

**INVESTIGATION ON ROAD INFRASTRUCTURE, TRAFFIC AND SAFETY
WITHIN THE PORT OF DURBAN**

By

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DECLARATION

This dissertation, except where indicated in the text, is the candidate's own work and has not been submitted in part, or in whole, at any other University or University of Technology.

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ABSTRACT

An increase in road traffic, poor road conditions and high numbers of road accidents are major challenges at the Port of Durban. Roads are considered as the most important transport mode at the Port of Durban. Road transport has taken almost 80% of the import and export cargo while railway transport is left with approximately 20%. It is estimated that 75 million lives in the world will be lost and 750 million people injured in road accidents in the first half of the 21st century.

The Port of Durban is an important vehicle for facilitating economic growth of local, regional and national industries. For the Port to maintain global competitiveness with the current trend of globalization, it has to ensure that roads are well maintained, safe and have a smooth traffic flow with no delays.

This study provides an overview of the road infrastructure within the Port of Durban in relation to road condition, safety, law enforcement and traffic. Existing and ongoing studies conducted in South Africa and abroad form part of the literature review. This study identifies factors that are affecting the condition of road infrastructure such as growth of container cargo, an increase in the dimension and weight of trucks, transport deregulation, port layout and handling equipments. Deregulation of road transport over the past years has resulted in an 80:20 split between road and rail transport putting more pressure on roads. Cost and time are the major deciding factors in the freight industry. Most customers prefer to use road transport due to the lower cost and reduced time compared to rail transport.

There are eight major roads within the Port that connect the South, West and North of eThekweni Municipality namely Bayhead, Quayside, Maydon, Rick Turner, Wisely, South Coast, Bluff and Iran Roads. Asset verification and assessment of the condition of the existing eight major roads found that Quayside Road is in a better condition compared to the other roads. Maydon and South Coast Roads are low rated roads which are in a poor condition. Identification and

assessment of the condition of 210 000m² of asphalt paved areas which included minor roads within the Port of Durban was also conducted. Most paved areas and roads fall under D (fair) category which is reasonable but maintenance work may be required within six months.

Comparison between the condition of the eight major roads within the Port and outside the Port was investigated. The findings indicate that sections of roads outside the Port are in a better condition than sections within the Port.

Traffic counts were conducted in order to determine the utilization of the existing eight major roads. Bayhead and South Coast Road are highly utilized roads. Road accident reports and death reports were analyzed on these roads. Most of the road accidents take place on South Coast Road.

A questionnaire survey was conducted, targeting road users who travel on these roads within the Port. Feedback was obtained on the status of road conditions, safety and traffic within the Port of Durban. Findings of this survey revealed that most of the respondents don't know where to report road defect/s within the Port. Approximately 37.5% of the road users felt not safe to drive on roads within the Port especially on South Coast Road. A high percentage of people (93%) witnessed accidents on these roads. Traffic signals within the Port are maintained by eThekweni Municipality and are very often non-functional. When road signs need to be repaired or replaced, it takes longer than expected. Also, there are limited parking areas around the Port resulting in trucks parking closer to the premises while waiting to collect or deliver cargo. This causes major traffic congestion, for example, on Maydon Road where most trucks park on the side of the road. Recommendations include assessment guidelines that could improve road condition, safety and traffic flow. Areas to be improved with regard to road infrastructure are also highlighted.

Keywords: Road maintenance, Safety, Law enforcement, Traffic congestion, eThekweni Municipality and Port of Durban

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ABBREVIATIONS

CAPSA – Conference on Asphalts for Southern Africa
CSIR – Council for Scientific and Industrial Research
DCP – Dynamic Cone Penetrometer
DCT – Durban Container Terminal
DJP – Durban Johannesburg Pipeline
GCM – Gross Combination Mass
GDP – Gross Domestic Product
ISPS – International Ship and Ports Facility Security
KZN – KwaZulu Natal
LDV – Light Duty Vehicle
MSA – Moving South Africa
NASTC – National Association of Small Trucking Companies
NATMAP – National Transport Master Plan
PMS – Pavement Management System
RTQS – Road Transport Quality System
SAAMA – South African Assets Management Association
SAPS – South African Police Services
SARS – South African Revenue Services
SATC – Southern African Transport Conference
SMME – Small Medium and Micro Enterprise
STIP – Short Term Implementation Project
TNPA – Transnet National Port Authority
TRH – Technical Recommended for Highways
UNRSC - United Nations Road Safety Collaboration
USA – United States of America
WHO – World Health Organization

LIST OF SYMBOLS

m – metres

TEU – Twenty Foot Equivalent Unit

US\$ - United States dollars

t - tons

CHAPTER 1

INTRODUCTION

1.1 Background of the study

In the past all roads within the Port of Durban were owned and maintained by Transnet National Ports Authority (formerly known as Portnet). However, when there is an increase in traffic on roads within the Port and roads are used by the general public, the roads then become public roads which fall under eThekweni Municipality. Currently, most roads within the Port are owned and maintained by Transnet National Ports Authority. Public roads within and outside of the Port are owned and maintained by eThekweni Municipality. EThekweni Municipality is the local government for the City of Durban, in which the Port of Durban is located. Roads such as Bayhead, Maydon, Rick Turner (formerly known as Francois Road), Wisely, South Coast, Bluff, Iran and a section of Quayside Road which connects the West, South and North of eThekweni Municipality are classified as public roads.

Currently, not all roads within the Port are owned and maintained by Transnet National Ports Authority (TNPA). Some of the roads are owned by eThekweni Municipality, Transnet Port Terminals, Transnet Freight Rail and private companies. TNPA is the landlord for the Port of Durban. Private companies and other Transnet divisions such as Transnet Port Terminals and Transnet Freight Rail lease land from TNPA. Change of ownership and delays in reaching agreements between the landlord and lessee contributes to the poor road maintenance.

The maintenance budget for eThekweni Municipality and Transnet National Ports Authority has increased slightly over the past years but not enough compared to the role that is played by these roads in the South African economy. Usually the norm for budgeting in developing countries is that the first priority is capital budget (new items to be bought or built), followed by operational budget and lastly the maintenance budget. This doesn't favor the maintenance of existing assets due to the limited funding.

In the past, South African Railways and Harbours held a monopoly on transport over a 50 km lead distance from the port and therefore all cargo owners, both import and export, were obliged to dispatch their produce by rail. This led to large areas of the Bayhead becoming the preserve of the railways. Large marshalling yards, carriage and wagon workshops were established in the area. When rail was the dominant mode of transport to the port, all the marshalling yards were used and in fact lack of marshalling space often proved to be the bottleneck of the port (Department of Transport KwaZulu Natal, 2010).

In the last fifteen years with deregulation of road transport there has been an immediate and extensive switch of general cargo from rail to road transport with the current split being close to 80% road and 20% rail. This switch has placed tremendous pressure on the road network while railway facilities are now greatly under-utilised and the usage of this prime space needs to be incorporated into the future planning of the port (Department of Transport KwaZulu Natal, 2010).

1.2 Problem statement

The following are some of the problems that are currently being experienced at the Port of Durban:

- Most of the roads within the Port of Durban are in a poor condition and require urgent attention.
- Transnet National Ports Authority as the landlord of the Port is not taking full responsibility for maintenance work especially on lessee's roads and vacant paved areas. Major problems are experienced when there is a change of ownership.

- Too many level crossings at Maydon Road resulting in road traffic congestion and causation of crocodile cracks.
- Shortages of parking areas close to the Port with the result that vehicles park on the roads thus reducing the effective width of the road, slow traffic and causing road accidents.
- The road infrastructure at Bayhead Road is over-utilised and this has resulted in major traffic congestion. Most heavy vehicles use this route to access the Durban Container Terminal.
- The connection between road and rail transport is not working effectively. Rail transport is under-utilized.
- A high number of road accidents on South Coast Road, some resulting in loss of lives.
- A high rate of copper theft on railway lines within the Port of Durban which causes derailments and delays, resulting in clients' loss of trust in railway transport and thus preferring road transport to avoid inconvenience and financial loss.
- Lack of law enforcement resulting in overloading of vehicles, speeding and disobeying of traffic rules.
- Most road users don't know where to report road defect/s on roads within the Port.

1.3 Objectives of the study

The overall objectives of this study were as follows:

- Identify and assess the existing road infrastructure and its condition;
- Determine the rate of deterioration or improvement of the road network;
- Compare condition of roads within and outside the Port which are owned by different authorities;
- Highlight factors affecting road infrastructure within the Port of Durban;
- Determine the utilization of existing road infrastructure by conducting traffic counts;
- Determine road safety by analyzing road accidents reports;

- Determine causes of road accidents and death reports within the Port of Durban;
- Obtain feedback from road users in regard to road condition, safety, traffic and law enforcement via a questionnaire survey; and
- Recommend strategies and guidelines that can be used to improve road conditions, safety, law enforcement and reduce traffic within the Port of Durban.

1.4 Methodology

The following points outline the research methodology:

- Literature review of research conducted locally and internationally, highlighting factors affecting road conditions.
- Verification and assessment of road infrastructure i.e. roads and asphalt paved areas, within the Port.
- Comparison of sections of eight major roads within and outside the Port.
- Traffic count to determine the frequency of utilization of roads within the Port.
- Investigation of road safety within the Port through analysis of road accidents within the Port.
- Questionnaire survey of road users to determine the status of road conditions, safety, traffic and law enforcement.
- Conclusions and recommendations of this study based on the findings.

1.5 Research delimitations

The study focused on road condition, safety, traffic and law enforcement issues within the Port of Durban. It covers eight major roads and asphalt paved areas including minor roads within the Port of Durban where almost 70% of the country's container cargo is handled. Gravel roads and concrete paved areas were excluded during the assessment. Analysis of road accidents was conducted only on the eight major roads which are the main routes of access to the Port of Durban. A questionnaire survey was conducted which targeted road users who

travel on these eight major roads within the Port using light or heavy vehicles. People who use motorbikes, bicycles and those who walk to access the Port were excluded from this survey because of their minor contribution in regard to road condition and traffic.

1.6 Overview of chapters

A brief overview of the chapters is presented below:

Chapter 1 – Introduction

This chapter provides the background to the study. It includes the challenges facing road infrastructure at the Port of Durban such as issues in regard to ownership, status quo of road condition, safety and traffic within the Port of Durban. It also deals with objectives, methodology, limitations of the study and overview of chapters.

Chapter 2 – Literature review

This chapter presents the literature review of existing and ongoing studies/policies related to road infrastructure, traffic and safety within port settings. It also identifies factors that affect the condition of road infrastructure and their contribution to poor road conditions, safety and traffic.

Chapter 3 – Assessment of major roads within the Port

This chapter covers the identification and assessment of eight major roads within the Port, and discussion of the assessment.

Chapter 4 – Assessment of asphalt paved areas within the Port

This chapter covers the identification and assessment of all paved areas which include minor roads within the Port of Durban, and discussion of the assessment.

Chapter 5 – Comparison between major roads within and outside the Port

This chapter outlines the identification and assessment of the section of the eight major roads which fall outside the Port. The assessment is discussed, and compared with the assessments of the sections of these roads which are within

the Port of Durban. The ownership issue and lack of platforms to report road defects is discussed.

Chapter 6 – Traffic survey

This chapter covers traffic counts that were conducted on the eight major roads within the Port of Durban and how road traffic affects the road condition.

Chapter 7 – Road safety within the Port of Durban

This chapter deals with road safety on the eight major roads within the Port of Durban. Road accidents reports on these roads were analyzed. Causes of road accidents and road deaths are discussed.

Chapter 8 – Questionnaire survey of road users

This chapter presents and discusses the results of the questionnaire survey that was conducted which targeted road users who frequently travel on roads within the Port. The questionnaire covered issues pertaining to road condition, safety, traffic and law enforcement.

Chapter 9 – Conclusion and recommendations

This chapter discusses the conclusion and recommendations drawn from the findings of the study. Recommendations regarding promoting the improvement of road condition and of road safety and reducing traffic within the Port of Durban are presented.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A port is a place where cargo is transferred from ships to road or rail transport and vice versa. Ports are gateways leading to and from inland areas (hinterlands) and can be a connection with other areas by means of coastal or inland waterway carriers. The primary objective of a port is to move cargo through the port quickly and economically.

A well-connected port offers greater accessibility, flexibility and reliability, and provides access to the important maritime trade routes which, in turn, offer access to all the significant global markets (CSIR, 2010).

Ports are possibly the most important gateway for trade in maritime countries and thus make a vital contribution to national economies, and directly or indirectly to employment at all levels (Bosman, 2004). Ports are strategic assets serving the nation as a whole.

The real estate of South African ports is currently owned by Transnet Limited. The port authority function is delegated to Transnet National Ports Authority and Transnet Ports Terminal as the operating arm. A port authority (Transnet National Ports Authority of South Africa) is responsible for the maintenance and development of port infrastructure. The port authority involves key role players in its strategic planning, for example the relationship between port and city (Department of Transport, 1996).

Transnet National Ports Authority is responsible for administering the port infrastructure, ensuring the long-term development of the ports to meet the needs of the economy, regulating the operations in the ports by controlling tariffs and service standards where this is necessary in a monopolistic situation, and providing, on a cost recovery basis, essential port services not willingly taken on by private enterprise. In order to promote low costs, high levels of service and shipper choice in the port operations, Transnet National Ports Authority needs to create a competitive environment that enables private enterprise to offer port services (Department Transport, 1996).

There are approximately 210,000 km² of asphalt paved areas and roads within the Port of Durban. In addition, there are eight major roads within the Port that connect the West, South and North of eThekweni Municipality namely Bayhead, Quayside, Maydon, Rick Turner, Wisely, South Coast, Bluff and Iran Roads. The facilities at the port consist of container terminals, a multi-purpose terminal, a general-purpose cargo terminal, a motor vehicle terminal and a bulk liquids terminal (Minnaar, 2003). The capacity of the Port of Durban container terminal is approximately 2.7 million Twenty Foot Equivalent Units (TEU) per year. A TEU is a standard unit for expressing a vessel's cargo-carrying capacity. One TEU implies a rectangular shape with dimensions 20 x 8 x 8 feet.

The Port of Durban is one of the most modern and well-equipped maritime facilities in the world. It is the busiest port in Africa in terms of container traffic and is rated as amongst the top 10 fastest growing ports in the world. There are eight ports in South Africa. The location of the Port of Durban is shown in Figure 1.



Figure 1: Locality map of South African Ports

Source: National Ports Authority, 2004

The port has 58 berths, and handles over 4500 commercial vessels and 55 million tons of cargo a year that is worth 50 billion rand, representing 46% of the total revenue earned by South African Ports. It is the main maritime gateway to Southern Africa and a major transshipment hub for the East African traffic and on the east-west shipping routes, connecting the American continent, Western Europe, Asia, the Far East and Australia. Figure 2 illustrates marine routing to other ports.

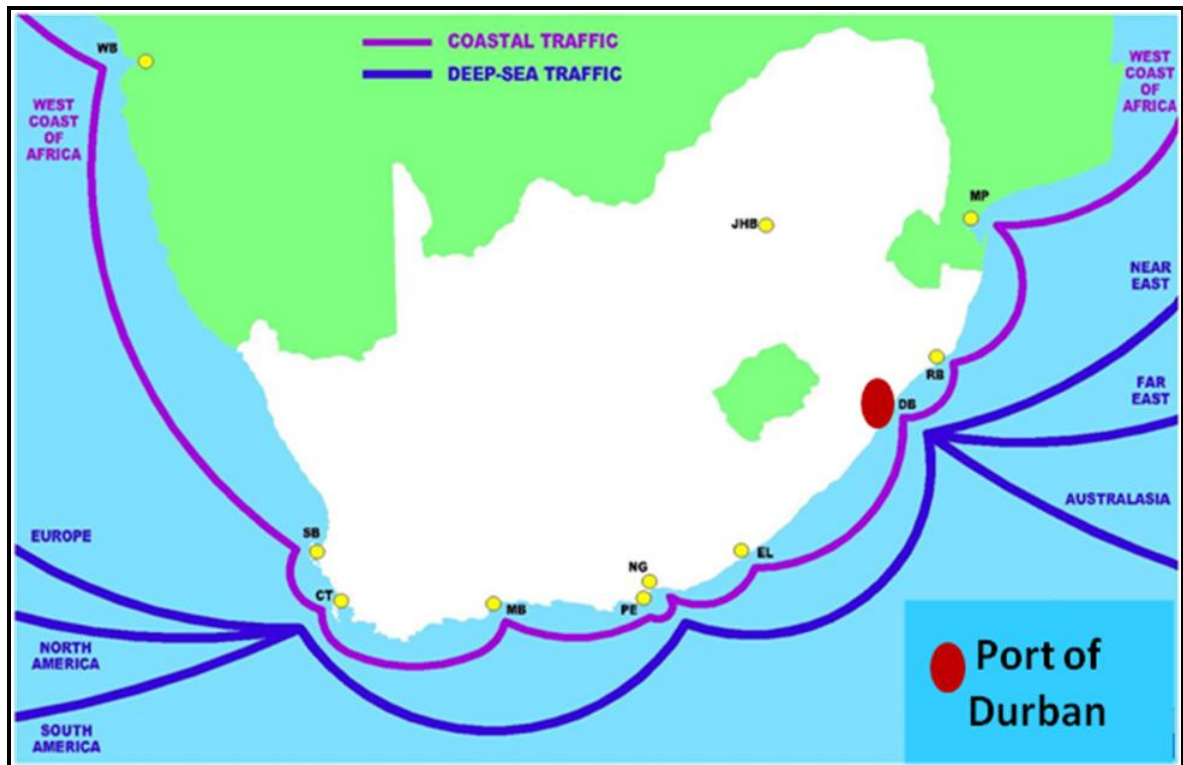


Figure 2: Maritime routing

Source: National Ports Authority, 2004

Given South Africa's distance from its major markets in Asia and Europe, ocean freight costs account for 68% of the cost of transport for containerized imports and 60% of transport cost for containerized exports. South Africa currently enjoys a cost advantage in the international maritime portion of shipping, due to the present imbalance of trade with other countries. A container export to Singapore, for example, enjoys a cost advantage of US\$9 per 100 nautical miles over a container import from Singapore. Similarly, because of the trade patterns, South Africa has a more favorable cost to export than other competing countries, like Argentina (Department of Transport, 1998).

2.2 Existing and ongoing studies/policies related to road maintenance, safety and traffic

In the United States certain states allow larger heavy vehicles on designated routes, but the national interstate highway standard is 36.3 tons (t). This compares to 40t in Great Britain, and 40t to 44t in most European countries. In

the United States, less than half a percent of heavy vehicles are overloaded (RailRoad Association of South Africa, 2005).

Traffic congestion costs the United States hundreds of billions of dollars which equals to 1.5% of the GDP. By 2050, expectations are for a 250% increase in freight traffic, yet miles of highways are only expected to grow by 10%. The national transportation system is stressed and running out of funding (Dutton, 2007).

In Australia, the well-known “Road Trains” have a maximum gross mass of 175 metric tons and standard “B-Triples” measure 36.5m and have a mass of between 82.5t and 90.5t, depending on the State. These vehicles, however, mostly travel over gravel roads in dry areas and have a very limited and controlled access into certain urban areas. In addition, the traffic volumes are comparatively small (RailRoad Association of South Africa, 2005).

In New Zealand, by comparison, the road transport operator pays the equivalent of R4.00 per kilometer for a 44t Gross Combination Mass (GCM) rig. There is no excise tax on diesel fuel for such commercial road operators (RailRoad Association of South Africa, 2005).

The studies and policies such as State of Logistic Survey, National Transport Master Plan 2005-2050, National Ports Master Plan, International Ship and Port Facility Security Code, Infrastructure Maintenance Policy and Procedure of 2003, Pavement Management System of 2003, Arrive Alive and Global Plan for Decade of Action for Road Safety are briefly discussed below.

2.2.1 State of Logistics Survey

The First State of Logistics Survey (CSIR, 2004) was the first of a planned annual initiative to evolve a comprehensive picture of the state of logistics in South Africa, incorporating a macro-economic viewpoint (top-down), an industry-level perspective (bottom-up), and a small business development perspective, dealing with logistics as a developmental constraint for small, medium and micro enterprises (SMMEs) in urban and isolated rural environments.

National Transport Policy White Paper of 1996 and the fourteen-month Moving South Africa (MSA) research project were strategies for the long term development of South Africa's transport and logistics infrastructure which includes the imbalance of road and railway transport. The White Paper document set short and medium period objectives for transport and policy decisions. The vision, in terms of the White Paper, was for "efficient and fully integrated transport operations and infrastructure". The Moving South Africa document was "designed to produce a data-driven program for strategic action" in realizing this vision (CSIR, 2004).

The local situation with freight is exactly the same as in the past number of years. Total freight in 2008 increased slightly by 2% or 32 million tons, with all growth being on road again. This is not ideal; not only is this the main contributor to high transportation costs, but heavy vehicles are damaging our road infrastructure. Various efforts over the past few years have not had the desired effect of getting some appropriate freight back onto rail (CSIR, 2009).

The 6th State of Logistics Survey highlighted the effect of bad roads on total logistics costs. The Survey showed that worsening road conditions can have a substantial increase on the maintenance and repair costs of freight trucks and vehicles, adding to high logistics costs. While South Africa's national roads are in reasonable condition, the roads that are the responsibility of provincial and local governments are deteriorating at an alarming rate. Roads are built to last up to 20 to 30 years, if maintained properly. The lack of maintenance is affecting the smooth running of the economy as well as the ability of South Africa to compete globally from a logistics point of view (CSIR, 2009).

Deteriorating road quality can potentially have many negative effects on the vehicle maintenance costs of a company, which in turn can translate into increased logistics costs and may eventually have a negative effect on the broader economy of a country. One aspect of the 2008 State of Logistics survey was a study on the potential effects of deteriorating road quality on vehicle maintenance and repair costs. The study found that the deterioration of road

quality can lead to drastic increases in vehicle maintenance and repair costs of companies (CSIR, 2009). Other factors, such as increased fuel consumption and increased road and environmental damage, could also be the unwanted consequences of trucks travelling on bad roads (CSIR, 2010).

Increased maintenance and repair costs lead to increased vehicle operating costs for transport operators. In addition, worsening road conditions could result in increased vehicle vibrations, which can eventually translate into increased damages to transported cargo. The transport operator may be held liable for any damage during the transportation of goods. It follows therefore that on roads with deteriorating ride quality the transport operator either has to make a loss or increase transport tariffs due to the higher operating costs. Consequently, the selling price of products may increase – the increased transportation costs are either absorbed by the seller or, as usual, transferred to the consumer (CSIR, 2009).

The impact of the recession can be seen in the reduction of freight tonnage moved during 2009, although the difference is fairly small. The tonnage split of freight between road and rail remained almost the same, 88.7% on road vis-a-vis 11.3% on rail. Once again, the concern needs to be expressed that too much freight is being transported on road. While market forces determine these, one should nevertheless ask the question whether rail is indeed cheaper than road, when one considers the entire value chain. Possibly this is a 'low cost, low service' situation compared to a 'high cost, high service' one (CSIR, 2010).

Modern and properly-maintained infrastructure, be it roads, rail, ports, pipelines or airports, remains critically important for economic growth and development. Supply chains 'operate' on and are the main 'users' of this extensive infrastructure network. South Africa has a comprehensive road network that spans the entire country. The primary network is well maintained, but the secondary roads, which are the responsibility of provincial and local governments, need serious attention. Damage to vehicles caused by potholes probably runs into millions of rand each year. On the rail side, only profitable rail infrastructure is utilised, while large components – notably the branch lines – in

the more rural areas are not used and are becoming increasingly dilapidated. It is interesting to note that the growth of freight on rural roads and rail has increased by 85% over the past six years, which is substantially more than on the traditional main corridors. It is therefore worrying that the infrastructure on which this freight is carried is deteriorating the fastest (CSIR, 2010).

A study commissioned by the Ports Regulator sketches an alarming picture of our ports in comparison with international ports. Not only is the Durban port the most expensive among 12 international ports used for benchmarking in this study, but at the same time, the productivity in Durban is the worst overall. As an example of productivity, the Durban port has an average of 30 crane operations per hour while Antwerp in Belgium has 94 crane operations per hour. Although the South African ports are by far the best on the continent, it is a concern that our ports compare so poorly internationally. Having said this, one needs to caution against making judgments without the proper context. For example, are all the ports used in this study operating in the same way and is it correct to compare the ports without an in-depth understanding of the environment of each port? It is therefore recommended that a more in-depth analysis be undertaken to determine the opportunities available to South Africa from this perspective (CSIR, 2010).

There is general agreement that there needs to be a drastic shift of freight from road to rail in an effort to drive down logistics costs, decelerate road wear and free-up road capacity. The 11% fuel price increase between 2009 and 2010 had a marked impact on transport costs, considering the fuel price is the primary transport cost driver. Had the fuel price remained as it was in 2009, total transport costs in 2010 would have been R5.8 billion less, consequently putting logistics costs as a percentage of GDP at an even more favourable 12.5%. Transport costs as a percentage of total logistics costs would then have been 52%, instead of 53%. Globally, transport costs as a percentage of logistics costs are less than 40%, which makes South Africa's percentage relatively high. Transport costs as a percentage of logistics costs are much higher for the USA than for South Africa, but this is believed to be due to a difference in methodology – some management and administration costs that are depicted separately in South Africa's survey seem to be included under transport costs in the USA (CSIR, 2010).

2.2.2 National Transport Master Plan, 2005-2050

The Transport Lekgotla held on the 08-09 April 2005 under Minute 8 resolved that an Integrated National Transport Plan should be developed, later referred to as the National Transport Master Plan, or NATMAP 2050. Transportation in South Africa is characterized and riddled with both intra- and inter-modal inherited and/or acquired problems, such as:

- the uncontrolled deterioration of rail services, road infrastructure maintenance (potholes) and institutional capacity deficiencies in the sector;
- Transport systems are not demand responsive;
- Poor land use/transport integrated planning in South Africa;
- Transport is inefficient in stimulating the economy optimally; and
- Financing of transportation systems, is often inadequate.

The National Transport Master Plan project goal is to develop a dynamic, long term and sustainable land use/multi-modal transportation systems framework for the development of networks, infrastructure facilities, interchange terminal facilities and service delivery that is demand responsive to national/provincial/district and/or any socio-economic growth strategy, and/or any sectoral integrated spatial development plan. The plan includes a coordinated implementation schedule and/or action agenda for the whole country and/or specific national and provincial spatial development corridors and regions until 2050 (Department of Transport KwaZulu Natal, 2010).

The National Transport Master Plan consisted of four phases, as follows:

- **Phase 1: Status Quo/Inventory:**
 - Transport infrastructure (Road, Rail, Air, Pipeline and Port);
 - Land use;
 - Economic activity; and
 - Population.
- **Phase 2: Analysis:**

- Future model (land use, economic activity and population);
- Analyse transport patterns;
- Analyse capacities; and
- Analyse issues and problems.
- **Phase 3: Forward Planning and Projections:**
 - Demand projection (Road, Rail, Air, Pipeline and Port); and
 - Identify and evaluate alternates.
- **Phase 4: Implementation of Action Agenda:**
 - Programmes, projects and costs;
 - Policies; and
 - Structures.

The promulgation of a NATMAP 2050 Implementation Act should incorporate all facets of transportation planning across the spheres of government, foster comprehensive co-ordination and co-operation, establish norms and standards with regard to project analysis to incorporate both economic and financial assessment within given policy framework(s), and establish integrated multi-modal goal achievement matrices that are measureable in response to land-use priorities and emerging land-use trends (Department of Transport KwaZulu Natal, 2010).

The NATMAP 2050 Implementation Act should – among other aspects– prescribe:

- planning cycles and plan interface among and between the various spheres of government;
- institutional support and executional structures;
- a seamless interface with the workings of the National Planning Commission as the primary input source for transportation investment throughout the country; and
- the empowerment conditions for mode-specific role players to execute upon their sectoral mandates.

