THE NATURE AND SCALE OF CONTAINER PACKING AND UNPACKING FACILITIES IN THE SOUTH DURBAN BASIN (SDB)

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MASTER OF TOWN AND REGIONAL PLANNING
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DECLARATION

Submitted in fulfilment / partial fulfilment of the requirements for the degree of ..... , in the Graduate Programme in ..... , University of KwaZulu-Natal, Durban, South Africa.

I declare that this dissertation is my own unaided work. All citations, references and borrowed ideas have been duly acknowledged. It is being submitted for the degree of ..... in the Faculty of Humanities, Development and Social Science, University of KwaZulu-Natal, Durban, South Africa. None of the present work has been submitted previously for any degree or examination in any other University.

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Student name

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Date

Acknowledgements

I have to dedicate this research paper to... the one and only... PX Shed in Bayhead, a model of modernism.

Slightly more seriously though, I'd like to dedicate this research to Durban's present and future port planners – from Transnet, the eThekwini Municipality, and of course the inevitable consultants. I trust and hope you will get it right.

My sincere thanks go out to:

- My parents for tirelessly and routinely encouraging me to get the work done. I'm glad you did!
- Anna for bearing with me, bringing tea and enduring the container-talk!
- The remarkably patient and accommodating Prof. Peter Robinson, my supervisor;
- My planning class-mates – it was a really great two years. Many of you are now colleagues (and clients);
- Paul for getting excited about ports and logistics and helping me figure it all out
- Richard for doing the rest;
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- The rest of the GMA crew;
- Mike, Theo, Nathan, Glanville and Kamalen for great ideas, inappropriate jokes and endless coffee;
- All the other people who ever said "just kill it, get it done!"

LIST OF ABBREVIATIONS

DCT	Durban Container Terminal
ESCAP	Economic and Social Commission for Asia and the Pacific
FPT	Fresh Produce Terminal
JIT	Just-In-Time
SAR&H	South African Railways and Harbours
SDB	South Durban Basin
TEU	Twenty foot equivalent unit (a 20 foot or 6 meter container)

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CHAPTER 1: WHY THIS TOPIC?

1.1 Background: Changing Ports

Against a backdrop of burgeoning international trade many port cities such as Durban have experienced extremely rapid local growth and expansion. The concurrent unprecedented increase in the containerisation of imported and exported cargos has put direct pressure on existing warehousing and industrial areas that were originally established for the throughput of bulk and break bulk cargos and for straightforward manufacturing.

The inherent differences between the movement of bulk or break bulk cargos and containerised cargos have brought on a very distinct change in the normal logistics chain and, hence, different spatial requirements in terms of buildings, land parcels and infrastructure (particularly road and rail access). Areas immediately adjacent to ports that were originally planned and designed 30, 40 even 50 or 60 years ago to accommodate facilities and equipment that move bulk cargos are thus faced with the challenge of accommodating facilities and equipment that move containerised cargo, and, logically, containers. Furthermore, areas that 50 years ago were considered sufficiently peripheral to ports to warrant non port-related activities such as manufacturing are frequently within a 10 km radius of the port and subject to market-related pressures to accommodate facilities that perform a logistics function.

The strategic importance of ports as the physical conduits of internationally traded cargos places direct and significant pressures on land and infrastructure in port cities to properly facilitate the movement of those cargos. Planning must clearly have both a clear conceptual understanding of the freight logistics chain as well as detailed knowledge of local operations. This research project thus seeks to inform any potential re-planning or redevelopment of such areas in Durban by providing a profile and analysis of the existing facilities in the broad industrial area adjacent to the Port of Durban that are currently being used for the packing and unpacking of containers.

1.2 Containerisation and associated pressures

Changes in the international movement of freight have had drastic implications for both ships and the ports that receive and dispatch freight – increased containerisation of cargos has necessitated the development of new types of ships (container liners) as well as specialized quayside infrastructure (e.g. overhead gantry cranes and stacking areas at the terminals). The increase in the share of general cargos, break bulk and even liquid bulk and bulk cargos now being shipped in containers has been occurring since the inception of containers in the 1950s, with the most rapid increases occurring in the past 15 to 20 years.

This has led to an import-export model for container movement (see Figure 1 below). Empty containers are brought from empty container storage depots to third party packing / unpacking facilities to be packed with cargoes for export before being transported to the container terminal to be shipped (full). In the exact reverse, full imported containers are picked up from the terminal and taken to third party packing / unpacking facilities to be unpacked, after which the cargo is distributed to its intended location and the empty container is taken to the empty storage depot. Some containers bypass the third party packing and unpacking facilities entirely and move straight from the importer or exporter to or from the container terminal (indicated by the dotted lines). Additionally, some containers are shipped empty as indicated by the solid lines directly between the container terminal and the empty container storage areas.

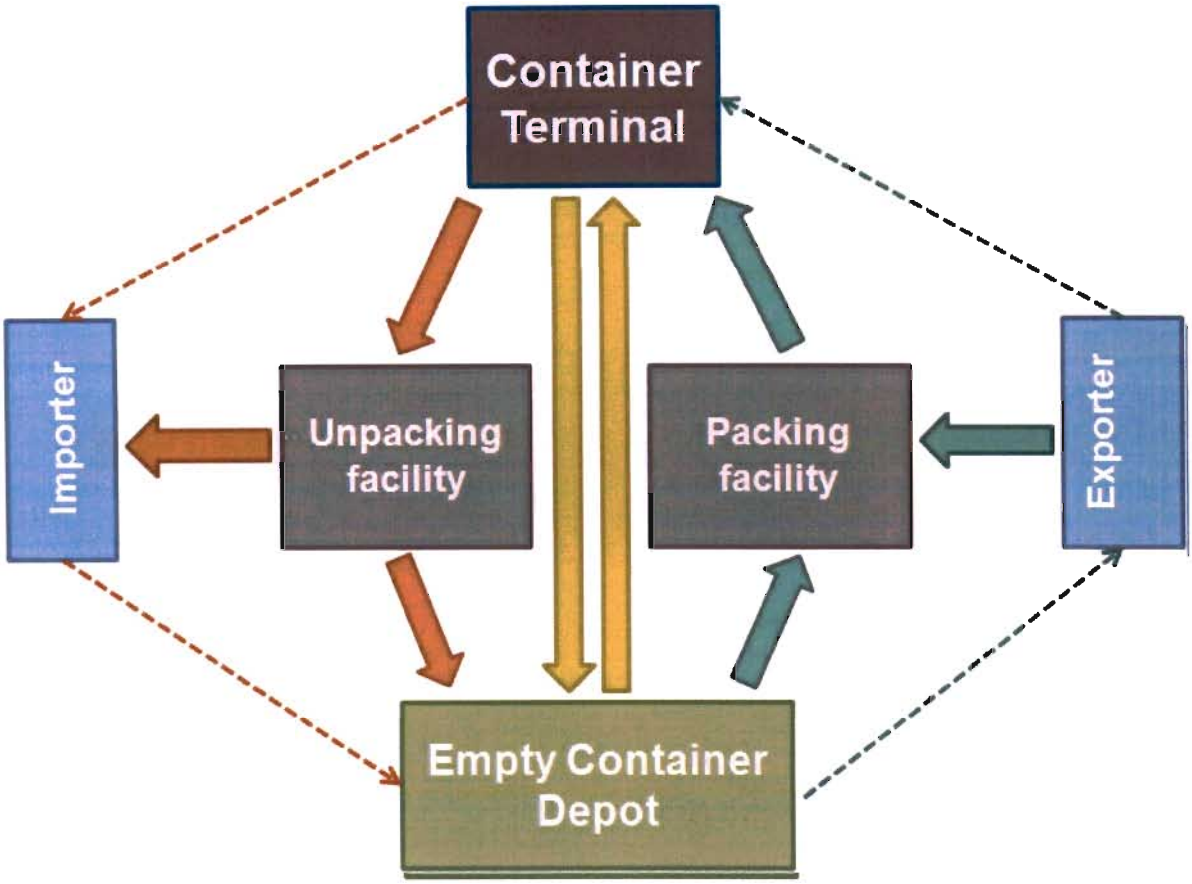


Figure 1 Diagrammatic import-export model for containers

Shipping lines control and often own the containers and are careful to make sure that containers stay relatively close to the port in question. Henceforth the packing and unpacking facilities are often required to be in close proximity to the container terminals while the origins (of exports) and destinations (of imports) can, of course, be considerable distances away and are often several 100 kilometers inland. Hence as containerisation has increased, so has the need for facilities close to ports in which to unpack imported containerised cargos which are then sent onward to their inland destinations, and in which cargos from the hinterland bound for export can be packed. The ability of the built environment in port cities to assemble adequately zoned and accessible land parcels in optimum location for such activities is proving to be a challenge across the world.

A number of conceptual approaches to the problem can and have been used to reach solutions. However, any spatial and design solution has to be implemented within the unique set of local circumstances found in that city. The import-export model for containerised cargo is universally implemented in a number of subtly different shapes and forms, yet local circumstances such as topography, land availability, governance, land ownership, quality of road and rail infrastructure and the range of activities already occurring in the relevant areas give each city a different set of implementation challenges.

A thorough scan of reports and analyses conducted by the eThekwini Municipality and interviews with relevant staff members at the Municipality has revealed that there is little local knowledge, and certainly none at the detail proposed by this study, of packing and unpacking facilities in the Durban port area. This research aims to provide an as yet little understood and critical piece within the range of knowledge needed to successfully re-plan or redevelop the logistics system in the Port of Durban – that is the location, extent and nature of the *existing* facilities used for the packing of export cargos and the unpacking of import cargos. These and future similar business operations will have to form an integral part of any new plans or redevelopments in the area, hence understanding the nature and extent of current operations is critical.

CHAPTER TWO: GENERAL RESEARCH METHODOLOGY

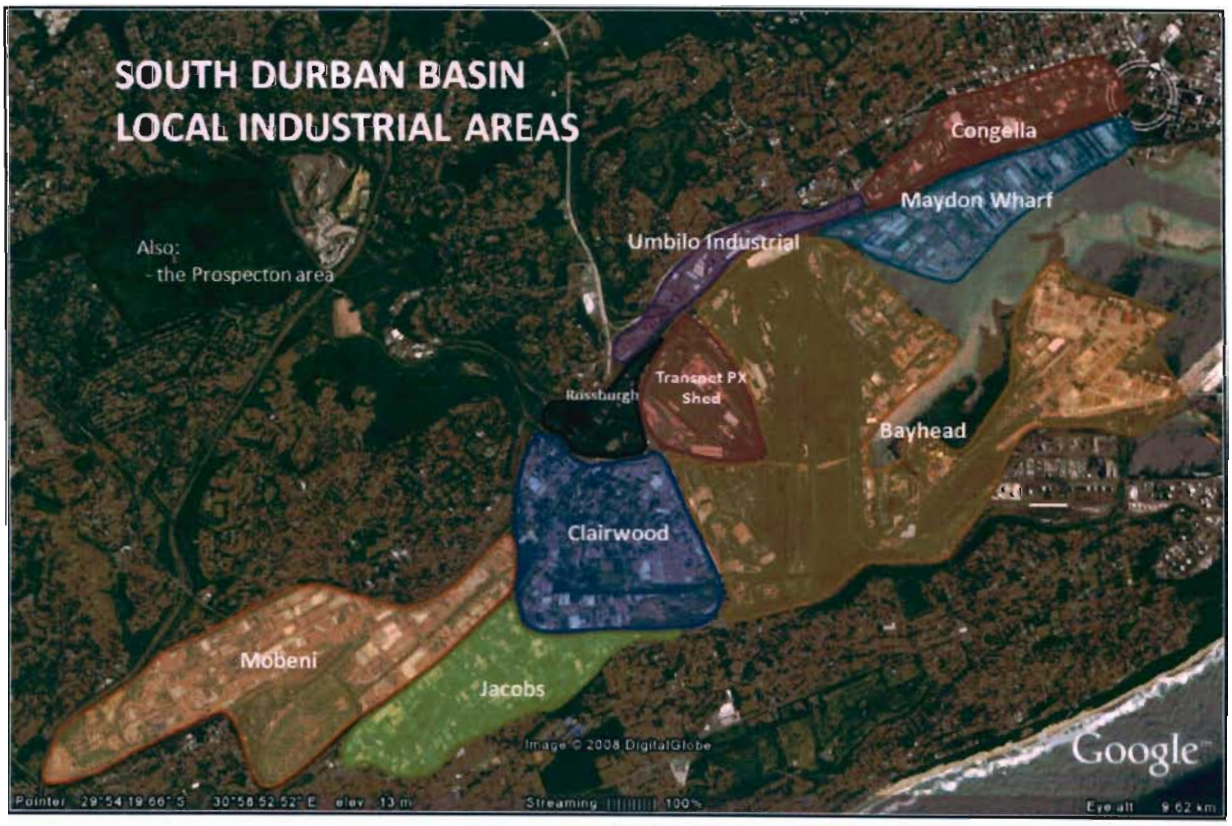
2.1 Scope of research and general assumptions

The scope of this project is ambitious but certainly not all-encompassing.

