

**AN INVESTIGATION INTO THE EFFICIENCY OF THE
PORT / RAIL INTERFACE AT THE PORT OF DURBAN**

by

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TRANSPORT ECONOMICS

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JUNE 2006

(i)

DECLARATION

“I declare that **AN INVESTIGATION INTO THE EFFICIENCY OF THE PORT/RAIL INTERFACE AT THE PORT OF DURBAN** is my own work and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references”.

PARIS FOOLCHAND

SIGNED ON THE 13TH DAY OF JUNE 2006

(ii)

SYNOPSIS

Trade liberalization and resultantly globalization has led to the relative free flow of goods, services, capital and people.

The transport system in South Africa must be highly reliable and rapid to contribute to economic development. The focus of this research study is on the Port/Rail Interface in the Port of Durban which critically assesses the transfer of goods particularly from rail transport to and from vessels within the port precinct. Some of the major constraints identified in the study related to poor infrastructure, operations and levels of services; lack of maintenance, availability of rolling stock, locomotives and cargo stacking space.

Transnet's role is pivotal in providing efficient port and rail operations and is currently upgrading infrastructure, operations and capacity of the port and rail services.

One of the main objectives of the study is to present recommendations to Transnet management that arise out of the shortcomings identified during the course of the research study.

Keywords : Intermodal; Port/Rail Interface; Rail Terminal;
 Port Terminal; Rail Freight Transport;
 Rail Operations; Port Operations; Logistics Node

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CHAPTER 1 INTRODUCTION

1.1. INTRODUCTION

Current South African economic policy is placing increasing emphasis on export-led economic growth with an increase in value-added manufactured goods and this will continue to affect the technology required by transport operators. International transport trends are having an influence on the manner in which South Africa operates its transport sector. Hence the transport sector needs to be shaped in order to compare favourably with international standards. A critical area of focus for government is a seamless logistics system characterized by an efficient flow of freight that promotes the South African economy's competitiveness. Government analysis points to the fact that poor performance of the transport system is imposing significant costs on business activity and therefore considers it important that blockages within ports and rail systems be dealt with urgently. This chapter provided a background to the problems of the port/rail interface in the Port of Durban and presented the research problem. The research objectives, research methodology and ethics were also discussed.

1.2 BACKGROUND TO THE STUDY

The Port of Durban is the largest port in Africa in terms of value of cargo handled as well as the number of vessels handled. It also has the largest container terminal in the southern hemisphere. The port is located on the eastern seaboard of the African sub-continent and at the convergence of the world's major shipping routes viz. to Australia, North America, Far East, South America and Europe. The port serves its own extensive hinterland, which includes Gauteng and many of the SADC countries.

The continued growth in world trade and the globalisation of production and markets has created intense rivalry amongst ports and countries. This intense rivalry is causing governments to enhance the efficiency of their ports. However this enhanced efficiency must be integrated with the total transportation system to improve supply chain performance and to provide a comparative advantage against other supply chain systems. The supply chain model is simplistically illustrated in Fig 1.1:

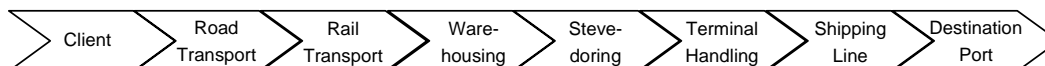


Fig 1.1 Supply Chain Model

N.B. Once at the destination port the supply chain activities are reversed until the commodity reaches the end user.

The supply chain approach integrates the logistics operations of suppliers with needs of customers and the cycle time is compressed in order to respond to customer demands. In this approach suppliers and customers enter into strategic alliances with transportation firms, warehouses and other third parties. A major benefit of this approach is service improvement and cost reductions for all members in the supply chain. Hence the growth in world trade and the developments in supply chain management allow the demands for goods to drive downstream consumption and the necessity for efficient upstream supply actions. Downstream consumption refers to business-to-consumer transactions whilst upstream supply functions refer to business-to-business transactions. Leading companies use true point-of-consumption information to trigger replenishment actions.

1.2.1 The Role of Transnet in the logistics chain

The National Ports Authority of South Africa (NPA) the landlord of the ports and South African Ports Operations (SAPO), the lessee are the two major entities that control port development and operations respectively. Spoornet is the country's sole rail freight operator and a service provider to the port. These three major divisions are part of Transnet Ltd., the biggest logistics service provider in Africa.

Transnet, in reviewing the contribution of transport to the GDP of the South African economy for 2003 (source The First State of Logistics Survey for SA - 2004) established that 745 million tons of goods were transported by road, rail and air transport at a total cost of R134 billion. Rail and air transport made a contribution of R11 billion each which equates to 18% of the total. This implies that road transport accounted for 83% of total transportation costs, which translates to R111 billion. Of this total over R50 billion was along the major transportation corridors. This breakdown highlights the small percentage share of rail transportation relative to road transport. This scenario has prompted the restructuring of the core businesses of Transnet to improve efficiencies and to significantly increase the market share of rail transport.

In the Transnet Annual Report 2003/04, the Report of the Directors states that Transnet plays a pivotal role in economic and social development in South Africa because the Group's business units that operate rail and port service infrastructure occupy a strategic position on the supply value chain of all of South Africa's major import and export industries. The competitive advantages of the industries that are geared towards exports are highly dependent on the efficiency of the rail and port services that Transnet operates. If the port and rail services are inefficient they add to the handling cost and export goods lose their price competitiveness. Transnet has recognized that maintenance and investments in port and rail infrastructure has been inadequate and are embarking on a major capital expenditure programme. Approximately R40 billion has been earmarked to upgrade the infrastructure of its core businesses (rail, ports and pipelines) over the next five years.

Transnet in announcing its strategy to the major transport divisions and subsidiaries within the group (17 November 2004) recognized the need to enhance the efficiencies of its core operations in order to reduce supply chain costs. It has adopted the following operational schemes:

- (i) To improve operational efficiencies i.e. to increase productivity in cargo handling operations in the port and in rail yards.
- (ii) To increase infrastructure development i.e. to create capacity before demand arises.
- (iii) To create logistics integration – the focus is to integrate and optimize the rail and port interface operations and to reduce logistic costs.
- (iv) To improve customer interaction and third party collaboration – to hold strategic operational forums that would focus on supply chain competitiveness and operational constraints.

1.2.2 The National Ports Authority of South Africa (NPA)

The restructuring of Portnet resulted in the creation of NPA and South African Port Operations (SAPO). The South African Ports Year Book 2004 states that from this date South Africa's seven commercial seaports are managed and controlled by NPA. The primary function of SAPO is to operate the various terminals at the seven commercial ports. SAPO is responsible to load and unload vessels, provide warehousing for goods and stacking areas for goods that are to be exported and imported. All the mechanical handling equipment including cranes, straddle carriers and tractors and trailers are provided by SAPO. NPA is responsible for the maintenance and investment in port infrastructure, which

is a vital function in sustaining the growth of the national economy. SAPO leases the terminals from NPA. NPA fulfils the role of the landlord function and operates as a strategic partner for all port users thus opening the door for more cost effective commercial usage.

According to Ports SA (summer edition 2003) the National Ports Authority Bill (B5-2003) was introduced in Parliament's National Assembly in February 2003. The aim of the NPA Bill is to provide for the establishment of the National Ports Authority Limited and the Ports Regulator. It is envisaged that NPA will move out of Transnet by 2007 and that it will become a separate state-owned enterprise. The Ports Regulator will reside in the Department of Transport and its primary function will be to review and approve NPA's tariffs and monitor the relationship of NPA with the various port users and with Transnet. The Bill could also result in setting up a competitive regime for all the ports under NPA's control. The emphasis however shall be on the competitiveness between similar port terminals. Each terminal is part of a longer logistics chain and terminals performing similar functions must be competitive for shipping companies wanting to use them. The Bill however will only be passed by Parliament during the course of 2006.

1.2.3 Growth in the Port of Durban

The South African Ports Yearbook 2004 recognizes the Port of Durban as South Africa's premier maritime gateway that boasts a range of specialist terminals, which handle more than 32 million tons of cargo annually. The Port of Durban cargo statistics (2004) illustrate that Durban is experiencing unprecedented growth rates since 1994:

- (a) Container traffic: The increase has been from 887216 twenty foot equivalent boxes (TEU's) handled in 1995 to 1421911 TEU's handled in 2003, which represents a growth of 61%.
- (b) Break bulk cargo volumes have increased from 9,0 million tons in 1995 to 12,0 million tons in 2003. This translates to an increase of 33%.

Transportation costs and links to the hinterland and the efficiencies of these systems have a major impact in supporting economic growth and the international competitiveness of the Port of Durban. The port serves as an intermodal facility or transfer station for goods from rail and road to ship and vice versa or from larger vessels onto smaller vessels that provide a feeder service. The Port requires to be an efficient and well-managed operations entity. Apart from the cost competitiveness of port operations many ports lose their dominance

and growth potential because of costly and unreliable transportation services and inadequate links with inland distribution systems.

Senior economist Iraj Abedian of Pan-African Advisory Services commented in the Engineering News, (March 2005) that recent economic data and private sector surveys indicate that the global competitiveness of productive sectors of the South African economy are hamstrung by inadequate and inappropriate infrastructure and logistical support which raises logistic costs. He also stated that it will be trade-hubs (a strategically located conglomeration of manufacturers producing goods for export) that compete in the global marketplace and not necessarily countries and that increasing the efficiency of transport hubs and corridors should therefore be seen as an important strategy to bring down the cost of doing business. In the same article research prepared by economic development specialist Kaiser and Associates shows that logistics costs in developed countries are significantly lower than those in developing economies such as South Africa's. South Africa's high logistics and transport costs are seen as a major reason for the relative decline in the manufacturing industry's contribution to gross domestic product.

The NPA, in recognizing the Port of Durban's vital role in the economy of the country, the problems with congestion due to growth in maritime traffic, the need for large capital investments and the long lead-time to provide infrastructure ahead of demand, has committed R2,5 billion of capital for an initial phase of expansion up to 2006. Long term planning is currently in progress to provide additional infrastructure for demand up to 2020. The anticipated capital expenditure is a further R22 billion.

1.2.4 Spoornet Operations in the Port of Durban

The Spoornet entity that manages the rail/port interface is known as Durban Harbour Operations. The primary business relationship with the Port of Durban is managed through a Service Level Agreement (SLA). A daily operational plan is prepared and co-signed between the Port Terminal Manager and Rail Operations Manager. The operational plan allows for the following:

- Shunting times
- Rail line allocation per commodity type
- Clearance of wagons at predetermined times
- Accommodate deviations such as ships not meeting their expected time of arrival

- Accommodate 50 wagon trains and to be split into 25 wagon blocks for loading and unloading
- Sharing of information on shipping line volumes and wagon availability

The philosophy behind the SLA is to enhance wagon turnaround times by working with block loads and ensuring that adequately maintained rolling stock and appropriate wagons are available in the port.

1.2.5 Spoornet's "Predictable Service" philosophy

In 1996 Spoornet embarked on a restructuring exercise to centralize the operations of the rail business with the fundamental aim being to provide a quality service. The centralization of marketing, reservations and planning was based on adopting a new operational philosophy of Predictable Service. The fundamental aim was to provide a quality service at the right price and in shortest time possible i.e. to as far as practically possible deliver the load directly to the client's siding. The success of the abovementioned operations strategy is based on having thorough processes, reliable rolling stock, well-maintained infrastructure and trained personnel

The application of this initiative entailed dissolving the various Regional Manager offices and relocating the personnel at head office in Johannesburg. This led to the loss of many experienced staff, resulting in a decline in service delivery and a loss of market share. The loss of market share by rail (30% modal split for rail in 2004) from Port of Durban statistics on a year-to-year basis actually mean that funds for capital expenditure and maintenance was not easily forthcoming. In effect the number of "not to go" wagons increased substantially and the infrastructure deteriorated due to planned maintenance being virtually non-existent. The focus therefore shifted to ad-hoc maintenance and emergency repairs. This scenario has also led to the compromising of safety standards especially in the marshalling yards.

1.2.6 The Bayhead Interface

The Bayhead Marshalling Yard is the nerve centre for the provision of rail services and operations to other satellite yards and the Port of Durban. Protekon, a consultancy division of Transnet, prepared a report on the Spoornet/Portnet Interface (1996). The following are some of the major issues that were identified in the Spoornet/Portnet Interface Report, which have contributed to the poor operations of the yard:

- Lack of planned maintenance
- Lack of funds for planned maintenance
- Budgetary constraints for repairs of wagons and locomotives
- Use of the yard for storage purposes especially of unworthy rail wagons
- Poor training and development programmes
- Lack of performance of affirmative action staff
- Unavailability of the right type of wagon when required by Clients
- Deterioration of the entire infrastructure in the Yard

1.2.7 Interfacing between the parties concerned

The National Ports Authority (NPA) is currently finalizing their Port Masterplan for Durban up to 2020. The proposed layout of the Port of Durban 2020 and a perspective of the new container terminal are depicted in Appendices 3 and 4 respectively. Unfortunately road and rail transport systems do not have a master plan to keep pace with the development of the Port of Durban. From discussions held with the planners from the Durban Metro, the Metro has to some extent reviewed road infrastructure needs, possibly for a five-year window.

The real challenge is to get all parties, (NPA, Spoornet and Durban Metro) to commit to integrating the planning of the different transport modes. Unfortunately Spoornet are way behind in upgrading its operations and in meeting the future challenges and opportunities arising out of the increases in shipping volumes.

1.3 RESEARCH PROBLEM

Rail freight transport is an extremely capital-intensive business venture with a high percentage of fixed to total costs. It is thus very sensitive to changes in volumes of cargo transported. The declining tonnages transported have not only resulted in a loss of revenue but also implies that assets are not being optimally utilised. In an attempt to contain costs adequate funding is not made available to maintain the infrastructure and rolling stock. This short-term strategy to reduce expenditure on maintenance has merely exacerbated the situation by compounding the problems of poor infrastructure, lack of maintenance of rolling stock and the incapability of operations management to deliver a reliable and cost competitive service.

The problem that was researched is the degree to which the various rail/port interfaces at the Port of Durban are contributing to service delivery given their current operational

constraints and how this service delivery can be enhanced by increasing efficiencies at the port/rail interface. The high growth rates in cargo handling in the Port of Durban necessitates such an exercise to assist the port in identifying operational constraints and together with the other stakeholders to find joint solutions. This is critical if the Port of Durban wants to maintain its dominant position in Africa.

1.4 RESEARCH AIM AND OBJECTIVES

The aim of this study was to analyse the workings of the port/rail interface and to provide recommendations on how to enhance efficiencies at the interface, particularly to Transnet management, for consideration and implementation.

In order to achieve the aim of the study the following objectives were set:

- (i) To discuss from literature studies what problems are experienced in other port/rail interface environments.
- (ii) To assess the level of current rail operations at the various terminals in the Port of Durban and obtain an understanding of the constraints that are inhibiting rail service delivery.
- (iii) To analyse the growth of the port and to obtain an understanding of the constraints inhibiting port operations.
- (iv) To establish whether the model of Pycraft, Singh and Philela (1997) can be used to enhance the efficiency of the port/rail interface.
- (v) To establish whether a performance management system can be utilised to measure performance outputs of the rail/port interface operations against set targets in order to focus on continuous improvement to render a cost effective service to intermodal users.

Comment [N1]: You are going to discuss this not address the problems

Comment [N2]: The last part of the sentence is the aim of the study. Rather indicate that you will obtain an understanding of the constraints inhibiting port operations.

Comment [N3]: You are not testing the model. You are going to establish whether the model can be used.

Comment [N4]: Again, you are going to establish whether the PMS can be used to measure outputs against set targets

Comment [N5]: I suggest you rephrase. Use "in order to"

1.5 RESEARCH METHODOLOGY

1.5.1 Quantitative versus qualitative research

The purpose of using a specific research methodology assisted in obtaining information from a representative sample of individuals within the organisation that would reflect the thinking on the various issues identified by the researcher. Two research methodologies can generally be used for such a purpose namely, quantitative and/or qualitative research. Quantitative research is based on meanings derived from the use of numbers and depicted by means of diagrams and statistical comparisons. Qualitative research is quite the

Comment [N6]: Do not discuss the theory as such. Rather indicate how and why you are going to use a certain methodology. I have made some changes here. Compare it to your original in order to see them.

opposite. Qualitative research is based on meanings expressed through words. Such meanings may be categorised and the analysis of which occurs through the creation of a conceptual framework.

The scope of qualitative research includes in-depth interviewing which is usually conversational rather than structured. Hartley in Van der Colff (2001; 149) states that qualitative methods best address questions for a case study. The investigation of the port/rail interface is deemed to be a case study and therefore use will be made of qualitative research in this study.

Comment [N7]: Paris, you have to insert a brief overview of what the essence of quantitative research is at the end of the previous para..

In case studies an in-depth contextual analysis of a few events or conditions is done. Such analysis will depend to a large extent on the availability of information. For the purposes of this study information was obtained from both primary and secondary data sources. Primary data was obtained by means of questionnaires and semi-structured interviews whilst secondary data was obtained from reports and documents from the various business units.

The questions asked in the questionnaires were investigative in nature and designed in a manner to obtain direct answers on issues contained in the research objectives described in Section 1.4. The data will be allocated to categories to assist with comprehension and identification of key themes and relationships. The semi-structured interviews were flexible and an attempt was made to elicit responsive interactions by allowing meanings to be probed, thus providing a fuller access to knowledge and meanings from respondents. This assisted to draw and verify conclusions.

1.5.2 The nature of qualitative data

Qualitative data is based on meanings expressed through words and is associated with concepts that allow one to explore a subject in a realistic manner. The data collected was classified into categories for meaningful analysis hence the Likert style rating scale was used for this purpose. The responses obtained utilising the five point Likert scale on how strongly the respondents agree or disagree with a statement was allocated against one of the five response categories.

1.5.3 Sampling

The target group for this study was the decision makers responsible for the operations and infrastructure development of the Rail/Port Interface. The respondents were from SAPO,

NPA, Spoornet and Protekon. Groenewald (1989; 18) referred to homogeneous samples as being purposefully selected in order to become better acquainted with a phenomenon. In this instance the phenomenon is an understanding of the workings of the port/rail interface. According to Saunders, Lewis and Thornhill (1997; 145) purposive sampling “enables you to use your judgement to select cases which will best enable you to answer your research questions and meet your objectives”.

Non-probability sampling or **purposive** sampling was used for this study. The sample was a small group of specialists and will include Terminal and Operations Managers in the port and the Operations Managers of the various rail yards and the Durban Harbour rail operations team. Some of the Project Managers from Protekon Consulting Engineers who provide engineering and an operations technical service to NPA, SAPO and Spoornet were also included. The homogeneous sampling case selected was intentional so as to assist with data collection and to answer research questions. The manner in which the sample size was drawn is discussed in Chapter 4.

1.5.4 Administering the questionnaire

A meeting was set up with each of the respondents explaining the purpose and nature of the survey to them. In introducing the questionnaire to the respondent, each respondent was given an opportunity to briefly review the questionnaire and thereafter a discussion on the workings of port/rail interface was pursued. This discussion then led itself into the semi-structured interview process where there was the opportunity to probe for answers based on the sub-problems that arose out of the research aim of this study under Section 1.4. Respondents were advised to answer the questions in an unbiased manner as possible.

1.5.5 Data analysis

The responses of the questionnaire were captured on an Excel spreadsheet and the percentage calculated for each of the five categories of response based on the Likert scale. If the majority of the responses of a particular question were in a particular response category this could be an indication of a clear understanding of the question. The responses from the questionnaire were compared with responses obtained from the semi-structured interview to ascertain the level of consistency of answers provided by the respondent. One also had to be aware that answers from the questionnaires may not vary that much.

The research process was discussed in detail in Chapter 4.

1.6 OVERVIEW OF THE STUDY

Chapter 1 provided an introduction to the research problem, which covers the background of the study, the research problem, research aim and objectives as well as the research methodology used.

Chapter 2 is primarily concerned with the literature review, which covers the importance and the components of the rail/port interface, freight transport (Moving South Africa Strategy), layout and operations of a marshalling yard.

Chapter 3 relates to the port/rail Interface which focuses on the rail service provider Spoornet, its operations, infrastructure, static capacity analysis of yards and terminals, current throughputs and identification of constraints, some of the port terminal workings and Transnet's re-engineering initiative.

Chapter 4 provides details on Research Methodology, the questionnaire and semi-structured interview questions used in the research study.

Chapter 5 provides details on the theoretical framework for the Balanced Scorecard and the Transformation Model.

Chapter 6 - The Research Findings will be discussed in detail.

Chapter 7 - Conclusions and Recommendations will be given thus fulfilling the aim of the study.

1.7 ETHICS

Protekon, the consulting and construction subsidiary of Transnet has undertaken many studies as a consultant to NPA, Spoornet and South African Port Operations. The port/rail interface has been viewed by Protekon as a Transnet integrated operation rather than as individual operations, which satisfies each division's self-interests. It was the intention of this study to propagate this operational philosophy.

The new strategic direction of Transnet is certainly assisting to implement and consolidate supply-chain practices. It is against this background that the study has been undertaken.

No financial assistance was provided by any of the aforementioned businesses to undertake this study. The information presented in this study is also factual and will be reviewed by the Transnet Steering Committee. Transnet has recently established a Steering Committee to review business cases for the development or improvement of infrastructure. This Steering Committee has representatives from the major transport divisions of NPA, Spoornet and South African Port Operations.

The amount of information available on the port/rail interface in the Port of Durban is very limited making this the first comprehensive study undertaken on this topic. An exhaustive search of the literature indicates that only a passing reference is made to the port/rail inter-relationship. Further, these references are not interpreted in the context of relevant theory which will assist one to better understand the port/rail interface. The current study is an attempt to address these shortcomings. The body of knowledge contained in this research paper amongst other initiatives will assist this Committee to identify the constraints that are inhibiting service delivery and expedite the implementation of corrective measures to enhance the efficiency of the port/rail interface in the Port of Durban. Recommendations took into account infrastructure improvements/development and operations improvements.

1.8 CONCLUSION

This chapter provided a detailed overview on the background to the problem of the Port/Rail Interface in the Port of Durban. Transnet as a major role player in the total transportation system has acknowledged the need to improve operational efficiencies and the competitiveness of the port/rail interface. This enhanced efficiency must be integrated with the total transportation system to improve supply-chain performance and to provide a comparative advantage against other supply-chain systems. Government's macro-economic policy with a sharp focus on export-led growth has also put tremendous pressure on Transnet and the transport sector as a whole to shape-up to international standards and to become competitive. Transnet has relinquished its role as a holding company and has become directly involved in the implementation of a major capital expenditure programme. Approximately R40 billion will be spent on upgrading the infrastructure of its core businesses (Rail, Ports and Pipelines) over the next five years.

Comment [N8]: Link to the next chapter.

Chapter 2 which follows presents a literature review on the research problem and the importance and workings of the port/rail interface.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

The objective of this chapter is to review the relevant published material relating to the topic of the study. According to Saunders, Lewis and Thornhill (1997; 39) the main purpose of a review is to assist in developing a good understanding and insight into relevant previous research and the trends that have emerged. This would assist the researcher to compare the current situation with the postulations in the theoretical framework. The port/rail interface is primarily an intermodal facility where the modes of rail, road and shipping converge to facilitate the loading and unloading of cargo from shipping vessels onto and from road and rail trucks. The roadway, rail tracks and terminal facilities which include the quay wall, warehousing and stacking areas are deemed to be the fixed component of the intermodal facility. The efficiency of operations determines the adequacy of the element of infrastructure that is provided.

A regional perspective is included to illustrate the importance of improving transportation and communication linkages and the need for greater economic integration when viewing transportation infrastructure within the SADC region. A brief review of intermodal freight transportation and an assessment of intermodal quality within the European Union is presented to evaluate present performance of intermodal transport and to identify the main trends and measures in a developed economy.

2.2 IMPORTANCE OF RAIL/PORT INTERFACE

The restructuring of the ocean transportation of general cargo, which began with the advent of containerization, led to the formation of shipping lines that specialize in the transport of containers. Standardized containers are generally 6m and 12m long. They have locking mechanisms at each corner that can be secured to a truck chassis, a rail wagon, and crane or on other containers. The use of standardized containers contributed to the seamless transport of international trade i.e. the movement of cargo from an origin in one country to a destination in another country by more than one transport mode became commercially feasible.

Previously cargo was moved as break-bulk cargo, which used to be placed on pallets. These pallets were generally moved one at a time onto a truck or rail wagon that conveyed them from a factory or warehouse to the docks. There each pallet was unloaded and

hoisted by a cargo net crane, off the dock and onto the ship. Once the pallet was in the ship's hold it had to be braced to prevent damage. The process was then reversed at the other end of the voyage, making the handling of cargo slow, labour intensive and expensive. Cargo in a container is only handled twice i.e. when loaded and unloaded from a container.

The technological improvement in shipping especially through containerization revolutionized ship design, cargo handling equipment, intermodal facilities, road and rail transport, port design, trade flow networks, port labour, port investments, inland transportation and international trade. All of the aforementioned elements have led to a reduction of operating costs, less pilferage, less handling and thus less damage to cargo. A break-bulk ship often took a week to unload and reload whilst with modern intermodal facilities a containership might be in a port for only 6 to 24 hours. Inland container terminals e.g. City Deep in Johannesburg are also major intermodal facilities that serve as major collection and distribution centres to large hinterlands.

Efficient intermodal facilities mean that larger vessels call only at a few ports known as hub ports where large volumes of containers would be consolidated by land transportation, barges and small feeder vessels. These vessels normally carry from 3500 to 5000 TEU's (20 feet equivalent units). Talley (2000; 941) in reviewing the twenty largest shipping lines, major trade routes and twenty of the world's major ports confirmed that ports are major nodes i.e. associated with the transfer of goods and that the movement of freight across many modes of transport in a supply chain facilitates land-way routing in conjunction with waterway routing. He concludes that ports that possess efficient cargo handling systems and intermodal connections are more competitive than rival ports in terms of attracting business. Some shipping lines have equity in companies that provide rail services especially in the United States and Canada. Because of the large distances between the west and east coasts of these countries, rail trucks were designed to carry containers that are double-stacked in an attempt to significantly reduce unit transportation costs to and from their vast inland destinations. In general it can be said that all major ports have dedicated rail and road terminal facilities in the vicinity of the dockside to facilitate the efficient transfer of goods to and from ships.

The impact of the efficiency of intermodal facilities is further illustrated by Cass (1996) by the means of an example of soya beans which is produced in the United States at a cost of US \$195 a ton and loaded on board a ship at a cost of only US \$ 20 per ton for a total of US \$ 215 whereas Brazilian soya beans cost US \$ 165 per ton and the cost of loading it on board a ship is US \$ 65 per ton for a total of US \$ 230 per ton. From the above it can be

seen that the competitiveness of a country's commodities are largely influenced by the efficiency and the resultant lower cost of intermodal operations.

2.3 FREIGHT TRANSPORT

The Moving South Africa (MSA) freight transport strategy for 2020 envisages that the transport system will meet the needs of customers for sustainable, highly reliable and rapid transport services at low systems cost through intermodal networks comprising road, rail, sea and air interchange infrastructure.

The following is envisaged:

- A limited number of highly developed multi-modal transportation corridors – between domestic centres and international destinations.
- Corridors must be connected to a limited number of highly specialized ports – international container hubs, bulk ports, feeder ports and niche ports.
- Lower density route lines must feed traffic into main corridors and nodes
- Efficient transfers between modes at the major ports and inland terminals must be achieved.

MSA identified several strategic imperatives to support the above strategy i.e.:

- (i) Building density in the transport system
- (ii) Building economics of scale in the different parts of the transport system
- (iii) Ensure sufficient investment to maintain quality of infrastructure and operations
- (iv) Building capabilities in logistics
- (v) Focus on the various modes to optimize their inherent advantage
- (vi) Remove bottlenecks currently in the system

2.3.1 Container traffic: MSA East-West Ports Option

MSA has proposed the consolidation of international container traffic through two container ports, as per 2.3(ii) above, one each on the Eastern and Western seaboard of South Africa. Hence traffic bound for Asia and the East would flow through the East-facing hub which would be the Port of Durban and traffic bound for the Americas and Europe would utilize the Port of Cape Town as the West-facing hub. Currently over 50% of vessels calling to South Africa stop at three ports viz Durban, Port Elizabeth and Cape Town. This

increases the costs to the shipping lines, which in turn is passed onto the cargo owners. Reducing the number of ports of call to only one can enhance the competitiveness of South African goods and also substantially reduce delays (up to 5 days), which helps goods to get to markets quicker.

MSA data analysis revealed that there are three opportunities which are available to reduce costs to the customer:

- (i) Reduce distance
- (ii) Reduce the number of ports of call
- (iii) Increase the average size of ships

Global shipping trends are moving in the direction of larger ships, fewer ports of call and the use of hub ports to direct traffic into feeder systems. Consolidation of freight along specific corridors enhances efficiencies, utilization of the corridor, and the price competitiveness of goods transported. For South Africa to achieve consolidation it requires the entire transport channel from inland to the ports to be optimized to offer maximum advantages to the customer as well as shipping lines. The inland freight system is already largely consolidated and will add impetus to port consolidation, hence the “East – West Port Option”. The corridor approach is envisaged to yield savings of between 2% to 11% in costs and 3 to 5 days in transit time depending on the use of designated ports by shipping lines. Benefits of the corridor vision are summarised in Table 2.1 below.

Table 2.1 Benefits of the Corridor Vision

	Maritime	Inland
Build density around corridors	Trade flow balancing raises prices by 18% to 25% from 2004. Reduction in multi ports calls: 2% to 11% in cost and transit time	Separation of core rail lines from branch lines reduces costs by 15% Investment in corridor freight network reduces vehicle operating costs.
Appropriate use of Models and Modal Economics of Scale	Increased vessel size decreases vessel costs by 17% Feeder and specialized ports save from 3-5 days	Rail operational use of unit trains improves service reliability Road user charges for infrastructure and externalities increase 0.5 to 1 cent per NTK (Net Tonne Kilometers)
Improve Firm-level Performance	Port investment, fixed vessel arrivals and operating efficiencies eliminates excess port delays	Rail operational improvements reduce general freight costs by 25% Road freight productivity improvements reduce costs by 25% Inland terminal improvements improve service reliability and reduce road freight costs

Source: Moving South Africa – The Action Agenda Part 4.

The costs benefit analysis of the corridor vision proposed by MSA shows that 95% of exporters will benefit from this vision and that 5% will not. The 5% will end up paying more for transport because by virtue of their location they have to be connected by a feeder system to a hub port.

Lowering total cost viz transport, handling and storage creates cost savings in the transport chain thus enhancing the price competitiveness of goods. The benefits of cost savings must then be spread among the various stakeholders. There has to be an evolving system to continually enhance service delivery and reliability to take customer needs into account. In analyzing the export competitiveness of value-added products it was found that 60% of the transport chain cost is attributed to shipping which is currently charged at a discount rate due to spare capacity on the backhaul leg. This backhaul discount is projected to disappear within the next 5 to 7 years as tradeflows begin to balance, leading to higher tariffs in the largest cost generator within the transport chain.

South Africa's key lever in reducing shipping costs lies in the configuration of its port system. As far as bulk exports are concerned, existing flows are highly consolidated e.g. coal at Richards Bay, and iron-ore at the port of Saldhana. A consolidation strategy is also required for general cargo i.e. to reduce shipping costs by reducing the average number of ports of call by shipping lines.

Any port consolidation strategy must have the backing of major shipping liner operators. They are an important part of the decision making process to identify the major core container ports and general cargo handling ports and the competitive feeder services that would have to be developed in order to maximize the benefits of consolidation. Such consolidation must achieve high levels of efficiencies and lower costs.

The tenets of the MSA Strategy is based on best planning practices and concurs with the requirements of Planning Management of Port Development discussed under Section 2.9 of this study which further emphasizes the value placed on optimizing investments and enhancing the competitive pricing of value added export goods.

The "East-West" strategic option is therefore to optimize the entire transport chain in order to reduce the total cost of transportation by as much as 30% for some customers, in particular for containerized import-export flows. These actions must be delivered to reduce shipping costs as stated above i.e. reduce distance, reduce the number of ports of call and attract larger ships.

The following tables reflect the transport chain costs for the export and import of containerized freight.

Table 2.2 TRANSPORT CHAIN COSTS FOR EXPORTS

Average Distance	20 km	720 km	500 m	11 200 km
Portion of transport costs	10%	17%	13%	60%
	Cross haulage and cartage	Inland terminal and trunk leg	Port at key side	Ocean transport

Source: Moving South Africa – The Action Agenda Part 4.

Table 2.3 TRANSPORT CHAIN COSTS FOR IMPORTS

Average Distance	20 km	720 km	500 m	11 200 km
Portion of transport costs	7%	12%	13%	68%
	Cross haulage and cartage	Inland terminal and trunk leg	Port	Ocean transport

Source: Moving South Africa – The Action Agenda Part 4.

From a rail perspective capital should be made available to upgrade the key routes and nodes, which carry the majority of freight volumes to assist densification and to achieve economies of scale. Accelerated investment is required for signaling systems, locomotive and rolling stock. Funds spent here will reduce operating costs and increase performance substantially. The level of funding for the major railway corridors should be economically justifiable i.e. linked to the amount of business generated by that corridor. Savings from operational efficiencies must flow back into the rail business units that generated them and ultimately to customers in order to make their goods more price competitive.

The supporting rail network (branch lines) that provide feeder and distribution services are generally low-density lines. MSA research found that 40% of the rail network only carries 5% of its total tonnage. As lower density lines require lower fixed and variable costs to operate it would be prudent to separate the supporting rail network from the core rail operations since the lower levels of fixed and variable costs could be employed to make the low density lines more competitive with road transport. To achieve this it is envisaged that operating costs of the branch lines could be reduced by between 15% to 20% through separation by means of concessioning or other bid processes.

From the above it can be seen that it is imperative for Rail to enhance its network and densify freight volumes. The corridor between Gauteng and the Bayhead Marshalling Yard, which services the Port of Durban is a critical link to the Gauteng hinterland and according to Spoornet is operating well below capacity.

2.4 SOUTH AFRICA'S MACRO ECONOMIC STATE OF TRANSPORT AND LOGISTICS

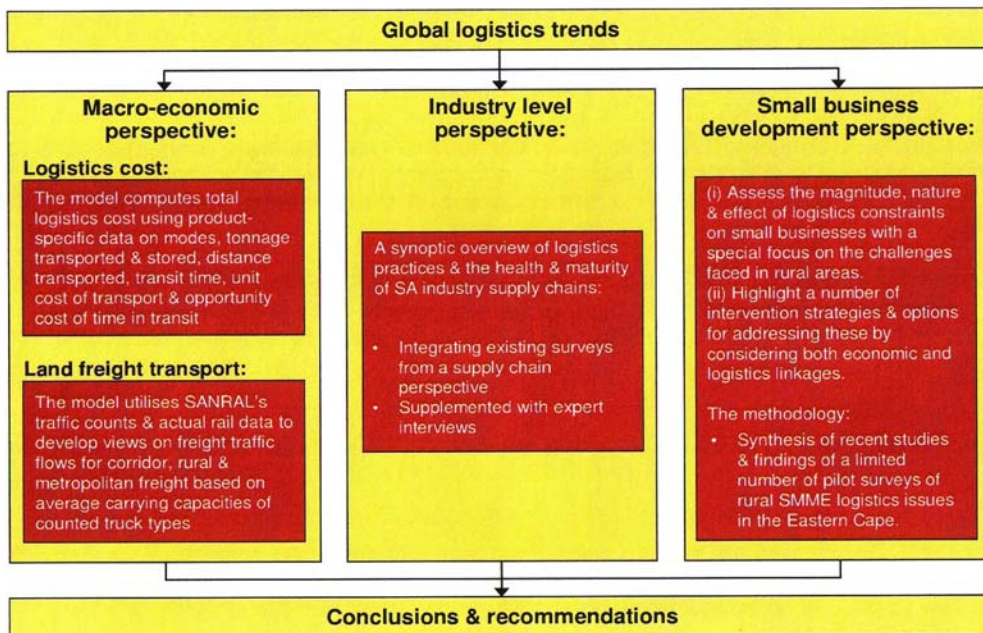
2.4.1 Introduction

The State of Logistics Survey for South Africa (2004) sponsored by the CSIR and Spoornet is the first initiative to provide a detailed annual review of the state of logistics in South Africa. It provides a macro viewpoint (top-down), an industry-level perspective (bottom-up) and a small business development perspective. The information presented below has been summarized from the aforementioned survey.

The inability to measure logistics costs on a regular basis hampers the continuous macro understanding of the state of logistics in South Africa and to gauge the impact of various public and private sector initiatives to reduce South Africa's logistics cost. Logistics cost measurement could be used to support future transportation planning, new investment requirements in rail, roads, ports and other logistics infrastructure and evaluate past performances and prepare for corrective action. The research approach used in this study focuses on the modeling of logistics costs in South Africa, the detailed modeling of transport costs as a sub-segment of logistics and the development of strategic themes to support these two models into the future. This approach is summarized in Table 2.4.

Sections 2.4.2 to 2.4.7 have been summarised from The State of logistics Survey for South Africa (2004).

Table 2.4 RESEARCH APPROACH



Source : The First State of Logistics Survey for South Africa 2004.

2.4.2 Development of a Logistics Cost Model

According to Voortman (2004;13) the distribution cost of products and services from a point of origin to a point of consumption is a very important part of a country's Gross National Product. Logistics cost measurement should therefore support government's decision-making for transport infrastructure investment. The development of a Logistics Cost Model in the absence of other measurement tools is a positive step in assisting government with its transport investment programme.

A Logistics Cost Model was developed by the Department of Logistics at the University of Stellenbosch (2004) and is based on the top-down and bottom-up approaches which will now be discussed in detail.