It is however crucial that NATMAP is implemented by all the transport authorities in the country. The Department of Transport and public entities, South African National Road Agency Limited, Transnet, Passenger Rail Agency of South Africa and Airport Company South Africa all have a crucial role to play to ensure that NATMAP is implemented. The National Transport Master Plan must be regarded as only the start of a continuous process consisting of annual updates and refinement. The proposed NATMAP Implementation Act will be crucial to facilitate coordination between all stakeholders and promote effective implementation (Department of Transport KwaZulu Natal, 2010).

2.2.3 National Ports Master Plan

The National Ports Bill states that the main function of the Authority is “to own, manage, control and administer ports to ensure their efficient and economic functioning”. The Ports Bill further states that the Transnet National Ports Authority must:

- plan, provide, maintain and improve port infrastructure;
- prepare a port development framework plan for each port, which must reflect the Authority’s policy for development and land use;
- control land use within each Port; and
- ensure that adequate, affordable and efficient port services and facilities are provided.

Transnet has to provide for the movement of freight; and to lower the cost of transport to the national economy. Transnet National Ports Authority has updated individual Port Development Frameworks in a Port Master planning Project. The primary purpose of the National Ports Master Plan is to co-ordinate and integrates these individual plans, and to ensure that the national ports system meets the requirements of the Bill and National Port Act. The practical function of the National Ports Master Plan is to provide strategic direction to the individual ports, to ensure that from national perspective investments in port infrastructure lead to a balanced system, providing economical and efficient port capacity ahead of market demand.

The development plans for Durban are driven by major container expansion required to ensure that the port component of the Durban to Gauteng Freight Corridor can meet future demand. The short term port expansions will be made within the existing port, followed by medium term development of a complementary new port on the old airport site followed by a long term expansion in Bayhead. Figure 3 shows the long term layout of the Port of Durban which includes full development of the existing port and a new dig-out port on the old airport site.

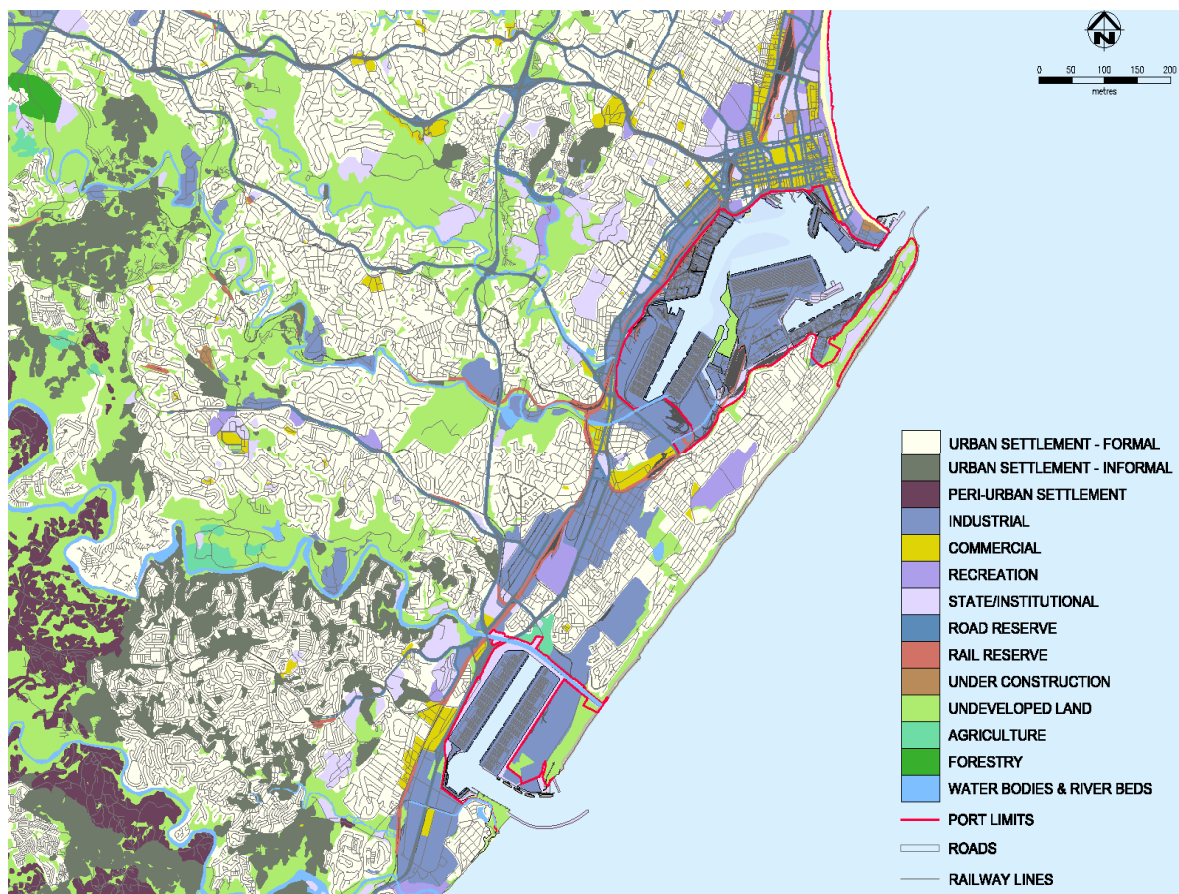


Figure 3: Long term layout for the Port of Durban

Source: Transnet National Port Authority, 2012

2.2.4 International Ship and Port Facility Security Code

The International Code for the Security of Ships and Port Facilities was adopted on the 12th December 2002 by the Conference of Contracting Governments to

the International Convention for the Safety of Life at Sea, 1974 (London, 9-13 December 2002).

The objectives of the International Ship and Port Facility Security (ISPS) Code was to establish an international framework involving co-operation between contracting governments, government agencies, local administrations and the shipping and port industries to detect/assess security threats and take preventive measures against security incidents affecting ship or port facilities used in international trade. In order to achieve its objectives, the Code embodies a number of functional requirements, one of which was to prevent unauthorized access to ships, port facilities and their restricted areas (International Maritime Organization, 2003).

There are three security levels on ISPS which are defined as follows: Security level 1 means the level for which minimum appropriate protective security measures are to be maintained at all times. At security level 1, the following activities must be carried out through appropriate measures in all port facilities, taking into account the guidance given in part B of this Code, in order to identify and take preventive measures against security incidents:

- ensuring the performance of all port facility security duties;
- controlling access to the port facility;
- monitoring of the port facility, including anchoring and berthing area(s);
- monitoring restricted areas to ensure that only authorized persons have access;
- supervising the handling of cargo;
- supervising the handling of ship stores; and
- ensuring that security communication is readily available.

Security level 2 means the level for which appropriate additional protective security measures are maintained for a period of time as a result of heightened risk of a security incident (International Maritime Organization, 2003).

Security level 3 means the level for which further specific protective security measures are maintained for a limited period of time when a security incident is probable or imminent, although it may not be possible to identify the specific target (International Maritime Organization, 2003).

Currently, Port of Durban is at security level 1 and looking forward to improve security in order to move to level 2. The introduction of the security control system known as the International Ship and Port Facility Security (ISPS) Code has also assisted in improving Port security which has a major impact on drivers' behaviour. The Port now has a clear boundary which is fenced all around and there are security check points on each and every Terminal entrance. Most of the time the law enforcement agencies such as Metro Police, South African Police Services (SAPS) and South African Revenue Services (SARS) are working hand in hand on operations. Currently, the weigh bridge at Bayhead Road is not working due to ownership and operational issues. This weigh bridge used to assist in ensuring that all vehicles carry legal goods, are of legal weight and that vehicles are in good condition.

2.2.5 Infrastructure Maintenance Policy and Procedures of 2003 for National Ports Authority of South Africa

The primary purpose of the Infrastructure Maintenance Policy and Procedures of 2003 for National Ports Authority of South Africa is to ensure that the infrastructural assets of the Transnet National Ports Authority are maintained at optimal levels of condition and at minimum total cost. In this context, the determination of optimal levels of condition shall take into account the required serviceability (functionality), reliability and availability, legal requirements, appearance and expected future life of assets. The determination of minimum total cost shall be comprehensive, taking into account the principles of total life cycle cost, resource mix and the requirements of other Transnet National Ports Authority policies and procedures (National Ports Authority of South Africa, 2004).

Other important objectives are:

- to provide a safe, effective and sustainable environment for port users, and users of navigational aids along the coast of South Africa;
- to reduce physical and financial risks;
- to ensure that the maintenance process is carried out in accordance with sound corporate governance principles;
- to provide consistency and continuity in the execution of maintenance, with minimal environmental impact;
- to ensure compliance with statutory requirements;
- to ensure adherence to and integration with other Transnet National Ports Authority policies;
- to ensure that adequate capacity and skills are available for maintenance of assets, and that resources are used effectively;
- to ensure that appropriate maintenance management information is recorded and monitored;
- to reduce the incidence of unplanned maintenance;
- to ensure that the Transnet National Ports Authority responds to the need of being an effective conduit for sea borne trade; and
- to ensure that assets are efficiently and effectively utilised.

The Infrastructure Maintenance Policy and Procedures of 2003 for National Ports Authority of South Africa lead to formation of the Maintenance Manual of 2004 for National Ports Authority of South Africa (National Ports Authority of South Africa, 2004). The Manual is divided into various Port infrastructure assets such as civil infrastructure (roads, water, buildings, quay walls, and dry docks), electrical infrastructure (street lights, cables, substations) and mechanical infrastructure (air-conditioning).

2.2.6 Pavement Management System for Port of Durban

The Pavement Management System (PMS) for Port of Durban covers the fourth evaluation of pavement that was conducted during July 2003, as part of the PMS which was implemented for Port of Durban during 1990.

The main aim of PMS for Port of Durban was based on identifying the condition of all paved areas around the Port of Durban by means of a visual inspection (National Ports Authority of South Africa, 2003).

The purpose of PMS for Port of Durban was to find answers to the following questions:

- What is the present condition of the pavements in the harbour?
- Which roads and loading areas should be scheduled as overlay or reconstruction projects for next 1-3 years?
- Which maintenance option will be the most cost-effective for a given situation?
- At what rate is the pavement deteriorating or improving?

The asphalt paved areas were divided into five areas namely Point, Maydon Wharf, Bayhead, Pier 1 and Island View. The findings of PMS highlighted that roads in the Point area were in good condition. In the Maydon Wharf area, roads were in a bad (very poor) condition. Roads in the Bayhead area were in a reasonable condition. In Pier 1 and Island View areas, roads were generally in good condition (National Ports Authority of South Africa, 2003).

The eThekweni Municipality service level agreement road maintenance states that a reasonable time for repair of potholes is within 48 hours, sink hole and traffic signals within 24 hours, road, sidewalk repairs, reinstatements of trenches, broken kerbs and road signs within 10 days (City of Durban, 1992).

2.2.7 Arrive Alive

The National Department of Transport sent a delegation from KwaZulu Natal (KZN) in 1996/1997 to Victoria, Australia to investigate the "World's Best Practice" on road safety in that state. This was then introduced in KZN originally as Project Victoria, and then rolled out nationally as the Short Term Implementation Project (STIP) prior to Arrive Alive. The success in KZN of 31% reduction of road accidents between 1996 and 1999 was unprecedented in the developing world (Department of Transport, 1997).

The Department of Transport then launched the Arrive Alive Road Safety Campaign in 1997 as a short term initiative to reduce the carnage on our roads. The first campaign ran from 1 October 1997 to the end of January 1998. This formed part of a R53 million national campaign and involved spending an additional 250,000 person-hours on the roads, in mobile courts, on daily roadblocks, on patrols and in administrative offices. Although this campaign involved all nine provinces, the campaign specifically targeted Gauteng, KwaZulu Natal and the Western Cape (Department of Transport, 1997).

An efficient transport system remains the main pillar of every successful and growing economy. The Department of Transport has programmes and transport systems that enhance poverty eradication, job creation, economic development, reducing the cost of doing business and traveling times. Transport is a responsibility that cuts across all spheres of government; requiring consistent co-operative governance, cooperation and coordination at all levels. Road traffic management, non-motorized transport, intra-city freight systems, public transport integration and inter-modal linkages for cargo and people, as well as land use planning are all issues considered as part of an effective transport planning strategy (Department of Transport, 1997).

2.2.8 Global Plan for Decade of Action for Road Safety

Globally, each year nearly 1.3 million people die as a result of a road traffic collision which is more than 3000 deaths each day and more than half of these people are not travelling in a car. Twenty to fifty million more people sustain non-fatal injuries from a collision, and these injuries are an important cause of disability worldwide. Ninety percent of road traffic deaths occur in low- and middle-income countries, which claim less than half the world's registered vehicle fleet. This is, in part, a result of rapid increases in motorization without sufficient improvement in road safety strategies and land use planning. The economic consequences of motor vehicle crashes have been estimated between 1% and 3% of the respective GNP of the world countries, reaching a total over \$500

billion. Reducing road casualties and fatalities will reduce suffering, unlock growth and free resources for more productive use (United Nations, 2011).

The United Nations Road Safety Collaboration (UNRSC) was established as a follow up to General Assembly resolution 58/289 of April 2004, recognizing the need for the United Nations system to support efforts to address the global road safety crisis. Resolution 58/289 invited World Health Organization (WHO), working in close cooperation with the United Nations regional commissions, to coordinate road safety issues within the United Nations System. The Collaboration is chaired by the World Health Organization, with the United Nations regional commissions as rotating vice chairs. It has brought together international organizations, governments, nongovernmental organizations, foundations and private sector entities to coordinate effective responses to road safety issues since 2004. It is an informal consultative mechanism whose members are committed to road safety efforts and which provides governments and civil society with good practice guidelines to address the major road safety risk factors (United Nations, 2011).

The Commission for Global Road Safety issued a call for a Decade of Action for Road Safety in its 2009 report. Endorsements for the proposal have come from a wide range of public figures as well as the United Nations Road Safety Collaboration. The United Nations Secretary-General, in his 2009 report to the General Assembly, encouraged Member States to support efforts to establish a Decade of Action. A decade would provide an opportunity for long-term and coordinated activities in support of regional, national and local road safety (United Nations, 2011).

The overall goal of the Decade of Action will be to stabilize and then reduce the forecast level of road traffic fatalities around the world by 2020. This will be attained through:

- adhering to and fully implementing the major United Nations road safety related agreements and conventions, and use others as principles for promoting regional ones, as appropriate;

- developing and implementing sustainable road safety strategies and programmes;
- setting an ambitious yet feasible target for reduction of road fatalities by 2020 by building on the existing frameworks of regional casualty targets;
- strengthening the management infrastructure and capacity for technical implementation of road safety activities at the national, regional and global levels;
- improving the quality of data collection at the national, regional and global levels;
- monitoring progress and performance on a number of predefined indicators at the national, regional and global levels;
- encouraging increased funding to road safety and better use of existing resources, including ensuring a road safety component within road infrastructure projects; and
- building capacities at national, regional and international level to address road safety.

2.3 Factors affecting condition of road infrastructure

There are a number of factors that contribute to the poor condition of roads within the Port of Durban such as:

- Growth of container cargo;
- Increase in the dimension and weight of trucks;
- Transport deregulation over the past years;
- Cost and time comparison between different transport modes; and
- Current layout of Port and type of handling equipment.

A brief discussion of each factor follows.

2.3.1 Growth of container cargo

The Port of Durban has been experiencing high growth rate in container traffic which impacts on road infrastructure condition. About 70% of South African

container cargo is handled at the Port of Durban. The Port of Durban has a dedicated Container Terminal that handles 2.6 million TEU per annum. Average growth of container volumes over the past few years is between 5-7% per annum.

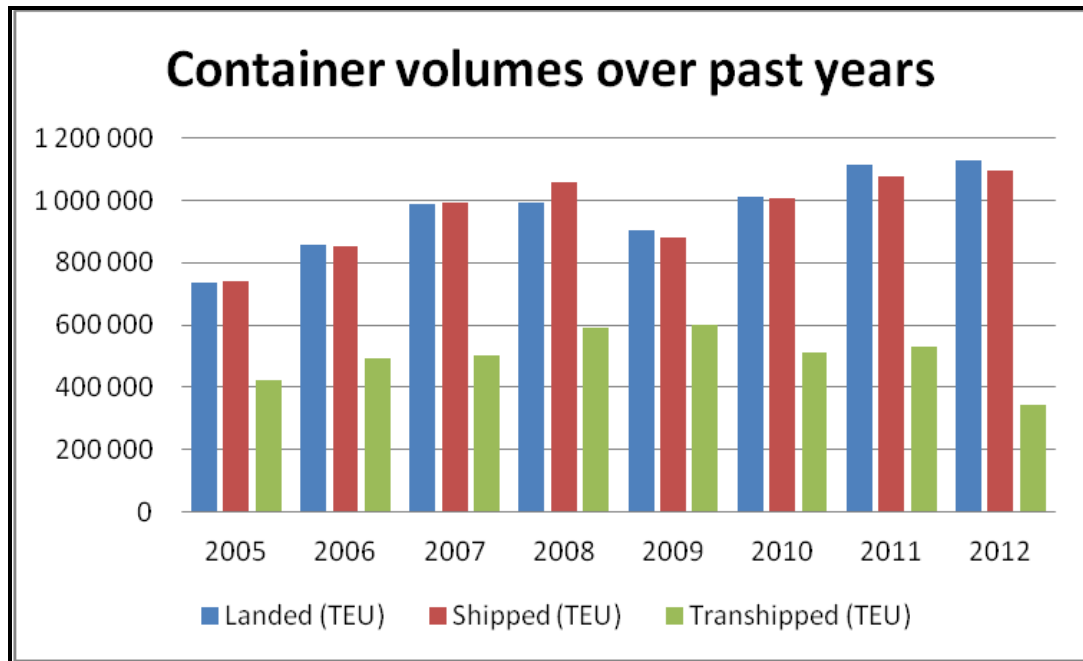


Figure 4: Container volumes at the Port of Durban

Source: Transnet National Port Authority, 2013

As illustrated in Figure 4, the container volumes handled at the Port of Durban over the years has increased from 1.9 million TEU in 2005 to 2.6 million TEU in 2012. The Port of Durban is in Phase 5 since the 1970's in terms of Port Development.

Here are the following major stages in Port Development:

- Phase 1: Traditional – general purpose break-bulk berths;
- Phase 2: Bulking of dry cargo – separate to break-bulk;
- Phase 3: Advent of unit loads e.g. containers and pallets – break bulk declines;
- Phase 4: Transitional multi-purpose terminal – bulk continues to diversify while retaining flexibility to handle unit loads; and
- Phase 5: Specialized – unit load traffic requires separate terminals.

The Port needs to look at European ports where they promote transshipment when they reach Phase 5 in order to avoid poor road conditions as a consequence of increased road traffic.



Figure 5: Growth of Container cargo at the Port of Durban

Figure 5 shows the growth of container cargo at the Durban Container Terminal (DCT) located at Pier 1 and Pier 2. There is high demand for expansion of Durban Container Terminal where medium term development plans for a new port dedicated container terminal at the old airport site and long term plans for Dig-out Port at Bayhead are at the planning stage.

2.3.2 Increase in dimension and weight of trucks

There has been an increase in the dimension and weight of trucks over the years. The overall length of trucks has increased rapidly from 13m in 1960 to 22m in 1996 – almost double the length and the most common length on the road nowadays. The weight, which is gross combination mass (GCM), has increased from 38000 tons to 58800 tons. These changes in dimensions and weight of trucks reflect global trends (Ghoos, Korsgaard, Runge-Schmidt and Agershchou, 2004). These changes have a major impact on the road conditions at the Port of Durban.

The South African history of the trucks dimensions and weight are as follows:

- In 1970: Overall length of truck increased from 13m to 17m. Gross combination mass increased from 38000 tons to 41020 tons.
- In 1980: Overall length of truck increased from 17m to 20m. Gross combination mass increased from 41020 tons to 47007 tons.
- In 1990: Overall length of truck increased from 20m to 22m. Gross combination mass increased from 47007 tons to 56000 tons.
- In 1996: Overall length of truck remains at 22m. Gross combination mass increased from 56000 tons to 58800 tons with 5% overload allowance (Sheat, 1997).

One of the examples of traffic congestion is that one passenger car unit may be considered to occupy 10m² of the deck including space around each car. The normal truck is equivalent to four to seven passenger car units depending on its size (Ghoos et al., 2004). Therefore if there are many trucks occupying the deck, this could result in high traffic congestion.

In the United States, size and weight restrictions vary among the states. Florida allows twin 53 foot trucks on the Florida Turnpike and truckers in Montana and Wyoming can run with a 53 foot truck and 28 foot trailer. Some other states also allow longer or heavier loads (Dutton, 2007).

2.3.3 Transport deregulation over the past years

By the 1970's, government realized that transport deregulation was necessary and that the railway administration would have to be relieved of its former social obligations for transport of uneconomic traffic or on money-losing branch and secondary lines, and for passenger services in general. The form of transport deregulation was debated for another ten years. By 1989 de-facto deregulation had taken place and a Government White Paper on Transport was published in 1991 (RailRoad Association of South Africa, 2007).

While specific issues were identified, consensus could not be reached on implementing necessary control mechanisms such as the Road Traffic Quality System (RTQS) and how fair and equitable road-user fees could be levied to the different size motor vehicles. But the legislation was enacted, the Road Permit system abolished, and a transport “free-for-all” was allowed to develop. Government enacted further legislation, while the Department of Transport unilaterally changed existing statutes, which resulted in larger heavy vehicles appearing on the highways. Axle loads were increased, the Bridge formula relaxed, but the RTQS was not implemented. Competition within the road industry – and not just against rail – led to price cutting, overloading, un-roadworthy vehicles and excessive pressure on truck drivers to work long and uncontrolled hours (RailRoad Association of South Africa, 2007).

The distribution of products and services from the point of origin to point of consumption is a very important part of any country’s gross national product, and indicates how much ‘money’ the country has produced or made. The logistics activities thus mean money to a country (CSIR, 2004).

Effective law enforcement is essential to ensuring equitable competition in road transport. It will also assist in ensuring equity between the road mode and the rail mode (which is effectively self-enforcing) and thus lay a better foundation for intermodal co-operation and interaction. Current road traffic law enforcement relating to various aspects of freight transport is deficient. The Road Transport Quality System (RTQS) is regarded as too complicated and has not yet been fully implemented (Department of Transport, 1996).

Enforcement is a particular issue in the area of truck overloading, where some haulers are able to improve their costs by overloading their vehicles, secure in the knowledge that enforcement will be sporadic at best. While the haulers realize a cost advantage, they create an additional cost in road maintenance and repair. Truck overloading is one of the principal sources of road damage in the country: the 30% to 40% of trucks that are overloaded cause 60% of the damage to the road network. KwaZulu-Natal has demonstrated the best record in enforcement, stopping six times as many vehicles as the next most aggressive

province. As a consequence, the province has the lowest recorded number of overloading incidents, at 35% of all vehicles checked. Even with the best record in the country, KZN need an additional 218 officers, or an additional 57% of existing staffing, to properly enforce the load limits (Department of Transport, 1998).

In the next 20 years, there will be approximately double the amount of freight volume on the nation's highways and growth in terms of lane miles of maybe five percent. So when companies are looking at their distribution systems, they are normally asked the following questions:

- What size of trucks do you need to have?
- Does the big tractor-trailer running around the urban areas make sense?
- Should the trucks be smaller, should they be located closer in, should manufacturing be closer to the ultimate customer and smaller? (Payne, 2007).

The road freight industry has come under increasing pressure because of the continuing problems of overloading. Incidences of motor vehicle roadworthiness non-compliance have been highlighted by the large number of trucks. Truck driver working hours have also become a major issue that must be urgently addressed as part of introducing an up-to-date RTQS for the road transport industry. The establishment of a Railway Safety Regulator has now set standards for the rail industry but a similar regulator is urgently needed for the road industry (RailRoad Association of South Africa, 2005).

The National Association of Small Trucking Companies (NASTC) of the USA focused on further reducing hours of service and championing wider use of electronic on-board recorders. The new hours allow a 14 hour service window and mandate a stop for 10 hours "even if you're 30 minutes from home". However, the new hours of service don't allow the driver flexibility. If drivers don't have the flexibility of driving when they need to drive and sleeping when they need to sleep, they can't do their jobs (Dutton, 2007).

2.3.4 Cost and time comparison between different transport modes

Before customers make a decision on which type of transport mode is best for transporting their goods, they need to consider cost and time. The main question will be how much will it cost to transport the goods and how long will it take. High prices, poor service levels and low reliability are the major problems in railway transport resulting in most customers using the road to transport their goods. Transit time by rail on the Johannesburg/Durban leg is approximately five to seven days whilst it is 24 hours by road. Hence, road transport is more efficient than railway transport (Parliamentary Monitoring Group, 2002).

Road competitors do not carry the full cost of the infrastructure while the rail carries the full cost of the rail infrastructure and facilities. The time and cost associated with transporting freight to rail loading points, the loading onto and off rail wagons and the distribution to receivers is much higher than road haulage. The tendency throughout the world is that rail freight cannot easily compete with road freight on distances less than 600 km (Department of Transport, 2008).

Many general consumer goods, fresh and processed foodstuffs, frozen foods, livestock, fruit and a host of other products are transported from the source to the final destination by road. In the past, and prior to the development of a web of all weather roads, rail was utilized almost exclusively for the long-leg portion, with a supporting Road Motor Service to collect and deliver where necessary. With deregulation of transport, rail has lost considerable market share for several reasons, including the speed and flexibility of road transport. Most importantly however, road transport rates are now often lower than rail, particularly where empty-leg pricing structures can be applied. These low rates have only been possible since road freight operators pay only a fraction of the cost they should be paying for the roads they use, while rail pays 100% of its infrastructure costs (Sheat, 1997).

The rail mode pays for the maintenance of its infrastructure, whereas with road transport the situation is very different. A road freight operator pays an annual license fee for each prime-mover and trailer unit, irrespective of the kilometers

travelled. The road user charge is based on the fuel tax paid for each kilometre travelled. With a typical 7-axle combination, this is less than 60 cents per kilometre (RailRoad Association of South Africa, 2005). Unfortunately, government is presently spending only about the equivalent of six cents, from each litre of petrol and diesel sold, on road maintenance and this is part of the problem (RailRoad Association of South Africa, 2005).

The issue of road user charges has been hotly debated for years but the time has now come to finally solve the problem and introduce a fair and cost-effective system. It has been claimed that the light motor vehicle user subsidises the heavy freight operator and this issue must now be finally resolved (RailRoad Association of South Africa, 2005).

Figure 6 illustrates the typical transit time in the import/export chain. The inland transport leg takes approximately 6 days for export cargo and 9 days for import cargo. The marine transport takes approximately 25 to 31 days for export cargo and 21-23 days for import cargo. Therefore it takes less time in total to import compared to export (Department of Transport, 1998).

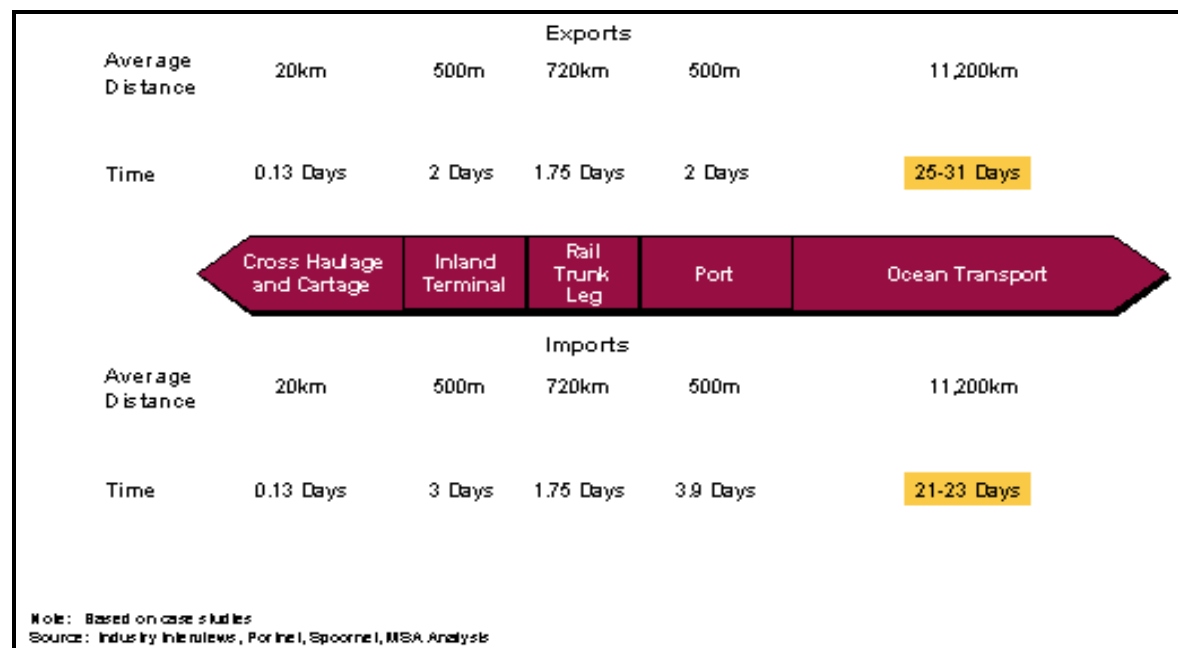


Figure 6: Transit Time in the Import/Export Chain

Source: Department of Transport, 1998

There is a need to improve Transnet Freight Rail (formerly known as Spoornet) by increasing asset utilization, rationalizing support operations in maintenance centers and marshalling yards, and investing in more efficient assets like signaling systems and rolling stock. Such actions could improve Transnet Freight Rail's cost position. However, structural factors such as length of haul, level of road freight competition, and double stack difficulties will impede efforts to reach world-best operating costs (Department of Transport, 1998).

