E TRANSPORT ENVIRONMENT

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E.1 OVERVIEW OF THE TRANSPORT SECTOR

E1.1 GENERAL

The Ministry of Works, Transport and Communication (MWTC) is on behalf of Government responsible for developing policy and regulating the transport sector. The Namibian transport sector consists of four main modes or sub-sectors all included in this study, namely Roads, Railways, Aviation and the Maritime modes. Namibia does not have inland waterways or pipelines for bulk transport of goods. The MWTC has organised the management of these sectors in different Directorates in the Department of Transport (DOT). These modes have developed according to pre-independence development patterns and today still show that trend.

The road sub-sector is by far the most important sub-sector. With Namibia’s small population and large land area the roads network forms the primary means of access to outlying parts of the country and contact between communities. This sector has historically taken the lead in infrastructure development and today Namibia has an extensive network of well-maintained roads. Traffic volumes are increasing quickly but are by world standards, still small. This sector still has significant available capacity.

The railway sector developed as a means of mass goods transport and still concentrates on the transport of bulk goods. This sector has over the last number of decades come under increased competition from the road sub-sector as demands on just-in-time delivery increased. This competition has led to a world-wide decline in rail utilisation. This decline is also apparent in Namibia where traffic volumes decreased significantly.

The civil aviation industry is centred in and around Windhoek. The international airport, Hosea Kutako, handles most of the foreign passenger and goods transport while Eros Airport acts as the domestic hub. The aviation repair industry is also concentrated at Eros. There are more than 400 landing strips, airports and aerodromes spread out over Namibia. Although they differ significantly in infrastructure quality, they are all characterised by very low traffic volumes.
The bulk of activities in the maritime sector concentrate on servicing the fishing industry, one of the backbones of the Namibian economy. Namibia has two ports: one at Walvis Bay that handles most of the fishing activities and almost all foreign cargo and passenger transport and Lüderitz that supports only coastal shipping and fishing activities. Both ports are under-utilised due to low traffic volumes. There is no organised transport on the perennial rivers and therefore the maritime mode consists of seafaring activities.

Government at Independence recognised that the existing highly regulatory policies prevented entry of new businesses and that these policies benefited only a few. It has therefore adopted a new policy of deregulation and based the new policies on the premise that efficiency can in most cases be achieved by promoting competition between suppliers of transport services (White Paper). The First National Development Plan (NDP1) recognises that there may still be a case for Government to intervene where inter alia the public safety and the environment are threatened or where these competitive practices do not promote socio-economic development (NDP1, Volume I, page 310). These policies will lead to major restructuring of the sector with MWTC transferring functions to new parastatals and government agencies, retaining only the policy-making and regulatory functions. The effect of this program called the MWTC2000 Project will be noted for each sub-sector below.

This chapter will shortly describe the four modes and discuss the issues particular to each mode. Historic development patterns and the major role players will be covered in full.
E1.2 THE ROADS SUB-SECTOR

E1.2.1 Background

The Namibian roads network initially developed to support the requirements and needs of the colonial powers, Germany and South Africa. At Independence the network provided good connections to South Africa and on a national basis, good connections between the major trading centres and population growth points. In the north the road network development did not always support natural development trends as some major extensions in the extreme north were mainly constructed to support the South African Defense Force efforts in Angola. These did not always make the network more accessible to the general population.

Since Independence the Namibian Government through the MWTC planned and developed major additions to the network to address the skew distribution of roads. Botswana was connected with the Trans-Kalahari Highway while the Trans-Caprivi Highway will shortly be completed with paved connections to Botswana and Zambia. Rapid improvements to and expansions of the rural networks in the Omasati, Ohangwena, Oshana and Otjikoto Regions also increased accessibility in these regions.

The traffic volumes have been increasing steadily over time. They are however still small by world standards and in many instances, the volumes are so low that meaningful data does not exist for the development of core indicators. For example, traffic congestion is not seen as a problem in Windhoek and no information exists on levels of gas emissions in the city.

Roads on the other hand act as development guides in especially the communal areas where new roads lead to changes in land use and population distribution. The most recent example of this phenomenon can be seen on the Trans-Caprivi Highway between Rundu and Divundu.
E1.2.2 The Role Of Government

The DOT of the MWTC is responsible for the regulation and control of the road sub-sector. Historically all infrastructure that forms part of the rural national road network was planned, designed, constructed and maintained by the DOT. Over time, planning and design work was contracted to consultants, while construction and major rehabilitation works were contracted out. This trend continued to the stage where the private sector contractors presently undertake all construction and rehabilitation work under contract. The DOT also as part of a pilot program implemented routine maintenance contracts.

This year Government will change its role significantly with the establishment of three new entities: the Road Fund Administration (RFA), the Roads Authority (RA) and the Road Contractor Company (RC). The legislation to establish these parastatals aims to ensure that the Namibian national roads network as well as the urban streets and the function of Traffic Policing will be financially sustainable over time.

The RFA will impose road user charges to fund a safe and economically efficient road sector. The RA will manage the national road ensuring safety and efficiency while the RC will be a Company maintaining and constructing roads.

Figure E1: New Road Management Dispensation: Funding Relationships
Figure E1 above gives a schematic layout of the new dispensation and the corresponding flow of funds. The RFA will be responsible for setting the levels of road user charges and allocating the revenues so collected to the different stakeholders. There will be Procedures Agreements between the RFA and the respective stakeholders that will set guidelines for economic efficiency. The RFA will collect these charges from road users and will distribute the funds so received to the different functionaries. These are the RA managing the national road network, the local authorities and MRLGH maintaining the urban streets as well as the Namibian Police currently managing the traffic policing function. Provision is also made to partially fund the National Traffic Information System (Natis) and other smaller functions that will be to the benefit of the road user. Each of these functionaries will have to implement methods to prove efficient service delivery and efficient utilisation of resources.

Once these changes are implemented, now targeted for October 1999, the DOT will only be responsible for the policy development and regulation of the sub-sector. Two of the important functions are safety and accessibility.

- The National Road Safety Council (NRSC) manages Road safety regulation on behalf of the Minister responsible for Transport.
- The MWTC will remain the owner of the national road network and will therefore still be responsible to determine the extent of this network. The MWTC may through initiatives from the general public or through own initiative, add roads to make regions or villages more accessible. Once part of the national network, these additions will be maintained and developed as part of the national road network.

Municipalities manage their own streets and roads. The Ministry of Regional and Local Government and Housing (MRLGH) is responsible for the streets in settlement areas and unproclaimed villages. Where Municipalities have not developed the internal resources to manage or fully fund the provision and maintenance of these networks under their control, the MRLGH also assists to ensure proper provision and maintenance.
E1.2.3 The Role of the Private Sector/Parastatals

As mentioned above, the Private Sector does not have a direct role in providing and maintaining road infrastructure. This will change when a more commercial approach to roads is established with the creation of the RFA, RA and RC later this year. Road users will have a larger say in the utilisation of the levies collected through the Road User Charging System while the requirements of efficiency will promote the introduction of open tendering methods to procure private sector outputs in road maintenance.

The MWTC is also awaiting the promulgation of the new Road Transport and Traffic Act, 1999 that will deregulate transport operations. This will free up entry into the passenger and freight transport markets. In future the market will determine how many companies will operate in these fields. Government will only ensure that safety standards are maintained overall.

The Private Sector undertakes nearly all road-freight and passenger operations and competition is keen. Currently there is still a permit system in place that will be abolished once the Road Transport and Traffic Act is promulgated. Thereafter competition is expected to become even keener as the current entry barriers will fall away. In its place the MWTC will create an Operators and Drivers Association (OPDA) that will be self-regulatory. OPDA will be run by Operators and Drivers Organisations and will control the quality of drivers and their equipment.

E1.2.4 Infrastructure

   E1.2.4.1 Road Types and Quantities
The Road sub-sector has since Independence concentrated on developing the rural road networks in Northern Namibia and the development and completion of paved road connections to all our neighbouring countries. These development programs have to some extent rectified imbalances caused by pre-Independence policies.
The Namibian roads network can be divided into three groups of roads:
- the national network consisting of the entire rural trunk, main and district road network,
- urban streets, and
- rural access roads.

The last group includes proclaimed farm roads (that provide access to several farms), minor roads, privately owned roads as well as access roads in the communal areas. Of these only farm road maintenance is funded by the MWTC and only to a very small extent. These road types are grouped together as no funding will be forthcoming from the Road Fund mentioned above for their development, upgrading or maintenance. Figure E2 shows the extent of the national road network.

Figure E3 shows the development trend with regards to improvement of the road infrastructure from 1981 to date. (DOT, unpublished sources) Reliable data for 1986 was not immediately available. This does not however affect the trend.

Figure E3: National Road Network: Increase in Gravel and Paved Roads

Figure E3 shows a progressive increase in road quality. In 1981 22 882km or 54.9% of the network consisted of gravel or paved roads. In 1997 31 926km or 75.1% of...
the network consisted of gravel or paved roads.

The national road network has over time not increased significantly in extent. In 1981 the national network consisted of 41 701 km of proclaimed trunk, main and district roads. This figure in 1997 stood at 42 496 km. This slow increase can be ascribed to two main reasons. Firstly the national network was proclaimed long before it was developed to ensure that land is available for road construction. Secondly, due to Namibia’s small population, traffic volumes remain small and very few roads other than those already proclaimed, were required over time.

E1.2.4.2 Road Quality

It is internationally recognised that the Namibian paved and gravel road networks are of the best maintained in the world. International norms for measuring paved road quality in terms of surface smoothness exist and are used by the DOT to measure the condition of the 5 240 km long paved road network. Table E1 summarises the change in condition of the paved network over the last fourteen years (DOT, unpublished sources).

<table>
<thead>
<tr>
<th>YEAR</th>
<th>POOR</th>
<th>WARNING</th>
<th>FAIR</th>
<th>GOOD</th>
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<tr>
<td>1985</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td>87</td>
</tr>
<tr>
<td>1988</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>91</td>
</tr>
<tr>
<td>1991</td>
<td>1</td>
<td>3</td>
<td>9</td>
<td>87</td>
</tr>
<tr>
<td>1994</td>
<td>3</td>
<td>5</td>
<td>18</td>
<td>74</td>
</tr>
<tr>
<td>1997</td>
<td>5</td>
<td>6</td>
<td>17</td>
<td>72</td>
</tr>
</tbody>
</table>

The paved roads are, although old, still in a very good condition overall. Table E1 summarises the changes in smoothness over time. As the paved network ages, the % good roads have been deteriorating steadily. The maintenance efforts have over time covered most of the maintenance requirements in the “Poor” and “Warning” categories. The deterioration has therefore been slow.
Similar international quality standards for gravel or earth roads do not exist due to the wide range of factors that influence the ultimate quality of the road surface. Factors like the type and quality of gravel, construction and maintenance methods and rainfall all have an influence on the wearing characteristics of the road surface. The DOT undertook studies to determine perceptive standards for gravel road quality. The categories so developed are based on how the driver "feels" while travelling on the specific stretch of road. These perceptions are recorded and the gravel roads are then grouped into categories of "Good", "Average" and "Poor". The present % distribution is estimated at 50, 25 and 25% respectively (Tekie, pers comm, 1998.).

E1.2.5 Traffic Volumes

   E1.2.5.1 Freight Transport

   There is no information readily available on the amount of freight transported by road. All road freight operations with the exception of Transnamib Carriers, a business unit of Transnamib, are in the hands of the private sector. Information is therefore not published but rather kept as confidential company information. The scope of this Study did not allow for further work in this regard. Information on cross-border freight can be obtained from the files of the DOT (number of approved cross-border permits inclusive of the destination and the mass of the freight) and the files of the Customs Directorate of the Ministry of Finance. This data collection exercise will due to the lack of computerised information be quite large.

   The DOT in 1996 commissioned the National Transport Development Plan (NTDP) (Sogreah/Systra). This study lists estimates of about 1 024 million tons of goods that are transported by road annually. The study also qualifies this amount by stating that a large portion of the freight market is not regulated and no information is available. No attempt is made to determine the resultant ton-kilometres quantities transported.

   The study however mentions a gradual decrease in market share of rail freight transport in favour of road freight transport. For Transnamib alone the rail/road ratio changed from 82% to 74% from 1990/91 to 1996/96 (Sogreah, pp6-23). This is in
line with current world trends where the railway sector is continuously losing market share to road freight operations. A German study estimates that by the year 2010 the German rail network will transport only 5% of all goods while the road sub-sector will transport about 65% of all freight. The remainder will be divided between pipelines and inland waterways *(Metchies, 1995)*.

**E1.2.5.2 Passenger Transport**

Similarly is there no centralised database on passenger volumes using the road network. *Sogreah* also estimates that in terms of the long-distance passenger transport about 60 000 passengers are transported per month, roughly half by scheduled services and the other half by unscheduled minibuses and other taxis. Comprehensive information on urban passenger transport is not available.

**E1.2.5.3 Registered Vehicles**

Uncertainty exists over the actual number of registered vehicles in Namibia *(Brock, pers comm, African, Du Plessis)*. This uncertainty is the result of the following,

- There is no central registering authority or database in Namibia that collects and updates all vehicle information.
- Several Ministries presently perform the vehicle registration function on an agency basis for the DOT.
- There is no reconciliation done between vehicle licensing income and licenses issued.

