2009 Container Logistics Chain Study Port of Melbourne

SUMMARY REPORT



12



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Attribution

Port of Melbourne Corporation and its joint project sponsors, the Victorian Department of Transport and the Essential Services Commission together with the study consultants IMIS Integrated Management Information Systems Pty Ltd and Victoria University's Institute for Logistics and Supply Chain Management would like to extend their heartfelt gratitude to all businesses that participated in providing data and information for the purposes of this container study. Without their help this project would not have been possible.

The study

Study need

For an island nation like Australia, ports have long held a central and critical economic role as the gateway to regional and international transport networks. This role is expected to become even more important in response to increasing global trade flows and closer supply chain integration with Australia's major world trading partners. As a result, a sound understanding of the international container supply chain , particularly on the landside is important to drive improvements in transport efficiency; plan and deliver essential transport infrastructure; and encourage private sector investment and employment.

Port of Melbourne Corporation, the Victorian Department of Transport and the Essential Services Commission jointly commissioned IMIS Integrated Management Information Systems Pty Ltd in association with Victoria University's Institute for Logistics and Supply Chain Management to undertake this 2009 Container Logistics Chain Study.

Two supply chain analysis packages were incorporated into this study. The first considered all of the movements related to container trade through the Port of Melbourne (the port), while the second focused on the movement of domestic containers through the Dynon Rail Terminals (the Dynon terminals). This summary report relates to the first of these packages.

Objectives

The key objectives of the study were to provide a comprehensive understanding of the container logistics chains for the port and Dynon terminals, including:

- landside origins and destinations
- road and rail transport modes and distances
- use of transport depots
- time of day for key transport operations
- dwell time at major logistic chain points
- import and export commodities packed in containers.

Study methodology

A comprehensive range of data was sourced directly from businesses and organisations that were involved in the container movement activities of the port and Dynon terminals.

A total of 105 businesses contributed valuable data and information to the study. They covered all of the main logistics industry sectors, including:

- stevedores
- transport operators
- importers and exporters
- freight forwarders
- empty container parks
- rail terminal operators
- customs and quarantine.

Data was provided by all participating businesses for an uninterrupted 14 day period that commenced on Monday 9 November 2009 and finished on Sunday 22 November. The collected data was then subjected to a rigorous validation process which included the testing of qualitative and quantitative logistics assumptions, the removal of partial/duplicate entries and correction of any data entry errors, before being used in the subsequent analysis.

In addition to the container specific information, PoMC provided port throughput and trade data, which enabled the movements identified during the two-week data collection period to be annualised for the 2009 calendar year using known seasonal and annual characteristics.

Geographic breakdown

Figures 1 and 2 show the broad geographic groupings of metropolitan Melbourne, regional Victoria and the rest of Australia used in the breakdown of origin and destination information.



Figure 1: Metropolitan Melbourne

Figure 2: Australia



Port of Melbourne container and rail terminals

An overview of the main container and rail terminals is required to understand the study findings presented within this document. Figure 3 indicates the locations of the four container terminals and the six rail terminals currently located within the port and the Dynon terminal precinct:





Port of Melbourne container trade

Figure 4 illustrates that just over 2.1 million TEU¹ of containers were handled at the port during 2009. This was an 8% reduction compared to throughput in 2008 (around 2.3 million TEU) and was clearly linked to the global economic downturn bearing in mind that these volumes are significantly greater than the volume in 2000 (about 1.3 million TEU).

Figure 4: Port of Melbourne 2000 to 2009 container trade



While 2009 was lower than the previous two years on an annual basis, the volume of container trade through the two-week survey period nearly matched that for the same period in the previous two years.

A breakdown of the 2009 container trade is shown in Table 1. This provides the container throughput information separated into imports and exports, full and empty, along with volumes of transhipped² containers.