In international settings, long-haul rail costs generally average below 70% of road, whereas currently in South Africa, rail and road freight have similar costs. The result of the changing cost relativity can be a likely shift in share from road freight back to rail for long-distance and from rail to road freight on shorter feeder routes, leading to a much more sustainable balance (Department of Transport, 1998).

Road use should be priced to fully recover the costs of infrastructure provision and maintenance, as well as externalities. This is necessary to restore economic logic to the system. Such a step will ensure long-term sustainability, reduce the negative externality effects, and create a self-supporting system that sends the right price signals for using roads. Correct price signals for different environments (e.g. urban and rural) will help to prevent congestion and pollution (Department of Transport, 1998).

As the balance of trade evens over time, however, the extent of discounted backhauling will decrease. As a result, the maritime cost advantage will deteriorate and the most expensive piece of the shipping chain will increase in price (Department of Transport, 1998).

2.3.5 Current layout of Port and type of handling equipment

The old design of Port Terminals have large warehouses, which are now no longer required, due to inland transport service becoming frequent as trucking has developed (Ghoos et al., 2004).

In order to speed up operating, reduce bottlenecks and avoid accidents, it is essential to prepare the layout of the land areas in such a way that different traffic categories are kept separate. The departing traffic should never interfere with the arrival traffic. The demand for storage facilities is reduced by limiting the time during which cargo is stored free of charge, and by sharply increasing the storage charge day by day after the free time has expired. The Port Master Plan for each port sets the long term development strategy for the port which will influence the future levels of traffic that use it (Ghoos et al., 2004).

The older ports are still using old types of equipment which is not efficient enough and not safe enough during bad weather conditions like wind or heavy rains. Quay cranes for general cargo have to a large extent been replaced by ship's gear, which has generally seen radical improvement. Cargo handling equipment systems should also in principle be optimized by comparison between additional capital, operating, and maintenance costs for equipment on the one hand, and benefits from reduction of waiting time and service time of ships and land transport as a result of increased cargo-handling capacity, as well as benefits from reduction of cargo handling costs and of damage to cargo, on the other hand (Ghoos et al., 2004).

One of the differences between the current operation system and the past operation system is in terms of equipments (quay cranes, husk and ship cranes) that are used to load and unload the ship. By looking at the latest technology, the efficiency equipment can reduce the traffic congestion at the Harbour. The weather (wind) in the Port of Cape Town always causes delays in loading or unloading of cargo because most high cranes can't work in high wind conditions. An interesting development is the "all-weather" terminal, which provides a covered dock for loading and unloading of products such as steel and paper. The improved quality and increased operability of such terminal is attractive for shippers and forwarders (Ligteringen, 2000).

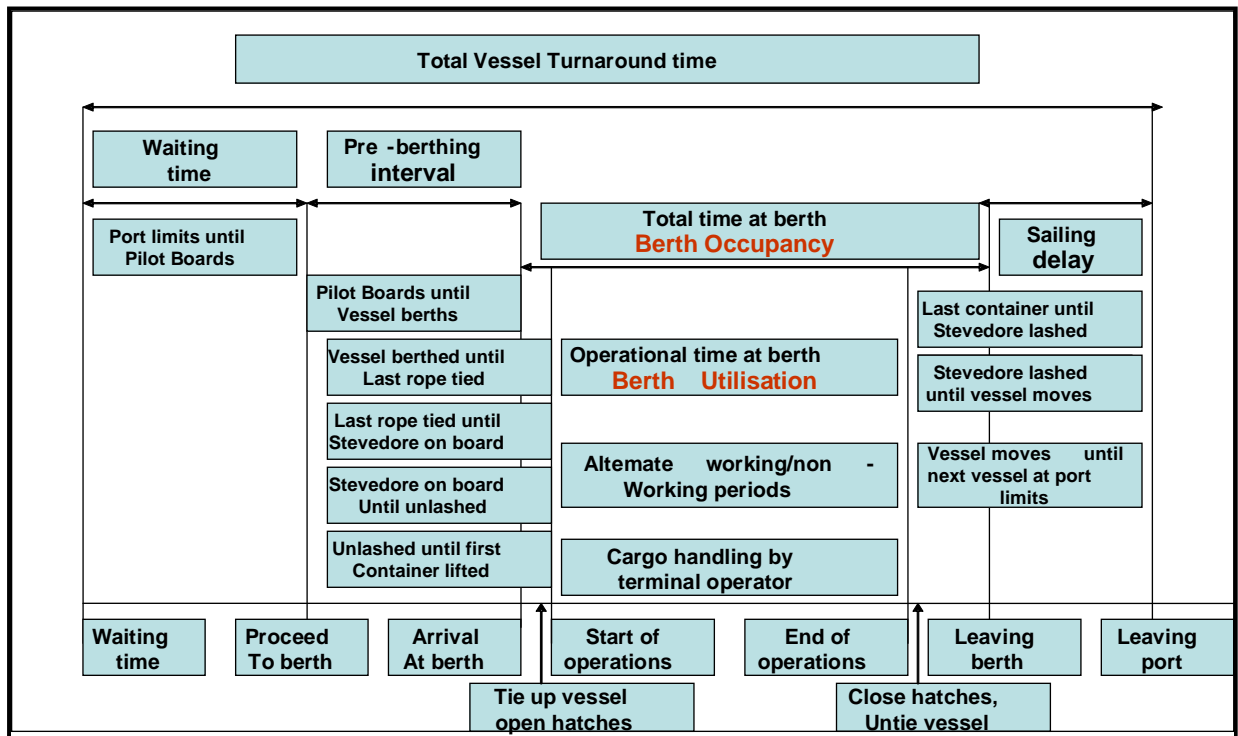


Figure 7: Vessel turnaround time

Source: National Ports Authority of South Africa, 2007

Figure 7 illustrates the process where the vessel arrived at the Port until leaving the Port. The normal target time for this process is two hours (National Ports Authority of South Africa, 2007).

An important measure of port efficiency is “turnaround time” (that is the time a vessel or cargo spends in a port). In the case of a vessel the “turnaround time” is the time required for it to move from harbour entrance to its berth (including possible waiting time at anchorage outside the port), to process the necessary documents associated with the movement of the vessel and its cargo, to take in fuel and load, and to proceed out of the port on its return or next subsequent leg of its voyage. In the case of cargo the “turnaround time” is the time required for the shipment to arrive and depart from the port area. A port with a good port infrastructure and with adequate physical equipment and services will attract cargo traffic from the hinterland that is also served by competitive ports, even though inland distances and rates may be somewhat disadvantageous (Bosman, 2004).

Random vessel arrivals and low levels of capital funding are the key system-level forces influencing poor performance, but there are also substantial operating inefficiencies at the firm level. These inefficiencies include structural concerns like terminal configurations, and operational issues such as low crane productivity, low crane intensity, inefficient links between customers' agents and ship lines, and constraints on systems and equipment. Substantial improvement will require a concerted effort by ship lines, ports, and infrastructure investors (Department of Transport, 1998).

2.4 Conclusion

National transport strategies used in countries like Argentina (Plan Nacional de Transport of 1982), United States of America (Moving America of 1991) and New Zealand (National Land Transport Strategy of 1998) have been successful in these countries. The strategy used in South Africa has seen little success since its implementation (Department of Transport, 1998).

Despite programmes and studies such as Project Victoria of 1996, Short Term Implementation Project of 1996, White Paper on National Transport Policy of 1996, Arrive Alive Road Safety Campaign of 1997, Moving South Africa Action Agenda of 1998, Infrastructure Maintenance Policy and Procedures of 2003, International Ship and Ports Facility Security of 2003, National Port Act of 2005, National Transport Master Plan (Phase 1 to 4) of 2011, Global Plan for Decade of Action for Road Safety of 2011 and First to Eight State of Logistics Survey of 2012 poor road conditions, safety, law enforcement and traffic still remain a challenge at the Port of Durban.

There are factors that contribute to the poor condition of roads within the Port of Durban such as growth of container cargo, increases in the dimension and weight of trucks, road transport deregulation over the past years, cost and time comparison between different transport modes, and current layout of Port and type of handling equipment. Container volumes have grown from 1.1 million TEU in 2003 to 2.7 million TEU in 2011. The overall length of trucks has increased from 13m in 1960 to 22m in 1996 and the weight (gross combination mass) has

also increased from 38000 tons to 58800 tons. Deregulation of road transport over the past years has put more pressure roads and resulted in an 80:20 split between road and rail. Due to the lack of law enforcement many trucks are overloaded, contributing to accidents on roads. Cost and time are the major deciding factor in freight industry and hence most customers prefer to use road transport due to lower cost and reduced time compared to rail transport. Port of Durban has upgraded their layout and has the latest handling equipments whereas other Africa ports lack infrastructure. This has put more pressure on Port of Durban to handle more cargo and transport it to the neighboring countries.

CHAPTER 3

ASSESSMENT OF MAJOR ROADS WITHIN THE PORT

3.1 Introduction

This chapter covers the asset verification and assessment conducted on the existing eight major roads within the Port. Asset verification and assessment were conducted on the following eight major roads: Bayhead, Quayside, Maydon, Rick Turner, Wisely, South Coast, Bluff and Iran Roads. The following Figure 8 shows the road network of the eight major roads within the Port of Durban.

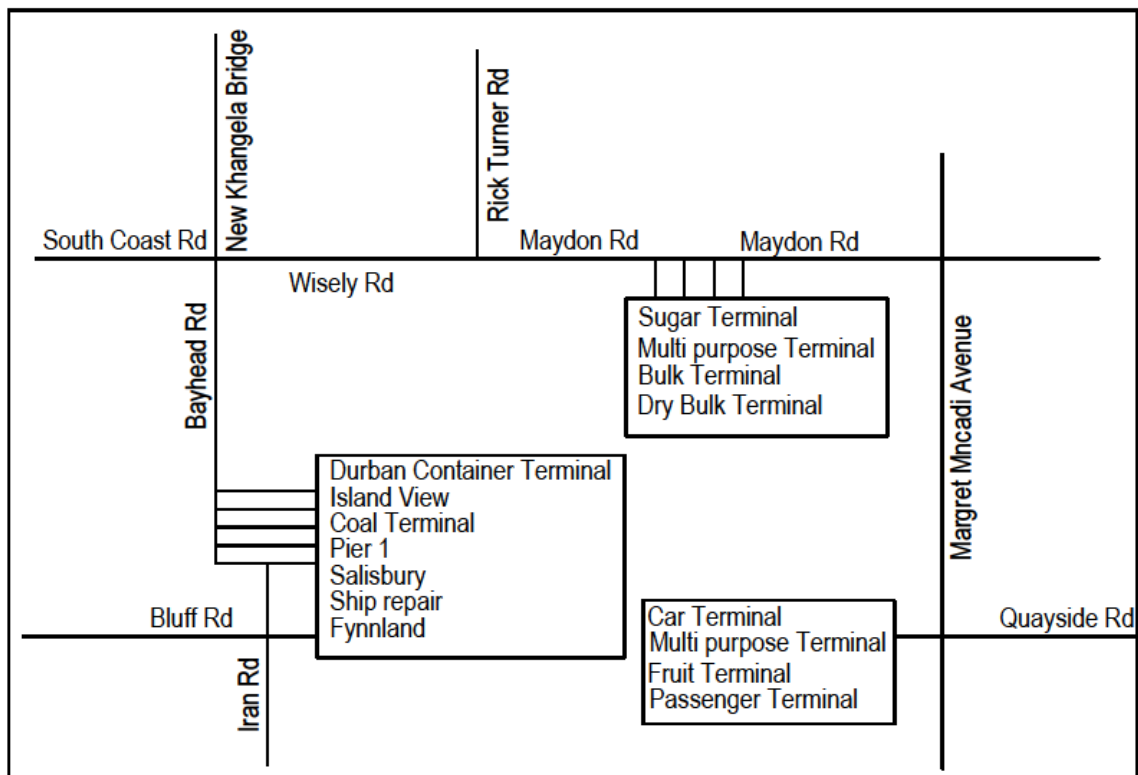


Figure 8: Road network within the Port of Durban

3.2 Asset verification

The Pavement Management System Manual was used as the reference for physical site measurements for the eight major roads within the Port of Durban which were conducted as part of the assets verification process. Roads were verified and the following results shown in Table 1 were obtained.

Table 1: Schedule of road verification within the Port

No.	Road name	Date of survey	Length within Port	Number of lanes in each direction
1.	Quayside	25/10/2011	3 km	1
2.	Maydon	27/10/2011	2.4 km	1
3.	Rick Turner	01/11/2011	0.4 km	1
4.	Wisely	01/11/2011	0.6 km	2
5.	Bayhead	03/11/2011	5 km	2
6.	South Coast	03/11/2011	2.3 km	1
7.	Bluff	10/11/2011	2.4 km	1
8.	Iran	10/11/2011	1.6 km	1

Note: The measurements for Maydon, Wisely and Iran Road represent the full length of the road. Bayhead, Quayside, Rick Turner, South Coast and Bluff Road measurements are divided into two sections. The measurements represent the section of roads that fall within the Port.

3.3 Assessment of roads within the Port

The visual inspection (eyeball method) was identified for assessing the condition of the road infrastructure. This method is a quick visual inspection of the road on a routine basis to identify problems. The visual inspections were conducted on

various days as illustrated in Table 1. Assessment results were recorded on inspection sheets and cover all eight major roads as per Appendix 1.

During the visual inspection of each road, an inspection report was compiled which included the following components: road markings, traffic signs, potholes, cracks, rutting, aggregate loss, riding quality, surface drainage and unpaved shoulders. Each component was rated using the rating method contained in Table 2.

Table 2: Rating method

Percentage	Description	Rating	Colour code	Description
100-90%	Excellent	A	Dark Blue	New and perfect. No maintenance work required at this stage
89-70%	Very good	B	Blue	Looks like new and minor maintenance work may be required at a later stage
69-50%	Good	C	Green	Moderate and maintenance work may be required within 12 months
49-30%	Fair	D	Yellow	Reasonable but maintenance work may be required within 6 months
29%-10%	Poor	E	Red	Not safe and needs urgent attention
9%-0%	Very poor	F	Dark Red	Very poor and reconstruction work required urgently

Source: National Ports Authority of South Africa, 2004

Figure 9 shows the typical defects found on Maydon Road and most of these crocodile cracks are a result of level crossings.



Figure 9: Crocodile cracks on Maydon Road

The findings of the assessment were recorded on the inspection report. Table 3 shows an example of an inspection report that was conducted on Bayhead Road.

Table 3: Example of an inspection report conducted on Bayhead Road

Component	Weight	Rating	Weighted Average
Road markings	10	65%	6.5
Traffic signs	10	65%	6.5
Potholes	20	45%	9
Cracks	10	45%	4.5
Rutting	10	45%	4.5
Aggregate loss	10	45%	4.5
Riding quality	10	50%	5.0
Surface drainage	15	45%	6.75
Unpaved shoulders	5	65%	3.25
TOTAL	100		50.5

The weighting of each component was identified based on importance and damage that can be caused if that particular component was not repaired. Rating score was based on the condition of the component and Table 2 was used during the rating process.



Figure 10: Longitudinal cracks on Bayhead Road

Figure 10 and Figure 11 show the type of asphalt defects observed during the assessment. Figure 10 shows the longitudinal cracks found on Bayhead Road where the asphalt layer failed on the joint. Figure 11 shows the depression on the asphalt layer found on Bayhead Road close to the intersection with South Coast Road.



Figure 11: Depression on the asphalt layer on Bayhead Road

3.4 Results

The results from the inspection reports are indicated in Figure 12. Maydon and South Coast Roads are low rated roads which are in a poor condition. Quayside Road is high rated which is in a very good condition.

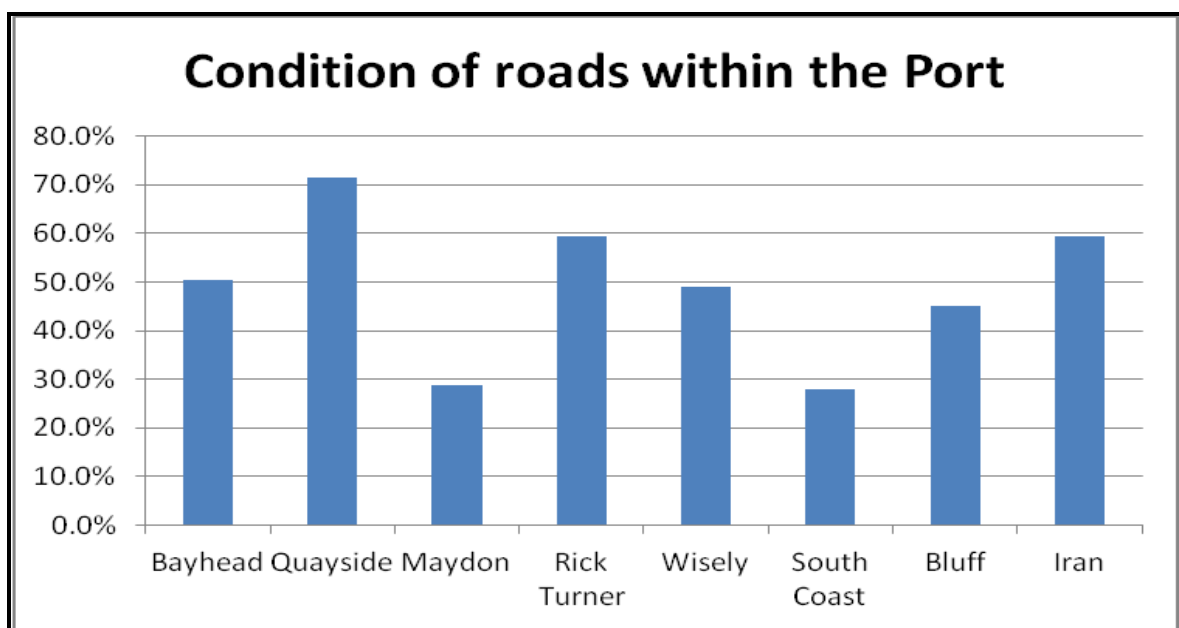


Figure 12: Summary of major roads condition within the Port

The following are results obtained during the assessment of roads within the Port:

- Quayside Road (71.5%) falls under B (very good) category. New and minor maintenance work may be required at a later stage.
- Rick Turner Road (59.5%), Iran Road (59.5%) and Bayhead Road (50.5%) fall under C (good) category. Moderate, but maintenance work may be required within 12 months.
- Wisely Road (49%) and Bluff Road (45%) fall under D (fair) category. Reasonable, but maintenance work may be required within 6 months.
- Maydon Road (28.8%) and South Coast Road (28%) fall under E (poor) category. Not safe and needs urgent attention.

3.5 Conclusion

Maydon and South Coast Roads are low rated roads which are in a poor condition. These roads are not safe and urgent attention is required. Quayside Road is the better road compared to other roads and it falls under B (very good) category. The road length of some roads such as Wisely and a section of Rick Turner Road within the Port are less than a kilometer.

CHAPTER 4

ASSESSMENT OF ASPHALT PAVED AREAS WITHIN THE PORT

4.1 Introduction

This chapter covers methods used during the asset verification and assessment of existing asphalts paved areas including minor roads within the Port of Durban in areas such as Point, Maydon Wharf, Bayhead, Pier 1 and Island View. The Point area consists of Multi Purpose Terminals and a Car Terminal. Maydon Wharf handles bulk and break bulk cargo. Bayhead consists of a Dry-dock where ships are repaired. Pier 1 specializes in container cargo. Island View area handles gas, chemical and petroleum cargo. The following was excluded from this chapter:

- Eight major roads (covered in Chapter 3), eThekweni Municipality roads, Transnet Port Terminals, Transnet Freight Rail and Private lessees' areas; and
- Concrete paved roads and gravel roads.

Figure 13 shows the subdivision of the Port of Durban into the five areas covered by the study.

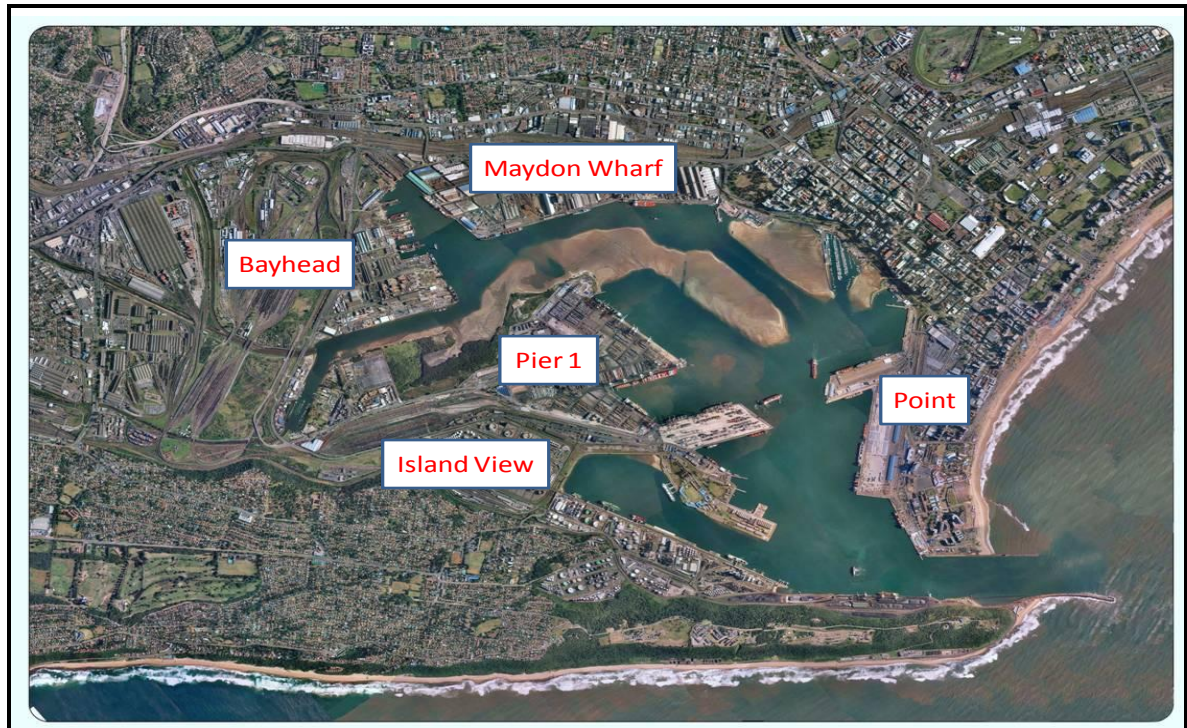


Figure 13: Asphalt paved areas within the Port of Durban

Source: National Ports Authority of South Africa, 2004

4.2 Methodology

The Pavement Management System Manual was used as the reference for physical site measurements of these paved areas and roads within the Port of Durban. Physical verification was conducted as part of the asset verification process. Graphs and Computer Aided Drawings (CAD) have been included to assist the Engineer in easily identifying affected areas.

For the purpose of evaluation and reporting, the Port has been divided into the five following areas:

- Point area – includes tug jetty area, Q-R Berth, O-P Berth, M and N Berth, T-Jetty and harbour entrance. Includes both paved areas (quayside areas) and roads.
- Maydon Wharf – Berths 1-6 and 8, Bollards 136-171, all roads corridors. Excluding: Berths 7, 10, 11 & 12 (Transnet Port Terminals Areas) and the main roads (eThekweni Municipality roads). Includes paved areas and roads.

- Bayhead – Bayhead Park, Incinerator site and Breder Road. Includes minor roads only and excludes main roads such as Bayhead Road which belong to eThekweni Municipality.
- Pier 1 – Gate 8 Entrance and Fire Station. Includes minor roads only and excludes main roads owned by eThekweni Municipality.
- Island View – Kuwait Rd (Power supply Depot). Includes minor roads only and excludes main roads owned by eThekweni Municipality.

Paved areas are divided into panels and each has a unique number. The numbers on the bollards along the quaysides are used to identify the panels, where possible, with the first row (A) adjacent to the quay face. Subsequent rows are numbered alphabetically as they get further away from the quay face. For example at Point area the panel in row A between bollards 180 and 181 is numbered A180-181 and the panel in the 3rd row is numbered C180-181.

Road panels are prefixed with AR, starting with AR1 onwards and the panels are normally approximately 30 meters in length. The distance between lampposts defines the length of certain panels represented by AP such as roads in the Point area.

Each panel was evaluated and the extent of the defects was recorded. Drawings using CAD and Microsoft Project were also used to control the progress of this study. Spreadsheets were used for recording data and creation of graphs.

4.3 Assessment

The visual inspection (eyeball method) was utilized for assessing the condition of the asphalt paved areas and roads. This method is a quick visual inspection of the paved areas and roads on a routine basis to identify problems. The visual inspections were conducted on all paved areas and roads highlighted in Appendix 2 to Appendix 5. Appendix 2 shows the Point area where panels start from A0 to A182, B94 to B182 and C178 to C182 which totals 19614m². Roads start from AR1 to AR120, AP1 to AP6 and AS13 which totals 30391m². Appendix 3 shows the Maydon Wharf area where panels start from A1 to A171 which totals

42534m². Roads start from AR300 to AR334 which totals 17309m². Appendix 4 shows the Bayhead area where Roads start from AR23 to AR125 which totals 8538m² and panels are not available. Appendix 5 shows Pier 1 and Island View areas. Roads for Pier 1 start from AR263 to AR330 which totals 32585m² and roads for Island View starts from AR218 to AR251 which totals 10846m². Panels are not available for these areas. The schedule of assessment dates that were undertaken is tabulated in Table 4.

Table 4: Schedule of assessment of areas

Assessment dates	Area (location)	Panels	Roads	Total area (m²)
Tuesday 15-02-2011	Point	19614	30391	50005
Thursday 17-02-2011	Maydon Wharf	42534	17309	59843
Tuesday 22-02-2011	Bayhead	N/A	8538	8538
Thursday 24-02-2011	Island View	N/A	32585	32585
Tuesday 01-03-2011	Pier 1	N/A	10846	10846

During the visual inspection of paved areas and roads, an inspection report was compiled which included the following components: road markings, traffic signs, potholes, cracks, rutting, aggregate loss, riding quality, surface drainage and unpaved shoulders. Each component was rated using the rating method highlighted in Table 2, Chapter 3. Assessment results for all five areas were recorded onto inspection sheets as per Appendix 6-10.

Typical defects found on Java Road are shown in Figure 14 and most of these crocodile cracks are as a result of level crossings.



Figure 14: Crocodile cracks on Java Road – Island View area

The findings of the assessment on the paved areas were recorded on the inspection report. Rating score was based on the condition of the component and Table 1 was used during the rating process to complete the inspection report as shown in Table 5.

