

VICTORIAN FREIGHT AND

LOGISTICS STRATEGY

2001

Aspects of the greater Melbourne freight task

PLANNING MELBOURNE FOR THE 21ST CENTURY

This report was commissioned by the Department of Infrastructure for the Victorian Freight and Logistics Strategy.

It also forms *Technical Report 7* in a series of background reports prepared for the Melbourne Metropolitan Strategy

Melbourne Metropolitan Strategy Technical Report 7

Message from the Minister

Freight and logistics contributes strongly to the Victorian economy, and, at the same time, shares resources and infrastructure with members of the community. The Bracks Government is increasingly aware of the need to facilitate the growth of this prosperous sector, while balancing the interests of the wider community.

Aspects of the Greater Melbourne Freight Task will help us to do that. This document was originally commissioned as an input to the development of the Victorian Freight and Logistics Strategy, but a second use for the document was quickly identified.

My colleagues, the Minister for Transport, Mr Peter Batchelor and the Minister for Planning, Mr John Thwaites, are overseeing the preparation of a Metropolitan Strategy. This strategy will set a clear vision for Melbourne's future liveability, prosperity and, importantly, its long-term sustainability. In order to make it as effective as possible, the Metropolitan Strategy's development is dependant on a wide range of inputs. Aspects of the Greater Melbourne Freight Task is one of these.

Using this document for two distinct purposes has a number of advantages. It ensures the alignment of objectives across two very different government projects. It reinforces the message that industry and the community share resources, and need to find ways to coexist. Finally, it ensures that the Victorian Government does not waste public resources by duplicating research.

Both the Metropolitan Strategy and the Freight and Logistics Strategy are reliant on feedback from Victorian industry and the community. I hope that this document will stimulate discussion, and encourage people to offer a response. A key purpose of the document is to inform and enhance the participation of the Victorian community in critical projects across Victoria.

While the report reflects the views of the authors and does not necessarily represent current government policy, it offers independent observation on issues that need to be taken into account. Consideration of these will ensure that both the freight and logistics industry and the metropolitan area remain sustainable and successful for the next 20 years and beyond

I encourage you to read this and other information provided by these projects. Please make your views known about the future of freight and logistics, or the future of Melbourne, by contacting us.

Candy Broad MP
Minister for Ports

Freight and Logistics Strategy

Tel. +61 3 9655 6030
Fax +61 3 9655 6900
Mail Level 23
80 Collins Street
Melbourne VIC 3000
Australia

Melbourne 2030

Tel. 1800 191 012
Email melbourne2030@doi.vic.gov.au
Mail Melbourne 2030
Department of Infrastructure
GPO Box 2797Y
Melbourne VIC 3001
Australia
Visit www.melbourne2030.vic.gov.au

Aspects of the greater Melbourne freight task

prepared by

*FDF Management,
a division of
Flagstaff Consulting
Group Pty Ltd*

FLAGSTAFF CONSULTING GROUP PTY LTD
Incorporating
FDF MANAGEMENT
Suite 6, 260 Auburn Road
Hawthorn, Victoria 3122
Telephone +61 3 9819 5811
Fax +61 3 981 9 5855
Email FDF@flagstaff.com.au
www.flagstaff.com.au
www.fdf.com.au

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Summary

The Victorian Government has a policy of realising a “seamless integrated freight transport network” concomitant with its *metropolitan (transport) strategy*.

To this end, the Department of Infrastructure has sought information on:

- the freight transport task engaging metropolitan Melbourne through seaports, airports, road, rail and intermodal freight hubs;
- the interaction between freight and passenger transport;
- trends in mass uplifted, volumes and commodities; and
- logistics issues impacting on vehicle types, movements and land use.

The freight transport task engaging metropolitan Melbourne

Melbourne represents 73% of Victoria’s population of some 4.8 million. Population is synonymous with the freight task related to consumables, foodstuffs, non-perishables and much of construction materials. Melbourne is also the location of some 53,000 or 74% of Victoria’s 72,000 manufacturing, wholesaling and retail enterprises. These are the origins and destinations of the most concentrated freight movements.

Broadly, 60% of Victoria’s freight (tonnes) is uplifted in the metropolitan area, and the balance in regional Victoria. However, when represented as the freight task (tonne kilometres), the metropolitan share is less than 30% of the total Victorian task.

In developed economies, logistics costs are generally estimated by the OECD to range between 11% and 16% of a nation’s GDP. Direct transport costs represent perhaps 25% of the logistics costs of most firms.

For the Melbourne metropolitan freight task, the annual transport costs alone are probably in excess of \$2billion per annum.

Road and sea (coastal and international shipping) are the predominant transport modes for Melbourne’s physical trade relationships (imports and exports) with the balance of Australia and the rest of the world.

Within Metropolitan Melbourne, nearly all freight with origins and destinations within the greater metropolitan area is transported by road. Small quantities do however move by rail and pipeline.

In 1995-96, FDF estimated that some 25 million tonnes of freight left Melbourne, while 34 million tonnes arrived at Melbourne, from its hinterland. Some 134 million tonnes were moved within Melbourne (having both an origin and destination within Melbourne). Almost all of the 134 million tonnes were moved by road. Commodities including soil, land-fill and unprocessed construction materials represented the largest tonnage. The internal movements within Melbourne are some 2.3 times the total of flows to and from Melbourne.

In 1994, FDF made the estimates presented in Table 3.10 of the metropolitan freight with origins or destinations in Melbourne's statistical sub-divisions. (In the table, Southern includes Southern, South Eastern and Peninsula.) The bias of activity to Melbourne's east and south is clearly indicated. However, so is the need for transport infrastructure which provides the connectivity, and thus accessibility, between the complementary zones of production, transformation and consumption of materials in the metropolitan area.

Table S.1:
Distribution of freight task in metropolitan Melbourne, estimated 1994

<i>Melbourne origin/destination region</i>	<i>% of total freight (tonnes)</i>	<i>% of total freight task (billion tkm)</i>
Central	18.2	15.3
Western	16.7	16.5
Northern	20.1	22.4
Eastern	17.4	17.6
Southern	27.6	28.2
Total	100.0	100.0

Source FDF FreightInfo™ (1993)

The port of Melbourne is a major generator of concentrated, large vehicle freight movements. It is estimated that each day some 5,300 truck trips are made in the course of moving containers in the course of servicing import and export trade flows. Significant other road freight trips arise at the port related to trade of liquid bulk, dry bulk, break bulk commodities, and finished motor vehicles.

Interaction between freight and passenger transport

Freight movements are ubiquitous in metropolitan Melbourne.

Transport systems – for passenger and freight movement, underpin and facilitate wealth creation. They both spatially shape and respond to, the physical form of cities. When passenger transport demands upon common use systems arise at times different from freight users, economic outcomes are likely to be maximised. If they are concurrent, adverse economic outcomes principally arising from congestion (affecting road user costs of travel time, freight time, vehicle operating costs, and crashes) will be exacerbated.

In Melbourne, over recent years the implications of increasing co-use of rationed road space by freight and passenger vehicles has altered the time of day pattern of many freight transport services. Shorter and more reliable trip times have been sought through scheduling to minimise the conflicting claim for road space during periods of peak private passenger vehicle use.

Problematic passenger and freight task interfaces

Intermodal: road and sea

This is focused at Footscray Road and pertains to the conflicts arising from at-grade rail access to the port precinct. Train operations are constrained and in turn influence road freight and passenger vehicle congestion in the area of high freight generating trips in the Footscray area. It is a matter being comprehensively addressed in on-going investigations by DoI and Melbourne Ports Corporation.

Shipping container transport from the port to Melbourne's eastern and south eastern industrial zones is presently seriously hindered by the absent connectivity promised by CityLink and the resultant concomitant claim for scarce road space by passenger and road freight vehicles. The palpable congestion on east-bound sections of City Road and Alexandra Avenue attests to this transport system problem.

Intermodal: road and rail

Melbourne's Dynon rail freight terminals in immediate proximity to the Port of Melbourne have strongly fostered the City's broader urban form and land use. They remain remarkably accessible by the arterial and freeway/tollway systems, but are also critically constrained by these systems. Access and egress related to the South Dynon Container Terminal is often impeded by passenger and freight vehicle movements.

Intermodal: road and air

The accessibility of Melbourne Airport has been profoundly enhanced in recent years through the commissioning of the Western Ring Road and CityLink (west). However, capacity constraints, exacerbating passenger freight vehicle interfaces, are emerging on the Tullamarine freeway (airport bound direction), at the Bulla Road ramp, Calder Freeway exit and at the entrance to the Melbourne Airport precinct.

Broader metropolitan road network

The sense (through observation) of a contest between road freight and passenger vehicles for scarce road space is heightened at a number of locations in metropolitan Melbourne. They include:

- at Somerton-Campbellfield on the Hume Highway between Craigieburn and the connection with the Western Ring Road;
- on the Westgate Freeway;
- on the Mulgrave Freeway, through to Dandenong;
- at the interface of the Eastern Freeway with its meandering connection to Melbourne's west and north; and
- in the outer-east north-south corridor (Scoresby) prospectively connecting Ringwood-Dandenong and Frankston and an extended Eastern Freeway.

Trends in the freight task

Growth in the freight task (tonnes uplifted times distance moved) tends to move in direct proportion with growth in GDP. However, it is inevitable that economic activity and its geography will produce meaningful variations in the map of the freight task, overtime.

Broad categories of freight demand drivers can be described as:

- the economic condition;
- the spatial distribution of economic activity represented by industrial location and the complementary infrastructure linking it;
- logistics systems and technologies; and
- the environment and safety setting in which the freight and logistics task is performed.

From the perspective of Victoria, significant freight materials categories are:

- **foodstuffs:** grains, dairy products, meat products, fresh foods, beverages. The sector is increasingly important because of its export orientation – both internationally and as a supplier to the balance of the Australian market. The freight task exhibits strong seasonality and for some segments, such as grains, large year to year fluctuations in volume;
- **crude construction and building materials:** this is transport intensive sector, with a strong metropolitan focus. The magnitude and spatial range of the task is volatile and directly related to construction activity in the domestic, commercial, industrial and infrastructure sectors. It is often associated with significant disruption to road network operations together with adverse amenity (e.g. arising from construction waste, noise, emissions and safety);
- **metals and manufactures:** Victoria is a major aluminium producer (at smelters at Portland and Point Henry), but most of it is exported, with a large proportion through Portland; BHP's Lysaght operation at Western Port using raw steel from NSW, is a key supplier of product to Melbourne's motor vehicle manufacturing industry and to the construction sector; it also exports through Melbourne. Growth is contingent upon the activity in these industry groups;
- **motor vehicles and components:** Victoria is strongly represented in Australian manufacturing of fully assembled vehicles, the import and export of components, and the supply of spares and components to enterprises in other Australian stages. It is a sector which seems to be exhibiting robustness and volume growth. It is highly attentive to the efficacy of supply chain arrangements. It exerts a strong influence on the location of supplier's manufacturing facilities, fostering responses which meet JIT objectives; minimise trip distances and maximise reliability in the attainment of a delivery window;

- ***paper and packaging, including bottles:*** Victoria is a significant producer and consumer; pulp, paper and paper product exports and imports are also strongly represented; printed products distribution is a meaningful and predictable task; the glass product task is strongly related to vehicles manufacturing and to the evolution of the food and beverage sectors;
- ***chemicals:*** this sector while strongly represented in western Melbourne, has witnessed major changes in the face of global restructuring and rationalisation initiatives; domestic manufacturing is increasingly supplanted or displaced by imports. It is also a sector which has made major advances in its logistics operations – to attain lower costs and superior amenity, environmental health and safety outcomes. It is a freight task sector meriting particular attention;
- ***waste and recycled material:*** the array of recycled materials and concurrent freight task is ever developing as technologies, supply chains and markets evolve, stimulated by the adoption of ESD initiatives and Greenhouse Gas management strategies. Waste streams are separated and are directed through many dimensional transport chains;
- ***consumables: household goods:*** foodstuffs are increasingly consumed out of the home or in a prepared format. Together with the broader array of household goods, the associated freight task is influenced by demographic change, scope of product choice, and consumer purchasing power. Small scale distributed domestic production, wholesaling and retailing are being replaced by rationalised national production and distribution centres, complemented by increased market shares achieved by imports, and large scale final points of sale;
- ***services sector task:*** this is a strongly growing and diverse sector embracing household, industrial and commercial consumers. It ranges across health, hospitality, and office suppliers. Time, and often skill intensive dimensions, are associated with the small mass of the freight consigned. This transport task is the domain of the ubiquitous light commercial vehicle (LCV). Will an aging, wealthy, population be more or less intensive in its demand for these services?;
- ***transport equipment:*** particularly empty containers, pallets and other specialist re-useable packaging, which is transported, locally, regionally, nationally and globally.

Logistics configuration

Freight transport is at the sharp end of logistics systems. It is the easy target of the ceaseless market quest to attain the lowest cost while ramping up the service quality dimensions. These include consignment complete against order, without damage, on-time, available in the shortest elapsed time between order placement and receipt.

Profound improvements have been stimulated through the conjunction of more open national and foreign markets, technology development of materials and IT, de-regulation and harmonisation of technical standards in related jurisdictions.

Every endeavour is applied to minimise inventory; to eliminate loss and damage at each stage of the supply chain; to harvest every available scale economy. Manufacturers of time critical components are co-locating with key customers (examples are to be found at Campbellfield and Altona in relation to Ford and Toyota respectively).

Management initiatives have often reduced the resource inputs applied to the logistics task: a higher volumetric or mass based payload is realised; less damage means fewer resources committed to return of damage goods or supply of replacements (but more being committed to purpose specific packaging materials or equipment to eliminate damage or increase the effective payload). Again, the motor vehicle manufacturing sector (in which Melbourne plays a prominent role) affords some significant insights into the altered structure of the freight task.

The future possible reconfiguration of supply chain processes – for *business to business* (B2B) and *business to consumer* (B2C) fostered by new information technology capabilities and *e-business* is starting to be articulated. How will e-business effect their fulfilment operations? Logistics and distribution efficacy are likely to be critical to the success of an e-commerce venture. Selling over the web requires a warehouse-cum-truck system that can deal with the delivery of a single package to an individual household (a system similar to that applied to Australia Post's task).

Transport technologies

Innovation advancing lifecycle cost, environmental, service reliability and other improvements are evident for every mode (aircraft, ships, train, road vehicles). The enhancements are demonstrable for the prime mover, for the trailer/wagon, the freight specific container or package integrated with the prime mover, and with the freight handling systems.

However, it is not always possible to realise the efficiencies available through the adoption of the transport technologies because of infrastructure, regulatory or other market constraints. Constraints include bridge axle load and clearance limits, vehicle length and axle load limits etc.

The gain in the power and payload performance of road vehicle prime movers realised through B-double configurations, stands out.

Rail wagon designs have also been implemented which offer significant payload increases for given axle load and train operating speed parameters.

We are aware of the post sale recapitalisation and application of ANR locomotives and wagons. Locomotives have been re-built and are available through hook-and-pull services suppliers to compete with the NRC's relatively young fleet.

SCT have rejuvenated the louvre van fleet with new bogies and applied them to the opportunity of the Melbourne-Adelaide-Perth "volumetric" freight task. The vans afford, by virtue of their geometry and mass, a higher yield than that available through use of containers. However, these economies have only been realised through concurrent and complementary development of loading and unloading (terminal) facilities.

Shipping containers and refrigeration equipment have also evolved to maximise economy in the transport of route specific freight types.

For Melbourne and Victoria's freight infrastructure evolution, perhaps the issue of broader adoption of B-triple configurations is a consideration.

Initiatives to inform the improvement of freight transport

Stuart Hicks in his essay *Urban Freight*, 1975 said:

"An old maxim says that once a problem is clearly defined it is more than half solved. In reality, the first problem in urban freight is the definition of the problem."

and

"The urban freight transport task should be performed at the lowest total social cost possible. The total amount of resources consumed and disbenefits created in performing the freight task should be minimised: efficiency is the goal, given any other social, commercial and equity objective agreed upon..."

Specifically, the problem is this: the discovery and effective implementation of measure which will reduce the total social cost of urban goods movement to the lowest possible level commensurate with the freight requirements and objectives of society."

It is hard to believe that the contemporary interests or need could have been better expressed.

In this context, and with some reflection (on the prevailing conditions related to logistics, Melbourne's freight task and its inter-relationship with Australia more broadly), we believe Victoria will be advantaged if the following are addressed:

- *Characterise the logistics and freight task of key industries:* Victoria can evolve infrastructure and transport policies which foster an increasing contribution of industry sectors to its economic wellbeing; assist the arrest of a declining contribution; or diminish adverse social outcomes (such as congestion, emissions, crashes) affecting other transport system users. But knowledge is required to develop apposite policy.
- *Characterise and review the scope, condition, performance and capability of the greater Melbourne rail infrastructure applied to Victoria's freight task:* The object of this work is to provide a point of departure for identifying and prioritising infrastructure and system operational enhancements, and an understanding of what might constrain their realisation.
- *Audit the environmental and safe operating performance of commercial vehicles:* There is increasing interest in the realisation of Ecologically Sustainable Development (ESD). However, infrastructure development policy and investment decisions methodologies are frail in their wherewithal to internalise externalities. More knowledge derived from better information is required.

- *Characterise the off-wharf, shipping service related container freight task:* The purpose of this investigation would be to establish a quantitative understanding of the role (functions, locations, service, resources) of the existing participants; and an assessment of its economic performance. Similarly, opportunities for enhancement e.g. reduction of road congestion; of port and rail terminal space demands; of total service costs; and of environmental externalities would be identified and assessed.
- *Evaluate and rank committed and planned road systems improvements according to the scope and scale of their contribution to freight and logistics performance enhancement:* Benefits accruing would be quantified in terms of:
 - vehicle operating costs;
 - travel time savings;
 - freight time value;
 - crash costs;
 - Greenhouse gas emissions; and
 - other particulate and gaseous emissions.

This information would inform the ‘body-politic’ on the merit of particular system improvements.

Part 1

Purpose and scope

The Victorian Government has a policy of realising a “seamless integrated freight transport network” concomitant with its *metropolitan (transport) strategy*.

The modestly resourced study reported here by FDF Management, has the purpose of outlining issues of the freight task which are relevant to evolving the metropolitan strategy. In this regard, it is a natural interest to foster the efficient delivery of goods with the least detriment to environmental amenity and human safety and health, through maximum possible co-use of the transport systems available for passenger use.

Efficiency will be advanced through adoption and implementation of policies which promote productivity through technology, and work practices, relevant to each transport mode. It will also be furthered through policies which achieve a more nearly optimal allocation of resources among the common use infrastructure which permit the use of the particular transport technologies. Resources committed to transport infrastructure are also likely to return higher benefits if the available capacity is used (more) uniformly through the day (and year).

Government will be interested to foster efficient resource use in a context of ecologically sustainable development (ESD). Initiatives are likely to entail:

- fostering higher utilisation of capital (infrastructure, plant, equipment);
- minimising whole of life costs, while recognising issues of technology redundancy, changes in relative costs of factor inputs, variability of use, etc;
- minimising or simplifying freight transshipments consistent with service level objectives for trip time, trip time reliability, damage, loss etc; and
- properly valuing and internalising environmental performance for parameters such as noise, emissions, health and safety.

Not only is it appropriate to encourage the adoption of relevant technologies. Policy initiatives can be developed to promote the efficient location of freight generating enterprises in the context of the existing economic geography and its evolution.

To this end, the Department of Infrastructure has sought information on:

- *the freight transport task engaging metropolitan Melbourne through seaports, airports, road, rail and intermodal freight hubs;*
- *the interaction between freight and passenger transport;*
- *trends in mass uplifted, volumes and commodities; and*
- *logistics issues impacting on vehicle types, movements and land use.*

Part 2

Facets of logistics and freight

The logistics concept

The logistics chain envelops the production sector, and the final consumer. Efficiency, service, quality and amenity objectives coexist in this envelope.

Logistics embraces managing the flow and storage of raw materials, work in progress and finished goods. Logistics management addresses the progress of materials through their physical transformation from the point of origin to the point of final consumption, in accordance with consumer needs.

Until about the early 1980's enterprises were generally organised to address on a discrete basis, elements of the logistics task. For example, materials and components sourcing and purchasing; materials management; and physical distribution. Now most enterprises have positions of accountability for integrating and managing logistics activities.

Why improve logistics performance?

Logistics costs have been estimated by the OECD to range between 11 and 16% of world GDP.

Australia's GDP in 1997-98, was about A\$560 billion. At the OECD rates, logistics costs Australia-wide are therefore likely to be in the range \$62 billion to \$90 billion per annum.

These sums provide a perspective on the benefits which might be available to the Australian economy through transport system investment which advances efficiency — allocative and technical, in the logistics sector. For example, if a once off reduction of only 1% in national logistics costs was realised, the gain for the Australian economy would be in the range of \$620million to \$900million per annum. If it were to be sustained at this level it would represent, in present value terms, about \$6 billion to \$9 billion (assuming even a high real discount rate of 10%). Benefits of this magnitude which were attributable to transport system improvements, would clearly underwrite major transport system capital programs.

In the context of the foregoing estimate of logistics costs, the OECD's North American TRILOG Taskforce report of 21 June 1998, page 17, asserts:

"The inefficiency of transport infrastructure and service can be considered a barrier to trade.industry views transportation and logistics expenditures as a transaction cost for business, that must be reduced to enhance corporate competitiveness in the global market place."

and

"The reliability of delivery schedules permit companies to reduce substantial inventory carrying costs. The

ratio of manufacturing and trade inventory-to-sales has been reduced substantially over the years as transportation facilities become more ubiquitous and as electronic communications technology facilitates the exchange of information among shippers and carriers, thus increasing the flow of deliveries. Since 1991 the ratio has reduced from 1.58 to 1.35 (a reduction of 15%), with a consequent reduction in overall logistics costs.”

In this broad context, it is the USA Department of Transport’s view that the attributes of transport systems required in the 21st century for the growth and development of the national, regional and local economies are:

- international in reach;
- intermodal in form;
- intelligent in character; and
- intensive in service.

Liv-Ellen Kaldager (Logistics Excellence in Europe, a study report, prepared by A.T. Kearney on behalf of the European Logistics Association) has presented a view of the changes in the costs, service quality and productivity of logistics services since 1982. Observations include that redeployment of industrial activity in Europe is realising:

- specialised production sites;
- European or multi-country logistics infrastructure;
- shared service centres;
- postponement of product customisation; and
- differentiated customers’ service.

These developments are reducing logistics costs (as a proportion of revenue) while increasing consumption of transport through longer hauls and more frequent trips.

Burkhard Horn, Head of Division OECD, has also commented (in a paper *From Transport Chains to Logistics Chains*; International Seminar on Prioritisation of Multimodal Transport Infrastructure, Noordwijk aan Zee, The Netherlands, May 12-15, 1996):

Shippers, be they industrial firms, wholesalers or retailers, are looking for a reduction of the costs of the physical circulation of goods. At the same time, they are looking for an increase in the service level they are able to give to their customers. They also try to offer services that are better adapted to the fluctuations and movements of markets which are themselves diversifying and have now turned fully international. Indeed, shippers are now considering the whole production-distribution system. They are no longer expecting a transport only service, but they are seeking complete logistics solutions.

Shippers want to be guaranteed that transport facilities are efficient and that the advertised quality of the service is really achieved. In fact the production sector calls for:

- Zero inventory
- Zero delay
- Zero default
- Zero paper

These ambitious goals are certainly the motivating factors persuading road freight transport to strive for intelligent commercial vehicle operations, advanced transport telematics and full participation in integrated logistics strategies.

Geography of the freight task

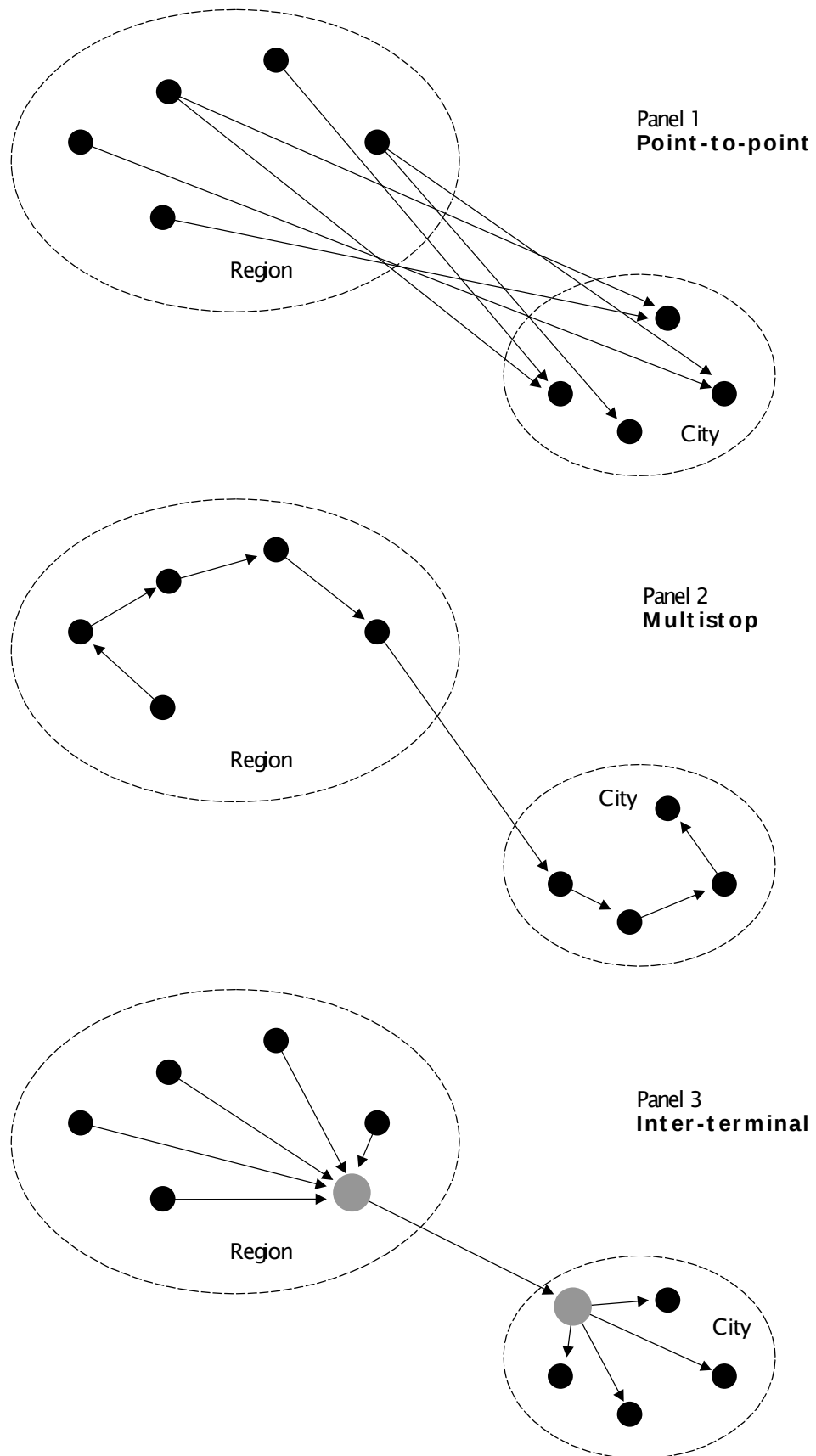
Freight movements in Australia with the overall logistics function of a firm can include one, several, or all of the following in combination:

- *trans-national or international* — by sea or air modes;
- *inter-capital* — by road, rail, sea or air modes;
- *up-country* from a capital city to a rural region, or *down-country* from a rural region to a capital city — by road, and or in some instances, by rail, air or coastal shipping;
- *inter-regional* — between origin and destination modes in non-capital city regions; generally by road, but possibly by rail, air, coastal shipping, or pipeline;
- *intra-regional* — between origin and destination modes within a region outside of a capital city; generally by road, but also possibly by rail, pipeline, conveyor or barge;
- *intra-capital* — between origin and destination modes within a capital city; predominantly by road, but also possibly by rail and pipeline.

