INVESTIGATION ON ASPHALT ROADS WITHIN THE PORT OF DURBAN

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1. ABSTRACT

Over the past years road traffic has increased at the Port of Durban and this has resulted in an increase in asphalt road maintenance work including its budget. 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%. There are eight major asphalt roads within the Port that connect the South, West and North of eThekwini Municipality namely Bayhead, Quayside, Maydon, Francois, Wisely, South Coast, Bluff and Iran Roads. The Port of Durban is an important vehicle for facilitating economic growth of local, regional and national industries. For Port to maintain global competitiveness with the current trend of globalization, it has to ensure that the roads are well maintained and has a smooth traffic flow with no delays. This paper provides an overview of the condition of asphalt roads within the Port of Durban. Asset verification and assessment of the condition of existing roads were conducted. Comparisons between condition of asphalt roads within the Port and those outside the Port were highlighted. Road accident reports were analyzed and factors affecting road conditions within the Port were also highlighted.

2. INTRODUCTION

2.1 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). Normally when a road increases its traffic, the road then becomes a public road which falls under the 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 eThekwini Municipality. Roads such as Bayhead, Maydon, Francois, Wisely, South Coast, Bluff and Iran Roads are classified as public roads. The unclassified period of change of ownership and delay in reaching agreements between the two parties has resulted in most of the roads not being maintained.

The maintenance budget for eThekwini Municipality and Transnet National Ports Authority has slightly increased over the past years but that's 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 the last will be the maintenance budget. Normally when the overall budget needs to be cut, the first cut is the maintenance budget.

In the eighty five years leading up to 1995, the 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 and 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, 2008).

In the last fifteen years with deregulation of road transport there was 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. The result of 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, 2008).

2.2 Objectives of the study

- To identify the existing asphalt roads within the Port of Durban.
- To assess the condition of existing roads within and outside of the Port.
- To analyze road accidents within the Port of Durban.
- To highlight factors that affects the road condition.
- To recommend guidelines based on the findings.

2.3 Study limitations

The study is limited to the eight major roads within the Port of Durban where almost 70% of the country's container cargo are handled at this Port. It is the busiest port in Africa and is rated as amongst the top 10 fastest growing Ports in the world.

The following Figure 1 highlights the location of the eight major roads within the Port of Durban namely Bayhead, Quayside, Maydon, Francios, Wisely, South Coast, Bluff and Iran Roads:

