Fremantle Ports

Fremantle Port Landside Container Study

March 2012

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This document has subsequently partially been edited by Fremantle Ports to make certain adjustments and to maintain participant confidentially.

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DEFINITIONS AND ABBREVIATIONS

Term	Definition
ABS	Australian Bureau of Statistics.
ANL	Australian National Line.
APL	American President Lines.
AQIS	Australian Quarantine and Inspection Service.
BAT Number	Container Terminal Operator provided truck identification number.
Bulk Run	Movement of a pre-determined minimum number of containers with a Container Terminal or an Empty Container Park which has also been pre-planned and separately notified.
CB&P	Australian Customs and Border Protection Service.
Clean Record	Data record checked, validated and linked to specific container ID.
Container	Standard sealed ISO metal box used for carrying cargo.
Container Park (CP)	Location for storing & maintaining dehired empty ISO containers.
Container Terminal (CT)	Location in the Port where container ships are loaded/discharged.
Database	File containing 65,428 clean records collected from Full Study.
Dehire	Time when a container is returned empty to care of shipping line.
DOT	Western Australian Department of Transport.
DPI	Western Australian Department for Planning & Infrastructure.
Dry Container	ISO Container used for carriage of general cargo.
Dwell Time	Time a container is held at a single location in the logistics chain.
EDIFACT	Electronic Data Interchange for Administration, Commerce and Transport – an ISO standard for EDI.
EPA	Environmental Protection Agency
Exporter	Business/Organisation exporting cargo from WA.
FAK	Freight All Kinds - forwarder consolidated cargo description.
FCL	Full Container Load.
FDW	Fixed Day of the Week Sailing Schedule.
FEU	Forty Foot Equivalent Unit (ISO Container) normally 12.2m in length.
FIT	Forrestfield Intermodal Terminal.
FP	Fremantle Ports.
Full Study	Collection of Transaction and Movement Data from 49 Participants 15/8 – 28/8/2011.
FY	Financial Year.
GFC	Global Financial Crisis 2008/9.
GPS	Global Positioning System.
HC	High Cube Container at least 8 feet 6 inches high.
Heavy Lift Vessel	Vessel with high capacity cranes designed to carry ultra heavy cargo.
Importer	Business/organization importing cargo into WA.
Intermodal Terminal	Location where container transfers between road & rail transport.
ISO	International Standards Organisation.
JIT	Just in Time.
K Line	Kawasaki Line.
LCL	Less than Container Load – more than 1 shipment in one container.
Logistics Chain	A series of linked cargo movements from origin to destination point.
MISC	Malaysian International Shipping Corporation.

Term	Definition
Movement	Single landside move by container from one location to next adjacent point in the container logistics chain.
Movement Record	Data provided by transport operator (road & rail) on landside container movement – 32,427 records in Study Database.
MSC	Mediterranean Shipping Company.
Multi Purpose Vessel	Geared vessel able to carry containers, break bulk & bulk cargo.
NQRT	North Quay Rail Terminal.
NTC	National Transport Commission.
Offhire	Time when shipping line returns container to leasing company.
OOG	Out of Gauge (cargo). For simplicity purposes, cargo which does not fit the regular dimensions of a high cube 40 foot container.
OOCL	Orient Overseas Container Line.
Pack Point	Location where cargo (loose, unitised or strapped) is placed in container for shipment.
Phase	1 of 6 key landside movements of full import, export or empty containers.
Prime Mover	Power unit of road transport vehicle.
Prime Road Route	Principal road used to move freight within Perth Metropolitan Area.
QAP	Quarantine Approved Premises where shipments can be inspected and if necessary fumigated or chemically treated by AQIS.
RAD	Reefer as Dry - off power carrying general cargo.
R&D	Receival and Delivery of Containers at Container Terminal.
Rail Terminal	Location where containers placed on or removed from rail wagons.
R&M	Repair and Maintenance.
Reefer Container	Powered Container used for carriage of chilled or refrigerated cargo.
Reposition	Landside repositioning of Empty Container surplus to local demand.
RFP	Request for Proposal
Road Depot	Location from which road transporter operates fleet of road vehicles.
SC	Steering Committee for Landside Container Study.
SLA	Statistical Local Area – area defined by ABS for statistical analysis.
SRS	Statistical Region Sector – large area covering several SLAs defined by ABS for statistical analysis.
Staging Point	Location where full container is temporarily held in landside import delivery/export shipment chain for checking or transport reasons.
Stevedore	Operator of terminal to load/unload container ships.
Stuffing/Unstuffing	Packing or unpacking of container with cargo.
TEU	Twenty Foot Equivalent Unit (ISO Container) normally 6.1m in length.
Time Slot	Specific time booked at CT for container receival or delivery by road.
Trade Cycle	Landside movement related to either full import or export container.
Transaction Record	33,001 Data records of containers on exit or entry to CTs (16,319 records), CPs (15,335 records) and QAPs (1,347 records).
Trial Study	72 hour trial Study with 26 participants held 28 – 30/6/2011.
Unpack Point	Location where cargo (loose, unitised or strapped) is removed from import container.
Vehicle Booking System (VBS)	System operated by container terminals to grant specific time slots for road transport operators to pick up or deliver a container at/to CT.
v.v.	Vice versa

Term	Definition
3PL	Third party logistics provider. A firm that provides service to its customers of outsourced (or "third party") logistics services for part, or all of their supply chain management functions

1 EXECUTIVE SUMMARY

1.1 PROJECT BACKGROUND & OBJECTIVES

Fremantle Port (FP) handled nearly 0.6 million 'twenty foot equivalent unit' (TEU) containers in 2010/11, using over seven container berths in the Inner Harbour via two container terminals operated by Patrick and DP World[1]. This throughput is a product of a compound growth over the last decade of some 5.4% p.a.. The majority of current container traffic moves to/from the current container terminals by road and the landside logistics chain related to this traffic was the subject of a major external review in 2003/4.

The need for an updated review of this chain was recognised by FP and a group of State Government Departments (including Transport and Main Roads) and has resulted in the current study whose prime aim has been to "gain a better understanding of the transport, storage and distribution of import/export containers between the Port and importers/exporters" as well as the movement of empty containers. The findings are intended to assist in improved industry planning and management, particularly in respect of:

- the inland origins and destinations of full containers (i.e. pack and unpack locations);
- the mode of transport used;
- staging of containers between container origins and destinations (both location and use); and
- timing of elements of the inland logistics chain - both day of the week and time of day.

1.2 PROJECT SCOPE, METHODOLOGY & DATABASE

The project focused primarily on four phases of the inland container logistics chain:

- full import movement and subsequent dehiring of containers to empty container parks (the import trade cycle); and
- the two similar reverse stages for exports (the export trade cycle).

In addition it collected and analysed data on empty movements to/from the container terminal (container repositioning) and container sizes, types and weights.

The project was made up of 2 stages:

- Stage 1 consisted of a project inception meeting, project planning, a 72 hour Trial Study period with 26 participants including 17 road operators, and a review of the outcomes.

[1] With modern shipping methods and equipment availability at the Port, currently two Panamax size ships can berth at each of the container terminals at any one time, making a capacity of 4 Panamax size ships.

- Stage 2 consisted of a two week Full Study period in the second half of August 2011, involving 49 participants including 37 road operators, followed by data collection, clearance, validation, consolidation and analysis prior to report writing.

The 49 Full Study participants consisted of five categories of organisation:

- container terminals (CT);
- container parks (CP);
- quarantine approved premises (QAP);
- road operators; and
- rail operators.

Specific data templates were created for each category. CTs and CPs generated 25% and 23% respectively of the 65,400 records collected for the data base, while the road, rail and QAP operators generated the balance. 36% of the data collected was in the agreed format, 39% required limited manipulation and 25% had to be manually transcribed.

The data base was created from:

- transaction records from container terminals;
- transaction records from container parks;
- movement records from import inland transport movements; and
- movement records from export inland transport movements.

The 33,001 transaction records provided by the container terminals and container parks provided part of the data anchors for the project. Road operator, QAP and rail operator records were invaluable in determining intermediate movements.

In the Full Study period:

- data collected from the two CTs covered 16,319 containers
- data collected from the five CPs covered 15,335 containers; and
- inland movement data relating to 82% of the CT container total and 78% of the CP container total were obtained from records generated by the 37 road transport operators and 2 rail operators who were among the 49 participants in the Full Study.

1.3 CONTAINER TRENDS & ANNUALISATION

Over the last decade FP's annual container volumes in TEUs have grown from just over 0.35 million to just under 0.6 million – 8% of this traffic was refrigerated containers. Last year the split between import and export container movements was 52/48 in favour of imports but 23% of total trade was empty containers, that were almost entirely exported. The ratio of full import to full export containers consequently was 63/37.

The Port's peak trading month is normally November when imports for the Christmas season are strong and agricultural exports are strengthening with the onset of summer. Because of the serious drought in 2010/11, export patterns in that year were atypical peaking on October. Full exports declined 7% in 2010/11 or some 19,000 TEUs overall, a reduction accounted for entirely by grains, cereals, hay and other agricultural products, which typically declined at least one third on the previous year as a result of the drought.

In the month of the project Full Study, August 2011, FP total container volume was 54,000 TEUs. This was comparable with the reported volumes in each month of the third calendar quarter of 2011 and also comparable to the numbers recorded in the peak month of each of the last two years. Consequently the impact of the drought in 2010/11 notwithstanding, the container numbers in the Full Study conducted in the second half of August are therefore considered a good representation of the current scale of container operations in the Port.

The relative mix of data from the Full Study was then applied to FP's container volumes for 2010/11 in two tranches to develop a profile of FP's landside container logistics chain on a full year basis:

- full container movements into and out of the Port;
- empty container movements subdivided into two categories;
    - inbound; and
    - Outbound which was further segregated between:
        - movements related to repositioning of surplus empty containers to/from the CTs; and
        - movements to/from CPs generated as a result of the delivery of import or pick up of export cargo.

The mix of container movements established in the Full Study was then applied to the relevant container numbers handled by FP in 2010/11.

1.4 INLAND CONTAINER LOGISTICS CHAIN

The Full Study data base contains 32,427 individual container inland movement records between the CTs and the CPs (19,475 import related and 12,952 export related) which are spread across the following six logistics phases:

1.	Full imports from CT to unpack point	35%
2.	Delivery of empty containers after unpacking to dehire location	25%
3.	Inbound Repositioning of empty containers from CT to a CP	1%
4.	Positioning of empty containers to export pack point	12%
5.	Full exports from Pack Point to the CT	16%
6.	Outbound Repositioning of empty containers from CP to the CT	11%

Typically imports from CTs, moving via unpack points to the dehire location, generated an average of 2.92 individual movements each, while exports from the empty container pick up location moving via pack points to the CTs generated an average of 2.61 individual movements each. However just under 35% of full import containers and 54% of full export containers moved directly between the CT and point of container unpacking or packing. Repositioning of empty containers was also normally a direct movement.

Rail handled 12% of the containers in the inland logistics chain, but only 7% of the total movements since each rail movement would normally generate two associated road movements to/from the rail terminal at the Port and inland.

1.5 IMPORT TRADE LOGISTICS

Based on the Full Study conducted, FP's full import container trade of some 293,000 TEUs would be likely to exhibit the following core characteristics.

- The top 12 unpack suburbs all located in the Perth Metropolitan area accounted for 70% of unpacking while the top three (Welshpool, Canning Vale and Kewdale) accounted for 32% of the total inbound traffic. Typically import containers travelled between 20kms and 30kms radial distance from the Inner Harbour;
- Direct delivery from the CT to unpack points occurred in just over a third of cases, with staging at road transport facilities accounting for the majority of the remainder (52%); and
- 73% of staging of inbound full containers took place in three suburbs (North Fremantle, Welshpool and Kewdale).

1.6 EXPORT TRADE LOGISTICS

Based on the Full Study conducted, FP's full export container trade of some 168,000 TEUs would be likely to exhibit the following core characteristics.

- The top 12 pack suburbs accounted for 72% of all exports in TEUs terms while the top three (Henderson, Forrestfield and North Fremantle) accounted for 44%. Three of the top 12 pack locations were outside the Perth Metropolitan area and the balance of country pack points, primarily in the Lower Western Statistical Region, accounted for 15% of the total.
- Direct delivery to the CTs from pack points occurred in 54% of cases; of the balance, road transport staging accounted for 26%. As with imports, most containers were packed within 30 radial kms of the Port, but some 20% originated significantly further away.
- Staging of full outbound containers occured less frequently than for imports and was more concentrated with the top three locations (North Fremantle, Kewdale and Bibra Lake) accounting for 85% of such activity.

1.7 CONTAINER TERMINALS

16,319 containers (24,425 TEUs) were handled by the two CTs during the Full Study. In TEUs terms this volume consisted of:

- 50% full imports;
- 25% full exports;
- 24% empty exports; and
- 1% empty imports.

This mix was similar to that prevailing for the whole of 2010/11, except that in that year full exports had a 3% points greater share of the total (28%) and empty exports 4% points less (20%). Other important features of the CT traffic profile were:

- 96% of landside traffic moved in or out of the CTs on weekdays, with Wednesday the busiest day primarily due to a strong peaking of empty repositioned equipment that day to meet departing ship schedules. Activity was sustained between 0700 and 2100 other than for quieter periods during the meal breaks in the morning and afternoon shift.
- In TEU terms 40 foot containers accounted for two thirds of the traffic (i.e. in container numbers were about equal to 20 foot containers).
- Again in TEUs terms, high cube containers accounted for 46% of the container volume, while the ratio of general purpose (GP) containers to specials (primarily refrigerated) was 9:1.
- All up container weights based on shipper declared cargo weights were around 17.5 tonnes for both 20 and 40 foot inbound full containers; for exports they were 22 and just under 25 tonnes respectively.

1.8 CONTAINER PARKS

In the Full Study the five participating CPs, operating from 10 locations, handled some 15,335 containers (23,068 TEUs). As one would expect the profile of their operation followed closely that of the CTs in respect of container type and activity volumes by day of the week. The following distinguishing features of the CP profile were identified.

- 51% of traffic consisted of inbound containers dehired from unpack loctions; export collections for packing and empty reposition each made up 24% of activity and import repositioning the remaining 1%.
- Operating hours were considerably more restricted than the CTs with the result that the great majority of movements in and out of the CPs was between 0700 and 1600.
- However, there were limited movements of empty containers into the terminals from selected CPs both up to 2000 on weekdays and up to 1000 on weekends – normally in bulk runs.

CP traffic mix was similar to the CTs, other than the fact that their daily activity was normally completed by their usual closing time of 1700 each day. Wednesday was also their busiest day of the week, primarily due to repositioning of empty containers to the CTs.

1.9 PROJECT SECONDARY OPTIONS

The project brief identified four unprioritised options for potential inclusion in this study, which for this reason were categorised as secondary to the prioritised objectives of the brief:

- The time of day for container movements - this has been included since the study was able to collect time stamps from transport operators and transaction time data from terminals and parks.
- Key road route data – Not completed by the consultant.
- Vehicle Capacity and Combination Type data - Not completed by the consultant. Only registration information provided by carriers as part of their general provision of data was included.
- Weight and commodity data - the former was collected from the CTs and to a lesser degree the road transport operators where provided, and is included in the data base. The data from the CTs, which is part of their EDIFACT operating system, is comprehensive but relies on the transparency of the shipper at origin. In the case of imports particularly, it is of varied reliability. Nonetheless it has been analysed in respect of the full containers that moved during the Full Study (both export and import, 20 foot and 40 foot units). The latter (commodity information) has not been included as this data was forthcoming from Customs & Border Protection (C&BP) and that from other sources is considered too unreliable to be statistically meaningful.

1.10 CONCLUSIONS

Given the four prime objectives of the Study set out in Section 1.1 above, the key findings derived from the Full Study carried out in the second half of August 2011 can be summarised as follows:

1. 12 of 140 unpack destinations handled 70% of Fremantle Ports' inbound full container traffic – all were located in the Perth metropolitan area. The top three (Welshpool, Canning Vale and Kewdale) handled one third of the total, while country locations accounted for only 2%.
2. 12 of 94 pack locations handled 73% of Fremantle Ports' outbound full container traffic – nine were located in the Perth metropolitan area. The top three (Henderson, Forrestfield and North Fremantle) handled 44%, while country locations combined handled 15%.
3. Based on data from 37 road and 2 rail operators, the modal split in TEUs of all container movements between road and rail on the landside was 88:12. For imports it was 90:10, for exports 85:15.
4. 35% of all container deliveries were made direct from the container terminal to the unpack point and 54% of exports similarly direct from pack point to container terminal.
5. On average full import containers made 2.92 discrete movements between the Port and the de-hiring point, while the equivalent for exports was slightly less at 2.61.
6. 10 locations in the Perth metropolitan area accounted for virtually all the staging of the full indirect movements. North Fremantle and Kewdale together with Welshpool for imports and Bibra Lake for exports accounted for 73% and 85% of this staging activity respectively.
7. The Port's two container terminals handled 96% of its containers on the landside (receival and delivery) on weekdays, primarily between 0700 and 2100. Wednesday was the busiest day for this activity as a result of a mid week surge in empty containers.
8. The five container parks studied handled virtually all their traffic on weekdays, like the container terminals, but within a shorter workday with little activity after 1600 – movement of empty containers to the container terminals in early evening and on weekend mornings was an exception.

2 PROJECT BACKGROUND AND OBJECTIVES

2.1 BACKGROUND

Fremantle Ports (FP) is the commercial Port manager of the fourth largest container Port in Australia, which handled just under 0.6M TEUs via the Inner Harbour in 2010/11. These container movements were almost entirely generated by full container vessels handled by FP's two container terminal operators (DP World at berths 4 - 6 and Patrick at berths 7 – 10; refer Annexe 1 for a map of the Inner Harbour). A minimal number of container movements were generated from calls at Berths 11 and 12 by Multi-Purpose and Heavy Lift vessels, but were not included in the container data collected by the two terminal operators and so are not covered by this study. Road access to the two container terminals is via Ruddenham Drive/Port Beach Road and Tydeman Road, and rail access is via the North Quay Rail Terminal (NQRT), which is connected with the inland rail terminal at Forrestfield via the line that runs south.

FP's container throughput in Financial Year 2010/11 set a new record for the Port. Over the last 10 years FP's compound growth rate has averaged 5.4% p.a.

Such growth places heavy demands on the berth and terminal capacity of the Port, the road and rail transport corridors and related activities that link the Port with inland destinations of import containers and the comparable origins for export containers. It also impacts the staging of empty containers in the unpacking of imports and the packing of export containers and in accommodating imbalances of container utilisation in the various international container shipping services calling in WA.

As a key part of its responsibilities to facilitate trade through this Port, FP is expected to provide competitive advantage to exporters and importers in WA in respect of the Port related freight logistics chain. To this end in 2003/4 SKM undertook a previous study primarily via a one week study of all container movements in the import and export supply chains linked to FP via discussions with a range of stakeholders involved in such landside container operations in the State. This study estimated that the 283,000 containers (not TEUs) that entered or departed from FP by sea in the 12 month period from October 2002 to September 2003 generated just under 0.743M discreet landside container movements - or an average of 5.25 movements per individual container.

Since that time the growth in trade and changes in infrastructure and industry practice have generated a need for an update and refinement of the earlier study. Recently, the major container ports in Brisbane, Melbourne, Sydney and Adelaide have all investigated their current container movements and this work was used to inform the study design for FP. The project stakeholders in WA determined to develop an understanding of the current movement of import, export and empty containers through the supply chain linking the Port and locations within greater Perth and beyond. These inland movements use the road and freight rail network to and from the Port shown in the map in Annexe 2.

This study was led by FP and has been jointly funded by the Port together with a number of stakeholders such as the WA Department of Transport, the Freight & Logistics Council of WA and Main Roads WA. These parties made up the Steering Committee for this project and are referred to collectively in this report as the SC.

2.2 INTERESTED PARTIES

The parties directly interested in the outcome of the study include:

1. The West Australian Department of Transport.
2. The West Australian Department of Planning and Infrastructure.
3. Other Transport Portfolio agencies: Main Roads and Public Transport Authority.
4. Other West Australian Government Departments: Environment and Conservation; Environmental Protection Authority; Treasury; and Local Government.
5. Commonwealth Departments: Infrastructure and Transport; Regional Australia, Regional Development and Local Government; the National Transport Commission (NTC); Australian Bureau of Statistics (ABS); Customs and Border Protection (C&BP) and Australian Quarantine Inspection Service (AQIS).
6. Relevant Local Government Authorities.
7. Transport & Logistics Industry members (See **Error! Reference source not found.**).
8. Peak local lobby groups (Freight & Logistics Council, Road Transport, Port Users and community and environmental groups).

2.3 PROJECT AIMS

The key aim of the study has been to gain a better understanding of the transport, storage and distribution of import/export containers between the Port and importers/exporters, particularly identifying the final point of container delivery for unpacking import containers or first point of export container packing. Also included is analysis of the supply chain related to the movement of empty containers. The whole process is intended to assist with strategic planning for the Port and its associated landside infrastructure. An important feature of the project has been to generate the required data on a timely basis to mitigate the risk of obsolescence and in such a manner that it can be updated at a later time with minimal lead time.

More specifically the data collected and related study findings are intended to be used for two purposes, namely industry planning and industry management as explained below:

2.3.1 Industry Planning

From a strategic perspective the outcomes of the study will be valuable in planning activities across the following areas:

- Land use.

- Strategic transport/network planning.
- Locations of and linkages between intermodal/inland terminals.
- Transport infrastructure overall.
- Development of industry clusters and their locations.

2.3.2 Industry Management

From a transport and logistics perspective, it is intended the study outcomes will enhance:

- Logistics staging efficiencies.
- Modal choices and their optimal combinations.
- The targeting of industry behaviour change strategies.
- Monitoring and managing traffic flows.
- Provision of data for traffic & transport modeling.

2.4 PROJECT OBJECTIVES

Consistent with the key or overriding project aim outlined in section 2.3 above, the Project Scope indicated that comparable studies in other Australian ports had a number of objectives, both primary and secondary, which are described below.

2.4.1 Primary Objectives

- To determine the *origins and destination* of export and import containers respectively, as well as empty containers.
- To identify the *land routes and modes* over which these containers move (2% moved by rail in 2002, 12.5% currently).
- To determine the location and importance of interim or *staging depots* in conjunction with the container terminals to establish the share of containers moving directly to/from the Port container terminal and those moving via interim depots.
- To establish the *utilisation of peak/business hours* and non-peak/after hours for such movements.

2.4.2 Secondary Objectives

Subsidiary objectives indicated for this study were:

- To obtain and analyse the data in a manner comparable with similar studies undertaken for major ports in other states to permit the development of meaningful industry benchmarks and performance indicators.
- To provide cost effective industry templates for similar future studies in WA derived from the lessons learned in the course of the present study.

2.5 REPORT STRUCTURE

This report has nine key elements:

- Section 3: A description of the project scope, methodology and a profile of the database created from the data collected from project participants.
- Section 4: A high level review of container trends through FP and annualisation and seasonality issues.
- Sections 5 to 9: Analysis of the Data collected and key findings, subdivided into five core elements:
  - Section 5: The inland logistics chain.
  - Section 6: The import trade logistics chain.
  - Section 7: The export trade logistics chain.
  - Section 8: Container terminals.
  - Section 9: Container parks.
- Section 10: Comment on those project secondary objectives not taken up in the main body of this study.
- Section 11: Conclusions.

3 WORK SCOPE, METHODOLOGY AND RESULTANT DATABASE

3.1 WORK SCOPE AND REQUIREMENTS

Based on the project aims and objectives outlined in Section 2.3 and Section 2.4 above, the scope of this study has been defined as covering the four basic phases within the container transport logistics chain associated with international trade:

- Container Terminal or Stevedore to final unpack destination (import).
- Unpack Point to Empty Container Park (import).
- Empty Container Park to Pack location (export).
- Packing origin to Container Terminal or Stevedore (export).

For the purposes of timing and analysis each of these four phases has been considered as the start and end point or phase container movement in the relevant supply chain.

In addition, movements of empty containers between the empty container parks, the majority of which are in the Port precinct, and the container terminals have been covered by the study. The prioritised areas of focus in this study are listed below.

3.1.1 Priority Requirements

Prime data collection requirements were defined as:

1. Ultimate destinations (point of unpacking) of import containers and origins (point of packing) of export containers.
2. Location and use of staging depots to assess the share of full containers transported directly in one movement and indirectly in more than one movement between the Port and inland point of container unpacking/packing. Also included are breaks in the container journey for quarantine inspections, and for modal transfer between road and rail transport at rail terminals.
3. Movement of empty containers between the container terminal and inland points of container unpack/pack.
4. Rail movements and their role in the Port container logistics chain.
5. Container data to identify the container in terms of type and size.

3.1.2 Secondary Requirements

Four additional requirements, which the project brief categorised as desirable but dependent on the cost benefit of providing such information, were also considered:

1. Routes commonly used by Port container traffic including distances and journey time.
2. Types and utilisation of vehicles.
3. Times of day for container movement.

4. Container all up weight and commodity content data.

The third of these additional items was incorporated in the mainstream study as was container weight data from the fourth. However since commodity data from Customs was not forthcoming, and such data collected from alternative sources was not considered to be meaninful, this item was not analysed.

Data on vehicle registrations was collected where accessible and included in the data base for future potential use. The rest of the requirement was not completed. Further separate analysis is continuing independently between Fremantle Ports and MRWA.

3.2 PROJECT METHODOLOGY

Fundamentally the project consisted of two stages, the first made up of inception and three preparatory tasks including a trial study (72 hours) and the second consisting of confirmation of all key aspects of the 2 week data collection process, its implementation, the review of the data collected and subsequent report writing.

3.2.1 Stage 1

3.2.1.1 Client Project Inception Meeting

This first element was held to develop a clear and common understanding between FP, the Steering Committee and the consultant of the requirements, scope, methodology, timelines and outputs of the project. Particular potential issues that were reviewed included:

- The need for joint FP/consultant briefing of stakeholders.
- Definition of origins/destinations and the issue of data confidentiality.
- The critical linking of all data to the container identification number (ID).
- The organization and timing of an initial Trial Study.
- Agreement on the size of the required study in relation to the data population to achieve a statistically valid sample.
- Selection of Road Transport respondents.
- The validity and significance of vehicle driver inputs.
- Questions concerning available container weight and commodity data.

3.2.1.2 Project Planning and Site Visits

This step was used to confirm, in light of the Inception Meeting, the data to be collected, the sources, the preferred formats and the key responsibilities of the consultancy team members, as well as issues of data compatibility, quality and quantity.

As noted in the previous section particularly crucial was the participation of the key road transport operators. FP expectations were to obtain data from the top 20 trucking companies moving containers to and from the Inner Harbour by volume, plus selected other smaller specialist operators over a two week period. The objective was to obtain a sample of sufficient size to be considered representative of all containers moved through the Port on land based modes – the Project Brief indicated 80% of the available population as appropriate.

Having established with FP those companies targeted for inclusion in the study, face to face meetings with some were employed.

Given the degree of preparatory ground breaking for this project undertaken by FP prior to the project it was not considered necessary to organise a combined industry briefing of the study participants.

3.2.1.3 72 Hour Trial

The Trial Study period was carried out to confirm:

- Participating stakeholders and their ability to provide the required data in an intelligible format.
- The methodology and sample sizes for the data collection period.
- The degree and need for personnel in the field.
- Any adjustments required for the full data collection plan.

A total of 30 participants agreed to be part of the 72 Hour Trial. This trial was critical in practical identification of problems with the process and their successful resolution. It was held mid-week (i.e. avoiding Monday or Friday, when terminals, depots and transport operators are traditionally under the greatest pressure from workload). The trial covered the period from 6am Tuesday 28th June 2011 to midnight Thursday 30th June 2011.

3.2.1.4 Review of the Trial

Table 1, upon completion of the Trial period, data was successfully received from 26 stakeholders out of 30. In the event 4 Road Transport operators who were planning to participate were unable to do so for a range of practical operational reasons. A detailed review of the outcome of the 72 Hour Trial was held by the full consultancy team and client representatives to resolve any key issues arising during the Trial particularly in respect of data sources, formats and collection.

Table 1 – Participating Businesses

Participant Groups	Number of Operators Targeted	Number of Operators who Provided Sample Data
Container Terminal Operators	2	2
Container Park Operators	4	4
Quarantine Operators	2	2
Road Transport Operators and Exporters	21	17
Rail Operator	1	1
Total	**30**	**26**

3.2.2 Stage 2

3.2.2.1 Full Field Study

Once the outcomes of the 72 Hour Trial of data collection had been fully reviewed, the implications reviewed and optimal adjustments agreed, the Consultants met with FP and the Steering Committee to confirm:

- The potential identity of parties participating in the 14 day Full Study.
- The data collection methodology.
- Estimated data sample sizes.
- A data collection plan.

Ongoing consideration was given to the proposed study sample size and the list of targeted participants was subject to adjustment up until the beginning of the Full Study period. This covered the period from 6am Monday 15th August 2011 to midnight Sunday 28th August 2011. The number of businesses who participated is summarised in the Table 2.

Table 2 – Full Field Study Participants

Participant Groups	Number of Operators who Provided Sample Data at Trial	Number of Operators who were part of Full Study
Container Terminal Operators	2	2
Container Park Operators	4	5
Road Operators and Exporters	17	37
Quarantine Operators	2	3
Rail Operator	1	2
Total	**26**	**49**

The participants in the Trial Study were substantially augmented by a further 20 road transport operators, who did not participate in the Trial. 112 road operators were reported by the Container Terminals as having picked up or delivered containers to the terminals during FY 2010/11. The resultant Full Study total of 37 road transport participants accounted for about 30% of this population. It included 100% of the operators in the top three relevant quartiles by TEUs volume – 15 operators. Another 22 smaller operators accounting for about 20% of the total

container volume and who handle about an equivalent share of the bottom quartile made up the balance.

3.2.2.2 Data Collection

The project required data to be collected in five categories from a variety of stakeholders in the landside container sector in WA.

- Container Arrival and Departure at Container Terminals.
- Container Arrival and Departure at Container Parks.
- Container Arrival and Departure at Quarantine Facilities.
- Road Movement Data.
- Rail Movement Data.

Assessment of data availability was made using the preliminary work conducted by FP. Based on the agreed objectives and deliverables and the assessment of data availability, the initial data requirement template was developed in a tabular format to define the required data fields. The templates were distributed one week before the first day of the 72 hour trial study period. These data templates were subsequently reviewed and refined. The updated templates were then released to the participants the week before the first day of the 2 week full study period. Detailed information on data templates and data requirements in the full study is outlined in Annexe 3, Table A to Table E.

The approach applied to data collection and analysis was based on understanding the required outputs before commencing data collection. In this process the consultancy team's aim was to adhere to a number of basic principles, in particular:

- Data extraction being as straightforward as possible.
- Minimising the administrative workload on all parties engaged in the process.
- Validating data at acceptable levels that avoided being unduly burdensome.
- Producing data outputs in a timely manner that would be administratively simple for FP to reproduce subsequently.

3.2.2.3 Analysis of Data Collected

The project database was created in Microsoft Access 2010. All the related tables have been populated by the consultants using project data retrieved from the participants' data systems (both electronic and manual) during the full study.

During the analysis stage there was a high level of client/stakeholder interaction and where necessary further meetings to review issues related to the data and the outputs of the analysis to ensure as far as possible that it accurately reflected the actual operational situation.

3.2.2.4 Report

On completion of the data analysis the consultants prepared this report, which contains both statistical and graphic summaries of the key data collected and a summary of the key features and conclusions drawn. Data supporting the Figures and Tables in this report is contained in the Annexes to the Report. After presentation of the Report to the Steering Committee, as required in the RFP, the resultant data base will be handed over to FP, together with basic information on its composition and manipulation.

3.3 DATA ADMINISTRATION

The project brief confirmed that data administration was unlikely to be simple in a number of respects, with potential problems in the following areas:

- Compatibility of electronic data held by stakeholders involved in different elements of the same end to end landside container movement.
- Gaps in the information held.
- The need to set up one off special reports in formats different from those normally used by the data owner.
- The collection and accuracy of paper records where electronic sources were not available.
- Lack of operator manpower to handle a one-off exercise for the stakeholder.

3.3.1 Data Entry and Processing

The first step in data processing is to ensure each individual dataset contains the data in the required data field and is in the standard format to allow consolidation.

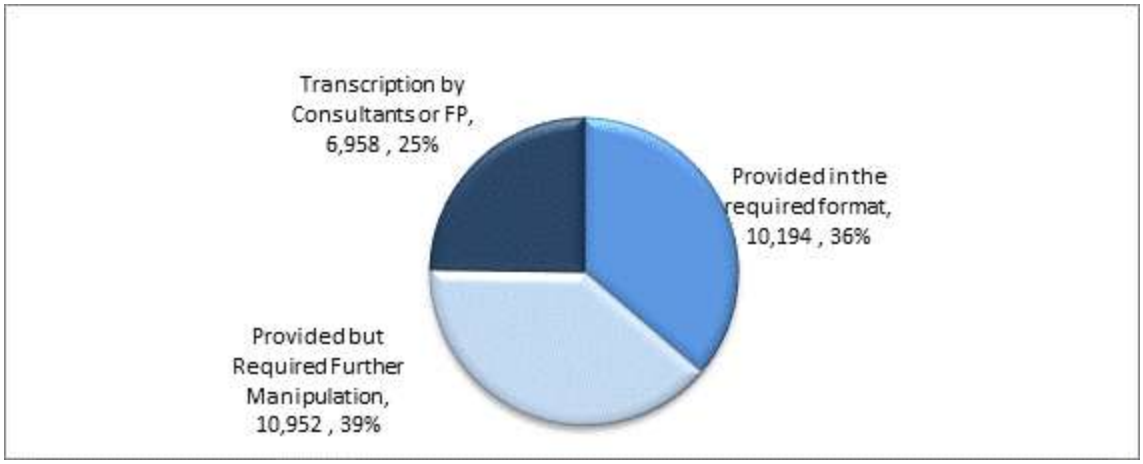
Table 3 below summarises the extent of data refinement required in this study. 40% of data was received in the specified format. Approximately 48% required some degree of manipulation to achieve the format required ranging from simple formatting annotation changes to more substantial changes. A further 12% was transcribed by a combination of resources from FP and the consultant team. It should be noted that this record count is the final number of records after data processing, data cleansing and data validation. Calculation of the number of records provided before processing is not possible because the data was provided in different formats. In many cases, data from one record had to be extracted and inserted into multiple records to populate the data base.

Table 3 - Summary of Data Processing

	Provided Data in required format	Data required manipula-tion	Trans-cription by FP or Consult ants	Total	Provided in required format	Data required manipula -tion	Trans-cription by FP or Consult ants	Total
	Number of Participants				Number of Clean Records			
CT	1	1	-	**2**	7,298	9,021	-	**16,319**
CP	4	1	-	**5**	3,920	11,415	-	**15,335**
QAP	2	-	1	**3**	700	-	647	**1,347**
Sub Total	7	2	1	**10**	11,918	20,436	647	**33,001**
Rail	2	-	-	**2**	4,323	-	-	**4,323**
Road Operator/ Exporter	14	10	13	**37**	10,194	10952*	6,958	**28,104**
Sub Total	16	10	13	**39**	14,517	10,952*	6,958	**32,427**
Total	**23**	**12**	**14**	**49**	**26,435**	**31,388**	**7,605**	**65,428**
%	**47%**	**24%**	**29%**	**100%**	**40%**	**48%**	**12%**	**100%**
** This includes 135 records from unidentifiable operators*								

Because of the variety of the systems and formats which were used by the road transport operators, significant effort was required to prepare the data for analysis. 36% of data records received from road operators were in the specified format shown in Figure 1 below.

Figure 1 - Road Operator Data Processing Requirement



39% or about 10,952 records required further manipulation in order to extract the data fields required. A large portion (25%) of data received from road transport operators required interpretation and manual entry into the standard electronic format.

3.3.2 Data Recoding, Cleansing and Validation

3.3.2.1 Data Recoding

As was to be expected, the values within each data field received from 49 participants were in various formats and contained different abbreviations and names or labels of essentially the same values. Standardising the labels for the same data field was necessary to permit the identification and grouping of the same value. Details about data recoding and coding schemes are given in Annexe 4.

3.3.2.2 Container Terminal, Container Park, and QAP Data Cleansing and Validation

Data records requested from CTs, CPs and QAPs were similar in that they were all transactional type data. These data records provided information relating to the arrival at or the departure of containers from the facility. Being transactional data, each data record was independent from other records, i.e. each import container ID or export container ID had only one record associating with it. Once the data was submitted, it was examined, cleansed and validated based on the following criteria:

- The number of records received was matched with expectations. This was done by checking with qualitative information on participants' relative business volumes and by checking the total number of records against annual statistics.
- Duplicated records were removed. In some cases, due to system reporting errors, some records appeared multiple times. This problem was corrected by removal of the duplicated records leaving a unique record in the dataset.
- Values in each data field were within the specified range. Records which had no container ID were removed.
- Out of scope data records were removed. Such data included movement records outside the study period and movements not directly related to import or export activities.
- Data values reflected the actual operations of the business - for example correction of timestamps relating to certain types of movements, which could be electronically pre-received at the container terminals before the containers physically arrived.

3.3.2.3 Road and Rail Movement Data Cleansing and Validation

Road operators, rail operators and exporters were asked to provide the relevant information about each movement of a container they handled. Each data record collected contained an origin for the container movement and a destination where it terminated together with two related timestamps. Information received from this group of participants was classed as movement data.

Data cleansing and validation of these records were therefore undertaken in two steps: firstly, cleansing and validating the individual dataset from each participant, and secondly cleansing and validating the consolidated data base.

Step 1 - Individual Dataset Cleansing and Validation

Different types of corrections were applied to clean and improve the quality of the data depending on the cause of problems. Examples of data cleansing criteria, issues and correction methods included:

- Whether the number of records received matched the expected at CT and CP data. Duplicated records were removed.
- Whether the values in each data field were within the specified range, were accurate and also consistent with the relevant data available from the CT and CP, such as container size, type and status (Full/Empty).
- Removal of movement records with no container ID.
- Removal of out of scope data records, such as those outside the study period, internal movements within a single facility, those not related to exports or imports, and movements of less than container load (LCL) shipments prior to container packing or post container unpacking.

Step 2 - Consolidated Database Cleansing and Validation

Upon completion of individual data set cleansing and validation, all movement records from both road and rail operators were consolidated into the same dataset.

The level of inconsistencies exposed when consolidating the different datasets was challenging. Inconsistencies were found when two related movements between either the same or two different operators were interfaced. This was caused by various factors:

- Missing data either in the entire record or part of the data fields - the most common cause of error. Where it was cost and time effective to source the missing part of data from the operators this was done. A small number of data records which had no container ID or container size were excluded from the study.
- Coding errors. An explanation of recoding is provided earlier in Section 3.3.2.1.
- Ambiguity arising from data interpretation and data transcription such as how different drivers used various abbreviations for the same origin and destination names.
- The use of both the 12 and 24 hour clock in the same data set.

In most cases, the records were sorted into the logical flow of movements relating to the same container number and issues were corrected by using the following rules:

1. Import containers or export containers should move in a logical direction for the activity in which they were involved, e.g. an import container should originate from the container terminal.
2. The destination of the previous leg should be the same as the origin of the following leg.
3. Timestamps should be in the sequence of the container movement.

3.4 RESULTANT DATABASE

3.4.1 Dimensions

Table 4 summarises the dimensions of the data derived from the 2 week Full Study. This produced 16,319 clean transaction records at the container terminals, 15,335 such records at container parks and 1,347 such records at quarantine facilities. All these records were reviewed in the manner described in Section 3.3.2 above to ensure they were clean, accurate and meaningful data elements in the database.

In addition the full study produced clean import and export movement records relating to more than 17,800 containers from the data provided by road and rail operators. On the import side, the database contains 19,475 such records covering both road and rail movements relating to some 9,642 containers. On the export side, the database contains 12,952 such records covering both road and rail movements relating to some 8,166 containers. All these records were reviewed in the manner described in Section 3.3.2 above to ensure they were clean, accurate and meaningful data elements in the database.

Table 4 - Two Week Study Data Base Dimensions (Number of Records)

Database	Number of Clean Records	Number of Containers
Container Terminals	16,319	16,319
Empty Container Parks	15,335	15,335
Quarantine Facility	1,347	1,347
Sub Total	**33,001**	**Not Applicable**
Import Movements	19,475	9,642
Export Movements	12,952	8,166
Sub Total	**32,247**	**17,808**
Total	**65,428**	**Not Applicable**
***** *If a container occurred in both the import and export cycle, it was counted separately in both cycles.*		

3.4.2 Structure

The data collected during the study was stored under field names and descriptors linked to the project participant. The database is made up of four main Tables, namely:

1) CT Table.
2) CP Table.
3) Import Movement Table.
4) Export Movement Table.

Although the Import and Export movements exist as two separate data Tables in the database, they have the same structure. Table A to Table B in Annexe 5 outline the structure of the Container Terminal Table, Container Park Table and Import/Export Table. These Tables are linked throughout using the Container ID number.

3.4.3 Security

As stated previously in Section 3.3.3 Confidentiality, the database constructed for this study contains commercially sensitive information. The use of this database is strictly for the purpose of providing statistical information on the landside movement of containers. Ownership of the database will be transferred to FP on completion of the project.

3.5 DATA COVERAGE

All containers imported via and exported from FP during the Full Study period were included in the database. The container movement data analysed in this study are reasonably representative of the total population under review. This has been achieved by selecting a range of carriers in different locations both on Port and off Port who handle significant volume of containers.

The sample size is representative of origin and destination locations and region. Smaller and niche carriers were also involved to cover container movements for certain particular commodity types,

such as fresh vegetables and data from additional carriers who handled these commodities were included in the Full Study.