These transport tasks will also have many different configurations in terms of directness or indirectness — of chain distribution, pick-up and delivery (multi-drop) and similar. Figure 2.1 illustrates some of these configurations which reflect the differences in logistics tasks of firms arising from freight commodity type, scale of the freight task, frequency of service and other variables. Again the complexity and range of the logistics task and its relationship with transport is illustrated.

The relative importance of these different freight transport configurations is of course constantly changing in response to the dynamics of markets — commodity trades wax and wane, regions grow and decline, products become obsolescent while others emerge, and distribution systems evolve.

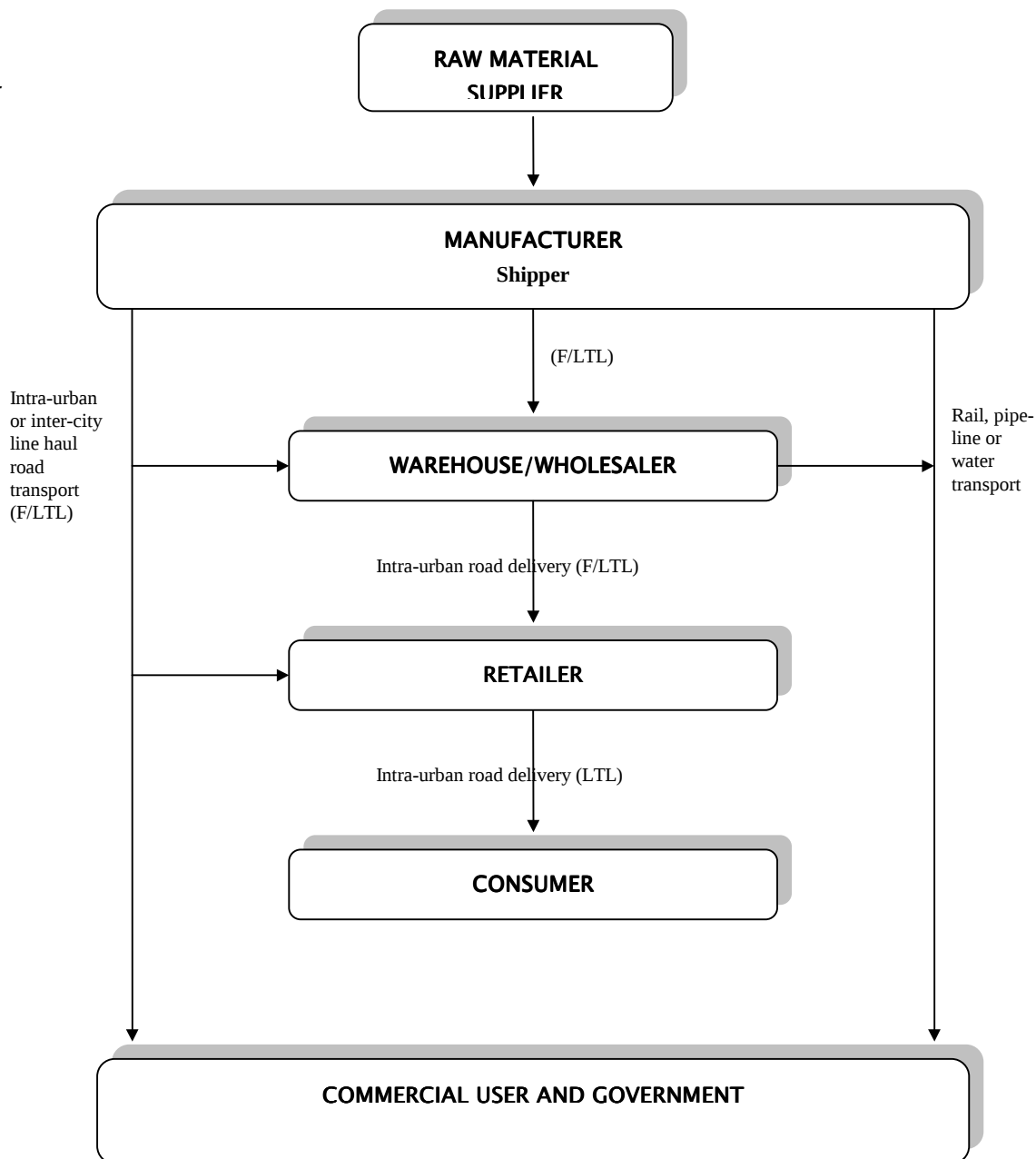
*Figure 2.1
Transport
options for
outbound
freight*



Charts 2.2 and 2.3 complement the previous chart by introducing some of the specific value

adding stages related to the movement of materials, the transport modes and roles of transport services providers.

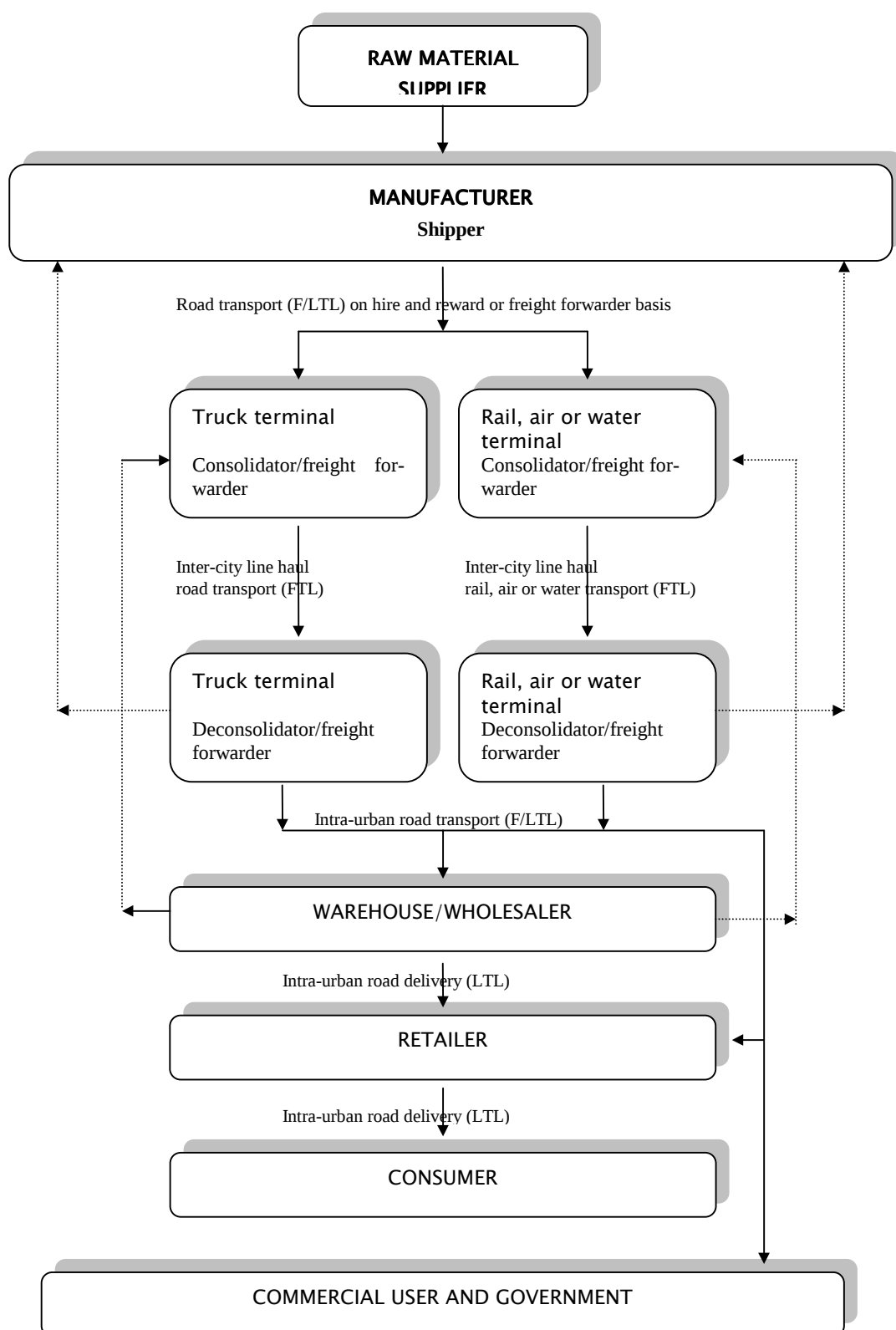
*Chart 2.2:
Freight
movement
process
with own
account/
fleet/ an-
cillary
operation*



F: full load

LTL: less than full load

Chart 2.3:
Freight
movement
process



Factors affecting freight demand

Improving the targeting of investment in freight transport infrastructure inescapably requires consideration of future levels of activity and influences on those levels. Changes in the materials' flows in the economy affect the volume of trips over the transportation system, the relative task performed by competing and complementary modes, and thereby, the scope and scale and efficiency of the transport systems.

Chart 2.4 illustrates something of the relationship between categories of factors affecting attributes of freight. The scale of the “dot” is indicative of the relative importance of the category of demand parameters on the categories of freight attributes.

Broad categories of freight demand drivers can be described as:

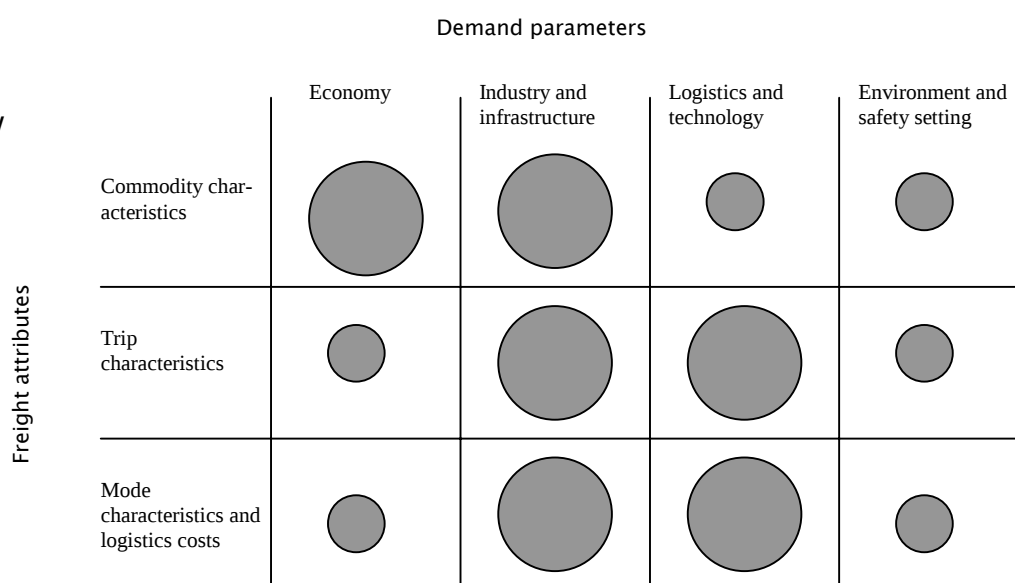
- the economic condition;
- the spatial distribution of economic activity represented by industrial location and the complementary infrastructure linking it;
- logistics systems and technologies; and
- the environment and safety setting in which the freight and logistics task is performed.

Each of these aspects of demand in turn affects attributes of the freight task which can be described as the:

- commodity characterisation;
- trip characteristics; and
- mode characteristics and logistics costs.

These are elaborated below.

Chart 2.4
*Demand
manifested
as freight
attributes*



Demand parameters

The subject of *economic factors* includes:

- level of economic activity;
- pattern of domestic and foreign production and distribution (globalisation);
- trade agreements influencing globalisation and the cost of trans-border material flows;
- international transport agreements which affect carrier entry or participation levels;
- regulation influencing price and service competition, multi-modal and inter-modal operations;
- user charges and taxes affecting cost of freight and thereby other attributes;
- fuel prices which might affect mode choice or commodity; and
- carrier subsidies which affect mode choice.

Industry and infrastructure influences include:

- infrastructure scope and associated services affect mode choice and cost performance;
- industrial location influencing the total tonne kilometre task and the mode choice;
- scope of recycling affecting origin and destination patterns; and
- transport system performance, reflected as congestion and impact on reliability of trip times.

Logistics and technology influences include:

- carrier shipper alliances to realise lower logistics costs, higher reliability of on time delivery and less damage or loss
- JIT inventory practices minimising inventory levels, but increasing frequency of shipments and decreasing lead times of shipments;
- intermodal operating agreements realising single accountability across modes, tailored services, lower costs and higher service levels;
- centralised warehousing increasing the freight task but reducing total inventory and warehousing costs;
- packaging reducing the average weight of shipments and increasing the volume or cube limit required of truck trailers and shipping containers; and
- transport technologies and size and weight limits; automated terminals, EOI, ITS, automated equipment identification.

Environment and safety setting influences include:

- environment policy and regulation increasing equipment costs and influencing location of industrial activity and thus the freight task; and
- safety policy and regulation increasing carrier capital and operating costs, while reducing accident related costs.

Freight attributes

The demand parameters described influence the freight attributes. On the other hand, demand

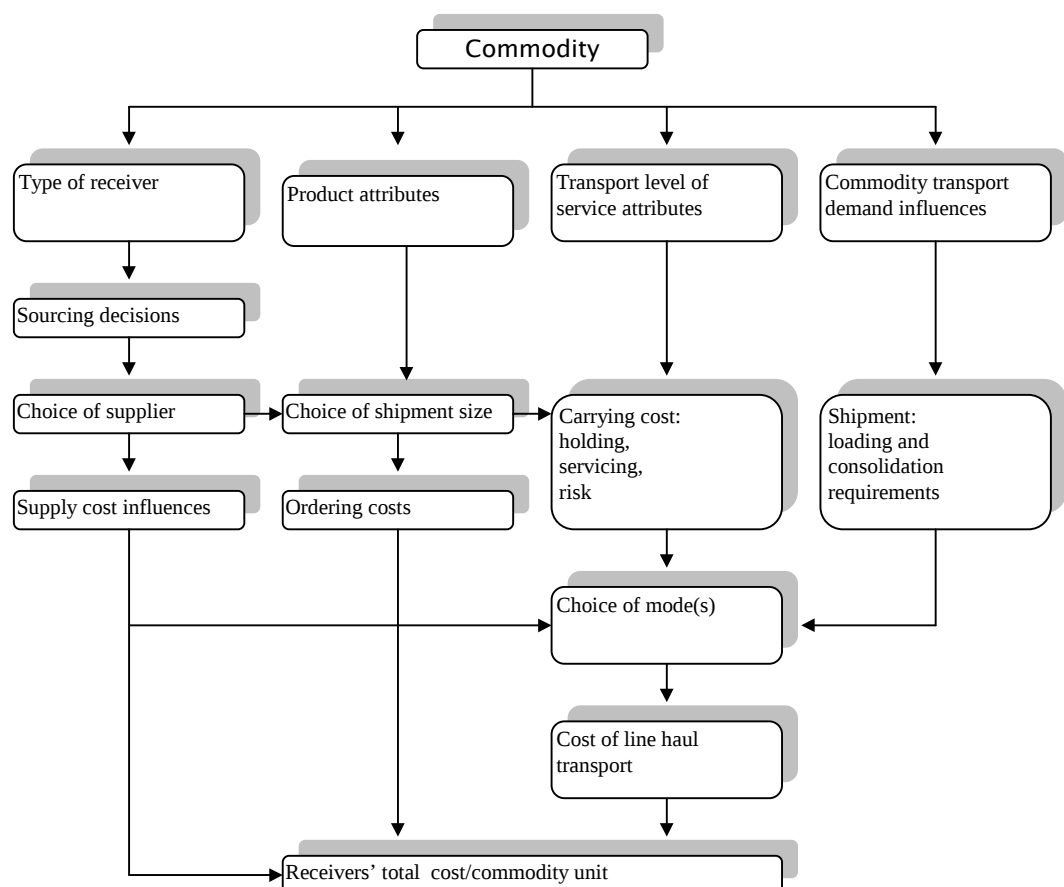
will be affected by the fundamental physical properties of the particular freight commodity and the available substitutes.

- *Commodity characteristics* include the type, weight, volume, value, perishability, storage space requirements and degree of hazard;
- *Trip characteristics* include line-haul distance, multi-drop/pick-up configurations etc. The characteristics of infrastructure and transport equipment facilitating these trips are determined in part by them; and
- *Mode and logistics costs characteristics* include whether “cube” (volumetric limits of transport equipment) or weight limits govern; the suitability of the mode for the hazard profile of the commodity; unit line-haul cost, pick-up and delivery costs; trip time, loading/unloading/wait time; and reliability of the trip time.

Mode choice

Chart 2.5 summarises the scope and interaction of factors which are embedded in a rational transport mode choice.

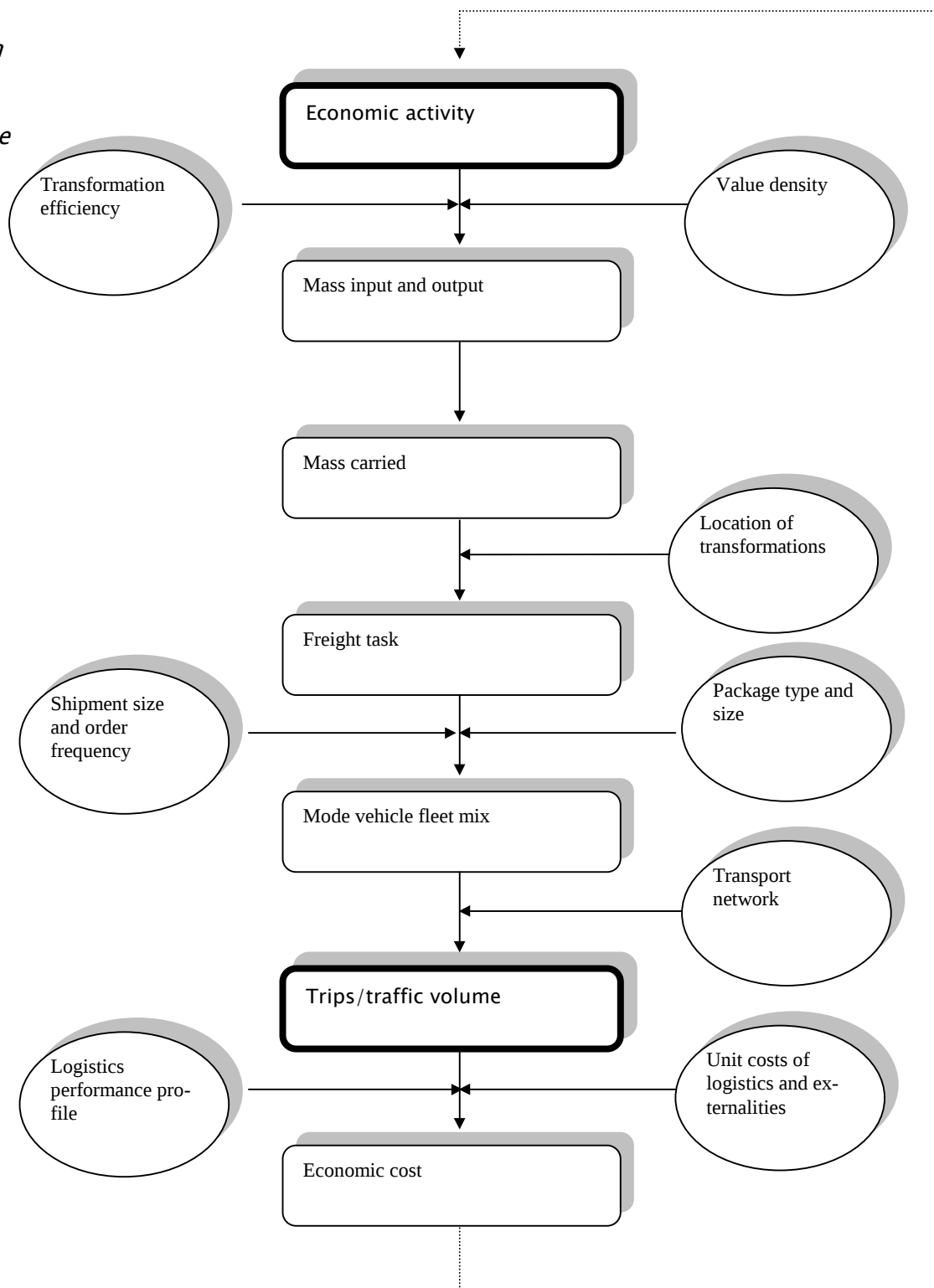
*Chart 2.5:
Factors
influencing
mode
choice and
logistics
costs*



Freight vehicle trips and the nexus with economic activity and technology

Chart 2.6 serves to inform of some of these influences.

*Chart 2.6:
Link between
economic
activity and
traffic volume*



Part 3

The freight task engaging greater Melbourne

Introduction

In this part of the report we present information on the magnitude and value of commodities moving from, to and within Melbourne.

Melbourne represents 73% of Victoria's population of 4.8 million. Population is synonymous with the freight task related to consumables, foodstuffs, non-perishables and much of construction materials. Melbourne is also the location of some 53,000 or 74% of Victoria's 72,000 manufacturing, wholesaling and retail enterprises. These are of course major generators of freight. Geelong, Ballarat, Bendigo, Shepparton, Wodonga, Gippsland and Mildura mostly share the remaining quarter of the state's population and business enterprises and significance as freight production and destination centres.

Figures 3.1 (Victoria's population density) and 3.2 (distribution of enterprises) illustrate the significance of Melbourne within the Victorian freight-generating context.

Melbourne, with population, industries, complementary sea, rail, air and road transport terminals and modal-interchanges, is clearly Victoria's dominant transport hub.

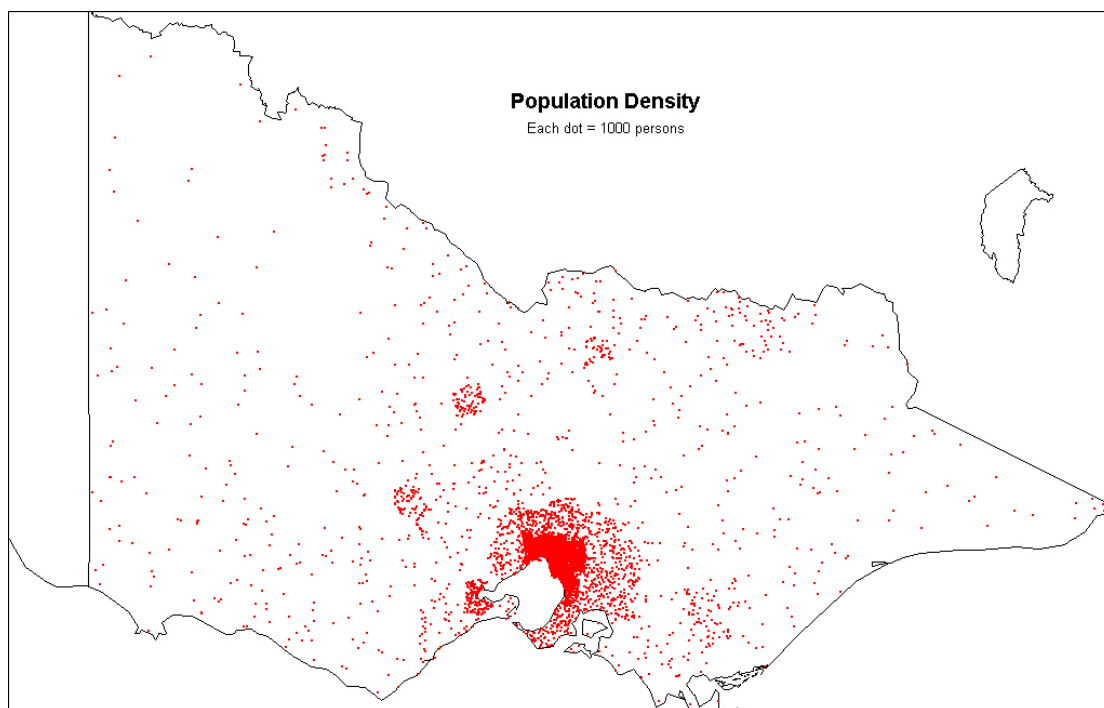
Broadly, 60% of Victoria's freight (tonnes) is uplifted in the metropolitan area, and the balance in regional Victoria. However, when represented as the freight task (tonne kilometres), the metropolitan share is less than 30% of the total Victorian task.