Table 5: Example of an inspection report conducted at Point

AREA ASSESSED : POINT AREA			
Panel No.	Area m²	Rating	Comments
A180-A181	326	B	P
A181-A182	326	D	P,O,D
B94-B95	353	A	N/A
B95-B96	467	A	N/A
B143-B145	300	D	P,O,D
B148-B149	623	D	P,O,D
B149-B150	939	D	P,O,D
B178-B179	408	D	P,O,D
B179-B180	408	D	P,O,D
B180-B181	408	D	P,O,D
B181-B182	408	E	P,O,Cr
C178-C179	408	E	P,O,Cr
C179-C180	482	E	P,O,Cr
C180-C181	334	F	P,O,D,Cr
C181-C182	408	F	P,O,D,Cr
A=Excellent, B=Very Good, C= Good, D=Fair, E=Poor & F=Very poor			
P=Potholes, O=Overlay, D=Depression, Cr=Cracks & R=Re-construct			

4.4. Findings

4.4.1 Point area

Most paved areas and roads at Point are in a fair condition. Approximately 10.1% are in excellent condition, 18.9% in very good condition, 20% in good condition, 32.6% in fair condition, 16.8% in poor condition and 1.5% in a very poor

condition. Figure 15 highlights the status of paved areas and road conditions at Point.

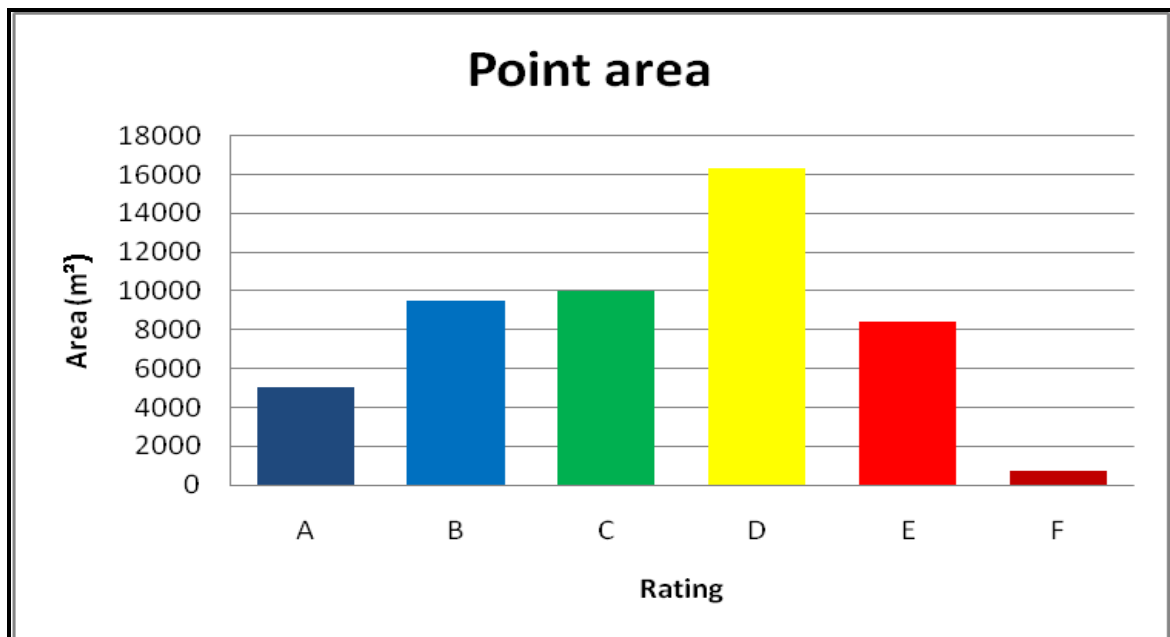


Figure 15: Condition of asphalt paved areas and roads at Point

4.4.2 Maydon Wharf area

Most paved areas and roads at Maydon Wharf are in a fair condition. There are 0.8% of paved areas and roads in excellent condition, 13.5% in very good condition, 18.4% in good condition, 43.9% in fair condition, 21.7% in poor condition and 1.6% in a very poor condition. Routine maintenance such as crack sealing, road overlay and pothole repair is required. Figure 16 indicates the status of paved areas and road conditions at Maydon Wharf.

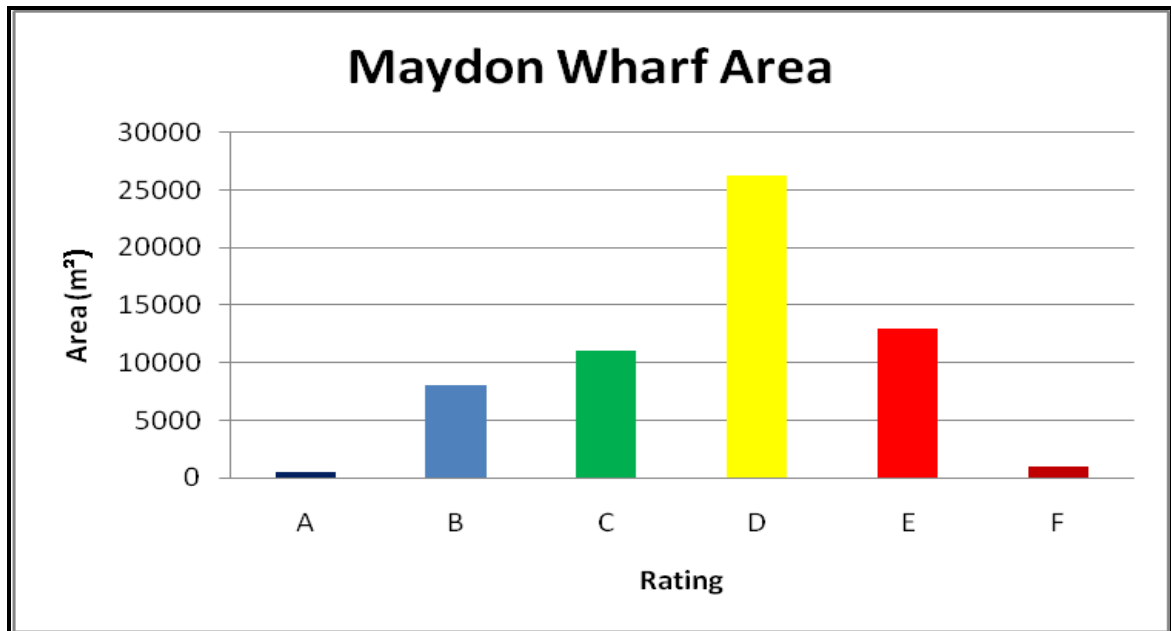


Figure 16: Condition of asphalt paved areas and roads at Maydon Wharf

4.4.3 Bayhead area:

Most roads at Bayhead are in a fair condition. Two percent of roads are in excellent condition, 15.1% in very good condition, 24.8% in good condition, 39.1% in fair condition, 17.7% in poor condition and 1.2% in a very poor condition. Figure 17 illustrates the status of road conditions at Bayhead.

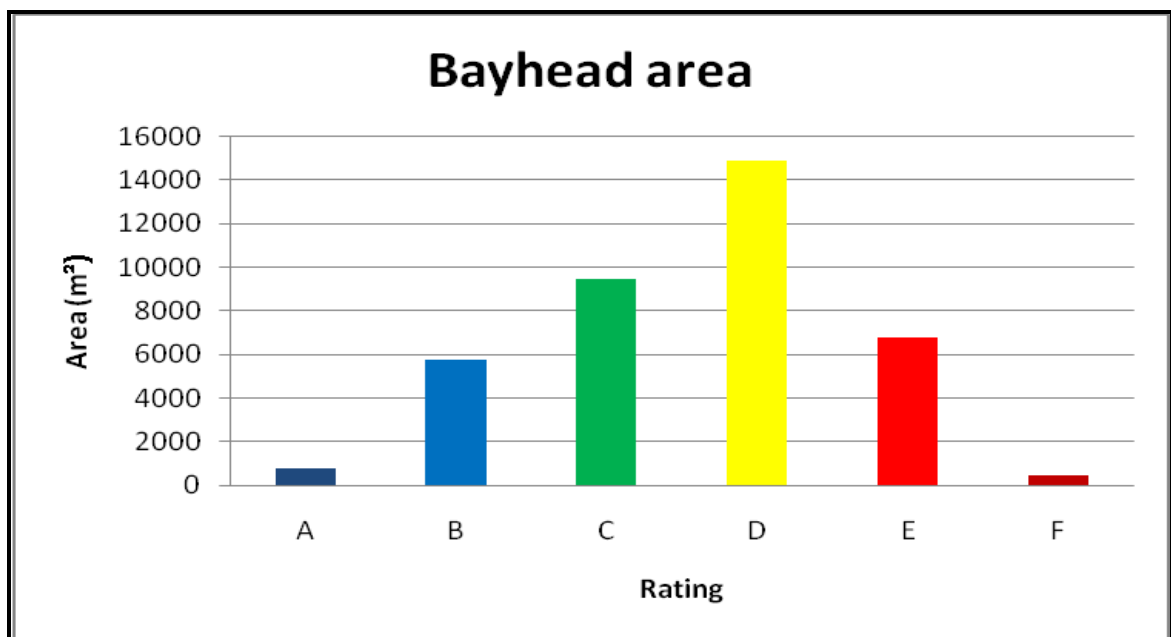


Figure 17: Condition of roads at Bayhead

4.4.4 Pier 1 area:

Most roads at Pier 1 are in a good condition. There are 2% of roads in excellent condition, 37.8% in very good condition, 47.9% in good condition, 9.9% in fair condition and 2.4% in poor condition. This is a well maintained area but continued inspections are required to keep the area in serviceable standard. Figure 18 indicates the status of roads at Pier 1.

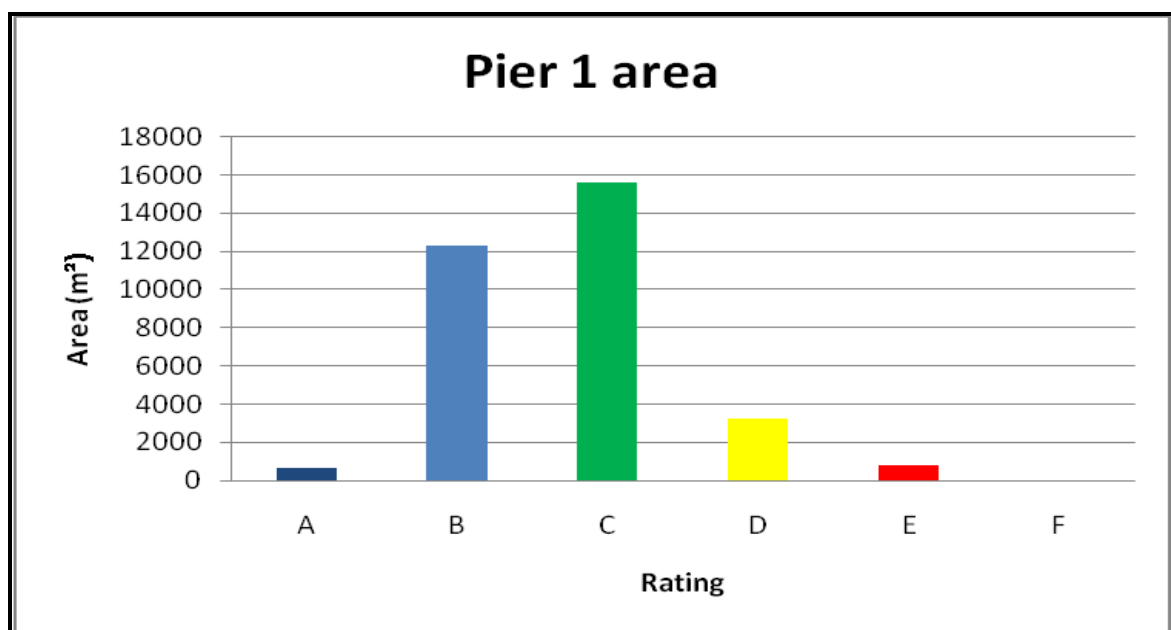


Figure 18: Condition of roads at Pier 1

4.4.5 Island View area:

These roads are within the fuel, gas and chemical storage area and roads are generally in a fair condition. There are 2.3% of roads in excellent condition, 7.5% in very good condition, 18.1% in good condition, 62.4% in fair condition, 8.5% in poor and 1.3% in a very poor condition. Routine maintenance such as crack sealing, road overlay and pothole repair will be required. Figure 19 indicates the status of roads at Island View.

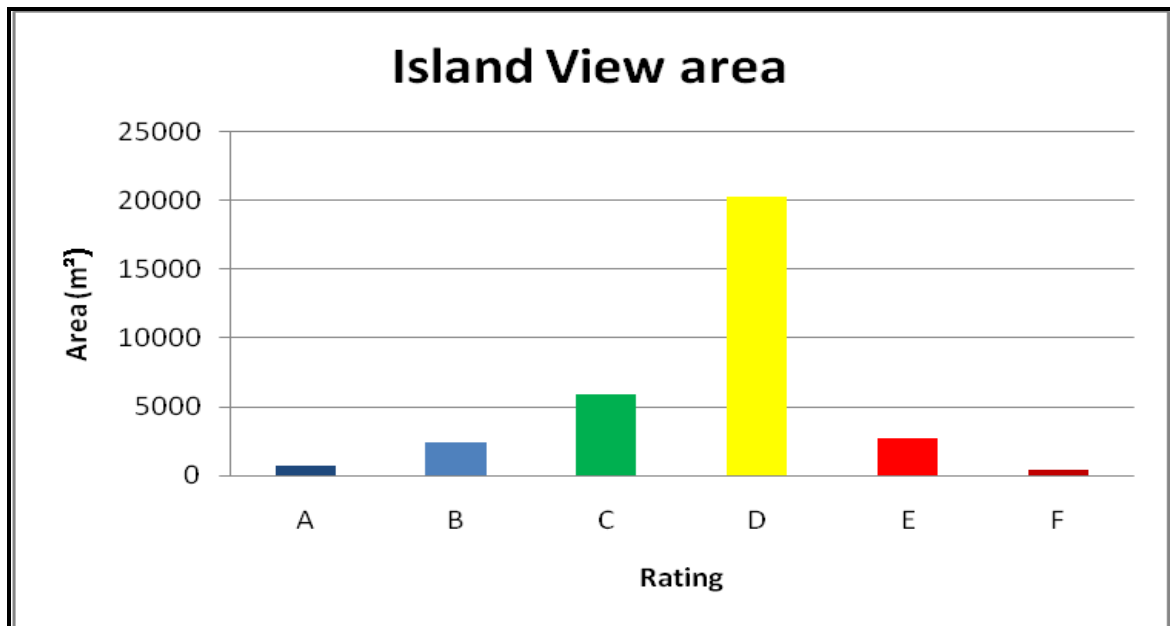


Figure 19: Condition of roads at Island View

4.5 Summary of results:

The results from the inspection reports conducted on the asphalt paved areas and roads within the Port are shown in Figure 20. Approximately 54% of paved areas and roads within the Port are between fair and very poor condition.

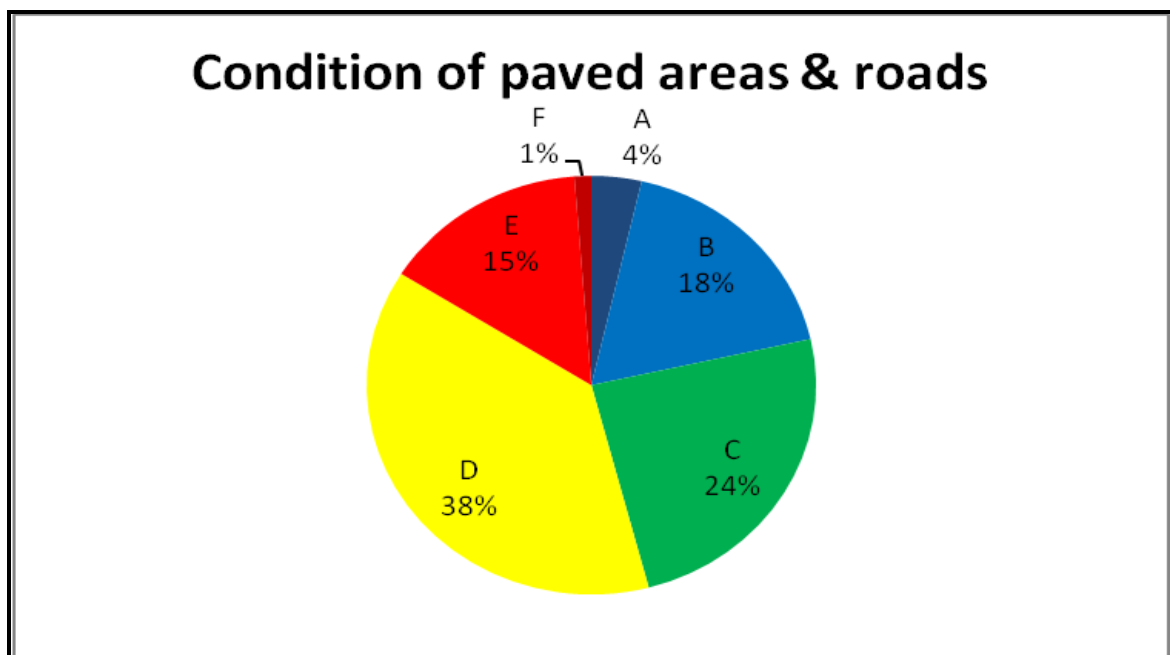


Figure 20: Summary of condition of asphalt paved areas and roads

The following are results obtained during the assessment of paved areas and roads within the Port:

- 4% of paved areas and roads fall under A (excellent) category. Look like new and perfect. No maintenance work required at this stage.
- 18% of paved areas and roads fall under B (very good) category. Look like new and minor maintenance work may be required at a later stage.
- 24% of paved areas and roads fall under C (good) category. Moderate maintenance work may be required within 12 months.
- 38% of paved areas and roads fall under D (fair) category. Reasonable but maintenance work may be required within 6 months.
- 15% of paved areas and roads fall under E (poor) category. Not safe and need urgent attention.
- 1% of paved areas and roads fall under F (very poor) category. Very poor and reconstruction work required urgently.

4.6 Conclusion

Most asphalt paved areas and roads within the Port falls under D (fair) category which is reasonable but monthly inspections need to be done. Roads at Pier 1 area are in better condition compared to other areas. Maydon Wharf and Island View areas are worse areas and need more attention.

CHAPTER 5

COMPARISON OF MAJOR ROADS WITHIN AND OUTSIDE THE PORT

5.1 Introduction

This chapter covers identification and assessment of existing sections of major roads that extend outside the Port. It also covers comparisons between major roads within and roads outside the port. Figure 21 shows road networks within the Port and roads highlighted in dotted lines are roads outside the Port where assessment was conducted.

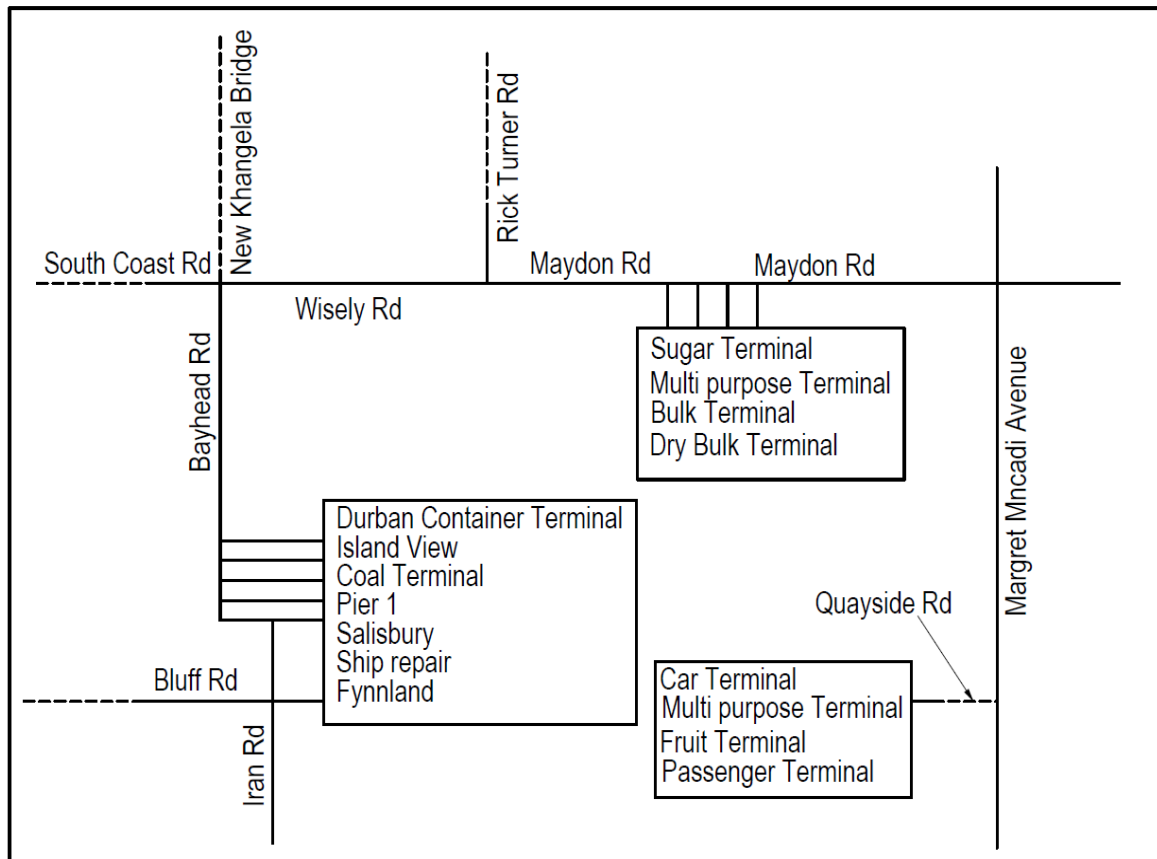


Figure 21: Network for roads within and outside the Port of Durban

The visual inspection (eyeball method) was utilized for assessing the condition of the road infrastructure outside the Port. A similar assessment process to what was used to assess roads within the Port was used to assess the roads outside the Port.

5.2 Asset verification

The Pavement Management System Manual was used as the reference for physical site measurements for the roads outside the Port of Durban and was conducted as part of the assets verification process. The roads were verified and the results shown in Table 6 were obtained.

Table 6: Schedule of road verification outside the Port

No.	Road name	Date of survey	Length outside Port	Number of lanes in each direction
1.	Quayside	25/10/2011	0.3 km	1
2.	Maydon	27/10/2011	0 km	N/A
3.	Rick Turner	01/11/2011	4 km	1
4.	Wisely	01/11/2011	0 km	N/A
5.	Bayhead	03/11/2011	0.5 km	2
6.	South Coast	03/11/2011	7 km	1
7.	Bluff	10/11/2011	6 km	1
8.	Iran	10/11/2011	0 km	1

Note: The full length of roads such as Maydon, Wisely and Iran Roads falls within the port. Bayhead, Quayside, Rick Turner, South Coast and Bluff Road measurements are divided into two sections. First section falls within the port and the other section falls outside the port. The measurement represents the section of road outside the Port.

5.3 Assessment of roads outside the Port

Assessment results for five sections of roads outside the Port were recorded onto inspection sheets as per Appendix 11. Figure 22 indicates the typical defects found on Rick Turner Road near King Edward Hospital.

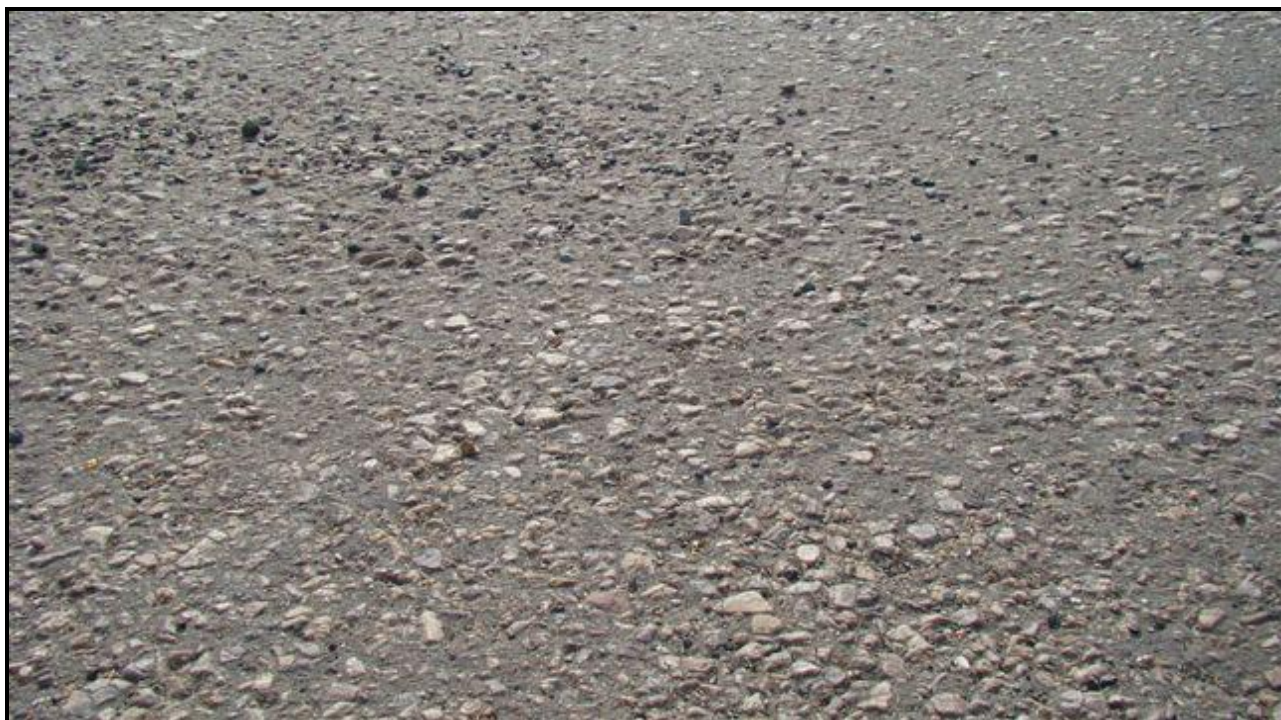


Figure 22: Aggregates loss on Rick Turner Road

The findings of the assessment of roads outside the port were recorded on the inspection report. An example of an inspection report conducted on Rick Turner Road is shown in Table 7.

Table 7: Example of an inspection report conducted on Rick Turner Road

Component	Weight	Rating	Weighted Average
Road markings	10	85%	8.5
Traffic signs	10	80%	8.0
Potholes	20	80%	16.0
Cracks	10	70%	7.0
Rutting	10	70%	7.0
Aggregate loss	10	45%	4.5
Riding quality	10	75%	7.5
Surface drainage	15	60%	9
Unpaved shoulders	5	70%	3.5
TOTAL	100		71.0

The weighting of each component was identified based on importance and damage that can be caused if that particular component was not repaired. Rating score was based on the condition of the component and Table 2 in Chapter 3 was used during the rating process.