The last detailed vehicle population data was collected in 1990/91 and 1992/93. Ever since all vehicle population figures were based on the data of this report and different growth rate assumptions.

The DOT has started with the implementation of the Namibian Traffic Information System (Natis) that will inter alia be a national database for all registered vehicles. The latest available estimates were compiled in support of the Road User Charging System *(KM International)*. These were correlated with the data already available.
from Natis. It was found that the Natis vehicle population totals were less than the estimates done to date. The authors did not elaborate further than stating that this discrepancy could be because of slow registration or because of too high a growth rate used to calculate the present vehicle population. Recent follow-up inquiries confirmed the lower figure based on the actual Windhoek figures (Brock, pers comm.). It is however still too early to form a clear picture of the number and types of vehicles. For the purpose of this report the low population estimate will be assumed as closest to actual. Table E2 below summarises the estimated vehicle population. These numbers are also in line with the findings of the Country Study on Climate Change that estimates the present vehicle population at 140 000 (Du Plessis). The correct data once Natis is fully implemented towards the end of 2000, should however be keenly awaited.

Table E2: Estimated Vehicle Population

<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Motor Cycle</td>
<td>P</td>
<td>5286</td>
<td>5868</td>
<td>5881</td>
<td>6122</td>
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<tr>
<td>Car</td>
<td>P</td>
<td>50143</td>
<td>55669</td>
<td>55774</td>
<td>58061</td>
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<tr>
<td>LDV</td>
<td>P</td>
<td>42687</td>
<td>47383</td>
<td>47482</td>
<td>49428</td>
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<tr>
<td>Mini Bus</td>
<td>P</td>
<td>3709</td>
<td>4117</td>
<td>4126</td>
<td>4295</td>
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<tr>
<td>LGV</td>
<td>D</td>
<td>3995</td>
<td>4434</td>
<td>4277</td>
<td>4452</td>
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<tr>
<td>Bus</td>
<td>D</td>
<td>555</td>
<td>616</td>
<td>783</td>
<td>815</td>
</tr>
<tr>
<td>2 Axle SUT</td>
<td>D</td>
<td>1737</td>
<td>1928</td>
<td>1932</td>
<td>2011</td>
</tr>
<tr>
<td>3 Axle SUT</td>
<td>D</td>
<td>457</td>
<td>507</td>
<td>508</td>
<td>529</td>
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<tr>
<td>4 Axle Comb</td>
<td>D</td>
<td>583</td>
<td>647</td>
<td>648</td>
<td>675</td>
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<tr>
<td>5 Axle Comb</td>
<td>D</td>
<td>350</td>
<td>388</td>
<td>388</td>
<td>404</td>
</tr>
<tr>
<td>6 Axle Comb</td>
<td>D</td>
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<td>193</td>
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<td>202</td>
</tr>
<tr>
<td>7 Axle Comb</td>
<td>D</td>
<td>174</td>
<td>193</td>
<td>194</td>
<td>202</td>
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<td>Caravan</td>
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<td>4096</td>
<td>4105</td>
<td>4273</td>
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<tr>
<td>Light Trailer</td>
<td>D</td>
<td>9266</td>
<td>10285</td>
<td>10306</td>
<td>10728</td>
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<tr>
<td>Other</td>
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<td>1792</td>
<td>1796</td>
<td>1870</td>
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<td>Total Petrol</td>
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<td>Total no Fuel</td>
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<td>12956</td>
<td>14381</td>
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<tr>
<td>Total</td>
<td></td>
<td>124420</td>
<td>138106</td>
<td>138392</td>
<td>144066</td>
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</tbody>
</table>

With an estimated population of 1.60 million people these estimates show that Namibia has on average 90 vehicles per 1000 inhabitants. This places Namibia
among the poorer nations.

E1.2.5.4 Traffic Volumes and Vehicle Kilometres Travelled

Road utilisation is measured as the traffic volume counted or expected per day (ADT) or the number of Vehicle Kilometres Travelled (VKT) on a road network.

VKT can only be determined with a reasonable amount of accuracy if the following data is available

- Traffic Volumes on each length of road (road link),
- Types of vehicles per road link,
- Annual fuel consumption, and
- Average speed and fuel consumption per vehicle type.

Few studies have in the recent past attempted to predict traffic volumes and traffic growth in Namibia. The DOT conducted a couple of traffic volume surveys over the last decade to determine traffic volumes per road link. However, due to the effort involved in counting traffic on each road link, these surveys are in many cases based on estimates only. The National Transportation Master Plan Study (NTMPS) is the most recent study that also estimated VKT (KM International). Table E3 below summarises the findings of the study.

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>ROAD CLASS</th>
<th>Km OF ROADS PER ADT CATEGORY</th>
<th>TOTAL km</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>1-20</td>
<td>21-200</td>
</tr>
<tr>
<td>Paved</td>
<td>Trunk</td>
<td>0</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>Main</td>
<td>0</td>
<td>1036</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>0</td>
<td>73</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td>0</td>
<td>1509</td>
</tr>
<tr>
<td>Gravel</td>
<td>Trunk</td>
<td>0</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Main</td>
<td>2076</td>
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<td></td>
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<td>Subtotal</td>
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<td>9649</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>25744</td>
<td>11158</td>
</tr>
<tr>
<td>% of Network</td>
<td></td>
<td>63,06</td>
<td>27,33</td>
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Table E3 shows that 63.06% of the network carry traffic volumes of less than 20
vehicles per day. These are all gravel roads. Table E3 also shows that 9.54% of the network carries more than 200 vehicles per day. These roads are almost all paved roads. In other words, a small portion of the road network carries a large portion of the total traffic. The surveys and studies undertaken recently all conclude that more than 75% of all trips undertaken use the paved network while it consists of only 15% of the road network.

At present the dominant portion of the DOT’s maintenance budget is spent on maintaining gravel roads. As the management of roads will become more commercial with the establishment of the RFA and RA, less funding will be allocated for gravel road maintenance and more to paved road maintenance. The net effect will only be seen in the medium to long term as riding quality on gravel roads will probably decrease on average. This will probably result in lower speeds thereby decreasing the severity of accidents when they occur.

The work done to determine growth in VKT is summarised in Figure E4 below. This shows a steady increase over time. But due to the many assumptions and calculations involved can at this stage only be seen as an aggregate representation of traffic volume increases.

**Figure E4:** Annual Vehicle Kilometres Travelled
E1.2.5.5 Traffic Congestion

The City of Windhoek is the only relatively large population concentration in Namibia that will over time be affected by traffic congestion. Although not a problem yet, the Windhoek Municipality commissioned a Transportation Study in 1995 for the greater Windhoek area. This study predicted traffic growth patterns for the period up to 2013 with 1993 as the base year (Stanway et al). The conclusion of the study was that Windhoek would not experience large congestion problems. It proposed certain improvements to the urban road network to alleviate traffic problems the city will experience due to future traffic growth.

From the study a growth model was developed to estimate traffic growth over time. Figure E5 below summarises this data.

Figure E5: Peak Hour Traffic Growth for Windhoek City

![Traffic Growth Chart]

The Windhoek City Council regularly undertakes traffic counts at intersections where localised congestion problems occur. These counts motivate road infrastructure changes to improve traffic flow and prevent congestion. To date the City of Windhoek has been able to solve congestion in this manner. (Van der Marwe, Windhoek Municipality, pers comm).
The Windhoek Municipal Traffic Police also inform road users during peak hour radio programs of current traffic flow problems. This service helps to smooth traffic flow.

The national network still has sufficient capacity, but congestion flows are noted between Okahandja and Windhoek as well as between Oshakati and Onadangwa during peak periods. This information is already included in the NTMP.

E1.3 RAILWAYS SUB-SECTOR

E1.3.1 Background

The railway network originally developed in the German colonial times to connect Windhoek and the mines in the Tsumeb area with Swakopmund. At the time Walvis Bay was British territory and Germany made use of Swakopmund as a harbour. The link to South Africa developed after the First World War when South Africa took over the management of Namibia as a mandate of the League of Nations.

The extent of the railway network remained stagnant for several years now. The last major capital works program took place in 1981/82 when the railway line between Swakopmund and Walvis Bay was re-routed behind the dunes to decrease delays due to sand storms. Since then the network improvements focused on carrying capacity increases only.

E1.3.2 The Role Of Government

Government is not involved in the day-to-day operations in this sub-sector. It transferred all operations to the now called Transnamib in 1987 when this Company was established. The MWTC presently acts as the shareholder of the Company to
ensure proper governance and also regulates all rail safety aspects. In this regard, Government has not been able to fulfil its proper role and especially governance issues were not properly managed. An example is the current problems experienced with Air Namibia, previously a subsidiary of Transnamib and now a separate Company under the Transnamib Holdings Company. Air Namibia has run up huge losses that threaten to bankrupt the railway operations as well. Government has been slow to react and when it did, the decisions were of a reactive nature.

E1.3.3 The Role of the Private Sector/ Parastatals

The Namibian rail mode is in its entirety managed and operated by Transnamib Limited, a parastatal that was established for that purpose in 1987. There is presently no other operator or owner of major sections of railway infrastructure in Namibia. Some mining companies for example, Rössing Uranium and Tsumeb Corporation have short sections of privately owned railway lines to link mining operations with the rail network.

This parastatal was restructured in 1998 from a multi-modal Company to a Holdings Company and several subsidiary Companies. This resulted in the formation of Transnamib Transport (Pty) Ltd out of the two business units Transnamib Rail and Transnamib Carriers. This restructuring has recently been taken further due to the poor performance of Air Namibia (Pty) Ltd. The Holdings Company will be abolished and each company will in future function on its own. This stage of the restructuring must still be effected.

The role of the Private Sector remains small in the rail sub-sector. It is only involved with support services where infrastructure maintenance work is done on contract. In the past the private sector also constructed numerous privately owned sidings in Namibia. The latest legislation to restructure Transnamib aims to open up this sector. The railway infrastructure will be transferred back to the MWTC who will pay for infrastructure maintenance and development costs. This legislation also allows for competition to operate train services. It is possible that other Companies will in future
enter this market in competition with Transnamib.

**E1.3.4 Infrastructure**

The Annual Reports of Transnamib provide sufficient details on the railway system. The rail network consists of 2,382 km of rail of different standard. The network is divided between the main network and three branch lines. The main network 1,769 km in length and connects Windhoek with South Africa, Walvis Bay and Tsumeb. The branch lines are 613 km in length and connect Windhoek with Gobabis, Otjiwarongo with Otjoo, and link the main line between South Africa and Windhoek with Lüderitz. Figure E6 shows the network in detail. These branch lines have always been making losses and Transnamib has in the past closed the Lüderitz line. Government however sees these lines as strategic and directed Transnamib to keep them operational. The infrastructure quality of these lines is poor and funding to upgrade these to the same standards as the main network is not available.

About 13% of the network consist of rails with a mass of 22 kg/m or less. 47% of the network consists of 30 kg/m rails while the remainder (40%) consists of rail masses equal or larger than 48 kg/m.

Of note is the fact that the maximum speed is set at 60 km/hour. This results in long travelling times compared to similar trips by road. In the case of Namibia where inter-town travel usually means a trip of several hundred kilometres, using road transport that may travel as fast as 120 km/h, the travel time differences are huge. Transnamib is busy with a program to upgrade its rolling stock to run at speeds up to 100 km/hr, but the positive effects of this program will clearly only be realised when sufficient numbers of rolling stock are rebuilt to increase the average speed of all trains.
Transnamib owns 51 locomotives with an average age of 28 years and about 1630 wagons and 145 coaches with average ages of respectively 24 and 27 years. With the decrease in railway operations over time (more on this in subsection E1.3.5 below), the Company sold off 37 locomotives over the last seven years decreasing the fleet from 88 in 1991. Of the 51 remaining 43 were reported operational in 1998 (Transnamib Annual Report, 1998).

The Company rebuilds and refurbishes locomotives, wagons and coaches in-house and has with this capacity rebuilt existing coaches for two upper-market trains and a revamped general passenger train service. The upper-market trains called the Shongololo Express and the Desert Express cater for tourists mostly. The Starline Service provides a seated overnight train service in two passenger classes, economy and business.

E1.3.5 Transport Volumes

   E1.3.5.1 Freight Transport

Transnamib includes this information in their Annual Reports. Figure E7 below shows the trend over time from 1990 to date.

Figure E7: Rail Freight Volumes
The amount of freight transported by rail is decreasing steadily over time. In terms of volume of freight the decrease has not been as marked as in terms of ton-kilometres, a unit of measure for the average distance that freight is transported. Both volume and distance are important as one represents the capacity and the other the payload.

In 1988 Transnamib transported 1 908 million ton-km and in 1998 only 983 million ton-km of freight. The average distance of conveyance over this period decreased from 913km to 578km. This represents a decline of about 5,2% per year or nearly 50% for the period.

In comparison the road sector has grown its market share significantly during the same period. As already mentioned in Section E1 2.5.1 above, this is a worldwide trend and Namibia should therefore be doubly cautious to develop new infrastructure in a sub-sector that is naturally losing market share.

E1.3.5.2 Passenger Transport

Transnamib also reports on the numbers of passengers making use of the rail passenger services. Figure E8 shows the trend over time.