Logistics costs, i.e. committed to transport, packaging and inventory management, represent some 11 to 16% of GDP. In turn they represent 5 and 25% of the monetary value of turnover of industry sectors. Direct transport costs represent some 25% of the logistics costs of most firms. For the metropolitan freight task, the annual transport costs alone are probably in excess of \$2billion per annum.

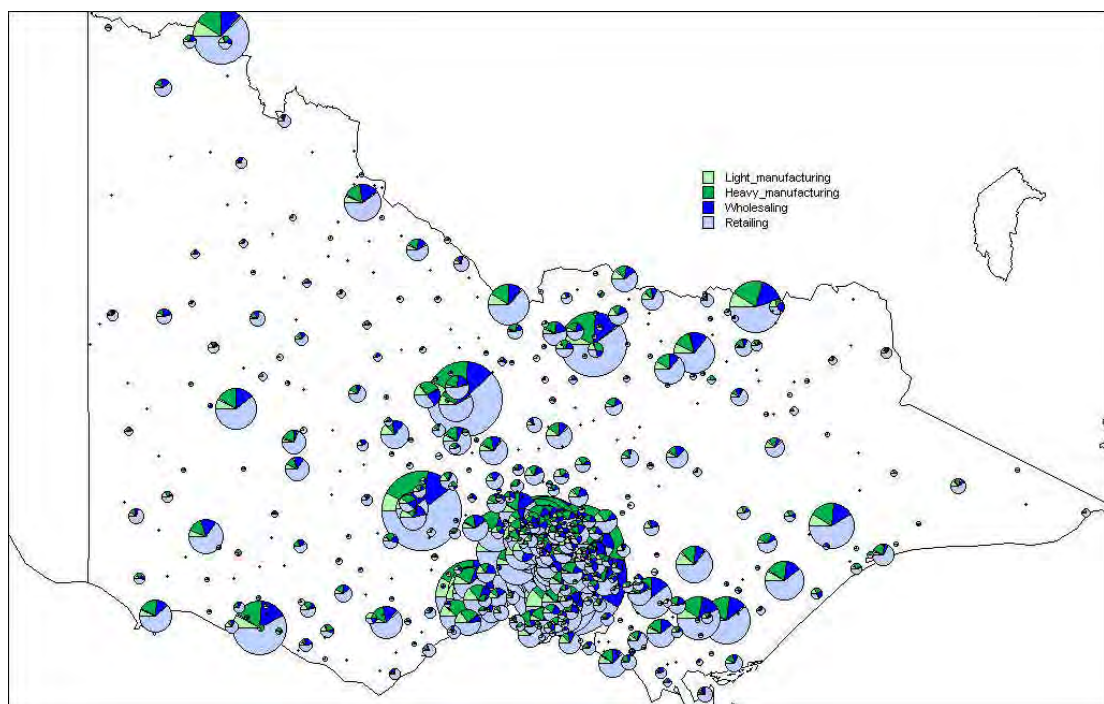
In Appendix 1, we present some considerations related to defining the nature of the directional freight task in Australia.

For the purpose of a context for this metropolitan focused study, Appendix 2 presents some characteristics assessed in 1995 for the freight task on the Melbourne-Sydney and Melbourne-Adelaide road corridors.

*Figure 3.1:
Distribution
of Victoria's
population*



*Figure 3.2:
Distribution
of Victoria's
enterprises*



Freight data

This report draws upon the *FreightInfo*TM database, developed and maintained by FDF. The data set applied is for the year 1995-96. The equivalent nationwide freight data set for year 1998-99 is nearing completion of its compilation. It is a task which occupies some 18 months post availability of key national data.

*FreightInfo*TM is a database of all freight flows within, to and from Australia. It records the mass of the freight carried, its origin, destination, commodity carried, and mode of transport. These data are embodied in an electronic database which can be interrogated to produce tabulated results to the user's specifications.

*FreightInfo*TM is based on a combination of interviews of freight producers and published statistics.

*FreightInfo*TM records the mass, origin, destination, commodity type and mode of transport of every freight flow within, to or from Australia and takes the form of an electronic database of records, each containing five data items.

The making of *FreightInfo*TM

*FreightInfo*TM relies on a combination of published sources, field interviews, and inference. Data from published sources and field interviews are incorporated into a rigorous methodological framework which accounts for every tonne carried. This ensures that *FreightInfo*TM estimates are consistent with known facts and with each other. For instance all freight consigned by a particular economic sector must equal the sum of freight received from that sector by all other sectors. This is similar to the process by which economists construct national accounts and input-output tables; and bears some resemblance to double-entry book-keeping in its use of in-built checks.

*FreightInfo*TM embodies a wide range of published sources.

Numerous field interviews are conducted for each *FreightInfo*TM cycle. Most take place at the premises of firms and other organisations which consign or receive substantial quantities of freight. Other interviews are conducted by telephone.

The intersectoral freight flow matrix

*FreightInfo*TM estimates are constructed around an intersectoral freight flow matrix showing the freight flows from every economic sector and industry which consigns freight to every other economic sector and industry. Each cell in the matrix normally corresponds to a single commodity (that is, the main commodity produced by the industry of origin).

The intersectoral freight flow matrix is the freight analog of the economist's input-output matrix; but where the input-output matrix records the value of goods and services provided by one sector to another, the *FreightInfo*TM intersectoral flow matrix has tonnage transferred from one sector to another. Like the input-output matrix, the intersectoral freight flow matrix has four quadrants (*figure 3.3*).

Figure 3.3:
Structure of
the
intersectoral
freight flow
matrix

		Sector of destination (consignee)										
		Agriculture	Mining	Manufacturing	Electricity	Construction	Other service ind'y	Households	Waste and recycling	Stocks	Traded goods	The environment
Sector of origin (consignor)	Agriculture	Quadrant 1 Intermediate usage: Flows of intermediate products, that is, items which are not consumed directly but are transformed into other products via another manufacturing process.						Quadrant 2 Final demand: Flows from industries to non-industrial sectors, including trade waste, stockbuilding, exports, and discharge to the environment.				
	Mining											
	Manufacturing											
	Electricity											
	Construction											
	Other service ind'y											
Sector of origin (consignor)	Households	Quadrant 3 Primary inputs to production: Flows to industries from non-industrial sectors, including recycling, destocking, imports, and extraction from the environment.						Quadrant 4 Primary inputs to final demand: This sector contains no significant flows.				
	Waste and recycling											
	Stocks											
	Traded goods											
	The environment											

The interzonal freight flow matrix

Once the intersectoral freight flow matrix is constructed, the freight flows in each cell of the matrix are allocated to *FreightInfo*TM origin and destination zones (*figure 3.4*). This is repeated for each mode of transport. Since each cell normally corresponds to a single commodity, we generate in this way all the *FreightInfo*TM records for that commodity. There are various ways of allocating freight flows to origins and destinations.

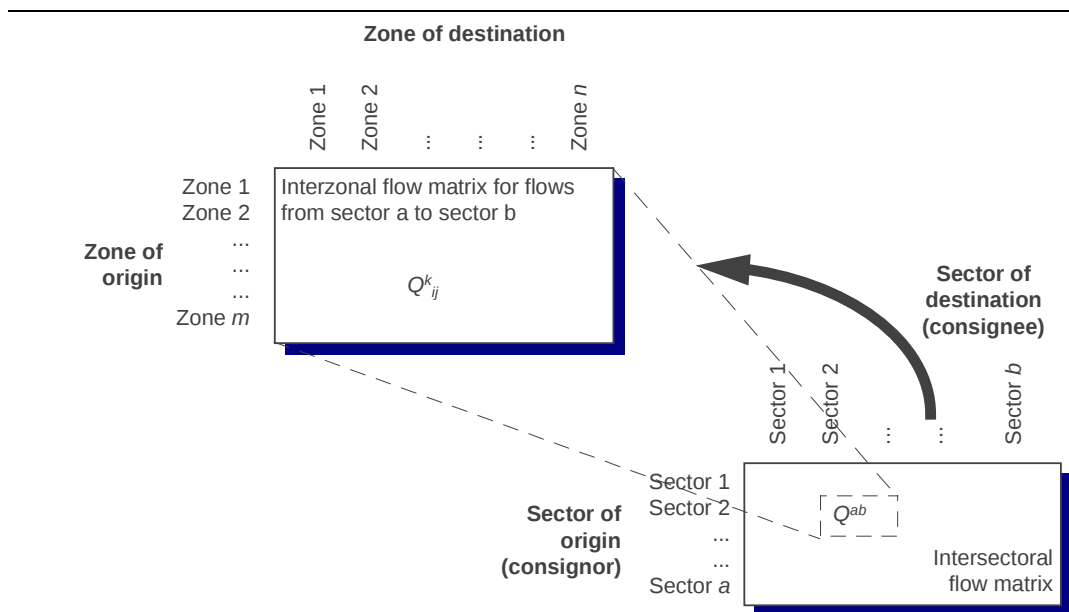
Interview. In the case of most of the larger flows, say from individual mines, destinations can be established by interview.

Published data. Origins and destinations of many freight flows are revealed in publications such as annual reports and yearbooks.

Modelling. More ubiquitous flows (of manufactures, say) are modelled on the basis of straightforward decision rules, which themselves are established by interview. For instance, we find that each state capital serves as the entrepot for distribution of manufactures for final consumption in a well-defined catchment. These catchments coincide mostly, but not completely, with state borders.

Intercapital flows. Freight flows between the capital cities represent mainly the distribution of similar goods to wholesalers in all states. Flows along these particular routes are those published by the ABS.

Figure 3.4:
Derivation
of the
interzonal
freight flow
matrix



Freight task summary

The tasks for any given commodity are:

- Step 1.** Identify production tonnage at the regional level.
- Step 2.** Obtain tonnage data for imports and exports.
- Step 3.** Set up the following mass balance equation at the national level:

$$[Production] - [Consumption] + [Imports] - [Exports] + [Change in stocks] = 0$$

- Step 4.** Identify the nature of this consumption, whether for further processing or for final consumption.
- Step 5.** For each particular use, determine consumption.
- Step 6.** Estimate freight flows within regions and between region-pairs.

Adjustment for unrecorded flows

FreightInfo's procedures detect nearly all freight flows of significant value, but there are some exceptions. Even though these are nearly all of low value and short distance, and so for many purposes they do not matter, we have corrected for them.

Flows not forming part of a production process. Based as it is on interviews and published statistics, FreightInfo's commodity coverage is biased towards items which form part of a production process. Freight flows which tend not to be recorded are: sand, gravel and soil from private property; builders' rubble; movement of cut-and-fill associated with construction and other earthworks; non-commercial freight flows such as machinery for repair; flows of a private nature; colliery washery refuse; waste products from factories; firewood; nursery and garden supplies; and retail deliveries.

Intra-industry flows. Unless there is evidence to the contrary we assume in the first instance that goods forming part of production process are moved only between industries and not within them. This is an approximation. For instance in metal fabrication, parts may be moved several times for fabrication, painting and so on.

Roadmaking. A large amount of crushed rock is moved from dump to dump during roadmaking.

Validation with other data sources

No accurate estimates exists of the total tonnage loaded on to road trucks. The ABS attempts to measure this with its *Survey of Motor Vehicle Usage* but the total road tonnage obtained is believed to be too high for two reasons. First, there is overstatement with the measurement of this variable using the ABS's recall methodology. Second, in the roadmaking task many registered trucks (included in the ABS survey) are used to carry cut-and-fill from and to locations along the construction route. This does not fall within the definition of freight used in *FreightInfoTM*. From our studies of the 'non-production', intra-industry and roadmaking flows, we estimate the true amount of road freight to be substantially lower than the SMVU estimate.

Freight from, and to Melbourne

Freight moving from Melbourne

Tables 3.1 and 3.2 present information, by mode, on freight flowing from Melbourne. Melbourne is the Melbourne Statistical Division as defined by the Australian Bureau of Statistics (ABS).

Table 3.1:
Freight
transport
task – from
Melbourne
1995–96
(ktonnes)

<i>Destination</i>	<i>Mode</i>				<i>Total</i> <i>ktonnes</i>
	<i>Road</i>	<i>Rail</i>	<i>Sea</i>	<i>Air</i>	
Victoria	6 449	253	4		6 706
NSW	2 712	601	2 734	55	6 102
Qld	1 136	287	337	12	1 772
SA	713	773		10	1 496
WA	384	510	1	14	909
Tas			1 400	9	1 409
NT	55	19			74
Overseas			6 490	181	6 671
Total	11 449	2 443	10 966	281	25 139
% of total	45.6	9.7	43.6	1.1	100

Source: FDF *FreightInfoTM* (1996)

In mass terms, the freight task reflecting Melbourne's physical export trade relationship with the rest of Australia and the rest of the world is dominated by road and sea modes – they are of broadly equal significance.

NSW is the predominant destination of road freight – some 50% of all interstate flows. Of the interstate rail freight task, nearly 60% involves the western states (South Australia and Western Australia) and 40% the eastern seaboard states (NSW and Queensland).

Overseas destinations represent in mass terms, some 60% of the Melbourne related sea freight

task. Australian coastal freight originating in Melbourne is dominated (61%) by NSW origins and destinations.

Rail has some 60% of the Melbourne to WA freight task and about 52% of the Melbourne to South Australia freight task. Growth in rail's share of this market segment is hindered by the:

- inability to operate double container stacked trains, Melbourne to Adelaide;
- operational constraints of horizontal and vertical alignment through the Adelaide Hills; and
- constraints on unimpeded train paths reflecting the single-track, passing loop, signalling and operating speed/axle load conditions prevailing.

On the eastern seaboard, rail's mode share related to NSW as a destination from Melbourne is a mere 10%, with road and sea modes broadly balanced at 45% each. Rail is unlikely to capture a significant proportion of the current sea freight task. Its propensity to capture mode share from road is constrained by the rapidly advancing technical performance of the road freight sector and the capability and performance of rail freight systems in the greater Sydney area. The availability of unrestricted train paths on the interstate rail track has improved significantly over the past several years.

The outwards rail freight task engaging Melbourne with Queensland is encumbered by the availability of train paths through greater Sydney and the alignment north of Sydney.

Table 3.2: Freight transport task – from Melbourne – Commodity value 1995–96 (\$m)

Destination	Mode				Total (\$m)
	Road	Rail	Sea	Air	
Victoria	30 545	2 815	1		33 361
NSW	22 134	9 694	573	2 970	35 371
Qld	10 668	2 619	72	648	14 007
SA	6 009	12 808		540	19 357
WA	4 843	4 583	1	756	10 183
Tas			15 434	486	15 920
NT	483	133			616
Overseas			16 863	1 665	18 528
Total	74 683	32 652	32 943	7 065	147 343
% of total	50.6	22.2	22.4	4.8	100

Source: FDF FreightInfo™ (1996)

Note: In this and following tables, commodity values are in 1998-99 prices.

The value of Melbourne's outwards international freight represented less than 13% of its total Australian and International outwards task. The value of freight from Melbourne with the balance of Victoria, and from Melbourne to NSW was (in 1995-96) broadly equal, and some 1.8 times the value of Melbourne's export international trade.

Road was the dominant mode, in terms of value of freight, for the Melbourne-NSW and Queensland export trades. However, the value of rail freight exported from Melbourne to South Australia was more than twice that for road. Broadly, the same value of road and rail "export" freight occurred for the trade with Western Australia.

The highest 'exported' value-density products are moved respectively, by air (\$25,000 per tonne on average), rail (\$13,000 per tonne), road (\$6,500 per tonne), and sea (\$3,000 per

tonne).

Freight moving to Melbourne

Information on freight moving to Melbourne is presented in tables 3.3 and 3.4.

Relative to the mode share for Melbourne's export freight task, rail is significantly more important for the imports – and mostly because of the agricultural commodities moved by rail to Melbourne. Predominantly empty rail wagons from Melbourne move to the grain producing areas to return full through a concentrated season.

The directional imbalance for rail is also significant for rail in the trades between Melbourne and NSW and Melbourne and Queensland. Freight mass by rail from Melbourne to NSW is only one third of that from the opposite direction. The mass from Queensland is only about one sixth of that to Queensland. That from Perth by rail is only about 25% of that to Perth.

Table 3.3:
Freight trans-
port task – to
Melbourne
1995–96
(ktonnes)

<i>Origin</i>	<i>Mode</i>				<i>Total</i> <i>ktonnes</i>
	<i>Road</i>	<i>Rail</i>	<i>Sea</i>	<i>Air</i>	
Victoria	12 908	2 295	3		15 206
NSW	2 532	1 591	1 251	47	5 421
Qld	612	51	428	9	1 100
SA	910	1 054	830	7	2 801
WA	485	127	1 298	7	1 917
Tas			1 709	10	1 719
NT	8	3			11
Overseas			5 965	79	6 044
Total	17 455	5 121	11 484	159	34 219
% of total	51.0	15.0	33.5	0.5	100

Source: FDF FreightInfo™ (1996)

Table 3.4
Freight trans-
port task – to
Melbourne
1995–96
(\$m)

<i>Origin</i>	<i>Mode</i>				<i>Total</i> <i>\$m</i>
	<i>Road</i>	<i>Rail</i>	<i>Sea</i>	<i>Air</i>	
Victoria	16 206	23 156	1		39 362
NSW	15 458	13 654	1 155	2 538	32 806
Qld	3 826	1 164	268	486	5 744
SA	6 480	15 576	160	378	22 593
WA	2 398	1 160	232	378	4 167
Tas			8 078	540	8 618
NT	92	49			141
Overseas			29 823	1 271	31 093
Total	44 459	54 758	39 717	5 591	144 525
% of total	30.8	37.8	27.5	3.9	100

Source: FDF FreightInfo™ (1996)

The highest 'imported' value-density occurs respectively for airfreight (\$35,000 per tonne on average), rail (\$11,000 per tonne), sea (\$3,500 per tonne), road (\$2,500 per tonne). Overall, averaged across all modes, Melbourne exports higher value-density products (\$6,000 per tonne) than it imports (at \$4,000 per tonne).

Road and rail freight by corridor

In the following tables (3.5, 3.6, 3.7 and 3.8), we present estimates of the freight moved in the major transport corridors connecting Melbourne with its hinterland.

The tables also provide information on the level of transformation of the freight. Unprocessed

materials are commodities such as fresh food and grains. Simply transformed manufactures (STM) include building materials, agri-products and foodstuffs. Elaborately transformed manufactures (ETM) include products such as electrical equipment, vehicles and pharmaceuticals.

Victoria's road and rail infrastructure facilitating the freight movement between Melbourne and hinterland are indicated in Figures 3.3 and 3.4.

Figure 3.3:
*Victoria's
major rural
arterial
roads*

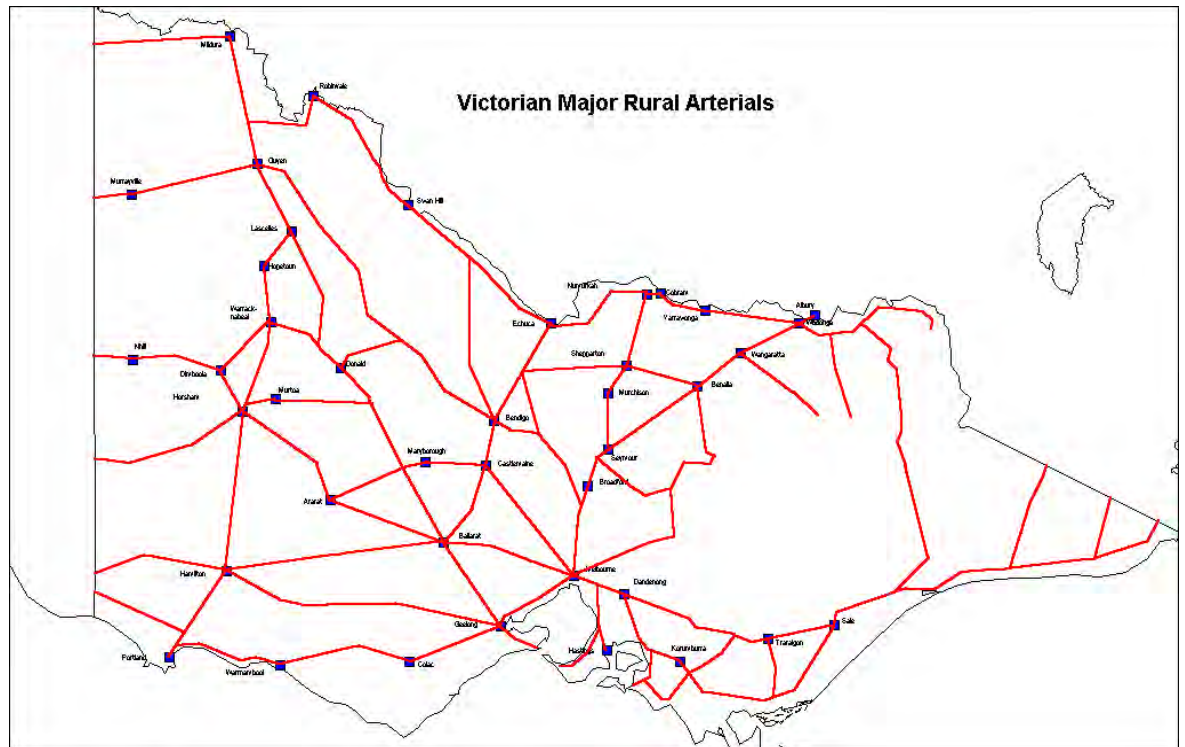


Figure 3.4:
Victoria's
railway
network

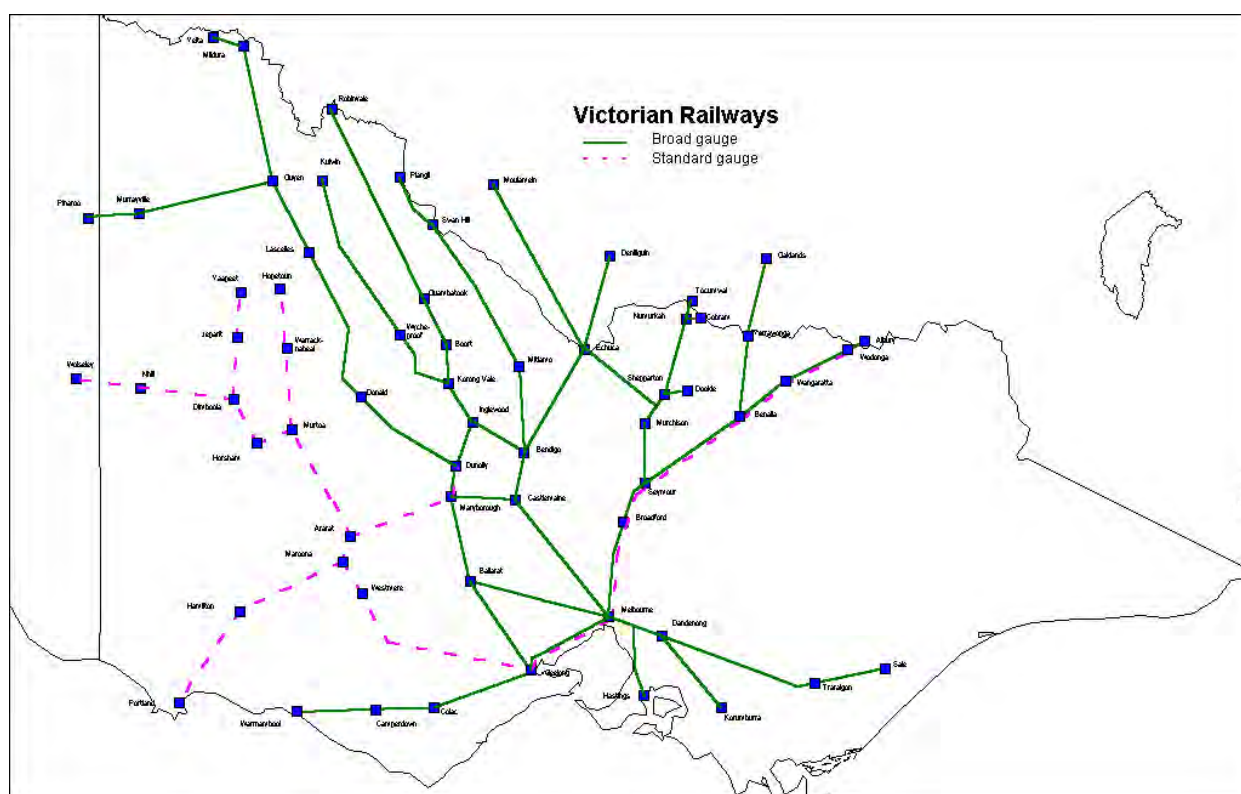


Table 3.5:
Roadfreight
from Mel-
bourne by
corridor
1995–96

Corridor	Unprocessed materials (ktonnes)	STP (ktonnes)	ETP (ktonnes)	Total (ktonnes)	Unprocessed materials (\$m)	STP (\$m)	ETP (\$m)	Total (\$m)
Calder	248	722	95	1 065	33	3 771	1 738	5 541
Hume	284	3 373	1 398	5 055	125	13 615	25 775	39 515
Princes East	372	809	121	1 302	44	3 468	2 080	5 592
Princes West	1 087	553	192	1 832	136	5 095	3 101	8 332
Western	236	1 409	550	2 195	53	5 652	9 998	15 703
Total	2 227	6 866	2 356	11 449	390	31 601	42 692	74 683

Source: FDF FreightInfo™ (1996)

Table 3.6:
Rail freight
from Mel-
bourne by
corridor
1995–96

Corridor	Unprocessed materials (ktonnes)	STP (ktonnes)	ETP (ktonnes)	Total (ktonnes)	Unprocessed materials (\$m)	STP (\$m)	ETP (\$m)	Total (\$m)
Calder		69		69		783		783
Hume		781	151	932		10 076	3 106	13 182
Princes East		22		22		163		163
Princes West	88	1 107	199	1 394	451	15 192	2 423	18 066
Western	6	20		26	2	456		459
Total	94	1 999	350	2 443	453	26 669	5 529	32 652

Source: FDF FreightInfo™ (1996)

Note: For rail freight: Calder (Bendigo line), Hume (Wodonga line – both gauges – via Sunshine), Princes East (Gippsland), Princes West (Geelong – both gauges) and Western (line to Ballarat).