To assess volume coverage, comparison was made between data received from the container terminals and from the container parks. As set out in Table 4 above some 16,319 containers were delivered or received on the landside by the two Fremantle container terminals in the 14 day period of the study, and the associated inland logistics chain movements of these containers generated just over 32,247 separate clean movement records, 19,475 of which related to Imports and 12,952 related to Exports. Of the 16,319 containers received at the terminal, records could be matched for 13,439 of the containers by the road operators (i.e. 82.4% including bulk run empty totals) as set out in Table 5 below. The equivalent figure purely for full containers was is still to be considered. The equivalent figures for containers entering or leaving the four container parks was 15,371 containers of which 11,910 or just over 77% can be matched with the data base of clean records provided by road and rail transport operators.

Table 5 – Volume Coverage

Category of Container	Container Population	Clean Road Operator Records	Percentage Coverage
Terminal Imports	8,434	6,512	77.2
Terminal Exports	7,885	6,927	87.9
Terminal Total	**16,319**	**13,439**	**82.4**
Park Incoming	8,018	5,712	71.1
Park Outgoing	7,317	6,198	84.5
Container Park Total	**15,335**	**11,910**	**77.5**

The 6% difference in container numbers between the data provided by the terminals and that originating from the container parks arose for two reasons:

a) Timing differences with containers in process between the terminals and parks; and
b) Minor leakage of containers stored at transport operators who either were not in the study or did not report storage activities as it was a marginal element of their business.

As shown on Table 6, of the total data movement records relating to full container import and export movements, 93% contained valid time stamps and 99% of the total records contained valid suburb addresses. However specific street addresses were only provided on 71% of these records.

Table 6 – Number of Clean Records for each Area of Data Requirements

Data Fields	Total Number of Clean Data Fields	Total Number of Records	Percentage
Container ID, Container Size, TEU	32,427	32,427	100%
Timestamps	30,042	32,427	93%
Suburb Addresses	32,212	32,427	99%
Street Addresses	23,168	32,427	71%

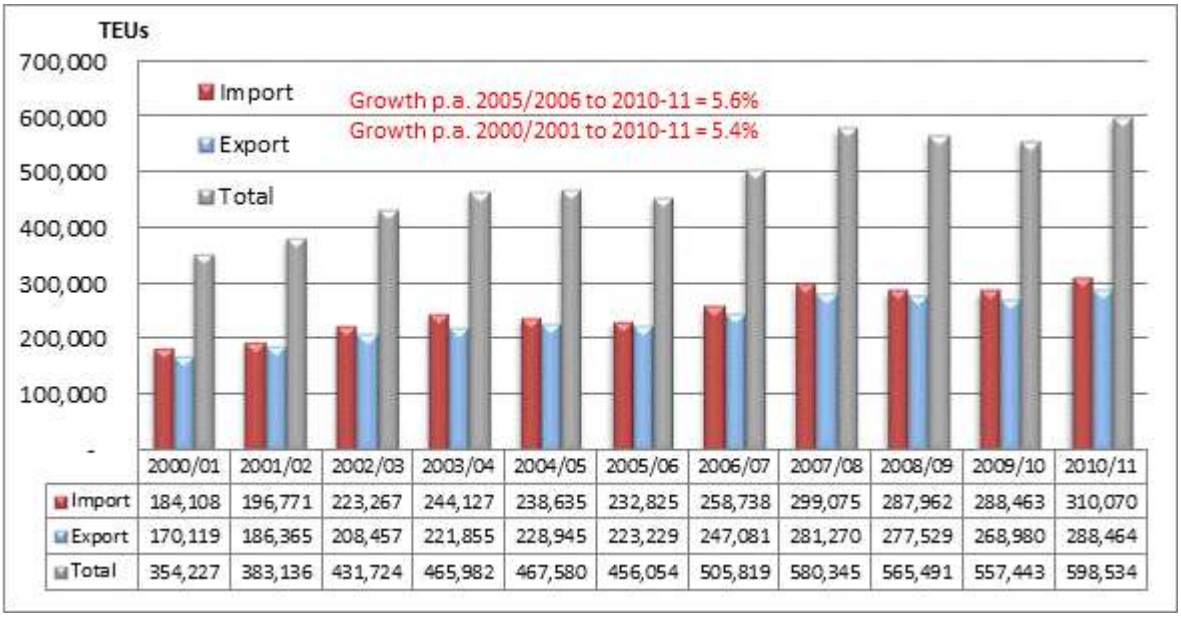
4 CONTAINER TRENDS AND ANNUALISATION

4.1 CONTAINER TRENDS THROUGH FREMANTLE PORTS

4.1.1 Historic Growth

FP handled just under 0.6M TEUs in 2010/11 of which just less than 52% were imports and just over 48% were exports. Figure 2 below details the 10 year growth pattern for the Port's container trade which overall has enjoyed a compound rate of 5.4% p.a. for the past decade.

Figure 2- Fremantle Container Trade Growth since 2000/01



	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Import	184,108	196,771	223,267	244,127	238,635	232,825	258,738	299,075	287,962	288,463	310,070
Export	170,119	186,365	208,457	221,855	228,945	223,229	247,081	281,270	277,529	268,980	288,464
Total	354,227	383,136	431,724	465,982	467,580	456,054	505,819	580,345	565,491	557,443	598,534

It is noticeable that with the onset of the Global Financial Crisis (GFC) in 2008/09 this compound rate dropped to just over 1% p.a. but in the most recent year overall growth has returned (7.4% in 2010/11). In the first quarter of the current financial year 2011/12, this trend appears to be continuing with the monthly TEU throughput averaging 54,000 TEUs or comparable to the peak month last year (October).

4.1.2 Full and Empty Containers

While FP's overall container trade in 2010/11 showed slightly more import than export containers (refer Table 7 below), the picture is very different for full containers where over 63% of volume was accounted for by imports and a similar percentage of that traffic was in 40 foot containers. Nearly 23% of the Port's container trade was in empty containers, over 87% of which were exported and which were primarily empty 40 foot containers arising from their deployment to service inbound consumer goods from Asia.

Table 7 - FP Container Volumes in 2010/2011 - TEUs

	Full					Empty					
	20D	20R	40D	40R	Sub Total	20D	20R	40D	40R	Sub Total	Grand Total TEUs
2010 - 2011											
Export	79,320	4,068	75,656	9,820	168,864	21,308	177	97,490	618	119,593	**288,457**
Import	102,835	2,539	177,712	10,122	293,208	9,489	1,709	2,694	2,970	16,862	**310,070**
Total	**182,155**	**6,607**	**253,368**	**19,942**	**462,072**	**30,797**	**1,886**	**100,184**	**3,588**	**136,455**	**598,527**

D= dry container R=refrigerated container

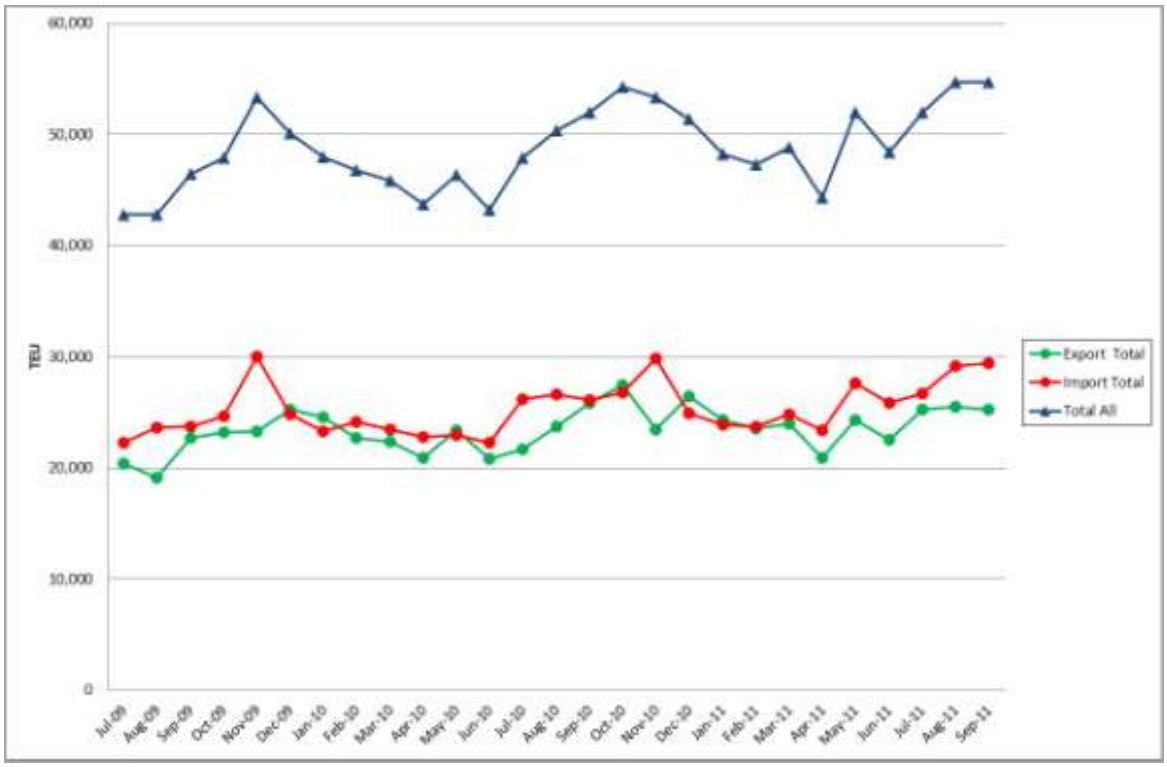
Port

4.2 SEASONALITY AND ALTERNATE VARIABLES

4.2.1 Seasonality

Figure 3 below sets out FP's monthly export and import container trade volumes since July 2009 and overall shows marked seasonal variations in trade volumes, with the peak occurring in the calendar fourth quarter and trough in the autumn (April).

Figure 3 - Fremantle Monthly Import & Export TEUs, July 2009 - September 2011



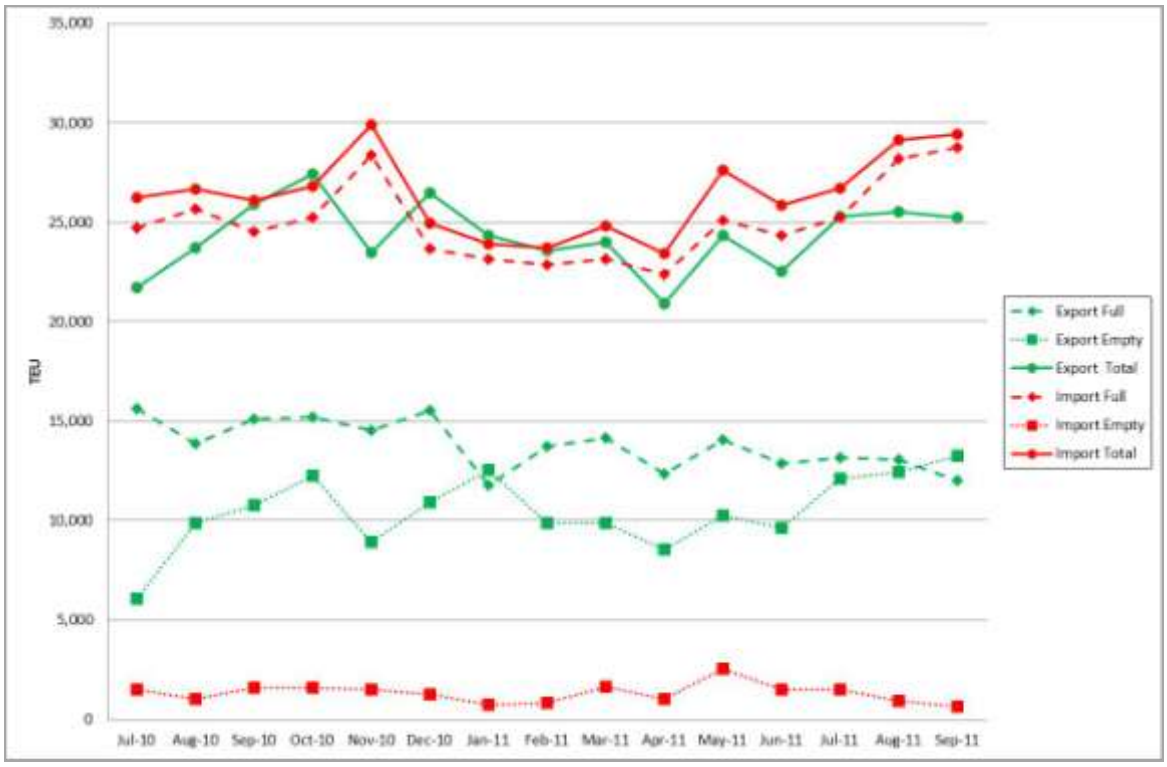
For the last two years the peak import container volume has been around 30,000 TEUs, a level that was also achieved in this project's Full Study during the month of August and again in September - the latest month for which Port data is currently available. The lowest month for import container volumes in 2010/11 was April with around 23,000 TEUs or nearly 25% lower than that year's peak month of November. Current import volumes handled through the Port are nearly the same as the November 2010 peak.

The 2009/10 export peak of about 25,000 TEUs was achieved in December 2009 and slightly less in January 2010. This level was exceeded by some 10% in October 2010 and between July and September 2011 export volumes were once more around 25,000 TEUs. The lowest recent month for export volumes was April 2011 at just under 21,000 TEUs, some 25% lower than the peak export month of October 2010.

4.2.2 Alternate Variables

The number of imported and exported containers can be broken down further into those that are empty and full. Full imports in 2010/11 varied between a low of just over 22,000 TEUs per month and a high of 28,000. The number of empty imported containers typically varied between 1,500 and 2,500 TEUs per month (refer Figure 4 below), although the volume in September 2011 was unusually low at less than 700 TEUs or 1.2% of total container volume and just under 5% of total empty movements. In August when the Full Study took place the number of import empty containers was slightly higher. The picture for exports, however, is somewhat different with full exports varying between 12,000 and 15,000 per month and empty exports ranging from as low as 8,000 TEUs last April to as high as 13,000 in the latest month reported (September).

Figure 4 - Monthly Container Volumes 2010/2011 Export & Import, Full & Empty



As shown in Table 8, full containers of exported grain, cereals and hay in 2010/11 declined overall by 37% or just over 20,000 TEUs compared with the previous year as a result of the prolonged drought in rural areas of the state. The drought adversely effected agricultural exports in containers such as hay and grains, most of which declined by over 33% compared with the previous year. Conversely, the movement of export empty containers rose by over 29,000 TEUs or nearly 33% compared with 2009/10 in consequence. This situation has put additional pressure on carrier equipment management in recent months to reduce the import of empty boxes and export as much surplus empty equipment as possible.

Table 8 - WA Containerised Exports of Grain, Cereals & Hay in 2010/2011 v 2009/2010

Export Commodity	2009/10 TEUs	2010/11 TEUs	% Change
Barley	2,427	881	-65.7
Canola Seed	1,042	675	-35.2
Hay	31,565	20,992	-33.5
Oats	8,894	5,252	-40.9
Other Cereals	1,215	765	-37.0
Wheat	9,209	5,681	-38.3
Full Export Sub Total	**54,352**	**34,246**	**-37.0**
Empty Exports Total	**90,088**	**119,593**	**+32.8**

4.3 TYPE OF BUSINESSES AND CATEGORIZATION OF LANDSIDE CONTAINER MOVEMENT

4.3.1 Type of Business Operation

This study involved the following types of business operations associated with the landside container movements.

- Container Terminals:

The Container Terminals are operated by third party commercial container stevedores at Fremantle Ports. There are two terminal operators, DP World (Berths 4 - 6) and Patrick (Berths 7 - 10). The terminals are the first entity to handle import containers after the container ship has berthed, and the last entity to handle export containers before the container vessel sails. Annexe 1 illustrates the location of these two prime container terminals.

- Container Parks:

Container Parks are another critical entity in the landside container logistics chain. Container Parks manage the empty containers in coordination with the shipping lines, who own or lease the containers, primarily in respect of storage and maintenance. Container parks accept empty container dehire once the importer or their agent has removed the cargo contents

from the container in the import trade logistics chain. At the instruction of the shipping line they undertake any essential maintenance or repairs to these containers and issue empty - containers to exporters or their agent for packing their cargo prior to movement in the export trade logistics chain. The container parks also work in line with instructions from the shipping lines when they want to strategically reposition containers to or from overseas. Five empty container park operators were included in the full study. They operate empty container parks in 10 discreet physical locations, of which 9 are located in the Port precinct (refer to Annexe 1).

In most cases, container parks are the end point in the import logistics chain, and the start point in the export logistics chain. However, there are infrequent cases where the import logistics chain does not end at the container parks, for example when containers are dehired to other facilities, primarily to container terminals. It is also possible that the export logistics chain will begin at facilities besides container parks, for example when the exporter's transport operator picks up the container directly from the container terminals.

- Staging Locations:

One of the major objectives in this study was to understand the location and importance of interim or *staging locations*. Staging is defined as "an intermediate location usually located between the CT and point of container unpacking or packing that permits:

a) cargo services such as quarantine inspection; or
b) change of land transport mode (e.g. from road to rail or v.v.); or
c) temporary holding of a full/empty containers pending opening hours at the next location in the landside container logistics chain".

It also includes empty containers located at Empty Container Parks as part of the reverse logistics chain

Important staging locations in the container logistics cycle at Fremantle Port include:

- North Quay Rail Terminal (NQRT):

NQRT is an on-Port rail terminal connecting Fremantle Port with the rail network. The terminal requires road transportation to transfer containers to and from the container terminals. NQRT currently operates on a 24 hour basis other than Sunday. Two rail operators provide container movement services at Fremantle Port from NQRT, namely ILS who services containers to Forrestfield (FIT), and Australian Railroad Group (ARG), who also regularly service containers to FIT on behalf of ILS and occasionally services containers to Kalgoorlie Terminal in the east of the State.

- Forrestfield Intermodal Terminal (FIT):

FIT is another major staging location for switch of land transport mode for those containers travelling by rail to or from NQRT. The terminal is approximately 35 kms. distance by road from the Port. There are usually two train services daily on weekdays between NQRT and FIT in each direction, one service in the morning and another service in the evening-night time - precise timings depend on cargo volumes:

a) Morning service: Departs NQRT 0400 to 0500, arrives FIT 0600 & 0700.
Departs FIT 0930, arrives NQRT 1130
b) Evening service: Departs NQRT 1730, arrives FIT around 1930
Departs FIT around 2230, arrives NQRT 0030

These service times are somewhat flexible and subject to container numbers tendered for carriage and may vary somewhat on a day to day basis.

- Other Rail Terminal:

Other rail terminals in this study include; Kewdale, Kwinana, Kalgoorlie. These rail terminals are part of the Western Australia rail network, which provide intra and interstate bulk and containerised freight distribution. However, they play a very minor role in Fremantle Port-related rail container movements.

- QAP:

There are designated quarantine inspection facilities throughout the Perth metro area. These are referred to as AQIS facilities or Quarantine Approved Premises (QAP), and in the study were considered a staging location. Four on-Port quarantine facilities (QUBE, AWH, Luckens and Stevenson's) were identified as "QAP" to verify the logistics cycles or movements reported in this study; however only the last three were full participants supplying *transaction record.* Containers staged at quarantine locations other than these four locations were reported as handled at "road transport staging locations".

- Road Transport Staging Locations:

Road transport staging locations included every other intermediate location where full or empty containers were staged other than those specifically mentioned earlier in this section. The majority of road transport staging locations were road operator yards.

- Unpack Locations:

This is the location where the contents of import containers are unpacked after its delivery from the Port's container terminal. It may be the premises of the purchaser of the cargo, a third party storage warehouse, a forwarder's, Third Party Logistics Providers (3PL) or Customs Agent's premises. Containers can also be unpacked at the facilities classified as "staging

locations" above such as QAP or road operator yards. In such cases, the locations are considered "unpack locations".

- Pack Locations:

This is the location where export containers are packed with export cargo prior to shipment overseas via the Port's container terminal. It may be the premises of the producer of the cargo, a third party storage warehouse, a forwarder's or 3PL's premises. Again, containers can be packed at the facilities classified as "staging locations" above such as QAP or road operator yards. In such cases, the locations are considered "pack locations".

4.3.2 Categorisation of Landside Container Movement

Inland movement of marine containers are categorized in this study into four basic categories – Import Trade Cycle, Export Trade Cycle, Import Reposition and Export Reposition; and in turn these subdivide into six basic phases. It should be noted each phase may consist of single or multiple movements. This structure is summarised in Table 9 and described more fully below.

Phase 1 refers to the movement (single or multiple) of a *full* container from when it is picked up from container terminal to the point of unpack. Phase 2 refers to the movement of the then *empty* container from the unpack point to the point of dehire. The point of dehire is typically the container park; however in some cases containers once emptied can be dehired to container terminals for export, or dehired at QAP. Such movements are also considered parts of Phase 2. Phase 1 and Phase 2 are associated with import trade containers, and referred to as the *Import Trade Cycle*.

Phase 3 involves the movements of an *empty* container from the container terminal to the container park. Phase 3 is referred to as *Import Reposition* and normally is to place the container in readiness for export.

Phase 4 refers to the movement of an *empty* container from the empty container pick up point (typically container parks) to the pack point. It should be noted that in some cases, empty containers can be picked up from the container terminals or other facilities for the purpose of export packing and then transported either directly or through staging points to the pack location thus bypassing the container parks. These movements are also considered part of Phase 4. Phase 5 refers to the movement of a *full* container from the pack point to container terminal. Both Phase 4 and Phase 5 are associated with export trade containers, and referred to as the *Export Trade Cycle*.

Phase 6 refers to the movements of *empty* containers from container parks to container terminals and is referred to as *Export Reposition* and normally is to place the container which is surplus to requirement in WA for return to an overseas market with a container equipment deficit.

Table 9 – Categorisation of Landside Container Movements by Category and Phase

Category	Phase	Definition
Import Trade Cycle	1. Full to Unpack	Full Container from Terminals to Final Unpack destinations.
	2. Empty from Unpack to De-hire	Empty Container from Unpack Point to Empty Container Park for de-hire.
Import Reposition	3. Empty from CT to CP	Empty container repositioning from Container Terminal to Container Park.
Export Trade Cycle	4. Empty to Pack	Empty Container from Pick Up Point to Pack Location.
	5. Full from Pack to CT	Full Container from Pack Location to Container Terminals.
Export Reposition	6. Empty from CP to CT	Empty container repositioning from Container Park to Container Terminals.

Each phase may comprise one or more movements. Multiple movements will occur when a container is staged at a location before reaching the defined destination of the phase in question.

As helpful background to develop a clear understanding of these movements, courtesy of WA Government Departments and FP, the following Annexes have been provided and are included in this report:

- Annexe 2: Perth and Fremantle Metropolitan Area Road and Rail Network (Planning Department at the Department of Transport).
- Annexe 6: Industrial Parks in Perth Metropolitan Area (Planning Department, Department of Transport).
- Annex 8: Perth Metropolitan Statistical Local Areas (SLA) and Statistical Regional Sectors (SRS)
- Annexe 8: Fremantle Port Container Process Map - Road (Fremantle Ports & Port Melbourne Corporation).
- Annexe 9: Fremantle Port Container Process Map - Rail (Fremantle Ports & Port of Melbourne Corporation).

4.4 ANNUALISATION OF STUDY DATA

In presenting the data collected and validated from the full study, it was decided to adopt a dual approach in this report by profiling the:

- Import and export logistic chains (Section 5, Section 6 and Section 7) based on the movement data provided by road and rail operators; and
- Activities at container terminals and empty container parks (Section 8 and Section 9) based directly on the transactional data provided by container parks and container terminal.

4.4.1 Import and Export Logistic Chains between the Container Terminals and Parks

For profiling the import and export logistic chains between the container terminals and relevant container parks where empty containers are stored for container shipping lines, the data collected was *annualised.* This was achieved by applying the relative mix of container movements identified in the full study as key elements of the logistics chain to the annual TEUs volumes reported by FP for 2010/11.

This was undertaken to produce a representative profile of the current total container landside logistics chain given the average of just under 50,000 TEUs per month handled by FP last year. This calculation is further reinforced by the fact that something over 54,000 TEUs were handled by the Port in the peak month of each of two previous years as well as in both the latest available (directly following the study period) reported operating months (August and September 2011) – refer Figure 4 above.

This data annualisaton process was broken down into the six elements or phases of the logistics chain associated with the import trade cycle, export trade cycle, import reposition and export reposition outlined in Section 4.3.2 above.

To annualise the *full container logistics chain (Phase 1 and Phase 5),* Full TEUs arrival and departure data to/from CTs during the 14 day Full Study was proportionately applied to the comparable annual totals of:

i) *Full* TEUs Import arriving at Fremantle Port as per FP 2010/11 trade data shown in Table 7 (293,208 TEUs).
ii) *Full* TEUs Export departing Fremantle Port as per FP 2010/11 trade data shown in Table 7 (168,864 TEUs).

The comparable movements between business types (e.g. CT, QAP, Rail Terminal, Road Staging Location, Pack or Unpack Point, CP) were then tracked back on a pro rata basis to the adjacent location in the landside logistics chain based on the mix of equivalent TEUs movements derived from the 14 day Full Study chain.

The *empty container logistics chain* in Phase 2, Phase 3, Phase 4 and Phase 6 is explained below.

Empty *export* TEUs at the container terminals derive from 2 sources:

i) Empty TEUs repositioned from the container parks (Phase 6 export reposition).
ii) Empty TEUs dehired direct to the container terminals (a Phase 2 import trade movement usually occurring to expedite the urgent export of particular equipment types to overseas deficit equipment areas).

These two components accounted for 93.5% and 6.5% respectively of the CT empty container total in the full study (see Table 10).

Empty *import* TEUs also derive from 2 sources:

i) Empty TEUs repositioned to container parks (a Phase 3 import reposition movement).
ii) Empty TEUs imported to directly be part of the export cycle bypassing the container parks (a Phase 4 movement usually occurring in response to a local shortage of a particular equipment type).

The sample size is too insignificant to appropriately analyse. The available figures, however, have been noted in Table 10.

The same method that was used in estimating the annual movement of full containers between locations in Phase 1 and Phase 5 was then applied to these four phases of empty container movement. The end result of this annualisation process is as shown in Figure 7 in Section 5.1.4 below. No attempt was made to adjust the statistical outcome for potential growth in the current financial year or beyond, given data for only the first 3 months of 2011/12 was available at the time the data base was created and the increasingly uncertain outlook for the container shipping industry since the last quarter of 2011.

Table 10 – Annual Estimation of Empty Containers based on 2010/11 TEUs

Components	Full Study TEUs	% Split	Annual Estimation (TEUs)
Phase 6: Empty from CP to CT (Export Reposition)	5,415	94%	111,841
Phase 2 - Partial: Empty from Unpack to De-hire at CT	377	6%	7,752
Empty TEUs Export in 2010/11			**119,593**
Phase 3: Empty from CT to CP (Import Reposition)	233	86%	14,551
Phase 4 – Partial: Empty from CT to Pack	37	14%	2,311
Empty TEUs Import in 2010/11			**16,862**

This annualisation will allow readers of the report to appreciate the relevant annual scale of the import and export logistics chains and make comparisons with similar data in other Australian container Port studies. That said it is a statistical projection and as such must be treated with caution as it is based on the fundamental assumption that the clean data emanating from an average of about 80% of the movements in the full study period is reasonably representative of the Port's landside logistics container chain in the latest reporting year of 2010/11[2].

4.4.2 Activities at Container Terminals and Parks

In respect of the data that profiles the activities at key locations in the landside container chain (such as the performance of container terminals and parks) this information is presented *directly*

[2] This is one method of annualisation. Discussion could be held on (i) the need to include growth for 11/12, as more authoritative figures had become available prior to the completion of this report in March 2012 (ii) other agricultural effects, (iii) the way in which seasonality was considered, etc. if required.

using the data extracted from the full study, i.e. without any annualisation. This is based on three considerations:

a) CT and CP performance is known to vary substantially with peak and low season volume variations.
b) The fact that the volume of traffic handled by FP in the month of the study was reasonably comparable with the peak month volumes in both 2010/11 and the previous year.
c) The data base covered 82% of the terminal container population and 78% of the container park population (of which a significant number were bulk run movements of empties).

In these circumstances it is considered that the sample data from the full study is reliably representative of the current total landside container activities related to FP. However, when the container volumes and mix change significantly, transactional data (relating to CTs and CPs) should be specifically re-measured at that time.

5 INLAND CONTAINER MOVEMENTS

This Section of the Report provides an overview of the 6 phases of landside container movement as set out previously (refer Section 4.3.2 above) from the following perspectives:

- Inland container movement by Phases.
- Average Movements.
- Average Movement by Mode of Carriage.
- Complete Logistics Chain.

It should be noted that for the purposes of the first 3 sub units of this section a movement is defined as the process whereby a container is relocated from one point in the container logistics chain to the next immediate point. **For this part of the report a container is treated as a single physical unit irrespective of its size (20 foot or 40 foot) or type. It should also be noted that in our analysis a transfer within one physical facility operated by a single business does not qualify as a movement.**

In the last part of this section, and all the subsequent Sections 6 – 9, all the analysis and related findings are made in Twenty Foot Equivalent Units (TEUs) – this means a 40 foot container is treated as 2 TEUs. This takes account of the fact that the common international unit of container trade measurement, vessel and terminal capacity and container Port throughput is TEU. This approach is necessary to permit this report and its contents to be comparable with other similar Australian reports and for it to be intelligible in the context of other container industry statistics.

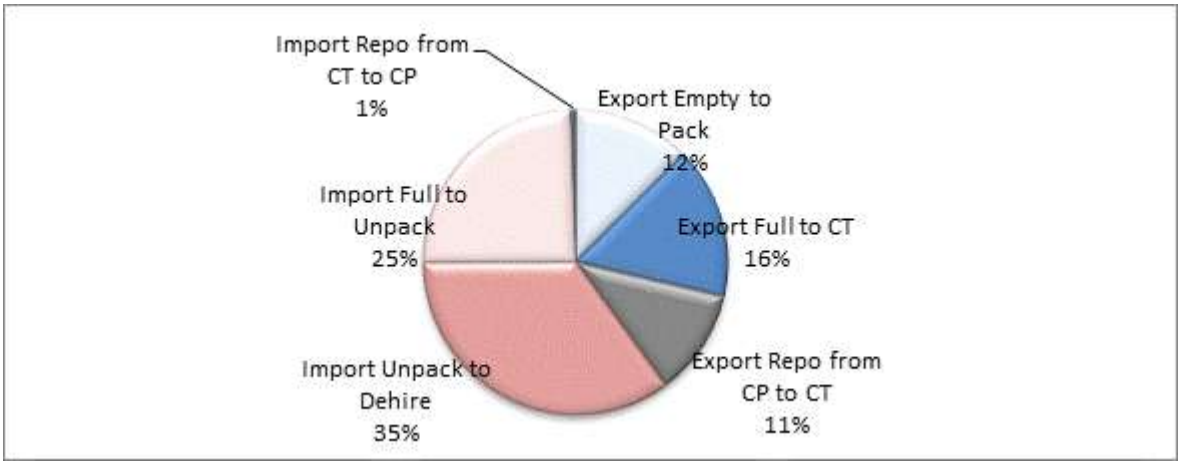
5.1.1 Inland Container Movement by Phases

As demonstrated in Table 11 and Figure 5 below 61% of the study's recorded *individual* movements related to inbound containers and 39% to export. This divergence arises both from the fact that inbound movements are generally more complex than outbound (i.e. with more staging) and the fact that a significant percentage of the outbound movements (11% of total) were simple transfers of empty equipment from container parks direct to the container terminals for shipment overseas.

Table 11 - Individual Container Movements in Full Study

Category	Phase	Number of Movements	Percent of Total
Import Trade	1. Full to Unpack	11,347	35%
	2. Empty from Unpack to De-hire	7,953	25%
Import Reposition	3. Empty from CT to CP	175	1%
Export Trade	4. Empty to Pack	4,060	12%
	5. Full from Pack to CT	5,229	16%
Export Reposition	6. Empty from CP to CT	3,663	11%
Total		**32,427**	**100%**

Figure 5 - Breakdown of Container Individual Movements by Movement Phase



5.1.2 Average Number of Movements by Phase

Based on the Full Study findings Table 12 and Table 13 below summarise the average number of completed movements for each phase in the inland container logistics chain - Table 12 reports the average movement for import containers and Table 13 reports the average movement for export containers. The population for this analysis includes *only* those containers which completed at least one full phase (irrespective of the number of individual movements) of the 6 different types defined in Table 11 above during the 14 day Full Study. This is different from Table 11 which merely tabulates the total individual container movements irrespective of whether or not they were part of a completed phase during the Full Study.

During the Full Study period, 4,900 full import containers regardless of size or type completed a total of 8,044 such movements between the container terminals and unpack points. The average number of movements for this Phase 1 was therefore 1.64. From the unpack points to the points of dehire (Phase 2), 5,224 containers completed 6,656 movements. This represented an average of 1.27 movements per container phase. The average movement for Phases 1 and 2 combined therefore was 2.92 per import trade container.

Table 12 – Average Number of Import Movements by Phase

Movement Phase	Number of Containers	Total Movements	Average Number of Movement
Import Trade Cycle			
Phase 1: Full to Unpack	4,900	8,044	1.64
Phase 2: Empty from Unpack to De-hire	5,224	6,656	1.27
Average Number of Movement per Import Trade Container			**2.92**
Import Reposition Container			
Phase 3: Empty from CT to CP	175	175	1.00
Average Number of Movement per Import Reposition Container			**1.00**

For full export containers, from the point of empty container pick up to the pack point (Phase 4), 2,999 containers underwent 3,696 movements, or 1.23 movements per container. In the following Phase 5 of full container movements from the pack point to container terminals, 3,153 containers underwent 4,331 movements of 1.37 movements per container. An average total movement for Phase 4 and Phase 5 combined was 2.61 movements per export container.

Table 13 – Average Number of Export Movements by Phase

Movement Phase	Number of Containers	Total Movements	Average Number of Movement
Export Trade Cycle			
Phase 4: Empty to Pack	2,998	3,696	1.23
Phase 5: Full from Pack to CT	3,153	4,331	1.37
Average Number of Movement per Export Trade Container			**2.61**
Export Reposition Container			
Phase 6: Empty from CP to CT	3,237	3,621	1.12
Average Number of Movement per Export Reposition Container			**1.12**

The greater logistics complexity of the import chain is reflected in the fact there were typically 2.92 movements per full inbound container compared with only 2.61 for every loaded outbound container. The complexity of import container movements is demonstrated in the first phase where up to 5 movements can be involved prior to cargo unpacking[3].

Table 12 and Table 13 also detail the Repositioning Movement of empty containers (Phase 3 and Phase 6) in each direction between the container parks and container terminals, which were much more straightforward than the Logistics Phases in the Import and Export Trade Cycles. The empty containers primarily made a single movement between container terminals and container parks, except in some cases of export repositioning where the empty container was moved on rail from the off Port container park. Overall, the full study period suggested an average of 1.00 movement per empty container in the few inbound instances that occurred and an average of just 1.12 movements per empty container outbound.

5.1.3 Average Movement by Mode of Carriage

Based on the same sample as used in analysing the average number of container movements per completed import or export phase of the landside container logistics chain, Table 14 illustrates the volume of containers and TEUs that travelled by road-rail composite mode as opposed to road only mode in each phase of the two Trade Cycles. On average, 12% of both containers and TEUs were moved by road-rail composite mode in the 4 Phases related to the import and export trade cycles. When comparing the different phases, road-rail composite mode was used more widely (18%) to service loaded TEUs in Phase 5, i.e. Export - Full from Pack to CT, and used least in Phase 1, Import – Full to Unpack (7%). Based on the information provided by the rail operator indicated

[3] As an example CTO - QAP - Staging Terminal 1 - Staging Terminal 2 - Importer

that the physical volume transported on rail during the month of the full study (August 2011) enjoyed a similar 12.5% share of the Port's traffic, i.e. 6,893 TEUs out of the Port volume of 55,269 TEUs.

Table 14 - Breakdown of Container Volume (Containers and TEUs) by Mode of Transport within the Study Period

	Container on All Modes	TEUs on All Modes	Container on Road-Rail Composite Mode	% Container on Road-Rail Composite Mode	TEUs on Road-Rail Composite Mode	%TEUs on Road-Rail Composite Mode
Import Trade Cycle						
Phase 1: Import - Full to Unpack	4,900	7,239	297	6%	481	7%
Phase 2: Import - Empty from Unpack to De-hire	5,224	7,739	615	12%	977	13%
Export Trade Cycle						
Phase 4: Export - Empty to Pack	2,998	4,130	418	14%	544	13%
Phase 5: Export - Full from Pack to CT	3,153	4,123	596	19%	722	18%
Total	**16,275**	**23,231**	**1,926**	**12%**	**2,724**	**12%**

As demonstrated in Figure 6 and Table 15 below, when taking into account the total of 32,427 inland movements (as opposed to containers or TEUs handled) in the two weeks full study, it is clear that road movements were the dominant mode of inland transport, with a 93% share. Rail accounted for 2,146 movements or 7%. This share was derived primarily from rail's participation in the following three phases:

- Phase 4: Empty containers from container park to export pack point (10% share for rail).
- Phase 5: Full export containers from pack point to container terminal (11% share for rail).
- Phase 1: Full import container from container terminal to unpack point (6% share for rail).

Containers transported by rail at any point effectively participate in a road-rail composite mode in whatever phase it occurs because the container requires road transfer at both North Quay terminal and Forrestfield terminal on to/off the rail network if the container is packed or unpacked outside FIT. Consequently, they generate road movements as well as rail movements, which result in rail's share of total movements in the landside container logistics chain falling below its share of the number of the Port's TEUs or Containers it handles.

Figure 6 - Container Movements in Full Study by Phase and by Transport Mode

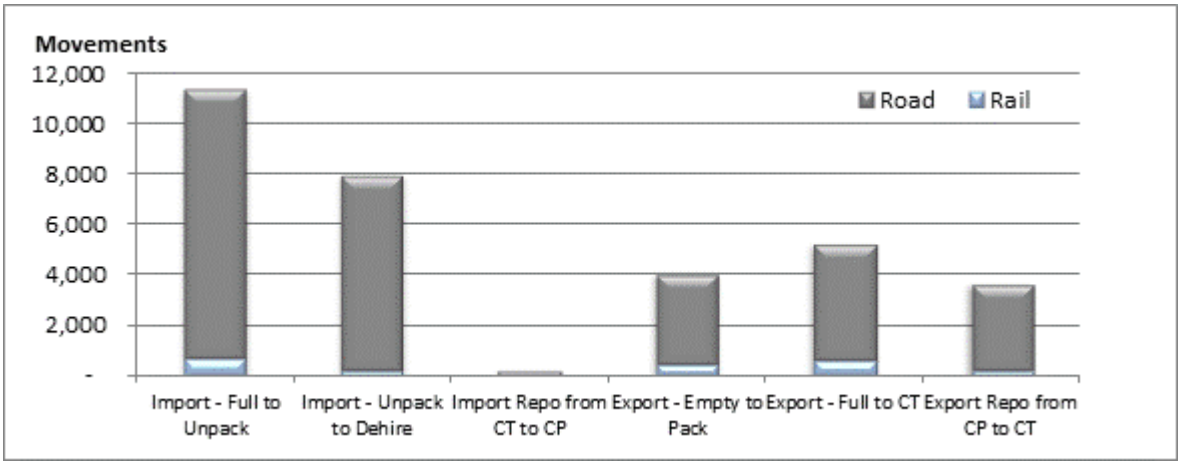


Table 15 - Breakdown of Movements by Mode of Transport within the Study Period

Movement Type	Rail Movement	Rail Movement Percent	Road Movement	Road Movement Percent	Total
Phase 1: Import - Full to Unpack	675	6%	10,672	94%	11,347
Phase 2: Import - Unpack to De-hire	247	3%	7,706	97%	7,953
Phase 3: Empty from CT to CP (Import Reposition)	-	0%	175	100%	175
Phase 4: Export - Empty to Pack	424	10%	3,636	90%	4,060
Phase 5: Export - Full to CT	601	11%	4,628	89%	5,229
Phase 6: Empty from CP to CT (Export Reposition)	199	5%	3,464	95%	3,663
Total	**2,146**	**7%**	**30,281**	**93%**	**32,427**

5.1.4 Complete Logistics Chain

Table 16 below shows the breakdown of TEU-movements between business types from the sample collected during the Full Study period. This indicates that out of the total movements in the Full Study of just over 48,000 the greatest inflow volume was that into container terminals (10,597 TEU-movements or 22%); half of this volume was the movement from container parks direct to container terminals. Approximately 20% of total movements were to road transport staging locations (9,818 TEU-movements), importers (8,872 TEU-movements), and container parks (8,748 TEU-movements). Not surprisingly the mix of outflow volume involved the same categories of operation in approximately the same proportions.