There had been significant drops in passenger numbers from 1990 to 1994 whereafter numbers have increased slowly. The 1989/90 numbers could however be seen as exceptional as it included the transport of UNTAG personnel and voters.

The passenger profile of a rail passenger has changed over time. In the past a substantial number of passengers purchased first and second class long distance tickets thereby ‘subsidising’ third class passenger travel. As road passenger transport became more accessible and convenient, the higher paying passengers moved from rail to road. This left Transnamib to compete with mini-buses and scheduled road passenger services for a share of the low-income market.

Transnamib in June 1994 introduced the Starline Service to better serve the new demand. It consists of seats-only coaches divided into economy and business class
sections. The economy class replaced the previous second and third class options while the business class replaced the first class service. Transnamib also introduced a flexible ticket pricing system based off-peak, peak and high-peak periods.

Although the prices of off-peak economy class tickets (the cheapest available) decreased in real terms over time, Transnamib still does not attract a large share of the total passenger market (Smit, Transnamib, pers comm). The only route where significant numbers use the Starline Service, is between Windhoek and Keetmanshoop. These passengers are mostly from low-income groups and base their decisions on price only. Passengers between Windhoek and the north include convenience and trip time with price in their decisions. Transnamib has basically no share on this route as most of these passengers use buses and mini-buses (Smit, pers comm).

Figure E8: Passengers Transported by Rail

![Rail Passengers Graph](image)

These annual figures also compare poorly with that of the road sub-sector where an estimated 60,000 passengers are transported per month (Sogreah).
E1.4 MARITIME SUB-SECTOR

E1.4.1 Background

The Maritime sub-sector has always been small. Port activities developed at Walvis Bay and Lüderitz to support mainly the fishing industry. In the years before the First World War Germany also developed and operated port facilities at Swakopmund, mainly because Walvis Bay belonged to Britain.

The shipping industry has always been small. Namibia with its small population does not have the natural freight potential for big port operations. While under South African control, the option to develop other markets to the detriment of port operations at South African ports, was never feasible. To achieve this efficiently investments were required in the ports as well as in a system of well developed road/rail connections to the land-locked neighbouring countries to tap into their freight potential.

Since Independence the management of this sub-sector changed significantly. The DOT created a Directorate Maritime Affairs (DMA) to take over the regulation and management of the maritime sub-sector from Pretoria. The port provision, maintenance and operations at both Walvis Bay and Lüderitz were transferred to a new parastatal, Transnamib. The road network also expanded with new paved connections to Botswana and South Africa (Trans-Kalahari Highway) and to Zambia and Zimbabwe (Trans-Caprivi Highway) thereby offering the potential for freight expansion.

E1.4.2 The Role of Government

The DMA regulates this mode. It is responsible for the registration of ships and certification of crews in terms of the Merchant Shipping Act (1951). Namibia still has some way to go to establish an efficient administration as South Africa controlled this sub-sector before Independence.
Presently all maritime legislation is under review while the MWTC has also embarked on a feasibility study to establish a more efficient establishment to perform its administrative functions in this regard.

Namibia is also not yet a party to any of the International Conventions dedicated to ensuring the safety of ships, life or property at sea or the protection of the marine environment. The DMA is presently in the process of drafting legislation for accession to the most important international conventions. Once these Acts are promulgated, Namibia will have definite obligations as regards to safety and pollution at sea. Appendix B lists the most relevant international conventions that Namibia will accede to in due course.

There is no economic regulation of this sub-sector. Shipping operations have always been handled by the Private Sector and developed over time in line with market forces.

Although Namibia has only two ports at Walvis Bay and Lüderitz, Government is eager to exploit the economic opportunities of the 200-mile Exclusive Economic Zone. A study carried out for the MWTC on future port facilities, identified the need for a harbour to enable the fishing industry to effectively and efficiently exploit the northern fishing grounds (First National Development Plan, Volume II, page 152). At present studies are ongoing to investigate the feasibility of a fishing harbour at Möwe Bay.

E1.4.3 The Role of the Private Sector/ Parastatals

Namibia has two commercially developed harbours at Walvis Bay and Lüderitz. Both these ports are managed and operated by the Namibian Ports Authority (Namport). Portnet, a subsidiary of Transnet (South Africa) managed and operated the port at Walvis Bay until 1994 when the Walvis Bay enclave was transferred to Namibia. At that time Namibia established the Namibian Ports Authority (Namport) to manage and
exercise control over port and navigational aids operations. Namport took over the facilities and operations at Walvis Bay on 1 March 1994. Transnamib managed and operated the port of Lüderitz from 1987 when this parastatal was established. This function was transferred from Transnamib to Namport on 1 April 1995.

Both ports have excess capacity. Namport and the major stakeholders have set up the Walvis Bay Corridor Group that aims to promote the use of Walvis Bay for imports and exports for the SADC region and Namibia and as a hub port on the West Coast of Africa. The combined use of Walvis Bay and the newly completed Trans-Caprivi and Trans-Kalahari Highways will cut travelling time for freight transport to neighbouring countries. The author is of the opinion that the current problems experienced with delays on Botswana leg of the Trans-Kalahari Highway are temporary and will be resolved in the short term.

All shipping liner services as well as fishing operations are provided by the private sector.

E1.4.4 Transport Infrastructure

The port of Walvis Bay is divided between the fishing harbour and the other shipping activities. The port is a multipurpose deep-water harbour with two bulk terminals, a new container terminal and an upgraded tanker jetty. It has 8 berths with a total jetty length of 1 430m in depth of 10,0m below chart datum (-10,0m). A feasibility study is presently ongoing to investigate an increase of this depth to -12,8m. This study includes an environmental impact assessment to assess the effects on the Lagoon, an internationally recognised Ramsar site.

The fishing harbour serve all the fish factories with a several berths spread out over a distance of about 2 500m. This is the area where most of the pollution experienced in the port of Walvis Bay occurs. In the past the effluent from the fishing factories was dumped directly into the harbour. This included fish oil and non-degradable products like fish scale. The solids settled on the sea floor and in some areas have
reached depths of up to one metre (Van Heerden, Namport, pers comm).

A thriving ship repair business is established at Walvis Bay. Namport operates
drydocking facilities in the form of a 2 000 ton synchrolift while various companies
provide repair services.

Walvis Bay also has a facility for accepting shipping waste on request. Current
legislation does not require this service but as soon as Namibia has acceded to the
international conventions listed in Appendix A, this service will become standard.

The port of Lüderitz is being expanded at present. A new 500m long quay with a
depth of -8,15m is under construction while the approach channel has been dredged
to -8,15m. Provision was also made for the increased container traffic handled by
the port. These developments will increase the capacity of the port significantly as it
could only handle ships with a length of 105 m maximum and a draught of 6,00 m to
date. Shipping repairs focus on the fishing industry with two slipways of 400 and
150 tons capacity respectively.

From the available data and other information in the annual reports of Namport, there
exists a definite over-supply of infrastructure at both ports. Namport as a member of
the Walvis Bay Corridor Group is actively marketing this spare capacity and its result
will be seen over time.

E1.4.5 Transport Volumes

E1.4.5.1 Freight Volumes
The port of Walvis Bay handles about 95% of all freight and passengers. Lüderitz due
to the infrastructure capacity and small freight demand handles the remaining 5%.
The transport volumes in the maritime sub-sector are expressed in terms of cargo
handled or number of ship/vessel visits per port. Namport supplies this information in
its Annual Reports (Namport, Annual Report). Figure E9 summarises the freight
volumes and groups all freight into three types namely dry freight, liquid freight and
containerised freight. This breakdown shows the relative importance of liquid freight consisting mostly of imported diesel and petrol fuels. Although hazardous, these fuels are light and evaporate quickly. From an environmental point of view, they are therefore not considered as too problematic. The DMA is responsible for a data bank of all spills but the systems are only now put in place. Namport collects data of spills in the port areas. This data shows only minor spills (Van Heerden, pers comm).

Figure E9: Cargo Handled at Walvis Bay and Lüderitz

![Cargo Handled by Type](image)

Figure E10 summarises the number of ships/vessels that visited both ports. Because of the infrastructure capacity of Lüderitz, relatively large numbers of small vessels use Lüderitz while the bigger vessels use Walvis Bay. Walvis Bay will therefore be the more likely port to be affected by the spills associated with shipping accidents.

There is no information on the number of ships and their tonnage that pass through Namibian waters without calling at either Walvis Bay or Lüderitz. The DMA does not monitor this shipping activity. Although Namibia has also not acceded to all the international conventions that regulate shipping in general, this shipping activity also raises concern for the environment, especially at times of accidents or disasters. The Prevention and Combating of Pollution by Oil Act, No. 6 of 1981, gives the MWTC the responsibility for and wide ranging powers regarding prevention and combating of oil pollution.
In 1993, due to the advent of petroleum exploration in Namibia, the National Petroleum Corporation of Namibia initiated and managed the drafting of Namibia's first National Oil Spill Contingency Plan. This Plan is now being revised to conform to International Maritime Organisation (IMO) guidelines for such plans and response organisations. In the revised plan, a National Oil Spill Response Organisation is established that will fall under the larger umbrella of the Emergency Management Unit that answers directly to the Secretary of the Cabinet and through him to Cabinet.

E1.4.5.2 Shipping Registrations

Namibia is a flag state and has till the end of 1998 registered 241 vessels at both Walvis Bay and Lüderitz, with a gross registered tonnage of about 80 600 tons. About 1/3 of all registered vessels are below 100t, and only about 6% are above 1 000t. More than 90% of all registered ships are fishing vessels. Figure E11 below gives a summary of the growth of the Namibian shipping fleet.

The initial steep rise in registrations was attributed to the re-registration of ships after Independence and after the reintegration of Walvis Bay. The flattening of the registration curve is attributed to a decline in fish stocks in recent years, and fishing vessels now generally being under-utilised. Consequently, even with a recovery of fish stocks, only a slow increase in the fishing fleet is expected.
Namibia is planning to accede to the International Convention for the Prevention of Pollution from Ships, commonly known as Marpol 73/78. Marpol 73/78 places restrictions on flag states. Ships must conform to strict design guidelines before being registered to carry environmentally harmful substances. Once a Party to this Convention, Namibia may refuse entry to her ports by non-Marpol vessels. As Namibia has not acceded to this Convention, the Namibian Shipping Register does not have information whether a ship is complying with Marpol 73/78 specifications or not.

E1.5 AVIATION SUB-SECTOR

E1.5.1 Background

The Civil Aviation Directorate (DCA) of the DOT regulates this sub-sector according to the Standards and Recommended Practices of the International Civil Aviation Organisation. All civil aviation licences whether for pilots, maintenance personnel, aircraft or airports and aerodromes, are issued by the DCA.
There are more than 400 runways in Namibia ranging from runways that can accept the largest aircraft in the world to a large number of air strips serving private farms and tourist camps. Until recently most of the government-owned airport and aerodrome infrastructure was operated and maintained by the DOT. In February 1999 the eight largest airports and aerodromes in Namibia were transferred to the newly established Namibian Airports Company.

The private sector undertakes the bulk of operations while traffic volumes are increasing steadily mainly in support of expanding tourism requirements.

### E1.5.2 The Role of Government

In 1990 the Civil Aviation Directorate (DCA) of the DOT took over the regulatory, managerial and operational functions from the South African Government. Namibia shortly thereafter became a Contracting State to the Convention on International Civil Aviation. As a member of the International Civil Aviation Organisation (ICAO), Namibia applies the principles of the Standards and Recommended Practices of ICAO to regulate and manage this sub-sector.

The DCA is also responsible for airport and aerodrome operations and air navigation services. In February 1999 the eight largest airports and aerodromes in Namibia were transferred to the newly established Namibian Airports Company (NAC). This Government-owned Company will in future be responsible for the development, maintenance and operations of the following airports and aerodromes; Hosea Kutako International, Eros, Keetmanshoop, Lüderitz, Walvis Bay, Ondangwa, Rundu and Katima Mulilo.

The MWTC is also investigating the establishment of a Civil Aviation Authority. This Agency will in all probability take over the control of air navigation services as well as most of the regulatory functions presently managed by the DCA. The MWTC will then focus on policy development and aviation safety aspects only.
The DOT has also undertaken as part of the National Transportation Master Plan Study (NTMPS) a study to determine aerodrome standards. Flowing from the NTMPS study, the DOT proposed and Cabinet approved a National Aerodrome Network (NAN) consisting of 41 airports and aerodromes to ensure minimum civil aviation access to as large a part of Namibia as possible. Figure E12 maps these airports and aerodromes. This network will serve as the primary network.

E1.5.3 The role of the Private Sector/Parastatals

The Private Sector undertakes all freight and passenger transport. Government has a small fleet of aircraft but other than VIP transport, transports insignificant numbers of passengers on charter flights.

Passenger transport is grouped into scheduled and unscheduled/charter flights. Charter flights are keenly contested by the private sector. Scheduled flights are still more regulated as the Namibian Transport Commission has approved only a small number of licences. This sector will also be affected by the promulgation of the Road Traffic and Transport Act, 1999 when entry barriers on scheduled flights will be abolished.

Air Namibia, presently a subsidiary of Transnamib, is one of the carriers that serve Namibia. It competes with major airlines like South African Airways, British Air, and Lufthansa on regional and international routes. These flights all use Hosea Kutako International Airport.