Table 3.7:
Road freight
to
Melbourne
by corridor
1995-96

Corridor	Unprocessed materials (ktonnes)	STP (ktonnes)	ETP (ktonnes)	Total (ktonnes)	Unprocessed materials (\$m)	STP (\$m)	ETP (\$m)	Total (\$m)
Calder	2 006	470	34	2 510	1 428	1 182	480	3 091
Hume	2 074	2 511	789	5 374	3 535	7 849	10 438	21 822
Princes East	2 838	627	10	3 475	2 564	961	69	3 594
Princes West	1 347	1 495	93	2 935	178	3 196	1 271	4 646
Western	1 428	1 387	346	3 161	1 859	2 821	6 627	11 307
Total	9 693	6 490	1 272	17 455	9 564	16 009	18 887	44 459

Source: FDF FreightInfo™ (1996)

Table 3.8:
Rail freight
to
Melbourne
by corridor
1995-96

Corridor	Unprocessed materials (ktonnes)	STP (ktonnes)	ETP (ktonnes)	Total (ktonnes)	Unprocessed materials (\$m)	STP (\$m)	ETP (\$m)	Total (\$m)
Calder	290	601		891	105	13 713		13 818
Hume	887	1 245	13	2 145	202	15 262	271	15 735
Princes East	97	131		228	18	1 585		1 603
Princes West	85	1 446	84	1 615	10	16 703	1366	18 080
Western		242		242		5 522		5 522
Total	1 359	3 665	97	5 121	334	52 786	1638	54 758

Source: FDF FreightInfo™ (1996)

The above tables highlight the importance of the Hume corridor for road freight movements in both directions.

For rail the most significant task occurs for the Geelong / Western Victoria Adelaide /Perth corridor. Most rail traffics (from the west and north) arrive at Melbourne from the west. Freight from Sydney uses a grade-separated system right through to the Dynon terminal.

The relatively small (3%) rail tonnage from the east (including paper from Maryvale – Gippsland and steel to and from Hastings) moves, along broad gauge tracks, through both Flinders Street and Spencer Street passenger stations. The freight train paths are shared with passenger train paths.

Commodities transported by pipeline provide an important contribution to Melbourne's functioning. Some 9,000 ktonnes of petroleum products were piped out of Melbourne in 1995-96. Some 22,000 ktonnes were piped in. Flows entirely within Melbourne include aviation fuel provided to Tullamarine.

Freight moving within Melbourne

Table 3.9 indicates the tonnages and value of Melbourne's internal freight task by broad commodity classification.

In 1995-96, FDF estimated some 25 million tonnes of freight left Melbourne while 34 million tonnes arrived at Melbourne from its hinterland. Some 134 million tonnes were moved within Melbourne (having both an origin and destination within Melbourne). Almost all of the 134 million tonnes were moved by road. Commodities including soil, land-fill and unprocessed construction materials represented the largest tonnage. The internal movements within Melbourne are some 2.3 times the total of flows to and from Melbourne.

Table 3.9:
Road and
rail freight
transport
task –
within
Melbourne
1995–96

<i>Commodity</i>	<i>ktonnes</i>	<i>\$m</i>
Livestock	189	2 332
Foodstuffs	5 556	52 667
Crude materials	2 294	4 122
Non-metallic minerals	92 081	11 362
Metallic minerals	379	266
Fuels	6 584	1 653
Chemicals	5 510	12 770
Non-metallic products	8 662	3 154
Metals, metal manufactures	9 711	63 771
Other manufactures / goods	3 480	49 485
Total	134 446	201 583

Source: FDF FreightInfo™ (1996)

In 1994, FDF made the estimates presented in Table 3.10 of the metropolitan freight with origins or destinations in Melbourne's statistical sub-divisions. (In the table, Southern includes Southern, South Eastern and Peninsula.) The bias of activity to Melbourne's east and south is clearly indicated. However, so is the need for transport infrastructure which provides the connectivity, and thus accessibility, between the complementary zones of production, transformation and consumption of materials in the metropolitan area.

Table 3.10:
Distribution of
freight task in
metropolitan
Melbourne,
estimated 1994

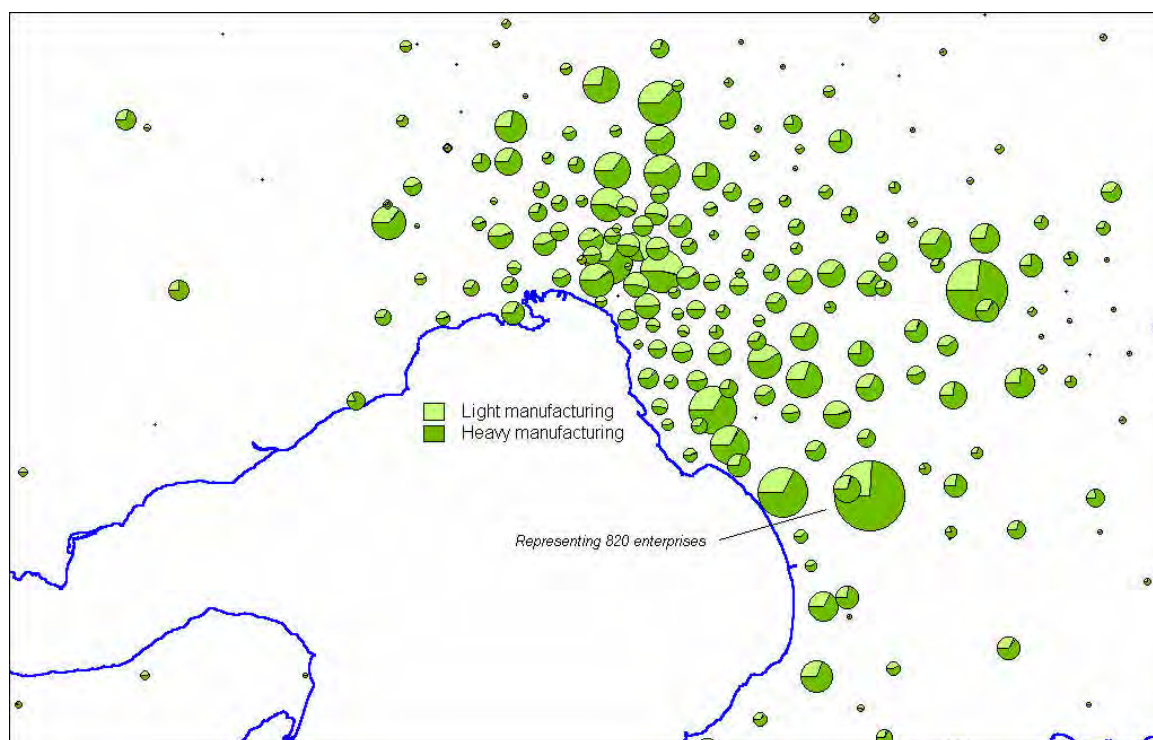
<i>Melbourne origin/destination region</i>	<i>% of total freight (tonnes)</i>	<i>% of total freight task (billion tkm)</i>
Central	18.2	15.3
Western	16.7	16.5
Northern	20.1	22.4
Eastern	17.4	17.6
Southern	27.6	28.2
Total	100.0	100.0

Source: FDF FreightInfo™ (1993)

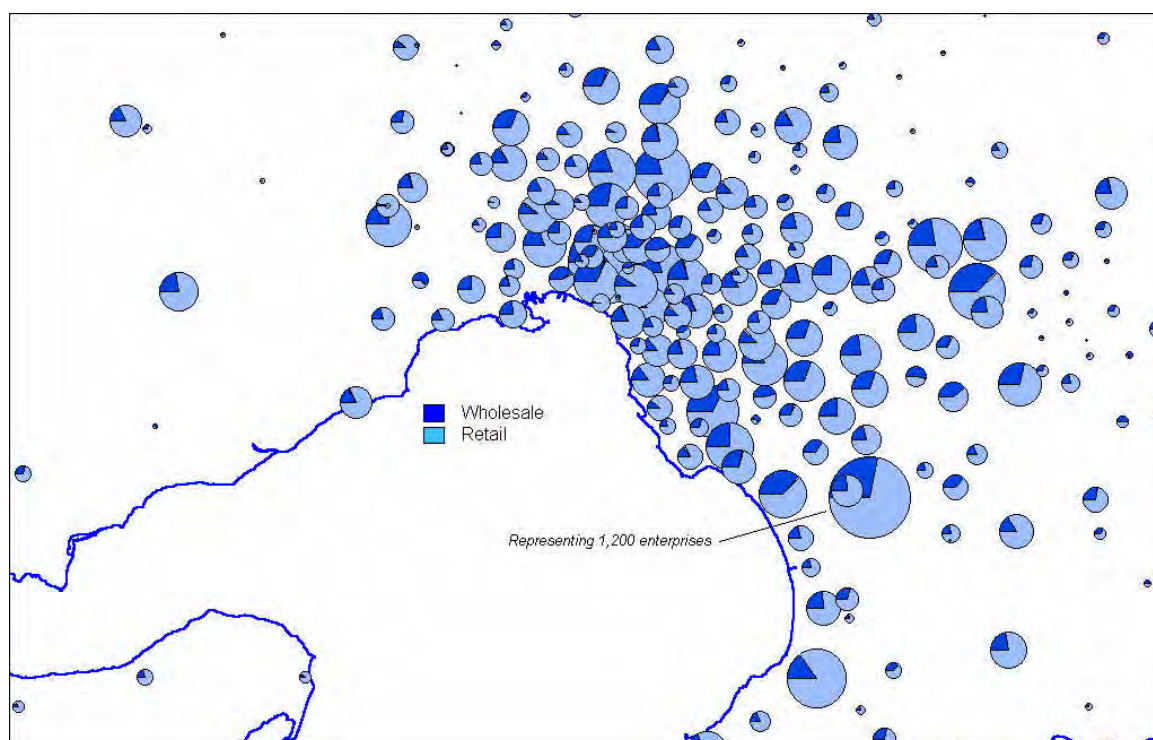
Figures 3.5 and 3.6 serve to illustrate the easterly bias of Melbourne's freight transport task related to its light and heavy manufacturing enterprises, and to its wholesale and retail enterprises.

The industry classification adopted reflects Australian and New Zealand Standard Industry Code (ANZSIC) as used by the Australian Bureau of Statistics. Light industry is comprised of C21 Food, C22 Textile, C23 Wood and Paper Product Manufacturing and C24 Printing. Heavy industry is comprised of C25 Petroleum, C26 Non-Metallic Mineral Product Manufacturing, C27 Metal Product Manufacturing, C28 Machinery and Equipment Manufacturing and C29 Other Manufacturing. Wholesaling is comprised of F45 Basic Material Wholesaling, F46 Machinery and Motor Vehicle Wholesaling and F47 Personal and Household Good Wholesaling. The retail enterprises include G51 Food Retailing, G52 Personal and Household Good Retailing and G53 Motor Vehicle Retailing and Services.

*Figure 3.5:
Melbourne
light and
heavy
manufac-
turing
enterprises*



*Figure 3.6:
Melbourne
wholesale
and retail
enterprises*



Overview of the intermodal freight task

Road – rail

In numeric terms, virtually all rail hauled commodities leaving or arriving in Melbourne (mostly through the north and south Dynon terminals and Melbourne Steel Terminal) are ultimately also moved by road. The Altona intermodal rail terminals of CRT and SCT are also of increasing importance. However, there is also a significant rail freight quantity which passes through Melbourne with origins and destinations both east and west of Melbourne.

Port – road

Again most non-bulk products passing through the Port of Melbourne are moved by road. The matter is discussed in Part 4.

Port – rail

Significant quantities of bulk products, including wheat and rice, are railed directly into Appleton Dock - all through Footscray. The efficacy of the existing rail to wharf system and its future development is the subject of comprehensive investigation by Melbourne Port Corporation. The matter is addressed further in Part 4.

Air – road

While the Melbourne air-to-road tonnages are small relative to the sea to road/rail the commodity-value relationship is much closer (\$b 7.58 air to \$b 23.35 sea). All airfreight is moved by road transport, generally using more transport-intensive rigid trucks and light commercial vehicles.

Melbourne's sea and air freight task in the Australian context

The following tabulations indicate the relative importance of Melbourne in the Australian context for coastal and international shipping freight and for air freight.

Coastal shipping

Table 3.11
Coastal
shipping
freight
(note Sydney
refers to Port
Botany, Syd-
ney Harbour
and Kurnell),
1998–99.

Port	Trade direction	Units	Freight format				Total
			Container	Dry bulk	Liquid bulk	Other	
Melbourne	Loading	Ktonnes	797.9	200.5	1 307.4	44.7	2 350.6
Sydney	"	"	107.1	30.5	183.1	1.4	322.1
Brisbane	"	"	366.3	233.8	1 554.7	1.7	2 156.5
Adelaide	"	"	644.0	199.3	526.9	0.9	1 371.1
Total		"	1 915.3	664.1	3 572.1	48.7	6 200.3
Melbourne	"	\$m	9 947	820	262	451	11 480
Sydney	"	"	648	106	37	17	808
Brisbane	"	"	1 932	161	315	21	2 430
Adelaide	"	"	2 483	145	107	11	2 745
Total		"	15 010	1 231	721	501	17 464
Melbourne	Discharges	Ktonnes	2 033.3	1 333.7	971.7	87.2	4 425.9
Sydney	"	"	851.3	704.6	2 907.4	1.2	4 464.5
Brisbane	"	"	688.7	926.1	1 030.3	2.8	2 647.9
Adelaide	"	"	57.6	1 424.0	1 048.6	0.0	2 530.2
Total		"	3 630.9	4 388.4	5 958.0	91.2	14 068.5
Melbourne	"	\$m	8435	1 358	184	1 542	10 295
Sydney	"	"	2 879	384	530	914	3 808
Brisbane	"	"	3 203	753	178	931	4 168
Adelaide	"	"	302	616	174	790	1 092
Total		"	14 820	3 111	1 065	4 176	19 363

Source: FDF FreightInfo™ (1999)

International shipping

Table 3.12: International shipping freight by port 1998–99.

Port	Trade direction	Units	Freight format				Total
			Container	Dry bulk	Liquid bulk	Other	
Melbourne	Export	ktonnes	4 316.1	1 209.1	1 286.2	293.6	7 105.0
Sydney	"	"	3 035.3	921.4	576.9	21.4	4 555.0
Brisbane	"	"	3 128.7	3 690.2	382.6	395.4	7 596.9
Adelaide	"	"	1 093.7	1 478.1	14.3	72.1	2 658.2
Total		"	11 573.8	7 298.8	2 260.0	782.5	21 915.2
Melbourne	Export	\$m	9 958	1 141	304	1 327	12 730
Sydney	"	"	6 402	1 319	127	219	8 066
Brisbane	"	"	4 336	672	96	158	5 262
Adelaide	"	"	1 468	368	5	626	2 467
Total		"	22 164	3 499	532	2 330	28 526
Melbourne	Import	ktonnes	3 755.8	1 352.8	2 772.9	544.6	8 426.2
Sydney	"	"	3 676.6	800.1	6 938.2	485.8	11 900.7
Brisbane	"	"	1 106.7	715.6	6 320.9	315.4	8 458.6
Adelaide	"	"	304.4	473.7	940.6	77.9	1 796.6
Total		"	8 843.4	3 342.2	16 972.7	1 423.7	30 582.1
Melbourne	Import	\$m	16 857	1 291	494	4 717	23 358
Sydney	"	"	18 714	1 384	1 085	4 123	25 306
Brisbane	"	"	3 611	511	1 020	2 454	7 597
Adelaide	"	"	1 031	228	137	703	2 100
Total		"	40 214	3 413	2 330	11 997	58 361

Source: FDF FreightInfo™ (1999)

Table 3.13: Air freight through Australian Airports, 1998–99.

Air freight

Airport	Export		Import	
	ktonnes	\$m	ktonnes	\$m
Melbourne	513.3	5 041	92.1	7 580
Sydney	1 219.7	6 065	153.4	17 387
Brisbane	39.3	580	19.2	1 072
Adelaide	6.9	213	5.3	451
Total	1 779.2	11 899	270.0	26 490

Source: FDF FreightInfo™ (1999)

Part 4

The port related metropolitan freight task

Port related freight interfaces

The Port of Melbourne is the major port-related origin and destination affecting road and rail freight flows through the metropolitan area.

If the Port of Hastings is developed to handle either containers or motor vehicles, or both, this could have a significant impact on the volume and direction of metropolitan road and rail freight movements. However, the Victorian Ports Strategic Study (VPSS) does not anticipate this in its Base Case forecast. It suggests only a continuation of the Port's current roles in handling liquid bulk and break bulk. Furthermore, because the Port's liquid bulk movements are all distributed by pipeline and the break bulk is all handled into and out of BHP's plant, the Port is otherwise not in itself an origin or destination for freight movements.

The Toll Geelong Port is the origin and destination of some metropolitan freight movements. However, their volume is relatively small.

Given the above, and the metropolitan focus of this report, the only port interface directly addressed is that with the Port of Melbourne. This is considered separately for categories of containers, liquid bulk (not including oil company distribution from their storage terminals which is dealt with elsewhere), dry bulk, break bulk, and motor vehicles. Of these, containers contribute the great majority of the landside freight movements.

The containerised freight task

Total annual container traffic (full and empty) through the Port of Melbourne currently exceeds 1.2m teu (20' equivalent unit). Table 4.1 shows the VPSS forecasts of container volumes for the years to 2030 for Low, Base Case and High Scenarios. The Base Case indicates a trebling of the current volume to 3.7m teu in 2030. (Refer VPSS Appendix C, Table C.1).

The Port of Melbourne current annual container volume is some 0.5m teu each of overseas imports and exports, and 0.2m teu of domestic (mainly Tasmania) movements. Of these figures, empty containers make up approximately 60,000 teu of the overseas imports, 100,000 teu of the overseas exports and 25,000 of domestic movements.

Table 4.1: Port of Melbourne Container Volume Forecasts (000's teu's pa)

Year	Low	Base	High
2000 (Actual)	1,250	1,250	1,250
2010	1,270	1,611	2,045
2020	1,466	2,355	3,397
2030	2,062	3,698	5,780

Task of container transshipments

Some of the above container movements include transshipments. A container moved from Tasmania to Europe that is transshipped in Melbourne is counted as both a local import and an overseas export. The impact of these movements on metropolitan infrastructure will reflect:

- containers transshipped within the same terminal; no engagement;
- containers transshipped between existing terminals it is limited to the port area road system. If transshipments engage Webb Dock, use of the metropolitan road system will also be entailed; and
- if container terminals were to be built outside the existing Melbourne port areas, more transshipment containers would move on metropolitan roads.

Impact of Darwin rail services

The very high percentage of containers handled in the Port of Melbourne which have metropolitan origins or destinations indicates it is unlikely that either of the proposed rail lines linking Darwin to the southern states would have significant effect on the forecast volumes of containers through the Port of Melbourne.

Empty container movements

The relatively large number of overseas empty container movements through the Port of Melbourne is due to a combination of:

- the high cost of containers and variations in seasonal demand causing shipping companies to re-deploy empty containers that cannot be utilised in the short term;
- volume imbalances on particular trade routes;
- the generally lower density of Melbourne's imports and higher density of its exports resulting in more 40 ft containers, and less 20 ft containers, arriving in Melbourne, than are required to handle exports; and
- the requirements for more export reefer containers than are available from refrigerated imports.

It is unlikely that these circumstances will change significantly in the foreseeable future.

Not all re-positioning of overseas empty containers is effected by ships and, therefore,

through the Port. Some empty containers are moved by regular interstate rail services. The shipping company (owner of the containers) may either pay a rail operator to move containers, or it may hire containers to an interstate freight forwarder for use on a one way trip.

Generally, overseas import and export empty containers move only between the container terminal and an empty container depot. Some of these depots are located in or close to the port area and some are more remote. Very often shipping companies will have two different depots to store their containers – one in or near the port and one further out. In the absence of confirming data, it can reasonably be assumed that 50% of empty containers are moved to/from near-port depots and 50% to/from other depots. In both cases, the trucks normally run with containers in one direction and are without a load in the opposite direction. This, together with the mixes of 20 ft and 40 ft containers, and semi-trailers and B-doubles suggests an average truck loading ratio of about two (2) containers per round trip or one (1) container per single direction truck trip.

Implications of port terminal operating regime on landside container transport movement

There is a significant discordance between hours of work of container ships and the importers/exporters they serve. Ships and the wharfside operations of container terminals operate 24 hours/day, 7 days/week. On the other hand, many importers and exporters are only open for 8 hours/day (or less), for 5 days/week. The container terminals and the wharf carriers provide the buffer between these conflicting work regimes. Generally, terminals load and unload trucks for about 16 hours/day, on 5 days/week. Theoretically they can provide almost sufficient buffer to enable a majority of containers to move directly between the terminal and the importer/exporter. However in practice, this is not so.

A number of factors cause a larger than expected proportion of containers to be double-handled through carriers' yards. The following are relevant:

- very few importers/exporters are open outside the hours of 7:00am to 5:00pm. However, in order to move the total weekly volume of containers into and out of a port container terminal, trucks must continue to access it for at least 16 hours/day;
- importers/exporters generally require a container to be delivered to them at a specified time, and the carrier may be unable to obtain a matching pick up or delivery time at the container terminal;
- in order to make efficient use of scarce wharfside real estate shipping, container terminals generally do not accept export containers more than five days prior to ship arrival, and charge heavily for storage of import containers not removed within three days of ship departure. In these circumstances, importers/exporters who are not equipped with container handling facilities and who cannot (un)pack their containers within these time limits, generally use their carriers to provide interim storage for at least some of them; and
- for many carriers (particularly larger operators) it is more efficient to take the majority of their customers' containers via their yards. This enables them to be sure they

can meet their customers' delivery time demands without the risk of delays at the terminal. It also enables better utilisation of their trucks through delivering to customers during the limited hours available. Also containers can be transported between the carrier's yard and the port container terminals (often loaded with multiple containers in both directions) during the evening and/or night hours.

Even for a simple direct container movement between an importer/exporter in the metropolitan area and a port container terminal there can be a total four truck trips. For an overseas import these entail:

- unloaded truck movement from transport yard to container terminal;
- movement of full container from port terminal to importer;
- return of empty container from importer to shipping line empty container depot; and
- unloaded truck from shipping line empty container depot to carrier's transport yard.

In practice, for a truck performing several jobs (container movements) during one day, the last trip in the above sequence may become the first trip of the next job. Or if the empty depot is in or near the port, it may not even arise. Thus receipt and final delivery of one import container may lead to between two and four separate single direction truck trips.

An export container movement will generate similar trips, but in reverse sequence.

Because domestic container movements generally do not pass through a shipping line's empty container depot between loads, they generally only generate two separate single direction truck trips for each container movement.

To maximise operational flexibility, and because shipping line's empty container depots are only open for limited hours for 5 days/week, larger carriers often bring empty export containers to their yards prior to the packing date. Similarly, they will often return empty import containers there after unpacking. Whenever possible, bridging the empty containers between the carrier's yards and the shipping line's empty container depots, is done in movements of multiple container loads and, preferably, with backloading.

The truck survey (in 1990) of the Port of Melbourne Authority found that 88% of overseas import containers through the Port had their ultimate destination within the metropolitan area. For containers for export through the port, 51% had their origin within the metropolitan area. Furthermore, it was found that many containers were taken to intermediate destinations in the metropolitan area; either carriers' yards (51% of imports and 36% of exports) or rail terminals (3.1% of imports and 8.7% of exports). The figures for domestic trades were similar. Over the past 10 years many changes have occurred, affecting these statistics. They include:

- there has been an increase in manufactured exports which has probably increased the proportion of metropolitan sourced exports (although there has also been strong growth in agricultural sourced exports);
- the closure of all on-wharf rail sidings (except at East Swanson Dock) which has probably led to a greater percentage of containers being transferred between the shipping terminals and rail terminals;
- there is no longer a direct shipping service between Sydney and Tasmania;
- due to improved efficiency of rail operations (including more services), there is now probably more freight with interstate origins or destinations passing through Melbourne (particularly related to Adelaide). This also may have led to an increase in the percentage transferred to and from rail; and
- the road operations of shipping container terminals are open for more hours per day, there are more after-hours bulk runs; and B-doubles have been introduced. Each of these occurrences has caused an increase in the percentage of containers being double handled through carriers' yards which, in turn, results in an increase in the number of metropolitan truck trips to move the same number of containers.

Port related metropolitan truck trips: to/from importers/exporters

In considering the number of metropolitan truck trips currently generated by overseas container traffic through the Port of Melbourne, it is reasonable (refer to the 1990 truck survey above) to assume that 80% of imports and 55% of exports have ultimate origins and destinations in the metropolitan area. Similarly, it is reasonable to assume 65% of domestic imports and exports are assumed to have origins and destinations in the metropolitan area.

For this discussion, the imports and exports that move by rail or to/from another wharf are ignored because the close proximity of the rail and shipping terminals means the road transport between them does not significantly affect the general road system. However, it should be noted that the remaining percentages of containers – delivered by road to/from origins and destinations outside the metropolitan area – also have to travel over the metropolitan sections of the main rural and interstate routes, and are also not addressed here.

