | 585-740 | 880 |
| | Brisbane | Sydney-Brisbane-Japan | 90-100 | 300 |
| East Asia | Adelaide | Melbourne-Adelaide-Melbourne | 460-570 | 285 |
| | Adelaide | Melbourne-Adelaide-East Asia (round-Australia route) | 130-160 | 285 |
| | Brisbane | Sydney-Brisbane-East Asia | 75- 80 | 250[d] |
| ECNA | Adelaide | Melbourne-Adelaide-Melbourne | 590-750 | 260[e] |
| | Brisbane | Sydney-Brisbane-ECNA | 285-315 | 300[d] |

a. This number is based on estimated feeder movements for loaded import and export containers, Figure 4.7.
b. Recently introduced monthly calls aimed mainly at exports have exchanged over 400 TEUs per call.
c. The resource savings from omitting a call at Sydney more than offset the additional costs of calling at Adelaide.
d. Number typically exchanged by vessels presently making these calls.
e. Combined estimate for West Coast and East Coast North America.

The calculation of break-even numbers for each of the alternatives listed in Table 7.2 is included in Appendix IX.

The estimates of container numbers available are based on feeder movements for loaded import and export containers during 1976-77. These estimates were presented

1. These particular comparisons should not be regarded as definitive of the present situation since it is certain that some significant changes in feeder movements will have occurred since 1976-77.

more fully in Chapter 4, where it was pointed out that there are uncertainties in some of the figures. It is suggested that these estimates are not sufficiently recent, or in some cases sufficiently accurate, to provide a final decision on the desirability of direct calls or their warranted frequency of call. They have been used in Table 7.2 and in the following section as an indicator of the likely magnitude of container numbers available, and hence the desirability or otherwise of direct calls. Additional work by shipper bodies, shipping lines and those negotiating for direct calls is necessary to estimate present container feeder movements before the validity and terms of direct calls could be firmly established.

Because of necessary averaging assumptions used to develop the results, it may be possible that detailed analyses of specific routes and vessel combinations may produce more appropriate results for those specific cases. This report has been presented in a form which allows this type of recalculation to be performed. (Readers are referred to the sensitivity analysis in this chapter for examples of changes to ship size and fuel rate).

## INTERPRETATION OF RESULTS

This discussion is intended to assist with interpretation of the results and to allow a presentation of financial analyses for those alternatives which appear favourable on resource cost grounds. The magnitude of savings available from the adoption of centralisation alternatives and other points relevant to particular alternatives are also covered.

The financial analysis calculations are developed in detail in Appendix X.

### UK/Europe trade

Three centralisation alternatives have been considered in this trade. Two are based on a service to Adelaide and the third involves a service to Brisbane. These alternatives are discussed in the order in which they are presented in Table 7.2.

Details of the diversion route to Adelaide and a graphical presentation of upper and lower break-even numbers for a call at that port are given in Figure 7.1. This alternative involves a total diversion of 167 nautical miles for an additional 9 hours steaming time at 19 knots. The net increase in time in port to handle the break-even estimate of 165 to 225 TEUs at Adelaide rather than Melbourne would be 9 to 11 hours, giving a total voyage time increase of a little under one day. When the range of break even container numbers is compared with the estimated average monthly trade volume available during 1976-77 (shown in detail in Figure 4.7), the break-even estimate of 165 to 225 TEUs per call is well below the expected 1976-77 monthly trade of 840 TEUs. If a distinction is drawn between import and export containers, it appears from the data in Figure 4.7 that there would be a stronger demand for a direct import call, although uncertainty in the allocation of a large proportion of the import containers between the various trades could mean that the export volume may be considerably understated[1].

Results of the financial analysis, based on the handling of 200 TEUs per call, suggest that shipping companies could trade-off additional ship and port costs against savings in rail charges and thereby experience a range of results varying from a $370 loss to a $10 950 saving per call, compared with the shipment of these containers via the port of Melbourne. Over a 12 month period, this would give a financial result varying from a loss of $4440 to a saving of $131 400 based on a monthly service handling 200 TEUs per call. When compared with the magnitude of ship operating costs (which can exceed $30 000 a day for fuel alone) and typical port charges (of the order of $10 000 to $30 000 per visit), these financial results could be considered to be marginally attractive.

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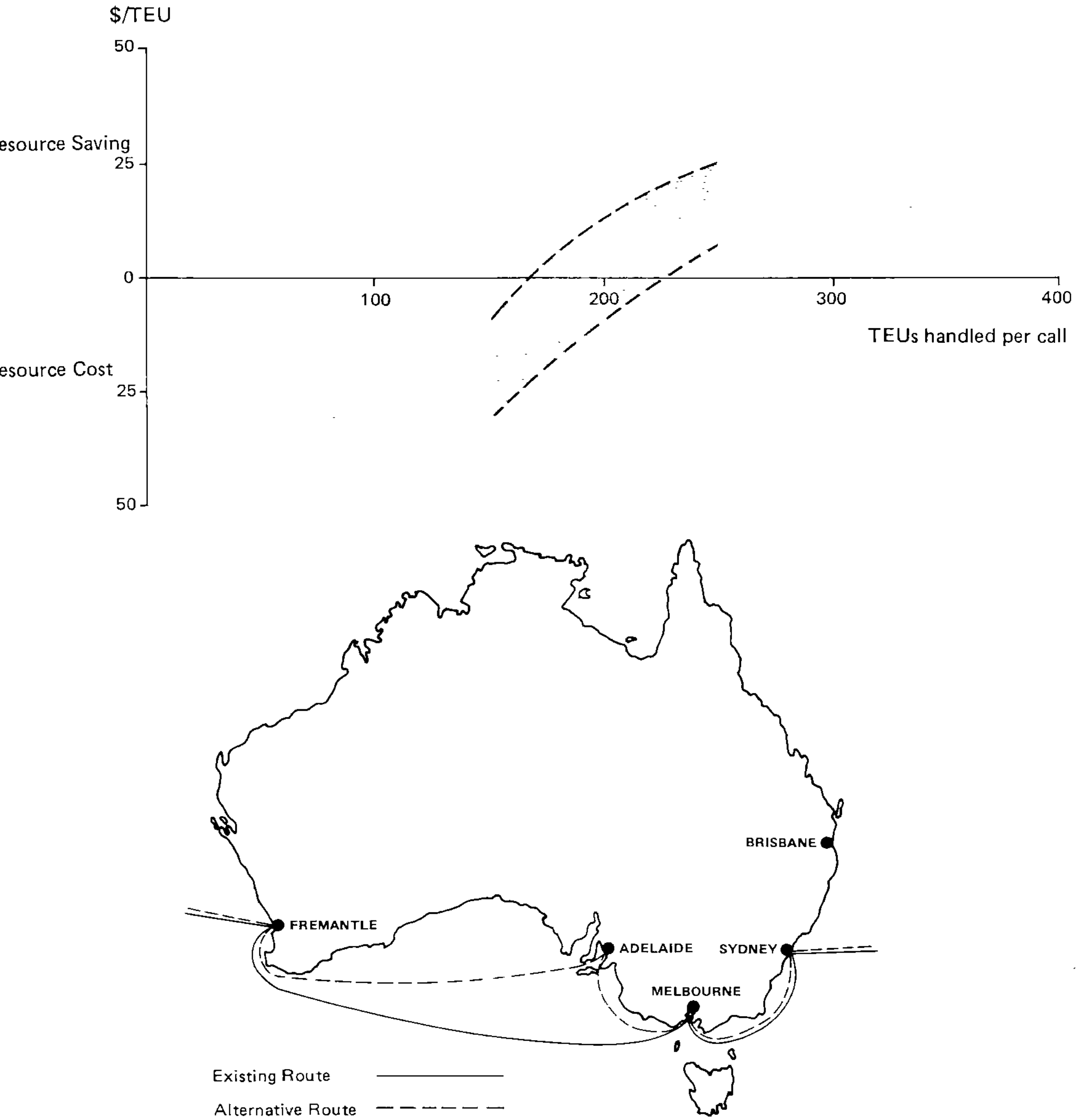
1. This has been verified by recent VicRail data which showed that 4030 TEUs were transhipped by UK/Europe operators from Melbourne to Adelaide and 5772 TEUs in the reverse direction during 1979-80.




ote:

. Vessels return to Europe either via the Suez or Panama Canal. Some vessels call at New Zealand on route to or from Europe.
. For those vessels arriving and returning via the Suez Canal the Adelaide call could be either an import or export oriented call.
. Vessels on an around the world itinerary travel in either an easterly or a westerly direction.
. The alternative route involves a 167 nautical mile diversion.

**Figure 7.1**
**UK/Europe Trade: Break-even analysis and alternative route to Adelaide**

The first call in a new regular direct service to Adelaide by fully cellular UK/Europe trade container vessels was made in March 1981 by a ship on its return leg to Europe via Suez. It handled an exchange of 415 TEUs, made up of 354 export containers and 61 import containers. This was well in excess of the 165 to 225 TEUs estimated to be required by the break-even analysis. Provided that these volumes can be sustained, it appears that there is sufficient trade available to support a regular export call with a frequency of at least one call per month. It may also be possible, based on 1976-77 trade estimates and more recent data from VicRail, that a separate import call is justified.

A second alternative based on Adelaide, is shown in Figure 7.2. It considers the possibility of a vessel calling at Fremantle, Adelaide and Melbourne before returning to Europe. The call at Adelaide could be on either the inward (import) or outward (export) leg. By omitting Sydney and adding the Adelaide call, the round voyage is shortened by 895 nautical miles, which saves 48 hours in steaming time compared with the present service to both Melbourne and Sydney. The total saving in voyage time, after accounting for time in port is expected to be something over two days.

The major reason for considering this alternative is to determine the magnitude of resource savings available and to see whether these savings are sufficient to compensate for a direct call at other ports, such as Brisbane, in this trade.

The analysis assumes that a small reduction in call frequency at Sydney can be achieved at no cost to shippers using that port. A reduction of one call per month at Sydney would increase the average time between arrivals for UK/Europe vessels from 5.4 days to around 6.5 days. Assuming that the present Sydney throughput could be handled by this reduced call frequency, inventory stocks for Sydney shippers would need to increase by an average 1.1 days. This increase is assumed to have a negligible impact. The service reduction would only be possible up to the date where trade increases cause a shipping capacity constraint at Sydney. The timing for this constraint is unknown, but is assumed to be sufficiently distant to justify consideration of this alternative.

The break-even analysis presented in Figure 7.2 shows that resource cost savings can be made, regardless of the number of containers handled. With an exchange of 250 TEUs, total resource savings of the order of $79 200 to $83 700 per call are available.

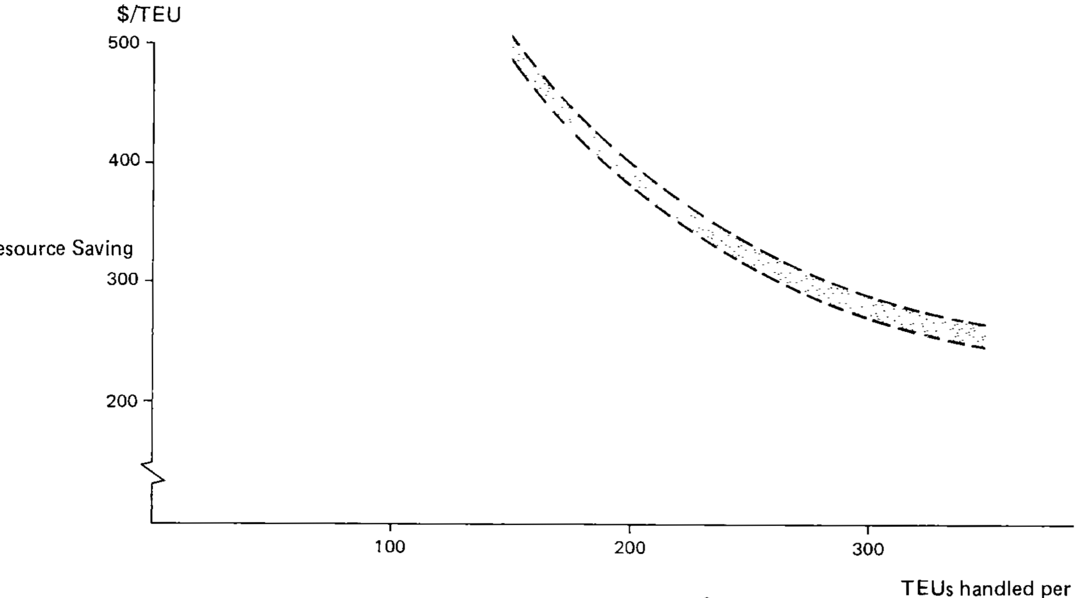
Financial savings also accrue to shipping companies from this alternative and are expected to be of the order of $117 200 to $130 900 per call. Provided that inventory costs and other effects of a service reduction at Sydney do not outweigh the above savings, this type of calling strategy would be justified on resource cost grounds.

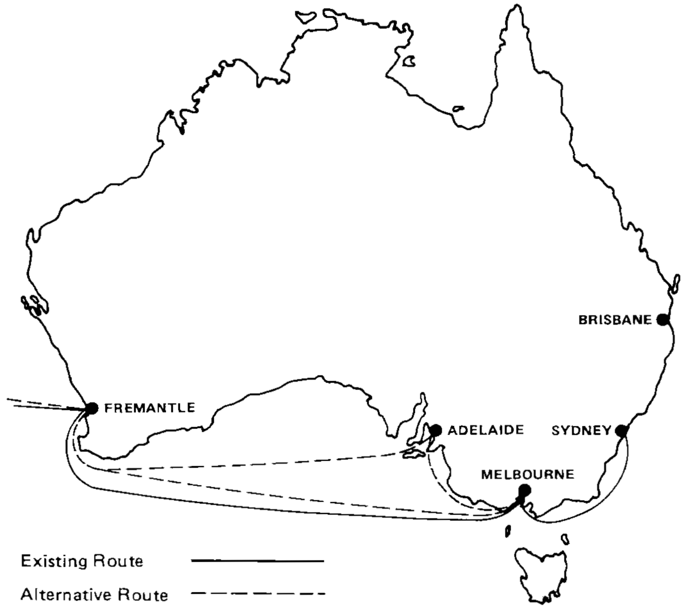
Brisbane calls have been examined in two parts, firstly as a direct call by a 'round-the-world' UK/Europe vessel and then in combination with the previous Adelaide-omit-Sydney alternative.

Figure 7.3 shows the diversion to Brisbane for a vessel sailing to or from Sydney via the Panama Canal, involving an additional 501 nautical miles with an increase in voyage steaming time of 26 hours. The net time in port is expected to increase by approximately 4 hours, giving a total voyage time increase of just over one day per visit.

The resource cost break-even analysis indicates that 385 to 450 TEUs need to be handled at Brisbane to justify this direct call. This is well below the average 1300 TEUs per month estimated to be available for this trade during 1976-77, and would indicate that a direct call on at least a monthly basis would prove favourable in resource cost terms.

To ensure that sufficient containers are available to support a monthly call, it would be necessary to attract a combination of import and export container cargoes. This may prove difficult since Brisbane would be the first port of call in Australia for voyages in one direction and the last port of call for voyages in the other direction. Thus exporters would favour calls in one direction and importers calls in the other. In addition to these qualifications, the logistics of handling a large 400 to 500 TEU exchange may involve

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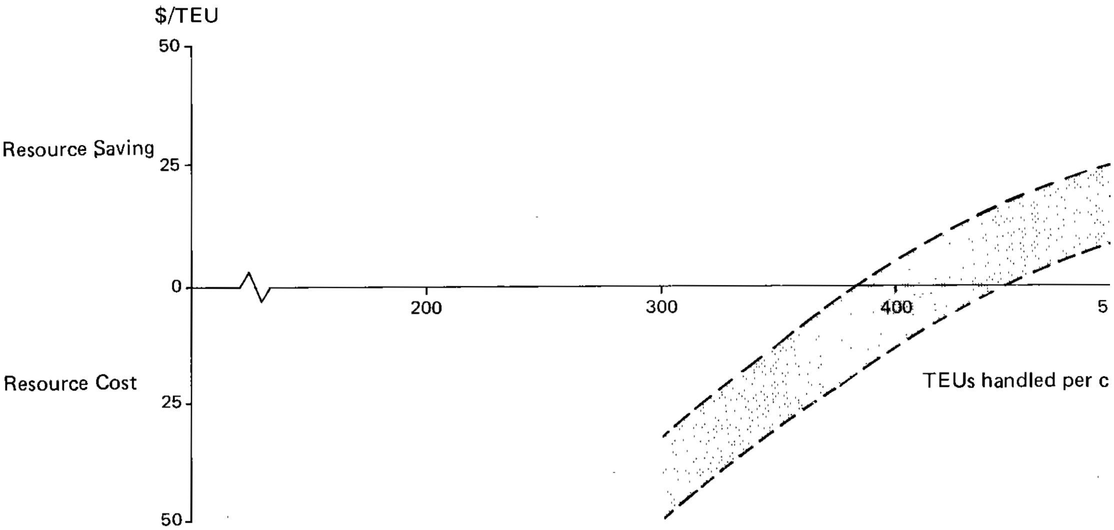
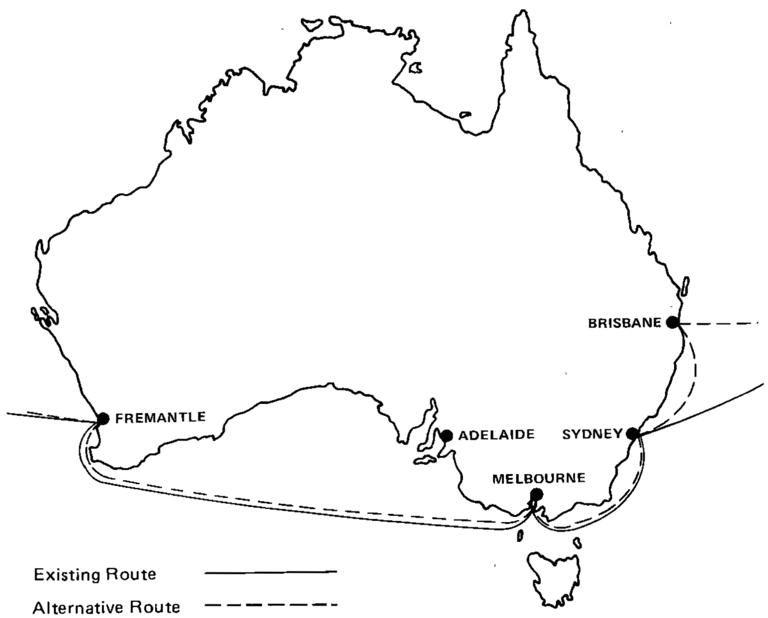
This alternative applies to those vessels arriving and returning to Europe via the Suez Canal.
The Adelaide call may be either an import or an export call.
The alternative route involves a saving of 895 nautical miles.

**Figure 7.2**
**UK/Europe Trade: Break-even analysis and alternative route to Adelaide (omitting Sydney)**




Note:

1. This alternative applies to those vessels which have an around the world itinerary. The vessels may sail in either an easterly or westerly direction.
2. The alternative route involves a 501 nautical mile diversion.

**Figure 7.3**
**UK/Europe Trade: Break-even analysis and alternative route to Brisbane**

additional inventory and restow costs. These factors are assumed to have a negligible effect on the resource cost analysis and have been excluded.

The financial cost analysis indicates that (for a call handling 400 TEUs), savings of the order of $26 700 to $51 300 would accrue to shipowners. On an annual basis, assuming a monthly call frequency, this would amount to a total saving of $320 400 to $615 600.

A second option has been examined for a direct UK/Europe service at Brisbane. This involves the co-ordination of two vessels, with one performing an Adelaide-omit-Sydney voyage as shown in Figure 7.2 and a second vessel calling directly at Brisbane as shown in Figure 7.3. By combining the resource analyses for these two separate voyage patterns, there is a small cost advantage available if the vessel calling at Adelaide handles a minimum 250 TEUs and the Brisbane calling vessel handles a minimum of 300 TEUs. This co-ordinated approach allows the sharing of resource savings across several different centralisation alternatives in the one trade. In the case of Brisbane, a co-ordinated approach would reduce the number of container movements needed to justify a call, when compared with a direct call at Brisbane by a vessel in the UK/Europe trade.

This approach is also subject to qualifications on reduced call frequencies at Sydney and the assumed availability of sufficient container traffic. Provided that these assumptions have a negligible effect on the analysis, direct calls can be justified on resource cost grounds at Adelaide and Brisbane for this trade.

**Japan/Korea trade**

Two centralisation alternatives have been considered for this trade. One is based on a service to Adelaide and the other considers the present Japan/Korea service to Brisbane.