Study area boundary

The study is limited to a geographic area close to the Port of Durban (see study area definition below, Map 1) and has not attempted to quantify any facilities that perform container packing or unpacking in any other parts of Durban. It is known that there is a significant concentration of packing and unpacking facilities in the area, which justifies the exclusion of other areas for a research study of this scale. The study area includes all of the significant non-residential areas within the South Durban Basin (see below): Maydon Wharf, Congella, Umbilo Industrial, Rossburgh, Bayhead, Clairwood, Jacobs, Mobeni and Prospecton.

Map 1 The study area: South Durban Basin local industrial areas



Non-containerised cargos

Facilities that move non-containerised cargos will not be included or quantified. Needless to say the role of facilities for non-containerised cargos and commodities is critical; however this study is specifically targeting and focusing on the extent of container handling in the area. There has been an element of blurring between certain companies who might move both containerised and non-containerised cargos – these have been dealt with logically and will be explained in the relevant chapter.

Empty container storage depots

A vital part of the container logistics chain is the successful operation and location of empty container storage depots – however the nature and extent of these facilities is not being studied in this research. The focus is on full container movements and facilities that deal with full containers.

Transporters

The study will not examine or take into account transporters (freight haulers), important as they may be. Where a transport company happens to have facilities within the study area that are used for the packing and unpacking of containers, they will be included. Most transporters do not perform this quite specialized function.

2.2 Key research questions

The study has aimed, at a broad level, to answer the following research questions:

- What is the location, extent, nature and function of the container packing and unpacking facilities located in or adjacent to the Port of Durban?
- What are the critical location requirements and issues experienced by these operators?
- What are the implications of the present situation for port and city operations and for future development?

The more detailed key sub-questions are:

Location:

- Where are the facilities located?

Size and extent:

- How many premises does each company operate out of?
- How large are these premises?

Nature and function of activities:

- What specific activities are taking place on the premises?
- What is the scale of operations?
- How are the facilities accessed (road, rail)?

Qualitative:

- What are the critical location requirements as well as issues and concerns experienced by the operator?

2.3 Respondents and interviews

In order to find answers to the above research questions it has been necessary to consult companies that pack and unpack containers. Several large and obvious companies were initially consulted; thereafter snowball sampling was used to identify other operators in the study area, i.e. the respondent at a particular company would be asked which other companies in the area also deals with large numbers of containers, and so on. This process has ensured that every major container packing / unpacking company in the area has been consulted.

It must be noted that the researcher has been engaged on behalf of a client as part of a broader port-related planning initiative in the area. As such and for reasons of confidentiality it is not possible to list the names of companies or the respondents. However, Table 1 below shows the number of companies (21 in total) and lists the locations of their premises. The respondents were mostly managing directors and at

times operations managers. During interviews respondents were asked a number of questions and engaged in focused discussions which were used to identify, *viz.* the numbers of containers handled, the company's physical size, location of premises, location sensitivity, and general issues etc. (see research questions above).

All of the companies handle significant numbers of containers on a monthly basis and operate out of large premises, and several of the companies are notably large in terms of both throughput and premises.

Table 1 List of consulted companies (confidential) and the locations of their premises

	Company	Location of premises
1	A	Bayhead (Edwin Swales)
2	B	Bayhead
3	C	Bayhead (PX)
4	D	Maydon Wharf and Fynlands (Island View)
5	E	Jacobs, Prospecton, Umbilo Industrial
6	F	Bayhead
7	G	Bayhead (PX)
8	H	Jacobs
9	I	Maydon Wharf
10	J	Umbilo Industrial, Mobeni, Congella
11	K	Clairwood
12	L	Bayhead, Island View, Jacobs
13	M	Bayhead (PX)
14	N	Clairwood
15	O	Umbilo Industrial, Bayhead
16	P	Maydon Wharf
17	Q	Bayhead (PX and Edwin Swales)
18	R	Umbilo Industrial
19	S	Bayhead (PX)
20	T	Umbilo Industrial, Congella, Bayhead (PX), Jacobs, Prospecton
21	U	Jacobs

2.4 Research objectives

It is presupposed that the efficient operations of strategic regional sea ports is of critical local, regional and national importance. There is no doubt that in order for Durban to retain its role as the pre-eminent port in South Africa, if not the whole of Africa, that both the port-side terminal operations and the logistics functions which they constantly interface with are able to function efficiently and optimally, allowing for freight movement to occur with the fewest externalities and at the most efficient cost. This clearly has strong implications for the areas immediately adjacent to the Port itself. Critically, this also entails the sensitive balance of port and logistic functions with the large residential component residing in the general vicinity. It is of interest to all involved that land uses are wisely and logically separated and that vehicle routes are, to some degree, segregated.

The whereabouts and demographics of residential populations in the South Durban Basin are well known and oft documented. This study will provide insight into another much needed aspect of the area – knowledge of the locations and details of the operations of the warehouse facilities that facilitate the packing and unpacking of containers (one of the most critical logistics functions).

Hence the research objectives are to provide:

- Understanding of the broad requirements of container packing and unpacking logistics facilities in order that they may be well accommodated for in any future plans for the area;
- Information regarding the generation of containers and preferred accessibility options that assist in providing the most suitable infrastructure (road and rail);
- The current hindrances experienced by the operators (this will include broad issues such as general levels of accessibility as well as details such as ideal warehouse sizes and the importance of proximity to the container terminal);

- Knowledge of the current extent and collective size of the operations in the area such that planning might take the possible expansion of those functions into account.

CHAPTER THREE: UNDERSTANDING PORTS AND LOGISTICS

3.1 Introduction to concepts

Ports are extremely complex economic and spatial zones involving numerous and varied actors and stakeholders at both operational and institutional levels. As conduits for internationally and regionally traded goods and commodities they are (often) essential contributors to local, regional and national economies.

Ports provide the essential link between end users originating within and from outside coastal countries, for instance a client in a distant part of the world and a local manufacturer. A diverse range of operators along the logistics supply chain have involvement at the port, including shipping lines, shipping agents, freight forwarders, the port itself (management, Harbour Master, tugs etc.), clearing agents, customs functions, terminal operators, transporters, third party logistics companies (e.g. packing and unpacking of containers), empty container storage depots, and the end users (importers and exporters). Naturally these supply chain actors exist in time and space, often within the city itself and close to the port. Importantly, several of them are major users of road and rail transport infrastructure.

Institutionally port management, planning and decision-making is often linked to more than one level of Government, *viz.* the local municipality (the city in which the port exists), regional, provincial and national Governments, as well as public rail operators. Ports themselves are frequently managed and run by port-specific public or semi-public Government organisations (e.g. the Port of Sydney) or, in the case of South Africa, a centralised transport parastatal company like Transnet.

This analysis of third party packing and unpacking facilities in Durban needs to be framed within a clear contextual understanding of ports and logistics in general and more specifically ports and trends within South Africa and, most importantly, the Port of Durban. This research context is provided in the exploration of a several bodies of literature and research. These are introduced below and addressed in detail thereafter:

- The evolution of ports (3.2)

  Ports are ancient areas that have inseparable links to the cities in which they exist. Their operations and requirements have evolved alongside all of the major technological advances of the last several hundred years. Sizes of ships and berths, the volumes and transportation modes of cargoes, and required amounts of various types of space have all changed dramatically over time. These and other changes have put pressures on urban environments within port cities and have frequently necessitated dramatic change (notably on the water bodies and berths themselves, but also on transport systems, city infrastructure and adjacent land).

- Changes and evolutions in the containerisation of cargoes (3.3)

  The pressure on land adjacent to ports is in part due to the steady increase in containerisation of cargoes. Non-containerised cargoes don't require packing or unpacking nor facilities that provide that service. Conversely, the increases seen in the throughput of containers has caused an increased need for container-related facilities (and associated infrastructure).

- Logistics and the goods supply chain (particular emphasis on landside logistics) (3.4)

  The third party packing and unpacking operations are a small but critical link in a far wider supply chain (internationally moved commodities and goods). Their requirements must be understood in context of the broader goods supply chain system in which they function.

- Port-related land use management (3.5)

  General warehouse provision is part of routine city planning. However, the packing and unpacking of containers is an extremely port-sensitive activity that

has a wider-than-normal range of requirements that planners in port cities should be cognisant of.

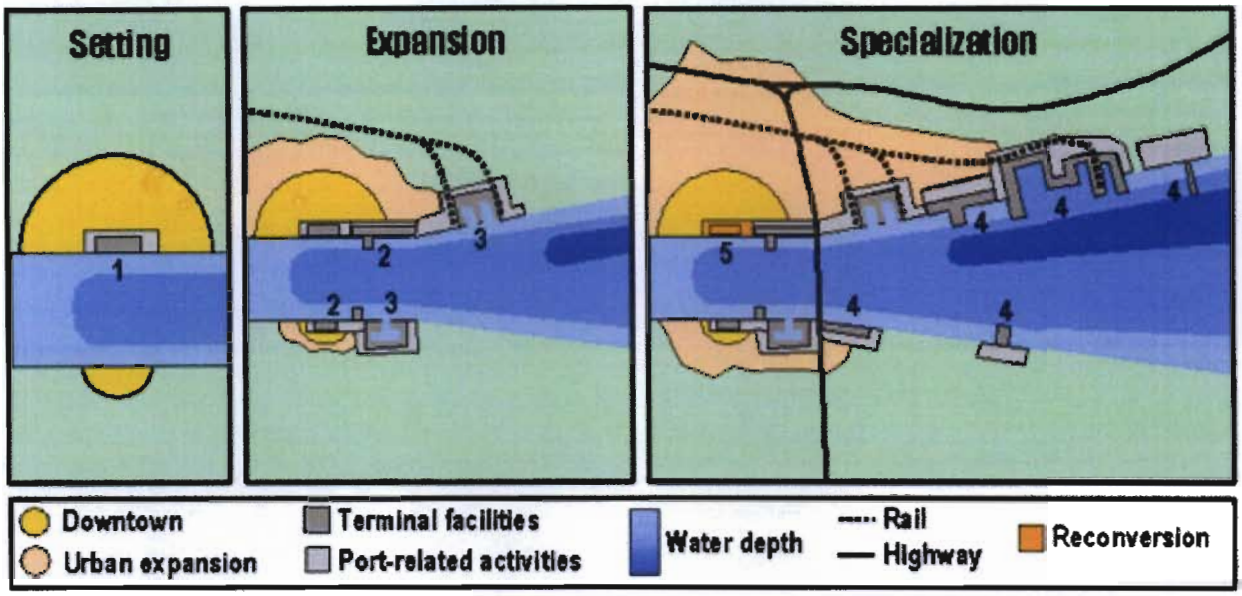
- Background and history of development in the Port of Durban (3.6)
  Understanding of logistics functions in Durban must be framed in an understanding of the historical context of development. The discussion will focus on the aforementioned factors and others that have had potentially the largest influence on logistics in the study area.

3.2 The evolution of ports

For centuries ports have been used as platforms for launching sea travellers, naval activities, fishing activities and traders. The scale of port activity tended to mirror that of the cities in which they operated. The profound changes that modern cities have undergone in the 20th century have certainly affected all aspects of urban areas, including port areas. New demands for goods and the sizes of ships have affected dramatic changes in both the physical port environment and the scale of activities. Various stages of development (notably in the 20th century) have played different roles in affecting the interface between urban areas and the physical harbour areas. In examining ports today it is helpful to understand these phases of development and the types of urban pressures that resulted.

Bird's Anyport Model (1963, in a summary by J.P. Rodrigue) was based on an empirical study into British ports and is widely recognised as one of the strongest conceptual perspectives on port development (Notteboom and Rodrigue 2005). Figure 2 below describes the evolution of port infrastructure over time: the setting, expansion and specialisation phases.