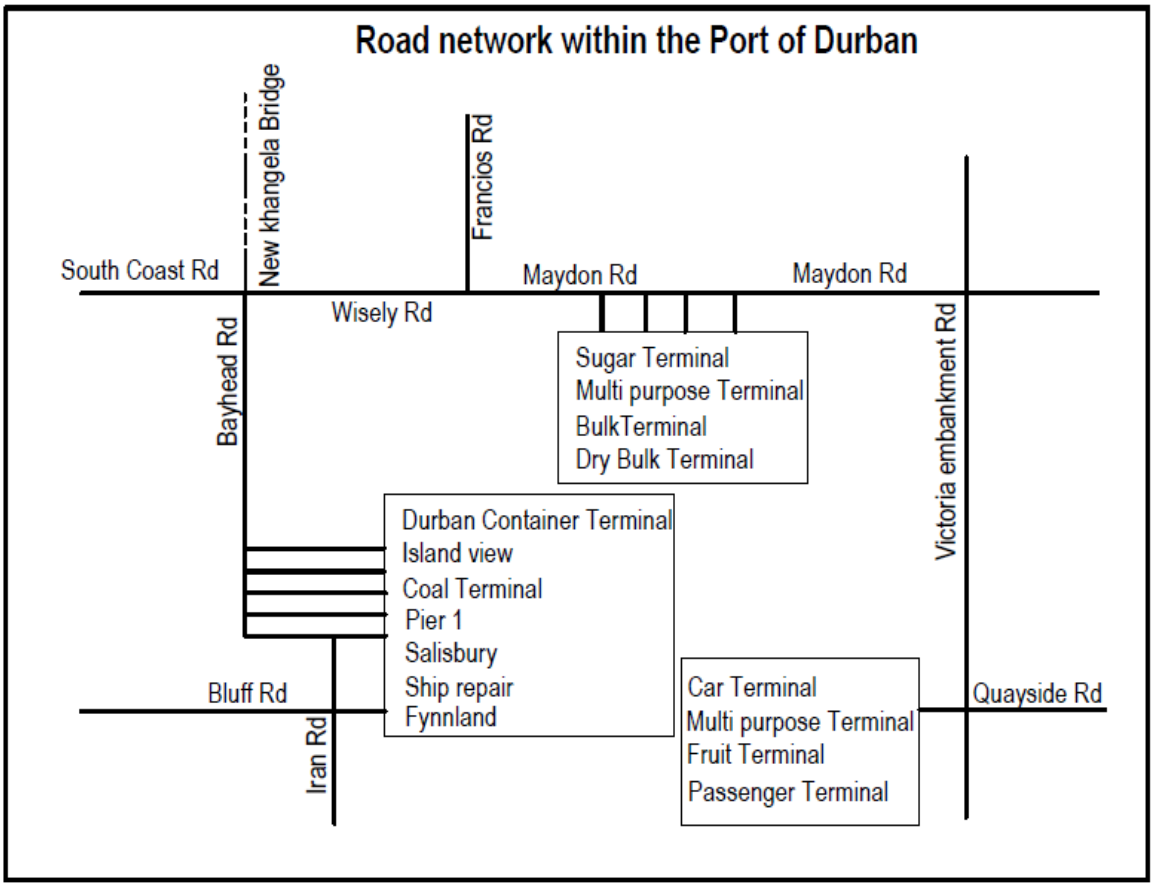

Figure 1: Road network within the Port of Durban

3. ASSET VERIFICATION

The Pavement Management System Manual TMH9 was used as the reference for physical site measurements of these eight major roads within the Port of Durban. Physical verification was conducted as part of the asset verification process.
Eight major roads were verified and the following results shown in Table 1 were obtained:

Table 1: Road Measurements

	Bayhead Road	**Quayside Road**	**Maydon Road**	**Francios Road**	**Wisely Road**	**South Coast**	**Bluff Road**	**Iran Road**
Length within the Port	5km	3km	2.4km	0.4km	0.6km	2.3km	2.4km	1.6km
Length outside of Port	0.5km	0.25km	0km	4km	0km	7km	6km	0km
Number of lanes in each direction	two	one	one	one	two	one	one	one

Note: The measurements for Maydon, Wisely and Iran Road represent the full length of the road. Bayhead, Quayside, Francois, South Coast and Bluff Road measurements are divided into two sections. The first measurement represents the section of road that falls within the Port and second measurement represents the section of road outside the Port.

4. ROAD ASSESSMENT

4.1 Assessment of roads within the Port

The visual inspection (eyeball method) was identified as the suitable method 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 all eight major roads highlighted in Figure 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 shown in Table 2 below:

Table 2: Rating method
Source: Transnet National Ports Authority, 2004

Percentage	Description	Rating	Description
100-90%	Excellent	A	It is new and perfect. No maintenance work required at this stage
89-70%	Very good	B	It looks like new and minor maintenance work may be required at a later stage
69-50%	Good	C	It is moderate and maintenance work may be required within 12 months
49-30%	Fair	D	It is reasonable but maintenance work may be required within 6 months
29-10%	Poor	E	It is not safe and needs urgent attention
9%-0%	Very poor	F	It is very poor and reconstruction work required urgently

Figure 2 below shows the typical defects found on Maydon Road and most of these crocodile cracks are result of level crossings.

Figure 2: Crocodile cracks on Maydon Road

The findings of the assessment on the eight major roads 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 3: Longitudinal cracks on Bayhead Road

Figure 3 and Figure 4 show the type of asphalt defects observed during the assessment. Figure 3 above shows the longitudinal cracks found on Bayhead Road where the asphalt layer failed on the joint. Figure 4 below shows the depression on the asphalt layer found on Bayhead Road close to the intersection with South Coast Road.