A call at Adelaide involves a vessel diverting from Melbourne and then returning to Japan/Korea via the east coast of Australia. The total diversion distance is 908 nautical miles, which involves an additional steaming time of about two days. Including the additional time in port as well as the steaming time, the total increase in voyage time is expected to be about three days for a break-even container number of 585 to 740 TEUs per call. Details of the diversion route and a graphical presentation of the upper and lower break-even volumes are given in Figure 7.4.

When the break-even range is compared with the estimated monthly trade of 880 TEUs available in 1976-77[1], it appears that on resource cost grounds a direct monthly call would be marginal.

Japan/Korea vessels call regularly at the port of Brisbane with an approximate frequency of one call every 5 days. The diversion which vessels must make to call at Brisbane is minor and amounts to only 64 nautical miles. Based on this diversion distance, the break-even analysis suggests that between 90 and 100 TEUs would be required to justify a direct call on resource cost grounds. Both the diversion route and break-even results are shown in Figure 7.5.

According to industry sources, vessels in this trade typically handle 300 TEUs at each call, which justifies the present level of service according to resource cost criteria.

**East Asia trade**

Three centralisation alternatives have been considered for the East Asia trade. These include two alternatives based on calls at Adelaide, with a third involving the present East Asia service to Brisbane.

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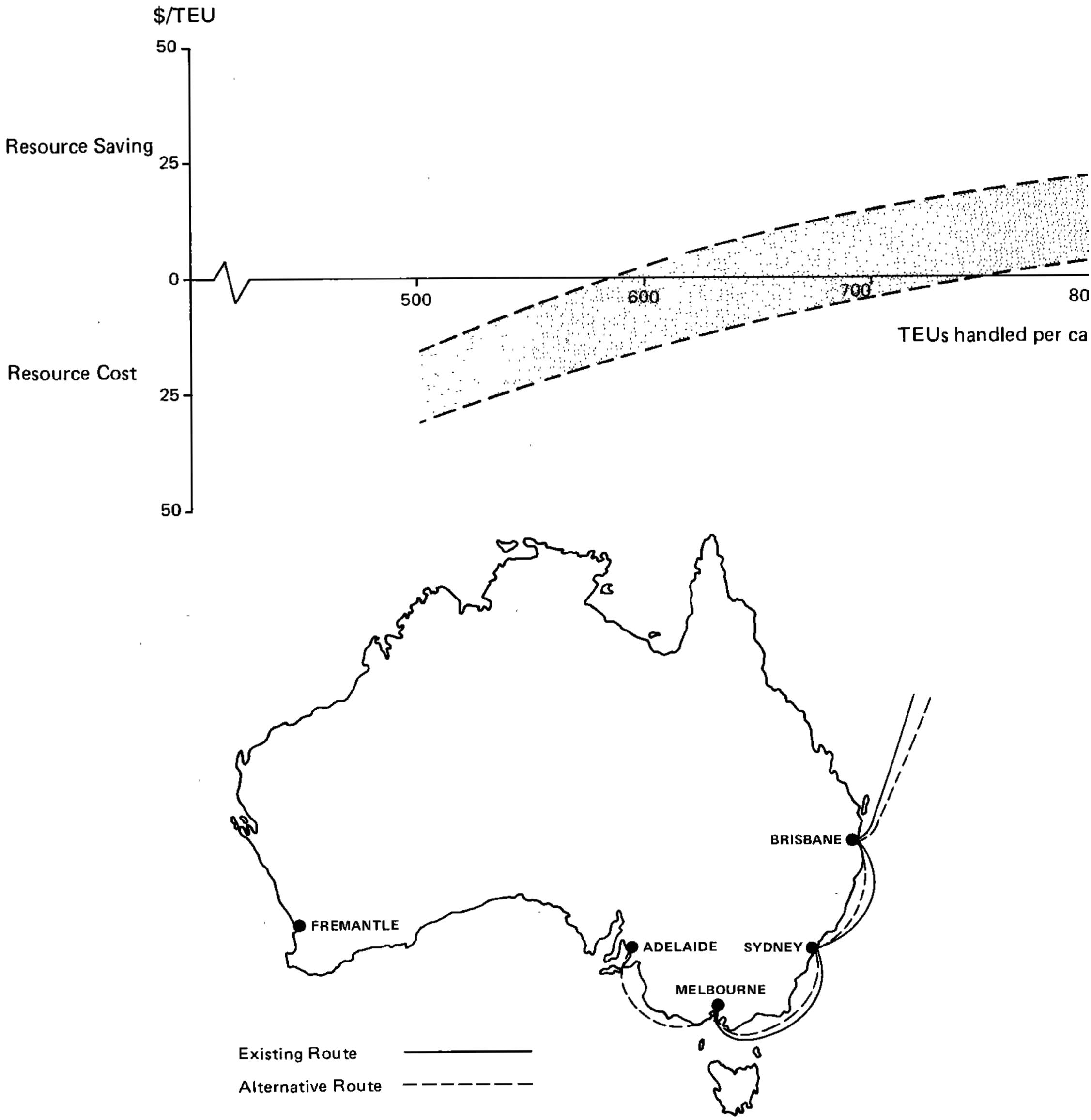
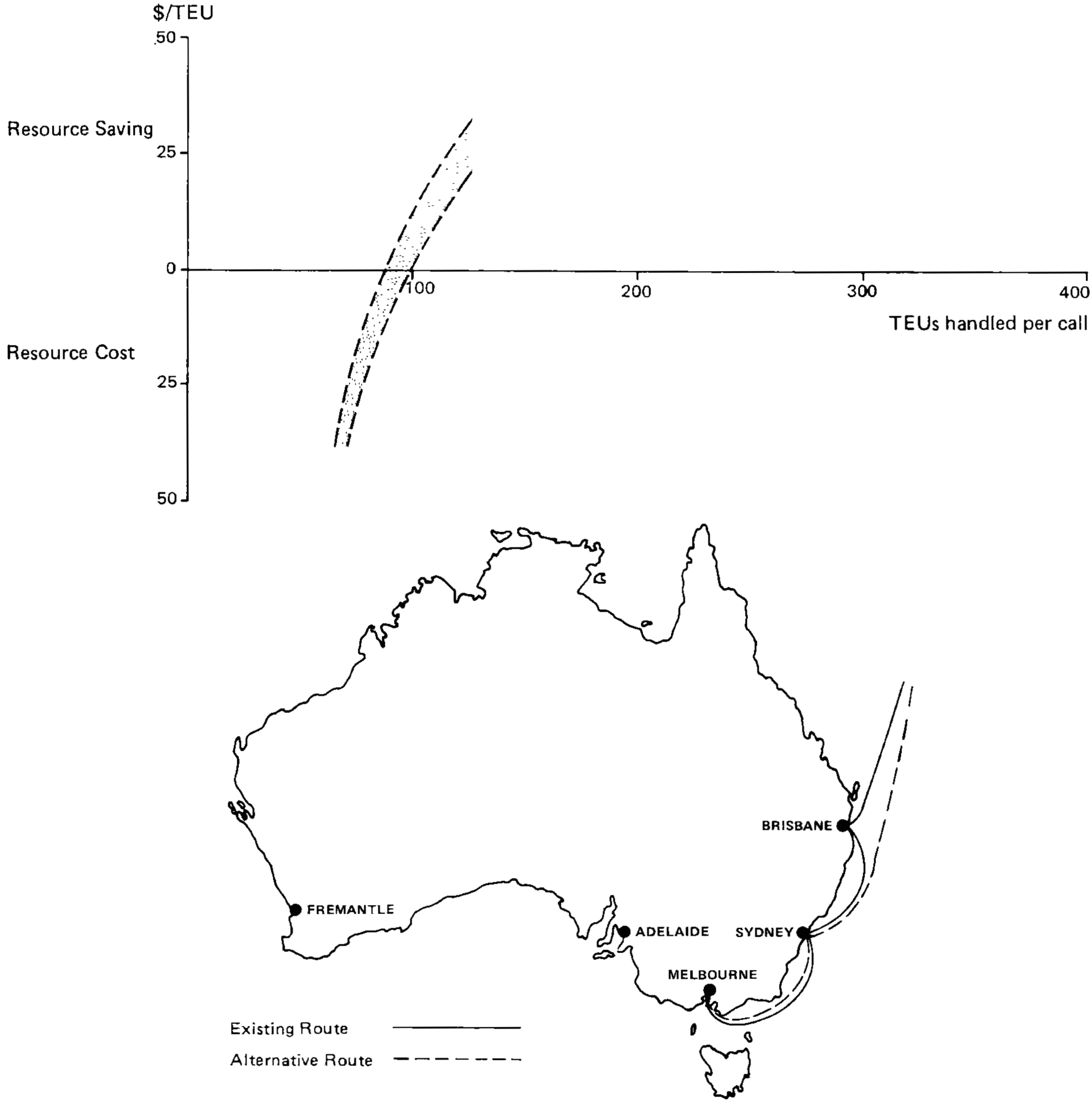
1. Indications are that this trade has increased to about 1100TEU per month in 1980-81. If this can be substantiated then there is now a greater margin of trade above the break even point, and the problem of accumulating sufficient cargo might be overcome.




Note:

1. Vessels arrive from and return to Japan/Korea by the same route. Some of the port calls shown may be omitted.
2. The alternative route involves a 908 nautical mile diversion.

**Figure 7.4**
**Japan/Korea Trade: Break-even analysis and alternative route to Adelaide**




Note:

1. Vessels arrive from and return to Japan/Korea by the same route. The existing route involves a call at Brisbane.
2. By omitting a call at Brisbane a saving of 64 nautical miles could be achieved.

**Figure 7.5**
**Japan/Korea Trade: Break-even analysis and existing route to Brisbane**

The first Adelaide alternative involves a diversion from Melbourne with a return to East Asia via the east coast of Australia, and is equivalent to the Adelaide call considered for the Japan/Korea trade. The diversion distance is 908 nautical miles with a total increment to the voyage time (including steaming time and the net increase in time in port) of a little under three days at the break-even volume of 460 to 570 TEUs. Figure 7.6 details the diversion route and break-even analysis. The break-even range is lower than that required for a call by the Japan/Korea trade at Adelaide because of the typically smaller vessels used in the East Asia trade.

Compared with the estimated trade of 285 TEUs per month in 1976-77 it appears that a direct call at Adelaide by the East Asia trade using this route could not be justified on resource cost grounds.

A second alternative, based on a round-Australia route, has been investigated for Adelaide. Compared with the present service to Brisbane, Sydney and Melbourne, a round-Australia route including a call at Adelaide adds 229 nautical miles to the round-trip voyage. The analysis shown in Figure 7.7 indicates that between 130 to 160 TEUs are required to be handled at Adelaide to justify a call. Including time in port and steaming time, this call would add an estimated one day to the voyage time at the break-even volume.

The 1976-77 estimate for East Asia trade containers centralised on Melbourne was 285 TEUs per month. Allowing for uncertainties in this estimate and the possible changes in this trade to the present time, it would appear that a direct monthly call would be justified if about half of the presently centralised containers were handled by that call. More recent estimates of the East Asia trade based on Adelaide are required before firm resource cost conclusions can be drawn for this alternative.

Financial analysis results based on the handling of 150 TEUs per call suggest that shipping companies could experience a range of results varying from a $1670 loss to a $6800 saving per call compared with the shipment of these containers via the Port of Melbourne. Assuming monthly calls, this would provide an annual financial result which could vary from a loss of $20 040 to a saving of $81 600.

A west to east round-Australia service in the East Asia trade is currently operated by two vessels from the Australia West Pacific Line. These vessels call with approximate 4 week frequency at Adelaide, and sail to both the East Asian and South East Asian regions before returning to Australia.
This route is considered to be less satisfactory from the shippers point of view than a service that is dedicated to the East Asia region.

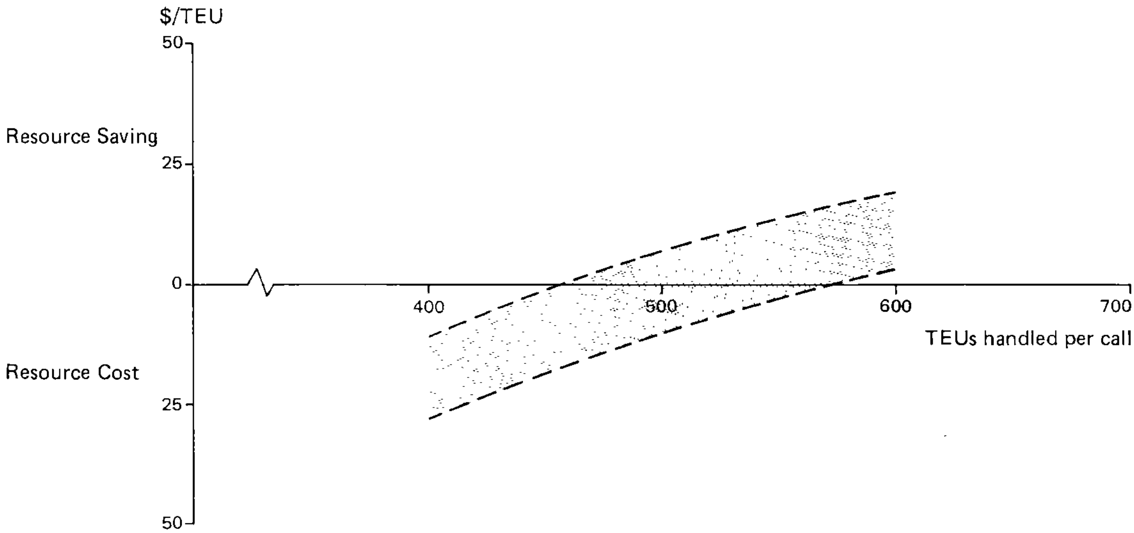
East Asia vessels regularly call at Brisbane, with an average 7-day call frequency. According to industry sources, they handle around 250 TEUs during each visit.

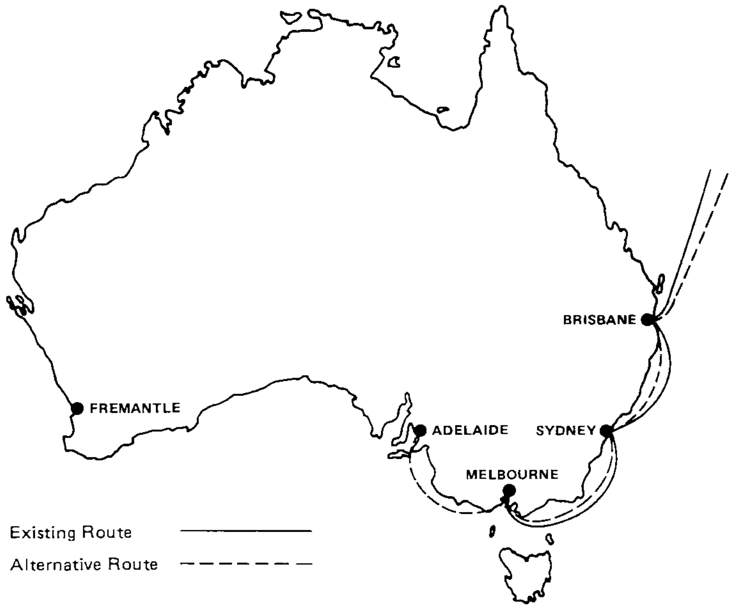
The diversion distance from the East Asia-Sydney route amounts to 64 nautical miles. Based on a typical East Asia trade vessel, the break-even analysis indicates that 75 to 80 TEUs are required to be handled at Brisbane to justify a direct call. Details of the route and break-even analysis are presented in Figure 7.8. As the present calls handle well in excess of the estimated break-even volume, it appears that the current level of service is justified on resource cost grounds.

## East Coast North America (ECNA) trade

Two centralisation alternatives have been considered for this trade, involving a direct call at Adelaide and a review of the present service to Brisbane.

Adelaide calls involve a diversion from Melbourne and a return to ECNA via the east coast of Australia. This diversion is identical to those previously-considered for the Japan/Korea and East Asia trades at Adelaide, and involves a 908 nautical mile diversion with about a three day increment in voyage time. Figure 7.9 details the route and break-even analysis.

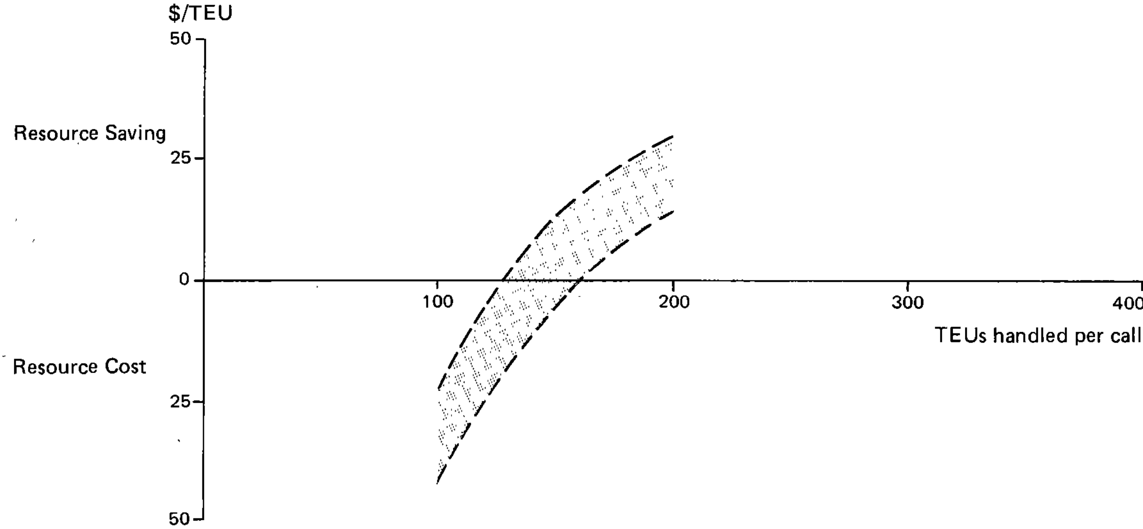


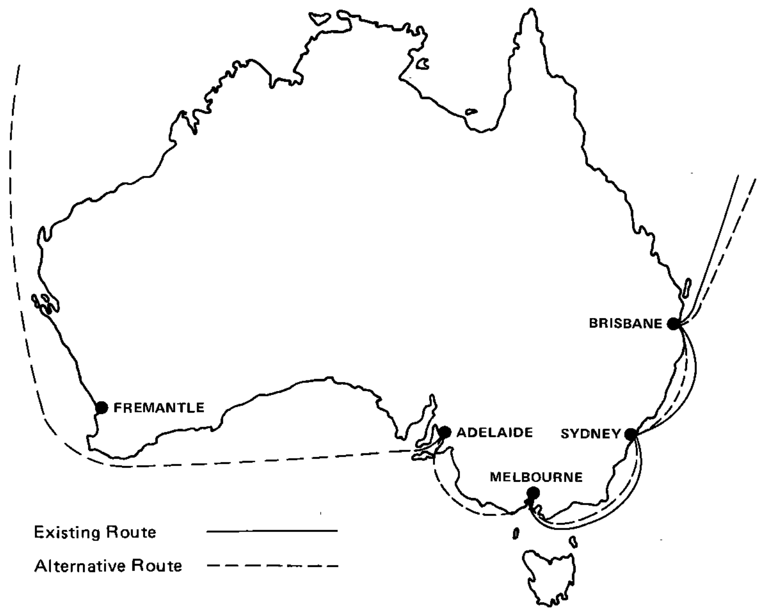




Note:

1. Vessels arrive from and return to East Asia by the same route. Some of the port calls shown may be omitted.
2. The alternative route involves a 908 nautical mile diversion.