(a) Disaggregate Approach (Top-down Approach)

The top-down or disaggregate approach separates data in the national accounts into transport and storage costs. The following is a summary of the national accounts information that formed the basis of the logistics cost analysis:

- The cost of logistics and communication are combined in the South African Reserve bank (SARB) publications. The combined Transport, Storage and Communication amount was R111bn in 2003.
- Information from sources within the Bank revealed that transport and storage accounts for 53% (R59bn) of the total cost of the sub-sector and that storage alone amounts to 8% (R5bn) of the transport and storage component.
- Passenger transport operators were also included under transport. A preliminary estimate indicated that the cost of passenger services accounts for 15% of the total transport cost. Therefore goods transport amounts to R41bn.
- According to the SARB transport and storage include only the cost of services provided by external service providers and excludes services that are provided internally by businesses as part of their daily operations. The focus of the disaggregate approach would be to calculate the potential to outsource logistics activities.

(b) Aggregate Approach (Bottom-up Approach)

The aggregate approach or bottom-up approach is based on the computation of the total logistics cost using detailed product-specific data on the quantity of goods transported and stored, the distance travelled, the transit time and unit cost of transport. The outputs from the model of this approach were validated against the “top-down” cost data as published by the SARB and Statistics South Africa as well as from independent sources such as the amount of fuel that was consumed in 2003. Although the survey referred to has logical checks that can be performed with the top-down and bottom-up approaches it did not expand on the correlation of data between these approaches.

2.4.3 Input requirements for the aggregate approach

(a) Throughput

Throughput is the total amount of goods that are transported and stored and is expressed as tonnage or volume. Goods produced not expressed in tons or volume were converted to ton-equivalent e.g. one litre of fuel is equal to 0,8kg. Throughput consists of local production plus imports.

The list of products used in the logistics cost study were in the two primary sector categories viz. mining and agriculture and the secondary sector which includes all

manufactured and processed products. The detailed list of products are those contained in approved lists as classified by the Department of Minerals and Energy, Department of Agriculture (national) and for manufactured as per the Standard Industrial Classification as applied by Statistics South Africa.

(b) Transport Cost

Transport cost is a function of throughput, mode usage, transport distance and the unit cost of transport throughput. The following six modes were identified:

- Road (collection and distribution)
- Road (line haul)
- Rail
- Air
- Water, from point where goods enter or leave the country
- Pipeline

The tonnage carried by each of the identified modes for each product type was determined. The total tonnage transported by all modes combined exceeded the total throughput as the same product could have utilised more than one mode.

The average distance each product is transported by each of the modes was determined from reports and discussions with practitioners. For mining and agriculture fairly detailed information was available. A recent CSIR study (2003) on logistics practices in the fruit industry provided valuable input for that sector. Very little accurate data was available for manufactured and processed goods. A distribution model for the secondary sector is to be developed to enhance accuracy.

The unit cost of transport per mode was ascertained in Rand per ton-km for each mode and product category as costs per unit per product differ substantially. The road freight industry publishes details of the operating cost of different vehicle classes in the Vehicle Cost Schedule (March 2003) which did assist. The costs of other modes of transport were obtained through discussions with the management of those modes e.g SAA for air cargo costs.

(c) Warehousing Cost

Warehousing cost has been described as a function of the duration and volume for storage, unit cost of storage and the handling cost of goods. Storage for freight consolidation purposes and intra-seasonal storage was considered. Freight consolidation occurs where commodities are accumulated at a certain location for onward transportation by transport modes delivering to and collecting from the accumulation point. Some commodities are harvested seasonally and delayed consumption necessitates intra-seasonal storage.

Through the aforementioned survey the unit cost of storage in R/ton/day and was obtained for each individual product line from the various manufacturers and producers. The following types of storage were identified:

- Hardstanding outside (dry products)
- Bulk warehouse (dry products)
- Silo (dry products)
- Shelved warehouse (dry products)
- Cold Storage (dry products)
- Bulk tankyard (liquids)
- Cold storage tanks (liquids)

The storage unit cost included storage and handling costs.

(d) Inventory cost

Inventory cost is a function of the value of products, the amount of goods transported and stored, the time in transit and the time value of money. Primary goods are valued at R290/ton and secondary goods at R671/ton. Secondary goods because of manufacturing or processing have a higher intrinsic value than primary goods. These values were obtained by dividing the total value of goods produced as reflected in the national accounts by the total production.

Time in transit refers to the duration of storage and the transport time. Transport time relates to the amount transported and the speed of travel of each mode. The time

value of money is the average prime lending rate. These elements contribute to the formulation of the inventory cost.

- (e) Management and Administration – the cost for this function was taken as a percentage of the unit cost of transport and warehousing. Information was provided by various companies in the logistics industry.

2.4.4 The Transport Model

The South African National Road Agency's (SANRAL) Comprehensive Traffic Observation (CTO) Yearbooks were utilised to develop and forecast road traffic flows in South Africa. The model differentiates between corridor, rural and metropolitan freight, the various net and average carrying capacities of the types of trucks that are used, compared to weighbridge data to develop measurements for specific periods ie for 1990, 1993, 1997 and 2003. This data is collated and compared to actual Spoornet data for the same period to develop opinions on market shares, corridor densities and investment strategies.

- (a) Calculation of road tonnages

The CTO stations are placed on selected links of the national and primary road network. The number of CTO stations per year is shown below:

Year	Number of stations
1990	344
1993	367
1997	236
2003	622

The calculation of road tonnage from traffic observations was as follows:

- The average daily truck traffic (ADTT) and the percentage split of trucks between short, medium and long trucks (SMLT) were captured per counting station. The total mass of each vehicle was also recorded.
- These percentages were multiplied with the ADTT to obtain actual numbers of SMLT per counting station.
- The total truck mass per SMLT was calculated by multiplying the truck mass with the number of trucks. The tare for SMLT was calculated based on the

average tare per vehicle. The freight weight was calculated by subtracting the tare from the total mass.

- The freight weight represents daily weight per SMLT per counting station. The annual weight is obtained by multiplying by 365.

(b) Calculation of rail tonnages

Spoornet's data was available in calendar years which was only available from 1991 onwards. Cross-border rail data was available after 1991. Rail income was deflated by PPI to obtain trends in real income. Double counting occurred where rail traffic was transported over two corridors e.g. from Durban to Gauteng and Gauteng to Beit Bridge.

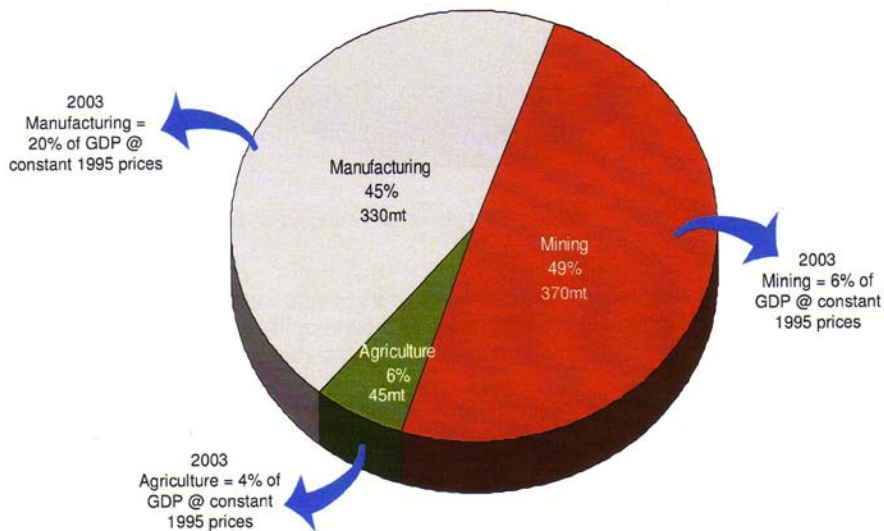
The double counting percentages per the four years analysed ranged as follows:

Income 12, 5% - 14, 6%, Tonnage 5, 5% - 6, 5%, Ton-km 8, 1% - 9, 9%.

2.4.5 Macro Economic Perspective

The production element of South Africa's GDP requires the movement of about 745 million tons, which can be divided between sectors as depicted in Figure 2.1.

Figure 2.1 THROUGHPUT (IMPORTS AND PRODUCTION) (2003)



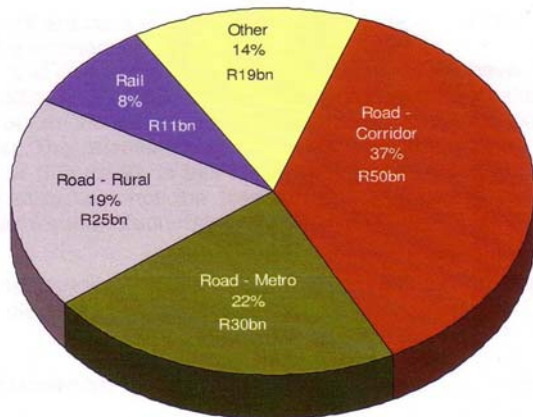
Source : The First State of Logistics Survey for South Africa 2004

The mining sector contributes only 6% of GDP by value but generates nearly half of the logistics requirements by weight (Figure 2.1). This heavy haul traffic is generally rail-bound. South Africa's predominance as a heavy haul exporter e.g coal line and ore-line could provide lessons for the manufacturing sector to emulate in respect of efficiencies, economics of scale and the relatively low ton km rate achieved.

(i) Logistics cost

The cost to the South African economy is R134 billion to transport 745m tons. The biggest portion of this cost is road transport, R111 billion (83%), as indicated in Figure 2.2.

Figure 2.2 COST OF TRANSPORTING PRODUCTION AND IMPORTS



Source : The First State of Logistics Survey for South Africa 2004

According to a report on South Africa's Road Industry 2005, road transport is deemed to be efficient and that the high gross vehicle mass (GVM) of 56t and the overloading of vehicles by between 15% and 20% has the effect of making road transport costs low in comparison to rail transport costs.

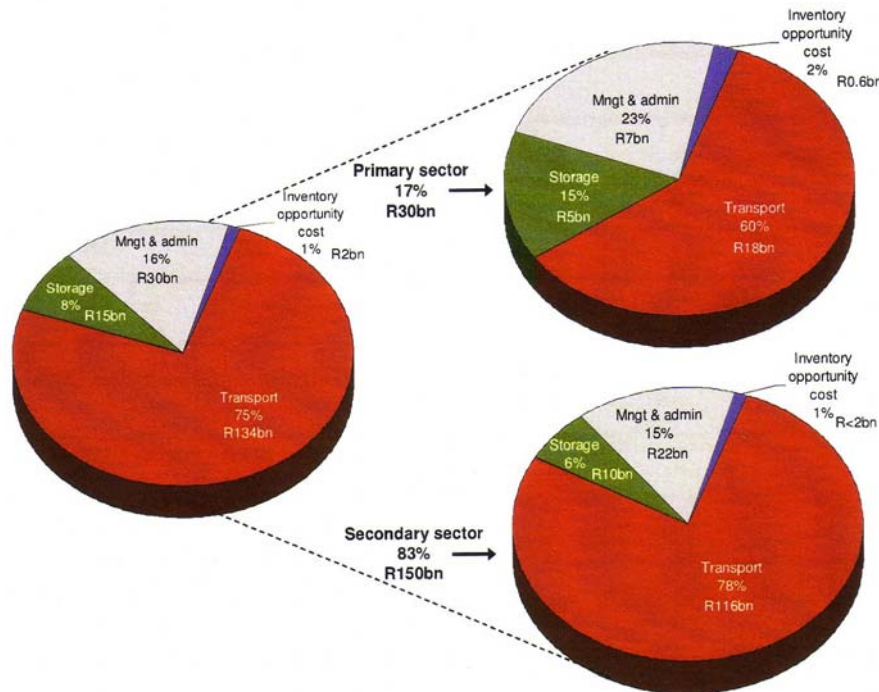
Department of National Transport estimates that overloaded vehicles cause 60% of road damage and that the cost of damage exceeds R600m per year. Cognisance needs to be taken of other external costs e.g. congestion, emergency services and the road accident fund to obtain a more realistic total cost of road freight transport.

An overarching investment strategy by government should consider the hypothesis that road transport costs the economy more than rail transport. Greater efficiency in rail is therefore paramount in an attempt to win back traffic from road transport whilst there also

exists the need for greater efficiency between road and rail i.e. to provide an efficient intermodal solution.

The South African economy consumes another R45 billion in associated logistics costs, amounting to a total logistics cost of R180 billion – 14.7% of GDP (Figure 2.3).

Figure 2.3 LOGISTICS COST IN SOUTH AFRICA



Source : The First State of Logistics Survey for South Africa 2004

Most of the total logistics costs are consumed in the secondary sector. Transport costs amount to 75% of the total logistics costs (Figure 2.3). This figure is high relative to transport costs for the primary sector. Collaboration and integration should lead to lower carrying costs whilst reconfiguration of transportation systems could also contribute to lower transportation costs. The relative transportation costs in the primary sector are lower than in the secondary sector (Figure 2.3).

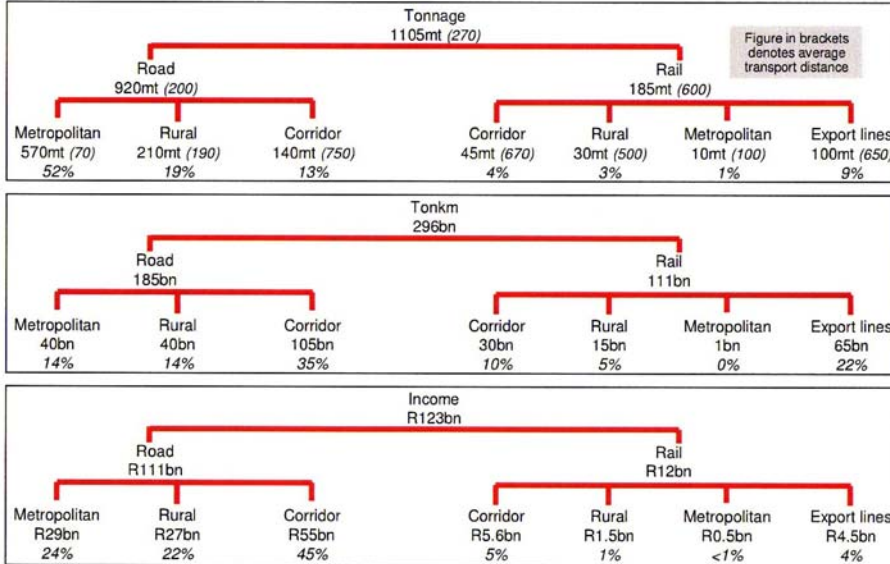
The UNCTAD 2003 Review of Maritime Transport as presented in the report on South Africa's Rail Industry 2005 stated that total freight costs as a proportion of import value of goods for African developing countries was at 12,65% compared to 8,7% for other developing countries. The average costs for sub-Saharan Africa excluding South Africa was 13,84% in 2001 and the highest cost being 20,69% for landlocked countries. High

transport costs reduce the competitiveness of exports from South Africa and Africa. A more clear understanding of transport being 75% of the total costs is discussed below.

(ii) Land freight transport

The tonnages produced and imported which is transported by road and rail transport is shipped an average of 1.4 times as determined by the First State of Logistics Survey (2004). Some goods are shipped more than once, translating into shipments of 1043 million tons i.e. 1, 4 x 745mt. These shipments are considered as movements within certain metropolitan areas, rural areas and corridors. Some goods will be shipped on some combinations of these categories in which freight shipments are observed. These combinations mean that shipped goods are observed 1.06 times per shipment (a double counting of around 6%) in terms of relative position (i.e. metropolitan, rural or corridor). This tonnage amounts to 1043 million tons x 1,06 = 1105 mt. These observations are depicted in Figure 2.4.

Figure 2.4 LAND FREIGHT TRANSPORT IN SOUTH AFRICA (PERCENTAGE DENOTES SHARE OF TOTAL)



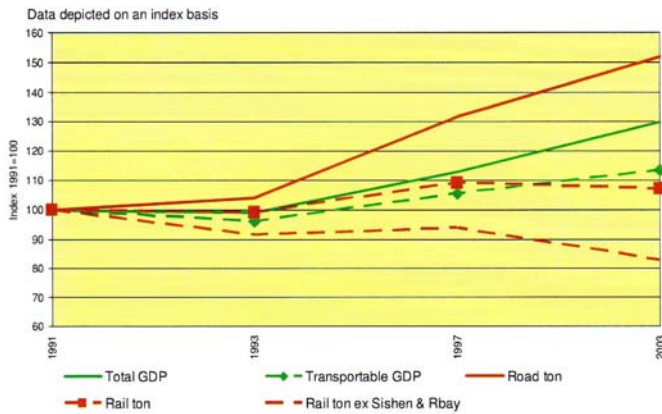
Source : The First State of Logistics Survey for South Africa 2004

The rail export lines are responsible for 9% of shipments by mass. Combined road and rail transport by mass is 53% for metropolitan traffic, rural traffic 22% and corridor traffic 17%, but corridor traffic amounts to 45% of traffic ton kilometres and 50% of costs. It would

appear that this is where structural changes occurred and the most costs could be saved. The nature of these structural changes is depicted in Figure 2.5

Rail freight declined to approximately 83% whilst road freight increased to about 152% during 2003 i.e. relative to the base year 1991. Rail's inability to respond to changing inventory requirements by businesses, lack of co-operation with road transport and poor service delivery are factors responsible for rail's loss of market share.

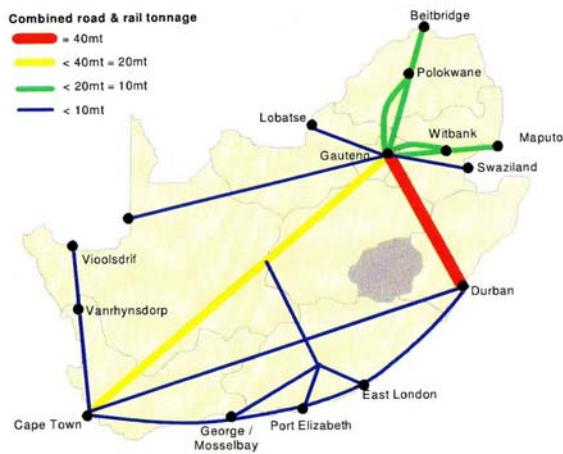
Figure 2.5 STRUCTURAL CHANGES IN FREIGHT TRANSPORTATION



Source : The First State of Logistics Survey for South Africa 2004

This is compounded by the fact that the majority of corridor traffic is concentrated in two corridors – Gauteng-Durban and Gauteng-Cape Town, as depicted in Figure 2.6.

Figure 2.6 FREIGHT FLOWS PER CORRIDOR (TONNAGE 2003)



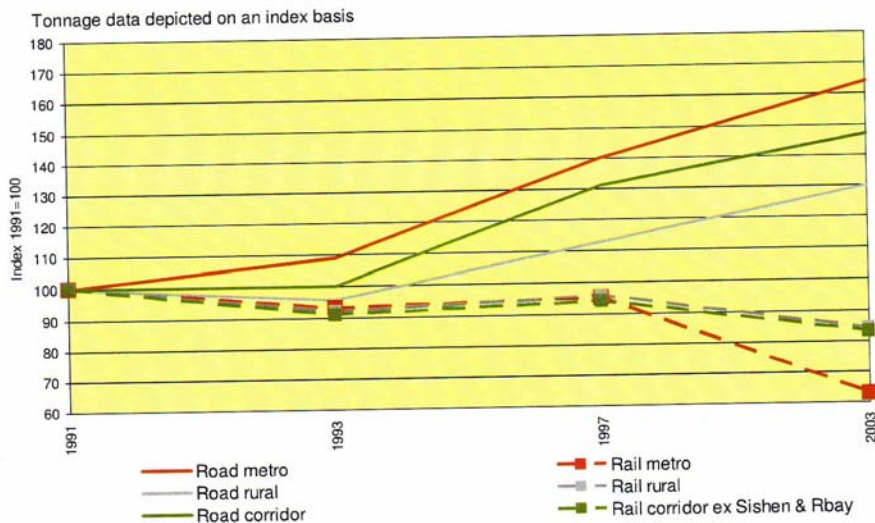
Source : The First State of Logistics Survey for South Africa 2004

If the specialist rail export lines are excluded, the tonnage transported by rail has declined by nearly 20% over the past decade. In contrast, road transport increased by more than 50% over the same period (Fig 2.5).

The growth in road freight transport could be due to freight liberalisation, just-in-time, speed, etc. In order to understand this picture better, freight traffic was analysed according to the three areas mentioned earlier, i.e. corridor, rural and metropolitan.

In each of these traffic types rail's share declined (Figure 2.7). This is especially disconcerting if one takes into account that the compounded annual growth rate (CAGR) for the total GDP was 2% from 1991-2003, the CAGR for the GDP for the transport sector by value (i.e. agriculture, mining, manufacturing and construction) was 0.8%, and the estimated CAGR for tonnage production and imports was 1.5% over the same period.

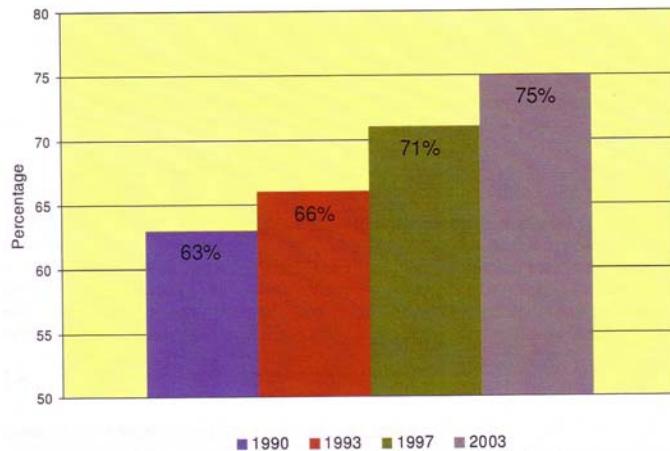
Figure 2.7 ROAD/RAIL TRENDS FOR THE THREE TRAFFIC TYPES



Source : The First State of Logistics Survey for South Africa 2004

The widening gap in corridor traffic, where large tonnages are shipped over long-haul densely populated road corridors is disconcerting. Road's increasing market share is depicted in Figure 2.8.

Figure 2.8 **CORRIDORS: ROAD'S MARKET SHARE**



Source : The First State of Logistics Survey for South Africa 2004

2.4.6 Industry level perspective

The First State of Logistics Survey ascertained that consumer demands are driving the need for faster and more flexible supply chains. Long term planning seems to be lacking within the logistics environment as studies tend to look at immediate and short term trends. The issues presented below are based on desktop research and expert opinions obtained through interviews with South African logisticians.

(i) **A Summary of South African Issues**

The research has indicated that South African Companies:

- Currently focus more on functional than strategic optimization of the supply chain
- Have limited collaboration with other industry players and logistics service providers
- Understand global logistics trends but do not implement such practices
- Do not focus as much on customer satisfaction as in the USA or Europe
- Attribute main causes of supply-chain bottlenecks to inadequate rail capacity and inefficiency, port congestion and customs clearance
- Have insufficient performance management systems to enable logistics integration internally and externally

(ii) **The Maturity Level of South African Companies**

The opinions obtained from the logistic survey indicated that the supply chain management of most companies is not very mature. Some of the different phases S.A Companies are moving through are:

- (a) Controlling logistics costs by driving down costs in the areas of transport, distribution and warehousing
- (b) Controlling overall costs by looking across the internal functions e.g. having flexible manufacturing to meet the needs of the market place whilst logistics is generally outsourced and pressure is placed on a third-party logistics service provider to reduce logistics costs
- (c) Strategic assessment of the entire supply chain and its different role players for long-term joint benefit. This process requires organisations to design, build and run comprehensive supply chain solutions.

General opinion was that most companies are in phase (b) which implies there is huge scope for improvement and that logistic costs could be reduced by 15% to 20%. Companies that are innovating and using fourth-party logistics service providers are seeing a 20% decrease in the base cost of distribution.

(iii) **Agricultural Industry Supply Chain Analysis**

The key challenge for the agricultural industry is to cost effectively distribute a low-value, low-density product that is produced in dispersed locations. The additional challenge is that this industry has to compete in a heavily subsidized global market.

The grain industry proposed the following: the development of a Grain Clearing House that will consolidate all grain movement and management, and that will lead to load consolidation and return loads for both road and rail transport. Wagon utilisation would improve to 3 to 4 times per month. The estimated transport and cost savings is R30 per ton. On 7,3 million tons the saving is R219m per annum. The current modal split between road and rail is 50/50 and with the use of the Clearing House the split could be 80/20 if rail capacity was available. The cost of rail transport is 30% lower than road transport. This example is workable from a purely logistics aspect. One has to ensure that free market principles in the agricultural industry are not compromised.

2.4.7 Conclusions from the Report

This first ever study of the macroeconomic state of South Africa's transport and logistics industry presents a bleak picture. The MSA imperatives of lowering cost, improving, reliability and cost competitiveness are still valid but they have not been achieved as yet.

Some of the core structural problems with transportation issues are highlighted by the following:

- First world countries achieved a reduction in the cost of transportation as a percentage of GDP of $\pm 5\%$ per decade and three times as much in inventory costs
- Logistics costs represent 14,7% or R180bn of GDP in the RSA compared to 8,5% in the USA
- Substantial long-haul tonnage occurs by road transport
- Further densification of Gauteng – Durban corridor in the long-term would lead to severe metropolitan congestion
- Supply chains need to respond to the requirements of different industries

A summary of actions to address current problems are as follows:

- Have a regulator to create an enabling logistics environment
- Continuous measurement of South Africa's macroeconomic state of transport and logistics and benchmark internationally
- Investment in multimodality
- Information sharing and collaboration between freight owners and service providers
- Develop robust supply and demand flow model for South Africa in order to shape competitive supply chain responses.
- Develop targets for logistics cost as a percentage of GDP

2.4.8 Barriers to Intermodal Transport in South Africa

The following points appeared in a report published by Eye for Transport (2005; 11) – Strategic Analysis of Intermodal Transportation on the barriers to intermodalism in the RSA.

- Lack of planning in government and private sector organisations
- Lack of financial resources for infrastructure
- Limited co-operation among modes
- Unequal resource allocation to the modes
- Government and its agencies should think intermodal rather than modal

- The need to develop public-private partnerships
- The need to improve the integration of transportation planning with environmental, energy and other relevant agencies within each country
- Lack of co-operation among countries to facilitate regional intermodalism

The above points concur with the findings presented by various authorities as found under Sections 2.4.7 and 2.6.3.

2.4.9 Impact on the Port of Durban

What has clearly emerged from the aforementioned findings is that the modal split of traffic by rail has declined by nearly 20% over the past decade for general freight whilst road transport increased by more than 50% over the same period refer (Fig. 2.5). This has resulted in creating severe traffic congestion on the main arterial roads that provide access to the Port of Durban i.e. via the Victoria Embankment for access to the Point area of the port and Bayhead Road for access to the Durban Container Terminal. Traffic counts performed by Iliso Consulting in February 2005 on behalf of the eThekweni Metro supported this view. This is further evidenced by the large number of road vehicles that are parked two lanes deep from the entrance of the Container Terminal for over a kilometre back onto Bayhead Road awaiting entry into the terminal. Traffic congestion causes delays for import and export bound freight which in turn could delay the departure of a vessel thus attracting a demurrage charge to the owners of the freight. This together with the efficiency of operations at the terminals have a direct impact on the price competitiveness of goods that are exported.

2.5 A REGIONAL PERSPECTIVE

The International Railway Journal October (2004; 13) reported the findings of a rail transport analyst that the rail services of government and parastatals should be replaced with greater private sector participation in order to enhance the efforts to improve rail infrastructure throughout Southern Africa. The analyst further stated that governments own the railway and road services but find that they do not have the funds needed to maintain the infrastructure. Private investment by a consortium of American and Mozambican companies drastically improved the efficiencies of Mozambique's Nacala port and railway system. The Nacala rail corridor presents the quickest and cheapest outlet to the sea for Malawi and large parts of Zambia. The success of the Nacala venture has led the Mozambican government to concession the Sena railway line to a subsidiary of the Indian Railway's called RITES. This line runs for 600 km from the Port of Beira to major

coalmines at Moatize in the west. A spur line crosses the Zambezi River and links up with the Malawi railway system. The medium growth traffic forecast on this line is initially 3 million tons of high grade coal per annum which will double to 6 million tons per annum within a five year period. RITES (2004) performed an economic analysis and indicated that the direct alternative to rehabilitating the railway is constructing a road to carry an equivalent volume of traffic. It was found that the economic costs of the rail transport yielded a far greater economic internal rate of return (EIRR) when compared to costs associated with road transport which included construction costs, vehicle operating costs and costs of accidents. With a projected EIRR of 20,45% based on a medium growth scenario the railway project was economically viable and conferred greater benefit to the economy. The concession also included upgrading facilities in the Port of Beira to handle the loading and unloading of vessels efficiently.

Other transport networks such as the Benguela railway corridor which links the Democratic Republic of Congo and Western Zambia to Angola's ports are also on a major programme of repair. Spoornet as part of a Nepad initiative has been identified as a leading contender for the contract to rehabilitate and operate this line on behalf of Angola Railways. Other parties are also engaged in upgrading the infrastructure of the ports in Inanda, Namib and Cabinda. This is further evidence that governments do recognize the importance of improving transportation and communication linkages and the ability of these facilities to generate foreign exchange, regional growth and greater economic integration.

2.6 EUROPEAN UNION INTERMODAL FREIGHT TRANSPORT AND QUALITY REVIEW

2.6.1 Introduction

The Eurostat Paper on Transport (2002) considers the development of intermodal transport as an important element of the Common Transport Policy. It states that intermodalism is a characteristic of a transport system that allows different modes to be used in an integrated manner in a door to door transport chain. This integrated approach focuses on the linkages between modes viz. road, inland waterways, rail and air which have in the past been developed independently.

In the 2001 White Paper on a common transport policy it was said that intermodalism is important for developing alternatives to road transport. The paper also indicates that intermodalism is cost efficient when the shipment of cargo involving more than one mode provides the user with choice, time-reliability, a fair price, flexibility and promotes economic development. One of the main objectives of a sustainable development strategy is

achieving a balance between different modes of transport which requires knowledge and understanding of mobility patterns, transport logistics and the impact of transport demand which is based on reliable statistical data. The compilation of statistics is difficult at present due to the mix of transport modes and the various transshipment nodes in the European Union, hence the focus used to be primarily on unitized and combined transport. In future the data will deal with the transport chain concept. A transport chain is a sequence of transport modes used to carry a consignment from its origin to its destination and may entail one or more transshipments along its journey.

2.6.2 Transport Trends

During 1998, 2635 billion tkm of freight was transported in the EU of which 44% was carried by road, 41% by sea (intra-EU) and only 8% by rail. The majority of the transport journeys were short distances and well below the 300-400 km threshold which is the limit under which intermodal transport is not competitive. These transport journeys utilised a combination of sea, road and rail transport.

The average growth rate of freight transport (t km) and GDP was 2,3% and 2,1% respectively from 1985 to 1999. The share of road transport amongst EU member states on average was 73% whilst for rail it was 14%. The share of road transport specifically in Spain, Ireland, Greece and Portugal was over 85%. The total EU container traffic in the maritime ports increased from 21,49 million TEU's in 1992 to 39,7 million in 1998. The three biggest ports of Rotterdam, Hamburg and Antwerp handled 53% of the total container traffic of the EU ports in 1999.

The aforementioned brief analysis appears to illustrate a relatively global trend in which rail transport tends to be losing significant modal share more especially in the developed economies.

2.6.3 Trends in Intermodalism

The quality of inter-modal transport was determined by means of a four-year project (1996 – 1999) listed within the IVth Framework Programme of the European Commission: Integrated Transport Chains. 42 Terminals and 196 suppliers and forwarders were interviewed to evaluate the present performance of inter-modal transport and to identify the main trends and measures. The project objective was to supply the necessary tools for enhancing European intermodal transport by improving :-

- inter-operability among terminals
- inter-connectivity and accessibility

Quality is considered as a key factor of competition and that non-quality appears as a source of cost in operating intermodal transport, which cannot be accepted by users and operators. In analyzing the transport chain quality as perceived by the final users, seven quality indicators were identified :-

- Time – total time between the moment that an Intermodal Transport Unit e.g. container is ready for transport and the delivery
- Reliability – absence of unforeseen deviation in performance
- Flexibility – ease of adjusting to an unexpected change in user requirements
- Qualifications – capacity to cope with complex user requirements
- Accessibility – ease of using the intermodal transport system
- Control – ability to obtain information on the status of the cargo
- Security – risk of loss or damage

The survey focused on the following areas:-

- Application of new technologies, e.g. information technology (hardware and software) on terminal performance
- Economic regulation of terminal operations with respect to tariffs, tariff structures, costs and infrastructure costs
- Order of magnitude of costs for terminal operations, rail traction and road haulage
- Identifying bottlenecks in the transportation chain
- Ascertain quality of terminal operations and the quality of road and rail modes of transport to develop a baseline quality framework
- Flow analysis of high and low density corridors

Some of the most important findings were:-

- that terminal performance is closely linked to organizational, infrastructural and management aspects
- that information technology can improve service
- that terminal performance depends more on the quality of interaction between road and rail operations than upon the terminal operations themselves

- that the technical characteristics of infrastructure and of the equipment must not be dissociated from the road and rail organization; so far intermodal transport development concentrated solely upon terminal operations
- that costs for the transport chain average were as follows : 7% for terminal operations, rail haulage 50% and road haulage 40% of the global costs
- that performances, competitiveness and profitability are closely linked to the types of train circulation, traffic volumes and quality requirements. For train operations the basic principle is consolidation i.e. to run block trains, or shuttle trains which operate at a lower unit cost, are more reliable, reduces shunting operations and transit times
- that the intermodal terminal infrastructure planning be subordinated to the development of train operating systems
- that the European rail network be harmonised with respect to gauge, signaling and electrification
- that at many terminals the greatest inefficiency was registered at the terminals rail access interface

2.7 THE EFFICIENCY OF MARSHALLING YARD LAYOUTS

Bebuschewitz and Peters (1989; 19) state that competition between road and rail will become stronger as a result of deregulation of the freight transport market and to ensure that rail obtains as large a share possible in traffic volumes, the railway system needs to be cost effective to supply services of a quality that will attract customers. They further state that marshalling yards form an essential part of the railway's production apparatus and ideally modern methods of shunting and control equipment are required in the automation of marshalling yards in order to make them highly efficient.

According to Daganzo C.F. (1987; 29) the layout of a rail yard and the number of tracks is based on the destinations that are required to be serviced and the frequency for each class of traffic. A rail yard typically serves many destinations with a schedule of departing and arriving trains. To achieve this, incoming trains must be broken up into wagons, which are then sorted to go to the next shunting yard or final destination and stored on separate tracks. Departing trains are formed by gathering the appropriate wagons from the appropriate tracks and transferring them onto a designated track for a particular destination.

Kraft (2002; 51) has asserted that railroads are an efficient means of moving products because they consolidate many shipments into a single trainload. However, the process of consolidation which occurs in the rail yard is enormously time consuming and expensive

hence the purpose of the rail yard to build trains or to break them down. A train consists of a group of wagons that are bound for a common direction and destination. By constructing yards at intermediate points, railroads can run trains built of many different blocks between these yards, thus maximizing their line-haul advantage.

There are two basic types of yards; flat yards and hump yards. A flat yard consists of a set of parallel tracks interconnected by switches in a ladder arrangement. Switches at each end facilitate access through the ladder arrangement of the tracks. Flat yards are simple to design, inexpensive to build and operate, labour intensive and versatile. They are however limited by their inability to classify a large number of wagons efficiently nor do they have the capacity to serve a large number of destinations. To sort large numbers of wagons efficiently gave rise to the hump yard where the tracks were raised to form a crest with the crest being higher than the rest of the yard. Individual wagons are given a push over the crest or hump by a yard locomotive which causes the wagon to accelerate purely by gravity into a designated track. Hump yards are subdivided into three distinct areas with specific functions: the receiving yard, the hump and classification tracks and the departure yard. In the receiving yard inbound traffic arrives and the locomotives detached. The wagons are inspected for mechanical defects and the brakes released to allow them to roll freely. The yard locomotive then moves the wagons to the classification yard where each wagon is classified according to destination and each destination allocated a track. The wagons are then shoved over the hump where gravity is used to roll them onto the predetermined track, hence wagons bound for the same destination are grouped on the same track. From the classification yard the wagons are then pulled over into the departure yard where they are coupled onto locomotives, the brakes tested and the train finally inspected before it departs. Hump yards would therefore appear to be more efficient than flat yards when it comes to wagon-by-wagon sorting to serve a large number of destinations.

Shunting yards also provide a variety of other support functions. They provide space to store empty wagons and hold loads awaiting final delivery to a customer's siding. Entire trains can be stored out of the way should there be a shortage of crews, motive power or other forms of delay. Trains that have block loads i.e. a consignment that is destined for a single customer can bypass the primary functions of the yard viz. reception and classification and could proceed to an adjacent area for inspection and mechanical servicing before departing again.

Intermodal yards are similar to flat yards described above but are located in the central city or adjacent to major highways. This type of yard like Kaserne in Johannesburg is used primarily for transfer purposes to and from rail to other modes of transport. This type of

specialized yard costs less to operate than classification yards because the need to sort individual wagons and to make connections is greatly reduced.

2.8 COMPONENTS OF RAIL INFRASTRUCTURE

A brief review of the components that make up rail infrastructure in the marshalling yard environment is given below in order to create a better understanding of the inter-relationship between the fixed assets and the operations of the facility that is very often referred to.

The Permanent Way Instruction Manual (South African Transport Services 1991) stipulates the following elements as being key components of the railway infrastructure. Explanations for these components, as contained in the Introduction to Multi-Disciplinary concepts in Railway Engineering (1999) University of Pretoria are also provided.