A new airline, Kalahari Express Airlines, was set to start operations with passenger jet aircraft in March 1999, flying scheduled services out of Eros. At the time of the report another Company also showed its intent to compete with Kalahari Express (Lourens, DOT, pers comm). It will increase the competition for regional passengers but noise levels around Eros Airport will rise due to the resultant increase in jet aircraft traffic.

The private sector also owns runways and aerodromes and in especially the tourist
sector, maintains theses to support fly-in safaris. Of the 41 aerodromes included in
the NAN, 13 are privately owned. Combined with the eight of the NAC, 21 of the 41
are not directly owned by Government.

E1.5.4 Transport Infrastructure

There are a large number of runways of different sizes in Namibia. The NTMPS Study
identified well over 400. A substantial number are not used any more, for example,
some of the longest runways were constructed during the war years before
Independence with the particular purpose to support the South African war efforts.
On the other hand, due to the vastness of Namibia and her sparse population, many
runways were developed for localised access. The result is a very extensive network
of runways and aerodromes that are in general hardly utilised.

The regulation and maintenance of such an extensive network is clearly not feasible
given the low traffic volumes. The MWTC in 1997 initiated a study to refocus
regulatory and maintenance efforts to the more important aerodromes. The NTMPS
Study on the basis of the Central Place Study as applied by the Delimitation
Commission in drawing up electoral boundaries, developed four different classes of
aerodromes. All aerodromes falling in the three classes defined below were included

**Class A**: Aerodromes capable of handling large jet aircraft and a high volume of
traffic, and facilities to handle international flights and passengers;

**Class B**: Infrastructure capable of handling smaller (commuter type) aircraft and
volumes, not necessarily a point of entry;

**Class C**: Minimum facility for access by air, implying a non-licensed facility with
rudimentary infrastructure to handle only small aircraft on an occasional basis;
Airports and Aerodromes

Legend

- Class A Airfields
- Class B Airfields
- Class C Airfields
The NAN consists of 41 airports and aerodromes owned by different Ministries and the private sector. All Class A and B airports and aerodromes were transferred to the NAC except for the ones at Tsumeb (privately owned) and Otjiwarongo (owned by municipality). The Government, municipalities and the private sector own the 31 Class C aerodromes. Appendix A lists these aerodromes while Figure E12 shows these on a map.

**E1.5.5 Transport Volumes**

**E1.5.5.1 Passengers**

The DCA does not have historical data on passenger movements throughout Namibia, but has concentrated on collecting data for the larger airports. The longest data series exist for Hosea Kutako International and Eros Airports. For the purposes of this study, this information will be sufficient as the one (Hosea Kutako) generally represents the international traffic while the other (Eros) represents domestic traffic. Hosea Kutako is managed as the main point of international entry while Eros as the domestic hub services the bulk of the domestic traffic. Almost all scheduled and unscheduled domestic traffic use Eros as base. The passenger data for these airports show an almost equal number of arriving and departing passengers. It could therefore be concluded with a reasonable amount of accuracy that these two airports handle almost all traffic. Figure E13 below gives a breakdown of the passenger movements over time.

At both these airports there has been a steady increase in passenger traffic over time. This increase provided support for the decision to commercialise the operations of these two airports and six others. The NAC will in future be responsible for the management of these airports. This will surely increase the accuracy of the available statistics as the information of the DCA varies depending on which official you request the information from. The NAC will depend on accurate passenger numbers as it will through passenger charges generate revenue to fund the operation and maintenance of its airports.
E1.5.5.2 Aircraft Movements

The DCA also has inconsistent data for the airports for which data was collected. The longest data series available are for Hosea Kutako and Eros Airports. Figure E14 below summarises this data on an annual basis.

At both these airports there has been a steady increase in aircraft movements. Hosea Kutako caters mainly for the regional and international traffic and will therefore show
a small number of movements relative to its passenger movements. Eros being the domestic hub caters for the smaller propeller-driven aircraft used on domestic scheduled routes and by the charter companies. A large number of training flights (nearly 15 000 in 1997) are also undertaken from Eros.

The figure for 1995 does not include training flights for that year while the 1996 and 1997 figures show decreases due to smaller numbers of training flights undertaken during those years.

The NAC will in future have more accurate data and also for a larger number of airports than the DCA now have as the NAC will obtain revenue from every movement on all eight of its airports and aerodromes.

**E1.5.5.3 Registered Aircraft**

At present there are 365 aircraft registered in Namibia. This number includes four aircraft with a certified maximum take-off weight of larger than 9 000 kg and 13 helicopters. The remainder are propeller-driven with the majority (191) being single engine aircraft. **Figure E15** summarises the change in the number of Namibian registered aircraft over time. Information for years prior to 1994 is not readily available (Mabonga, DCA, pers comm).

**Figure E15: Number of Registered Aircraft**

![Graph showing number of registered aircraft from 1980 to 1998](image)
Annex 16 Volumes I and II, of the ICAO International Standards and Recommended Practices provide guidelines on aircraft noise and engine emissions to aircraft manufacturers and contracting states. The Annex makes provision for the certification of most types of aircraft based on their noise and emission characteristics. Namibia will in the amended Regulations of the Aviation Act state clearly methods how these guidelines will be applied here.

The current register does not make provision for the international classification standards and the information on the numbers of Namibian registered planes in each class is not available.

The passenger jets to be operated by Kalahari Express Airlines from Eros, are older aircraft known for their high noise levels. Should these operations commence from Eros, complaints about increased noise will surely be forthcoming (Lourens, DOT, pers comm).
E2 ACTIVITY IN THE TRANSPORT SECTOR

E10.1 ROAD SUB-SECTOR

E2.1.1 Resource Inputs And Sourcing

E2.1.1.1 Infrastructure

The road sub-sector utilises a combination of locally available materials, i.e. water, soil, gravel and crushed stone, and imported materials like bitumen and cement, for road construction. Paints for road markings and all materials for road signs are also imported. No information is available on the actual quantities of materials used but rough estimates can be made for the major groups of material used based on the annual development and maintenance plans of the DOT. For bitumen consumption the MME data includes the total bitumen consumption in Namibia.

The DOT constructed an average of 19,4 km of gravel road and 111,6 km of paved road per year during the period 1993/94 to 1997/98. During the same period the DOT regraded an average of 566 km of gravel roads and rehabilitated an average of 23 km of paved roads annually (KM International, Volume 2). Using average cross-sections the volumes of materials used were calculated as listed in Table E4.

Table E4: Average Annual Volumes of Road Building Materials Used
(1993/94-1997/98)

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitumen</td>
<td>6 078 000 l</td>
</tr>
<tr>
<td>Gravel and back fill</td>
<td>1 900 000 m³</td>
</tr>
<tr>
<td>Water</td>
<td>130 000 m³</td>
</tr>
</tbody>
</table>

Bitumen and water consumption is insignificant when compared with the annual on-road fuel consumption and Namibian water consumption figures respectively. Of environmental importance is the volume of gravel and back fill material consumed annually. This comes from borrow-pits in close proximity to the area of road works.
In the past these borrow-pits were developed without taking due care of their environmental effects. The DOT does not have an Environmental Management Plan in place to completely prevent poor site management practices but efforts are made on especially new developments to ensure proper borrow-pit development.

E2.1.1.2 Operation of Transport Services

E10.1.1.1.1 Diesel and Petrol Consumption

The Ministry of Mines and Energy (MME) maintains a database on Namibian petroleum consumption of which fuel consumption on roads forms a substantial part. Figure E16 below summarises the growth in fuel consumption on the Namibian road network. Some doubt exists over the accuracy of these figures as different personal computer databases exist within the MME. The raw data is supplied to the MME by the oil industry who then reworks and collates the data. The discrepancy among the databases is not large, and will certainly not affect the accuracy of this study (Du Plessis). Also, the total Namibian energy consumption is addressed as a separate Chapter of this report.

Figure E16: Annual Road Transport Fuel Consumption
Figure E16 shows the steady increase in fuel consumption on the road networks in Namibia. The decrease in on-road diesel consumption can be ascribed to the decrease in economic activity in Namibia. It must be noted that Diesel is consumed off-road (mining, fishing, railways, farming and power generation) as well as on-road. The actual split is difficult to determine, but fairly accurate estimates are possible from the fuel refunds database that the Ministry of Finance (MOF) maintains. This database manages the refunding of portions of the existing fuel levies and excise duties on diesel to specific industrial sectors as a subsidy to those sectors.

The Motor Industries Federation requested the MME to introduce unleaded petrol in Namibia, mainly due to the international changes in car designs that require compatibility with unleaded petrol. This introduction took place in 1997 and the latest market penetration figures show that unleaded petrol now constitutes about 13% of all petrol sold in Namibia (Von Jeney).

The public relations campaign that ran with the introduction of unleaded petrol did not concentrate much on the environmental benefits of unleaded petrol. Lead in fuel is one of the main contributors to high concentrations of ambient lead in congested areas (Faiz, et al). A high concentration of ambient lead causes lead poisoning. Although no studies have to date been made to measure the lead content of Namibian blood (Dodds, pers comm), the introduction of unleaded petrol will provide an opportunity for decreasing lead emissions into the atmosphere.

E10.1.1.1.2 Tyres

All tyres and rubber products used in Namibia are imported, mainly from South Africa. Disposal of tyres is a problem world-wide and this Study attempted to obtain a picture of the size of the Namibian problem.

Namibia also imports second-hand tyres that are consumed in the bottom end of the market, mainly the taxi industry. There is reason to believe that most of these tyres have originally not been manufactured for local conditions and that these add to safety risks on the roads (Wiese, Bandag, Pers Comm). Wiese also raised a concern that discarded tyres are exported to Namibia as second hand tyres mainly to escape
the high disposal cost in first world countries.

There are several Companies selling tyres into the market and aggregated information on the number of tyres imported into Namibia is not available. The Central Statistics Office of the National Planning Commission (CSO) keeps a database on the value of tyre product imports (Ampweya, H). For the period 1993 to 1997, it was found that new tyres constituted about 88% of all tyre product imports while retreaded and used tyre imports made up only 2.7% of the imports. The remainder is made up of new tubes and other products associated with the retreading and repair of tyres. Of the new tyres 91.3% (96.3%) was purchased by road users for use on cars, lorries, buses and motor cycles. Private sector data supports the facts that between 150 000 and 200 000 tyres are imported annually (Taylor, unpublished data, 1998).

These tyres are mostly dumped at dumpsites. The only dumpsite where an attempt is made to count tyres as they are dumped, is the Windhoek Kupferberg municipal dumpsite. Figures available for 1997 and 1998 show that about 12 500 tyres are dumped per year (Beukes, unpublished data). This is much lower than the estimated imports. An additional 106 000 tyres discarded during previous years were stacked at the dumpsite. The Municipality cut up these casings and dumped them as part of the general waste dump.

There is clearly insufficient data available to form a picture of the environmental problem created by tyres as a waste product, and further study on this issue is clearly warranted.

E2.1.2 Transport Processes

The transport processes affecting the environment include the development and maintenance of the road infrastructure, the increase in safety risks and the production of waste products by vehicles.
The first group of processes produces outputs that can in most cases be determined through Environmental Impact Assessment Studies. Remedies can also be developed that are incorporated in the actual construction and maintenance works.

The second group of processes is dependent on the quality of driver’s education. If drivers are poorly informed about the negative effects of vehicle use, the risk of accidents, injuries and fatalities increases. Road standards also play a role in this group of processes.

The third group of processes namely the production of waste products is dependent on the number of vehicles and the level of their utilisation. The more vehicles on the road, the higher the volume of noxious gases emitted, the higher the noise levels and the higher the chances are for congestion.

E2.1.3 Transport Outputs

E2.1.3.1 Infrastructure Development and Maintenance
There are numerous examples of road development and maintenance practices that can negatively affect the environment. In Namibia the siting of borrow-pits in environmentally sensitive areas as well as poor rehabilitation work on project completion have been problematic for some time. Lately the DOT has included environmental assessments as part of the planning process for new roads but an overall Environmental Management Plan is not in place yet.

These negative outputs can largely be negated through proper implementation practices and ensuring that site staff is made aware of the negative effects their actions may have on the environment.

E2.1.3.2 Safety
Data availability on accidents and road fatalities and injuries are collected by the Namibian Road Safety Council and its secretariat (NRSC). These statistics are very
inconsistent and the personnel of the NRSC are in a process to upgrade the collection systems. For example, in 1997 the statistics on deaths in State-owned hospitals due to injuries sustained in road accidents were collected for the first time (Tendekule, pers comm). Figure E17 below summarises the available information.

The available information cannot be used for any meaningful analysis. There is no disaggregation of data and information such as the number of drivers involved in accidents that are under the influence of alcohol is non-existent. In this regard the excuse is that blood sample results are only available long after the accident reports have been completed. Also, no information is available on types of road user (driver, passenger, cyclist or pedestrian) that were involved in accidents and the severity of their injuries.

This output clearly affects the environment that we live in and it is recommended that the NRSC be supported to develop proper and sustainable data collection systems that include all stakeholders.

Figure E17: Vehicle Accident Statistics
E2.1.3.3 Emissions

On a world-wide scale, passenger cars alone emit about 60% of all CO₂, 60% of all hydrocarbon and more than a third of all nitrogen released into the atmosphere (Tsunokawa, Hoban). Add to this sulphur dioxide and lead, emissions from the combustion of motor fuels clearly present an environmental problem.