Figure 2 Conceptual Diagram: Bird's Anyport Model of Port Development



Source: Bird 1963, in summary by J.-P. Rodrigue

Initially, small lateral quays were located directly adjacent to the town centre. Wharf expansion was a result of improvements in maritime technologies and cargo handling. This expansion starts taking the wharfs further away from the urban core and central business district rendering older industrial areas and parts of down town redundant. Eventually, terminal capacity improvements have extended into new areas requiring major arterial roads and new rail access. The phases are explained in Table 2 below:

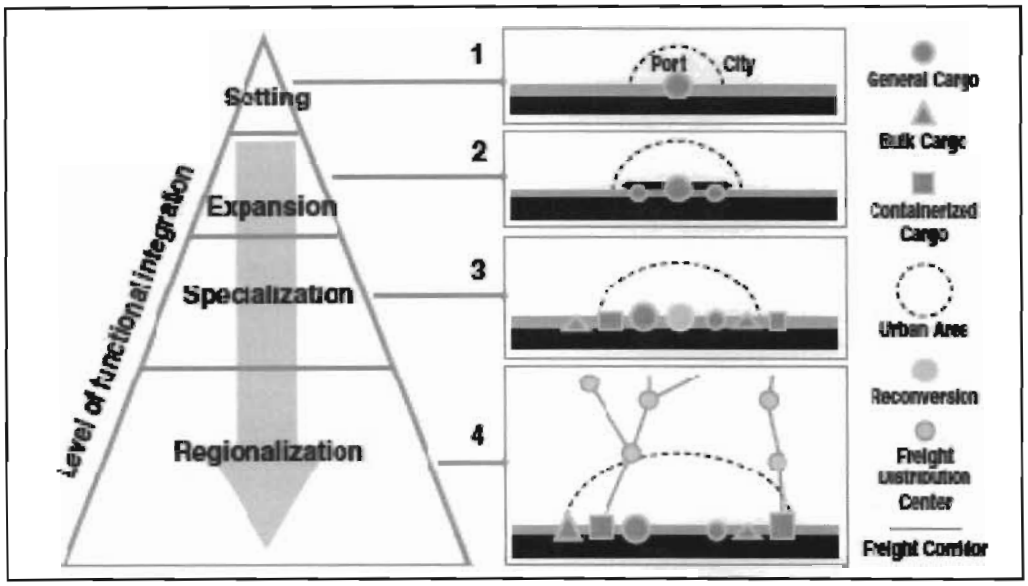
Table 2 Rodrigue's explanation of bird's anyport model	
SETTING	The initial setting of a port is strongly dependent on geographical considerations. On the above example [Figure 2], the setting is related to the furthest point of inland navigation by sailships. A standard evolution of a port starts from the original port, most of the time a fishing port with trading and shipbuilding activities, which includes several quays. For many centuries until the industrial revolution, ports remained rather rudimentary in terms of their terminal facilities. Port-related activities were mainly focused on warehousing and wholesaling, located on sites directly adjacent

	to the port.
EXPANSION	The industrial revolution triggered several changes that impacted on port activities. Quays were expanded and jetties were constructed to handle the growing amounts of freight and passengers as well as larger ships. As the size of ships expanded, shipbuilding became an activity that required the construction of docks. Further, the integration of rail lines with port terminals enabled access to vast hinterlands with a proportional growth in maritime traffic. Port-related activities also expanded to include industrial activities. This expansion mainly occurred downstream.
SPECIALIZATION	The next phase involved the construction of specialized piers to handle freight such as containers, ores, grain, petroleum and coal, which expanded warehousing needs significantly. Larger high-capacity ships often required dredging or the construction of long jetties granting access to greater depths. This evolution implied for several ports a migration of their activities away from their original setting and an increase of their handling capacities. In turn, original port sites, commonly located adjacent to downtown areas, became obsolete and were abandoned. Numerous reconversion opportunities of port facilities to other uses (waterfront parks, housing and commercial developments) were created.

Source: Extract from Rodrigue, 1971

While adequately modelling port development and expansions up until the 1980s, the Anyport Model neglects to account for the complex array of inland distribution networks that have emerged over time, as well as subsequent reconversions within port areas (refer to Figure 3 below). Notteboom and Rodrigue (2005) assert that modern container ports form part of a vast multimodal supply chain and are linked at regional scales to other trade destinations. The zone of influence of any major port and the supply chain of which it comprises extends far beyond that port's boundary.

Figure 3 Evolution of a port



Source: Notteboom and Rodrigue, 2005

Other authors refer to generation of ports (first, second and third generations), according to functions as well as the time period during which facilities were built. Accordingly (adapted from ESCAP 2002):

- ***First generation ports*** refer to ports prior to the 1960s. At that time the main activities in the port region were cargo handling and cargo storage, leaving other activities extremely unrepresented. [At that time] it was considered enough to develop and invest only in port facilities as the main functions of the port were cargo handling, storage and navigation assistance. For these reasons important changes in transportation technology were neglected.

- ***The second-generation ports*** are those built between 1960 and 1980, and had a system comprising of government and port authority. Here the port service providers could understand each other and cooperate for mutual interests. The activities in these ports were expanded, ranging from packaging, labeling and physical distribution. Compared to first-generation ports, the second generation ports have a characteristic that freight forwarders and cargo owners had a tighter

relationship. The second-generation ports had begun to notice the needs of customers, but when it came to keeping a long-term relationship with customers, they took a passive attitude.

- **The third-generation ports:** from 1980, container transportation had been developed quickly and the new intermodal transport system emerged. The activities of production and transportation linked to form an international network. The former services function has been enlarged to include logistics and distribution services. The environment and protection facilities are becoming more important and ports are developing closer relationships with those in their surrounding neighborhoods. Compared to the past, today's port authorities are focusing on efficiency rather than effectiveness. In the third-generation ports, the needs of customers were analyzed in detail and port marketing has been actively engaged.

  (Source: adapted from ESCAP 2002, pg 20)

The sustainable and efficient movement of containers is marred by an array of real issues and challenges. Many of these, such as terminal capacities, involve the ports themselves. However, both the inland freight distribution and the repositioning of empty containers have been highlighted as significant constraints and logistical challenges (Notteboom and Rodrigue, 2008). Consider:

> "[...*congestion and delays in the container supply chain*] undermine the very fundamentals of the container system and urge market players and governments around the world to look for innovations in the way in which container flows and the associated logistics infrastructure are managed. Smarter management of the container system is a prerequisite for a sustainable deployment of the container concept in global supply chains in the longer term." (Notteboom and Rodrigue 2008, pg 172)

The potential re-planning of logistics activities in and around the Port of Durban is in effect attempting to solve the very issue cited above – that as ports and container volumes grow to hitherto unknown monolithic proportions, the efficiency, integration and operational success of the component parts of the logistics supply chain within ports is a key part of port planning and indeed in achieving optimal costs associated with international trade.

3.3 Changes in the containerisation of cargoes

The shipping of goods in containers started in earnest in the 1960s (Schommer, Notteboom and Rodrigue 2005 and 2008), and has been acknowledged as an innovation that has "had a tremendous impact on production and distribution" (Levinson 2006, in Notteboom and Rodrigue 2008). Container volumes have been increasing steadily across the world over the last 50 years, with particularly accelerated growth occurring since the mid-1990s (Notteboom and Rodrigue 2008).

It is estimated that the total throughput handled (fulls, empties and trans-shipment) by the world's container ports increased from about 236 million TEUs in 2000 to an estimated 399 million TEU in 2005 (average annual growth of 11%). The total throughput was less than 40 million TEUs in 1980, reached 75 million TEUs in 1990 is expected to reach 628 million TEU by 2010 (Drewry shipping consultants 2006, in Notteboom and Rodrigue 2008). This quite simply and explicitly reveals the massive upward trend in container volumes.

Advantages

Schommer and Notteboom and Rodrigue (2008) consider several reasons for the increased popularity of the use of containers in the goods supply chain:

- The potential to increase cargo capacity
    - Containers themselves can carry large volumes
    - Ships can increase their cargo capacity (easy stacking and storage etc.)
- Improvement in the handling of cargo

  - Cargo handling during the ship's journey is limited to the handling of the container itself
  - Damages are minimised
- Quicker vessel turnaround time at ports (economic advantage)
  - Increased velocity in freight distribution (Notteboom and Rodrigue 2008)
  - Terminal equipment can offload container ships very quickly and efficiently
  - This allows smaller fleets to carry a greater volume of goods at greatly reduced handling costs

Maritime transport has always played an important role throughout history. In the second half of the 19th century, rail became the dominant mode of land transportation but it was overtaken by road transport in the second half of the 20th century (Notteboom and Rodrigue 2008). Ports represent a critical spatial zone at which all three of these modes converge and are required to interact efficiently.

Notwithstanding the shipping and logistics industry's respective reasons for using containers, it is the *effects* of the container trends and the parts of the supply chain other than the maritime leg that affect land-side land use planning, *viz.* the land side supply chain.

3.4 Logistics and the goods supply chain

For the purposes of this study the literature consulted refers mainly to the *container* supply chain; the reason being that third party packing and unpacking facilities deal only with containers. The supply chains here will be examined in two parts:

- the complete chain including maritime and land-side legs, in broad terms, and
- the container-specific land-side logistics that interface directly with the port and the hinterland

3.4.1 The complete logistics chain

> "Logistics is a procedure to optimize all activities to ensure the delivery of cargo through a transport chain from one end to the other." (ESCAP 2002, pg 22)

In the context of international trade, the comparative efficiency of a country's logistics supply chain is critical in increasing the relative competitiveness of its economy (ESCAP 2002). With so much at stake it is useful to cite a seemingly demure assertion; that the ultimate decision to route cargo through a given port is taken by shippers (Tongzon 2002). There are of course many factors that contribute to that decision, but shippers are the final decision-makers in the maritime marketplace. According to Van Niekerk and Fourie (2002) those decision are based on i) network planning and scheduling (logistical arrangements) and ii) port, terminal and hinterland facilities.

There are a diverse range of operators along the logistics supply chain who are related directly or indirectly to ports, including:

- shipping lines,
- shipping agents,
- freight forwarders,
- the port itself (management, Harbour Master, tugs etc.),
- clearing agents,
- customs functions,
- terminal operators,
- transporters,
- third party logistics companies (e.g. packing and unpacking of containers),
- empty container storage depots,
- the end users (importers and exporters).

Van Niekerk and Fourie (2002) provide an astute overview of some of the differences between established bulk supply chains and more recently established container supply chains:

> "The management of supply chains is not new and has been successfully handled in the bulk industry since the advent of the shipment of bulk cargo such as coal and ore. An integrated system dedicated to specific cargo has been established with the mines, railway companies, shippers, factories and ports in import and export countries. Although individual ownership of the supply chain participants exists, the focus is on a single commodity... With the advent of containerisation, liner ships on the other hand were offering scheduled services to many cargo owners who could freely choose any shipping line depending on the cost of the line and the service offered. Naturally, participants in the supply chain were focusing on maximum shareholders' value for their own entities through distinct services. With the globalisation of economies the real increase in freight rates was negative and new strategies were sought to lower costs and increase market share. That has given rise to the use of bigger ships and eventually to horizontal and vertical integration of participants in the supply chain. (Van Niekerk and Fourie 2002, pg 3)

The efficiency of a scheduled liner service coupled with the decreased general costs of containerising cargoes (discussed in previous section) has enabled a new range of participants to enter the supply chain.

Intermodal (maritime/land) freight movement is dependent on a synchronisation of different systems of circulation and geographic makeup (Notteboom and Rodrigue 2008). Clearly when one or both of the systems is under stress "the maritime/land interface as a whole is more vulnerable to disruptions" (Notteboom and Rodrigue 2008). In other words while examples of major port-specific challenges in the supply chain include direct physical terminal capacity constraints, water depth and the quality of equipment on the berths, disruptions in the supply chain can and do occur outside of the

immediate port realm. Tensions and inefficiencies in road and rail transport infrastructure and in the accessibility and of sufficient warehousing and distribution facilities are causes of interruption to the supply chain.

The logistics industry at large is increasingly characterised by the need for just-in-time (JIT) delivery (Cole and Villa 2006, Marlow and Paixao 2002, and Notteboom and Rodrigue 2005). This keeps costs low but creates a strong reliance on the efficiency of transport (Cole and Villa 2006). The cost and efficiency advantages of just-in-time appear to be matched by a vulnerability and sensitivity to disruption. More than ever before firms require an even and reliable supply chain. Pressure is on Governments and participants within the supply chain to facilitate, enable and provide that level of service.

3.4.2 Land-side logistics functions

In light of increasing realisation of the importance of the extended regional and hinterland logistics chain and increased port competition, it is unsurprising that considerable resources are being allocated to ensuring seamless warehousing and distribution.

Boske and Cuttino cite the following five general logistics activities according to Porter (Boske and Cuttino 2002):

- *Inbound logistics* (receiving, storing and disseminating inputs to the product, i.e., materials handling, warehousing, inventory control, vehicles scheduling, and returns to suppliers);
- *Operations* (transforming inputs into final goods, machining, packaging, assembly, etc.);
- *Outbound logistics* (collecting, storing, physically distributing product to buyers);
- *Marketing and sales*; and,
- *Service*

At least three of these are directly relevant to the part of the logistics chain that undertakes the packing and unpacking of containers – these being *inbound logistics* (receiving, storing, warehousing), *outbound logistics* (physically distributing to clients or to the container terminal) and *service*.

In examining a sample of international company's choices for locating in the Netherlands, the following factors were established (refer Table 3 below):

Table 3 Factors affecting the site choice for logistics centres

FACTORS	MAIN FEATURES
Port infrastructure	• Adequacy of port facilities • Spaciousness of port area • Availability of feeder vessels
Land / Land prices	• Availability of land • Affordability of land prices • Low rental fees for land
Labour	• Availability of English speaking port workers • Availability of specialized technicians • Availability of trained or non-trained technical labourers • Labour cost in distribution centre
Technology / Information	• Level of port information services • Supply of information infrastructure
Market factors	• Distance between port and hinterland • Distance between port and major cities
Related industries	• Ease of access to parts and raw materials • Distance between port and industrial complex
Back-up city	• Existence of large consumer city behind port areas • Quality of workers in DC
Institutional factors	• Incentive programme offered by host country • Simplicity, ease and efficiency of administrative procedures needed in operating distribution centres • Financial assistance in constricting distribution centres • Free trade system and related law provided by host countries
Connecting transport system	• Airport access to provide speedy linkage between the distribution centre and major markets • Effective land transport system • Establishment of feeder service (hub and spoke system)

Source: Korea Maritime Institute, in ESCAP 2002

It has also been shown empirically that location advantage and the importance of linkages and access all affect rental prices *viz.* the demand for warehousing space (Sivitandou 1996).

