

**GOVERNMENT OF THE REPUBLIC OF NAMIBIA
MINISTRY OF WORKS, TRANSPORT AND COMMUNICATION
DEPARTMENT OF TRANSPORT**

NATIONAL TRANSPORTATION MASTER PLAN STUDY

VOLUME 7

**NATIONAL TRANSPORTATION MASTER PLAN FOR
NAMIBIA**

Final Report September 1998

**KM International AB
P O BOX 7124
S-170 07 SOLNA
SWEDEN**

**In association with
VKE (Namibia) Inc.,
Nordic Consulting Group
and SweRoad**

NATIONAL TRANSPORTATION MASTER PLAN FOR NAMIBIA

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ABBREVIATIONS

AADT	Average Annual Daily Traffic
ADT	Average Daily Traffic
ATM	Aircraft takeoff and landing movement
BCR	Benefit/Cost Ratio
BMS	Bridge Management System
CSO	Central Statistics Office
DCA	Directorate Civil Aviation
DOT	Department of Transport
DPTM	Directorate Planning and Transport Management
DTIMC	Directorate Transportation Infrastructure Maintenance and Construction
EAADT	Estimated Average Annual Daily Traffic
EU	European Union
FYRR	First Year Rate of Return
GDP	Gross Domestic Product
GRN	Government of the Republic of Namibia
HDM	Highway Design and Maintenance Standards Series (World Bank)
IRR	Internal Rate of Return
LDV	Light Delivery Vehicle (“bakkie”)
LGV	Light Goods Vehicle
MOF	Ministry of Finance
MRLGH	Ministry of Regional and Local Government and Housing
MWTC	Ministry of Works, Transport and Communication

NDP	National Development Plan
NEPRU	The Namibian Economic Policy Research Unit
NPV	Net Present Value
NTAB	Namibian Transport Advisory Board
NTMPS	National Transportation Master Plan Study (This Study)
NZ	New Zealand
PAX	(Aircraft) passengers
PEM	Project Evaluation Manual (of Transit, New Zealand)
PIF	Project Identification Form
PMS	Pavement Management System
POL	Petrol, Oil and Lubricants
RMS	Road Management System
RSA	Republic of South Africa
SACU	Southern Africa Customs Union
SADC	Southern African Development Community
SOGREAH/SYSTRA	French consultant in the transport sector
SOOE	State Owned Operational Entity
SUT	Single Unit Truck
TNL	TransNamib Limited
VOC	Vehicle Operating Costs

NATIONAL TRANSPORTATION MASTER PLAN FOR NAMIBIA

1. INTRODUCTION

1.1 *Background and Purpose*

1.1.1 The Assignment

The Government of the Republic of Namibia (GRN), through its Ministry of Works, Transport and Communication (MWTC) has commissioned the Swedish Consultants KM International AB in association with VKE (Namibia) Inc., Nordic Consulting Group (NCG) and Swedish National Road Consulting AB (SweRoad) to undertake a National Transportation Master Plan Study (NTMPS). In order to cover all aspects of the Study, the Consultant has also sub-contracted the firms Opus International Consultants (NZ), AFRICON and SwedeRail.

1.1.2 Terms of Reference

One of the main objectives of the Study is to formulate a master plan for the development of road network, rail network and airports for the period up to 2012. Study task 22 reads as follows:

Taking into account the planning work already done and in the process of being completed, as well as the new institutional arrangements in the sector, the Consultant shall prepare a master plan in co-operation with the staff of the Ministry. The Consultant will be responsible for this work, but he will at the same time undertake training by involving Ministry staff in this work. The output shall be of use both for the National Development Plan (NDP) of Namibia, and as a long term instrument to allow the Ministry to monitor development in the sector, as well as to identify actions that it should undertake on its own. It is important that this work is structured in such a way that it can be revised and updated with a minimum of effort every three years by the staff of the Ministry.

In addition to the master plan the Consultant is also required to develop and implement procedures, tools and instruments to be used by the Ministry and the new Roads Authority, for planning and monitoring of roads and aerodromes.

1.1.3 Purpose of this Master Plan

The emphasis in this Master Plan is on national transport infrastructure maintenance and development in the road, railway and air transport sectors. All transport services, and internal transport and infrastructure in respect of urban areas are therefore excluded.

The main purpose of the Master Plan is to give the Government of Namibia and its affiliated agencies guidance as to the programmes and projects needed in order to comply with the agreed goals and strategies for transport infrastructure during the period up to the year 2012.

This report (Volume 7) may be read as a stand-alone document but in order for the reader to obtain more information on specific details, reference is made to other reports of the National Transportation Master Plan Study (NTMPS) as shown in Figure 1.1 on page 3. An executive summary is given in Volume 1.

1.2 Methodology

1.2.1 Preliminary work

The Consultant accepted, as a point of departure, the documentation on completed and ongoing studies and plans made available by the Ministry. In addition the Consultant has applied internationally recognised standards and practices, *e.g.* concerning road planning and project evaluation methodology to develop the Master Plan.

During the first stages of the Study the Consultant focused on the preparation of tools and instruments for planning and budgeting of roads and aerodromes. In the process of doing that, the basis for the preparation of the master plan was laid down.

The more significant deliverables of the Study which preceded and had impact upon the master plan were:

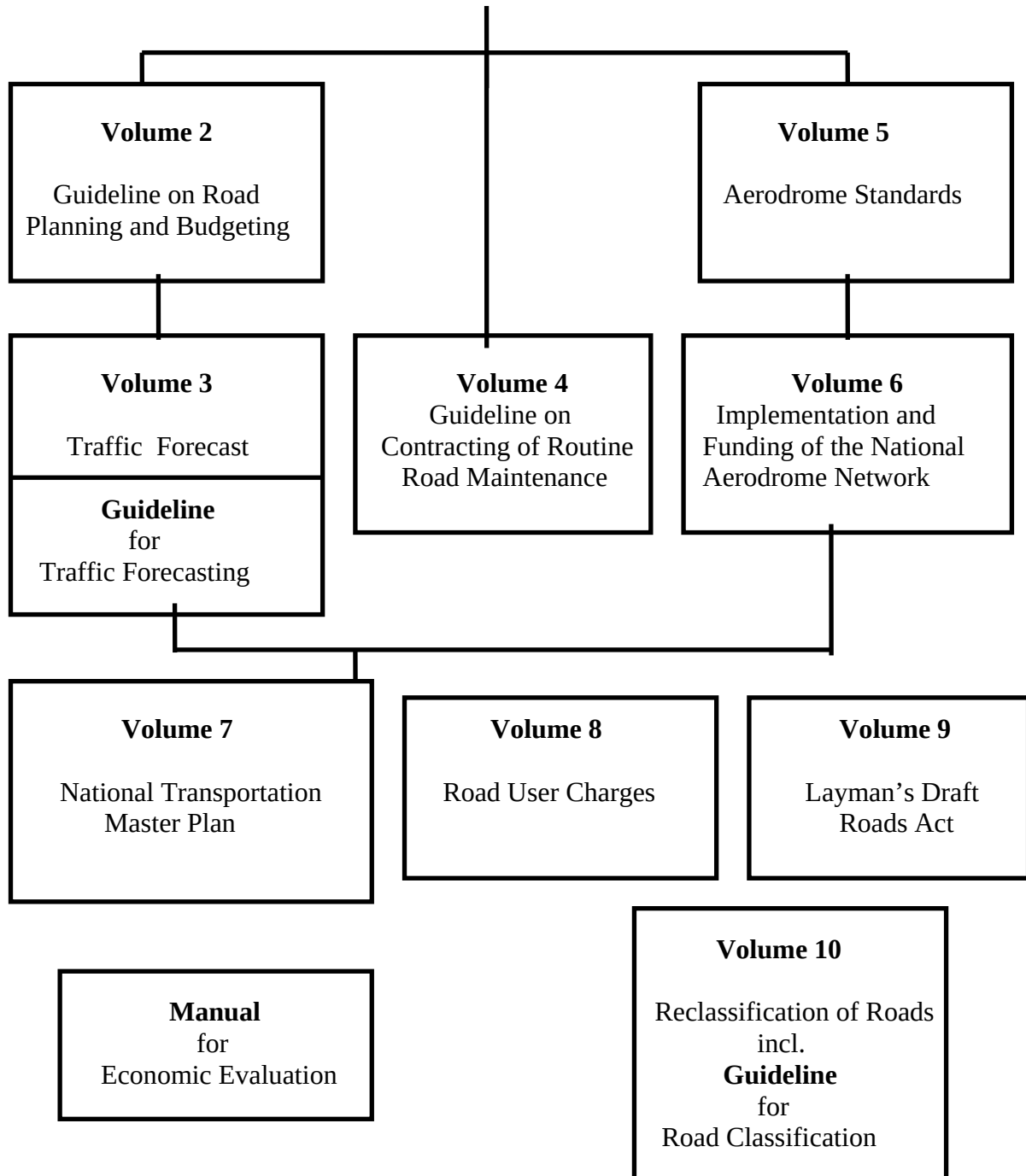
1. Policy Principles Underlying an Aerodrome Master Plan for Namibia, 22 February 1997
2. Framework for a National Aerodrome Master Plan, 26 February 1997
3. Situational Assessment of Namibian Aerodromes, 27 May 1997
4. Final Report on Road User charges, 28 May 1997
5. Draft Issues Report on Road Project Evaluation, 25 June 1997
6. Draft Issues Report on Road Classification, 7 October 1997
7. Road Planning and Budgeting in Namibia, A Guideline, October 1997
(Continued on page 4)

Figure 1.1 Main Structure of Study Outputs



Volume 1

Summary of Findings and
Recommendations



8. Funding the National Aerodrome Network, 26 November 1997
9. National Aerodrome Network, Implementation Report, 26 November 1997
10. Aerodrome Standards Report, 27 November 1997
11. Draft Report on Traffic Forecast, 5 December 1997

12. Draft Guideline on Contracting of Routine road Maintenance, 3 December 1997
13. Proposal for Reclassification of Proclaimed Roads in Namibia, April 1998

Important background documentation considered during the Consultant's work is:

- White Paper on Transport Policy, 26 June 1995
- First National Development Plan (NDP1), Volumes I and II
- National Transport Development Plan, Step 1, Final Report, SOGREAH/SYSTRA, France, December 1996 (In the further text of this report called "The SOGREAH/SYSTRA Report")

A more comprehensive list of references used by the Consultant is contained in Appendix A.

1.2.2 Preparation of the National Transportation Master Plan

The actual preparation of the master plan was a joint exercise between the Ministry staff and the Consultant. In addition to a number of meetings with individuals in the MWTC and other ministries or agencies the following major events contributed significantly to the progress in the preparations of the Master Plan.

Date	Subject	Participants, excl. Consultant
5/11 1996	Review of current methods, instruments and procedures for road planning, etc (Tasks 3 & 4)	DOT Task Force G Seydack
5/12 1996	Workshop on Road User Charges	DOT+ Stakeholders
10/2 1997	ToR for Aerodromes Tasks 5, 14 and 15	FW Poolman, EH Lowe, B Zapke, DCA staff, DTIMC
11/4 1997	Inputs to the RUC Model	Zapke, Gericke, Detering, De Klerk, Seydack
21/4 1997	Workshop on Road User Charges	Poolman, Gericke, Seydack, Ravenscroft, Brock, Mundia, Stakeholders
14/5 1997	MWTC comments on Draft Final Report on RUC	Poolman, Gericke, Bruzelius, Ravenscroft

(cont.)

Date	Subject	Participants, excl. Consultant
9/7 1997	Workshop on National Aerodrome Network	Dep. PS, Poolman, Lowe, Zapke, DCA staff, Swart (MRLG&H), Stakeholders
23/9 1997	Road Planning and Budgeting	Lowe, Detering, Zapke
14/10 1997	Presentation of Draft Guideline for Road Planning and Budgeting	Gericke, Nel, Swart, Runji, Mvungi, Al Jaf

4/2 1998	Discussion on Road Classification	Lowe, Detering, Kiggundu, Swart, H. Hess (Stewart Scott Namibia), G. Nolting (Bicon),
6/2 1998	Discussion and DOT comments on Draft Guideline on Road Planning and Budgeting	Kiggundu, Gericke, Detering, Swart, Al Jaf, Seydack
25/2 1998	Workshop on Road Project Evaluation Methods & Feasibility Studies/Road Master Plans	Lowe, Gericke, Seydack, Thieman, Tekie, Iddi
26/2 1998	Presentation to DOT of Proposed Methods for Traffic Forecast	Gericke, Detering, Seydack, Tekie, Iddi
26/3 1998	Workshop on Strategies and Projects for Inclusion in the National Road Master Plan	Poolman, Lowe, Kiggundu, Gericke, Detering, Swart, Nel, Runji, Mvungi, Al Jaf, Thieman, Iddi, Mkwizu, Becker, du Plessis, Hartmann, Hundemer, H H Schmidt (NTAB), Seydack
3/4 1998	Workshop on Implementation of the National Aerodrome Network	Poolman, Kiggundu, Detering, DCA Director & Staff, MRLG&H, MOF
14/5 1998	Presentation of HDM-4 by Dr H R Kerali, University of Birmingham	DOT staff, private consultants
1/9 1998	Meeting on Implementation of the National Aerodrome Network	Poolman, Lowe, Zapke, Lourens, Oskarsson, Ngenomesho

2. NAMIBIA AND THE REGION

2.1 *General Economic Situation and Outlook*

From a national economy point of view Namibia is characterised by the contrasts and conflicts between being a middle income country and yet experiencing a high degree of poverty.

The following positive economic factors can be noted:

- Large resources in minerals and fish
- Developed infrastructure
- Political stability
- Priority on education and health
- Promotion of the private sector

On the negative side there are:

- Extreme income inequality
- Poverty, especially in rural areas
- Unemployment and underemployment
- High dependency on extraction of natural resources
- Very small manufacturing sector
- Fluctuations in outputs from agriculture and fishing due to the climate

Despite a prolonged drought and a sustained world and regional recession during the early 1990's Namibia has achieved a modest but firmly positive average rate of economic growth during the years since Independence. This average growth rate, however, has been too low to significantly improve per capita income, and has been based mainly on primary and Government sectors whose potential for future growth is extremely limited. The slow structural change in the economy has resulted in the economic growth not being translated into employment creation on a large scale and has consequently not led to any significant poverty alleviation and changes in income distribution. The following trend has been noted over the last 15 years:

- Stagnation in the agricultural sector which employs half of the labour force
- Steeply declining mining sector
- Slowly growing manufacturing sector, mainly confined to the processing of agricultural and mineral raw materials
- Strongly expanded public sector, despite being recognised as having an adverse impact on the private sector development

In the absence of any significant and substantial direct foreign investments and with a limited investment capital base, growth will likely remain stagnant for some time.

The GRN has recognised the need for foreign capital and has therefore created the Investment Centre, an agency designed as a “one stop shop” for foreign investors and created Export Processing Zones that offer very attractive fiscal advantages for manufacturers. These investment incentives, political will, the relatively good overall development, good infrastructure and good communication systems should form a solid platform for positive development of the national economy.