**Figure 7.6**
**East Asia Trade: Break-even analysis and alternative route to Adelaide**

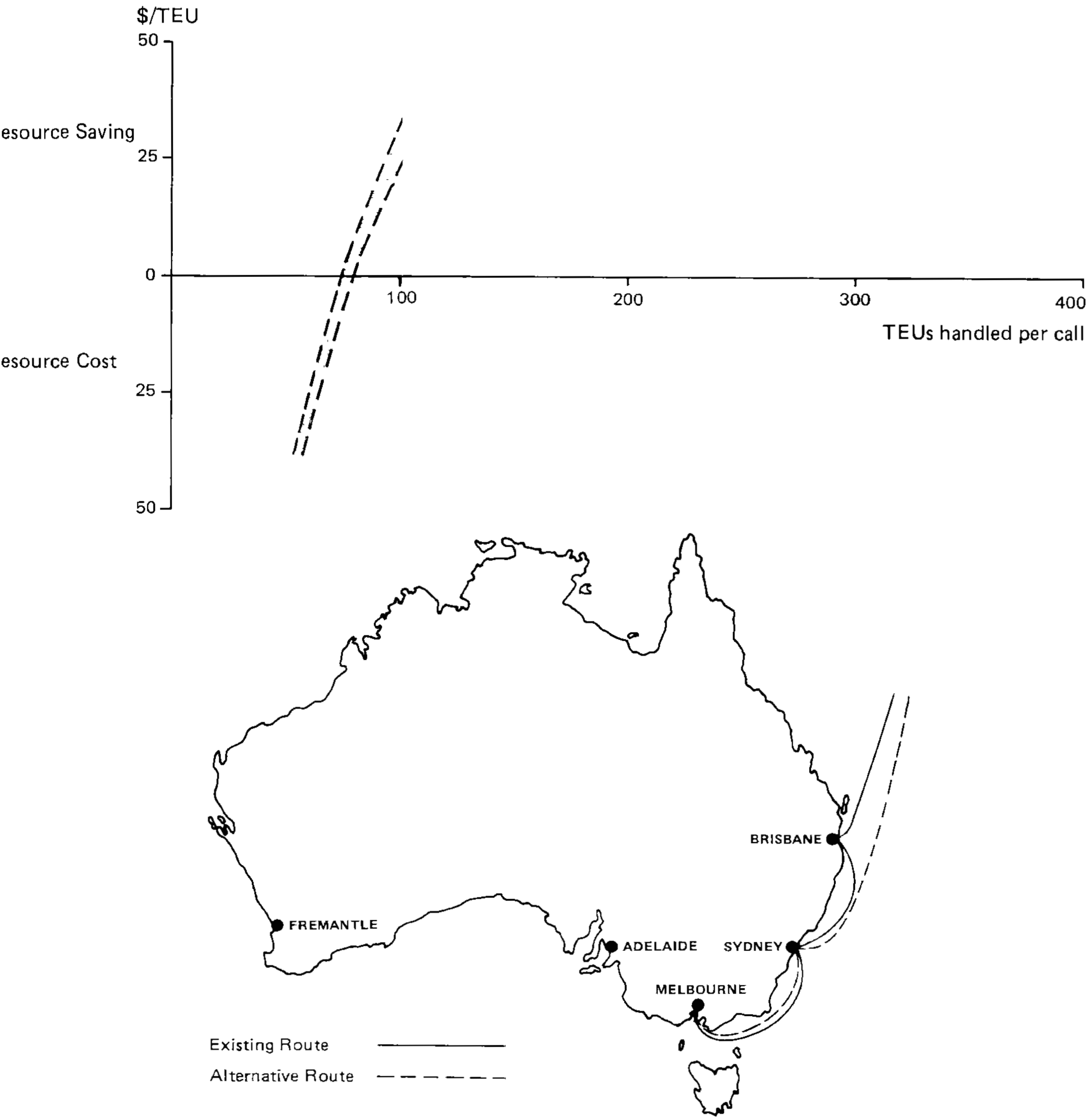



Note:

1. Vessels currently arrive from and return to East Asia by the same route, although some port calls shown may be omitted.
2. A vessel could travel the alternative route in either an easterly or westerly direction.
3. The alternative route involves a 229 nautical mile increase in the total distance sailed.

**Figure 7.7**
**East Asia Trade: Break-even analysis and alternative route to Adelaide (Round Australia Route)**

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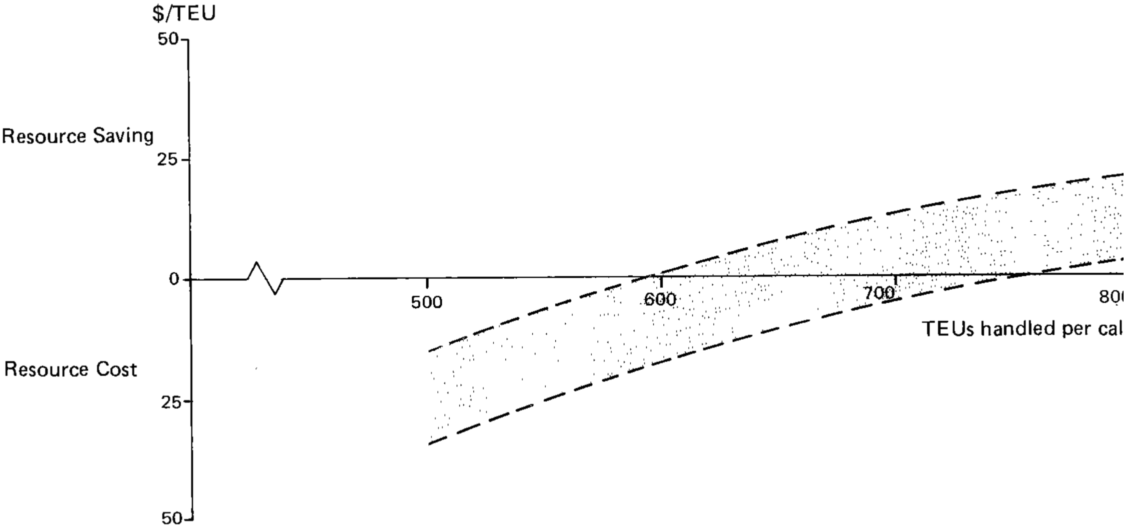
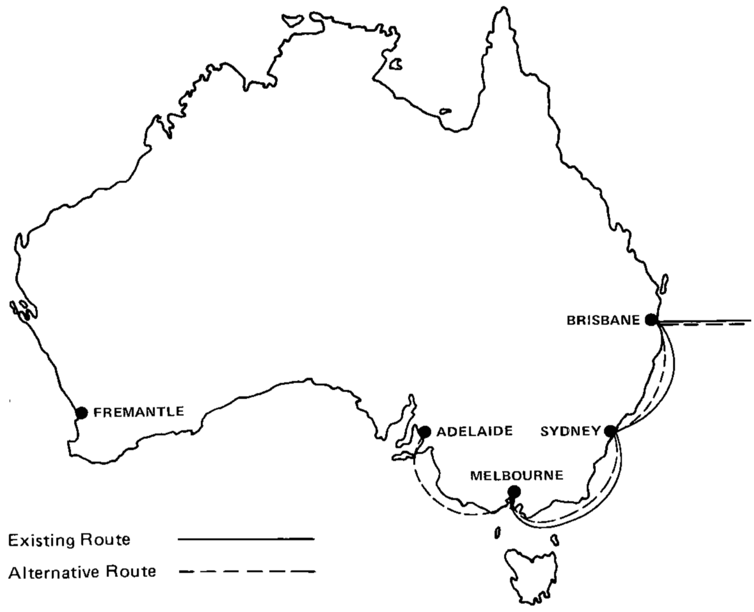
Vessels arrive from and return to East Asia by the same route. The existing route involves a call at Brisbane. By omitting a call at Brisbane a saving of 64 nautical miles could be achieved.

**Figure 7.8**
**East Asia Trade: Break-even analysis and existing route to Brisbane**




Note:

1. Vessels arrive from and return to East Coast North America by the same route. Some of the port calls shown may be omitted individual visits.
2. The alternative route involves a 908 nautical mile diversion.

**Figure 7.9**
**East Coast North America (ECNA) Trade: Break-even analysis and alternative route to Adelaide**

The break-even estimate of 590 to 750 TEUs differs from those for the Japan/Korea and East Asia trade calls at this port, because of the different vessels adopted for each trade. If the break-even range is compared with the estimated trade available during 1976-77 (an average 260 TEUs per month), it appears that there is insufficient trade to support a direct call.

This break-even estimate is based on a 908 mile diversion to and from Melbourne, but some vessels carrying ECNA cargo now sail past Adelaide, mainly in a west to east direction, as part of a round-the-world trip or in combination of UK/Europe and ECNA trade. If such vessels were to make direct calls to Adelaide, they would contribute to a reduction in the break-even volumes. Since no information is available at present on either the frequency of such voyages or the practicality of calling at Adelaide, no account has been taken of the possible impact on break-even numbers in this study.

Also the estimate of trade available relates only to goods originating in, or destined for South Australia. There also exists a trade between ECNA and Western Australia and the Northern Territory which passes through Adelaide on the rail journey to or from Melbourne. If this trade could be captured by ships calling at Adelaide, it would affect the attractiveness of direct calls.

The rail link between Adelaide and Port Pirie is now being converted from broad to standard gauge and this is scheduled for completion in late 1982. At that time rail movements between Melbourne and Northern Territory, Western Australia and northern parts of South Australia will face a break of gauge in Adelaide instead of Port Pirie, and there will be a direct standard gauge link between these areas and Port Adelaide. This factor has not been taken into account in this report.

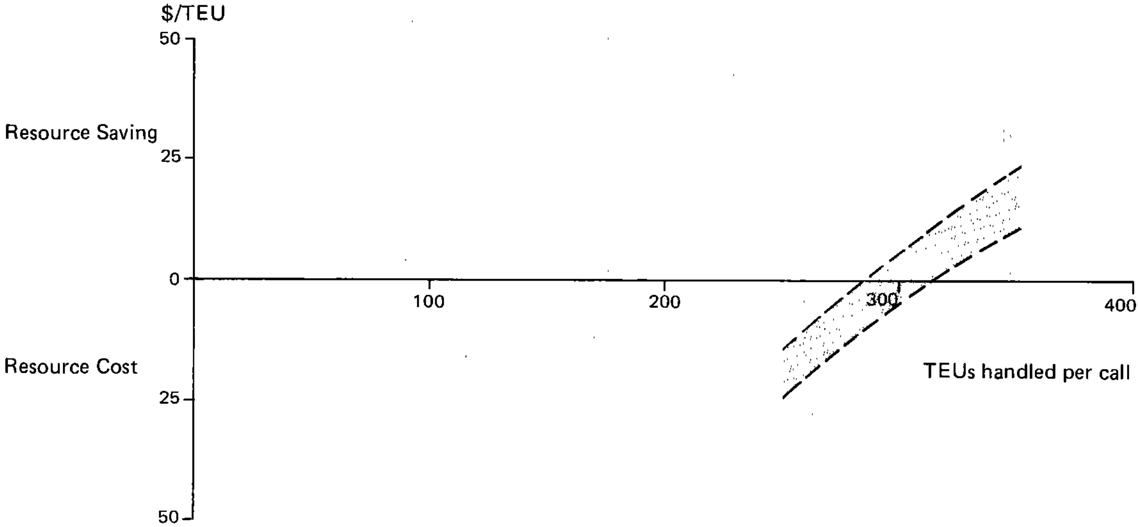
Brisbane currently receives a direct service in the ECNA trade, with an average frequency of one call every 6 days. The additional distance to Brisbane compared with a service only calling at Sydney and Melbourne is 501 nautical miles. For a typical ECNA trade vessel, the break-even volume required to justify this diversion is estimated to be 285 to 315 TEUs per call. The break-even analysis and ship route are illustrated in Figure 7.10.

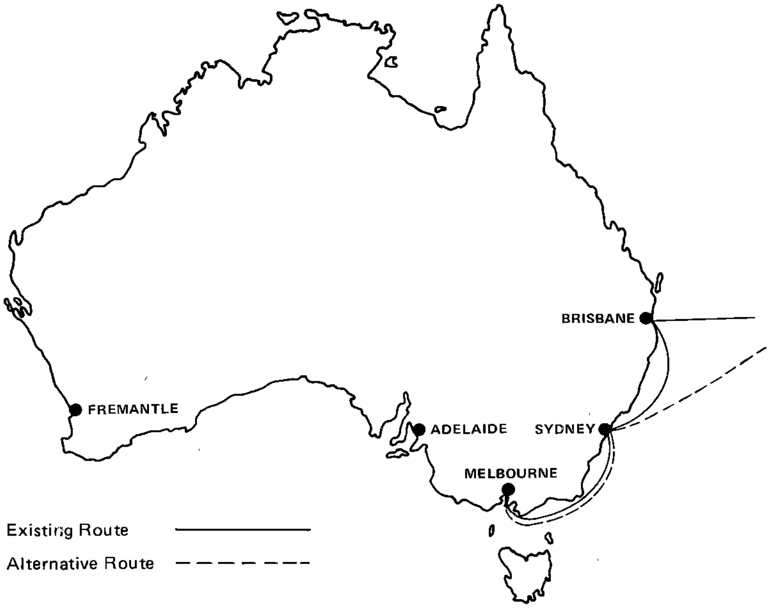
Industry sources have indicated that ECNA vessels handle around 300 TEUs during each call at Brisbane. This approximates the number required by the break-even analysis and suggests the current level of service is appropriate, based on resource cost criteria.

## EFFECT OF SHIP SPECIFICATION ON RESULTS

The break-even analysis uses a range of cost data, particularly for rail and container terminal operations, to reflect the different types of equipment and operating techniques as well as differing performance rates encountered in the industry. This approach gives a break-even result with upper and lower bounds on the number of containers needed to be handled to justify a call on resource cost grounds. These bounds represent the limits on the results for the assumptions adopted, and are expected to cover most situations for the cases considered. The only exception to this approach has been in the choice of a single typical vessel size for each trade. This method was adopted to avoid producing an unwieldy number of results, and because *it is believed that over a period of time the types of vessels likely to call would be similar to the typical vessels specified.*

To test the sensitivity of the results to changes in vessel specification. two approaches were investigated. The smallest vessels (in terms of deadweight tonnes) operating in the UK/Europe, Japan/Korea, East Asia and ECNA trades were used to recalculate break-even container numbers for selected alternatives in these trades. These vessels and their break-even results are shown in Table 7.3, alongside the typical vessels and break-even results already reported. Since the smaller vessels needed to implement this option are already serving these trades, no significant change to fleet operating




Note:

1. Vessels arrive from and return to East Coast North America by the same route. The existing route involves a call at Brisbane.
2. By omitting a call at Brisbane a saving of 501 nautical miles could be achieved.

**Figure 7.10**
**East Coast North America (ECNA) Trade: Break-even analysis and existing route to Brisbane**

TABLE 7.3—BREAK-EVEN CONTAINER VOLUMES REQUIRED FOR DIRECT CALLS ASSUMING SMALLER VESSELS

| | | *Specification* | | *Break-even volumes* | | *Reduction in break-even volume* |
|---|---|---|---|---|---|---|
| *Trade* | *Diversion port* | *Typical fleet vessel* | *Smallest fleet vessel* | *Typical fleet vessel (TEUs)* | *Smallest fleet vessel (TEUs)* | *(per cent)* |
| UK/Europe | Adelaide[a] | 30 000 DWT<br>1 550 TEU | 27 000 DWT<br>1 200-1 400 TEU | 165-225 | 150-205 | 9 |
| | Brisbane[b] | 30 000 DWT<br>1 550 TEU | 27 000 DWT<br>1 200-1 400 TEU | 385-450 | 340-405 | 10-12 |
| Japan/Korea | Adelaide | 28 000 DWT<br>1 500 TEU | 23 500 DWT<br>1 450 TEU | 585-740 | 480-600 | 18-19 |
| East Asia | Adelaide[c] | 20 000 DWT<br>10 000 TEU | 14 000 DWT<br>600-800 TEU | 130-160 | 80-100 | 38 |
| ECNA | Adelaide | 23 000 DWT<br>1 200 TEU | 20 000 DWT<br>1 200 TEU | 590-750 | 500-650 | 13-15 |
| | Brisbane | 23 000 DWT<br>1 200 TEU | 20 000 DWT<br>1 200 TEU | 285-315 | 240-265 | 16 |

a. Diversion from the Fremantle-Melbourne route.
b. For diversion Sydney to Brisbane, returning to Europe via Panama.
c. For diversion Melbourne to Adelaide by round-Australia route.

costs is expected. Capacity problems that may arise for individual vessels have been ignored.

The break-even results using the smaller vessels are between 9 and 38 per cent lower than those assuming the use of the larger, typical vessels. For centralisation alternatives which require a very large number of containers to be exchanged to achieve a break-even position, the use of smaller vessels is not expected to reduce the break-even results sufficiently to justify a direct call. Other results such as calls at Adelaide by the East Asia (round-Australia route) and Japan/Korea trade may prove more attractive with the use of the smaller vessels, particularly if current trade levels are substantially above those for 1976-77.

The sensitivity of the results to changes in fuel consumption have been examined. Table 6.2 lists the at-sea fuel cost (in dollars per hour) for each of the typical vessels adopted. A number of vessels currently operating in the UK/Europe, Japan/Korea, East Asia and ECNA trades have at-sea fuel costs considerably below those shown in the Table. Break-even results have been recalculated for Adelaide calls to test the effect on results of lower hourly fuel costs, and are shown in Table 7.4. They indicate that with a 20 per cent reduction in at-sea fuel costs, break-even volumes would be reduced by 15 to 19 per cent for the centralisation alternatives shown. This reduction may be as high as 36 per cent if fuel costs can be reduced by 40 per cent compared with those assumed for the typical vessels.

Over time, the introduction of new (or re-engined) tonnage will, through their effect on typical vessel specifications, lower break-even volumes. At present, the sensitivity tests indicate that the break-even results for the typical vessels are robust, and that the conclusions remain unaltered even with the assumed use of small vessels, or typical vessels with lower fuel costs.

## COMMENT ON LONG-RUN CONSEQUENCES

### Introduction

The following evaluation of long-run costs and their effect on the centralisation options is approximate only. The detailed assessment required to produce a more accurate result has not been performed, but the results derived are believed to be robust for the range of assumptions adopted. These results are only an adjunct to the major short-run resource cost evaluation on which this report is based.

The consideration of long-run costs has been divided into ship, terminal and railway cost categories. Each is discussed on the basis of direct calls at Adelaide for the UK/Europe and East Asian trades, and Brisbane for the UK/Europe trade.

### Shipping costs

Changes in long-run shipping costs can arise from a change in effective capacity as a result of the adoption of alternative centralisation arrangements. As each alternative involves diversion of a vessel into an additional port, or trading of some calls at one port for calls at another, some increase in overall round-trip time generally occurs. In the long-run, this has the effect of diminishing the shipping capacity on the particular route, and therefore advances the time at which an additional vessel would be required.

The increase in round voyage time for the centralisation alternatives considered in this chapter is typically 12 to 72 hours per call. For the calls which appear feasible on the basis of the resource cost analysis and past traffic volumes, voyage time increases are generally less than 30 hours per visit. When compared with round voyage times of the order of 90 days for the UK/Europe trade and 40 days for the East Asia Service, the diversion of one or two vessels per month from typical fleets of 11 to 20 vessels in each trade is expected to have a negligible overall effect on present shipping capacity. In the long-run, this is also expected to have a negligible effect on the timing of the purchase of additional shipping capacity and has therefore been excluded in this analysis.

TABLE 7.4—BREAK-EVEN CONTAINER VOLUMES REQUIRED FOR DIRECT CALLS ASSUMING REDUCED FUEL COSTS[a]

| *Trade* | *Diversion port* | *Break-even volumes* | | | | | *Estimated containers available during 1976-77* |
|---|---|---|---|---|---|---|---|
| | | *Typical fleet vessel* | *With 20 per cent fuel reduction* | | *With 40 per cent fuel reduction* | | |
| | | *(TEUs)* | *(TEUs)* | *(per cent reduction)* | *(TEUs)* | *(per cent reduction)* | *(TEUs per month)* |
| Japan/Korea | Adelaide | 585-740 | 495-620 | 15-16 | — | — | 880 |
| East Asia | Adelaide[b] | 460-570 | 375-480 | 16-18 | — | — | 285 |
| ECNA | Adelaide | 590-750 | 480-630 | 16-19 | 380-480 | 36 | 260[c] |

a. Vessel specifications for each trade are as shown in Table 6.1 with the exception of engine type and power, which is assumed to allow fuel savings of 20 to 40 per cent compared with typical vessels.
b. Diversion route is Melbourne-Adelaide-Melbourne.
c. Combined estimate for West Coast and East Coast North America.

## Container terminal costs

Long-run container terminal costs can be affected by adoption of alternative centralisation procedures if the alternative procedures have an effect on the timing of the requirement for new facilities. As terminal facilities have recently been expanded at Sydney and Brisbane, considerable excess capacity exists and will continue to be available unless some of the older facilities at these ports close down. The consequence of a direct call at Brisbane in the UK/Europe trade, which would allow up to the order of 4000 Brisbane containers currently handled at Sydney terminals each year to be handled directly at Brisbane, is expected to have a negligible impact upon the long-run capital commitment at both ports. In percentage terms, a monthly direct call would increment Brisbane's throughput by 4 to 5 per cent, which is well within annual trade fluctuation levels. At Sydney, the loss of trade would be even less significant, contributing to an estimated 1 to 2 per cent annual downturn. The long-run effect on the capital commitment at Sydney and Brisbane resulting from the adoption of centralisation alternatives is therefore expected to be negligible and has been excluded.

Long-run labour and mobile handling equipment capital costs at Sydney and Brisbane are also not expected to be affected by centralisation changes. This is due to the relatively small change in throughput at these ports. The long-run costs for labour and equipment have therefore been ignored.