Figure 4: Depression on the asphalt layer on Bayhead Road

The results from the inspection reports conducted on the eight major roads within the Port are shown in Figure 5 below. 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.

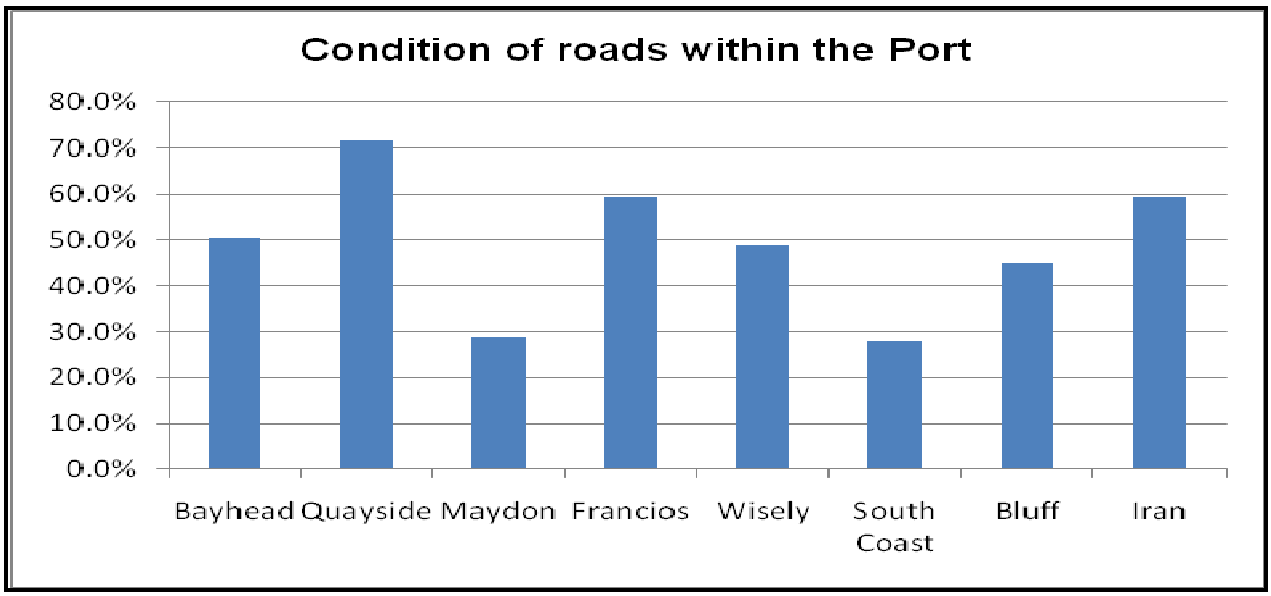

Figure 5: Assessment of road condition within the Port

- Quayside Road (71.5%) falls under B (very good) category. It looks like new and minor maintenance work may be required at a later stage.
- Francois Road (59.5%), Iran Road (59.5%) and Bayhead Road (50.5%) fall under C (good) category. It is moderate and maintenance work may be required within 12 months.
- Wisely Road (49%) and Bluff Road (45%) fall under D (fair) category. It is reasonable but maintenance work may be required within 6 months.
- Maydon Road (28.8%) and South Coast Road (28%) fall under E (poor) category. It is not safe and needs urgent attention.

4.2 Assessment of roads outside of the Port

The results from the inspection reports conducted at the five major roads that have sections which fall outside of Port are shown in Figure 6 below, namely Bayhead, Quayside, Francois, South Coast and Bluff Roads. The full length of Maydon, Wisely and Iran Road falls within the Port and it 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%.