The Namibian economy is highly dependent on exports and imports. Except for 1996, and more recently in 1998 when the South African Rand was depreciated against major currencies the trade balance has been slightly in the surplus since Independence. The Namibian currency is linked to that of South Africa. No high trade deficits are foreseen in the medium term.

2.2 *Namibia in the Regional Economy*

The Southern African economy is dominated by South Africa and the region's economic performance is heavily influenced by that country. Important natural resources in Namibia, such as diamonds and uranium, are typically controlled by South African and other foreign groups. Since Namibia lacks the market size and economies of scale necessary to start manufacturing products currently imported from or via South Africa, attempts to add value to existing indigenous resources have been slow. The most significant achievements have been made in the fishing industry which is modern, equipped with state-of-the-art technology and managed by people skilled in international marketing. An important driving force in that development has been the injection of foreign capital and know-how.

The convenience of having South African manufactured consumer goods available next door at competitive prices, primarily as a result of the weak Rand, seems to be one of the reasons behind the relatively poor efforts to create an indigenous manufacturing industry. It is somewhat surprising though that even the large cattle ranching industry, despite favourable conditions for exporting to Europe, has barely managed to fill its beef quota to the EU. A large amount of cattle is sent live to the RSA with minimal added value for Namibia.

The insular mentality which seems to affect the local industry negatively must be changed into a more open attitude to international exchange of knowledge and information. Although the efforts of the GRN are important, no government can by itself create the necessary development. The firm base for positive economic development must be a knowledgeable, forward looking private sector which can produce local goods and create employment.

Further information on the economy can be found in the recent ‘Overview of the Namibian Economy’, January 1998, by the Namibian Economic Policy Research Unit (NEPRU).

2.3 *Population and Employment*

In Table 2.3.1 below, employment data from the 1991 Censusⁱ are shown. The regional differences are clearly indicated and there are also large discrepancies in income between the regions. In general the regions in the north have the lowest income per household.

Not surprisingly, these are farming communities which generate little surplus. In contrast, Khomas has a more diversified industry and subsequently the highest household incomes are found in this region.

The population growth is more than 3 % per annum which reduces the per capita economic growth to a level which will not be enough to overcome poverty in the short to medium term. The over-supply of labour on the market will therefore become more serious during future years. Namibia will face many challenges in meeting the objectives of creating employment, at the same time developing a streamlined and efficient public sector, considering affirmative action, and international competition.

Table 2.3.1¹ Regional employment (in thousands) and average income

Region		Caprivi	Erongo	Hardap	Karas	Khomas	Kunene	Ohangwena	Kavango	Omaheke	Omusati	Oshana	Oshana	Oshana
Agriculture, hunting, forestry	A	17,80	3,44	5,88	4,28	3,85	13,31	27,06	23,79	8,40	36,75	12,28	17,93	12,35
Fishing	B	0,99	0,10	0,00	0,93	0,03	0,00	0,17	0,02	0,00	0,32	0,15	0,09	0,01
Mining and quarrying	C	0,03	2,49	0,05	6,05	0,96	0,09	0,46	0,31	0,01	0,58	0,43	2,34	0,89
Manufacturing	D	0,77	1,22	0,56	0,69	5,08	0,34	3,32	0,68	0,26	2,91	2,31	1,79	2,98
Electricity, gas, water	E	0,10	0,18	0,18	0,15	0,85	0,22	0,12	0,13	0,19	0,15	0,18	0,07	0,45
Construction	F	0,72	1,78	2,13	1,01	5,40	0,82	0,65	0,64	0,53	1,11	1,77	0,56	1,53
Wholesale and retail trade, veh.rep	G	1,08	1,99	1,41	1,56	10,04	0,91	2,11	1,34	0,85	3,13	4,90	1,98	2,49
Hotels and Restaurant	H	0,14	0,52	0,20	0,39	1,15	0,51	0,07	0,06	0,08	0,03	0,19	0,25	0,45
Transport , storage, communication	I	0,14	0,48	0,49	0,96	4,26	0,19	0,14	0,13	0,27	0,17	0,49	0,36	1,25
Financial Intermediation	J	0,12	0,22	0,18	0,22	2,32	0,06	0,01	0,18	0,08	0,01	0,18	0,10	0,26
Real estate, renting, business activities	K	0,11	0,26	0,13	0,11	3,05	0,07	0,03	0,15	0,09	0,06	0,17	0,10	0,30
Public adm., defence, soc. security	L	1,59	1,05	1,05	1,59	8,93	1,17	0,67	1,65	0,77	0,69	2,64	0,62	4,73
Education	M	1,52	1,15	1,53	1,25	3,61	1,34	1,66	1,50	1,08	2,60	1,92	1,47	1,77
Health and social work	N	0,43	0,55	0,47	0,70	3,25	0,40	0,47	0,81	0,21	0,82	1,39	0,61	0,65
Other community, soc. & personal service	O	0,22	0,48	0,29	0,39	2,52	0,16	0,21	0,27	0,14	0,23	0,30	0,26	0,37
Private households with employed persons	P	1,02	1,79	1,94	1,71	6,63	0,89	0,28	0,63	1,64	0,51	0,82	1,18	2,81
Extra-territorial organizations & bodies	Q	0,01	0,02	0,00	0,00	0,56	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Not stated	R	0,05	0,09	0,06	0,05	0,24	0,03	0,07	0,06	0,02	0,10	0,08	0,09	0,07
Income/household, N\$ per year		7248	21055	22308	26991	47409	10583	6439	8944	17183	8441	10528	8689	13756

¹File employ1.xls, sheet 1991 Census

2.4 Institutional Framework

2.4.1 Southern Africa Customs Union (SACU)

This organisation covers Botswana, Lesotho, Namibia, South Africa and Swaziland. All trade between these five countries takes place as if they were part of one and the same country. Therefore, there are no customs duties or formalities between these countries.

2.4.2 Southern African Development Community (SADC)

This community, which was originally instated in order to meet the threats and dominating role of the former apartheid regime of the Republic of South Africa, has changed into a forum for development co-operation. The SADC community which now consists of 14 members, one of them being Namibia, signed a Protocol on Transport, Communications and Meteorology in Maseru, Swaziland, 24 August 1996. The general objective of the Protocol is to establish transport, communications and meteorology systems which provide efficient, cost-effective and fully integrated infrastructure and operations, which best meet the needs of customers and promote economic and social development while being environmentally and economically sustainable.

In the transport sector the following objectives shall be promoted:

- high performance standards and consistent levels of efficiency and reliability of all individual component parts of the transport chain;
- modal choice optimization, seaport hinterland optimization and with due regard to modal advantages;
- preservation of the region's transport infrastructure;
- encouraging the development of multimodal service provisions; and
- compatibility with responsible environmental management.

2.4.3 National Planning Commission (NPC)

The National Planning Commission was established in 1990 in accordance with the provisions of the Constitution. The NPC Secretariat was set up shortly after Independence and played an important role in the preparation of the First National Development Plan (NDP1). The Secretariat is now part of the Ministry of Finance and supervises and co-ordinates the development planning within the different sectors of Government. Annual development budgets are also processed through the NPC.

2.4.4 Namibian Regional and Local Government

Namibia is divided into 13 administrative regions and 29 districts with boundaries, organisation and powers in accordance with *inter alia*

- the Constitution of the Republic of Namibia (Article 102);
- the result of the First Delimitation Commission of Namibia on the Determination of Regions, Constituencies and Local Authorities;
- The Regional Councils Act, 1992; and
- The Local Authorities Act, 1992

Each region is governed by a Regional Council which shall have the power to undertake, with due regard to the powers, duties and functions of the National Planning Commission, the planning of the development of the region for which it has been established. This should be done with a view to *inter alia* the existing and the planned infrastructure, such as water, electricity, communication networks and transport systems in such a region.

Cabinet has approved a Policy for Decentralisation Development and Democracy according to which the key roles of central government will be overall national issues, such as

- policy making;
- overall control and monitoring of all national organs including Regional Councils;
- budget and other national economic development functions within which framework the regions and local authorities will carry out their own regional functions.

The NDP1 recognises that for participative development, redressing of regional imbalances and sustainable development to take place, meaningful decentralisation has to be implemented as a matter of priority. The following assumptions have been the cornerstones of the policy:

- When people manage their own resources there will be less wastage and more responsibility;
- The closer to the point of service delivery the technical cadre is the cheaper the cost of such services; and
- The more people see of what their money is buying, the easier it will be to raise revenue.

It is recognised that all regions are not yet ready for decentralisation of the large number of possible functions and therefore the responsible Ministry (MRLGH) will develop a schedule for decentralisation in consultation with each region and level of local authority.

With this background it is obvious that the preparation of future transportation master plans needs to be made in consultation with the MRLGH and those regions which have developed their planning functions.

3. PRESENT TRANSPORT SYSTEM

3.1 The Regional Transport System

The National Transport Development Plan, Step 1, (SOGREAH/SYSTRA 1996) provides an excellent description of the regional transport system which links Namibia with surrounding territories and the sea.

The Namibian transport system is extensive and reaches most parts of the country by road, rail or air.

3.2 The Road Network

3.2.1 Road Lengths

The most recent data presented by DOT end of 1997 are shown in Table 3.2.1 below. Data on roads are also provided in the annual Statistical Abstract by the CSO.

Table 3.2.1 Public Road Network - Length of Proclaimed Roads by Road Class and Surface Type

<u>Road class</u>	<u>Total km</u>	<u>Bitumen Surface, km</u>	<u>Gravel, etc. km</u>	<u>Bitumen %</u>
Trunk Roads	3 959	3 862	97	97.5
Main Roads	9 612	1 298	8 314	13.5
District Roads	26 392	80	26 312	0.3
Farm Roads (estim.)	23 295	0	23 295	0.0
Total	63 258	5 240	58 018	8.3
Total, excl. farm roads	39 963	5 240	34 723	13.1

N.B. In addition, there are 2 533 km of proclaimed district roads which have not been built and are consequently not being maintained.

3.2.2 Present Road Standard

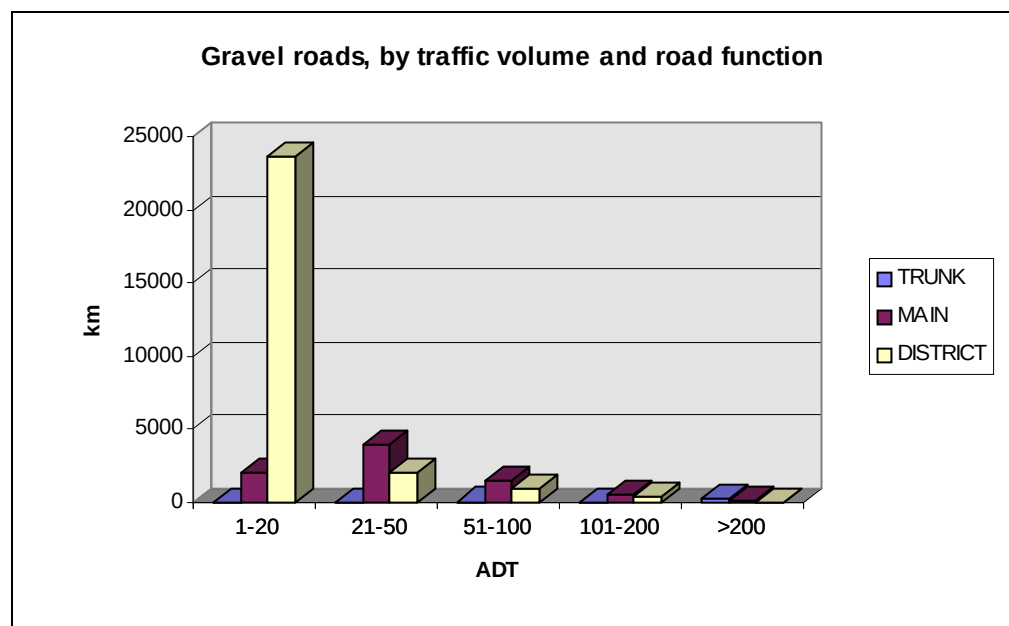
The main North-South axis by road connects the central parts of Namibia including the capital Windhoek with the South African border in the South and the Angolan border in the North.

The West-East direction is covered by the road links Walvis Bay - Windhoek - Botswana border at Buitepos (Trans-Kalahari Highway), Keetmanshoop - Lüderitz and Grootfontein - Caprivi (Trans-Caprivi Highway).

The current standard of the road system in relation to the traffic volume it accommodates will determine the needs in terms of routine maintenance, periodic maintenance and improvement of capacity in the road transport system.

Figures 3.2.1 through 3.2.5 illustrate the actual situation and may be seen as indicators for tentative needs. In relation to the vehicle km travelled, it is apparent that the high level of service on most gravel roads which has been provided to date, may be disputable. The large size of the country and its small population have however demanded this relative inefficiency.

Figure 3.2.1: Road types and road classes in relation to traffic volume



Very few gravel roads carry traffic volumes > 100 ADT

Figure 3.2.2: About 4000 km (11%) of the gravel roads have a traffic volume >50 ADT.