Centralisation alternatives based on the diversion of some of the traffic presently handled at Melbourne to the port of Adelaide offer potential long-run resource savings through deferral of new facilities at Melbourne. They also incur additional costs through the increased demand for mobile handling equipment and labour at the Adelaide terminal.

Introduction of direct calls at Adelaide could be expected to have an effect on the timing of the Melbourne Port Authority's plan to construct an additional five berths at Webb Dock over the next 20 years (Port of Melbourne Authority 1980). If a throughput transfer of the order of 10 000 TEUs per annum to Adelaide from Melbourne were to occur as a result of these direct calls, long-run resource savings at Melbourne could be achieved. Assuming a long-run growth in throughput at Melbourne of 2.3 per cent per annum, and an assumed cost of $33 to $38 million per berth[1], the sequential deferral of three of the future berths by approximately one year (commencing from year six) would result in a present value resource saving of $2.9 to $3.4 million at 1980 prices, using a 10 per cent rate of discount.

The berth and gantry crane used by container vessels at Adelaide presently handles less than 10000 TEUs per annum. Increases in throughput resulting from adoption of centralisation alternatives together with long-term trade increases are not expected to be sufficient to warrant upgrading of these facilities over the foreseeable future.

Additional labour and mobile equipment costs could be incurred at Adelaide to cope with the increased throughput if centralisation alternatives were adopted. As the present manning and equipment levels at Adelaide are sufficient to handle only a small annual throughput, expansion by some 10 000 TEUs per annum could require the provision of one additional item of equipment and up to nine additional men. Based on straddle carrier cost estimates of $0.39 to $0.45 million per unit, and allowing annual labour costs of $25 000 to $30 000 per employee, the present value of the long-run costs of employing the additional labour and machinery is $2.5 to $2.9 million at 1980 prices. A 10-year straddle carrier life has been assumed with all discounting performed at a rate of 10 per cent. If two straddle carriers and up to 15 additional employees are required, the present value of long run costs would increase to approximately $3.7 to $4.5 million. Discussions with the Adelaide operators suggest that the need for one straddle carrier is more likely.

1. BTE estimates based on expenditure at Fisherman Islands, Webb Dock No 4 and 5 and ANL Port Botany Terminal. Costs include dredging, hardstanding, mobile handling equipment and two cranes.

The value of savings in mobile equipment and labour in Melbourne is not clear. An annual transfer of 10 000 TEUs to Adelaide would represent a fall of some 3 per cent in Melbourne throughput at present trade levels. Manning levels and equipment purchase schedules are thought to be insensitive to such small changes in the short-term, although they would be expected to show up over a period of time. Clearly the delay in response would have an important bearing on the present value of the savings, when they finally accrue, and there is no satisfactory way of estimating that delay. The most that can be said is that the additional costs in Adelaide would be offset to some extent by long-term savings in Melbourne.

To summarise, terminal costs for Sydney and Brisbane appear to be largely unaffected in the long-run by the adoption of centralisation alternatives. Substantial savings appear feasible from the possible deferral of new facilities at Melbourne, though these savings would be reduced to some extent by the cost of employing additional labour and mechanical equipment at the Adelaide terminal to handle the increased throughput which would not be completely balanced by an equivalent saving in Melbourne.

**Rail costs**

An analysis of railway operations for the Sydney-Brisbane and Adelaide-Melbourne corridors suggests that long-run savings can be achieved through deferral or avoidance of replacement of some capital equipment such as locomotives and rolling stock. However, the savings are highly dependent on the degree of traffic imbalance and the ability of the railways to reorganise schedules and redeploy equipment to suit the new traffic levels.

Some savings in track maintenance could be assumed, although the level of savings is likely to be small and has been ignored.

If direct calls at Adelaide mainly handle export containers, as the recently introduced direct UK/Europe call does, fewer containers will be carried on the Adelaide-Melbourne service. This would make a reduction in train numbers difficult to achieve, because of the traffic imbalance caused, and would increase the level of empty wagon movements on the Adelaide-Melbourne leg. Under these conditions, few if any long-run savings in the deferral of rolling stock and locomotive replacement would be achieved.

If direct calls at Adelaide were exactly balanced between import and export containers, the maximum level of rail savings from indefinite deferral of capital equipment would have a present value of the order of $1.3 million[1].

For a monthly service to Brisbane in the UK/Europe trade, approximately 3600 TEUs per annum could be expected to be handled directly at Brisbane rather than through the port of Sydney. Even if direct calls at Brisbane were exactly balanced between import and export containers, the reduction in rail traffic is expected to be insufficient to allow deferral of capital equipment in the long run.

**Other long-run factors**

Other factors apart from direct transport costs, can also contribute to the long-run cost consequences of centralisation. A report by the Commonwealth Department of Environment, Housing and Community Development (1976) stated, 'while container terminals have been constructed to provide for the rapid turnaround of ships, land access provisions have generally been inadequate, transferring to surrounding areas and communities problems such as congestion and visual intrusion'.

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1. For a reduction of 4200 to 5000 TEUs in each direction. Assume indefinite deferral from year 10 of one train set. Capital costs are based on an average train consisting of 19 wagons, one brake van and an average requirement of 1.8 locomotives; with a total cost of $3.5 million at December 1980. All discounting is at a rate of 10 per cent.

These problems can impose costs on communities which are not taken into account in the pricing system. Although it can be argued that congestion and visual intrusion are being lessened at ports such as Sydney and Brisbane, with the opening of new terminals in more appropriate locations, these factors can be expected to have continuing negative influences on local communities. The use of ports such as Adelaide and (particularly) Brisbane, which both have facilities located away from urban areas, in preference to ports such as Melbourne and Sydney could contribute to some lessening of land access congestion at the larger ports. The evaluation of this externality and of any saving from a lessening of its effects is difficult to perform. It does, however, add some weight to arguments favouring centralisation alternatives based on ports such as Adelaide and Brisbane.

**Summary of long-run consequences**

The long-run resource cost consequences of adopting alternative centralisation procedures appear to reinforce the conclusions from the short-run analysis that direct calls at Adelaide are justified under certain circumstances. Long-run savings accrue mainly from deferral of the provision of terminal facilities at Melbourne and railway rolling stock and locomotives for the Adelaide-Melbourne freight service. Additional costs would be incurred mainly through expansion of the Adelaide container terminal. The level of costs appears sensitive to the degree of expansion required at Adelaide, but it is expected that these additional costs would be less than the savings made in Melbourne.

Little can be concluded about the long-run consequences of direct calls at Brisbane due to the present high level of excess terminal capacity at both Sydney and Brisbane and the relatively small throughput changes expected with the introduction of direct calls.

# CHAPTER 8—IMPLICATIONS OF CENTRALISATION ALTERNATIVES

In this chapter the distributional effects on operators involved in the transport and handling of overseas containers through the adoption of cargo centralisation alternatives are considered. Means of achieving changes to present centralisation arrangements and an alternative to cargo centralisation are also discussed.

## DISTRIBUTIONAL EFFECTS

Economic analysis is often directed towards maximisation of efficiency and/or welfare. Distributive effects are rarely considered explicitly. It is useful, when suggesting changes to an existing system, to examine not only the overall economic consequences but to quantify the relative impact on individuals or groups. Such an analysis is important also when consideration is being given to the likelihood that market forces will tend to a more efficient allocation of resources.

This section considers the relative financial effect on shipping companies, rail authorities, port operators and shippers of the introduction of alternatives to the present centralisation arrangements. Regional welfare is also discussed.

### Shipping companies

Of the alternatives to the present centralisation arrangements examined in this report, there appear to be four which satisfy resource cost criteria at the 1976-77 trade level and also offer financial savings to shipping companies. In addition, one option (call at Adelaide by ships in the Japan/Korea trade) was regarded as marginal. These alternatives and their expected financial results are summarised in Table 8.1 along with data for a European trade call involving greater than break-even exchange of containers.

On an annual basis, introduction of two direct services per month to Adelaide in the UK/Europe trade, handling a minimum 200 containers per call, could allow shipping companies to trade-off additional ship and port costs against savings in rail charges, to obtain a net financial saving of between $79 000 and $350 000. For the alternative involving the omission of a call at Sydney on voyages which call monthly at Adelaide, a financial gain the order of $1.5 million would be expected over a 12-month period. This gain would need to be offset against any costs to shippers resulting from the service reduction at Sydney. Monthly calls at Adelaide by East Asia vessels would be expected to provide savings to shipping companies of the order of $12 000 to $113 000 per annum. A monthly call by Japan/Korea trade ships with an exchange of 650 TEUs would be expected to produce savings of between $103 000 and $581 000 per annum. Calls by UK/Europe vessels at Brisbane are expected to yield financial gains of between $525 000 and $819 600 per annum for a monthly service.

If direct calls were to be made on the basis of exchanging the break-even volumes estimated for each trade and port then the financial gain to shipping companies would be marginal. This is not surprising since resource costs and savings balance at this level of activity. A direct call at Adelaide in the UK/Europe or East Asia trades would be expected to reduce round voyage costs by less than 0.2 per cent[1]. A direct call at

1. Calculated as the reduction in costs for the entire UK/Europe conference fleet, and includes ship operating costs, port and terminal charges and rail freight payments. Administration and other overheads have been omitted.

Adelaide by a ship in the UK/Europe trade which omitted a call at Sydney would reduce round voyage costs by between 0.6 and 0.7 per cent. If these savings were passed on to shippers the resultant reduction in freight rates would be very small[1].

TABLE 8.1—FINANCIAL RESULTS FOR SHIPPING COMPANIES FOR SELECTED CENTRALISATION ALTERNATIVES

| *Trade* | *Diversion port* | *No containers handled* | | *Annual financial saving* |
|---|---|---|---|---|
| | | *per call (TEUs)* | *per annum (TEUs)* | *($'000)* |
| UK/Europe | Adelaide | 200 | 4 800[a] | 79.0 to 350.0 |
| UK/Europe | Adelaide | 300 | 7 200[a] | 482.5 to 889.2 |
| UK/Europe | Adelaide (omit Sydney) | 250 | 3 000 | 1 459 to 1 623 |
| UK/Europe | Brisbane | 400 | 4 800 | 520.0 to 819.6 |
| Japan/Korea | Adelaide | 650 | 7 800 | 102.8 to 580.8 |
| East Asia | Adelaide | 150 | 1 800 | 11.6 to 113.1 |

a. Two calls per month are assumed for this alternative.

Clearly savings to shipping companies would increase as the number of containers to be exchanged increased beyond break-even volumes. For example, as indicated in Table 8.1, if the number of containers exchanged per call by a ship in the UK/Europe trade increased from 200 to 300 then the savings to the shipping line would be expected to rise from the range $79 000 to $351 000 to the range $483 000 to $889 000 per annum.

**Rail authorities**

The introduction of direct calls at ports such as Adelaide and Brisbane by trades which do not presently call at these ports on a regular basis could result in a typical throughput increase of 2500 to 5000 TEUs per annum for a monthly service. If more frequent calls are made or several trades commence calls this increase could be even higher. The effect on rail authority finances of a reduction in traffic on the Melbourne-Adelaide and Sydney-Brisbane rail routes has been estimated in Table 8.2, based on 1976-77 rail movements and December quarter 1980 rail freight rates.

The results shown in the table indicate that rail transport revenue derived from the carriage of overseas containers along the two corridors will decrease by 3.5 to 15.6 per cent for the Melbourne-Adelaide corridor and by 5.3 to 21.7 per cent for the Sydney-Brisbane route, based on a traffic reduction of 2500 to 10 000 loaded TEUs per annum. After allowing for operating cost savings, the loss in traffic would represent a decrease in cash flow of $0.23 to $1.03 million for the Melbourne-Adelaide corridor, and $0.45 to $1.86 million for the Sydney-Brisbane corridor. These losses are small when compared with total revenue from all sources.

The estimates shown in Table 8.2 do not include allowances for potential diverted traffic and changes in the number of empty positioning movements. Adoption of alternative arrangements could increase the containerisation at ports such as Adelaide and Brisbane, for cargoes which are presently rail freighted from South Australia and Queensland to the major ports before being containerised. This diversion of traffic could increase the number of containers which would be available at the ports of Brisbane and Adelaide. No allowance has been made for this in the analysis.

The pattern of empty overseas container positioning movements around Australia is complex and not well documented. Figure 4.8 in Chapter 4 shows estimates for 1976-77

1. Freight rates are decided via a negotiation process based on one leg of a voyage, with only the outward legs negotiated in Australia.

TABLE 8.2—ESTIMATED EFFECT OF CENTRALISATION ALTERNATIVES ON RAIL AUTHORITY FINANCES

| *Rail corridor* | *Traffic reduction* ('000 TEUs pa) | *Revenue[a] reduction* ($'000 pa) | *Operating[b] cost saving* ($'000 pa) | *Net reduction* ($'000 pa) | *Estimated[c] revenue* ($'000 pa) | *Percentage reduction[d]* (per cent) |
|---|---|---|---|---|---|---|
| Melbourne— | 2.5 | 387 | 128-157 | 230-259 | 6 615 | 3.5-3.9 |
| Adelaide | 5 | 775 | 259-317 | 457-516 | | 6.9-7.8 |
| | 10 | 1 550 | 520-638 | 912-1 029 | | 13.8-15.6 |
| Sydney— | 2.5 | 644 | 178-192 | 452-466 | 8 569 | 5.3-5.4 |
| Brisbane | 5 | 1 288 | 357-384 | 904-931 | | 10.6-10.9 |
| | 10 | 2 577 | 717-771 | 1 806-1 860 | | 21.1-21.7 |

a. Based on December quarter 1980 rates for loaded containers.
b. Fuel and maintenance costs only.
c. Based on 1976-77 estimates for overseas container movements from Figure 4.7 and 4.8.
d. As a proportion of revenue derived from carriage of overseas containers along the particular corridor.

of known movements by road, rail and coastal shipping. These figures do not generally include positioning movements by overseas containers loaded with domestic cargo, and can therefore be regarded as lower estimates for some routes. Positioning of empty containers is brought about by imbalances in container imports and exports across the country, as well as by the requirements for specialised containers such as reefers by some exporters. As each shipping company or consortium owns and controls its own containers, imbalances can occur in different centres for each operator, resulting in continual two-way flows of empty containers between centres in Australia.

Changes in container positioning movements resulting from the introduction of alternative centralisation arrangements are very difficult to estimate. They will depend on the type of call proposed (export or import-oriented), frequency of service and mix of container types used. Some alternatives may result in an increase in positioning movements. No estimate of the likely change in this traffic has been made because of the large number of variables involved.

**Port operators**

The change in traffic through ports as a result of the adoption of alternative centralisation procedures will have an effect on port revenues. Centralisation alternatives generally entail an increase in the number of port calls by container ships at ports such as Adelaide and Brisbane, without any reduction in calls at ports which are presently served. The number of containers handled would decrease at present ports in favour of the new ports of call.

The effect of these changes on port authority revenues can be estimated by considering total revenue derived from dues on cargo and ships, pilotage, removal fees, conservancy dues and any changes to these revenues due to the new ship calling procedures. The estimated changes in annual port revenues resulting from the adoption of selected alternative centralisation arrangements at Adelaide, Melbourne, Brisbane and Sydney are shown in Table 8.3. The figures indicate that, for centralisation alternatives of the type investigated and the break-even volumes shown in Chapter 7, the percentage increase in port revenue at Adelaide might be as high as 3.9 per cent if fortnightly calls by UK/Europe vessels, monthly calls by East Asia vessels and monthly calls by Japan/Korea vessels were introduced. The introduction of these calls at Adelaide would result in port revenue at Melbourne falling by about 2.4 per cent. Monthly calls at Brisbane by UK/Europe vessels would increase Brisbane port revenues by about 1.4 per cent and reduce Sydney port revenues by about 0.5 per cent.

### Shippers

In financial terms, the immediate effect on shippers from the adoption of alternative centralisation arrangements is expected to be small. Some reduction in freight rates may occur, but the average magnitude is expected to be below one per cent. However, other benefits of an even less quantifiable nature could also arise. The most important of these is a change in the time spent in waiting for cargo to arrive and its impact in terms of inventory costs.

An additional factor would be the enhanced reliability associated with a less complex transport system which avoids additional land transport links. Although it is not possible to assess this factor, it may prove important in some instances, and would avoid disruptions associated with such matters as industrial actions in the land transport modes.

Alternative centralisation arrangements may prove desirable from a shipper's viewpoint if inventory costs are reduced by the proposed changes. To examine the likely impact on inventory costs the change in overall transit time for containers shipped directly to Adelaide in the UK/Europe trade is assessed in Appendix XI. The conclusion from this work is that considerable inventory savings in terms of a reduction in transit time could be achieved for Adelaide bound containers. These savings are

TABLE 8.3—ESTIMATED EFFECT OF SELECTED CENTRALISATION ALTERNATIVES ON PORT AUTHORITY REVENUE

| *Port* | *Sets of centralisation alternatives* | *Change in revenue ($'000 pa)* | *Estimated total revenue ($'000 pa)* | *Percentage change (per cent)* |
|---|---|---|---|---|
| Adelaide | Two UK/Europe calls per month[a] One East Asia call | 254 | 6 500 | +3.9 |
| Melbourne | Loss of some UK/Europe, East Asia and Japan/Korea traffic to Adelaide | −752 | 31 348 | −2.4 |
| Brisbane | One UK/Europe call per month | 164 | 11 950 | +1.4 |
| Sydney | Loss of some UK/Europe traffic to Brisbane | −218 | 39 891 | −0.5 |

a. 200 TEUs handled per call.

*Source:* Port authority annual reports 1979-80 and correspondence with port authorities. Port charges at December 1980.

generally offset by increased transit times for through-containers bound for Melbourne and Sydney.

As a result of the increased transit time for through-containers, little advantage in terms of a net reduction in container transit times are expected from the introduction of a southbound direct call at Adelaide. This result indicates that savings in transit time for one port or region may be offset by increases in transit times for containers bound for other areas.

Given the reported current long delays experienced by Adelaide bound containers unloaded in Melbourne a northbound ship call at Adelaide could be expected to provide a nett benefit to Adelaide shippers. However, it must be pointed out that the same result could be obtained by practicable changes to current practices in the land side operations.

**Regional welfare**

The effect on a port or region of the introduction of alternative centralisation arrangements can be expected to extend beyond shippers and transport operators. The change in container traffic, particularly if it is a significant change, can have employment and revenue generating effects beyond those already discussed. In general, benefits which accrue to one region will be at the expense of another area, particularly where trade is relocated from one port to another. This transfer of benefits between regions, whilst a valid issue at the local level is not usually relevant in an economic analysis on a national basis.

One exception involves the transfer of transport related jobs from Sydney and Melbourne to Brisbane and Adelaide. It is believed that the reduced throughput of the central ports would be so small as to have no effect on manning levels while the smaller ports would hire additional staff. Given that South Australia, at least, has a depressed labor market, the additional jobs generated by direct services would in principle have some national benefits. Since the changes in unemployment levels cannot be assessed, such potential benefits have been excluded from the analysis.

## MEANS OF BRINGING ABOUT CHANGE

Although this report has identified alternative centralisation arrangements which are considered desirable in resource cost terms, it may be that there are impediments which prevent these alternative arrangements from being adopted.

The alternative calling arrangements from Chapter 7 which were favoured on resource cost grounds were also analysed on a financial basis to determine their profitability from the shipping company viewpoint. In each case, savings would accrue to the shipping company if the changes were adopted. As a result, provided the present trade levels are sufficient to support a call, no intervention should be necessary to ensure that these changes are adopted.

If direct calls deemed desirable by the community are not arranged, inducements such as changes to present port charges and rail freight rates could be applied to shipping companies. The means of calculating and applying such charges are considered to be outside the terms of this study.

## AN ALTERNATIVE TO CARGO CENTRALISATION

This report has limited itself to a consideration of existing port facilities and ships which are currently in use in the overseas liner trades. However, these ships and the centralised container terminals which have been constructed to service them may not provide an optimal solution to the provision of liner services.

As fully cellular container ships require specialised container cranes and back-up facilities (such as mobile handling equipment), the provision of these capital-intensive facilities at only a limited number of Australian ports was seen as a necessary requirement in the 1960s for the introduction of containerisation. The decision to provide specialised facilities at a limited number of ports provided a barrier to the introduction of container services at other ports unless similar facilities were also constructed.

The successful use of ro-ro ships on the European run since the introduction of containerisation has shown that there are alternatives to the fully cellular ships generally used on most trades. Ro-ro vessels have the advantage compared with container ships of requiring fewer specialised facilities. They are capable of calling (and do call) at ports such as Adelaide, Burnie, Newcastle and Townsville on a regular basis. The increased use of ro-ro vessels would provide more flexibility in the number of ports that could be served directly.