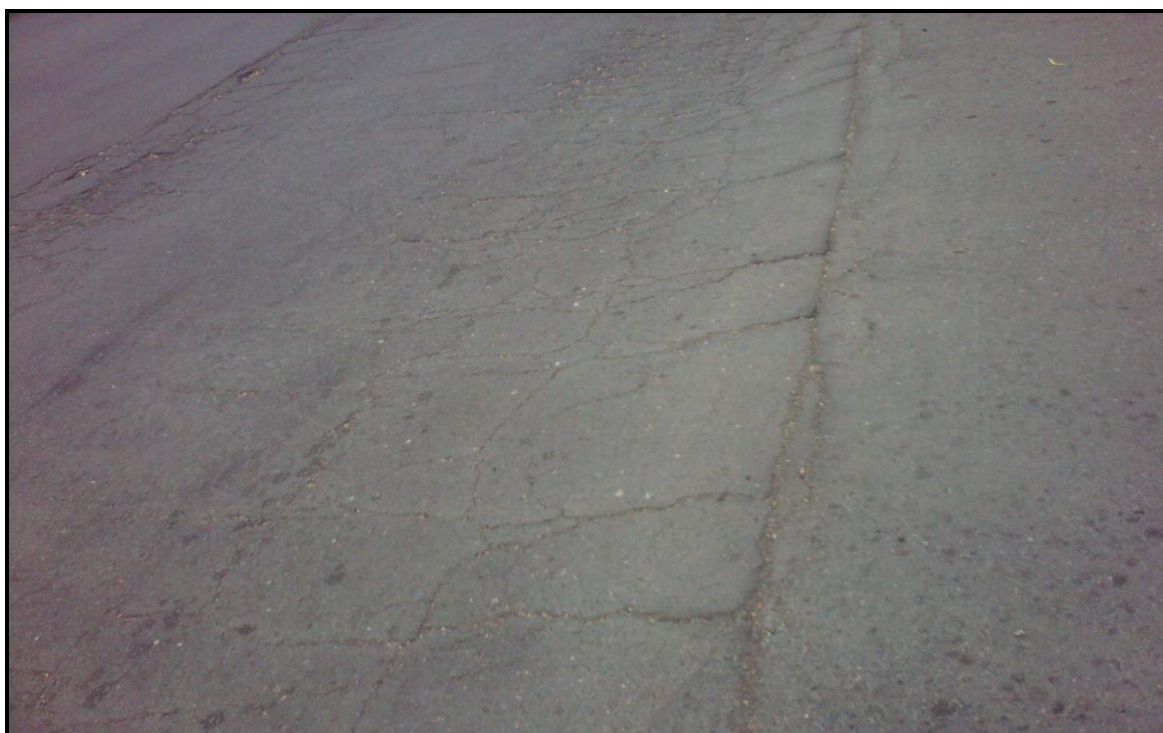


Figure 23: Longitudinal and crocodile cracks on South Coast Road

The type of asphalt defects observed during the assessment is shown in Figure 23 – longitudinal and crocodile cracks found on South Coast Road near Rosburgh Railway Station where the asphalt layer failed on the joint and where vehicle wheels ride.

5.4 Results

5.4.1 Road condition outside the Port

The results from the inspection reports conducted at the five major roads that have sections which fall outside of the Port are indicated in Figure 24, namely Bayhead, Quayside, Rick Turner, South Coast and Bluff Roads. The full length of Maydon, Wisely and Iran Road falls within the Port and can't be assessed under this section. South Coast Road is a low rated road which is in a fair condition and all other roads are rated above 70%.

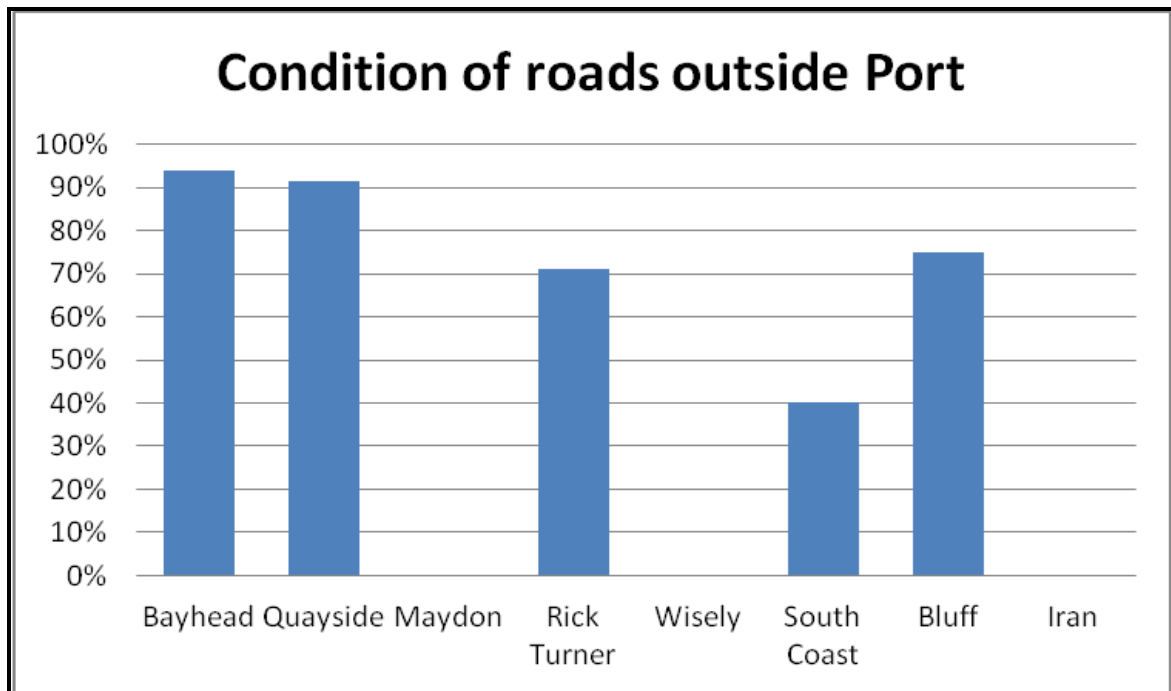


Figure 24: Assessment of road condition outside the Port

The following are results obtained during the assessment of roads outside the Port:

- Bayhead (94%) and Quayside Road (91.5%) fall under A (excellent) category. New and perfect. No maintenance work required at this stage.
- Rick Turner (71%) and Bluff Road (75%) fall under B (very good) category. Looks like new and minor maintenance work may be required at a later stage.
- South Coast Road (40%) falls under D (fair) category. Reasonable but maintenance work may be required within 6 months.

5.4.2 Comparison between roads within and outside the Port

A comparison of roads in good condition within and without the Port is illustrated in Figure 25.

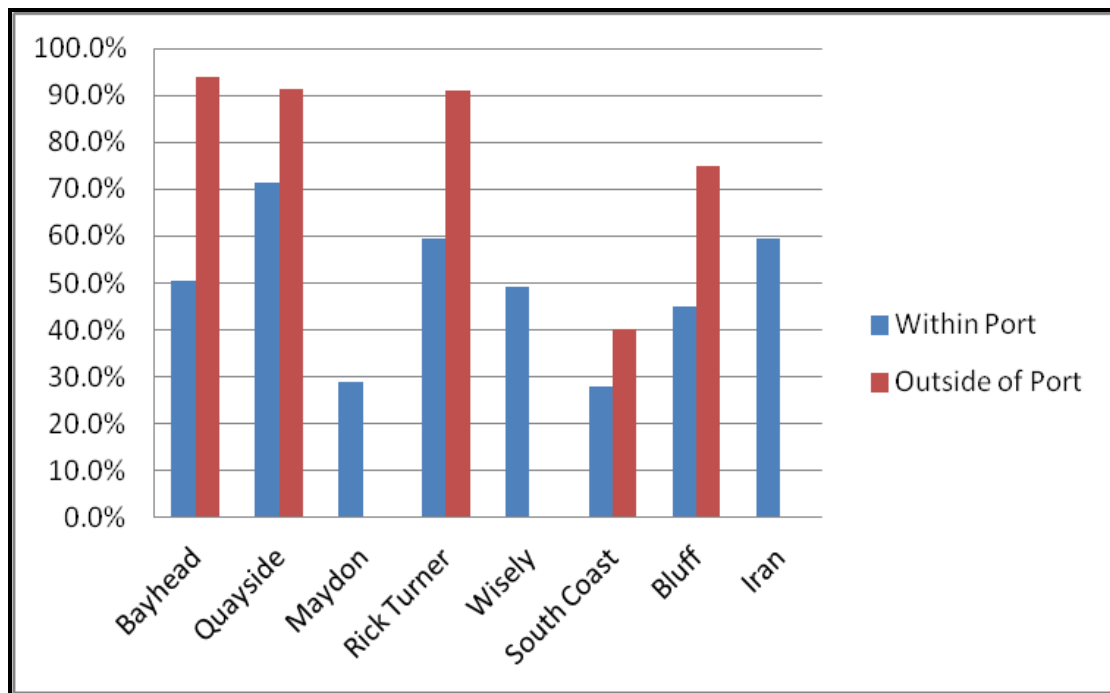


Figure 25: Comparison between roads in good condition within and outside the Port

5.5 Conclusion

Maydon Road and the section of South Coast Road which falls within the Port are low rated roads which are in a poor condition. The section of South Coast Road which falls outside the Port is a low rated road which is in a fair condition.

All sections of roads which fall outside of the Port are owned by eThekwini Municipality and are in good condition. There is a clear understanding of ownership and eThekwini Municipality is accountable for these roads. The public are involved in ensuring that these roads are well maintained by informing eThekwini Municipality via a toll free number at anytime. Transnet National Ports Authority owns all sections of roads which fall within the Port and they are in a fair condition but much work needs to be done. The public are not well informed on who can assist if there are defects on the road. The major problems are experienced when there is a change of ownership.

CHAPTER 6

TRAFFIC SURVEY

6.1 Introduction

The growth of container, bulk, break-bulk, dry-bulk and liquid cargo in the Port of Durban over the past years have an impact on road traffic. The majority of import and export cargo is transported by road transport (trucks). Transportation of cargo by rail is normally a preferred option for long-distance and road transport for shorter feeder routes but this has little success at the Port of Durban.

Transnet National Ports Authority is the landlord of South African Ports and Transnet Ports Terminal is the major lessee that controls port development and operations. Transnet Freight Rail (former Spoornet) is the country's sole rail freight operator and service provider to the port. Transnet Pipelines is dealing with transportation of petroleum or chemicals via pipeline. These divisions are the major transport businesses within Transnet.

6.2 Utilization of existing road infrastructure

This chapter covers the road traffic survey that was conducted in the form of volume counts for heavy and light vehicles entering/exiting the Port. Road traffic counts were taken at eight survey stations located within the port area and Figure 26 shows the location of the stations. Stations were numbered as follows: Station 1 – Quayside road, Station 2 – Intersection of Maydon road and Margret Mncadi Avenue, Station 3 – Intersection of Maydon Road and Rick Turner Road, Station 4 – Rick Turner Road, Station 5 – South Coast Road, Station 6 – Bayhead Road, Station 7 – Bluff Road and Station 8 – Iran Road.

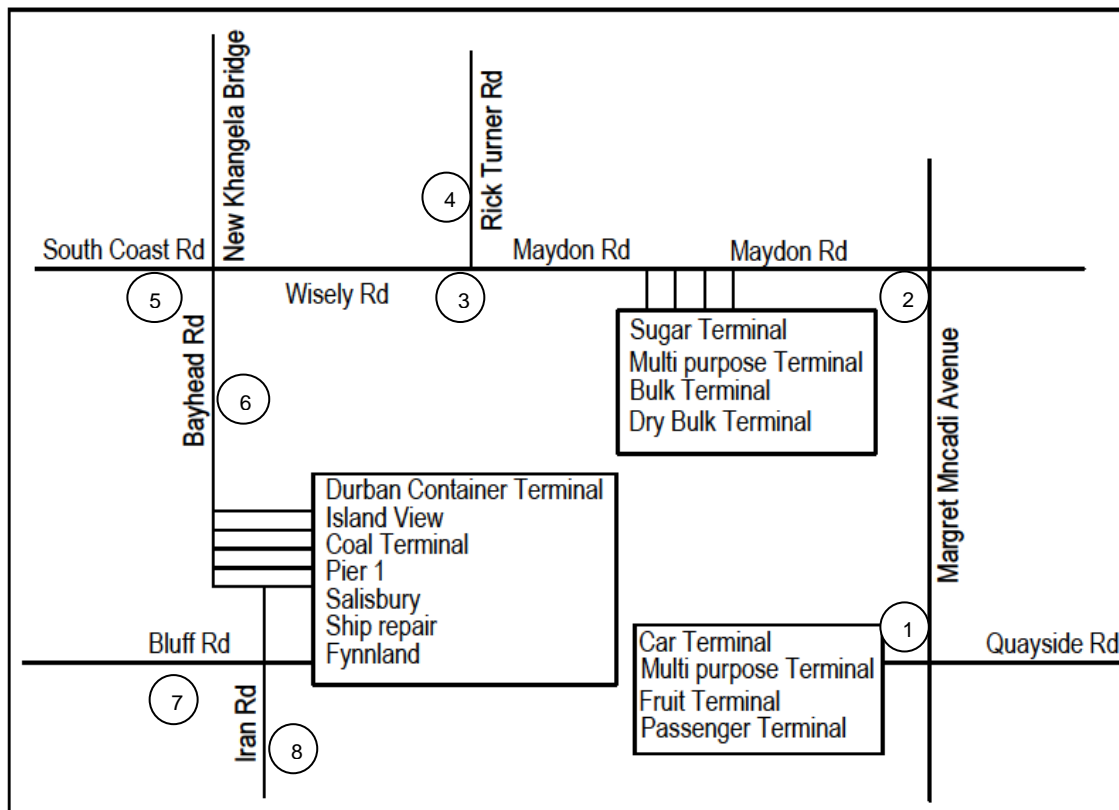


Figure 26: Road network and stations where traffic counts were taken

The survey was conducted during the weekday, morning (06:00am – 09:00am), afternoon (15:00pm – 18:00pm) commuter peak periods and (09:00am – 15:00pm) the inter peak period. Figure 27 shows traffic counts conducted at the intersection of Rick Turner Road and Maydon Road.



Figure 27: Traffic counts survey at intersection of Rick Turner and Maydon Road

The survey was conducted on different days due to practical reasons relating to the extent of the survey and availability of resources. To accommodate daily fluctuations in Port traffic, the surveys were conducted over three consecutive weeks. The schedule of the surveys that were undertaken is tabulated in Table 8.

Table 8: Schedule of traffic count surveys

Survey Date	Survey Direction	Station
Tuesday 14-02-2012	Outbound	Station 1, 2 & 3
Thursday 16-02-2012	Inbound	Station 1, 2 & 3
Tuesday 21-02-2012	Inbound	Station 4, 5 & 6
Thursday 23-02-2012	Outbound	Station 4, 5 & 6
Tuesday 28-02-2012	Outbound	Station 7 & 8
Thursday 01-03-2012	Inbound	Station 7 & 8

6.3 Results

The road counts were conducted at each of eight major roads entering and exiting the Port of Durban. The results of counts for the eight major roads were recorded as per Appendix 12. Table 9 gives a summary of traffic counts taken per station or road.

Table 9: Sample of manual traffic counts per station

Number of heavy/light vehicles enter and exit the Port per day (24 hrs)					
No.	Station name	Inbound (light)	Inbound (heavy)	Outbound (light)	Outbound (heavy)
1	Quayside Road	4339	2170	5491	2746
2	Intersection of Maydon & Margret Mncadi	5134	2567	7931	3966
3	Intersection of Maydon & Rick Turner road	8186	4094	4759	2380
4	Rick Turner Road	6581	3291	5138	2570
5	South Coast Road	11007	5504	11402	5702
6	Bayhead Road	15725	7863	16144	8072
7	Bluff Road	3739	1867	2384	1192
8	Iran Road	628	314	208	104
	Total	55339	27670	53457	26732

There are approximately 83009 heavy/light vehicles entering and 80189 heavy/light vehicles exiting the Port per day. Figure 28 illustrates the traffic during peak hour at the intersection of Bayhead and South Coast Road or Station 6.



Figure 28: Traffic during peak hour at intersection of Bayhead and South Coast Road

Bayhead and South Coast Road are over-utilized and major traffic congestion is experienced on these roads as shown in Figure 29. This has resulted in major delays on the import and export of cargo. It has also resulted in an increase in road maintenance work and road accidents.

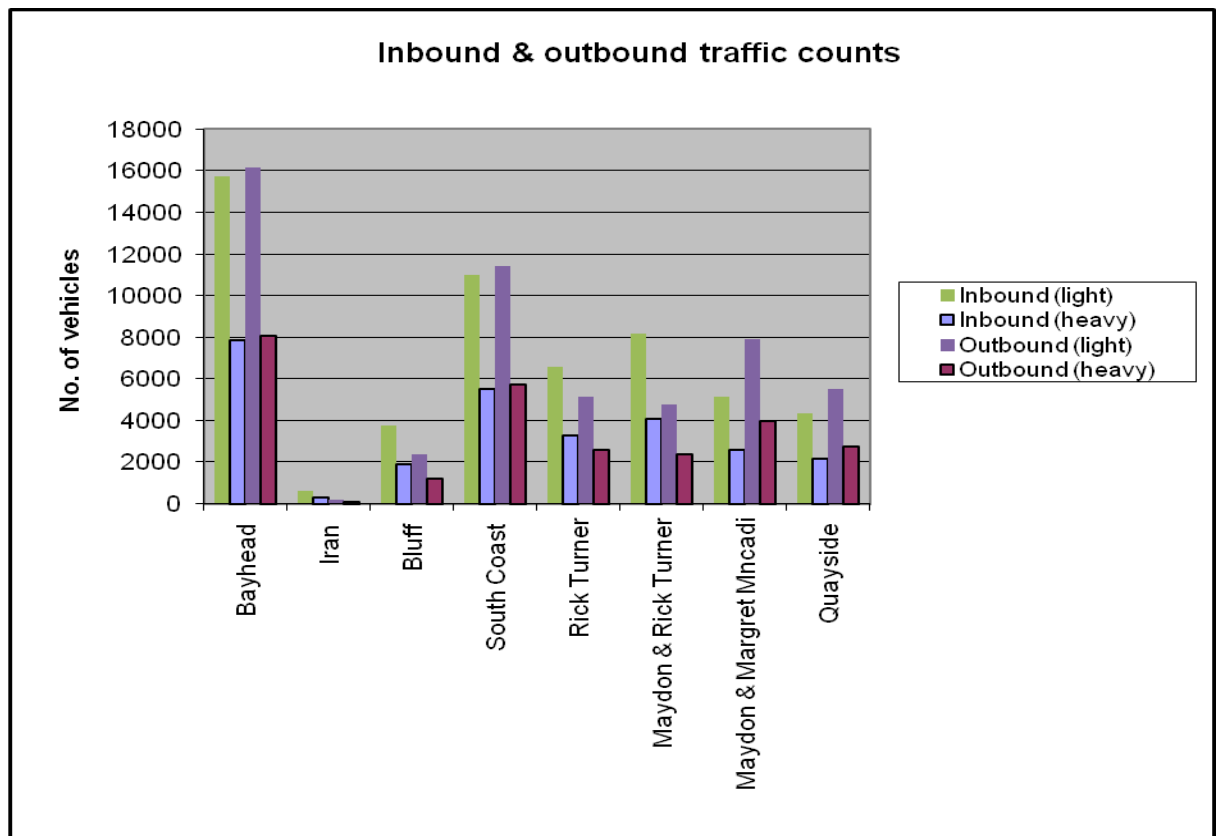


Figure 29: Sample of manual traffic counts per station

The peak period in the morning (06h00 to 09h00) and late afternoon (16h00 to 18h00) for total vehicles is illustrated in Figure 30. Heavy vehicles are normally constant between 500 to 550 vehicles per hour travelling on Bayhead Road.

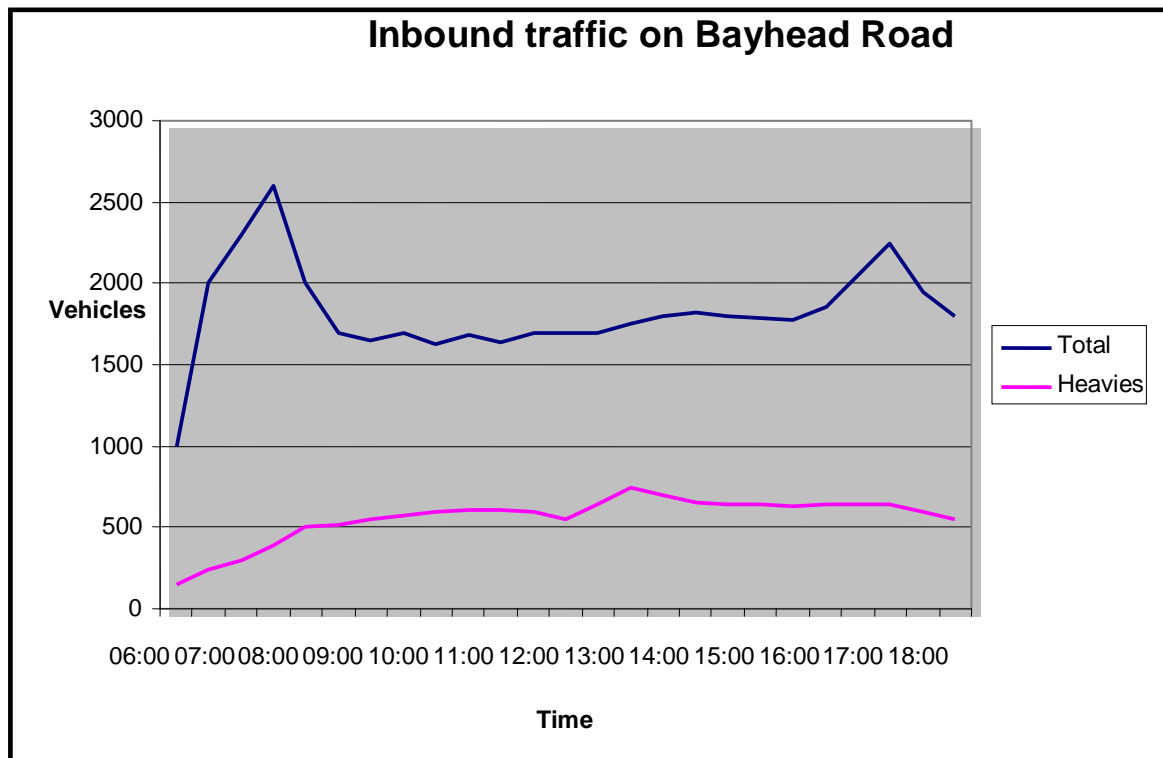


Figure 30: Profile for heavy and total vehicles on Bayhead Road

6.4 Conclusion

The results of the road traffic survey have confirmed that approximately 83000 vehicles are entering the Port via the eight major roads. Approximately 30% of the total road traffic entering the Port comes through Bayhead Road.

As the volume of cargo traffic increases at Port of Durban especially at the container cargo, the Port will be challenged to fast track the Infrastructure Development Program (implementation of Ports Master Plan and Rail Master Plan) in order to meet the demand. Transnet has delivered a number of projects such as Remodeling of Maydon Wharf, Berth Deepening at Pier 1, Entrance Channel Widening, A-Check (Truck staging – Phase 2), New Multipurpose Products Pipeline, Car Terminal and Point Development. There are a number of projects in the pipeline such as the Bayhead Dig-out and the National Container Strategy (New Container Terminals at old Airport site). Khangela Bridge has assisted in reducing the traffic congestion at the Bayhead Road / South Coast Road intersection by providing an alternate route for both light and heavy vehicles. There is still a need for other routes to relieve Bayhead Road.

CHAPTER 7

ROAD SAFETY WITHIN THE PORT OF DURBAN

7.1 Introduction

Over the past years, road accidents at Port of Durban have slightly decreased from 3972 in year 2007 to 2729 in year 2010 but this is not enough. Some road accidents result in loss of life which means that road safety is very important to all road users. South Coast Road had the highest number of accidents compared to other roads within the Port of Durban. The reports for road accidents for year 2007 until year 2010 on these roads were obtained from eThekweni Transport Authority. It was analyzed based on probable causes of accidents on each road. The number of deaths on each road was also identified.

The contribution of air transport accidents and water transport accidents to total transport accident deaths was relatively small. Road traffic accidents contributed 99.8% of the total transport accident deaths from 2001 to 2006.

South Africa consists of nine provinces namely Gauteng, KwaZulu Natal, Western Cape, Eastern Cape, Free State, Mpumalanga, North West, Limpopo and Northern Cape. The number of registered vehicles in South Africa has increased by 266 032 (2.75%) from 9 678 989 in March 2010 to 9 945 021 vehicles in March 2011 as per Figure 31. Gauteng province has highest number of registered which is approximately 3 865 050 followed by Western Cape and KwaZulu Natal.

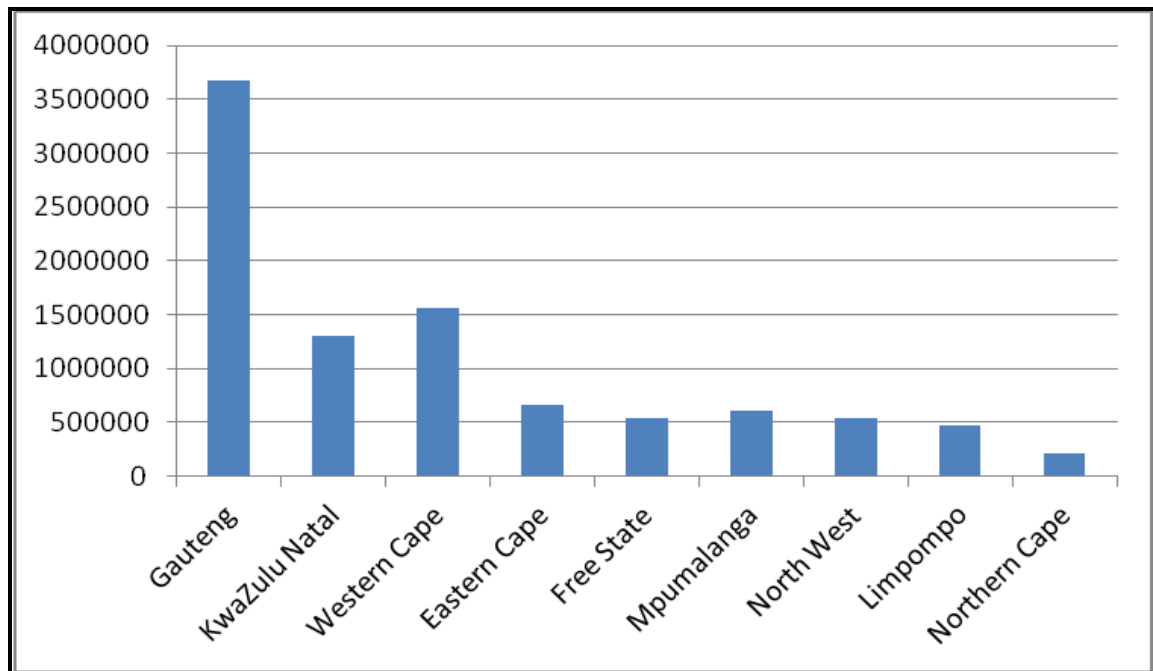


Figure 31: Number of registered vehicles in South Africa

Source: Road Traffic Management Corporation, 2011

Figure 32 indicates that out of 9 945 021 registered vehicles in South Africa, 57.0% are motorcars followed by 20.4% of bakkies. Trucks account for only 3.3% and 10.2% are towed vehicles.

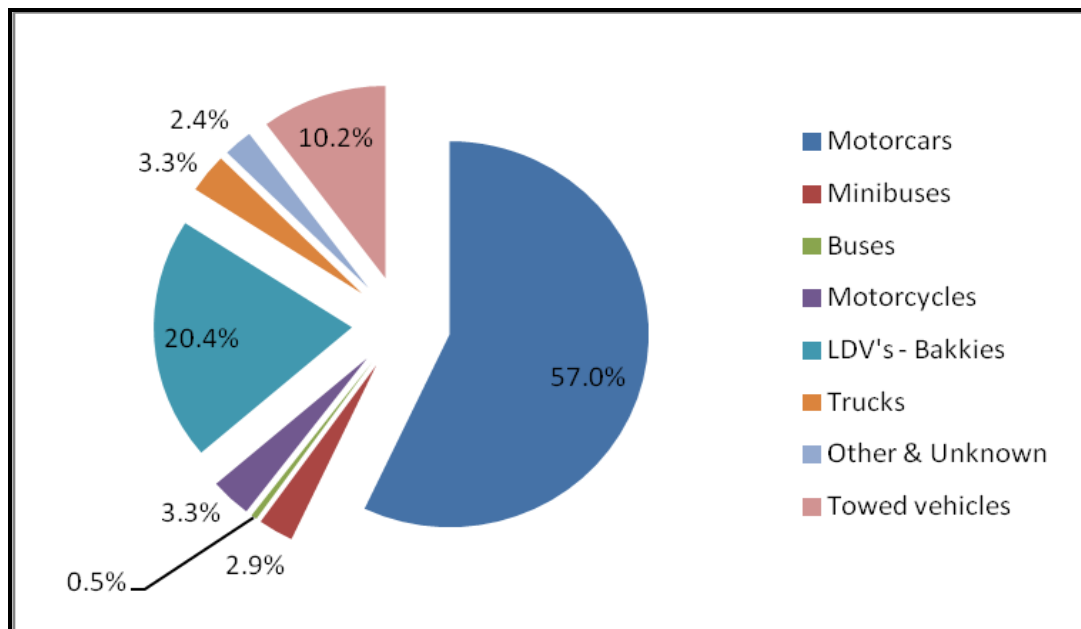


Figure 32: Various types of registered vehicles

Source: Road Traffic Management Corporation, 2011

7.2 Analysis of road accidents reports

As illustrated in Figure 33, there has been a decrease in the number of road accidents in the Port over the past years from almost 3972 to 2729 per annum.