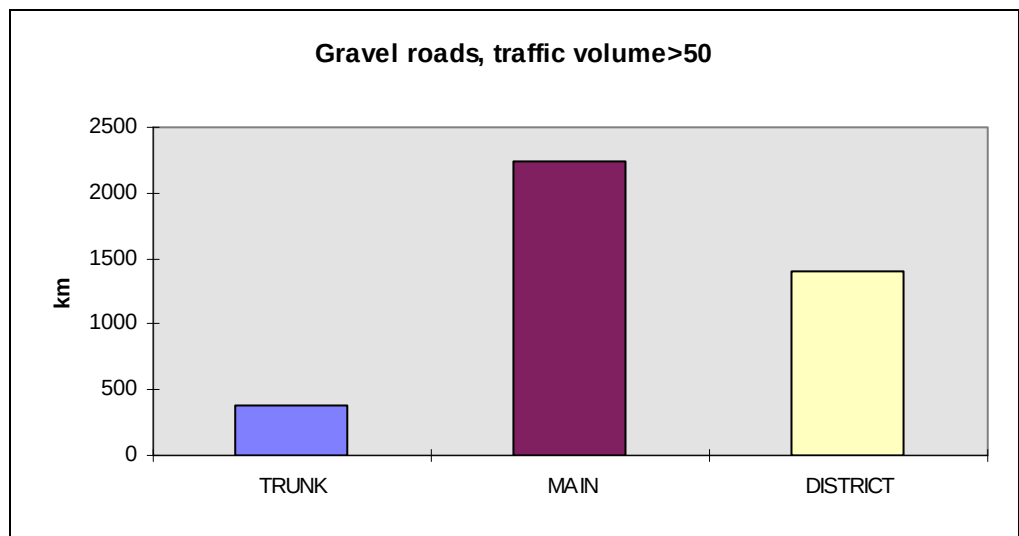


Figure 3.2.3: About 470 km (1,3%) of the gravel roads have a traffic volume >200 ADT (N.B. Before reclassification of TR 15/1 to Main road status)

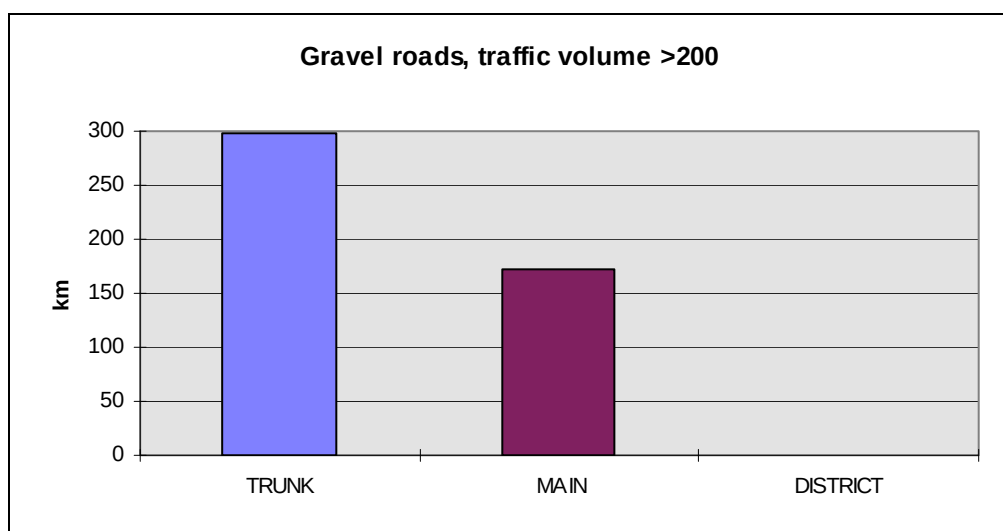


Figure 3.2.4: The average bitumen road has a traffic volume of 200-1000 ADT

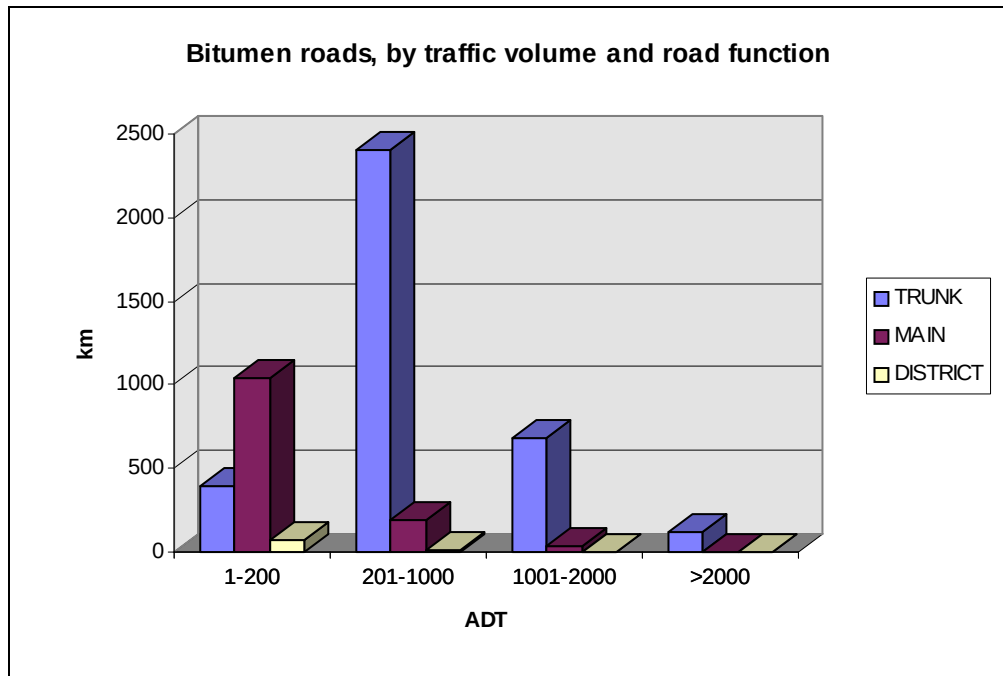
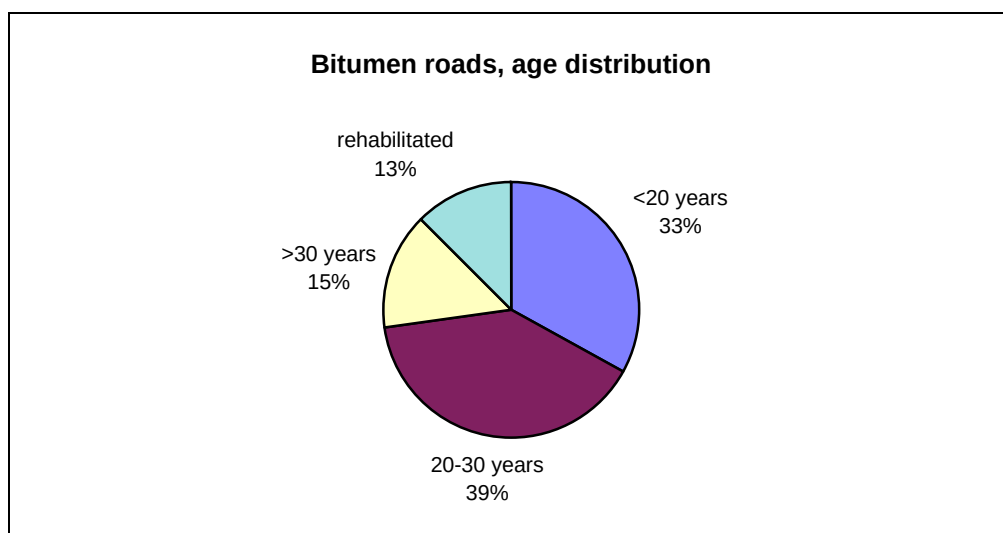


Figure 3.2.5: Bitumen roads by age



Of the roughly 5,000 km of bitumen roads in the country, 2,810 km were completed more than 20 years ago. About 1100 km of these have not yet been rehabilitated although they are more than 30 years old. To date, about 650 km of road have been rehabilitated or have received a major overlay.

Appendix B contains more details on the present standard and status of the trunk and main roads in Namibia.

3.2.3 Bridges

The DOT data base in the Bridge Management System (BMS) contains 533 items. Some of the items no longer exist or have been replaced. Others have been designed but not built. The vast majority of the existing bridges are made of reinforced concrete. No proper follow-up of the data base has however been made lately, which renders the data not quite reliable. On the other hand, a detailed bridge inspection programme is in progress since 1995, which provides information on items for monitoring and planning of repairs for each individual bridge on the trunk roads. For the purpose of the master plan an estimate of the status and quality of the bridges has to be limited to a few simple parameters, such as design loading and width. Table 3.2.2 gives a summary of the existing bridges.

Table 3.2.2 Number of Existing Bridges on Trunk, Main and District Roads by Width (m).

Road Class	No of bridges	W	I	D	T	H	> 10.00
		< 4.00	4.01 - 6.00	6.01 - 7.00	7.01 - 8.52	8.53 - 10.00	
Trunk	209	1	1	44	6	117	40
Main	164	14	1	3	8	130	8
District	18	6	0	4	0	8	0
Total	391	21	2	51	14	255	48

The number of sub-standard bridges (width between kerbs < 8.53 m) is 88

There are also bridges, which for other reasons such as structural problems, do not meet the standard requirements.

Furthermore, the implications of increasing the standard permissible axle load up to 9.0 tonnes, which has been done in the RSA, have not been considered here. This would namely require an in depth study into the actual design loads for each individual bridge.

For more details on bridge data see Appendix B.

3.3 The Railway System

3.3.1 Railway Network

The National Transport Development Plan, Step 1, (SOGREAH/SYSTRA 1996) provides sufficient details on the railway system. A few data in summary are mentioned below.

The railway network covers 2 380 km connecting Windhoek and Gobabis with Tsumeb/Grootfontein/Outjo, Walvis Bay, Lüderitz, and RSA via Ariamsvlei in the South. The weight of the rails varies from 22 kg/m or less on sections that have never been renewed since they were first built (approx 1914-1925) to 48 kg/m or more according to the following distribution.

≤ 22 kg/m	13 %	of the network
30 kg/m	47 %	of the network
≥ 48 kg/m	40 %	of the network

The gauge is 1067 mm which is the dominant gauge in southern Africa. Some of the latest upgraded sections with 48 and 57 kg/m rail weight have also been continuously welded (CWR).

The sleepers are made of steel, wood or monolithic concrete. The permissible axle load is 16.5 tonnes on the main lines while on the secondary lines it is limited to 11.5 and 13.5 tonnes.

The maximum speed is set to 60 km/h, although some trains with certain wagons are allowed 70 km/h.

The network includes 146 bridges between 9 and 280 metres long. The longest bridge spans the Swakop river at Okahandja.

The rail system is mainly focused on goods transport but also accommodates passengers. There are at present regular passenger train services combined with goods trains (Star line service).

The slow movements (normally 60 Km/h) of combined freight and passenger trains is a deterrent factor in terms of passenger attraction. Recently (April 98) a special luxurious tourist train called the Desert Express started operations between Windhoek and the coastal resort Swakopmund. Another tourist train, called Shongololo Express is being leased and operated by a private tour operator.

3.3.2 Rolling Stock

The **locomotive** fleet includes 49 units with an output of 1340 to 1605 kW built by General Electric (GE) USA. The average age is 28 years. A

programme of rebuilding fifteen units was started during 1995 and four have already been completed. Due to the static freight market mentioned further in chapter 3.6 the number of active locomotives were reduced to 43 units.

The **goods wagon** fleet numbers 1625 with an average age of 23 years. The capacity is ranging from 20 to 44 tonnes and an axle load not exceeding 16 tonnes.

The wagons are bogie type and fitted with a central automatic coupling device and vacuum braking system. A bogie conversion project is currently in progress whereby the existing Spoorbaber-bogies are upgraded to run at higher speeds - up to 100 km/h.

The **coach fleet** numbers 139 of which 32 are non earning. The average age is 27 years. All the cars are fitted with bogies and vacuum brakes. They are of the following categories

- 1st and 2nd class mainline cars
- 3rd class cars
- parcel vans

3.4 The Road Vehicle Fleet

Detailed vehicle population and road use data were collected for 1990/91 and 1992/93 by other consultants for use in calculating initial road user charges for Namibia. The 1992/93 vehicle data and the growth from the 1990/91 data is documented in the Report on the Implementation of the Proposed Policy on Road User Charging in Namibia: Parts A and B, prepared by VWL Namibia Inc. in April 1994. Previous RUC calculations documented the difficulties of obtaining accurate vehicle registration information in the absence of a nationwide computerised vehicle registration and licensing system. Since the new nationwide vehicle registration system is now being developed but not yet completed, extrapolation of the 1990/91 and 1992/93 vehicle population and road use data has been used as the basis for this Study with the addition of Walvis Bay data after its integration into Namibia. A summary of vehicle data for 1993/94 and 1996/97 is shown in Table 3.4.1.

Table 3.4.1. The Namibian Road Vehicle Fleet

Vehicle Type	No. of Vehicles 1993/94	No. of Vehicles 1996/97
Motor Cycle	6,450	7,032
Car	61,175	66,691
LDV	52,079	56,775
Mini Bus	4,525	4,933
LGV	4,873	5,312
Bus	677	738
2 Axle SUT	2,119	2,310
3 Axle SUT	557	607
4 Axle Comb	711	775
5 Axle Comb	426	464
6 Axle Comb	212	231
7 Axle Comb	212	231
Caravan	4,502	4,908
Light Trailer	11,304	12,323
Other	1,970	2,148
Petrol	140,035	152,662
Diesel	11,757	12,816
Total	151,792	165,478

Legend

LDV = Light Delivery Vehicle (Gross Vehicle Mass < = 3500 kg)
 LGV = Light Goods Vehicle (Tare Mass < 5000 kg)
 SUT = Single Unit Truck
 Light Trailer = Trailer with a Gross Vehicle Mass < = 3500 kg

The data indicate an annual growth rate of the vehicle fleet of about 3 %.

3.5 Road and Rail Transport

3.5.1 Goods Transport

The SOGREAH/SYSTRA Study provides data on annual road goods transport in comparison with rail goods transport as shown in Table 3.5.1.

Table 3.5.1 Transport mode of common commodities. Tons transported annually²

Commodity	RAIL	ROAD
CATTLE MEAT		17 000
CEMENT	210 000	90 000
CLINKER		60 000
COAL	99 000	
COKE		28 000
COPPER	30 000	
COPPER CONC	179 000	24 000
COTTON		6 000
DIESEL	1 000	
FISH		6 000
FISH MEAL		60 000
FLUORSPAR CONC	60 000	60 000
GRANITE		12 000
LEAD CONC	38 000	32 000
LEAD INGOTS	30 000	
MACKEREL FROZEN		15 000
MAIZE		45 000
MANGANESE ORE	120 000	120 000
MARBLE	15 000	16 000
PILCHARD CANNED		35 000
POL	589 000	24 000
PYRITE	140 000	
SALT		200 000
SMALL STOCK MEAT		25 000
STEEL		14 000
SUGAR		24 000
SUNFLOWER OIL		3 000
WHEAT		35 000
WOOD		10 000
ZINC CONC	63 000	63 000
Total	1 574 000	1 024 000

²File goods1.mdb, table bas1, query commodity by mode

The following statistics have been provided by TransNamib:

Rail freight traffic over the years

	1991	1992	1993	1994	1995	1996	1997
Net tonnes (000 000)	1.68	1.70	1.68	1.68	1.73	1.76	1.59
Tonnes km (000 000 000)	1.20	1.23	1.11	1.07	1.08	1.08	0.97

3.5.2 Passenger Transport

The SOGREAH/SYSTRAL report provides sufficient information on this issue, some of which is summarised below.

Road transport by bus is offered by

- TransNamib Carriers
- INTERCAPE Mainliner
- NAMIB CONTRACT HAULAGE
- Bailey's
- ECOLINER

TransNamib and INTERCAPE each carry some 6000 passengers per month between the main cities and towns as well as to RSA. The number of passengers using TransNamib has been declining during recent years.

NAMIB CONTRACT HAULAGE transports about 13000 passengers per month, mainly between the Northern Regions and Windhoek/Walvis Bay.

Bailey's mainly provide commuter bus services between Windhoek and Rehoboth, serving a fairly large amount of passengers.

The majority of passenger transport by road however seems to be provided through unscheduled taxi and minibuss services.

The following passenger volumes have been transported by **rail** over the last few years:

	1991	1992	1993	1994	1995	1996	1997
Passengers (000)	215.18	159.34	125.32	91.87	110.46	123.77	122.927
Passenger km (000 000)	56.56	46.14	34.01	24.15	34.69	48.52	59.24

3.6 The Air Transport System

3.6.1 Present airport and aerodrome infrastructure

The following table indicates the approximate number of Namibian airports, aerodromes and landing strips per ownership category.