Consideration of an integrated liner service based on a mix of ro-ro and cellular container vessels, whilst not investigated in this report, is felt to be worthy of further consideration, particularly as one means of increasing the number of ports at which direct calls could be made in future. An investigation of this type may prove timely, as a number of the conference vessels on the UK/Europe service were built in the late 1960s and early 70s, and can therefore be expected to be replaced over the next five to ten years.

# CHAPTER 9—CONCLUDING REMARKS

The primary objective of this study was to examine the general implications of cargo centralisation from a national perspective. The complexity of the system and the absence of comprehensive basic data precluded the development of a generalised modelling approach and so study analysis was concentrated on possible changes to the pattern of liner service port calls which were judged most likely to produce net economic benefits. The approach taken in the study was to examine some specific instances of decentralisation from Melbourne and Sydney to Adelaide and Brisbane. Although they cannot be fully substantiated several reasonable inferences can be drawn from the results of the (necessarily) limited analysis.

The relationship between break-even container exchange and ship diversion distance, as indicated by the case studies reported here, is shown in Figure 9.1. The variation in break-even volumes for any particular distance is the result of factors such as differing ship types and landside costs. The figure gives a general indication of the order of magnitude of container numbers needed to justify a ship diversion and would provide a basic starting point for analysis of any individual case.

The results of the study as a whole indicate that at least some existing ship call schedules are not optimal, in that total costs could be reduced by extension of calls to Adelaide and Brisbane giving both increased economic efficiency and better financial returns to ship owners.

In this context, it appears that there is no marked divergence between the economic and financial benefits of changed ship call schedules and so, under current institutional arrangements, ship owners can be expected to tend towards the provision of economically efficient services without the need for additional inducements. In the event of a slow response to these pressures, either through institutional inertia or because of perceived external benefits or costs, local community pressure can be expected to redress the balance quite quickly. This has been demonstrated recently by the response of some trades in extending services to Adelaide. Such a response would be expected to occur whenever local pressure corresponds with a financial benefit (or, at worst, a small financial cost) to the shipping lines concerned.

However, the relatively small magnitude of the economic pay-offs for increased direct calls at Adelaide and Brisbane examined in this study suggest that there is little or no likelihood of serious resource misallocation due to the centralisation of container cargo from the more remote regions. The results for decentralisation calls at Adelaide and Brisbane are marginal in overall economic terms and so it appears most unlikely that further extension of cellular container ship calls to regional ports would be justified. In this context it seems possible that a change in fleet structure, with increased use of ro-ro ships, would be necessary before further decentralisation would appear to offer any hope of cost savings. This possibility has not been explored in the present study.

In analysing the relative merits of additional ship calls the implicit assumption has been made that conferences are able to 'rationalise' call patterns between companies and individual ships. That is, if the volume of traffic will justify only one ship call per month then it is assumed that the conference members can agree as to which ship should call and make internal adjustments to compensate any members for loss of traffic brought about by the changed schedule.

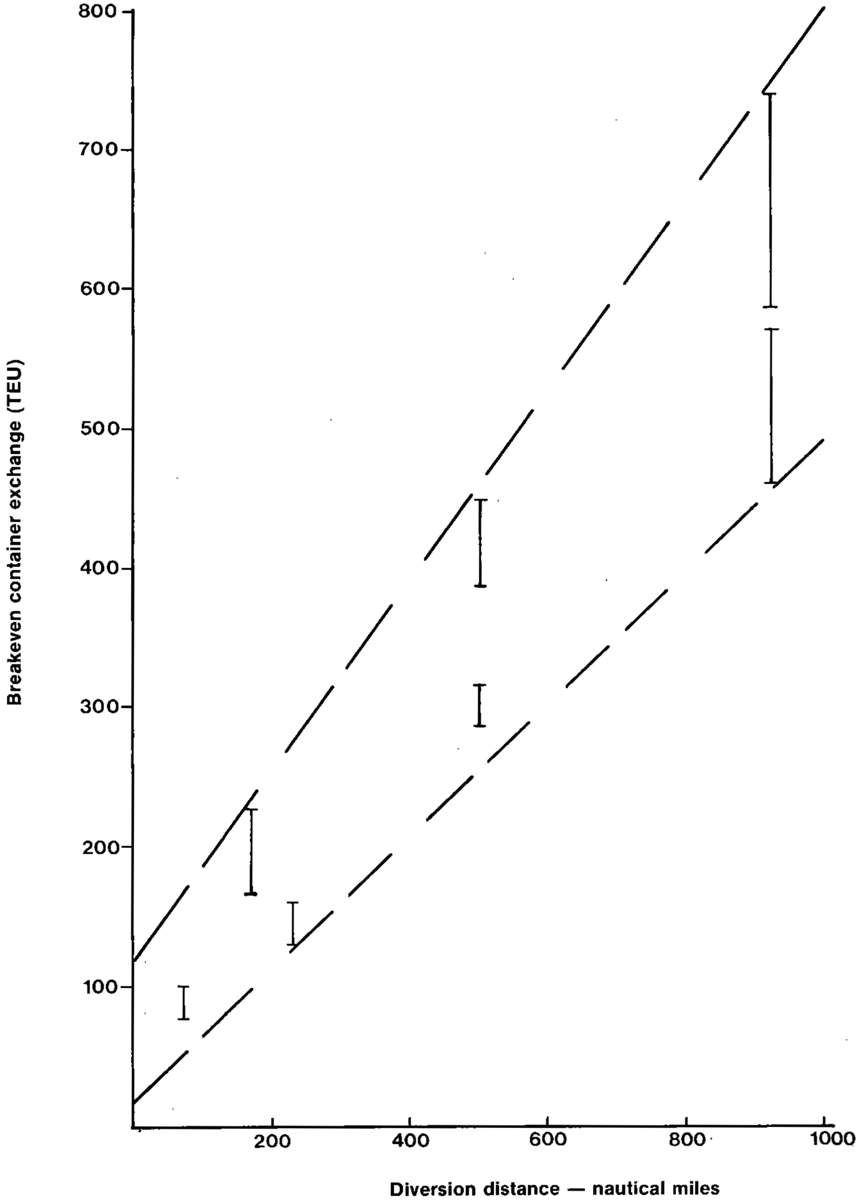



**Figure 9.1 Break-even container numbers as a function of ship diversion distance**

The analysis indicates that where financial savings accrue to shipping lines through changes in call schedules the amounts involved are small compared to the overall fleet operating costs. Thus, even if such savings were passed in their entirety to shippers the effect on freight rates, given current rate setting practices, would be small, of the order of fractions of one percent for any particular trade.

Changes to the present centralisation arrangements would have an impact on railway and port authority finances. Since the majority of containers are moved between ports by rail the adoption of direct ship calls would reduce railway revenues. Savings from reduced operating costs would not balance revenue lost and so an overall net loss would be experienced by the railway systems. Although small in comparison to total revenue from all sources this net loss would be significant in absolute terms.

Changes in aggregate port authority revenues would be small in absolute terms, but distributional effects could be significant. For the selected centralisation alternatives considered in Table 8.3 Adelaide could expect about a four per cent rise in port revenue and Brisbane about a one per cent rise. Melbourne would experience about a two per cent fall in port revenue while Sydney would experience a revenue fall of less than one per cent. Similarly, because of the relatively small changes in through-put at the ports of Sydney and Melbourne employment there would be unlikely to change significantly whereas additional workers would probably be required at the smaller ports to deal with the proportionately larger increase in traffic.

Overall, changes in such items as inventory costs of shippers would be small, improved level of service in the outports being matched by reduced level of service at the central ports. However, the fact that at the outports relatively few shippers would gain significantly while at the central ports relatively many shippers would lose slightly would tend to make the gains more visible.

Clearly, while changes to ship call patterns of the magnitude discussed here would produce relatively small changes in the national economy, they would produce benefits to the decentralised regions which would oppose the past trends towards centralised development. Taken alone, such changes would probably be insufficient to attract or retain industry, but they could be an important component of a total package including land, labour, etc. It is not possible to quantify this aspect of the present study since the impact of changes depends upon specific local conditions and particular ship movements and their relationships with particular industries. However, since it is apparent that overall transport costs are relatively insensitive to changes in ship calling patterns of the general level analysed in this study, regional benefits may well outweigh minor overall transport cost increases. Thus, if the effects of direct ship calls are judged to be positive and significant in respect of regional development then this would almost certainly outweigh any minor increase in overall transport costs which might be incurred.

# APPENDIX I—TERMS OF REFERENCE

MINISTER FOR TRANSPORT
Parliament House
CANBERRA. ACT 2600
14 January 1977

DIRECTOR,
BUREAU OF TRANSPORT ECONOMICS.

CENTRALISATION PROCEDURES IN OVERSEAS LINER TRADES

As you are aware, the May meeting of the Marine and Ports Council of Australia supported a proposal for a study of centralisation procedures in overseas liner trades.

Subsequently, the proposed terms of reference for the Study were circulated to interested parties. Examination of their responses indicates that there is no need to alter the original terms of reference. However following the examination of Commissioner Summers' third Report, the November meeting of the MPCA agreed that a fifth term of reference should be added to focus specific attention on matters affecting the movement of container cargoes.

I am now able to confirm that the terms of reference for the Study are as follows:

1. Do the existing centralisation procedures minimise total transport costs?
2. Are there alternatives which would give greater benefits for similar resource consumption?
3. Are there alternatives which are likely to encourage more decentralisation development but which incur negligible transport resource cost penalties?
4. If alternatives appear desirable, what measures may be effective in influencing shipowners to adopt shipping patterns more consistent with those alternatives?
5. Can procedures be improved for the movement of container cargoes between Australian origin/destination and ship?

Shippers and Port Authorities have shown considerable interest in this Study which runs to important issues in national development. While recognising the Study to be of substantial proportions, and therefore it is not appropriate to stipulate a time for completion, I would like to be in a position to be able to report to successive MPCA meetings on progress being made.

(P.J. NIXON)

## APPENDIX II—AUSTRALIAN OUTBOUND CONFERENCES 1980

This appendix lists details of conferences according to agreements filed pursuant to Part X of the *Trade Practices Act* 1974. This list covers only the basic conferences and does not include inter- or intra-conference agreements.

| *Conference* | *Members* | *Areas subject to agreement* |
|---|---|---|
| Australia to Europe Shipping Conference (AESC) | Associated Container Transportation (Australia) Ltd<br>Overseas Containers Limited<br>Ocean Transport and Trading Limited<br>Dolphin Line Ltd<br>Shaw Savill & Albion Co Ltd<br>The Clan Line Steamers Ltd<br>The Scottish Shire Line Ltd<br>The Peninsular & Oriental Steam Navigation Co<br>Compagnie Generale Maritime<br>Hapag-Lloyd Aktiengesellschaft<br>Nedlloyd Lijnen Bv (Nedlloyd Lines)<br>Lloyd Triestino Societa Per Anzioni Di Navigazione<br>Jadranska Slobodna Providba (Yugoslav Line)<br>Scancarriers A/S (Scandinavian Australia and New Zealand Carriers Ltd)<br>Aktieselskabet det Ostasiatiske Kompagni (The East Asiatic Company Ltd)<br>Redenaktiebolaget Transatlantic<br>Wilh. Wilhenmsen<br>Australian National Line<br>Baltic Shipping Company<br>Compania Naviera Marasia SA | Aden, Djibouti, Red Sea Ports, Gulf of Akaba Ports, Egyptian Ports, Mediterranean and North African Ports, Adriatic Sea, Aegean Sea, Turkish and Black Sea Ports, Portuguese and Spanish Ports, French, Belgian, Netherlands and German Ports, Scandanavian and Baltic Ports, UK and Eire Ports |
| Australia Northbound Shipping Conference (ANSCON) | Asia Australia Express Ltd<br>Australia Japan Container Line<br>Australian National Line<br>Knut Knutsen (Knutsen Line) | Philippines, Sabah, Brunei, Sarawak, Hong Kong, Taiwan, China, Japan and Korea (and such additional ports or areas as may be entered in Conference freight tariffs) |

| | | |
|---|---|---|
| | Orient Overseas Container Line<br>Kawasaki Kisen Kaisha<br>Mitsui Osk Lines<br>Nippon Yusen Kaisha<br>Yamashita Shinnihon Stemaship Co<br>Nedlloyd Lijnen Bv<br>(Nedlloyd Lines)<br>Rederiaktiebolaget Helsingborg<br>(Australia West Pacific Line) | |
| Australia/Pacific Rate Agreement | Farrell Lines Inc<br>Hamburg-Suedamerikanische<br>Dampschiefffahrts-Gesellschaft<br>Eggert & Amsinck<br>(Columbus Lines)<br>Pacific Australia Direct Line | Pacific Coast Ports USA and inland |
| Australia/East Canada Shipping Conference | Associated Container Transportation<br>(Australia) Ltd<br>Australian National Line<br>Farrell Lines Inc<br>Trader Navigation Co Ltd<br>(Atlanttrafik Express Service) | East Coast of Canada |
| Australia/Eastern USA Shipping Conference | ABC Containerline NV<br>Associated Container Transportation<br>(Australia) Ltd<br>Australian National Line<br>Farrell Lines Inc<br>Hamburg-Suedamerikanische<br>Dampschifffahrts-Gesellschaft<br>Eggert & Amsinck<br>(Columbus Lines)<br>Refrigerated Express Lines (A/Asia) P/L<br>Trader Navigation Co Ltd<br>(Atlanttrafik Express Service) | Atlantic and Gulf Ports of the United States of America, Puerto Rico and the Virgin Islands |
| Australia/Thailand Outward | Australian National Line<br>Australia Straits Container Line P/L | Thailand |

| | | |
|---|---|---|
| | Nedlloyd Lijnen Bv (Nedlloyd Lines)<br>Neptune Orient Lines Ltd<br>Malaysian International Shipping Corporation<br>Southern Shipping Lines | |
| Australia/West India Outward Shipping Conference (WESTINDIACON) | Nedlloyd Lijnen Bv (Nedlloyd Lines)<br>Shipping Corporation of India Ltd | West India |
| Australia/Sri Lanka Outward Shipping Conference | Nedlloyd Lijnen Bv (Nedlloyd Lines)<br>Shipping Corporation of India Ltd | Sri Lanka |
| Australia/Singapore and West Malaysia | Australian National Line<br>Blue Funnel Line Ltd<br>Kawasaki Kisen Kabushiki Kaisha<br>Nippon Yusen Kabushiki Kaisha<br>Malaysian International Shipping Corporation<br>Nedlloyd Lijnen Bv (Nedlloyd Lines)<br>Neptune Orient Lines Ltd<br>Peninsular & Oriental Steam Navigation Co<br>Shipping Corporation of India Ltd<br>Southern Shipping Lines | Singapore and Ports in West Malaysia (and other ports relevant to the trade as set out in the Freight Schedule from time |
| Australia/Indonesia Outward | Australian National Line<br>Blue Funnel Line Ltd<br>Nedlloyd Lijnen Bv (Nedlloyd Lines)<br>Neptune Orient Lines Ltd<br>PT Djakarta Lloyd<br>Nippon Yusen Kabushiki Kaisha<br>Shipping Corporation of India Ltd | Ports in Indonesia as set out in the schedule from time to time (at present Surabaya, Semerang and Djakarta) |
| Trans Tasman Freight Conference (TASMANCON) | Tucker Shipping Pty Ltd<br>Union Steamship Co of New Zealand Ltd<br>Abel Tasman Shipping Co Pty Ltd | New Zealand |

## APPENDIX III—DESCRIPTION OF MAJOR AUSTRALIAN CONTAINER TERMINALS

Information concerning major Australian container terminals referred to in this Report has been summarised in this appendix. Details of the names of companies who operate each terminal, the shipping lines that call and shift arrangements operated, as well as technical information on cranes, wharves, terminal areas and access are included.

| *Terminal* | *Operator* | *Lines served* | *Shift arrangements* | *Wharf cranes & handling gear* | *Wharf* | *Terminal area* | *Access* |
|---|---|---|---|---|---|---|---|
| MELBOURNE<br>Webb Dock<br>Berth No 4 | ANL | ANL<br>K Line<br>NYK/MOL/YSL | 5/3 roster<br>8 hour shifts | 36t single lift travelling crane. Forklifts, tractors. | Length 220m<br>Stern ramp 8.8m wide | 18 ha common with berths 1 to 3 | Road |
| MELBOURNE<br>Swanson Dock West<br>Berths 1 to 3 | Seatainers owned 50% by each of OCAL and Bulkships | OCL<br>Seabridge<br>SCONZ<br>NYK/MOL/YSL<br>Columbus<br>AJCL | 5/3 roster<br>8 hour shifts | 3 x 45t twin lift travelling cranes. Straddle carriers. Forklifts. Tractors and trailers. | Length 765m | 19 ha | Road<br>Rail |
| MELBOURNE<br>Swanson Dock East<br>Berth No 1 | Common user. Predominantly used by Liner Services, owned:<br>40% by Wilhelmsen<br>40% by Farrell<br>20% by Scan Carriers | Farrell<br>Scan Carriers<br>OOCL<br>MOL<br>AES<br>AWPL<br>Malaysian Shipping | 5/2 roster<br>7 hour shifts | 45t twin lift travelling crane. Straddle carriers. Forklifts. | Length 295m | 12 ha | Road<br>Rail |
| MELBOURNE<br>Swanson Dock East<br>Berth No 2 | Common user. Predominantly used by Trans-Ocean Terminals and Liner Services | ACTA/ANL<br>PACE<br>AWPL<br>AAE<br>Blue Star<br>Farrell<br>Scan Carriers<br>OOCL<br>MOL<br>AES<br>Malaysian Shipping | 5/2 roster<br>7 hour shifts | 45t twin lift travelling crane. Straddle Carriers. Forklifts. | Length 337m | 8 ha | Road<br>Rail |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MELBOURNE<br>Swanson Dock East<br>Berth No 3 | Common user. Predominantly used by Trans-Ocean Terminals which is a division of Terminal Properties of Aust, who are owned:<br>2/3 by ACTA<br>1/3 by ANL | ACTA/ANL<br>PACE<br>AWPL<br>AAE<br>Blue Star | | 45t twin lift crane.<br>Forklifts.<br>30.5t rail mounted electric crane services rail sidings. | Length 295m | | Road<br>Rail |
| SYDNEY<br>White Bay<br>Berths No 4, 5 & 6 | Seatainers owned 50% by each of OCAL and Bulkships | OCL<br>Seabridge<br>SCONZ<br>NYK/MOL/YSL | 5/3 roster<br>8 hour shifts | 3 x 45t twin lift travelling cranes with 66t heavy lifting capacity.<br>Forklifts.<br>45t trailers.<br>3 x 45t overhead cranes in shed. | Length 680m | 10.3 ha | Road<br>Direct rail to Chullora & Villawood depots. |
| SYDNEY<br>Glebe Island<br>Berths No 1 & 2 | Glebe Is Terminals owned:<br>25% by Columbus<br>25% by Farrell<br>25% by Liner Services<br>25% by Patrick Ops. | Columbus<br>Farrell<br>AAE<br>AES<br>AWPL<br>ABC<br>Fesco<br>Zim | 5/3 roster<br>8 hour shifts | 2 x 35t travelling cranes with 63t heavy lift capacity.<br>Transtainers.<br>Forklifts. | Length 467m | 9.7 ha | Road<br>Direct rail to Chullora & Villawood depots. |
| SYDNEY<br>Botany Bay | ANL | ACTA/ANL<br>PACE<br>OOCL<br>ESS<br>KASS<br>ANRO 25t<br>ANL Coastal | 5/3 roster<br>8 hour shifts | 3 x 36t single lift travelling cranes.<br>Transtainers.<br>Forklifts.<br>ITVs.<br>luffing crane. | Length 1000m<br>3 ramps for ro-ro vessels | 42.2 ha | Road<br>Rail |
| BRISBANE<br>Hamilton<br>Berths No 1 & 2 | Briswharves owned by P & O | OCAL<br>NYK/MOL/YSL<br>ANL<br>AAE<br>OOCL<br>AWPL<br>Columbus<br>Farrell<br>PACE<br>AES | 5/3 roster<br>8 hour shifts<br>(Hamilton No. 2 only. Labour at No. 1 berth only on demand) | 45t twin lift travelling crane.<br>Straddle carriers.<br>Forklifts.<br>5t overhead crane for empty containers. | Length 360m | 18.5 ha | Road<br>Narrow gauge rail to Acacia Ridge. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BRISBANE<br>Newstead | ANL | K Line<br>NYK/MOL/YSL<br>ANL | 1 x 7 hour shift per day with extensions of 2 or 4 hours | 25t travelling crane.<br>Forklifts. | Length 225m.<br>Stern ramp. | 3.6 ha | Road |
| BRISBANE<br>Fisherman Is<br>Berth No 1 | BATL, owned:<br>60% by Briswharves<br>40% by ANL | | To be advised | 36t single lift crane with the option of hiring a second crane from Berth No. 2 | Length 250m with further 52m including ramp. | 12 ha | Road<br>Narrow gauge rail to Acacia Ridge. |
| BRISBANE<br>Fisherman Is<br>Berth No 2 | Seatainers owned 50% by each of OCAL and Bulkships | Not fully operational | To be determined | 36t single lift with the option of hiring a second 52m crane from Berth No. 1. | Length 300m with further including ramp | 10 ha | Road<br>Narrow gauge rail to Acacia Ridge |
| FREMANTLE<br>North Quay<br>Berths No 11 & 12 | Seatainers owned 50% by each of OCAL and Bulkships | OCL<br>Seabridge<br>ACTA/ANL<br>K Line (Mitsui-OSK-NYK)<br>AES<br>Southern Shipping<br>ABC<br>ANRO<br>Blue Star<br>MISC<br>NYK (Gulf) | 5/2 roster<br>7 hour shift | 45t twin lift crane with 65t heavy lift capacity. | Length 429m<br>Stern ramp | 6.3 ha | Road<br>Rail |
| ADELAIDE<br>Outer Harbour<br>Berth No 6 | Trans-Ocean Terminals which is a division of Terminal Properties of Aust, who are owned:<br>2/3 by ACTA<br>1/3 by ANL | OCL<br>Seabridge<br>ACTA/ANL<br>Safocean<br>Jumbo | 5/2 roster<br>7 hour shifts | 45t single lift travelling crane.<br>Straddle carrier.<br>Sideloaders.<br>Forklifts. | Length 303m | 8 ha | Road<br>Rail |

# APPENDIX IV—CONTAINER MOVEMENTS THROUGH AUSTRALIAN PORTS 1976-77

The definitions of trade areas adopted in this Report are those used by the Australian Bureau of Statistics and the Department of Transport Australia in their shipping publications up to July 1979. Since that date, a revised list of trade areas has been adopted. Both classifications are outlined in the Department of Transport Australia publication *Port Related Statistics Collections* (1981). Table IV.1 details the definitions adopted.