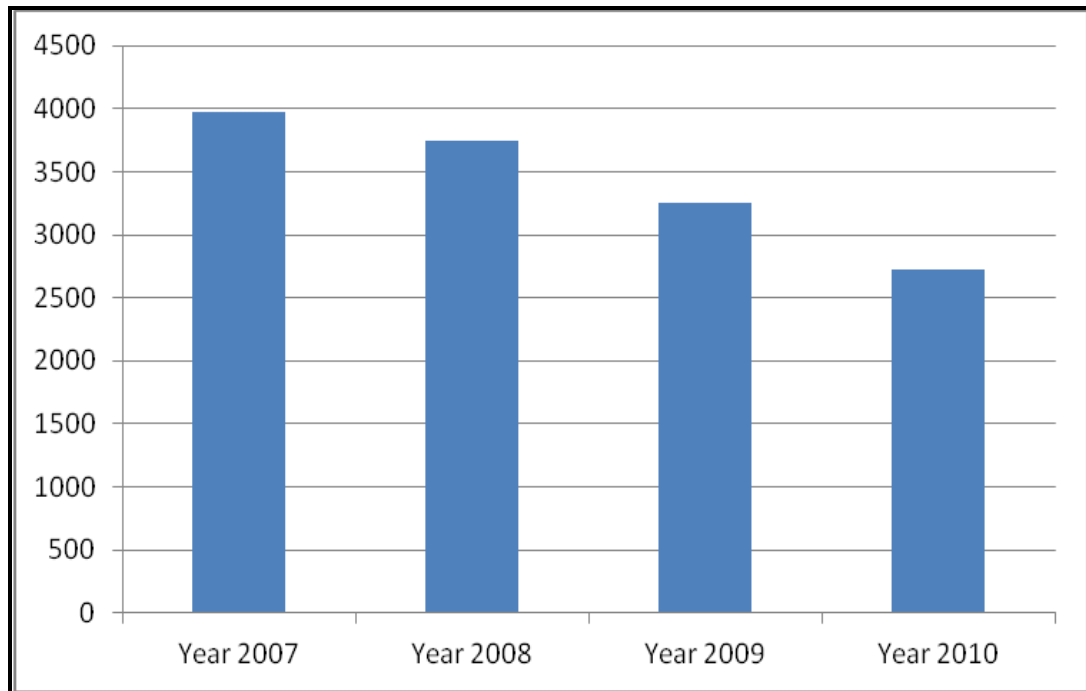


Figure 33: Road accidents within the Port over the past years

Figure 34 shows a road accident at the intersection of Bayhead and South Coast Roads where two trucks were involved.



Figure 34: Road accident at intersection of Bayhead and South Coast Roads

As illustrated in Figure 35, there has been a decrease in the number of road accidents over the past years although South Coast Road remains a major site of these accidents.

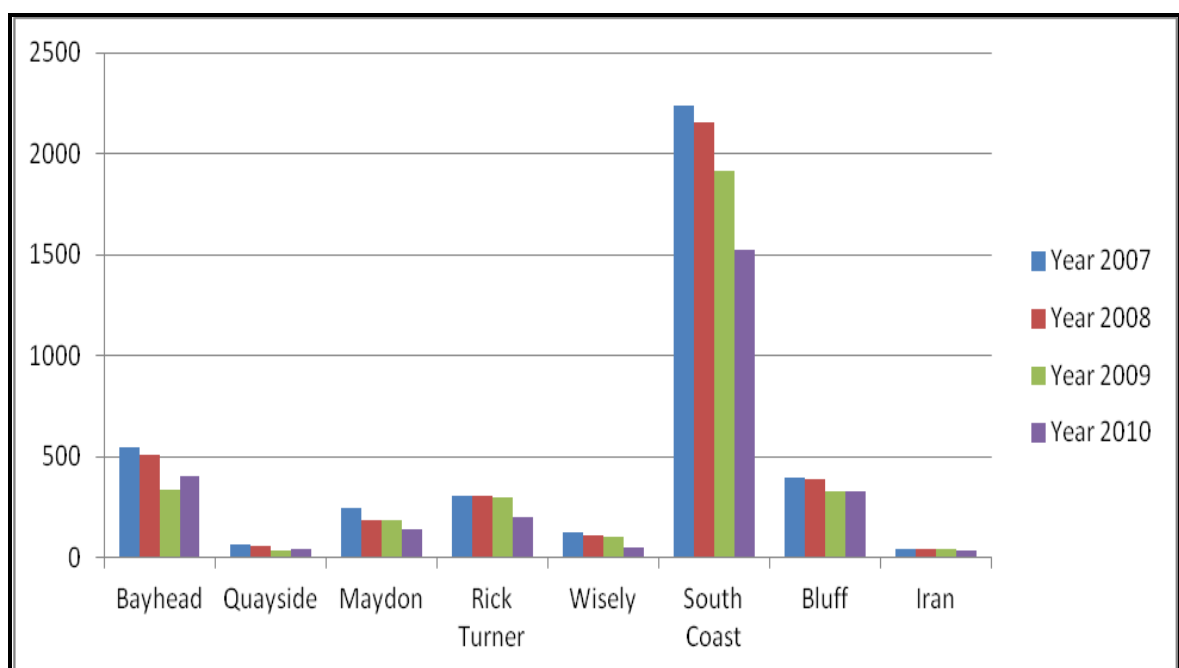


Figure 35: Road accidents on each road

Source: eThekweni Municipality, 2011

Figure 36 indicates that 1527 accidents happened in year 2010, there were 1318 (86%) people who sustained no injury, 155 (10%) people were slightly injured, 41 (3%) people were seriously injured and 13 (1%) had fatal injuries.

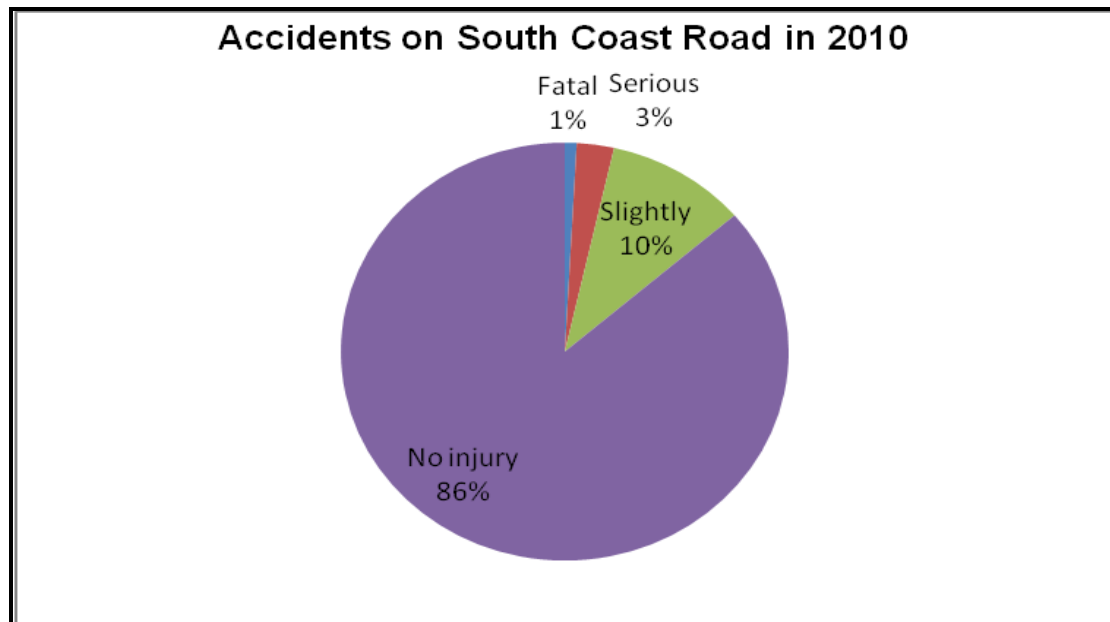


Figure 36: Road accidents on South Coast Road

Source: eThekweni Municipality, 2011

7.3 Contributing factors to road accidents

Drivers' error, pedestrian error, road condition and vehicle defects have major impacts on road accidents within the Port of Durban.

Road accidents do not just happen – they happen because of certain real contributory factors. These contributory factors are circumstantial elements that are present at the time of the accident and are generally classified under four main categories, namely: human, vehicle, roadway and the environment. The first three factors reflect human and authority behaviour, attitude and performance, while the fourth factor, the environment could, to a certain extent, be regarded as being beyond the control of the driver or the authorities (Road Traffic Management Corporation, 2011).

It should be noted that it is very seldom that an accident happens because of only one contributory factor. In most cases there are 2, 3 and even 4 or more factors from any one or more of the above categories present simultaneously (Road Traffic Management Corporation, 2011).

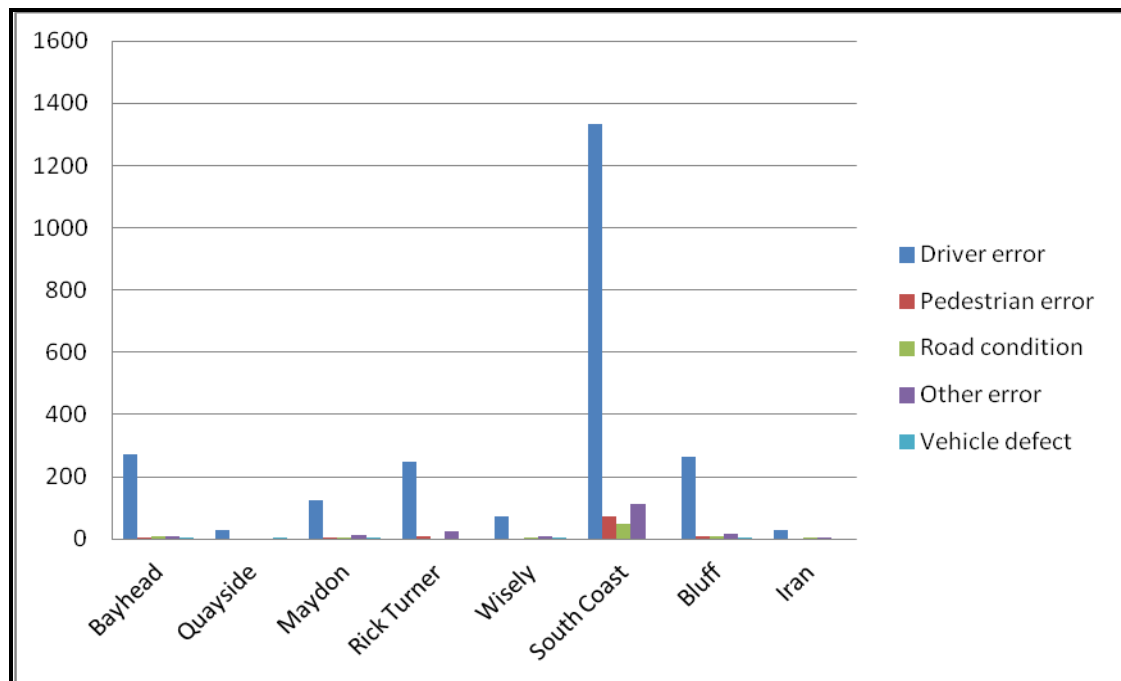


Figure 37: Probable causes of road accidents in year 2010

Source: eThekweni Municipality, 2011

Figure 37 illustrates that driver and pedestrian error, road condition and vehicle error are the most common cause of road accidents within the Port of Durban. South Coast Road has the highest number of road accidents followed by Bayhead, Bluff and Rick Turner Roads.

7.4 Analysis of road death reports

Figure 38 indicates that in 2007, 20 people died on these roads and in 2010 it still remained at 20 deaths. South Coast Road had the highest number of deaths. No deaths were reported on Quayside (rated as B category) and Iran Roads (rated as C category) since 2007.

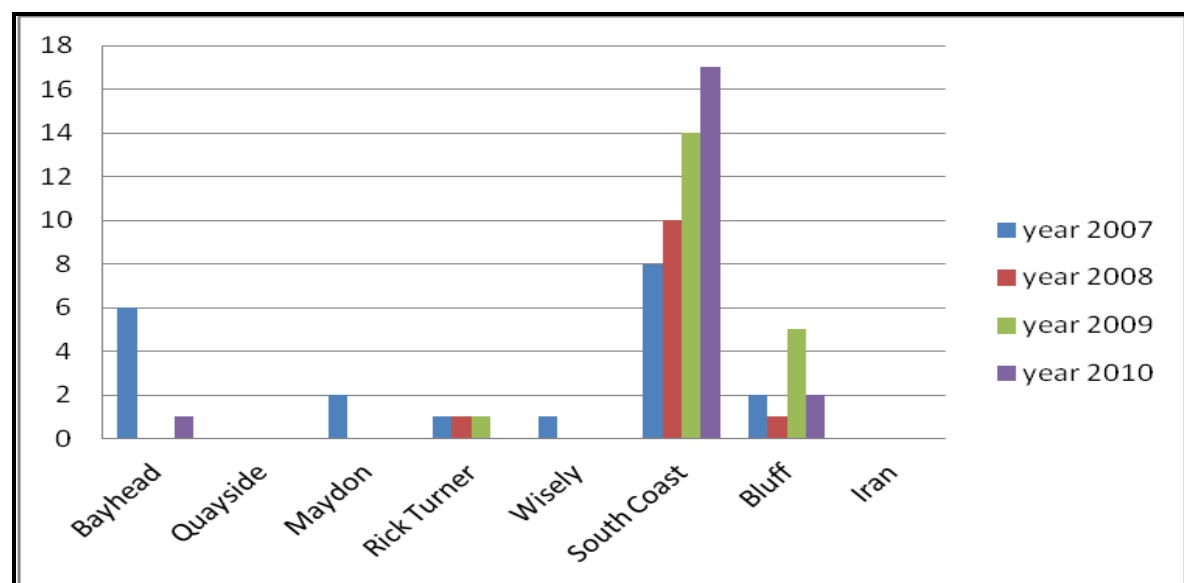


Figure 38: Number of people died over the past years

Source: eThekwin Municipality, 2011

7.5 Conclusion

There are a high number of accidents on South Coast Road because of poor road condition and lack of law enforcement. Most deaths took place on this road and the number of deaths is increasing each year. Road accidents have slightly decreased over the past years. It has been noted that most of the road accidents taking place within the Port involve heavy vehicles. There are a higher number of light vehicles registered on South African roads compared to heavy vehicles.

It is accepted that 95% or more road accidents happen as a direct result of traffic offences or non-compliance with prescribed norms and standards. In this regard the human element plays a major role. For example, should a road accident

result from a burst tyre, generally classified under vehicle factors, it still is the responsibility of the driver or owner of the vehicle to see that the worn or damaged tyre is replaced timeously.

In case of a road accident happening as a result of a pothole in the road or a smooth road surface, generally classified under road factors, it is the responsibility of the driver to reduce speed and drive more carefully under such circumstances. In such a case it is also the responsibility of the roads authority to detect the unsafe conditions through regular inspections and efficient routine maintenance programmes and either effect the required remedial measures as soon as possible or, to at least provide the required road signs to warn road users of the unsafe condition of the road.

CHAPTER 8

QUESTIONNAIRE SURVEY ON ROAD USERS

8.1 Introduction

Three hundred and sixty (360) people participated in the questionnaire survey. These included road users from Government, private sector and unemployed road users. The questionnaire survey was completed in November 2011. The main purpose of the questionnaire survey was to obtain feedback from road users on:

- existing road infrastructure;
- road safety and law enforcement; and
- road traffic.

8.2 Methodology

Appendix 15 shows the typical questions that the vehicle users were asked. The questionnaire survey forms were handed to road users on selected dates at various stations as reflected in Table 10. These questionnaires were handed out to every road user approaching the survey station between 06h00 – 18h00. There were 600 questionnaire survey forms distributed and each station was allocated 100 forms resulting in an overall return rate of 60%. Some road users refused to participate in this survey by not taking the forms or taking the form but not returning it. Some road users completed the forms on site while others completed the form in their own time. Completed forms were sent back via fax or email address as indicated on the questionnaire.

Table 10: Schedule of dates for questionnaire surveys

Survey Dates	Stations	Station number
Tuesday 25-10-2011	Quayside road	Station 1
Thursday 27-10-2011	Maydon and Margret Mncadi Avenue	Station 2
Tuesday 01-11-2011	Rick Turner and Maydon Road	Station 3
Thursday 03-11-2011	Bayhead and South Coast Road	Station 4
Tuesday 08-11-2011	Langerberg and Bayhead Road	Station 5
Thursday 10-11-2011	Bluff and Iran Road	Station 6

The questionnaire consisted of 32 questions and was simplified so that road users could choose between yes, no or not applicable (not sure). Allowance was also made for detailed comments for those who wanted to give more information on this topic.

The feedback received was analysed and presented in a summarised format. Some of the answers are combined and details are discussed under the findings. Figure 39 shows a surveyor on site explaining the questionnaire survey to the road user.



Figure 39: Picture taken on site during the questionnaire survey

8.3 Analysis of results

Figure 40 shows that approximately 250 (69.4%) of the respondents indicated that they often travel on these roads and 110 (30.6%) travel seldomly on these roads. Seldom travellers included first time travellers on these roads.

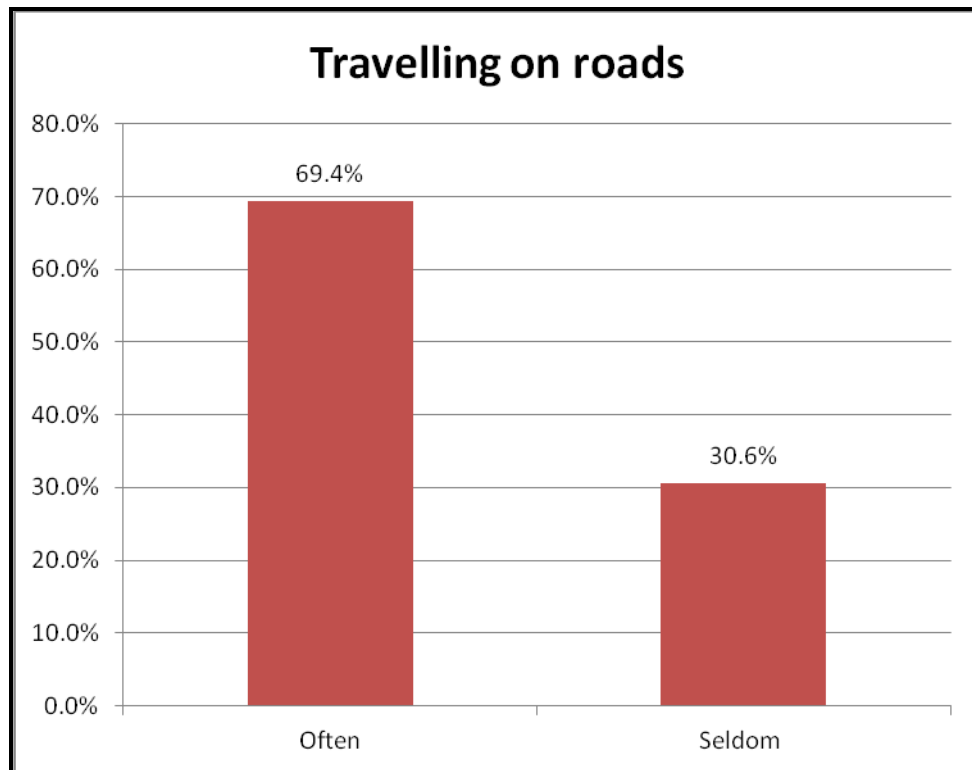


Figure 40: How often do you travel on roads within the Port?

As illustrated in Figure 41, 67% of the road users use light vehicles and are employed by both Government or the private sector. Approximately 33% of road users use heavy vehicles such as trucks to deliver or collect cargo at the Port of Durban and are employed by the private sector.

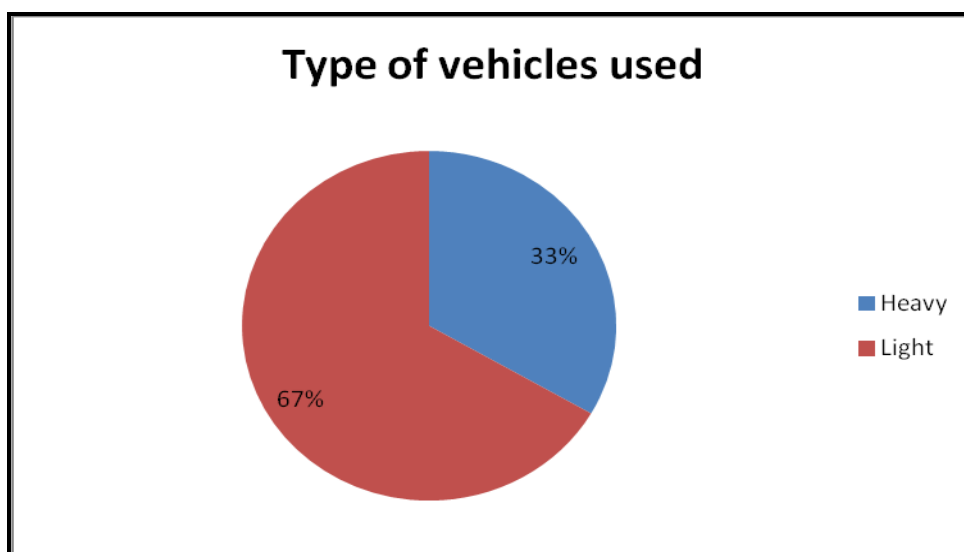


Figure 41: What type of vehicle do you normally use?

As can be seen in Figure 42, just over 69.4% of the road users were privately employed, 26.7% were employed by the government (Transnet, Local, Provincial or National Government) and 3.9% of the respondents were not employed.

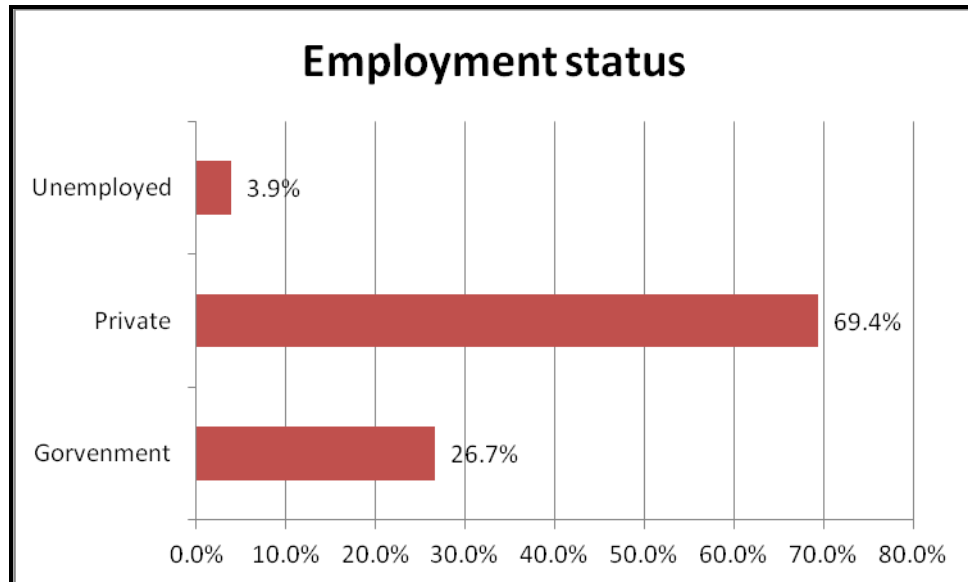


Figure 42: Which company are you working for?

As can be seen from Figure 43, 97% of the respondents claimed to have valid driving licences, although the surveyors didn't ask them for proof so this information may be unreliable.

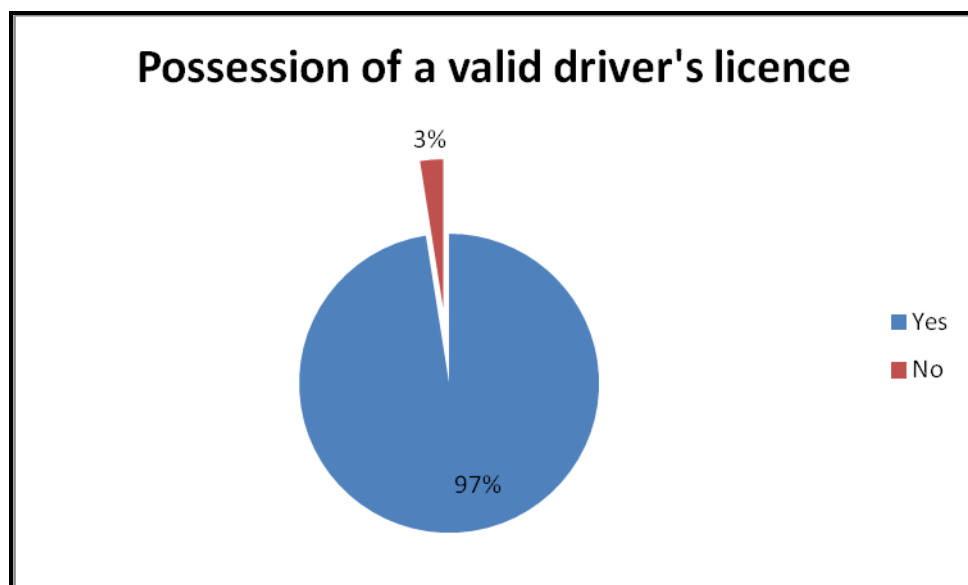


Figure 43: Are you in possession of a valid driver's licence?

Figure 44 shows that although 62.5% agreed that it is safe to drive on the roads within the Port compared to roads outside Port, 37.5% felt that it not safe to drive on these roads.

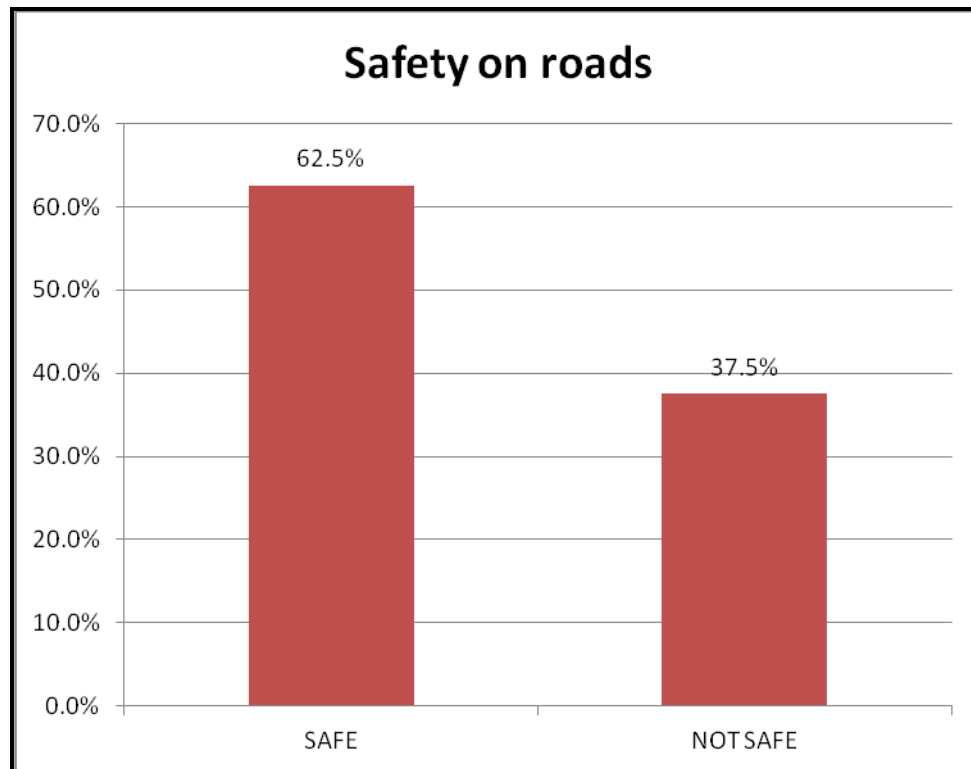


Figure 44: Is it safe to drive on roads within the Port of Durban?