- (a) Formation: this relates to the earthworks component upon which the railway track is constructed. A geotechnical investigation is conducted to determine suitability of ground conditions, the stability of cutting and embankments and groundwater conditions. The properties of the existing materials are ascertained to determine suitability for construction. The design of the formation takes into account the types of materials to be used and the management of stormwater. Good drainage is required to ensure the stability of the formation. Poor control of stormwater in most instances leads to the degradation of the formation. The various layers of material in the formation are well compacted to overcome shear resistance from the vertically applied loads. The formation is part of the substructure.
- (b) Ballast: this is crushed quarry stone approximately 75mm in size, which is packed onto the formation and upon which the sleepers are placed. This also forms part of the substructure. Ballast provides resiliency and energy absorption for the track and helps with the drainage of water falling onto the track.
- (c) Sleepers are generally made of concrete and are utilised to fasten the steel rails onto them and assist in holding the track true to gauge. The sleeper forms part of the superstructure and is the interface with the substructure described above.
- (d) Rails are steel rolled sections that have a crown on the top end upon which the steel wheels run, a web and a flat bottom end. They normally come in 18m lengths and are continuously welded together to form a continuous length. The track, which has two rails fastened onto the sleepers, has a vertical and horizontal alignment. Horizontally the track can have straight or tangent sections, transition and horizontal curves and vertically it has vertical circular curves. The basic requirement of a track

structure is to sustain the applied forces in size and quantity for a reasonable time without excessive maintenance. Fasteners are used to retain the rails against the sleepers to resist vertical, lateral and longitudinal movements of the rail.

- (e) Overhead traction equipment relates to a series of steel masts (6m high) that are connected by a horizontal steel beam. The beam has connections to fasten the various power supply cables and wires that run parallel to the rail lines but are positioned about 5m above the rail lines. The electrification in the Durban area is 3kV direct current (DC). From the substations, electrical supplies are taken to overhead line equipment by means of feeders. The current is collected from the overhead line by the train's pantograph and taken to the motors in the locomotive. Electrification is justifiable where traffic is heavy or frequent.

2.9 PLANNING AND MANAGEMENT OF PORT DEVELOPMENT

The United Nations Conference on Trade and Development (UNCTAD) have published a handbook on Port Development (1985) for international port development based on best practices that are economically and technically sound. In formulating a national ports plan they have stipulated that the following factors be considered:

- that a coordinated plan for a transportation system be developed to include shipping, port and inland transport facilities in order to optimize the capacities of the various ports. This is particularly relevant in developing countries where freight traffic is rapidly growing and changing.
- that within the ports sector a plan is needed for the handling of each type of commodity. The number of ports, their area of specialization and location have to be considered as part of their contribution to the country's trade and should be included as part of a national plan.
- national planning will assist to implement, monitor and optimize investment strategies for ports which can only afford to install low volume equipment. Where national resources are limited the trend should be to develop specialized high-throughput terminals e.g. Iron-Ore Terminal at the Port of Saldanha and the Richards Bay Coal Terminal at the Port of Richards Bay irrespective of geographical considerations. Economies of scale are obtained through the use of large bulk carriers at these specialized terminals, which in turn translate into lower unit handling and transportation costs for the annual throughputs, which are measured in millions of tons.

- that a National Ports Authority (NPA) which in most instances is a specialist government agency be established to articulate expenditure for port infrastructure, set financial objectives e.g. return on investment, set-up a tariff structure, collect, collate, analyse and disseminate statistical information on port activities for public and business use and concessioning of terminals for use by other parties. The NPA is precluded from operating any of the terminals for the handling of cargo. It purely performs a landlord function. The NPA should consult with port users and terminal operators when setting and reviewing tariffs.
- that continuous improvement initiatives be implemented independent of any medium and long-term investment plans. There is always a need for technical and operational improvements e.g. expansion for storage space and additional cargo handling equipment
- that the identification and removal of bottlenecks, which impede the productive flow of goods, be studied by methods indicated by UNCTAD on berth throughputs. Current throughputs and efficiencies and estimates of future productivities have a major impact on how much of additional infrastructure is required.
- that in the preparation of a National Ports Plan the following factors should be reviewed:
 - i) Industrial sector plans : Surveys of specialized traffic from refineries, other processing plants, mines, agriculture and other stockholding points provide valuable inputs for bulk commodities.
 - ii) Estimated national demands : Estimated national general cargo demands arising out of consumption, general manufacturing and international transit traffic
 - iii) Existing ports : A survey of the traditional hinterland, local cargo demand, specialized traffic and existing cargo handling facilities is essential to address capacity issues.
 - iv) Transport capacities : Road, rail, inland waterway and air route capacities taking into account demands between ports and other origins need to be established. Associated with the above is the need to determine fleet capacities for road vehicles, coastal shipping, rail rolling stock and inland waterway vessels.

The aforementioned very simplistically summarizes the main activities to forecast national demand for maritime traffic transport, the capacity of each port and the national means of

transport available for maritime traffic. A number of related plans conceived at a broad strategic level will emanate from this exercise viz.

- a) A maritime traffic assignment plan
- b) A national port investment plan
- c) An inland routing plan
- d) A coastal shipping plan

The planning of detailed facilities occurs for specific port development projects. The main duties of port planning can be identified as follows:

- a) National port planning : policy decisions define the role of each port and ensure that national resources are used in the most economical manner
- b) Port master planning: this provides the long-term pattern of development for a port without specifying the time at which any one step in this development will take place
- c) Port project planning: this aims to turn each part of the master plan into reality at the right time and in the right form.

The layout and provision of port-related infrastructure which includes the provision of quay walls, adequate depth for large vessels to use berthing facilities, cargo-handling equipment, road and rail storage facilities have a major impact on the efficiency of the intermodal facility.

2.10 COMPONENTS OF PORT-RELATED INFRASTRUCTURE

- i) Quay walls are massive marine structures that separate the water and landside infrastructure by acting as a large earth retaining structure. Its base is generally founded under water at depths of -16m to -22m below mean sea level. Most quay wall construction, at least from the 1970's, utilize concrete caissons, which are large tubs approximately 18m x 18m x 20m deep in size. In greenfield sites these quay walls can be constructed in the dry and the basin is then flooded, whilst in existing ports the caissons are cast elsewhere and then floated into position on prepared foundations underwater. The caissons are then pumped with dredged material to keep them in position. The top of the quay wall has a massive concrete capping with anchor points and fenders. The quays are generally several hundred metres in length with the berths at an average of 300 metres in length. Hence a quay wall that is 1000m in length can accommodate 3 No. large sized vessels.

- ii) Stacking space – the area behind and along the quay wall has a width of at least 250m. The area is generally paved in concrete which is typically 350mm to 500mm thick depending on the type of cargo that is handled at that berth. The stacking area is where the transfer of cargo occurs and accommodates cargo handling equipment which load and off-load vessels, roadways and rail terminals. Where railway lines are close to the berth, railway trucks could be loaded or unloaded directly. The most recent trend is to provide rail terminals which are situated towards the rear of the stacking area i.e. +- 200m away from the quay wall. Forklifts and tractor and trailers then convey the cargo to be loaded or unloaded from road or rail trucks. This is the case for general cargo. In the case of containers, quay side container cranes load and unload containers onto ships from tractors with trailers or straddle carriers that pick up or drop off containers at the quayside. The stacking areas have demarcated zones to receive consignments of goods that have to be loaded or unloaded from vessels. All cargo movements occur 90 degrees to the berth in order to traverse the shortest distance possible from the end of a stack to the quayside.

2.11 PRODUCTIVITY AND OPERATIONAL PLANNING : PORT TERMINAL

2.11.1 Introduction

UNCTAD's manual on Port Development (1985) states that estimating cargo handling is a vital part of planning future port development or current terminal upgrades. Planners often utilise recorded data or performance figures taken from different countries. Great caution is needed before adopting such performance figures because climatic conditions, labour intensive working methods and the degree of mechanization have an impact on productivity levels. Difficult climatic conditions e.g. tropical climate with high humidity levels effect labour intensive operations, equipment performance and reliability.

2.11.2 Rated and Effective Productivity

UNCTAD states that there are three basic elements in cargo handling performance. The first is the rated productivity, defined as the number of tons each gang, crane, shiploader, pump etc. handles when it works for one hour without interruption. The second element is the interruptions which tend to happen and the consequent idle time that reduces output. The average hourly performance as a result of idle time is termed as effective productivity. The third element is the manner in which gangs and handling equipment are used e.g. how many are used per hatch and per ship, number of shifts and overtime

worked. The total effort is determined and combined with the effective productivity to produce long-term performance.

A planner has a major task to make realistic assessments of effective productivity from local and foreign operations together with information supplied by manufacturers of cargo handling equipment which tend to be optimistic. Container terminal operators for example quote productivities of 700 TEU's per day but UNCTAD's analysis of 21 major container terminals showed that only one was able to maintain a productivity of 749 TEU's per day over several months. The great majority of terminals working with two container gantry cranes generally achieved productivity within the range of 300-500 TEU's per day.

Productivity targets should take into account industry averages whilst due cognisance must be taken to allow for real increases in productivity, which could be achieved through continuous improvement programmes. Productivity improvements arise out of a combination of enhancing labour and operating skills development, technical improvements and purchasing additional equipment for the horizontal movement of cargo and by setting targets for operating staff which are higher than those determined by planners.

2.11.3 Interface Operations and Operational Planning

The most important links at the port terminal interface are between ship-cargo handling systems and storage and onward transport by road, rail or a feeder service by water and between the cargo handling systems loading and unloading directly to and from road and rail trucks that are found next to the quayside. The various links are described by UNCTAD as berth throughputs. Sufficient capacity must be made available to store cargo (covered and open storage) that is discharged from a vessel in a manner that prevents congestion from arising whilst also allowing an adequate time frame for its onward transportation. Such capacity provision to dispatch or receive cargo from transit storage areas must be able to match the flow of cargo from the quayside. Storage capacity is very time-sensitive as the duration of storage is dependent on time required for custom clearance formalities and the timeous dispatch or receipt of these goods in the transit areas. Normal rates must be applied for storage for agreed timeframes e.g. 2 days and abnormal levies applied for periods greater than that allowed for in order to discourage clients from using the port as a storage medium.

The methods of operation proposed at the interface must have a balanced throughput capability i.e. the various sub-systems must function together because the effectiveness

of one affects the operations of the others. The two major capital costs in many terminals would be berthing points i.e. the quay walls with the associated cargo handling equipment on the one hand and extent of storage areas on the other. The design of the capacity of discharge, loading, transfer to and from storage points and the clearance of goods from storage areas has a material effect on the cost of goods especially those destined for export.

Operation planning is a key activity when reviewing layout, equipment, methods of operation of cargo handling areas, productivity levels and the costs of operations. UNCTAD provides planning charts for the handling of different classes of cargo and their relevant productivity throughputs. These are average throughputs volumes that have been obtained through conducting analyses of various types of terminal operations. These throughputs have to be tested against the traffic demand of operations by considering ship call frequency, consignment size, storage characteristics, loading and discharge rates, inspections, tallying, sorting and the mode of transport for each movement in the port area and for its onward transportation.

2.12 CONCLUSION

A major theme that has emerged from the literature review is that the integration and efficiency of a transport chain is the key to attaining comparative advantage against other supply chain systems. The components of the transport chain within the South African context exist as individual entities that tend to function in isolation and are predominantly driven by single modal applications. What is lacking is co-operation between the different modes of transport, a centralized agency possibly a public - private partnership organisation responsible for intermodalism in South Africa and unequal resource allocation for the different modes, which results in rail undertaking very limited infrastructure development. The developed economies of Europe, the U.K. and the USA utilise integrated multimodal solutions which results in major benefits in service improvement and cost reductions for all members in the supply chain.

It is also clearly evident that there exists a strong inter-relationship between the provision of infrastructure and capacity based on the premise that high levels of productivity are achieved. Planners have a major task to make realistic assessments of productivity based on local and foreign operations together with information supplied by manufacturers of cargo handling equipment. The planning and management of the port/rail interface should be a sub-set of a National Plan that optimises investment strategies for the different ports and classes of maritime traffic together with an integrated

plan for a transportation system that includes shipping, port and inland transport facilities. The provision of an inland transportation system for road and rail from the port to the hinterland depends largely on the planned port throughput information, the total tonnage capacities of the various terminals, long-term forecasts and forecasts on the modal split between road and rail. The efficiency of a port is as good as its inland transportation system.

Chapter 3 which follows presents a review on operations of the port/rail interface and the associated infrastructure associated with these operations, the Bayhead Marshalling Yard, Spornet's Operations and some of the constraints affecting the efficiency of rail operations and Transnet's response in enhancing the efficiency of the port/rail interface.

CHAPTER 3

THE PORT/RAIL INTERFACE

3.1 INTRODUCTION

The purpose of this chapter is to review the operations of the port/rail interface in the Port of Durban, the Bayhead Marshalling Yard (BMY) and the associated infrastructure concerned with these operations. The BMY is the nerve centre of operations to the Port of Durban and the satellite yards that are linked to it e.g the Kings Rest Yard, which predominantly serves the Container Terminal. The rail freight industry in South Africa falls under Spoornet. In a review of Spoornet by Creamer Media (South Africa's Rail Industry 2005) the nature of Spoornet's business and operations and the impact it has on the economy of the country and the price competitiveness of export commodities is discussed. The review also articulates the major initiatives that have been implemented by Transnet in order to address the operational constraints that affect efficient service delivery. In order to obtain an understanding of the interface issues that needs to be addressed the interaction between the working of the terminals in the port will be discussed. The current layout of the Port of Durban and terminal usage is depicted in Appendix 1. The existing rail network that serves the Port of Durban is depicted in Appendix 2.

3.2 SPOORNET : RAIL FREIGHT SERVICE PROVIDER

3.2.1 Introduction

The report on South Africa's Rail Industry (2005) prepared by Creamer Media, provided comprehensive information on Spoornet and its operations which is presented below. Sections 3.2.1 to 3.2.5 have been summarised from the aforementioned report.

Spoornet had its origins through the formation of South African Railway and Harbours (SAR&H) in 1910. In 1981 SAR&H was restructured into South African Transport Services (SATS) which became a multimodal organisation including railway, harbour, road, aviation and pipeline services. In 1990 SATS became Transnet, a corporation with the State as sole shareholder.

Spoornet is the largest rail company in Africa and maintains an extensive rail network in South Africa and connects with networks of other African countries. In the year ended March 2002 it transported about 180 million tons of freight and achieved a turnover of R10,56 billion. At this stage Spoornet had 88 000 freight wagons, 2 410 locomotives,

30 400 kilometres of track and employed 34 344 people. In 2003 a profit of R400m was achieved on a turnover of R11,8bn. In 2003 the capacity demanded for general freight transport was 97 million tons but only 82 million tons was available. The company has since experienced financial and operational difficulties due to the appreciation of the Rand and loss of market share to road hauliers. In 2004 Spoornet made a R668m loss on a turnover of R13,4 billion.

Spoornet's rolling stock is on average 27 years old. Spoornet intends upgrading the fleet over a period of 15 years which will involve capital expenditure of R42bn at a rate of between R2bn and R3bn a year and will seek public-private partnerships to raise funding to implement its renewal programme. R14bn in capital-expenditure projects over the next five years has been finalised to rehabilitate infrastructure, locomotives and wagons. The 15 year upgrade will take Spoornet's general freight capacity to 110 million tons.

3.2.2 Restructuring

Spoornet is in the process of restructuring to evolve into a business capable of delivering efficient logistics solutions and attracting foreign investment into South Africa. UK consultant N M Rothschild was commissioned by the government in 2001 to guide the restructuring process. Rothschild recommended that the bulk-export lines Coallink (operating between Ermelo and the Coal Terminal at Richards Bay) and Orex (operating between Sishen and the Port of Saldanha) be concessioned to the private sector in order to create a greater focus for the General Freight Business's (GFB) turnaround strategy. Orex and CoalLink operate as two dedicated corridors with their own infrastructure and rolling stock. The corridor concept could be extended to the City Deep – Durban line that transports much of South Africa's value-added exports and imports. Other corridors could include the Phalaborwa – Richards Bay and Rustenburg – Richards Bay lines, the link between Johannesburg and Cape Town and the Hotazel – Port Elizabeth lines.

Spoornet management and labour resisted this recommendation due to the fact that the GFB could make massive losses each year and this would undermine the objective of creating an efficient logistics channel on the GFB routes.

A fixed-train plan is to be rolled out to make the general freight lines more efficient. The fixed-train plan will have three cargo categories. Category A will include predictable, long distance and rail friendly cargo such as coal, iron ore and manganese. Category B traffic will entail customers booking capacity in advance. Business of this category is normally erratic and costly. Category C traffic will include ad-hoc, non rail-friendly and time-sensitive

cargo.

A restructuring proposal was also agreed to by Spoornet Management, Dept. of Transport, Dept. of Public Enterprises, and the trade unions which entails the retrenchment of a maximum of 8 000 staff between 2003 and 2006. Orex and CoalLink are to be reintegrated back into the Spoornet structures, whilst the leasing of branch lines which are non-productive to private companies, is being considered.

3.2.3 Operations

In 2004 the General Freight Business (GFB) transported 83 million tons of general cargo, CoalLink transported 66 million tons of coal and Orex 27 million tons of iron ore. Much of the general freight transported originates from specific industries such as the paper and timber industry, automotive, grain, milling and stock feed, fast moving consumer goods sector and the non-ferrous metals industry.

Many of the customers in these industries require customised wagons e.g. paper, cement, liquids, automotive, grain and refrigeration for temperature sensitive cargo. Double-decker wagons are used to transport 8 motor cars per wagon at a time whilst containers are used widely for textiles, clothing, footwear, pharmaceuticals, furniture, machinery, plant and industrial equipment. Other sectors that are served by rail include cement and lime, foods and beverages, base metal concentrates, steel, petroleum and chemicals.

Transportation of general freight has not been profitable. Although general freight accounts for almost 50% of the total freight tonnage it is the biggest loss maker – R469m loss in 2002. The deregulation of the road freight industry in 1988, which allowed for a gross vehicle mass (GVM) of 56t (amongst the highest in the world) compared to 28t prior to deregulation combined with illegal overloading has made road transport costs low in comparison to rail transport costs and consequently have significantly eroded rail's market share in the general freight industry. Road has an additional competitive advantage in that road freight companies do not carry direct cost responsibilities for highway maintenance and construction whilst Spoornet is responsible for the development and maintenance of its infrastructure it uses for its operations. The current state of affairs is that the country's vast rail infrastructure is underutilised whilst the road system is deteriorating rapidly because of additional volumes and the weight of heavy vehicle traffic. The dedicated ore and coal lines are very profitable and are one of the country's largest earners of foreign exchange, contributing about 2% to the RSA's GDP. Mining continues to favour rail transport and has been involved in long-term relationships with Spoornet.

Cremer Media's review of the South Africa's Rail Industry 2005 intimates that Spoornet is attempting to provide a service to almost any business in South Africa and in doing so is failing to deliver on its promise of efficient cost and expedient delivery. Spoornet should target customers who can offer block loads at frequent intervals and enter into long term relationships with such businesses. Spoornet has identified its top 50 general freight customers which account for between 80% and 90% of its turnover with a view to meeting the needs of these companies. Spoornet's smaller and ad hoc customers should be encouraged to utilise road transport by adding a substantial premium to the rates for such consignments.

3.2.4 Current Capital Projects

Spoornet's underinvestment for a long period and aging fleet close on to 30 years is the main cause of its capacity problems. Wagons generally do not suit the changing needs of customers and locomotives are old and unreliable. The 15 year venture to upgrade locomotives and wagons and to procure brand new equipment entails capital expenditure of some R42 billion. This programme will reduce the average age of the Spoornet fleet from about 27 years at present to 15 years by 2018. Overall capacity is to be raised from 180 million tons to 234 million tons per annum within five years.

The upgrade programme is already underway to refurbish and recommission 200 locomotives, which were mothballed, at a cost of R1 billion. These locomotives would be utilised for the general freight business. This process will increase the operating life of a locomotive by 15 years and traction capacity by 20% at a cost of between R6m and R10m per unit compared to the R30m to R40m required to purchase a new locomotive. 31 locomotives will be upgraded at a cost of R300 million for the iron-ore line and 45 locomotives, which operate on the coal line, will be upgraded at a total cost of R450 million. An amount of between R450m to R600m a year over six years has been set aside to upgrade wagons i.e. to increase their capacity in line with the needs of clients in order to sustain traffic flows that are profitable.

Infrastructure capacity constraints are being addressed by expediting maintenance of its track and to free-up capacity for operations by utilising high-capacity track maintenance machines. These machines will reduce occupation times dramatically especially on high density tracks.

Line upgrades are currently under way for the coal line and ore line. Capacity will be increased from 72 million tons to 82 million tons on the coal line over the next five years at a cost of some R1,8bn. The income to Spoornet of the additional traffic exported on this line will be R3 billion per year.

Transnet plans to invest R21,0 billion to increase the capacity of other rail lines, with the aim to increase annual growth of tonnages to between 4% and 6%. R11 billion has been earmarked for the Gauteng-Durban corridor which handles 67% of the country's container traffic. About R1,19bn on the Gauteng-Maputo corridor, R4,79bn for the Gauteng to Port Elizabeth and East London corridor and R2,14bn on the Gauteng to Cape Town route. R1,83bn has been allocated to the Sishen-Saldanha corridor in order to increase capacity from 29 million tons (2004) to 38m tons by 2007.

3.2.5 Operations in Africa

Spoornet is involved in developing rail infrastructure and operations in Africa with the intention of establishing sustainable rail corridors in line with the objectives of the New Partnership for Africa's Development (NEPAD). Spoornet is able to do this because an uninterrupted rail network of single gauge (1067mm) connects SADC countries all the way through to Malawi.

Spoornet runs container trains from Johannesburg to the transshipment facility in Kidatu in Tanzania. At this transshipment facility the rail gauge changes from 1067mm to 1000mm and runs to the north to Tanzania, Uganda and Kenya. In Ghana, Spoornet is a supplier of rolling stock and pursuing rail concessions for the western railway line which services bauxite and manganese producers.

Spoornet in a joint venture with New Limpopo Project Investments has been awarded a concession to run Zambia Railways over a 20 year period. The consortium will invest about \$80m in upgrading 510km of track and other assets owned by Zambia Railways. The same consortium has also been awarded a \$67,7m, 15 year concession to operate rail links in Mozambique. The Ressano Garcia rail link between Komatipoort in South Africa and the Port of Maputo will provide a seamless rail route from Gauteng and Mpumalanga to the Port of Maputo. Traffic will increase from 3 million tons to more than 6,8 million tons annually in 15 years time. There is also the prospect of transporting 4 million tons of magnetite per year over a 25 year period from Phalaborwa to Maputo for a proposed iron and steel plant in Maputo.

3.2.6 Concluding Comments

The aforementioned overview provides some depth of exposure of Spoornet's role in rail freight transport in South Africa and to some parts of Africa. Transnet, the parent company of Spoornet, is responding to government's call to reduce the transport and logistics cost in South Africa. This is evidenced by the massive capital expenditure of R40,0 billion for the next five years that has been committed to upgrade infrastructure and operations of the major rail corridors and the port/rail interface in the Port of Durban.

3.3 PROVISION OF A PREDICTABLE RAIL SERVICE

Spoornet embarked on a major restructuring exercise in 1996 based on centralizing its service and providing a predictable service. According to Spoornet's Predictable Service Manual (1996) the rollout focused on the needs of the Client and the objectives Spoornet wanted to achieve.

(i) What it means for the Client

- Be on time every time
- Be reliable and consistent all the time
- Take care of consignment
- Provide trucks which are clean and in good condition
- Be able to track the consignment through its journey

(ii) What it means for Spoornet

- We will meet our Client's expectations
- We will keep current Clients and attract new Clients
- We will use our current resources more effectively
- We will become more efficient and provide transport at a lower cost than our competitors
- We will only promise what we can deliver
- We will compete against the current and future demands of the market place

Spoornet recognized that it was largely reliant on export traffic (export of coal through Richards Bay and iron ore through Saldanha) due to the large volumes moved whilst income in the general traffic markets was low and targeted this as a growth area. Spoornet also recognized road transport as a major competitor and cited the following as reasons for the increase in road competition:

- Free access for all
- Road loads the highest in the world
- Road very competitive and reliable
- Road is accessible to any customer

The other major tenets of the Predictable Service Plan expressed very simplistically were:

- (i) Plan the Work – i.e. to plan the whole lifecycle of the journey from delivering empty trucks to the Client, collecting loaded trucks, delivering loaded trucks to their destination and then collecting the empty trucks from its destination.
- (ii) Work the Plan – the Client Service Centre is to communicate the Plan to the Yard and when the task is completed in the Yard it will communicate this back to the Client Service Centre based on the premise that “if it is planned it will happen”.

3.4 RATIONAL OPERATIONS BASED ON PREDICTABLE SERVICE

Predictable service is an ongoing initiative implemented by Spoornet to continually give customers the best service possible. The fundamental concept is to provide a quality service at the right price and in the shortest time possible i.e. to as far as practically possible deliver the load directly to, the client's siding.

In order to put the above concept into perspective one has to draw parallels with road transport. Road haulers provide a door-to-door service with a transit time of 12 hours from Gauteng to Durban compared with Spoornet's 17 hours from terminal to terminal. Clients can generally live with the longer journey time but are concerned with the additional time taken to process traffic from the terminal to the clients siding hence the need to take traffic directly to the clients siding and minimise this source of potential delay. Clients are often willing to pay a premium to road haulers to provide a quick delivery service. If rail could guarantee a predictable service a similar premium in transport costs could be obtained thus off-setting higher operational costs which could arise.

Management in a road transport enterprise is available 24 hours per day whereas with rail, decision-making management is only available for 8 hours per day. Most rail departures occur at night and the entire co-ordination of operations rests in the hands of line function personnel. This is a totally undesirable situation as lower efficiency levels

could arise through poor supervisory control. At the end of the day what is actually sought is accountability from top management downwards and perhaps the implementation of the corridor concept on the Durban – Gauteng line shall assist to facilitate this. Spoornet is quite vulnerable to the general goods traffic because of open competition with road haulers. Income from general goods traffic is high but efficiency is low. On the other hand Spoornet is a world leader in some areas of bulk traffic e.g mining where quantities are vast, income per tonne low and efficiency is world class. These block loads would however reduce with time hence there is a dire need for Spoornet to grow in the general goods market.

The general goods market generates a greater number of trips from origin to destination. In order to provide a scheduled service Spoornet has to rely heavily on the latest technology available. An advanced computer software package is required to master schedule all requests, from clients, create loads for particular destinations, guarantee departure / arrival times, provide information on consignment whilst in transit, to reschedule the service appropriately where delays have been experienced and apportion costs to the various cost centres for their level of inputs.

In other words what is required is a National Optimisation of Traffic Flow which would also accommodate the proposed Corridor Management approach.

Advanced software packages are available from Mercer Management Consultants, an American enterprise specialising in rail transport. This package is deemed to maximize all scheduled movements on a national scale and is the single most important operational tool in implementing predictable service.

3.5 THE BAYHEAD MARSHALLING YARD

The Bayhead Yard was constructed in the mid 1950's and the layout of the yard complemented the nature of rail traffic for that period. Rail traffic enjoyed preferential status until the deregulation of road transport. Due to the gradual decline in rail traffic after 1988 as a result of the deregulation of road transport, maintenance of the facility has been neglected. A thorough assessment of the infrastructure is required to quantify the investment needed to improve the workability of the yard.

Protekon, the consulting engineering division of Transnet evaluated the infrastructure and the operations of the Bayhead Marshalling yard. Sections 3.5.1 to 3.5.5 and

sections 3.6.1 and 3.6.2 have been summarised from a report entitled the Spoornet/Portnet Interface Project: Port of Durban (1996).

3.5.1 Layout

The Bayhead yard comprises the following:

	no. lines	Capacity
i) Reception Yard 1	34	994 trucks
ii) Reception Yard 2	24	840 trucks
iii) Classification yards	52	1950 trucks
iv) Exchange Yard	11	264 trucks
v) Mainline Yard	40	970 trucks

Total static capacity excluding running roads, departure roads and air brake test lines is 5018 trucks.

3.5.2 Assessment of Infrastructure

A foot evaluation of the yard was conducted in order to assess the condition of the infrastructure.

(i) Formation

The formation generally consists of black fly ash with a combination of contaminated ballast: One can presume that the track had settled and that during the re-railing and re-sleeping process between 1975 - 1981 new ballast was utilised to pack and lift the track by an average of 100mm (ascertained from PWI Bayhead). A notable shortcoming is the lack of any material remotely comparable to sub-ballast standard and also the severe lack of suitable drainage. Wide spread pumping and loss of ballast has resulted in damage to rails and sleepers.

(ii) Rails and Sleepers

The yard was relaid between 1975 and 1981 with second hand rails and a combination of VAG and P2 concrete sleepers. The condition of the rails in the staging roads are generally good whilst the VAG type sleepers have deteriorated considerably and require immediate replacement. The sets are in a sub-standard

condition with defects such as slacks, corrugations, twist, gauge problems and poor alignment.

3.5.3 Operations

Traffic originating from the New Main Line and North Coast Line utilise Reception 1 as their arrivals yard from where trucks are marked and humped into the Classification Yard to dedicated roads representing various local destinations and satellite stations. Loads are made-up on these lines. The 14 satellite stations fall under control of the Bayhead Yard from where a two-way feeder service operates to the satellite stations. Loaded traffic originating from various destinations and destined for the New Main Line, North Coast and South Coast Lines are staged in Reception Yard no. 2 where they are marked and humped onto roads dedicated to particular destinations.

Process diagrams have been prepared to concisely depict the various activities in the Yard and provide an effective instantaneous overview of the various processes as opposed to having a descriptive format. These process diagrams are depicted in the following figures have been sourced from the Spoornet / Portnet Interface Project : Port of Durban (1996).

- Figure 3.1 Indicates the two-way interaction between the Bayhead Yard and the satellite stations
- Figure 3.2 Depicts the various yards and interaction between them
- Figure 3.3 Represents the process at Reception Yard No. 1 prior to humping
- Figure 3.4 Indicates in detail the humping process at Hump No. 1
- Figure 3.5 Depicts the various activities within the Classification Yard
- Figure 3.6 Depicts the process to and from the Exchange Yard
- Figure 3.7 Represents the process at Reception Yard no. 2 prior to humping
- Figure 3.8 Indicates in detail the humping process at Hump No. 2
- Figure 3.9 Depicts a typical process that occurs at a satellite station in this instance Congella