The fierce competitiveness among ports has led to the development of a number of logistics centres in Asia and the Pacific (ESCAP 2002). These centres, also commonly called distriparks (distribution parks) are essentially focussed areas established for the purposes of clustering logistics activity with the aim of enhancing efficiency.

Consider the following example of a Distripark in Rotterdam:

The Distripark Maasvlakte (extract from ESCAP 2002)

Distripark Maasvlakte, a logistics centre on the western edge of the port area [of the Port of Rotterdam], is an excellent example of transport infrastructure management by the City of Rotterdam and the port of Rotterdam Municipality... it was completed in 1997. With a logistics park of 125 hectares, it was designed for companies seeking to centralize their distribution activities in order to gain greater control over their European distribution activities.

The Port of Rotterdam designed Distripark Maasvlakte for:

- Companies wishing to set up set up their own European Distribution Centre;
- Mega-carriers wishing to further penetrate the logistics chain;
- Mega-distributors wishing to set up a maritime hub for their European operations;
- Other (global) logistics service providers; and
- European exporters wishing to create a maritime export hub.

A unique characteristic of the Distripark Maasvlakte is its location close to the [container terminals], giving it special connection with these terminals through a dedicated internal track. When a container is transported from a [terminal towards the Distripark], the containers are not imported into the European economy. This results in time and cost saving since expensive customs handling is no longer necessary. Distripark Maasvlakte offers immediate access to multimodal facilities for transport by rail, coastal shipping, inland shipping and truck.

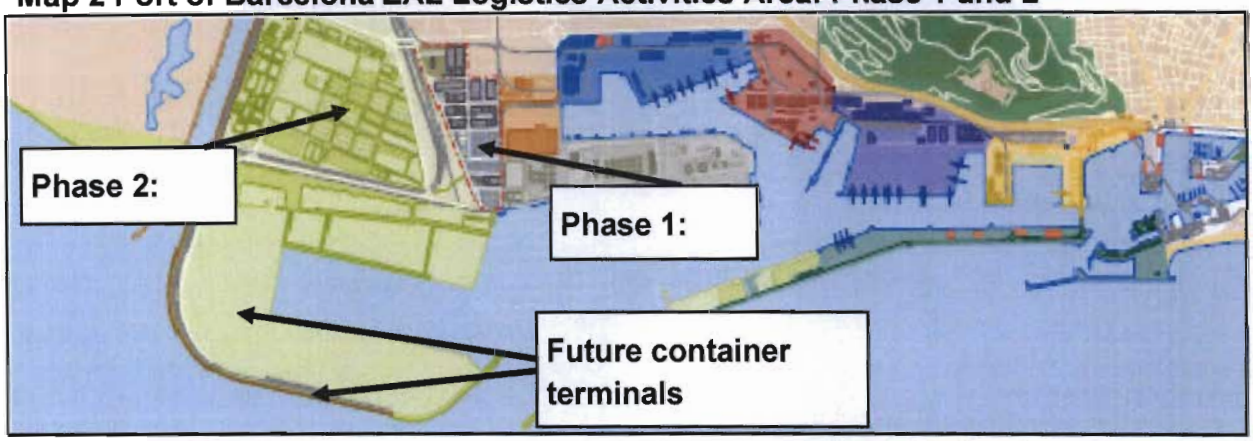
The Distripark Maasvlakte

Source: extracts from ESCAP 2002

Another example of a distripark is found in Barcelona. The port of Barcelona has created a Logistic Activities Area (abbreviated ZAL in Spanish) on prime land directly next to their future container terminal. This will help them to achieve their objective (Port de Barcelona, 2006):

- as a multimodal centre, offering a broad range of transport options, and
- as a distribution and supply platform, providing distribution and supply logistic services, as well as post-industrial and pre-commercial services.

Map 2 Port of Barcelona ZAL Logistics Activities Area: Phase 1 and 2



Source: Port de Barcelona, 2006

The proliferation of distriparks clearly demonstrate a new wave of intense focus on the improvement of landside container logistics adjacent to ports as part of efficiencies of regional distribution networks.

The following major obstacles to establishing logistics centres (distriparks) in Asia and the Pacific were identified (adapted from ESCAP 2002):

- Constraints in infrastructure
- Lack of professionalism and third-party logistics providers
- Expensive land for the development of logistics centres
- Inefficient administrative procedures
- Poor service level at ports in the ESCAP region

3.5 Port-related land use management

The expansion and specialisation phases of port development as per Notteboom and Rodrigue's interpretation of Bird's Anyport model (Notteboom and Rodrigue 2005) differentiate roughly between development in ports from 1960 to 1980 and thereafter (Rodrigue 1971, Notteboom and Rodrigue 2008). Prior to 1960, port-related land use management was historically overwhelmingly focussed on the berths, quayside

infrastructure and bulk commodity-related warehouses only. A good example of this is Maydon Wharf in Durban.

The period from the 1960s to the 1980s (the expansion phase) was primarily geared at upping port capacity and technology to meet the demands of the new production complex; it was the birth of a new era. What Notteboom and Rodrigue (2005) refer to as the regionalisation phase of port development (1980s onwards) sees ports competing fiercely against each other, implementing port efficiency improvement projects such as new berths, increasing water depth and investing in technology and equipment. In this phase there is also a focus on ensuring that landside logistics function seamlessly.

The Melbourne Port Corporation in Australia have recognised in their 2001 land use plan that in the next 20 years there might be a need to provide land in the immediate vicinity of the port for cargo related uses for which an on-port location is critical (Port of Melbourne Land Use Plan, 2001). These possible activities are listed as follows:

> "...equipment maintenance, equipment rental and leasing, cleaning facilities, tanking, safety and security services, offices, information and communication services, storage, loading/unloading, stripping/stuffing of containers, consolidation of loads, distribution, assembly, quality control, testing, repair, accessorising autos, grain storage and fumigation, news print storage and cold storage." (Source: Port of Melbourne Land Use Plan, 2001, pg 83)

The Melbourne port planners also recognise the need for distriparks and similar logistics development in the future. They are also aware that terminal and berth expansions decrease the land available for such activities whilst increasing the throughput that generates the need in the first place (Port of Melbourne Land Use Plan, 2001).

Perhaps one of the most significant impediments to the development of logistics in ports at a global level is the acute shortages of available land directly behind or adjacent to the quaysides that could be used for logistics. This land in question is invariably used

for non port-related or outdated activities. The need for ports to provide these areas for concentrated logistics activity has revealed the redevelopment challenge of finding adequate undeveloped land (ESCAP 2002, Notteboom and Rodrigue 2005 and 2008). Should logistics centres or distriparks become an increasingly common feature on the wish-list of regional ports, the land use management challenge will be daunting indeed.

It is universally recognised that logistics areas or distriparks need to be properly accessed by road and, ideally, rail networks, which presents a different type of challenge – logistics areas require excellent multimodal access (ESCAP 2002, Port of Melbourne Land Use Plan 2001, Notteboom and Rodrigue 2008).

The picture is thus painted: land in and around ports is scarce and that in the future ports should anticipate:

- Increasingly demanding port users;
- Shifting user requirements for logistics services; and
- Changing infrastructure needs and competitiveness in maritime transport services.

  (Source: ESCAP 2002)

3.6 Background and history of development in the Port of Durban

This brief contextual discussion of the Port of Durban follows similar threads to the bodies of literature examined thus far.

3.6.1 Phases of development and critical junctures

Prior to the 1970s South Africa was essentially serviced by five ports, namely Cape Town, Port Elizabeth, East London and Durban within South Africa, and by Maputo in Mozambique (Lawrance 2000). Subsequently the Government developed two bulk ports, Richards Bay, located in northern Natal (so named at that time) was created to facilitate coal exports from the Mpumalanga and Natal regions, and Saldanha Bay,

north of Cape Town on the West Coast, was intended to serve a similar role in relation to iron ore exports (Lawrance 2000).

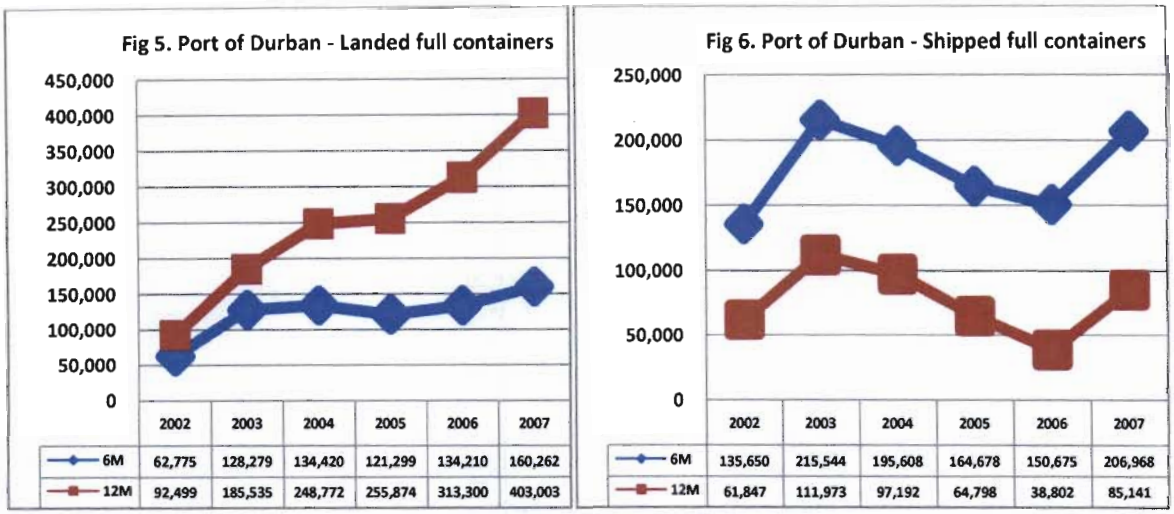
From the initial burst of container volumes in the 1960s Durban and Maputo competed as container handling ports. The functional demise of Maputo in the mid-1970s gave Durban the chance to firmly establish itself as the leading regional container handling (general cargo) port. Durban has continued to focus on containers, liquid bulk and break-bulk cargoes, and Richards Bay, the closest rival port, has remained a bulk and neo-bulk specialist (Jones 1997, in Port of Durban Economic Footprint).

Port evolution in Durban can be fairly accurately modeled by Bird's Anyport model and Notteboom and Rodrigue's additions to that model. While not a particularly old port, it certainly underwent the dramatic expansions between 1960 and 1980 and is currently playing catch-up with logistics and linkages to inland distribution (as purported by the model).

3.6.2 Scale, effects and implications of containerisation in Durban

Durban is operating on an outdated transport system and is having difficulty managing both the new import-export container model *per se* and the increasing volumes of containers.

Figures 4 and 5 Port of Durban landed and shipped full containers, 2002 – 2007



Source: Transnet container data, in eThekwini Municipality (2008 in progress)

Figures 4 and 5 above show across-the-board increases in container growth, in terms of both 6m and 12m boxes, over the five years. 12m landed containers (imports) have grown from 92,499 in 2002 to 403,003 in 2007.

Table 4 Port of Durban: growth in full containers (landed and shipped)

	LANDED		SHIPPED	
YEAR	CONTAINERS	TEUS	CONTAINERS	TEUS
2007	46,939	80,522	24,342	31,437
Average Annual Growth from 2002	29.4%	31.28%	8.14%	7.78%

Source: Transnet container data, in eThekwini Municipality (2008 in progress)

Table 4 differentiates between containers and twenty foot equivalent units (TEUs); nonetheless the growth rates are extremely high over the same period.

The huge increases in container volumes (approximately 2.4 mill TEUs in 2008) have put a number of pressures on Durban. Some concern the terminal and berth capacity

over time. Others concern road congestion that arises, *inter alia*, from the following factors:

- Port congestion (terminals)
- Inadequate access roads to the terminal
- High road share
- Bayhead and South Coast roads are shared between container and other forms of road traffic.

Both the port system (berths and terminal capacity) and the transport and logistics systems as they currently operate are struggling to cope at peak times. They will certainly need upgrades and investment if they are to cope with forecasted container volumes over the next 20 years.

3.6.3 Considering port-related land use management in Durban

The institutional environment concerning management of the Port of Durban has had a profound effect on land use management. The Port has been controlled by the centralised arm of government initially known as South African Railways and Harbours (SAR&H) then as Portnet and now Transnet (Lawrance 2000). The lack of a role for the local municipality has strained the interface between the Port and the City and resulted in the sole occurrence of activities in the Port area that could be considered traditionally port-related (berths, bulk warehouses, railway marshalling yards, ship repair yards, etc.). The results are alarming – on one side of the Port boundary are extremely large amounts of underutilised space (e.g. Bayhead marshalling yards) and on the other a bustling proliferation of non port-related activities, including residential, commercial, service and light industry and manufacturing. The result is a lack of any planned area for modern logistics.