Owner	Number
MWTC (Airports Company)	8
MWTC (Operational)	22
MWTC (Non-operational)	34
MWTC Total	64
Ministry of Environment & Tourism	13
Municipalities/towns/villages	19
Private (commercial)	7
Private (other)	300 +
TOTAL	400 +

There are three groups of aerodromes which fall under the responsibility of MWTC:

- aerodromes to be commercialised through the Airports Company (8);
- further aerodromes currently ‘operated’ by MWTC (22); and
- aerodromes which were once active, but have now fallen into disuse and are not maintained (approximately 34).

Government ownership is divided between MWTC, the Ministry of Environment & Tourism and local authorities (municipalities, towns and villages). The Ministry of Defence and its Air Wing currently do not own or operate any aerodromes (*i.e.* there are no ‘military aerodromes’). Private ownership is made up of commercial ownership (eg mines and tourist lodges) and individual ownership (farmers).

The levels of facilities cover a broad spectrum, from Windhoek International (Hosea Kutako) Airport which handles intercontinental traffic, to purely general aviation traffic facilities encompassing nothing more than a landing strip (most private airfields).

For more details on the aerodrome network see NTMPS report Situational Assessment of Namibian Aerodromes, 27 May 1997.

3.6.2 Air transport volumes

The latest information on the overall air transport volumes is provided in the Facts Booklet, part of the Study on Commercialisation of Airports and Air Navigation Services in Namibia, July 1995, and the SOGREAH/SYSTRA

report. Table 3.7.1 gives details on a sample of airports and aerodromes in Namibia.

Table 3.7.1 Aircraft (ATM) and passenger (PAX) movements, 1995 and 1996

Airport/Aerodrome	Average ATMs per month		Average PAX per month	
	1995	1996	1995	1996
<u>New Airports Company</u>				
Windhoek Hosea Kutako	833	590	31 553	28 829
Windhoek Eros	2 704	1 967	8 272	7 983
Keetmanshoop	184	208	728	901
Ondangwa	160	145	240	n.a
Walvis Bay	331	356	5 069	6 071
Katima Mulilo (Mpacha)	128	n.a.	1 014	n.a.
Lüderitz	306	n.a.	1 642	n.a
Rundu	60	n.a.	300	n.a.
<u>Other aerodromes</u>				
Tsumeb	180	n.a.	580	n.a
Otjiwarongo	50	n.a	150	n.a.
Aminuis	10	n.a.	19	n.a
Bagani	5	n.a.	16	n.a.
Bethanie	< 1	n.a.	n.a	n.a.
Eenhana	9	n.a	57	n.a.
Gobabis	55	n.a.	116	n.a
Grootfontein	74	105	313	242
Kamanjab	7	n.a.	10	n.a.
Karibib	30	n.a.	70	n.a.
Khorixas	3	n.a.	16	n.a.
Mariental	20	n.a.	80	n.a.
Nepara	9	n.a.	24	n.a.
Okakarara	13	n.a.	36	n.a.
Opuwo	15	n.a.	105	n.a.
Oranjemund	20	n.a.	80	n.a.
Oshakati	160	n.a.	637	n.a.
Swakopmund	590	552	2 298	2 394

3.7 Transport Sector Management

3.7.1 The Present Ministry of Works, Transport and Communication

The MWTC is organised in the following three departments:

- Department of Administration and Centralised Support Services

- Department of Transport, which is sub-divided into
 - * Directorate: Transportation Infrastructure Maintenance and Construction;
 - * Directorate: Planning and Transportation Management;
 - * Directorate: Civil Aviation; and
 - * Directorate: Maritime Affairs
- Department of Works

After a rationalisation exercise, including the commercialisation of post and telecommunication services, during the years 1990-1993 the establishment of the Ministry was downsized to some 8 400 posts. During recent years the number of posts has been further reduced to about 7 500. In October 1997 the actual number of staff was 7 030.

3.7.2 The MWTC 2000 Project

The effects from the rationalisation exercise mentioned above being only marginal the Cabinet, following the recommendations of the White Paper on Transport Policy, launched a project for the restructuring of the MWTC called MWTC 2000. The main components of the restructuring are

- a) Reduction in staff to make the Ministry manageable;
- b) Clarification of roles and functions of the various posts and entities in the Ministry;
- c) Delegation of authority and identification of responsibilities for clearly specified and logically coherent areas of activity;
- d) The provisions of commercial services subject to cost recovery requirements, and within an organisational format that allows for the imposition of user charges; and
- e) Recruitment of competent staff and the development and implementation of human resources development (HRD) programmes to gradually fill posts in the Ministry required for policy formulation and regulation as well as monitoring of the different SOOEs.

The project is now well underway. The following milestones which pave the way for the implementation of the project are notable:

- Cabinet decision in July 1995 to introduce a Road User Charging System;
- Cabinet approval on 28 October 1997 for the establishment of a Namibian Airports Company, target date for operations June 1998, and the principles for a National Aerodromes Network (based on a proposal by the NTMPS);
- Cabinet approval on 28 October 1997 to implement a Roads Authority to manage the national road network; and
- Cabinet approval on 28 October 1997 to MWTC, in consultation with the Ministry of Finance, to continue with the establishment of the Road Fund Administration which will manage the Road User Charging system.

3.7.3 TransNamib Limited

In September 1996 the Cabinet of the Government of Namibia decided upon a restructuring of TransNamib Limited. The new structure of TNL will be defined as three autonomous companies, each operating under its own Board of Directors and executive management. The ownership of these companies will be placed in a new holding company TransNamib Holdings Limited, which will be responsible for the overall strategic and financial management of the group.

The three companies are

- Air Namibia (Pty) Ltd
- TransNamib Transport (Pty) Ltd
- TransNamib Properties (Pty) Ltd

TransNamib Transport (Pty) Ltd will entail the integration of the entire surface transport business of the former TransNamib Ltd with the emphasis on rail transport. The strategic aim of this new company will be the provision of a premium “door to door” transport service with focus on enhanced rail transport complemented by road transport.

The new organisation took over the responsibility from the first of April, 1998. Appointments of staff and details of implementing the new structure is presently in progress (May 98). The Department of Civil Engineering (infrastructure) has a staff of slightly less than 900 persons.

The organisation consists of five Business Regions and Departments. These Departments under the Managing Director are

- Business Development & Co-ordination
- Finance
- Human Resources
- Mechanical Engineering
- Civil Engineering
- Management Services/Pool of Expertise

3.7.4 The New Airports Company

The new company will manage the airports of Windhoek International and Keetmanshoop, and the aerodromes of Eros, Walvis Bay, Ondangwa, Rundu, Katima Mulilo and Lüderitz.

It will be financed through income from landing-, passenger and rental charges which entails that the users will pay for airport services and amenities. The income from these charges will be used to cover the costs of staff, maintenance and development of the resources belonging to the company.

The present airports management services carried out by the Directorate of Civil Aviation will be transferred to the Airports Company. The directorate

will however retain the tasks of licensing pilots and aircraft, as well as conduct investigations. Air Traffic Control and Aviation Security will also stay with the Ministry.

The Minister of MWTC will appoint a Board of Directors consisting of people from the private sector. The board must ensure that Government policy is adhered to and that the company is run on a profitable basis.

4. GOVERNMENT POLICIES

4.1 Existing Policies Influencing the Transport Sector

4.1.1 White paper on Transport Policy

The White Paper on National and Sectoral Policies quoted in the White Paper on Transport Policy (DOT 1995) includes *inter alia*:

”(i) sustained socio-economic development aimed at

- a) the eradication of poverty and the concomitant provision of better living standards for the people of Namibia*
- b) narrowing the income gap*
- c) facilitating agricultural and industrial development and other productive activities that will increase national income and reduce unemployment*

(ii) optimum utilisation of scarce resources”

The White Paper considers the promotion of efficiency (optimum utilisation...) to be the primary goal to create the economic growth necessary for the secondary goals connected to equity (sustained socio-economic development).

The White paper continues to advise that the means to achieve efficiency is by promoting competition in the transport sector. This is achieved by providing a regulatory framework which also takes into account environmental effects and safety.

Concerning the secondary goals of equity, the White paper argues that this is primarily achieved outside the transport sector.

4.1.2 First National Development Plan (NDP1) - 1995/1996 - 1999/2000

4.1.2.1 General goals

The First National Development Plan (National Planning Commission 1995) lists four National Development Goals.

- 1 Reviving and Sustaining Economic Growth*
- 2 Creating Employment*
- 3 Reducing Inequalities in Income Distribution*

4 Reducing Poverty

For each one of these goals a number of targets are set. For example the GDP growth target for the period 1995 to 2000 is set to 5% per year.

Of interest for the transport sector is the target to diversify export and import markets to reduce the share of trade with South Africa. No target number is however given.

The overall transport sector goal is to:

- ensure the availability of safe, effective and efficient transport services in the different transport modes.

This goal is broken down into:

- ensure that transport infrastructure is provided effectively and efficiently.
- ensure that transport services are operated efficiently.
- ensure that quality standards in transport are achieved and maintained

4.1.2.2 Road Sector Goals

"The Government is committed to redressing previous imbalances in the distribution of transport infrastructure and to giving high priority when considering new road projects to areas previously under-served."

In chapter 20 (NDP1, pp 297-318) on Transport & Communication the Department of Transport policy on effectiveness is explained (Box 20:1 Balancing Infrastructure and Vehicle Operating Costs to Optimise Total Transport Costs):

- All road projects - new roads, upgrading from gravel to tar - should be analysed in respect of their costs and benefits
- The expected volume and type of traffic on a particular road is the major determinant of the level to which the road should be constructed and maintained. Local conditions which affect costs - such as the quality of construction materials, the distances to quarries, the efficiency of maintenance operations, the cost of equipment and labour and weather conditions - can influence decisions about roads in specific areas.

For a more detailed description of the programme objectives see NDP1 Volume II pp 138-149.

4.1.2.3 Railway Sector Goals

The First National Development Plan (NDP1) covers the development of railways to a very limited extent. Thus the only railway sector goal mentioned

in the NDP1 is the completion of a railway construction to the northern border by the year of 2005.

4.2 *Changed or New Policies*

4.2.1 Road Sector Policies

As a result of the MWTC2000 Project a Roads Authority will be created to manage the national road network. The activities of the Roads Authority (RA) will be guided in accordance with the Roads Authority and draft Road Fund Administration (RFA) Acts. These new dispensations focus strongly on safety and economic efficiency and contains very specific processes which must be followed and which inevitably have preference over declared national goals. In order to conform to this legislation and to guide its management the RA will have to prepare its own corporate plan in which its core functions are formulated, based on commercially-driven principles.

The new legislation, however, also provides for projects and strategies which will be initiated from a socio-economic or strategic point of view, the so called “social roads”. The construction of these roads will essentially be dependent on funding from other financial sources than the Road User Charging System.

Typically, “social roads” will have a certain importance to road users but will not fully comply with the criteria for economic viability. Therefore it is envisaged that the construction of projects on these roads will be co-financed through a combination of road user charges and government revenue funds.

The Roads Authority, as official road agency of MWTC, will be responsible for the construction and maintenance of these roads as long as they are part of the national road network.

4.2.2 Railway Sector Policies

The restructured organisation of TransNamib Transport (Pty) Ltd (see Sub-section 3.7.3) will perform according to a new legislation defined in a draft Bill named “Bill to provide for the incorporation of a holding company to undertake, either by itself or through any subsidiary company, transport services in Namibia or elsewhere; and to provide for matters incidental thereto.”

The Bill defines, in general, the terms for the railway infrastructure in section 13 “Transfer of railway to State and management of railway”. In this section it is described that the ownership of the rail infrastructure is transferred to the State but will be managed by the Holding Company.

An “Agreement for the maintenance of rail permanent way infrastructure between the Ministry of Works, Transport and Communication and TransNamib Transport (Pty) Ltd “ is envisaged to be the main instrument for the State to monitor the relationship with TransNamib Transport.

This agreement stipulates more in detail the relationship between the MTWC as a buyer of rail infrastructure services and TransNamib Transport as a seller of these services concerning i.a. scope of work, financing, planning, accounts to be kept, organisation, training, quality requirements, subcontracting etc.

The financing of the services is defined in Chapter 6 including the following significant statement:

“For the five year planning, maintenance work such as routine maintenance and reinvestment work, shall be financed out of accrued revenue of the Transport Company. However , the Transport Company may enter into an agreement with the MWTC for financing certain upgrading projects of the rail permanent way infrastructure”.

The principle is thus that the existing budget of the Civil Engineering Department for maintenance and reinvestment, accrued within the Transport Company, is the equivalent to a fictive track fee or track user charge which could have been paid to the owner of the railway infrastructure for running of trains on the track by the train operator.

On ownership of new lines the Agreement states “... *the MWTC will have the right to enter into a separate agreement for maintaining new railway lines with the Transport Company or any other organisation.*” (underlining by the Consultant).

This also opens a possibility for future competition in the maintenance of railways as in the case of roads.

4.2.3 Air Sector Policy

The Government of the Republic of Namibia has through its Cabinet decided to secure the future functionality of a National Aerodrome Network. The NTMPS assisted in the preparations for the aerodrome network.

From various guiding documents, such as the Constitution, NDP1 and Decentralisation Policy, the following basic principles for the aerodromes policy surface:

- i) the safety of air transport is of paramount importance and remains the responsibility of Government, which implies that certain minimum standards with respect to infrastructure and personnel must be maintained;
- ii) the market mechanism will not always result in the required infrastructure facilities being provided where required, so that some level of Government intervention will remain necessary, but the nature and extent of such involvement needs to be reviewed; and
- iii) efficiency in aerodrome provision and operation should be improved through a more commercial approach.

The aerodromes policy is proposed to cover the distribution of aerodromes; appropriate standards for facilities, operations and maintenance; the responsibility for the provision of aerodromes; funding; and oversight and monitoring.

Regarding distribution, the following policy principles are proposed:

- i) For international strategic purposes, Namibia should be served by:
 - at least one point of intercontinental and international access; and
 - at least two regional access points providing access to neighbouring states.
- ii) For economic purposes, aerodromes should be situated:
 - at locations which are major centres of economic activity.
- iii) For the purposes of providing equitable access by air to the entire country, and to encourage regional and local empowerment, there should be aerodromes at:
 - each regional capital; and
 - locations in the country which will provide sufficient remote access. These aerodromes are to be situated at district capitals where these capitals are also centrally situated in such areas of remote access.
- iv) For aviation purposes specifically, there should be :
 - at least one centre which will serve as the domestic hub aerodrome and centre for aviation support services.

The resulting network of aerodromes referred in the Cabinet decision is presented in Appendix C.

Details on the standards, implementation and funding of the National Aerodrome Network are presented in Volumes 5 and 6 of the NTMPS.