Table 16 – Container Movements between Business Types (TEUs in 14 Days) – Import and Export

From Business Type	To Business Type: CP	CT	Unpack Point	Pack Point	FIT	NQRT	QAP	Transport Staging	Other Rail Terminal	Total	% Business Type Origin
CP	-	5,086	-	3,220	362	476	2	670	17	9,833	**20%**
CT	233		3,318	31		924	254	5,071	18	9,849	**21%**
Unpack Point	5,954	168			292		5	2,115	9	8,543	**18%**
Pack Point		2,581	-	-	24	585	351	1,128	84	4,753	**10%**
FIT Intermodal	22	-	460	8	-	855	-	153	-	1,498	**3%**
NQRT Terminal	355	837		389	1,070		45	-	76	2,772	**6%**
QAP	15	472	194	1	-	6	-	148	2	838	**2%**
Transport Staging	2,165	1,453	4,886	571	50		94	533	5	9,757	**20%**
Other Rail Terminal	4	-	14	63	-	84	-	-		165	**0%**
Total	8,748	10,597	8,872	4,283	1,798	2,930	751	9,818	211	48,008	**100%**
% Business Type Destination	**18%**	**22%**	**18%**	**9%**	**4%**	**6%**	**2%**	**20%**	**0%**	**100%**	

Based on the movement data set out in Sections 5.1.1 to 5.1.3 and Table 16 above, Figure 7 below depicts the likely total landside container movements for FP for FY 2010/11. This annualisation (refer Section 4.4 above) is achieved by applying the movement mix established in the full study (Table 16) to the basic elements of FP's container trade in 2010/11 in Table 7 Section 4.1.2 above, namely imports and exports, full and empty containers in TEUs terms .

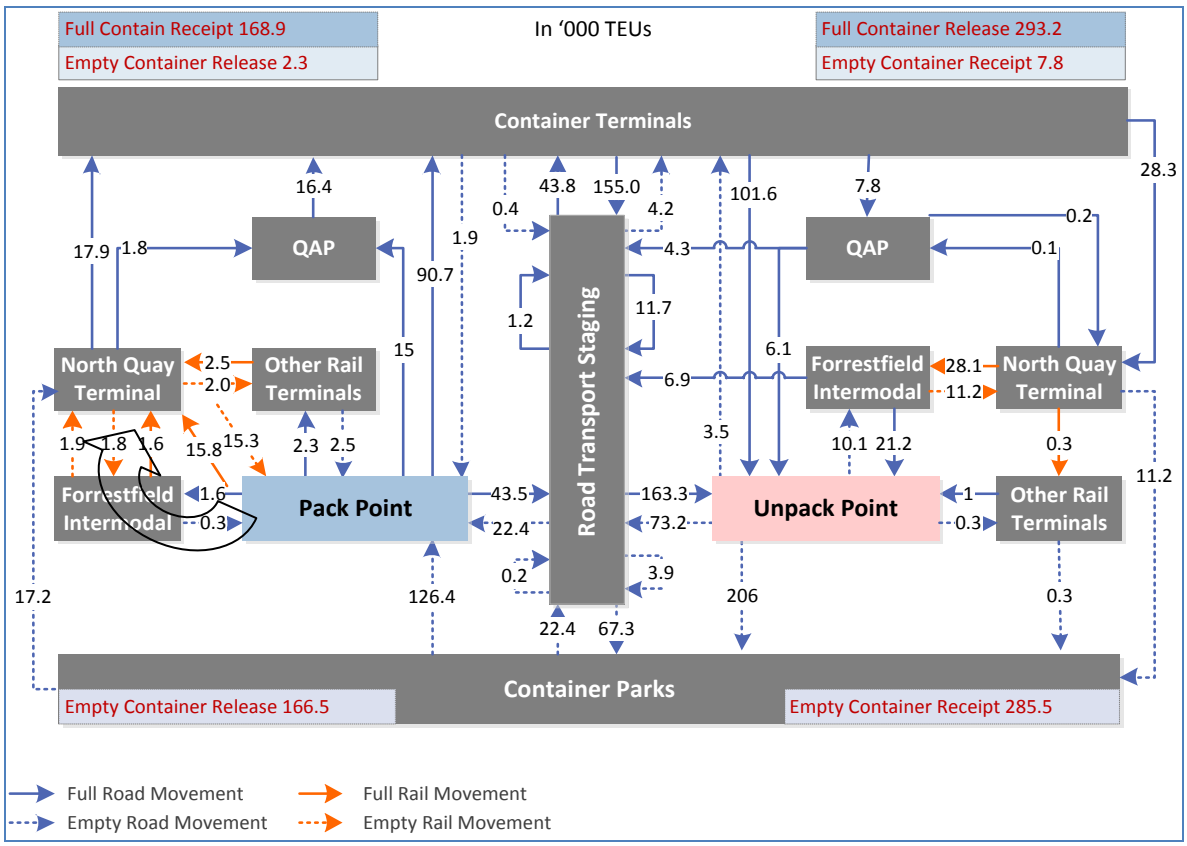
This process takes account of the mix in the Full Study of movements between the various locations in the landside container chain, primarily the Container Terminals from which all imports originated and to which all exports were destined and equally importantly the Container Parks where the large majority of empty containers were held. It also includes other elements of the landside container logistics chain, most importantly the Road Transport Staging locations, together with QAP and the relevant rail terminals (primarily Forrestfield and NQRT). The detailed movements will be subsequently reviewed by phase, but it should be noted that there will be variations to these phases as the monthly container volumes by phase vary.

Figure 7 sets out all the significant landside movements directly linked to the import trade and export trade TEUs (Phases 1,2, 4 and 5 as defined at the start of Section 4.3.2 above). To facilitate understanding of this flow chart the following points should be noted:

- Phase 1 and Phase 4 movements are identified by solid lines (full container movements).
- Phase 2 and Phase 5 movements are identified by dotted lines (empty container movements).
- Movement direction is depicted by the relevant arrow.

- The two boxes at the head of the figure on the left represent annual movements in TEUs '000s where the CT is directly involved in full exports (firstly full export TEUs received at the CTs and secondly empty TEUs delivered from the CTs to inland points for packing export cargo) (refer section 4.4.1 and Table 10 above for an explanation of this empty activity).
- The two comparable boxes at the head of the figure on the right represent annual movements in TEUs '000s where the CT is directly involved in full imports (firstly full import TEUs delivered from the CTs, and secondly empty TEUs returned directly to the CT from inland points of unpacking import cargo) (again refer section 4.4.1 and Table 10 above).
- Just under 54% of all full export TEUs (168,900) are estimated to have moved from the pack point directly to the CT – the other 46% were all staged in some manner.
- Just under 35% of all full import TEUs (293,200) are estimated to have moved from the CT directly to the inland unpack point – the other 65% were all staged in some manner.
- Supporting details are supplied in Table A to Table D of Annexe 10. It should be noted that some minor movements between business types in these Tables, where the numbers are not significant, are not included in this Figure or in related Figure 9, Figure 10, Figure 17 and Figure 18 below – this is to avoid their becoming unduly congested with marginal data. The exclusions are not all of the same numerical size, but in all cases the exclusion criteria have been based on the relative scale of the TEU flow into or out of the particular location in the Figure. All such excluded data is included and highlighted in the Tables in Annexe 10, which are comprehensively representative of the Data Base from which this data is drawn.

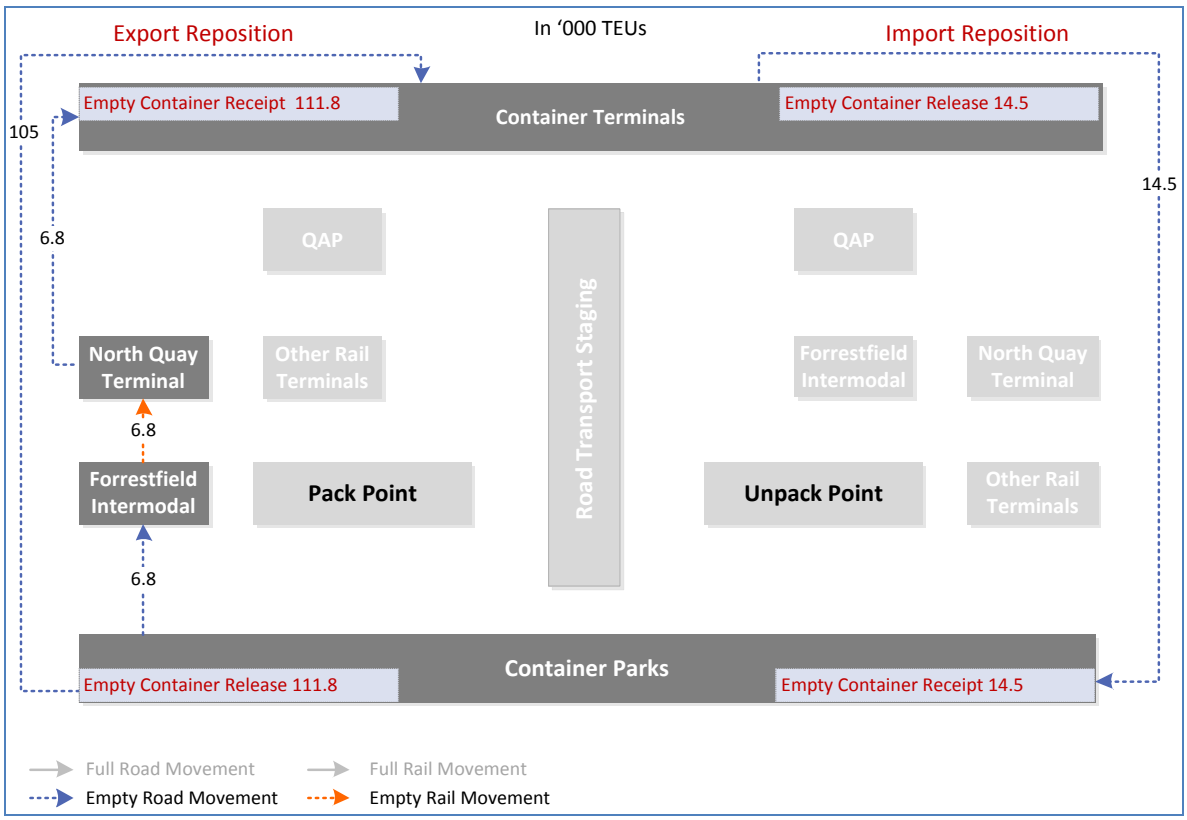
Figure 7 - Fremantle Ports Logistics Chain Movement ('000 TEU) – Import and Export Trade Containers Excluding Reposition (Annual Estimation)



It should be noted this figure includes 15.3k empty TEUs moving by rail from NQRT to Pack Point and 15.8k full TEUs moving by rail from Pack Point to NQRT. These numbers represent movements of containers packed for export at FIT, which facility received the MTs by rail from the Port, packed them with export cargo within its intermodal facility and returned them to the Port again by rail. In other words FIT acted as the Pack Point. This is consistent with the treatment of similar movements where a road transport depot acted as the Pack Point for export cargo delivered to the Port by road. Where the movement between container receipt or despatch and cargo packing occurred entirely within a private facility operated by a single party, i.e. does not involve the use public transport infrastructure, such movement has not been counted in this study. Should it have been, it would have significantly inflated and so distorted the data recorded in respect of staging. The large arrow includes in the figure provides an indication of this movement.

Figure 8 depicts the import reposition and export reposition movements in TEUs on an annual basis where containers were either imported empty to meet outward cargo demand (minimal) or repositioned overseas empty from WA (significant). Again this is derived from the mix of such movements in the full study data. Table E and Table F in Annexe 10 show the details of such movements between business types in the full study and the annual estimation for both import and export container repositioning.

Figure 8 - Fremantle Ports Logistics Chain Movement ('000 TEU) – Import and Export Reposition (Annual Estimation)



It can be seen that the logistics chains related to import and export containers that are repositioned (Phase 3 and Phase 6) are less complex than the logistics chain of the import trade and export trade cycles (Phase 1 and 2 and Phase 4 and 5 respectively). Section 6 and Section 7 below are therefore dedicated to examining import trade container movements and export trade container movement in greater detail.

6 IMPORT MOVEMENTS

This section of the report examines the movement of containers in the Import Trade Cycle (Phases 1 and 2) from a number of perspectives, namely:

- Import Movements by Stakeholder.
- Import Logistics Chain for Phase 1 Full Containers and Phase 2 Empty Containers.
- Unpack Destinations.
- Transport Mode and Distances.
- Road Transport Staging Locations.
- Dwell Time.

All these elements are examined on an annualised basis other than the dwell time which is based directly on data gathered in the study.

6.1 IMPORT MOVEMENTS BY STAKEHOLDER

Using the approach outlined in Section 4.4.1 Table 17 below depicts the estimated annual total Import Trade TEUs movements between business types for Phase 1 and Phase 2 combined, based on the sample data captured during the 2 week study. Some 933,322 TEU-movements are estimated in total. Of these 31.4% are TEU-Movements to unpack points (293,208 TEU-Movements), 30.6% are TEU-Movements to container parks (285,456 TEU-Movements) and 27.3% to road transport staging locations (255,102 TEU-Movements). Most of the remaining 9.9% are to rail terminals. A detailed breakdown of TEUs Movement between Business Types for both the study period and annually are in Table A and Table B in Annexe 10 as far as these were studied.

Table 17 – TEUs Movements between Business Types (Annual Estimation) – Phase 1 and Phase 2

	To Business Type (TEU-Movement)									
From Business Type	CP	CT	Unpack Point	FIT Inter-modal	NQRT Terminal	QAP	Road Transport Staging	Other Rail Terminal	Total	**% Business Type Origin**
CT	-	-	101,562	-	28,283	7,775	155,037	551	**293,208**	**31.4%**
Unpack Point	205,993	3,455	-	10,102	-	173	73,174	311	**293,208**	**31.4%**
FIT Intermodal	589	-	21,232	-	11,190	-	6,931	-	**39,942**	**4.3%**
NQRT Terminal	11,169	21	-	28,109	-	83	-	275	**39,657**	**4.2%**
QAP	91	82	6,111	-	184	-	4,316	63	**10,846**	**1.2%**
Road Staging	67,268	4,195	163,280	1,730	-	2,816	15,645	168	**255,102**	**27.3%**
Other Rail Terminal	346	-	1,023	-	-	-	-	-	**1,369**	**0.1%**
Total	**285,456**	**7,752**	**293,208**	**39,942**	**39,657**	**10,846**	**255,102**	**1,369**	**933,332**	**100%**
% Business Type Destination	**30.6%**	**0.8%**	**31.4%**	**4.3%**	**4.2%**	**1.2%**	**27.3%**	**0.1%**	**100%**	

6.2 IMPORT LOGISTICS CHAIN

The highlighted section of Figure 9 (derived from Figure 7 above) depicts the flows of Full Import containers from the CT, which in 2010/11 totalled some 293,208 TEUs, distributed pro rata to the logistics pattern observed in the 2 week study. It should be noted that some small volume movements are not depicted in this graphical presentation. For full details of movements between locations both in the full study and the annual estimation, please refer to Table C and Table D in Annexe 10.

Table 18, 101,562 TEUs (34.64%) are estimated to be transferred directly from container terminals to unpack destinations. Road transport staging points are estimated to receive 155,037 TEUs (52.88%) of the total where 11,702 TEUs would be transferred to another road transport location before being delivered to unpack destinations. The remainder (12%) would be accounted for by QAP and rail terminals.

Figure 9 - Fremantle Ports Full Container Movement in Import Trade Logistics Chain (TEUs) – Annual Estimation

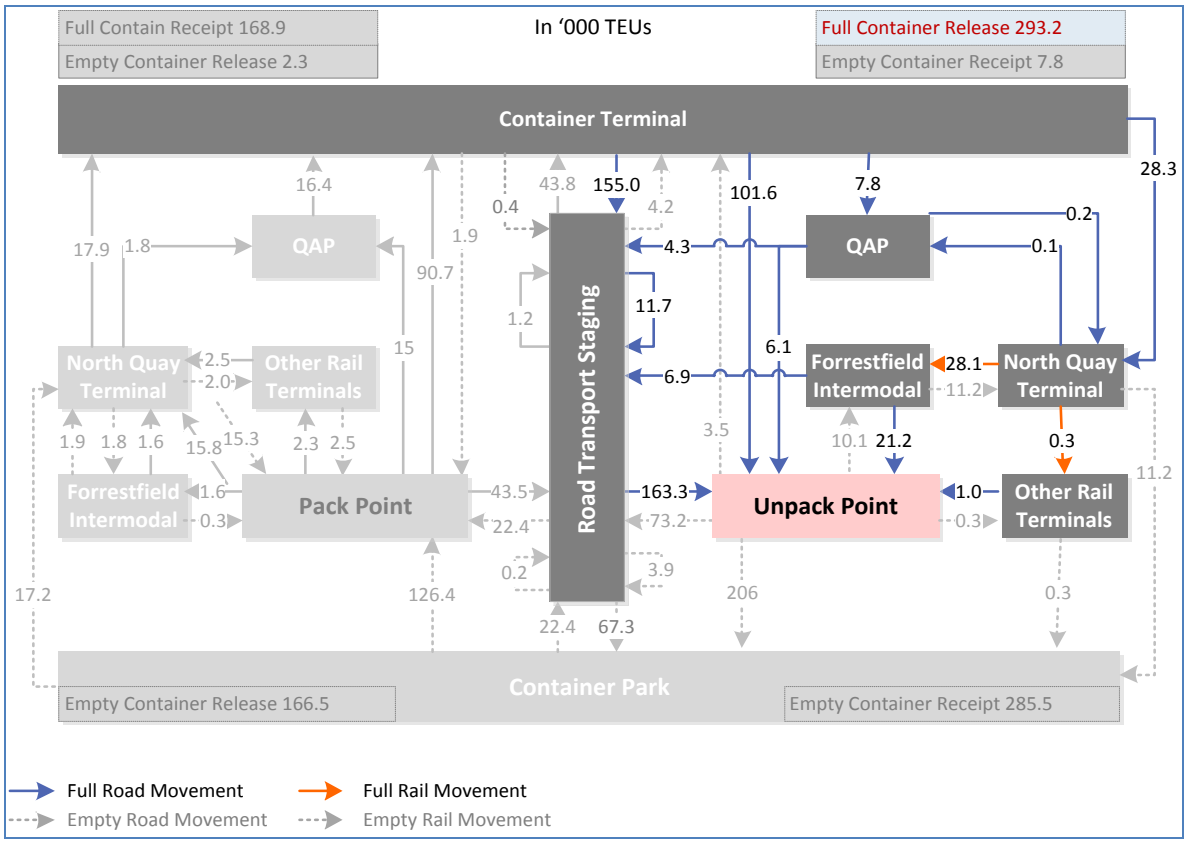


Table 18 –Phase 1 Full TEUs Movements from Container Terminals (Annual Estimation)

Movements from CT to	TEUs	Percent of Total
Unpack Location	101,562	34.64%
NQRT Terminal	28,283	9.65%
QAP	7,775	2.65%
Road Transport Staging	155,037	52.88%
Other Rail Terminal	551	0.19%
Grand Total	**293,208**	**100.00%**

In the highlighted section of Figure 10 (again derived from Figure 7 above) and Table 19 below is depicted the estimated annual movement of empty Import TEUs into the CPs after unpacking. It is estimated that 285,456 TEUs would be dehired to container parks; of these 205,993 TEUs (72.16%) are estimated to originate from unpack points and 67,268 (23.57%) from road staging points. The remainder would originate from Rail Terminals (4% combined). The 2.6% discrepancy between TEUs volumes at unpack locations and container parks is a result of a small proportion of empty TEUs being dehired at other locations such as container terminals.

Figure 10 - Fremantle Ports Empty Container Movement in Imports Logistics Chain (TEUs) – Annual Estimation

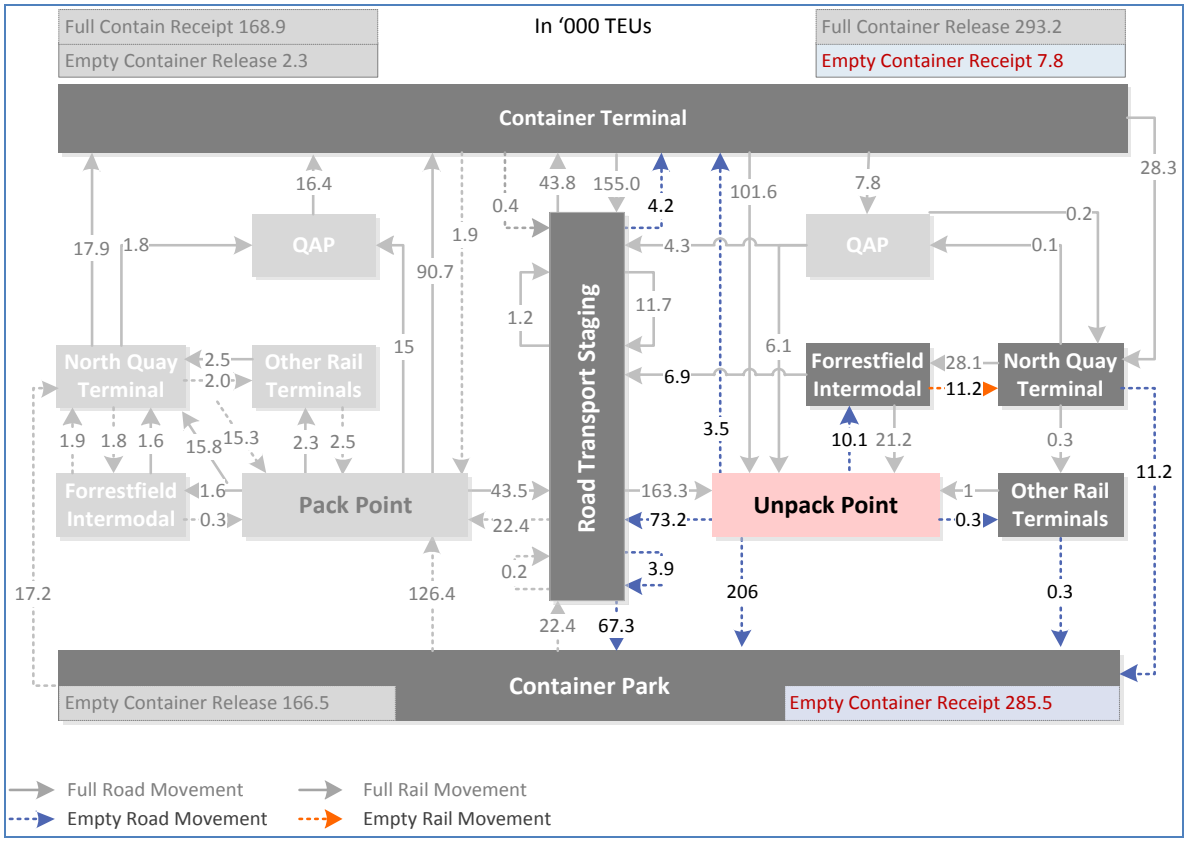


Table 19 – Phase 2 Empty TEUs Movements to Container Parks (Annual Estimation)

Movements to CP from	TEUs	Percent of Total

Unpack Location	205,993	72.16%
FIT Intermodal	589	0.21%
NQRT Terminal	11,169	3.91%
QAP	91	0.03%
Road Transport Staging	67,268	23.57%
Other Rail Terminal	346	0.12%
Total	**285,456**	**100.00%**

6.3 UNPACK DESTINATIONS

6.3.1 Location

From the data collected during the Full Study, unpack locations can be identified for 10,762 TEUs. Table 20 below identifies the top 12 unpack locations for import trade containers in TEUs - they account for 70% of the full import TEUs covered by the full study. The top three locations (Welshpool, Canning Vale and Kewdale) each accounted for at least one thousand TEUs during the 2 week study and almost one third of the total inbound full movements.

The percentage of unpack volume by locations has been applied to FP total full TEUs import trade in FY 2010/11 which permits an annual TEUs estimation per location also to be given in the table. In addition a comparison is made of the Full Study results with a comparable estimate made by the Australian Bureau of Statistics (ABS) in its Information Paper 5368.0.55.018 of 16/9/11 in respect of 2010/11 data.

Table 20 - Top 12 Container Unpack Locations

Rank-ing	Suburb	Post-code	SLA Name*	SRS Name*	TEUs (Study)	TEUs (Annual Estimation)	% of Total (Study and Annual)	ABS %**	Cumula-tive %
1	WELSHPOOL	6106	Canning (C)	South East Metropolitan	1,431	38,987	13.3%	11.4%	13.3%
2	CANNING VALE	6155	Canning (C)	South East Metropolitan	1,050	28,607	9.8%	8.6%	23.1%
3	KEWDALE	6105	Belmont (C)	South East Metropolitan	1,000	27,245	9.3%	9.6%	32.3%
4	BIBRA LAKE	6163	Cockburn (C)	South West Metropolitan	910	24,793	8.5%	9.1%	40.8%
5	NORTH FREMANTLE	6159	Fremantle (C) - Remainder	South West Metropolitan	673	18,336	6.3%	2.8%	47.1%
6	FORRESTFIELD	6058	Kalamunda (S)	East Metropolitan	656	17,873	6.1%	5.0%	53.1%
7	OSBORNE PARK	6017	Stirling (C) - Central	North Metropolitan	508	14,004	4.8%	5.3%	57.9%
8	MALAGA	6090	Swan (C)	East Metropolitan	514	13,840	4.7%	4.2%	62.6%
9	WANGARA	6065	Wanneroo (C) - South	North Metropolitan	246	6,702	2.3%	2.6%	64.9%
10	JANDAKOT	6164	Cockburn (C)	South West	201	5,476	1.9%	n/a	66.8%

Rank -ing	Suburb	Post-code	SLA Name*	SRS Name*	TEUs (Study)	TEUs (Annual Estimation)	% of Total (Study and Annual)	ABS %**	Cumula -tive %
				Metropolitan					
11	O'CONNOR	6163	Fremantle (C) - Remainder	South West Metropolitan	186	5,068	1.7%	See #4	68.5%
12	BELMONT	6104	Belmont (C)	South East Metropolitan	180	4,904	1.7%	2.5%	70.2%
	Total				**10,762**	**293,208**	**100.0%**	**100.0%**	

** SLA (Statistical Local Area) and SRS (Statistical Region Sector) based on Australian Bureau of Statistics Catalog Number 1216.0 - Australian Standard Geographical Classification (ASGC), July 2011; C = City; S = Shire; T = Town. The location and boundaries of Perth Metropolitan SLAs and SRS are shown in the map in Annexe 7.*

*** From Australian Bureau of Statistics 5368.0.55.018 Information paper: Experimental Statistics on International Shipping Container Movements, 2009-10 of 16/9/11.*

It is worth noting that:

a) All these top 12 suburbs are the location of significant Industrial Parks identified in Annexe 6.
b) Other than in the case of North Fremantle the share of full inbound TEUs by suburb is reasonably comparable with the data circulated by ABS, which was based on 2009/10 container data; of 673 TEUs reported to be unpacked in North Fremantle during the Full Study, 63% were unpacked within the area of the Port precinct.
c) As demonstrated by Table 21 below, when the unpack destinations are grouped in ABS SRS, 98% were located in Metropolitan SRS, and two thirds on the southern side of the City (refer Annexe 7 for the location and boundaries of these SRS)
d) Of the remaining 2% of the TEUs in the full study that were unpacked in locations outside Metropolitan SRS (Lower Western & Balance of WA) more than half of these were in locations north of Perth.

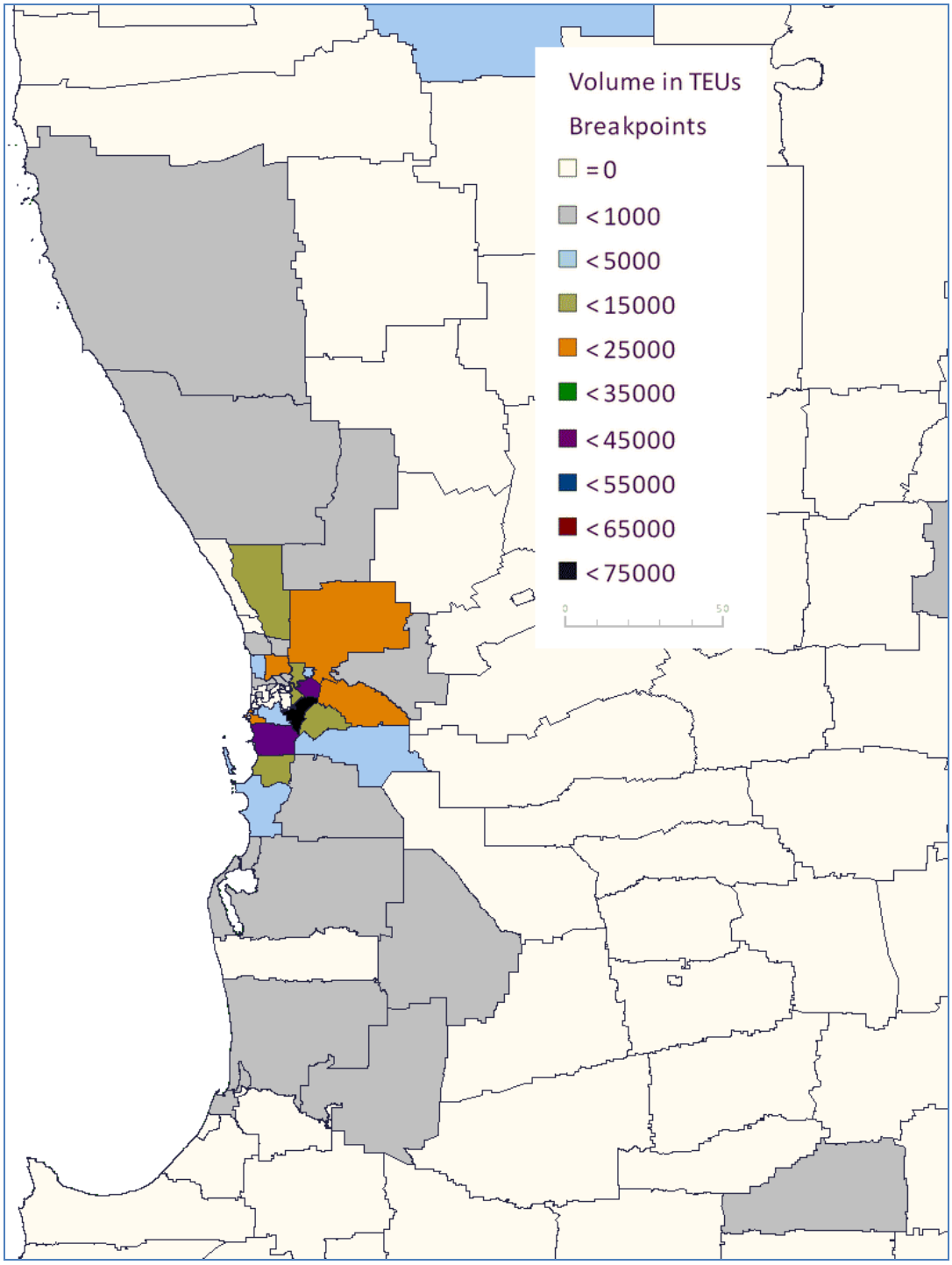
Table 21 – Annual Estimation of Unpack Volume (TEUs) by ABS SRS

Statistical Region Sector (SRS)	Annual Estimation (TEUs)	Percent
South East Metropolitan	125,380	42.8%
South West Metropolitan	78,765	26.9%
East Metropolitan	49,694	16.9%
North Metropolitan	32,094	10.9%
Lower Western WA	1,553	0.5%
Central Metropolitan	1,335	0.5%
Remainder - Balance WA	4,386	1.5%
Total	**293,208**	**100.0%**

Figure 11 below applies the estimated FP full import container trade statistics by unpack location postcode for 2010/11 in Table 20 to suburbs by Statistical Local Area (ABS SLA: Catalog Number

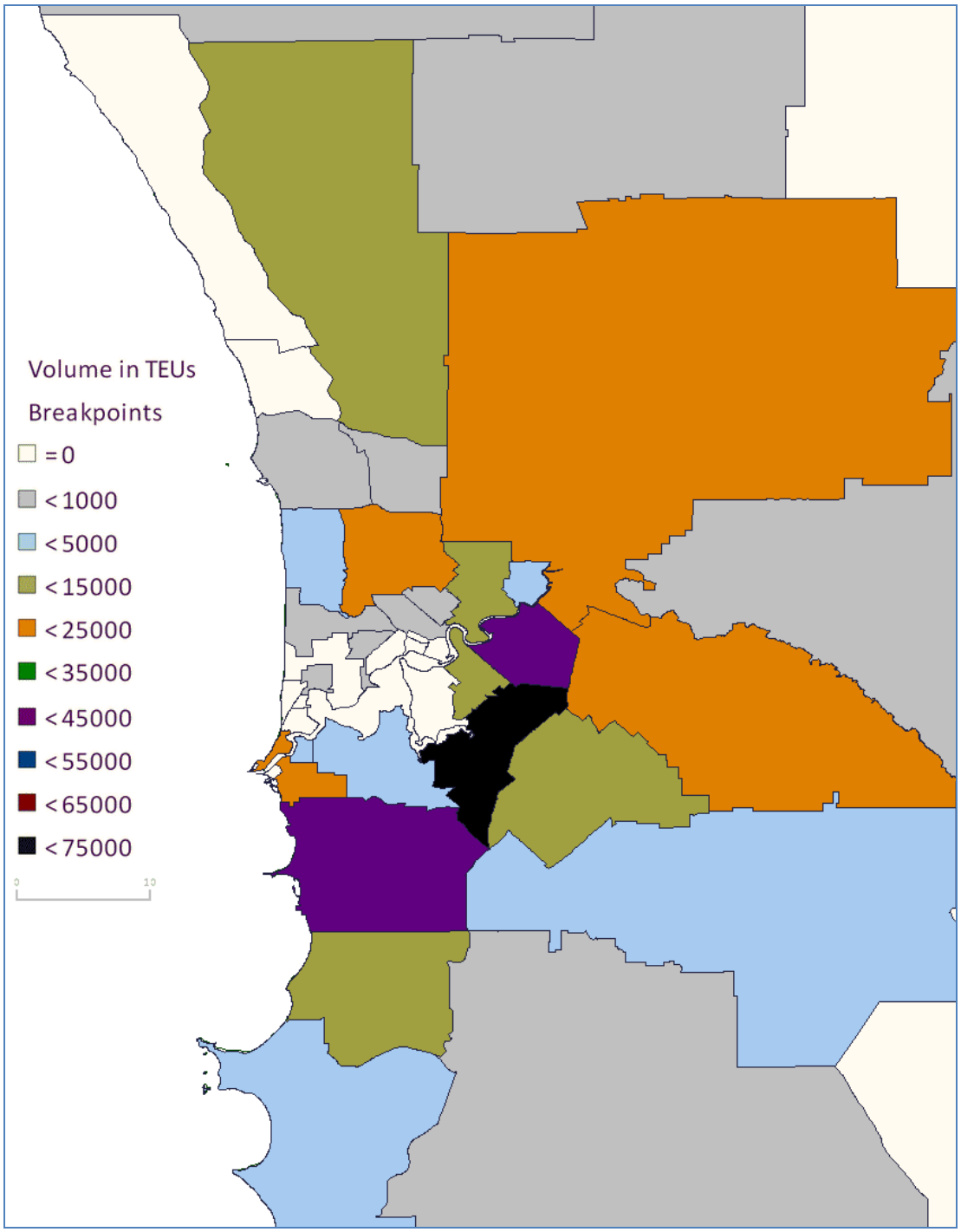
1216.0 - Australian Standard Geographical Classification); this demonstrates the clear concentration of the majoriy of container unpack destinations in greater Perth Metropolitan area.

Figure 11 - Unpack Destinations of Imports by Statistical Local Area (SLA)



It is also worth noting that all 12 of the top import unpack suburbs in Table 20 above fall in the Perth Metro area within SLAs shown in Figure 12 below generating in excess of 5000 TEUs p.a. for unpacking.

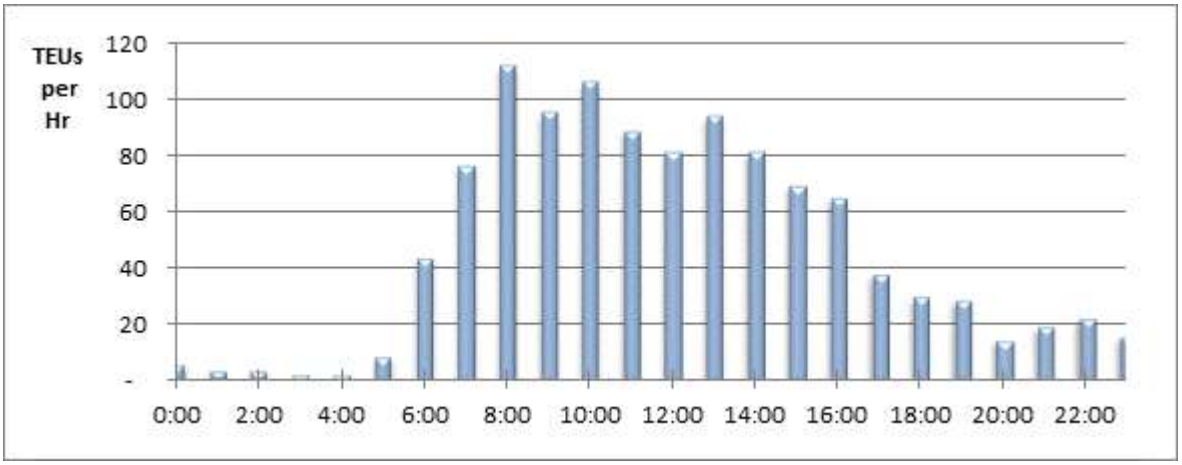
Figure 12 - Unpack Destinations of Imports by Statistical Local Area in Perth Metropolitan Area



6.3.2 Delivery Time of Day to Unpack Location

Figure 13 sets out the distribution by time of day when import TEUs are delivered to unpack locations - as one would expect this occurs primarily between 0700 and 1600 with the period between 0800 to 1100 being the busiest. This is a consequence of inbound warehouses wanting to take delivery of new inventory as early as possible in the working day. A small volume of containers (less than 30 TEUs per hour) were delivered to unpack locations working evening shifts after 1800. Detailed figures of breakdown of time of day based on sample data and annual estimation are available in Table I, Annexe 10.

Figure 13 – Full Container Delivery to Unpack Location - Time of Day



6.4 TRANSPORT MODE AND DISTANCE FROM FREMANTLE PORT

Figure 14 and Table 22 profile the radial distances between the Port and inland unpack locations. The findings in this section focus on the radial distance from the Port to the final unpack destination regardless of the actual distance each TEU travelled. Some 9% of unpack locations were within 10kms radial distance from the Port. The majority of unpack locations (80%) were between 10 and 30kms from the Port (34% of between 10 and 20 kms and 46% of between 20 and 30kms). Just over 10% were at least 30 kms further from the Port. This underlines the concentration of leading import unpack suburbs as set out in Table 21 which is scarcely surprising given the suburbs in which the major Industrial Parks in Annexe 6 are located. In addition Figure 11 and Figure 12 showing which SLAs receive most full import containers for unpacking convey the same message.

Figure 14 – Radial Distance from Port - Import Container Unpack Location (TEUs per an Average Day)

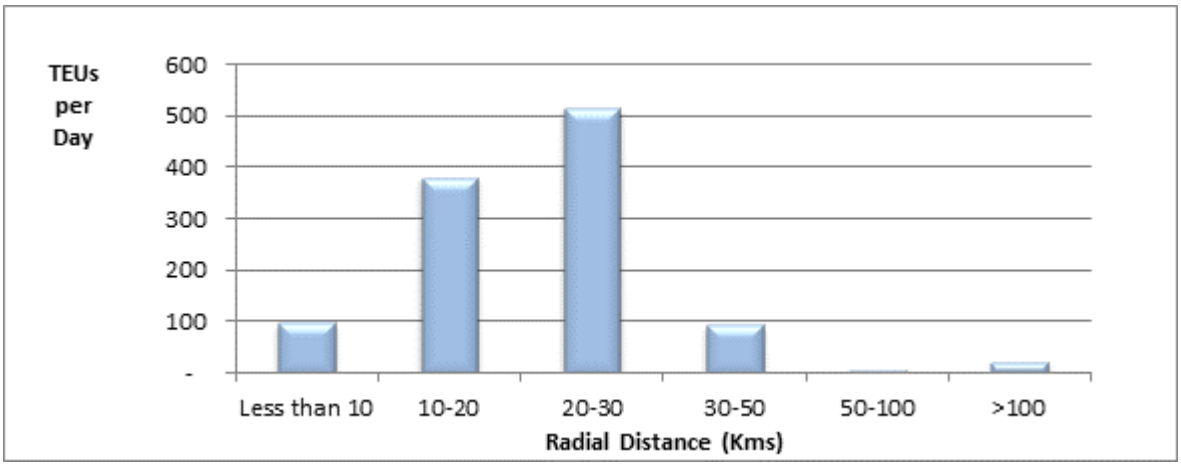


Table 22 - % of Container Volume (TEUs) by Radial Distance from Port to Unpack Location

Distance (Kilometres)	TEUs per Day	Percentage	Cumulative Percentage
Less than 10	98	9%	9%
10-20	380	34%	43%
20-30	513	46%	89%
30-50	95	9%	98%
50-100	3	0%	98%
>100	20	2%	100%
Total	1,108	100%	n/a

6.4.1 Road Only Mode of Transport

The distance profile of full import containers travelling by road set out in Figure 15 below does not differ materially from the previous distance profile for the totality in Figure 14 and Table 22 above.