TABLE IV.1—TRADE AREAS AND THEIR DEFINITION

| *Trade area* | *Definition* |
|---|---|
| UK/Europe | Including the UK, Mediterranean ports, Atlantic and North Sea ports, Russian Baltic and Black Sea ports. |
| East Coast North America (ECNA) | Atlantic Coast of Canada and USA, Newfoundland, Great Lakes, Gulf Ports of USA. |
| West Coast North America (WCNA) | Pacific Coast of USA and Canada, Alaska, Hawaii. |
| Japan/Korea | Japan, South and North Korea. |
| East Asia | Philippines, Hong Kong, Taiwan, Macau, USSR (Eastern Region), China. |
| South East Asia | West Malaysia, Singapore, Indonesia, Thailand, Brunei, Kampuchea, Sabah, Sarawak, Vietnam. |
| Pacific | Papua New Guinea, New Hebrides, New Caledonia, Fiji, Nauru and other Pacific Islands. |
| Other | Trade areas not elsewhere specified such as Persian Gulf, Central Asia, Africa and Central and South America. |

*Source:* Department of Transport Australia (1981).

Tables IV.2 to IV.7 detail container movements by trade area through Australian ports and for the ports of Melbourne, Sydney, Brisbane, Fremantle and Adelaide respectively, for 1976-77. This information was collected as part of the BTE survey of the movement of overseas containers throughout Australia (BTE 1981, unpublished).

TABLE IV.2—CONTAINER MOVEMENTS THROUGH AUSTRALIAN PORTS, 1976-77

*(TEUs)*

| *Trade area* | *Data source* | *Empty imports* | *All imports* | *Empty exports* | *All exports* | *Total movements* |
|---|---|---|---|---|---|---|
| UK/Europe | PA[a] | 1 144 | 83 601 | 19 477 | 81 818 | 165 419 |
| | ASIA[b] | 1 900 | 112 132 | 24 564 | 103 476 | 215 608 |
| ECNA[c] | PA | 2 585 | 55 501 | 15 510 | 38 524 | 94 025 |
| | ASIA | 2 535 | 45 226 | 14 550 | 40 970 | 86 196 |
| WCNA[d] | PA | 359 | 11 207 | 2 396 | 8 950 | 20 157 |
| | ASIA | 1 646 | 18 174 | 5 079 | 19 618 | 37 792 |
| Japan/E Asia | PA | 3 692 | 136 592 | 36 940 | 144 192 | 280 784 |
| | ASIA | 5 427 | 142 672 | 40 079 | 151 030 | 293 702 |
| SE Asia | PA | 714 | 12 728 | 1 756 | 16 936 | 29 664 |
| | ASIA[e] | 453 | 6 615 | 996 | 8 450 | 15 065 |
| Pacific | PA | 3 651 | 5 107 | 350 | 7 152 | 12 259 |
| | ASIA | 4 143 | 5 896 | 375 | 8 157 | 14 053 |
| Other | PA | 444 | 24 995 | 7 995 | 31 231 | 56 226 |
| | ASIA | 744 | 6 045 | 1 795 | 7 380 | 13 425 |
| TOTAL | PA | 12 589 | 329 731 | 84 424 | 328 803 | 658 534 |
| | ASIA | 16 848 | 336 760 | 87 438 | 339 081 | 675 841 |

a. Port authorities.
b. Australian Stevedoring Industry Authority.
c. East Coast North America.
d. West Coast North America.
e. Data represents trade with Malaysia only.

*Source:* BTE (1981, unpublished).

TABLE IV.3—CONTAINER MOVEMENTS THROUGH THE PORT OF MELBOURNE, 1976-77

*(TEUs)*

| *Trade area* | *Data source* | *Empty imports* | *All imports* | *Empty exports* | *All exports* | *Total movements* |
|---|---|---|---|---|---|---|
| UK/Europe | PA[a] | 297 | 27 358 | 2 343 | 26 798 | 54 156 |
| | ASIA[b] | 853 | 54 480 | 9 793 | 48 694 | 103 174 |
| ECNA[c] | PA | 342 | 27 204 | 4 758 | 14 592 | 41 796 |
| | ASIA | 411 | 23 304 | 7 021 | 20 295 | 43 599 |
| WCNA[d] | PA | 346 | 6 246 | 965 | 4 097 | 10 343 |
| | ASIA | 364 | 6 754 | 2 104 | 7 005 | 13 759 |
| Japan/E Asia | PA | 2 064 | 65 168 | 16 855 | 72 420 | 137 588 |
| | ASIA | 2 498 | 64 150 | 16 448 | 78 872 | 143 022 |
| SE Asia | PA | 40 | 4 617 | 528 | 9 667 | 14 284 |
| | ASIA[e] | 7 | 2 756 | 41 | 4 035 | 6 791 |
| Pacific | PA | 2 425 | 3 636 | 42 | 5 168 | 8 804 |
| | ASIA | 2 128 | 3 281 | 281 | 3 712 | 6 993 |
| Other | PA | 185 | 15 713 | 1 934 | 21 202 | 36 915 |
| | ASIA | 85 | 2 818 | 794 | 3 805 | 6 623 |
| TOTAL | PA | 5 699 | 149 942 | 27 425 | 153 944 | 303 886 |
| | ASIA | 6 346 | 157 543 | 36 482 | 166 418 | 323 961 |

a. Port authorities.
b. Australian Stevedoring Industry Authority.
c. East Coast North America.
d. West Coast North America.
e. Data represents trade with Malaysia only.

*Source:* BTE (1981, unpublished).

TABLE IV.4—CONTAINER MOVEMENTS THROUGH THE PORT OF SYDNEY, 1976-77

(TEUs)

| Trade area | Data source | Empty imports | All imports | Empty exports | All exports | Total movements |
|---|---|---|---|---|---|---|
| UK/Europe | PA[a] | 485 | 46 312 | 13 518 | 35 454 | 81 766 |
| | ASIA[b] | 189 | 47 661 | 11 075 | 35 773 | 83 434 |
| ECNA[c] | PA | 477 | 21 621 | 8 969 | 14 552 | 36 173 |
| | ASIA | 404 | 16 586 | 5 461 | 10 899 | 27 485 |
| WCNA[d] | PA | 21 | 3 154 | 908 | 1 788 | 4 942 |
| | ASIA | 296 | 8 050 | 2 055 | 7 826 | 15 876 |
| Japan/E Asia | PA | 290 | 54 627 | 15 037 | 46 197 | 100 824 |
| | ASIA | 446 | 59 392 | 14 598 | 44 942 | 104 334 |
| SE Asia | PA | 20 | 6 471 | 501 | 3 900 | 10 371 |
| | ASIA[e] | 9 | 2 914 | 213 | 2 921 | 5 835 |
| Pacific | PA | 1 226 | 1 366 | 304 | 1 589 | 2 955 |
| | ASIA | 1 467 | 1 933 | 69 | 3 806 | 5 739 |
| Other | PA | 0 | 7 461 | 5 890 | 7 914 | 15 375 |
| | ASIA | 473 | 2 395 | 660 | 2 308 | 4 703 |
| TOTAL | PA | 2 519 | 141 012 | 45 127 | 111 394 | 252 406 |
| | ASIA | 3 284 | 138 931 | 34 131 | 108 475 | 247 406 |

a. Port authorities.
b. Australian Stevedoring Industry Authority.
c. East Coast North America.
d. West Coast North America.
e. Data represents trade with Malaysia only.

*Source:* BTE (1981, unpublished).

TABLE IV.5—CONTAINER MOVEMENTS THROUGH THE PORT OF BRISBANE, 1976-77

(TEUs)

| Trade area | Data source | Empty imports | All imports | Empty exports | All exports | Total movements |
|---|---|---|---|---|---|---|
| UK/Europe | PA[a] | 0 | 1 195 | 0 | 1 874 | 3 069 |
| | ASIA[b] | 262 | 1 387 | 205 | 2 611 | 3 998 |
| ECNA[c] | PA | 1 541 | 5 253 | 1 758 | 9 343 | 14 596 |
| | ASIA | 1 636 | 4 544 | 1 725 | 8 508 | 13 052 |
| WCNA[d] | PA | 167 | 978 | 274 | 2 060 | 3 038 |
| | ASIA | 678 | 1 766 | 485 | 2 679 | 4 445 |
| Japan/E Asia | PA | 1 083 | 13 755 | 4 340 | 19 665 | 33 420 |
| | ASIA | 2 270 | 16 187 | 8 475 | 24 539 | 40 726 |
| SE Asia | PA | 0 | 0 | 0 | 205 | 205 |
| | ASIA[e] | 437 | 486 | 526 | 526 | 1 012 |
| Pacific | PA | 0 | 96 | 0 | 354 | 450 |
| | ASIA | 548 | 682 | 25 | 639 | 1 321 |
| Other | PA | 0 | 96 | 0 | 760 | 856 |
| | ASIA | 15 | 310 | 41 | 348 | 658 |
| TOTAL | PA | 2 791 | 21 373 | 6 322[f] | 34 261 | 55 634 |
| | ASIA | 5 846 | 25 362 | 11 482 | 39 850 | 65 212 |

a. Port authorities.
b. Australian Stevedoring Industry Authority.
c. East Coast North America.
d. West Coast North America.
e. Data represents trade with Malaysia only.
f. Numbers do not add due to inconsistency in source data.

*Source:* BTE (1981, unpublished).

TABLE IV.6—CONTAINER MOVEMENTS THROUGH THE PORT OF FREMANTLE, 1976-77

(TEUs)

| Trade area | Data source | Empty imports | All imports | Empty exports | All exports | Total movements |
|---|---|---|---|---|---|---|
| UK/Europe | PA[a] | 321 | 7 756 | 3 544 | 15 488 | 23 244 |
| | ASIA[b] | 516 | 7 744 | 3 341 | 14 621 | 22 365 |
| ECNA[c] | PA | 225 | 1 411 | 25 | 25 | 1 436 |
| | ASIA | 84 | 792 | 343 | 1 268 | 2 060 |
| WCNA[d] | PA | 3 | 265 | 76 | 117 | 382 |
| | ASIA | 294 | 1 064 | 379 | 1 520 | 2 584 |
| Japan/E Asia | PA | 175 | 2 257 | 694 | 3 585 | 5 842 |
| | ASIA | 180 | 2 689 | 538 | 2 247 | 4 936 |
| SE Asia | PA | 463 | 1 066 | 686 | 2 172 | 3 238 |
| | ASIA[e] | 0 | 191 | 186 | 627 | 818 |
| Pacific | PA | 0 | 2 | 4 | 3 | 5 |
| | ASIA | 0 | 0 | 0 | 0 | 0 |
| Other | PA | 59 | 139 | 221 | 344 | 483 |
| | ASIA | 161 | 488 | 277 | 777 | 1 265 |
| TOTAL | PA | 1 246 | 12 896 | 5 250 | 21 734 | 34 630 |
| | ASIA | 1 235 | 12 968 | 5 064 | 21 060 | 34 028 |

a. Port authorities.
b. Australian Stevedoring Industry Authority.
c. East Coast North America.
d. West Coast North America.
e. Data represents trade with Malaysia only.

*Source:* BTE (1981, unpublished).

TABLE IV.7—CONTAINER MOVEMENTS THROUGH THE PORT OF ADELAIDE, 1976-77

(TEUs)

| Trade area | Data source | Empty imports | All imports | Empty exports | All exports | Total movements |
|---|---|---|---|---|---|---|
| UK/Europe | PA[a] | 10 | 795 | 54 | 1 685 | 2 480 |
| | ASIA[b] | 80 | 860 | 150 | 1 777 | 2 637 |
| ECNA[c] | PA | 0 | 12 | 0 | 12 | 24 |
| | ASIA | 0 | 0 | 0 | 0 | 0 |
| WCNA[d] | PA | 15 | 331 | 77 | 346 | 677 |
| | ASIA | 14 | 540 | 56 | 588 | 1 128 |
| Japan/E Asia | PA | 2 | 199 | 10 | 106 | 305 |
| | ASIA | 33 | 254 | 20 | 430 | 684 |
| SE Asia | PA | 2 | 315 | 33 | 673 | 988 |
| | ASIA[e] | 0 | 268 | 30 | 341 | 609 |
| Pacific | PA | 0 | 3 | 0 | 36 | 39 |
| | ASIA | 0 | 0 | 0 | 0 | 0 |
| Other | PA | 0 | 1 686 | 0 | 964 | 2 650 |
| | ASIA | 10 | 34 | 23 | 142 | 176 |
| TOTAL | PA | 29 | 3 341 | 174 | 3 822 | 7 163 |
| | ASIA | 137 | 1 956 | 279 | 3 278 | 5 234 |

a. Port authorities.
b. Australian Stevedoring Industry Authority.
c. East Coast North America.
d. West Coast North America.
e. Data represents trade with Malaysia only.

*Source:* BTE (1981, unpublished).

## APPENDIX V—GENERAL STATEMENT OF RESOURCE COST CALCULATIONS

The approach to calculation of resource costs in this study can be stated in general terms. With the present centralisation procedures, the container trade generated in the region of port X is transported between ports X and Y by rail and transferred to or from ships at the container terminals at Y. Under an alternative centralisation procedure, some ships carrying this trade would be diverted to X (either before or after calling at Y), thus reducing the need for rail transport between X and Y. The issue is to determine the costs (or savings) associated with the new procedure and hence the economic justification (if any) for this alternative.

The overall cost of adopting a direct call at port X rather than transfer through port Y is expressed as:

$$C_x = A + B - C - D \qquad (V.1)$$

where: A = cost of ship diversion to X, including additional port costs
B = additional terminal costs at X
C = terminal savings at Y
D = rail transport savings.

Conceptually, it is possible to present a generalised model of the cost structure for each term in the above expression. Thus, the cost of ship diversions to X can be expressed as the sum of fixed and variable parts:

$$A = A_f + A_v d \qquad (V.2)$$

where: $A_f$ = fixed cost associated with the diversion to port X, regardless of the distance of diversion, and can include such items as the costs of pilotage and of fuel for tugs
$A_v$ = variable cost of the diversion per nautical mile of extra distance, d, travelled. It represents fuel consumption at sea and in port, as well as repair and maintenance costs.

In a similar manner, terminal costs at X can be expressed approximately as:

$$B = B_f + B_v n_c \qquad (V.3)$$

where: $B_f$ = fixed cost associated with terminal operations at port X, regardless of the number of containers to be exchanged. In a short run analysis this cost can be assumed to equal zero.
$B_v$ = variable cost per container and consists of fuel used by terminal machinery during the handling operation, repair and maintenance costs and the cost of labour.
$n_c$ = total number of containers to be handled.

The terminal savings at Y are given by a similar expression:

$$C = C_f + C_v n_c \qquad (V.4)$$

where: $C_f$ = fixed cost associated with terminal operations at port Y. These costs are assumed to equal zero if the ship always handles containers at Y, as the alternative procedure merely reduces the number of containers handled at port Y by $n_c$.
$C_v$ = variable cost per container.

Rail transport savings are achieved by reducing the number of containers carried by rail between ports X and Y. These savings can be expressed as:

$$D = D_f + D_v d_r n_c \qquad (V.5)$$

where: $D_f$ = fixed cost associated with rail operations between X and Y. These costs can be assumed to equal zero for a short run analysis.

$D_v$ = variable rail cost per kilometre for each container carried

$d_r$ = rail distance between the two ports.

The quantity $n_c$ is the decision variable. By rearranging the equations (V.1) to (V.5) the overall cost of adopting a direct call can be expressed as:

$$C_x = (A_f + A_v d + B_f - C_f - D_f) + (B_v - C_v - D_v d_r) n_c \qquad (V.6)$$

There is a 'break-even' value of $n_c$ (the total number of containers to be handled), at which costs become zero. This can be expressed as:

$$n_c = \frac{A_f + A_v d + B_f - C_f - D_f}{D_v d_r + C_v - B_v} \qquad (V.7)$$

In the event fixed costs do not change as a result of making a direct call, $A_f$, $B_f$, $C_f$ and $D_f$ are zero, and equation V.7 becomes:

$$n_c = \frac{A_v d}{D_v d_r + C_v - B_v} \qquad (V.8)$$

In the simplest situation, terminal operating costs, $B_v$ and $C_v$, are the same, and the break even volume, $n_c$, can be expressed as:

$$n_c = \frac{A_v d}{D_v d_r} \qquad (V.9)$$

Since $A_v$ and $D_v$ have opposite signs, the break even volume is simply the ratio of ship diversion costs, $A_v d$, to rail operating costs per container, $D_r d_v$.

For container numbers greater than $n_c$, the alternative centralisation procedure is justified in resource terms. Expression (V.6) can be represented graphically in a plot of cost versus number of containers, as shown in Figures 7.1 to 7.10. The intercept of the line with the $n_c$ (or TEUs handled per call) axis gives the 'break-even' value $n_c$ from equation (V.7). As there is a range of likely values for many of the variables used in the analysis, the expression shown as equation (V.6) is properly represented by an uncertainty band. For values of $n_c$ outside the band, an unambiguous decision can be made about the centralisation alternative under consideration. For values within the band more detailed analysis is required.

# APPENDIX VI—SHIP AND PORT RESOURCE COSTS

Ship and port cost estimates are based on information from a forthcoming BTE Information Paper (BTE 1982), in which costs were calculated for 1978, updated to December 1980. Relevant short-run ship costs are fuel consumed and repair and maintenance expenditure related to the alternative ship calling arrangement. The only port cost of significance is fuel consumed by tug boats used for berthing container ships. All costs have been calculated using as a basis the four typical vessels described in Table 6.1. These costs are summarised in Table 6.2.

## CONTAINER SHIP FUEL CONSUMPTION

Estimated hourly fuel consumption is shown in Table VI.1 for vessels at sea and in port. All vessels including those designed for higher speeds are assumed to operate at 19 knots. The fuel consumption rate for vessels under pilotage is assumed equal to the 'at sea' rate.

TABLE VI.1—FUEL CONSUMPTION FOR TYPICAL CONTAINER SHIPS

| *Trade* | *Vessel size and engine type* | *Fuel consumption at sea (tonnes/hr MFO)* | *Fuel consumption in port (tonnes/hr MFO)* | *Fuel cost[a] at sea ($/hr)* | *Fuel cost[a] in port ($/h)* |
|---|---|---|---|---|---|
| UK/Europe | 30 000 DWT Steam Turbine | 6.76[b] | 0.87 | 1 304 | 168 |
| Japan/Korea | 28 000 DWT Diesel | 4.83[b] | 0.61[c] | 933 | 119 |
| East Asia | 20 000 DWT Diesel | 3.85 | 0.44 | 743 85 | |
| ECNA | 23 000 DWT Steam Turbine | 4.96[b] | 0.67 | 958 | 129 |

a. Based on a marine fuel oil (MFO) price of A$193/tonne at December 1980.
b. A slow steaming factor of 0.85 has been used for these vessels.
c. Diesel-engined vessels use marine diesel oil (MDO) for generating auxiliary power in port. This consumption has been converted to an equivalent MFO consumption using an MDO/MFO price ratio of 1.5 at December 1980.