5. FUTURE TRANSPORT NEEDS AND SYSTEM REQUIREMENTS

5.1 *Scenarios for National Development*

In the table below, basic assumptions have been summarised for three growth scenarios (Low, Medium and High Growth Scenario). Population and GDP growth are taken from the long term forecasts in the NDP1. In the Low Growth scenario the Low Population Growth rate has been assumed and employment growth commensurate with population growth. GDP growth is faster than employment growth due to increased productivity in non-primary sectors. Trade remains high as a proportion of GDP.

In the Medium Growth Scenario, the Medium Population Growth is assumed and employment forecasts are based on assumed growth in each economic sector. The GDP figure is taken from the NDP1 forecast and converted to 1996 N\$. Trade in proportion of GDP is expected to decline to become more in line with other economies in Southern Africa. Still, trade is higher than in the low growth scenario.

The High Growth Scenario uses the high population growth figures from the NDP1. It is estimated that employment and productivity is higher than in the Medium Growth. The increase in employment between 1996 and 2012 shall be compared to a projected increase in the economically active labour force in the ages of 15-65 years of about 500 000 during the same period.

The difference between the Medium and High Growth Scenario is not large. The more optimistic growth scenario implies that GDP targets are reached a few years earlier than in the Medium Growth Scenario.

Table 5.1.1³ Summary of scenarios

	All Scenarios	Low Growth	Medium Growth	High Growth
	Base 1996	Forecast 2012	Forecast 2012	Forecast 2012
Population (000)	1 650 000	2 600 000	2 650 000	2 700 000
Employment (000)	424 000	700 000	854 000	900 000
GDP N\$ Million (1996 Prices)	13 886	25 000	35 000	40 000
Exports N\$ Million(1996 Prices)	6 840	12 000	14 000	15 000
Imports N\$ Million(1996 Prices)	8 032	13 000	16 000	20 000
RSA Trade (Percent of total trade)	80%	75%	70%	65%
GDP/Employed	32 750	35 714	40 984	44 444
Trade/GDP	107%	100%	86%	88%
Employment/Population	26%	27%	32%	33%

5.2 Traffic Forecasts

Namibia has, in comparison with other countries in the region, a well developed transportation network particularly in relation to its small population. Traffic flows are generally low. Thus the focus within the forecasting period will be on maintenance and improvements of the present network rather than investments in completely new links. The main use of forecasts will therefore be as an input in a maintenance management system and for forecasting the need for pavement upgrading (i.e. gravel road to paved road, and rehabilitation). At the same time it is likely that one or two new road links will be introduced before the end of the forecasting period. Traffic forecasts will also be used for road user revenue projections.

A simple approach to forecasting is to base it on historic trends. A more complex approach involves demand modelling based on traffic generation, distribution, modal split and traffic assignment to the network.

Following a discussion of the advantages and disadvantages of these different approaches it was concluded to use a more refined technique on the trunk road network and to use a historic trend analysis for the low volume network. The latter represent 80% of the road network but account for only 20% of total traffic. Although the trend model is difficult to implement now it will be straightforward once the new traffic surveillance system is in place. For details see NTMPS Volume 3, Final Report on Traffic Forecast, containing results, methodology and a guideline for traffic forecasting in future. A sample forecast map is shown on in Figure 5.2.1.

³File gdp, sheet Summary

FIGURE 5.2.1

5.3 Economic Evaluation of Strategies and Projects

5.3.1 Basic Principles and Methods for Economic Evaluation

The present system for appraising and preparing projects in Namibia is comprehensive and well documented. The procedures set by the NPC in their Development Planning Manual for preparation of PIF's and budgets are informative and well prepared. It is expected that the present procedures can be applied in the new organisations but may have to be reviewed once responsibilities and duties of the various parties are established. The set-up of the new organisations may require more economical evaluations to prove the viability of each individual investment project or maintenance strategy.

The DOT Economic Evaluation Manual is aimed at providing guidelines for the economic appraisal of road investment proposals. It must be used by consulting engineers during feasibility studies and when updating economic indicators during the design process. The main purpose of the manual is to ensure uniformity in the economic evaluation of road projects so that the results of different studies are comparable.

The principles laid down in the two mentioned manuals are basically sound. The NPC Manual recommends the following three main approaches to measuring the viability of a project, *viz.*

1. Net Present Value (NPV)
2. Internal Rate of Return (IRR)
3. Benefit/Cost Ratio (BCR)

The third option uses the discounted NPV of benefits and costs as inputs.

The basis for the calculation are the benefits and costs associated with each project, discounted to a pre-set date, using a social discount rate. The choice of discount rate should ideally be made by those who provide the funds for the projects, *i.e.* the road users. The NPC and DOT manuals recommend a discount rate of 10 %, which is also the rate most frequently applied by international banks around the world, such as the World Bank. It is also the rate commonly used by private investors. For these reasons the Study Team recommends the use of a provisional discount rate of 10 % in the economic evaluations. When the road user charging system and the Road Fund Administration have been put in place the discount rate to be used should be established through a dialogue between the RFA and the road users.

It is the Consultant's view that the BCR is the easiest to understand and it is also being more commonly used, *e.g.* in the Project Evaluation Manual (PEM) developed by Transfund, New Zealand. In addition, in order to distinguish between projects with the same BCR the First Year Rate of Return (FYRR) is added to the evaluation criteria of the PEM.

For reasons of transparency and simplicity the Consultant recommends the use of a combination of NPV, BCR and FYRR in future project evaluation in Namibia. The IRR is difficult to calculate using a simple spreadsheet method. In principle it does not add to the information needed to rank projects by the other criteria and can therefore be restricted to those projects where it is specifically required by donors, etc.

Based on the Transfund PEM the consultant has prepared a set of simplified procedures for project evaluation which may be useful for preliminary economic evaluation and screening of packages of rural road projects which are simple and straightforward. They have also been found valuable for evaluation of road maintenance strategies, such as for blading at network level and regravelling.

In those cases where the evaluation methods mentioned above are not suitable, for instance in underdeveloped areas with very little or no traffic, a utility analysis is recommended to be used. This would be a typical instrument for the evaluation of so called social roads.

The same basic principles as for the economic evaluation of roads should apply to the development of new railways and aerodromes.

5.3.2 Evaluation Parameters

The DOT Economic Evaluation Manual makes many references to South African manuals and procedures. World Bank's Highway Design and Maintenance Standards Model (HDM-III) is also referred to. The vehicle operation costs in the CSIR programme COSTDATA are based on South African prices of vehicles, fuels, lubricants, etc. but can be calibrated for use in Namibia. However, COSTDATA offers too few options in terms of output data on different types of roads. It only provides data for four lane highways, two lane paved and two lane unpaved roads without specifying road roughness as an input. Thus, it is too limited for the purposes of this Master Plan. The Consultant has therefore prepared a set of evaluation parameters based on recent feasibility studies and master plans prepared by other consultants in Namibia. The most recent study is the Caprivi Roads Master Plan which is currently being prepared by VKE (Namibia) Inc.

The Study Team shares the opinion of that study that the most efficient, easy-to-understand and user-friendly software for calculation of Vehicle Operating Costs is the HDM-VOC. In those cases where a direct comparison was possible the outputs were in any case very similar to those from COSTDATA.

Other significant road user cost inputs for the economic evaluations are Time Costs and Accident Costs. Time costs are available from Namibian studies. Since the local basis for Namibian accident costs is very weak the use of South African accident costs is presently recommended.

Road Maintenance and Construction Costs have been prepared through this Study on the basis of available information on recent contract works in DOT.

The methodology and parameters for economic evaluation of road projects and strategies used in this Master Plan are contained in an updated version of the DOT Manual for Economic Evaluation, which forms part of the documentation of the NTMPS.

5.4 *Transport Infrastructure Requirements*

5.4.1 Road Maintenance Needs

5.4.1.1 General Approach

Without a full-fledged road management system (RMS) it is not possible to fully analyse or evaluate long term effects of different strategies as to maintenance standard assessments.

A full-fledged RMS would consist of the following main components, some of which already exist in Namibia although in simplified and sometimes obsolete form:

- Information Management and Control System
- Traffic Surveillance System (TSS, exists)
- Geographic Information System (GIS, under development)
- Pavement Management System (PMS, exists)
- Unpaved Road Management System (URMS)
- Bridge Management System (BMS, exists in simple form)
- Geometric Management System
- Costing System

Awaiting the further development of the RMS, routine maintenance, periodic maintenance, spot improvements or upgrading of roads to surfaced standards, shoulder surfacings, climbing lanes, etc., can with convenience be evaluated

through simplified evaluation models based on principally traffic volume and sound technical and economical judgements.

It is apparent that traffic volume is the major determinant of the economically viable standard levels for road maintenance. Some activities will yet be justified on other grounds e.g. preservation of capital investment.

The NTMPS Volume 2 on Road Planning and Budgeting in Namibia, describes in detail how maintenance needs can be expressed through a simplified approach and also gives recommendations for future system developments.

5.4.2 Road Network Development

The NDP1 is the foundation for road network development during the first few years of the planning period. The NDP1 contains the following:

- T&C 2 Planning studies
- T&C 4 Labour-based Construction and Maintenance
- T&C 5 Walvis Bay Trans-Caprivi Transport Corridor
- T&C 7 Gobabis-Grootfontein Link Road
- T&C 8 Development of Roads in Regions

which were considered as part of this Study. Planned projects, projects under study and new project initiatives undergo an economic analysis if no acceptable benefit/cost analysis can be presented. A ranking list strictly in accordance with the B/C-ratios can then be established.

The majority of road development projects will likely be initiated by traffic reaching critical levels from an economic (road user cost) point of view. Typical examples will be the widening of existing bitumen roads, surfacing of gravel roads and construction of gravel roads as replacement of tracks.

Since the Trans-Caprivi Highway is now nearing completion, only a few “new roads” are likely to appear in the period up to the year 2012, such as

- the Gobabis - Grootfontein Link Road;
- a link between Oranjemund and Aus or Lüderitz;
- the Windhoek Southern Bypass, and also perhaps;
- a shortcut between Windhoek and Walvis Bay through the Namib Desert;
- the Gobabis - Aranos road; and
- Divundu - Mohembo

5.4.3 Aerodrome Network Development

The principles for the National Aerodrome Network are explained in sub-section 4.2.3.

The development of airports and aerodromes within the responsibility of the Airports Company will be based on commercial principles. Studies on such development will fall outside the scope of this Study. Future projects will however have to be contained in the National Development Plans.

The majority of the non-commercial aerodromes within the framework of the National Aerodrome Network will basically only be maintained at the present level of standard.

Two potential targets for future development are the aerodromes at Tsumeb and Otjiwarongo where the length of the runways do not meet the standard requirements. These two aerodromes have been classified in the B category which should provide infrastructure for handling smaller aircraft (commuter type) and volumes, although not necessarily a point of entry into Namibia.

5.4.4 Railway Network Development

Railway traffic in Namibia has been in constant decline over the last fifteen years affecting both passenger and freight traffic. TNL has been subject to increasing competition from the road sector. There are many reasons for this development. One reason is the continuously improved road infrastructure allowing higher speeds which affect mostly passenger traffic, and increased axle loads for trucks (legal or illegal) which affects freight traffic.

This development generating increased traffic on the roads is rather universal and not unique for Namibia. While society has improved the road network over the years, the railways have only continued maintaining their infrastructure with sections built 90 to 150 years ago. The heavy investments needed to change the alignments of the track for higher speeds and to upgrade the track superstructure/bridges for increased axle loads, have often not been possible entirely within the economic framework for the railway companies.

Consequences on environment, pollution and road/air congestion effects, high accident rates on roads etc., were/are some of the reasons which attributed to changes in economic framework for the railways in many countries within the European Union.

The future development of the railways must be discussed in an environment where a fair balance between the different transport modes is established. This balance is not constant. It changes due to i.a. development in each mode, and politicians may decide to change the balance when needed in order to get the desired development.

Factors in this debate in favour of the railway could be environment and pollution effects, road congestion, road accidents rates etc.

Railways have the characteristics of high fixed costs and less variable costs. Railways are operating at their best where there are volumes to be transported of both passengers and goods. This would entail a lower limit for transported freight and passengers where it is economically justified to operate railways.

Within a Transportation Master Plan a special plan for the track network should be elaborated on, taking into account the possibilities/ potentials of the foreseen development of the country.

The plan must stipulate *i.a.* the design speed, the axle load, estimated volumes of passenger and goods, capacity of the tracks, opportunities of railways connections to the north and east etc. Competition factors against other modes of transport are punctuality and speed of trains and high axle loads. Socio-economic calculations using parameters obtained from the MWTC (See Section 5.3) must justify the proposals unless political/social factors direct otherwise.

One could assume that the present rail network is possibly too extensive for future estimated volumes of freight and passengers. The proposed and eventually accepted network in a Railway Master Plan should then be implemented, including the financial arrangements.

The definition of the future projects within the proposed railway network and calculation of its socio-economic values is a major task which should be carried out as a separate study with representatives from TransNamib Transporters and MWTC.

6. INVESTMENT OPPORTUNITIES

6.1 *Road Network Conservation and Development*

6.1.1 Strategies for Road Network Conservation

Currently there are no comprehensive tools nor sufficient data available to make a technical-economical evaluation of the long term effects of various strategic approaches on road maintenance in Namibia. The ongoing development of an RMS will include the development and implementation of a very much needed effective PMS. It will take a number of years to collect all the necessary data and calibrate the models before they will be useful for prediction purposes to any reasonable degree of accuracy. In the meantime a combination of empirical evaluation tools, based on local experience, and simplified cost-benefit are recommended.

The methodology for evaluation of strategies for road network conservation is described in detail in Volume 2 of the NTMPS and will not be repeated here. A summary of the evaluation process and the results of the evaluation is given below.

6.1.1.1 Routine gravel road maintenance

For a number of years the activities have been carried out mainly as blading of gravel road surfaces in Namibia (See 6.1.1.2 below). This approach is envisaged to continue.

6.1.1.2 Blading of gravel roads

Table 6.1.1 below is meant to be a preliminary tool to identify a maintenance standard for blading. The recommended blading frequencies are based on an economic evaluation, using the model described in the Economic Evaluation Manual.

The frequencies have also been set having in mind that there are certain minimum standard requirements related to the functional road classification for low volume roads (<10 ADT).

Table 6.1.1 Recommended optimal blading frequencies and volumes

Blading frequencies	ADT 1-10 no/year	ADT 11-20 no/year	ADT 21-50 no/year	ADT 51-100 no/year	ADT 101-200 no/year	ADT >200 no/year	Total blkkm
Min-Max	4	4-8	8-20	20-36	36-52	52	
Main	4	7	12	24	44	52	
District	4	5	12	24	44	52	
Gravel km	km	km	km	km	km	km	
Main	475	1601	4017	1524	545	172	
District	15197	5928	4620	1015	387	0	
Annual need	blkkm	blkkm	blkkm	blkkm	blkkm	blkkm	Total blkkm
Main	9,500	56,035	241,020	182,880	119,900	44,720	
District	243,152	118,560	221,760	97,440	68,112	0	
TOTAL	252,652	174,595	462,780	280,320	188,012	44,720	1,403,079

6.1.1.3 Regravelling

Regravelling should be made to the extent that gravel losses caused by traffic and climatic conditions are replaced on a timely basis. Research in Sub-Saharan Africa, including Namibia, 10-15 years ago offers a good basis for prediction of regravelling needs. The regravelling frequencies recommended in Table 6.1.2 are therefore deemed to be justified from technical and economical point of view. The reduction in average annual gravel replacement in Namibia from 1540 km per year between 1981 and 1988, to 816 between 1989 and 1993, to 572 between 1993 and 1996, and to 439 km during 1997/98 indicate the possibility of a serious backlog developing.