	Imports		Ехр	orts	Total	
Trade	Full	Empty	Full	Empty	Full	Empty
International and Mainland Coastal	816	48	555	261	1,371	309
Tasmanian	84	52	113	31	197	83
Sub-Total	900	100	668	292	1,568	392
Transhipped	70	9	69	10	139	19
Total	970	109	737	302	1707	411

Table 1: Port of Melbourne 2009 container trade ('000 TEU)

The scope of this study covered the international, mainland coastal and Tasmanian trade components of the port's throughput that had associated landside logistic movements. While transhipped containers may have had related road movements, they did not leave the port precinct and hence were not included in the logistics chain analysis.

The table indicates that the vast majority of containers handled at the port are related to the international and mainland coastal trade, with Tasmanian trade accounting for only 13% of containers.

¹⁸²Refer Glossary

Study findings

A wide range of container and logistics information was gathered during the study, including container origins and destinations, land transport movement patterns, transport modes and travel distances. In addition, at the main points in the logistics chain, arrival and departure day of week, time of day and dwell times, along with the most significant imported and exported containerised commodities, were also identified.

Summarised findings for each of these port aspects are provided in this section.

Origins and destinations

This section provides a summary of the origin and destination information for the port of Melbourne, for both export and import container trade.

Table 2 shows that for international and mainland coastal containers imported through the port almost all (87%) are delivered to destinations located in the metropolitan area. The origins of export containers are more widely split between metropolitan Melbourne (54%), regional Victoria (23%) and interstate (23%).

For containers imported from Tasmania the table shows a similar level (86%) of metropolitan destinations. Again, the origins of containers exported to Tasmania are widely split between metropolitan Melbourne (48%), regional Victoria (35%) and interstate (17%).

	International and mainland coastal*				Tasmanian*			
	Imports		Ехр	orts	Imports		Exports	
Area	TEU ('000)	%	TEU ('000)	%	TEU ('000)	%	TEU ('000)	%
Metropolitan Melbourne								
Inner Melbourne	61	8%	76	14%	17	20%	11	9%
Outer Eastern	74	9%	4	1%	5	6%	-	-
Outer Northern	157	19%	38	7%	6	7%	1	1%
Outer South East	205	25%	37	7%	29	34%	41	36%
Outer Western	215	26%	143	26%	16	19%	2	2%
Metropolitan Sub-Total	713	87%	297	54%	72	86%	54	48%
Regional Victoria								
Eastern Corridor	3	-	35	6%	-	-	6	5%
Goulburn Corridor	2	-	1	-	-	-	-	-
Hume Corridor	4	1%	-	-	-	-	-	-
North Western Corridor	3	-	4	1%	-	-	-	-
Peninsula	1	-	4	1%	-	-	-	-
South Western Corridor	9	1%	32	6%	1	1%	31	27%
Western Corridor	2	-	54	10%	-	-	3	2%
Regional Victoria Sub-Total	23	3%	130	23%	1	1%	39	35%
Rest of Australia								
New South Wales	21	3%	59	11%	5	6%	8	7%
Northern Territory	-	-	-	-	-	-	-	-
Queensland	7	1%	3	1%	3	4%	7	6%
South Australia	47	6%	65	12%	2	2%	3	3%
Western Australia	4	-	-	-	-	-	1	1%
Rest of Australia Sub-Total	80	10%	128	23%	10	12%	20	17%
Total	817	100%	555	100%	84	100%	113	100%

Table 2: Port of Melbourne import and export container trade

*These trade figures exclude transhipments

International and mainland coastal import and export containers

The concentration of international and mainland coastal container import destinations, and export container origins, are shown geographically in Figures 5, 6 and 7 below. The information is presented at postcodes level with the darker colours indicating higher container densities.

87% of full import containers are delivered to destinations located in the metropolitan Melbourne area as shown in Figure 5. Dandenong, Laverton North, Somerton, Altona and Tullamarine are the suburbs receiving the highest number of import containers



Figure 5: Import container destinations - metropolitan Melbourne

Export containers come from a broader geographic area. 54% have origins in the metropolitan area as shown in Figure 6 and almost all the rest (43%) come from regional Victoria and the port of Melbourne catchment in southern New South Wales and south eastern South Australia shown in Figure 7.