FIGURE 3.1 : FEEDER SERVICES

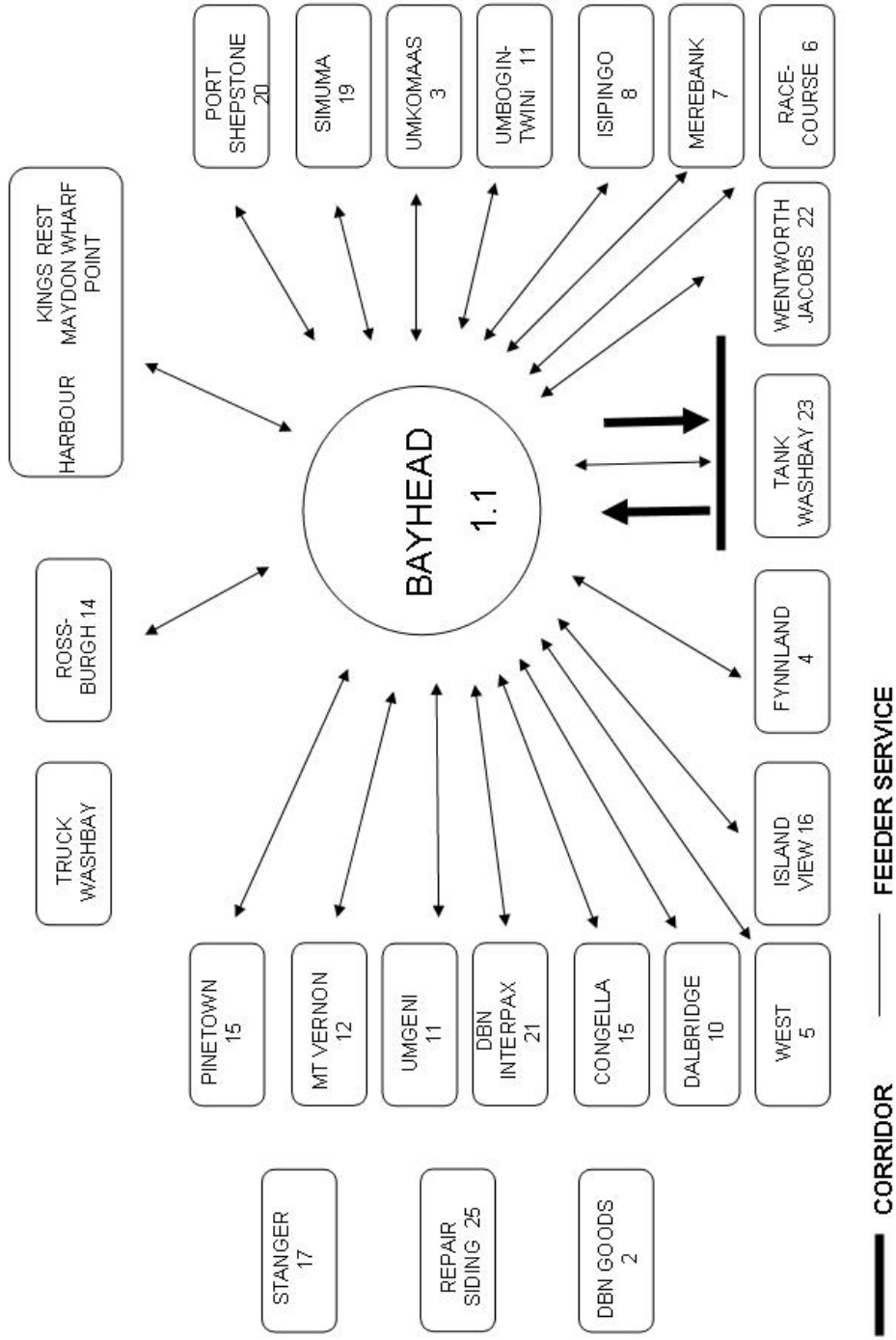


FIGURE 3.2 : BAYHEAD PROCESSES

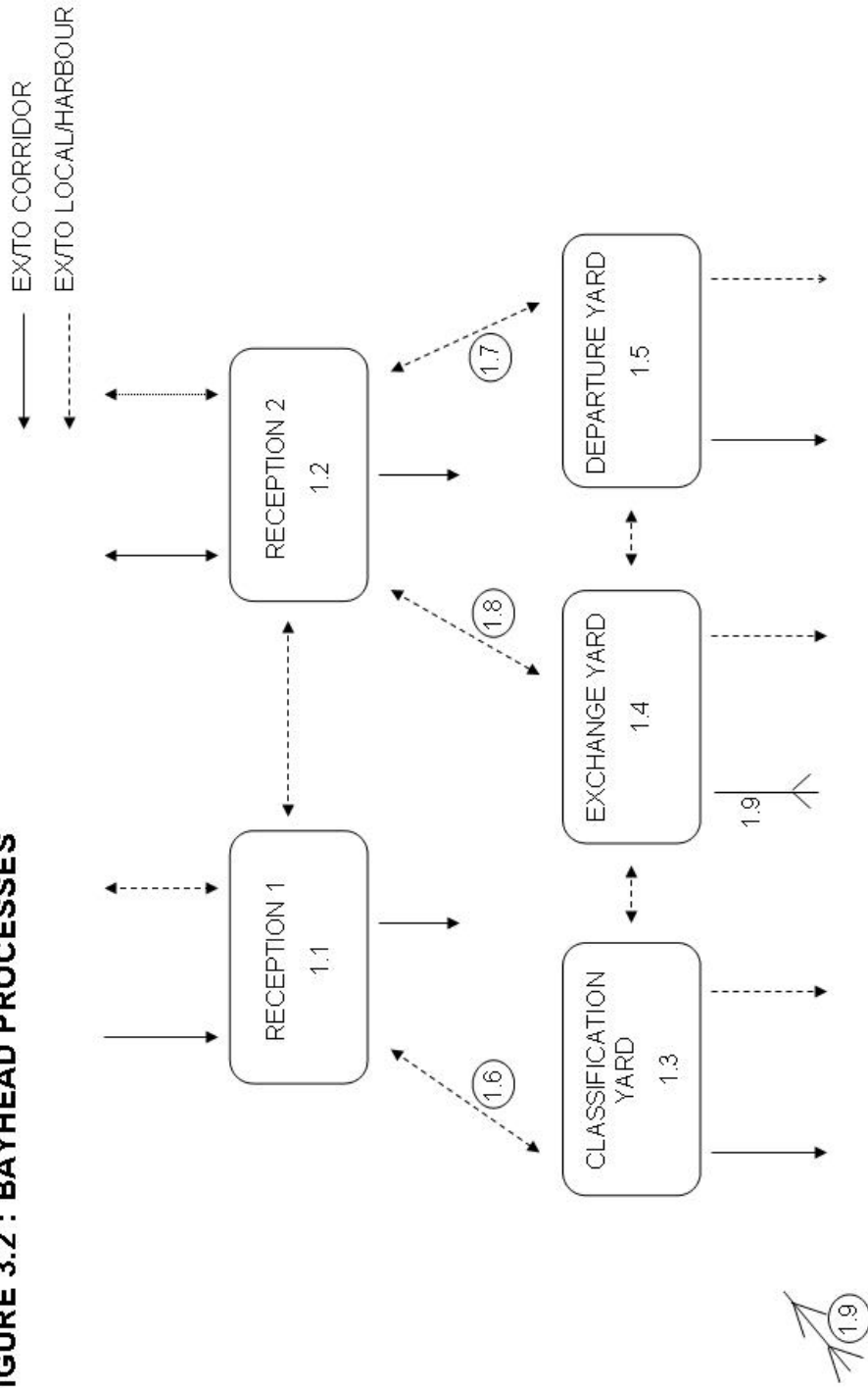


FIGURE 3.3 : PROCESSES FOR RECEPTION NO.2

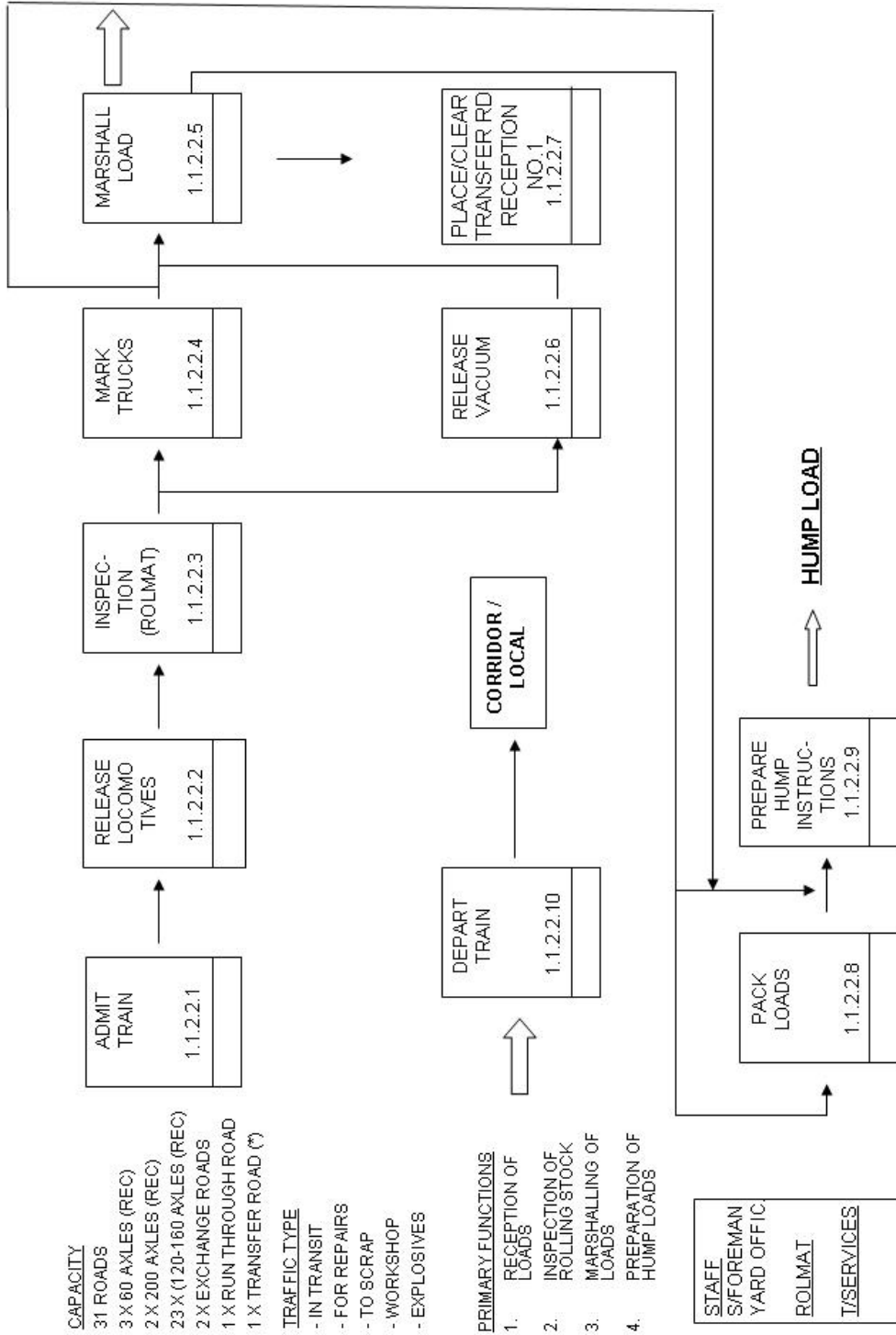


FIGURE 3.4 : PROCESSES : HUMP NO.1

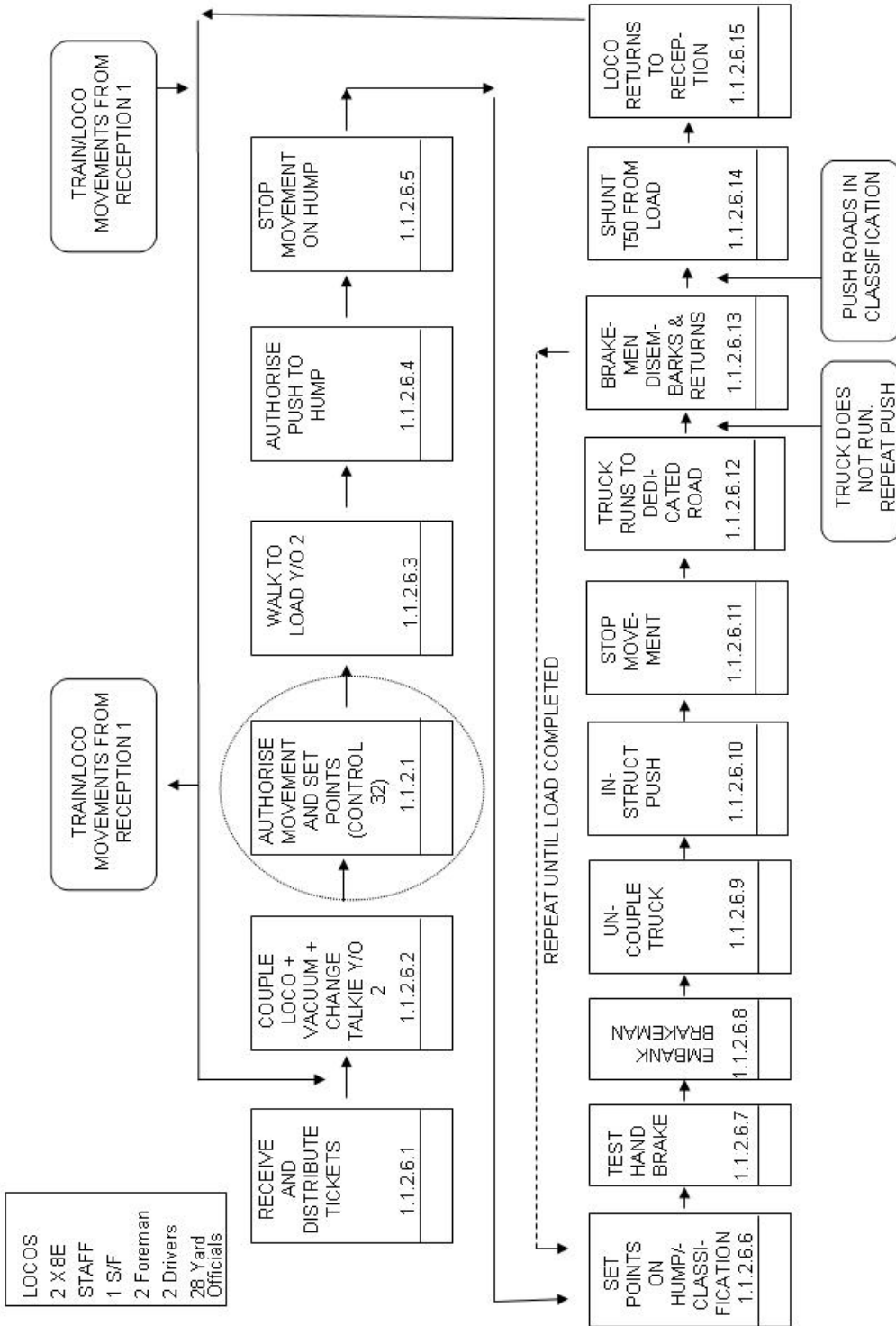


FIGURE 3.5 : PROCESSES FOR CLASSIFICATION YARD

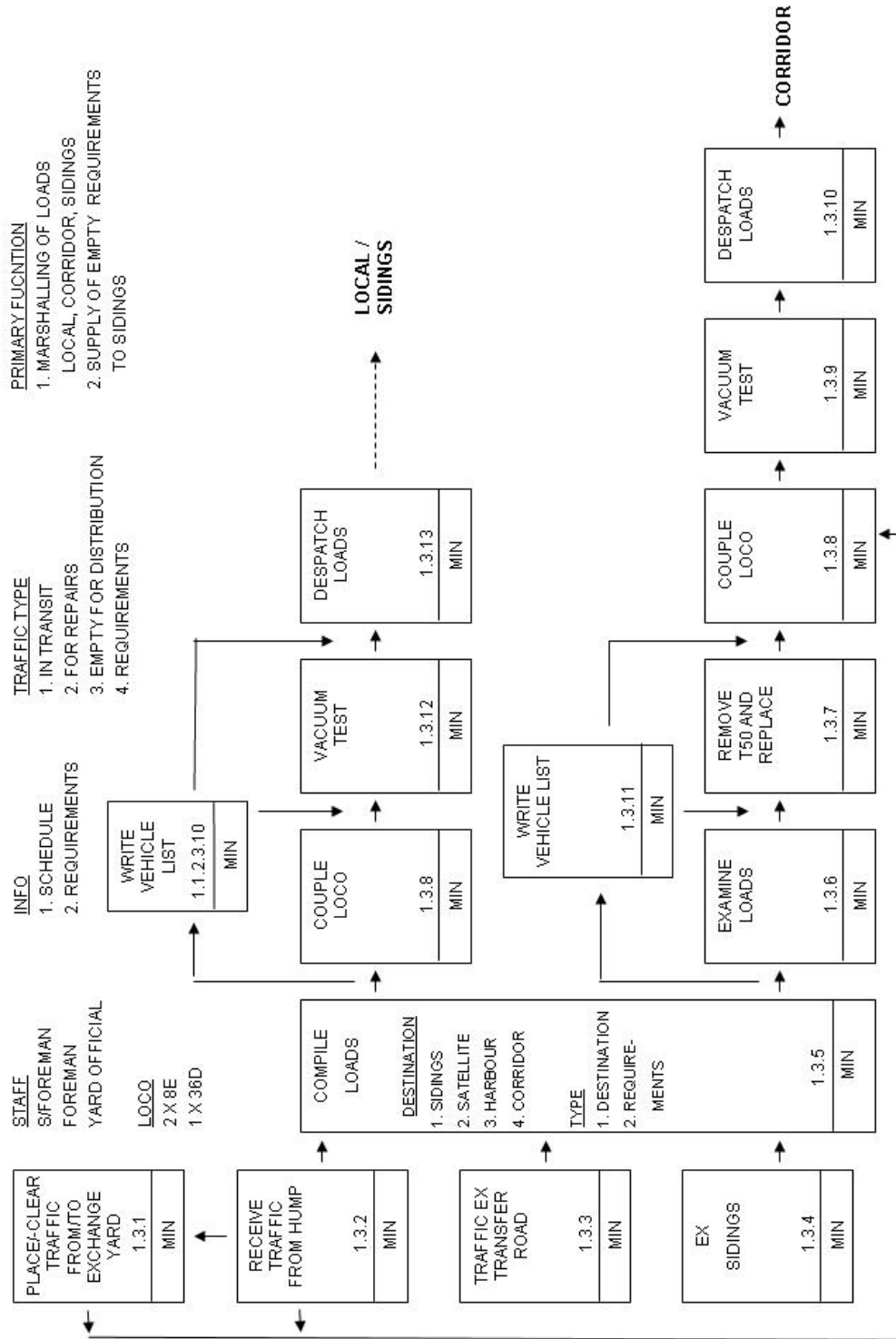


FIGURE 3.6 : EXCHANGE YARD PROCESS

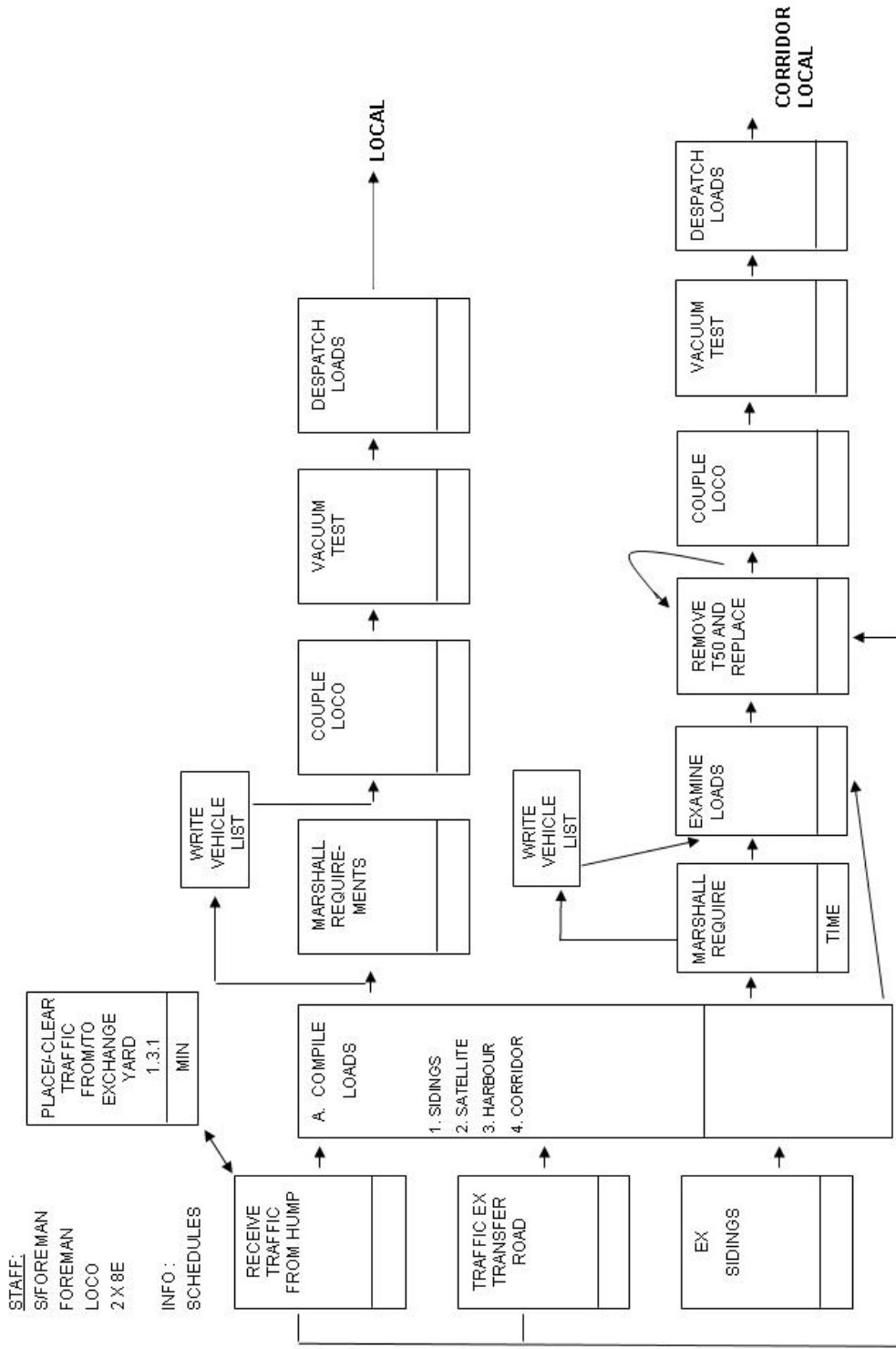


FIGURE 3.7 : PROCESSES FOR RECEPTION NO.2

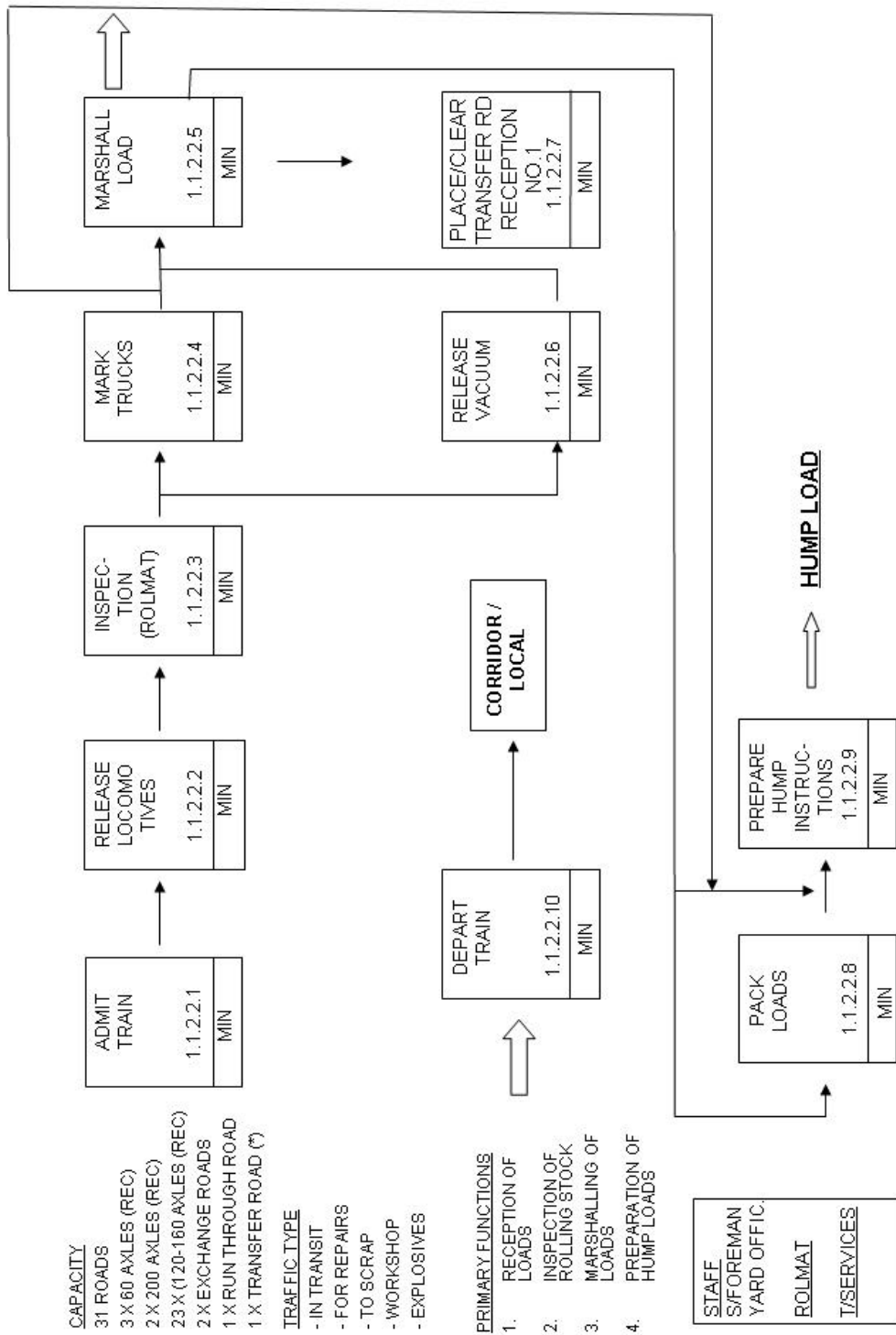


FIGURE 3.8 : HUMP PROCESS : HUMP NO.2

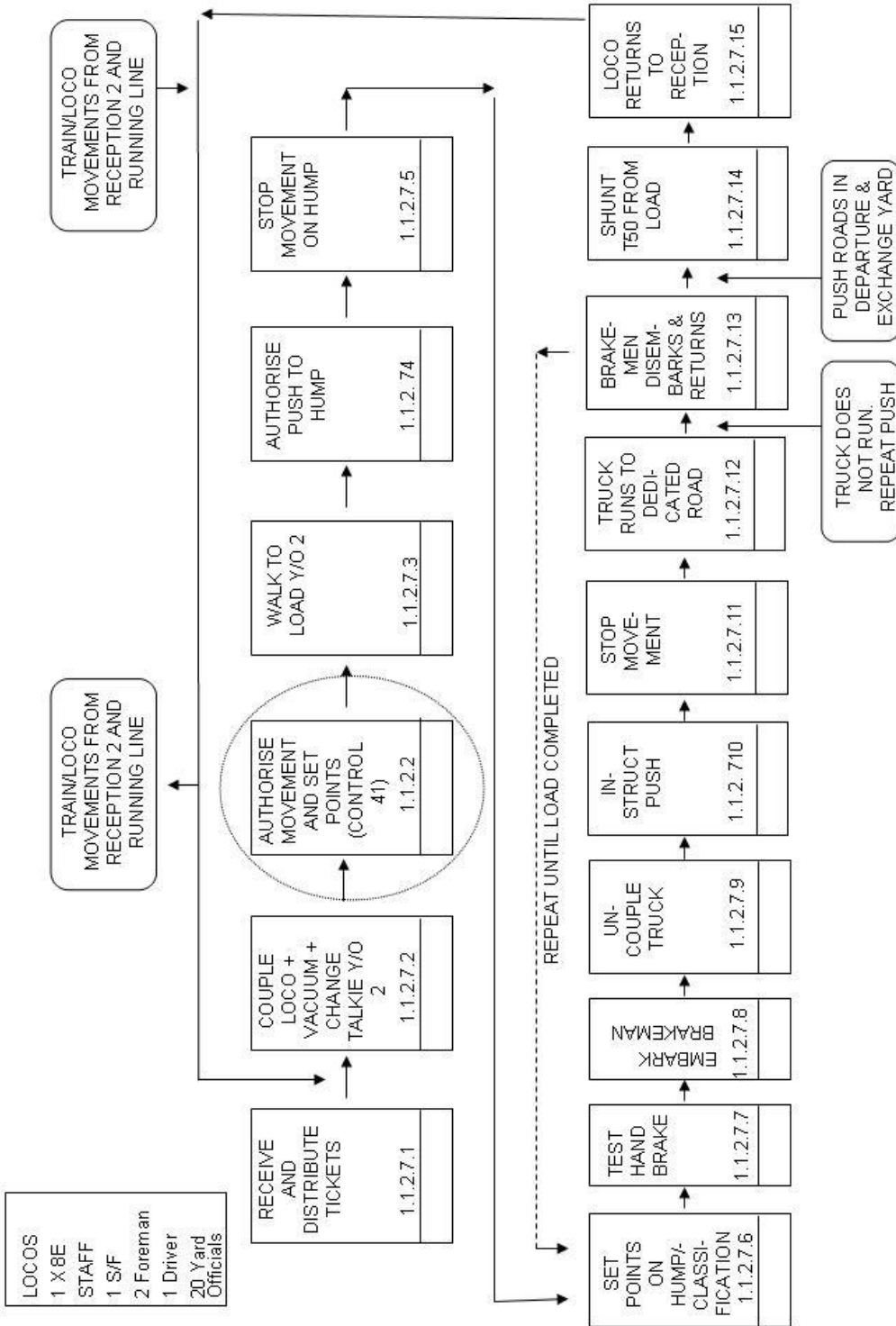
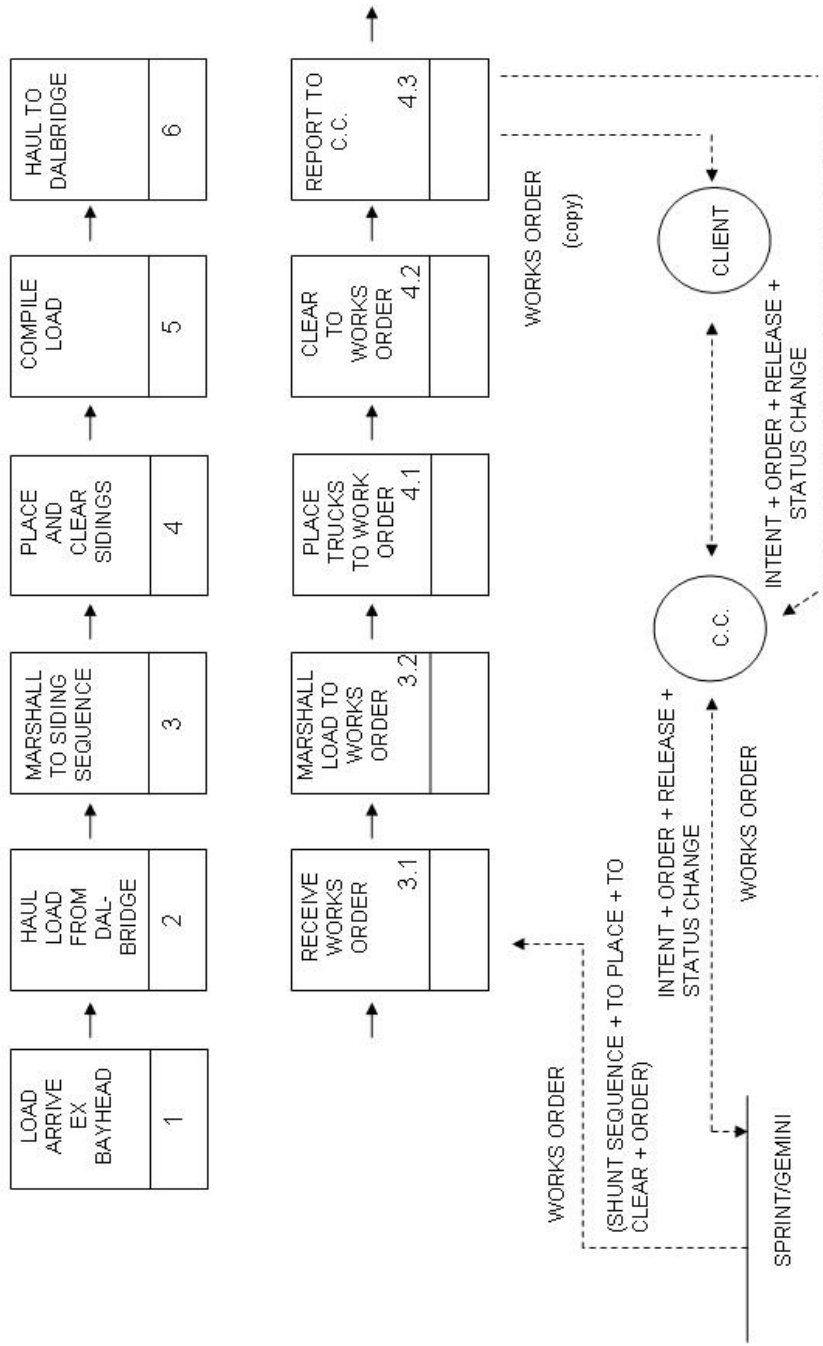


FIGURE 3.9 CONGELLA YARD PROCESS



3.5.4 Constraints affecting the efficiency of operations

Various constraints in the operation of the Bayhead Yard have been identified and are discussed below:

The Bayhead Yard has a total staging capacity for 5018 trucks. Running lines, and departure roads have been excluded. The average number of not to go trucks (T50's) staged in the yard between January 1996 and mid May 1996 was 1300 trucks and they occupied approximately 30 rail lines. Although the T50's utilised 26% of the capacity of the yard, 40% of the yard is not operational due to some rail lines being only partially full as a result of classifying loads for the repair siding. This situation impacts grossly on operations as the yard was originally planned to accommodate only 300 T50's. However with the current downward trend in rail traffic the situation is not unbearable to live with. The reasons for the large number of T50's are as follows:

- (i) Carriage and Wagon have had severe financial constraints imposed onto them thus curtailing overtime and week-end work. This has resulted in the loss of a potential output of at least 150 repaired trucks per week.
- (ii) Truck Services' tardy response to Carriage and Wagon's requests results in shunts not arriving / departing timeously thus causing a delay of some 2 to 3 hours per day in which period repair personnel are unproductive.
- (iii) Damage to trucks by clients not utilizing specialized equipment to load/unload trucks generates an extremely large number of unscheduled repairs which impacts on the limited resources of Carriage and Wagon.
- (iv) Trucks for general traffic (30 to 40 years old) is rapidly going out of service due to severe corrosion of doors, floors and undercarriage.
- (v) The closure of the Fynnlands Repair Siding makes severe demands on Carriage and Wagon whose output is limited.
- (vi) Communication amongst the various subsystems e.g. between Bayhead's shunters, satellite stations, people undertaking event reporting and the data clerk recording events on the yard control system, is a major problem because of the limitations in range of the Walkie-talkie system and poor accessibility to telephones to timeously report events or receive instruction to place trucks.

Comment [N9]: Why are you making recommendations at this stage. Your aim in this chapter was to discuss the workings of the BHY and identify the constraints not making recommendations as such.

Comment [N10]: Briefly indicate that a NTG is a T50.

Comment [N11]: Somehow this does not make sense. A potential loss of 150 repaired trucks does make sense.

Comment [N12]: Does not make sense. Do the repair personnel wait until all trucks have been repaired before talking to ops to remove them? If it is not the case then the reason given for unproductiveness is not the true reason.

Comment [N13]: Give an example of such damage or relate to the use of specialised equipment. It is difficult to imagine damaging a truck.

Comment [N14]: Sentence must be rephrased. Does not understand how the age of the truck is going out of service. The age might give cause to trucks becoming unserviceable due to

- (vii) The humping process at Hump No. 1 is limited by the single shunting line on the hump. The 34 lines in Reception Yard 1 operate as two modules i.e. Lines 1 - 13 and lines 14 - 34 which utilise two shunt cars B3 and B4 respectively whilst B3 is pushing B4 is stationary and vice versa. This severely restricts the number of shunts that could be undertaken.
- (viii) The manual operation of each hump is totally reliant on a contingent of some 28 personnel. Absenteeism affects the fluency of operations and reduces productivity.
- (ix) The lack of experience of affirmative action personnel result in inaccurate information being fed into the Yard Control System. Staff morale is generally low because of anxiety of the pension fund. Many personnel are also awaiting rumoured packages. Should these experienced personnel leave there would be no immediate competent replacement staff available.

Comment [N15]: Indicate that this is a major restriction and leave the recom until later.

3.5.5 Action Plans

Protekon set-up a liaison committee comprising personnel from Truck Services, Carriage and Wagon and Field Maintenance. The committee convened every Friday morning for a period of 8 months to discuss operational constraints, the T50 situation and Carriage and Wagon's output. These meetings were initiated in May 1996.

Action plans were implemented to:

- (i) Standardise the symbols utilised to mark T50 wagons for heavy repair, light repair, van siding and scrapping
- (ii) To sort loads for the repair siding into the various repair categories for ease of identification and repair.
- (iii) Place/remove loads from the repair siding timeously through effective communication and to consider staging the 015 shunting locomotive at the repair siding.
- (iv) Obtain consent from management to work overtime and week-ends in order to reduce the backlog of T50's.

- (v) Request management to expedite the scrapping programme in order to unblock the staging roads in the Yard.
- (vi) Stage T50's temporarily at satellite stations with a view to compiling loads for repair at Uitenhage and Danskraal.
- (vii) Improve communication amongst the various categories of Yard personnel by introducing the wider use of trunking radios. However a problem with the availability of channels does exist at this stage.
- (viii) Approval has been received to proceed with the construction of an additional shunting line across Hump no.1 with the necessary modification to sets. The number of shunts across the hump should increase from 10 to 20 per shift within each module.

Comment [N16]: I am assuming that this is within each module. If it is then state it as such

The weekly meetings and the implementation of the above action plans has resulted in an increase in the output of Carriage and Wagon by some 25% and a reduction in the number of T50's and scrap trucks from an average of 1300 to 300 per month. This situation however has regressed as the number of scrap trucks have increased to former levels. Productivity improvements in the Bayhead Yard have been noted but the current downward trend in rail traffic "overshadows" some of the benefits achieved to date.

Comment [N17]: Is this per week, per month or per year?

Comment [N18]: This downward trend must be serious if its effects can be noticed in such a short time span

The mechanisation of the hump has been considered but the cost to do so is extremely high considering current traffic levels. The problems highlighted eight years ago are still relevant today and in addition the infrastructure has deteriorated even further.

3.6 AN OVERVIEW OF RAIL OPERATIONS AT CITY TERMINAL

The areas in the Port served by Spoornet are City Terminals, Maydon Wharf, Pier No.1 and Pier No.2. The following is an overview of rail operations at City Terminals which is also used to provide a general view of similar operations at other terminals within the port environment.

3.6.1 City Terminals

The quay side from A to R berths is generally served by two tracks on the quay. i.e. the waterline and shed line. Crisscross lines running through stack areas, particularly at "B" and "C" berths, are a nuisance to operations as trucks left on these rail lines reduce the

Comment [N19]: How do these lines impede the flow? I can only assume it happens if trucks are left on these lines. If this is the case then state it else explain how they impede free flow and capacity.

capacity of the stack areas considerably and cause equipment handling cargo to travel longer distances. A rail terminal comprising a through service line to the Granite Terminal and two siding loops each for 20 truck block trains with the possibility of an extension in the future to Berth "A" was suggested in August 1996. The rail terminal would be located at the rear of the stack area adjacent to the Point Road boundary. The rail terminal will allow Spoornet to place 40 trucks at a time. The terminal is not restricted to dead-end working, thus additional flexibility is provided. Cargo operations can be based on placing 2 x 20 truck block loads into the rail terminal and unloading the first block load closest to the quay side. Spoornet will then be required to remove these empty trucks in order to access the second block load immediately adjacent to it. Cargo volumes would dictate the demand for trucks and therefore number of block loads to be placed and/or removed from the rail terminal per 12 hour shift.

As a result of environmental concerns, in particular noise pollution, shunting in certain areas of City Terminals is restricted after 22:00 hours. A rail terminal would mean less shunting and rail trucks will be off-loaded from one side only implying that truck doors need only be dropped on that side. Dropping the truck doors in the rail terminal may be planned and organised more systematically resulting in fewer accidents and more control on door posts being misplaced.

3.6.2 Shortage of stacking space at Citrus Terminal and Q and R berths

Stacking space at "M" shed and the Citrus Terminal and at the rear of "Q"/"R" berths is very limited for efficient cargo handling. Generally stacking space in the entire City Terminal area is at a premium due to it being encumbered by severe geographical constraints including the close proximity of railway staging yards to the quay side. Block stacking is a critical element in facilitating the receipt and shipping of cargoes simultaneously with the transfer of cargo being sourced from road and rail trucks. The increase in tonnages of cargo handled necessitates the provision of additional back-up areas which space is beginning to impact on adjoining rail infrastructure.

"L" and "M" berths generally handle bulk cargo which require at all times that clean rail trucks be staged in terms of the agreement between Spoornet and Portnet. If these trucks are sourced from the Point area at least 4 hours notice prior to a ship unloading must be given, but should these trucks arrive from an area outside the Point area, 8 hours notice is required. If the tracks between the Citrus Terminal and "M" shed are uplifted these trucks would not be able to be staged in advance thus creating a potential delay to vessels that are in the process of loading/unloading. Similar staging requirements are

Comment [N20]: Up t this point you have explained the limitations in rail capacity. Here you are explaining limitations in capacity to handle cargo from both road and rail. You should indicate it as such.

also required during the citrus season for the Citrus Terminal. The cost of delaying a vessel is approximately 20 000 US dollars per day.

Comment [N21]: What would the cost impact be in the case of shipping?

The proposed redevelopment of "Q/R" berths entails the upliftment of some 2000 meters of track. These are the first three tracks located at the rear of the quay side apron. The short term consequence of the above situation is quite severe on rail operations due to the lack of alternative staging yards in the Point area. This could also result in delaying the loading of vessels and the inefficient handling of cargo which would have to be conveyed over much longer distances. The impact in the long term is that shipping lines would prefer to use road transport.

Comment [N22]: What restraint will this pose for shipping and cargo handling. Remember you are discussing constraints and should discuss their impact in both the short and long term both on operational aspects as well as cost.

Several meetings were held with Spornet Operating and the Operational Managers of the respective berths to discuss the proposal of uplifting the tracks. There is a perception that Spornet would like to hold onto every track in the port in order to have a large but underutilized storage facility on hand. The removal of tracks at the Station Yard could be cited as an example whereby Spornet rationalized operations and could do without the infrastructure. There is however a cut-off point which dictates the limits one can go to. It would appear that this limitation is fast approaching. It has therefore been recommended to the Manager, City Terminals that prior to uplifting any tracks, sets to these tracks be spiked for at least a period of one month on a trial basis in order to critically assess the impact of such action on rail operations.

Comment [N23]: This is understandable as the more space there is available the easier it is place/remove trucks timeously. What incentives are there for Spornet to adhere to this request??

The upliftment of tracks in the Station Yard has reduced the capacity of staging roads considerably. The only staging areas are 6 roads parallel to Q and R berths with a capacity of 150 trucks and 4 roads in between the Citrus Terminal and M-shed with a capacity of 60 trucks. The only other area presently and possibly temporarily available as a staging facility is the Cato Creek Yard. However future port developments may impact on this area and it could be lost permanently to providing a rail service.

When ships unload it is essential to stage trucks prior to the commencement of unloading. Hence there has to a minimum staging capacity available to accommodate these trucks. The loaded trucks have to be shunted out and replacement trucks must be immediately available to prevent any possible delay to the vessel and to comply with the terms of the Spornet-Portnet agreement.

Comment [N24]: When the above para is read with this one and then compared to what has been said previously it does make sense that rail does not want to lose any more facilities.

Rail traffic destined for the harbour area is on a permit system in order to control traffic into the harbour. Loaded rail trucks generally arrive a day prior to a ship berthing or two days prior should the load require to be mass measured. The delay of a ship at sea

Comment [N25]: This can only be possible if there is sufficient stacking space which seems to be the bone of contention between port and rail operations.

affects rail traffic that is already loaded and en route to the harbour, as this traffic cannot be held back at the loading point. Staging roads to accommodate block loads do not exist in the harbour to accommodate traffic for the period of the delay. The options that do exist are:

- i) Stage the traffic at Kings Rest or the Bayhead yard.
- ii) Stage the traffic at Cato Ridge in a secured area – particularly for Main Line traffic.
- iii) Stage traffic at Durban Station - capacity for 80 trucks presently occupied by T50's.