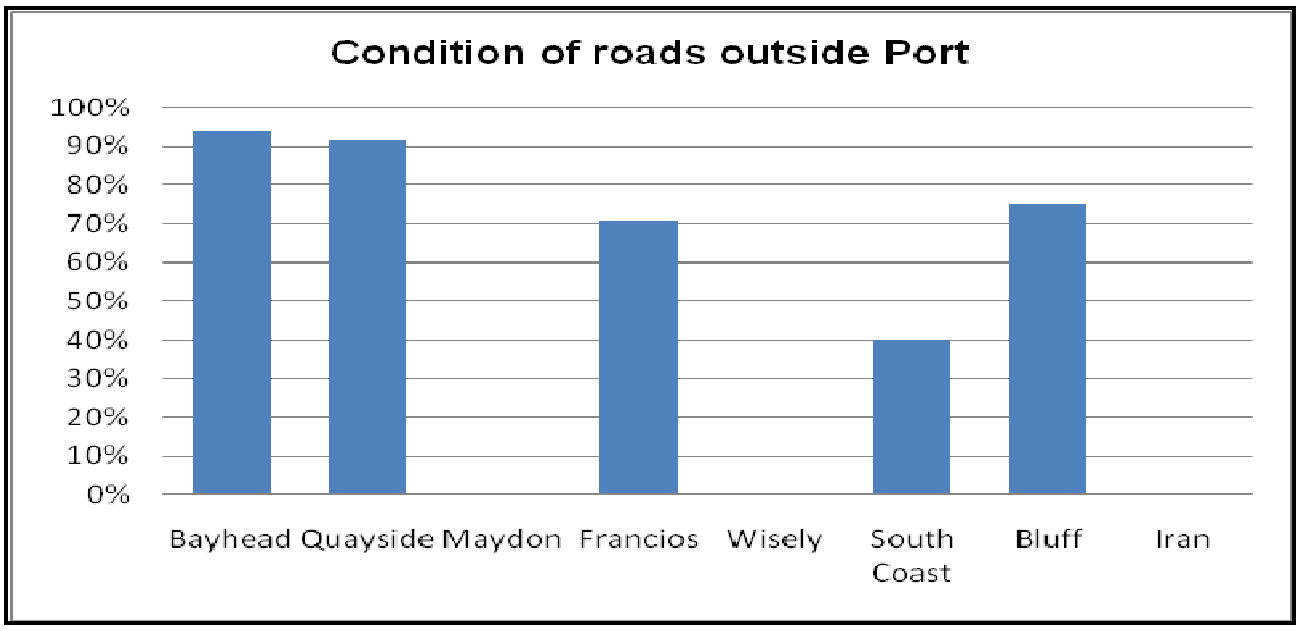

Figure 6: Assessment of road condition outside of the Port
Source: eThekwini Municipality, 2010

- Bayhead (94%) and Quayside Road (91.5%) fall under A (excellent) category. It is new and perfect. No maintenance work required at this stage.
- Francios (71%) and Bluff Road (75%) fall under B (very good) category. It looks like new and minor maintenance work may be required at the later stage.
- South Coast Road (40%) falls under D (fair) category. It is reasonable but maintenance work may be required within 6 months.

4.3 Comparison of road within and outside of the Port

The section of roads which falls outside the Port are in a good condition compare to section of roads within the Port as shown in Figure 7 below.