Figure 15 - Radial Distance from Port - Import Container Unpack Location (Road-Only Mode)

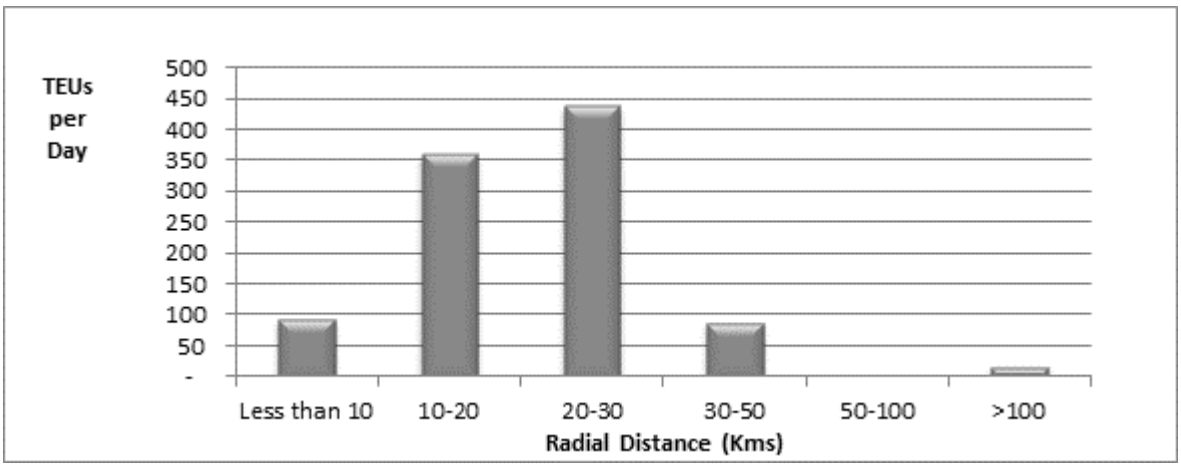


Table 23 – % of Container Volume (TEUs) by Radial Distance from Port to Unpack Location–Road Only

Distance (Kilometres)	TEUs per Day	Percentage	Cumulative Percentage
Less than 10	93	9.3%	9.3%
10-20	360	35.9%	45.2%
20-30	438	43.7%	89.0%
30-50	89	8.9%	97.9%
50-100	3	0.3%	98.2%
>100	18	1.8%	100.0%
Less than 10	**1,000**	**100.0%**	

6.4.2 Road and Rail Composite Mode of Transport

Containers moved from North Quay by rail to Forrestfield.

Figure 16 and Table 24 demonstrates that 96.1% of all the inbound full TEUs where rail constituted the prime leg of the journey from the Port were destined to unpack locations which were located between 20 and 30 kms from the Port. Forrestfield, Kewdale and Welshpool area accounted for 97% of unpack locations for full containers that travelled by road and rail composite mode during the full study period.

Figure 16 - Radial Distance from Port - Import Container Unpack Location (Road-Rail Composite Mode)

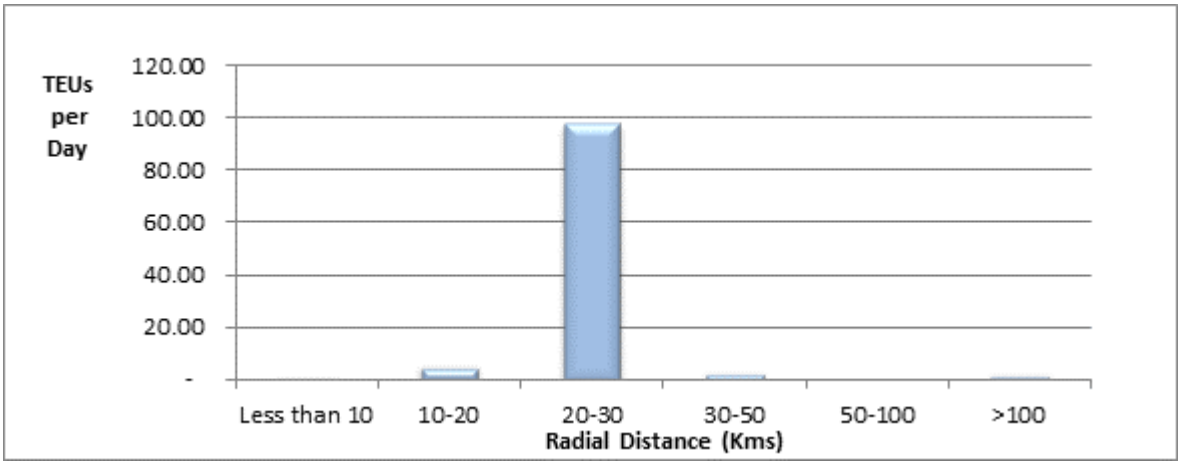


Table 24 - % of Container Volume (TEUs) by Radial Distance from Port to Unpack Location (Road-Rail Composit Mode)

Distance (Kilometres)	TEUs per Day	Percentage	Cumulative Percentage
Less than 10	0.55	0.5%	0.5%

10-20	5.2	4.8%	5.3%
20-30	98	90.8%	96.1%
30-50	2	2.2%	98.3%
50-100	-	0.0%	98.3%
>100	2	1.7%	100.0%
Total	**108**	**100.0%**	

6.5 ROAD TRANSPORT STAGING LOCATION

Table 25 analyses the top 10 locations used to stage import full and empty TEUs in Phase 1 and Phase 2 of the import trade logistics chain. The data from the full study indicates that 10 locations accounted for 98% of road transport staging activities. Three locations (North Fremantle, Welshpool and Kewdale), all key land transport hubs, between them account for nearly three quarters (73%) of the staging process. On an annual basis, some 255,102 TEUs are estimated to be staged at road transport staging locations as part of the Import Trade Cycle (Phase 1 and Phase 2 as shown previously in Table 17).

Table 25 – Major Road Transport Staging Locations in Import Trade Cycle

Ranking	Suburb	Post-code	SLA Name	SRS Name	TEUs (Sample)	TEUs (Annual)	Percent	Cumulative Percentage
1	NORTH FREMANTLE	6159	Fremantle (C) - Remainder	South West Metropolitan	4,805	78,342	47%	47%
2	WELSHPOOL	6106	Canning (C)	South East Metropolitan	1,410	22,989	14%	61%
3	KEWDALE	6105	Belmont (C)	South East Metropolitan	1,289	21,016	13%	73%
4	BIBRA LAKE	6163	Cockburn (C)	South West Metropolitan	931	15,179	9%	83%
	Total				**10,220**	**255,102**	**100.0%**	

7 EXPORT MOVEMENTS

This section of the report examines the movement of containers in the Export Trade Cycle (Phases 4 & 5) from a number of perspectives, namely:

- Movements by Stakeholder.
- Export Logistics Chain for Phase 4 Empty Containers and Phase 5 Full Containers.
- Export Pack Origins.
- Transport Mode and Distances.
- Road Transport Staging Location.
- Dwell Time.

All these elements are examined on an annualised basis other than the dwell time which is based directly on data gathered in the Study.

7.1 PHASE 4 AND PHASE 5 MOVEMENTS BY STAKEHOLDER

Table 26 profiles the estimated annual total TEU movements in Phase 4 and Phase 5 combined. Some 469,584 TEU-movements are estimated for Phase 4 and Phase 5 of the export logistics chain. Of these 36% were to the CTs (168,864 TEU-Movements), 36% to pack locations for packing (168,864 TEU-Movements) and 14.5% were to road transport staging locations. QAP and rail terminals made up the remainder (13.6% combined). A detailed breakdown of TEUs Movement between Business Types in Phase 4 and Phase 5 for both the study period and the annual estimation are displayed in Table C and Table D in Annexe 10.

Table 26 – TEUs Movements between Business Types (Annual Estimation) – Phase 4 and Phase 5

	To Business Type								
From Business Type	Container Terminal	Pack Location	FIT Inter-modal	NQRT Terminal	QAP	Road Transport Staging	Other Rail Terminal	Grand Total	**% Business Type Origin**
Container Park	-	126,413	-	17,180	39	22,350	507	166,489	**35.5%**
Container Terminal	-	1,936	-	-	-	375	-	2,311	**0.5%**
Pack Location	90,705	-	1,570	15,834	14,959	43,522	2,274	168,864	**36.0%**
FIT Intermodal	-	314	-	3,447	-	67	-	3,828	**0.8%**
NQRT Terminal	17,888	15,272	1,819	-	1,790	-	1,967	38,735	**8.2%**
QAP	16,447	39	-	-	-	387	-	16,873	**3.6%**
Road ransport Staging	43,824	22,417	-	-	85	1,391	-	67,717	**14.4%**
Other Rail Terminal	-	2,473	-	2,274	-	-	-	4,747	**1.0%**
Total	168,864	168,864	3,388	38,735	16,873	68,092	4,747	469,563	**100%**
% Business Type Destination	**36.0%**	**36.0%**	**0.7%**	**8.2%**	**3.6%**	**14.5%**	**1.0%**	**100%**	

7.2 EXPORT LOGISTICS CHAIN

The highlighted section of Figure 17 (derived from Figure 7 above) projects the flow of full Export Containers into the CTs after applying the logistics mix data from the Full Study to FP 2010/11 export trade data. It indicates during the year 168,864 TEUs would be received by the CTs, of which the most significant sources would be Export Pack locations 90,705 TEUs (53.7%) and Staging Points 43,824 (26%). The balance would derive from QAP and Rail in almost equal proportions (Table 27).

Figure 17 - Fremantle Ports Full Container Movement in Export Logistics Chain (TEU)

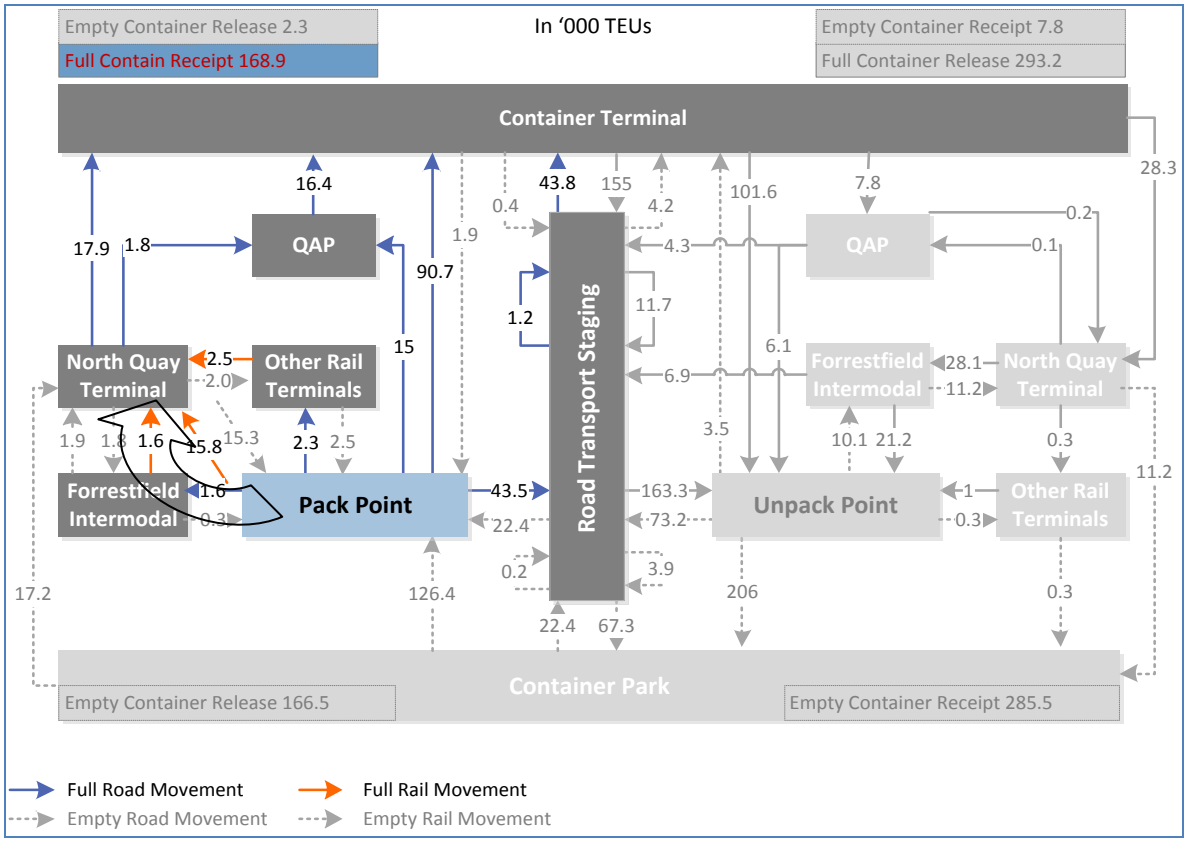


Table 27 –Phase 5 Full TEUs Movements to Container Terminals (Annual Estimation)

Movements to CT from	TEUs	Percent of Total
Pack Point	90,705	53.7%
NQRT Terminal	17,888	10.6%
QAP	16,447	9.7%
Road Transport Staging	43,824	26.0%
Total	**168,864**	**100.0%**

The highlighted section of Figure 18 (again derived from Figure 7 above) depicts the flow from CPs of empty containers to satisfy export demand by applying findings from the Full Study to 2010/11 FP trade data. This indicates 166,489 empty TEUs would leave the CPs. The most significant destinations would be export pack locations - 126,413 TEUs (75.9%) with Road Staging Points and Rail Terminals accounting for the balance (13.4% and 10.6% respectively) as shown in Table 28.

Figure 18 - Fremantle Ports Empty Container Movement in Export Logistics Chain (TEU)

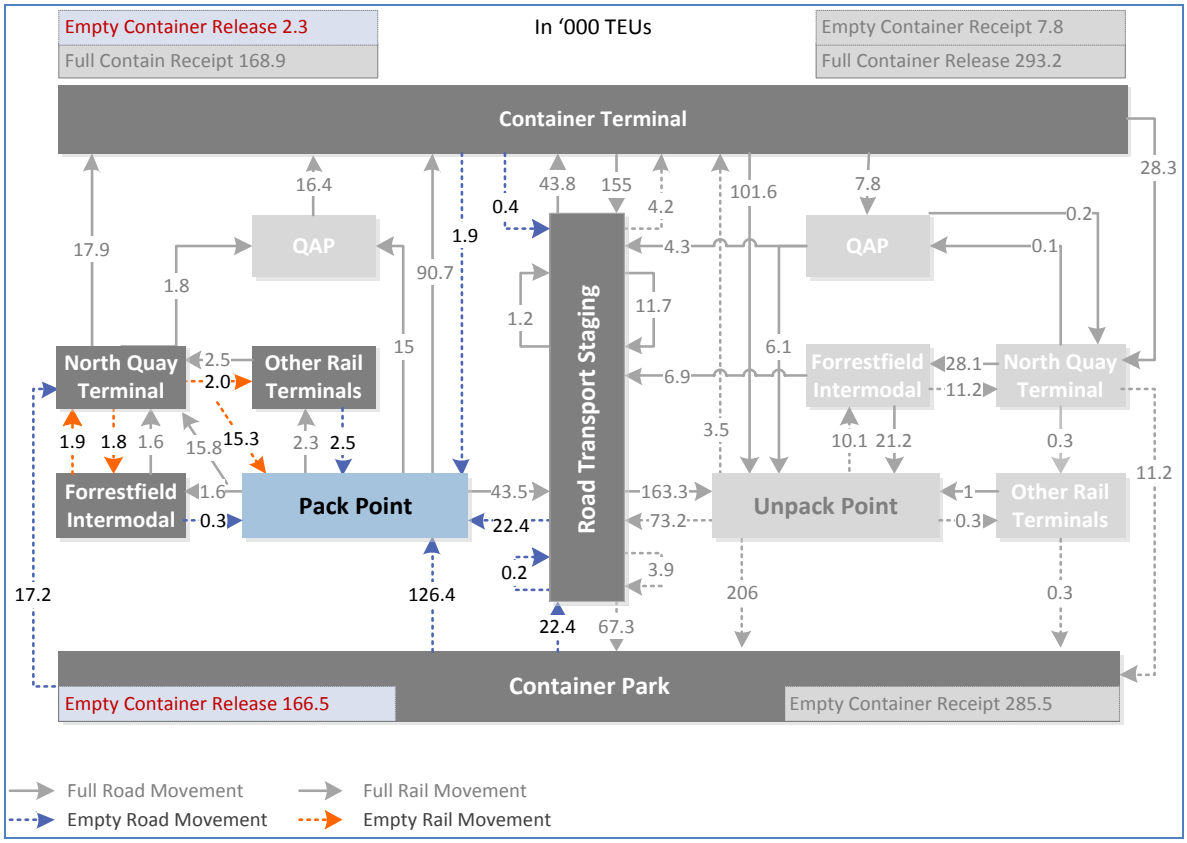


Table 28 –Phase 4 Empty TEUs Movements from Container Parks (Annual Estimation)

Movements from CP to	TEUs	Percent of Total
Pack Point	126,413	75.9%
NQRT Terminal	17,180	10.3%
QAP	39	min
Road Transport Staging	22,350	13.4%
Other Rail Terminal	507	0.3%
Total	**166,489**	**100.0%**

7.3 EXPORT PACK ORIGINS

7.3.1 Export Pack Location

As can be seen from Table 29 below, as with imports, the top 12 export packing locations accounted for over 70% of 5,586 TEUs from the 2 week Full Study. Henderson was the leading location and when combined with Forrestfield, North Fremantle and Kewdale accounted for half the export containers packed during the study.The Table also demonstrates that by contrast with the comparable import data only 9 of the 12 are located in Perth Metro and 3, accounting for over 6% of the export volume, are country districts.

The percentage of pack volume by locations has been applied to FP total full TEUs export trade in FY 2010/11 which permits an annual TEUs estimation per location also to be given in the table.

Table 29 – List of Top 10 Export Packing Locations and Volume (TEUs)

Ranking	Suburb	Post-code	SLA Name*	SRS Name*	TEUs (Study)	TEUs (Annual)	% of Total (Study and Annual)	Cumula-tive %
1	HENDERSON	6166	Cockburn (C)	South West Metropolitan	1,126	34,039	20.2%	20.2%
2	FORRESTFIELD	6058	Kalamunda (S)	East Metropolitan	833	25,181	14.9%	35.1%
3	NORTH FREMANTLE	6159	Fremantle (C) - Remainder	South West Metropolitan	513	15,508	9.2%	44.3%
4	KEWDALE	6105	Belmont (C)	South East Metropolitan	321	9,704	5.7%	50.0%
5	CANNING VALE	6155	Canning (C)	South East Metropolitan	286	8,646	5.1%	55.1%
6	WELSHPOOL	6106	Canning (C)	South East Metropolitan	184	5,562	3.3%	58.4%
7	KWINANA	6167	Kwinana (T)	South West Metropolitan	172	5,200	3.1%	61.5%
8	BIBRA LAKE	6163	Cockburn (C)	South West Metropolitan	153	4,625	2.7%	64.2%
9	(LOWER WESTERN)		(Name Witheld)	Remainder - Balance WA	146	4,414	2.6%	66.8%
10	BALCATTA	6021	Stirling (C) - Central	North Metropolitan	112	3,386	2.0%	68.9%
	Total				**5,586**	**168,864**	**100.0%**	

** SLA (Statistical Local Area) and SRS (Statistical Region Sector) based on Australian Bureau of Statistics Catalog Number 1216.0 - Australian Standard Geographical Classification (ASGC), July 2011. Refer Annexe 8 for a map showing the location and boundaries of Perth Metropolitan SLAs and SRS.*

Table 30 below analyses FP's full export annual TEUs volume by ABS SRS (WA suburbs or communities by SRS are categorised in Table K in Annexe 10). This analysis indicates:

- Almost half of FP's full export TEUs are packed in the SW Metropolitan area.
- A third of this volume is packed in the East or South East Metropolitan areas.
- Over 15% is packed in country regions with nearly 10% occurring in Lower Western WA.

While the share of traffic from country areas may be lower than might normally be expected it needs to be remembered the Full Study took place at the end of winter in a year still suffering from the effects of the earlier drought.

Table 30 – Annual Estimation of Pack Volume (TEUs) by ABS SRS

Statistical Region Sector (SRS)	Sum of TEU (Annual)	Percent
South West Metropolitan	72,945	43.2%
East Metropolitan	33,676	19.9%
South East Metropolitan	27,660	16.4%
Lower Western WA	15,659	9.3%
North Metropolitan	8,736	5.2%
Remainder - Balance WA	10,187	6.0%
Total	**168,864**	**100.0%**

A complete list of pack location with the associated categorisation by SLA and SRS is displayed in **Error! Reference source not found.**, Annexe 10 and the related Metropoitan boundaries and ocations are shown in Annexe 7.

In Figure 19 and Figure 20 the percentage of pack volume by locations has been applied to FP total full TEUs export trade in FY 2010/11 which permits an annual TEUs estimation per location also to be given by Statistical Local Area (ABS SLA: Catalog Number 1216.0 - Australian Standard Geographical Classification).

Based on the Full Study a complete list of pack locations with the associated categorisation by SLA and SRS is displayed in **Error! Reference source not found.**, Annexe 10.

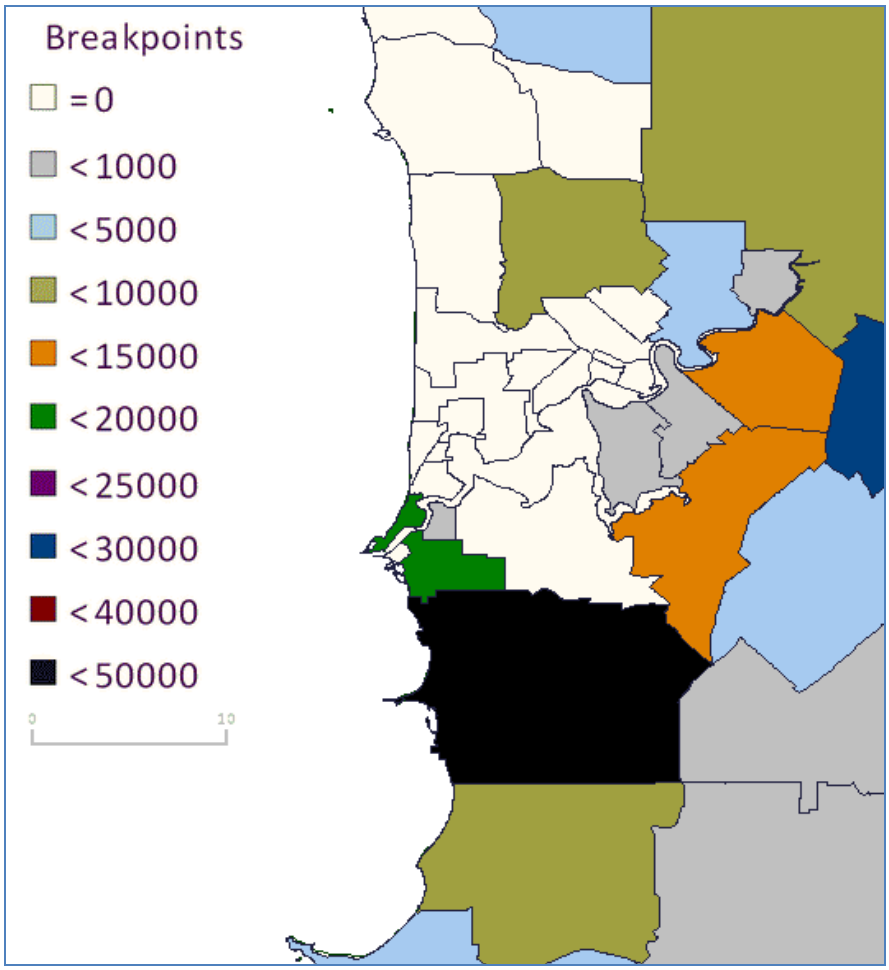
Figure 19 below applies the estimated FP full export container trade statistics by pack location for 2010/11 in Table 20 to suburbs by Statistical Local Area (ABS SLA: Catalog Number 1216.0 - Australian Standard Geographical Classification); this also illustrates the reduced concentration of container pack destinations in the Perth Metro area compared with the import unpack profile and the wider geographic spread of such locations.

Figure 19 - Pack Locations of Exports by Statistical Local Area

Note: Removed for Commercial in Confidence reasons

A more focussed analysis of the Perth Metro area in Figure 27 again reflects the concentration within this area of packing activities in North Fremantle, to the south of Fremantle and in Kewdale/Forrestfield area within the Perth Metro area.

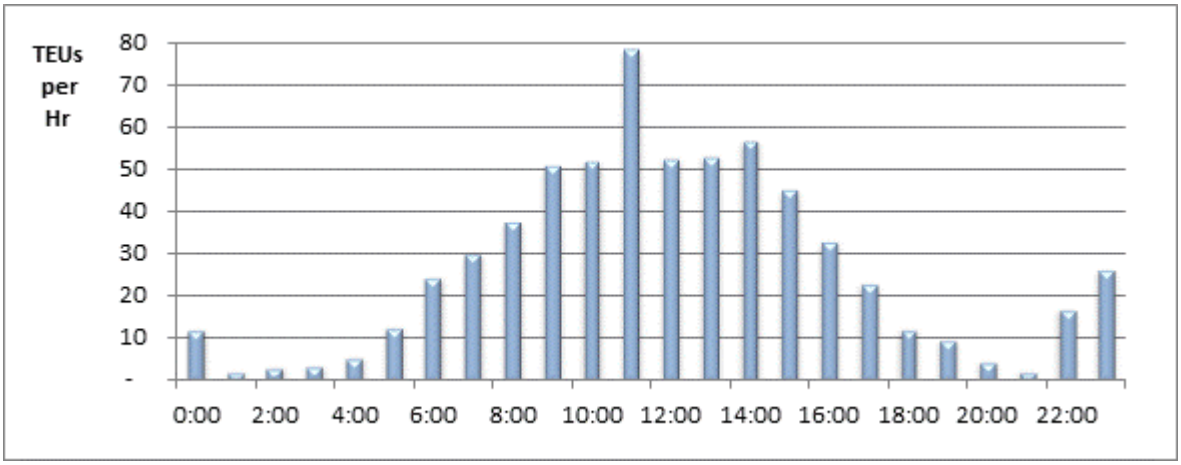
Figure 20 - Pack Locations of Exports by Statistical Local Area - Outer Perth Metropolitan Area



7.3.2 Pick up Time of Day at Pack Location

Figure 21 below sets out the distribution by time of day when full TEUs are picked up from pack locations. The pickup volume is relatively consistent from 0900 to 1500 with a midday peak that is driven in part by rail schedules (discussed previously in Section 4.3.1).

Figure 21 - Full Container Pick Up Time of Day from Pack Location



7.4 TRANSPORT MODE AND DISTANCES FROM PORT

Table 31 and Figure 22 below profile the distances from the Port at which export containers were packed. The majority of TEUs (75%) were packed between 10 and 50 kms from the Port. 10% were packed within 10kms from the Port and approximately 16% were packed in excess of 50 kms away.

Figure 22 - Radial Distance from Port - Export Container Pack Location (TEUs per an Average Day)

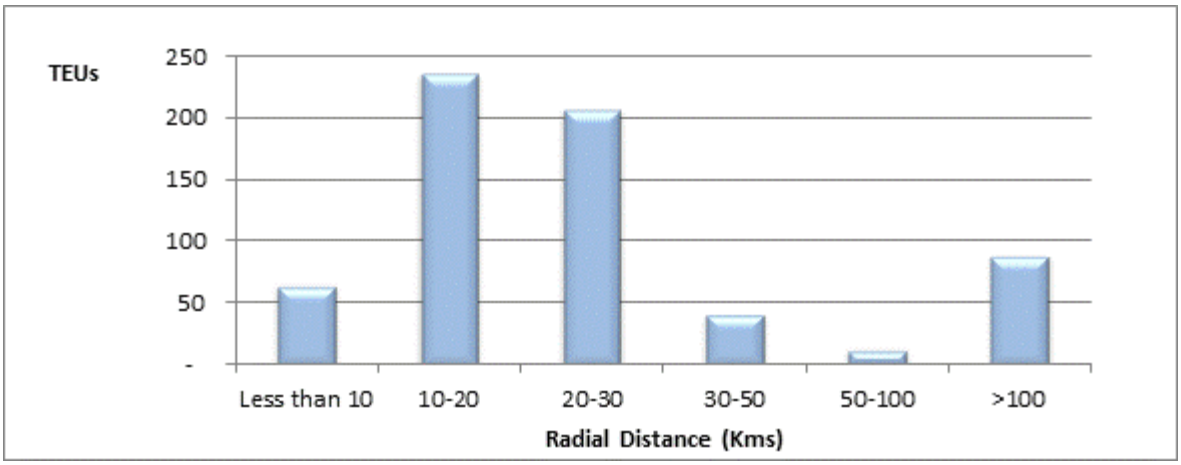


Table 31 -% of Container Volume (TEUs) by Radial Distance from Port to Pack Location

Distance (Kilometres)	TEUs per Day	Percentage	Cumulative Percentage
Less than 10	64	10%	10%
10-20	236	37%	46%
20-30	206	32%	78%
30-50	40	6%	85%
50-100	11	2%	86%
>100	88	14%	100%
Total	646	100%	10%

7.4.1 Road Only Mode of Transport

Figure 23 profiles the distance from the Port of the point of packing for export containers moved to the terminals by road. Given nearly 90% of export movements were by road it is not surprising this profile differs little from the equivalent for total movements - the only exception is the increased percentages in shorter distance categories (less than 10 kms and 10 - 20 kms) for export containers.

Figure 23 - Radial Distance from Port to Export Container Pack Location (Road Only Mode TEUs)

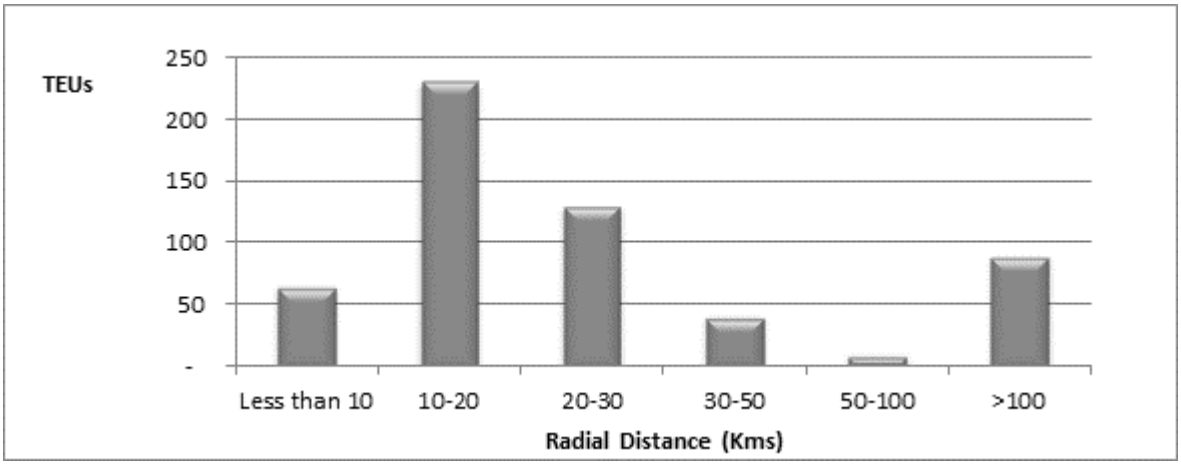


Table 32 – % of Container Volume (TEUs) by Radial Distance from Port to Pack Location (Road Only)

Distance (Kilometres)	TEUs per Day	Percentage	Cumulative Percentage
Less than 10	63	11.5%	11.5%
10-20	223	40.8%	52.3%
20-30	126	23.0%	75.3%
30-50	40	7.3%	82.6%
50-100	9	1.6%	84.1%
>100	87	15.9%	100.0%
Total	547	100.0%	

7.4.2 Road and Rail Composite Mode of Transport

Figure 24 demonstrates clearly that 86.3% of all the outbound full TEUs movements where rail constituted the prime leg of the journey to the Port originated in packing locations between 20 and 30 kms from the Port, while around 10.6% were packed within 10 to 20 kms of the Port and a handful (3%) beyond 50 kms. The only significant other locations were Kwinana and a locality north of Perth[4].

[4] It should be noted that while there is a rail service handling Kalgoorlie based freight, there was minimal activity on this service during the two weeks of the study period.

Figure 24 - Radial Distance from Port to Export Container Pack (Road-Rail Composite Mode TEUs)

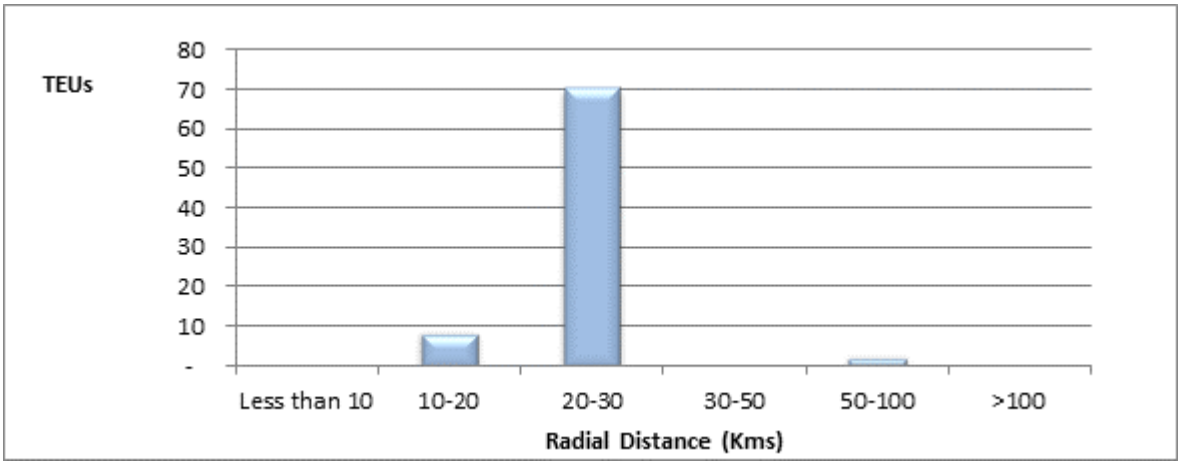


Table 33 - % of TEUs by Radial Distance from Port to Pack (Road-Rail Composite Mode)

Distance (Kilometres)	TEUs per Day	Percentage	Cumulative Percentage
Less than 10	-	0.0%	0.0%
10-20	11	10.6%	10.6%
20-30	86	86.3%	97.0%
30-50	-	0.0%	97.0%
50-100	3	3.0%	100.0%
>100	-	0.0%	100.0%
Total	99	100.0%	

7.5 ROAD TRANSPORT STAGING LOCATION

Table 34 below profiles the staging locations for full export TEUs in the Perth Metropolitan area. 2,485 TEUs staged at road transport staging locations took place in North Fremantle (74%). When combined with Kewdale, Bibra Lake and the Kwinana area, these four locations accounted for 90% of export staging activity. On an annual basis, some 68,076 TEUs are estimated to be staged at road transport locations as part of export trade in Phase 4 and Phase 5 of the Export Trade Cycle cycle as shown in Table 26. The pro rata annual estimate is based on the 2 week study.

Table 34 - Key Export Staging Locations by Suburb

Rank	Suburb	Postcode	SLA Name	SRS Name	TEU (Study)	TEU (Annual)	Percent	Cumulative Percentage
1	NORTH FREMANTLE	6159	Fremantle (C) - Remainder	South West Metro	1,830	50,132	74%	74%
2	KEWDALE	6105	Belmont (C)	South East Metro	164	4,493	7%	80%
3	BIBRA LAKE	6163	Cockburn (C)	South West Metro	125	3,424	5%	85%
4	KWINANA AREA	616X		South West Metro	124	3,397	5%	90%
	Total				**2,485**	**68,076**	**100.0%**	

8 CONTAINER TERMINALS

This section of the report examines the activities of the container terminals from a number of perspectives, namely:

- Location.
- Volume of container activity.
- Equipment type.
- Day of container exit or entry.
- Time of day for container exit or entry.

All the data in this segment of the report is based directly on the 14 day Full Study period.

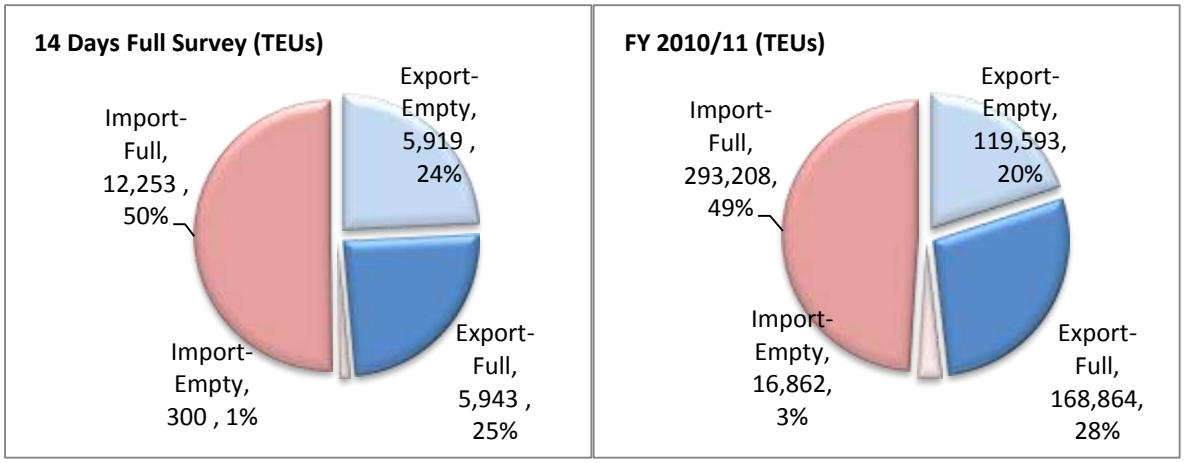
8.1 TERMINALS

Container terminals at Fremantle Port are operated by DP World (Berths 4 to 6) and Patrick (Berth 7 - 10). Annexe 1 illustrates the location of these two container terminals. The map also shows the common user Berths 11, which is used to service multi purpose vessels, and which carry limited numbers of containers with other break bulk and bulk cargo. During the 14 day Full Study only 68 TEUs or 0.4% of the total TEUs were shown to arrive or exit the common user berths by road operators who were part of the study. The findings in this section derived exclusively from the data collected from Patrick and DP World and excluded the insignificant number of containers arriving or exiting Berths 11 or very occasionally 12.

8.2 FULL AND EMPTY CONTAINERS

Figure 25 compares the total container volume moving in or out of terminals in the 14 day full study period with the annual data from the Financial Year 2010/11. Over the study period, the two major container terminals handled 16,319 containers representing 24,415 TEUs. The Import full container volumes as a percentage of the total number of containers for the 14 day Full Study and for FY 2010/11 were almost identical (50% and 49% respectively).

Figure 25 – Volume Container Terminals – Comparison between 14 Day Full Study and FY 2010/11(TEUs)



In contrast, there was a lower percentage of full export containers during the Full Study compared with FY 2010/11(25% versus 28%).

It can also be seen that that the mix between full and empty containers from the Full Study period was different to the FY 2010/11. A larger percentage of empty export containers entered the terminal during the Study period than during the previous financial year (24% versus 20%), while the import empty percentage fell from 3% in FY 2010/11 to 1% in the Study period. As discussed in Section 4.2.1 Seasonality, the proportion of import and export, full and empty containers vary at different time of year depending on import and export trade patterns.

The total volume of TEUs in the full study period was equivalent to 4.1% of the annual volume in the FY 2010/11 as can be seen in Table 7.

Table 35 - Total Volume at Container Terminals - 14 Days

Movement Type	14 Day Full Study Number of Containers	14 Day Study Period TEUs	FY 2010/11 TEUs	14 Day Study Period TEUs as % of FY 2010/11
Import-Empty	241	300	16,862	1.8%
Import-Full	8,193	12,253	293,208	4.2%
Export-Empty	3,532	5,919	119,593	4.9%
Export-Full	4,353	5,943	168,864	3.5%
Total	**16,319**	**24,415**	**598,527**	**4.1%**

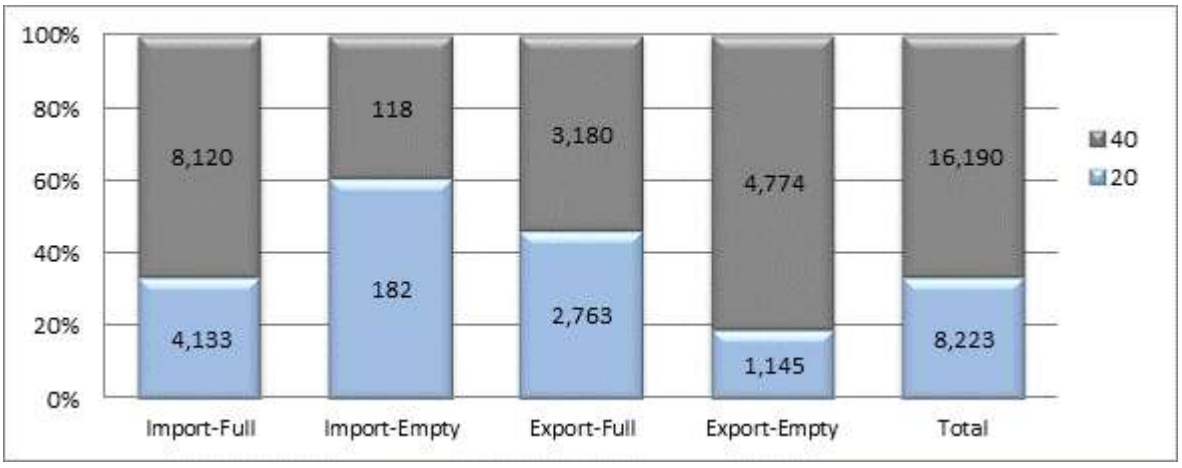
The sample data collected in the full study period was used to analyse the container movements at the container terminals in this section. Should volumes and mix of containers vary significantly in the future from those existing at the time of the full study, data on operations at the terminal such as time of day or day of week may also be different from that prevailing during this full study period. Caution must therefore be exercised when drawing any implications from the results presented.

8.3 EQUIPMENT TYPE AND WEIGHT

8.3.1 Container Size

Figure 26 provides a breakdown of equipment type at the container terminals for the Full Study. In TEUs terms 66% of the overall volume was made up of 40 foot containers as it was for full imports - by contrast for full export 40 foot containers the proportion was only 54% in TEUs terms, whereas for export empty containers it was 81%.