Table 6.1.2 Regravelling frequencies (no of years in between regravelling) and corresponding annual need.

Regravelling frequencies	ADT 1-50 Years	ADT 51-100 Years	ADT 101-200 Years	ADT >200 Years	Total km
Min-Max	11-50	9-40	7-13	5-9	
Main	50	15	8	5	
District	50	20	10	7	
Annual need	km	km	km	km	
Main	122	106	70	94	
District	515	51	39	0	
TOTAL	637	157	109	94	997

6.1.1.4 Routine Bitumen Road Maintenance

This group of activities described in detail in Volume 4 of the NTMPS must be evaluated on a basis of work volumes during previous years, adjusted in accordance with the degree of success in previous years. Since the bitumen road network has been generally kept in a good condition through routine maintenance it is deemed viable to continue within the same principal policy. Through the application of contracting of routine bitumen road maintenance during future years and collection of data on various links on the road network it will in future be possible to carry out more sophisticated evaluation of different strategies in this category.

6.1.1.5 Periodic Bitumen Road Maintenance

In Namibia most bitumen roads have a single seal plus a slurry seal (Cape seal) or alternatively plus a thin asphalt mix ("Koffiemoer"). There are only a few roads which have an asphalt premix wearing course, which were in general added as an overlay during rehabilitation operations. The optimum time interval between reseals is difficult to establish on a network level. Project identification must be based on road link related condition surveys. In general terms a reseal would be necessary every eight to twenty years, essentially depending on the following factors;

- pavement design (strength)
- traffic volume
- vehicle axle loads
- climatic conditions
- routine maintenance
- performance of existing surfacing

Namibia is a very dry and hot country with generally low traffic volumes. Less than 850 km of the nearly 5,000 km of bitumen roads carry traffic volumes >1000 ADT. For the majority of the bitumen roads, ageing will be the determining factor for the reseal interval. Due to the hot and dry climate with extremely high ultra violet radiation, weathering of the bitumen results in a brittle wearing course that often leads to extensive temperature cracking (block and transverse cracking). Preventive maintenance measures like timely rejuvenation sprays are therefore highly recommended. However, routine maintenance cracksealing is normally very effective on this type of surface damages and should not be neglected.

For planning purposes the appropriate reseal intervals will be presumed to be related to traffic volume for volumes >1000 ADT. For roads carrying less traffic the estimate will be based on a 15-20 year reseal cycle on average. A maintenance strategy for sealed roads, including routine and periodic maintenance crack sealing, rejuvenating seals and reseals, would then be provided for according to Table 6.1.3:

Table 6.1.3 Resealing intervals (years).

Action	ADT 1-200 Frequency	ADT 201-1000 Frequency	ADT 1001-2000 Frequency	ADT >2000 Frequency	Total (km)	Net total (km)
Rejuvenation spray	3 years	3 years	3 years	3 years		
Reseal or slurry seal	20 years	15 years	12 years	9 years		
Total km surf.road	1509	2603	721	127	4960	
Annual rejuvenation spray, km	503	868	240	42	1653	1331
Annual reseal, slurry seal, km	75	173	60	14	322	219

6.1.1.6 Rehabilitation of Bitumen Roads and Bridges

Rehabilitation should rather be regarded as a heavy maintenance action meant to bring back the original capacity, riding quality and strength to the particular road section before it will fail completely and calls for reconstruction. On a network level the screening and evaluation of rehabilitation projects can to some extent be done using the simplified methods recommended in the NTMPS. However, the justification of rehabilitation must, like for reseals, be made on the basis of detailed investigation of individual road links. Technical and economical factors will be taken into consideration before embarking on rehabilitation projects since they are often very costly.

From a long term strategic point of view the fact that a majority of the existing bitumen roads were built more than 20 years ago should be taken into account. Even though it may be economically feasible to postpone major rehabilitation works over most of the following 15 year period, it should be noted that this will eventually create a high demand when all those roads reach the age of 35-40 years. It therefore in principle seems wise to start some rehabilitation works at an earlier stage than theoretically required in order to smoothen the requirement for funds. Funds could alternatively be allocated to a “rehabilitation fund” for use when economically justified. The big variation in rates of construction of bitumen roads in the past however predict bottlenecks in the private sector’s capacity to deal with large scale rehabilitation work if not spread over longer periods.

The point of departure for identification of the annual needs for rehabilitation of bitumen roads were the rough criteria proposed in a draft version of the guideline on road planning and budgeting. This top-down approach was however regarded as not accurate enough for the preparation of a program for rehabilitation in the medium term. Therefore, the information contained in the Pavement Management System of DOT was utilised.

The period up to the year 2012 was covered by the The Study Team by preparation of the following long term scenarios based on the PMS data for discussion of the five year estimates:

1. NTMPS Optimistic Strategy
2. NTMPS Conservative Strategy
3. DOT PMS Strategy

For details see NTMPS Volume 2 sub-section 5.5.2. A summary of the recommended strategy is shown in Appendix J of Volume 2.

A number of bridges need attention because of structural deficiencies. During general bridge inspections between 1990 and 1993 a number of “suspect” bridges were identified and on the basis of the general inspections 23 bridges were inspected in detail. Some have been rehabilitated in the meantime, eight still need rehabilitation and the rest were found structurally sound. The following rehabilitation projects still remain to be implemented urgently in order to avoid severe traffic problems due to bridge failure:

Priority 1

B0191 - Swakop River Bridge on TR 2/1 at Swakopmund

B0316 - Korabib River Bridge and B0294 - Gamkap River Bridge both on TR 1/1

Priority 2

B0411 - Road over Rail Bridge at Arandis on TR 2/2

B0030 - Swakop River Bridge at Okahandja on TR 1/6

B0328 - Road over Road Bridge at Karibib on TR 2/3

The following bridges need to be monitored on a regular basis but do not need immediate replacement or rehabilitation:

Priority 3

B0250 - Swakop Road over Rail on TR2/2 (awaiting road realignment in Swakopmund))

B0383 - Ugab River on TR 2/5 (Small number of heavy traffic)

6.1.1.7 Concluding Remarks on Road Conservation Strategies

As seen from the contents of sub-section 6.1.1 above the proposed maintenance strategies can only to some extent be supported by economic evaluation. However, since Namibian roads have been well kept in the past, a review of the various inputs during recent years should give some useful additional evidence and guidance for the future. It should be remembered that in the economic analysis for upgrading to bitumen standards, the implications of long term periodic and routine maintenance strategies for a road are already included. No separate additional economic evaluation will then be required to also prove the economic viability of the maintenance strategy selected. A study of the record of expenditure on roads in the past gives reason for the following comments:

- Despite increasing traffic the annual quantity of gravel road blading km has been fairly constant and also fairly close to the quantities recommended in Table 6.1.1.
- The annual regravelling quantities have fluctuated been 439 and 690 km, which should be compared with the almost 1000 km annually required according to Table 6.1.2 above. This should be a matter of great concern since it indicates that the present strategy will create a considerable backlog.
- No conclusions can be drawn from the resealing practices of the past since there has been only little but fluctuating activity during recent years. A regular future application of rejuvenation sprays might delay the need for reseals tremendously.
- The volume of road rehabilitation is increasing rapidly.

6.1.2 Screening and Evaluation of Road and Bridge Improvement and Development Projects

6.1.2.1 Screening process and results

The baseline for identification of road investments was decided by the following two main criteria:

- Only projects on existing or proposed new trunk and main roads are included
- Assumed economic viability based on expected traffic volumes

The actual project identification was supported by the following (not listed in any order of importance):

- The First National Development Plan (NDP1)
- Existing feasibility studies or design studies
- Master Plans
 - * Herero Roads Master Plan (completed)
 - * Ovambo Roads Master Plan (completed)
 - * Caprivi Roads Master Plan (completed)
 - * Kavango Roads Master Plan (in progress)
- ROAD PLANNING AND BUDGETING IN NAMIBIA, A guideline, June 1998 (NTMPS Volume 2)
- PROPOSAL FOR RECLASSIFICATION OF PROCLAIMED ROADS IN NAMIBIA, April 1998 (NTMPS)

- DRAFT FINAL REPORT ON TRAFFIC FORECAST, June 1998 (NTMPS Volume 3)
- DOT Traffic Surveillance System (TSS)
- DOT Pavement Management System (PMS)
- DOT Bridge Management System (BMS)
- Data of Tarred Roads (DOT Plan No. N 1475)
- Interviews with DOT staff

The screening resulted in the total road improvement “needs” on the existing trunk and main roads (including those district roads which were proposed by the NTMPS team to be reclassified as main roads) presented in Tables 6.1.4 and 6.1.5 below.

For trunk roads the existing carriageway width was selected as criterion to determine which roads are sub-standard, based on the current DOT standard cross sections, which are related to traffic volumes.

For upgrading (surfacing) of gravel main roads a Benefit/Cost Ratio of 1.0 was used as the main criterion for project selection. This selection process was however difficult because of all the uncertainties in terms of existing and future traffic volumes on those roads. Two alternative traffic growth rates were used in principle, a conservative 3 % per year and a more optimistic 5 % per year. The construction cost had to be treated very summarily, using two border cases. One was called “Low cost option” represented by a simple re-shaping of the existing gravel road (only minor adjustments of the alignment included), adding a basecourse layer and a 6.8 m wide single surface treatment, total financial cost of some N\$ 340 000 per km. The other one was called “High cost option” represented by the construction of a new road with 6.8 m surfacing on 9.8 m formation in accordance with the current DOT geometric standards. In the high cost option the existing road will as a rule not be incorporated in the new road but may be used for detours during construction, and where necessary utilising the existing road’s gravel in the side slopes of the new road. The financial cost of the high cost option is N\$ 760 000 per km (1997 price level).

It should be emphasised that this method of screening is just a rough tool for initial identification of potential projects. The existing criteria for selection of standard cross-sections can be questioned from an economic point of view. The South African Technical Recommendations for Highways No.17 (TRH 17) on geometric design for rural highways indicates that two lane roads could carry up to 6000 vehicles per day for a level of service C except where very high peak hour flows occur. This peak traffic situation actually occurs over long weekends, public and school holidays on the Windhoek - Okahandja, Oshakati - Ondangwa and Walvis Bay - Swakopmund links. The first step should however be to provide passing lanes which would likely make it possible to postpone the dual carriageway option for a number of years.

Table 6.1.4. Road Improvement Screening, Total km

Road Class & Present Type	Traffic Volume Design Criterion vpd	Required Standard Cross Section	Sub-standard km 1998	Sub-standard Add. km 1998-2005	Sub-standard Add. km 2005-2012
<u>Trunk Road</u>					
• Bitumen	300 - 1000 800 - 2000 1600 - 3300 > 3000	6.8/11.4 7.4/12.4 7.4/13.4 Dual CW	0 680 424 0	128 0 0 55 1)	0 0 0 67 2)
<u>Main Road</u>					
• Existing Bitumen	150 - 400	6.8/9.8	0	0	0
• New Bitumen	150 - 400	6.8/9.8	See Table 6.1.5	See Table 6.1.5	See Table 6.1.5
<u>New Main</u>					
• New Bitumen	150 - 400	6.8/9.8	See Table 6.1.5	See Table 6.1.5	See Table 6.1.5

- 1) TR 1/6 Windhoek - Okahandja
2) Walvis Bay - Swakopmund and Ondangwa - Oskahati

Table 6.1.5. Screening of Gravel to Bitumen Road, Total km

DOT Region	Annual Traffic Growth, %	Low Cost Surfacing	High Cost Surfacing
Keetmanshoop	2.5	Nil	Nil
Windhoek	5	909	7
	3	492	0
Swakopmund	5	1356	430
	3	509	74
Otjiwarongo	5	788	166
	3	234	125
Oshakati	5	401	25
	3	170	25

The total funds required during the period up to the year 2012 to cover the needs according to Tables 6.1.4 and 6.1.5 have been estimated as shown in Table 6.1.6 below.

Table 6.1.6 Estimate of screened road improvement costs

Road Class	Km of road	Unit cost per km	Total cost, m N\$
<u>Trunk Road</u>			
6.8/11.4	128	500 000	64.0
7.4/12.4	680	550 000	374.0
7.4/13.4	424	700 000	296.8
Dual CW 1)	122	2 000 000	244.0
Total Trunk Road			978.8
<u>Main Road</u>			
Low growth/High cost	224	760 000	170.24
High growth/High cost	628	760 000	477.28
Low growth/Low cost	1405	340 000	477.7
High growth/Low cost	3454	340 000	1174.36

1) Keeping the existing road, adding two lanes and one service road, one interchange per 20 km of road.

A simple data base on spreadsheet used as a starting point for the screening of road improvements is included in Appendix B.

Details on sample projects used as a basis for the screening process are presented in Appendix D.

Bridge development (improvement) projects were screened on the basis of the existing DOT Structures Manual in terms of bridge width in relation to road type. Table 6.1.7 below shows the result of that exercise.

Table 6.1.7. Screening of Bridge Improvements, Total Numbers and Million N\$

Road Class	No. of Sub-standard Bridges Width <8.53 m	Estimated total bridge area after widening, m ²	Total replacement cost, Million N\$ 1)	Total cost, Mill. N\$, of widening existing bridges 2)
Trunk	52	18,860	56.580	44.282
Main	26	25,116	75.348	58.968
District	10	9,936	29.808	23.328
Total	88		161.736	126.578

1) 9.2 m (total width) x 10 m (length of one span) x no. of spans x 3 000 N\$/m²

2) 4.0 m (widening) x 10 m (length of one span) x no. of spans x 5 400 N\$/m²

Details are given in Appendix B.

In order to check the level of funding of the potential road and bridge improvements presented above, a comparison with the anticipated expenditure within the future road user charging system must be done.

The total amount resulting from the screening exercise above for road and bridge improvements is in the order of N\$ 1 275.6 million to N\$ 2 314.9 million depending on traffic growth rate and design (on surfacing of gravel roads). All amounts above are presented at 1997/98 level.

Distributing the total amounts over a 15 year period gives a required annual amount for these improvements of some N\$ 85 to 155 million (1997/98 price level). The implications of such amounts on the future road user charges will be discussed in Chapter 7.

It can be debated whether surfacing of gravel roads should be regarded as maintenance or development projects. Gravel roads with relatively high traffic volumes could be given a bitumen surface simply in order to reduce maintenance costs.