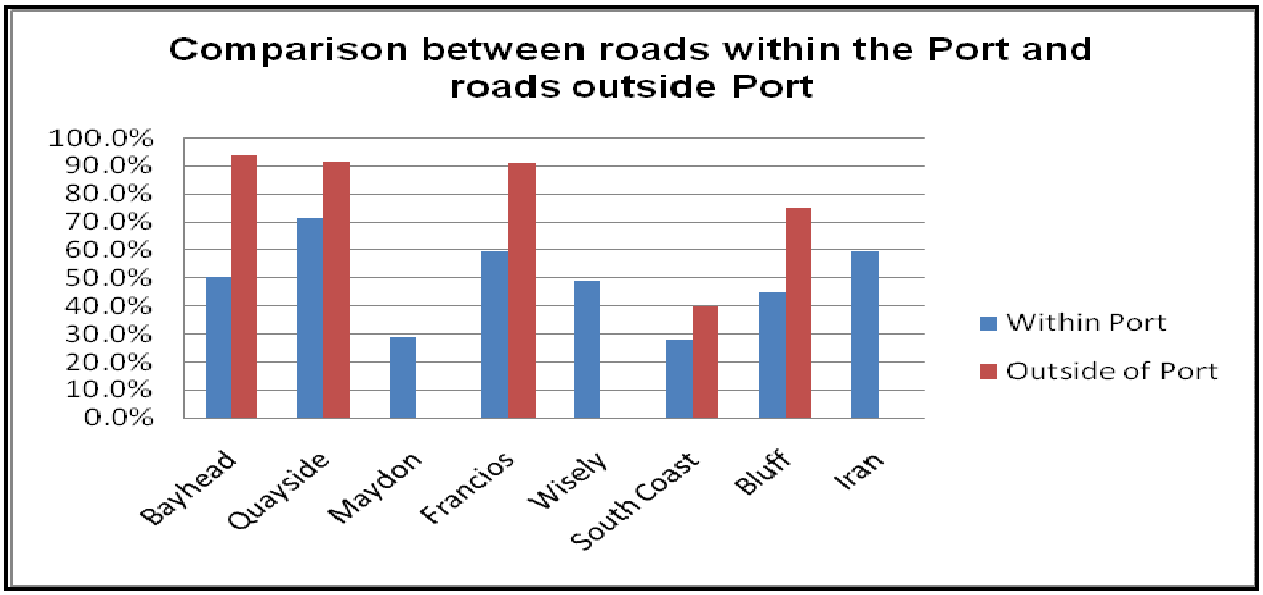

Figure 7: Comparison between roads within and outside of the Port
Source: eThekwini Municipality, 2010

5. ROAD ACCIDENTS

Over the past years the road accidents have decreased from 3972 in year 2007 to 2729 in year 2010. Figure 8 below shows that there has been a decrease in the number of road accidents over the past years although the number of deaths remain the same. South Coast Road had the highest number of accidents.