Figure 26 - Proportion of Equipment Type at Container Terminals (TEUs)



8.3.2 Container Type – High Cube and Standard

Figure 27 below illustrates the breakdown of high cube and standard container volume during the Full Study in TEU terms. The classification of high cube and non-high cube container based on ISO code is displayed in Table H, Annexe 10. Both import full TEUs and export full TEUs have a slightly greater proportion of High Cube TEUs compared with standard TEUs (56% and 58% of the total respectively) as can be seen in Table 36. The imbalance of container volume between imports and exports resulted in a higher proportion of High Cube TEUs being repositioned to container terminals for export empty than standard TEUs (53% High Cube versus 47% Standard).

Figure 27 - Breakdown of High Cube and Standard Container Type at Container Terminals (TEUs)

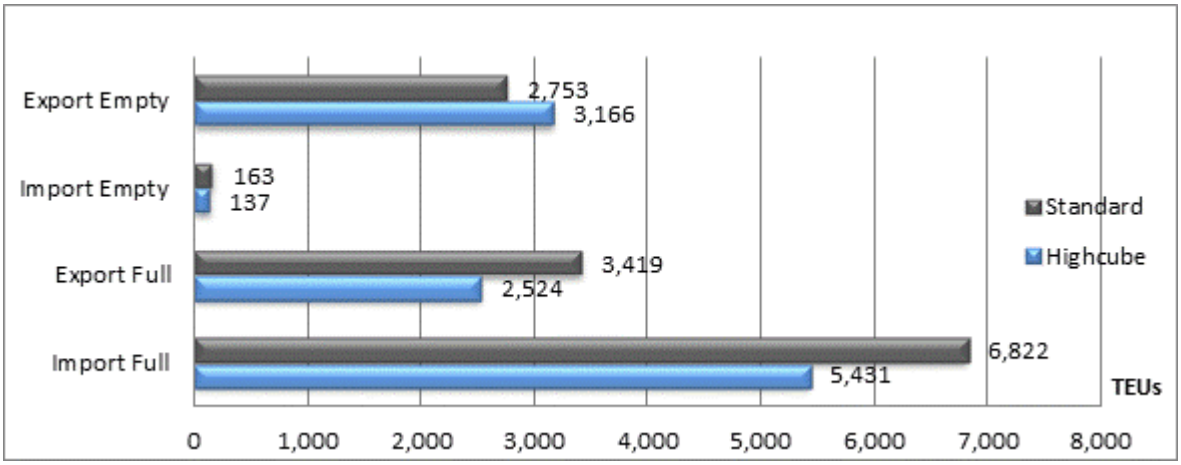


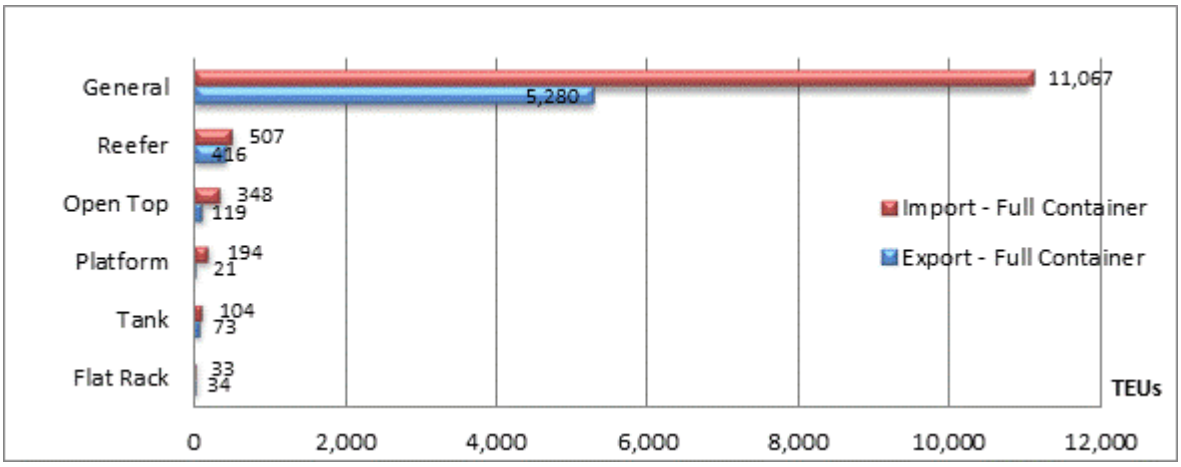
Table 36 –% of High Cube and Standard Containers at Container Terminals

Container Type	Import Full	Export Full	Import Empty	Export Empty	Overall
Standard	56%	58%	54%	47%	54%
High Cube	44%	42%	46%	53%	46%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

8.3.3 Container Type – ISO Code Classification

Figure 28 below illustrates the breakdown of container type by basic ISO code classification during the Full Study (see the classification and description of each container type in Table G and Table H, Annexe 10). General purpose containers made up 90% of the total volume (TEUs). Refrigerated, open top, platform, tank and flat rack containers made up the remaining 10%. The figure also highlights an imbalance of container volume and so demand between imports and exports in particular in the general, open top and platform categories.

Figure 28 - Breakdown of Container Type at Container Terminals (TEUs) – Full Containers



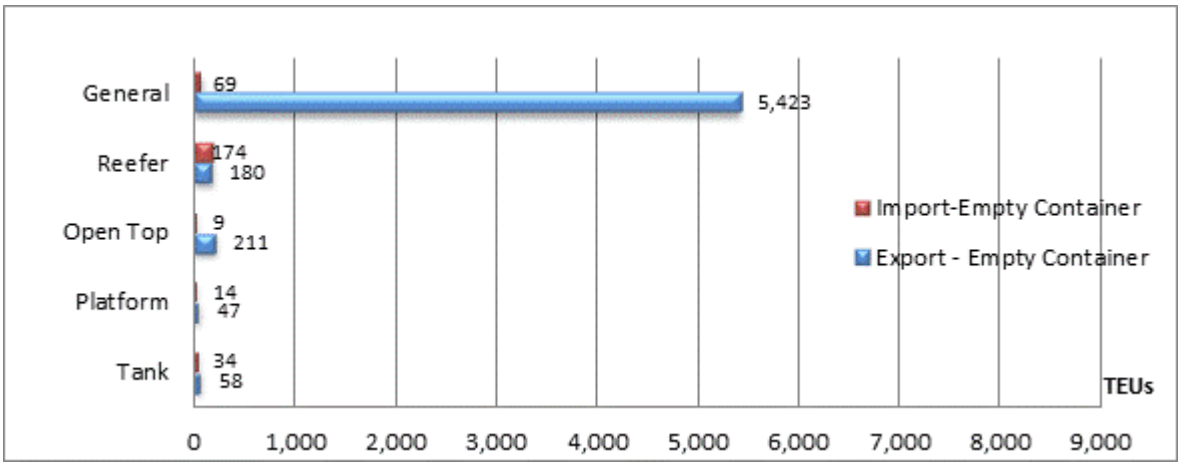
Dangerous goods made up 3% of the full Teus moving via FP CTs during the Full Study period (Table 37).

Table 37 - % of Dangerous Goods Containers at Container Terminals(TEUs)

Container Type	Import	Export	Total
Dangerous Goods	322	216	538
Total Full TEUs	12,253	5,943	18,196
Percentage of Total	**2.6%**	**3.6%**	**3.0%**

Figure 41 shows that the excess General and Open Top containers are repositioned back Empty to the container terminals for export.

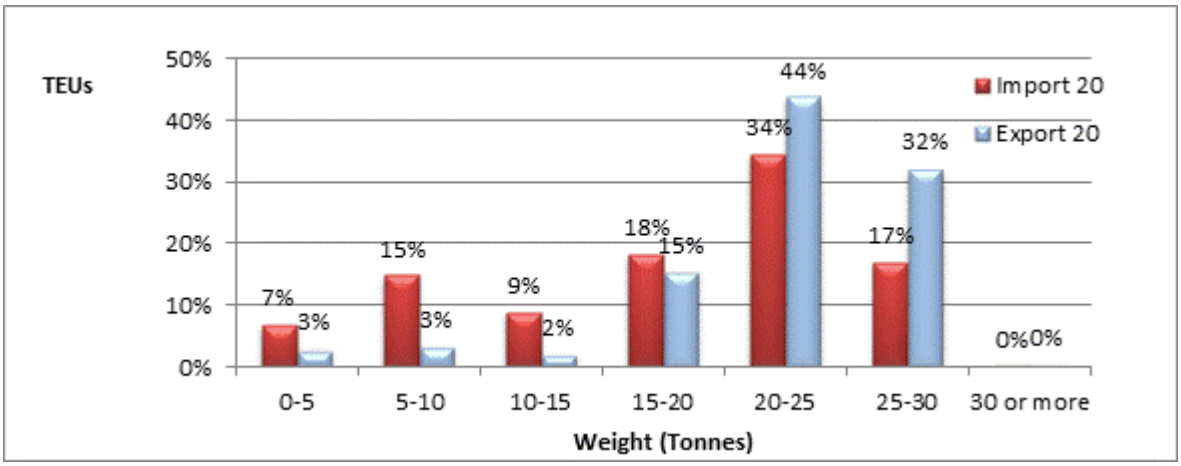
Figure 29 - Breakdown of Container Type at Container Terminals (TEUs) – Empty Containers



8.3.4 Container Weight

Figure 42 demonstrates that the highest proportion of both import and export 20 foot full containers weighed between 20 - 25 metric tonnes (34% and 44% of the total respectively).

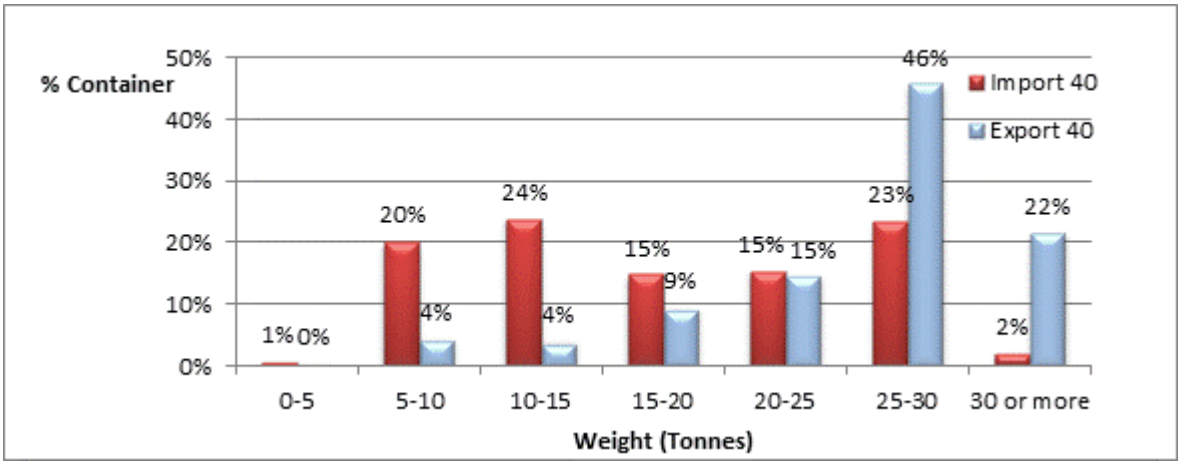
Figure 30 – Full 20 Foot Container Weight at Container Terminals



- Average all up weight of 20 foot import container = 17.6 tonnes.
- Average all up weight of 20 foot export container = 22.0 tonnes.

Figure 31 indicates that 40 foot import containers were relatively evenly distributed across all weight categories between 5 and 30 tonnes (15% to 24%). 40 foot export container weights, however, were concentrated (more than two thirds) over 25 tonnes.

Figure 31 - Full 40 Foot Container Weight at Container Terminals

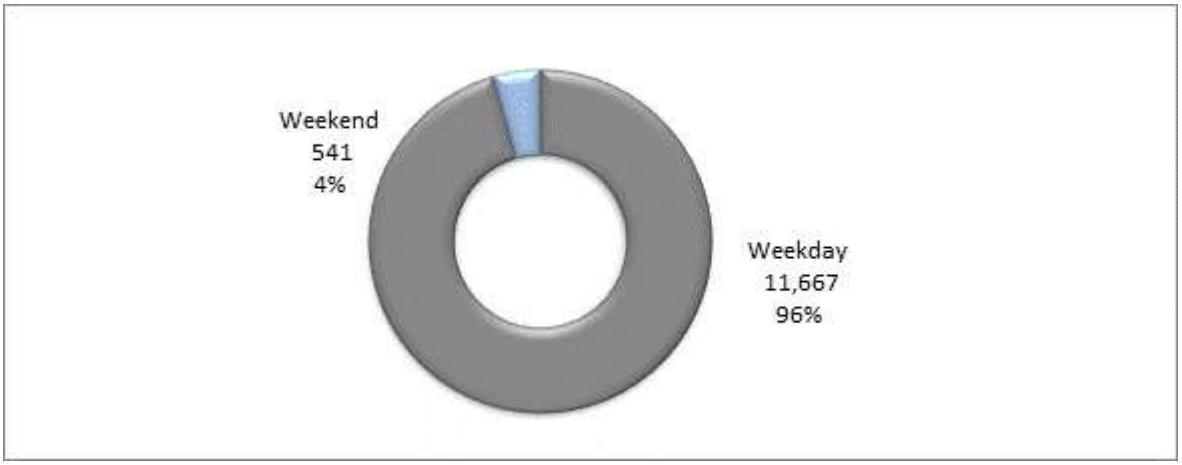


- Average weight of 40 foot import container = 17.4 tonnes.
- Average weight of 40 foot export container = 24.9 tonnes.

8.4 TERMINAL DAY OF EXIT AND ENTRY

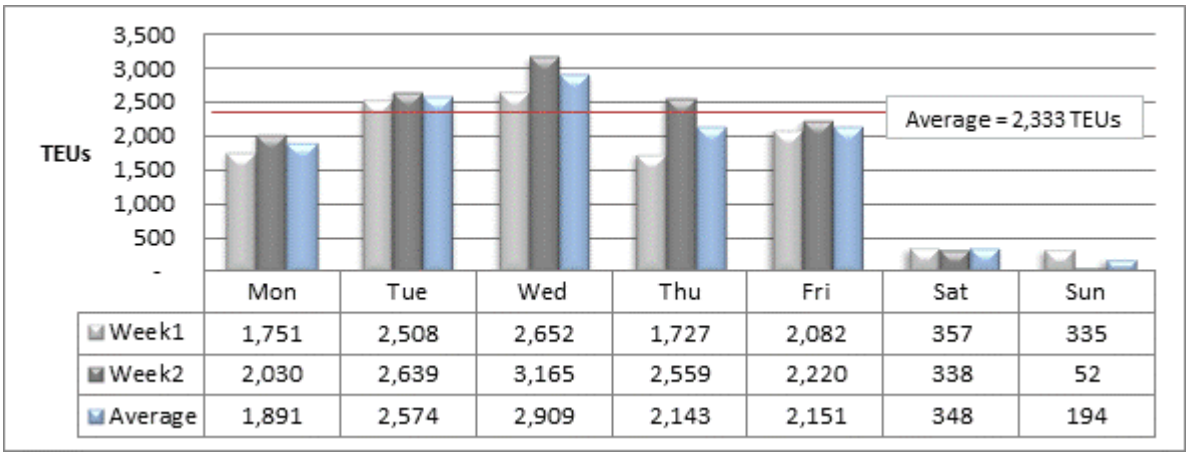
Figure 32 presents the proportion of TEUs volume handled at the two container terminals on weekdays compared with weekends. 96% of TEUs volume entered or exited the terminal during the weekdays.

Figure 32 - Proportion of Week End and Week Days Volume at Container Terminals (TEUs per Week)



From Figure 33, the total volume by TEUs handled on the 10 weekdays was 23,333 providing a daily weekday average of 2,333 TEUs. A total of 1,082 TEUs were handled on the weekends providing a daily average on weekends of 270 TEUs.

Figure 33 – Average Daily Volume at Container Terminals (TEUs)



	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Week1	1,751	2,508	2,652	1,727	2,082	357	335
Week2	2,030	2,639	3,165	2,559	2,220	338	52
Average	1,891	2,574	2,909	2,143	2,151	348	194

- Total TEUs handled on weekdays = 23,333, weekday average = 2,333.
- Total TEUs handled on weekends = 1,082, weekend daily average = 270.

The busiest day of the week for overall TEUs handling was Wednesday when the volume was some 25% higher than the weekly average (Table 38). This may be explained by the fact that the

majority of vessel cut offs in the two weeks of the Full Study took place in the second half of the week, putting pressure on exporters to deliver their containers prior to cut off and on carriers to move empties to the CTs for shipment overseas. However in such circumstances the low volume of movements on Thursday in Week 1 appear anomalous. The breakdown of the average daily volume for both import and export, full and empty TEUs is discussed below in Section 8.4.1 and Section 8.4.2.

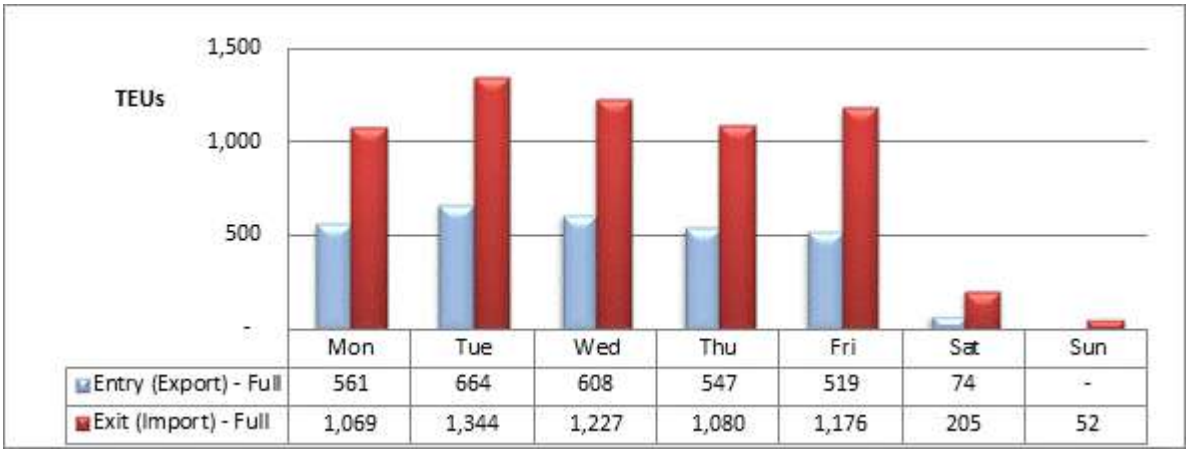
Table 38 – Degree of Variation from Weekday Daily Average at Container Terminals

Mon	Tue	Wed	Thu	Fri
-19%	+10%	+25%	-8%	-8%

8.4.1 Day of Exit and Entry – Full TEUs Import and Export

Full TEUs entry and exit at the container terminals is displayed in Figure 34. The busiest day at the container terminals for full TEUs arrival and departure was Tuesday where an average of 664 TEUs per day arrived at the container terminals and an average of 1,227 TEUs departed. The least busy weekday for import full TEUs was Monday (1,069 TEUs) while the least busy weekday for export full TEUs was Friday (519 TEUs).

Figure 34 – Average Daily Full TEUs Entry and Exit at Container Terminals

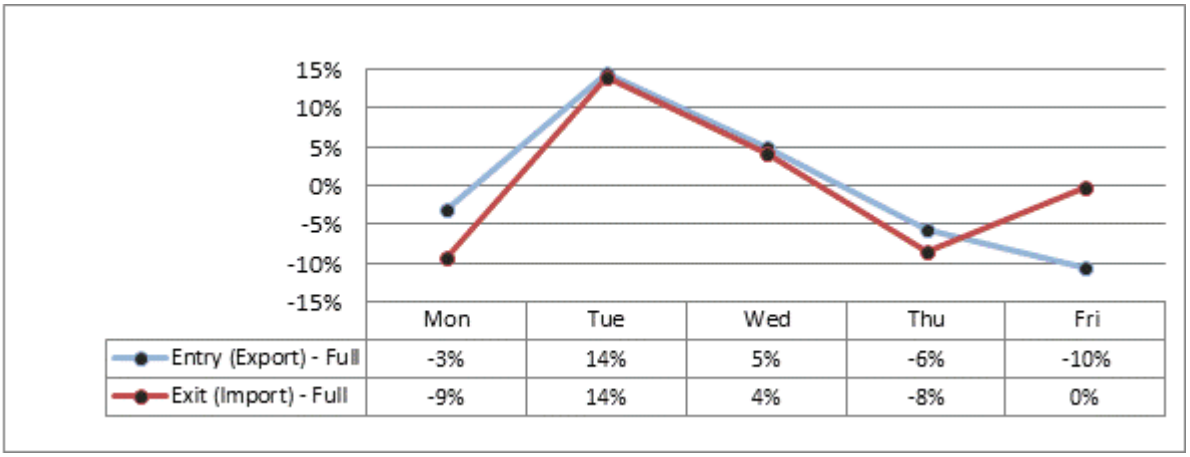


	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Entry (Export) - Full	561	664	608	547	519	74	-
Exit (Import) - Full	1,069	1,344	1,227	1,080	1,176	205	52

- Total Full Export TEUs handled on weekdays (10 Days) = 5,796, weekday average = 580.
- Total Full Import TEUs handled on weekdays (10 Days) = 11,791, weekday average = 1,179.

Figure 35 displays the degree of variation from the weekday daily average for full import and export containers. The volume of full containers (TEUs) entering or exiting the terminals varied between -10% and +14%.

Figure 35 – Full TEUs Entry and Exit at Container Terminals - Degree of Variation

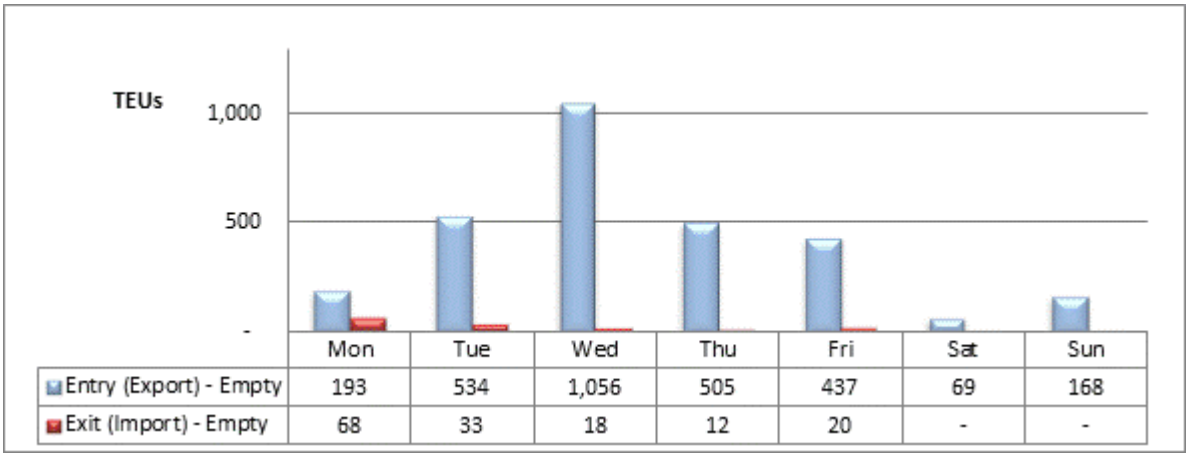


	Mon	Tue	Wed	Thu	Fri
Entry (Export) - Full	-3%	14%	5%	-6%	-10%
Exit (Import) - Full	-9%	14%	4%	-8%	0%

8.4.2 Day of Exit and Entry – Empty TEUs Import and Export

The volume of empty containers entering or exiting the terminals varied greatly during the week as displayed in Figure 36. This was driven by the empty export TEUs. Container parks and container terminals jointly plan to reposition empty containers typically in bulk movements in response to the shipping line cut off schedule and at the same time trying to avoid Monday and Friday when the preference is to focus on the normal R&D activities. During the period of the Full Study, empty export TEUs peak operations occurred mid-week on Wednesday and the quietest day of operation was on Monday. The former may be a result of the pattern of vessel cut-offs during the Full Study mentioned in relation to Figure 45 above.

Figure 36 - Average Daily Empty TEUs Entry and Exit at Container Terminals



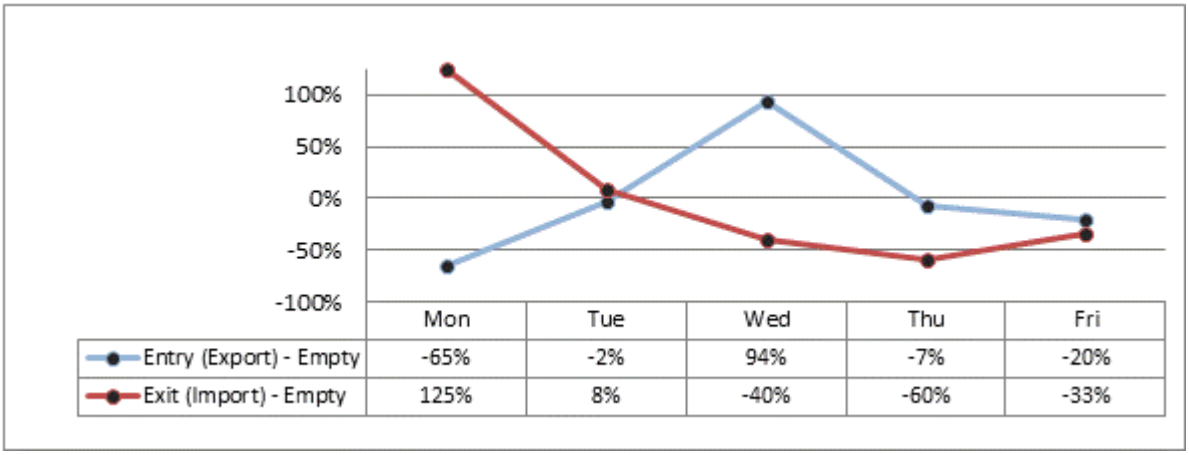
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Entry (Export) - Empty	193	534	1,056	505	437	69	168
Exit (Import) - Empty	68	33	18	12	20	-	-

- Total Empty Export TEUs handled on weekdays (10 Days) = 5,446, weekday average = 545.
- Total Empty ImportTEUs handled on weekdays (10 Days) = 300, weekday average =30.

Figure 49 illustrates the degree of variation from weekday daily average volumes for empty TEUs import and export – 30 and 545 respectively. During the period of the study, empty container volume *entering* the terminals varied from-65% to +94% of the weekday daily average volume. Volumes were quite stable on Tuesday, Thursday and Friday.

The variation of empty container volume *exiting* the terminals ranged between -60% and +125% of the weekday average *exiting* volume. Peak volumes relating to this group of containers occurred on Monday where the volume jumped to over 100% of the average. It should be noted that the volume of empty containers exiting the terminal was very low (300 TEUs) when compared with the volume entering (5,919 TEUs).

Figure 37 – Empty TEUs Entry and Exit at Container Terminals - Degree of Variation



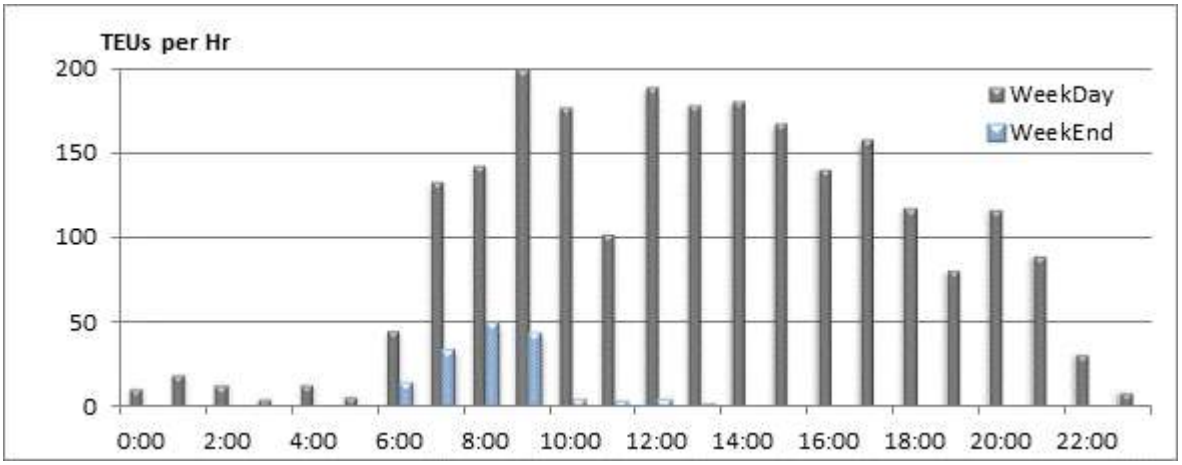
	Mon	Tue	Wed	Thu	Fri
Entry (Export) - Empty	-65%	-2%	94%	-7%	-20%
Exit (Import) - Empty	125%	8%	-40%	-60%	-33%

8.5 TERMINAL TIME OF EXIT AND ENTRY

8.5.1 Terminal Time of Exit and Entry - Overall

Both container terminals operate 3 shifts on weekdays. DP World morning shift is 0600 – 1400, evening shift: 1400 – 2200, and night shift 2200 – 0600. Receival and Delivery, for transport operators, is usually (and during the period of this study was) only available from 0600 - 2259. At Patrick, all shifts start and finish one hour later than at DP World and, similarly, standard Receival and Delivery activity is from 0700 - 2359. Figure 38 displays the distribution of container volume entering or exiting the container terminals over the different times of day. Between 0900 and 1600, a relatively stable average volume of 175 TEUs per hour was handled. The peak hour of weekday operations was in the morning between 9am to 10am at 200 TEUs per hour. A sharp drop can be seen between 11am and 12pm coinciding with the morning shift meal break. In this period the terminals handled an average of 100 TEUs or half of the peak hour volume. Annex 11, Table P provides a detailed table for TEUs (import and export, full and empty) moving into and out of the terminals by hour of the day for the Full Study period, while Tables Q & R provide a similar separate analysis for total weekday and weekend movements respectively.

Figure 38 - Container Terminals Receival & Delivery Time of Day - Overall

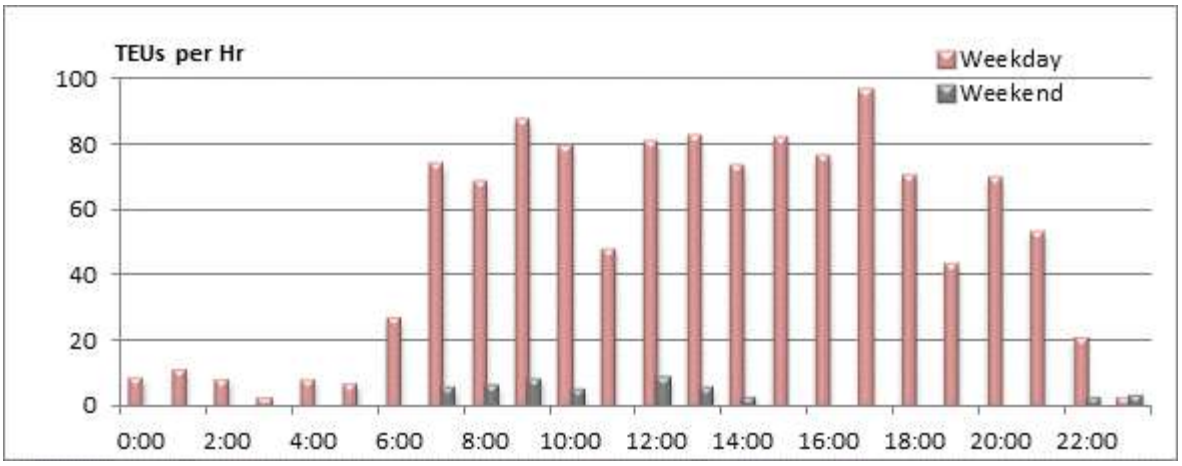


8.5.2 Terminal Time of Exit – Full Imports

Figure 39 demonstrates the volume distribution of Import Full containers exiting the container terminals at different times of day. Full containers exited the container terminals at a relatively stable rate of approximately 80 TEUs per hour during the normal operating hours. The peak hour was between 1700 to 1800, i.e. just prior to the normal evening meal break, when the volume approached 100 TEUs per hour. This peak late in the day is also likely to be related to the high incidence (c 34%) of overnight staging of import containers (refer Table 28 in Section 6.6.2 above).

A small volume of import full containers were picked up from the terminals during the weekend at less than 10 TEUs per hour during the Full Study period.

Figure 39 - Time of Exit from Container Terminals - Import Full TEUs

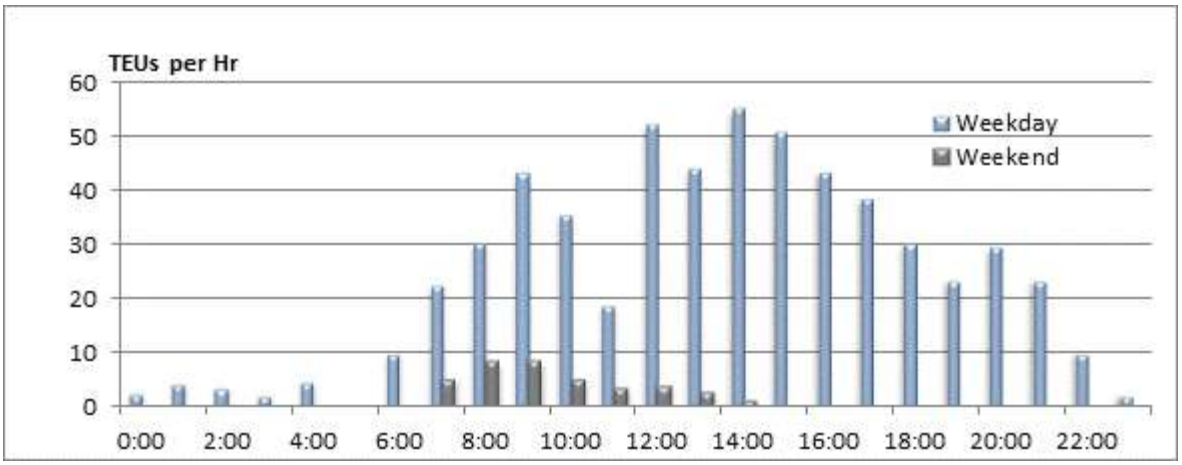


8.5.3 Terminal Time of Entry – Full Exports

Figure 40 shows time of day pattern for Full Export TEUs arrivals at the terminals. The arrival rate ranged from 20 TEUs per hour to 55 TEUs per hour from 0700 to 2100. It can be seen that the volume built up from 0600 at the opening of DP World to peak at 0900 then dropped off towards the lunch hour. The arrival volume picked up again after the lunch hour to peak at 1400 and then steadily declined apart from a slight surge at 2000.

A small volume of Export Full TEUs were delivered to the terminals on the weekend, mainly on Saturday as shown previously in Figure 34 - at a rate of less than 10 TEUs per hour.

Figure 40 - Time of Entry at Container Terminals - Export Full TEUs



8.5.4 Terminal Time of Exit – Empty Imports

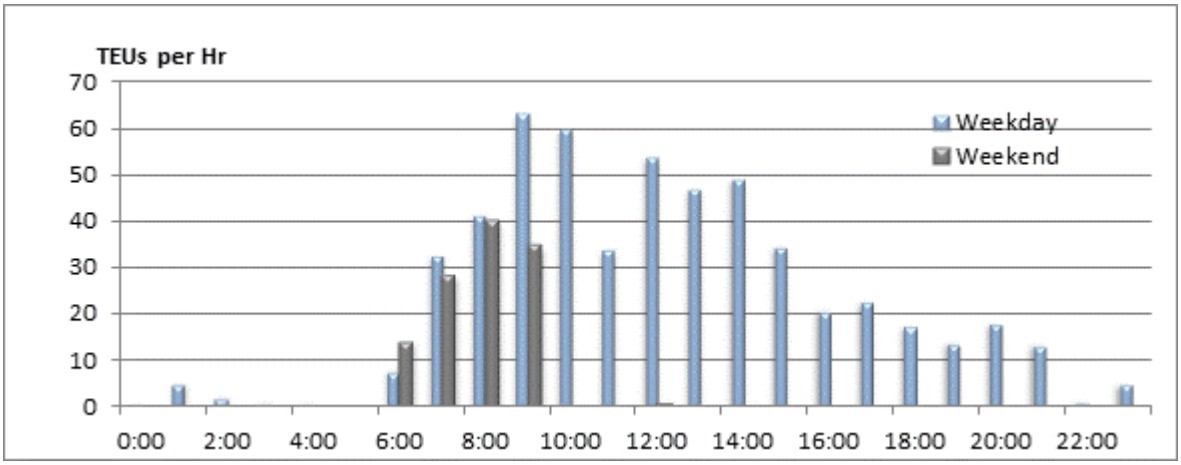
The volume of empty import TEUs during the study period was small (300 TEUs). These empty import containers left the terminals at the rate of less than 6 TEUs per hour. Consequently a meaningful pattern can not be determined from such a small population.

8.5.5 Terminal Time of Entry – Empty Exports

The time of entry for empty export TEUs at container terminals is illustrated in Figure 41. The average rate of weekday receipt from 0700 to 1800 was 42 TEUs per hour. The individual hourly rate varied quite significantly from this average. It peaked between 0900 and 1100 at more than 60 TEUs per hour. During the late afternoon into the night from between 1600 to 2200 the arrival rate was around 20 TEUs per hour.

Container terminals received a significant volume of empty TEUS for export up to 1000 during the weekend. In this period it was at a similar rate to that of weekday receipts or approximately 30 TEUs per hour. According to the qualitative discussion with the terminal operators, these empty export volume appear to be largely due to bulk runs.

Figure 41 - Time of Entry at Container Terminals - Export Empty TEUs



9 EMPTY CONTAINER PARKS

This section of the report examines the activities of the Empty Container Parks from a number of perspectives, namely:

- Empty Container Park Locations.
- Volume compared with container terminals.
- Equipment type.
- Day of entry or exit.
- Time of entry or exit.

All the data in this segment of the report is based directly on the 14 day Full Study period.

9.1 EMPTY CONTAINER PARK LOCATIONS

This section reports the container volume profiles across 10 empty container park locations. The empty container park is a critical category of facilities in the container supply chain. It functions as a storage and maintenance depot, receiving empty containers on de-hire and releasing empty containers to the export container chain, as well as container repair and food grade preparation.

An exception however exists for Cargolink. where certain types of 40 foot containers are accepted for dehire for the sole purpose of repositioning to CTs for export in coordination with the shipping lines. Containers are not rehired.

The location of the 9 Port precinct container parks are shown in the Port Precinct map in Annexe 1. Another container park, included in this study, is located off Port in the Forrestfield area adjacent to the FIT. This off-port container park is approximately 35 kilometres by road from the Port and it can be accessed by both road or by rail.

9.2 CONTAINER VOLUME AT CONTAINER PARKS

Table 39 shows the total empty container volume at the 10 container parks locations that participated in the study. Over the 14 days, these container parks handled 15,335 containers which was equivalent to 23,068 TEUs, a weekly average of 11,534 TEUs. Both container volume and TEU volume are just above 94% of the total volume shown at the container terminals. The reasons for the differences have been discussed previously in Section 3.5.

Table 39 - Total Volume at Container Parks - 14 Days

	Containers	TEUs
CP Volume	15,335	23,068
CT Volume	16,319	24,415
CP Weekly Average	7,667.5	11,534
CT Weekly Average	8,159.5	12,207.5

CP as % of CT	94%	94%

Figure 42 provides a breakdown of TEU volume at the container parks in four categories - Dehire, Collection, Repositioning Export and Repositioning Import.

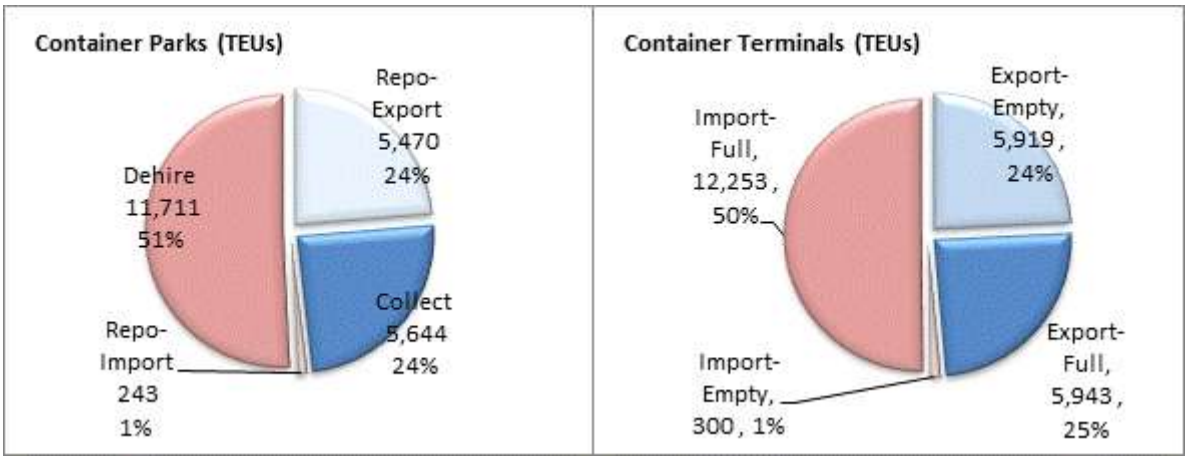
The mix of different container categories are approximately the same in TEUs terms when matched appropriately with activities at the container terminals in the following activity pairs:

- CP Dehires compared to CT Import Full
- CP Hires compared to CT Export Full
- CP Repositioning Export compared to CT Export Empty.
- CP Repositioning Import compared to CT Import Empty.