*Source:* Fuel consumption estimated from BTE (1982).
Fuel prices from BP (1980).

Pilotage fuel costs have been based on the pilotage distance into port shown in Table VI.2.

The fuel costs during pilotage are tabulated for each port in Table 6.2.

## CONTAINER SHIP REPAIRS AND MAINTENANCE

Repairs and maintenance include running repairs whilst the ship is in service as well as periodic or fixed-interval maintenance, survey and damage repairs. Estimated rates, based on BTE (1982) are given in Table 6.2.

TABLE VI.2—PILOTAGE DISTANCES, PORTS OF MELBOURNE, SYDNEY, BRISBANE AND ADELAIDE

*(nautical miles)*

| *Port* | *Distance* |
|---|---|
| Melbourne | 48 |
| Sydney | 7 |
| Brisbane | 57 to Fisherman Islands |
| Adelaide | 7 to Outer Harbour |

*Source:* Department of Transport Australia (1980b).

## TUG BOAT FUEL CONSUMPTION

Container ships are assumed to require the services of two 1864 KW (2500 BHP) and one 1119 KW (1500 BHP) tug boats for a total of 4 hours for each port visit. A fuel consumption rate of 201 grams per kilowatt-hour has been assumed for each tug with a marine fuel oil price of A$193 at December 1980, giving a total fuel cost of $750 per port call.

# APPENDIX VII—RESOURCE COST OF LABOUR AT CONTAINER TERMINALS

Resource costs have been calculated only for the ship loading-unloading operation. Other yard functions are assumed to be unaffected by a change in throughput caused by different ship calling schedules. The only exception is in the rail loading-unloading operation at container terminals in Sydney and Melbourne. Under the alternative centralisation arrangements, fewer containers would be transhipped from these ports, which would allow additional labour savings through a reduction in the rail transport operation.

Table VII.1 details the estimated number of employees required per shift to perform the loading-unloading operation, using either one or two cranes and for two different ship types. The number of employees normally required to perform the rail transport loading-unloading operation is also shown.

TABLE VII.1—LABOUR REQUIREMENTS BY VESSEL TYPE AND CRANE COMBINATION

*(employees/shift)*

| *Operation* | *Pure cellular vessel* | | *deck vessel* |
|---|---|---|---|
| | *Using one crane*[a] | *Using two cranes* | *Using one crane* |
| Ship loading-unloading[b] | 9 | 16-18 | 13-15 |
| Rail loading-unloading[c] | 6 | 6 | 6 |

a. Cranes generally refer to portal cranes. A few installations do have slewing-luffing cranes available.
b. Number of employees required to perform the ship-to-shore and shore-to-stack operation.
c. Number of employees required for typical rail loading-unloading operation.

*Source:* Information supplied by operators.

Waterside workers at container terminals are employed under various Special Award Agreements which entitle them to separate pay and hours arrangements compared with workers employed under Normal Award conditions[1]. The wages paid to waterside workers classified as permanent employees are a function of the number of hours worked, with a minimum weekly guaranteed payment. In addition to wages payments for hours worked, idle time payments are also made to employees for shifts where they are rostered but not required to work.

Table VII.2 presents average hourly wage and idle time rates for waterside workers classified under Special Agreement Awards at the ports of Melbourne, Sydney, Brisbane and Adelaide for the December Quarter 1980. The difference between the wage and idle time rates are also shown in the table.

The resource cost per shift for scheduling or cancelling a shift (shown in Table 6.3), has been calculated on the basis of information contained in the tables in this appendix.

1. At 30 December 1980, 3127 out of the total 8526 waterside workers permanently employed at Australian ports were classified under various Special Awards.

TABLE VII.2—AVERAGE WAGE AND IDLE TIME RATES FOR WATERSIDE WORKERS CLASSIFIED UNDER SPECIAL AGREEMENTS, DECEMBER QUARTER 1980

($/hour)

| Port | Wage[a] | Idle time[b] | Wage - Idle time |
|---|---|---|---|
| Melbourne | 12.04 | 6.50 | 5.54 |
| Sydney | 12.38 | 6.50 | 5.88 |
| Brisbane | 11.77 | 6.00 | 5.77 |
| Adelaide | 8.94 | 6.30 | 2.64 |

a. Excludes compensation, long service, redundancy, superannuation, pro-rata annual leave or sick leave on retirement.

b. Full shift idle time. Part shift idle time is included in wages.

*Source:* Wage from Department of Transport Australia (1980a). Idle time derived from Department of Transport Australia (1980a).

# APPENDIX VIII—RESOURCE COST OF RAIL TRANSPORT

The cost of transporting a container by rail along the Melbourne-Adelaide and Sydney-Brisbane corridors has been estimated using information supplied by VicRail and Australian National and from discussions with Queensland Railways. The cost components shown in Tables 6.6 and 6.7 have been derived using the unit costs presented in Table VIII.1, together with the following information and assumptions:

- the rail distance from Melbourne to Adelaide is 778 km;
- the rail distance from Sydney to Brisbane is 1000km;
- a typical train on the Melbourne-Adelaide corridor weighs 1000 gross tonnes, consists of 19 wagons and carries 44 TEUs; and
- a typical train on the Sydney-Brisbane corridor weighs 750 gross tonnes, consists of 15 wagons and carries 36 TEUs.

The basis of unit costs shown in Table VIII.1 varies depending on the cost item quoted and its source. For fuel and locomotive maintenance two cost estimates are presented, representing data from different sources. Both estimates were used to calculate the fuel and locomotive maintenance costs presented in Chapter 6.

TABLE VIII.1—UNIT COSTS FOR THE TRANSPORT OF A CONTAINER BY RAIL, DECEMBER QUARTER 1980

| *Cost item* | *Unit cost* |
|---|---|
| Fuel | $1.39/km to $1.99/1000 gross tonne km[a] |
| Crew | $0.78/km[b] |
| Track maintenance | $0.71/1000 gross tonne km |
| Locomotive maintenance: | |
| Melbourne-Adelaide | $0.32/1000 gross tonne km to $0.39/km[c] |
| Sydney-Brisbane | $0.32/1000 gross tonne km to $0.34/km[c] |
| Wagon maintenance | $0.0226/wagon km |
| Brake van maintenance | $0.0833/km |
| Shunting | $8.52/wagon |
| Rail terminal operation[d] | $5.50/TEU |

a. Based on an average world price of 25.78 cents per litre.
b. Includes allowance for annual leave, long service leave and superannuation.
c. Based on weighted average for the types of locomotives in use.
d. Only included for the Sydney-Brisbane route, for exchange of containers between rail gauges at Acacia Ridge. Based on a BTE estimate.

*Source:* Various rail authorities.

# APPENDIX IX—RESOURCE COST ANALYSIS

Resource costs and savings which result from the adoption of alternative centralisation arrangements are shown in Tables IX.1 to IX.4 for selected cases. The results shown in these tables represent cases where the number of containers handled during the call produces an approximate break-even result in resource cost terms. To derive the curves presented in Figures 7.1 to 7.10, the resource cost calculations must be repeated for a range of TEU exchanges.

The at-sea fuel costs in Tables IX.1 to IX.4 are based on the distance by which the typical ship must divert from its present route to call at the additional port. The diversion distance for alternatives considered are shown in Figures 7.1 to 7.10.

Time spent in port was estimated using the container handling rates shown in Table 6.4, with a two-hour allowance at either end of the cargo operation. Labour costs are based on the estimated in-port time and the cost per shift of labour shown in Table 6.3.

The remaining costs and savings presented in the tables are based on unit costs shown in Tables 6.2, 6.6 and 6.7.

TABLE IX.1—TYPICAL CALCULATIONS, RESOURCE COST ANALYSIS—UK/EUROPE TRADE

*($)*

| *Cost item* | *Resource cost* | | |
|---|---|---|---|
| | *Adelaide call 200 TEUs* | *Adelaide call (omit Sydney) 250 TEUs* | *Brisbane call 400 TEUs* |
| Fuel | | | |
| at sea | -11 461 | 61 425 | -34 384 |
| pilotage | -961 | — | -7 824 |
| in feeder port | -3 696 to -3 192 | -4 368 to -3 864 | -4 872 to -3 360 |
| in major port | 1 344 to 2 184 | 1 680 to 2 688 | 2 688 to 4 200 |
| Repair and maintenance | -439 | 2 355 | -1 318 |
| Tug boat fuel | -750 | — | -750 |
| Terminal labour | | | |
| feeder port | -498 to -332 | -498 | -1 660 to -830 |
| major port | 665 to 1 330 | 1 330 | 1 412 to 2 824 |
| Rail operations | 13 850 to 16 200 | 17 313 to 20 250 | 41 060 to 43 220 |
| Net saving | -1 946 to 2 579 | 79 237 to 83 686 | -5 648 to 1 778 |
| Net saving/TEU | -10 to 13 | 317 to 334 | -14 to 4 |

NOTE: A - corresponds to a cost, and a + to a saving.

TABLE IX.2—TYPICAL CALCULATIONS, RESOURCE COST ANALYSIS—JAPAN/KOREA TRADE

($)

| Cost item | Resource cost | |
|---|---|---|
| | Adelaide call 600 TEUs | Brisbane call 100 TEUs |
| Fuel | | |
| at sea | -44 588 | -3 143 |
| pilotage | -687 | -5 598 |
| in feeder port | -6 902 to -5 831 | -1 309 to -952 |
| in major port | 2 856 to 4 403 | 476 to 833 |
| Repair and maintenance | -2 246 | -158 |
| Tug boat fuel | -750 | -750 |
| Terminal labour | | |
| feeder port | -1 162 to -996 | -415 |
| major port | 1 995 to 3 325 | 706 |
| Rail operations | 41 550 to 48 600 | 10 265 to 10 805 |
| Net saving | -9 934 to 1 230 | 74 to 1 328 |
| Net saving/TEU | -17 to 2 | 1 to 13 |

NOTE: A - corresponds to a cost, and a + to a saving.

TABLE IX.3—TYPICAL CALCULATIONS, RESOURCE COST ANALYSIS—EAST ASIA TRADE

($)

| Cost item | Resource cost | | |
|---|---|---|---|
| | Adelaide call 500 TEUs | Adelaide call (around Australia route) 150 TEUs | Brisbane call 75 TEUs |
| Fuel | | | |
| at sea | -35 508 | -8 955 | -2 503 |
| pilotage | -547 | -547 | -4 458 |
| in feeder port | -4 165 to -3 570 | -1 445 to -1 275 | -765 to -595 |
| in major port | 1 870 to 2 975 | 510 to 935 | 425 to 510 |
| Repair and maintenance | -1 673 | -422 | -118 |
| Tug boat fuel | -750 | -750 | -750 |
| Terminal labour | | | |
| feeder port | -996 to -830 | -332 | -415 |
| major port | 1 746 to 2 910 | 582 to 1 164 | 706 |
| Rail operations | 34 625 to 40 500 | 10 388 to 12 150 | 7 699 to 8 104 |
| Net saving | -5 398 to 3 507 | -971 to 1 968 | -179 to 481 |
| Net saving/TEU | -11 to 7 | -6 to 13 | -2 to 6 |

NOTE: A - corresponds to a cost, and a + to a saving.

TABLE IX.4—TYPICAL CALCULATIONS, RESOURCE COST ANALYSIS—ECNA TRADE

*($)*

| *Cost item* | *Resource cost* | |
|---|---|---|
| | *Adelaide call 600 TEUs* | *Brisbane call 300 TEUs* |
| Fuel | | |
| at sea | -45 782 | -25 260 |
| pilotage | -706 | -5 748 |
| in feeder port | -7 482 to -6 321 | -2 967 to -2 064 |
| in major port | 3 096 to 4 773 | 2 580 to 3 096 |
| Repair and maintenance | -1 912 | -1 055 |
| Tug boat fuel | -750 | -750 |
| Terminal labour | | |
| feeder port | -1 162 to -996 | -1 245 to -830 |
| major port | 2 328 to 3 492 | 2 118 |
| Rail operations | 41 550 to 48 600 | 30 795 to 32 415 |
| Net saving | -10 820 to 398 | -1 532 to 1 922 |
| Net saving/TEU | -18 to 1 | -5 to 6 |

NOTE: A - corresponds to a cost, and a + to a saving.

# APPENDIX X—FINANCIAL COST ANALYSIS

Financial cost analyses for selected centralisation alternatives are presented in Chapter 7. The costs and savings involved have been calculated from published charges or based on BTE estimates. All BTE estimates with the exception of ship capital charges have been taken from a forthcoming BTE Information Paper (BTE 1982).

Financial costs in this analysis include ship operating costs, port and container terminal charges and rail charges.

## SHIP OPERATING COSTS

These include ship capital charges, crew costs, ship insurance, victuals, fuel costs at sea and in port and repair and maintenance costs.

### Ship capital charges

Ship capital charges were estimated by considering the ship's initial capital cost, its present age and expected life, and the method of financing.

All ship capital charges were based on the typical vessels described in Table 6.2. The assumed capital cost in December 1980 dollars for each typical vessel is shown in Table X.1.

TABLE X.1—ASSUMED CAPITAL COST AND DAILY CAPITAL CHARGES FOR TYPICAL VESSELS, DECEMBER 1980

| *Trade* | *Vessel size ('000 DWT)* | *Year of building* | *Capital cost ($ million)* | *Daily capital charges ($)* |
|---|---|---|---|---|
| UK/Europe | 30 | 1970 | 43.2 | 6 910 |
| Japan/Korea | 28 | 1977 | 42.9 | 12 620 |
| East Asia | 20 | 1974 | 30.1 | 6 690 |
| ECNA | 23 | 1971 | 37.2 | 6 950 |

*Source: BTE estimate.*

### Crew costs

These were based on typical Australian crew costs of $2800 per day. Although foreign crew costs are expected to be lower (possibly even half that for Australian crews), the use of Australian crew costs produces a conservative financial result. Adoption of lower crew costs would not affect the conclusions of the financial analyses.

### Ship insurance

Daily insurance estimates (BTE 1982) for each typical vessel were assumed to be $916 for UK/Europe trade vessels, $864 for Japan/Korea trade vessels and $648 for East Asia and ECNA trade vessels.

**Victuals**

An allowance of $600 per day per vessel was included.

**Fuel, Repair and Maintenance Costs**

These were calculated on the basis of information presented in Appendix VI and Table 6.2.

## PORT CHARGES

The financial cost of an alternative port calling pattern includes both the cost of port charges at the newly-served port and the saving in port charges at the major port. The port charges used in this analysis were obtained from each port authority involved. The basis on which charges are levied varies between ports, but generally involves some combination of berthage/tonnage, wharfage, pilotage, conservancy/light dues, tug and mooring charges.

## RAIL CHARGES

Rail charges were calculated using only the rates for loaded containers as insufficient information was available to predict the effect of changed ship call patterns on the movement of empty containers.

Rail charges between Melbourne and Adelaide in both directions were assumed as $155 per TEU.

The rail charges between Sydney and Hamilton container terminal in Brisbane, (including gauge exchange at Acacia Ridge or Clapham) were assumed to be $298 per TEU for the Sydney to Hamilton link, and $217.50 per TEU for the Hamilton to Sydney link.

Under present arrangements, all overseas containers travelling between Sydney and Brisbane must pass through the Hamilton container terminal, regardless of their origin or final destination within the Brisbane area.

## CONTAINER TERMINAL CHARGES

The fees charged by container terminals to lift containers were assumed to be $170 to $200 per TEU in Melbourne, $170 to $200 per TEU in Sydney, $174 per loaded TEU and $96 per empty TEU in Brisbane and $168 per TEU in Adelaide.

## FINANCIAL COST OF CENTRALISATION ALTERNATIVES

The effect of centralisation alternatives on shipping company finances has been estimated in Tables X.2 to X.5 for container numbers calculated to give approximate break-even results (in resource terms) for selected calls at Adelaide and Brisbane.

TABLE X.2—FINANCIAL COST ANALYSIS—CALL AT ADELAIDE BY THE UK/EUROPE TRADE (200 TEUs HANDLED)

| *Cost item* | *Financial cost ($)* |
|---|---|
| Ship operating costs | |
| Capital | -6 756 to -4 456 |
| Crew | -2 742 to -1 808 |
| Insurance | -897 to -592 |
| Victuals | -588 to -388 |
| Fuel | |
| at sea | -11 461 |
| pilotage | -961 |
| in Adelaide | -3 696 to -3 192 |
| in Melbourne | 1 344 to 2 184 |
| Repair and maintenance | -439 |
| Port charges | |
| Tonnage | |
| in Adelaide | -1 470 |
| in Melbourne | 366 to 595 |
| Wharfage in Melbourne | 9 792 |
| Pilotage in Adelaide | -736 |
| Conservancy in Adelaide | -2 388 |
| Tugs in Adelaide | -6 576 |
| Mooring in Adelaide | -500 |
| Rail charges | 31 000 |
| Container terminal charges | 0 to 6 000 |
| Net saving | 3 292 to 14 604 |
| Net saving/TEU | 16 to 73 |

NOTE: A – corresponds to a cost, and a + to a saving.

TABLE X.3—FINANCIAL COST ANALYSIS—CALL AT ADELAIDE BY THE UK/EUROPE TRADE (300 TEUs HANDLED)

| *Cost item* | *Financial cost ($)* |
|---|---|
| Ship operating costs | |
| Capital | -8 194 to -4 744 |
| Crew | -3 325 to -1 925 |
| Insurance | -1 088 to -630 |
| Victuals | -713 to -413 |
| Fuel | |
| at sea | -11 461 |
| pilotage | -961 |
| in Adelaide | -5 208 to -4 368 |
| in Melbourne | 2 016 to 3 192 |
| Repair and maintenance | -439 |
| Port charges | |
| Tonnage | |
| in Adelaide | -2 060 |
| in Melbourne | 549 to 870 |
| Wharfage in Melbourne | 14 688 |
| Pilotage in Adelaide | -736 |
| Conservancy in Adelaide | -2 388 |
| Tugs in Adelaide | -6 576 |
| Mooring in Adelaide | -500 |
| Rail charges | 46 500 |
| Container terminal charges | 0 to 9 000 |
| Net saving | 20 104 to 37 049 |
| Net saving/TEU | 67 to 124 |

NOTE: A – corresponds to a cost, and a + to a saving

TABLE X.4—FINANCIAL COST ANALYSIS—CALL AT ADELAIDE BY THE UK/EUROPE TRADE: OMITTING SYDNEY (250 TEUs HANDLED)

| *Cost item* | *Financial cost ($)* |
|---|---|
| Ship operating costs | |
| Capital | 8 940 to 11 530 |
| Crew | 3 630 to 4 680 |
| Insurance | 1 190 to 1 530 |
| Victuals 780 to 1 000 Fuel | |
| at sea | 61 425 |
| in Adelaide | -4 368 to -3 864 |
| in Melbourne | 1 680 to 2 688 |
| Repair and maintenance | 2 360 |
| Port charges | |
| Tonnage | |
| in Adelaide | -1 722 to -1 524 |
| in Melbourne | 458 to 733 |
| Wharfage in Melbourne | 12 240 |
| Pilotage | |
| in Adelaide | -736 |
| in Sydney | 2 600 |
| Conservancy in Adelaide | -2 388 |
| Tugs | |
| in Adelaide | -6 576 |
| in Sydney | 3 834 |
| Mooring in Adelaide | -500 |
| Rail charges | 38 750 |
| Container terminal charges | 0 to 7 500 |
| Net Saving | 121 597 to 135 282 |
| Net Saving/TEU | 486 to 541 |

NOTE: A - corresponds to a cost, and a + to a saving.

TABLE X.5—FINANCIAL COST ANALYSIS—CALL AT BRISBANE BY THE UK/EUROPE TRADE (400 TEUs HANDLED)

| *Cost item* | *Financial cost ($)* |
|---|---|
| Ship operating costs | |
| Capital | -13 053 to -7 878 |
| Crew | -5 297 to -3 197 |
| Insurance | -1 733 to -1 046 |
| Victuals | -1 135 to -685 |
| Fuel | |
| at sea | -34 384 |
| pilotage | -7 824 |
| in Brisbane | -4 872 to -3 360 |
| in Sydney | 2 688 to 4 200 |
| Repair and maintenance | -1 318 |
| Port charges | |
| Berthage in Brisbane | -2 115 to -1 410 |
| Tonnage in Sydney | 727 to 1 136 |
| Wharfage | |
| in Brisbane | -7 200 |
| in Sydney | 17 200 |
| Pilotage in Brisbane | -3 496 |
| Conservancy in Brisbane | -1 249 |
| Tugs in Brisbane | -7 260 |
| Rail charges | 103 818 |
| Container terminal charges | 10 256 to 22 256 |
| Net saving | 43 753 to 68 303 |
| Net saving/TEU | 109 to 171 |

NOTE: A - corresponds to a cost, and a + to a saving.