The greatest numbers of export containers come from Laverton, West Melbourne, West Footscray, Laverton North and Altona in the metropolitan area, and from Morwell, Horsham, Adelaide and Myall Park.



Figure 6: Export container origins - metropolitan Melbourne



Figure 7: Export container origins - Port of Melbourne catchment

Tasmanian import and export containers

The concentration of Tasmanian import container destinations and export container origins are shown in Figures 8, 9 and 10.

Figure 8 shows that most containers imported from Tasmania go to the metropolitan Melbourne suburbs of Dandenong, West Melbourne and West Footscray. A total of 86% of all Tasmanian import containers are delivered to destinations located in the metropolitan area.



Figure 8: Tasmanian import container destinations - metropolitan Melbourne

Less than half (48%) of containers exported to Tasmania come from origins located in metropolitan Melbourne. As shown in Figure 9 most of these come from the suburbs of Dandenong, West Melbourne and Bentleigh East.



Figure 9: Tasmanian export container origins - metropolitan Melbourne

Around a third (35%) of containers exported to Tasmania come from regional Victoria and the remaining 17% from New South Wales, Queensland and South Australia.

Figure 10 shows that Lara and Morwell are the main Victorian origins of Tasmanian export containers.



Figure 10: Tasmanian export container origins - Victoria

Land transport

Movement patterns

A wide range of land transport movements are associated with containerised freight involving a number of business types using road and rail transport modes. For the port of Melbourne these movements can be presented using the movement flow diagram shown in Figure 11.

To interpret this diagram it is necessary to appreciate:

- 1. the coloured boxes represent the key land transport/logistics business types (identified within the Glossary)
- 2. the arrows signify the road and rail transport movements (with different colours for full and empty containers and dotted lines for rail movements, as identified within the key)
- 3. the numbers denote the quantity of TEUs (in thousands) that moved between each business function in 2009
- 4. the diagram is divided into two halves - the left half being export containers and the right half import containers.

Figure 11: Port of Melbourne logistics chain movements



The above diagram is reproduced in Figures 12 and 13 highlighting the full container export and import chain movements respectively.

Export container logistics chain

During 2009 around 668,000 TEU of full containers were exported. The diagram shows that:

- 242,000 (36%) were delivered direct to the stevedore by road
- 292,000 (44%) were transported by road to an intermediate location before delivery to the stevedore
- 135,000 (20%) were moved either directly or indirectly to the stevedore by rail.

On average, each full container was moved 1.9 times before it reached the stevedore.

Figure 12: Export logistics chain movements

Import container logistics chain

The import container logistics chain is similar to the export chain, however it has significantly more movements overall (900,000 TEU) and a correspondingly higher proportion of road only movements via transport depots (597,000 TEU, 66%). In addition the diagram shows that:

- 263,000 TEU (29%) of full import containers were moved directly from the port to importers
- 40,000 TEU (around 5%) were moved by rail.

On average, each container was moved 1.8 times before it reached the importer.

Table 3 summarises the quantity of full and empty containers (in thousands of TEU) moved between individual land transport/logistics businesses during 2009.

	To Business Type							
From Business Type	Stevedore	Transport Depot	Importer	Exporter	On Port / Dynon Rail Terminal	Regional / Interstate Terminal	Container Park	Total
Stevedore	-	704	263		1	-	32	1,000
Transport depot	593	73	597	357	137	-	48	1,804
Importer	-	272	-	-	-	7	621	900
Exporter	242	292	-	-	-	135	-	668
On Port /Dynon Rail Terminal	63	76	-	-	-	141	2	283
Regional /Interstate Terminal	-	-	40	101	141	-	-	283
Container Park	63	387	-	211	4	-	-	664
Total	960	1,804	900	668	283	283	703	5,601

Table 3: Container movements between business types

The table reveals that transport depots are a major component within the container logistics chain managing around 1.8 million TEU (34%) of all container movements. The largest volume of container movements (13%) was between stevedores and transport depots. Movements between transport depots and importers, transport depots and stevedores, and importers and container parks were also significant at approximately 11% each.