Empty wagons required for the off loading of ships which are delayed could similarly be staged at Kings Rest or Bayhead yard for short delays or when the capacity of the Wentworth yard proves to be inadequate.

The initial reaction to limited staging capacity in the harbour area may prompt one to investigate the possibility of establishing alternative staging facilities in close proximity to the harbour. This is not absolutely necessary if the operations of the Bayhead Yard are rationalised and in keeping with the Corridor Principles of Service and if Spoornet acquires the National Optimisation of Traffic Flow software package to reschedule the service to accommodate delays.

One cannot help but to stress the need for the master scheduling program in order to effect predictable service. The Bayhead Yard which has the capacity to stage at least 100 block loads should, purely from a statistical point of view, play a leading role as a service provider to the harbour and the harbour traffic. The provision of a shuttle service between the Bayhead Yard and City Terminal would necessitate utilizing a greater number of locomotives and perhaps consideration should also be given to use the line capacity of the Esplanade line as a transitory staging road in an attempt to address the predominant issue of lack of stacking space at the port/rail interface.

3.7 AN OVERVIEW OF OPERATIONS IN THE DURBAN CONTAINER TERMINAL

3.7.1 Introduction

The following diagrams simplistically illustrate the processes associated with the export and import of containers by road and rail respectively and have been sourced from the Durban Container Terminal Report (2004).

Abbreviations:

ETA = Expected Time of Arrival

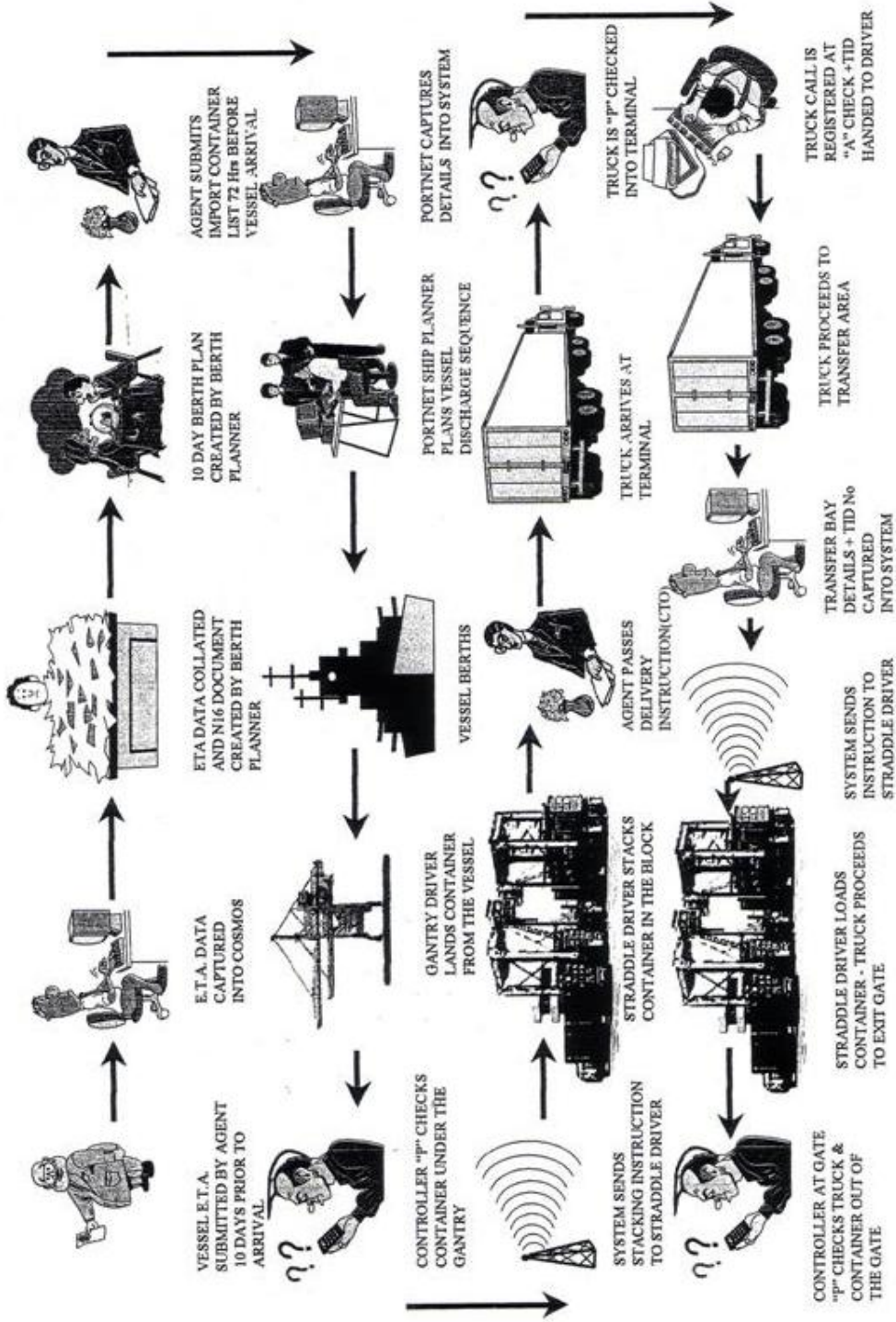
Cosmos is a computerised system of stacking containers in slots. Actual slots are marked on the ground and numbered. The stack number and stack height is recorded for every container that is placed or removed.

Comment [N26]: What the heck is this???

TID = Truck Instruction Document

Cosmos Document & Container Flow-IMPORT BY ROAD

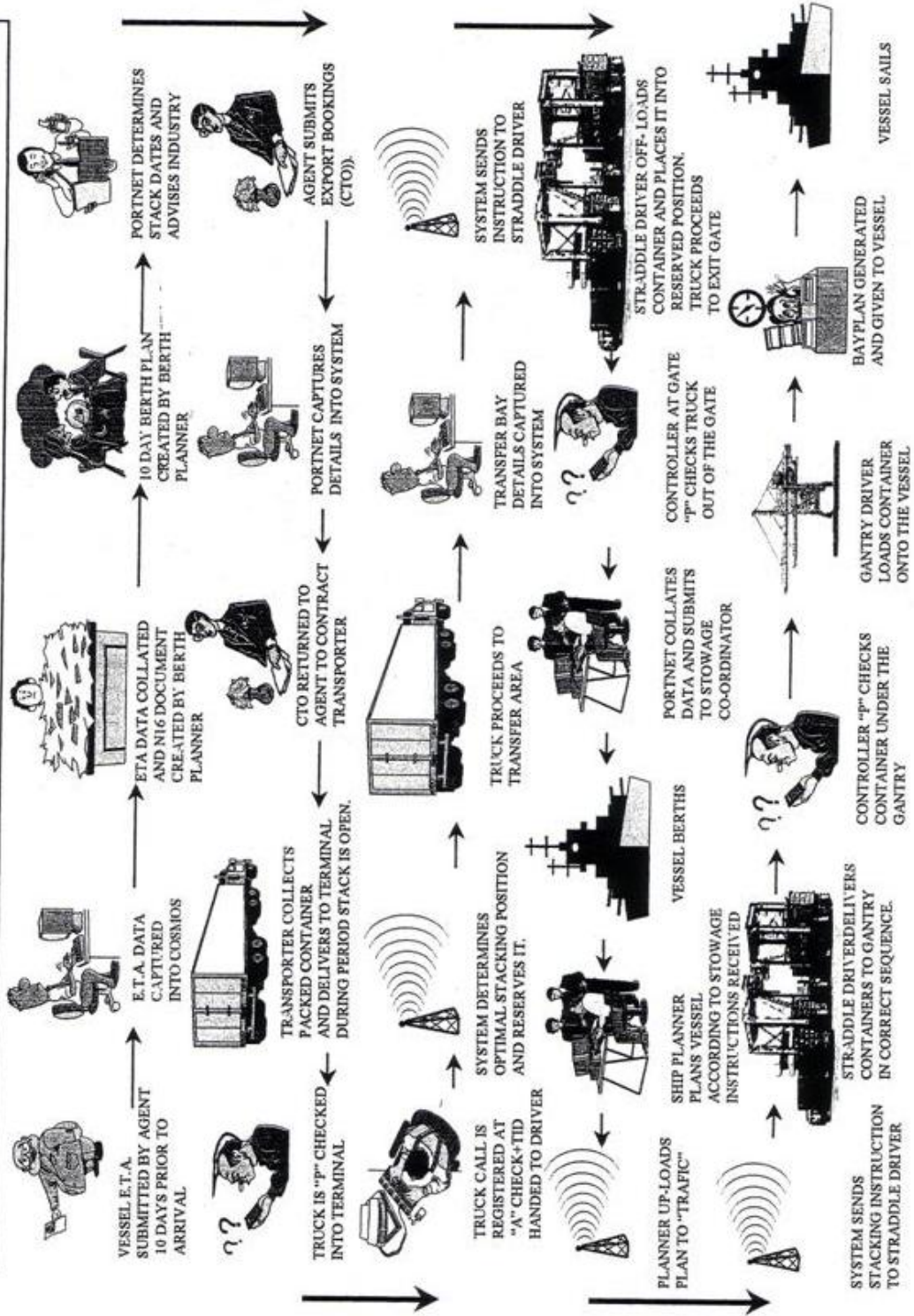
Fig 3.10



Source : Durban Container Terminal Report (2004)

Fig 3.11

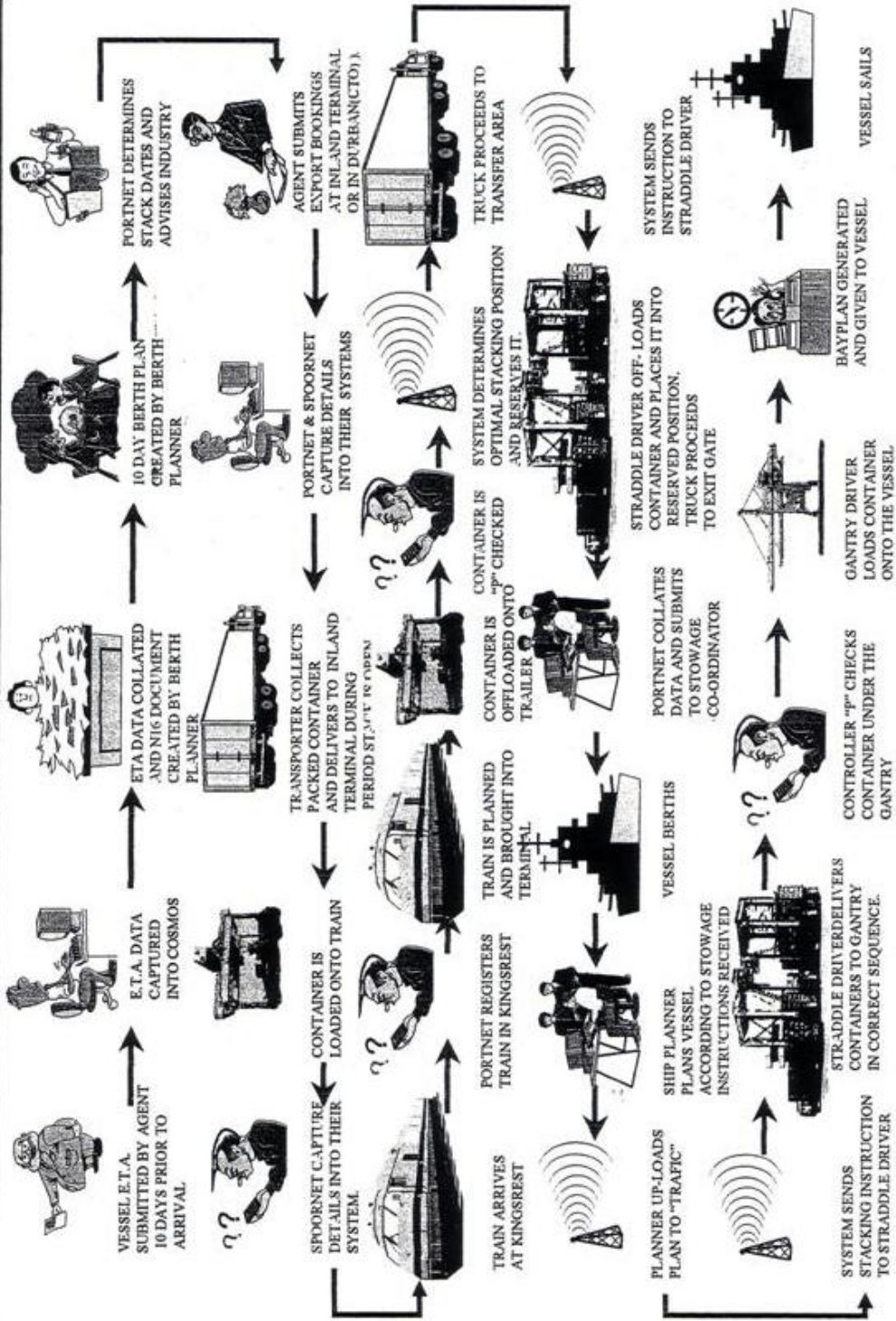
Cosmos Document & Container Flow-EXPORT BY ROAD



Source : Durban Container Terminal Report (2004)

Cosmos Document & Container Flow-EXPORT BY RAIL

Fig 3.12



Source : Durban Container Terminal Report (2004)

3.8 A TYPICAL CAPACITY PLANNING EXERCISE FOR CONTAINERS

3.8.1 Introduction

The Durban Container Terminal (DCT) which is operated by SAPO is the largest container terminal in the southern hemisphere and handles 64% of all container traffic in and out of South Africa. Containers are available in twenty and forty foot sizes. The standard global practice, when measuring volumes processed through a terminal is to convert all containers processed to Twenty-Foot Equivalent Units (TEU's).

During the peak period (May-Dec) DCT handles in excess of 1,24 million TEU's. This results in the occupation factor increasing and the stacks becoming congested which has negative impacts on container handling operations and vessel turn-around times.

Comment [N27]: Why?? You haven't even discussed the problem yet you are making a conclusion

3.8.2 Capacity Analysis

The capacity of the terminal is a function of the utilisation of berthing capacity, crane capacity, straddle carrier capacity and stacking capacity with the lowest of these factors being the capacity limit:

- **Berthing Capacity**

This refers to the length of quayside available for receiving vessels. At present DCT has 1 900 metres of usable quayside which is able to accommodate a maximum of 19 cranes. This equates to the handling of a maximum of 1.99 million TEU's p.a. using the international benchmark of 105 000 TEU's per crane per annum i.e. 12 moves per hour.

- **Crane Capacity**

This refers to the number of cranes available to service the vessels. The terminal currently has a fleet of 16 cranes resulting in crane capacity of 1.68 million TEU's p.a. (105 000 TEU's per crane per annum). With the delivery of the three IMPSA cranes which are currently under construction, the total fleet of cranes would increase to 19. Based on the international benchmark of 105 000 TEU's per crane, the terminal's crane capacity would be increased to 1.99 million TEU's p.a.

- **Straddle Carrier Capacity**

This refers to the number of straddle carriers available to service the cranes. At present DCT, have 85 "3-high" straddle carriers (straddle carriers capable of stacking

containers 3-high), which equates to a capacity of 1.62 million TEU's per annum. With the delivery of fifteen additional straddle carriers expected by mid 2006, the terminal's straddle carrier capacity will be extended to 100 and capacity will be increased to 1.91 million TEU's p.a. as indicated by the formula below:

$$\frac{105\,000 \text{ TEU 's per crane}}{5.5 \text{ straddle carriers per crane}} \times 100 \text{ straddle carriers} = 1,91 \text{ million TEU 's p.a.}$$

- **Container Stacking Capacity**

This refers to the number of ground slots available to stack the containers and the height of the stack. At present DCT have 13 087 ground slots with the stack capacity equating to a maximum of 1.65 million TEU's per annum. The fifteen additional straddle carriers mentioned above are of the "4-high" type (i.e. capable of stacking containers 4-high). This will enable the import stack average height to increase from 1.72 to 2.1. This will result in additional stacking capacity of 210 000 TEU's per annum, thus increasing the overall stacking capacity of the terminal to 1.86 million TEU's.

Comment [N28]: Differentiate between static and dynamic capacity. Show how each is calculated

Comment [N29]: Indicate how this was determined.

- **Capacity Limit**

The capacity of DCT, after the commissioning of the IMPSA cranes and the acquisition of the 15 straddle carriers, will therefore be 1.86 million TEU's as this capacity is defined by the lowest capacity, which in this case will be the stacking capacity.

Comment [N30]: You will have to show your calculations as at this stage one cannot see why this is the limiting factor. I will use the following to indicate this:

13087 ground slots x3 high = 39261 potential stacking slots. Each straddle carrier can only move 52 containers per day (limited by crane) which equates to 5200 total per day. This means that the turnaround time per container in the terminal is more than 6.78 days given a ten percent safety factor until full. The problem therefore does not seem to be the stacking area itself but rather the turnaround time allowed for containers.

In order to lead the reader to make the correct conclusion you will have to more specific, especially with regards to this last capacity.

Comment [N31]: You are making recommendations!!!

To overcome this limit it is proposed that an area, which is currently vacant, adjacent to DCT be utilized to create additional stacking for DCT. The area in question is owned by NPA and was previously leased to Freight Dynamics for the parking of their trailers. This area is known as the "Y-Site". The "Y-Site" is currently rail-locked by rail lines to Pier 1 and an electrified shunting leg from Kingsrest Yard. Vehicle access to this site is only possible by a level crossing resulting in restrictive usage of the now vacant land. The "Y-Site" is just outside the entrance of DCT and is furthest from the quayside. The use of this site for container stacking at present would not be viable given the long travel distances to the quayside, therefore the following investments are proposed to enable its use for container stacking space:

- Relocation of the rail lines thereby preventing the site from being rail-locked.
- Relocation of DCT's support services to the "Y-Site" (i.e. workshops, staff parking, container scanning facilities, stores and workshop staff facilities)

- Adequate paving and roadways

These investments would enable the demolition of existing workshops (Straddle Carrier Workshop; Container Vehicle Repair Workshop), stores etc, and thereby releasing valuable land to be upgraded to accommodate container-stacking operations. The terminal's current workshops and stores are located much closer to the quayside which is not desirable. The relocation of DCT's ancillary services would result in excess of 1,000 TEU ground slots being created. This would result in DCT's capacity increasing by approximately 116,800 TEU per annum, as indicated by the calculations below:

Description	
Additional TEU ground slots created	1000
Peak Factor	1.25
Occupation Factor	0.8
Days Annually	365
Average stack height	1.75
Average dwell time	3.5
Additional Capacity (Containers per Annum)	116,800

Additional Capacity (TEU's per Annum) is calculated using the following formula:

$$\frac{\text{Ground Slots} \times \text{Average Stack Height} \times \text{Occupation Factor} \times \text{Working Days}}{\text{Average Dwell Time} \times \text{Peak Factor}}$$

Thus DCT's Container Stacking Capacity would increase to **1.98 million TEU's**, which is more in keeping with its potential throughputs.

3.8.3 Financial Implications

The total estimated cost of the capital investment is R300m. This expected total cost is not included in SAPO's 5 year Capital Expenditure Budget.

Summary of construction costs for the development of the Y-site

1. Relocation of rail tracks and building	R 7,75m
2. Construction of new workshops and paving areas	R108,32m
3. Demolition of DCT workshops and conversion to stacking area	R 50,86m
4. Preliminary and general cost	R 41,75m

Comment [N32]: Why is the peak factor used to increase the average dwell time instead of increasing the average stack height? One would surmise that peaks are more easily handled by increasing stack height thus utilising stacking capacity more effectively than by increasing dwell time which is seen as turnaround time of a container in DCT.

Comment [N33]: State at the beginning of the DCT discussion that SAPO is the current operator of DCT

5.	Dayworks rates	R <u>8,34m</u>
	Sub-total	R217,02m
6.	Add professional fees and disbursements @ 15%	R <u>32,55m</u>
	Sub-total	R249,57m
7.	Add contingencies @ 20%	R <u>49,91m</u>
	Total estimated cost	<u>R299,48m</u>

The construction period for this project is 18 months.

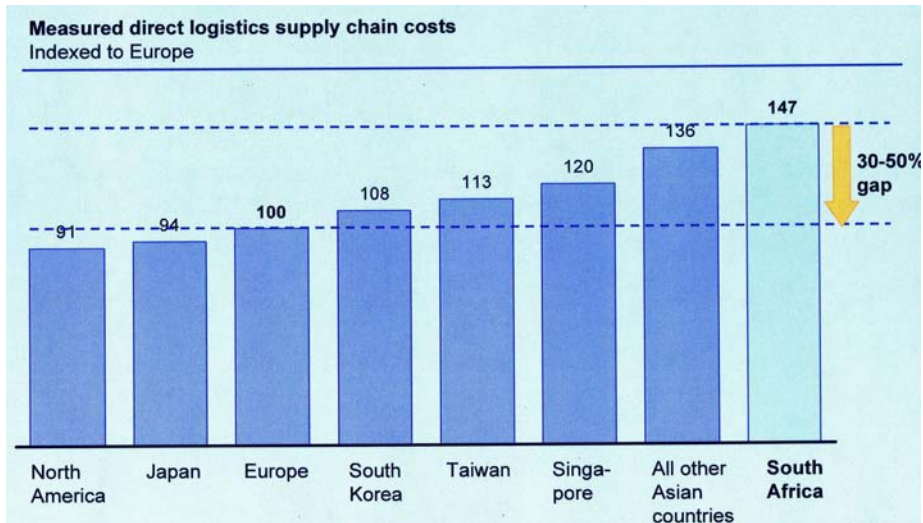
The estimated additional annual revenue that would be generated from this investment (based on the average revenue of R850/TEU) is R99,3m. The break-even period for capital expenditure of R300m is 3 years. If one takes the interest charges into account the payback period will be 7 years.

3.9 TRANSNET'S RESPONSE TO ENHANCING THE EFFICIENCY OF THE PORT/RAIL INTERFACE

3.9.1 Introduction

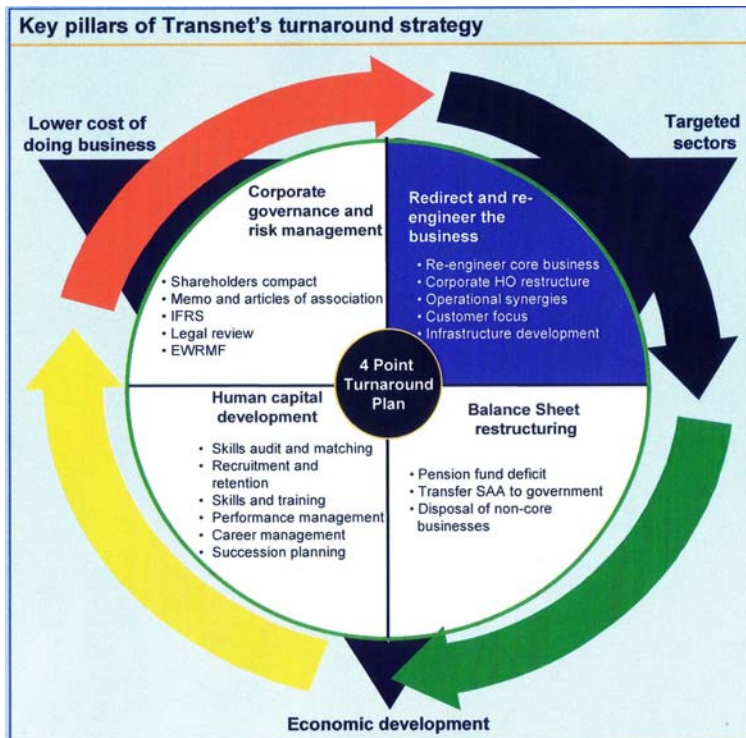
Transnet as a national transport and logistics service provider is crucial to the economic development of South Africa and is a key enabler of South Africa's economic success. The President of South Africa in his 2005 opening address to Parliament highlighted the need to reduce the cost of doing business in South Africa. The Transnet Board of Directors have responded by launching its "Vulindlela" initiative to re-engineer the core businesses and operational process of Spoornet, South African Port Operations, National Port Authority and Petronet in order to deliver on a highly ambitious mandate of 30% improvement in productivity over the next three years coupled to achieving volume growth. The Group CEO of Transnet Ms. Maria Ramos outlined Transnet's strategy at a forum of Senior Transnet Managers on 14 September 2005 and this strategy is now being rolled down for actioning within all the businesses. The following figures provide a broad outline of the re-engineering strategy.

3.9.2 Figure 3.13 Measured direct logistics supply chain costs indexed to Europe



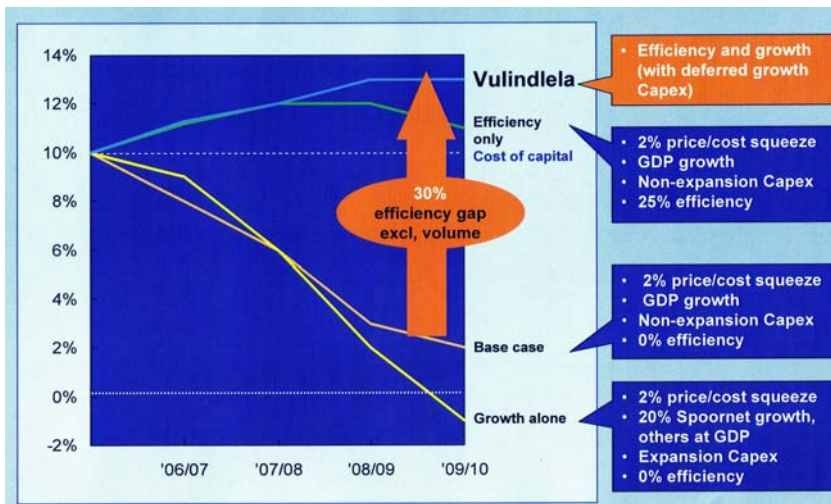
Source : Transnet (2005) Vulindlela – Transformation Lekgotla

3.9.3 Figure 3.14 Key pillars of Transnet’s turnaround strategy



Source : Transnet (2005) Vulindlela – Transformation Lekgotla

3.9.4 Figure 3.15 Estimated % return on invested capital (pre tax)



Source : Transnet (2005) Vulindlela – Transformation Lekgotla

3.9.5 European visit – Constraints faced by players

- High labour cost – 40% to 70% of costs – and aging workforce
- Old equipment – at least equivalent to Spoonet
- Rigid and inflexible labour environment with many unions (unions tougher than S.A.)
- Market share of rail dropping everywhere (from 40% to well below 20%) driven by road (more recently entry of low safety, low cost eastern European trucking) and barging. Volumes are now static.
- High complexity infrastructure – freight and commuter, ports and railroads have different owners, country specific technical specs, competitors share common infrastructure – although infrastructure funded by government
- Stringent safety regulations (more stringent than road)
- Road is cheaper than rail (opposite to S.A.) given the short distances
- Very low margins – all freight businesses making losses (but interventions on-track to bring them into the “black”)

3.9.6 European visit – common themes

- Top-down aspiration setting by the Exco and Board
- Significant improvements made – 30% cost reduction in three years. Achieved successes within operating constraints, high competitive intensity and volume growth limitations

- Increased asset utilisation dramatically despite aging rolling stock (mostly older than Spoornet)
- Common improvement themes within all companies visited
- Increasing asset utilisation
 - improving maintenance practices and culture
 - focus on costs, process simplification and improved service implementation
 - commercial redesign based on a deep understanding of customer needs and economics to increase profit and decrease complexity
 - aggressive procurement programmes
 - overhead rationalisation
- 3 year programmes that also deliver significant benefits early on

3.9.7 European visit – What has been achieved in 3 years

Operating model

- Organised to optimise asset utilisation – implemented dual operating model
 - Trunk : scheduling high speed, high frequency, low cost trains between major hubs; no derailments
 - Source/destination services: differentiated market development in geographic markets with tailored service(s) and pricing
- 30% cost reduction
 - Centralised support, purchasing, scheduling, pricing/tariffs
 - Multi skilled workers at stations/sidings/depots
 - Aggressively managed down overtime and casual labour
 - Optimisation of procurement

Rolling Stock

- Massive rationalisation of rolling stock (up to 30%)
- Very limited investment to achieve efficiencies
- Low/no derailments and high safety record
- Moving towards standardized equipment

Maintenance

- Culture of planned maintenance and safety
- Rolling stock maintenance schedule controlled by maintenance division

- Maintenance responsible for equipment reliability and availability – availabilities >80%
- Large cost reduction through planned maintenance, site rationalisation and reduction in rolling stock
- Maintenance typically a cost centre (versus Transwerk which is a profit centre)
- Reviewing make versus buying of locomotives

Infrastructure

- Massive reductions in marshalling yards, depots, sidings possible
- IT business enablement a key focus area not “state-of-art” but integration of what you have
- High utilisation of infrastructure (3 000 trains per day in Germany)
- Working very hard on the rail/port interface

Customers

- Detailed customer, contract, segment, route profit management introduced
- Rationalisation of non profitable routes, contracts, customers, segments creating benefits far greater than lost volume
- Better pricing (incentives, not sticks) allowing greater margins. Tariffs structured to reflect size, frequency, planning window, service elements improving margins by 15-20% in some areas. Customers welcoming incentives

3.9.8 Transnet Board of Directors and Exco's approach

- Focussed priorities for the group agreed at Exco level – 25 projects at a time with clear milestones every quarter; top down target setting
- Significant senior management time devoted to reviewing and supporting progress
- Bi-weekly standard reporting and tracking of programmes (both activity and bottom line impact) to create transparency for both centre and divisional key programmes
- Formal escalation processes for deviations from plan
- Direct link of programmes to budget and actual financials and incentives
- Consequence management for both high and poor performers
- Used as a mechanism to accelerate capability building – top performers are the future leaders of Transnet
- Board to review actual progress at every board meeting

3.9.9 Table 3.1 Transformation Programme

1 Top management and stakeholder alignment on targets and approach	<ul style="list-style-type: none"> • Visible top management involvement • External stakeholder management • Compelling case for change
2 Balance short-term turnaround and long-term growth focus: 'Restructure to grow AND grow to restructure'	<ul style="list-style-type: none"> • Stabilise business (service, quality) to earn the right to grow • Service, cost and growth programmes
3 Do not stop ongoing efforts – keep momentum by accelerating and integrating ongoing efforts	<ul style="list-style-type: none"> • Detailed review of ongoing initiatives • Accelerate, adapt, add initiatives
4 Focused approach (versus 'big bang') and early successes	<ul style="list-style-type: none"> • Prioritise initiatives for maximum impact • Quick wins and no-regret moves
5 Detailed bottom-up action plans developed	<ul style="list-style-type: none"> • Clear targets and accountabilities • Detailed action plans • Broad mobilisation • Labour management plan
6 Maximum transparency – systematic and transparent tracking of activities and outputs	<ul style="list-style-type: none"> • Set a clear baseline • Detailed implementation tracking – no 'budget and forget' • Integrated with financial and operational plans
7 Well-staffed, independent turnaround management	<ul style="list-style-type: none"> • Strong turnaround project manager and programme office • Direct access to top management • Centralise/decentralise resources
8 Aligned incentives and consequences for good and poor performance	<ul style="list-style-type: none"> • Align performance management with turnaround objectives • Review performance management systems and implementation

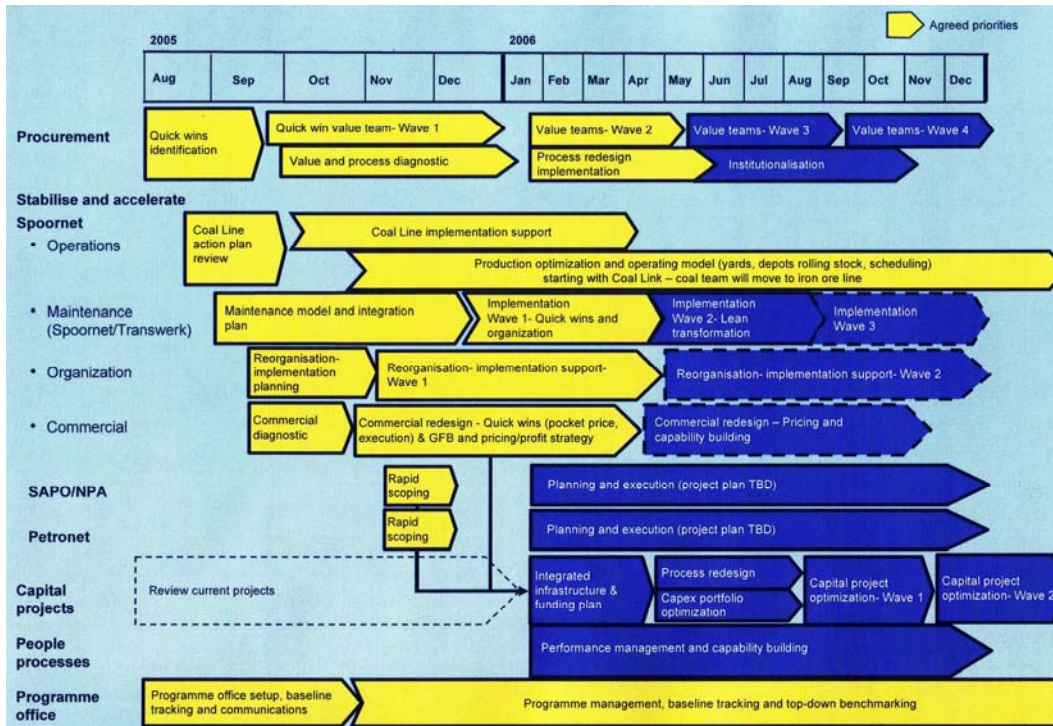
Source : Transnet (2005) Vulindlela – Transformation Lekgotla

3.9.10 Table 3.2 Prioritised Programmes

Procurement	Programme Management	People	Capex
1 Procurement (incl. IT)	2 Programme management, baseline tracking and top-down benchmarking (KPI's)	3 Overhead optimisation	5 Coordinated CAPEX implementation planning*
		4 Capability building and people processes	6 Integrated infrastructure funding plan
Stabilise and accelerate			
7 Commercial diagnostic and redesign	19 Lean transformation	20 Repositioning of marine services	22 Optimisation of terminal operations
8 Customer service process redesign		21 Real estate management	23 Market share protection and growth
9 Production optimisation/operating model (including asset utilisation, scheduling, shunt yard, depot and branch-line optimisation)			
10 Performance tracking/quality management			
11 Safety			
12 Coal line capacity extension			
13 Iron ore capacity extension			
14 Rolling stock maintenance optimisation			
15 Infrastructure maintenance optimisation (Protekon)			
16 Re-organisation implementation			
17 Facilities management			
18 Strategy projects (incl. divestments, vertical separation)			
			24 TBD

Source : Transnet (2005) Vulindlela – Transformation Lekgotla

3.9.11 Table 3.3 Project Vulindlela : Road map for the first 16 months



Source : Transnet (2005) Vulindlela – Transformation Lekgotla

3.9.12 Transnet’s Integrating Role

The Board of Directors of Transnet (2005) have changed the structure of the company from that of a holding company to a fully hands-on operating business. This new structure necessitated the appointment of a Chief Operating Officer which was effected from 01 May 2005. The new operating philosophy of Transnet ensures that the major transport divisions Spoornet, SAPO, NPA and Petronet do not operate in isolation as they did under the holding company arrangement. The EXCO and Board of Directors of Transnet are now beginning to review Transnet’s operation as a single logistics business thus ensuring that greater synergies and co-operation could be obtained from Transnet’s integrating role to assist businesses in South Africa to make their commodities more price competitive by reducing the cost of logistics. It is against this background that Transnet management prepared the aforementioned response in order to expediently deliver on efficiencies of its entire transportation network.

3.10 CONCLUSION

The overview of Spoornet and the extent of its operations and a brief review of its Predictable Service Strategy provides valuable insights with respect to the complex nature of the rail business. The rail marshalling yards are the nerve-centres for the movement of freight between the various origins and destinations. Poor service along this continuum of delivery i.e. between various origins and destinations coupled with the lack of block-train loads merely exacerbates the inefficiencies of rail transport.

Some of the major constraints affecting the efficiency of rail operations are:

- Poor maintenance of infrastructure and rolling stock
- Utilising obsolete operational methods with respect to shunting, communication and yard control systems
- Lack of investment in new technology

The shortage of stacking space within the port terminal areas and at the port/rail interface has also emerged as a major operational issue that hampers expeditious loading/unloading of cargo to and from vessels.

Transnet's detailed response to enhancing the efficiency of the port/rail interface and other rail corridors was also presented in order to emphasise the seriousness with which the parastatal has embraced government's challenge to lower transport costs.

Chapter 4 follows next. The research methodology utilised for this research study is discussed in detail. Questionnaires and semi-structured interviews were used to obtain primary data to address the research problem.

Comment [N34]: Where is your conclusion at the end of this chapter?

CHAPTER 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

The purpose of this chapter is to discuss the research methodology used to obtain information from a representative sample of individuals from the business units on the various issues identified under Section 1.3 and 1.4 in Chapter 1. According to Mouton (2003; 149) the research design of this study could be classified as an ethnographic study. This type of case study lends itself to utilising qualitative research due to the fact that a very small group of managers, who are specialists are responsible for the operations of the port/rail interface. By utilising a qualitative approach a better understanding of the issues related to the efficient functioning of the port/rail interface can be obtained through semi-structured interviews.

Questionnaires and semi-structured interviews will be used to obtain the primary data from respondents and the research findings would be utilised to address the research problem. The primary data collected would be textual data. According to Saunders, Lewis & Thornhill (1997; 158) secondary data relates to an organisation's records on personnel, communications, administrative issues, reports, minutes of meetings etc. These documents will be used in the research and shall be indicated later. It can therefore be construed that the organisation's policies and processes are deemed to be secondary data. Such data on operational practices has been reviewed elsewhere (Chapter 3) to ascertain its contribution to the Ports / Rail Interface at the Port of Durban.