When considering landside container operations, the number of containers to be moved is more relevant than the number of teu – particularly for road. The teu-ratio (number of teu divided by the number of containers) for the population of overseas containers passing through the port of Melbourne is currently about 1.31. It has risen from around 1.25 in 1998 due to

the increasing use of 40' containers – particularly for imports. On the other hand, the teu-ratio for domestic containers is only about 1.05. (For later calculations it is assumed to be 1.00.) Based on these ratios, the number of containers currently moved through the Port of Melbourne is about 1.0m per annum.

Based on:

- the above data on container origins and destinations;
- that most importers and exporters do not possess handling equipment for full containers and, therefore, containers must be (un)packed on the truck or trailer;
- only one 40 ft container can fit on a semi-trailer; and
- the gross weight of many 20 ft containers (particularly those for export) is so high that it is illegal to carry more than one container on a semi-trailer (except inside the Swanson/Dynon area).

It follows that the majority of containers delivered to metropolitan importers/exporters travel only one to a truck.

Port related metropolitan truck trips: to/from wharf interface

Substantial experience of the author in managing both shipping container terminal and specialist shipping container road transport services underpins the following discussion.

Currently the average truck entering an overseas container terminal carries a total of about 1.4 containers into and out of the terminal. The shipping range from which this average is drawn extends from the 70% (approximately) of trucks that carry only one container (in or out) to the super-B-doubles that can carry up to eight containers (4 x 20' in and 4 x 20' out). However, it must also be noted that the many of the 70% of trucks that carry a total of one container into, or out of, a particular terminal will also often carry one or more containers in the other direction from, or to, either:

- an adjacent shipping terminal, or
- a container depot.

That is, the effective truck loading ratio into and out of the port precinct is considerably higher than any one shipping terminal's figures would indicate. It is probably in excess of two containers per truck per round trip, or in excess of one container per single direction container related truck trip. Considering this with the movements of trucks already carrying multiple containers to a container terminal, the overall truck loading ratio for container trucks entering the port is estimated to be 1.2 containers per single direction truck trip.

On the other hand, given the considerations above, the average of 1.4 containers per truck at the terminal gate, would be greater than the average number of containers per truck actually picking up from, and delivering to, exporters and importers. Many of the trucks carrying multiple containers either into or out of the container terminals are merely transferring them to

or from a carrier's yard – say, at an average loading of two containers per round trip or one container per single direction truck trip. Between the carrier's yard and the importer/exporter, most of these containers will be carried one container per truck for the round trip. Based on this reasoning, the effective average loading to and from the importer/exporter may be as low as 1.2 containers per truck per round trip. Using the logic above, this would give a truck loading ratio of between 0.6 and 0.3 containers per single direction truck trip – say, an average of 0.5.

For there to be an increase (say over the next 30 years) in the average number of containers per truck, and hence a reduction in the total number of single direction container related metropolitan truck trips per annum, some or all of the following would need to apply.

- a large reduction in the number of carriers servicing the waterfront (currently over 300) to give the fewer, larger carriers more opportunities to backload to and from the terminals;
- a change from payment to owner-drivers of per-job rates based on starting from a terminal, to hourly rates or (lower) per-job rates starting from a carrier's yard; and
- significant further investment in container lifting equipment by importers/exporters and by carriers.

However, even if the above requirements are satisfied, the very large number of individual importers and exporters, which gives rise to many small and irregular container shipments, makes it unlikely that the containers per truck ratio will increase significantly.

Based on the data above and the operational changes discussed, it may be assumed that at present about 60% of overseas imports and 50% of overseas exports are double handled between the importer/exporter and the terminal. However, not all of these double handlings cause additional truck trips that have a significant impact on metropolitan roads. This is because some of the carriers' yards are within, or very close to, the port area. The carriers operating these nearby yards are relatively few in number but they are generally the larger wharf carriers. They move a disproportionate percentage of the total containers. A reasonable guess is that these carriers are responsible for about 50% of the containers that are double handled. This therefore leaves about 30% of imports and 25% of exports whose double handling results in additional metropolitan truck trips.

In summary, the current road movement of overseas containers to and from the shipping container terminals can be represented as follows:

Imports:

- 14% to rail or another wharf;
- 20% direct to importers in the metropolitan area;
- 6% direct to importers outside the metropolitan area;
- 30% to importers in the metropolitan area via a carrier's on-port yard; and
- 30% to importers in the metropolitan area via a carrier's off-port yard.

Exports:

- 18% from rail or another wharf;
- 5% direct from exporters inside the metropolitan area;
- 27% direct from exporters outside the metropolitan area;
- 25% from exporters inside the metropolitan area via a carrier's on-port yard; and
- 25% from exporters inside the metropolitan area via a carrier's off-port yard.

The various estimates above can be combined to give a current estimate of the total number of truck trips on the metropolitan road network generated by the containers imported and exported through the Port of Melbourne. Subject to the assumptions that have been set out, Appendix 5 shows there are now approximately 1.3m single direction container related metropolitan truck trips per annum – ie. about 5,000 per day (based on 260 days pa). By 2030 this will have at least doubled. If, during the next 30 years, there is a further transfer of container movements into and out of the Port from road to rail, the number of metropolitan road trips is still likely to increase significantly. However, such a transfer would cause the origin/destination of many trips to change from the Port itself to one of a number of inland ports and the average length of trip would probably reduce.

(Note: In addition to these trips generated by containers, there are approximately 22,000 roll-on-roll-off freight movements per annum to and from Tasmania. Each one of these generates at least one single direction metropolitan truck trip.)

In Appendix 5 we have also estimated the current total value of road transport in the metropolitan area (not including the metropolitan component of interstate or rural trips) arising from container movements from and into the Port of Melbourne to be about \$144m per annum.

Rail mode port related container movements

The VPSS notes (Table 11.4) that currently about 150,000teu/annum of container traffic through the Port of Melbourne arrives at or departs from the port precinct via North or South Dynon rail terminals. This is in addition to the containers handled directly at the East Swanson Dock rail siding – about 30,000teu/annum on Patrick's Adelaide train and 3,000teu/annum on the "Rice" train. In total, this represents about 15% of the Port's throughput of 1.25m teu's.

Observations on proposals for inland ports

Consideration is being given to increasing the volume of containers moving into and out of the Port area by rail in order to reduce the number of trucks entering the area. (Refer the draft final report "Port Rail Logistics Strategy Study" by Connell Wagner for the Melbourne Port Corporation.) This would be achieved by having rail sidings at most container terminals (currently only at East Swanson Dock) connected to collection and distribution depots (often called inland terminals or inland ports) located in metropolitan and rural centres. There is no doubt that, given sufficient volume, the strategy is appropriate for rural Victoria. In fact, Freight Australia has operated it successfully for several years. We are also aware that CRT and FCC among others are aggressively developing proposals.

The inland port strategy is also used within a number of cities around the world in order to overcome the road traffic congestion caused by their geography and demography. However,

whether it will be effective for Melbourne metropolitan area, remains at issue. It would appear to be particularly relevant to cities that have their port on one side and much of their industrial area diametrically opposite, with an inadequate road system connecting them. Sydney, is a prime example, and such measures have been in place since 1970. In contrast, Melbourne's port is near the centre of the urban area, and there are relatively good road connections to all the surrounding industrial areas. This may mean that in Melbourne the costs of any small delays in direct delivery by road to and from the wharf are less than the cost of the double handling that is inherent in the inland terminal strategy.

At wharf rail sidings

The other question to be considered in regard to rail movement of containers is whether, given the potential volumes and the geography of the Port of Melbourne, it is best to have individual rail sidings at each terminal or to have a central siding serving the whole port, as at Dynon. Factors impacting on this decision include:

- length of siding which it is practical to build in a terminal compared to the ever-increasing length of trains required for economic operation;
- volume of containers available on a daily basis at one container terminal to exchange between ships at the berth and a train going to any specific destination. For instance, for how many days would the first container available for the Sydney-Brisbane train have to wait before there were enough containers to fill the train? Similarly, how far in advance of the last ship's close-off would it be necessary to dispatch containers from Adelaide in order to ensure a full train and still meet the earliest ship's close-off?; and
- the cost of transferring containers by road between the shipping terminals and Dynon. This is currently minimised by using super-B-doubles. However, it could be reduced further if larger and heavier vehicles – for which Docklink Road was designed – were used, and an overpass was built in Footscray Road to avoid traffic conflicts.

Port interface liquid bulk freight task

Most liquid bulk imports and exports through the Port of Melbourne are transferred into and out of the port by pipeline. Two significant exceptions generating road transport trips are:

- liquid bulk imports and exports at No.1 Maribyrnong berth, and the various tank farms on Coode Island; and
- butadiene imports at Breakwater Pier.

Compared with container-related truck movements, neither of the above activities generates a large volume of truck trips. However, the majority of these movements relate to products classified as Dangerous Goods.

Based on records kept at the Terminals Pty Ltd weighbridge, about 13,000 trucks per annum

pick up and deliver product at the tank farms on Coode Island. Because road tankers are normally only loaded in one direction on any return trip, this means that up to 26,000 single direction metropolitan truck trips per annum are generated by the liquid bulk imports and exports through Coode Island. This is equivalent to 100 single direction truck trips per day (based on 260 days pa).

Four or five 2000 tonne shipments of butadiene per annum arrive at Breakwater Pier for Qenos Pty. Ltd. This is transferred to Altona in road tankers of about 20 tonne capacity. That is, there are about 100 road tanker loads per shipment. Therefore, this activity generates about 900 single direction metropolitan truck trips per annum.

The VPSS estimates that liquid bulk shipments through the Port of Melbourne will increase until 2010 and then reduce during the period until 2030. However, it is doubtful that these projections for the total liquid bulk market (mostly crude and refined petroleum, distributed by pipeline) can also be directly transferred down to the relatively small volumes of the above specialised commodities within that total. We offer the following comments:

- unless an alternative to Coode Island is found for receiving and storing chemicals and the other products currently stored there, it is probable that volumes through it will increase at a rate at least in line with the growth in the Victorian economy. Consequently, the annual number of truck trips generated by this activity is also likely to increase in parallel with growth in the economy; and
- the volume of butadiene imported has been stable over a number of years. However, because it is only one product being imported by one user, it is impossible to estimate how much (if any) might be imported in future years.

There are no rail freight movements directly generated by liquid bulk shipments through the Port of Melbourne.

Port interface dry bulk freight task

The VPSS forecasts for total annual dry bulk traffic through the Port of Melbourne for the years to 2030 are given in Table 4.2.

Table 4.2: Port of Melbourne Dry Bulk Forecasts (000's tonnes pa)

Year	Scenario		
	Low	Base	High
1996	1,946	1,946	1,946
2010	2,072	2,515	3,538
2020	2,249	3,448	5,660
2030	2,712	4,869	7,028

Based on these volumes, VPSS (Section 7.2.1) has estimated that in 2030 the daily number of one-way dry bulk truck movements caused by the port activity will be:

- for the Base Case: 730 for a 90% road mode share or 720 for a 75% road mode share; and

- for the High Scenario: 1,070 for a 90% road mode share, or 1,020 for a 75% road mode share.

Because trucks moving dry bulk are normally loaded in one direction only on a return trip, the daily number of single direction metropolitan truck trips that are generated by dry bulk shipments through the Port of Melbourne would be almost double these figures. These figures are about 20% of those arising from container movements.

The Port Rail Strategic Study (Connell Wagner), Table 10, shows an average “Direct to Dock Train Generation” of 3 per week for Grainco in 2001 rising to 3 or 4 per day in 2030. It also forecasts that other wharves (Victoria, South Wharf and Maribyrnong) used for both dry and break bulk, will commence being served by rail at various times prior to 2030. This is forecast to result in the generation of an additional 2 to 6 direct to dock trains per day. In this context, in 2030, the Port could “generate” between 5 and 10 direct to dock trains per day. (The breadth of this range is due to the range of estimates used by VPSS for forecasting both the Port’s total dry bulk throughput and the degree of success rail will have in acquiring mode share.) Connell Wagner note that these are average daily figures based on annual product flows. They point out that there will be wide variations in actual daily flows due to seasonal and market demand changes and to rail traffic operational constraints. They also estimate that actual train movements will be about double the theoretical number of trains “generated”.

Port interface break bulk freight task

The VPSS forecasts of total annual break bulk traffic through the Port of Melbourne for the years to 2030 are shown in Table 4.3.

Table 4.3: Port of Melbourne Break Bulk Forecasts (000’s tonnes pa)

Year	Scenario		
	Low	Base	High
1996	1,812	1,812	1,810
2010	2,345	2,684	3,077
2020	2,793	3,870	4,664
2030	4,159	6,310	8,242

Based on these estimated volumes, VPSS (Section 7.2.1) it is estimated that in 2030 the daily number of one-way break bulk truck movements caused by the port activity will be:

- for the Base Case: 840 for a 90% road mode share, or 700 for a 75% road mode share;
- for the High Scenario: 1,190 for a 90% road mode share, or 1,080 for a 75% road mode share.

Backloading of trucks engaged in break bulk movements into and out of the port is theoretically possible. However in practice, due to the spasmodic nature of the shipments and the need to move freight on or off the wharf in a relatively short time, it is unlikely that any significant level backloading will be achieved. That is, trucks will normally be loaded in one direction only and therefore the daily number of single direction metropolitan truck trips that are generated by break bulk shipments through the Port will be almost double the above fig-

ures. Again, these figures are an order of magnitude smaller than those arising from the movements of containers.

Port interface motor vehicles freight task

Table 4.4 presents the VPSS forecasts total annual motor vehicle traffic through the Port of Melbourne for the years to 2030.

Table 4.4: Port of Melbourne Motor Vehicle Forecasts (000's of units pa)

Year	Scenario		
	Low	Base	High
1996	335	335	335
2010	567	569	656
2020	813	977	1,104
2030	1,239	1,468	1,679

Based on these estimated volumes, VPSS (Section 7.2.1) has calculated that in 2030 the daily number of one-way car carrier movements caused by the port activity will be:

- for the Base Case: 670 for a 90% road mode share, or 590 for a 75% road mode share; and
- for the High Scenario: 780 for a 90% road mode share, or 690 for a 75% road mode share.

Backloading of trucks moving vehicles into and out of the port is theoretically possible. However in practice, due to the spasmodic nature of the shipments and the need to move vehicles on or off the wharf in a relatively short time, it is unlikely that any significant level of backloading will be achieved. That is, car carriers will normally be loaded in one direction only and therefore the daily number of single direction metropolitan truck trips that are generated by vehicle shipments through the Port will be almost double the above figures. Again, these figures are an order of magnitude smaller than those arising from container movements.

Although VPSS forecasts car carrier truck volumes based on two levels of mode sharing with rail, further investigation would be required to determine whether it is practical and economic to have, or whether the vehicle importers/exporters would want, a direct rail interface at the wharf. If the answer is no, the potential number of daily one-way car carrier movements could be higher than those shown for the 90% road mode share above.

Part 5

Engagement of passenger and freight transport tasks

The purpose of this section of the report is to briefly acknowledge the engagement of the freight transport task with the passenger transport task and to reflect on matters of complementarity, of one abetting or hindering (or both) the performance of the other.

The reader is also reminded that the whole report has only been funded to support ten days' work. Constrained in this respect, the following must only be considered as “a point of departure” rather than as definitive consideration.

Urban form and the freight task

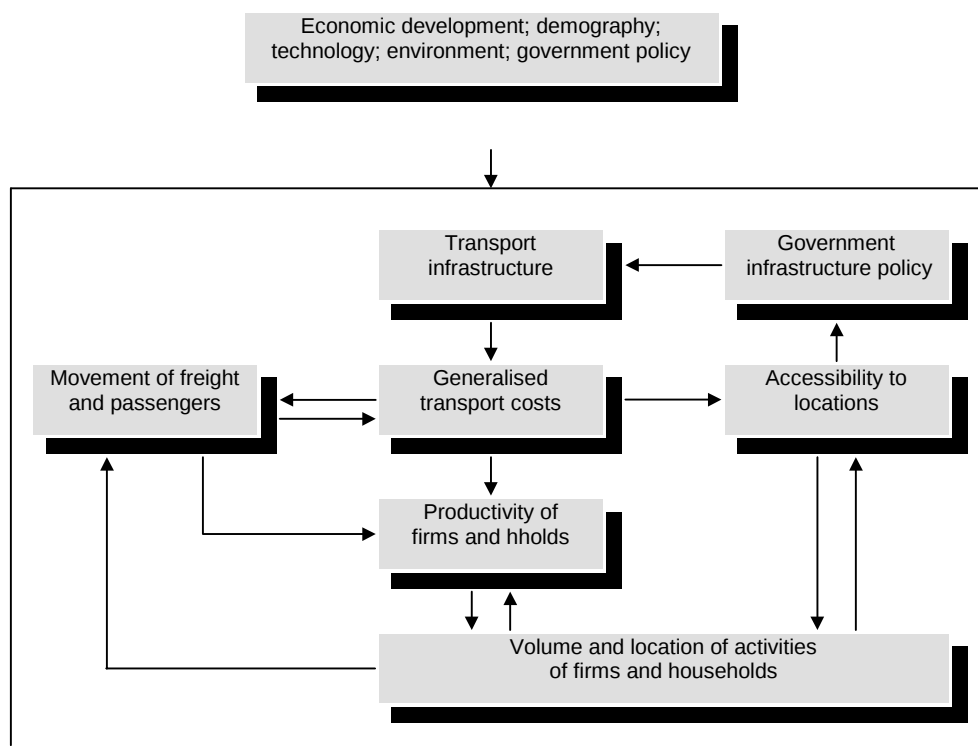
Transport systems – for passenger and freight movement underpin and facilitate wealth creation. They both spatially shape and respond to, the physical form of cities. When passenger transport demands upon common use arise at times different from freight users, economic outcomes are likely to be maximised. If they are concurrently adverse economic outcomes principally arising from congestion (affecting road user costs of travel time, freight time, vehicle operating costs, and crashes) will be exacerbated.

In Melbourne, over recent years, the implications of increasing co-use of rationed road space by freight and passenger vehicles has altered the time of day pattern of many freight transport services. Shorter and more reliable trip times have been sought through scheduling to minimise the conflicting claim for road space during periods of peak private passenger vehicle use.

In many respects, Melbourne is relatively advantaged by its configuration of urban transport infrastructure. Appendices 3 and 4 compare and contrast aspects of Melbourne's road and other transport infrastructure and its urban form variously with that of Sydney, Brisbane and Adelaide. The overview suggests that Melbourne is comparatively advantaged by the accessibility of its seaports and airports and of its freight intensive regions, one to the other.

Chart 5.1 illustrates the interdependence of urban form — the location, scale of freight generating activity with scope and capacity of infrastructure, the costs, and qualitative performance of the logistics function. The chart serves to reveal issues central to delivering efficient and effective transport infrastructure.

*Chart 5.1:
Interdependence
of logistics and
urban form*



Problematic passenger and freight task interfaces

Intermodal: road and sea

This is focused at Footscray Road and pertains to the conflicts arising from at-grade rail access to the port precinct. Train operations are constrained and in turn influence road freight and passenger vehicle congestion in the area of high freight generating trips in the Footscray area. It is a matter being comprehensively addressed in on-going investigations by DoI and Melbourne Ports Corporation.

Shipping container transport from the port to Melbourne's eastern and south eastern industrial zones is presently seriously hindered by the absent connectivity promised by CityLink and the resultant concomitant claim for scarce road space by passenger and road freight vehicles. The palpable congestion on east-bound sections of City Road and Alexandra Avenue attests to this transport system problem.

Intermodal: road and rail

Melbourne's Dynon rail freight terminals in immediate proximity to the Port of Melbourne have strongly fostered the City's broader urban form and land use. They remain remarkably accessible by the arterial and freeway/tollway systems, but are also critically constrained by these systems. Access and egress related to the South Dynon Container Terminal is often im-

peded by passenger and freight vehicle movements.

Intermodal: road and air

The accessibility of Melbourne Airport has been profoundly enhanced in recent years through the commissioning of the Western Ring Road and CityLink (west). However, capacity constraints, exacerbating passenger freight vehicle interfaces, are emerging on the Tullamarine freeway, airport bound direction, at the Bulla Road ramp, Calder Freeway exit and at the entrance to the Melbourne Airport precinct.

Broader metropolitan road network

The sense (through observation) of a contest between road freight and passenger vehicles for scarce road space is heightened at a number of locations in metropolitan Melbourne. They include:

- at Somerton-Campbellfield on the Hume Highway between Craigieburn and the connection with the Western Ring Road;
- on the Westgate Freeway;
- on the Mulgrave Freeway, through to Dandenong;
- at the interface of the Eastern Freeway with its meandering connection to Melbourne's west and north; and
- in the outer-east north-south corridor (Scoresby) prospectively connecting Ringwood-Dandenong and Frankston and an extended Eastern Freeway.

Part 6

Issues and trends

The following is offered as a point of departure, rather than the definitive discourse on these matters. The exposition is prompted by the considerations presented in previous Parts for the implications which might arise for a metropolitan freight strategy.

Freight task and key commodities

The freight task, reflected as tonne kilometres, arises because materials (at various levels of transformation) have a higher value at their destination than at their origin.

Evolution of a freight strategy, variously reflected in government's policy, regulations and infrastructure provision must be responsive to the dimensions among others, of:

- commodity, and its particular requirements for packaging, storage and transport technology; and
- the places of production, transformation, storage, importation, export, final consumption or disposal.

From the perspective of Victoria, significant freight materials categories are:

- **foodstuffs:** grains, dairy products, meat products, fresh foods, beverages. The sector is increasingly important because of its export orientation – both internationally and as a supplier to the balance of the Australian market. The freight task exhibits strong seasonality and for some segments, such as grains, large year to year fluctuations in volume;
- **crude construction and building materials:** this is transport intensive sector, with a strong metropolitan focus. The magnitude and spatial range of the task is volatile and directly related to construction activity in the domestic, commercial, industrial and infrastructure sectors. It is often associated with significant disruption to road network operations together with adverse amenity (e.g. arising from construction waste, noise, emissions and safety);
- **metals and manufactures:** Victoria is a major aluminium producer (at smelters at Portland and Point Henry), but most of it is exported, with a large proportion through Portland; BHP's Lysaght operation at Western Port using raw steel from NSW, is a key supplier of product to Melbourne's motor vehicle manufacturing industry and to the construction sector; it also exports through Melbourne. Growth is contingent upon the activity in these industry groups;
- **motor vehicles and components:** Victoria is strongly represented in Australian manufacturing of fully assembled vehicles, the import and export of components,

and the supply of spares and components to enterprises in other Australian stages. It is a sector which seems to be exhibiting robustness and volume growth. It is highly attentive to the efficacy of supply chain arrangements, particularly of the logistics. (Refer to later discussion.) It exerts a strong influence on the location of supplier's manufacturing facilities, fostering responses which meet JIT objectives; minimise trip distances and maximise reliability in the attainment of a delivery window;

- ***paper and packaging, including bottles:*** Victoria is a significant producer and consumer; pulp, paper and paper product exports and imports are also strongly represented; printed products distribution is a meaningful and predictable task; the glass product task is strongly related to vehicles manufacturing and to the evolution of the food and beverage sectors;
- ***chemicals:*** this sector while strongly represented in western Melbourne, has witnessed major changes in the face of global restructuring and rationalisation initiatives; domestic manufacturing is increasingly supplanted or displaced by imports. It is also a sector which has made major advances in its logistics operations – to attain lower costs and superior amenity, environmental health and safety outcomes. It is a freight task sector meriting particular attention;
- ***waste and recycled material:*** the array of recycled materials and concurrent freight task is ever developing as technologies, supply chains and markets evolve, stimulated by the adoption of ESD initiatives and Greenhouse Gas management strategies. Waste streams are separated and are directed through many dimensional transport chains. Once the effort was predominantly in recycled metals and recyclable consumer durables. Now the consumer durables have a shorter and more direct life cycle from manufacturer to tip, while reinforced concrete, pavement materials and green waste are re-used. The residual waste stream is also disaggregated for disposal according to strict environmental guidelines (for example, contaminated soil and different categories of medical waste, chemicals and radioactive residuals). All of this has impacted upon the scope and scale of the freight transport task. It is likely to continue to be a significant transport issue for some time to come. While the domestic waste sources are ubiquitous, the sinks are not, and will forever be contentious locations and sites. Commercial waste is rarely contentious. Sources of industrial waste streams tend to be concentrated in a few localities and are most often associated with systematic recycling initiatives;
- ***consumables: household goods:*** foodstuffs are increasingly consumed out of the home or in a prepared format. Together with the broader array of household goods, the associated freight task is influenced by demographic change, scope of product choice, and consumer purchasing power. Small scale distributed domestic production, wholesaling and retailing are being replaced by rationalised national production and distribution centres, complemented by increased market shares achieved by imports, and large scale final points of sale. It is everywhere evident – with the advent of Officeworks providing only one example. Once wholesalers distributed stationery products widely to retailers who often then delivered to the customer. Now the customers, from an even more extensive retail catchment, seek a wider range of products from the large warehouse outlet;

- **services sector task:** this is a strongly growing and diverse sector embracing household, industrial and commercial consumers. It ranges across health, hospitality, and office suppliers. Time, and often skill intensive dimensions, are associated with the small mass of the freight consigned. The freight might be pharmaceuticals (retail pharmacists are generally recipients of two or three deliveries each day!), linen, prepared food, office supplies, express document delivery, household maintenance and repairs etc. This transport task is the domain of the ubiquitous light commercial vehicle (LCV). Will an aging, wealthy, population be more or less intensive in its demand for these services?;
- **transport equipment:** particularly empty containers, pallets and other specialist reusable packaging, which is transported, locally, regionally, nationally and globally. National Rail Corporation and Brambles are two, for example, who have highly systematised services for the repositioning of empty containers, and pallets respectively.