If the alignment is acceptable from a safety point of view the low surfacing approach described previously could be applied. This type of low cost surfacing should therefore be funded under maintenance of gravel roads as a kind of betterment similar to upgrading of track to gravel road.

Upgrading of gravel main roads requiring major changes of the alignment on the other hand should be regarded as development projects.

New roads, such as the Gobabis-Grootfontein Link road, are not included in the amounts above.

6.2.2.2 Project Evaluation

Except for the largest projects identified during the screening process mentioned above the majority of the projects were evaluated using the Simplified Procedures, part of the Economic Evaluation Manual . The results of those analyses are presented in Appendix E. The following general comments to the evaluations are offered.

Vehicle operating costs, calculated through the HDM-VOC software, which play a dominant role in most of the evaluations are very dependent on road roughness values. They are also dependent on traffic volumes now and in future. Due to the many uncertainties in not only present traffic volumes but also future traffic growth it is advisable in all situations, before final decision on embarking on any project implementation, to revisit the facts underlying the project analysis.

Furthermore the actual costs of maintaining the existing road as well as a the various cost options for implementation of the project should be properly estimated for each individual project.

All evaluations in this Study have been based on general data on network level. All projects recommended here should therefore be preceded by a proper feasibility study taking into consideration not only the basic economic data and evaluations as illustrated in the analysis examples but also any intangible effects of each project. In

most cases, however, the simple tools for project evaluation used in this Study should be sufficient as a basis for decision.

The following projects, which are of a magnitude not suited for simplified evaluation procedures, must be evaluated by full feasibility studies outside this Study.

1. Gobabis - Grootfontein Link Road (Feasibility study of the section Gobabis - Otjinene done by Stuart Scott Namibia, March 1996);
2. Shortcut between Windhoek and Walvis Bay through the Namib Desert;
3. Upgrading to dual carriageway road or freeway of TR1/6 Windhoek - Okahandja

Only very rough estimates of the investment costs of those projects have been possible in this Study.

The Southern Windhoek Bypass has recently been studied by VKE and found not economically viable in the foreseeable future. It may nevertheless be regarded as necessary for instance for environmental reasons. The project will therefore be included in the total list of investment opportunities without further action within the NTMPS.

Over a 15 year period an average annual expenditure of N\$ 8.5 - 10.8 Million would be required in order to upgrade all the existing **narrow bridges** to the current geometric standards. The actual total amount for bridge development projects starting during 1998 is some N\$ 10.1 Million. This however, includes only N\$ 5.37 Million for widening of bridges (on TR 1/7). The balance is spent on two new bridges on TR 8/7 and repair of the bridge over Omuramba river on TR 1/10.

6.2 Railway Infrastructure Development

In an environment where the State takes the responsibility for the basic infrastructure, the same principles for planning of construction and maintenance in the different transport modes will apply. The short - and long term planning instruments would have the same framework concerning length in time and update/revision routines.

The proposed railway infrastructure investments in the plans should therefore be appraised using the same socio-economic calculation procedures as for other transport modes in order to be comparable. Guidelines for these calculations should be submitted by the MWTC.

6.3 Civil Aviation Infrastructure Development

The following three categories of development of the infrastructure for civil aviation needs to be considered:

- Class A and B (commercial) airports and aerodromes under the responsibility of the Airports Company, total eight locations;
- The remaining class B and C aerodromes within the network, total 33 locations; and
- Air Navigation System development which is the responsibility of the Ministry, in future likely to be given to a Civil Aviation Authority under the Ministry.

The future development of the eight commercial airports/aerodromes will be based on commercial principles. The following capital expenditure (N\$ x 1 000) for development with high priority has been identified at this stage:

Item	Windhoek	Eros	Walvis Bay
Buildings	3 590.4	1 044	2 721.4
Runways	40 463.6	2 436	3 436.6
Power/lights			
Finishings	24		
Equipment	600		27
Total	44 768	3 480	6 185

The Namibian Airports Company must ensure funding of these development projects based on financial benefit/cost analysis.

The existing runways at the non-commercial aerodromes at Otjiwarongo and Tsumeb may need to be upgraded to the appropriate standard for class B aerodromes at some stage. The runways at both aerodromes are namely too short compared to the requirements. However, current aircraft movements do not seem to justify the major investments needed for upgrading to class B standard.

No significant development of the remaining aerodromes in the National Aerodrome Network is envisaged in the short or medium term. Any improvement outside the necessary routine and periodic maintenance will have to be identified and financed on its own merits.

Based on changes in the network criteria, the standards index and/or the detailed standards, the national network may need to be updated (i.e. aerodromes added in, taken out or re-prioritised). It is proposed that this takes place once every five years.

The network review may result in specific aerodrome projects being identified. For each such project (if it can be executed in terms of the budget), a detailed design must be undertaken, a contractor engaged and the work carried out and supervised. As MWTC should attempt to limit its operational and executive duties, work resulting from the identification of a project should be out-sourced as far as possible.

Concerning Air Navigation Systems the most urgent problem to be attended to is the inadequate facilities for air traffic control (ATC) and information services for the Windhoek Flight Information Region (FIR) at Windhoek International Airport. All ATC and flight information services are presently being conducted from a single operator's position in the control tower at the airport. Aviation safety is thus being violated.

In a preliminary study by the Consultant ATNS Co. (C.D. Norval) it has been found that a new Area Control Centre (ACC) should be established at Eros Airport where surveillance and communication facilities will be provided at a number of operator's positions in order to ensure a safe and internationally acceptable ATC area control service in Namibian airspace.

The following expenditure has been assessed for the establishment of the facility:

<u>Financial year</u>	<u>1998/99</u>	<u>1999/2000</u>	<u>2000/2001</u>
Annual amount N\$ x 1000	200	1 230	48 040

A detailed project analysis as proposed by the DCA should be carried out soonest as a basis for a possible development project and further processing via MWTC to the National Planning Commission.

7 PROGRAMMES FOR IMPLEMENTATION

7.1 *Road Conservation and Development Programme*

7.1.1 Long term strategic plans to the year 2012

The criteria for long term (strategic) road planning were briefly discussed in Section 5.4 and described in detail in Volume 2, Road Planning and Budgeting. For road and bridge maintenance the proposed criteria can only be used as indicative and must be refined through further development of the Road Management System. Work volumes and funding levels presented below are recommended as a basis and indication for the strategic planning but need to be updated regularly in accordance with the requirements in the Road Fund Administration and Roads Authority Acts. The strategic plan should be updated every 3-5 years.

A: Routine maintenance

The annual amounts during the first few years are the same as those represented by an average over the last five years including 1997/98. These amounts may be conservative and could be questioned on the grounds that future maintenance under contract must be cheaper for efficiency reasons. However, the amounts are recommended as a point of departure for the new Roads Authority.

Blading represents the main activity in routine gravel road maintenance but also includes related sundries and overhead costs. The level of ambition is set at 1 400 000 blading kilometres per year which corresponds fairly well with the current level. This level has also been confirmed by the economic evaluation on blading frequencies at different traffic volumes.

B: Periodic maintenance

The amounts for rejuvenating sprays and reseals are based on the criteria proposed for the road network level in Volume 2. A stepwise phasing in from the present low annual amounts is recommended for the first two years of the plan.

The amounts for regravelling are based on the long term needs identified by applying the criteria in Volume 2 and the actual annual regravelling carried out in the past. It has been noted that the annual kilometres of regravelling have been substantially reduced during recent years. A backlog has thereby been created. This trend must be reversed to prevent serious problems with conservation of the gravel road network.

C: Rehabilitation and improvements

As a first approach, the point of departure for identification of the annual needs for rehabilitation of bitumen roads were the criteria proposed in Volume 2 sub-section 4.2.4. This top-down approach was however regarded as too inaccurate for the preparation of a program for rehabilitation in the medium term. Therefore, the information contained in the Pavement Management System of DOT was utilised. The Study Team prepared the following long term scenarios based on the PMS data for discussion of the five year estimates:

1. NTMPS Optimistic Strategy
2. NTMPS Conservative Strategy
3. DOT PMS Strategy

Tables and graphs showing the details on the various strategies are contained in Volume 2 Appendix J.

The rehabilitation programme also contains a number of bridges to be widened, replaced or strengthened during the period. The viability of the widening projects has been studied using the Simplified Procedures in the Economic Evaluation Manual.

Only two spot improvement projects of this type have been identified, namely climbing lanes on TR 1/5 between Aris and Windhoek on TR 1/6 between Brakwater and Teufelsbach - as a temporary measure awaiting a dual carriageway road between Brakwater and Okahandja. A long term provisional sum of N\$ 2.5 million per year is proposed.

The annual mounts for spot improvements on bitumen and gravel roads are just tentative and should be further developed by identification of projects through the RA regional staff.

The low cost surfacings of gravel roads have been identified on the basis of economic viability using the Simplified Procedures. The programming has been made in order to allow for more detailed studies on actual and future traffic volumes and costs, before final decision to go ahead with any of the projects. The programme is expected to provide some 70 km of bitumen roads per year.

D: Development projects

No major development projects are envisaged during the first five years. The projects on bitumen roads listed in the programme have been ranked in accordance with their B/C Ratios. The plan also contains a number of potential projects which may become feasible at a later stage, such as:

- New Trunk Road Otjinene - Grootfontein;
- Dual Carriageways between Brakwater and Okahandja, Walvis Bay - Swakopmund; and
- Ondangwa - Oshakati.

These are major undertakings which require detailed feasibility studies outside the scope of this study. Preliminary assessments indicate low BCRs within the next five years. Therefore these projects are not recommended for implementation until further studies have been made.

For the same reasons the new link between Windhoek and Walvis Bay is not proposed for implementation in the short term.

The Windhoek Southern Bypass which has been studied recently by VKE is not a viable project from an economic point of view.

Those projects which have not been studied through full feasibility studies as indicated in the plan were identified by the Study Team using the Simplified Procedures for Surfacing of Gravel Road or Road Widening. The comments on further detailed studies made in the Paragraph C above also applies to these projects.

The tentative amounts proposed for development of gravel roads are on the same level as the average for the last five years.

The long term strategies have been applied in the preparation of the five year plan in sub-section 7.1.2. There is not enough detailed information available to work out details after year five. Projects listed later than the financial year 2003/2004 should be analysed by more detailed feasibility studies in order to improve the basis for updating the strategic plan when required.

7.1.2 Draft Five Year Plan 1999/2000 - 2003/2004

A draft five year plan has been elaborated and is contained in summary forms selected from Volume 2, Guideline for Road Planning and Budgeting Procedures, as follows:

- Estimates of expenditure - Summary of five year plan. Including loans and grants;
- Estimates of expenditure - Summary of five year plan. Excluding loans and grants;
- Five year plan - Rehabilitation of Roads & Bridges. With and without loans and grants;
- Five year plan - Carriageway widenings;
- Five year plan - Spot improvements;
- Five year plan - Surfacing of gravel roads;
- Five year plan - New Roads and Bridges and Major Upgrading Projects. Including loans and grants; and
- Five year plan - New Roads and Bridges and Major Upgrading Projects. Excluding loans and grants.

7.2 Railway Developments

As mentioned in Chapter 5 a special plan for the railway network is proposed to be elaborated whereby the railway investment proposals are calculated on a socio-economic basis as in the case for road investments.

In such a plan developments that have been discussed within TransNamib, ITF, NDP 1 and the SOGREAH/SYSTRA reports should be considered. The most significant developments are the following:

7.2.1 Feasibility study

The most densely populated region in the North of Namibia has no railway connection. A feasibility study for an extension of the existing network from Tsumeb to Oshakati is presently (Sept. -98) being executed.

The most recent estimate indicates a total cost in Namibia of some N\$ 520 million (Sept. -98).

7.2.2 Other possible developments

Upgrading of the line from Windhoek to Gobabis to allow 18.5 ton axle loads and higher speeds.

Rough cost estimate: N\$ 150 million

Extension of the network from Gobabis eastward to join up with Botswana Rail network at Gaborone.

Rough cost estimate: N\$ 1 540 million

7.2.3 Increasing speeds and axle loads

In order for TransNamib Rail to become more competitive, effective and client friendly, higher speeds and axle loads should be accommodated, initially only between the Southern border and Walvis Bay.

Track work: upgrading

Cost estimate N\$ 96 million

On track equipment

Cost estimate N\$ 20 million

The existing Five Year Plan for Extra Ordinary Track Maintenance covering the years 1998/99-2002/03 elaborated by TransNamib Ltd is shown in Appendix F.

7.3 Sea Transport Development

The Terms of Reference do not require the inclusion of projects related to sea transport. However, at a late stage of the work the Study Team obtained a copy of a feasibility study for deepening of the Port of Walvis Bay. There was not enough time to penetrate the feasibility study in detail. It seems, though, that such a project, which appears to be financially and economically viable may have a significant influence on the future transport volumes on the road and rail networks in Namibia.

The Ministry must consider this when updating traffic forecasts in future, particularly for the Trans-Kalahari Development Corridor and road/rail connections to Northern Namibia, Angola and Zambia.