CHAPTER FOUR: RESEARCH RESULTS

4.1 Introduction

This chapter analyses the operations of companies that pack export cargos and unpack import cargos in and out of containers on behalf of customers. The structure is as follows:

- Definition and approach (4.2)
- Methodology and assumptions (4.3)
- The broader road network (4.4)
- Current space used by third party container packing and unpacking facilities (4.4)
- Monthly full TEUs, containers and full truck trips (4.5)
- Issues, experiences and requirements of the third party packing and unpacking facilities (4.6)

4.2 Definition and approach

Third party packing and unpacking logistics facilities are used for the packing of export cargos and the unpacking of import cargos on behalf of customers (importers and exporters). They form an integral part of the freight logistics chain because they pack or unpack ***all*** full containers that are not taken directly to or received directly from the end customer. Their function is especially important in light of the increased containerisation of cargos and consequently their role in the back of port zone must be taken account of in planning. The following strategic questions were posed to operators who are located in the local areas under analysis:

- What is their size (warehouses and yards)?
- Where are they located (specifically)?
- How many full TEU's and container movements are they generating?
- What are their location requirements?
- What are their requirements for growth

- What are their issues?

Snowball sampling of operators was used to achieve a comprehensive picture, with 21 companies consulted. By adding up the sizes and monthly TEU numbers of the company premises according to the local area in which they fall, it has been possible to produce both an overall and local profiles. The analysis provides insight into the amount of land currently take up by this activity, the area in which it is generated (i.e. the location of the facilities), the numbers of full containers moved on a monthly basis between the facilities and the container terminal, the traffic implication in terms of number trucks, as well as critical operational criteria and issues.

4.3 Methodology and assumptions

A number of companies were consulted (interviewees were mostly managing directors and sometimes logistics managers). Individuals were asked about:

- the general operations of the business,
- the number, locations and sizes of their premises,
- the number of imported and exported TEUs moved between their premises and the container terminals on a monthly basis,
- the suitability of their premises in terms of location, building design and access,
- their plans for expansion,
- and constraints to growth (e.g. lack of space),
- and any pertinent issues or experiences that could inform this study

Some companies were both willing and able to give their operational information in the form of TEUs per month while others, citing confidentiality, provided the researcher with tonnages, monthly or annual. The annual tonnages were simply divided by 12 to give monthly volumes. Where the weights of the cargos was known, e.g. steel exports being packed at 26 tons per container, then this figure was used to calculate the number of containers used to move that cargo. However many of the companies chose not to or were unable to provide that level of detail, hence average container weights were used:

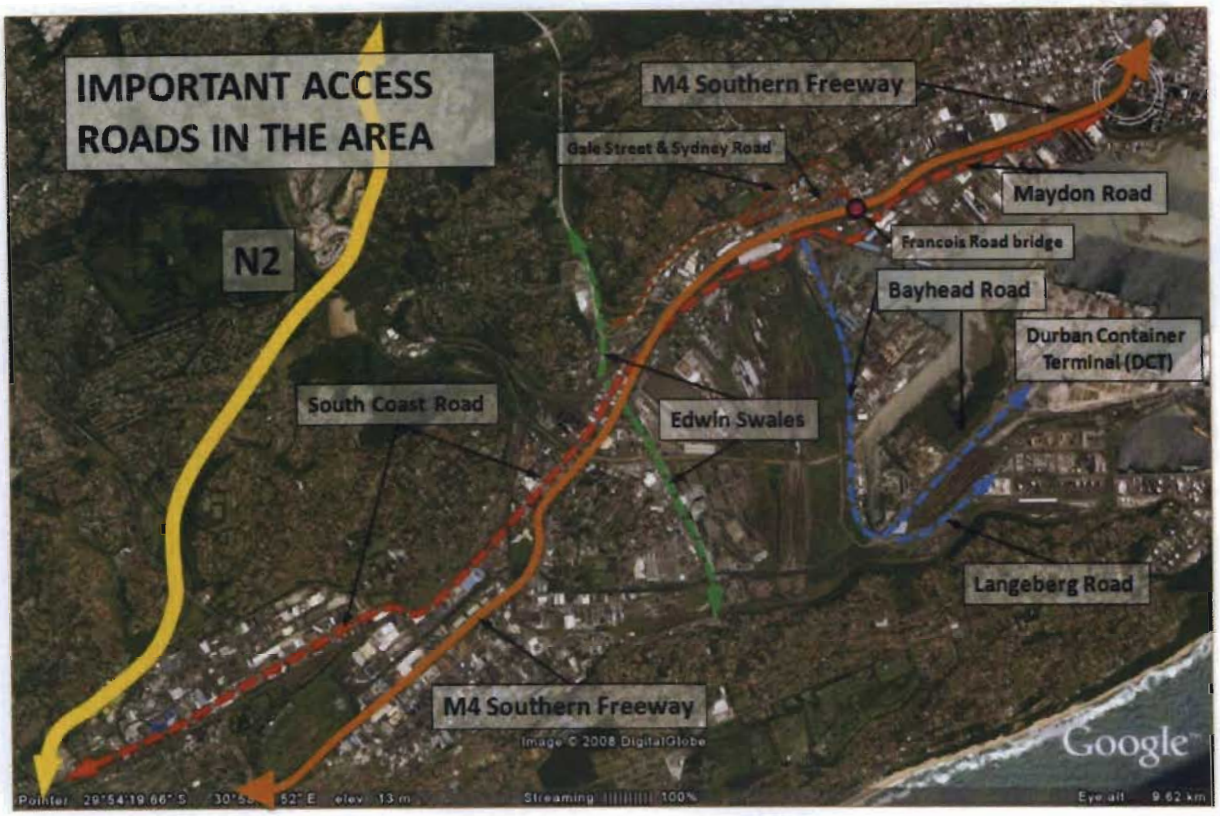
- nine tons for imports; and
- 14 tons per exports[1].

It's important to note that the calculations are intended to provide an indicative rather than exact measure of the monthly movements, i.e. approximate or average numbers. Hence, peaks and troughs have been absorbed in order to obtain these average monthly figures[2]. Clearly certain parts of the year are busier for both imports and exports, however neither infrastructure nor land parcels are designed and funded for only certain parts of the year. Planning should take into account the maximum amounts anticipated for any given month.

[1] As per the average weights used in the Transnet National Ports Masterplan 2007
[2] The seasonal peaks and troughs in the movement of certain cargos was been deemed too fine-grained a level of detail for the purposes of obtaining answers to the questions posed regarding these functions

4.4 The broader road network

Map 3 Important access roads in the area



The relevant road network is shown above in map 3. Note that the container terminal is only accessible along Bayhead Road which is in turn accessed off South Coast from the south or via Maydon Road (Francois Road bridge).

4.5 Current space used by third party packing and unpacking facilities

Container packing and unpacking is performed by a range of companies that vary considerably in scale. Several of the major companies have competencies far more diverse than container packing and unpacking, e.g. Grindrod who operate extensively in other functions of the Port. Several others operate out of one facility that vary in size from the 13 ha (130,000m²) to 10,000m². Companies frequently operate out of single premises of 30,000m². There are also several instances where companies operate out of more than one site. One company currently has nine premises, located in Congella,

Umbilo Industrial, Maydon Wharf, the PX Shed, Jacobs and Prospecton, and totalling 127,000m² (12.7 ha).

Table 5 below shows that the total space occupied in the local areas is approximately 136 ha, a considerable size indeed. The 79 ha of space taken by warehousing exceeds the 57 ha taken by open yards by 39%. Most significant are the high proportions of land taken up by premises in Maydon Wharf (28.6 ha at 21%), Bayhead (34.5 ha at 23.5%) and the PX Shed precinct (39.7 ha at 29.1%). These areas are all in or immediately adjacent to the harbour itself and can be understood as the primary packing and packing areas (see map 4 below). Operators in these areas all expressed a strong desire to be located in close proximity to the terminal. Jacobs (7%), Mobeni (5.4%), Umbilo Industrial (5.1%) and Congella (3.5%) all contain significant yet smaller proportions of overall facilities and could be regarded as secondary areas. They are all also slightly set back from the immediate port area.

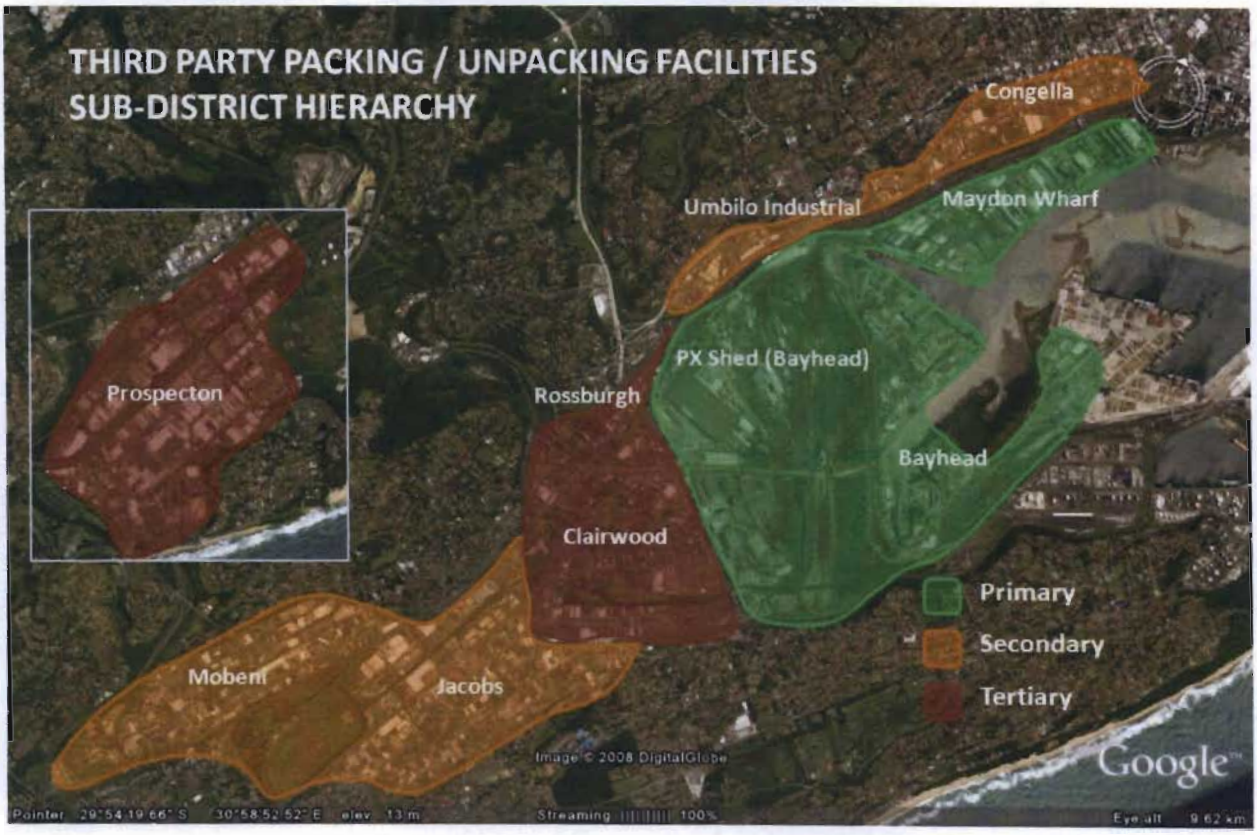
Table 5 Sizes of third party packing and unpacking logistics facilities

AREA	THIRD PARTY PACKING / UNPACKING FACILITES							
Local Area	Approx # of sites	%	Total Site Space (m²)	%	Open Yards (m²)	%	Warehouses (m²)	%
Point	1	1.5%	FPT		FPT		FPT	
Congella	6	9.2%	48,000	3.5%	5,000	0.9%	43,000	5.4%
Umbilo Industrial	5	7.7%	69,000	5.1%	30,500	5.3%	38,500	4.9%
Maydon Wharf	24	36.9%	286,000	21.0%	73,000	12.7%	213,000	26.9%
Bayhead	9	13.8%	344,800	25.3%	206,800	36.0%	138,000	17.5%
Transnet PX Shed	8	12.3%	397,000	29.1%	178,000	31.0%	219,000	27.7%
Rossburgh	1	1.5%	9,000	0.7%	7,000	1.2%	2,000	0.3%
Clairwood	1	1.5%	15,000	1.1%	9,866	1.7%	7,234	0.9%
Jacobs	5	7.7%	95,500	7.0%	32,000	5.6%	63,500	8.0%
Mobeni	3	4.6%	74,000	5.4%	32,000	5.6%	42,000	5.3%
Prospecton	2	3.1%	24,180	1.8%	0	0.0%	24,180	3.1%
TOTAL	65	100%	1,362,480	100%	574,166	100%	790,414	100%
HECTARES			136		57		79	

Source: Primary research, 2008

Certain smaller areas such as Rossburgh, Clairwood and Prospecton contain far fewer and smaller premises, as well as extremely small proportions of packing and unpacking facilities relative to other areas. These tertiary packing / unpacking areas are dominated by non port-related activities such as residential and service industry (Clairwood), and manufacturing and service industry (Toyota in Prospecton and the Tongaat-Hullett's refinery in Rossburgh). The proposed Bayhead dig-out port expansion option poses a serious challenge to the logistics chain in Durban because it will displace the companies that comprise the majority of the primary packing and unpacking area. This requires careful consideration[3].