TABLE X.6—FINANCIAL COST ANALYSIS—CALL AT ADELAIDE BY THE JAPAN/KOREA TRADE (650 TEUs HANDLED)

| *Cost item* | *Financial cost ($)* |
|---|---|
| Ship operating costs | |
| Capital | -44 956 to -32 337 |
| Crew | -9 975 to -7 175 |
| Insurance | -3 078 to -2 214 |
| Victuals | -2 138 to -1 538 |
| Fuel | |
| at sea | -44 588 |
| pilotage | -687 |
| in Adelaide | -7 497 to -6 426 |
| in Melbourne | 3 094 to 4 760 |
| Repair and maintenance | -2 246 |
| Port charges | |
| Tonnage | |
| in Adelaide | -4 100 |
| in Melbourne | 1 323 to 2 035 |
| Wharfage in Melbourne | 32 708 |
| Pilotage in Adelaide | -736 |
| Conservancy in Adelaide | -2 228 |
| Tugs in Adelaide | -6 576 |
| Mooring in Adelaide | -500 |
| Rail charges | 100 750 |
| Container terminal charges | 0 to 19 500 |
| Net saving | 8 570 to 48 402 |
| Net saving/TEU | 13 to 74 |

NOTE: A – corresponds to a cost, and a + to a saving.

TABLE X.7—FINANCIAL COST ANALYSIS—CALL AT ADELAIDE BY THE EAST ASIA TRADE: AROUND AUSTRALIA ROUTE (150 TEUs HANDLED)

| *Cost item* | *Financial cost ($)* |
|---|---|
| Ship operating costs | |
| Capital | -6 633 to -4 682 |
| Crew | -2 777 to -1 960 |
| Insurance | -643 to -454 |
| Victuals | -595 to -420 |
| Fuel | |
| at sea | -8 955 |
| pilotage | -547 |
| in Adelaide | -1 445 to -1 275 |
| in Melbourne | 510 to 935 |
| Repair and maintenance | -422 |
| Port charges: | |
| Tonnage | |
| in Adelaide | -785 |
| in Melbourne | 275 to 504 |
| Wharfage in Melbourne | 7 344 |
| Pilotage in Adelaide | -650 |
| Conservancy in Adelaide | -1 590 |
| Tugs in Adelaide | -4 972 |
| Mooring in Adelaide | -400 |
| Rail charges | 23 250 |
| Container terminal charges | 0 to 4 500 |
| Net saving | 965 to 9 421 |
| Net saving/TEU | 6 to 63 |

NOTE: A – corresponds to a cost, and a + to a saving.

# APPENDIX XI—INVENTORY COSTS

Changes in inventory costs resulting from adoption of cargo centralisation alternatives have been examined by considering a hypothetical shipping service to Adelaide, based on the present UK/Europe service to Australia. Ships are assumed to regularly depart from Europe, bound for Melbourne.

A number of postulates have been made about the shipping service and the availability of containers, in order to undertake a practical analysis. These are:

- regular ship departures from Europe every Td days;
- every nth ship makes a direct call at Adelaide prior to calling at Melbourne;
- shippers choose vessels which give the fastest transit time; and
- containers become available at random and are not co-ordinated with ship departure.

An important measure of performance of a service, particularly from the view of inventory costs is the overall delay and transit time, T, from the time the container is ready to be shipped in Europe to its availability in Adelaide. This time includes any delay prior to ship departure.

The transit time for a container from its availability in Europe to its availability in Adelaide is assumed to be either Tm or Ta, where:

Tm = transit time for a container shipped via Melbourne; and
Ta = transit time for a container shipped direct to Adelaide.

The difference between Tm and Ta is Tx, where:

Tx = the additional time taken to ship a container to Adelaide via Melbourne, compared with a direct service.

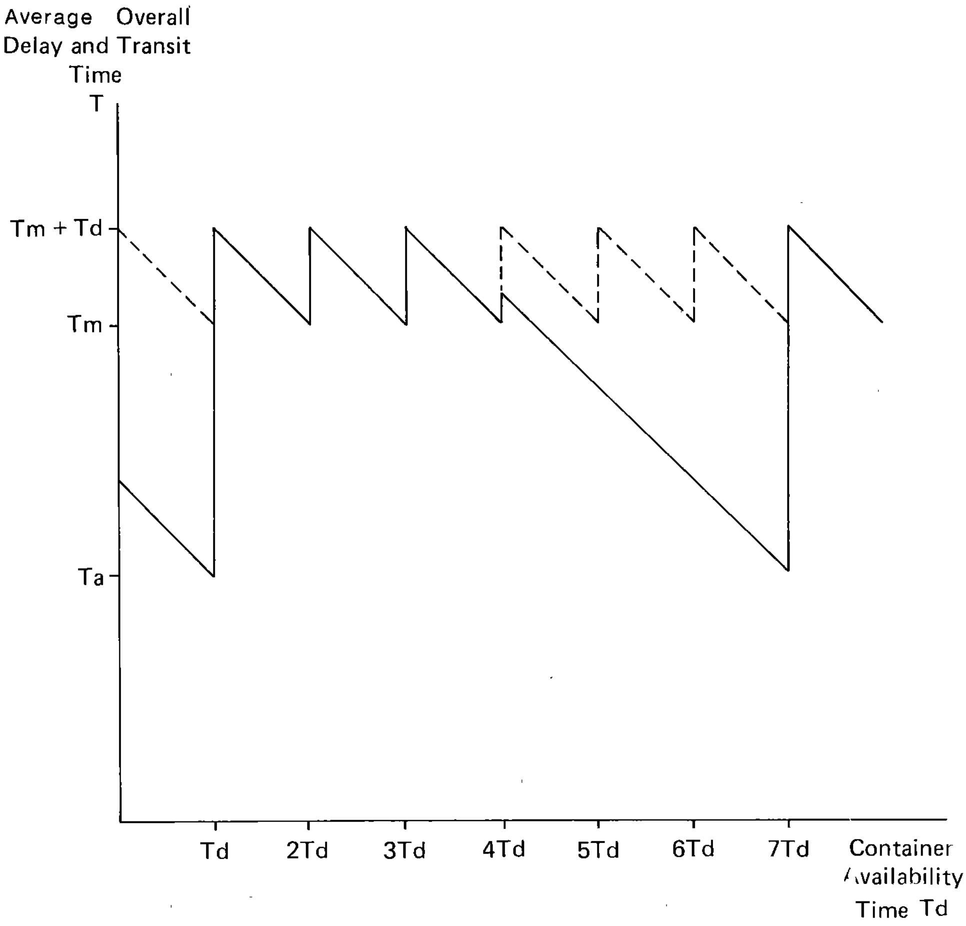
Figure XI.1 plots the overall delay and transit time, T, for a container from Europe bound for Adelaide, against the time at which a container is available for shipment. It is assumed in the figure that every sixth ship makes a direct call at Adelaide prior to calling at Melbourne.

An Adelaide bound container that becomes available for shipment just as a ship is ready to depart from Europe has an overall transit time of Tm or Ta, depending on whether that particular vessel is scheduled to call at Melbourne, or Adelaide prior to Melbourne. If the container becomes available for shipment between vessel departures, its overall transit time is increased by the amount of time it must wait before the next vessel departs.

Ships are shown to depart at regular intervals, Td in the figure. Adelaide bound containers that become available after time 3 Td and up to 4 Td are loaded on the vessel departing at time 4 Td. Containers bound for Adelaide available after time 4 Td and up to 7 Td are loaded on the vessel departing at 7 Td, as this provides an earlier delivery to Adelaide than the ships departing at times 5 Td and 6 Td, which sail via Melbourne.

If there are no direct ship calls at Adelaide, the average overall delay and transit time for all Adelaide bound containers is:

$$Tav = Tm + 0.5\ Td \qquad (XI.1)$$




Note: Every sixth ship is shown making a direct call with overall transit time Ta.

**Figure XI·1**
**Container availability versus transit time**

In general, the average overall delay and transit time from Europe to Adelaide, with every nth vessel calling at Adelaide, can be shown to be:

$$Tav = \frac{1}{2n}\left[ (2n-i-1)\ Tm + (i+1)\ Ta + (n-(i+1)f)\ Td \right] \quad (i+f) \leqslant n \qquad (XI.2)$$

where: i = integer part of Tx/Td
f = fractional part of Tx/Td.

If (i + f)>n, this implies Tx>nTd
and

$$Tav = Ta + 0.5\ n\ Td \qquad (XI.3)$$

In this situation, the difference in overall transit time between containers arriving via Melbourne and those shipped directly would be sufficiently large to ensure that Adelaide bound containers would always arrive earlier if shipped on vessels calling at Adelaide.

Equation XI.2 can be used to calculate average overall delay and transit time (Tav) for a perfectly regular service. Figure XI.2 plots Tav against Tx (the additional time taken to ship a container to Adelaide via Melbourne compared with a direct service), for a range of Tx from 0 to 20 days.

Recent analyses by the Department of Marine and Harbors South Australia (1980) and the Port of Melbourne Authority in conjunction with VicRail (Daily Commercial News 1980) have suggested typical additional transit times, Tx, of up to 12 days for a service to Adelaide via Melbourne in the UK/Europe trade. Values of Tx of 6, 9 and 12 days have been chosen for this analysis.

From Figure XI.2, for an assumed value for Tx of 9 days, the average overall delay and transit time to Adelaide, Tav, is 45.5 days where all cargo is transhipped via Melbourne, 43.3 days for monthly vessel calls at Adelaide, and 41.2 days for fortnightly vessel calls at Adelaide.

The figure also shows average overall delay and transit times for cases where containers are shipped directly to Adelaide with no transhipment of containers via Melbourne.

## ALTERNATIVE SHIPPING SERVICES

Five alternative shipping services for Adelaide have been considered, together with their estimated impact on inventories, measured in TEU-days. The five services are:

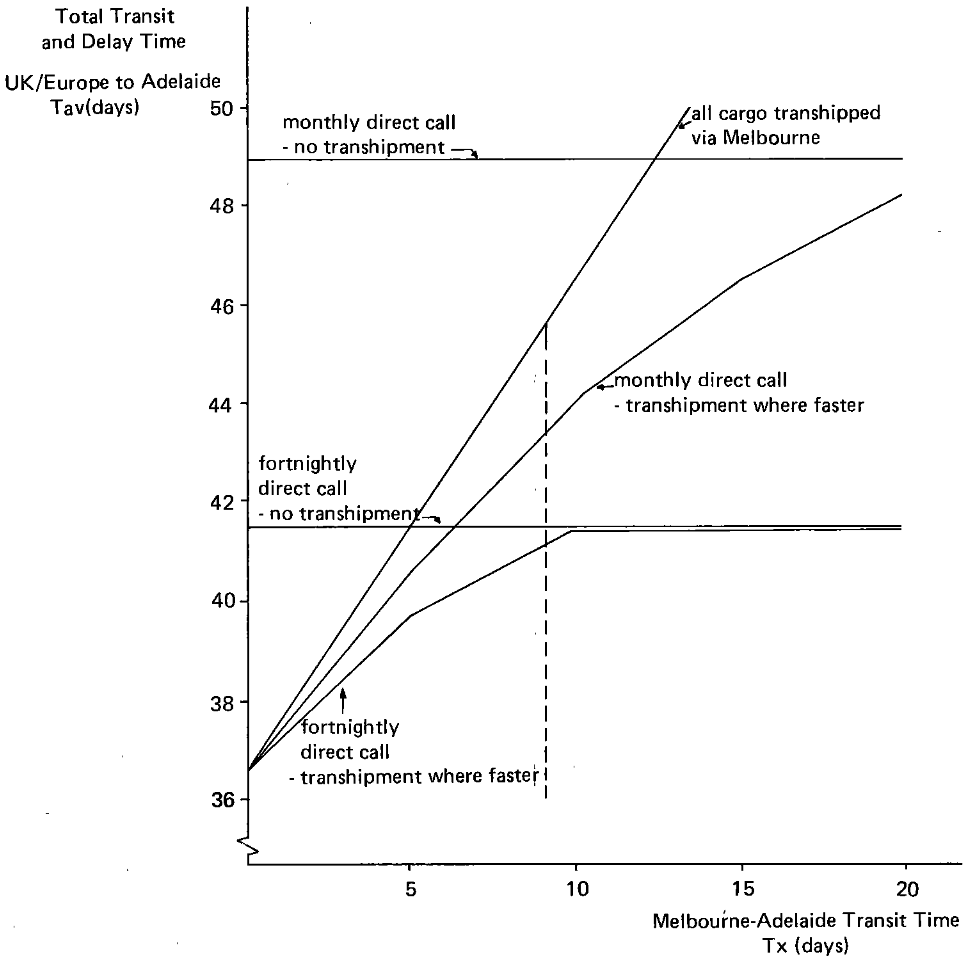
(1) All cargo via Melbourne—no direct calls
(2) One direct call per month—service via Melbourne when faster
(3) Fortnightly direct calls—service via Melbourne when faster
(4) One direct call per month—no service via Melbourne
(5) Fortnightly direct calls—no service via Melbourne.

For alternatives (1) (2) and (3), vessels are assumed to depart UK/Europe every 5 days. Alternatives (4) and (5) provide the same direct service frequency at Adelaide as alternatives (2) and (3) respectively, but it is assumed that for alternatives (4) (5) no containers (or very few), are transhipped via Melbourne.

Assuming three levels of additional transit time, Tx, of 6, 9 and 12 days, Table XI.1 shows the effect on inventories in terms of TEU-days, for each of the five alternative shipping services.

## COMMENT ON THESE SERVICES

Service (1) is assumed to be the base case. For direct calls at Adelaide including access to a service via Melbourne (corresponding to service (2) and (3)), considerable inventory savings in terms of TEU-days per month are available for Adelaide-bound containers. These savings are achieved at the expense of delays to through-cargo




Notes: 1. Average sea transit time UK/Europe to Adelaide assumed as 34 days.
2. Departures from Europe assumed every 5 days.

**Figure XI-2**
**Average transit time to Adelaide for import containers in the UK/Europe trade**

TABLE XI.1—ALTERNATIVE SHIPPING SERVICES TO ADELAIDE IN UK/EUROPE TRADE AND THEIR EFFECT ON INVENTORIES

| *Service to Adelaide* | *Average additional time to Adelaide (Tx)* | | | | | | *Delays to other cargo on Adelaide-bound ship*[b] | |
|---|---|---|---|---|---|---|---|---|
| | *6 days* | | *9 days* | | *12 days* | | *(TEU-days/month) For Adelaide call of* | |
| | *Tav (days)* | *TEU-days/ month saved*[a] | *Tav (days)* | *TEU-days/ month saved* | *Tav (days)* | *TEU-days/ month saved* | *1 day* | *2 days* |
| (1) via Melbourne | 42.5 | — | 45.5 | — | 48.5 | — | — | — |
| (2) monthly | 41.3 | 620 | 43.3 | 1 137 | 45.0 | 1 810 | -1 000 | -2 000 |
| (3) fortnightly | 40.2 | 1 189 | 41.2 | 2 223 | 41.5 | 3 619 | -2 000 | -4 000 |
| (4) monthly no transhipments | 49.0 | -3 360 | 49.0 | -1 810 | 49.0 | -259 | -1 000 | -2 000 |
| (5) fortnightly no transhipments | 41.5 | 517 | 41.5 | 2 068 | 41.5 | 3 619 | -2 000 | -4 000 |

a. Savings are shown as positive numbers. The 1976-77 import estimate of 517 TEUs per month for Adelaide has been used to calculate TEU-day delays.
b. Vessels calling at Adelaide are assumed to have 1000 TEUs on board bound for Melbourne and Sydney.

bound for Melbourne and Sydney. For a ship diversion to Adelaide which delays through-cargo by one day (compared with a service by-passing Adelaide), inventory savings on Adelaide cargo exceed inventory delays to through-cargo provided that values of Tx are 9 days or greater. If through-cargo is delayed by two days, inventory savings for Adelaide cargo would not exceed these delays unless Tx was greater than 12 days.

Services which ship all Adelaide containers through that port and which do not require cargo transhipment via Melbourne (service (4) and (5)), provide a poor alternative to the present service (in inventory terms), if delays to through-containers are included. These services may arise if all shippers were required to meet their own rail freight charges between Melbourne and Adelaide.

In summary, inventory savings in terms of reduced transit time for import cargoes from Europe bound for Adelaide would be available for all alternative services with the exception of service (4). In this case, restrictions on transhipments would outweigh any direct service savings. If inventory delays are included for those shippers in Sydney and Melbourne who have their cargo delayed as a result of a direct Adelaide service, total inventory changes could be negligible.

## FURTHER QUALIFICATIONS

The inventory analysis presented has assessed changes in terms of TEU-days. No estimate of the value of delays has been made because of the difficulty of determining a suitable cost basis. In particular, it is unlikely that the cost of a large delay to cargo in one container can be assumed equivalent to a small delay to cargoes in a large number of containers. Equally, small delays may occasion no cost consequences at all whereas large delays to particular cargoes may prove very costly.

## STOCK INVENTORY

A shipping service which has some variability in its transit time can have a large effect in determining the stock control policy of firms, particularly if long intervals between deliveries are common, and additional inventories must be carried as a buffer against stocks being exhausted. A broad knowledge of the requirements of firms and their attitude to risk would be required before an assessment of the impact on stock policy resulting from changes to service variability could be made. No estimate of these factors has been made here.

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## GLOSSARY OF TERMS

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| Break-even number | The number of containers required to be handled at a port by a ship in order to justify a direct call in resource cost terms. At the break-even number, the additional costs resulting from the ship diverting to make a direct call are just balanced by the savings achieved by not transhipping the containers between ports. |
| Cargo centralisation | The concept of handling overseas cargo at a small number of major ports in Australia. Cargo bound for or originating from other centres is transhipped to and from these major ports mainly by rail. |
| Centralisation alternative | An alternative ship calling arrangement to that presently offered by the overseas liner shipping conferences calling at Australia. |
| Centralised port | Ports at which regular calls are made by overseas liner shipping conferences. These include the ports of Melbourne, Sydney and Brisbane for most trades. Fremantle and Adelaide also receive a regular service in some trades. |
| Conference | An association of liner shipping operators who act together to offer common prices and rationalised sailing schedules over defined routes on which the conference operates. |
| Deadweight tonnes | Total mass in tonnes which a ship carries at its summer loadline draft. It includes cargo, fuel, water in tanks, stores, baggage, passengers, crew and their effects but excludes water in boilers. |
| Diversion distance | The extra distance sailed in order to make a call at an additional port, compared with the present route sailed. |
| Diversion route | The alternative route sailed in order to make a call at an additional port. |
| Feeder movement | Movement of containers between a port which had traditionally received a direct service (prior to cargo centralisation) and the major ports. |
| Financial cost | Generally refers to the price paid for a service. In some instances financial costs equate with resource costs. |
| Inventory cost | The cost of holding a stock of goods, which can include the stock cost of goods in transit. |
| Liner service | A shipping service which is operated over a specific route and on a regular basis. |
| Long-run | The time span over which all costs become variable. Ultimately all costs become variable over the long-term, but it is more realistic to consider horizons that are |

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| | somewhat less than this particularly as there is a large degree of uncertainty attached to most long-range forecasts. A twenty year horizon has been adopted as a satisfactory long-run period for calculation purposes in this study. |
| Major port | The ports at which regular calls by overseas liner shipping conferences are presently centralised. Also known as a centralised port. |
| Positioning movement | Relocation of empty overseas containers within Australia. Containers being positioned are sometimes loaded with domestic cargo. |
| Resource cost | The value of resources (net of subsidies, taxes, profits and institutional constraints) committed to a particular task. |
| Short-run | The time span over which not all costs are variable. This period can vary from the very short-run where virtually all factors are fixed, through to time spans approximating the long-run, where many factors are variable. For this Report the short-run corresponds to a period sufficiently long to allow labour to be rescheduled (in the case of rail operations), but is sufficiently short to ensure that major capital investment remains fixed. |
| TEU | Twenty-foot equivalent unit. Used to describe a 20ft x 8ft x 8ft ISO container, or the number of equivalent twenty foot units. |
| Trade | Generally refers to a geographic trading area, such as the UK/Europe or Japan/Korea trade. Conferences are organised on a trade basis to provide shipping services between two or more geographic areas. |
| Traditional port | A port which received direct calls by overseas liner trade vessels prior to the introduction of cargo centralisation. |
| Transhipment | Land transport of loaded containers between the centralised port and their origin or destination in Australia. |