As shown in Figure 45, 75% of the road users don't know where or how to report road defects. Approximately 25% of the road users know where or how to report road defects. For Transnet's roads, the defect/s can be reported via the Port Engineer's Department (Road Maintenance Section). For roads belonging to eThekweni Municipality, the defect/s can be reported via their Call Centre. It is not easy for road users to know the authority owning the road since no boards or signs are visible on the road highlighting this.

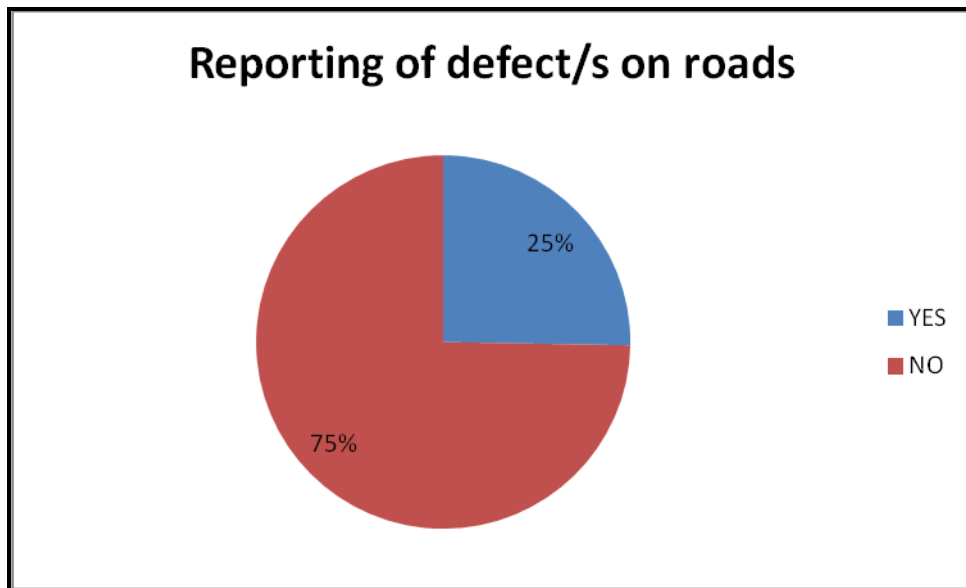


Figure 45: If you see a defect on the road, do you know where or how to report it?

Figure 46 shows a non-functional traffic signal at the intersection of South Coast Road and Ian Road. Approximately 57% of the respondents perceive that traffic signals are not always working and they take time to repair.



Figure 46: Non functional traffic signal at intersection of South Coast and Ian Road

Figure 47 shows that 25% of respondents perceive that road signs are either damaged or not there at all.

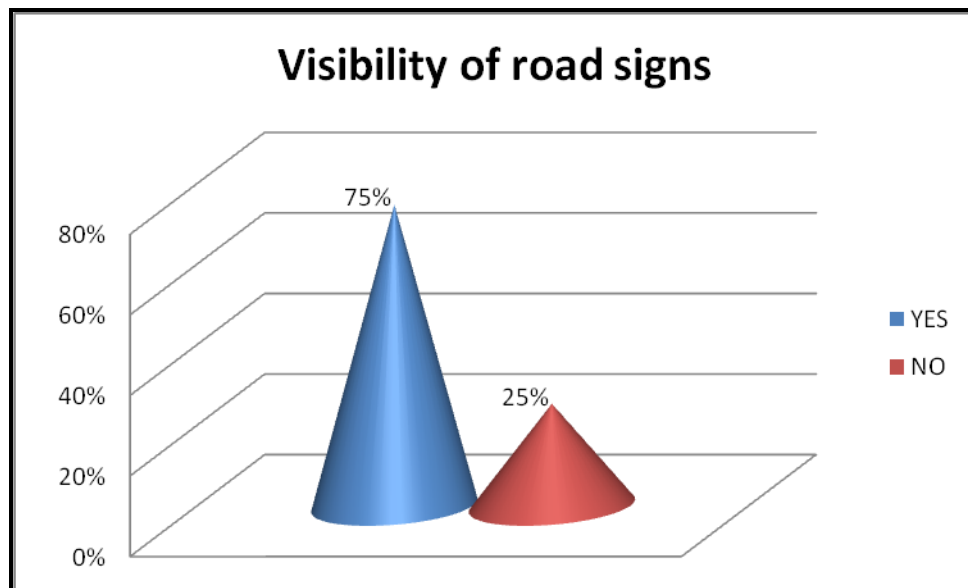


Figure 47: Are road signs visible all the time?

Figure 48 shows 72% of respondents perceive that roads are being repaired within a reasonable time frame and 28% disagreed. The reasonable time for repair of potholes is within 48 hours, sink hole and traffic signals are within 24 hours, road, sidewalk repairs, reinstatements of trenches, broken kerbs and road signs are repaired within 10 days (City of Durban, 1992).

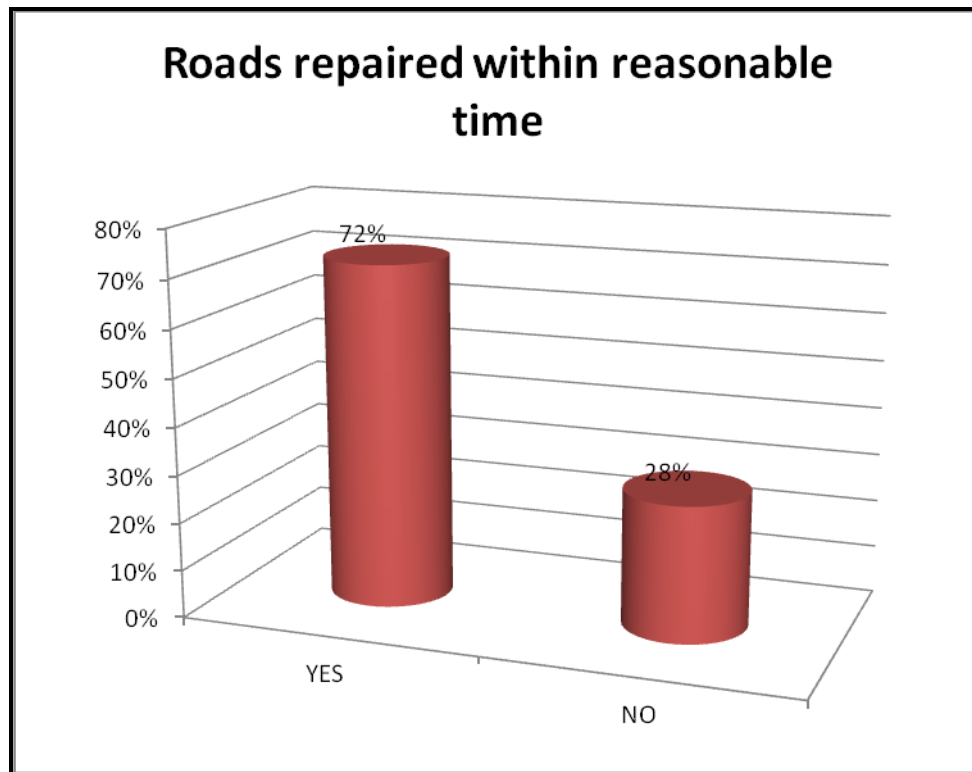


Figure 48: Are roads repaired within a reasonable time?

Figure 49 indicates that the majority (69%) of respondents perceive that traffic signals and road signs are not replaced or repaired within a reasonable time. It can take approximately six months to replace road signs but traffic signals are normally repaired faster than roads signs.

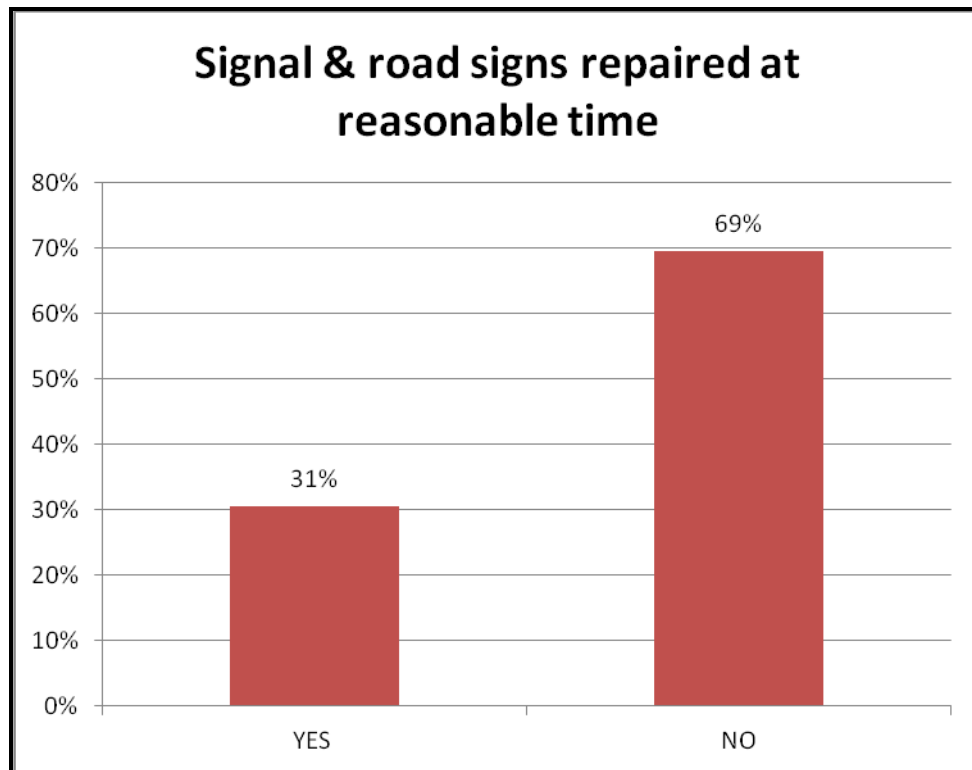


Figure 49: Are traffic signals and road signs repaired within a reasonable time?

As illustrated in Figure 50, the majority (83%) of the respondents disagreed that maintenance of roads within the Port is better than outside the Port. The maintenance of road includes the repair of potholes, sink holes, sidewalks, reinstatements of trenches, broken kerbs, replacement of traffic signs and signals.

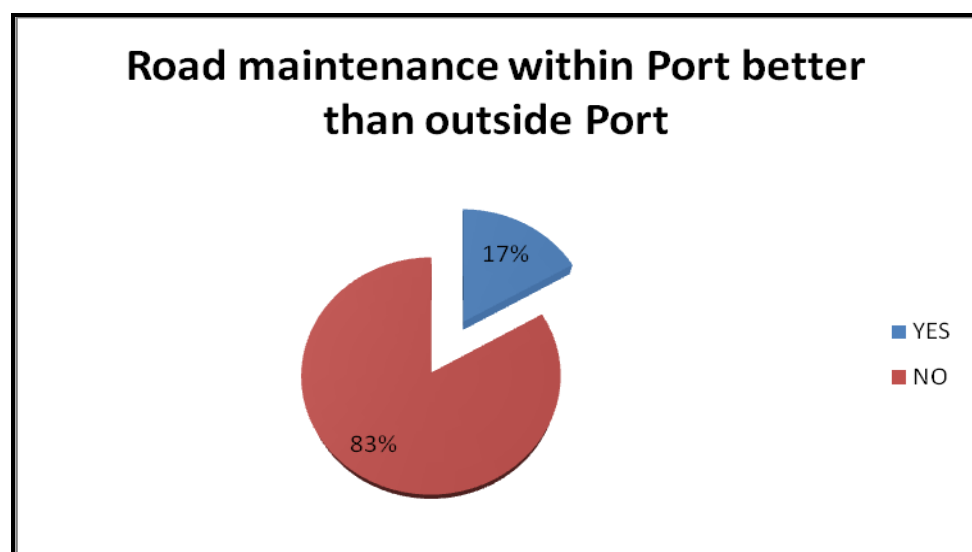


Figure 50: Is maintenance of roads within the Port better than outside the Port?

As can be seen from Figure 51, 29% of respondents indicated that their vehicles had been damaged due to poor road condition such as potholes, depressions, loss of aggregates, open manholes or other defects.

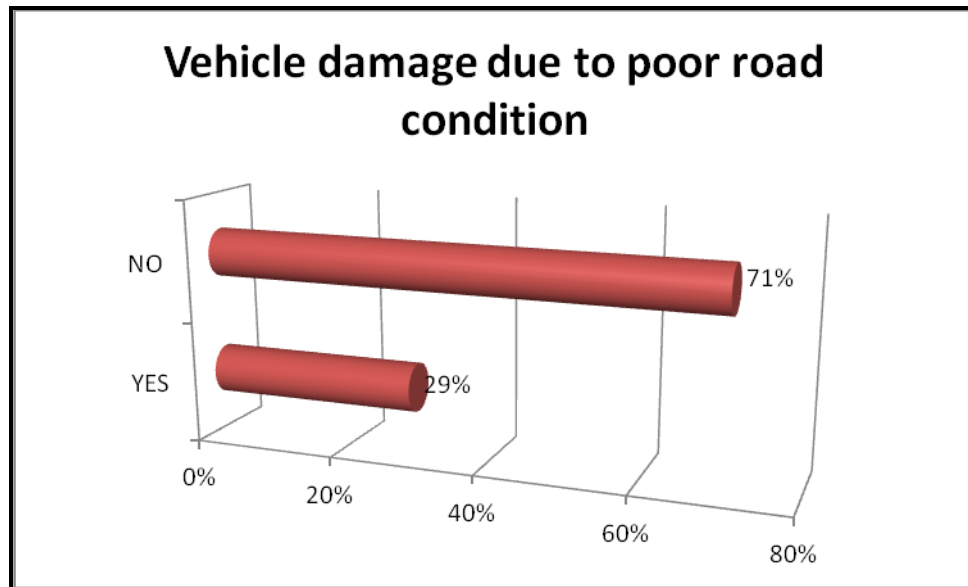


Figure 51: Was your vehicle damaged due to poor road condition?

Figure 52 shows that 57% of respondents disagreed that roads within the Port are suitable or designed to carry heavy traffic. These roads were built to carry limited load but over the past years they have been upgraded to carry increased loads.

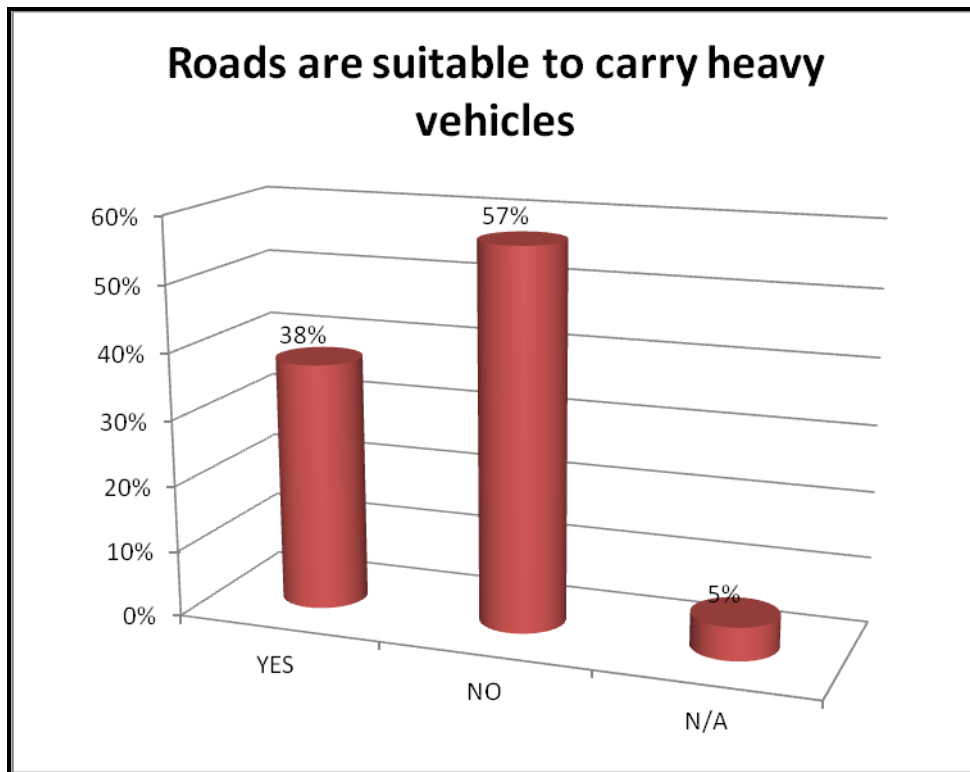


Figure 52: Are roads within the Port suitable to carry heavy traffic?

Figure 53 indicates that the majority (63%) of respondents agreed that the roads in the past were better than at present.

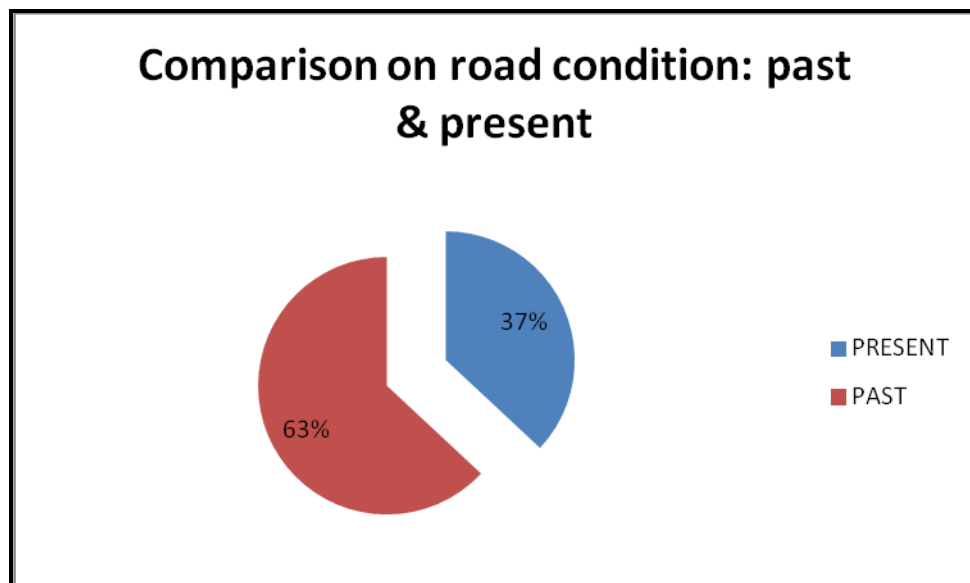


Figure 53: Are roads conditions better now than in the past?

Twenty four percent (24%) of respondents are experiencing delays getting in or out of the Port due to poor road conditions (Figure 54).

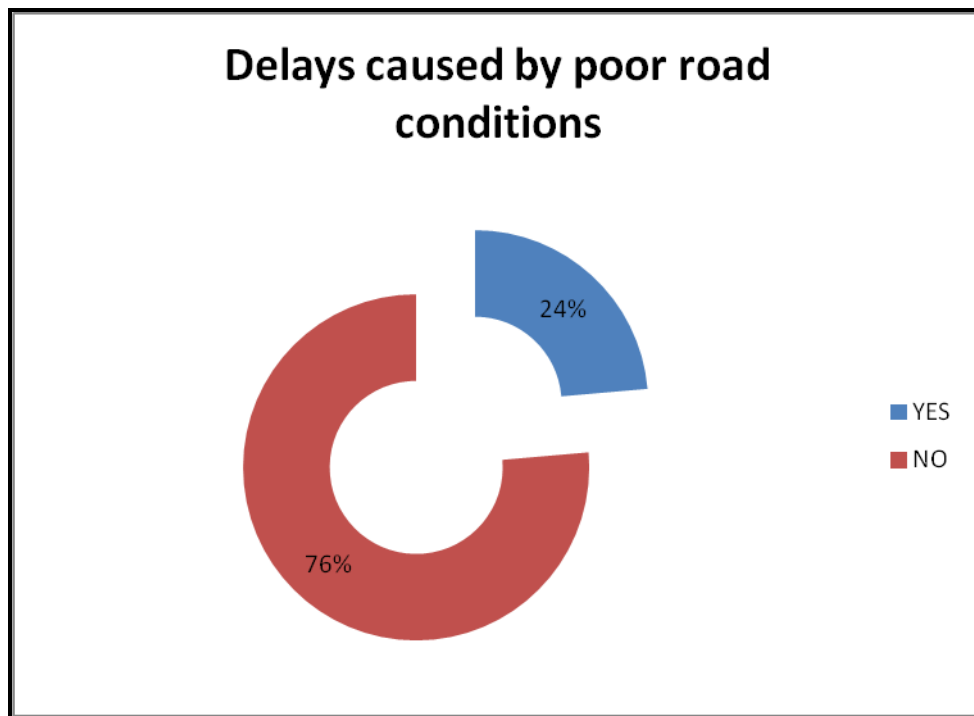


Figure 54: Are you experiencing delays getting in or out of Port due to poor road conditions?

Most (58%) respondents have experienced traffic congestion during road repairs (Figure 55).

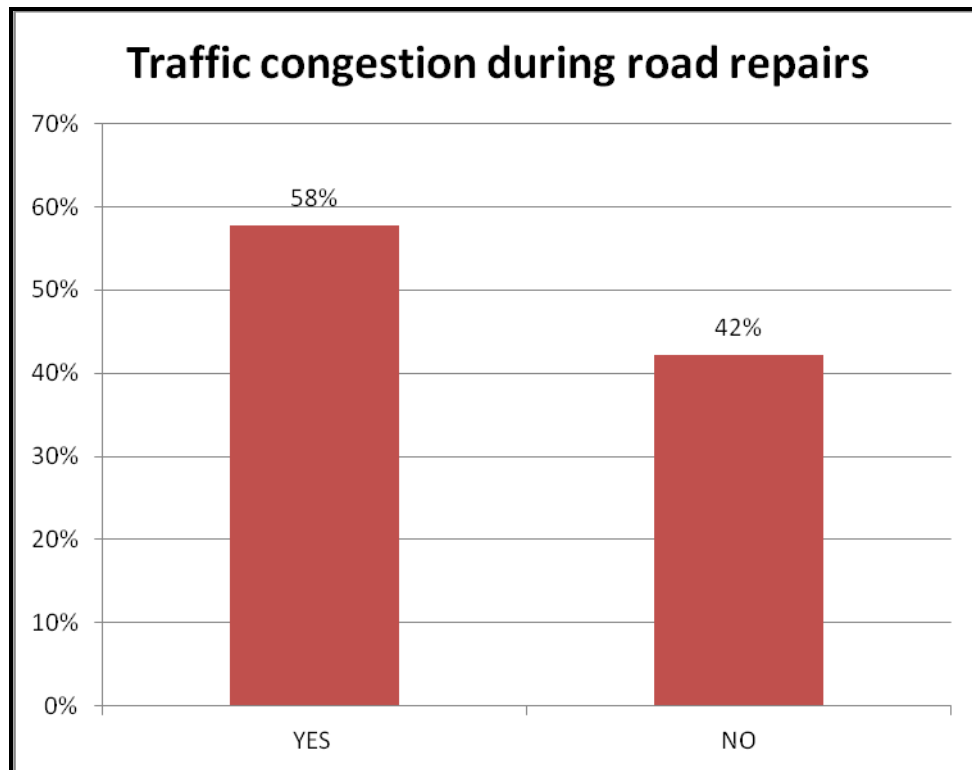


Figure 55: Have you experienced any traffic congestion during the road repairs?

Figure 56 shows that approximately 93% of respondents witness accidents on these roads.

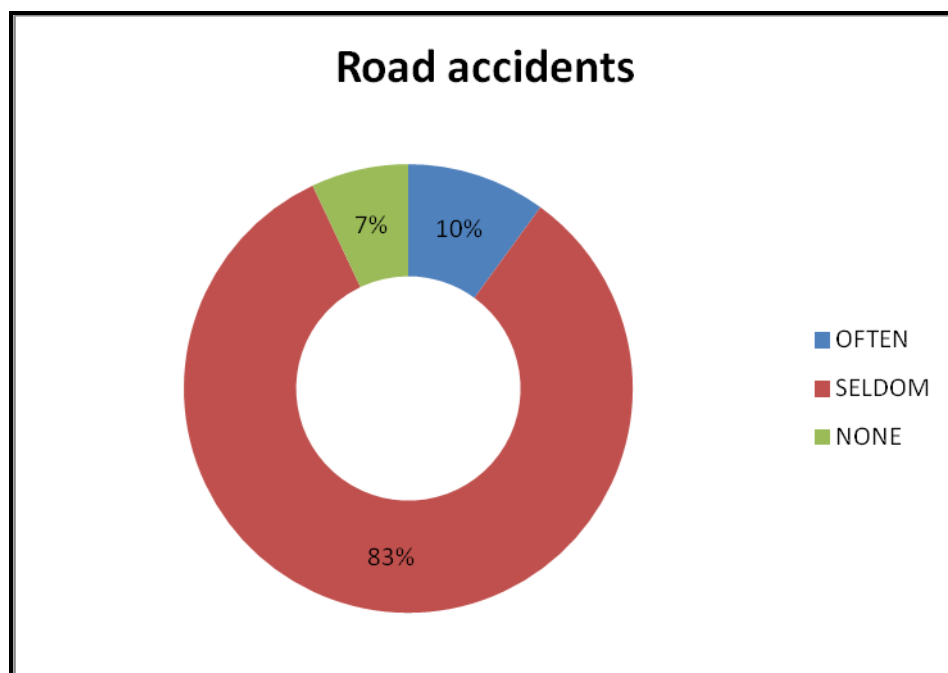


Figure 56: Do you always witness accidents on these roads?

Figure 57 shows that approximately 83% of the respondents don't wear a seatbelt when driving. This is of serious concern.

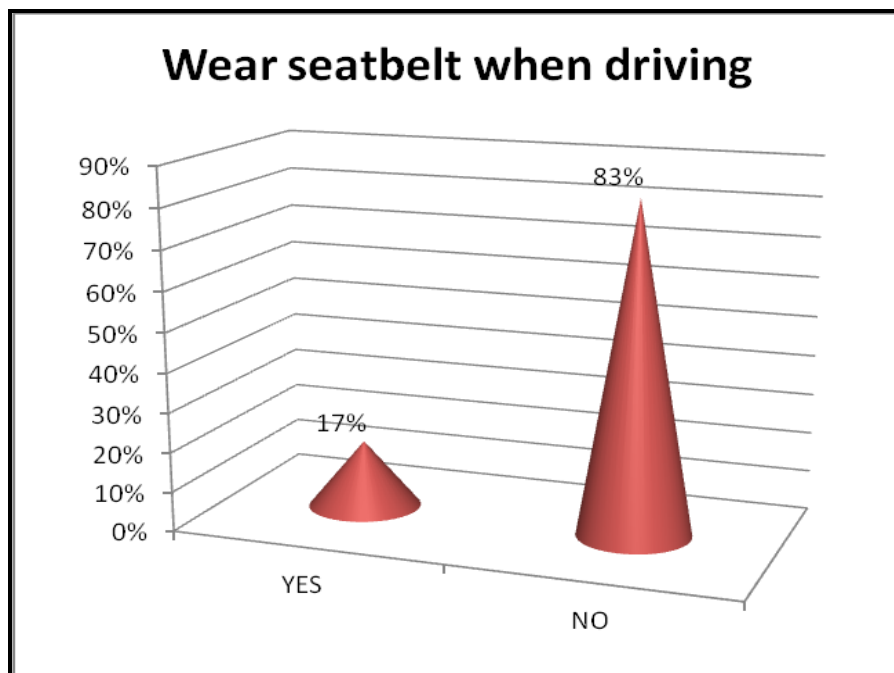


Figure 57: Do you wear a seatbelt when driving?