Comment [N35]: Rather state that these documents will also be used in your research as will be indicated later

4.2 QUANTITATIVE OR QUALITATIVE RESEARCH

According to Saunders, Lewis and Thornhill (1997; 339) quantitative research is based on meanings derived from numbers and that the analysis is conducted through the use of diagrams and statistics.

Cooper and Schindler (2001; 139) state that quality is the essential character or nature of something, whilst the scope of qualitative research includes in-depth interviewing which is usually conversational rather than structured and case studies for an in-depth contextual analysis of a few events or conditions. **Qualitative research** shall be utilised in this study and would entail the use of semi-structured interview questions prior to handing out the questionnaire to the respondents.

4.2.1 Strategies used for qualitative analysis

Yin (1994) (in Saunders, 1997; 348) has identified two strategies to analyse qualitative research:

- Using a theoretical or descriptive framework to analyse qualitative data which is to be deductive by nature when commencing with a research project. To devise a theoretical or descriptive framework one needs to identify the main variables, components, themes and issues in the research project and the presumed relationship between them.
- Exploring qualitative data without a pre-determined theoretical or descriptive framework is considered to be inductive. This strategy is resource intensive and likely to involve a lengthy period of time.

The **deductive approach** has been chosen for this study.

4.3 RESEARCH DESIGN

According to Cooper and Schindler (2001; 134) research design is the plan and structure of an investigation to obtain answers to research questions. Methods and procedures are specified for the collection, measurement and analysis of data. Groenewald (in Van der Colff, 2001; 95) defines research design as “the general form or system according to which the study is executed” and have indicated that strategic and operational decisions are to be weighted simultaneously to ensure that the most appropriate design is chosen. Cooper and Schindler (2001; 134) offer the following classification for designs:

- a) A study may be viewed as exploratory or formal. Exploration usually helps to develop hypotheses or questions for further research. The goal of formal research is to test the hypotheses or answer the research questions posed.
- b) The method of data collection includes observational studies which entails inspection of activities without eliciting responses from anyone.
- c) Communication based studies occur when the researcher questions subjects and collects their responses by personal or impersonal means.

- d) If the research is concerned with finding out who, what, where, when or how much then the study is descriptive. If the research is concerned with learning why i.e. how one variable produces changes in another, it is causal.
- e) Cross-sectional studies are carried out once and represent a snapshot of one point in time. Longitudinal studies are repeated over extended period and study change and development. Longitudinal research may have constraints of budget and time. Robson (in Saunders *et al.*, (1997; 177) often employ the survey strategy.
- f) Case study - according to Hartley (in Van der Colff, 2001; 208) a case study can be defined as consisting of “a detailed investigation, often with data collected over a period of time, of one or more organisations, or groups within organisations, with a view of providing an analysis of the context and processes involved in the phenomenon under study”. Van der Colff (2001; 98) states that this method is primarily used when a dissertation focuses on a set of issues within a single organisation. An investigation into the efficiency of the port/rail interface is deemed to be a case study and it will be used to test the applicability of theory to the research performed.
- Measuring instruments used to gather data for analysis is either qualitative or quantitative or both. The emphasis however is more on qualitative methods. Questionnaires, observation, participant observation as well as interviews are some of the techniques utilised.
- g) Surveys
- Saunders *et al.* (1997; 76) state that surveys allow the collection of a large amount of data from a sizable population in a highly economical way. Based most often on a questionnaire, the data is standardised, allowing for easy comparison. Greater control over the research process is exercised using a survey approach. Much time will be spent designing and piloting the questionnaire and analysing results. Structured observation like in organisation and methods research and structured interviews i.e. using standardised questions also fall into this category.
- h) Saunders *et al.* (1997; 80) state that the use of multi-methods in the same study e.g. case study and surveys is known as triangulation. Triangulation ensures that the data are telling you what you think they are telling you. Semi-structured interviews shall be used to triangulate data collected by questionnaires for this research study. This process shall also assist to enhance the reliability of information obtained.

The research design applied to this study is **cross-sectional** with the focus of the research on Transnet owned businesses managing the port/rail interface in the Port of Durban. This could be deemed **to be a case-study**. **Questionnaires** and **semi-structured** interviews will be administered which can be construed as **triangulation**.

4.4 TYPES OF DATA COLLECTED

Mouton (2003; 108) refers to textual data which are rich in meaning and are difficult to capture in a short and structured manner and numeric data which refers to quantitative measurements which are well structured, easy to capture but not as rich in meaning as textual data.

Textual data will be the primary data type for this survey. Responses to the structured questionnaire which is based on the Likert Scale will be categorised in one of the five response categories and the percentage calculated for each category. The response category with the highest percentage will reflect the majority opinion of the respondents for that particular question.

4.5 DATA COLLECTION

4.5.1 Document Review

Spoornet and South African Port Operations have several documents that detail policies and procedures that can be utilised for the execution of the various operational activities.

Protekon the Consulting Engineering division of Transnet have also prepared detailed reports on infrastructure and operations assessments for these Clients on selected aspects of their business operations. Collectively this information has provided valuable insights on operational issues at the port/rail interface.

4.5.2 Questionnaires

According to Saunders *et al.* (1997; 243) questionnaires are used extensively to conduct surveys and to a lesser extent for experiment and case-study research strategies. The design of the questionnaire is of paramount importance to ensure the collection of precise data to answer research questions and to achieve your objectives. The design of the

questionnaire could influence the response rate, the reliability and validity of the data collected. Response rates, validity and reliability can be maximised by:

- careful design of individual questions
- clear layout of the questionnaire form
- lucid explanation of the purpose of the questionnaire
- pilot testing

The design of the questions were similar in structure to that of a closed question with the exception that the answer was not a “yes” or “no” but based on the Likert-style rating scale in which the respondent is asked to agree or disagree with each statement. The purpose of the questionnaires was explained to each respondent when the semi-structured interview was administered. The pilot testing was administered on the Executive Manager of KZN who has overseen developments of port and rail infrastructure in the greater Durban area.

Saunders *et al.* (1997; 271) refer to self-administered questionnaires which were handed personally to respondents and collected after completion. Interview administered questionnaires are generally open questions which is designed to encourage the interviewee to provide a more detailed answer; probing questions can be used to explore responses which are significant to the research topic and could also be used to seek an explanation from the interviewee whilst closed questions are used to obtain specific information or to confirm a fact or opinion. A semi-structured interview was used to achieve more details on specific themes.

4.5.3 Semi-structured interviews

According to Saunders *et al.* (1997; 215) with semi-structured interviews the interviewer will be guided by a set of questions or themes and shall attempt to establish rapport with the respondent to produce richer data. The advantage of a semi-structured interview is the flexibility in obtaining information based on themes eg. economic development, importance of exports, globalisation, infrastructure development and performance outputs at the port/rail interface. It also provides the opportunity to probe answers, to build on the interviewees responses and to address the sub problems under Section 1.4. A pilot survey will be conducted to ascertain the level of reliability, validity and ambiguity in respect of understanding the issues and the responses. The questions for the interview are in Appendix 5.

4.6 DESIGN OF QUESTIONNAIRES

Saunders *et al.* (1997; 259) state that the rating scale most commonly used is the Likert-style rating scale in which the respondent is asked to agree or disagree with each statement. Each response is given a numerical score to reflect the degree of favourableness. Likert scales help us to compare an individual's score with the distribution of scores of the group.

The questions are based on the sub-problems as stated under Section 1.4 and the literature review associated with them. The **questionnaire** appears under **Appendix 5** and the **semi-structured interview** questions under **Appendix 6**.

4.6.1 Question Methodology

In an attempt to obtain the best possible response to the questionnaire the procedure adopted in administering the questionnaire was as follows:

- The targeted individuals were advised of the purpose of the questionnaire and were given a copy to review
- A schedule was developed to undertake the semi-structured interview
- The questions in the semi-structured interview provided themes to probe the respondent's understanding of issues
- Other questions and issues were noted from discussions with respondents

4.7 DATA ANALYSIS

The data collection and analysis is based on the theoretical framework that was developed initially. According to Saunders (1997; 340) there would be a recurring theme emerging from the analysis in respect of satisfying the postulations developed in the theoretical framework. Yin (1994) (in Saunders *et al.*, 1997; 350) suggests the Pattern Matching and Explanation Building procedures for analytical purposes. The pattern matching procedure utilises a theoretical framework to which data is matched especially in respect of the generic questions that apply to all of the abovementioned respondents. The pattern matching procedure would be adopted to perform qualitative analysis as the explanation building procedure, although similar in concept to pattern matching is a time consuming iterative process. Saunders *et al.* (1997; 361) suggest that qualitative data should be

allocated to categories to assist with comprehension, identification of key themes and relationships.

4.7.1 Data Quality Issues : Reliability, Validity, Forms of Bias

- i) Reliability – Groenewald (in Van der Colff, 2001; 185) states that reliability can be related to the capacity of the observer to carry out the process of measurement consistently. If the subject of study does not change it can be assumed that the results would be the same from one measurement to the next. The questions were simple and unambiguous in order to facilitate easy understanding.

According to Cooper and Schindler (2001; 215) reliability relates to the notion of consistency. Reliability does contribute to validity but is not the only condition required for validity. Reliability is concerned with estimates of the degree to which a measurement is free of random or unstable error. The forms of reliability are stability, equivalence and internal consistency. A measure is said to be stable if you can secure consistent results with repeated measurements of the same person with the same instrument. Equivalence considers how much error may be introduced by different investigators (in observation) or different samples of items being studied (in questioning or scales). Internal consistency uses only one administration of an instrument or test to assess consistency or homogeneity among the items. The semi-structured interview was used to enhance the reliability of the responses to the questionnaire. This was achieved by discussing the themes around which the questions were based. The major themes of the study relate to operational efficiencies and constraints of the port/rail interface, infrastructure development, economic development, logistics management, integrated planning and the measurement of outputs.

- ii) Validity – refers to the question whether the instrument measures what it is supposed to measure i.e. has the researcher gained full access to knowledge and meaning from respondents. Semi-structured interviews were administered in this study to allow meanings to be probed. Triangulation will assist in enhancing validity. An audit can be performed to reconcile the respondents with their various inputs.
- iii) Forms of bias – interview bias occurs when the interviewer attempts to impose his own beliefs through the questions asked. Response bias is caused by perceptions of the interviewer or perhaps due to the sensitivity of probing questions. The semi-

structured interview discussion was relatively informal and was used to test the respondent's understanding of the themes around which the questions were based.

4.8 REPRODUCTION OF INFORMATION

A table will be prepared for each question which shall reflect the percentage obtained for each of the five categories of response based on the Likert scale. An average score shall also be computed to indicate the general agreement, disagreement or neutrality for a particular question. The responses to the semi-structured interviews have been summarised and presented in a text format. The aforementioned analysis appears under Chapter 6 – Research Findings.

4.9 SAMPLING

According to Saunders *et al* (1997; 125) sampling saves time when deadlines are tight and that data collection is more manageable when fewer people are involved. The smaller number for which you need to collect data means that more time could be spent designing and piloting the means of collecting the data.

Comment [N36]: First start with the population, sizes, groups etc. Use numbers as far as practically possible. From the population you can then determine sample sizes.

Comment [N37]: You have to be specific when quoting sources. Page numbers must be inserted in such cases.

4.9.1 Sampling Technique

Sampling is divided into two types (i) probability or representative sampling (ii) non-probability or purposive sampling.

With probability sampling the selection of sample from the population is usually equal for all cases. It is thus possible to answer research questions and achieve objectives by estimating statistically the characteristics of the population from the sample. Probability sampling is usually associated with surveys and experimental research. It is thus possible to answer research questions and achieve objectives by estimating statistically the characteristics of the population from the sample.

For non-probability sampling, statistical inferences cannot be made to answer research questions or objectives due to the probability of each case being selected is unknown. Thus non-probability sampling is more frequently used for case-study research as one can generalise from non-probability samples about the population. Non-probability sampling will be the method used in this study with the type being judgement sampling. Judgement sampling is appropriate for this study as it targets the decision makers that are responsible for the operations and the infrastructure development of the port/rail interface at the Port of

Durban. According to Cooper and Schinder (2001; 196) the goal of non-probability sampling is the discovery of a range or extent of conditions.

4.9.2 Sample size

The size of the population is 40 employees who are employed at various levels in operations management at Spoornet and South African Ports Operations. The questionnaires were given to senior members of the management team of the various terminals at the Port of Durban, the Bayhead Marshalling Yard, the Rail Operations Manager for the port, Senior Managers at NPA and Protekon. The researcher is looking for very specific information on the nature of operations of the port/rail interface, hence he has to limit the investigation to decision makers who are associated with the operations and development of the Port/Rail Interface.

The homogeneous sample cases are as follows:

Sample No.	Interviewee
No.1	Manager – City Terminals
No.2	Manager – Maydon Wharf
No.3	Manager – Container Terminal
No.4	Manager – Car Terminal
No.5	Manager Rail Operations, Bayhead
No.6	Manager Rail Operations, Point
No.7	Rail Client Manager – City Terminal
No.8	Rail Client Manager – Container Terminal
No.9	Manager Capacity Planning – SAPO
No.10	Manager Equipment Engineering – SAPO
No.11	Ports Engineer – NPA
No.12	Infrastructure Manager – NPA
No.13	Protekon Client Manager – City Terminals
No.14	Protekon Client Manager – Container Terminal
No.15	Protekon Senior Manager – Consulting Services

4.10 CONCLUSION

The qualitative research methodology would be utilised to obtain information from a representative sample of individuals associated with the operations management of the port/rail interface. Qualitative research is based on meanings expressed through words. The scope of qualitative research includes in-depth interviewing which is usually

conversational. Thus the use of semi-structured interviews would provide the researcher with a better understanding of the issues related to the efficient functioning of the port/rail interface.

The semi-structured interview was administered with the distribution of the questionnaire which assisted to establish the context of the survey. The themes of the semi-structured interview hinged on economic development, globalisation, price competitiveness of goods, infrastructure development and performance outputs at the port/rail interface. The questions asked in the questionnaire were investigative in nature and designed to obtain direct answers on issues contained in the research objectives.

Non-probability sampling would be used in this study with the type being judgement sampling. Judgement sampling is appropriate for this study as it targets decision makers that are responsible for the operations and infrastructure development of the port/rail interface.

Chapter 5 which follows presents details of the theoretical framework of the Balanced Scorecard and the Transformation Model. It is essential to obtain an understanding of these concepts as they form the basis for recommendations that are made in Chapter 7.

Comment [N38]: After reading your study I suggest that your research methodology chapter becomes ch 3 and your present chapter 3 becomes ch 4. In this way the theory forms the first 3 part and the practical the second part of the dissertation. Remember to add the page numbers as this is deemed necessary in this chapter.as you are referring to specific text within a book and not to the book in general.

CHAPTER 5

THEORETICAL FRAMEWORK FOR THE BALANCED SCORECARD AND THE TRANSFORMATION MODEL

5.1 INTRODUCTION

This chapter provides a review of the theoretical framework for the Balanced Scorecard and the Transformation Model in particular as they contribute quite significantly towards understanding objective numbers (iv) and (v) under Section 1.4, Research Aim and Objectives. Such understanding is deemed necessary as a prerequisite to the recommendations that are based on them and that follow in Chapter 7.

5.2 THE BALANCED SCORECARD AS A MANAGEMENT SYSTEM

Comment [N39]: Is it a system or a management tool??

Implementing a new operating strategy requires ownership by all those affected by the change. In addition to rolling out the new strategy it is also essential to measure the performance outputs and to take relevant action should the desired results not materialize. Regular performance reviews will certainly assist to ascertain to what degree the revised operations strategy has been able to embed itself within the port and rail terminals.

According to Kaplan and Norton (1996) the Balanced Scorecard is a structure that translates mission and strategy into a coherent set of objectives and performance measures that view organisational performance from the perspectives of financial, customer, internal business process and learning and growth. The four perspectives permit a balance between short and long-term objectives, between desired outcomes and the performance drivers for those outcomes, and between hard objectives measures and softer more subjective measures.

Top management is generally responsible for the formulation of the business and operating strategy which then has to be translated to organisational objectives. The communication of the Balanced Scorecard's Strategic objectives and measures encourages dialogue between business units and amongst the different levels of management. This process enables the organisation to:

Comment [N40]: One would assume that the aim and objectives of the organisation are first set and that strategies are then developed to achieve these objectives. By first developing strategies and then objectives the cart is put in front of the horse.

- a) plan and set targets through benchmarking
- b) identify mechanisms and provide resources to achieve these targets by focussing on continuous improvement, re-engineering and transformation programs

- c) by establishing short term objectives for financial and non-financial measures on the Scorecard

This proposal is in keeping with the new strategic direction of Transnet discussed under Section 1.2.1 and would contribute immensely in tracking the benefits of the large investments that are being made by the major transport divisions.

5.2.1 Financial Perspective

Kaplan and Norton (1996; 51) state that the following financial themes drive business strategy and provide linkages across all four scorecard perspectives.

- Revenue growth and mix – Cost reduction/productivity improvement
- Asset utilisation/investment strategy
- Reducing risk.

The financial objectives are typically return on capital employed (ROCE), economic value added (EVA), operating income, gross margin and cash flow. The revenue and growth mix refers to expanding product and service offerings, reaching new customers and markets, and repricing products and services. The cost reduction and productivity objective refers to efforts to lower direct costs of products and services, reduce indirect costs and to share common resources with their business units. For asset utilisation, working capital levels should be reduced to support a given volume of business. Greater utilisation of assets, using resources efficiently and the disposal of poor performing assets will improve return on investment. The management of risk is extremely important e.g. if actual results are below expectations, this may lead to unexpected borrowings and thus a higher risk to the business. The long-term financial objective is to provide value to shareholders. The financial themes are linked to the sequence of actions that must be undertaken in the other perspectives to deliver long-term financial performance which is not necessarily accounting related. Hence every measure selected in each perspective should be part of a link of cause-and-effect relationship that culminates in improved financial performance.

5.2.2 Customer Perspective

Core measures under this perspective are market share, customer retention, customer acquisition, satisfaction and profitability. If businesses are to achieve long-run superior financial performance they must create and deliver services that are valued by customers. Hence the mission and strategy statements must be translated into specific market and

customer based objectives. Market share, customer retention and acquisition relate to targeting customer segments in order to grow the business. Customer satisfaction is important to achieve loyalty, retention and profitability. Unique products and service attributes can create value adding relationships for which some customers are willing to pay a premium in price.

Image and reputation reflect the intangible factors that attract a customer to a company. It is important to establish a relationship with this customer segment through advertising and differentiating the product offering. A customer satisfaction measure should be introduced to measure satisfaction amongst the different customer segments.

The value proposition delivered to customers is based on objectives and measures from the following attributes:

- Product and service attribute – functionality, quality and price
- Customer relationship – quality of purchasing experience and personal relationships
- Image and reputation

Time, quality and price are major competitive dimensions that customers continuously seek. On time delivery has a major impact on the logistics chain, making reliability of delivery a critical element of any production environment e.g. Toyota's inventory operates on the just-in-time principle which implies that it carries zero inventories of parts and raw materials and allows only a one hour time window for items to be delivered. Short lead times for introducing new products and services are a valued performance driver for customer satisfaction.

Providing excellent quality may still offer opportunities for companies to distinguish themselves from their competitors. Customers take for granted that suppliers will produce according to product and service specifications. Customers perceived quality measures must be included in the scorecard to track the extent of quality failure before it commences to affect the loss of customers.

Price sensitive customers are looking for low costs and not low prices. Low cost implies meeting the buyer's specifications, delivering defect free products, just-in-time thus reducing inventory costs. Low prices may not meet the aforementioned criteria, in fact it could cost the buyer more in lost production time through rework.

5.2.3 Internal Business Process Perspective

Objectives and measures for this perspective are derived from explicit strategies to meet shareholder and targeted customer expectations. The internal process value chain commencing with the innovation process – providing solutions for customer's future needs through to the operations process which is responsible for delivering products and services provides the basis for measurements. Typical measures are cost, quality, throughput and time measures. However for sustainable competitive advantage these measures must outperform those of competitors.

The internal-business-process perspective generic value chain model identifies customer needs and satisfies customer needs through the process of innovation, operations and post sale service. An effective, efficient and timely innovation process is paramount to a company's success. The innovation process is a major link in the value creation as companies design and develop new products and services that enable them to reach new markets and customers and to satisfy customers newly identified needs. Information on markets and customers provides the input for the product/service design and development process. Many companies achieve competitive advantage from a continued stream of innovative products/services thus highlighting the importance of research and development as part of the business value chain.

The operations process starts with a customer order and ends with the delivery of the product or service to the customer. The process stresses efficient, consistent and timely delivery of products and services to customers. Total quality management, productivity, capacity utilisation, time based practices and cost form part of the critical performance measures. Costs used to be measured for every aspect of the process e.g. the use of activity based costing to track the performance of the entire process and to consider improvements.

The final stage in the internal value chain is post sale service which includes warranty and repairs, defects and returns and the processing of payments. Time, cost and quality measures can be used to target customers expectations.

5.2.4 Learning and Growth Perspective

The objectives under this perspective are the drivers for achieving and/or exceeding the required outcomes for the first three perspectives. Organisations must invest in people,

systems and procedures to achieve long-term financial growth objectives. There are three principle categories for this perspective:

- a) Employee capabilities
- b) Information systems capabilities
- c) Motivation, empowerment and alignment

(a) Employee capabilities

Organisations realise the importance of investing in people to continually improve the standards through benchmarking for internal processes, customer responses and for future performance. The shift into information age thinking requires the reskilling of employees to achieve organisational objectives. The use of the Internet for employees and customers to process orders will significantly reduce the processing costs of transactions when compared with a conventional system.

Competency upgrades are essential in maintaining the provision of superior levels of services or products to clients. This aspect is deemed to be the value added by clients who expect cost effective services or products. Innovation plays a major role in achieving the aforementioned and should be developed as a culture within the organisation. Employees need to react to customers requests and to proactively anticipate customers needs. This may entail change in roles and responsibilities. The extent of reskilling depends on the company's needs. Strategic reskilling will occur where a focused portion of the work force would require a high level of new strategic skills. Competency upgrade occurs when some portion of the workforce requires an upgrade of core skills. The timing and duration of these initiatives are important to achieve success.

Core employee measurements are i) employee satisfaction ii) employee retention and iii) employee productivity.

(i) Employee satisfaction

Employee morale is important and companies should measure employee satisfaction through a rolling survey by randomly choosing employees each month. Elements in the survey could include:

- Involvement with decisions
- Recognition for doing a good job
- Access to information to do a job well

- Use of creativity and initiative
- Overall satisfaction with the company

(ii) Employee retention

An organisation making long-term investments in its employees cannot sustain unwanted departures and thus a loss in intellectual capital. Loyal employees know the values of the organisation, the processes and the needs of the customers. Employee retention is measured as a percentage of key staff turnover.

(iii) Employee productivity

Employee productivity is an outcome measure of the aggregate impact of enhancing employee skills and morale, innovation, improving internal processes and satisfying customers. A typical measure is revenue per employee. Ideally the revenue should increase with a limited number of employees. Another measure could be the value added per employee which is obtained from subtracting externally purchased materials, supplies and services from the revenue.

(b) Effective information systems are required to provide feedback to employees.

It should ideally be real-time and should provide information on improvement programmes, eliminate defects and reduce costs. Computer-controlled operations and advanced information and communications can reduce costs and time in anticipating customer's needs by having direct access to customer's information systems.

(c) Motivation, empowerment and alignment

The organisational climate must exist for employee motivation and initiatives and the ability to make decisions and take actions. Management can publish successful suggestions and illustrate the benefits and improvements achieved. Motivation and the empowerment of employees can be measured by the number of suggestions made by employees and the number implemented.

Once the measures and objectives of the scorecard have been developed for the Business Unit it must be cascaded downward within the organisation to staff level. Employees should have their activities and goals linked to the scorecard objectives and measures for organisational alignment.

Measures of team performance are necessary where teams are involved with product development, customer service and internal operations. The team concept can be extended further to include gain-sharing. Gain-sharing distributes rewards to all team members when the team achieves a common goal. The measures communicate clearly the corporate objectives for individuals to work effectively in teams. This initiative lends itself extremely well for lower grade employees who are employed at the port and rail terminals. The measures would differ from those provided in the format under Section 7.3.2. The financial measures would relate to performing activities below the costs set by management for undertaking such activities. This is directly associated with efficiencies which implies that time-motion studies would have been undertaken to set targets. The learning and growth perspective will ensure that training plans are in place and that appropriate training takes place. Peer pressure will assist under performers in a team to pull their weight in order that the bonuses of the team are not compromised.

5.2.5 The Balanced Scorecard as a tool for change

The Scorecard as a management tool would ensure that two-way communication would be implemented to foster a good management – employee relationship. Employee buy-in is absolutely necessary to understand what Transnet's new strategic direction and investment plan is meant to deliver as far as enhancing efficiencies at the port/rail interface and reducing the cost of logistics to businesses in South Africa. Sharing this vision with employees will create alignment and commitment and can be consolidated by introducing the Scorecard for individuals (in management), teams and departments.

Carnall (1995) states that the following are some issues that need to be reviewed when implementing change:

- Management must keep everyone informed, allow for questions and clarification and show how change fits business needs and plans
- Management must develop clear objectives, plans and a timetable. Review processes and focus meetings to roll-out the Scorecard must have the support of top management
- Measurements and rewards could be a motivator to enhance commitment especially if management and employees together set targets and benchmarks.

5.3 OPERATIONS – A PROCESS OVERVIEW

Pycraft, Singh and Philela (1997) state that there are general classes of activities that apply to all types of operations no matter how functional boundaries have been drawn. These activities include:

(i) Strategic Objectives for Operations

The operations management team must understand what it is trying to achieve i.e. how the operation should contribute to the organization achieving its long-term goals and to translate these goals into performance objectives. Such performance objectives may include **quality** of its goods and services, the **speed** with which they are delivered to customers, the **dependability** with which the operation keeps its delivery promises, the **flexibility** of the operation to change what it does and the **cost** of producing its goods and services.

(ii) Developing an operations strategy

At a business level, operations strategy is defined as the total pattern of decisions and actions which set the role, objectives, and activities of the operation so that they contribute to and support the organisation's business strategy.

The micro operations strategy, which may be developed around the various processes in turn, will contribute to and support the operations strategy of the business. This implies that each unit's operations strategy contributes to the strategic objectives of the next level up in the hierarchy. Customers influence the priority an organization gives to its performance objectives. A firm's competitive factors determine how well its operation function excels at the performance objectives.

(iii) Process Layout

According to Pycraft, Singh and Phihlela (1997) the prime objective of a process layout is to minimize the cost of operations and that the general approach to designing a process layout is the following:

- Collect information to understand the flow between various activities
- Draw up a schematic layout showing the activities and flow between them, putting the work centres with the greatest flow closest to each other

- Adjust the layout to take into account constraints of the area into which the layout must fit
- Ascertain the effectiveness of the layout in terms of movement i.e. total distance traveled and try to reduce costs
- Exchange any two work centres to check if it will reduce total distance or the cost of movement.

In most examples of process layout the prime objective is to minimize the cost of the operation, which is associated with the flow of transformed resources or services through the operation. In the detailed design stage of any type of layout the following decision needs to be made:

- What cycle time is needed?
- How many stages are needed?
- How to cope with task-time variations?
- How to balance the layout?
- How to arrange the stages?

The aforementioned decisions are required to review current operations or new operations. The calculation of cycle times of activities, the number of stages in an operation and the task-time variations for certain activities determine whether there is a loss in processing time or the need to introduce more resources in the operation for the loss of efficiency resulting from work time variation. This simplistic model forms the basis to determine the efficiency of the workings of most types of operations and could be applied to review the throughputs at the port/rail interface and at the Bayhead Marshalling Yard.

5.4 A SIMULATION MODEL

Pycraft, Singh and Phihlela (1997; 118) also postulate that simulation based on a model or computer-based software could be used to predict whether the layout is functional and the design cost effective from an operations point of view. Simulation of some sort can assist designers to explore the consequences of a design decision without having to construct the product service or process. If a model of the design is made the results can help a designer to either confirm the original results or make adjustments based on the outcomes of the simulation. Simulation is useful in the design of complex operation processes e.g. computer simulation is used to redesign a shipping port. The designer can gain an

understanding of how the detailed design of berths can affect the turnaround times of ships loading and unloading cargoes at the port. This illustrates the fact that the provision of infrastructure is highly interdependent with operations and vice-versa.

5.5 THE TRANSFORMATION MODEL

Pycraft, Singh and Philela (1997; 10) state that all operations are input – transformation – output processes which produce goods and services or a mixture of the two by the transformation process. A logistics Transformation Model has been developed for the port/rail interface and appears under Section 7.3.1.

5.5.1 Inputs

Inputs could be transformed resources which an operation will utilise and is usually a mixture of materials, information and customers. Very often one of these is dominant in an operation. A motor vehicle plant as an example transforms steel, plastic cloth and other materials to make them into motor vehicles. A bank on the other hand processes customers by processing requests and information regarding their financial needs.

Inputs could also be referred to as transforming resources of which there are two types viz.

- (i) Facilities – buildings, equipment, plant and process technology of the operation.
- (ii) Staff – those who operate, maintain, plan and manage the operations.

The exact nature of both facilities and staff differ between operations. Each type of operation has a specification for the type of building and equipment required and a set of skills needed by staff in order to make an effective contribution towards a particular type of operation.

5.5.2 The Transformation Process

Operations which process materials like manufacturing operations generally transform the physical properties of the inputs. Other operations which process materials do so to change their location e.g. parcel delivery companies or to change their possession or ownership e.g. retail operations.

Information processing allows operations to transform their informational properties that are the shape and form of the information, as done by accountants.

Operations which process customers also transform them in a variety of ways e.g. hairdressers and cosmetics surgeons could change some physical properties whereas most entertainment services such as music, theatre and television as a customer – processing operation are concerned with the transforming of the physiological state of their customers.

5.5.3 Outputs

The outputs from the transformation process are goods and services which are different in nature. Goods are tangible e.g. a television set or newspaper whereas a service is intangible i.e. you can often see or feel the results of the service but you cannot touch it. Goods can also be stored for a short time after their production whilst services are non-storable. Goods because of their tangibility can be transported. A service cannot be transported. Goods are generally produced prior to the customer seeing or receiving them. A service is often produced simultaneously with their consumption e.g. when buying something the service is rendered or consumed as the seller offers you your purchase.

In the production of goods customers have a low contact level with the operations which produce goods. With services, because they are produced and consumed simultaneously there is high contact between customer and operation.

The quality of goods is reasonably evident through the judgment of the customer whereas in services the customer not only judges the outcome of the service but also the aspects of the way in which it was produced e.g. courteous service from a shop assistant.

5.6 ADVANTAGES, DISADVANTAGES AND LINKAGE OF THE BALANCED SCORECARD AND THE TRANSFORMATION MODEL

According to Kaplan and Norton (1996) the Balance Scorecard is the ideal framework to translate Transnet's new strategic direction into a coherent set of objectives and performance measures. They also state that this process must be driven by top management and cascaded to all operational levels of the business. A major disadvantage would be if Transnet did not obtain professional assistance to develop and implement the scorecard company wide. The implementation process would involve several workshops with top and operations management to obtain information about objectives, measures, targets and resistance to the scorecard. Kaplan and Norton (1996) also indicate that a typical timeframe for the roll out of the scorecard from inception is about 16 weeks and that ownership of the process resides with senior management.

The application of the Transformation Model to re-engineer the various processes also requires specialist expertise that is internationally recognised. Ideally a management consulting company with proven expertise in a logistics environment would be best suited to undertake the re-engineering exercise. Constant monitoring, review and training programmes are necessary to embed the best practices that have been implemented.

The Balanced Scorecard is a typical measurement tool that can be utilised to plan and set targets and to measure and monitor what has been achieved at regular intervals. The four perspectives provide focus on achieving short and long term objectives, desired outcomes and the measures responsible to achieve these outcomes. The Scorecard as a framework provides structure to performance management measurement and the strategic objectives for each perspective of the Scorecard. The Transformation Model is associated with the operations function of the various facilities comprising the port/rail interface. The model provides a framework to ensure that any re-engineering exercise will make processes concise and efficient, utilising the least amount of resources to achieve maximised outputs. The operational processes focus on productivity, capacity utilisation, cycle times and cost. These elements have a linkage to the performance measures of the Internal Business Process Perspective and the management of costs under the Financial perspective. Refer to Fig 7.2 and Fig 7.5 for examples of measures.

5.7 CONCLUSION

The Transformation Model is fundamental to the understanding of the various processes that are associated with the workings of the port/rail interface. The outputs are a critical element of the transformation process. The benefit derived from these outputs can be enhanced through their assimilation into the four perspectives of the Balanced Scorecard. The Balanced Scorecard is essentially a management tool to monitor the outputs/targets of the various processes associated with the workings of the port/rail interface and to track continuous improvement progress.

The advantages and disadvantages of the Balanced Scorecard and the Transformation Model was provided to demonstrate the enormous task Transnet top management has in terms of commitment to implement these initiatives with the aid of professional practitioners. The direct linkage of the outcomes of the operational processes of the Transformation Model as measures in the Financial and Internal Business Process Perspectives reinforces the strong inter-relationship of these instruments.

Transnet has embarked on a major re-engineering exercise as discussed under Section 3.9. A major portion of the exercise is the review and redesign of processes and production optimisation which is central to what the Transformation Model advocates. In order to maximise the benefits of re-engineering and to make the best practices sustainable it is necessary to measure and monitor the outputs and targets continuously. The Balanced Scorecard is a logical management tool to facilitate the ongoing review of outputs and targets. Any re-engineering exercise that does not measure outputs will negate the purpose of the exercise resulting in a wastage of financial and human resources and defeating the central purpose of reducing the cost of logistics to businesses in South Africa.

The Research Findings follow in Chapter 6. This chapter focuses on the analysis and outcomes from the structured questionnaire and discussions arising from the semi-structured interviews.

CHAPTER 6 RESEARCH FINDINGS

6.1 INTRODUCTION

The purpose of the questionnaires was to obtain an understanding of the constraints encountered in the workings of the port/rail interface and its impact on the ability of rail to render a cost effective and efficient service. The questions were designed to probe the respondent's opinions and evaluation of the current state of problems experienced. The responses from the questionnaires and the semi-structured interviews would provide adequate information to fulfill the objectives of the study and to provide recommendations on how to enhance the efficiencies at the port/rail interface.

This chapter focuses on the analysis and outcomes from the structured questionnaires and is supplemented with details from discussions arising from the semi-structured interview. The analysis took the form of a summary that was prepared for each question and the different views and perceptions of the sample were compared and commented upon. A table was prepared for each question reflecting the five categories of the Likert scale, the percentage obtained for each category and the average score for each question. The average score would indicate the extent to which agreement, disagreement or neutrality prevailed for a particular question.

6.2 ANALYSIS OF FINDINGS

The questions were purposely designed to provide a critical review of the service provided by rail to the Port of Durban. On the one hand we have SAPO, which is generally efficient in its operations in most terminals, handling higher tonnages of cargo and on the other we have Spoornet which has performed poorly and lost major market share to road transport in a growth scenario. The criticism leveled at Spoornet with particular reference to the general freight business relates to all areas of its operations.

Question 1 : The Bayhead Marshalling Yard (BMY) utilizes modern rail operation practices.

	Percentage
Average score	2,25 or 45,0%
% Strongly disagree	25,0%
% Disagree	41,7%

% Somewhat	25,0%
% Agree	0,0%
% Strongly agree	8,3%

The response to this question suggests that most of the respondents disagree that the BMY utilises modern rail operation practices. Respondents from most of the transport divisions did not concur with the statement which implies they do possess some understanding of the operational issues prevalent in the Yard. Respondents who did not have any interaction with the Bayhead Yard tended to agree with the statement.

Question 2 : The short term capacity planning of the BMY is in keeping with Client requirements.

	Percentage
Average score	2,67 or 53,3%
% Strongly disagree	8,3%
% Disagree	25,0%
% Somewhat	58,3%
% Agree	8,3%
% Strongly agree	0,0%

The relatively low score of 53,3% reinforces the perception that capacity planning in the Bayhead Marshalling Yard is not a rigorous exercise. The fact that rail's market share has dropped drastically supports this opinion intimating that capacity is not an operational constraint. However the reality is that about 1300 unserviceable rail wagons are being staged in the Yard occupying valuable operational capacity.

Question 3 : That the BMY handles a diverse range of cargoes.

	Percentage
Average score	4,00 or 80,0%
% Strongly disagree	0,0%
% Disagree	0,0%
% Somewhat	16,7%
% Agree	66,7%
% Strongly agree	16,7%

The high average score of 80% suggests that respondents are of the opinion that the Bayhead Marshalling Yard does handle a diverse range of cargoes. During the semi-

structured interview process respondents indicated that cargo type was predominantly general goods transported by 'DZ' type wagons. They were also aware that steel coils, fuel, grain, timber and chemicals are the other cargo types handled at the Yard.

Question 4 : The volumes of the different cargoes reflect a declining trend.

	Percentage
Average score	3,33 or 66,7%
% Strongly disagree	0,0%
% Disagree	33,3%
% Somewhat	16,7%
% Agree	33,3%
% Strongly agree	16,7%

The relatively high average score of 66,7% indicates that respondents are aware through Spoornet's operating results which is available to the management cadre of the various divisions on a monthly basis that heavy losses are incurred on the general freight routes due to a sharp reduction in the tonnages transported. Financial results of Transnet tend to be more widely known amongst employees. Unfortunately the same level of understanding does not exist on the operational constraints that are inhibiting service delivery.

Question 5 : The long-term planning is based on aggregated demand forecasts.