In Namibia with its small vehicle population, these emissions have to date not been taken seriously as local air pollution due to the use of vehicles have not yet reached measurable levels. No data is available on air quality in Windhoek (Aribibe, Van der Merwe, Windhoek Municipality, per comm) while no studies have been conducted on the effects of ambient lead emitted from vehicles (Dodds, pers comm).

The quantity of green house gases emitted by traffic can only be calculated with a set of reliable emission factors. There are several countries that developed emission factors and standards based on their particular road and vehicle fleet conditions. These factors can however not be used to determine emission quantities elsewhere as they vary significantly with changes in engine and emission control technology, vehicle size and mass, driving cycle characteristics and the state of maintenance of vehicles (Faiz, Weaver, Walsh).

The NCSCC in its report, Sources and Sinks of Greenhouse Gases in Namibia, estimated these for 1994. These estimates as listed in Table E5 below are in line with the world trends that road transportation is emitting the bulk of national greenhouse gas emissions. In the world context, these emissions are however negligible (Du Plessis).

<table>
<thead>
<tr>
<th>Sector</th>
<th>Greenhouse Gas Inventory By Type (ton × 1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CO₂</td>
</tr>
<tr>
<td>Roads</td>
<td>757</td>
</tr>
<tr>
<td>Railways</td>
<td>44</td>
</tr>
<tr>
<td>Aviation</td>
<td>99</td>
</tr>
<tr>
<td>Subtotal</td>
<td>899</td>
</tr>
<tr>
<td>Other</td>
<td>922</td>
</tr>
<tr>
<td>Sectors</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1 821</td>
</tr>
</tbody>
</table>
E2.1.3.4 Lead Emissions

Over time there has been a tendency to develop vehicle engines with higher compression ratios. Higher compression ratios result in more power and decreased fuel consumption (Faiz, Weaver, Walsh). Fuel for spark-ignition engines has a characteristic to "knock" or detonate. Increased knocking reduces power output and vice versa. The octane number of a fuel is a measure to describe its resistance to "knocking." The higher the octane number the higher the fuel's resistance. Lead has been the traditional additive to enhance octane numbers. A typical lead content of 0.4 g/l boosts the octane level by about 6 units (Faiz et al).

In the past fifteen years the negative effects of ambient lead became known and reductions of lead content and the introduction of unleaded fuel were introduced to overcome these negative effects. Ambient lead significantly impairs learning capacity in children and increases levels of irritation and even heart attacks in adults.

The MME introduced unleaded petrol in Namibia in 1997, mainly on request of the motor industry to supply a fuel compatible with the latest engine specifications. There are many models that run on unleaded fuel only and where the use of leaded fuel will cause under-performance and ultimately, engine damage. Figure E18 gives the total amount of lead that petrol-driven vehicles emit into the Namibian atmosphere annually.

Figure E18: Ambient Lead Emissions from Motor Vehicles
Figure E18 clearly shows that lead emissions increased steadily from just over 72t in 1987 to over 107,8t in 1996. With the introduction of unleaded petrol in 1997, lead emissions decreased to 101,7t, a decrease of 5,7%.

However, against the world total of about 60 000t in 1993, the Namibian total is insignificant.

E2.1.3.5 Dust
Dust is a problem especially on the gravel network where the roads pass urban centre or population concentrations. No work in this regard has been done in Namibia, but the most feasible option to alleviate this problem is to pave those sections where dust is really causing problems.

E2.2 RAILWAY SUB-SECTOR

E2.2.1 Resource Inputs And Sourcing

E2.2.1.1 Infrastructure Development and Maintenance
The rail infrastructure has undergone minimal change due to local upgrading in carrying capacity. These works focused on replacement of sleepers and rails, all of which are imported.

There is an active market for second hand wooden and steel sleepers respectively. Wooden sleepers are used for furniture while the steel sleepers are used as fence poles. Reinforced concrete sleepers are due to their mass not marketable and Transnamib utilises most of these as additional flood protection at bridges and culverts.
E2.2.1.2 Operation of Transport Services

E10.1.1.1.3 Fuel Consumption

Transnamib does not report annually on its diesel fuel consumption per mode while the data supplied by MME also does not specifically report on rail fuel consumption. Unpublished data within Transnamib supplied figures for the period 1996 to 1998 (Hengari, Slabbert). Table E6 below summarises this data.

Table E6: Annual Diesel Consumption of rail mode in litre

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<tbody>
<tr>
<td></td>
<td>15 114 300</td>
<td>14 644 010</td>
<td>13 700 710</td>
</tr>
</tbody>
</table>

E2.2.2 Transport Processes

The transport processes affecting the environment include the development and maintenance of infrastructure, the increase in safety risks and the production of waste products by train operations.

The first group of processes produces outputs that can in most cases be determined through Environmental Impact Assessment Studies. Remedies can also be developed that are incorporated in the actual construction and maintenance works.

The second group of processes is dependent on the quality of the operational staff and to a large extent in Namibia, the age and quality of permanent way material, i.e. the sleepers and rails themselves.

The third group of processes namely the production of waste products is dependent on the number of train-km travelled. The higher the train-km, the higher the volume of greenhouse gases emitted and the higher the noise levels in urban areas.
E2.2.3 Transport Outputs

E2.2.3.1 Infrastructure Development and Maintenance

This transport process is very small and its impact is insignificant when measured against the effects caused by the other two processes mentioned below.

E2.2.3.2 Safety

The types of data supplied by Transnamib in the Annual Reports vary over time. There is a lack of consistency on the type of accidents and their severity, the number of injuries and fatalities and a breakdown of these between employees, passengers and the public. Figure E19 below summarises the available details.

Figure E19: Railway Accidents and Fatalities

Transnamib also changed its way of reporting accidents and injuries to employees and members of the public as from March 31, 1997. On that date the Health and Safety Regulations framed in terms of the Labour Act of 1992 became effective. From that date accidents and injuries are measured in terms of the Disabling Injuries Frequency Index (DIFR). This is a measure of man-hours lost due to injuries per million man-hours worked. For the Transnamib Rail this index changed from 15.2 to 18.3 during the 1997-reporting year.

The formation of Transnamib Transport (Pty) Ltd. as one Company overseeing both the rail and road transport activities of Transnamib, may in future impact on the
relevance of the DIFR. It will in future be calculated for each Company and not for each mode. Transnamib Transport also operates the road transportation arm of Transnamib.

E2.2.3.3 Greenhouse Gas Emissions
Compared to the road sector the emissions from rail operations are negligible. These emissions will also decrease if the present trend of less goods being transported by rail, continues.

E2.3 MARITIME SUB-SECTOR

E2.3.1 Resource Inputs And Sourcing

E2.3.1.1 Infrastructure
The two ports have since they were transferred to Namport, been included in a process of upgrading and development. The resources used here are mostly local building materials. The quantities used are insignificant compared to the consumption of the building industry at large.

E2.3.1.2 Operation of Transport Services
Similarly, the port operations consume minimal amounts of resources. The shipping industry is on the other hand a consumer of bunker and diesel oil. This consumption takes place on sea and over a very large area.

What warrants mention here is the effect of accidents and spills. Namibia will when it accedes to the Marpol 73/78 Convention have certain obligations as to its readiness to react in time when a spill occurs. As already mentioned Namibia has a NOSCP (see
E1.4.5.1 above) and Namport is already in possession of containment equipment to assist with spills in harbours.

Oil spills from accidents along the Namibian coastline will not seriously affect the coastal environment. The Benguela Current is flowing in an offshore direction along the Namibian coast and such spills will be carried away from the coastline. (*Miller, pers comm*).

E2.3.2 Transport Processes and Outputs

The Maritime sub-sector is really small and the processes and outputs are not sufficient in size to report meaningfully.

Namport already includes environmental impact assessments as part of all their developments. In the case of the new quay at Lüderitz, a second EIA was undertaken to ensure donor satisfaction.

The major concern in this sub-sector is the effect that effluent from the fishing factories has on the environment in the port of Walvis Bay. The port of Walvis Bay is one of the most polluted along the West African coast (*Aidijervi, pers comm*). Fish scale and fish oil is killing off what is left of marine life (*Van Heerden, pers comm*). From these interviews the solution was not seen as regulatory but rather proper enforcement of current policies.

Also, once Namibia has acceded to all the current International Conventions, the port operations will come under international scrutiny. This will improve current practices.
E2.4 AVIATION SUB-SECTOR

E2.4.1 Resource Inputs And Sourcing

E2.4.1.1 Infrastructure
In the last number of years very little has changed as regards to the aviation infrastructure. The only significant project was the lengthening of the main runway at Eros Airport to accommodate larger aircraft. The quantities of materials used were very small.

E2.4.1.2 Operation of Transport Services
The aviation industry currently consumes between 60 000 and 70 000l of aviation fuel per annum. These amounts are insignificant when compared with the road sub-sector where more than 420 million litres is consumed per annum.

E2.4.2 Transport Processes

ICAO has published strict specifications for aircraft noise and emission control (ICAO, Annex 16, Volumes I and II). These specifications force aircraft manufacturers to produce aircraft that comply as contracting states may forbid uncertificated aircraft from landing at airports and aerodromes that experience noise or other environmental problems. Namibia is currently preparing Regulations to empower the Director Civil Aviation to enforce these ICAO guidelines where they apply.

E2.4.3 Transport Outputs

E2.4.3.1 Aviation Safety
The DCA has little historical data on aircraft accidents and accident statistics. Figure E20 below summarises what is available.
E2.4.3.2 Aircraft Noise

Almost all of Namibia’s airports are situated away from urban centres or population concentrations. Noise will therefore not affect operations there. The exception is Eros Airport where numerous complaints were addressed to the MWTC about rising noise levels around the airport. This led to the DCA curtailing hours of operation from 06h00 to 21h00. Except for emergencies, no engine ground run-up outside these operating hours are currently allowed. MWTC also conducted a noise envelope study to determine the effects of existing noise levels around Eros. This study found all noise levels well within the required parameters (Kaber, Mujetenga, pers comm). The DCA expects significant changes in noise levels as soon as Kalahari Express Airlines start operations from Eros. The planes to be used are much noisier than the ones currently operating regularly from Eros (Mujetenga, pers comm).

E2.4.3.3 Fuel Consumption

Based on the very small volume of fuel consumed, this sub-sector does not carry a major environmental risk. Also, once Namibia implements Annex 16, the DCA will automatically have the right to prevent older types of aircraft to operate to, from or over Namibia, thereby ensuring full control.
E3 CURRENT ENVIRONMENTAL EFFECTS

3.1 INTERDEPENDENCE BETWEEN TRANSPORT SECTOR AND OTHER SECTORS

E3.1.1 General Comments

Transport does not exist for its own sake and the sector should therefore be viewed in relation to the society it serves. There is therefore substantial interdependence between the transport sector and the other sectors. The transport infrastructure traditionally developed to connect producers to markets, communities with one another and to provide access to countries as a whole.

The Danish Transport Action Plan for Environment and Development furthermore aptly states that

The resulting environmental problems caused by transport can be divided into three categories:

- Global problems (contribution to the greenhouse effect)
- Regional problems (contribution to vegetation damage, forest damage, acid rain and nitrogen deposition)
- Local problems (high pollution levels, noise, accidents, insecurity, pollution of surface- and groundwater) (Jansson, Bodnar, et al, pp11).

These general characteristics are also applicable to the Namibian transport sector. This Section will highlight specific problem areas caused by infrastructure development and operations.
E3.1.2 Infrastructure Development and Maintenance

Throughout the transport sector the type of resources required to develop and maintain the infrastructure, mainly comes from local sources. Especially with earthworks and for economic reasons, the bulk of the material is sourced as close to the project as possible.

The transport sector is dependent on the manufacturing industry to supply the steel, cement, plant and equipment required for executing the works. In the case of Namibia with its small manufacturing sector, these materials and equipment are all imported.

E3.1.3 Transport Operations

The transport industry is by definition a service industry and requires fuel and vehicles/rolling stock/ships and aircraft to convey goods and passengers. For Namibia, these resources are all imported.

It is also a fact that the transport sector cannot survive if there is nothing to transport. In this regard it is connected to all sectors of the economy.

E3.2 RESOURCE DEPLETION

E3.2.1 Infrastructure Development and Maintenance

Namibia has large quantities of quality soils and gravels required for infrastructure construction and maintenance. These soils and gravels are not well distributed and in the Ohangwena, Omusati, Otjikoto and Oshana Regions thick layers of overburden
must be removed to get to suitable materials. Current practices can be improved to ensure proper site planning and finishing off.

E3.2.2 Transport Operations

As already mentioned, the fuel, tyres and equipment used for transport operations are all imported. Most of the raw materials are non-renewable but come from other countries. Their use in Namibia therefore depletes foreign resources.

E3.3 POLLUTION EFFECTS AND CONCERNS

E3.3.1 Infrastructure Development and Maintenance

In general, poorly planned and constructed infrastructure poses serious environmental problems. It can seriously affect changes in land use and change run-off and flow patterns of streams and rivers. It can increase noise and dust levels around population centres and affect the safety risk to users.