Figure 58 shows that majority (94.4%) of respondents knew the speed limit of roads within the Port, but no evidence was gathered regarding adherence to the speed limit.

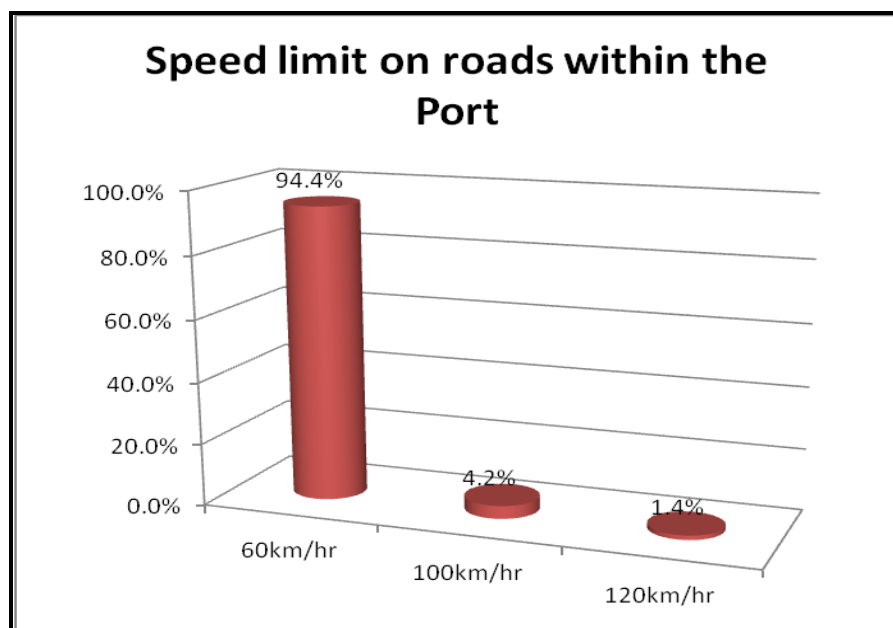


Figure 58: What is the speed limit on roads within the Port?

Figure 59 shows that only 1% of respondents have driven vehicles under the influence of alcohol and 99% obey the law in this regard, but surveyors did not ask them to prove this. Hence, the authenticity of this feedback is questionable.

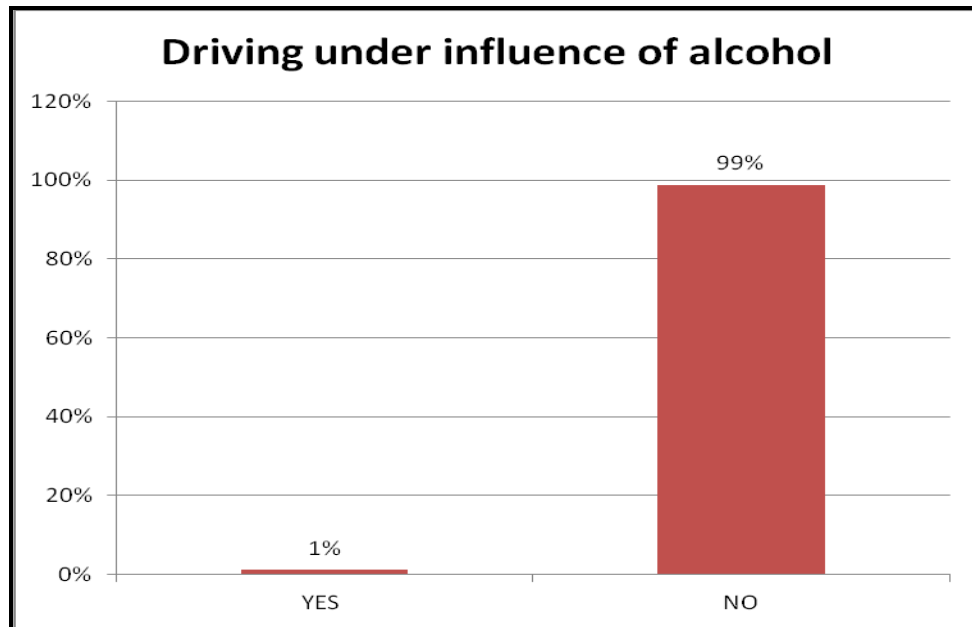


Figure 59: Have you driven a vehicle while under the influence of alcohol?

Responses to the question about answering the cell phone while driving were divided almost equally. Figure 60 shows that 50.8% of respondents do answer the cell phone while driving, while 49.2% obey the law and do not.

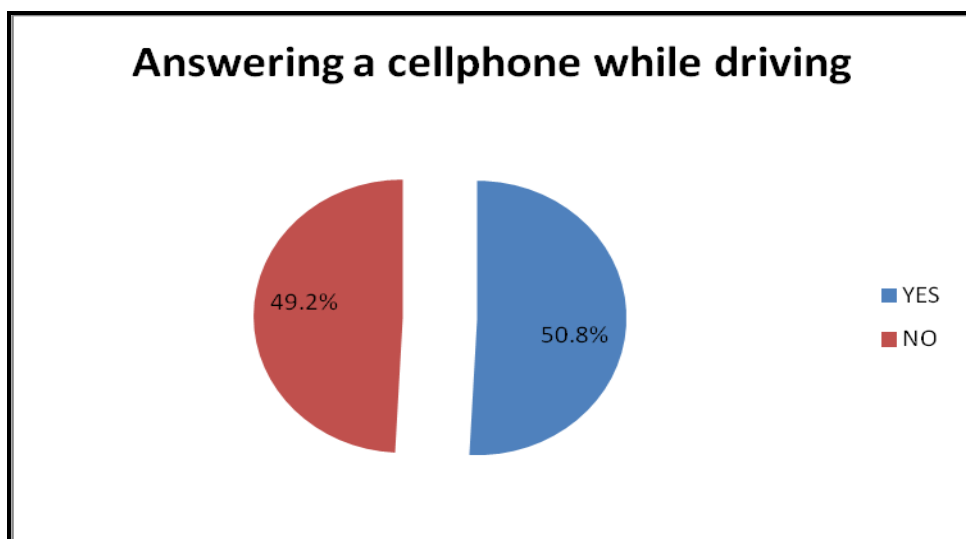


Figure 60: Have you at any stage answered your cell phone while driving?

Figure 61 shows trucks parked on both side of Maydon Road. Approximately 83% of drivers parked close to the gate of the premises while waiting to deliver or to collect goods.



Figure 61: Trucks parked on both sides of Maydon Road

Figure 62 indicates that the majority (82.5%) of the respondents have experienced traffic congestion.

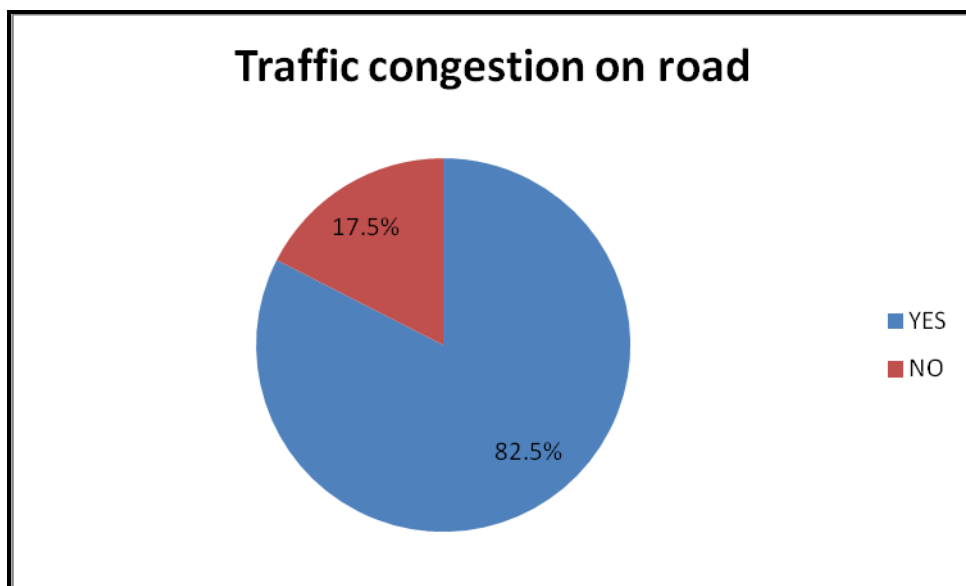


Figure 62: Have you experienced any traffic congestion within the Port?

Approximately 52.5% of respondents perceive that traffic signals and roads signs are not obeyed (Figure 63). This is a major cause of road accidents.

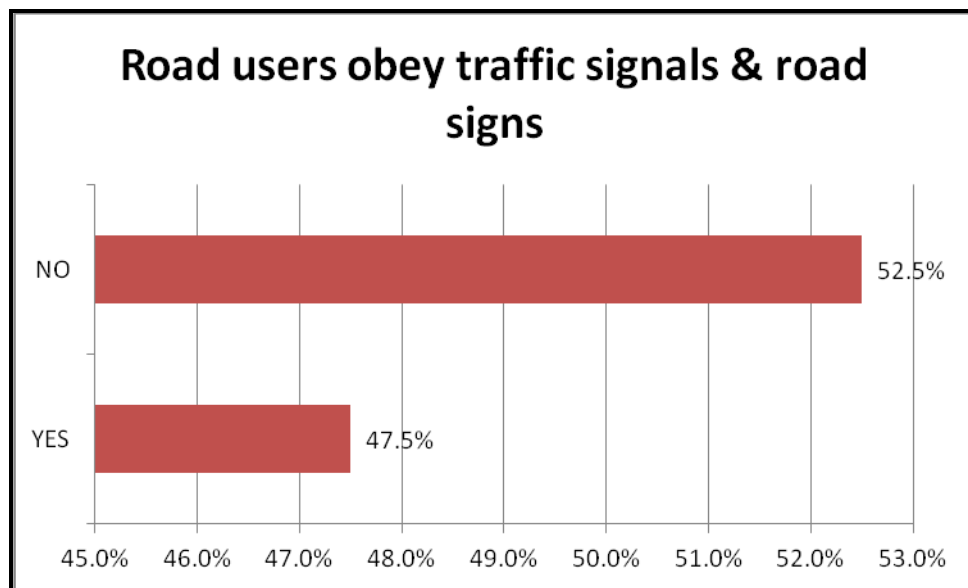


Figure 63: Are road users obeying traffic signals and road signs?

Figure 64 shows a high volume of traffic on Bayhead Road. Almost 91.7% of respondents perceive that there is major traffic congestion during peak hours. Peak hours refer to 06h00 to 09h00 in the morning and 15h00 to 18h00 in the afternoon.



Figure 64: Traffic congestion at Bayhead Road during peak hour

From Figure 65, it is evident that 77% of respondents perceive that there is no traffic at night, 6% perceive that there is traffic during night and 17% were not sure or don't know.

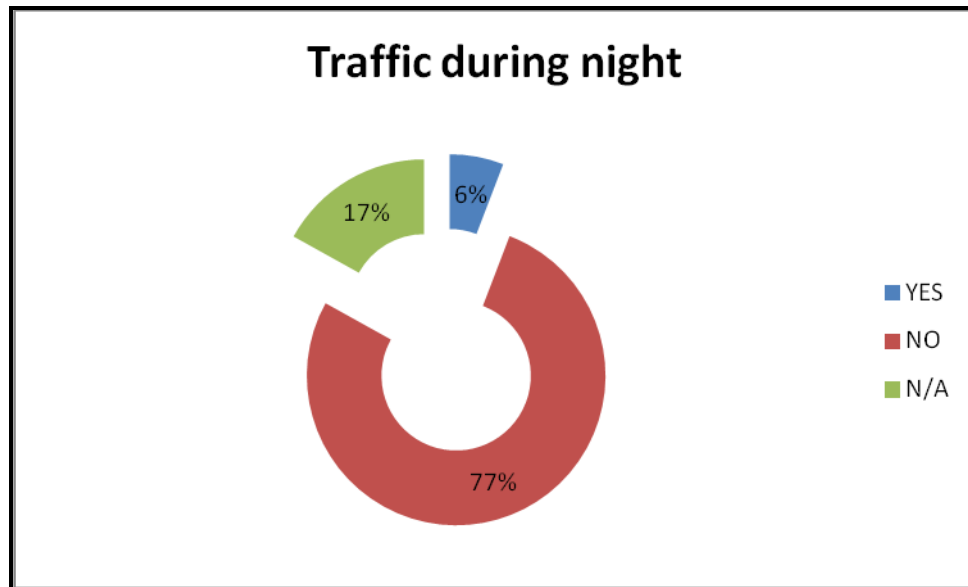


Figure 65: Is there a high volume of traffic during night?

As can be seen from Figure 66, most respondents think that the police are doing enough to enforce the law. However, approximately 44.8% of respondents perceive that law enforcement on these roads is not enough. Respondents felt that a much greater presence of the police force was necessary.

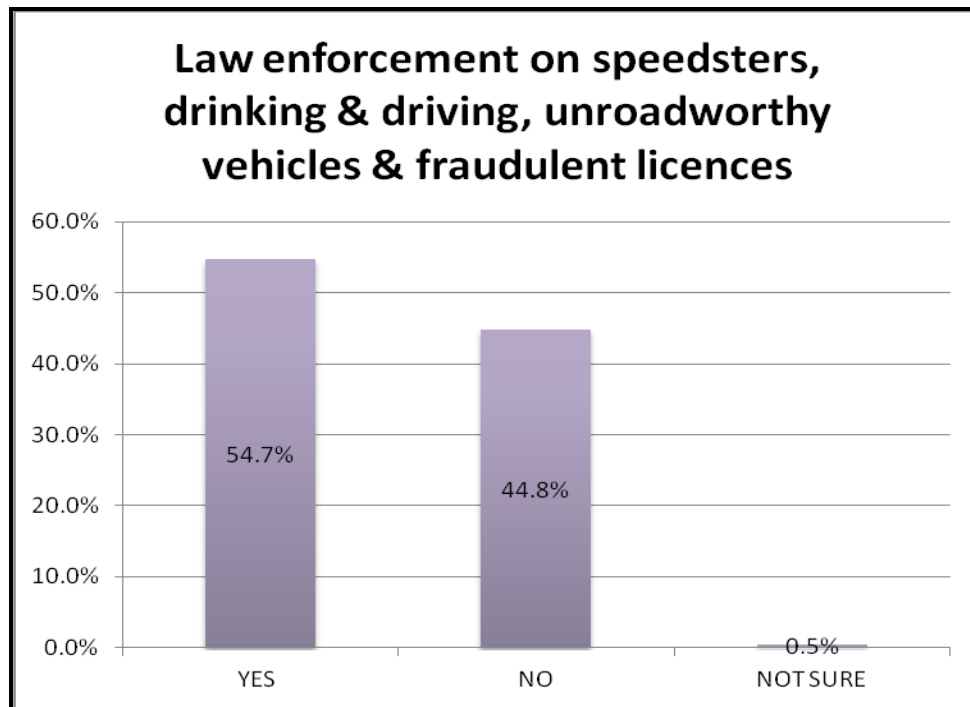


Figure 66: Do you think the police are doing enough with regards to clamping down on speedsters, drinking and driving, unroadworthy vehicles and fraudulent licenses?

Thirty point three percent (30.3%) of respondents have last seen or passed through a roadblock over a year ago while 5.8% have not seen or passed through a roadblock on these roads within the Port and they perceive that it doesn't happen. Sixty three point nine percent (63.9%) have often seen or passed through a roadblock (Figure 67).

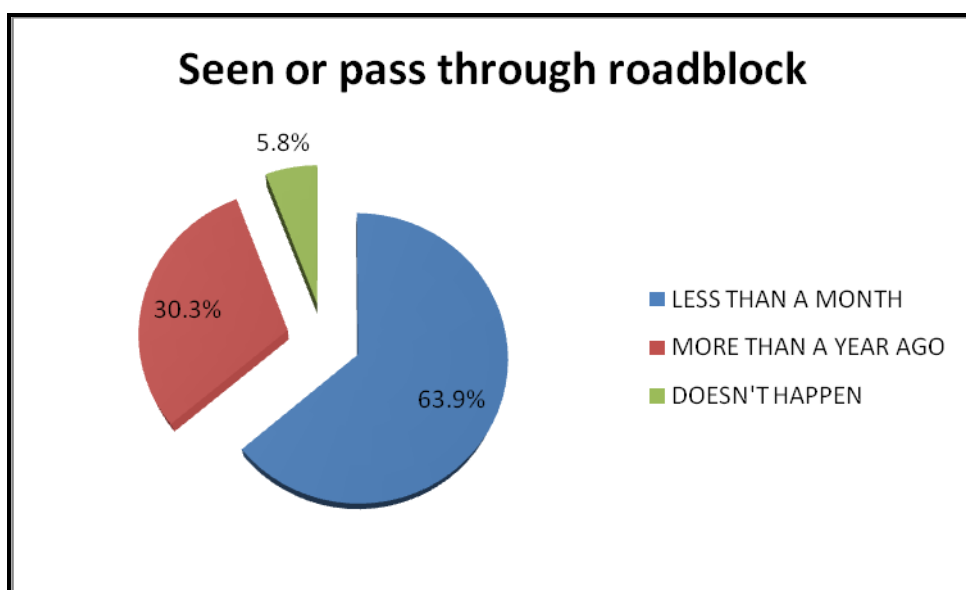


Figure 67: When last did you see or pass through a roadblock?

8.4 Conclusion

Maintenance of roads outside the Port is much better than inside the Port. Most (75%) road users don't know where to report defect/s on roads within the Port. Also, about 57% of the road users perceive that roads are not suitable or not designed for heavy vehicles.

Approximately 37.5% of respondents did not feel safe to drive on roads within the Port especially on South Coast Road. A high percentage of people (93%) witnessed accidents on these roads. Traffic signals within the Port are maintained by eThekweni Municipality and are very often non-functional. When road signs need to be repaired or replaced, it takes longer than expected. Most of the drivers don't wear seatbelts and also answer their cell phones while driving.

Most (82.5%) of the road users have experienced traffic congestion on these roads especially during road repair work and peak hours. Drivers parked close to the gate of the premises while waiting to collect or deliver goods cause major traffic congestion.

CHAPTER 9

CONCLUSION AND RECOMMENDATIONS

9.1 Recommendations regarding assessment of road conditions.

Arising from this study, the following assessment guidelines for the improvement of road conditions, road safety and road traffic are recommended:

- Treat and assess the eight major roads separately to other roads because of their importance. These roads must be allocated their own budget.
- Inspections and assessments should be conducted by qualified personnel with the relevant experience. The Area Supervisor, Maintenance Manager and Road Engineer for both parties (eThekweni Municipality and Transnet National Port Authority) should conduct visual inspections annually.
- Visual inspection of the roads/paving should be conducted on a routine basis to identify problems and workload, preferably in a cycle – at least annually. Problem areas should be inspected as often as required.
- Instrument methods such as taper gauges for width of cracks, measuring wheel, survey equipment, and Dynamic Cone Penetrometer (DCP) must be used where the need arises. Site or laboratory material testing be conducted as and when there are failures to the base, sub-base and road surface layers (asphalts).
- Assessment of the road condition must meet Pavement Management System (PMS) specification as part of the Technical Recommendations for Highways (TRH 22) requirements.

The possible solutions for addressing the defects (failures) were identified as follows:

- Minor repairs/patches include road marking and erection of traffic signs;
- Milling and overlay;
- Re-construct; and
- Binding or crack sealing.

9.2 Recommendations for improvement of road infrastructure

Road users should be informed of the reporting process with regard to road defects and malfunctioning of traffic signals. Boards or signs should be placed on roads highlighting the responsible authority and their contact details.

Transnet National Ports Authority as the landlord of the Port should take full responsibility for maintenance work especially where there are “grey” areas.

Major problems are experienced when there is a change of ownership. The handover period for ownership should be fast tracked and continuity of maintenance maintained. Transnet National Ports Authority should ensure that all lessees are maintaining their roads at acceptable standards. Inspections, assessment and maintenance of roads within the Port should be conducted by qualified personnel with the relevant experience. EThekweni Municipality and Transnet National Port Authority should use a common standard/benchmark when undertaking road inspections and maintenance work. More attention should be paid to regular inspections of roads within the Port in order to improve their standards to be similar to roads outside the Port.

Growth of container traffic, an increase in the dimension and weight of trucks and transport deregulation over the past years are major contributors to poor road condition. Accidents and deaths on South Coast Road can be reduced by improving road conditions and law enforcement.

This study recommends that law enforcement be improved to effectively address the following:

- Illegal parking especially on Maydon Road;

- Use of cell phones while driving;
- Lack of seat belt usage;
- Disobeying traffic signals and road signs; and
- Overloading.

The typical relationship between inland and maritime transport at Port of Durban is shown in Figure 68. It is important that the maritime transport (vessel) and inland transport (road, rail or air) work together so that cargo can move from origin to destination and *vice versa* as per Figure 68. Platforms where both industries meet and discuss challenges are essential. Transnet National Ports Authority as the landlord for the Port plays a crucial role in ensuring that both industries understand each other.

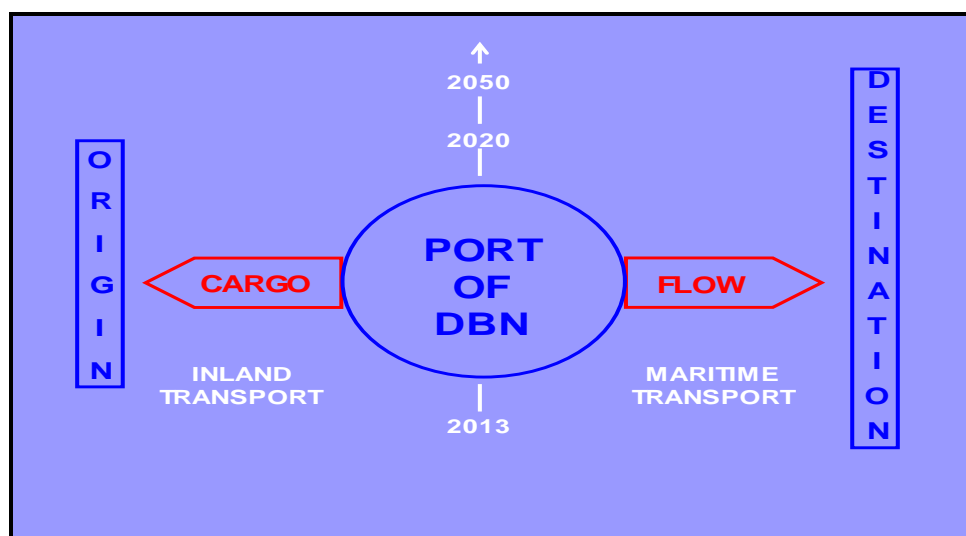


Figure 68: Relationship between inland and maritime transport

Transnet should improve efficiency such as vessel turnaround time, loading and unloading of cargo and transportation of goods by rail or pipelines so as to relieve road transport. Transnet should promote trans-shipment, that is moving cargo from port to port for example moving cargo from Port of Durban to Port of Richards Bay by ship instead of using road or rail transport.

Transnet Pipelines transports refined fuels from the Sapref and Enref fuel refineries in Durban and imported fuels from the Port of Durban at Island View, through a 12 inch diameter pipeline known as the Durban-Johannesburg Pipeline

(DJP). The demand for fuel in South Africa is increasing yearly by 4.2%. To meet the future fuel demand Transnet Pipelines has in progress the construction of a New Multipurpose Products Pipeline. The construction of a new 525 km multi products liquid fuel pipeline or trunkline with 24 inches diameter made from carbon steel started in 2008 from Durban to Jameson Park near Heidelberg in Gauteng. The project is anticipated to be completed in 2013. Once complete, the state-of-the-art pipeline will contribute to the supply of petroleum products for the inland market for the next 70 years, safely, cost effectively and in an environmentally friendly manner. This project will also assist in reducing road traffic since the number of heavy vehicles that are currently transporting petroleum products will be reduced.

The long tenant leases at Maydon Wharf area need to be reviewed by Transnet because the current arrangement causes “width constraint” on rail yards, inappropriate location of buildings and equipment within the rail yards, intrusive layout of Port yards, unfavorable modal split and limited rail usage. This study recommends that rationalization of the rail infrastructure within the port yards be encouraged in order to support future clustering.

The safety of goods and delays in railway transport are still a concern in the freight industry. The initiative by Transnet Freight Rail (formerly known as Spoornet) for introduction of three ways to stop cable thieves has improved the situation but it requires constant funding especially regarding monitoring. The three ways of reducing cable theft on railway lines are:

- Upgrade and improve the rail network;
- Installation of new cables with no copper wire which will make them less attractive to thieves; and
- Better monitoring of alarms on the network will mean faster responses.

This study recommends that cargo be separated in line with transportation mode (road, rail or pipeline). A possible classification of products and mode of transport is shown in Table 11.

Table 11: Classification of products related to mode of transport

Product	Mode of transport		
	Road	Railway	Pipeline
Agricultural products		√	
Livestock	√		
Food	√		
Fodder	√		
Oil & fuel gas			√
Solid metal fuels		√	
Iron and iron-ore		√	
Metal scrap		√	
Steel		√	
Non-ferro metal		√	
Raw metal		√	
Construction material		√	
Fertilizers		√	
Chemical			√
Vehicles & machinery		√	
Wood products		√	
Petroleum			√

Truck stop/staging and storage of empty containers need to be located outside the port area (Inland Port). Departing traffic should never interfere with arrival traffic. Empty containers should not be mixed with full containers. The demand for

storage facilities can be reduced by limiting the time during which cargo is stored free of charge, and by sharply increasing the storage charge day by day after the free time has expired. In order to speed up operation, reduce bottlenecks and avoid accidents, it is essential to prepare the layout of the land areas in such a way that different traffic categories are kept separate.

Promote intermodal split or share the amount of traffic between road and rail, and not rail verses road. There is a need for integrated planning in order to improve Transnet Freight Rail's (Spoornet) service delivery market share and capacity. The infrastructure development needs to be reviewed from a Transnet and a logistics management perspective as opposed to the major transport divisions viewing their own requirements independently.

All stakeholders namely owners, regulators, operators, shippers, suppliers, investors, road users and many others including the public need to work together to improve road conditions, reduce traffic congestion, and reduce road accidents at the Port of Durban.

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APPENDICES

Appendix 1
**Inspection sheet for section of Bayhead,
Quayside, Maydon, Rick Turner, Wisely, South
Coast, Bluff and Iran Road within the Port**

Appendix 2

Layout of asphalt paved areas and roads at Point area

Appendix 3
Layout of asphalt paved areas and roads at
Maydon Wharf area

Appendix 4

Layout of roads at Bayhead area

Appendix 5

Layout of roads at Pier 1 and Island View area

Appendix 6
Inspection sheet for asphalt paved areas and
roads at Point

Appendix 7
Inspection sheet for asphalt paved areas and
roads at Maydon Wharf

Appendix 8

Inspection sheet for roads at Bayhead

Appendix 9

Inspection sheet for roads at Pier 1

Appendix 10
Inspection sheet for roads at Island View area

Appendix 11
Inspection sheet for section of Bayhead,
Quayside, Rick Turner, South Coast and Bluff
Road outside the Port

Appendix 12

Road traffic counts within the Port

Appendix 13

Road accident reports

Appendix 14

Road death reports

Appendix 15

Questionnaire survey form on Road users

Appendix 16

List of publications and conference presentations

PUBLICATIONS

Publication of paper on the South African Assets Management Association (SAAMA) website. Kunene, O. and Allopi, D. 2011. Assessment of road infrastructure within the Port of Durban. www.saama.org.za/papers.

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CONFERENCE PRESENTATIONS

7th Annual Symposium – Transportation Research: The Eastern Centre of Transport Development (Ecotd). Kunene, O. and Allopi, D. 2007. An investigation on road and railway within the Port of Durban. Paper delivered at the 7th Annual Symposium – Transport Research: The Eastern Centre of Transport Development (Ecotd), Assagay (Shongweni), South Africa, October 2007.

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