	Percentage
Average score	3,17 or 63,3%
% Strongly disagree	0,0%
% Disagree	25,0%
% Somewhat	33,3%
% Agree	41,7%
% Strongly agree	0,0%

From the result obtained for this question it would appear that long-term planning does to a limited extent occur. However what has emerged from discussions is that Spoornet is good at capturing information on a database of what trips and tonnages of cargo were conveyed to the various destinations and this information is merely in the form of data. Very little effort is put into analyzing the data to determine trends and future capacity requirements. Views expressed indicate that the formulation of a Rail Master Plan will change the situation.

Question 6 : That there is a planned maintenance programme for BMY.

	Percentage
Average score	3,25 or 65,0%
% Strongly disagree	0,0%
% Disagree	16,7%
% Somewhat	58,3%
% Agree	8,3%
% Strongly agree	16,7%

Although only 16,7% of the respondents disagree the others were not entirely convinced that there exists a planned maintenance programme for the Bayhead Marshalling Yard. Employees at the Yard reinforced the researcher's opinion that maintenance is ad hoc and emergency in nature. This is reflected by the poor state of infrastructure in the Yard viz. rusted masts for OHTE, poor drainage, lack of ballast and rusted rail lines.

Question 7 : The present condition of the rail lines in the yard makes operations unsafe.

	Percentage
Average score	3,0 or 60,0%
% Strongly disagree	0,0%
% Disagree	33,3%
% Somewhat	33,3%
% Agree	33,3%
% Strongly agree	0,0%

The respondents associated with the workings of the Bayhead Marshalling Yard agreed with the question whilst others indicated 'somewhat'. Protekon's report on the assessment of the condition of the infrastructure highlighted the unsafe conditions in the Yard. Minor derailments have been experienced as a result of the poor condition of the rail lines.

Question 8 : The present condition of the electrification in the yard makes operations unsafe.

	Percentage
Average score	3,08 or 61,7%
% Strongly disagree	0,0%
% Disagree	33,3%
% Somewhat	33,3%

% Agree	25,0%
% Strongly agree	8,3%

The response obtained for this question is very similar in nature to Question 7. Due to the severe rusting of the masts for the OHTE, Spornet short of transgressing the requirements of the Health and Safety Act have embarked on a refurbishment programme to replace the masts in selected areas of the Yard which are utilised more often. In other areas the OHTE service has been decommissioned and the masts removed if they did pose a hazard to operations.

Question 9 : All employees understand their roles in the yard operations.

	Percentage
Average score	3,50 or 70,0%
% Strongly disagree	0,0%
% Disagree	16,7%
% Somewhat	25,0%
% Agree	50,0%
% Strongly agree	8,3%

The result obtained tends to imply that respondents are of the opinion that employees in the Yard have an understanding of their roles in the operation of the Yard. However from discussions held with some of the respondents they have indicated that many of the highly skilled employees have taken early retirement due to the poor financial performance of Spornet and affirmative action interventions. The decline in tonnage throughputs in the Yard may have masked the real issue of the loss of key skills.

Question 10 : The operations in the yard are efficient.

	Percentage
Average score	2,67 or 53,3%
% Strongly disagree	16,7%
% Disagree	25,0%
% Somewhat	33,3%
% Agree	25,0%
% Strongly agree	0,0%

The response obtained indicates that the respondents are in disagreement with the statement. What has emerged from discussions with the Bayhead Marshalling Yard

personnel during the survey and from other studies that were performed by Protekon over the past ten years supports this view. One of the key reasons cited for this situation is the departure of skilled operational personnel for the reasons provided under Question 9. No measures exist to evaluate the turnaround time of wagons once a train is admitted into the Yard. The high rate of absenteeism amongst the operational personnel and the inadequate training of recently appointed personnel are major contributory factors of inefficiency. The Balanced Scorecard perspective on Internal Business Processes is the type of intervention required to create benchmarks and manage continuous improvement. Protekon shared the success it had with the Balanced Scorecard with Spoornet persons having utilised it for the past 8 years.

Question 11 : There is a training and development plan for the various jobs in the yard.

	Percentage
Average score	3,33 or 66,7%
% Strongly disagree	0,0%
% Disagree	16,7%
% Somewhat	41,7%
% Agree	33,3%
% Strongly agree	8,3%

In terms of the Skills Development Act, Transnet is heavily committed to providing appropriate training for its personnel. A skills audit is performed to identify the training needs. However due to the poor management of personnel not much occurs in terms of providing a structured training plan. The high rate of absenteeism amongst employees further exacerbates the issue because employees cannot be released for training at the expense of operations coming to a complete standstill. In reality training plans do exist but lag severely in its implementation. The response obtained suggests some disagreement with the question which perception does hold good.

Question 12 : Employees productivity in the Yard is measured using a performance management system.

	Percentage
Average score	2,83 or 56,7%
% Strongly disagree	0,0%
% Disagree	33,3%
% Somewhat	50,0%

% Agree	16,7%
% Strongly agree	0,0%

Most respondents disagreed with the statement intimating that a performance management system does not exist. Respondents associated with the operations of the Yard indicated that they do not have productivity targets to achieve. The Yard operates as a cost centre which reinforces the culture of poor service delivery. The decline in tonnages, the cancellation of trains because of the frequent breakdown of rolling stock and locomotives are some of the other frustrations employees have to contend with. Some respondents intimated that an external consultant should be commissioned to design and implement schemes to enhance motivation e.g. to reward exceptional performance. If rewards are used as motivators they need to be integrated into an appraisal system for individual and group achievements.

Question 13 : The process flows of the entire yard are understood by the respective employees

	Percentage
Average score	3,17 or 63,3%
% Strongly disagree	0,0%
% Disagree	25,0%
% Somewhat	33,3%
% Agree	41,7%
% Strongly agree	0,0%

The process flows were developed for the operations of the Yard by Protekon in August 1996. The respondents associated with the operations of the Bayhead Yard agreed with the statement due to the fact that all activities associated with the making-up of trains, breaking-up of trains and shunting operations do occur. Other respondents are of the perception that process flows are not well understood due to encountering incidents of rail trucks carrying particular consignments disappearing in the Yard or are mistakenly rerouted to the wrong destination.

Question 14 : The rail layout is optimal for current operations within the Port.

	Percentage
Average score	2,00 or 40,0%
% Strongly disagree	33,3%
% Disagree	41,7%

% Somewhat	16,7%
% Agree	8,3%
% Strongly agree	0,0%

There is major disagreement with this statement. Respondents indicated that the Yard and other rail sidings were designed and became operational in the early 1950's. The nature of traffic inbound and outbound suited the current layout of the Yard until the early 1990's. The deregulation of road transport in 1988 and the advent of South Africa's democracy changed traffic patterns substantially i.e. causing substantial increases in most commodities. The characteristic of loads became block in nature which meant they could be taken direct from the quayside to its onward destination or vice-versa. The rail tracks adjacent to the quayside were not practical as the placement and retrieval of rail trucks cut across the staking areas adjacent to the quayside and impeded the stacking, loading and unloading of cargo from the various modes of transport. There was general consensus that a rail terminal is a more efficient operation.

Question 15 : The capital expenditure programme for the development of the Port/Rail interface is adequate.

	Percentage
Average score	2,08 or 41,7%
% Strongly disagree	33,3%
% Disagree	25,0%
% Somewhat	41,7%
% Agree	0,0%
% Strongly agree	0,0%

There is general disagreement with this question. Due to the increased growth in port traffic it became necessary to revisit the operational philosophy of the terminals. Rail tracks that served the quayside are in the process of being eliminated. There is also an acute shortage of stacking areas, open and enclosed. Creating road and rail terminals behind the stacking areas i.e. on the landside is now becoming the new norm in the port/rail interface environment. These additional infrastructure requirements need massive capital expenditure. The respondents are quite aware of the constraints inhibiting efficient operations and have thus disagreed with the statement.

Question 16 : Employees participate in improvement programs to enhance efficiency.

	Percentage
Average score	2,58 or 51,7%
% Strongly disagree	8,3%
% Disagree	41,7%
% Somewhat	33,3%
% Agree	16,7%
% Strongly agree	0,0%

There is generally disagreement on this issue due to the lack of employee participation in continuous improvement programs. It would appear that operations managers take decisions without or very little consultation when considering alternative methods to improve efficiencies. This appears to be the case in the port and rail terminal / yard environment as reflected by the 'disagree' responses received from operational personnel both in SAPO and Spoornet. Enhancing efficiencies is a company-wide initiative and requires to be incremental and well structured. The Balanced Scorecard as proposed in Chapter 5 has the right type of framework to implement change and continuous improvement programs.

Question 17 : The operations personnel have identified bottlenecks in the intermodal interface processes.

	Percentage
Average score	2,92 or 58,3%
% Strongly disagree	8,3%
% Disagree	16,7%
% Somewhat	50,0%
% Agree	25,0%
% Strongly agree	0,0%

The result obtained would intimate that this occurs in isolated instances and that there isn't a structured approach to addressing constraints. The lower categories of operational personnel on the port and rail side tend to have a narrow view i.e. to concentrate on their side of the operations. What could be an appropriate strategy is to interchange employees between SAPO and Spoornet for periods between 3 to 6 months in order for each business to obtain a broader and more detailed understanding of each parties operational requirements thus generating great synergies in operations and efficiencies.

Question 18 : The operations strategy for the interface is reviewed regularly.

	Percentage
Average score	2,67 or 53,3%
% Strongly disagree	8,3%
% Disagree	41,7%
% Somewhat	25,0%
% Agree	25,0%
% Strongly agree	0,0%

The port/rail interface has been a much neglected environment. The result obtained and the views expressed indicate the lack of integrated planning. The responses to many of the aforementioned questions convey a similar sentiment. Transnet's new business strategy, operational philosophy and massive capital expenditure program will eliminate the silo type of mentality that prevailed within the various transport divisions. The logistics management approach by Transnet in addressing the need to make goods price competitive is a 5 to 20 year challenge to eliminate operational constraints and to provide additional capacity.

Question 19 : The performance objectives are monitored on a regular basis.

	Percentage
Average score	3,00 or 60,0%
% Strongly disagree	8,3%
% Disagree	8,3%
% Somewhat	58,3%
% Agree	25,0%
% Strongly agree	0,0%

There appears to be some consensus that performance objectives are monitored on a regular basis. In discussions the primary concern hinged around meeting financial targets. In the case of the Bayhead Marshalling Yard the objective was not to exceed budget due to it being a cost centre. In the case of the port terminals the focus was on improving profit targets. Improving efficiencies did not emerge as a high priority intervention i.e. to do more with fewer resources. Budgets could be inflated hence the focus on efficiencies is lost.

Question 20 : The maintenance budget is based on the planned maintenance programme.

	Percentage
Average score	2,83 or 56,7%
% Strongly disagree	8,3%

% Disagree	16,7%
% Somewhat	8,3%
% Agree	16,7%
% Strongly agree	0,0%

There is disagreement on this issue. It is common knowledge amongst the various business divisions that the previous focus of Transnet had been on short term financial gain. This was achieved at reducing the budget on maintenance. Hence any maintenance work that was undertaken was ad hoc in nature or emergency. The lack of planned maintenance has resulted in severe backlogs in maintenance. This applies to infrastructure and rolling stock. Major refurbishment programmes which is near equivalent to replacement are now required to address the backlog in maintenance albeit at a much higher cost. Performing this work in an operational environment means that areas of the terminal will be out of commission for several months for the work to be undertaken in an uninterrupted manner and in the shortest possible time scale. Spoornet is required to make an interim investment of R14 billion over the next 5 years in infrastructure refurbishment and on new rolling stock in order to enhance its level of service.

Question 21 : That a simulation model for the capacity of the BMY exists.

	Percentage
Average score	2,25 or 45,0%
% Strongly disagree	8,3%
% Disagree	66,7%
% Somewhat	16,7%
% Agree	8,3%
% Strongly agree	0,0%

There is disagreement on this issue. One of the respondents involved in planning at Spoornet agreed but indicated that the program is not used. The Rail Master Planning exercise would require to critically review operations and capacity expansion in order to optimise capital expenditure in creating capacity for future growth. This review may have to be extended to incorporate the major rail corridors that are served by the Bayhead Marshalling Yard.

Question 22 : That the level of service to the Port of Durban is in keeping with the Client's requirements.

	Percentage
Average score	1,92 or 38,3%
% Strongly disagree	41,7%
% Disagree	41,7%
% Somewhat	0,0%
% Agree	16,7%
% Strongly agree	0,0%

The low score achieved for this issue clearly illustrates that the service rendered by Spoornet is not client centric. Client satisfaction surveys are not undertaken by Spoornet to obtain an appreciation of the type of service rendered and what remedial measures should be implemented to address shortcomings. The National Ports Authority on the other hand has regular meetings with the shipping lines and agents to assess the level of service offered by SAPO and Spoornet. Shipping lines cannot rely on rail to service its requirements and when that dissatisfaction persists they turn to road transport which is more expensive but timeous.

Question 23 : Management reports on finance and operations are reviewed monthly to review the performance of the terminal and intermodal interface.

	Percentage
Average score	2,75 or 55,0%
% Strongly disagree	8,3%
% Disagree	25,0%
% Somewhat	50,0%
% Agree	16,7%
% Strongly agree	0,0%

There is some level of disagreement on this issue. The operational managers of the respective port and rail terminals responded as 'somewhat' indicating that the assessment of reports on finance and operations is not a rigorous exercise. SAPO personnel however are more actively concerned with finances and operations than their Spoornet counterparts. SAPO's strong financial position may be responsible for this action. With the case of SAPO each berth within a terminal operates as a business entity which contributes towards ownership and pride amongst employees. Operations targets also exist for the different shifts deployed at a particular berth.

Question 24 : A perception survey is conducted on a regular basis to gauge Client's satisfaction.

	Percentage
Average score	2,42 or 48,3%
% Strongly disagree	8,3%
% Disagree	50,0%
% Somewhat	33,3%
% Agree	8,3%
% Strongly agree	0,0%

The low score obtained for this question reflects the degree of disagreement on this issue. During discussions respondents tended to agree that a client perception survey is an excellent tool in identifying client's complaints. This tool could be instrumental in tracking underperformance at the terminals. Workshops as a follow-up can assist to discuss and implement remedial measures to address client concerns. The lack of a form of assessment on service delivery has caused service delivery to drop to very poor levels. The fact that 10 to 12 trains are cancelled per day for technical reasons supports the view of poor service delivery.

Question 25 : The intermodal interface has measurable standards for all key processes.

	Percentage
Average score	2,58 or 51,7%
% Strongly disagree	0,0%
% Disagree	50,0%
% Somewhat	41,7%
% Agree	8,3%
% Strongly agree	0,0%

The respondents from SAPO in their responses tended to agree whilst others disagreed. There are no measures to determine what the throughputs are at the port / rail interface. Only the Container Terminal has a rail terminal facility which SAPO utilises to load containers onto rail wagons. The throughput of the Container Terminal can be determined by recording the number of containers SAPO can load / unload onto from road vehicles and rail trucks in a given time interval, normally an hour. No benchmarks exist for this activity.

Question 26 : Employees have a good understanding of the Port/Rail Interface.

	Percentage
Average score	2,42 or 48,3%
% Strongly disagree	8,3%
% Disagree	50,0%
% Somewhat	33,3%
% Agree	8,3%
% Strongly agree	0,0%

This question attracted a relatively low score which implies that most of the respondents are in disagreement. The Port / Rail Interface relates to the Bayhead Marshalling Yard which is the nerve centre of operations to the Port of Durban and the satellite yards that serve the various port terminals. Very few operational personnel understood details of the rail network and shunting operations, the making-up and breaking-up of trains and the allocation of rolling stock and locomotives. Respondents from Protekon the consulting engineering division from Transnet had a far better understanding of the operational issues plaguing Spoornet and the port/rail interface because of their intimate involvement in addressing infrastructure and operational constraints on behalf of Spoornet and SAPO.

Question 27 : Employees have a good understanding of the quayside throughputs at the various terminals.

	Percentage
Average score	2,08 or 41,7%
% Strongly disagree	25,0%
% Disagree	50,0%
% Somewhat	16,7%
% Agree	8,3%
% Strongly agree	0,0%

The result scored for this question was low which indicates that very few operational personnel understood or did not have a clear understanding of what tonnages can be handled for the different cargo types. This is particularly relevant for the other terminals which handle bulk and break-bulk cargoes for varying commodities. With respect to container traffic the capacity calculations provided as an example under Section 3.8 indicate that the container service is far more structured and the level of the service is the highest due to the immense pressures brought to bear by the shipping lines.

Question 28 : There is a decline in tonnages transported by rail from the quayside.

	Percentage
Average score	4,42 or 88,3%
% Strongly disagree	0,0%
% Disagree	0,0%
% Somewhat	8,3%
% Agree	41,7%
% Strongly agree	50,0%

This question attracted the highest score and reinforces the fact that rail is grossly losing market share to road transport. Spoornet's figures on annual tonnages transported relative to the total tonnages handled by SAPO at the various terminals reflects this situation. The poor level of service rendered by Spoornet is the biggest single contributory factor. A change in the operations philosophy and addressing infrastructural needs will assist substantially to address the issue but the lack of availability of railworthy rolling stock and locomotives is exacerbating the problem.

Question 29 : Rail will be able to cope with the increase in Port tonnages.

	Percentage
Average score	2,33 or 46,7%
% Strongly disagree	33,3%
% Disagree	33,3%
% Somewhat	0,0%
% Agree	33,3%
% Strongly agree	0,0%

The result obtained suggests that under current operating conditions rail transport will be unable to increase its market share. Major interventions like addressing operational constraints and infrastructure development coupled to a massive capital expenditure program is required to remedy the situation. This initial wave of investment is a medium term investment and will take at least 5 years to achieve.

Question 30 : That a Rail Terminal is the most effective manner of transferring goods from rail to and from ships.

	Percentage
Average score	3,33 or 66,7%

% Strongly disagree	8,3%
% Disagree	8,3%
% Somewhat	25,0%
% Agree	58,3%
% Strongly agree	0,0%

There has been agreement on this question. Layout of rail lines on the quayside adjacent to the water's edge has proved to affect the fluent loading and unloading of vessels due to the fact that placing and removing rail trucks cut across the stacking areas thus causing major interruptions to the loading and unloading of vessels. The Rail Terminal concept is widely used by most ports and has proven to be quite effective as an intermodal facility. In fact the layout of the rail terminal could be designed to be utilised by road vehicles when unoccupied by rail trucks. From discussions with the respondents this concept has emerged as a very strong recommendation.

6.2.1 The Transformation Model

Several questions focussed on operational issues in the Bayhead Yard and at port/rail interface. Most respondents were of the opinion that process flow diagrams were essential for employees to have an understanding of the sequence of activities related to executing a particular task. Respondents also intimated that processes should be concise and efficient, utilising the least amount of resources and that outputs must be maximised. Hence the implementation of the framework of the Transformation Model would provide the basis to review all areas of operations in order to maximise outputs and minimize inputs. Respondents agreed that the reengineering of the port/rail interface was a priority issue. The IVth Framework Programme of the European Commission : Integrated Transport Chains under Section 2.6.3 identified operations interaction with terminals, road and the rail interface as a major constraint that required immediate attention as it impacted on the performance, competitiveness and profitability of intermodal terminals.

UNCTAD (Section 2.9) also states that there is a need for operations and technical improvements, identification and removal of bottlenecks to achieve designed throughputs and efficiencies thus reinforcing the need for a critical operations review.

6.2.2 A Performance Management System

Most of the respondents agreed that a formal performance management system did not exist and that there was a need for a system to monitor incremental improvements and targets for finance, productivity, training and development, business processes and client satisfaction. Respondents were given a briefing on the four perspectives of the Balanced Scorecard viz. financial, customer, internal business process, learning and growth. The respondents were keen to adopt a performance management system that was holistic and could measure outputs and targets for several items under each perspective and provide a view of organisational performance in a concise format. Currently the focus is on finances whilst other areas of operations tend to be neglected. Respondents liked the quarterly review cycle of the scorecard in order to address shortcomings at an early stage and the format of the scorecard which could embed best practices and allow for stretch targets to be included to cater for future capacity growth. The need for a performance management system was also a finding of the First State of Logistics Survey under Section 2.4.6(i) which supports the implementation of such a system at the port/rail interface to enable logistics integration. UNCTAD (Section 2.11.2) also states that productivity improvements, skills development, technical improvements, setting targets and continuous improvement programmes are essential to achieve the required throughputs at the port/rail interface. The scorecard is a suitable tool to achieve this. The various sub-points under the key pillars of Transnet's turnaround strategy reviewed in Section 3.9.3 lend themselves to be incorporated under the four perspectives of the Balanced Scorecard thus making a strong case for its formal implementation.

6.3 SEMI-STRUCTURED INTERVIEW FINDINGS

The design of the questions were similar in structure to that of a closed question. The questions were investigative in nature in order to obtain direct answers on issues contained in the Research Objective under Section 1.4. This study is a case study which is investigative in nature and lends itself to qualitative research and entailed the use of semi-structured interview questions. The semi-structured interviews were flexible, assisted to probe issues, elicited responsive interactions, identified key themes and relationships and provided the researcher with a fuller access to knowledge and meanings from the respondents.

Question 1 : What is your understanding of economic development in South Africa?

There was general understanding about economic development in that it was concerned with the production, distribution and consumption of goods and services. In South Africa strong emphasis has been placed by government on economic growth (target of 6%) in an attempt to increase employment and reduce poverty. In order to achieve sustainable economic development large investments are required in the various sectors of the economy, infrastructure and skills development. Government develops policies and provides incentives to attract direct foreign investment. Discussion also hinged around the need to provide additional capacity at the port terminals to cater for future growth.

Question 2 : What is logistics management?

The responses referred to logistics management as the cost effective management of the handling, storage and transport of :

- Raw materials as inputs for manufacture
- Manufactured goods
- Distribution of completed goods and other commodities from source to the final consumer.

Some respondents included services and related information between the points of origin and destination which made the definition more complete.

Question 3 : What is the relationship between economic development and logistics management?

Most respondents view logistics management as being a key driver for a country or region to stimulate and create economic growth by allowing cost effective trading of goods and commodities in the global marketplace. They also stated that logistics has become critical in enhancing the competitiveness of a country and ensures that goods are delivered on time, at right place and in the right condition. The successful expansions into new markets will in turn increase investment, improve employment and profits.

Question 4 : How does globalization affect the South African economy?

Most of the respondents views on globalization was that South Africa was a player in the global market and that there were no trade barriers. For South Africa to succeed it had to adopt high quality standards, be price competitive, possess the resources, skills, capacity and infrastructure to deliver to different markets. Lack of these fundamental requirements will adversely affect economic development and direct foreign investment.

Question 5 : What is your understanding of intermodalism?

The most common understanding was that intermodalism related to the management of all modes of transport and logistics with the focus being on supplying a service at the least

possible cost and timeously. Views also hinged around the seamless movement of goods across transport modes i.e. road, rail, water or air transport.

Question 6 : How important is infrastructure development?

The response was unanimous in that infrastructure development was critical for economic growth. The general opinion was that it is the backbone of economic development and related to all modes of transportation including the development of intermodal facilities, ports and communication. Views were also expressed about the poor state of rail infrastructure in the Bayhead Yard and the lack of stacking areas for cargo in the port terminals. Respondents were aware of the major capital expenditure programme and concurred with the view that a centralised planning and project execution office managed by Transnet would expedite infrastructure development and review operational needs as a holistic transportation solution.

Question 7 : What is your understanding of the port / rail interface?

The responses focused on the integration of rail and port master planning, alignment of budgets, business plans and capital investments. The basic understanding was that it facilitated the transshipment of goods from vessel to rail and vice-versa and that collaborative working on all levels with the port and rail entities was required. There were strong sentiments expressed about the efficiency, effectiveness and capacity of the rail service which is an integral component of the interface. Some Spoornet respondents were aware of the process flow diagrams that were prepared for the Bayhead Yard by Protekon and intimated that a process model with flow diagrams were also required to capture the concise workings of the port/rail interface. They also indicated that a simulation model would assist to optimise operations and continuous improvement initiatives.

Question 8 : Is the efficiency of the port / rail interface a risk to business in South Africa?

The response attracted a unanimous yes. There was a substantial amount of criticism for the inefficiency, poor planning and erratic service and poor turnaround times for the rail service. The major risks cited were that the mandate given by government to reduce the cost of doing business would not materialize and that Spoornet delivery of cargo after a vessel has departed could ruin our exporting potential.

Question 9 : Are you aware of initiatives to improve the functioning of the port / rail interface?

There was a majority yes and the medium through which this awareness was created was through the Port of Durban Master Plan and through operational meetings between SAPO and Spoornet management. Some respondents indicated that they would like to see more action. Some of the proposals shared related to the outsourcing of shunting services in the rail yards, the use of rail terminals to improve the transfer of cargo to and from rail wagons

into stacking areas from where cargo is loaded or unloaded to and from vessels. This will assist to improve the turnaround time of vessels and rail wagons. However one of the major proposals shared was the creation of an Agile Port i.e. an inland holding area for containers which would assist to relieve the congestion at the Durban Container Terminal by reducing the large number of road trucks that call directly at the container terminal.

Question 10 : Are you aware of performance indicators to measure throughputs of the various terminals in the Port of Durban?

The SAPO and Protekon respondents were very aware of the port's performance targets due to the upgrading initiatives of portside facilities and stacking areas to accommodate higher throughput. Respondents were keen to consider the implementation of the Balanced Scorecard as a formal tool to monitor targets and to improve processes. A brief review of the four perspectives of the Balanced Scorecard was shared with respondents. Respondents liked the fact that best practices could be embedded and stretch targets introduced to cater for future capacity growths.

Question 11 : Are you aware of performance indicators that measure rail throughputs at the various yards and sidings that service the Port of Durban?

Some respondents indicated that Spoornet has a database of goods transported to and from the Port of Durban which it utilises to compile its revenue claims but does not have performance indicators to measure its throughputs or the turnaround times of wagons. The Port Master Planning respondents indicated that the principles and logic of Spoornet's service are now put into place but at an infancy stage of implementation. The use of the Balanced Scorecard as a performance management system was viewed as an imperative issue.

Question 12 : Are you aware of and / or contributed to the Port Masterplan?

The majority of respondents were aware of it and a few had inputs. The Spoornet respondents in particular were aware that cargo is no longer going to be loaded/unloaded directly from the ship directly onto rail wagons. If rail's service is predictable the Rail Terminal concept will assist rail to provide a more reliable service and to increase its market share. Hence the wider use of Rail Terminals was considered by the respondents as being a priority matter.

Question 13 : Are you aware of and / or contributed to the Rail Masterplan?

Many of the respondents are aware of it. Only one respondent contributed directly on the Rail Masterplan as this initiative is being initiated by Spoornet head office in Johannesburg. The preparation of the plan is also at a very preliminary stage. Respondents shared their thoughts on a turnaround strategy for Spoornet and cited the following as major interventions: use of the corridor approach for Gauteng – Durban, reintroduce large scale

training of personnel, have structured maintenance plans, embed best operational practices, have continuous improvement programmes, use project management principles to undertake multi-disciplinary maintenance. Due to the lack of suitable space for expansion, many respondents indicated that only half the Bayhead Yard needed to be upgraded and utilised thus releasing scarce land for other uses.

6.4 CONCLUSION

The following is a summary of major issues that emerged from the research findings. Detailed conclusions based on the analysis are presented under Section 7.2.

- Lack of maintenance
- Lack of availability of good and suitable rolling stock
- Poor maintenance of infrastructure and rolling stock
- Lack of integrated planning and investment
- Lack of availability of railworthy locomotives
- No performance management system to measure outputs
- Lack of training and appropriate skills

What also emerged as a major theme from the interaction with respondents from the various divisions was that the operations management personnel tend to function in silos. Only senior managers from either SAPO or Spoornet had a holistic overview of operations of the port/rail interface together with project managers from Protekon who provide consulting engineering and operations management services to both divisions. A centralised and integrated planning and investment approach is deemed critical for the operational success of the port/rail interface and for rail to provide a predictable service in order to regain market share.

Views expressed through the semi-structured interviews encapsulated the alignment of thinking of Transnet, the operations management team of NPA, SAPO and Spoornet and government's mandate on promoting economic growth and reducing the cost of doing business. Respondents had a good understanding of the relationship between economic growth and logistics management and the pressing need for Transnet and South Africa to succeed as an exporting country. Many of the respondents who were senior managers of the various business units shared similar ideas on the type of interventions required for a turnaround strategy for Spoornet. The suggestions have been included under Section 7.3.8.

Responses obtained from the semi-structured questions on performance measurement, infrastructure development and the functioning of the port/rail interface triangulated well with the responses obtained from the structured questionnaire.

Chapter 7 which follows presents details on conclusions from the analysis performed in this chapter, recommendations for the aforementioned conclusions and a summary.

CHAPTER 7

CONCLUSIONS, RECOMMENDATIONS AND SUMMARY

7.1 INTRODUCTION

This chapter shall focus on making conclusions on the findings of the analysis of the port/rail interface and providing recommendations to the Transnet Steering Committee on infrastructure development, thus fulfilling the aim of this study. Transnet's interventions discussed under Section 3.9 provide the necessary framework and impetus to drive the restructuring efforts to improve the efficiencies of the various businesses and the port/rail interface. The recommendations that will be made will cover operational issues, infrastructure development/improvements and the utilization of a performance management system to measure performance outputs. Recommendations will also be related to specific conclusions and reasons will be provided for making the recommendation.

Comment [N41]: Relate to the port/rail interface

7.2 CONCLUSIONS FROM THE ANALYSIS

The major findings from the analysis are presented below:

7.2.1 Conclusion 1

Questions 1, 9, 10, 13, 17, 21 and 26 from the structured questionnaire and questions 5, 7, 8 and 9 from the semi-structured interview focussed on operational issues in the Bayhead Yard and at the port/rail interface. The following conclusions are drawn from the analysis done:

- (i) Most respondents concurred that the formal processes used for the efficient functioning of the port/rail interface, and the understanding of the various processes by both SAPO and Spoornet, did not exist and that an intervention like the re-engineering of processes was necessary to address this issue. This is because efficient processes generally generate better productivity levels which in turn enhance capacity and the amount of infrastructure required.
- (ii) Associated with the lack of understanding the interaction between the processes is the issue of poor skills levels that was created by the departure of highly skilled employees who had opted for early retirement.

7.2.2 Conclusion 2

Questions 11, 12, 19, 22, 23, 24, 25, 27 and 29 from the structured questionnaire and questions 10 and 11 from the semi-structured interview relate to the measurement of performance objectives for finance, customer relationships, core competencies and productivity. The questions were very direct in order to ascertain if there were any performance measures in the areas described above which are deemed to cover the major functional areas of a business. The following conclusion is drawn:

- (i) The majority of the respondents indicated that there was a lack of a formal measurement system. What also surfaced quite strongly was that the emphasis was on financial criteria/performance whilst other critical areas of the business e.g. operations and skills received lesser attention.

7.2.3 Conclusion 3

Questions 9,12 and 13 from the semi-structured interview sought to provide insights to the current workings of the port/rail interface and highlighted congestion at the Durban Container Terminal as a major operational issue. The following conclusions are drawn:

- (i) The congestion at the container terminal occurred due to the growth in container traffic which has created a major shortage of stacking space. Although areas for expansion have been identified adjacent to the existing facility to overcome this problem, it would take at least 24 to 30 months to complete. Suggestions made to look at stacking areas away from the existing terminal to ease the immediate impact of congestion and to integrate rail and port planning to cater for future growth have been included as recommendations under 7.3.3 and 7.3.5 respectively.

The manner in which land freight transport is currently serving the Port of Durban demonstrates the lack of integrated planning between road and rail transport modes. The poor service delivery by rail transport is causing road transport to grow exponentially. There is general consensus from respondents that if rail can enhance its service by acquiring new rolling stock, improving maintenance programmes and guaranteeing delivery times, this initiative will singularly improve the functioning of the port/rail interface.

7.2.4 Conclusion 4

Questions 7, 8, 12 and 13 focussed on understanding the port/rail interface, its efficiency and assessing contributions to the formulation of the Rail Masterplan. The following conclusions are made:

- (i) Respondents agreed that collaborative working was necessary and that there should be an integration of the rail and port masterplans, business plans and capital investments.
- (ii) Negative sentiments were expressed about the efficiency and capacity of the rail service and that the erratic rail service posed a risk to business in general in South Africa. However respondents indicated that an integrated planning and investment strategy will assist to prioritise initiatives that can bring benefits to the rail and the port service much sooner.
- (iii) Respondents who are aware of the Port Masterplan indicated the urgent need for a similar initiative for the rail freight business.
- (iv) The lack of a measurement system is highlighted by the need for determining the efficiency of the various processes and the setting of production targets.

Comment [N42]: Are you sure the term is centralised as there are specific connotations to this term. I would personally prefer you use the term integrated as it can then be used as cooperation between different enterprises. You have used the term integrated in 7.2.5.(ii) so rather stay with it.

Comment [N43]: Benefits to whom rail or port or both?

7.2.5 Conclusion 5

Question 6 from the semi-structured interview related to the importance of infrastructure development which is deemed to be critical for economic growth i.e. creating capacity to meet increasing future demand, and to address capacity constraints that are inhibiting efficient service delivery. The following conclusions were drawn:

- (i) A major shortcoming that emerged from the analysis was that the transport divisions adopted a silo mentality when attempting to render a logistics service to business.
- (ii) The lack of integrated planning had a negative impact on Spoornet's service delivery and market share.
- (iii) Infrastructure development was viewed in isolation by the various major business units. Infrastructure development should be seen as an integral part of service delivery from a Transnet and a logistics management perspective.

7.2.6 Conclusion 6

Questions 14 and 30 from the structured questionnaire and question 9 from the semi-structured interview made specific reference to the current yard layouts and the use of sidings that are adjacent to the quayside. The objective of these questions was to ascertain whether these layouts were efficient and relevant for intermodal transport. The following conclusions were drawn:

- (i) Respondents were very clear that the general practice to have railway lines adjacent to the quayside to facilitate direct loading/unloading from the ship onto/from rail wagons is an inefficient manner of handling cargo. This practice interferes with the fluent operations of the stacking areas and reduces the turnaround times of vessels and rail trucks. This practice applies to the handling of containers, bulk and general cargo. This method of handling cargo is time consuming and results in delays to vessels which are costly. The use of stacking areas may entail more handling of cargo but the benefits to all parties concerned is much greater. The Bayhead Yard is underutilised and the layout would have to be reconfigured if Spoornet are in future going to concentrate on obtaining block loads i.e. delivering a 50 wagon load from origin to a single destination. The Classification and Exchange Yards could be dispensed with, whilst the Reception and Departure yards could be consolidated and made compatible for intermodal operations.
- (ii) Question 30 in particular was a direct question on the development of a rail terminal on the landside of the stacking area in the port for which there was a very positive response.

Comment [N44]: Is this applicable to all cargo even when it is loaded and unloaded from block loads? If it is not applicable then it would be easier to differentiate between containers, bulk and general cargo. See the comment below.

Comment [N45]: Is it inefficient or is it time consuming as it does lead to a reduction in handling of cargo. Rather relate to the fact that the time delay is very costly to both ships and other assets involved and the cost trade-off when stacking areas are used is beneficial to all parties even though more handling of cargo is involved.

Comment [N46]: As this stands it means that the BH yard is not suitable for 50 truck block loads. Does this mean that it cannot handle block loads? If this is the case then does the yard have right to exist at all as it cannot meet modern requirements?

Comment [N47]: What is meant by the implementation of a rail terminal?? Rephrase as it does not make sense.

7.2.7 Conclusion 7

Questions 9 and 13 from the semi-structured interview ascertained if respondents were aware of problem areas and initiatives to improve the functioning of the port/rail interface and the Bayhead Yard. The following conclusions were drawn:

- (i) Delays were experienced in the provision of shunting services particularly in the rail yards which impacted on the turnaround times of rail wagons and resultantly vessels where rail provides a service at the port terminal.
- (ii) The Bayhead Yard is underutilised and that any refurbishment exercise to improve the infrastructure and workings of the Yard should take cognisance of this fact.
- (iii) Any improvements in infrastructure and work processes in the BHY will also reduce costs significantly.

Comment [N48]: This is a proposal not a conclusion. What conclusion did you draw?

Comment [N49]: This is a proposal not a conclusion. What conclusion did you draw?

7.2.8 Conclusion 8

Question 13 from the semi-structured interview was used to ascertain whether participants had an insight of the turnaround strategy of Spoornet. The following conclusions were drawn:

- (i) The problems experienced by Spoornet are manifold which can be related mainly to the following:
 - lack of maintenance;
 - lack of infrastructure;
 - lack of availability of rolling stock;
 - lack of locomotives; and
 - a shortage of skills.

- (ii) The majority of respondents indicated that there seems to be a lack of a holistic view in the business and its deliverables. Recommendations made or plans implemented for any re-engineering programme should take cognisance of this fact.

7.3 RECOMMENDATIONS

It is clear from the conclusions made that there is a dire need to address the problems currently being experienced in the rail/port interface. The following recommendations are made in line with the conclusions presented under Section 7.2 in order to address the problems identified in the analysis:

7.3.1 Recommendation 1

It is recommended in response to Conclusion 1 that all processes and systems of the port/rail interface be re-engineered on the basis of the Logistics Transformation Model proposed in Fig 7.1 below.

Comment [N50]: Where is this figure?? Give the correct number.