In the Namibian context, these factors are all small and very localised when they occur on privately owned land. On the other hand, in communal areas where land use and population movements are not as restricted, for example, along the Trans-Caprivi Highway between Rundu and Divundu, people relocated along the road. A change in land use from natural forest to subsistence farming is also evident. The conclusion can therefore be made that new roads in communal areas will set development patterns that may substantially change the area through which the road is planned.
E3.3.2 Transport Operations

E3.3.2.1 Overview

In terms of importance the pollution effects of transport operations are much more serious. In a country context, the transport sector is by far the major energy consumer. The White Paper on Energy Policy states that in 1995 the transport sector accounted for 55% of all energy consumed in the economy (Energy Policy Committee and Hamutwe, Wamukonja). This White Paper therefore also focuses on determining policy towards the regulation of downstream liquid fuels. The policy regarding environment, health and safety reads as follows,

*Government will implement health, safety and environmental standards in accordance with all relevant laws (pp 41)*

The major pollution effects of transport operations can be grouped into the areas of safety and pollution. In both cases the Namibian record compares well with the rest of the world. By analysing the effect these operations have on the Namibian environment, they also show a small to insignificant impact only. The report, Sources and Sinks of Greenhouse Gases in Namibia, furthermore state that that Namibia can be considered a global carbon sink. Based on unsubstantiated data more than 3 times the CO₂ emitted through fossil fuel consumption is removed from the atmosphere annually by growing woody biomass (*Du Plessis, 5.1, p33*).

Within the transport sector this report shows that the road sub-sector is by far the dominant sub-sector. This sub-sector has large spare capacity and pollution effects from operations have not reached dangerous levels both on a regional and urban level. It was found that the typical issues that plague more populated countries namely, traffic congestion and poor air quality due to high levels of greenhouse gas and ambient lead emissions, are not yet of significance in Namibia.

The railway sub-sector is decreasing in importance while the maritime and aviation sectors have a large spare capacity. There is also concern that the railway sub-sector will never regain its former position again (*Department of Transport, Chapter 2.5*).
Namibia is therefore in an excellent position to plan the implementation of remedial measures to ensure that the transport sector will be sustainable in the longer term. This Study in the process to develop indicators will therefore separate issues on the basis whether they have or will have an impact in the short and medium term or the longer term.
E4 GOVERNMENT POLICIES IN THE TRANSPORT SECTOR

E4.1 LEGISLATION

The current legislation for the transport sector in most cases date back to before Independence. These Acts and Regulations were drawn up in a period when industry and infrastructure developed in a highly regulated environment. Government was responsible for the provision and maintenance of infrastructure and only in exceptional cases contracted the private sector to perform certain development tasks. The functional and in most cases the operational responsibility remained with Government.

Some of these Acts have been amended to allow for the new policy directions that developed after Independence. Some of the most important Acts are the following,

- Road Traffic Ordinance, (Ordinance 30 of 1967) as amended;
- Roads Ordinance 1972, (Ordinance No 17 of 1972) as amended;
- Road Transportation Act, 1977, (Act No 74 of 1977);
- Merchant Shipping Act, 1951, (Act No. 57 of 1951); and

E4.2 WHITE PAPERS

At Independence the new Government introduced new policies that aim to achieve
larger participation in the economy by alleviating poverty and by opening up the economy to previously disadvantaged groups (FNDP, Gericke). These new policies led to Cabinet approval of the first White Paper on Transport Policy on 4 October 1994 and submission to Parliament on 26 June 1995 (White Paper).

The White Paper made several recommendations regarding the reform of the transport sector to ultimately achieve a sector that is safe, effective and efficient while providing services in balance with the needs and capacity of Namibia. The White Paper states clearly that the performance in the sector can mainly be improved by competition. *Increased competition will not only serve to open up opportunities for all Namibians, it will ensure that better use is made of resources and contribute to economic growth and overall welfare. White Paper, pES-1."

The White Paper concluded that for the maritime and civil aviation sub-sectors, the international conventions provide sufficient provisions for environmental and safety concerns. Once accession is achieved, Namibia must ensure that these provisions are enforced.

The same White Paper further recommends that the road sub-sector be managed by national regulatory controls that support new developments elsewhere. Because Namibia does not influence issues like vehicle and engine design, Namibia must ensure that these more efficient innovations are supported here.

The White Paper further recommended on the basis of poor enforcement capacity, that the function of road safety be reviewed and further strengthened.

**E4.3 INTERNATIONAL AGREEMENTS**

Namibia has since Independence ratified several international conventions and is in the process of ratifying several more. The most important ones focusing on the
environment and safety are listed per sub-sector below while the White Paper, Annex 1, provides a complete list.

E4.1.1 Road Sub-sector

The following conventions are reflected in the Namibian legislation,

- International Convention relative to Motor Traffic (Paris, 1926); and

Namibia also on 30 July 1997 (Proclamation No. 24 of 1997) ratified the SADC Protocol on Transport, Communications and Meteorology. This Protocol states as one of its objectives the promotion of effective environmental management with due consideration of relevant international and regional conventions (SATCC-TU).

In Article 4.1 on road infrastructure objectives member states agree to ensure the development of an adequate road network in such a way as to minimise the detrimental impacts to the environment. Articles 6.1 and 6.15 echo this concern when road traffic environmental control is addressed. Article 6.15.1.is repeated verbatim hereunder.

Member states shall adopt and implement road traffic measures which shall enhance their capacity to assess and their capability to control the impact of road traffic on the environment, including-

(a) common standards to enhance vehicle pollution control;
(b) measures relating to transboundary movements of hazardous substances; and
(c) developing and implementing incident management systems for environmental incidents impacting on road transport......
E4.1.2 Railway Sub-sector

The SADC Protocol in Article 7.1 states that Member States shall inter alia facilitate the provision of environmentally-friendly railway services.

E4.1.3 Maritime Sub-sector

The following conventions are in force in Namibia,

- International Convention for the Safety of Life at Sea (SOLAS-74), as amended until 1983;
- Convention on the International regulations for preventing Disasters at Sea, 1972, as amended until 1981; and

The SADC Protocol in Article 8.5 states that member states affirm their intention to apply the international standards and recommended practices of the International Maritime Organisation. According to the DMA Namibia is currently drafting legislation to ratify the conventions listed in Appendix B of this report. The ratification is planned within the next two years.

E4.1.4 Aviation Sub-sector

Namibia has already become a contracting state to the Convention on International Civil Aviation, 1944 (Chicago Convention). This convention in its International Standards and Recommended Practices (SARP) devote Annex 16 to environmental protection. Volume I deals with noise and Volume II deals with emission control.
The SADC Protocol on Transport, Communications and Meteorology fully supports the SARP of the Chicago Convention.

E4.2 NEW LEGISLATION

The MWTC is in order to implement the policy changes approved in the White Paper, presently reviewing all existing legislation that regulate the transport sector. There are also major restructuring proposals that will be embodied in legislation during 1999.

In the road sub-sector the legislation to establish a Roads Authority (RA) and a Road Fund Administration (RFA) is important as functions currently performed by the DOT and the Ministry of Finance will in future be performed by these two new entities. The RA will manage the national road network while the RFA will through the Road User Charging System fund road development and maintenance activities.

The new RFA Bill specifies the object of the RFA as to manage the road user charging system .....with a view to achieving a safe and economically efficient road sector. (Road Fund Administration Bill, 1999). In the Bill it is clearly stated that funding will only be allocated to economically efficient development and maintenance programs.

The RA Bill further states that the Minister responsible for Transport may prescribe minimum standards for the maintenance of such (national) road network which are reasonably required to-

(a) achieve a safe road system;
(b) ensure compliance with the international obligations of the State; or
(c) cause the least possible disruption of the environment,...... (Clause 16(5)).
The Road Traffic and Transport Bill, 1999 will replace the Roads Ordinance and the Road Transportation Act mentioned above and will therewith deregulate the transportation sector.

The amended regulations under the Aviation Act will incorporate the latest amendments of international conventions while the Namibian Airports Company was formed to manage and operate the eight largest airports in Namibia.
E5 ANALYSIS OF GOVERNMENT POLICIES

E10.1 ROAD SUB-SECTOR

The road sub-sector is the dominant sub-sector and is also the main contributor to pollution and damage to the environment. The current policies of Government as reflected in the new legislation shows an overall commitment to safeguarding the environment.

On the infrastructure side the restructured road sub-sector under the DOT and RA as main players will have to develop Environmental Management Plans (EMP) that cover more than development projects only. The road sub-sector must include maintenance activities as well. Such a plan must e.g., take care of the current problems regarding borrow-pits.

Concerning road traffic, the vision of the new policies is to safeguard the environment. In this regard nothing has been done to date and no work is planned. It is recommended that studies to now determine the effect of emissions and ambient lead be given serious attention. The Windhoek Municipality has formed an environmental protection unit but this unit is presently focusing on environmental issues like waste management.

E5.1 RAIL SUB-SECTOR

The net effect of the railway sub-sector and its operations on the environment is minimal. It could rightly be asked whether these sub-sector warrants further study. The volume of goods and passengers are either decreasing over time or remain stable. The rolling stock continues to decrease in number and with that there is a decrease in fuel use.
E5.2 MARITIME SUB-SECTOR

The Government policies are clear in this sector. Namibia is desirous to protect her marine environment. Although Namibia has not yet acceded to all international conventions and in particular to Marpol 73/78, the intention is to do so in the short term.

The regulation of this sector is progressing slowly, most probably since the DMA was not an established organisation at Independence. There is also a lack of well-trained staff to enforce the environmental requirements that the new conventions will place on Namibia.

Namport as port operator, is also not in a position to service the requirements of Marpol 73/78. In this regard it cannot for example, receive sewage and garbage from ships at both Walvis Bay and Lüderitz.

E5.3 AVIATION SUB-SECTOR

The civil aviation sub-sector is regulated by the international SARP of ICAO. In this regard the current Namibian legislation and the new Regulations under the Aviation Act that will be published in the Government Gazette shortly, are fully in support of Annex 16.

Annex 16 focuses on the manufacturing process of aircraft and requires adherence to specific standards before an aircraft is certified for civilian use. These standards place aircraft in three categories, Chapter One, Two and Three aircraft. Chapter One aircraft are the noisiest and have the highest emission rates while the others perform progressively better. It is up to countries to forbid Chapter One and Two aircraft from using busy airports close to population concentrations.
ICAO is presently initiating a study to investigate more stringent noise standards for aircraft than those prescribed for Chapter Three aircraft (*ICAO, Transport and the Environment*). The same publication also proposes to use a more balanced approach to aircraft noise. Instead of restricting it only at point of manufacture, operational procedures and compatible land-use planning should also be reviewed.

Following complaints from the public about excessive noise at night at Eros Airport, the DCA has in 1997 issued measures that prohibit planes from performing engine run-ups outside the official airport operating hours of 06h00 to 21h00. Only in exceptional circumstances and with prior approval of the DCA, will engine run-ups be allowed outside these hours (*Bagenda, E*).
E6 TRANSPORT DEVELOPMENT PLANNING

E10.1 AN OVERVIEW OF INFRASTRUCTURE PLANNING

The planning function has undergone and will still undergo rapid changes as new parastatals are formed this year to take over operational functions from the MWTC.

- Namport is responsible for the development planning for port activities at Walvis Bay and Lüderitz.
- Transnamib was to date responsible for the same in the railway sub-sector. The modalities on railway infrastructure planning are not clear at this stage as the latest legislation provides for the transfer of this asset back to Government.
- The Namibian Airports Company (NAC) will be responsible for planning at the eight airports transferred to the NAC. The other airports in the NAN will remain the responsibility of their present owners, but from traffic volumes it is clear that developments will rather take place at the NAC airports and not the rest.
- The new Roads Authority will take over the national road network planning function from the DOT.

As these parastatals are all set up to make independent decisions as to developing the infrastructure they are responsible for, the need to co-ordinate the overall development of the transport sector becomes essential. The MWTC will retain that function to assist the Minister with overall strategic planning.

The National Development Plan as published by the NPC also collects the development plans from all these parastatals and together with any projects initiated by the MWTC, publishes this development information under the Heading; "Transport and Communications" (NDP1, Volumes I and II). The NDP1 was published in 1995 and is currently undergoing a mid-term review. The updated documents are not available yet and the study combined the information contained in the NDP1 with the latest available information.

E6.1 MULTI-MODAL TRANSPORT INFRASTRUCTURE DEVELOPMENTS
There are two major projects ongoing at present. The works planned for the
development of the Walvis Bay-Trans-Kalahari Corridor is completed with the
completion of the Trans-Kalahari Highway. Work is still ongoing to develop the port
facilities, but these projects will be discussed in Section E6.7 hereunder.

The other project is to develop the Walvis Bay-Trans-Caprivi Transport Corridor. The
road construction works are nearly completed with the major outstanding issue, the
bridge over the Zambezi at Katima Mulilo. The development of the port at Walvis Bay
will likewise be reported hereunder.

E6.2 NATIONAL AND REGIONAL ROADS DEVELOPMENT

The NDP1 and the NTMPS suggest that the following projects will be considered in
the next five years. The work on the Trans-Caprivi Transport Corridor Project is not
included, as it is ongoing and nearly completed.