Container staging (full containers)

The above information confirms that not all containers are directly collected from, or delivered to the port. In fact, the vast majority are temporarily held at various intermediate, or 'staging', locations on their trip to and from the port.

This staging is undertaken for a range of commercial and practical reasons, one of which is the need for temporary storage to facilitate deliveries between transport/logistics businesses with different operating hours or delivery expectations. For example, a transport company may collect a container from the port during the night shift but be unable to deliver it to the importer until normal business hours the following day.

The movement flow diagram (Figure 11) indicates that 71% of full import containers and 54% of full export containers are staged through a transport depot. Almost all of the staging depots are located within the inner and outer western suburbs of Melbourne. The key staging locations within metropolitan Melbourne for full international and mainland coastal import containers are shown in Figure 14.

Figure 14: Import containers staging locations

Empty containers

Almost all full container movements within the land transport logistics chain have a corresponding empty container movement. The majority of these moves either originate in, or terminate at, a container park. The container park receives, stores, and supplies empty containers to meet demand from exporters, or arranges for the repositioning to international markets on behalf of the shipping lines.

Both Table 3 and Figure 11 above, indicate that in 2009 almost 1.4 million TEU container movements were to and from container parks which represents around 26% of all movements.

Transport mode and travel distances

Transport mode share

The movement flow diagram (Figure 11) shows that the vast majority of port related containers are transported by road. Rail transport does, however, play a significant role in the transport of full export containers from regional Victoria and the port of Melbourne catchment areas in South Australia and southern NSW moving more than 40% of the containers from these areas to the port³.

Rail has a less significant role for the transport of full import containers as around 87% of these have destinations within the metropolitan area. Rail is however, used for the transport of around 35% of full containers imported to regional Victoria and interstate destinations.

Overall, around 248,000 TEU of full and empty containers (14% of port throughput, excluding transhipments) were transported by rail in 2009.

A significant number of empty containers that are transported by rail through the port and Dynon terminals to regional and interstate destinations for packing, originate from empty container parks located close to the port. While these containers may not have come directly from the port, they are an integral component of the port export container logistics chain.

Road only import and export container travel distances

Typical daily road travel distances for import and export containers are shown in Figure 15. For those containers that are transported by road only, the figure shows:

- almost all full import containers (91%) delivered by road alone have destinations within 50km of the port, which approximates the Melbourne metropolitan area
- by contrast, exports transported by road are more likely to have come from further afield, with around a third of export containers having an origin more than 50km from the port.

Figure 15: Road only travel distances 700 Imports 600 Exports 500 400 TEU per Day 300 200 100 0-5 5-10 10-20 20-30 30-50 50-200 200+ Distance (km)

Combined road and rail import and export container travel distances

For combined road and rail movements the travel distances presented in Figure 16 includes the total of the rail and road legs. The figure shows:

- approximately half of both full import and export containers transported by a combination of road and rail have destinations of between 600 and 800km from the port, which includes Adelaide
- around 10% of import containers have destinations between 200 and 600km from the port (covering regional Victoria and southern NSW) compared to 40% for export containers.

Figure 16: Road and rail travel distances

³Note that there is always a road based component for containers transported by rail. As a result, within this study, containers moved by rail at some point in the logistics chain are identified as 'road and rail' movements. Containers that do not have a rail movement anywhere in the logistics chain are identified as 'road only' movements.

Arrival and departure time of day

The primary arrival and departure points along the containerised freight logistics chains include stevedores, transport depots, importers, exporters and empty container parks. Each of these facilities has a specific operating arrangement according to their role within the logistics chain. Consequently, operational activity at each location can, and does, vary considerably across the day.

International and mainland coastal stevedores

Weekday arrival times for export containers and departure times for import containers at the international and mainland coastal stevedores are indicated in Figure 17. This figure shows:

- there is a reasonable match between the import and export container arrival and departure times
 the peak import container collection time is around 7 am and the peak export container arrival time is around 1 pm
- the majority of export containers (around 60%) arrive at the stevedores within the 6 am to 6 pm window and the majority of import containers depart within the same period.