Logistics configuration

Freight transport is at the sharp end of logistics systems. It is the easy target of the ceaseless market quest to attain the lowest cost while ramping up the service quality dimensions. These include consignment complete against order, without damage, on-time, available in the shortest elapsed time between order placement and receipt.

Profound improvements have been stimulated through the conjunction of more open national and foreign markets, technology development of materials and IT, de-regulation and harmonisation of technical standards in related jurisdictions.

Every endeavour is applied to minimise inventory; to eliminate loss and damage at each stage of the supply chain; to harvest every available scale economy. Manufacturers of time critical components are co-locating with key customers (examples are to be found at Campbellfield and Altona in relation to Ford and Toyota respectively).

Management initiatives have often reduced the resource inputs applied to the logistics task: a higher volumetric or mass based payload is realised; less damage means fewer resources committed to return of damage goods or supply of replacements (but more being committed to purpose specific packaging materials or equipment to eliminate damage or increase the effective payload). Again, the motor vehicle manufacturing sector (in which Melbourne plays a prominent role) affords some significant insights into the altered structure of the freight task.

The future possible reconfiguration of supply chain processes – for *business to business* (B2B) and *business to consumer* (B2C) fostered by new information technology capabilities and *e-business* is starting to be articulated. How will e-business effect their fulfilment operations? Logistics and distribution efficacy are likely to be critical to the success of an e-commerce venture. Selling over the web requires a warehouse-cum-truck system that can deal with the delivery of a single package to an individual household (a system similar to that applied to Australia Post's task).

With respect to the implications of e-business for the freight transport task the following observations (The Economist 26 February 2000) merit consideration:

Yet two things soon became clear. One was the shipping costs were (and remain) one of the biggest deterrents for consumers considering online purchases of physical products. The second was that traditional warehouse and distribution centres were not well suited to the business of e-commerce fulfilment; if it is to work properly it needs newly designed systems. Both these things have combined to undermine some of the economic advantages of on-line shopping.

Perhaps this should not have come as a surprise. Physical shoppers, after all, handle their own order fulfilment, by choosing the goods and paying for them at the check-out, as well as their own delivery, by personally taking them home. And they do all this at their own expense, in both time and money. Merely to replicate this system efficiently, down to the individual consumer, is demanding enough; financing it, whether by absorbing the cost or by adding it to the bill, makes it even harder. It might have been better had e-commerce firms given more attention to this end of their business first.

and later;

Implausible? Worrying? Only five years ago, in the pre-Amazon era, almost nothing was bought on-line. But extrapolate the past five years' growth, and it is easy to believe that by 2010 close to a fifth of American retail spending could be carried out over the Internet. and for things like books, music, films, toys, white goods and cars, the share seems likely to be much, much bigger.

Transport technologies

Innovation advancing lifecycle cost, environmental, service reliability and other improvements are evident for every mode (aircraft, ships, train, road vehicles). The enhancements are demonstrable for the prime mover, for the trailer/wagon, the freight specific container or package integrated with the prime mover, and with the freight handling systems.

However, it is not always possible to realise the efficiencies available through the adoption of the transport technologies because of infrastructure, regulatory or other market constraints. Constraints include bridge axle load and clearance limits, vehicle length and axle load limits etc.

The gain in the power and payload performance of road vehicle prime movers realised through B-double configurations, stands out.

Rail wagon designs have also been implemented which offer significant payload increases for given axle load and train operating speed parameters.

We are aware of the post sale recapitalisation and application of ANR locomotives and wagons. Locomotives have been re-built and are available through hook-and-pull services suppliers to compete with the NRC's relatively young fleet.

SCT have rejuvenated the louvre van fleet with new bogies and applied them to the opportunity of the Melbourne-Adelaide-Perth "volumetric" freight task. The vans afford, by virtue of their geometry and mass, a higher yield than that available through use of containers. However, these economies have only been realised through concurrent and complementary development of loading and unloading (terminal) facilities.

Shipping containers and refrigeration equipment have also evolved to maximise economy in the transport of route specific freight types.

For Melbourne and Victoria's freight infrastructure evolution, perhaps the issue of broader adoption of B-triple configurations is a consideration.

Supply of freight transport services

Profoundly different circumstances exist for the modes: rail, road (coastal), shipping and air.

The modes are both complementary and substitutable, one for the other, to different degrees. Efficient logistics and freight transport outcomes for Victoria require that policy initiatives and infrastructure development foster productive complementary configurations. This in turn demands that all externalities be properly accounted for; that short term advantage not jeopardise or compromise medium and longer term outcomes.

Here we make some observations on circumstances prevailing for each of the modes.

Rail

In recent years, we have seen the remarkable restructuring of the rail sector and the emergence of more positive market sentiment towards the sector. The creation of National Rail Corporation; the wind-up of Australian National Railways; gauge standardisation of the Melbourne to Adelaide track; the advent of the interim Track Access and its evolution into Australian Rail Track Corporation administering train access to the standard gauge network (initially from Kalgoorlie, but questing for the balance to Perth, to Alice Springs, to Broken Hill, to Bordertown, and now through Victoria to Albury). These have been the key initiatives which have encouraged the development of more efficient rail services.

The opening-up of access to the interstate standard gauge system has fostered competitive freight train services – CRT, NSW Freight Corporation, Patricks, SCT, and Toll, complementing NRC. These services are also underpinned by the availability of competitive 'hook-

and-pull' locomotive services.

The sale of VLine Freight, now reconfigured as Freight Australia, commanding above and below rail, broad gauge services in Victoria is another notable event. Does this vertical integration constrain the advent of other above rail services?

Further afield, the sale of WestRail and NSW Freight Corporation will have ripple-through effects for Victoria. The sale of NRC will be a more profound perturbation for freight rail services in Victoria. Queensland Rail is another highly capitalised rail services entity which might well play a future role in the Victorian rail freight market.

Freight services users are keenly interested in frequency of service and the reliability of the trip time. More freight train operators are likely to mean more services. However, these demand more train paths on a highly constrained, limited capacity track system. And then there is the issue of access to intermodal terminal facilities – both space and capital intensive. Melbourne, in recent years has been advantaged by the development of the CRT and SCT terminals at Altona complementing the Dynon and west Melbourne (steel) terminals. And there is the further prospect of the intermodal terminal at Somerton.

Road

This is a ferociously competitive freight transport sector. The copious supply of vehicles of all capabilities, configurations and condition, primarily through indebted owner-drivers, contributes to much road congestion through high levels of empty and part-load running.

It is our observation that such is the supply of the freight vehicle fleet, that shippers can realise any complement of service outcomes (minimum trip time, on-time performance, zero freight damage and loss) for the price they establish.

Does this advantage Melbourne and Victoria? Are the externalities of the road freight transport sector appropriately accounted for? We think not. But these considerations are not new. We note the perspective presented in the Bureau of Transport and Communications Economics Information Paper, *The Road Freight Transport Industry*, 1993.

Cost issues

Operating cost issues in the industry were cited as the major cause of the road freight blockades in 1979. Other concerns with cost recovery matters and the implementation of user pays principles have been the subject of recent studies (see BTCE 1988; ISC 1986, 1987, 1990).

In the highly competitive environment applying to much of the road freight transport industry, costs will inevitably remain an important issue, especially to owner drivers. Competitive conditions in the line haul sector, which consists mainly of owner drivers, have been such that freight forwarders could, at least from time to time, secure a price that was below the long term economic cost of providing these line haul services.

Increasing attention is now being paid to externalities associated with the road freight transport industry. Issues of road damage cost recovery from heavy vehicles, and questions of congestion, pollution and safety costs, are likely to assume greater importance in the future.

Competition and supply 'overhang'

The most recent major studies of the road freight transport industry, conducted in the late 1970s and early 1980s, all identified competition within the line haul trucking sector as an important issue.

The National Road Freight Industry Inquiry report published in 1984 suggested that a supply 'overhang' in the line haul trucking sector was the main cause of extensive price cutting within the industry. This study found that a disequilibrium between the demand for and the supply of line haul services existed, and termed it a supply overhang. At the time it was argued that any disequilibrium should be of a short-term nature only, as a competitive industry should return to a situation of equilibrium.

The intense competition in the transport services sector has been sustained (perhaps intensified?) by the initiatives of all categories of enterprises to improve their supply chain performance. Logistics services have been outsourced and integrated logistics services providers have arisen, often from a core freight transport services operation. In this market, we have witnessed industry restructuring – significant takeovers, mergers and acquisitions. And they continue with the unresolved Toll initiative to acquire Finemore.

The rationalisation has brought with it significant recapitalisation – the re-equipping of fleets, the adoption of IT intensive logistics management services, and the establishment of purpose specific terminals, warehousing and cross-docking facilities. The initiatives of TNT, Linfox, Toll and Australia Post among others offer particular insights.

Once dedicated road freight transport operators are also now intermodal, capitalising upon the economic advantage available through optimising multimodal capabilities.

Shipping

International shipping operators predominantly service Victoria's international and coastal trade. However, BHP's transport company is an important, and we understand, committed shipping operator servicing Western Port (steel), Melbourne and Geelong for specialist break bulk and bulk trades.

Given the penchant for de-regulation, concomitant with an increasingly competitive shipping services market (and an aging fleet with lesser skilled operatives), it is an issue for Victoria that (adverse) environmental and safety outcomes do not erode all of the price and service frequency benefits which might be enjoyed by consignors and consignees, arising out of the highly competitive supply of shipping services.

Air freight

Melbourne and Victoria is increasingly utilising air freight services for time sensitive and high value density trades. Time sensitive freight embraces perishables (fruit, vegetables, cut flowers), as well as non-perishables such as documents, manufacturer's prototypes and samples, components and precious metals (particularly gold). In mass terms, the total trade is relatively small. The freight services are predominantly available through the residual hold capacity of scheduled passenger airline services. Complementary dedicated air freighter services are available on a charter and scheduled basis. Expansion of their scope can be expected as and when predictable demand patterns emerge.

Victoria's demand for air freight services is likely to be presented with most opportunity through the broadening of international passenger services into and out of Melbourne. This is advantaged by Melbourne Airport's curfew free status and low level of congestion, but compromised by its secondary role to Sydney, Australia's gateway.

Linfox's endeavour to develop Avalon as an air freight service centre for fresh food trade with Asia advantages Melbourne in making additional capacity available. However, frequent, sustained air services will only arise in response to a predictable freight task.

Infrastructure and urban structure

Observations follow with respect to rail, road, air and seaports.

Rail

Many facets of the adequacy of existing rail infrastructure and proposals for improvements are currently under active consideration.

Evident issues related to improving the efficacy of rail freight services in the near term, or for encouraging new operating paradigms to emerge include:

- the unavailability of night-time train paths on the Melbourne-Adelaide standard gauge track;
- similarly the highly constrained train path access on both the Sydney-Melbourne and Adelaide-Melbourne corridors at the Melbourne metropolitan interface. This is particularly so of the track sections Somerton to South Dynon, and Manor Loop to South Dynon;
- the limited opportunity to store or marshall trains on the standard gauge track approaching Melbourne;
- constrained access, across Footscray Road, to the Port of Melbourne's wharves and the limitations on train length, necessitating the breaking of trains with associated complexity and cost of shunting and storage of train sections;
- problematic re-establishment of train access to Webb Dock in context of development of Westgate Terminal;
- residual capacity and capability to reconfigure North and South Dynon terminals for longer term needs;
- constrained capability of West Melbourne Steel Terminal (MST);
- the broad gauge interface of rail track to BHP's Western Port operations at the MST with the standard gauge services to Adelaide and NSW;
- freight train loading gauge constraints precluding double stacking, including but not limited to, the Bunbury Street tunnel west of Maribyrnong River;
- any factors which might limit the longer term ability to capitalise on the new inter-modal rail terminals developed by CRT and SCT at Altona, and with respect to the

facility under development at Somerton;

- similarly, any factors which might inhibit the productive re-engagement of industrial sidings established at Somerton (Ford), Dandenong and locations elsewhere;
- conversion of residual broad gauge track to dual or standard gauge track in the context of improved accessibility of freight related to trade flows through Melbourne, Geelong and Portland;
- the matters of a standard gauge rail track to Hastings (Western Port) to avoid passenger service train path and loading gauge constraints, in conjunction with development of a container trade capability;
- complexity of train control regimes interfaces – ARTC for interstate standard gauge; Freight Australia and the metropolitan passenger service franchisees for broad gauge; and various operator (especially NRC) agreements; and
- inland rail ports in the context of their wherewithal to reduce port related road freight congestion and thereby foster a mode switch from road to rail for wharf trades.

Road

Road infrastructure, its scope and capacity, is the major influence upon the utility of Melbourne's land committed to freight generating activity. Melbourne is alert to the profound improvements accruing to freight traffic availing itself of the Western Ring Road and the west bound section of City Link. Undoubtedly the completion of the east bound section will significantly improve accessibility for Melbourne's inter-regional freight task.

The incapacity of the interconnection of the Hume Highway with the Western Ring Road through Somerton and Campbellfield significantly impacts on the efficiency of road freight services.

The potential (indicated in FDF Management's 1994 report, *Strategic Planning Investigation of the Scoreby Transport Corridor*) afforded by the Scoresby transport corridor, represents a major opportunity for Melbourne. Similarly, the gain available for Melbourne and Victoria through improving the accessibility and connectivity of the north east of Melbourne, is indicated in FDF Management's report, *Economic and Urban Impact of a Metropolitan Ring Road*, June 1995.

Air

Both Melbourne Airport and Avalon are highly accessible by road transport. Neither has rail services, but it is likely to be the very long term before this becomes an issue. Both airports are also advantaged by the absence of operating curfews and their airside operating capacity.

Port

The matter of port infrastructure is at-large through the Victorian Ports Strategy Study.

External costs

At issue are matters of the social costs related to air and noise pollution, traffic congestion, road crashes and other facets of amenity (e.g. visual impact, fear induced by proximity of commercial vehicles to small passenger cars, etc).

While the matter of congestion is generally accounted for in conventional economic evaluations which recognise travel time value, and vehicle operating costs, other external costs are not. (The matter of vehicle crash costs is also an exception, but at issue currently is an informed view that they are significantly underestimated.) These external costs associated with degradation of amenity, and likely to be increasingly important, are most relevant to the evolution of transport systems which embrace principles of Ecologically Sustainable Development.

Freight transport factor costs

Conventionally recognised costs are for the infrastructure (construction, maintenance, operation, administration); and of the transport equipment and operation (wages, vehicle running costs, depreciation, registration, maintenance, finance).

The relativity of these factor costs will alter in the face of real increases in fuel costs, depreciation of the Australian currency (affecting costs of vehicles and spare parts), and possible increase in interest rates. The advent of limited road pricing (toll) regimes is also adjusting the total factor costs, as has the adoption of new transport equipment technologies.

Some freight consignors have also re-assessed the value of service attributes such as risk of damage or loss (e.g. of chemical commodity spillages; of damage to finished motor vehicles) related to freight transport mode.

These considerations are continually influencing mode choice for the freight task.

Policy and regulation

In recent years, Australia has benefited from a willingness to embrace harmonisation of nationally and internationally relevant technology standards and work practices.

However, the processes of Government, and geography of jurisdictions, impact significantly upon the orderly and timely realisation of transport infrastructure development initiatives. This affects the efficacy of the Melbourne, Victorian and Australian freight and logistics tasks.

The lead time involved in bringing major freight related infrastructure projects to fruition can entail many decades. Realisation of the major investments demands continuity of policy and inevitably, bi-partisan commitment. The matter of achieving in future a standard gauge rail link to Hastings is a case in point.

Part 7

Initiatives to inform the improvement of freight transport

Stuart Hicks in his essay *Urban Freight*, 1975 said:

“An old maxim says that once a problem is clearly defined it is more than half solved. In reality, the first problem in urban freight is the definition of the problem.”

and

“The urban freight transport task should be performed at the lowest total social cost possible. The total amount of resources consumed and disbenefits created in performing the freight task should be minimised: efficiency is the goal, given any other social, commercial and equity objective agreed upon...”

Specifically, the problem is this: the discovery and effective implementation of measure which will reduce the total social cost of urban goods movement to the lowest possible level commensurate with the freight requirements and objectives of society.”

It is hard to believe that the contemporary interests or need could have been better expressed.

In this context, and with some reflection (on the prevailing conditions related to logistics, Melbourne’s freight task and its inter-relationship with Australia more broadly), we believe Victoria will be advantaged if the following are addressed.

Characterise the logistics and freight task of key industries

Victoria can evolve infrastructure and transport policies which foster an increasing contribution of industry sectors to its economic wellbeing; assist the arrest of a declining contribution; or diminish adverse social outcomes (such as congestion, emissions, crashes) affecting other transport system users. Candidate industry sectors for characterisation include:

- motor vehicles and automotive components;
- grains, fresh and processed foods (including dairy products and beverages);
- chemicals and petroleum products; and
- recycled materials and waste.

The logistics and freight transport task of these sectors would be characterised in terms of the following, among other parameters:

- of input materials streams: origin, magnitude, seasonality, diurnal variation, trans-

port equipment and pack type employed; transport and logistics service level imperatives;

- output materials streams as for the above parameters;
- intermodal interfaces and performance issues: scope and task performed at modal interchange; time and direct costs incurred in transfer; factors driving the transfer; matters which would improve efficiency, reliability performance etc;
- costs incurred, and value added (or lost?) in the transport chain; and
- externalities arising from the transport and logistics task: energy use, emissions, crashes etc.

With regard to pursuing the foregoing, it is likely that consideration of the initiatives of the *Holland International Distribution Council* (HIDC) will prove rewarding. HID has among its purposes, the enhancement of the quality and services of the logistics industry in The Netherlands and the improvement of the Dutch business climate for transportation and logistics.

Characterise and review the scope, condition, performance and capability of the greater Melbourne rail infrastructure applied to Victoria's freight task

The object of this work is to provide a point of departure for identifying and prioritising infrastructure and system operational enhancements, and an understanding of what might constrain their realisation. We anticipate that the study would report on the following, among other factors:

- network sections (broad gauge, standard gauge and dual gauge), applied to freight services: track, passing loops, turnouts, structure, crossings, signals and communications systems; defining speed, axle load limits; rail, sleeper and ballast residual life; train length limit;
- freight train services on line sections, identifying train operator, specifics of freight task including commodity, origin, destination, intermodal services interfaces;
- constraints on train path availability: limiting train length; current schedule passenger service train path conflicts;
- track and signals systems constraining train service performance;
- rail reservation constraints arising from shared use with other utilities, cadastral limits, or adjoining uses;
- intermodal terminals and industrial sidings: scope and issues relevant to current and longer term capability; constraints; reasons for closure or non-use of sidings, conditions necessary to bring back into service; options for medium and longer term relocation and associated network development requirements;
- the detailed characterisation of the demand for on-wharf rail services: wagon type, container category (size, empty, full, refrigerated, etc) to and from wharf; origin and

destination; and

- corridor options and key strategic issues definition related to achieving a standard gauge rail link to Hastings which efficiently interfaces with the Adelaide and Sydney standard gauge systems, and with the Victorian broad gauge network.

Audit the environmental and safe operating performance of commercial vehicles

There is increasing interest in the realisation of Ecologically Sustainable Development (ESD). However, infrastructure development policy and investment decisions methodologies are frail in their wherewithal to internalise externalities. More knowledge derived from better information is required.

The following could be characterised:

- in service vehicles noise and emissions outputs;
- vehicle safe operation – not simply reported incidents and crashes, but on-road operation hazard creation – entering and existing property, lane switching, speeding, “tail-gating”, load spillage, and other behaviour or practices intimidating other users of road space; and
- monetary value for a unit improvement (or loss) of amenity related to each attribute.

The EPA and the Greenhouse office would be likely collaborators for the former research and Victoria Police, Federal Office of Road Safety and Transport Accident Commission, for the latter.

Characterise the off-wharf, shipping service related container freight task

The purpose of this investigation would be to establish a quantitative understanding of the role (functions, locations, service, resources) of the existing participants; and an assessment of its economic performance. Similarly, opportunities for enhancement e.g. reduction of road congestion; of port and rail terminal space demands; of total service costs; and of environmental externalities would be identified and assessed.

Evaluate and rank committed and planned road systems improvements according to the scope and scale of their contribution to freight and logistics performance enhancement

Benefits accruing would be quantified in terms of:

- vehicle operating costs;
- travel time savings;
- freight time value;

- crash costs;
- Greenhouse gas emissions; and
- other particulate and gaseous emissions.

This information would inform the ‘body-politic’ on the merit of particular system improvements.

Appendices

Appendix 1

Patterns of freight movement

This chapter identifies and describes patterns of road freight movement nationwide. It makes use of the FreightInfo database of freight movements. In particular it introduces two concepts—the freight ‘catchment’ and a system for categorising freight movements—which are central to an understanding of the role of the NHS.

Freight catchments

Analysis of road freight movements reveals a distinctive pattern based upon the mainland state capitals (The Hunter and Illawarra districts were grouped with Sydney, and Geelong with Melbourne, because these two cities combine with neighbouring regions to form single economic units.) Each functions as a distribution centre and economic outlet for a largely rural hinterland. These hinterlands constitute freight catchment areas for their respective capitals; that is to say, the bulk of freight movements in each catchment are within, not between, catchments.

Catchments approximate to states, with some notable differences. For instance, as far as road freight is concerned, the Riverina lies mainly in Melbourne’s catchment hinterland not Sydney’s; Broken Hill and Bourke look to Adelaide rather than Sydney; and certain northern regions of NSW look to Brisbane, not Sydney. As a general rule, non-metropolitan regions are served by the *nearest capital city* regardless of which state they are in.

A consequence of this is that each non-metropolitan region tends to be served by a single capital city from which it draws nearly all of its goods and to which it sends nearly all of its road freight. It is rare for the servicing of a non-metropolitan region to be split between capitals, even when the region is roughly equidistant between them.

By the standards of most countries, this is a simple pattern of freight movement. It occurs because Australia’s population and manufacturing is concentrated in the state capitals.

A categorisation of freight movements

The existence of distinct freight catchments suggested the following categorisation of freight movements in terms of the type of region in which the freight originates and terminates (table A1.1):

- intercapital
- upstream
- downstream
- country
- local
- metropolitan.

The NHS caters for only some of these freight categories. It carries nearly all intercapital freight; a large proportion of upstream and downstream freight (collectively termed ‘tributary freight’); a small proportion of country and local freight (except in those regions through which the NHS passes, where the proportion is higher); and virtually no metropolitan freight. (Besides these categories, table A1.1 shows for completeness two further categories, imports and exports, none of which, naturally, travels by road.)

Table A1.1
*Categorisation
of freight
movements*

Origin	Destination						
	Capital 1	Capital ...	Capital n	Non-metro region 1	Non-metro region ...	Non-metro region n	Outside Australia
Capital 1	6	1	1	2	2	2	8
Capital ...	1	6	1	2	2	2	8
Capital n	1	1	6	2	2	2	8
Non-metro region 1	3	3	3	5	4	4	8
Non-metro region ...	3	3	3	4	5	4	8
Non-metro region n	3	3	3	4	4	5	8
Outside Australia	7	7	7	7	7	7	

Key:

- Intercapital1
- Upstream2
- Downstream3
- Country4
- Local5
- Metropolitan6
- Imports7
- Exports8

Intercapital freight

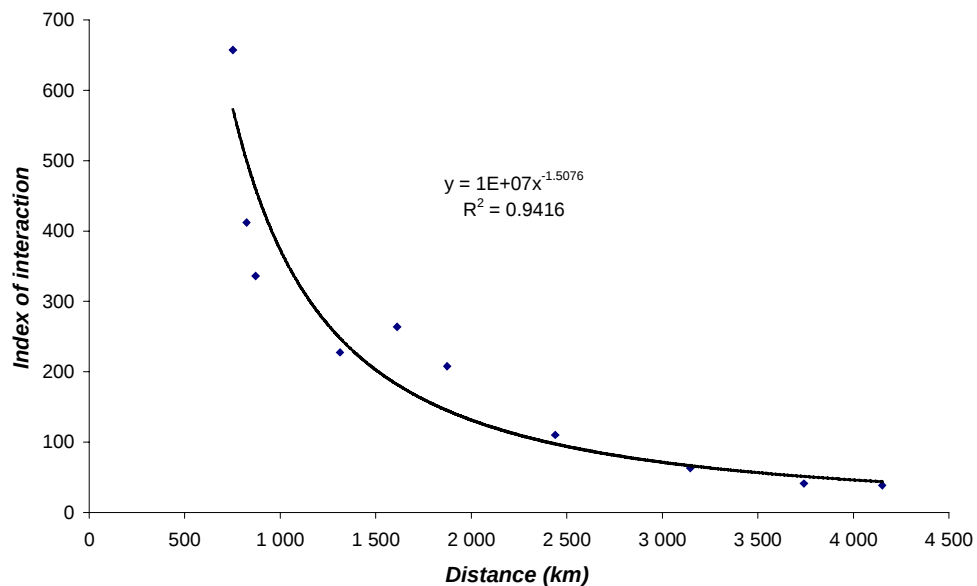
Intercapital freight is that which moves between the state capitals. It consists mainly of manufactures which have been made in one capital but are to be consumed in another capital or its hinterland; or goods which have been imported to a single port (usually Melbourne or Sydney) and distributed nationally by road. Intercapital freight can be regarded in economic terms as a kind of internal trade. By producing all of a given good in a single location, manufacturers can reap economies of scale through the specialisation of tasks and longer production runs. They can also profit from the comparative advantage that each capital city offers. An analogous logic applies to imports, as there are normally economies in having a fewer ports of call and larger consignments. Without intercapital freight, each capital would have to be largely self-contained in terms of manufacturing, and imported consignments would be distributed among several ports, not one.

As transport costs decline in relation to production costs, and as scale economies become more important, we can expect to see an increase in intercapital freight as each capital city specialises in what it is good at. There is evidence that this is happening. Intercapital freight grew at about 3% per annum faster than GDP from 1975 to 1994.