However it should be noted that variations have been identified for the following reasons:

- Empty Import containers may not be transferred to the container park but directed straight to pack location for packing specific export commodities. Such containers travel directly from the container terminals to a packing location and return directly back to the terminals as a full container, bypassing the container park in the process.
- Full import containers that are unpacked and then returned directly to the container terminal to be exported as empty containers. This type of movement cycle again bypasses the container park.

Figure 42 - Total Volume (TEUs) at Empty Container Parks – Comparison with the Container Terminals



As has already been noted in the Container Terminal section above, the volume and the mix between the four categories of movement at the container parks will vary from period to period. This section of the report presents the container operation profiles at container parks based on the data from the study period. Findings in some areas such as time of day or day of week are likely to differ from the sample period when the business mix changes or when the volume

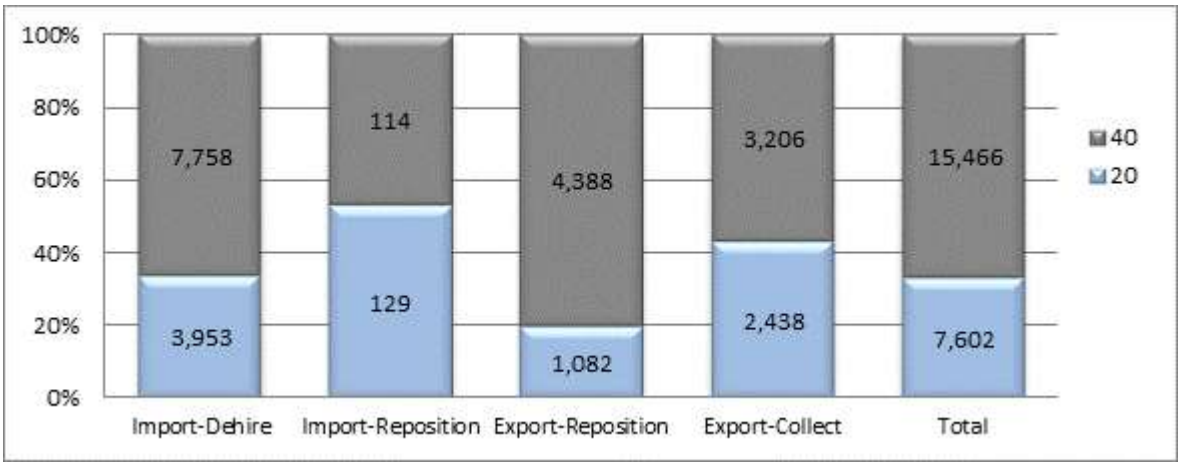
fluctuates significantly. Caution must therefore be exercised when drawing any implications from the results presented.

9.3 MIX OF EQUIPMENT TYPE

9.3.1 Container Size

Figure 43 provides a breakdown of equipment type during the 14 days of the Full Study. 67% of the overall TEUs volume was made up of 40 foot containers. For container de-hire operations, 66% consisted of 40 foot containers, while for container hires it fell to 56%. By contrast for repositioning to the container terminals (export reposition) the proportion for 40 foot containers was 80% in TEUs terms.

Figure 43 - Proportion of Equipment Type at Container Parks (TEUs)



9.3.2 Container Type – High Cube and Standard

Figure 44 and Table 40 below display the breakdown of high cube and standard containers in TEU terms at container parks. Consistent with the breakdown of container type for import full and export full at the container terminals, both hire of empty TEUs and dehire of empty TEUs showed a slightly higher proportion of standard containers (55%) as can be seen in Table 36. The figure suggests that both high cube and standard cube containers were dehired more than hired, leading to the surplus TEUs being repositioned and exported overseas.

Figure 44 - Breakdown of Container Type at Container Parks – High Cube and Standard (TEUs)

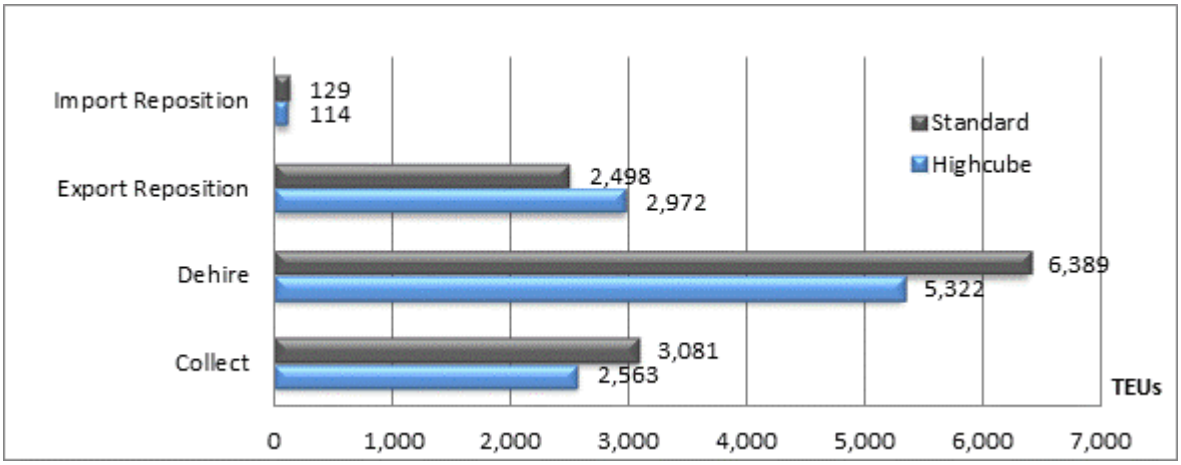


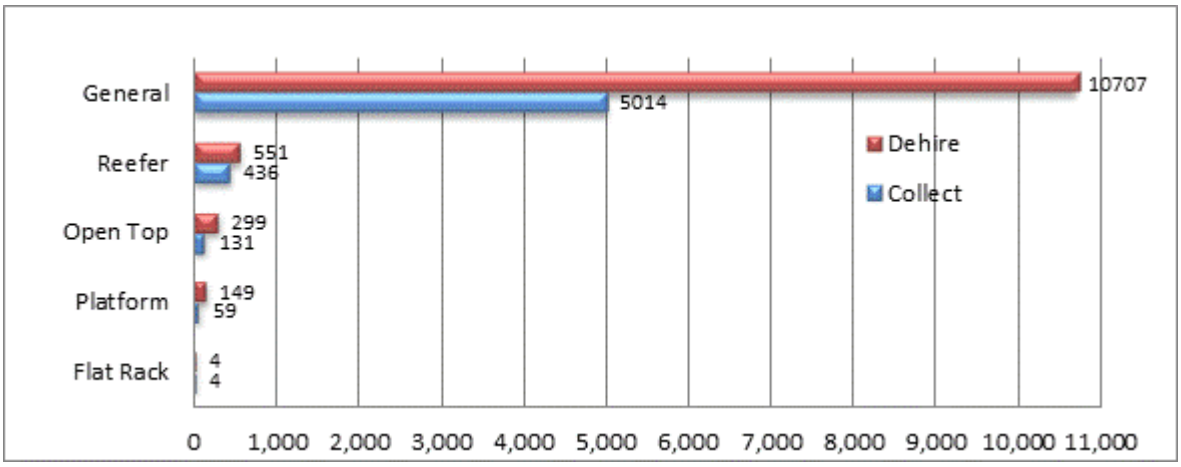
Table 40 – % of High Cube and Standard TEUs at Container Parks

Container Type	Collect	Dehire	Export Reposition	Import Reposition	Overall
Standard	55%	55%	46%	53%	52%
High Cube	45%	45%	54%	47%	48%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

9.3.3 Container Type – ISO Code Classification

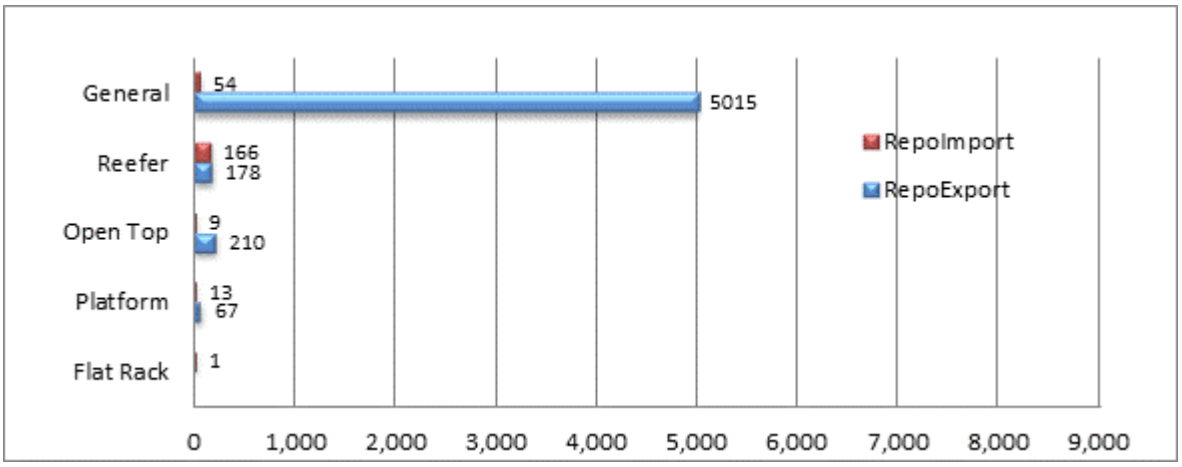
Figure 45 below displays the breakdown by basic ISO container type of containers handled during the Full Study at the Container Parks. Approximately 10,707 TEUs of general purpose containers were de-hired in the study period, in comparison with slightly over 5,000 TEUs being hired during the same period for packing with export cargo. This suggests that over 50% of general purpose empty TEUs were in excess of what the export market required during the study period.

Figure 45 - Breakdown of Container Type at Container Parks - Dehire and Collection (TEUs)



Approximately 5,015 TEUs were sent to container terminals for repositioning (Figure 46).

Figure 46 - Breakdown of Container Type at Container Parks - Repositioning Import and Export (TEUs)

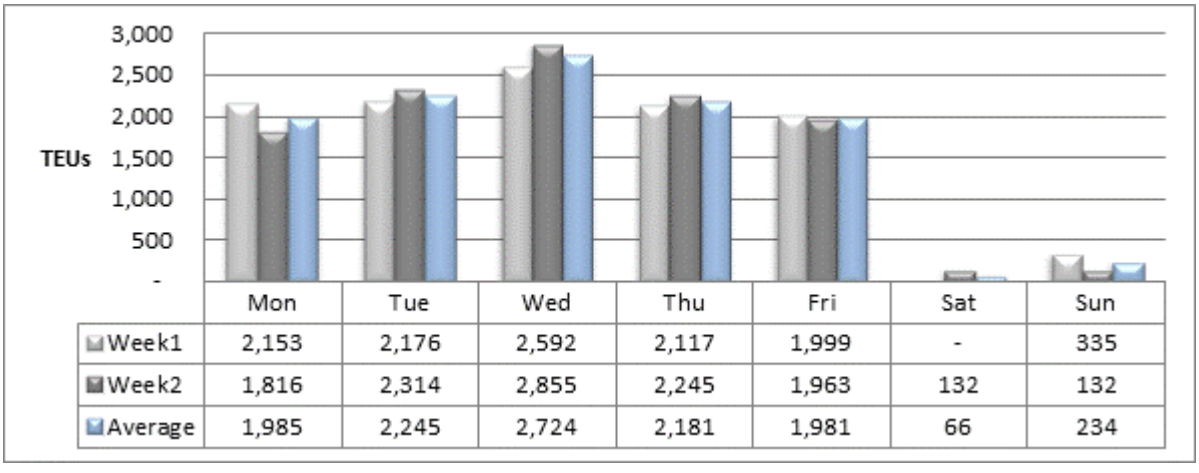


9.4 CONTAINER PARK DAY OF EXIT AND ENTRY

It appears that only 3% of volume entered or exited the parks on Saturdays or Sundays. As no container parks operated for normal equipment receival and delivery activities on weekends during the Full Study, all the weekend volume is related to bulk run export repositioning. Detailed breakdowns of average daily volume for dehire and hire, import and export repositioning are discussed below in Section 9.4.1 and 9.4.2.

The parks handle a total volume of 22,230 TEUs on weekdays with an average of 2,223 TEUs per day and a total volume of 599 TEUs on weekends with an average of 199 TEUs per day as can be seen from Figure 47. The busiest day of the week was Wednesday when the volume was 23% higher than the weekday daily average.

Figure 47 - Average Volume per Day at Container Parks



	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Week1	2,153	2,176	2,592	2,117	1,999	-	335
Week2	1,816	2,314	2,855	2,245	1,963	132	132
Average	1,985	2,245	2,724	2,181	1,981	66	234

Total TEUs handled on weekdays = 22,230, weekday average = 2223.
Total TEUs handled on weekends = 599, weekend daily average = 60.

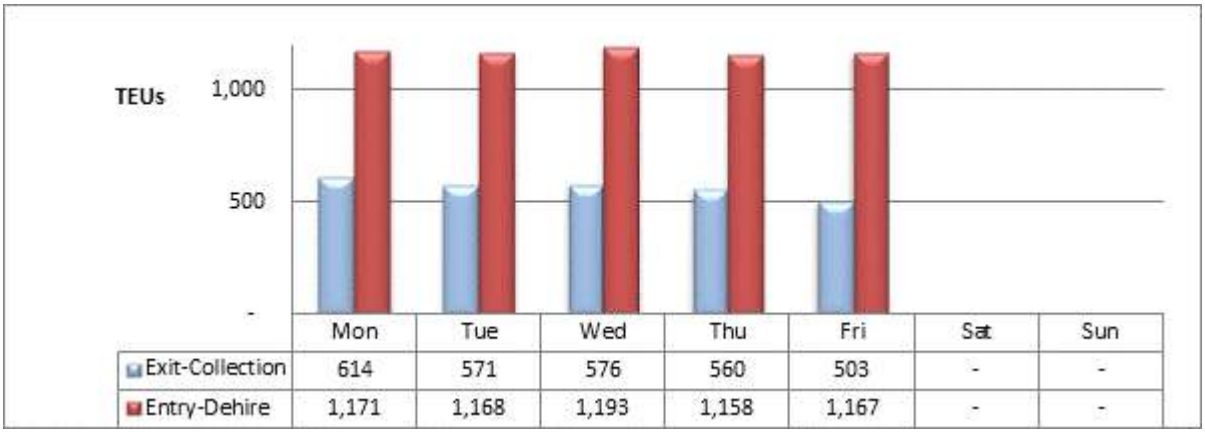
Table 41 - % Volume Variation from Weekday Average at Container Parks

Mon	Tue	Wed	Thu	Fri
-11%	1%	23%	-2%	-11%

9.4.1 Day of Exit and Entry – Container Hire and Dehire

As can be seen in Figure 48 and Figure 49, container de-hire volume was stable at about 1,160 TEUs per day. The variation was less than 2% from the weekday average.

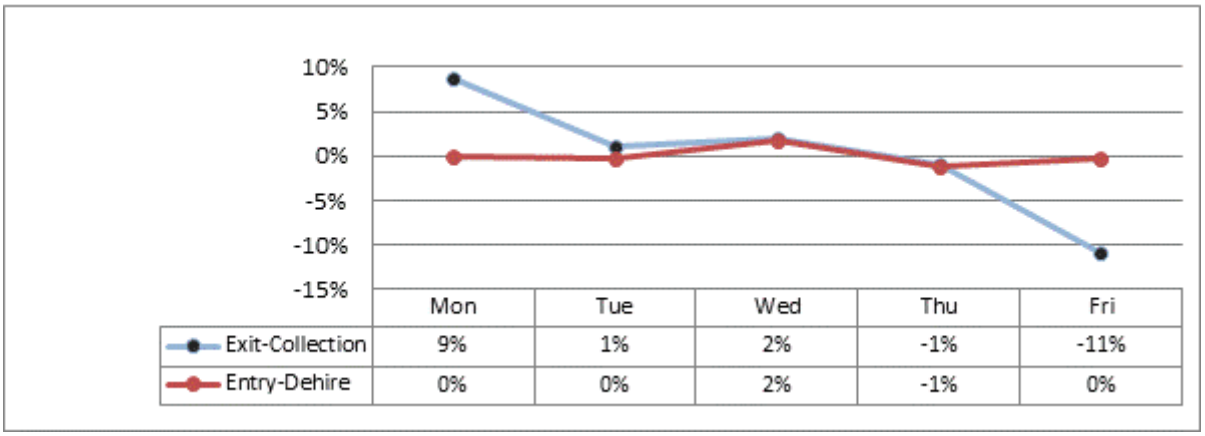
Figure 48 - Container Parks Container Hire and Dehire (TEUs per Day)



	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Exit-Collection	614	571	576	560	503	-	-
Entry-Dehire	1,171	1,168	1,193	1,158	1,167	-	-

Empty Container Collection volume was also relatively stable during the mid-week (Tuesday to Thursday). Some variation can be seen on Monday and Friday. Monday was the busiest day for empty container hires for export packing with the volume being about 10% above the weekday average. Friday was the least busy day with the volume dropping by 11% from the weekday average and being around 20% lower than Monday.

Figure 49 - Container Parks Container Hire and Dehire - Degree of Variation

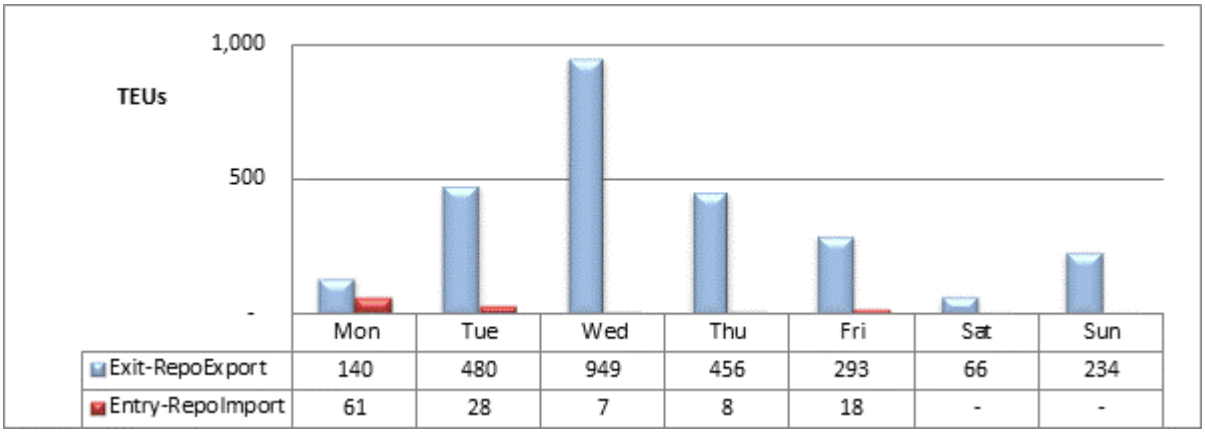


	Mon	Tue	Wed	Thu	Fri
Exit-Collection	9%	1%	2%	-1%	-11%
Entry-Dehire	0%	0%	2%	-1%	0%

9.4.2 Day of Exit and Entry – Import and Export Reposition

Figure 50 presents the volume (TEUs) entering or exiting the container parks in the repositioning categories. The variation of empty container repositioning was very large, in particular on the export side. Nearly 1,000 TEUs exited the container parks for repositioning on Wednesday which was the peak period of the week. A separate study, reviewing the shipping patterns of the time showed that there was a correlation between shipping cut offs and bulk run activity (Source: Fremantle Ports: TRIM Ref 5671175).

Figure 50 - Container Parks Empty Containers Repositioning (TEUs per Day)



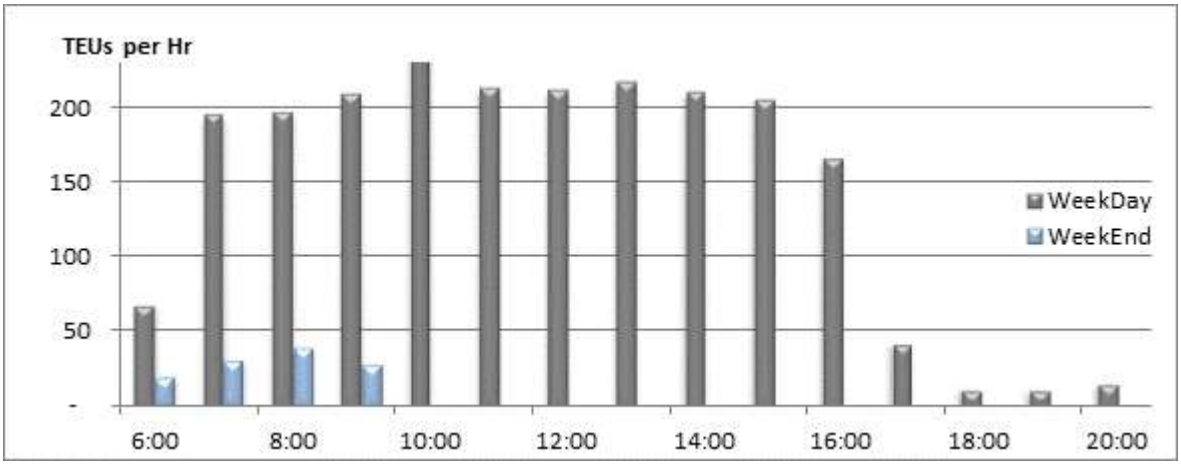
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Exit-RepoExport	140	480	949	456	293	66	234
Entry-RepoImport	61	28	7	8	18	-	-

9.5 CONTAINER PARK TIME OF EXIT AND ENTRY

9.5.1 Container Park Time of Exit and Entry – Overall

Operating hours of the ICL container parks was from 0715 to 1640. There are 3 locations (QUBE Central, Irene Street and Tydeman) out of 10 which are open for slightly longer operating hours i.e. from 0630 until 1730. MCD and ICS operated similar hours. The container parks do not normally operate on weekends except some locations which open on special request, under very restrictive conditions, particularly concerning minimum numbers. Figure 51 displays the distribution of container volume entering or exiting these container parks at different times of day. The distribution of volume was very uniform at around 200 TEUs per hour during the normal hours between 0700 to 1700. The figure also shows weekend operations of less than 50 TEUs per hour in the first part of the morning only. Movements outside standard operating hours seen in the figure were associated with empty container export repositioning.

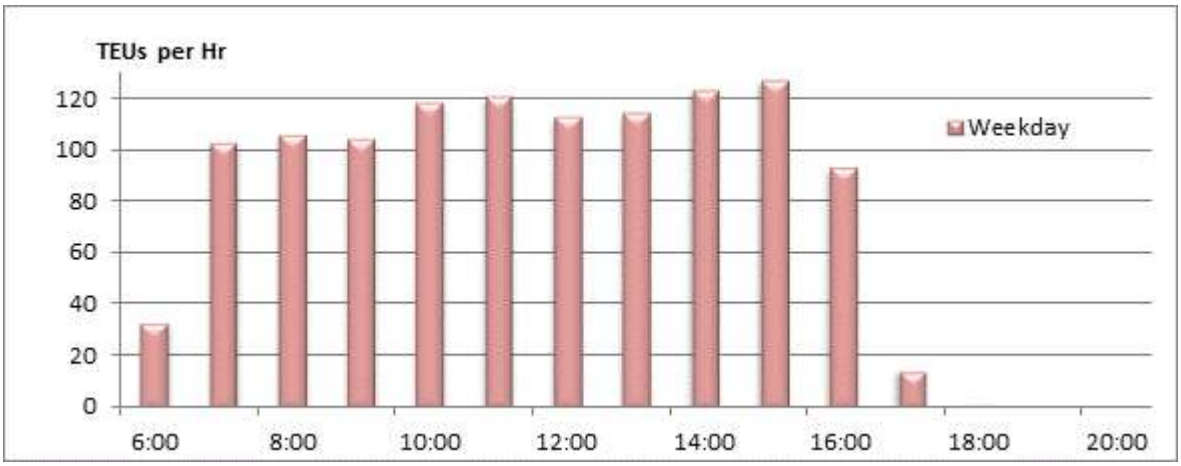
Figure 51 - Container Parks Time of Day - Overall Volume (TEUs)



9.5.2 Container Park Time of Entry – De-Hire

Figure 52 displays the time of day containers were de-hired to container parks. A steady volume of containers were delivered on weekdays for de-hire during operating hours. The profile shows that the average volume per hour in the early morning hour (0700 to 1000) was slightly less than in the period from late morning up to mid afternoon (1000 to 1500).

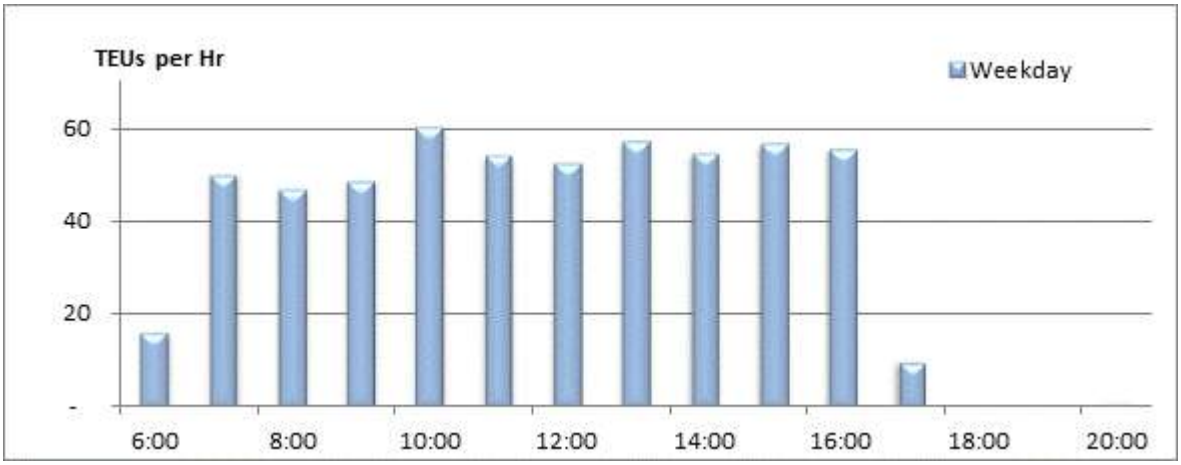
Figure 52 - Time of Entry to Container Parks – De-hire (TEUs)



9.5.3 Container Park Time of Exit – Hired

Figure 53 shows the time of exit from container parks for packing purpose. Approximately 55 TEUs per hour were picked up from the parks for packing purposes. The average container volume hired per hour was about half of the average container volume de-hire.

Figure 53 - Time of Exit from Container Parks – Collection for Packing (TEUs)



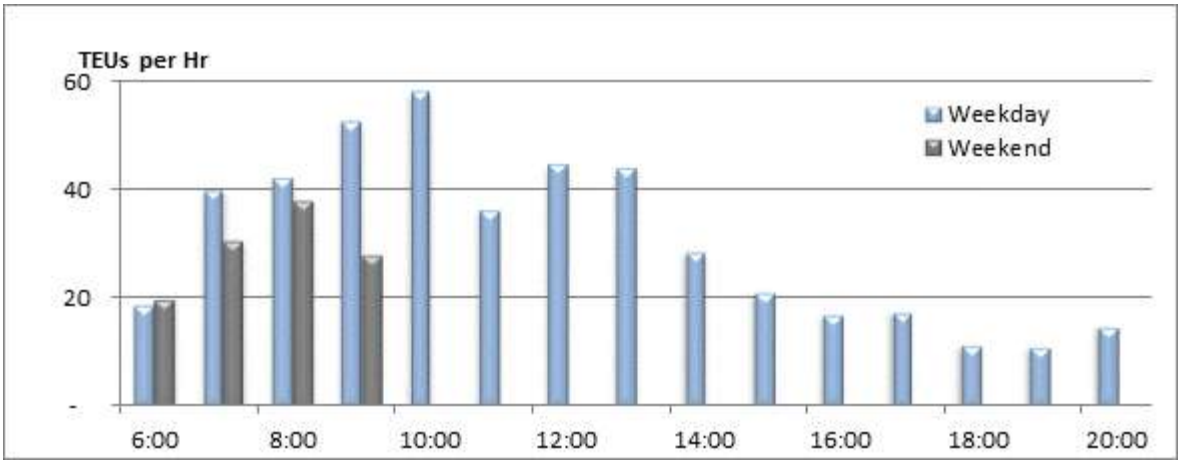
9.5.4 Container Park Time of Entry – Import Repositioning

The import repositioning volume at the parks was small. Empty containers entered the container park between 2 to 4 TEUs per hour until mid-afternoon.

9.5.5 Container Park Time of Exit– Export Repositioning

Figure 54 sets out the time of day empty repositioning TEUs left the parks. According to the profile, the volume fluctuated from between approximately 20 TEUs to about 60 TEUs per hour between 0600 and 1700. The majority of the activities occurred in the morning where the volume started building up from 0700 to peak at 1000 before dropping in the lunch hour. Limited activity at selected CPs occurred outsider normal working hours, i.e. between 1800 and 2000. At weekends all activity occurred before 1000. According to information from the CPs virtually all such movements to the CTs were in bulk runs.

Figure 54 - Time of Exit from Container Parks - Export Repositioning (TEUs)



10 PROJECT SECONDARY OPTIONS

The original project brief outlined four secondary options for consideration by the consultant in undertaking this Landside Container Project, namely:

1. Routes commonly used by Port container traffic including distances and journey time.
2. Types and utilisation of road transport vehicles.
3. Times of day for container movement.
4. Container all up weight and commodity content data.

It was agreed to incorporate option 3 in the main body of study and the outcomes are covered in this report. It was also agreed to analyse the weight data collected from the CTs, despite its variable accuracy, but not the commodity data due to the unreliability from available sources and the non-availability of such information from Customs. The outstanding balance of these three options are reviewed in the subsequent three sub- sections of the report.

10.1 GPS & ROUTES

The consultant decided not to perform this requirement. Fremantle Ports used its own resources to gather data on 122 vehicles and are currently working with MRWA to complete this exercise separately.

10.2 TYPES & UTILISATION OF VEHICLES

The consultant decided not to perform this requirement, other than to include, as part of the database, licence plate information which had been gathered as a by-product of the material provided by transport operators.

10.3 WEIGHTS AND COMMODITIES

It was recognised at the outset that the information available in these two areas from the Container Terminals was dependent on shipping documents, which particularly for imports are often subject to under declaration of weight (due to road weight restrictions at origin) and mis-declaration of commodities (or use of meaningless terms such as “Freight All Kinds” or FAK).

It was agreed to incorporate the container terminal data on all up container weights in the data base for future potential comparative reference; this information is analysed and commented on in this report but caution should be exercised in its use. This is particularly true for imports where the original source of the data (which is transmitted by EDIFACT message to the CT at destination) is overseas cargo shippers, who frequently have both motive and opportunity to underdeclare the weight of cargo shipped.

At the outset of the project it was hoped that Customs and Border Protection (C&BP) data on commodities might be available as an input to this study - in the event that information was not forthcoming and any effort to analyse commodity data was therefore excluded from this project as alternative sources were considered too inconsistent, inaccurate or general in nature.

11 CONCLUSIONS

As noted at the beginning of this report FP handled a record volume of just under 0.6M TEUs in the last financial year (2010/11). This represents a compound growth rate of 5.4% p.a. over the last decade. Such growth also means the container volume handled since the Fremantle Inner Harbour Container Movement Study released in March 2004 has increased by nearly 40% from 0.43M TEUs (2002/3). This is the context in which the following conclusions on the current Landside Container Movements are drawn in respect of the four defined key objectives of this Study. They are based on the data collected during the Full Study period conducted in the second half of August 2011.

11.1 INLAND CONTAINER DESTINATIONS AND ORIGINS

11.1.1 IMPORT UNPACK DESTINATIONS

FP Import containers covered by the Full Study (10,762 TEUs) were unpacked in 140 different suburbs or communities. The top 12 (all Perth Metro) accounted for 70% of this volume and the top 3 (Welshpool, Canning Vale and Kewdale) accounted for one third of the total (Table 20). Two thirds of this volume of containers was unpacked in the ABS defined SRS areas of South West and South East Metropolitan (Table 21). A mere 2% was unpacked in areas outside Perth Metro, with about half this volume accounted for by areas north of Perth Metro.

11.1.2 EXPORT PACK ORIGINS

FP Export containers covered by the Full Study (5,586 TEUs) were packed in 94 different suburbs or communities. The top 12 (9 of which were Perth Metro) accounted for 73% of this volume and the top 3 (Henderson, Forrestfield and North Fremantle) accounted for 44% (Table 35). Almost half this volume of containers was packed in the SRS area of South West Metropolitan. 15% was packed in country areas, two thirds of which was accounted for by Lower Western SRS (Table 36).

11.2 MODE OF LANDSIDE TRANSPORT

11.2.1 ROAD

Road Transport Operators, of whom 37 participated in the Full Study, were solely responsible for moving 88% of the TEUs involved in the land transport task analysed in this Study (Table 14). Road's dedicated share of this task was slightly higher for import movements at 90% compared with that for export movements at 85%. In respect of delivery of full import containers in TEUs terms 90% were to locations within 30 kms of the Port (radial distance - see Table23). For full exports 75% were collected from packing locations within 30 radial kms of the Port (Table 32).

11.2.2 RAIL

The rail network between NQRT and FIT handled 12% of the TEUs involved in the land transport task analysed in this Study (Table 14). It should be noted, however, that because all rail movements have to be transferred by road to/from NQRT and in some cases also at FIT or other inland rail terminals, rail's share of the total movements in the inland logistics chain was only 7% (Table 15). In other words, in most cases for every rail movement there were two linked road movements, i.e. a road-rail composite transaction.

11.3 STAGING OF CONTAINERS

Direct deliveries from the CT to unpack locations is estimated to occur with about 35% of TEUs handled by FP and in the case of direct export movements from pack point to CT this share is estimated to be significantly higher at 54% (Figure 7). Direct dehiring of empty containers to CPs or movement from CPs direct to pack points typically occurs in 72% and 75% of cases respectively. And in the case of repositioning of empty containers there is no significant staging – only about 7% by rail in the case of exports (Figure 8).

11.3.1 IMPORTS

Typically an FP import container is estimated to undergo an average of 2.92 movements in the Import Trade Cycle between CT and CP (Table 12). 10 locations in Perth Metro accounted for 98% of the 10,220 inbound TEUs found in the Full Study to have been staged – of these North Fremantle, Welshpool and Kewdale accounted for 73% of the total (Table 25). One of the reasons for staging imports is the mismatch of working hours between the CTs (see 11.4.1 below) and the restricted daytime working hours at most importer premises.

11.3.2 EXPORTS

Typically an FP export container is estimated to undergo an average of 2.61 movements in the Export Trade Cycle between CP and CT (Table 13). Again 10 locations in Perth Metro accounted for 99% of the much smaller number of 2,485 TEUs staged in the Export Trade Cycle between CP and CT - of these North Fremantle, Kewdale and Bibra Lake accounted for 85% of the total (Table 40)

11.4 TIMING OF CONTAINER HANDLING

11.4.1 CONTAINER TERMINALS

96% of TEUs handled by the CTs moved in or out of the terminal on the landside on weekdays. During the Full Study the busiest day overall was Wednesday, primarily due to the influx on that day of over 1000 empty Repositioned TEUs, which was more than double the volume for that category on the next busiest days (Tuesday and Thursday – Figure 48). Flows of full containers

were much more stable across the five weekdays with Tuesday being marginally the busiest day; full import deliveries typically were twice the volume of full export receivals (Figure 46).

Full import deliveries and export receivals typically occurred between 0700 and 2100 with a peak in the morning and a temporary lull coinciding with the morning and afternoon shift meal breaks (Figures 50 – 52). Receivals of empty containers also peaked on weekday mornings and tailed off substantially in the afternoons; however receivals continued through the second half of the afternoon shift on weekdays and the first half of the morning shift at weekends (Figure 53).

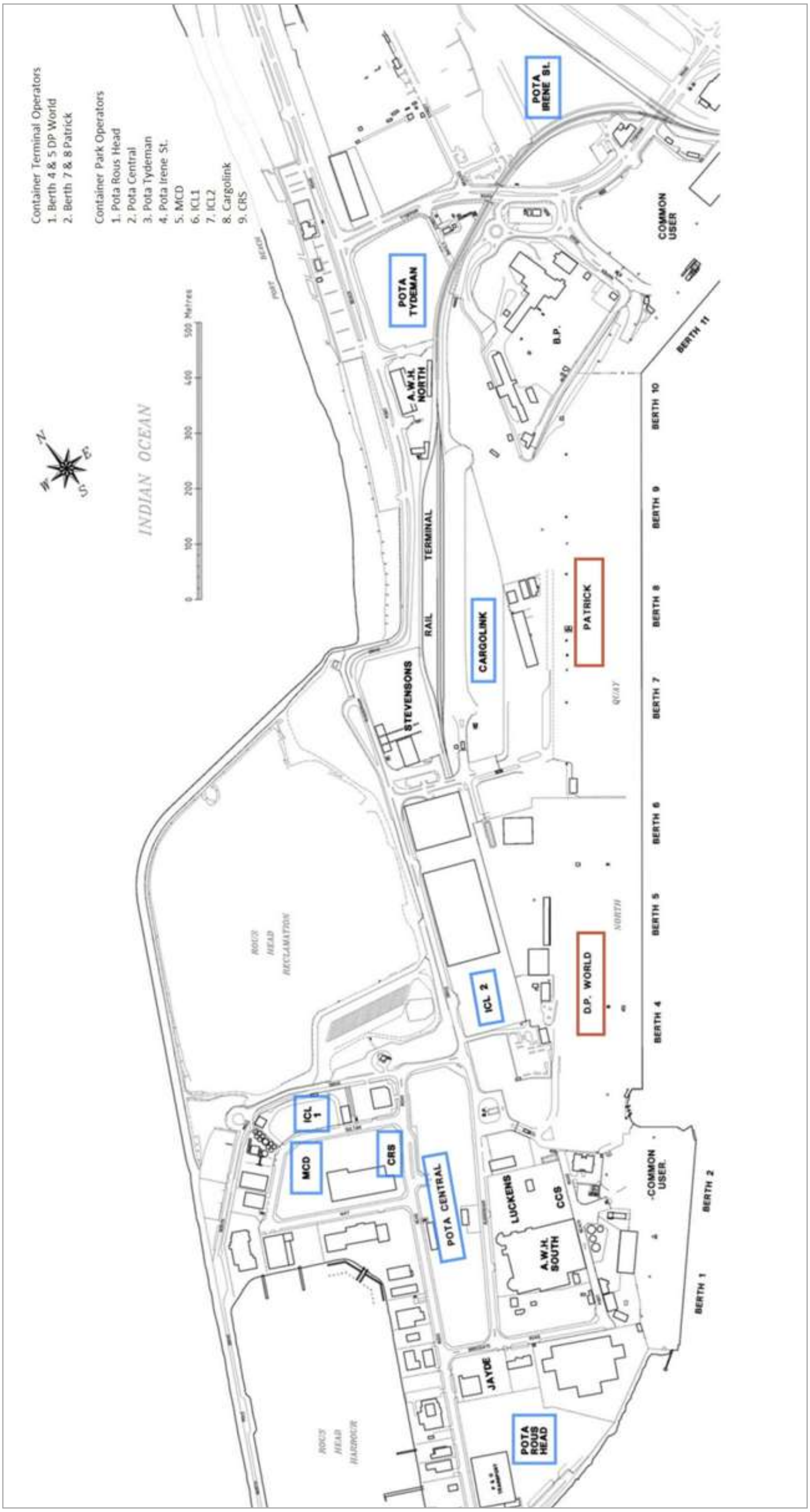
11.4.2 CONTAINER PARKS

97% of the 23,068 TEUs handled by CPs during the Full Study moved on weekdays. During the Full Study the busiest day was Wednesday when 50% more TEUs were handled than on the next busiest days (Tuesday and Thursday – Figure 60). De-hire and collection activities remained reasonably consistent on weekdays whereas empty repositioning surged on Wednesdays to double the level of any other day of the week (Figure 63).