Figure 17: Arrival and departure times international and mainland coastal stevedores

Tasmanian stevedores

Figure 18 provides the weekday export and import container arrival and departure times respectively for the Tasmanian stevedores. This figure shows:

- there are markedly different container arrival and departure time profiles between the international and mainland coastal and the Tasmanian stevedores
- due to the use of dedicated Tasmanian trade vessels arriving in Melbourne around 7 am and typically departing around 4 pm to 5 pm import and export container departure and arrival times are largely concentrated between 6 am and 6 pm
- the import container departure peak is at 7 am in the morning (when the vessel arrives) and the export container arrival peak is between 12 noon and 3 pm in the afternoon (in readiness for the 4 pm to 5 pm departure).

Transport depots

Weekday arrival and departure times for import and export containers at the transport depots are indicated in Figure 19, which shows:

- around two thirds (67%) of containers arrive at transport depots between 6 am and 6 pm
- a slightly higher proportion of containers depart from transport depots during the same period
- the peak container arrival times at transport depots are 9 am and 3 pm, whilst the peak departure time is 7 am
- transport depot arrival times are closely associated with the departure times at international and mainland coastal stevedores.

most containers arrive at importers and depart

from exporters (85%) between 6 am and 6 pm there is a strong correlation between arrival and

departure times and normal business hours.

Importers and exporters

departure times are both 8 am

Figure 20 provides the weekday container arrival and departure times at importers and exporters respectively. The figure shows:

the peak import and export container arrival and

Arrivals Departures Departures Departures Departures Departures Departures Departures Departures Departures Time of Day

Figure 20: Arrival and departure times - importers and exporters

Empty container parks

Weekday arrival and departure times for containers at the empty container parks are indicated in Figure 21, which highlights that:

- almost all empty containers (99%) arrive at the empty container parks between 6 am and 6 pm
- nearly all empty containers depart from the empty container parks between 6 am and 6 pm. The small number of containers departing outside these hours generally involve bulk runs that are arranged with the stevedores to facilitate container repositioning.

Figure 21: Arrival and departure times - empty container parks

Figure 19: Arrival and departure times - transport depots

Arrival and departure days of week

The vast majority of movements across the port container logistics chain occur Monday to Friday. As an example, Figure 22 shows arrivals and departures for the international and mainland coastal stevedores.

Tasmanian stevedores, who have a relatively high proportion of trade on Saturdays due to their regular six day a week shipping service to and from Tasmania, are an exception to this pattern.

Figure 22: International and mainland coastal stevedores arrival and departure days of the week

Dwell time at major points in the logistics chain

Figures 23 and 24 indicate the container dwell times at significant points along the port related container logistics chain.

Figure 23 shows the dwell times at the: importer, exporter, transport depot (import containers), transport depot (export containers), and indicates:

- the majority of containers (63% or more) stay for less than 24 hours at each point along the logistics chain
- the exception to this is at the exporters, where the majority of containers stay for more than 24 hours.

Figure 24 shows the dwell times at empty container parks and highlights that:

- around 18% of containers spend less than 48 hours in the empty container parks
- by comparison more than 70% of containers remain at the empty container parks for more than 4 days.

The average stay for containers at the empty container parks is between 15 and 16 days.

Figure 23: Dwell times - importer, exporter and transport depot

Import and export containerised commodities⁴

During the study data was gathered on the commodities that are typically transported in containers moved through the port. A summary of these findings is provided below.

Imports

The most prevalent commodities imported were classified as 'Manufactured Goods Classified Chiefly by Materials.' This classification accounted for 39% of full container imports and included commodities such as paper, non-metallic mineral and metal manufactures as well as iron and steel and non-ferrous metals. 'Chemicals and Related Products', 'Machinery and Transport Equipment' and 'Food' represented 18%, 17% and 15% respectively. The distribution of these containerised commodities across metropolitan Melbourne, regional Victoria and the rest of Australia is indicated in Table 4.