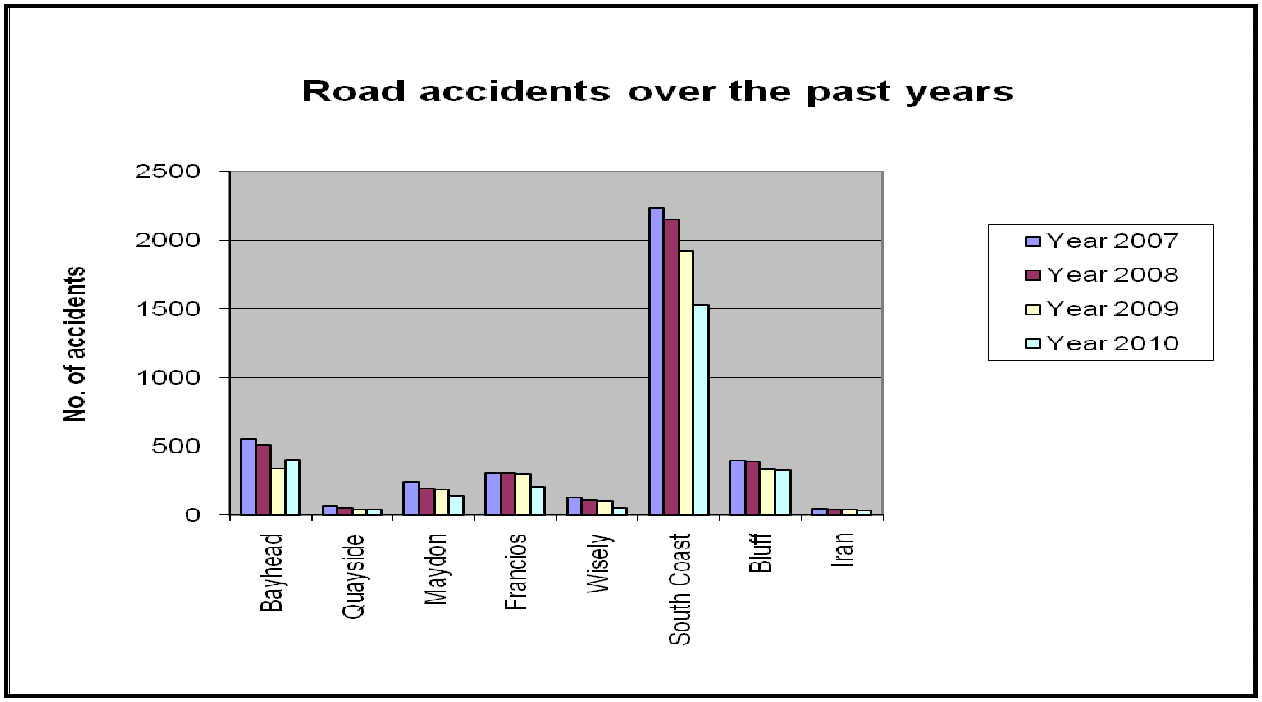

Figure 8: Road accidents over the past years
Source: eThekwini Municipality, 2010

Figure 9 below shows that 1527 accidents happened in year 2010, there were 1318 (86%) people who came out with no injury, 155 (10%) people were slightly injured, 41 (3%) people were seriously injured and 13 (1%) had fatal injuries.

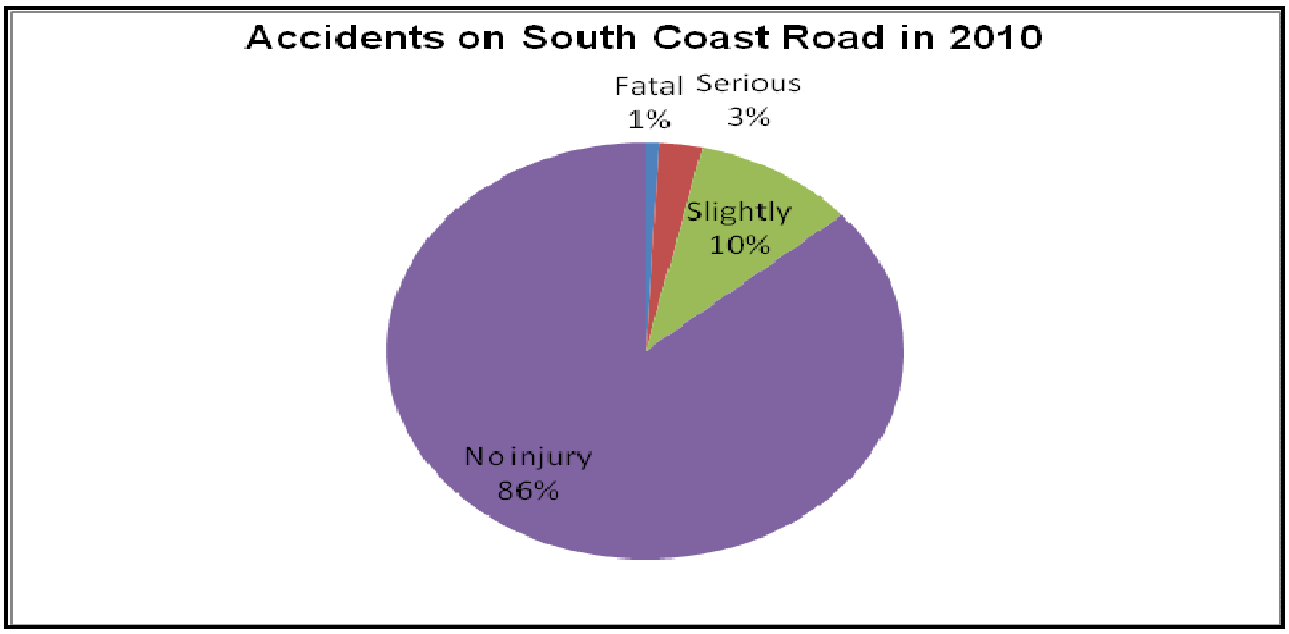

Figure 9: Road accidents on South Coast Road
Source: eThekwini Municipality, 2010