Map 4 Sub-district hierarchy of broad packing and unpacking areas



Source: Primary research, 2008

[3] Note: the Fresh Produce Terminal (FPT) at the Point technically isn't a packing facility as most cargos are moved as break bulk, yet small proportions of its cargos are packed into refrigerated containers and sent to DCT.

4.6 Monthly full TEUs, containers and full truck trips

The number of TEUs will always exceed the number of actual containers (this is due to 40 foot containers being counted as two TEUs). But full containers are almost exclusively transported one at a time when moved by truck, i.e. one full container = one truck. Hence the number of full containers (as opposed to TEUs) moved to DCT and Pier 1 *from* facilities each month (exports) and the number of fulls *moved out* of DCT and Pier 1 each month (imports) will be approximately equal to the number of truck trips taken to moved the full containers. The actual ratios of 20 foot containers to 40 foot containers shipped and landed in 2007 were used to generate export and import truck factors that calculated the approximate number of containers for every TEU counted. The export factor for 2007 was 0.7754, the import factor 0.6832. Where it was known that a certain facility, such as a cold store, was only moving 40 foot reefers then the factor used was simply 0.5.

Table 6 Monthly fulls packed and unpacked versus actual fulls shipped and landed

	EXPORTS	%	IMPORTS	%	TOTAL	%
Full containers packed or unpacked in consulted facilities	21,627	88.8%	13,881	29.6%	35,508	49.8%
Actual fulls shipped and landed in 2007	**24,342**	**100.0%**	**46,939**	**100.0%**	**71,281**	**100.0%**

Source: Primary research, 2008, and Transnet container data

Table 6 above simply depicts the extent to which the consulted packing / unpacking facilities have accounted for the actual containers moving. The facilities that were interviewed have accounted for 88.8% of all export cargos that are packed in the area. It can thus be deduced that very high proportions of exports are packed in Durban and that they are packed by third party logistics companies as opposed to the actual exporter of the cargo. Conversely, the small proportions (29.6%) of imports passing through third party companies tells us that the majority of full imported containers are taken directly to importers who unpack the containers themselves before returning them to the empties depot.

Table 7 Number of monthly TEUs and containers packed and unpacked

AREA	MONTHLY EXPORTS			MONTHLY IMPORTS		
Local Area	Total TEUs	Total Containers	%	Total TEU's	Total Containers	%
Point	733	367	1.7%	0	0	0.0%
Congella	0	0	0.0%	80	55	0.4%
Umbilo Industrial	3,650	2,830	13.1%	690	471	3.4%
Maydon Wharf	7,169	5,132	23.7%	1,380	943	6.9%
Bayhead	8,597	6,666	30.8%	6,317	4,316	31.5%
Transnet PX Shed	4,037	3,131	14.5%	6,364	4,348	31.8%
Rossburgh	0	0	0.0%	2,000	1,366	10.0%
Clairwood	165	83	0.4%	600	300	2.2%
Jacobs	2,095	1,624	7.5%	1,655	1,131	8.3%
Mobeni	1,597	1,198	5.5%	1,050	717	5.2%
Prospecton	981	597	2.8%	50	34	0.2%
TOTAL	**29,024**	**21,627**	**100**	**18,106**	**13,681**	**100**

Source: Primary research, 2008

Table 7 above shows that on the **export** side, third party companies pack a total of on average 21,627 full containers (29,024 TEUs) per month. Most of these are passing through Bayhead and the PX Shed (6,666 and 3,131 containers per month respectively) although large amounts of bulk and break bulk products are being packed into containers for export in Maydon Wharf for transport to DCT and Pier 1. Facilities in Umbilo Industrial account for about 13.1% of exported full containers per month. These 21,627 full exported containers account for 88.8% of the actual 24,342 containers exported in 2007[4].

The 13,681 **imported** full containers that are being unpacked in the area on a monthly basis are mostly passing through Bayhead and the PX Shed. Companies in Maydon Wharf are weighted strongly towards the packing of exports (23.7%) as opposed to the unpacking of imports (6.9%), with Jacobs actually handling a higher proportion of imported containers (8.3%).

[4] Source: Transnet container data

Table 8 Local area proportions of imported to exported full containers (monthly)

AREA	EXPORTS	IMPORTS	TOTAL (EXPORTS + IMPORTS)		PER LOCAL AREA		
Local Area	Total TEUs	Total TEU's	Total TEUs	Total containers	% Exports	% Imports	Total
Point	733	0	733	367	100.0%	0.0%	100%
Congella	0	80	80	55	0.0%	100.0%	100%
Umbilo Industrial	3,650	690	4,340	3,302	85.7%	14.3%	100%
Maydon Wharf	7,169	1,380	8,549	6,075	84.5%	15.5%	100%
Bayhead	8,597	6,317	14,914	10,982	60.7%	39.3%	100%
Transnet PX Shed	4,037	6,364	10,401	7,478	41.9%	58.1%	100%
Rossburgh	0	2,000	2,000	1,366	0.0%	100.0%	100%
Clairwood	165	600	765	383	21.6%	78.4%	100%
Jacobs	2,095	1,655	3,750	2,755	59.0%	41.0%	100%
Mobeni	1,597	1,050	2,647	1,915	62.5%	37.5%	100%
Prospecton	981	50	1,031	631	94.6%	5.4%	100%
TOTAL	**29,024**	**18,106**	**47,130**	**35,308**			

Source: Primary research, 2008

This is shown clearly in Table 8 above. The large differences between imported and exported containers handled within many of the areas can be attributed to certain large contracts being handled by certain companies. For instance, one company packs large quantities of steel, paper/pulp and sugar for export each month but handles very few imports. Another company uses a warehouse in Prospecton to pack large amounts of chrome into containers for export, which tips that area the way of exports. Most of the companies in Bayhead have a fairly even proportion of imports to exports, with one of the largest, South African Container Depot (SACD) reporting an almost exact 50/50 split in 2007.

Table 9 Number of monthly truck trips generated by full container moves, per local area

LOCAL AREA	FULL CONTAINER TRUCK MOVES BETWEEN AREA & TERMINALS					
	Outbound full trucks	%	Inbound full trucks	%	Total Trucks	%
Point	367	1.7%	0	0.0%	367	1.0%
Congella	0	0.0%	55	0.4%	55	0.2%
Umbilo Industrial	2,830	13.1%	471	3.4%	3,302	9.4%
Maydon Wharf	5,132	23.7%	943	6.9%	6,075	17.2%
Bayhead	6,666	30.8%	4,316	31.5%	10,982	31.1%
Transnet PX Shed	3,131	14.5%	4,348	31.8%	7,478	21.2%
Rossburgh	0	0.0%	1,366	10.0%	1,366	3.9%
Clairwood	83	0.4%	300	2.2%	383	1.1%
Jacobs	1,624	7.5%	1,131	8.3%	2,755	7.8%
Mobeni	1,198	5.5%	717	5.2%	1,915	5.4%
Prospecton	597	2.8%	34	0.2%	631	1.8%
TOTAL	**21,627**	**100**	**13,681**	**100**	**35,308**	**100**

Source: Primary research, 2008

Table 9 above shows the numbers of truck tips generated by the movement of full containers to and from DCT and Pier 1. It is important to note that there are many different types of trucks moving freight in the SDB at any given time. These include container trailers (full and empty boxes), 33 ton flatbed and tipper trucks moving dry bulk, and 30 ton tankers moving liquid bulk. Table 8 is accounting only for the truck trips generated by the companies that are packing and unpacking and hence moving full containers between their premises and the container terminals. The truck trips have been quantified per local area as well as totalled.

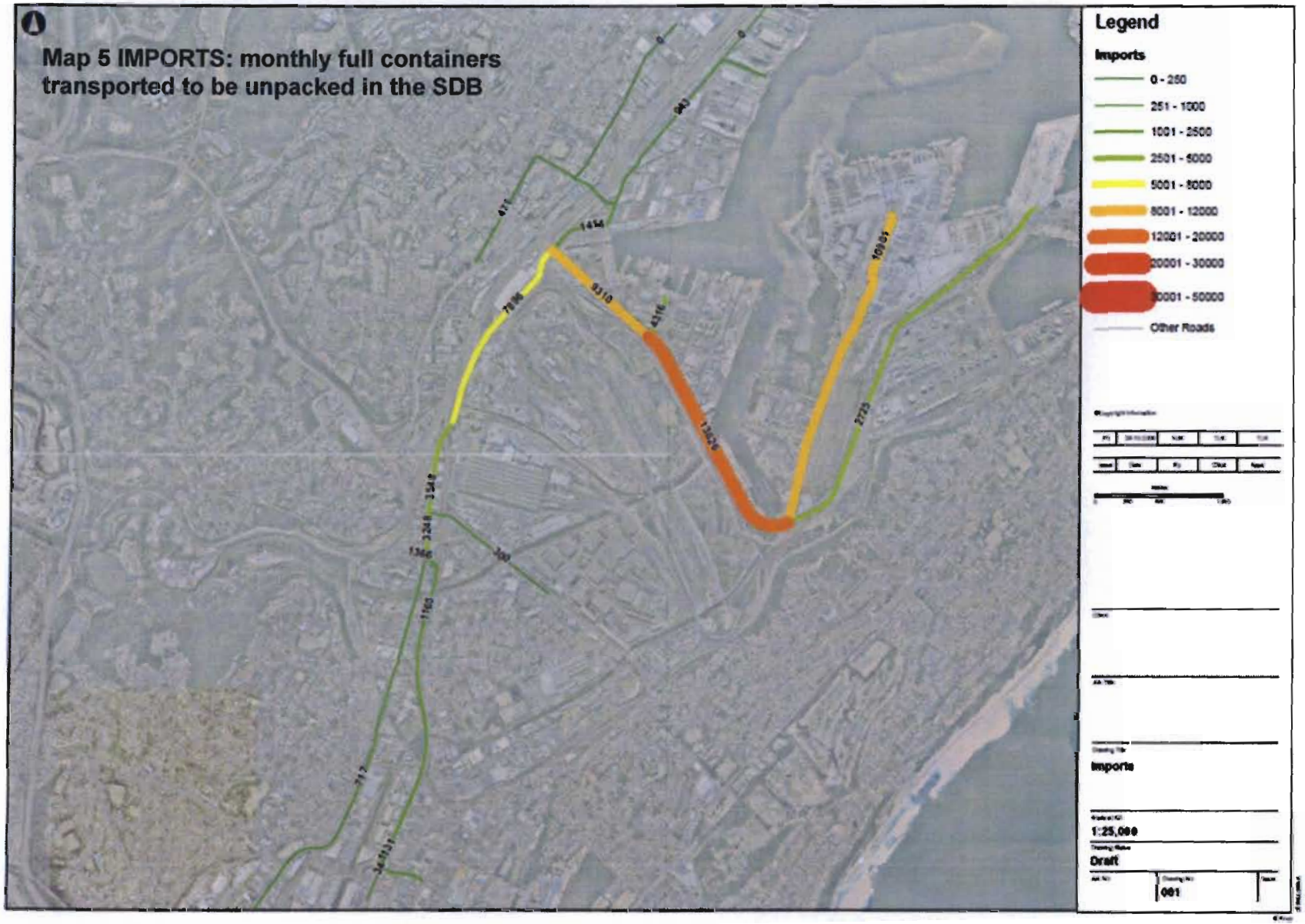
The 21,627 outbound (export) truck trips and 13,681 inbound (import) truck trips combined total 35,305 truck trips moving full containers between DCT / Pier 1 and the various packing and unpacking facilities in the SDB. Again the primary packing / unpacking areas of Maydon Wharf, Bayhead and the PX Shed account for 14,929 exported full containers per month (69%). If one includes the PX Shed in Bayhead then that single precinct accounts for 45.3% of the outbound (export) truck trips.