⁴Australian Transport Freight Commodity Classification, Catalogue 1210.0, Australian Bureau of Statistics, 1994

Exports

The most significant containerised export products included 'Food' commodities such as meat, dairy products, vegetables and fruit; and 'Manufactured Goods Classified Chiefly by Materials' which accounted for 42% and 35% of export containers respectively. The distribution of these commodities across metropolitan Melbourne, regional Victoria and the rest of Australia is also indicated in Table 4.

		Import	ts	Exports				
Commodities	Metro Melbourne	Regional Victoria	Rest of Australia	Total	Metro Melbourne	Regional Victoria	Rest of Australia	Total
Manufactured goods	38%	0%	1%	39%	30%	6%	-	36%
Chemicals and related products	12%	2%	4%	18%	3%	-	-	3%
Machinery and transport equipment	16%	0%	1%	17%	1%	-	-	1%
Food	14%	0%	1%	15%	16%	16%	11%	43%
Others	8%	0%	2%	11%	5%	2%	10%	17%
Total	88%	3%	9%	100%	55%	24%	21%	100%

Table 4: Port of Melbourne import and export containerised commodities

Key findings

Origins and destinations

- 87% of imported international and mainland coastal containers are delivered to importers located in metropolitan Melbourne
- 46% of international and mainland coastal export containers are packed at regional Victoria and interstate locations
- Tasmanian trade characteristics broadly mirror those for international and mainland coastal trade

Land transport

- 29% of international and mainland coastal import containers move directly from the port to the importer
- 14% of the port's throughput, excluding transhipment, is transported by rail
- Rail is predominately used for transport distances greater than 200km
- The majority of container logistics chain transport movements occur between 6am and 6pm Monday to Friday
- A number of businesses involved in the container chain operate 24 hours a day Monday to Friday. This includes the international and mainland coastal stevedores, transport depots, rail terminals and some importers and exporters.
- For international and mainland coastal terminals 43% of containers arrive and depart between 6 pm and 6 am Monday to Friday
- 63% of containers stay for less than 24 hours at each point along the logistics chain
- The average container dwell time at empty container parks is around 16 days

Commodities

- 'Manufactured Goods' account for 39% of containerised imports and 36% of exports
- Containerised 'Machinery and Transport Equipment', 'Chemicals and Related Products' and 'Food' are also significant imports
- 'Food' is the major export commodity accounting for 43% of all exports

Glossary

Term	Definition
Empty Container Park	This is a facility that manages the receival, storage and delivery of empty containers on behalf of shipping lines
Exporter	A business operating primarily for the purpose of exporting freight, or providing export-related services to other businesses.
Importer	A business operating primarily for the purpose of importing freight, or providing import-related services to other businesses
Port / Dynon rail terminal	This is a rail terminal located in, or adjacent to, the port of Melbourne, where trains carrying domestic and port related containers from regional Victoria and interstate locations are loaded and unloaded
Regional and interstate rail terminal	This is a rail terminal located in regional Victoria or interstate, where trains are unloaded and loaded
Stevedore	A business that engages in the loading and unloading of cargo from vessels. For the purposes of this study this relates to containerised cargo only
TEU	Refers to a Twenty-foot equivalent unit - the international standard container measurement unit
Transhipped container	Refers to a container discharged from one vessel at the port, stored for a limited period of time, and then loaded onto another vessel. These containers are typically either transhipped between one international and mainland coastal vessel and another, or between an international and mainland coastal vessel and a Tasmanian trade vessel
Transport depot	This is an intermediate road based transport facility, where containers are temporarily stored during their movement between importers, exporters, rail terminals, empty container parks and the stevedores

This Port of Melbourne Summary Report is one of three 2009 Container Logistics Chain Study documents that have been produced, with the other documents being: 2009 Container Logistics Chain Study, Full Report, 2009 Container Logistics Chain Study, Dynon Rail Terminals Summary Report

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