- Upgrading Swakopmund-Henties Bay to paved standard
- Upgrading Gobabis-Otjinene to paved standard in phases with continuation from
  Otjinene to Grootfontein later
- Upgrading Bagani-Mohembo to paved standard
- Upgrading Okatana-Onuuno to paved standard

There are also a number of large projects that are not feasible in the next five years
but with expected traffic growth could become feasible later. These are,

- Upgrading Maltahöhe-Solitaire to paved standard
- Dual Carriage ways between
  - Windhoek-Okahandja
  - Oshakati-Ondangua
  - Swakopmund-Walvis Bay
- Paved direct route between Windhoek and Walvis Bay.
- Windhoek Southern Bypass

The NTMPS also proposed during the next five years the low cost surfacing of the following gravel roads on economic grounds:

- Uis-Khorixas-Kamanjab
- Road to Otjosondu mine
- Henties Bay-junction of D2303 on road to Torra Bay.

E6.3 ROAD MAINTENANCE AND REHABILITATION

The DOT implemented several major rehabilitation projects that will according to the NTMPS study satisfy the most urgent requirements. For the next five years the following new rehabilitation projects are planned:

- Mururani-Grootfontein
- Ondangwa-Oshikango
- Wasser-Ebenerde
- Several Bridges

E6.4 LABOUR-BASED WORKS PROGRAM

The DOT initiated a labour based works program to develop roads in the northern parts of Namibia. This program is supported with donor funding from Sweden and Germany. From the NDP1 these projects are all planned in the Oshana, Ohangwena
and Omusati Regions. Individually these projects are short in length and are therefore not reflected as individual projects in this study. The DOT is the fact that the DOT is implementing labour based road maintenance and labour based contracting initiatives.

There is concern that the program is not as efficient as originally planned. The MWTC has recently commissioned consultants to review the impact this program has so far had on the socio-economic development of the affected regions. This review will also where required, recommend improvements for the efficient expansion of the labour-based program.

E6.5 RAILWAY DEVELOPMENT

The NDP1 does not list a development project for this sub-sector but the MWTC is planning an extension from Tsumeb to Ondangwa and Oshikango with the vision to ultimately link up with the Angolan railway network. This will be a major expansion of the existing network. In the light of the decline in importance of the railway sub-sector, the feasibility of this project is doubtful.

E6.6 MARITIME DEVELOPMENT

The NDP1 lists the feasibility study of a fishing harbour at Möwe Bay. The vision is to supply infrastructure to fully exploit the fishing reserves along the Northern Coast of Namibia. This study is presently ongoing and the result thereof is expected during this year.

Namport also lists several projects for the development of Walvis Bay. According to
their company brochures, these projects are not funded yet. These are

- Deepening of Walvis Bay Harbour to −12.8m
- Free port distribution Facility
- Grain Silos
- 5 000t Synchrolift
- Common User Facility
- Quay and Cold Storage Developments.

E6.7 AVIATION DEVELOPMENT

The NAC has recently been established and has not yet published its intended development programs. The DOT initiated a project to rehabilitate the Hosea Kutako runway and proposed the lengthening of the Walvis Bay runway to improve the transport of frozen fish to Europe.
E7  ANALYSIS OF DEVELOPMENT PLANS

E10.1 ROAD SUB-SECTOR

The development plans of this sub-sector are all reviewed with a Cost-Benefit analysis procedure. Only viable projects are currently included in the planning for the next five years. The DOT has also as part of the feasibility studies lately included environmental impact assessments. This process will be formalised once the planned environmental legislation is promulgated. With the environmental requirements already included in the new legislation, the to be established RA will have to ensure that projects are also environmentally sustainable.

The impact of new roads in communal areas differs from that in commercial areas. In communal areas there is a definite trend for the local population to settle along the new roads. This shift in population significantly affects land use patterns. The new alignment of the Trans-Caprivi Highway from Rundu to Divundu resulted in such a population shift. Land adjacent to the road is also cleared for subsistence farming. This trend is also prevalent in the Caprivi. An Environmental Profile and Atlas of Caprivi, a report commissioned by the Directorate: Environmental Affairs shows that the highest population densities occur along the major roads of the Eastern Caprivi (Mendelsohn, Roberts pp13). Similarly this report also shows that the highest cattle densities occur along the same roads.

The above-mentioned development plans for the road sector do not include the construction of new roads but cover the upgrading of existing roads only. The impacts of population shifts and changes in land use will therefore not be as significant as with the already mentioned Trans-Caprivi Highway.

E7.1 RAIL SUB-SECTOR
E7.2 MARITIME SUB-SECTOR

Namport also accepts and applies the guidelines of environmental impact studies for new projects.

The environmental aspects of daily operations are controlled through the implementation of existing port regulations.

E7.3 AVIATION SUB-SECTOR

There is nothing to report.

E7.4 SUMMARY

The transport sector has started with the implementation of environmental impact assessment studies as part of the planning process, but the new environmental legislation is required to ensure that studies are done for all development projects throughout the sector.
The sector as a whole is not performing completion audits on completed projects nor are fully-fledged environmental management plans in place. These issues must be addressed in the future to ensure that firstly, the recommendations of the planning process are adhered to and secondly, to measure the variance in expected outcomes over time.
E8 EXISTING TOOLS FOR ENVIRONMENTAL CARE

E10.1 DEVELOPMENT PROJECTS

The transport sector in general applies the guidelines of environmental impact assessment studies as recommended by the DEA. All new projects are reviewed with some form of EIA.

E8.1 MAINTENANCE AND REHABILITATION WORKS

In this field the various role players are developing in different directions. The maritime and aviation sub-sectors are guided by international standards and they tend to aim for adherence there. The railways and road sub-sectors do not have specific plans to address these two activities, but rely on ad-hoc initiatives in many cases.

E8.2 OPERATIONS

In this area there are no tools in place throughout the sector. The road sub-sector will be the first to develop tools because of its relative importance. There are certain databases that could be used for environmental programs, but the information is primarily collected for planning and other purposes and not to present environmental issues. The information must therefore be adjusted to also support environmental information tools.
E9 SUMMARY OF ENVIRONMENTAL CONCERNS

E10.1 POLICY RELATED CONCERNS

As regards policy, the sector as a whole will have all the legal requirements in place once the restructuring of the DOT is complete and the ratification legislation for the international maritime conventions is promulgated.

The planned environmental legislation will strengthen the legal requirements set out in the above-mentioned legislation and will guide the development of appropriate environmental management plans for each sub-sector. Where co-ordination exists between sub-sectors, such co-ordination should also include environmental concerns.

E9.1 INFRASTRUCTURE CONCERNS

E9.1.1 Development Projects

The sector applies EIA studies to new development projects, but there is a need to formalise the process. This will only happen once the planned environmental legislation is promulgated.

There is also a need for completion audits. This procedure is currently not consistently executed.

E9.1.2 Maintenance and Rehabilitation

There is a need for Environmental Management Plans for each of the sub-sectors.
E9.2 OPERATIONS

In this regard the only available statistics are on accidents as well as resultant injuries and fatalities. Even this information is cryptic.

There is nothing in place to sensitise the Namibian population on the environmental effects of transport operations. The report shows that the Transport Sector still has a minimal impact on the environment, but those areas of concern, e.g. vehicle emissions and plans to make maintenance operations more environmentally friendly, already provide an excellent base to inform the general public on goals achieved.
E10 IDENTIFICATION OF INDICATORS

E10.1 GENERAL

In this section an attempt will be made to identify possible indicators that will gauge and monitor the state of the environment in regard to the transport sector. An attempt will be made to identify indicators useful for an overall assessment, as well as an assessment of the various sub-sectors.

It must be stressed that there are a large number of indicators available that were developed in countries with higher population and vehicle densities or that are subject to serious emission and congestion problems. These are not relevant for the Namibian situation and will therefore not be discussed in this report.

The indicators listed below will be refined based on the following principles to select the best and most applicable for further development in Volume 2 of this report,

- The information must be readily available in simple format;
- The information must be relevant, efficient and reliable; and
- The information must provide a direct linkage between the sector and the environment

E10.1 FIELD OF APPLICATION

The study divides the indicators in three fields of application. These are

- policy (how committed is Government to sustainable practices),
- infrastructure management (how committed are the parastatals in implementing national policy both for infrastructure development and maintenance), and
• operations (how does the public respond to environmental sustainability when utilising the transport sector).

E10.2 OVERALL SECTORAL INDICATORS

E10.2.1 Possible Indicators

Table E8 below lists the possible indicators identified for overall sectoral use and provides an indication of their use and the concerns they address.

<table>
<thead>
<tr>
<th>FIELD OF APPLICATION</th>
<th>DEFINITION OF INDICATOR</th>
<th>USES OF INDICATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy</td>
<td>Legislation and regulations that refer to the transport sector in terms of social, economic and ecosystem sustainability</td>
<td>Provides an indication whether decision makers recognise the environment as important</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Sensitivity to environmental issues on project level</td>
<td>Indication of application of environmental policies including the biophysical, social and economic environment</td>
</tr>
<tr>
<td>Operations</td>
<td>Contribution of the Transport Sector to the Economy</td>
<td>To provide an indication of the relative importance of the Transport Sector in the economy Also international comparison</td>
</tr>
</tbody>
</table>

E10.2.2 Evaluation of Possible Indicators

• Legislation and Regulations that refer to Transport Sector Management in terms of social, economic and ecosystem sustainability gives an overview of the political commitment to socio-economic sustainability. The Transport Sector is regulated by a large number of International Conventions, Acts and Regulations. This report
attempted to look at the more important pieces of legislation only as a complete review will be very time-consuming.

The study also found that the whole sector will be affected by new legislation currently either under discussion in Parliament or being prepared for submission to Parliament. The common thread through the new legislation is a firm support for sustainability.

This indicator is therefore discarded as Government already showed its commitment.

It should be noted that the legislation itself would not be the final solution. Acceptance thereof by the general population and enforcement where required, will guarantee sustainability.

- **Sensitivity to Environmental Issues on a Project Level** will indicate the application of environmental policies.

The study found that all stakeholders in the transport sector are already applying the principles of environmental assessment in their infrastructure development studies. These practices will be further strengthened with the promulgation of the new environmental legislation.

The usefulness of this indicator is therefore not relevant to Namibia and is discarded.

- **Contribution of the Transport Sector to the Economy** will show the relative importance of the Transport Sector in the economy. This indicator will also provide a means for international comparison.

Information is readily available from the Central Statistics Office and this indicator is recommended for further refinement.
E10.3 ROAD SUB-SECTOR

E10.3.1 Possible Indicators

Table E9 lists the possible indicators specific to the road sub-sector and provides an indication of their use and the concerns they address.

<table>
<thead>
<tr>
<th>FIELD OF APPLICATION</th>
<th>DEFINITION OF INDICATOR</th>
<th>USES OF INDICATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy</td>
<td>Support for other road transport modes</td>
<td>Measure of pressure to change to public transport like buses, trains, etc. or bicycles.</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>The portion of road infrastructure at gravel road standard</td>
<td>Provides measure of service level of the core road network</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Road distribution</td>
<td>Indication of accessibility per region to national network</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Bitumen road quality</td>
<td>Provide measure of the quality of the &quot;high-volume&quot; roads</td>
</tr>
<tr>
<td>Operations</td>
<td>Annual fuel consumption</td>
<td>Measures use of non-renewable resources Indication of noxious gas emissions on a national level</td>
</tr>
<tr>
<td>Operations</td>
<td>Annual lead emissions</td>
<td>Indication of Ambient lead concentrations</td>
</tr>
<tr>
<td>Operations</td>
<td>Road safety</td>
<td>Provide a measure of safety for road users</td>
</tr>
<tr>
<td>Operations</td>
<td>Fuel efficiency of vehicles</td>
<td>Would provide a measure of the efficiency of use of non-renewable resources</td>
</tr>
<tr>
<td>Operations</td>
<td>Utilisation of roads</td>
<td>Indication of traffic volumes per region or type of road, both in terms of freight and passengers</td>
</tr>
<tr>
<td>Operations</td>
<td>Access to vehicles</td>
<td>Indication of mobility of population</td>
</tr>
<tr>
<td>Operations</td>
<td>Tyre consumption</td>
<td>Indication of utilisation of road sector, production of pollutants</td>
</tr>
</tbody>
</table>

E10.3.2 Evaluation of Possible Indicators

- Support for other road transport modes will indicate the pressure to move away from private transport to either public transport or more environmentally friendly options like bicycles.
The study showed that Namibia does not experience regular congestion yet. The need for public transport is most highly developed in the lower-income group as a means of cheap transport and not as a way to reduce the environmental impact of transport. These two factors will be prevalent for the next number of years and this indicator is therefore not relevant.

- **The % of Roads at gravel road standard** provides a measure of the service level of the core road network. It reflects the quality of road infrastructure available and together with the *bitumen road quality* provides a measure of the service level that is available.

This indicator is recommended for further development.

- **Road distribution** is the measure of skewness that exists in a road network. This indicator shows whether certain regions/areas have fewer roads than other regions/areas.

This problem is to a certain extent present in Namibia, mainly due to the political practices of the past.

It is however a very difficult indicator to quantify meaningfully in Namibia as population distribution and income as well as land use also impact on eventual roads distribution. Roads should only be provided where they are required to support communities/development.

Road network development is a long-term process and this indicator will therefore not change in the short term.

This indicator is therefore discarded.