Figure 10 below shows that in year 2007, 20 people died on these roads and in year 2010 it still remained at 20 deaths. South Coast Road had the highest number of deaths. No deaths were reported on Quayside (B category) and Iran Roads (C category) since year 2007. Driver and pedestrian error, road condition and vehicle defects have a major impact on road accidents within the Port of Durban.

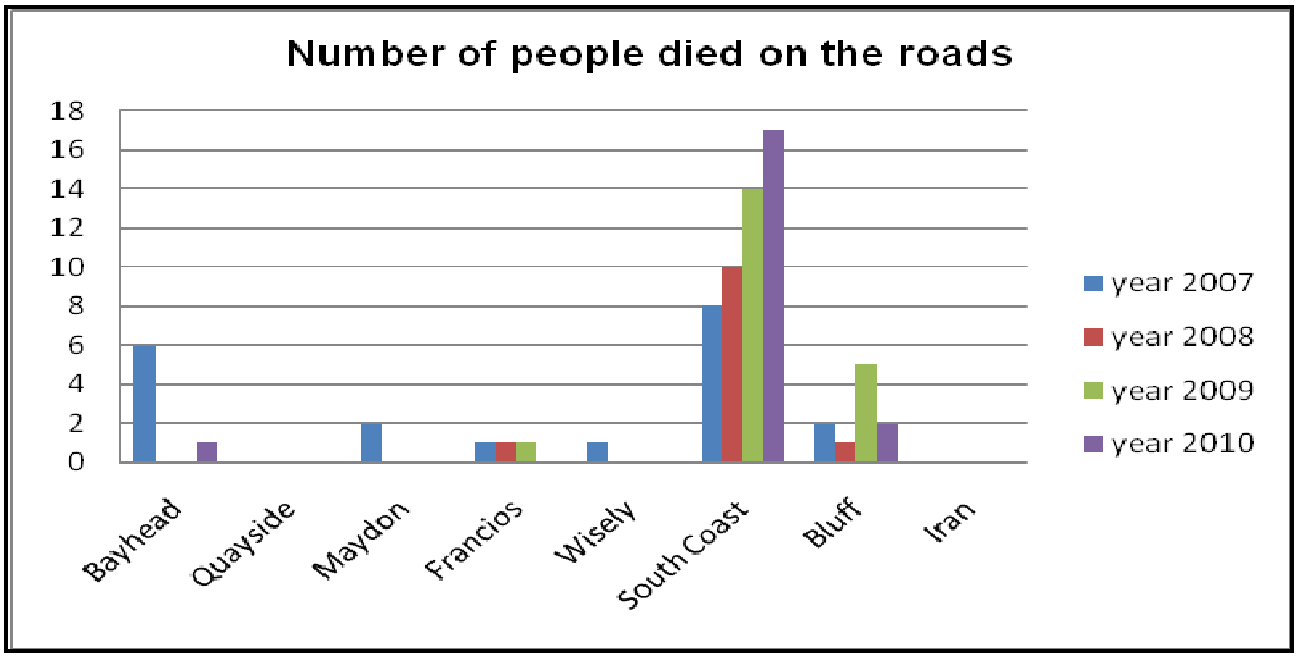

Figure 10: Number of people died over the past years
Source: eThekwini Municipality, 2010

6. FACTORS AFFECTING ROAD CONDITION

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

- Growth of container cargo
- An increase in the dimension and weight of trucks
- Transport deregulation over the past years (results on road vs rail)

A brief discussion on each factor is highlighted:

6.1 Growth of container cargo

Port of Durban has been experiencing high growth rates in container traffic which impacts on road infrastructure condition. About 70% of South African container cargos are handled at the Port of Durban. The Port of Durban has a dedicated Container Terminal that handles 200 000 Twenty Foot Equivalent Units (TEU) of container per month which equates to 2, 4 million Twenty Foot Equivalent Units per annum. Average growth of container volumes over the past few years is between 5-7% per annum (Transnet Projects, 2007).