The volume of intercapital freight between any city-pair conforms closely to a gravity model with population for the mass terms and highway distance as the impedance term (chart A1.1).

Thus the volume of intercapital freight between any pair of cities is largely proportional to the multiple of their populations and to a negative exponential function of the distance between them. As expected, for intercapital freight, distance inhibits interaction.

Chart A1.1
Intercapital freight: the effect of distance and city size on freight volume



Source: Adapted from FreightInfo.

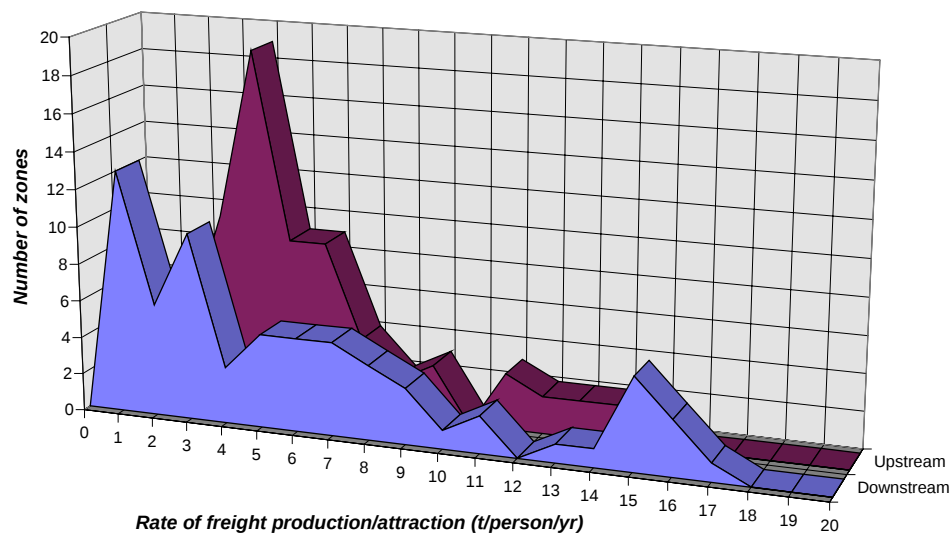
Upstream freight

‘Upstream’ freight is that which is sent from capitals to metropolitan regions. Nearly all upstream freight is destined for the non-metropolitan hinterland of each state capital. Thus Sydney’s upstream freight is mostly destined for Sydney’s ‘catchment’ (map A1.1) though some may go to non-metropolitan regions outside this.

Upstream freight consists mostly of manufactures (including food products) and fuel to be consumed by the resident population, and to a lesser extent supplies for primary and manufacturing industry. Upstream freight reflects each capital’s entrepot function: the non-urban population calls on the (normally) nearest capital city to supply virtually all its material needs, even when the goods concerned are made in, or imported into, another capital. For example, tyres made or landed in Melbourne are likely to be transshipped and warehoused in Brisbane before being sold in Queensland; they are most unlikely to be transported direct. Even where the goods in question are themselves manufactured in a country region, they are likely to be first taken to the relevant capital for warehousing and distribution. Thus processed food products made in, say, Ballarat are likely to be shipped to Melbourne before appearing on the supermarket shelves in Ballarat.

Because most upstream freight consists of final consumption items—groceries, consumer durables, clothing, fuel, certain building materials and so on—its volume is determined largely by the size of the population served. Line-haul distance appears to have little if any effect, except to determine which capital city the freight is drawn from. Most country zones ‘import’ between one and three tonnes of upstream freight per person per annum, though a few import much more (chart A1.2).

Chart A1.2
Upstream and downstream freight: number of zones by rate of freight production/attraction



Source: Adapted from FreightInfo.

Per capita upstream freight can be abnormally high or low for two reasons. First, the transshipment of upstream freight tends to obscure the simple linear relationship between freight and population. Suppose a consignment destined for zone A is transshipped *en route* in zone B; this will cause zone A's upstream freight to be overstated and B's to be understated. Second, the zones attracting the greatest volume of per capita upstream freight include some places which are manufacturing centres in their own right (unlike most non-metropolitan regions) and draw industrial supplies from their neighbouring capitals. These appear as upstream flows even though, as intermediate goods rather than final consumption goods, they are of a very different from most upstream flows.

Downstream freight

'Downstream' freight is that which is sent from the hinterland to the capital which serves it. Downstream freight consists mainly of primary products—agricultural produce and some mineral products—which are destined for export, for consumption or as a manufacturing input. In general, it is the higher-value or perishable goods that are transported by road, such as fruit and vegetables, cattle and wool. Most grains and minerals are transported by rail, but because the total volume of these commodities is so large, road's share is substantial in absolute terms. Quarry materials for the construction industry also form a substantial part of the downstream traffic which originates from zones adjacent to the capitals.

The volume of downstream freight depends on the nature and size of primary industry, hence zones vary widely in their per capita production of downstream freight (chart A1.2). Most zones produce little downstream freight, reflecting the nature of their primary production base.

Country and local freight

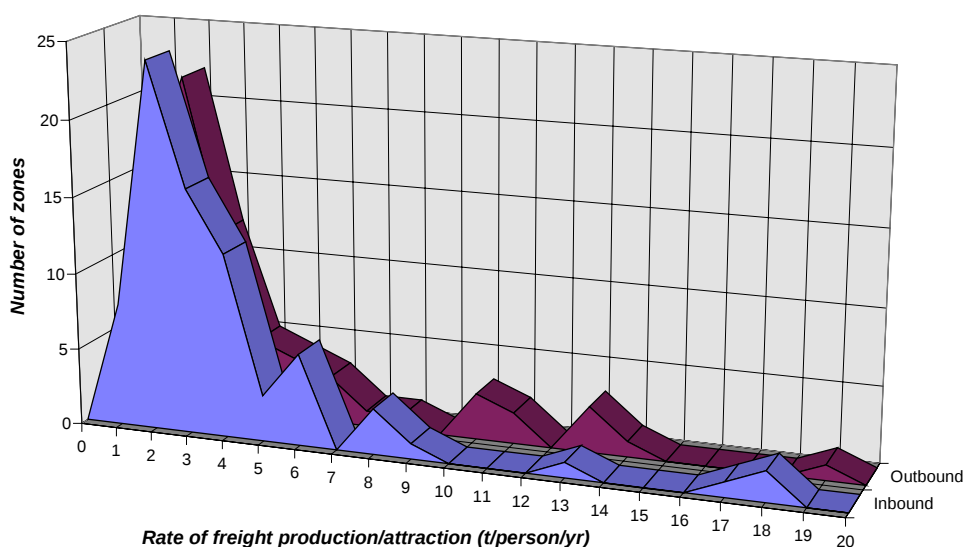
'Country' freight and 'local' freight is that which neither originates nor terminates in a capital

city. Local freight stays within the same non-metropolitan zone; country freight passes from one non-metropolitan zone to another. Most country/local freight consists of local or short-haul movements of manufactures for local consumption, and agricultural supplies and produce.

These movements often occur as a result of transshipment. If upstream freight is transshipped en route, it becomes country freight or local freight, depending on the length of the second transportation leg. For instance, groceries for a country town may be obtained from a regional centre; or a farmer may obtain supplies from the local stock and station agent. The reverse occurs in the case of downstream freight. A contractor for example takes grain to a silo at a railhead, or cattle to a country abattoir. In this case the product starts out as country/local freight, then becomes downstream freight. Transshipment commonly occurs either to consolidate the load (grains), change transport mode (road to rail), or as part of the manufacturing chain (turning cattle into meat). Other country/local freight consists of cut-and-fill and quarry materials for the construction of buildings and roads.

The volume of country freight depends significantly on the population served (chart A1.3). Generally, zones 'import' and 'export' between one and four tonnes per person per year. This scatter supports the view that upstream freight is being transshipped, and thus 'converted' to country freight. Transshipment takes place in a few largish provincial towns, whose outbound country freight is thereby boosted.

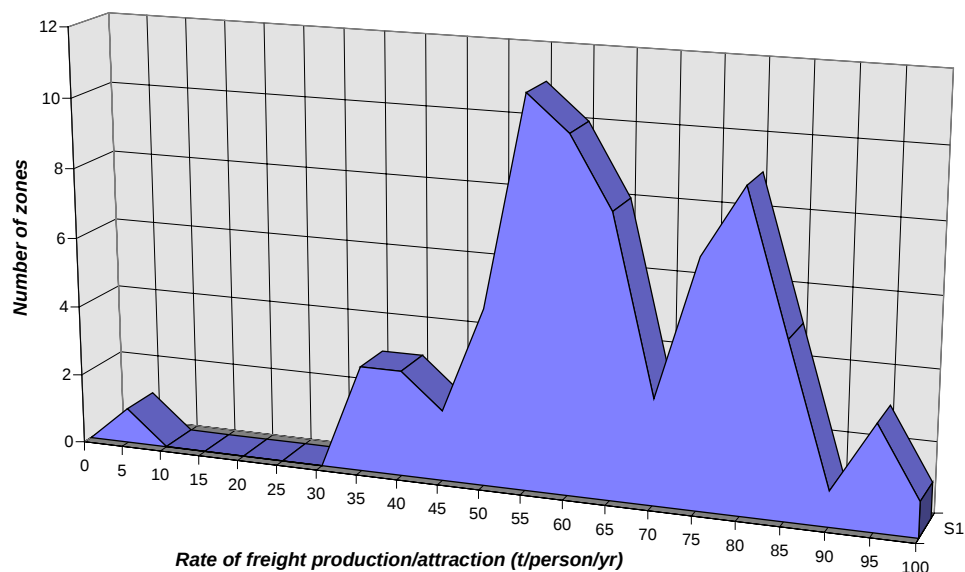
Chart A1.3
Country freight:
number of
zones by rate of
freight
production/
attraction



Source: Adapted from FreightInfo.

Besides the country freight referred to, there is a very large volume of local freight, amounting to between 50 and 90 tonnes per person per year (chart A1.4). This reinforces the view that most freight movements are over short distances.

Chart A1.4
Local freight:
number of
zones by rate of
freight
production/
attraction

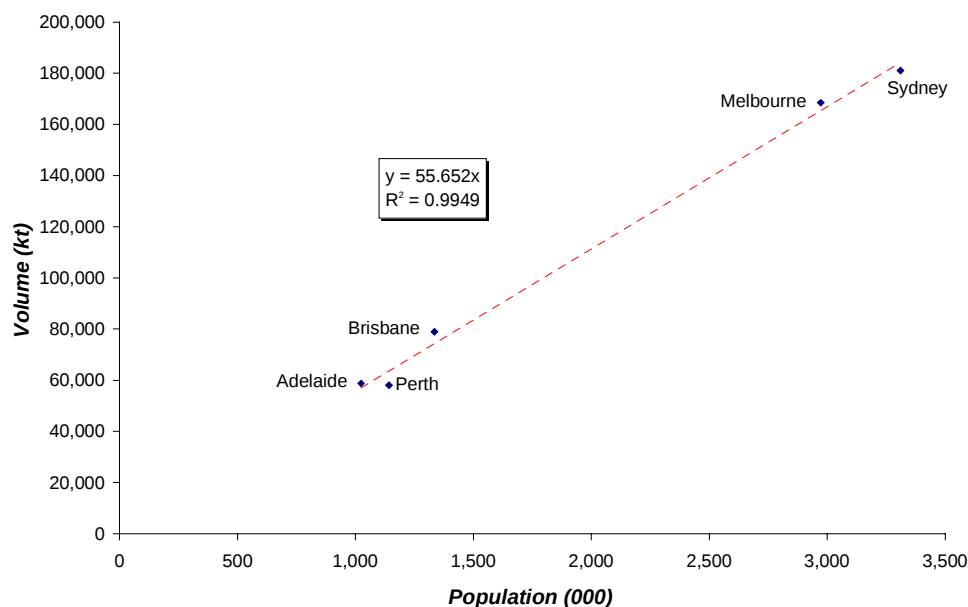


Source: Adapted from FreightInfo.

Metropolitan freight

We use the term 'metropolitan' freight to denote freight which originates and terminates within the same capital city. Metropolitan freight is the urban analog of 'local' freight and accounts for the bulk of all tonnes moved, and, despite a short average length of haul, a substantial proportion of tonne-kilometres. But because practically none uses the NHS it is not analysed in this study. The volume of metropolitan freight largely depends on the urban population (chart A1.5).

Chart A1.5
Metropolitan
freight: the
effect of city
size on
freight
volume



Source: Adapted from FreightInfo.

On average 55 tonnes of metropolitan freight are transported per annum for each resident of Australia's capital cities.

Appendix 2

Road freight corridor analyses

Corridor 1 Sydney–Melbourne

Location and context

The Sydney–Melbourne corridor of the NHS runs from Liverpool (outer Sydney) to outer Melbourne. It carries 7.9 billion tonne-km/yr, 23% of the NHS total.

Freight composition by category

The carries mainly intercapital freight—57% of the freight task. Most is between Sydney and Melbourne, though for part of its length the corridor also carries intercapital freight between Adelaide and Sydney, and between Melbourne and Brisbane. Tributary freight is 36% of the freight task—23% downstream, and 13% upstream. Country/local freight is 7% of the freight task.

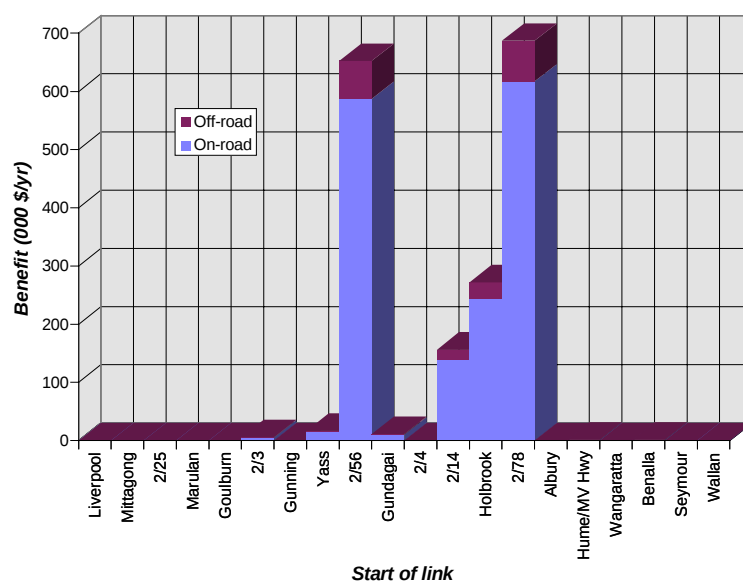
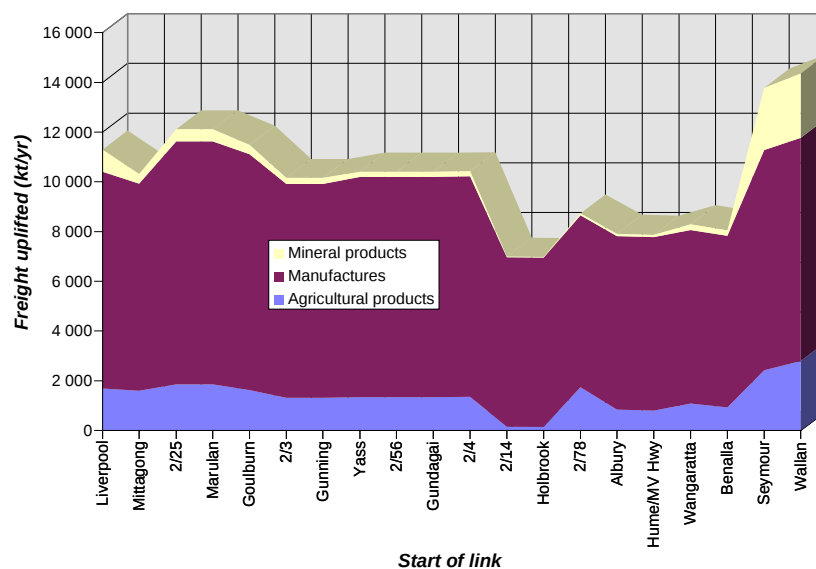
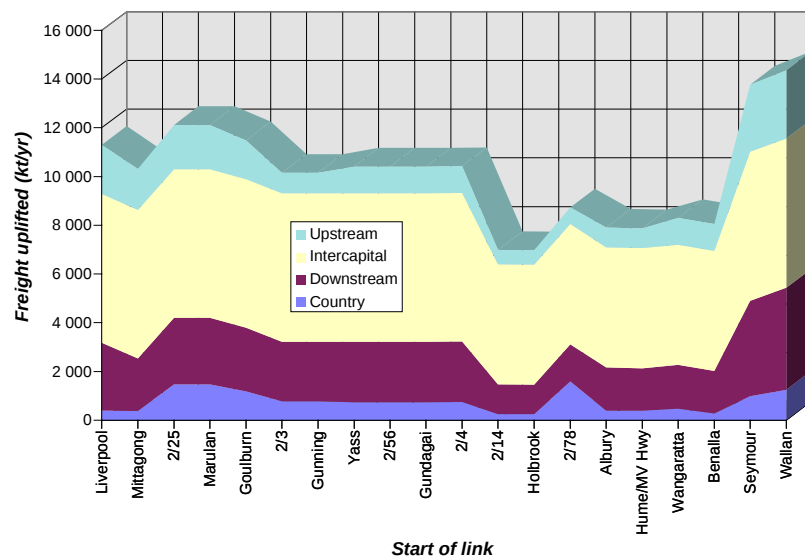
Freight composition by commodity group

The corridor carries mainly manufactures—82% of the freight task. Agricultural products are 13% of the freight task, and mineral products 5%.

*Estimated
freight task,
by
commodity:
Corridor 1
SYD–MEL,
1995*

	Freight task	
	(million tonne-km/yr)	(%)
Category of freight		
Country/local	515	7%
Downstream	1 830	23%
Intercapital	4 534	57%
Upstream	1 037	13%
Commodity group		
Agricultural products	1 019	13%
Manufactures	6 504	82%
Mineral products	392	5%
<i>Total</i>	<i>7 916</i>	<i>100%</i>

Freight flows, by link and category or commodity group:
Corridor 1
SYD-MEL,
1995



Corridor 2 Melbourne–Adelaide

Location

The Melbourne–Adelaide corridor of the NHS runs from outer Melbourne to outer Adelaide. It carries 3.0 billion tonne-km/yr, 9% of the NHS total.

Freight composition by category

The corridor carries mainly intercapital freight—54% of the freight task. Tributary freight is 40% of the freight task—23% downstream, and 17% upstream. Country/local freight is 17% of the freight task.

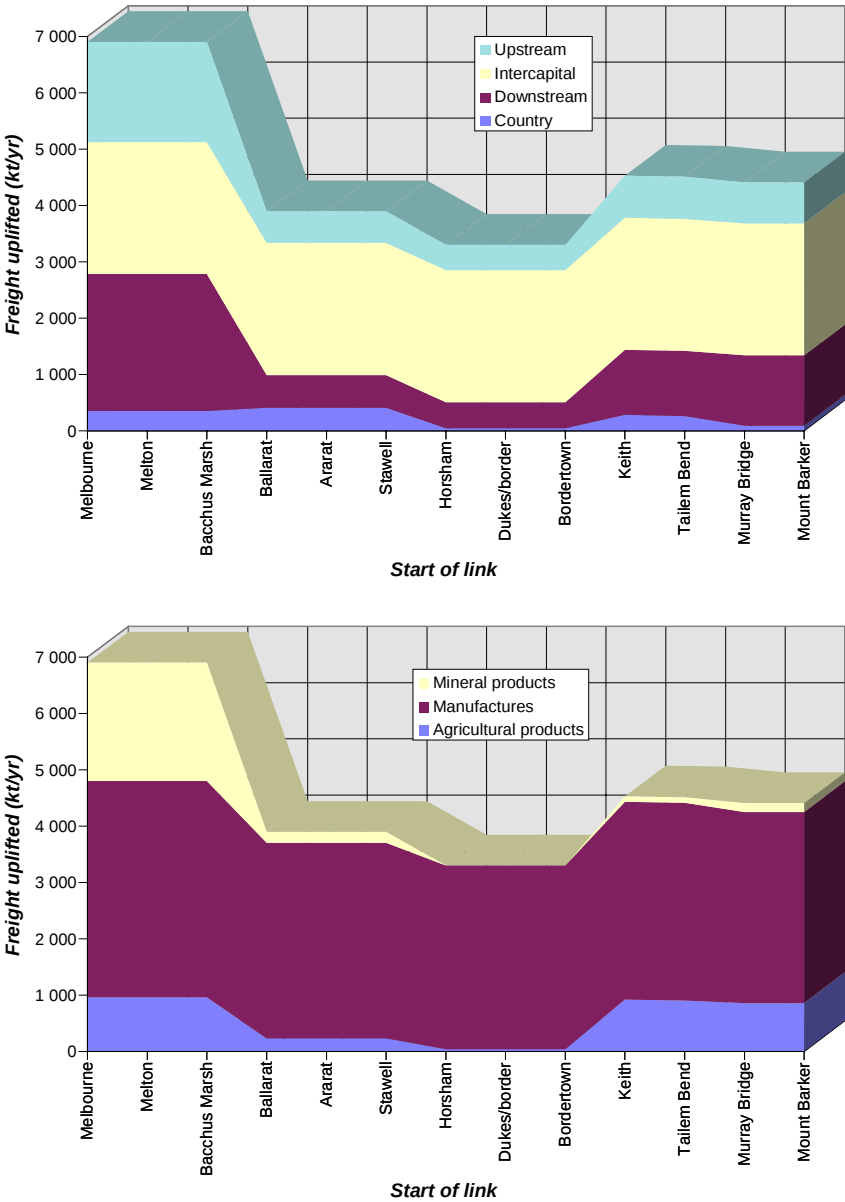
Freight composition by commodity group

The corridor carries mainly manufactures—80% of the freight task. Agricultural products are 11% of the freight task, and mineral products 9%.

*Estimated
freight task,
by commodity,
category of
freight::
Corridor 2
MEL–ADL,
1995*

	Freight task	
	(million tonne-km/yr)	(%)
Category of freight		
Country/local	164	5%
Downstream	703	23%
Intercapital	1 648	54%
Upstream	533	17%
Commodity group		
Agricultural products	344	11%
Manufactures	2 437	80%
Mineral products	268	9%
<i>Total</i>	<i>3 048</i>	<i>100%</i>

Freight flows,
by link and
category or
commodity
group:
Corridor 2
MEL-ADL,
1995



Appendix 3

Comparative performance of road infrastructure applied to the road freight task in Australian cities

TABLE A3.1 MELBOURNE ROAD FREIGHT – ROAD INFRASTRUCTURE

Corridor	Hume Highway - Northern Entry to Bell St	Tullamarine Fwy - Airport to City	Western Hwy - entry to City	West Gate / Princes Fwy - SW entry to city	West Gate / Princes Fwy city	Western Ring Road	South Eastern Arterial	South Eastern Arterial	Springvale Road	Springvale Road	Bell St Manningham Rd /	Bell St Manningham Rd /
Link	Hume Highway - Northern Entry to Bell St	Tullamarine Fwy - Airport to City	Western Hwy - entry to City	West Gate / Princes Fwy - section	West Gate / Princes Fwy section	Completed section between Hume and Tullamarine Fwys	East of Springvale Road	West of Springvale Road	South of SE Arterial	North of SE Arterial	Doncaster Road	Doncaster Road
length (km)	6	20	14	22	14	8	15	21	13	14	6	15
AADT	34088	113847	46357	62691	109928	53340	94517	66881	36964	51329	na	56648
Cars	29723	103707	42701	55215	98417	44888	84935	61074	34767	48202	na	53162
Heavy vehicles	4365	10140	3656	7476	11511	8452	9582	5807	2197	3127	na	3486
% heavy vehicles	12.8	8.9	7.9	11.9	10.5	15.8	10.1	8.7	5.9	6.1	na	6.2
Average am peak speed km/hr	na	na	na	88	89	na	65	44	42	41	38	37
Intersections	25	10	93	6	9	3	7	11	75	107	41	173
Signalised intersections	5	0	23	0	0	0	0	1	19	25	13	40
Intersections per km	4.2	0.5	6.6	0.3	0.6	0.4	0.5	0.5	5.8	7.6	6.8	11.5
Distance between intersections (metres)	240	2000	151	3667	1556	2667	2143	1909	173	131	146	87
Distance between signalised intersections (metres)	1200	na	609	na	na	na	na	21000	684	560	462	375

TABLE A3.2 SYDNEY ROAD FREIGHT – ROAD INFRASTRUCTURE

Corridor	F3 northern entry - Gosford to Hornsby	F5 southern entry - Campbell town to Liverpool	M4 Penrith to Burwood	M4 Penrith to Burwood	Route 7 - Hornsby to Liverpool	Route 7 - Liverpool	Route 3 - Gordon to Hurstville	Route 3 - Gordon to Hurstville	Route 3 - Hurstville to Chullora	Hume Highway - Liverpool to Chullora	M5 - Liverpool to general Holmes Dr	M5 - Liverpool to General Holmes Dr	Pacific Highway - Hornsby to East Sydney	Pacific Highway - Hornsby to East Sydney	Southern Cross Dr East Sydney to Brighton	Foreshore Rd - Botany to Port Botany
Link	F3 northern entry to Hornsby	F3 Southern entry to Liverpool	Pennith to Parramatta	Pennith to Parramatta	Hornsby to M4	M4 to Liverpool	M4 to Gordon	M4 to Gordon	M4 to Liverpool	M4 to Liverpool	M5 from Liverpool to Beverly Hills	Beverly Hills to Gen Holmes Dr	Hornsby to Chatswood	Hornsby to Chatswood	East Sydney to Port Botany	Botany to Port Botany
length (km)	24	17	36	10	21	15	15	12	16	14	5	14	10	10	16	5
AADT	55000	45000	75000	80000	40000	25000	60000	50000	62000	56000	43000	50000	100000	100000	60000	29000
Cars	50000	40800	68000	75500	35100	22800	58170	47130	58200	52440	40400	47700	98000	98000	58000	26910
Heavy vehicles	4500	4200	6800	4500	4900	2200	1830	2870	3800	3560	2600	2300	2000	2000	2000	2090
% heavy vehicles	8.2	9.3	9.1	5.6	12.3	8.8	3.1	5.7	6.1	6.4	6.0	4.6	2.0	3.3	7.2	7.2
Average am peak speed km/hr	60	80	40	60	30	40	25	40	40	70	25	na	50	50	25	60
Intersections	6	4	12	4	96	53	67	61	83	6	43	103	59	60	6	6
Signalised intersections	1	2	0	0	44	24	24	27	37	1	15	41	35	17	5	5
Intersections per km	0.3	0.2	0.3	0.4	4.6	3.5	4.5	5.1	5.2	0.4	8.6	7.4	5.9	3.8	1.2	1.2
Distance between intersections (metres)	4000	4250	3000	2500	219	283	224	197	193	2333	116	136	169	267	833	833
Distance between signalised intersections (metres)	24000	8500	na	na	477	625	625	444	432	14000	333	341	286	941	1000	1000