- **Bitumen Road Quality** provides a measure of the quality of the ‘high-volume’ roads in Namibia. The sustainability of road operations is directly dependent on road quality, the poorer the road conditions, the higher the vehicle operating
costs. In Namibia at least 75% of all trips are undertaken on the bitumen network. Therefore a measure of the bitumen road quality will provide a clear indication whether road operations will be sustainable in the long term.

This indicator is recommended for further refinement.

- **Annual fuel consumption** is a measure of the non-renewable fuel resources consumed by the road sub-sector. This forms a large part of all energy consumed in Namibia.

Although Namibia does not have a noxious gas emission problem, this indicator can be used as an approximation of this concern.

This indicator is recommended for further refinement.

- **Annual lead emissions** are a measure of the amount of lead emitted into the atmosphere through the use of leaded fuel.

Although the study showed that the road sub-sector does not emit significant quantities of lead, the health problem associated with lead poisoning warrants further refinement of this indicator.

- **Road safety** is a measure of the safety of road users in general. The data availability is poor and inconsistent and it not possible to develop a core indicator.

The study recommends that this indicator be properly defined once reliable data is available.

- **Fuel efficiency of vehicles** is a measure of the utilisation of non-renewable resources. This indicator combines several aspects indicative of the quality of the country’s vehicle fleets namely, the manufacturing specifications as well as the average age and the quality of maintenance. The most important aspect is the manufacturing specifications while the others become more significant with old vehicle fleets.
Namibia is not manufacturing vehicles while the current fleet is relatively young. This indicator is therefore not relevant in Namibia and is discarded.

- **Utilisation of roads** measures the actual changes in transport patterns, especially broken down in regional format.

This indicator relies on large inputs and calculations that the DOT seldom undertakes. Data on freight and passenger volumes is also difficult to compile regularly. In this regard there has been no reliable data for many years.

The study therefore discards this indicator and proposes to use **access to vehicles** as an indicator of road utilisation.

- **Access to vehicles** is a measure of the number of registered vehicles relative to population size. This indicator shows the relative ease of access to road network that Namibians enjoy.

The availability of reliable data is a problem, but will be resolved in the next two years.

The study recommends that this become a developmental indicator.

- **Tyre Consumption** is an indicator of the utilisation of roads in general. Reliable data does not exist to develop this indicator.

The study recommends that this indicator be discarded.
E10.4 RAIL SUB-SECTOR

E10.4.1 Possible Indicators

Table E10 below lists the possible indicators identified to measure the impact of the rail sub-sector and provides an indication of their use and the concerns they address.

<table>
<thead>
<tr>
<th>FIELD OF APPLICATION</th>
<th>DEFINITION OF INDICATOR</th>
<th>USES OF INDICATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy</td>
<td>Sustainability of Railways</td>
<td>Measures the infrastructure utilisation over time</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Accessibility of rail network</td>
<td>Measures ease of access to railways</td>
</tr>
<tr>
<td>Operations</td>
<td>Railway Safety</td>
<td>Provides a measure of safety for rail users</td>
</tr>
<tr>
<td>Operations</td>
<td>Fuel Efficiency</td>
<td>Would provide a measure of the efficiency of use of non-renewable resources</td>
</tr>
<tr>
<td>Operations</td>
<td>Utilisation of network</td>
<td>To measure relative importance of this sub-sector</td>
</tr>
<tr>
<td>Operations</td>
<td>Utilisation of locomotive units</td>
<td>Measures efficiency of operations</td>
</tr>
</tbody>
</table>

E10.4.2 Evaluation of Possible Indicators

- **Sustainability of railways** is a measure of the long-term sustainability of the railway sub-sector. There is a world-wide shift from rail transport to road transport and this shift is also prevalent in Namibia.

The financial data required to assess the sustainability of the rail sub-sector is difficult to obtain and warrants thorough analysis. The study recommends that this indicator be discarded and that the utilisation of the rail sub-sector be used to measure operational indicators.

- **Accessibility of rail network** indicates the ease of access Namibians have to the rail network. The Namibian network is small and does not serve the more
populated areas in the north. The largest part of the population therefore does not have easy access to the rail network.

This indicator is therefore not relevant and is discarded.

- **Railway Safety** provides an indication of the relative safety of the rail network. In this regard the information published in the Transnamib Annual Reports show a very low accident rate. So low that a meaningful analysis is not possible.

Due to the importance of safety, the study recommends that the relevance this indicator be reviewed from time to time.

- **Fuel efficiency** provides an indication of the use of non-renewable resources. Again the study has shown that the volume of diesel consumed annually is insignificant compared with the road sub-sector. Also as a stand-alone sub-sector the fuel consumption does not allow for a meaningful analysis.

The study therefore discards this indicator.

- **Utilisation of network** gives a measure of the relative importance of the sub-sector. The study showed that the rail network is under-utilised and that freight transport volumes are decreasing steadily. Freight and passenger data is available but the volumes are small when compared with the information available for the road sub-sector. This indicator would therefore not be meaningful and is discarded.

- **Utilisation of locomotive units** measures the efficiency of railway operations. The current under-utilisation of the sector also affected locomotive utilisation. To provide a comprehensive service, locomotives regularly run below capacity.

This indicator is therefore also not relevant and is discarded.
E10.4.3 Summary

From the above it is clear that the study does not recommend any indicator for the rail sub-sector. This recommendation is in line with the current situation in this sub-sector. The sector is constantly decreasing in size and where meaningful indicators can be motivated for increased activities, the opposite is true of the rail sub-sector.

E10.5 MARITIME SUB-SECTOR

E10.5.1 Possible Indicators

The possible indicators to represent this sub-sector are listed in Table E12 below.

<table>
<thead>
<tr>
<th>FIELD OF APPLICATION</th>
<th>DEFINITION OF INDICATOR</th>
<th>USES OF INDICATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure</td>
<td>Accessibility of ports</td>
<td>Measures the size of the Namibian sub-sector</td>
</tr>
<tr>
<td>Operations</td>
<td>Pollution awareness</td>
<td>Measures Namibia's support for decreasing pollution of the seas</td>
</tr>
<tr>
<td>Operations</td>
<td>Maritime Safety</td>
<td>Measures shipping safety in terms of accidents and incidents</td>
</tr>
<tr>
<td>Operations</td>
<td>Efficiency of harbour operations</td>
<td>Gives a measure of efficiency of operations in total</td>
</tr>
</tbody>
</table>

E10.5.2 Evaluation of Indicators:

- **Accessibility of ports** measured in terms of cargo handled provides an indication of the size of this sub-sector relative to the economy. This study showed that compared to the capacity of both ports, relatively small quantities of cargo are handled annually.
The decision to commercialise the port operations with the establishment of Namport furthermore ensures that the spare capacity will be marketed efficiently.

This indicator is recommended as a development indicator.

- **Pollution awareness** provides an indication of the stakeholders' response to the prevention of spills. The DMA does not have a reliable database from where information can be easily extracted. Nor does Namport keep a comprehensive database.

As an indicator the data available is not meaningful and this indicator is therefore discarded.

- **Maritime safety** measured in terms of accidents and incidents do provide a measure of the safety of the Namibian maritime environment. The data required to develop a meaningful indicator is not readily available and this indicator although it touches an important issue, is therefore discarded.

- **Efficiency of port operations** gives a good indication of the operational capacity of the port management. Data on the volume of cargo handled is available but the time taken to handle the cargo is relatively difficult to obtain. The first indicator above can be used as an approximation of measuring efficiency as well. This indicator is therefore combined with the first one, Accessibility of ports.
E10.6 AVIATION SUB-SECTOR

E10.6.1 Possible Indicators

Table E13 below lists the possible indicators for this sub-sector and provides an indication of their use and the concerns they address.

<table>
<thead>
<tr>
<th>FIELD OF APPLICATION</th>
<th>DEFINITION OF INDICATOR</th>
<th>USES OF INDICATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure</td>
<td>Accessibility</td>
<td>Measures general proximity of population to regularly maintained aerodromes</td>
</tr>
<tr>
<td>Operations</td>
<td>Aviation Safety</td>
<td>Measures relative safety of civil aviation operations</td>
</tr>
<tr>
<td>Operations</td>
<td>Pollution Awareness</td>
<td>Measures support for decreasing pollution caused by aviation operations</td>
</tr>
<tr>
<td>Operations</td>
<td>Quality of planes used</td>
<td>Measures the pollution qualities of Namibian planes</td>
</tr>
</tbody>
</table>

E10.6.2 Evaluation of Possible Indicators

- **Accessibility** measures the proximity of well-maintained aerodromes to the population. The DOT has recently established such a National Aerodrome Network ensuring equitable access throughout Namibia.

  The need for this indicator is therefore not relevant at this stage and it is discarded.

- **Aviation Safety** indicates the safety of the aviation sub-sector. The study showed that there is only a small amount of information available. However, the recommendation is to refine the information into a developmental indicator.

- **Pollution awareness** in the aviation sector can be measured as the decrease in noise around airports and the emissions of aircraft engines. In both cases the study showed that the impact of both is minimal in Namibia. This indicator is therefore discarded.
• **Quality of planes used** provides an indication how the Namibian registered planes comply with international pollution standards. In this regard the Namibian register as maintained by the DCA does not require this information and the indicator can therefore not be developed meaningfully.

### E10.7 SUMMARY OF PREFERRED INDICATORS

Table E14 below summarises the preferred indicators to measure environmental changes due to changes in the transport sector. These indicators will be refined further in Volume 2 of this study.

**Table E14: Preferred Indicators for the Transport Sector**

<table>
<thead>
<tr>
<th>SUB-SECTOR</th>
<th>FIELD OF APPLICATION</th>
<th>DEFINITION OF INDICATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport Sector in general</td>
<td>Operations</td>
<td>Contribution of the Transport Sector to the Economy</td>
</tr>
<tr>
<td>Road</td>
<td>Infrastructure</td>
<td>The portion of road infrastructure at gravel road standard</td>
</tr>
<tr>
<td></td>
<td>Infrastructure</td>
<td>Bitumen road quality</td>
</tr>
<tr>
<td></td>
<td>Operations</td>
<td>Annual fuel consumption</td>
</tr>
<tr>
<td></td>
<td>Operations</td>
<td>Annual lead emissions</td>
</tr>
<tr>
<td></td>
<td>Operations</td>
<td>Access to Vehicles</td>
</tr>
<tr>
<td>Rail</td>
<td>Infrastructure/Operations</td>
<td>Accessibility of Ports</td>
</tr>
<tr>
<td>Maritime</td>
<td>Infrastructure/Operations</td>
<td>Accessibility of Ports</td>
</tr>
<tr>
<td>Aviation</td>
<td>Operations</td>
<td>Aviation Safety</td>
</tr>
</tbody>
</table>
E11 CONCLUSIONS AND RECOMMENDATIONS

This Report clearly shows that on a policy level much is presently done to address environmental sustainability in the Transport Sector. Although the current legislation still does not reflect this, the new legislation that are either already in Parliament or will follow soon, show a clear commitment to environmental sustainability.

Namibia is a large country with a small population mostly concentrated in certain areas or towns. This leads to largely under-utilised infrastructure in the rural areas. The environmental impact of the development and maintenance operations is also shown to be small. Even in the more populated towns like Windhoek, Oshakati, Ongwediva, and Ondangwa, infrastructure deficiencies are still small.

On the operational level the report showed that the road sub-sector is by far the most dominant and will remain so for the foreseeable future. Even for the road sub-sector very little has to date been done to address possible negative environmental effects caused by traffic. The present level of traffic flows is still too small to cause significant environmental problems.

However on an operational level, the issues of safety and health are already standing out as concerns that need to be addressed in the medium term.

The indicators identified for possible application in Namibia, their use and limitations as well as indicative future trends will be discussed in detail in Volume 2 of this report.
E12 REFERENCES


Hamutwe. G. S. and Wamukonya, L. 1998.*Energy Efficiency and Conservation in


Namibian Ports Authority. 1998. *Port of Walvis Bay, Port of Lüderitz*. Namibian Ports Authority


Victor, WC, Gericke, B and Van Zyl, WM. 1998. Establishment of the Namibian
Roads Authority and Road Fund Administration. Tanzanian Road Conference, November 1998.

APPENDIX A: AIRPORTS AND AERODROMES INCLUDED IN THE NATIONAL NETWORK

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Notes: 1. The Study recommended that the status of the aerodromes in the network must be reviewed from time to time.
APPENDIX B: INTERNATIONAL SHIPPING CONVENTIONS THAT NAMIBIA PLANS TO
ACCEDE TO

B1  The International Convention For Safety Of Life At Sea 1974 (Solas 74), As
Amended after 1983;

B2  The International Convention For The Prevention Of Pollution From Ships 1973
As Modified By The Protocol Of 1978 Relating Thereto (Marpol 73/78), As
Amended;

B3  The International Convention on Load Lines 1966 as modified by the Protocol
of 1988 relating thereto (LL 66);

B4  the International Convention on Standards of Training, Certification and
Watchkeeping 1978 (STCW 78), as amended;

B5  the Convention on the International Regulations for Preventing Collisions at
Sea 1972 (COLREG 72), as amended;

B6  the International Convention on Tonnage Measurement of Ships 1969
(Tonnage 69); and

B7  the Merchant Shipping (Minimum Standards) Convention 1976 (ILO
Convention 147).

B8  Memorandum of Understanding on Port State Control for the West and Central
African Region