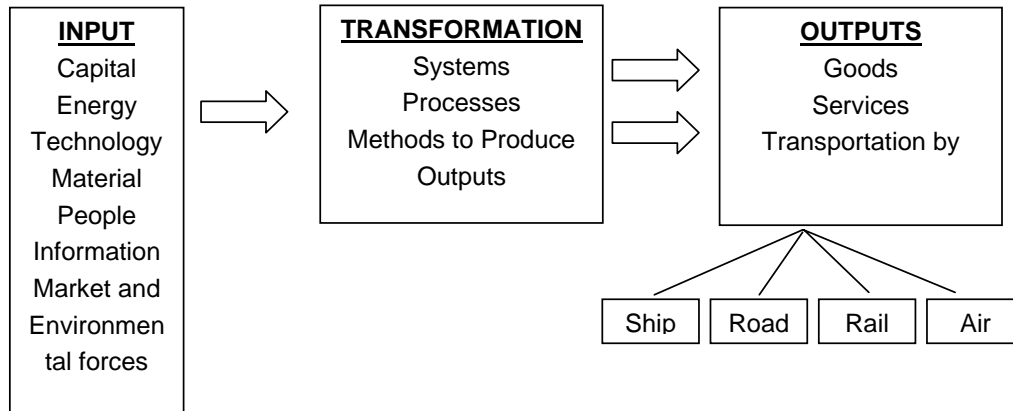


Fig. 7.1 Logistics Transformation Model

The theoretical framework discussed under Sections 5.3, 5.4 and 5.5 can be applied to the logistics process within the port / rail interface to reflect the production of goods and services. The operations function is responsible for creating this service. The inputs of people, energy capital, materials, technology are transformed into an output in this case a service. This process focuses on operations management in a logistics environment with outputs related to port, road and rail and air transport services. These services must be efficient and are critical to the creation of value and the competitive pricing of goods and services that are produced for export.

The operations function is quite crucial when analysing the efficiency of the various facilities comprising the port/rail Interface. The throughputs of cargo loaded and unloaded from vessels, rail trucks and road vehicles and the time taken to achieve the turnaround of these assets is a critical measure in assessing the efficiency of the port/rail interface as there is a strong inter-relationship between the provision of infrastructure and its efficiency. If the operations function is not performing at an optimal level, it could lead to unnecessary expenditure for the provision of infrastructure. Simulation is useful in the design of complex operation processes e.g. computer simulation can help a designer to obtain an understanding on how best to construct the process in order to optimise the use of resources.

Pycraft, Singh and Philela (1997; 31) assert that performance objectives relate to the quality of service, the speed with which they are delivered to customers, the dependability with which the operation keeps its delivery promises, the flexibility of the operations to change its activities and the cost of producing the service. The aforementioned objectives constitute the core to providing efficient operations within the port/rail interface.

Comment [N51]: Ensure that your quotation method is consistent e

The above assertion also correlates well with the performance measures of the four perspectives found in the Balanced Scorecard as discussed under Section 5.2 thus reinforcing the need to measure outcomes and to address inefficiencies where the measures are below target values.

The port / rail interface transformation model also relates to the port terminal infrastructure (including quay walls, roadways, rail tracks, stacking areas), cranes, material handling equipment, on-shore buildings, warehouses and staff are seen as the inputs. The movement of cargo from ship to shore and vice versa is seen as the transformation process. The output is the service rendered i.e. the transportation of goods via ocean transport to and from far away destinations and by road and rail transport to and from landside destinations. The development of a rail terminal on the landside of a stacking area will assist to enhance the loading/unloading of rail trucks and improve the frequency of rail services by improving the turnaround times of rail wagons that are utilising the rail terminal thus increasing the market share of rail bound traffic. UNCTAD in reviewing inland transport capacities (discussed under Section 2.9) for developing countries considers rail transport to be an efficient and major contributor to the transportation of goods to and from ports.

Comment [N52]: What is meant by the term "the implementation of rail terminals"? It does not make sense

The implementation of the above model provides a framework to ensure that the processes will be concise and efficient, utilising the least amount of resources to achieve maximised outputs.

7.3.2 Recommendation 2

The second recommendation is that a performance management system in the format of the Balanced Scorecard be introduced to establish business objectives, plan and set targets, focus on continuous improvements and to monitor progress. This recommendation is in response to Conclusion 2.

The Balanced Scorecard presented below is a typical measurement tool that can be utilised to plan and set targets and to measure what has been achieved at both quarterly and annual intervals. In an operations environment, it is imperative that all the assets be utilised optimally and if the utilisation of assets are below the set targets, then that operational entity is at risk for not generating the required shareholder value. Targets for the various measures can be set and productivity and processes monitored to track progress.

Comment [N53]: Returns in terms of what? If it is a monetary value then you need to explain whether it is possible to determine a monetary value for the utilisation of a rail truck, loco or a container crane. You should rather hours utilised as the benchmark.

Fig 7.2 - Financial Perspective

STRATEGIC OBJECTIVE	MEASURES	CURRENT PERFORMANCE 2005/06	2006/07					2007/08	2008/09
			ANNUAL TARGET	Q1 TARGET	Q2 TARGET	Q3 TARGET	Q4 TARGET	ANNUAL TARGET	ANNUAL TARGET
Sustainable Profitability	ROAM								
	Operating Profitability by product: Steel Granite Other Bulk								
	Total Operating Profit								
Grow Revenue	Incremental Revenue from new business: Steel Granite Pitch Coke								
	Total New Revenue								
Manage Costs	Operating cost as a percentage of Turnover								

The strategic objectives for the Financial Perspective (Fig 7.2) are sustainable profitability, grow revenue and manage costs.

- (i) Return on assets managed (ROAM) = $\frac{\text{Net operating profit}}{\text{Total assets}} \times 100$
- (ii) Profitability per product = Revenue per product – handling costs
 - Revenue per product relates to the tariff charged for loading/unloading a vessel, loading/unloading road and rail trucks and storage.
 - Handling costs refer to the operating costs viz. energy, labour, materials, maintenance, land charges and depreciation.
- (iii) Sustainable profitability is based on market forecasts for the different types of products handled and industry trends for these products. Normally the total throughputs of a terminal are known. If the terminal is operating under capacity then active marketing occurs to grow revenue of existing products handled or for new products which would utilise existing equipment as far as practically possible. Normally the marketing department identifies and pursues new business opportunities and assists to expand existing business.

The Innovation and Learning Perspective (Fig 7.4) relates to employment equity ratios, training plans, competencies and improving employee morale. A skills audit would have to be performed to determine the needs for training and development for the various operation functions. Links can be developed between business performance targets and employee rewards. If employees are performing optimally it influences profitability positively and also results in higher customer satisfaction.

Fig 7.5 - Internal Business Process Perspective

STRATEGIC OBJECTIVE	MEASURES	CURRENT PERFORMANCE 2005/06	2006/07					2007/08	2008/09
			ANNUAL TARGET	Q1 TARGET	Q2 TARGET	Q3 TARGET	Q4 TARGET	ANNUAL TARGET	ANNUAL TARGET
Improve Process Efficiency	Adherence to norms (Tons per hour – by product)								
	Plates 40								
	Rounds 40								
	Sections 40								
	Channels 40								
	Billets 60								
	Rebars 40								
	Flats 40								
	Human Resources								
	Coils 90								
	CR Coils 90								
	Cost per ton offloaded per hour (Rands)								
	Cost per ton shipped per hour (Rands)								
Increase resource utilisation	Equipment utilisation (%)								
	Personnel utilisation – permanent workforce (%)								
Employment safety and working environment	Reduction of fatalities								
	Reduction of injuries								
	NOSA Rating								
Improve BEE involvement	Spend on BEE as a % of total procurement								

The Internal Business Process Perspective (Fig 7.5) relates primarily to improving processes, efficiencies and resource utilisation. A Master Terminal Operations Schedule is central to reviewing daily, weekly and monthly outputs, resource allocation i.e. people and equipment for the assigned tasks, monitoring operational efficiency by improving equipment and labour utilisation rates and monitoring vessel, rail and road truck turnaround times. Improving processes reduces handling costs and increases profitability.

The Transformation Model can also be applied to the Internal Business Perspective since this perspective focuses on processes and the optimisation of resources.

Kaplan and Norton (1996; 30) refer to the chain of cause and effect relationships which pervade all four perspectives of the scorecard. For example sustained profitability depends on the amount of repeat and new business from satisfied customers. The business must

Comment [N54]: Relate to where you will be discussing (or have discussed) this perspective.

increase and deliver services that are valued by customers. Hence customer satisfaction is measured under customer perspective.

The efficient handling of cargo is achieved through short cycle times of operating processes. A business can improve the quality of its service and reduce the cycle time of their processes through training and improving the skills of its employees. Hence training and development are measures found under the innovation and learning perspective.

7.3.3 Recommendation 3

The third recommendation is that an agile port be created at Cato Ridge which is about 50 km to the west of Durban on the main railway line to Johannesburg. This recommendation is in response to Conclusion 3.

An agile port is an inland storage and sorting location that removes the bulk of storage from the waterfront. Containers arriving by vessel at the port can be transferred onto rail trucks immediately upon discharge and moved inland. Containers destined for export can be collected, sorted and stored inland pending the vessel's arrival and transported to the port by the same dedicated shuttle trains. By moving the storage and sorting function inland the port can save on property and reduce the severe traffic congestion at the Durban Container Terminal located at Bayhead as identified by the Protekon/Iliso Consulting Report on the development of Salisbury Island (2005).

Containers destined for export can be stored and sorted at Cato Ridge and shuttled to the Durban Container Terminal by the rail shuttle service just prior to a vessel's arrival. It is also recommended that SAPO manage the inland terminal and the scheduling of the shuttle rail service in order to have complete management and operational control over the movement of containers to and from the agile port to the Durban Container Terminal. The Cato Ridge yard is currently underutilised and can be converted into an intermodal facility at a relatively low cost (estimate R40m including equipment).

According to Eye for Transport (2005; 42) rail companies in Canada and Germany are currently providing cost effective short-haul services i.e. between 50-100 km for container traffic. In the same article it is stated that a minimum volume throughput of 10000 loaded TEU's per annum is needed to make an intermodal terminal economically viable whilst an annual throughput of 15000 to 20000 TEU's should result in a significant profit. The proposal made should therefore be given serious attention as the following hypothetical example will show.

Assume that the cost of transporting and handling a TEU over a 50 km distance by rail is R450,00 and that out of a probable 1,7m TEU's handled at least 5% utilises the agile port. The revenue thus generated translates to $0,05 \times 1,7m \times R450,00 = R38,25m$. The break-even point for the investment of R40m required to set-up the agile port at Cato Ridge is therefore one year which makes the above mentioned proposal viable. Making the further assumption that economies of scale can be utilised and given a 10 to 15 percent growth per annum (which is in line with the long term container growth rate for the Port of Durban) for this service, the agile port facility can grow into a major facility which will assist to alleviate traffic congestion and create the potential for greater handling capacity up to the year 2020 at the Durban Container Terminal.

One of the major proviso's is that a significant amount of co-operation is required between SAPO and Spoornet to fine tune the shuttle service from a cost perspective.

The Balanced Scorecard can also be utilised to monitor the performance objectives of this particular proposal and based on the outcomes, decisions can be made to expand the agile port service. The Transformation Model can also be applied to this proposal in order to develop the processes and ensure resource optimisation.

7.3.4 Recommendation 4

The fourth recommendation relates to the preparation of a Rail Master Plan. This recommendation is in response to Conclusion 4. Spoornet have unfortunately responded very slowly to the recommendations presented in the Draft Port Master Plan 2020 for the Port of Durban which focuses on the expansion initiatives of the Port of Durban to the year 2020 and beyond. This has been articulated under Section 1.2.6.

The development of a Rail Master Plan should take the following into consideration:

- (a) Market demands – an analysis was performed for each sector of the economy and freight types and flows have been ascertained based on growth projections for the various types of commodities. This information from the Port Master Plan shall provide the inputs for the Rail Master Plan in addition to any other freight flows which are not destined for either export or import.
- (b) Freight types and flows – the origin and destination for each type of commodity plays an important role in ascertaining the total throughput through a particular rail corridor. In the instance of the port/rail Interface at the Port of Durban, the greatest

freight flow would be along the New Main Line from Durban to Gauteng. Other freight flows are along the North Coast Corridor to Richards Bay and the South Coast Corridor to Port Shepstone. The type of commodity transported is an important aspect of planning as it determines the different types of wagons required.

- (c) Network capacity analysis – the primary purpose for the analysis is to review the theoretical capacity of the network with the projected capacities and the operational capacity. The operational capacity is generally much lower than the theoretical capacity due to constraints e.g. lower speeds and bottlenecks in the network. Some typical problems encountered relate to signaling which utilises old technology and cannot provide short lead times for the dispatch of trains, poor maintenance of infrastructure, tight radii for curvature and steep gradients. Signaling provides two significant benefits to railway operation. The first is safety as conflicting movements can be avoided and secondly the line capacity can be enhanced. Due to the complexity of the network in the greater Durban area the old signaling technology is actually an impediment to more intense traffic flow.
- (d) Investment Plans – due to the capital intensive nature of the rail business long term investment plans based on low and high growth scenarios are required. The initial investment plan should be for a 20 year period and, depending on the financial returns within the first 10 years, a further investment period up to 2050 should be considered. Investment is generally two fold i.e. for infrastructure development and improvement and for locomotives and rolling stock. The types of freight and tonnages are important in determining the type of wagons to be procured particularly for the General Freight Business. The Orex Line and Coal Line have specific types of locomotives viz. 50 KV and 25 KV respectively. The rolling stock and locomotives are not interchangeable. The general freight corridor between Durban and Gauteng is 3 KV, which also entails using a different type of locomotive.
- (e) Durban Port/Rail Development Proposal. The cargo projections arising out of the Port of Durban Masterplan (2005) indicated high growth rates (7% year on year) for container traffic and a moderate (4% year on year) for general freight traffic. The concept of an Agile Port as proposed under Section 7.3.3 has undoubtedly a major role to play as an economical logistics service provider to the Port of Durban.

Several limiting geographical constraints severely contain expansion options for the Port of Durban and in particular the Durban Container Terminal. It is therefore recommended that the Agile Port be developed at Cato Ridge and that the existing rail infrastructure between the Bayhead Yard and Cato Ridge which is a portion of the New Main Line to Gauteng be

utilised solely as a dedicated shuttle service for container traffic to and from the Durban Container Terminal.

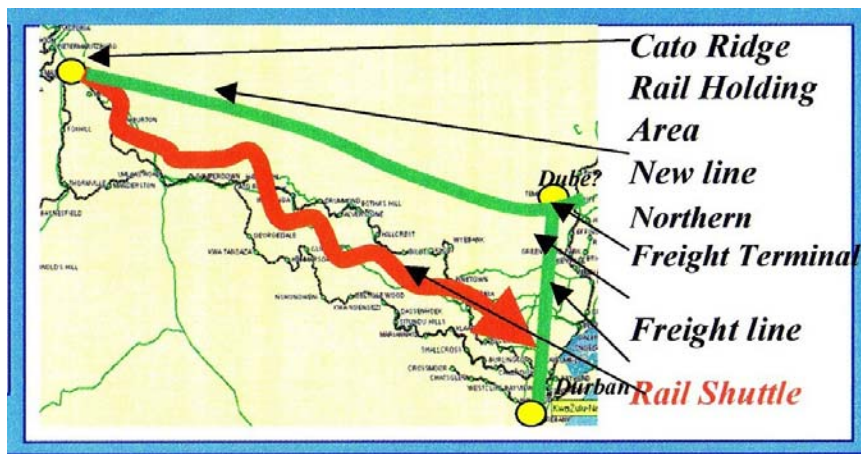
The Dube Tradeport, a largely provincial initiative, is being planned as a major logistics hub close to the proposed King Shaka Airport at La Mercy to the north of Durban. In this proposal rail is seen as a catalyst to grow the Dube Tradeport into a sustainable logistics facility as part of the proposal is a recommendation that the section of the North Coast Line i.e. from Durban to Tongaat be upgraded and that a new 50 km section of rail line be built from Tongaat to Cato Ridge to carry general freight traffic on to Gauteng. The topography of the proposed line from Tongaat to Cato Ridge is much flatter than that of the existing New Main Line which reduces the cost of construction by having fewer bridges, tunnels, flatter gradients and curvature, hence the operating speeds of the trains will also be much higher. The construction of a new section of rail line from Tongaat to Cato Ridge will serve several purposes:

- (i) Embed the dedicated rail shuttle service from the Durban Container Terminal to the proposed container depot at Cato Ridge.
- (ii) Help to support the Dube Tradeport as a major logistics hub.
- (iii) Improve the capacity handling at the Durban Container Terminal due to the creation of a satellite facility at Cato Ridge.

Comment [N55]: Link to the container port

The Balanced Scorecard and the Transformation Model can be applied to each of the operational areas where rail services are provided e.g. Bayhead Yard and at the various sidings and proposed rail terminals.

Fig 7.6 Proposed rail connection between Tongaat and Cato Ridge



7.3.5 Recommendation 5

The fifth recommendation is that a centralized planning and project execution office be established at Transnet Corporate level to manage the capital expenditure requirements of Transnet which amounts to over R40 billion for the next five years. This recommendation is in response to Conclusion 5. The major transport divisions currently have their own technical divisions that are responsible for capital expenditure programmes and maintenance work. The transport divisions to a large extent work in isolation except for the recently formed Steering Committee (mentioned under Section 1.7) which is now beginning to perform an overarching function by reviewing Transnet projects in the context of a single logistics business. A major function of the centralised planning office would be to ensure that integrated planning occurs in order to deliver cost effective logistics management services. Stakeholders involved with this process would include the Durban Metro, NPA, SAPO, Spoornet and Department of Transport.

Comment [N56]: Relate this also to integrated planning with other interested parties such as NPA, Durban City Council and others.

Senior engineers and project managers from the various businesses including Protekon can be transferred into this office which will perform the following functions:

- Co-ordinate all capital expenditure
- Undertake integrated planning and feasibility studies
- Prepare Port and Rail Master Plans
- Prepare business cases for projects
- Arrange for Business Unit approvals and Transnet Board approval
- Set-up project management teams to implement projects
- Arrange for multi-disciplinary designs to be performed by private consultants and Protekon
- Arrange for Managing Consultants to be appointed to procure construction services and materials
- Manage commissioning and hand-over of projects on completion to Business Units
- Review projects to test the recommendations in the business cases and feasibility studies

The expenditure of an average of R8 billion per annum over the next five years is quite an onerous task given that South Africa is currently experiencing a substantial technical skills shortage. It is therefore prudent to consolidate the skills base within the various transport divisions into a centralised planning and projects office in order to obtain greater efficiencies and expedite delivery of projects. Additional personnel could be recruited from the private sector to assist with financial modeling for the business cases and project

management. It is imperative that the best systems and practices are adopted to facilitate the expedient delivery of projects. Many of the operational problems identified arise out of poor infrastructure development. In the instance of the port/rail interface at the Port of Durban, projects have been identified for the expansion of capacity and those that will address operational constraints. This two pronged approach will assist to provide a holistic, integrated and structured solution in enhancing the efficiencies of the Port/Rail Interface.

The compilation of the business cases for the proposed projects will certainly have to address the logistics requirements of the facility in respect of operations, funding and cost of service to the owners or shippers of cargo. This major initiative can be implemented within a two to three month period.

A scorecard can be formulated for the Centralised Planning Office to monitor the implementation of the capital investment programme for all logistics related projects. Protekon has utilised the scorecard for the past 7 years for the delivery of projects and found it very successful.

7.3.6 Recommendation 6

The sixth recommendation is that rail terminals be developed at all terminals in the Port of Durban. This recommendation is in response to Conclusion 6. It has been the general practice at most port terminals to have railway lines adjacent to the quayside in order to facilitate direct loading/unloading from the ship onto/from the rail wagons. This practice served the needs of the port reasonably well when cargo throughputs were reasonably low. In attempting to increase the turnaround times of vessels it has been necessary to review the workings of terminals in order to increase the cargo throughput of terminals. Most berths at Multi-Purpose Terminals which used to have average cargo throughputs of 200 000 tons per annum per berth can now achieve up to 400 000 tons per annum through the construction of a rail terminal located about 250 to 300m from the quayside. This arrangement is being utilised internationally and is proving to be very successful.

Most Multi-Purpose Terminals provide covered and open storage areas. With the increased turnaround times of vessels the discharge and loading operations of vessels should be uninterrupted. This can only be achieved if cargo due for export is stacked and ready for loading prior to a vessel's arrival. Similarly cargo discharged from a vessel can be stacked and ready for its onward transportation without causing any delay to the

vessel. Unreliable service by rail transport utilizing rail facilities adjacent to the quayside can cause delays to vessels thus incurring demurrage charges.

Rail terminal facilities will improve the throughput of cargo at the various port terminals and reduce the potential of congestion and demurrage charges as a result of delays caused by other either rail or road transport. The Balanced Scorecard and the Transformation Model can be formulated for each rail terminal in order to monitor performance objectives and to ensure that processes are efficient and optimal.

7.3.7 Recommendation 7

The seventh recommendation is that the shunting services at the Bayhead Marshalling Yard be outsourced. This recommendation is in response to Conclusion 7. The BMY is the second largest marshalling yard in South Africa. It is the nerve centre of operations to the Port of Durban via other satellite yards and rail terminals. The following are major issues that are affecting the operations of the yard:

- Poor infrastructure (formation, perway and OHTE) due to lack of maintenance. R400m capital is required to rehabilitate the infrastructure in the yard.
- Productivity in the yard is poor due to the loss of skilled personnel who had opted to go on early retirement.
- Traffic volumes are low when compared to throughputs in yard in 1996. Notwithstanding this situation the turnaround time of trains has not improved.
- Poorly maintained locomotives and rail wagons affect the timeous departure of trains due to the high incidence of breakdowns.

It is further recommended that:

- Only half the yard be upgraded and utilised. Only one Reception Yard (i.e. No.2) could be utilised and the Exchange Yard and Departure Yard consolidated to accommodate all other shunting operations that may be necessary. This implies that Reception Yard No.1 and the Classification Yard could be uplifted. The replanning of operations of the yard would release valuable land which would be absorbed by the future expansion (2020) of the Container Terminal in this precinct. With a review of rail operations at the various terminals within the port i.e. utilizing rail terminals to load/unload rail trucks, block loads can be compiled in the port and dispatched directly to its onward destination. It is not necessary for the train to depart from the Bayhead Yard as is presently the case.

- The operations of the BMY be concessioned to a private operator as a pilot case. The BMY currently operates as a cost centre. This implies that revenue is only recognized for the movement of trains along the Durban – Gauteng Corridor and that the cost of operations of the yards at either end is charged to a separate account. This philosophy of operations affects productivity and accountability for the timeous turnaround of trains in these yards.

Where private terminal operators (e.g. Rennie's Bulk Terminals and Engen) utilise their own shunting locomotives to receive and dispatch block loads from their private sidings they are able to do so well under the times agreed to in the service level agreements with Spoornet. Similar service level agreements with quantifiable measures for the turnaround times of rail wagons and repairs to defective rolling stock require to be implemented for the proposed concessionaire at the BMY. Spoornet will also require to guarantee the concessionaire certain volumes of cargo as throughputs, which would necessitate Spoornet to aggressively market its service to achieve those throughputs, otherwise Spoornet could be liable for penalties. Similarly the concessionaire will be liable for penalties should he under perform. The guaranteed throughputs of cargo volumes in the BMY are necessary because the concessionaire will be required to make large investments to upgrade and maintain the infrastructure of the BMY.

The proposed dedicated shuttle service for containers (discussed under Section 7.3.3) will utilise the rail terminal facilities at the Container Terminal to receive and dispatch block loads without entering the Bayhead Marshalling Yard. This will ensure that the BMY with its reduced size and efficient operations will have adequate capacity for the next 25 to 30 years.

A Balanced Scorecard and Transformation Model can be formulated for the concessionaire of the Bayhead Yard in order to ensure that the delivery of services are in keeping with the concessionaire's contractual obligations and in alignment with Transnet's growth strategy.

7.3.8 Recommendation 8

The eighth recommendation relates to the turnaround strategy for Spoornet. This recommendation is in response to Conclusion 8. From the various discussions held with respondents and through probing and prompting on key themes such as best operational practices, corridor working, training of personnel, continuous improvement, monitoring of

outputs and maintenance, the following is recommended to form part of the Spoornet turnaround strategy:

(a) Corridor Working

- (i) Utilise a corridor approach for the Gauteng – Durban line with respect to the scheduling of rolling stock, manpower and traction. Dedicate the necessary resources to the corridor and don't allow operations to move it to other regions. Monitor and control train turnaround times strictly in order to ensure adherence to set schedules. Train planners and other personnel engaged in such tasks must be seen to actively manage the service.
- (ii) Make individuals responsible for the timeous departure and arrival of trains.
- (iii) Ascertain the maximum capacity of the existing general freight corridors.
- (iv) Analyse traffic forecasts together with NPA's Port Masterplan for 2020 and ascertain short, medium and long term resourcing.
- (v) Acquire new rolling stock and locomotives for dedicated use on the Durban – Gauteng corridor.
- (vi) Utilise cost effective radio frequency identification tags to track cargo especially containers.

(b) Maintenance and Training

- Introduce a robust maintenance strategy to address backlogs and current requirements.
- Reintroduce compulsory training for critical operations personnel.
- Ensure that different training standards are set and that all key staff have received at least the minimum standard of training necessary to do the work expected.

(c) Financial

- (i) Establish the fixed costs of operations based on current tonnage throughputs and then work out reduced freight rates based on a combination of containing fixed costs and increasing tonnages of targeted commodities substantially. Spoornet needs to double revenue within a three year window.
- (ii) Develop specialised rates for express deliveries.

(d) Operational Practices

- (i) Introduce Project Management practices throughout the organization in order to focus on responsibilities, accountabilities, time and cost and as a change management tool
- (ii) Create project teams to analyse the various operational needs, implement solutions and monitor progress
- (iii) Identify pockets of excellence within the business, obtain best practices from operational teams in the regions, video the procedures, debate, acknowledge inputs and implement
- (iv) The best practices will form the basis for ISO 9001 accreditation which will measure continuous improvement.
- (v) Test new practices through pilot introduction i.e. to minimise any disruptiveness
- (vi) Create a dedicated team to focus on continuous improvement
- (vii) Utilise the expertise of individuals who are proficient and are on early retirement
- (viii) Encourage large scale interaction between the operations and engineering teams
- (ix) Ensure senior management involvement for all activities in a corridor e.g. from Port of Durban interface to City Deep
- (x) Utilise the Balanced Scorecard to measure outputs/improvements

(e) Engineering

- (i) Identify engineers occupying administrative roles and redeploy
- (ii) Reinforce project management principles and encourage registration as professional practitioners
- (iii) Identify infrastructure needs and register projects to manage implementation of needs
- (iv) Create dedicated multi-disciplinary project teams to assist with infrastructure development, improvements and maintenance
- (v) Prepare budgets for engineering inputs and introduce time sheets for project teams to record activities and to manage time spent (hours) on relevant projects. This will assist to create a culture of value add
- (vi) Scope and funding requirements of projects are to be developed in-house, then focus on resourcing for implementation phase i.e. use external contractors

- (vii) Utilise performance management to measure outputs. Measures are readily available for the various categories of engineering personnel from Protekon
The aforementioned is simplistically the core of the turnaround strategy.

The Scorecard and the Transformation Model can be formulated for Spoornet as a whole, for each of the rail corridors, the major shunting yards, rail terminals and sidings.

7.4 CONCLUSION WITH REGARD TO RECOMMENDATIONS MADE

The purpose of the recommendations is to articulate to Transnet top management solutions that will not only address the operational inefficiencies, constraints and infrastructural problems that have been identified by the research study but can also be implemented in order to enhance the competitiveness of the port/rail interface and to substantially improve the service delivery.

Recommendation Nos. 3, 4 and 5 relate to the creation of an agile port, a rail master plan and a centralised planning and project execution office. These recommendations can be implemented with immediate effect and tangible results should be seen within a relatively short period of time (2 to 3 months).

Recommendation Nos. 1, 2 and 8 relate to the re-engineering of processes, the formulation of the Balanced Scorecard and the turnaround strategy for Spoornet. Because these recommendations are interrelated, they can be implemented in parallel and completed in 9 to 12 months. However, Transnet will be required to obtain the services of professional external service providers to drive these initiatives (discussed under Section 5.6).

Recommendation Nos. 6 and 7 relate to the development of rail terminals and the outsourcing of shunting services at the Bayhead Marshalling Yard. The implementation of these recommendations could take between 18 to 24 months to complete.

The implementation of the Port and Rail Masterplans are long term (25 years) and require massive investments. Fortunately the capital expenditure programme, R40 billion over the next five years, has been approved and is being currently rolled out. However physical constraints may delay the implementation of some recommendations e.g. Rail Terminal development at all port terminals.

7.5 SUMMARY

The approach used in this study was to review the role of transportation with specific reference to the port/rail interface. The role of Transnet as a major player within the logistics and supply-chain systems was highlighted together with the dependence of business in South Africa on Transnet who operate most of the terminals at the seven major ports as well as the rail freight service. The role of the major transport divisions viz. NPA, SAPO and Spoornet were reviewed in detail together with the growth of cargo volumes, the necessity for long term planning and the provision of additional infrastructure was discussed. The research aim i.e. to analyse the workings of the port/rail interface together with objectives that were set under Section 1.4 were utilised to achieve the aim of the study.

Transnet's strategy announced on 17 November 2004 together with its new Board of Directors and its "Vulindlela" initiative (discussed under Section 3.9) launched on 14 September 2005 chartered a structured response to enhancing the efficiency of the Port/Rail Interface at the Port of Durban and improving the workings of the numerous rail freight corridors that have their origins and destinations at the various ports. The two most notable features of the strategy is (i) the R37,0 billion capital expenditure proposed for port and rail development over the next 5 years of which R14 billion has been earmarked for Spoornet (ii) integrated planning for port and rail services that will promote logistics management practices.

The Moving South Africa strategy and South Africa's economic state of Transport and Logistics highlighted the short comings of South Africa's transportation network especially rail's loss of market share, the high cost of transportation, the lack of an enabling logistics environment and long term planning.

Rail is a major player in any transportation system because of its carrying capacity and the relatively low cost of transport over distances greater than 400 km. Road transport is not a cost effective alternative to rail transport due to the severe congestion road trucks cause at the various terminals and the damage to our road system the repair cost of which is borne by the public. The projected growth in cargo volumes up to the year 2020 and beyond suggest that the timing is most appropriate to implement investment plans now to address the backlog of maintenance and procurement of rolling stock and locomotives. Spoornet's procurement of new rolling stock and locomotives together with its turnaround strategy to provide a predictable service can guarantee customers delivery times. If these delivery times are not met, then Spoornet should pay its customers penalties. This strategy

together with the types of commodities it would prefer to transport i.e. cargo that can be handled with less sophisticated equipment and that can be assembled into stacks after unloading with relative ease will help Spoornet to regain its market share.

The aforementioned recommendations together with Transnet's business re-engineering exercise will assist tremendously to enhance the logistics management service rendered by Transnet with the associated benefit of reducing the cost of services to businesses in South Africa.

The theoretical framework for the Transformation Model and the Balanced Scorecard demonstrated that an interrelationship can be established between the outputs of the Transformation Model and the monitoring of these outputs/targets under the four perspectives of the Balanced Scorecard. For any re-engineering exercise to be successful and sustainable, requires outputs and targets to be measured and reviewed on an ongoing basis. The Balanced Scorecard is designed as a management tool to fulfill the need to embed best practices and to achieve stretch targets to cater for future capacity growth. The findings of the IVth Framework Programme of the European Commission: Integrated Transport Chains and the First State of Logistics Survey for South Africa highlight the need for best operations practices and a performance management system.

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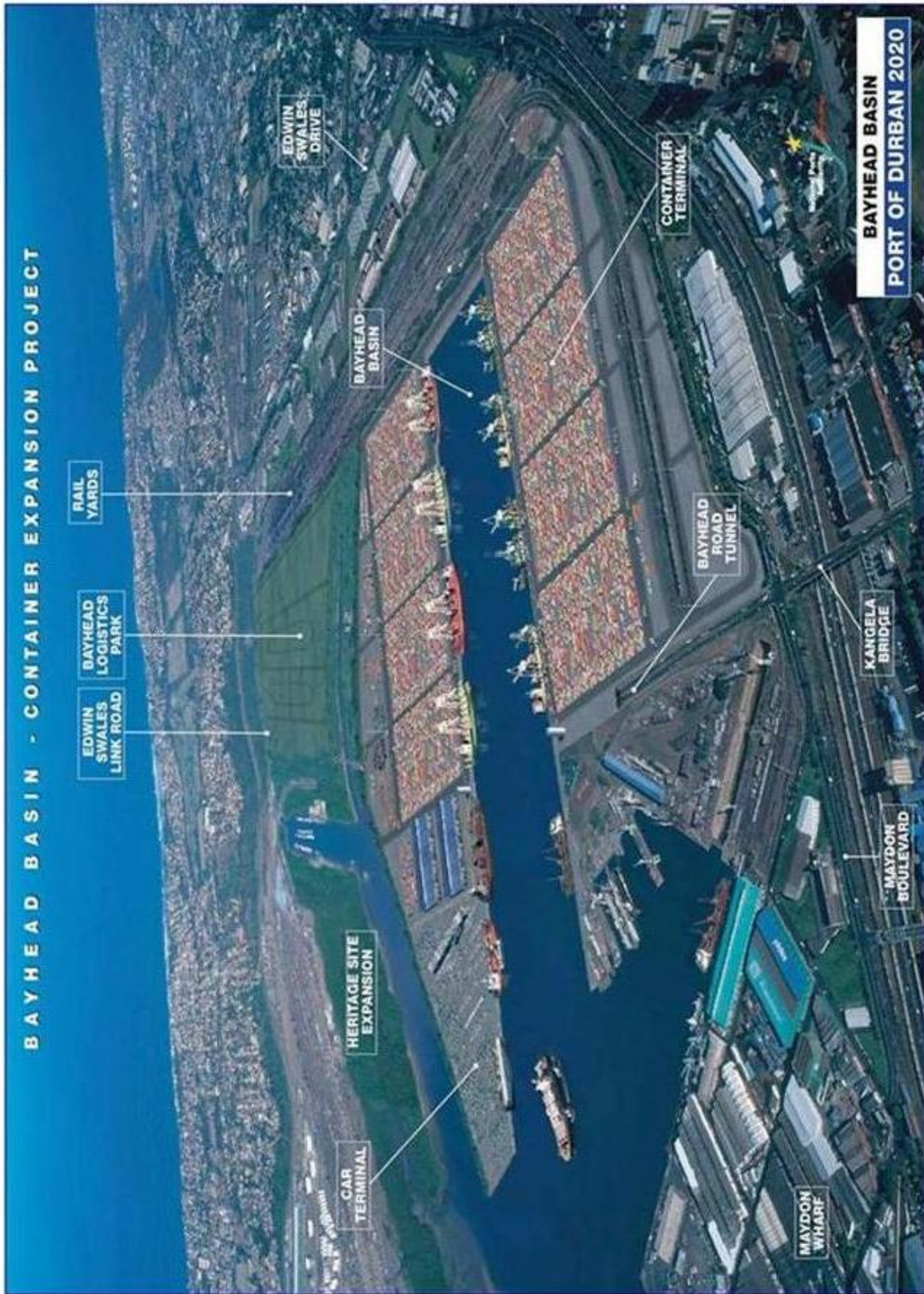
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APPENDIX 4



APPENDIX 5 - STRUCTURED QUESTIONNAIRE

- Question 1** The Bayhead Marshalling Yard (BMY) utilizes modern rail operation practices.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 2** The short term capacity planning of the BMY is in keeping with Client requirements.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 3** That the BMY handles a diverse range of cargoes.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 4** The volumes of the different cargoes reflect a declining trend.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 5** The long-term planning is based on aggregated demand forecasts.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 6** That there is a planned maintenance programme for BMY.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 7** The present condition of the rail lines in the yard makes operations unsafe.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 8** The present condition of the electrification in the yard makes operations unsafe.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 9** All employees understand their roles in the yard operations.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 10** The operations in the yard are efficient.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 11** There is a training and development plan for the various jobs in the yard.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 12** Employees productivity in the Yard is measured using a performance management system.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 13** The process flows of the entire yard are understood by the respective employees
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 14** The rail layout is optimal for current operations within the Port.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 15** The capital expenditure programme for the development of the Port/Rail interface is adequate.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree

- Question 16** Employees participate in improvement programs to enhance efficiency.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 17** The operations personnel have identified bottlenecks in the intermodal interface processes.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 18** The operations strategy for the interface is reviewed regularly.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 19** The performance objectives are monitored on a regular basis.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 20** The maintenance budget is based on the planned maintenance programme.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 21** That a simulation model for the capacity of the BMY exists.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 22** That the level of service to the Port of Durban is in keeping with the Client's requirements.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 23** Management reports on finance and operations are reviewed monthly to review the performance of the terminal and intermodal interface.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 24** A perception survey is conducted on a regular basis to gauge Client's satisfaction.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 25** The intermodal interface has measurable standards for all key processes.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 26** Employees have a good understanding of the Port/Rail Interface.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 27** Employees have a good understanding of the quayside throughputs at the various terminals.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 28** There is a decline in tonnages transported by rail from the quayside.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 29** Rail will be able to cope with the increase in Port tonnages.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree
- Question 30** That a Rail Terminal is the most effective manner of transferring goods from rail to and from ships.
(5) Strongly Agree (4) Agree (3) Somewhat (2) Disagree to (1) Strongly disagree

APPENDIX 6
SEMI-STRUCTURED INTERVIEW QUESTIONS

1. What is your understanding of economic development in South Africa?
2. What is logistics management?
3. What is the relationship between economic development and logistics management?
4. How does globalization affect the South African economy?
5. What is your understanding of intermodalism?
6. How important is infrastructure development?
7. What is your understanding of the port / rail interface?
8. Is the efficiency of the port / rail interface a risk to business in South Africa?
9. Are you aware of initiatives to improve the functioning of the port / rail interface?
10. Are you aware of performance indicators to measure throughputs of the various terminals in the Port of Durban?
11. Are you aware of performance indicators that measure rail throughputs at the various yards and sidings that service the Port of Durban?
12. Are you aware of and / or contributed to the Port Masterplan?
13. Are you aware of and / or contributed to the Rail Masterplan?