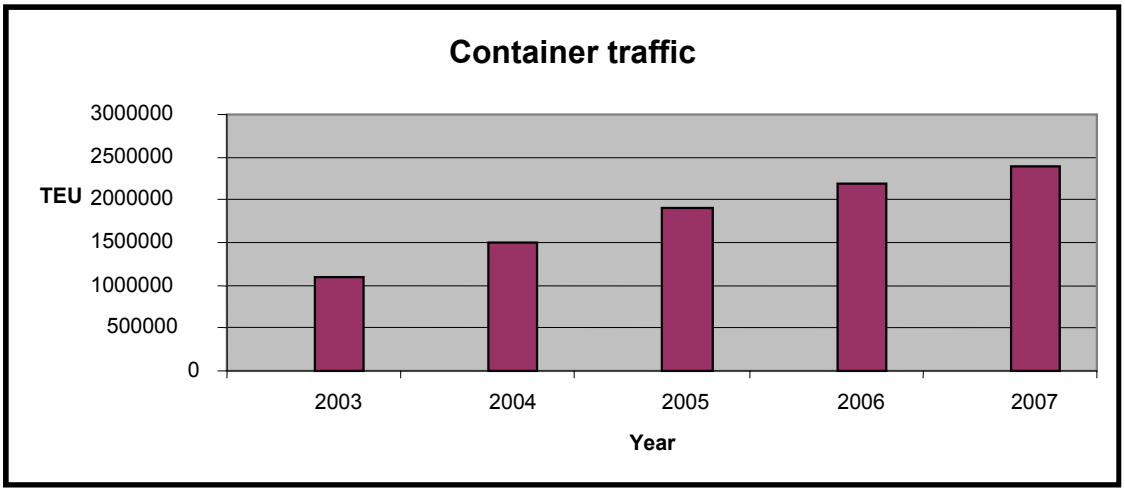

Figure 11: Container volumes at the Port of Durban
Source: Transnet Projects, 2007

Figure 11 shows the container volumes handled at the Port of Durban over the years where it increased from 1,1 million TEU in 2003 to 2,4 million TEU in 2007.

6.2 An 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, which is currently used these days, that is almost double. The weight, which is gross combination mass (GCM) has increased from 38000 tons to 58800 tons. These changes in dimensions and weight of trucks have resulted due to global modification of trucks capacity. These changes have major impact on road condition at the Port of Durban (Telford, 2004).

The 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).

6.3 Transport deregulation over the past years (results in rail vs road)

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. 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, unroadworthy vehicles and excessive pressure on truck drivers to work long and uncontrolled hours (Road & Rail Association, 2007).

7. CONCLUSION

- Maydon and section of South Coast Roads 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.
- 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.
- Growth of container, increase in dimension and weight of trucks and transport deregulation over the past years are major contributors to poor road condition.

8. RECOMMEDATIONS

- It is recommended that these eight major roads have their own budget and assessed separately to other roads because of their importance. The ownership must be clear and owners must take full responsibility. The public must be able to report any defect on any road under the ownership of Transnet National Ports Authority or eThekwini Municipality.
- Fast track handover period for ownership and ensure that there is continuity in terms of maintenance.
- Reduce accidents and deaths on South Coast Road by improving road condition and more effective law enforcement.
- More attention must be paid in terms of regular inspections on roads within the Port in order to improve its standard to be similar to roads outside the Port.
- It is recommended that the Area Supervisor, Maintenance Manager and Road Engineer for both parties (eThekwini Municipality and Transnet National Port Authority) conduct visual inspections annually. It is further recommended that problem areas be inspected as often as required.
- It is recommended that site or laboratory material testing be conducted as and when there are failures to the base, sub-base and road surface layers (asphalts).

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