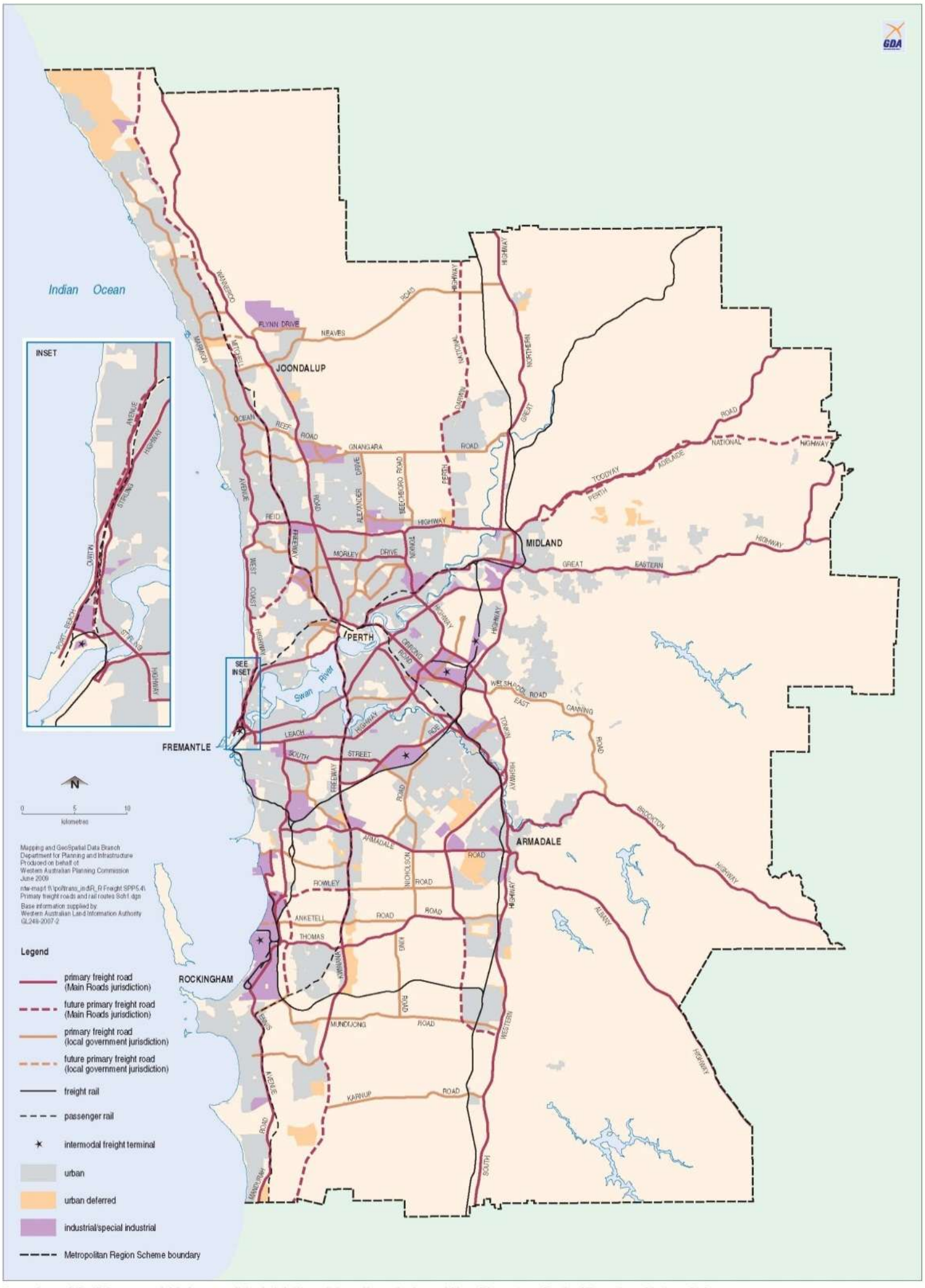
Timing of TEUs movements on weekdays was typically constrained by normal working hours and occurred for dehire and collections on a reasonably consistent basis between 0700 and 1600 (Figure 65). Empty Repositioning primarily took place up to 1300, but there were also significant movements in this category from 1400 to 2000 on weekdays and up to 1000 on weekends (Figure 68).

LIST OF ANNEXURES

ANNEXE 1. FREMANTLE PORT CONTAINER FACILITIES



ANNEXE 2. PERTH & FREMANTLE METRO AREA ROAD AND RAIL NETWORK



Road and Rail Transport Noise and Freight Considerations in Land Use Planning State Planning Policy 5.4

Schedule 1. Primary freight roads and rail routes (Perth metropolitan region)

Source: Courtesy WA Department of Planning & Infrastructure

ANNEXE 3. DATA REQUIREMENTS

Table A. Container Terminals' Data Requirements

The two major Container Terminal operators - Patrick and DP World - were asked to provide records of all container movements covering both landside arrival and departure (i.e. container receival and delivery) occurring during the 14 day study period. The Table below provides an illustration of the data types we requested from the two major Container Terminal Operators.

	Data Fields
Container Information	Container ID
	ISO Code
	Status (Full/Empty)
	Gross Weight (Metric Tonne)
	Commodity
	OOG (Yes/No)
	Dangerous (Yes/No)
Transport Carrier Information	Transport Carrier Name (Code)
	Vehicle Registration Number
	Bat Number
Departure or Arrival Information	Movement Category (Import/Export)
	Processing Time with Trucks
	Booking Number
	Booking Slot

Table B. Empty Container Park Data Requirements

Five empty container park operators handling empty containers were included in the full study. The participants were asked to provide records of all container movements at their operating facilities during the 14 day period. These empty container parks are situated in 10 physical locations of which 9 are located in the Port precinct (refer to Annexe 1). After consulting with the operators, we agreed that the operators were to provide one set of data for each physical facility.

The Table below provides an illustration of the data type collected from the empty container parks.

	Data Fields
Container Information	Container ID
	ISO Code
	Shipping Line Owner
Transport Carrier Information	Transport Carrier Name (Code)
	Vehicle Registration Number
Departure or Arrival Information	Movement Category (Inbound/Outbound)
	Processing Date and Time

Table C. Quarantine Facility Data Requirements

At QAP facilities, goods may be stored under bond at the quarantine facilities and tasks performed on site include washing, fumigation, AQIS inspection, tailgate inspection, unpacking and dehire. The reason for requesting the data from the on Port QAP facilities was because many of the road transport operators do not capture or record the movement through quarantine premises for activities which do not require a significant amount of time such as tailgate inspection. The information captured from the quarantine facilities was used to cross validate the data provided by the road operators. The table below contains the data requirements from quarantine facilities.

	Data Fields
Container Information	Container ID
	ISO Code or Container Size
	Shipping Line Owner
Transport Carrier Information	Transport Carrier Name (Code)
	Vehicle Registration Number
Departure or Arrival Information	Movement Category (Inbound/Outbound)
	Processing Date and Time
	Task Performed (Tailgate, Fumigation, etc.)

Table D. Rail Operators' Data Requirements

We included in our study the two rail operators, who operate landside container movement by rail between NQRT in North Fremantle and the intermodal terminal in Forrestfield (FIT). The data templates were also designed to capture the relatively small volume of import or export related movements between NQRT and the Kwinana and Kalgoorlie areas. The participants were asked to provide records of all inbound and outbound container movements to/from NQRT. The Table below provides an illustration of the data types we requested from the Rail Operators.

	NQRT Outbound	NQRT Inbound
Container Information	Container ID	Container ID
	Container Size	Container Size
	Container Type	Container Type
	Status (Full/Empty)	Status (Full/Empty)
	Category (Import/Export)	Category (Import/Export)
	OOG (Yes/No)	OOG (Yes/No)
	Dangerous (Yes/No)	Dangerous (Yes/No)
	Gross Weight	Gross Weight
	Commodity	Commodity
Origin Information	Origin	Origin
	Transport Carrier Delivered to NQRT	Transport Carrier Delivered to Origin
	Date and Time Delivered to NQRT	Date and Time Delivered to Origin
	Date and Time on Train (Finished Loading)	Date and Time on Train (Finished Loading)
	Departure Date and Time	Departure Date and Time

	NQRT Outbound	NQRT Inbound
Destination Information	Destination	Destination
	Arrival Date and Time	Arrival Date and Time
	Transport Carrier Pick Up at Destination	Transport Carrier Pick Up at Destination
	Date and Time Picked up from Destination	Date and Time Picked up from Destination
	Client	Client

Table E. Road Operators Data Requirements

The templates developed for road operators were designed to capture every transportation leg of container landside movement. The templates focussed on four basic phases within the container transport logistics chain. As shown in the table below, the participants were asked to provide data relating to movements of containers in the following stages:

- Stage I: Records relating to movement from container terminals to unpacking locations or records of empty container movements imported directly from container terminals.
- Stage II: Records relating to movement from the unpacking point to de-hiring the empty containers at container parks.
- Stage III: Records relating to movement of empty container from Container Park to packing locations.
- Stage IV: Records relating to movement from packing locations to container terminals or records of empty container export movements from the container park to the container terminal.

	Import: Stage 1	Import: Stage 2	Export: Stage 3	Export: Stage 4
Reference Information	Job Number	Job Number	Job Number	Job Number
Vehicle Information	Vehicle Rego	Vehicle Rego	Vehicle Rego	Vehicle Rego
	Vehicle Type	Vehicle Type	Vehicle Type	Vehicle Type
Container Information	Container ID	Container ID	Container ID	Container ID
	Size	Size	Size	Size
	Container Type	Container Type	Container Type	Container Type
	OOG (Yes/No)	OOG (Yes/No)	OOG (Yes/No)	OOG (Yes/No)
	Dangerous (Yes/No)	Dangerous (Yes/No)	Dangerous (Yes/No)	Dangerous (Yes/No)
	Status	Status	Status	Status
	Weight	Weight	Weight	Weight
	Commodity	Commodity	Commodity	Commodity

	Import: Stage 1	Import: Stage 2	Export: Stage 3	Export: Stage 4
Origin Information	Origin Name	Origin Name	Origin Name	Origin Name
	Origin Street Address	Origin Street Address	Origin Street Address	Origin Street Address
	Origin Suburb	Origin Suburb	Origin Suburb	Origin Suburb
	Departure Date and Time	Departure Date and Time	Departure Date and Time	Departure Date and Time
Destination Information	Destination Name	Destination Name	Destination Name	Destination Name
	Destination Street Address	Destination Street Address	Destination Street Address	Destination Street Address
	Destination Suburb	Destination Suburb	Destination Suburb	Destination Suburb
	Arrival Date & Time	Arrival Date & Time	Arrival Date & Time	Arrival Date & Time
Additional Information	Unpack at Yard (Yes/No)	Date notified of Empty containers		Pack at Yard (Yes/No)
		Dehire Date		

It should be noted that the movements in these 4 stages were later re-categorized and recoded into 6 phases as outlined in Section 4.3.2 in the main report for the purpose of analysis in this study.

ANNEXE 4. DATA RECODING

Recoding of Container Terminal, Container Park, and QAP Data

Recoding the road transport operator name to a standard code was important especially at the container terminal and container park. At 2 CT locations, 10 CP locations and 3 QAP locations, various codes and names were used internally for the same carrier operator. Standardised coding of road operators' identities at the container terminals and the container parks permitted the identification and grouping of containers and business volumes handled by an individual operator. This allowed checking of data received from these operators and identification of missing records.

For this purpose, a master set of standard codes for road transport operators was developed. Various names and codes of carrier supplied by CT, CP and QAP were re-coded to this standard code.

Recoding of Road and Rail Operator Data

Container movement data received from road and rail operators were coded in 6 categories to facilitate data analysis.

The first area of coding which was applied to the dataset was the identification of Origin Type and Destination Type, which was subdivided into 9 major types of location in the container movement supply chain as displayed in Table A below.

Table A. Origin Type and Destination Type Coding Scheme

[OType2] or [DType2] Coding Scheme	Description
CP	Container Park Facilities.
CT	Container Terminal Facilities
Exporter	Packing Locations
IMDFIT	Intermodal Forrestfield
Importer	Unpacking Locations
QAP	Quarantine Facilities
Staging	Road Transport Staging Locations
STG IMDOTH	Other Rail Terminals
STG NQRT	North Quay Terminal

The second area of coding which was applied to the dataset was the identification of Movement Phase. Coding of movement records in to 6 phases allowed the grouping of movements related to normal full import or export containers and the movements relating to empty container repositioning between CT and CP. Table B below explains the coding scheme for movement phases.

Table B. Origin Type and Destination Type Coding Scheme

[Phase] Coding Scheme	Description
Import Full to Unpack	Movement records occurred as part of Full Import Container to Unpack
Import Unpack to Dehire	Movement records occurred as part of Import Unpack to Dehire Depot
Import Reposition	Movement records occurred as part of Import Container Repositioning
Export Empty to Pack	Movement records occurred as part of Export Empty to Packing Location
Export Full to Terminal	Movement records occurred as part of Export Pack to Container Terminal
Export Reposition	Movement records occurred as part of Export Reposition of Empty

Another area of coding which was applied to the dataset was the identification of transport mode related to the movement of a container as outlined in Table C below.

Table C. Transport Mode Coding Scheme

[Mode2] Coding Scheme	Description
Road Only	Movement records of container which travel the entire import or export cycle using road as the only transport mode
Road Rail Composite	Movement records of container which contains at least one rail movement as part of it travelling via the import or export cycle

ANNEXE 5. DATABASE STRUCTURE

The data collected during the study has been stored in four main tables relating to container terminal transactions, container park transactions, import movements, and export movements. The tables below suggest the data field names and descriptors in each table.

Table A. Container Terminal Database Structure

Data Fields	Description
[ID]	Database Primary Key
[ContainerID]	Container Number
[CTcode]	Container Terminal Location
[CarrierCode]	Road Operator Carrier
[Stud Inclusion]	Inclusion of the Carrier Code in the Study
[TruckRego]	Vehicle Registration Number
[Handle]	Processing Time
[ISO]	Container ISO Code
[Type]	Container Type
[Size]	Container Size
[Category]	Import or Export
[Status]	Full or Empty
[Weight]	Weight

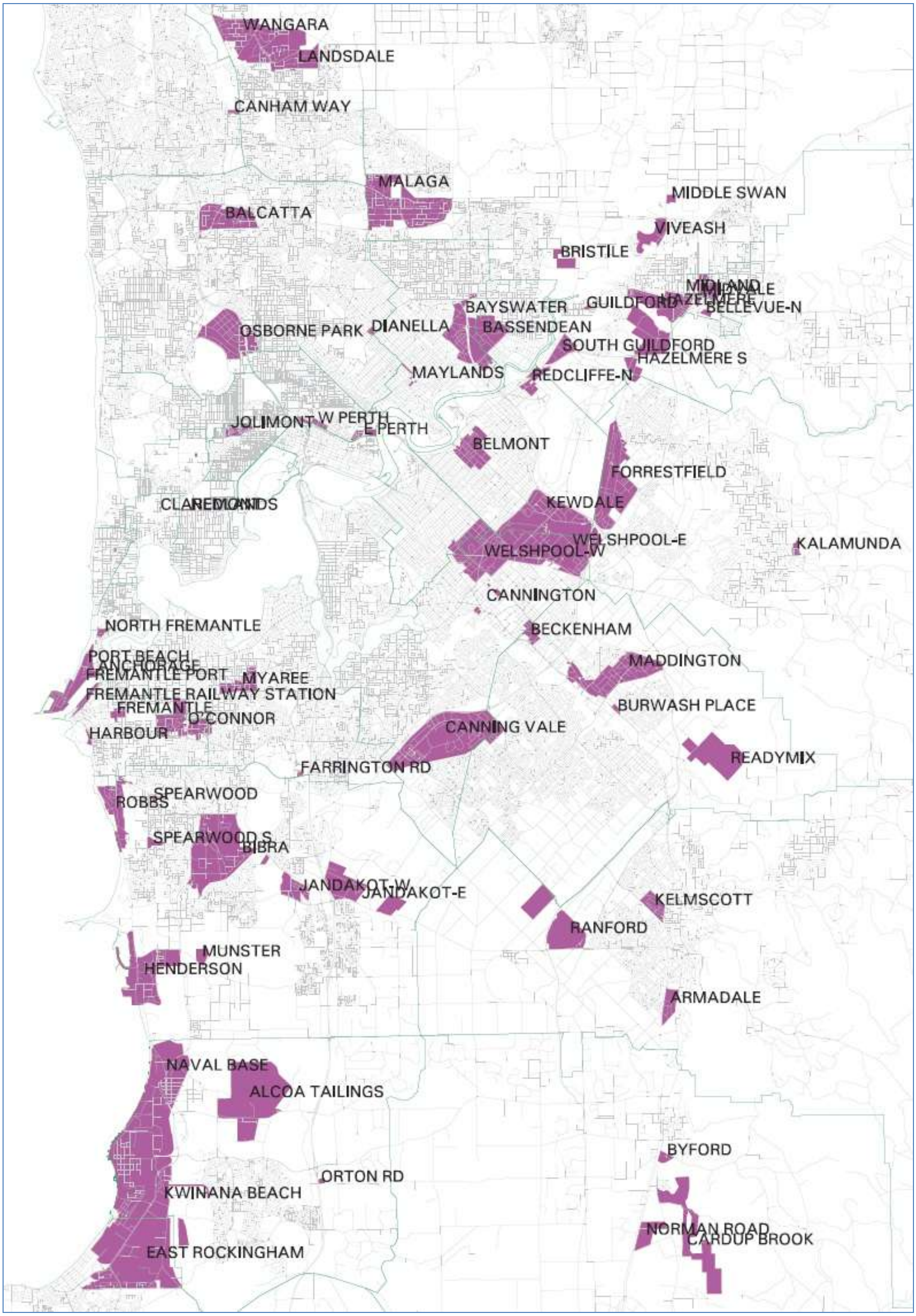
Table B. Empty Container Park Database Structure

Datafields	Description
[ID]	Database Primary Key
[ContainerID]	Container Number
[Mode]	Movement inbound or outbound
[LocationCode]	Container Park Location
[Processing]	Processing Time
[Size]	Container Size
[ISO]	Container ISO Code
[CarrierCode]	Road Operator Carrier
[TruckIn]	Timestamp of truck entering at gate
[TruckOut]	Timestamp of truck departing from gate
[Grade]	Container Grade
[Customer]	Owner/Operator of Container
[Carrier]	Original Road Operator Carrier Code
[CarrierName]	Original Road Operator Carrier Name
[Vrego]	Vehicle Registration Number
[Driver]	Driver Name

Table C. Import and Export Movements Database Structure

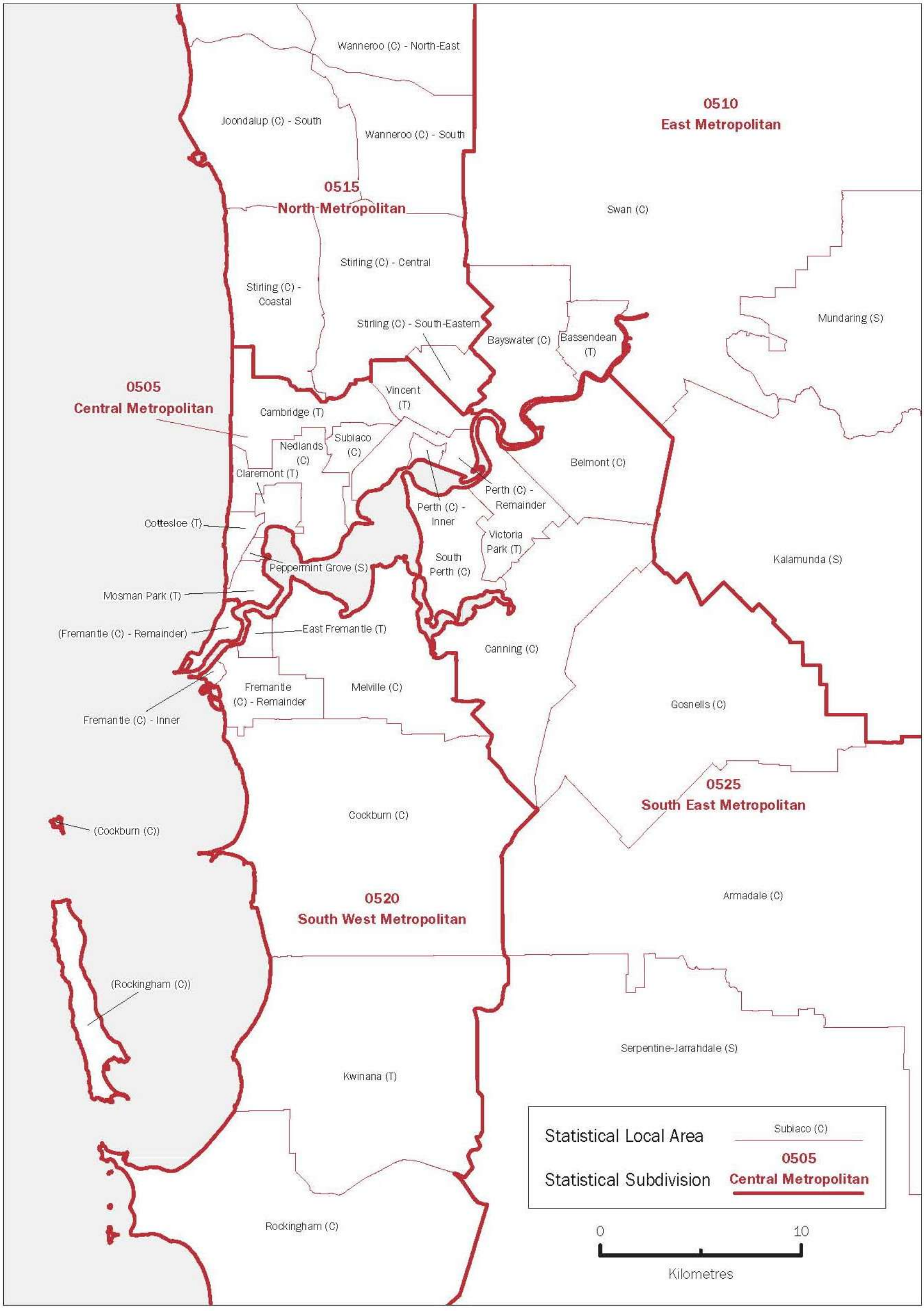
Datafields	Description
[ID]	Database Primary Key
[Mode1]	Transport mode - Road or Rail
[Operator]	Carrier Operator Code
[Mode2]	Road only or Road-Rail Composite
[ContainerID]	Container Number
[Order]	Sequential Order
[Gr1]	Import or Export
[Phase]	Movement Phase
[Status]	Full/Empty
[UseTime]	Timestamp Validity
[Otype2]	Origin Type
[Ostreet]	Origin Street
[Osuburb]	Origin Suburb
[Otime]	Departure Time
[Dtype2]	Destination Type
[Dstreet]	Destination Street
[Dsuburb]	Destination Suburb
[Dtime]	Destination Time
[Size]	Container Size
[TEU]	TEU

ANNEXE 6. INDUSTRIAL PARKS IN METRO PERTH AREA



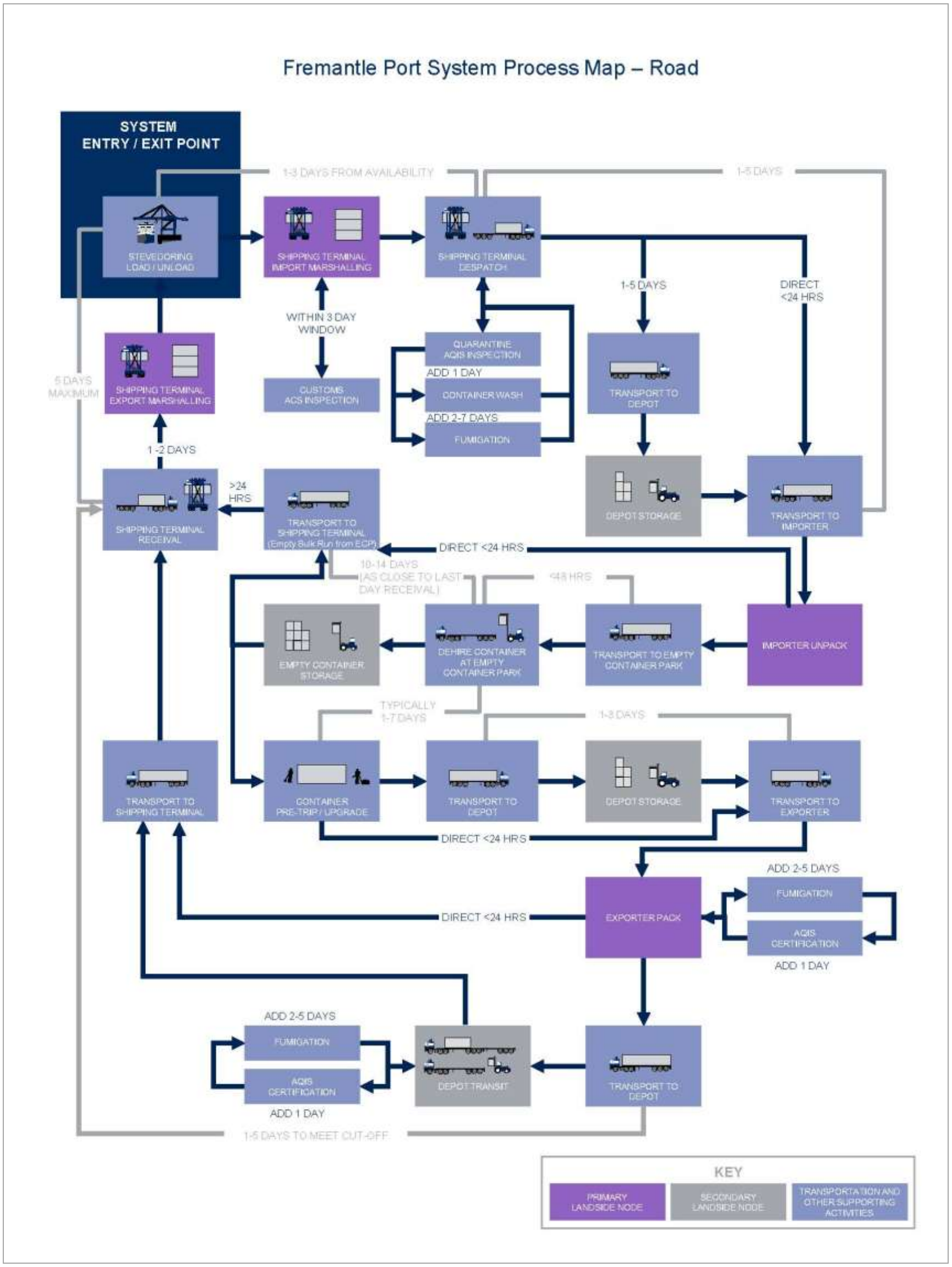
Source: WA Department of Planning

ANNEXE 7. PERTH METROPOLITAN SLA AND SRS



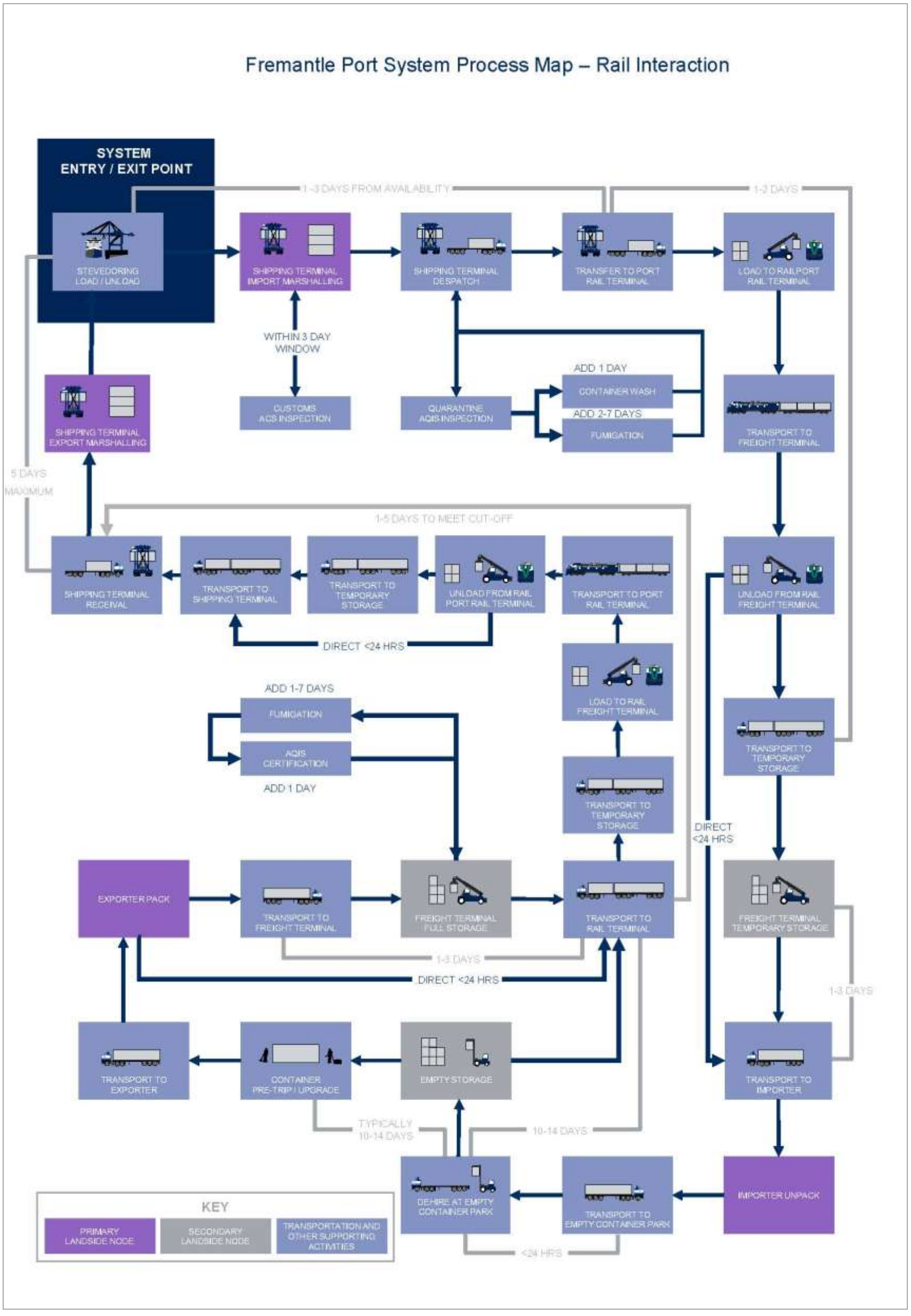
Source: Australian Bureau of Statistics Catalog Number 1216.0

ANNEXE 8. FREMANTLE PORT CONTAINER PROCESS MAP (ROAD)



Source: Courtesy Fremantle Ports Logistics & Port of Melbourne Corporation

ANNEXE 9. FREMANTLE PORT CONTAINER PROCESS MAP (RAIL)



Source: Courtesy Fremantle Ports Logistics & Port of Melbourne Corporation

ANNEXE 10. FIGURES SUPPORTING SECTION 5 TO SECTION 9 ANALYSIS

Table A. Phase 1 and Phase 2: Detailed Breakdown of TEUs Movement between Business Types (Full Study Period)

	To Business Type								
	CP	CT	Unpack Location	FIT Intermodal	NQRT	QAP	Road Transport Staging	Other Rail Terminals	Total
From Business Type									
Phase 1: Import Full to Unpack									
CT	**-**	**-**	**3,318**	**-**	**924**	**254**	**5,065**	**18**	**9,579**
Road	-	-	3,318	-	924	254	5,065	18	9,579
FIT Intermodal	**-**	**-**	**460**	**-**	**-**	**-**	**149**	**-**	**609**
Road	-	-	460	-	-	-	149	-	609
NQRT	**-**	**-**	**-**	**1,022**	**-**	**3**	**-**	**10**	**1,035**
Rail	-	-	-	1,022	-	-	-	10	1,032
Road	-	-	-	-	-	3	-	-	3
QAP	**-**	**-**	**194**	**-**	**6**	**-**	**137**	**2**	**339**
Road	-	-	194	-	6	-	137	2	339
Road Transport Staging	**-**	**-**	**4,886**	**-**	**-**	**92**	**382**	**4**	**5,364**
Road	-	-	4,886	-	-	92	382	4	5,364
Other Rail Terminals	**-**	**-**	**14**	**-**	**-**	**-**	**-**	**-**	**14**
Road	-	-	14	-	-	-	-	-	14
Total	**-**	**-**	**8,872**	**1,022**	**930**	**349**	**5,733**	**34**	**16,940**
Phase 2: Import Unpack to Dehire									**-**
Unpack Location	**5,954**	**168**	**-**	**292**	**-**	**5**	**2,115**	**9**	**8,543**
Road	5,954	168	-	292	-	5	2,115	9	8,543
FIT Intermodal	**22**	**-**	**-**	**-**	**418**	**-**	**2**	**-**	**442**
Rail	-	-	-	-	418	-	-	-	418
Road	22	-	-	-	-	-	2	-	24
NQRT	**355**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**356**
Road	355	1	-	-	-	-	-	-	356
QAP	**15**	**4**	**-**	**-**	**-**	**-**	**-**	**-**	**19**
Road	15	4	-	-	-	-	-	-	19
Road Transport Staging	**2,165**	**204**	**-**	**50**	**-**	**-**	**114**	**1**	**2,534**
Road	2,165	204	-	50	-	-	114	1	2,534
Other Rail Terminals	**4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4**
Road	4	-	-	-	-	-	-	-	4
Total	**8,515**	**377**	**-**	**342**	**418**	**5**	**2,231**	**10**	**11,898**
Grand Total	**8,515**	**377**	**8,872**	**1,364**	**1,348**	**354**	**7,964**	**44**	**28,838**

Movements highlighted in grey were not shown in the graphical presentation of the logistics chain

Table B. Phase 1 and Phase 2: Detailed Breakdown of TEUs Movement between Business Types (Annual Estimation)

	To Business Type								
	CP	CT	Unpack Location	FIT Inter-modal	NQRT	QAP	Road Transport Staging	Other Rai Terminals	Total
From Business Type									
Phase 1: Import Full to Unpack									
CT	**-**	**-**	**101,562**	**-**	**28,283**	**7,775**	**155,037**	**551**	**293,208**
Road	-	-	101,562	-	28,283	7,775	155,037	551	293,208
FIT Intermodal	**-**	**-**	**21,232**	**-**	**-**	**-**	**6,877**	**-**	**28,109**
Road	-	-	21,232	-	-	-	6,877	-	28,109
NQRT	**-**	**-**	**-**	**28,109**	**-**	**83**	**-**	**275**	**28,467**
Rail	-	-	-	28,109	-	-	-	275	28,384
Road	-	-	-	-	-	83	-	-	83
QAP	**-**	**-**	**6,111**	**-**	**184**	**-**	**4,316**	**63**	**10,673**
Road	-	-	6,111	-	184	-	4,316	63	10,673
Road Transport Staging	**-**	**-**	**163,280**	**-**	**-**	**2,816**	**11,702**	**134**	**177,932**
Road	-	-	163,280	-	-	2,816	11,702	134	177,932
Other Rail Terminals	**-**	**-**	**1,023**	**-**	**-**	**-**	**-**	**-**	**1,023**
Road	-	-	1,023	-	-	-	-	-	1,023
Total	**-**	**-**	**293,208**	**28,109**	**28,467**	**10,673**	**177,932**	**1,023**	**539,412**
Phase 2: Import Unpack to Dehire									
Unpack Location	**205,993**	**3,455**	**-**	**10,102**	**-**	**173**	**73,174**	**311**	**293,208**
Road	205,993	3,455	-	10,102	-	173	73,174	311	293,208
FIT Intermodal	**589**	**-**	**-**	**-**	**11,190**	**-**	**54**	**-**	**11,832**
Rail	-	-	-	-	-	-	-	-	-
Road	589	-	-	-	-	-	54	-	643
NQRT	**11,169**	**21**	**-**	**-**	**-**	**-**	**-**	**-**	**11,190**
Road	11,169	21	-	-	-	-	-	-	11,190
QAP	**91**	**82**	**-**	**-**	**-**	**-**	**-**	**-**	**173**
Road	91	82	-	-	-	-	-	-	173
Road Transport Staging	**67,268**	**4,195**	**-**	**1,730**	**-**	**-**	**3,943**	**35**	**77,170**
Road	67,268	4,195	-	1,730	-	-	3,943	35	77,170
Other Rail Terminals	**346**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**346**
Road	346	-	-	-	-	-	-	-	346
Total	**285,456**	**7,752**	**-**	**11,832**	**11,190**	**173**	**77,170**	**346**	**393,920**
Grand Total	**285,456**	**7,752**	**293,208**	**39,942**	**39,657**	**10,846**	**255,102**	**1,369**	**933,332**

Movements highlighted in grey were not shown in the graphical presentation of the logistics chain

Table C. Phase 4 and Phase 5: Detailed Breakdown of TEUs Movement between Business Types (Full Study Period)

	To Business Type							
	CT	Pack Location	FIT Inter-modal	NQRT	QAP	Road Transport Staging	Other Rail Terminals	Total
From Business Type								
Phase 4: Export Empty to Pack								
CP	**-**	**3,220**	**-**	**476**	**2**	**670**	**17**	**4,385**
Road	-	3,220	-	476	2	670	17	4,385
CT	**-**	**31**	**-**	**-**	**-**	**6**	**-**	**37**
Road	-	31	-	-	-	6	-	37
IMDFIT	**-**	**8**	**-**	**52**	**-**	**2**	**-**	**62**
Rail	-	-	-	52	-	-	-	52
Road	-	8	-	-	-	2	-	10
NQRT	**-**	**389**	**48**	**-**	**-**	**-**	**66**	**503**
Rail	-	389	48	-	-	-	66	503
QAP	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
Road	-	1	-	-	-	-	-	1
Road Transport Staging	**-**	**571**	**-**	**-**	**-**	**7**	**-**	**578**
Road	-	571	-	-	-	7	-	578
Other Rail Terminal	**-**	**63**	**-**	**-**	**-**	**-**	**-**	**63**
Road	-	63	-	-	-	-	-	63
Total	**-**	**4,283**	**48**	**528**	**2**	**685**	**83**	**5,629**
Phase 5: Export Full To CT								
Pack Location	**2,581**	**-**	**24**	**585**	**351**	**1,128**	**84**	**4,753**
Rail	-	-	-	585	-	-	-	585
Road	2,581	-	24	-	351	1,128	84	4,168
FIT Intermodal	**-**	**-**	**-**	**58**	**-**	**-**	**-**	**58**
Rail	-	-	-	58	-	-	-	58
NQRT	**509**	**-**	**-**	**-**	**42**	**-**	**-**	**551**
Road	509	-	-	-	42	-	-	551
QAP	**468**	**-**	**-**	**-**	**-**	**11**	**-**	**479**
Road	468	-	-	-	-	11	-	479
Road Transport Staging	**1,247**	**-**	**-**	**-**	**2**	**30**	**-**	**1,279**
Road	1,247	-	-	-	2	30	-	1,279
Other Rail Terminal	**-**	**-**	**-**	**84**	**-**	**-**	**-**	**84**
Rail	-	-	-	84	-	-	-	84
Total	**4,805**	**-**	**24**	**727**	**395**	**1,169**	**84**	**7,204**
Grand Total	**4,805**	**4,283**	**72**	**1,255**	**397**	**1,854**	**167**	**12,833**

Movements highlighted in grey were not shown in the graphical presentation of the logistics chain

Table D. Phase 4 and Phase 5: Detailed Breakdown of TEUs Movement between Business Types (Annual Estimation)

	To Business Type							
	CT	Pack Location	FIT Intermodal	NQRT	QAP	Road Transport Staging	Other Rail Terminals	Total
From Business Type								
Phase 4: Export Empty to Pack								
CP	**-**	**126,413**	**-**	**17,180**	**39**	**22,350**	**507**	**166,489**
Road	-	126,413	-	17,180	39	22,350	507	166,489
CT	**-**	**1,936**	**-**	**-**	**-**	**375**	**-**	**2,311**
Road	-	1,936	-	-	-	375	-	2,311
FIT Intermodal	**-**	**314**	**-**	**1,877**	**-**	**67**	**-**	**2,258**
Rail	-		-	1,877	-		-	1,877
Road	-	314	-	-	-	67	-	381
NQRT	**-**	**15,272**	**1,819**	**-**	**-**	**-**	**1,967**	**19,057**
Rail	-	15,272	1,819	-	-	-	1,967	19,057
QAP	**-**	**39**	**-**	**-**	**-**		**-**	**39**
Road	-	39	-	-	-		-	39
Road Transport Staging	**-**	**22,417**	**-**	**-**	**-**	**234**	**-**	**22,651**
Road	-	22,417	-	-	-	234	-	22,651
Other Rail Terminal	**-**	**2,473**	**-**	**-**	**-**	**-**	**-**	**2,473**
Road	-	2,473	-	-	-	-	-	2,473
Total	**-**	**168,864**	**1,819**	**19,057**	**39**	**23,025**	**2,473**	**215,277**
Phase 5: Export Full To CT								
Pack Location	**90,705**	**-**	**1,570**	**15,834**	**14,959**	**43,522**	**2,274**	**168,864**
Rail	-	-	-	15,834	-	-	-	15,834
Road	90,705	-	1,570	-	14,959	43,522	2,274	153,030
FIT Intermodal	**-**	**-**	**-**	**1,570**	**-**	**-**	**-**	**1,570**
Rail	-	-	-	1,570	-	-	-	1,570
NQRT	**17,888**	**-**	**-**	**-**	**1,790**	**-**	**-**	**19,678**
Road	17,888	-	-	-	1,790	-	-	19,678
QAP	**16,447**	**-**	**-**	**-**	**-**	**387**	**-**	**16,834**
Road	16,447	-	-	-	-	387	-	16,834
Road Transport Staging	**43,824**	**-**	**-**	**-**	**85**	**1,158**	**-**	**45,067**
Road	43,824	-	-	-	85	1,158	-	45,067
Other Rail Terminal	**-**	**-**	**-**	**2,274**	**-**	**-**	**-**	**2,274**
Rail	-	-	-	**2,274**	-	-	-	2,274
Total	**168,864**	**-**	**1,570**	**19,678**	**16,834**	**45,067**	**2,274**	**254,286**
Grand Total	**168,864**	**168,864**	**3,388**	**38,735**	**16,873**	**68,092**	**4,747**	**469,563**

Movements highlighted in grey were not shown in the graphical presentation of the logistics flow

Table E. Phase 3 and Phase 6: Detailed Breakdown of TEUs Movement between Business Types (Full Study Period)

	To Business Type				
	CP	CT	FIT Intermodal	NQRT	Total
From Business Type					
Phase 3: Import Reposition					
CT	**233**	**-**	**-**	**-**	**233**
Road	233	-	-	-	**233**
Total	**233**	**-**	**-**	**-**	**233**
Phase 4: Export Reposition					
CP	**-**	**5,088**	**362**	**-**	**5,450**
Road	-	5,088	362	-	**5,450**
FIT Intermodal	**-**	**-**	**-**	**327**	**327**
Rail	-	-	-	327	**327**
NQRT	**-**	**327**	**-**	**-**	**327**
Road	-	327	-	-	**327**
Total	**-**	**5,415**	**362**	**327**	**6,104**

Table F. Phase 3 and Phase 6: Detailed Breakdown of TEUs Movement between Business Types (Annual Estimation)

	To Business Type				
	CP	CT	FIT Intermodal	NQRT	Total
From Business Type					
Phase 3: Import Reposition					
CT	**14,551**	**-**	**-**	**-**	**14,551**
Road	14,551	-	-	-	14,551
Total	**14,551**	**-**	**-**	**-**	**14,551**
Phase 4: Export Reposition					
CP	**-**	**105,087**	**6,754**	**-**	**111,841**
Road	-	105,087	6,754	-	111,841
FIT Intermodal	**-**	**-**	**-**	**6,754**	**6,754**
Rail	-	-	-	6,754	6,754
NQRT	**-**	**6,754**	**-**	**-**	**6,754**
Road	-	6,754	-	-	6,754
Total	**-**	**111,841**	**6,754**	**6,754**	**125,348**

Table G. Classification of Container Type based on ISO Code

Container Type	Description
General Container	General containers are generally suitable for the carrying all types of general cargo
Reefer Container	Reefer containers or refrigirated containers are for transportation of temperature sensitive cargo
Tank Container	Tank containers are for carrying liquids, gases and pressurized dry bulk cargo
Open Top Container	Open Top Containers are similar to general container except that it has no rigid roof but instead, a removable cover. They are designed to allow loading through both the top opening and the rear doors and are consequently suitable for the carriage of heavy, bulky or long objects
Flat Rack Container	Flat Rack containers are containers without sidewalls or a roof. They have vertical front sides. They are suitable for bulky cargo with overdimensions such as big machinery objects.
Platform Container	Platform containers consist solely of a floor structure with extremely high loading capacity. The containers have no side or end walls.
High Cube Container	High-cube containers are similar in structure to standard containers. The have the same width and base dimensions, but are 9'6" tall (for the purposes of this study).