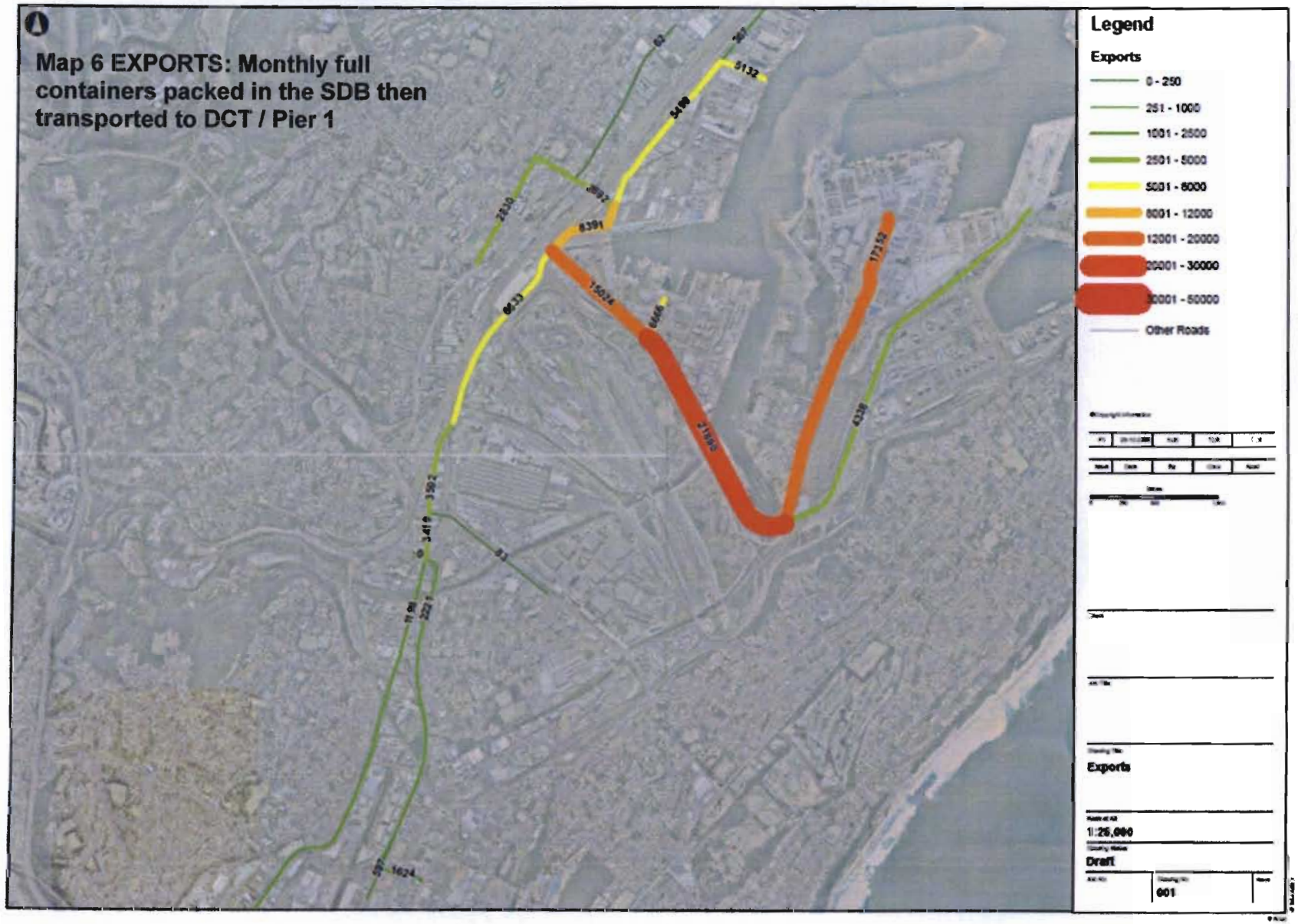
There are fewer imported fulls being unpacked than fulls being packed for export. There are 13,681 truck trips generated by the transportation of full imported containers to be unpacked in the SDB. 8,664 of these (63.3%) are trucks travelling from the terminal to Bayhead and the PX Shed. These truck trips are only taking into account the 29.6% of imported full containers that are being unpacked in the area (by the main packing / unpacking companies that were consulted). Furthermore, because the 21,627 monthly export containers account for 88.8% of the actual 24,342 exported fulls, the 35,305 truck trips shown here are in fact 49.8% of the total 71,281 truck trips generated in total by all of the imported and exported fulls. The unaccounted for 51.2% (36,496 full container truck trips per month) consists primarily of imported containers that bypass third party packing and unpacking logistics facilities in the SDB to be unpacked at the premises of the importer. Approximately 10% of the exports also bypass these third party companies.

Maps 5, 6 and 7 below depict the truck volumes when fed into the eThekwini Municipality's SATURN traffic model for the South Durban Basin. They show the cumulative monthly impacts of the trucks as they travel from parts of the SDB to and from the container terminals DCT and Pier 1. The container terminal is essentially only accessible via Bayhead Road, which is in turn accessed only by South Coast Road and Maydon Road. The M4 freeway happens to run directly alongside the intersection of South Coast and Bayhead Roads but no off-ramp or any access to the port area exists. The result is that all vehicles must take either Edwin Swales VC Drive or Maydon Road to ultimately gain access to the terminal. Two other factors exacerbate this problem:

- the roads have inadequate lanes and capacity
- the route is shared with:
    - other trucks moving empty containers to and from empty container storage depots ,
    - tankers moving to and from the Island View area, and
    - a host of smaller light vehicles.

It is important to note again that the imports on Map 5 only depict 29.6% and the exports on Map 6 show 88.8% of the actual full container traffic generated along Bayhead Road. While the routes chosen by the other 36,496 trucks that do not pass through packing and unpacking facilities will obviously differ depending on where the trucks are coming from or ultimately going to, they must all travel on Bayhead Road at some point in the journey. Consequently the line along Bayhead Road on Map 7 could be doubled. This can be more or less doubled again if the trucks travelling empty in or out of the area once the container has been picked up or dropped off (the empty leg) is taken into account. This gives a rather crude but alarming suggestion of approximately 141,220 truck trips per month generated by the movement of containers along Bayhead Road (half of these would be empty legs and 35,305 trips would be between the terminal and packing / unpacking facilities in the SDB).


Map 5 IMPORTS: monthly full containers transported to be unpacked in the SDB
Legend
Imports
0 - 250
251 - 1000
1001 - 2500
2501 - 5000
5001 - 8000
8001 - 12000
12001 - 20000
20001 - 30000
30001 - 50000
Other Roads
Imports
1:25,000
Draft
001


Map 6 EXPORTS: Monthly full containers packed in the SDB then transported to DCT / Pier 1
Legend
Exports
0 - 250
251 - 1000
1001 - 2500
2501 - 5000
5001 - 8000
8001 - 12000
12001 - 20000
20001 - 30000
30001 - 50000
Other Roads
Exports
1:25,000
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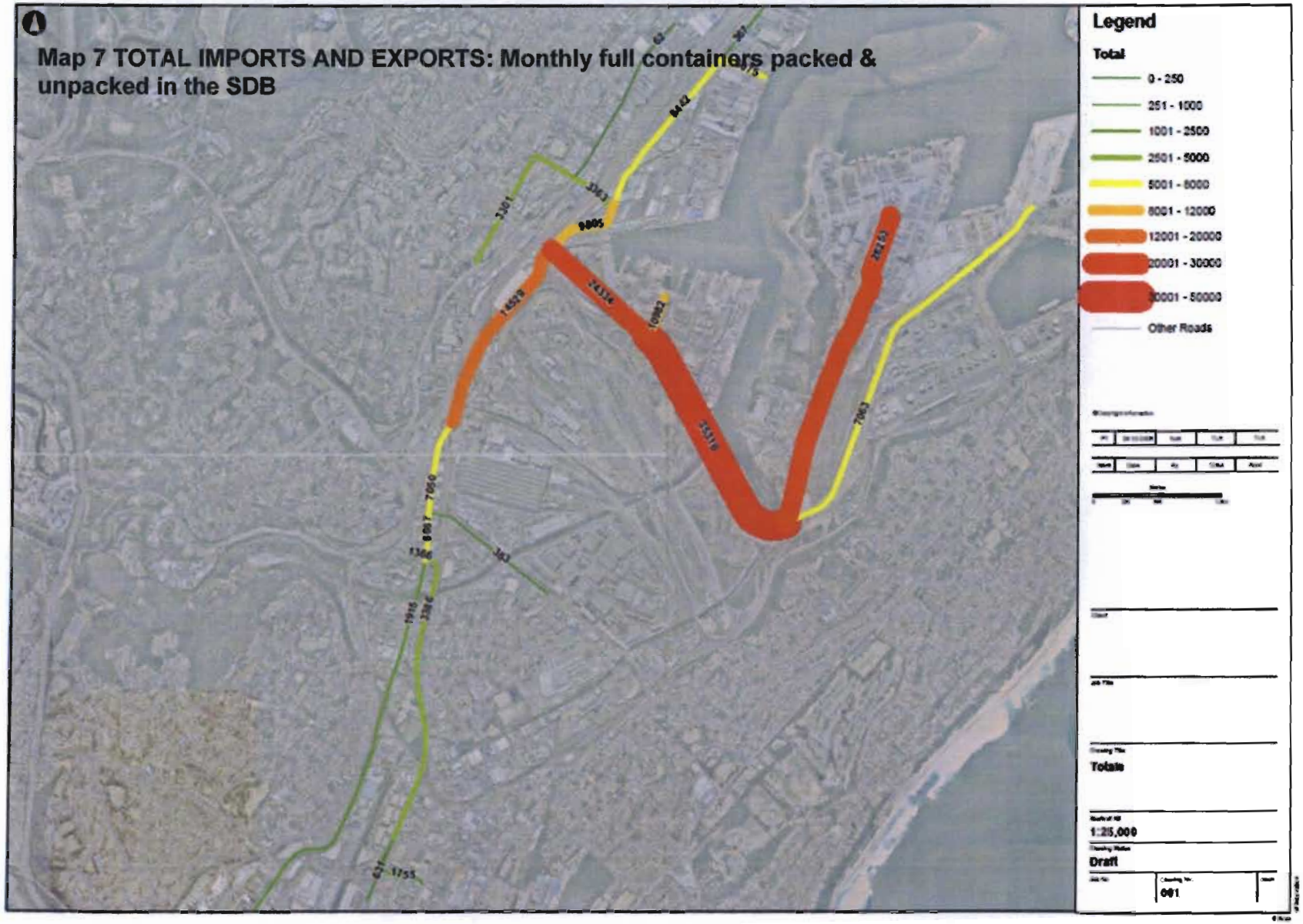
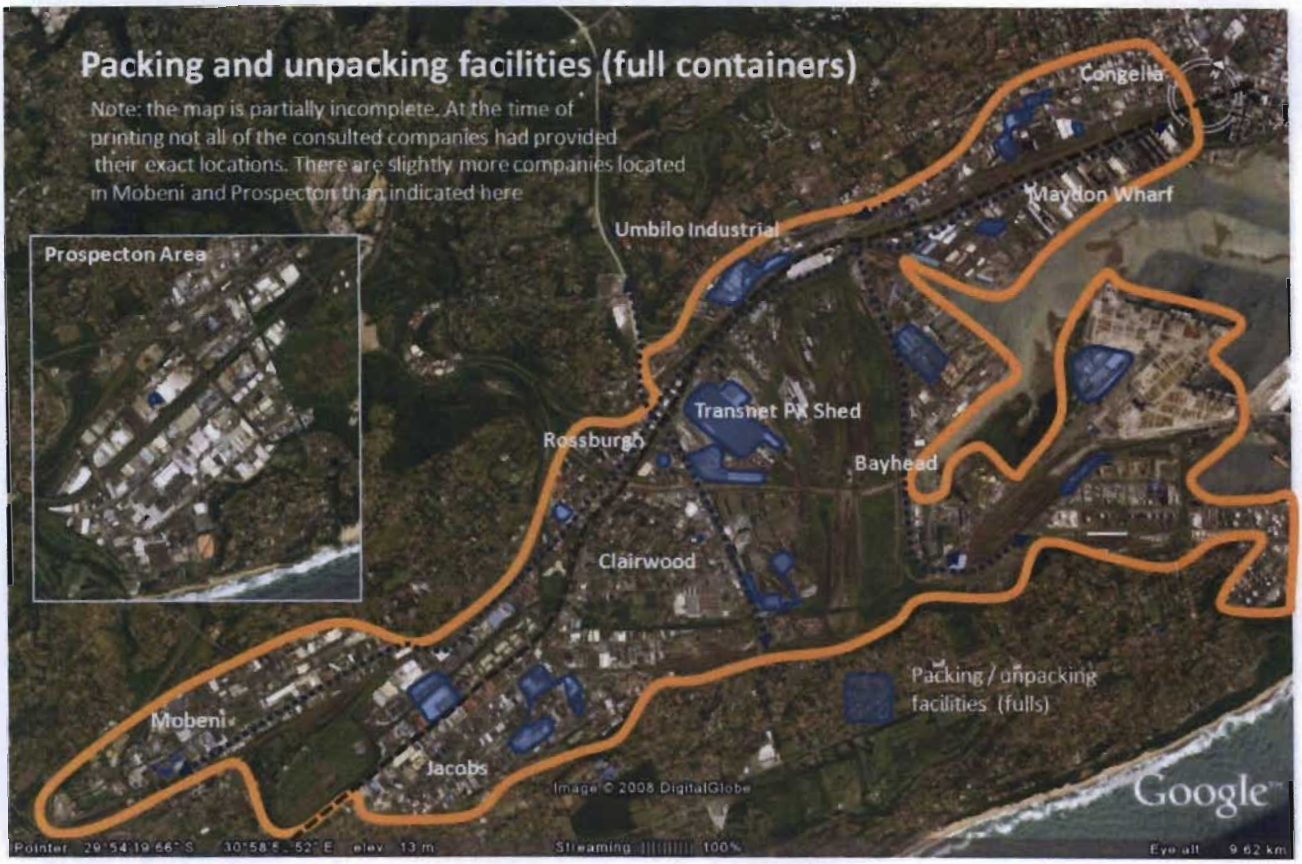
001


Map 7 TOTAL IMPORTS AND EXPORTS: Monthly full containers packed & unpacked in the SDB
Legend
Total
0 - 250
251 - 1000
1001 - 2500
2501 - 5000
5001 - 8000
8001 - 12000
12001 - 20000
20001 - 30000
30001 - 50000
Other Roads
Totals
1:25,000
Draft
001

4.7 Issues, experiences and requirements of the third party packing and unpacking facilities

It is confounding that logistics functions are so frustrated in an area that is so strategically located adjacent to the busiest port in Africa. But this is indeed the case. Refer to map 8 below which shows the majority of the packing and unpacking facilities in the area.