TABLE A3.3 BRISBANE ROAD FREIGHT – ROAD INFRASTRUCTURE

Corridor	Main northern entry - Caboolture to Brisbane	Main northern entry - Caboolture to Brisbane	Main southern entry - Logan River to Brisbane	Main southern entry - Logan River to Brisbane	Main southern entry - Logan River to Brisbane	Gateway Arterial - Eight Mile Plains to Bald Hills	Gateway Arterial - Eight Mile Plains to Bald Hills	Gateway Arterial - Eight Mile Plains to Bald Hills	Main Western entry - Dinmore to South East	Western Arterial - Darra to Nundah	Western Arterial - Darra to Nundah	Western Arterial - Darra to Nundah	Griffith Arterial - Cunningham	Logan Motorway - Goodna to Logan River
Link	Caboolture to Bald Hills	Bald Hills to City	Logan River to Eight Mile Plains	Logan River to Eight Mile Plains	Logan River to Eight Mile Plains	Eight Mile Plains to Brisbane	Eight Mile Plains to Brisbane	Brisbane River to Bald Hills	Dinmore to Brisbane	Darra to Jindalee	Jindalee to Everton Park	Everton Park to Nundah	Archerfield to Wishart	Goodna to Logan River
length (km)	16	15	14	14	16	14	14	22	26	6	15	9	11	29
AADT	52000	52000	113000	113000	90000	35000	35000	26000	42000	35000	45000	20000	40000	11000
Cars	na	48880	na	na	85500	32200	32200	23000	36960	32900	42700	19200	35600	10300
Heavy vehicles	na	3120	na	na	4500	2800	2800	3000	5040	2100	2300	800	4400	700
% heavy vehicles	na	6.0	na	na	5.0	8.0	8.0	11.5	12.0	6.0	5.1	4.0	11.0	6.4
Average am peak speed km/hr	na	38	na	na	68	80	80	80	80	72	32	40	38	na
Intersections	5	93	12	12	9	6	6	9	98	10	85	69	39	9
Signalised intersections	1	22	0	0	0	0	0	0	24	2	15	18	11	0
Intersections per km	0.3	6.2	0.9	0.9	0.6	0.4	0.4	0.4	3.8	1.7	5.7	7.7	3.5	0.3
Distance between intersections (metres)	3200	161	1167	1167	1778	2333	2333	2444	265	600	176	130	282	3222
Distance between signalised intersections (metres)	16000	682	na	na	na	na	na	na	1083	3000	1000	500	1000	na

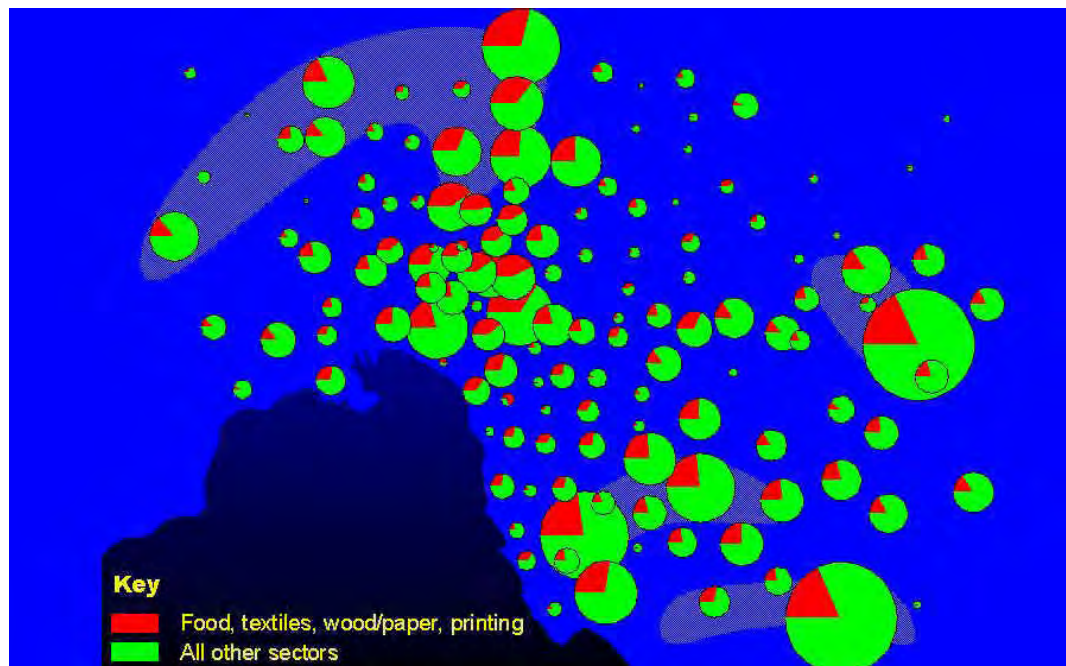
TABLE A3.4 ADELAIDE ROAD FREIGHT – ROAD INFRASTRUCTURE

Corridor	Eastern entry to Glen Osmond to Gepps Cross		Glen Osmond to South Adelaide	Glen Osmond to mile End via Greenhill & Richmond Rds	Glen Osmond to Emerson	Noarlunga to Port Adelaide to Craven, north of Gepps Cross	Port Adelaide to Gepps Cross	Northern entry to Gepps Cross	North-east entry to Gepps Cross	North-east entry to Gepps Cross
Link	Murray Bridge to Glen to Gepps Cross Osmond		Glen Osmond	Glen Osmond	Glen Osmond to Emerson	Noarlunga to Craven, north of Gepps Cross, via South Rd	Port Adelaide to Gepps Cross City, via Port Rd via Junction Rd	Northern entry to Gepps Cross (Wakefield Rd)	Gawler to Elizabeth	Elizabeth to Gepps Cross
length (km)	9	15	7	6	23	12	9	29	15	17
AADT	26000	24000	32000	22000	41000	36000	40000	40000	20000	38000
Cars	23900	22300	30300	21000	37000	33250	35350	35150	18500	35500
Heavy vehicles	2100	1700	1700	1000	4000	2750	4650	4850	1500	2500
% heavy vehicles	8.1	7.1	5.3	4.5	9.8	7.6	11.6	12.1	7.5	6.6
Average am peak speed km/hr	40	35	35	35	35	40	40	40	na	40
Intersections	2	156	56	55	188	107	56	43	44	34
Signalised intersections	1	27	14	11	35	27	12	7	7	14
Intersections per km	0.2	10.4	8.0	9.2	8.2	8.9	6.2	1.5	2.9	2.0
Distance between intersections (metres)	4500	96	125	109	122	112	161	674	341	500
Distance between signalised intersections (metres)	9000	556	500	545	657	444	750	4143	2143	1214

Appendix 4

Urban form and the metropolitan freight task for Australian cities

Figure A4.1
Melbourne:
freight-intensive
areas



Melbourne has two main freight-intensive industrial areas. The larger is located in the north to north-west where rapid growth is continuing along the Western Ring Road. The second is located in clusters in the Moorabbin to Braeside to Dandenong to Bayswater to Clayton corridor.

Figure A4.2
Melbourne
: major freight
links



Melbourne has a complete cross-town freeway link and a partially completed Western Ring Road. With the proposed Scoresby Freeway plus the a possible Eastern Ring Road will give Melbourne, alone among the major cities, a complete ring road of freeway standard.

Figure A4.3
Melbourne
cross-town flows



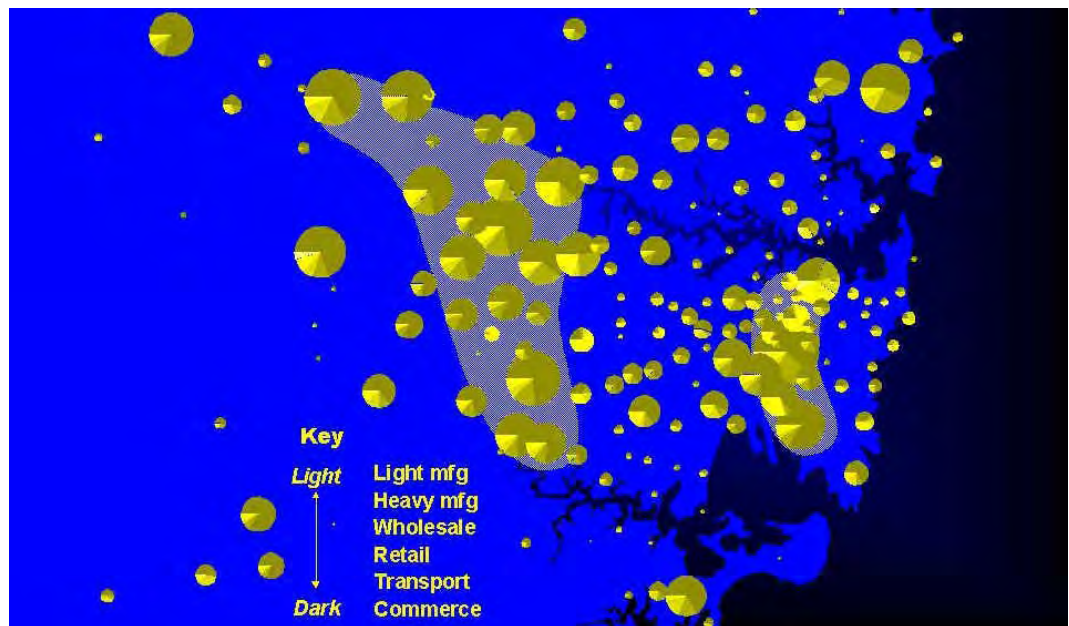
Western Suburbs industry has ready access to intercity routes by virtue of its position landside of the metropolis. Eastern suburbs industry has similar access via CityLink and, eventually, the Ring Road.

Figure A4.4
Melbourne:
a freight
assessment



Melbourne's main industrial areas, its seaport and airport are well linked to each other and to their hinterland. This linkage will improve with the completion of the ring road.

Figure A4.5
Sydney
: freight-
intensive
areas



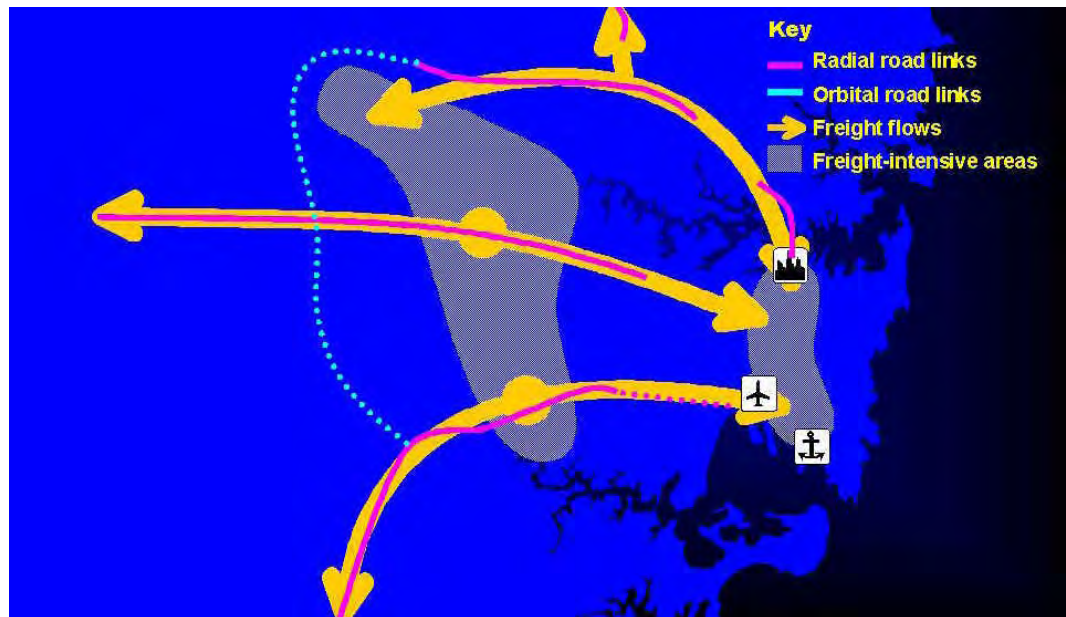
Sydney has two main freight-intensive industrial areas. The larger is spread through the western suburbs and Parramatta. The smaller, older, and more concentrated area is located between Botany and the City.

Figure A4.6
Sydney
: major
freight links



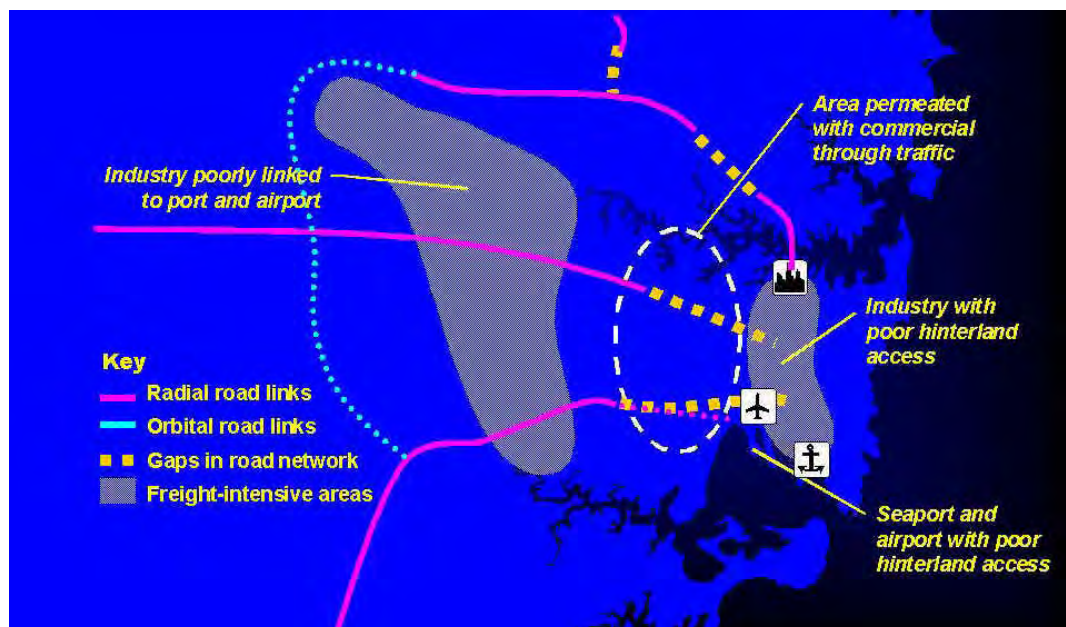
Sydney has an incomplete orbital and radial motorway system. Key gaps are west of Botany and on the Pacific Hwy north of the Harbour Bridge.

Figure A4.7
Sydney
: major
cross-town
flows



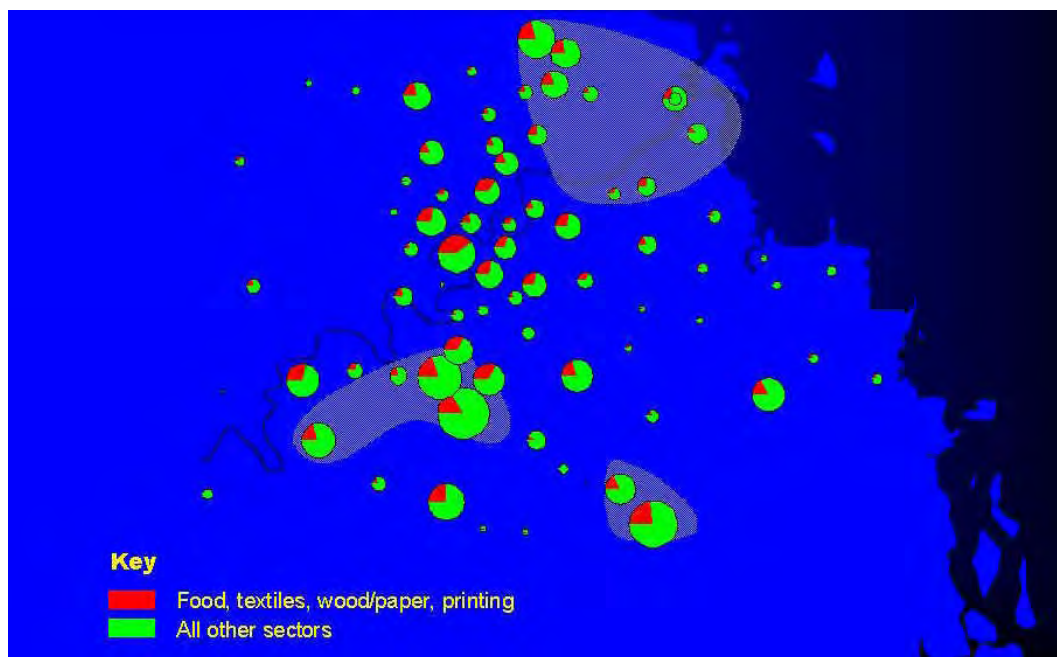
Sydney's main freight flows are East-West, between the Botany area (including the seaport and airport) and the Western Suburbs and intercity routes.

Figure A4.8
Sydney
: a freight
assessment



Sydney is hampered by an incomplete motorway system. Industry in the Botany area, the seaport, and the airport are all poorly linked to Western Suburbs industry and intercity routes

Figure A4.9
Brisbane:
freight-
intensive areas



Brisbane has two main freight-intensive areas: Ipswich and the mouth of the Brisbane River. The latter contains a vast amount of undeveloped land. For this reason, and its prime location close to ports and highways, further development is expected. Brisbane is unique in having so much industrial land next to its seaport.

Figure
A4.10
Brisbane:
major
freight links



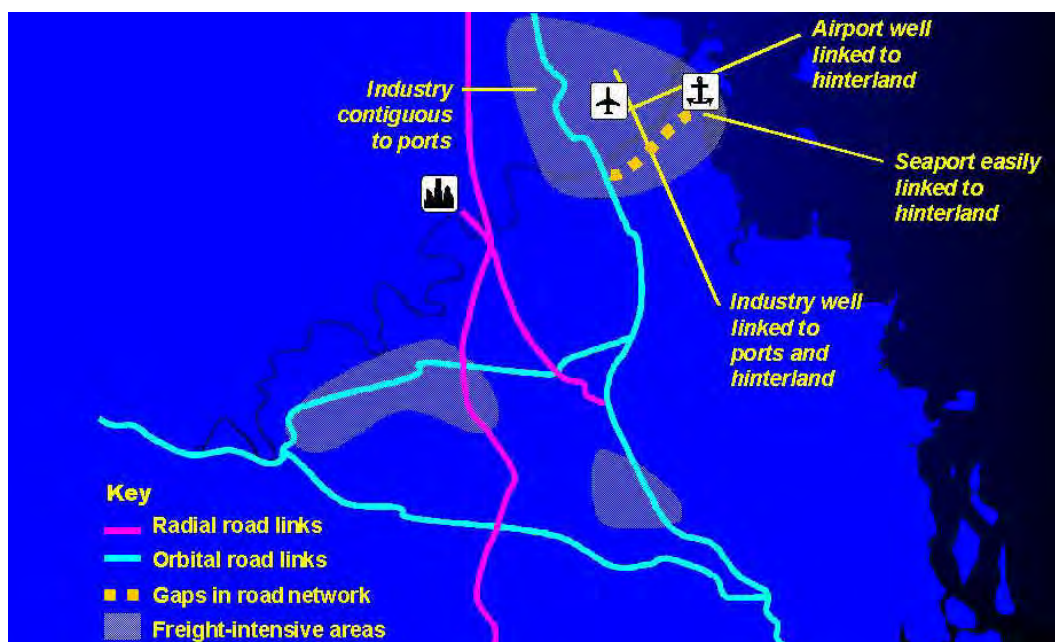
Brisbane's network of freight routes is the least developed of the three cities, reflecting Brisbane's smaller size. Although Brisbane lacks a ring road of motorway standard, it has less need of one since it is smaller than the other cities, and its industry is largely located on the urban periphery.

Figure A4.11
Brisbane
: Major cross-
town flows



Brisbane's main flows are North-South, skirting the city centre to the east, passing close to the seaport and airport, and serving a massive (and as yet largely undeveloped) area suitable for heavy industry around the mouth of the Brisbane River.

Figure
A4.12
Brisbane:
a freight
assessment



Brisbane performs well in freight terms because its seaport and airport are contiguous, easily accessed from north and south, and surrounded by vast areas of potential industrial land.

Appendix 5

The port related land freight transport task

Estimated current annual metropolitan truck trips generated by container imports and exports through the Port of Melbourne

Trips arising from Imports: Parameter	% of total	TEU's	Containers	No. of containers per metro. road trip	Total no. of trips on metro. roads
Full containers		470,000	358,779		
Empty containers		59,000	45,038		
Full container movement category					
• Rail or wharf	10		35,878	N/A	0
• Importers in metro. area direct	20		71,756	0.5	143,511
• Importers outside metro. area	5		17,939	N/A	0
• Importers via on-port yard:	33		118,397		
- Terminal to yard				1.0	118,397
- Yard to importer				0.5	236,794
• Importers via off-port yard:	32		114,809		
- Terminal to yard				1.0	114,809
- Yard to importer				0.5	229,618
Empty container movement category					
• On-port depot	50		22,519	N/A	0
• Off-port depot	50		22,519	1.0	22,519
Total trips: Imports					865,649
Trips arising from Exports: Parameter	% of total	TEU's	Containers	No. of containers per metro. road trip	Total no. of trips on metro. roads
Full containers		390,000	297,710		
Empty containers		96,000	73,282		
Full container movement category					
• Rail or wharf	20		59,542	N/A	0
• Exporters in metro. area direct	5		14,885	0.5	29,771
• Exporters outside metro. area	25		74,427	N/A	0
• Exporters via on-port yard:	25		74,427		
- Exporter to yard				1.0	74,427
- Yard to terminal				0.5	148,855
• Exporters via off-port yard:	25		74,427		
- Exporter to yard				1.0	74,427
- Yard to importer				0.5	148,855
Empty container movement category					
• On-port depot	50		36,641	N/A	0
• Off-port depot	50		36,641	1.0	36,641
Total trips: Exports					512,977
Total annual metropolitan truck trips (Based on 260 days pa)					1,378,626
					5,302 truck trips per day

Estimated current annual cost of metropolitan road transport of containers to and from Port of Melbourne

1. Overseas imports					
Movement category	Container size	TEU's	Containers	Transport rate/unit \$	Transport cost \$
Number of Imports:					
• full	20' (69%)	470,000	247,557		
	40' (31%)		111,221		
• empty	20' (69%)	59,000	31,076		
	40' (31%)		13,962		
Total		529,000	403,817		
If 80% of full are unpacked within the metropolitan area:					
• full	20' (69%)		198,046	200.00	39,609,000
	40' (31%)		88,977	240.00	21,355,000
And 14% off full are delivered to rail or another wharf:					
• full	20' (69%)		34,658	65.00	2,253,000
	40' (31%)		15,571	80.00	1,246,000
• Return empty after unpacking	20' (69%)		34,658	25.00	866,000
	40' (31%)		15,571	50.00	779,000
And all empties are delivered to metropolitan depots:					
	20' (69%)		31,076	25.00	777,000
	40' (31%)		13,962	50.00	698,000
Total overseas import transport cost				\$	67,583,000
2. Overseas exports					
Movement category	Container size	TEU's	Containers	Transport rate/unit \$	Transport cost \$
Number of Imports:					
• full	20' (69%)	390,000	205,420		
	40' (31%)		92,290		
• empty	20' (69%)	96,000	50,565		
	40' (31%)		22,718		
Total		486,000	370,992		
If 55% of full are packed within the metropolitan area:					
• full	20' (69%)		112,981	200.00	22,596,000
	40' (31%)		50,760	240.00	12,182,000
And 18% of full arrive from rail or another wharf:					
• full	20' (69%)		36,976	65.00	2,403,000
	40' (31%)		16,612	80.00	1,329,000
• empty delivery prior to packing	20' (69%)		36,976	25.00	924,000
	40' (31%)		16,612	50.00	831,000
And all empties are delivered from metropolitan depots:					
	20' (69%)		50,565	25.00	1,264,000
	40' (31%)		22,718	50.00	1,136,000
Total overseas export transport cost				\$	42,665,000
3. Coastal imports and exports					
Movement category	Container size	TEU's	Containers	Transport rate/unit \$	Transport cost \$
Number of Imports & Exports:					
• full		238,000	238,000		
• empty		25,000	25,000		
Note: 95% are 20', ignore cost differential for 40')					
Total		263,000	263,000		
If 15% are to/from rail:			35,700	65.00	2,321,000
And 65% are to/from Metro. area:			154,700	200.00	30,940,000
And all empties are delivered to/from metropolitan depots:			25,000	25.00	625,000
Total coastal domestic transport cost				\$	33,886,000
Total annual metropolitan container transport cost				\$	144,134,000
Annual container volumes are from Melbourne Port Corporation Trade Statistics					

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