Table H. List of ISO Codes and Classification of Container Type

ISO	High Cube	TEU	Size	ISO Type
2070		1	20	Tank
2075		1	20	Tank
20G0		1	20	General
20G1		1	20	General
20T0		1	20	Tank
20T5		1	20	Tank
20T6		1	20	Tank
2200		1	20	General
2210		1	20	General
2211		1	20	General
2230		1	20	Reefer
2232		1	20	Reefer
2233		1	20	Reefer
2250		1	20	Open Top
2251		1	20	Open Top
2260		1	20	Platform
2263		1	20	Platform
2264		1	20	Platform
2270		1	20	Tank
2273		1	20	Tank
2275		1	20	Tank
2276		1	20	Tank
22G0		1	20	General
22G1		1	20	General
22P0		1	20	Flat Rack
22P1		1	20	Flat Rack
22P3		1	20	Platform
22P5		1	20	Platform
22P8		1	20	Platform
22R0		1	20	Reefer
22R1		1	20	Reefer
22T0		1	20	Tank
22T3		1	20	Tank
22T5		1	20	Tank
22T6		1	20	Tank
22T7		1	20	Tank
22U0		1	20	Open Top
22U1		1	20	Open Top
22U3		1	20	Open Top
22U5		1	20	Open Top
22U6		1	20	Open Top
2300		1	20	General
2361		1	20	Platform
2400		1	20	General

ISO	High Cube	TEU	Size	ISO Type
2432		1	20	Reefer
2500	Highcube	1	20	General
2510	Highcube	1	20	General
2530	Highcube	1	20	Reefer
2532	Highcube	1	20	Reefer
25G0	Highcube	1	20	General
25G1	Highcube	1	20	General
25GP	Highcube	1	20	General
25R1	Highcube	1	20	Reefer
25U1	Highcube	1	20	Open Top
28U2		1	20	Open Top
2950		1	20	Open Top
2EG1		1	20	General
2EG9		1	20	General
4200		2	40	General
4210		2	40	General
4250		2	40	Open Top
4251		2	40	Open Top
4260		2	40	Platform
4262		2	40	Platform
4263		2	40	Platform
4264		2	40	Platform
4270		2	40	Tank
42G0		2	40	General
42G1		2	40	General
42P1		2	40	Flat Rack
42P3		2	40	Platform
42T6		2	40	Tank
42U0		2	40	Open Top
42U1		2	40	Open Top
42UT		2	40	Open Top
4300		2	40	General
4310		2	40	General
4332		2	40	Reefer
4350		2	40	Open Top
4351		2	40	Open Top
4361		2	40	Platform
4363		2	40	Platform
4410		2	40	General
4500	Highcube	2	40	General
4510	Highcube	2	40	General
4530	Highcube	2	40	Reefer
4531	Highcube	2	40	Reefer
4532	Highcube	2	40	Reefer
4551	Highcube	2	40	Open Top
45G0	Highcube	2	40	General
45G1	Highcube	2	40	General
45P1	Highcube	2	40	Platform
45P3	Highcube	2	40	Platform
45P8	Highcube	2	40	Platform
45R0	Highcube	2	40	Reefer

ISO	High Cube	TEU	Size	ISO Type
45R1	Highcube	2	40	Reefer
45U1	Highcube	2	40	Open Top
45U6	Highcube	2	40	Open Top
48P3		2	40	Platform
4EG1		2	40	General
4FG0		2	40	General
4FG1		2	40	General
L5G1		2	40	General
9510		2	40	General
2070		1	20	Tank
2075		1	20	Tank
20G0		1	20	General
20G1		1	20	General
20T0		1	20	Tank

Table I. Time of Day at Importers for Full Container Delivery

Delivery to Unpack Location*	TEUs (Full Study, Weekday Only)	Percent	TEUs (Annual)	TEUs per Day
0:00	40	0.5%	1,484	6
1:00	24	0.3%	890	3
2:00	24	0.3%	890	3
3:00	16	0.2%	594	2
4:00	14	0.2%	519	2
5:00	59	0.8%	2,189	8
6:00	308	4.0%	11,427	44
7:00	538	6.9%	19,960	77
8:00	784	10.1%	29,087	112
9:00	670	8.6%	24,858	96
10:00	744	9.6%	27,603	106
11:00	623	8.0%	23,114	89
12:00	571	7.4%	21,185	81
13:00	660	8.5%	24,487	94
14:00	569	7.3%	21,110	81
15:00	488	6.3%	18,105	70
16:00	455	5.9%	16,881	65
17:00	265	3.4%	9,832	38
18:00	210	2.7%	7,791	30
19:00	202	2.6%	7,494	29
20:00	103	1.3%	3,821	15
21:00	134	1.7%	4,972	19
22:00	156	2.0%	5,788	22
23:00	111	1.4%	4,118	16
Total	**7,768**	**100%**	**288,199**	**1,108**

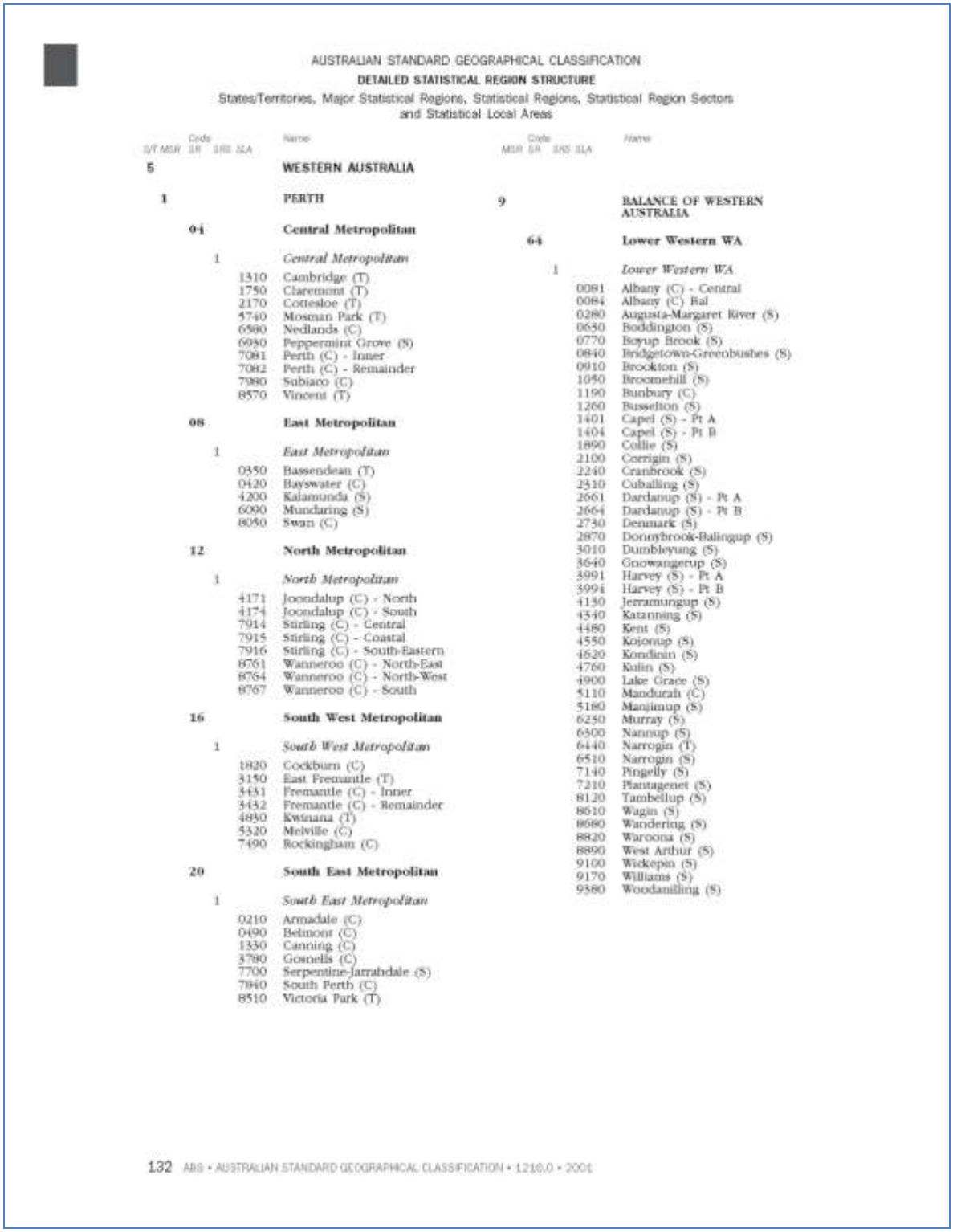
*Arrival Time
Assuming 260 Weekday per Year
Exclude 135 TEUs delivered on weekend (equivalent to 5,009 TEUs Annually)

Table J. Time of Day at Pack Location for Full Container Pick Up

Pick Up from Pack Location*	TEUs (Full Study, Weekday Only)	Percent	TEUs (Annual)	TEUs per Day
0:00	76	1.8%	2,954	11
1:00	10	0.2%	389	1
2:00	20	0.5%	777	3
3:00	22	0.5%	855	3
4:00	37	0.9%	1,438	6
5:00	84	1.9%	3,265	13
6:00	162	3.8%	6,297	24
7:00	200	4.6%	7,775	30
8:00	251	5.8%	9,757	38
9:00	340	7.9%	13,217	51
10:00	342	7.9%	13,295	51
11:00	527	12.2%	20,486	79
12:00	354	8.2%	13,761	53
13:00	355	8.2%	13,800	53
14:00	382	8.8%	14,849	57
15:00	303	7.0%	11,778	45
16:00	221	5.1%	8,591	33
17:00	154	3.6%	5,986	23
18:00	81	1.9%	3,149	12
19:00	65	1.5%	2,527	10
20:00	30	0.7%	1,166	4
21:00	13	0.3%	505	2
22:00	114	2.6%	4,432	17
23:00	176	4.1%	6,842	26
Total	**4,319**	**56%**	**160,239**	**646**

*Departure Time
Assuming 260 Weekday per Year
Exclude 25 TEUs delivered on weekend (Equivalent to 972 TEUs Annually)

Table K. WA Communities by ABS Statistical Region Sector



AUSTRALIAN STANDARD GEOGRAPHICAL CLASSIFICATION

DETAILED STATISTICAL REGION STRUCTURE

States/Territories, Major Statistical Regions, Statistical Regions, Statistical Region Sectors and Statistical Local Areas

Codes S/T	MSR	SR	SRS	SLA	Name
5					**WESTERN AUSTRALIA**
	1				**PERTH**
		04			**Central Metropolitan**
			1		*Central Metropolitan*
				1310	Cambridge (T)
				1750	Claremont (T)
				2170	Cottesloe (T)
				5740	Mosman Park (T)
				6580	Nedlands (C)
				6930	Peppermint Grove (S)
				7081	Perth (C) - Inner
				7082	Perth (C) - Remainder
				7980	Subiaco (C)
				8570	Vincent (T)
		08			**East Metropolitan**
			1		*East Metropolitan*
				0350	Bassendean (T)
				0420	Bayswater (C)
				4200	Kalamunda (S)
				6090	Mundaring (S)
				8050	Swan (C)
		12			**North Metropolitan**
			1		*North Metropolitan*
				4171	Joondalup (C) - North
				4174	Joondalup (C) - South
				7914	Stirling (C) - Central
				7915	Stirling (C) - Coastal
				7916	Stirling (C) - South-Eastern
				8761	Wanneroo (C) - North-East
				8764	Wanneroo (C) - North-West
				8767	Wanneroo (C) - South
		16			**South West Metropolitan**
			1		*South West Metropolitan*
				1820	Cockburn (C)
				3150	East Fremantle (T)
				3431	Fremantle (C) - Inner
				3432	Fremantle (C) - Remainder
				4830	Kwinana (T)
				5320	Melville (C)
				7490	Rockingham (C)
		20			**South East Metropolitan**
			1		*South East Metropolitan*
				0210	Armadale (C)
				0490	Belmont (C)
				1330	Canning (C)
				3780	Gosnells (C)
				7700	Serpentine-Jarrahdale (S)
				7840	South Perth (C)
				8510	Victoria Park (T)

Codes MSR	SR	SRS	SLA	Name
9				**BALANCE OF WESTERN AUSTRALIA**
	64			**Lower Western WA**
		1		*Lower Western WA*
			0081	Albany (C) - Central
			0084	Albany (C) Bal
			0280	Augusta-Margaret River (S)
			0650	Boddington (S)
			0770	Boyup Brook (S)
			0840	Bridgetown-Greenbushes (S)
			0910	Brookton (S)
			1050	Broomehill (S)
			1190	Bunbury (C)
			1260	Busselton (S)
			1401	Capel (S) - Pt A
			1404	Capel (S) - Pt B
			1890	Collie (S)
			2100	Corrigin (S)
			2240	Cranbrook (S)
			2310	Cuballing (S)
			2661	Dardanup (S) - Pt A
			2664	Dardanup (S) - Pt B
			2730	Denmark (S)
			2870	Donnybrook-Balingup (S)
			3010	Dumbleyung (S)
			3640	Gnowangerup (S)
			3991	Harvey (S) - Pt A
			3994	Harvey (S) - Pt B
			4130	Jerramungup (S)
			4340	Katanning (S)
			4480	Kent (S)
			4550	Kojonup (S)
			4620	Kondinin (S)
			4760	Kulin (S)
			4900	Lake Grace (S)
			5110	Mandurah (C)
			5180	Manjimup (S)
			6250	Murray (S)
			6300	Nannup (S)
			6440	Narrogin (T)
			6510	Narrogin (S)
			7140	Pingelly (S)
			7210	Plantagenet (S)
			8120	Tambellup (S)
			8610	Wagin (S)
			8680	Wandering (S)
			8820	Waroona (S)
			8890	West Arthur (S)
			9100	Wickepin (S)
			9170	Williams (S)
			9380	Woodanilling (S)

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AUSTRALIAN STANDARD GEOGRAPHICAL CLASSIFICATION

DETAILED STATISTICAL REGION STRUCTURE

States/Territories, Major Statistical Regions, Statistical Regions, Statistical Region Sectors and Statistical Local Areas

Code S/T	MSR	SR	SRS	SLA	Name
5					**WESTERN AUSTRALIA**
	68				**Remainder - Balance WA**
		1			*Remainder - Balance WA*
				0250	Ashburton (S)
				0560	Beverley (S)
				0680	Broome (S)
				1120	Bruce Rock (S)
				1470	Carnamah (S)
				1540	Carnarvon (S)
				1610	Chapman Valley (S)
				1680	Chittering (S)
				1960	Coolgardie (S)
				2050	Coorow (S)
				2380	Cue (S)
				2450	Cunderdin (S)
				2520	Dalwallinu (S)
				2590	Dandaragan (S)
				2800	Derby-West Kimberley (S)
				2940	Dowerin (S)
				3080	Dundas (S)
				3220	East Pilbara (S)
				3290	Esperance (S)
				3360	Exmouth (S)
				3500	Geraldton (C)
				3570	Gingin (S)
				3710	Goomalling (S)
				3851	Greenough (S) - Pt A
				3854	Greenough (S) - Pt B
				3920	Halls Creek (S)
				4060	Irwin (S)
				4281	Kalgoorlie/Boulder (C) - Pt A
				4284	Kalgoorlie/Boulder (C) - Pt B
				4410	Kellerberrin (S)
				4690	Koorda (S)
				4970	Laverton (S)
				5040	Leonora (S)
				5250	Meekatharra (S)
				5390	Menzies (S)
				5460	Merredin (S)
				5530	Mingenew (S)
				5600	Moora (S)
				5670	Morawa (S)
				5810	Mount Magnet (S)
				5880	Mount Marshall (S)
				5950	Mukinbudin (S)
				6020	Mullewa (S)
				6160	Murchison (S)
				6570	Nannebeen (S)
				6620	Ngaanyatjarraku (S)
				6650	Northam (T)
				6720	Northam (S)
				6790	Northampton (S)
				6860	Nungarin (S)
				7000	Perenjori (S)
				7280	Port Hedland (T)
				7350	Quairading (S)
				7420	Ravensthorpe (S)
				7560	Roebourne (S)
				7650	Sandstone (S)
				7770	Shark Bay (S)
				8190	Tammin (S)
				8260	Three Springs (S)
				8330	Toodyay (S)
				8400	Trayning (S)
				8470	Upper Gascoyne (S)
				8540	Victoria Plains (S)
				9030	Westonia (S)
				9250	Wiluna (S)
				9310	Wongan-Ballidu (S)
				9450	Wyalkatchem (S)
				9520	Wyndham-East Kimberley (S)
				9590	Yalgoo (S)
				9660	Yilgarn (S)
				9730	York (S)
				9779	Off-Shore Areas & Migratory

Table L. Breakdown of TEUs Volume in One Hour Time of Day Intervals at Container Terminals – 14 Days

Weekday plus Weekend					
Time Interval	Import Full	Import Empty	Export Full	Export Empty	Total
0:00	82	-	26	5	113
1:00	107	-	41	50	198
2:00	78	-	36	20	134
3:00	22	-	22	8	52
4:00	81	-	46	6	133
5:00	64	-	-	-	64
6:00	267	8	98	134	507
7:00	793	41	243	439	1,516
8:00	746	30	335	573	1,684
9:00	957	58	465	771	2,251
10:00	844	29	374	601	1,848
11:00	486	18	203	339	1,046
12:00	887	23	537	543	1,990
13:00	881	50	450	471	1,852
14:00	756	27	554	495	1,832
15:00	821	2	507	346	1,676
16:00	762	8	434	208	1,412
17:00	968	-	386	226	1,580
18:00	705	3	303	174	1,185
19:00	432	3	234	138	807
20:00	696	-	295	181	1,172
21:00	534	-	233	134	901
22:00	232	-	100	9	341
23:00	52	-	21	48	121
Grand Total	**12,253**	**300**	**5,943**	**5,919**	**24,415**

Table M. Breakdown of TEUs Volume in One Hour Time of Day Intervals at Container Terminals – Weekdays Only

	Weekday Only				
Time Interval	Import Full	Import Empty	Export Full	Export Empty	Total
0:00	5	26	-	82	113
1:00	50	41	-	107	198
2:00	20	36	-	78	134
3:00	8	22	-	22	52
4:00	6	46	-	81	133
5:00	-	-	-	64	64
6:00	78	98	8	267	451
7:00	326	223	41	739	1,329
8:00	413	303	30	687	1,433
9:00	633	433	58	876	2,000
10:00	601	354	29	794	1,778
11:00	339	189	18	479	1,025
12:00	539	522	23	805	1,889
13:00	471	440	50	827	1,788
14:00	493	550	27	736	1,806
15:00	346	507	2	819	1,674
16:00	208	434	8	762	1,412
17:00	226	386	-	967	1,579
18:00	174	303	3	705	1,185
19:00	138	234	3	432	807
20:00	181	295	-	696	1,172
21:00	134	233	-	534	901
22:00	9	100	-	208	317
23:00	48	21	-	24	93
Grand Total	**5,446**	**5,796**	**300**	**11,791**	**23,333**

Table N. Breakdown of TEUs Volume in One Hour Time of Day Intervals at Container Terminals – Weekends only

	Weekend Only				
Time Interval	Import Full	Import Empty	Export Full	Export Empty	Total
0:00	-	-	-	-	-
1:00	-	-	-	-	-
2:00	-	-	-	-	-
3:00	-	-	-	-	-
4:00	-	-	-	-	-
5:00	-	-	-	-	-
6:00	56	-	-	-	56
7:00	113	20	-	54	187
8:00	160	32	-	59	251
9:00	138	32	-	81	251
10:00	-	20	-	50	70
11:00	-	14	-	7	21
12:00	4	15	-	82	101
13:00	-	10	-	54	64
14:00	2	4	-	20	26
15:00	-	-	-	2	2
16:00	-	-	-	-	-
17:00	-	-	-	1	1
18:00	-	-	-	-	-
19:00	-	-	-	-	-
20:00	-	-	-	-	-
21:00	-	-	-	-	-
22:00	-	-	-	24	24
23:00	-	-	-	28	28
Grand Total	**473**	**147**	**462**	**-**	**1,082**

ANNEXE 11. FREMANTLE PORTS ANNUAL ACCESS ROAD CENSUS

North Quay Fremantle Truck Survey 2011

Analysis and Conclusions

10th Annual Truck Survey

October 2011

Fiona Callander
October 2011

Survey objectives

To observe changes in road-based container handling by monitoring:

- Container truck numbers
- Proportion of container trucks in local traffic
- Container truck types
- Container truck loading (TEU/truck)

Fiona Callander
October 2011

Survey locations

Fiona Callander
October 2011

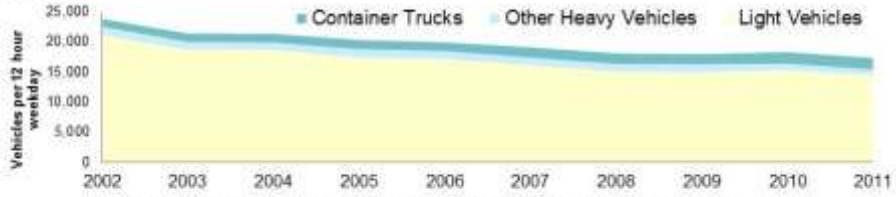
Survey timing and data collected

- Survey timed to coincide with container movement study
- Data collected over two consecutive weeks
  - Week 1 – Monday 15th August to Friday 19th August 2011
  - Week 2 – Monday 22nd August to Friday 26th August 2011
- Survey carried out over 16 hours, 0600hrs to 2200hrs
- Week 1 all vehicles, light and heavy recorded
- Week 2 only container trucks recorded
- Trucks classified by cargo type and axle configuration
- Number and size of containers carried recorded

Fiona Callander
October 2011

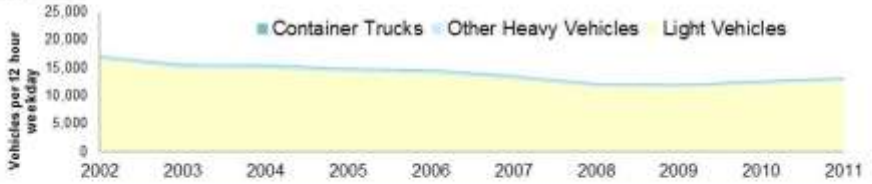
How much traffic is there?

Tydeman Rd



11% of all vehicles are now container trucks. In 2002, this figure was 5%

Port Beach Rd



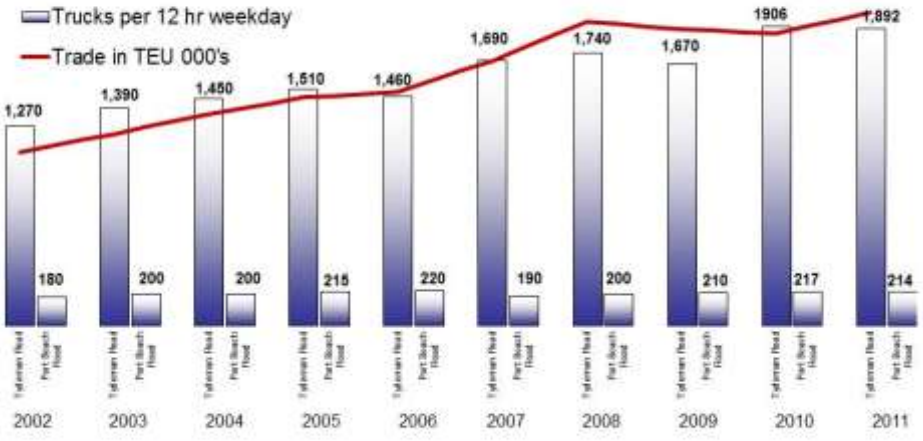
2% of all vehicles are now container trucks. In 2002, this figure was 1%

Fiona Callander
October 2011

How many container trucks a day?

2,106 container trucks per 12 hour weekday
1% fewer trucks than in September 2010

Annual Trade increased by average of 7% pa 2002 to 2011
Truck numbers increased by average of 4% pa 2002 to 2011



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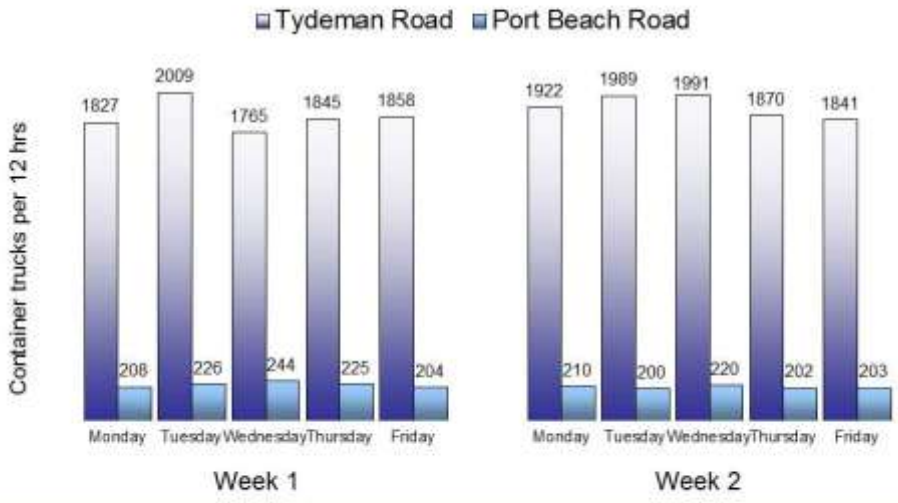
How did this vary over the survey period?



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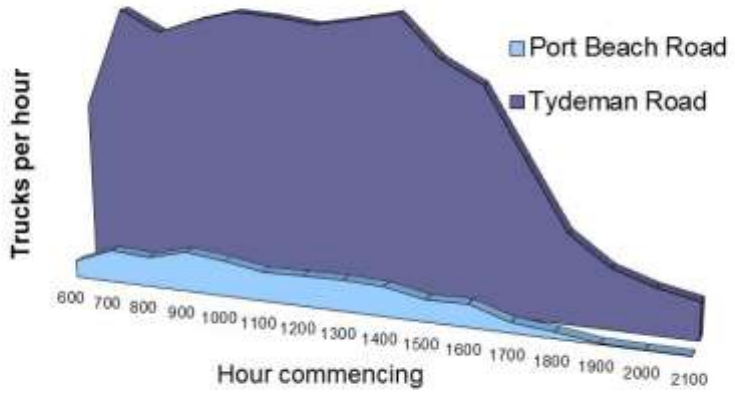
October 2011

How does this vary over the course of the day?



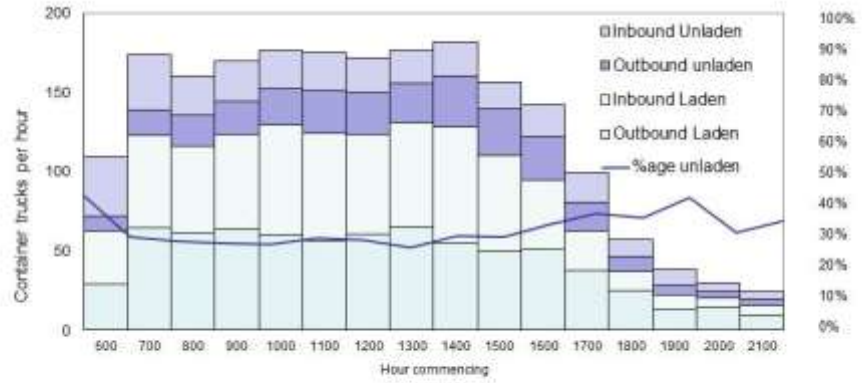
Only 7% of trucks appear after 6pm and 74% of trucks appear before 3pm

Fiona Callander
October 2011

Empty container trucks on Tydeman Road

30% of container trucks on Tydeman Road are unladen

This equates to 619 trucks every 16hr weekday



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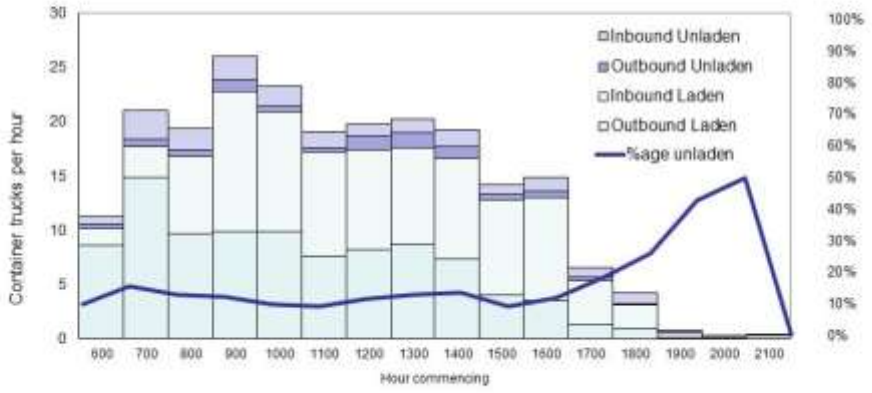
October 2011

Empty container trucks on Port Beach Road

13% of container trucks on Port Beach Road are unladen

This equates to 28 trucks every 16hr weekday



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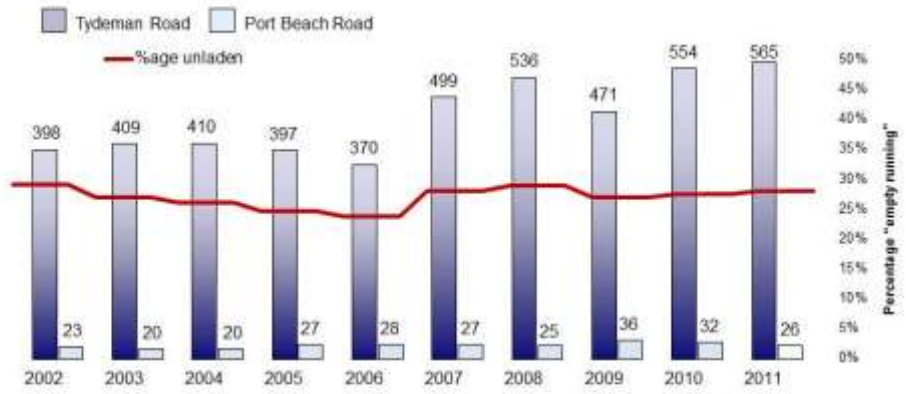
October 2011

How has empty running been changing?



Empty running fell from 29% in 2002 to 24% in 2006 but has risen to 28% in 2011 over a 12 hour day

In 2011, 29% of vehicles were unladen over a 16 hr average weekday

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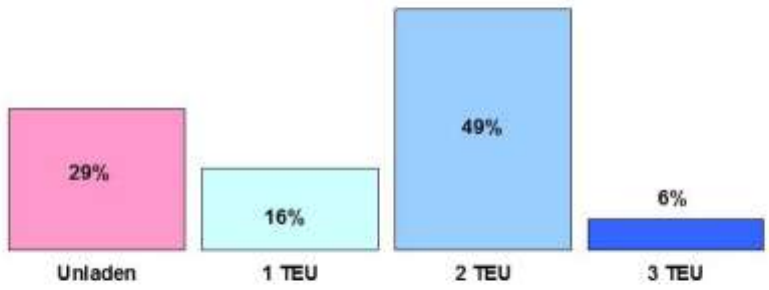
October 2011

How many TEU does each truck carry?



Empty trucks and those with 1TEU carry only 13% of the TEU task but represent 45% of all trucks

The remaining 55% of trucks carry 87% of the TEU task

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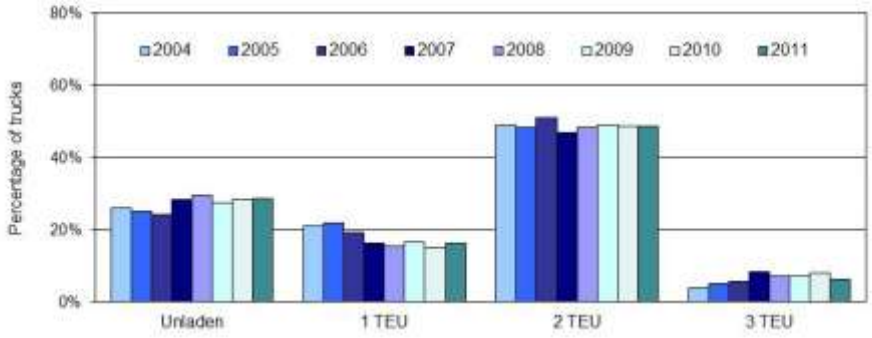
October 2011

How has this been changing over time?



Empty running has stayed steady as has the proportion of trucks carrying 2 TEU.

The proportion carrying only 1TEU has risen slightly

The proportion carrying 3 TEU has fallen

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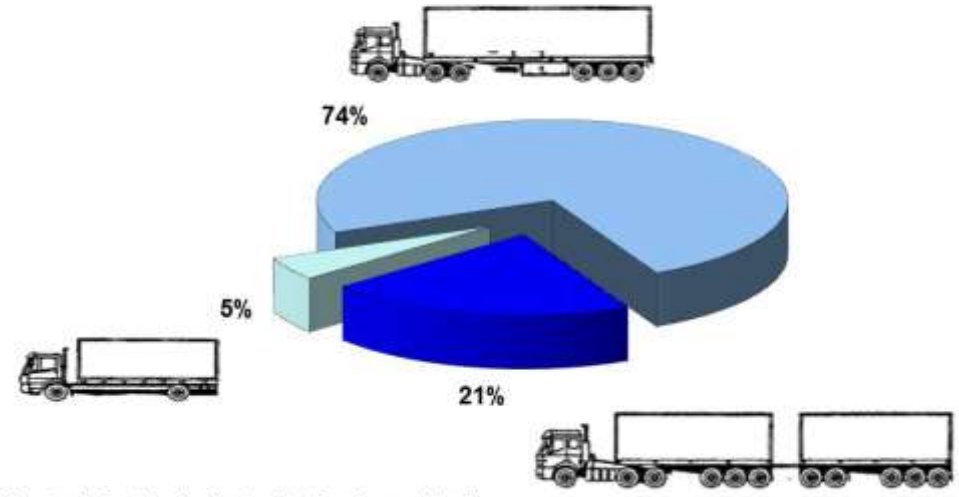
October 2011

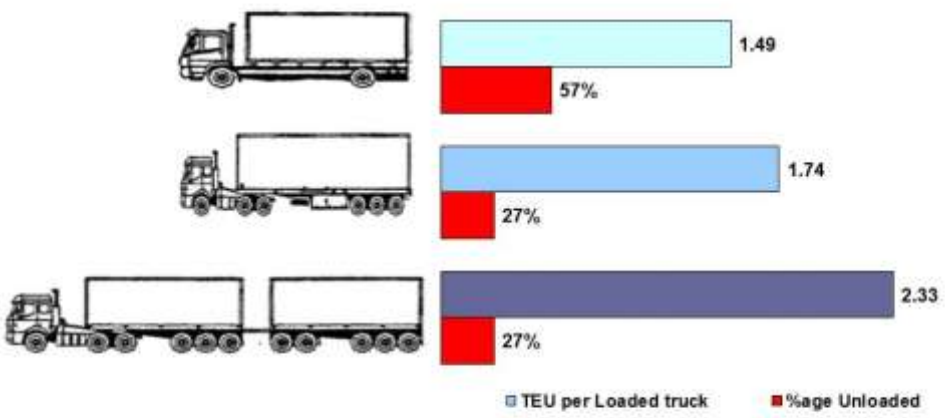
What types of truck are servicing the trade?



The truck fleet is dominated by 6-axle semi-trailers

Fiona Callander
October 2011

What are these types of truck carrying?



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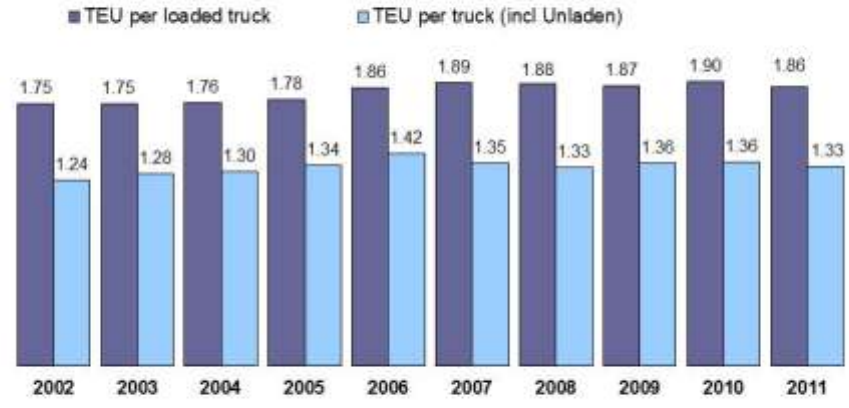
How has truck loading been changing?



TEU per truck has fallen although changes are very small....

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October 2011

Trucks with Lifting Capability

- 37% of all container trucks have lifting capability
- 90% of these are 6-axle semi trailers
- Laden trucks with lifting capability carry only 1.70 TEU compared with 1.97 for other container trucks
- 63% of container trucks on Port Beach Road have lifting capacity
- 35% of container trucks on Tydeman Road have lifting capacity

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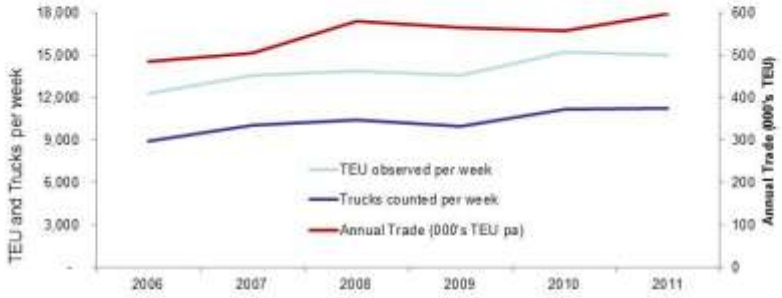
Overall Trends since 2006



Good News:

Truck Growth has not matched trade growth over time

Bad News:

Truck numbers are trending upwards along with the road based TEU task

Truck productivity (TEU/truck) therefore shows little improvement over time

Fiona Callander
October 2011

Summary – road-based container task

- This year's survey was timed to coincide with the container movement study and was carried out in August rather than the usual September date.
- During the average survey week some 11,300 container trucks were observed serving the port. These trucks carried a total of 15,030 TEU
- This compared with 11,226 container trucks last year carrying a total of 15,280 TEU.
- That is there has been a 1% increase in trucks but a 2% decline in the TEU task from September 2010 to August 2011
- Together these features have contributed to lower truck productivity in 2011.
- In terms of the observed road-based TEU task, 2011 has been very similar to 2010. However, this is somewhat at odds with the 9% cross-wharf trade increase in the 12 months to August 2011.

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October 2011

Summary – truck loading

- The spread of truck movements during the day changed slightly with only 93% of trucks arriving between 6am and 6pm compared to 95% last year.
- This resulted in the truck numbers observed between 6am and 6pm actually falling by 1% between Sep 10 and Aug 11 although overall truck numbers rose slightly.
- Empty running remains at a similar level to the past 5 years, with 29% of trucks observed travelling unladen.
- There are now 646 unladen trucks per 16hr day servicing the port
- On average each loaded truck carries 1.86 TEU, a small decline since last year but a 6% improvement over observed loading in 2002.
- The increased empty running combined with lower TEU per loaded truck has seen overall loading fall to 1.33 TEU per truck.

Fiona Collander
October 2011

ANNEXE 12. REFERENCES

1. Fremantle Annual Report and Accounts 2010-2011.
2. Fremantle Inner Harbour Container Movement Study – March 2004; Sinclair Knight Merz.
3. Information Paper: Experimental Statistics on International Shipping Container Movements, 2009 – 10 – Sept 16, 2011 Australian Bureau of Statistics - Ref 5368.0.55.018.
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