Map 8 Packing and unpacking facilities in the SDB



Source: Primary research, 2008

The area delineated in Map 8 above is characterised by numerous types of infrastructure and natural features that form very impermeable edges between many of the local areas:

- A railway line separates Congella and Umbilo Industrial from the port area and forces access via Maydon Wharf (Francois Road bridge) or Edwin Swales VC Drive (onto South Coast Road). The railway line also separates Clairwood from Jacobs.
- The M4 serves as another barrier not unlike the railway line and cuts Congella and Umbilo Industrial from the port. It also separates Jacobs from Mobeni.
- Several canals limit connectivity and potential for access in the area.
- The convoluted and narrow access given to Bayhead by South Coast Road serves to limit the extent to which it can integrate with other areas. Note that this access route would have been originally designed to avoid traversing the extensive railway marshalling yards with the Bayhead area.
- Maydon Road's poor capacity results in severe bottlenecks which seriously impede the connectivity between Maydon Wharf and Bayhead.

The inadequate provision of adequately zoned space for logistics has led to many if not most operators taking whatever sites they can lay their hands on (in the fiercely competitive property market of the SDB). These sites are frequently inefficiently located and poorly accessed. As such the existing packing and unpacking facilities in the broader area (in blue on map 8 above) are very scattered and *ad hoc* and use a variety of routes to access South Coast road and the container terminal. The physical barriers and edges discussed above play a key part in exacerbating the inefficiencies that operators experience in terms of in access, building suitability and distance:

- While **Umbilo Industrial** offers some attractively large sites, the short absolute distance (as the crow flies) to the terminal is negated by having to cross the railway line and the M4.
- **Congella** suffers similarly and the area generally offers smaller sites than in Umbilo Industrial
- Note that both the above areas are ideally placed to access (rather than traverse) the ample rail infrastructure in and adjacent to the areas.

- **Bayhead** itself does offer operators who locate there the quickest access to the terminal. However, the high levels of congestion on Bayhead Road have a considerably negative impact on their operations. Trucks queuing down Bayhead Road and South Coast Road effectively shut down logistics businesses that are located there.
- Importantly, although **Bayhead** is literally 'round the corner' from Maydon Wharf and 'across the road' from Clairwood, Jacobs and Mobeni, the poor capacity of South Coast Road limits its integration and connectivity.
- **Clairwood and Rossburgh** are in fact ideally located for logistics activity. However, small land subdivisions and conflicting zonings have made it extremely difficult for more than one or two large companies to penetrate these areas.
- **Jacobs and Mobeni** are at the periphery of the 0-5 km zone yet still close enough to the terminal to operate efficiently. The zoning and site sizes are more akin to large-scale logistics than Rossburgh and Clairwood, and unsurprisingly several large premises are located in these areas. There is good scope for both road and rail access into the terminals in future plans. Furthermore, changes from the other broad industrial uses to logistics would be far more easily achieved than in residential areas.
- **Prospecton** is currently housing logistics companies and an empties depot and there is scope for expansion of these as the markets demands it. However, as with other parts of the SDB that are far closer to DCT and Pier 1, there is little land available there and the closer options will be more popular. However, clearly in the event of DIA dig-out port it will be the closest industrial land and doubtless experience high demand for logistics.

Third party packing and unpacking companies are affected by several related but distinct issues:

a) Lack of adequate access

The port area, particularly Bayhead and Maydon Wharf, is extremely congested. This is mostly attributed to logistics activity of various kinds occurring on a massive scale on infrastructure that is mostly completely inadequate. Consequently the companies that are located in Bayhead, the PX Shed and Maydon Wharf are routinely impacted (e.g. access to companies who occupy the PX Shed is completely blocked when trucks back up along South Coast Road). The problem of access is primarily concerned with access to the container terminals but also naturally includes linkages to other parts of the city.

b) Lack of land / space

A few older companies, and companies with financial leverage, have been able to secure large, well-located sites close to the terminal. However, these sites have invariably been outgrown and there is insufficient space to expand. A very small proportion of companies are content with the space that they currently occupy. However, the vast majority of operators have taken whatever sites they can, many of which are inefficient and sub-optimal. Every company with more than one site was strongly in favour of the consolidation of their operations.

c) Limited scope to use the short distance rail links to the terminal and external links to the hinterland

The decline in the use of rail over the past 20 years has affected all of the companies and has contributed directly to the proliferation of truck transport in the last decade and a half.

d) Traffic congestion close to the container terminals

The queues and delays experienced by trucks attempting to access DCT / Pier 1 and the empties depots on Bayhead Road is a critical issue. Truck queues are known to extent down Bayhead Road, into South Coast Road and onto Edwin Swales VC Drive. The issue is seriously exacerbated by trucks using South Coast and Bayhead roads to access empty container depots in that area and petroleum product and lubricant distribution points within the Island View area.

e) Inadequate / outdated buildings

Most of the operators lease their premises which limits their scope for investment down the line in the site and buildings. Ironically, while the PX Shed's cavernous size suggests that it would be an ideal logistics warehouse, its low ceiling severely limits the height to which bulk and break bulk cargos can be stacked. Furthermore, large portions inside are taken up by rail tracks. Note that two of the operators who lease space in the PX Shed are using the space primarily for storage and distribution of locally milled sugar, for local distribution (i.e. not using the port at all).

f) Traffic enforcement

Trucks frequently violate a host of traffic regulations that pose serious externalities in the general area and on other road users:

- Permissible routes (residential areas)
- Illegal parking (blocks further access and exacerbates congestion)
- Roadworthiness and servicing / maintenance
- Weight restrictions.

g) Capacity and opening hours of empties depots

Packing and unpacking facilities operate according to container stacks at the terminals. They have three days in which to fetch an imported container or get an exported container into the stack. Unless they are permitted to stack their own empties, (most are

not permitted to do this) they are dependent on being able to receive or deposit empty container timeously. Empty containers are always picked up or deposited at depots appointed by the shipping lines (they own and control the containers). The container terminal runs 24/7 and peak day-time congestion makes night-time operations an attractive option. Unfortunately most empties depots are not open 24/7. Their opening hours and the general busyness at empties depots hampers the packing / unpacking company's ability to pick up or deposit its empty container, which in turn impacts directly on its ability to work within the three day window at the terminal.

h) Lack of an overnight truck stop

There is currently nowhere for the overnight (up country) trucks to be park when not in use and no ablution services available for the truck drivers. Drivers currently park wherever is convenient, and parts of South Coast Road have become active spots for such activity.

4.8 Concluding remarks on the research results

The research has traced and yielded detail on several aspects of the container logistics chain in Durban.

It has been shown that approximately 89% of exported full containers and 30% of imported full containers are packed or unpacked by third party packing / unpacking facilities in the SDB (accounting for 50% of the total shipped and landed fulls passing through the Port of Durban). These packing / unpacking facilities desire to be as close to the container terminal entrance as possible. This is reflected by the extremely high numbers of companies located in Bayhead, the PX Shed and Maydon Wharf (Bayhead and the PX Shed alone account for approximately 25,315 full containers per month). It also explains the increases in warehouse conversions in Congella as the Congella Bridge nears completion.

The locations of the majority of the packing / unpacking facilities have been mapped and shown to be extremely disparate and *ad hoc*. Public sector land use management planning should take careful note of past errors and endeavour to cater for logistics activity going into the future.

It has been calculated that the packing / unpacking facilities occupy approximately 136 ha (79 ha is warehousing and 57 ha is open yards). That this is not an exact figure is hardly relevant; it gives planners an informed and researched basis for calculating the amount of land needed for logistics against the port's container throughput going into the future (i.e. crudely speaking, in 2007/8 the 2.5 million TEU's have required, *ceteris parabis*, 136 ha of local space for packing and unpacking by third party logistics companies. This could easily form the basis for more meaningful calculations and extrapolations).

The traffic impact of the truck moves of the full containers that have passed through third party logistics companies, to or from the container terminal, has been modelled and mapped through Arup's traffic model.

Lastly but importantly it has also been shown that in the event of Transnet's proposal to dig out the Bayhead area (including the PX Shed) for future container terminal expansion, that extremely significant numbers of packing / unpacking facilities will be displaced. This opens the possibility for a major disruption to the container logistics chain. Transnet and the eThekwini Municipality should consider this and prepare suitable mitigation strategies.

CHAPTER FIVE: SUMMARY AND IMPLICATIONS FOR DEVELOPMENT

5.1 A snapshot of the Port of Durban in context

The Port of Durban finds itself on a similar trajectory to other major regional container-handling ports around the world:

- It is handling more than three times the volumes of containers that it was in the 1980s and has outgrown its infrastructure that was built in the 1970s. Durban is in the process of specialising and entrenching its regional status; as such the increasing of container handling capacity going into the future is an urgent agenda of Transnet.
- The landside logistics function is becoming an increasingly crucial element to overall success of ports as port supply chains are ever integrated into global supply chains, linking with the rest of the world and regional hinterlands. Yet little meaningful attention has been given to planning for logistics in the areas immediately adjacent to or behind the Port of Durban.
- Furthermore over time much of the land that would be suited for logistics activities has been taken up by non port-related activities, which increases pressures on port functionality.

There are several other crucial features exhibited by the Port of Durban:

- The rail share is extremely low and the vast majority of freight is moved by road truck.
- Road access to the container terminals is congested and woefully insufficient for the volumes of trucks using the route (the route is shared with large amounts non-container traffic as well as traffic moving empty containers and not in fact destined for the terminal).
- Transnet has proposals to dig out the Bayhead marshalling yards and / or the existing Durban International Airport (DIA) site as a means to reaching the required container handling capacity. The Bayhead option will displace many

third party packing and unpacking operators located in Durban's primary logistics area.

5.2 The current situation and the implications for future development

5.2.1 Third party packing and unpacking facilities *status quo*:

The logistics operators in the South Durban Basin who are packing and packing containers have received very little planning support:

Their locations are scattered and disparate, usually bearing no relationship to the location of empties depots.
Many businesses operate out of more than one location and would welcome the opportunity to consolidate their operations.
Most operators would like to expand their businesses but are severely curtailed by a lack of space.
Operators need to be located as close to the container terminal as possible (0-5 km is optimal, 0-10 km is crucial).
Most operators have poor road access to the container terminal.
The variety of access routes from each precinct into the port area (DCT) is inefficient and presents a planning challenge for the future.
All operators, particularly those located in Bayhead and the Px Shed, are both affected and frustrated by the frequent traffic congestion on Bayhead Road, South Coast Road and Maydon Road.
Operators are most often leaseholders and thus disincentivised from improving their building, many of which are not optimally suited for modern logistics (e.g. PX Shed).
The current operations collectively occupy approximately 136 ha, of which 79 ha is warehousing and 57 ha is open yards

5.2.2 Implications for development in the future:

Since the 1990s as container volumes have soared, logistics centres (also known as distriparks) are becoming the benchmark for regional container ports. If container

throughput is to increase in Durban as has been forecasted, then the lack of land-side logistics functionality clearly emerges as one of the primary concerns for the success, efficiency and price of moving goods through the complete supply chain, *viz.* international trade between South Africa and the rest of the world. Should logistics in the Port of Durban not receive considerable attention in terms of planning, implementation and funding the future success of the Port of Durban itself, the economic base of eThekwini Municipality and consequently the logistics link in South Africa's trading platform stand to be severely undermined.

It would be of great benefit to the Port of Durban if area/s of focussed and concentrated logistics akin to the Maasvlakte and ZAL distriparks in Rotterdam and Barcelona could be developed in very close proximity to the container terminal (or at least to the entrance). This would provide companies such as those packing and unpacking containers as well as empty container storage depots certain key opportunities:

- Consolidation of disparate premises;
- Expansion of operations;
- Shared access routes (possibly dedicated freight routes) in and out of the area and to the container terminal;
- Improved rail access.

These would all contribute to far higher levels of efficiency and productivity as well as lower costs, broadly speaking, in the area.

The 136 ha of land currently used by third party logistics companies in the area is a useful if prudent indication of demand for space (most companies need more space than they currently occupy) and could be used as a baseline with which to allocate new areas for consolidated logistics activity (e.g. a distripark). Furthermore, in the event of major port expansions, the current land usage could be modelled against overall port container throughput to calculate the approximate land demand for the future – e.g. it could be calculated approximately how much space would be needed if container

throughput were four million, eight million or twelve million TEUs per year. This gives planners the ability to plan land allocation intelligently.

The ultimate development of a dedicated logistics park would require considerable resources to be spent on planning and infrastructure and would call for political will from both Transnet and the eThekwini Municipality. Critically it would also require the unlocking of significant amounts of land in the South Durban Basin area and the redesign of key transport infrastructure.

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