FIVE YEAR PLAN FOR ROADS AND BRIDGES

Appendix A. List of References

Appendix A. List of References

A. General

1. Statistical Abstract, 1996, No. 5, Central Statistics Office, National Planning Commission, Windhoek
2. 1991 Population and Housing Census, Central Statistics Office, National Planning Commission, Windhoek, December 1994
3. Human Resource Development in the Transport Sector, Exploratory Study, Hana Ardelius, ISO Swedish Management Group, September 1994
4. Department of Transport, General Brochure on Organisation, Policies, etc., March 1996
5. Corporate Plan 1996, Ministry of Works, Transport and Communication

B. Transport planning and policy

6. White Paper on Transport Policy, Republic of Namibia, Ministry of Works, Transport and Communication, Department of Transport, 26 June 1995
7. Transport and Communications in Namibia, Sida/SWECO, March 1990
8. The Institutional Framework of Rural Transport Infrastructure, Approach Paper, Christina Malmberg Calvo and Jerry Silverman, Sub-Saharan Africa Transport Policy Program, Working Paper No.17, October 1995
9. National Transport Development Plan, Step 1, Final Report (3 volumes), SOGREAH-SYSTRA, December 1996
10. Zimbabwe National Transport Study, Sida/SWECO, 1985

C. Economy and financing

11. TOWARDS FAIR AND EFFICIENT PRICING IN TRANSPORT, Policy options for internalising the external costs of transport in the European Union, 1996
12. Road maintenance and rehabilitation: funding and allocation strategies, Road Transport Research, OECD, Paris 1994
13. Vehicle Operating Costs, Evidence from Developing Countries, Andrew Chesher and Robert Harrison, The World Bank 1987
14. Vehicle operating cost tables, TRRL, U.K., 1986

15. Estimating Vehicle Operating Costs, Rodrigo S. Archondo-Callao and Asif Faiz, World Bank Technical Paper Number 234, Washington, 1994
16. Overseas Road Note 10, Costing Road Accidents in Developing Countries, TRL, U.K., 1995
17. African Road Funds: What Works and Why?, Anne Balcerac de Richecour and Ian G. Heggie, The World Bank and Economic Commission for Africa, Working Paper No.14, March 1995
18. Report of the Interministerial Committee of Technical Experts on the Proposed System of Road User Charges, Government of the Republic of Namibia, 23 August 1994
19. Introduction of a system of road user charging in Namibia, Ministry of Finance, 6 July 1995
20. Introduction of a system of road user charging in Namibia, Ministry of Works, Transport and Communication
21. Report on the road user charging system, phase I and II, Coopers & Lybrand, December 1995
22. Overview of the Namibian Economy, NEPRU, January 1998

D. Management and organisation

23. Investigation into Restructuring the Directorate of Transport, Infrastructure Maintenance and Construction, Executive Summary, Deloitte & Touche, October 1995
24. MWTC 2000, Project for the Restructuring of the Ministry of Public Works, Transport and Communication, Final Project Document, 12 June 1995
25. Report on a Review of the Governance of Parastatal Organisations in Namibia, Deloitte & Touche, March 1996
26. Commercialisation of Airports, Aerodromes and Air Navigation Services in Namibia, Lexetran et al., Facts Booklet, July 1995
27. A Proposal for the Restructuring of the Namibian Road Sector, Nils Bruzelius, 1996-03-31
28. Commercialisation of Airports, Aerodromes and Air Navigation Services in Namibia, Africon et al., Final Report, April 1996
29. Impact of Incorporating Air Navigation Services into the Proposed Namibia Airports Company, Africon et al., Final Report, July 1996

- 30. Investigation into the establishment of an operators' and professional drivers' association, Consilium Namibia (Pty) Ltd, December 1993
- 31. Directorate Transport, Infrastructure Maintenance and Construction, Working Document - Version 2, Deloitte & Touche, August 1995
- 32. The Roads Contractor Company, Corporate Strategy 1997 - 2000. Deloitte & Touche, October 1996

E. Development planning

- 33. Development Planning Manual for Namibia, Volume I - Principles and Techniques, National Planning Commission, July 1994
- 34. First National Development Plan (NDP1), Volume I, GRN
- 35. First National Development Plan (NDP1), Volume II, Sector 20 (Pages 131-153), GRN
- 36. Economic Evaluation Manual, MWTC/DOT, July 1994
- 37. Project Evaluation Manual, Transfund New Zealand, 1997
- 38. Manual for Cost-benefit Analysis in South Africa, Central Economic Advisory Service, April 1989

F. Road management

- 39. The Kenya road transport cost study: research on road deterioration, TRRL Laboratory report 673, 1975
- 40. The TRRL Road Investment Model for developing countries (RTIM2), Linda L. Parsley and R. Robinson, 1982
- 41. Rating Unsurfaced Roads, A field manual for measuring maintenance problems, US Army Corps of Engineers, August 1987
- 42. The Highway Design and Maintenance Standards Model, Volume 1, Description of the HDM-III Model, The World Bank, 1987
- 43. Road Deterioration and Maintenance Effects, Models for Planning and Management, William D. O. Paterson, The World Bank, 1987
- 44. Information Systems for Road Management: Draft Guidelines on System Design and Data Issues, W D O Paterson and T Scullion, The World Bank, September 1990
- 45. The Macroeconomics of Road Investment, John B. Cox, Proceedings of the 16th Australian Road Research Board Conference, 1991

46. Rural Roads Standards and Construction and Maintenance Methods, Report of a Visit to Namibia, A Buhrman & D Newill, August 1992
47. ROADS, A new Approach for Road Network Management and Conservation, United Nations Economic Commission for Latin America and the Caribbean, Santiago, Chile, June 1993
48. Secondary and Feeder Road Development Programme, Final Report, Zimbabwe Government, Ministry of Transport and Energy, Department of State Roads, Sida/SweRoad, November 1995
49. National Road Management Plan 1994-2003, Swedish National Road Administration
50. Annual Report 95, Swedish National Road Administration
51. Management and Financing of Roads, An Agenda for Reform, Ian G. Heggie, World Bank Technical Paper Number 275
52. Economic and strategic road planning - an introduction, Mats Andersson, Swedish National Road Administration, 22 August 1996
53. Road Management System Master Plan, V&V Consulting Engineers, Waterkloof, October 1996

G. Road maintenance

54. The Kenya Maintenance Study on Paved Roads: Optimum Maintenance Strategies, T E Jones, TRRL, 1984
55. Maintenance Management for District Engineers, Overseas Road Note 1, TRRL, 1987
56. Road Monitoring for Maintenance Management, Volumes 1-2, Road Transport Research, World Bank/OECD, Paris 1990
57. Maintenance of minor roads using the lengthman contractor system, T E Jones R C Petts, TRL U.K., 1991
58. Towed graders and tractor-based maintenance of low volume roads, R C Petts and T E Jones, Fifth International Conference on Low Volume Roads
59. International Road Maintenance Handbook, Volumes I - IV, PIARC, 1994
60. Highway maintenance - a neglected art?, A discussion paper by Malcolm F. Mitchell Pr.Eng, Deputy Director-General, Transport, South Africa, Member of the South African Roads Board, 1994

61. Urban Road Maintenance Model, Africon/WCE, undated

H. Road planning and design

62. Overseas Road Note 5, A guide to road project appraisal, TRRL, U.K., 1988

63. Overseas Road Note 6, A guide to geometric design, TRRL, U.K., 1988

64. Strategic Environmental Impact Assessment, Draft Chapter II, OECD Road Transport Research Programme, 15 January 1993

I. Budgeting

65. Development Budget for the Financial Year 1 April 1996 - 31 March 1997, National Planning Commission, Republic of Namibia

J Contract management

66. Conditions of Contracts for Works of Civil Engineering Construction, Parts I and II, Federation Internationale des Ingenieurs-Conseils (FIDIC) 4th edition 1992

67. Guide to the Use of FIDIC Conditions of Contracts for Works of Civil Engineering Construction, FIDIC, 1989

68. General Conditions of Contract, 1986 and updated January 1994, South African Committee of State Road Authorities (CSRA)

69. Standard Specifications for Road and Bridge Works, 1987, and as amended after that, (CSRA)

70. Procedures Manual, MWTC/VKE

71. Contracts for Road Maintenance, Works Agreements for Work by Direct Labour, (Contracting Out of Road Maintenance Activities, Volume II), World Bank and Economic Commission for Africa, May 1991

72. Managing Small Contracts, (Contracting Out of Road Maintenance Activities, Volume IV), World Bank and Economic Commission for Africa, April 1993

73. Sample Bidding Documents, Procurement of Works (Smaller Contracts) The World Bank, Washington, D.C., March 1992

74. General Conditions of Contract (AB 92) for Building and Civil Engineering Works and Building Services, Construction Contracts Committee, Stockholm

75. Managing Small Contracts, Practical Guidance on How to Streamline and Manage Small contracts for Public Works and Services, World Bank/Africa Region, April 1993

76. General Conditions of Turnkey Contracts (ABT 94) for Building, Civil Engineering and Installation Works, Construction Contracts Committee, Stockholm
77. Project Audit Procedures, ADB Management Information System in MCTPC (Ministry of Communication, Transport, Post and Construction), ACER Freeman Fox/SK Consultant, Lao PDR, July 1996

J. Legislation

78. Swedish Road Law (in English), No.948, 1971, 1994 update
79. Swedish Decree on Roads (in English), No.954, 1971, 1994 update
80. Road Transport Act of Malaysia, No.323, 1987
81. Land Acquisition Act, 1960 (Act 486), Laws of Malaysia
82. Proposal for a Road Law, Draft 20 November 1995, SweRoad, Vientiane, Lao PDR
83. Decree on Roads, Draft 22 November 1995, SweRoad, Vientiane, Lao PDR
84. Draft Road Traffic and Transport Bill, Draft 13/5/1996, Windhoek, Namibia
85. Advertising on Roads and Ribbon Development Ordinance (1960), Namibia
86. Roads Ordinance (Ord. 17 of 1972), Namibia.
87. Namibian Transport Advisory Board Act, 1991
88. Roads Authority Bill, May 1998
- Road Fund Administration Bill, May 1998

**Appendix B. Present Status and Standard of the Trunk and
Main Roads and Bridges in Namibia**

Appendix C. National Aerodrome Network

APPENDIX C
NATIONAL AERODROME NETWORK

Criterion	Location	Owner ¹	CPS Index ²		Population ³		ATMs ⁴		Total ⁵		Cumm ⁶	Class ⁷
Intercont. access	Windhoek	NACo	100	1	178 747	1	3	1	25.4%	1	25%	A
Domestic hub	Eros⁸	NACo	100	2	178,747	2	3	1	25.4%	2	51%	A
Regional access	Walvis Bay	NACo	42	3	29,776	4	1	3	7.6%	3	58%	A
Region HQ	Swakopmund	Munic										C
Region HQ	Oshakati	MWTC	18	4	43,321	3	1	3	6.3%	4	65%	C ¹⁰
Region HQ	Rundu	NACo	11	9	28,137	5	1	3	5.0%	5	70%	B
Region HQ	Keetmanshoop	NACo	13	7	16,727	10	1	3	4.5%	6	74%	B
Region HQ	Katima Mulilo	NACo	9	12	20,861	6	1	3	4.4%	7	79%	B
Economic centre	Lüderitz	NACo	15	6	9,269	13	1	3	4.3%	8	83%	B
Region HQ	Ondangwa¹⁰	NACo	4	16	19,766	8	1	3	3.9%	9	87%	B
Region HQ	Tsumeb¹¹	Pvte	17	5	18,746	9	0	11	2.4%	10	89%	B
Region HQ	Otjiwarongo	Munic	12	8	19,926	7	0	11	2.0%	11	91%	B
Region HQ	Gobabis	MWTC	10	10	9,831	11	0	11	1.4%	12	93%	C
Economic centre	Oranjemund	Pvte	10	11	9,359	12	0	11	1.3%	13	94%	C
Region HQ	Mariental	MWTC	9	13	8,702	14	0	11	1.2%	14	95%	C
Remote access	Khorixas	Munic	6	15	8,357	15	0	11	0.9%	15	96%	C
Remote access	Karibib¹²	MWTC	7	14	3,969	20	0	3	0.8%	16	97%	C
Remote access	Karasburg	Munic	4	17	5,331	16	0	11	0.6%	17	98%	C
Region HQ	Opuwo	MWTC	3	18	4,251	18	0	11	0.5%	18	98%	C
Remote access	Maltahohe	Munic	2	19	2,281	24	0	11	0.3%	19	98%	C
Remote access	Bethanie	Munic	2	20	2,051	25	0	11	0.3%	20	99%	C
Remote access	Okakarara	MWTC	-	24	4,526	17	0	11	0.2%	21	99%	C
Region HQ	Eenhana	MWTC	-	25	4,010	19	0	11	0.2%	22	99%	C
Remote access	Otjinene	MWTC	-	26	3,423	21	0	11	0.2%	23	99%	C
Remote access	Kamanjab¹³	MWTC	1	21	1,190	26	0	11	0.1%	24	99%	C
Remote access	Aroab	Munic	1	22	1,170	27	0	11	0.1%	25	99%	C
Remote access	Aminuis	MWTC	-	27	2,768	22	0	11	0.1%	26	100%	C
Remote access	Rosh Pinah	Pvte	1	23	1,004	28	0	11	0.1%	27	100%	C
Region HQ	Uutapi	MWTC	-	28	2,590	23	0	11	0.1%	28	100%	C
Remote access	Sesfontein	MWTC	-	29	907	29	0	11	0.0%	29	100%	C
Remote access	Otjituuo	MWTC	-	30	741	30	0	11	0.0%	30	100%	C
Remote access	Tsumkwe	MWTC	-	31	432	31	0	11	0.0%	31	100%	C
Remote access	Bagani¹⁴	MWTC	-	32	-	23	0	11	0.0%	32	100%	C
Remote access	Nepara	MWTC	-	33	-	24	0	11	0.0%	33	100%	C
Remote access	Okongwati	MWTC	-	34	-	25	0	11	0.0%	34	100%	C
Remote access	Terrace Bay	ME&T	-	35	-	26	0	11	0.0%	35	100%	C
Remote access	Okaukuejo	ME&T	-	36	-	27	0	11	0.0%	36	100%	C
Remote access	Rietfontein	Pvte	-	37	-	28	0	11	0.0%	37	100%	C
Remote access	Zais	ME&T	-	38	-	29	0	11	0.0%	38	100%	C
Remote access	Sesriem	ME&T	-	39	-	30	0	11	0.0%	39	100%	C
Remote access	Tweerivieren	Pvte	-	40	-	31	0	11	0.0%	40	100%	C

Notes on the table:

- 1 Owner: NACo = Namibian Airports Company
MWTC = Ministry of Works, Transport & Communication
Pvte = Private owner
Munic = Municipality, town or village
ME&T = Ministry of Environment & Tourism
- 2 CPS Index Results of Central Place Study carried out by Delimitation Commission
- 3 Population Population estimates for 1995 based on 1991 census
- 4 ATMs Air traffic movements (2: 20+ ATMs/week; 1: 5<ATMs/week<20; 0: 0<ATMs/week<5)
- 5 Total Weighted index of CPS, Population and ATMs.
Total = (CPS/SumCPS*Weight₁) + (Pop/SumPop*Weight₂) +

		$(ATM_i / \sum ATM_i * Weight_i)$
		Weight all equal 33% (ie even weights)
		(Please note: the ranks of 'CPS', 'Population', 'ATMs' and 'Total' are shown next to each value)
6	Cumm	Cumulative index
7	Class	Standard of facility.
		'A' facilities end with break between Walvis Bay and Oshakati
		'B' facilities end with break between Otjiwarongo and Gobabis (so that
		90% of the cumulative index is covered by 'A' or 'B' facilities)
8	Windhoek sphere also covers Okahandja and Rehoboth as district HQs. Eros is also a regional access point	
10	Ondangwa is superior facility to Oshakati	
11	Tsumeb sphere also covers Grootfontein as district HQ	
12	Omaruru (district HQ) falls within the sphere of Karibib	
13	Outjo (district HQ) falls within the sphere of Otjiwarongo	
14	Bagani (rather than Mukwe) because superior facility	

**Appendix D. Sample economic evaluation of projects as a
basis for screening**

Appendix E. Summary sheets of project evaluations

Appendix F. Railways

Five Year Plan : Extra Ordinary Track Maintenance

Estimates of expenditure																	Date	#####								
Financial Years 1999-2003.....																	Nation-wide/Region				Nation-wide					
Development projects																	Five year plan - New Roads and Bridges and Major Upgrading Projects Including loans and grants									
Rank	Road class T,M,D	Bridge or Road no	Project name	New Road Section	Conti- nuation /New	Total km	1997 ADT	1998 B/C ratio	Feasib. study Yes/No	Prel. design Yes/No	Detail. design Yes/No	Cost/ km N\$	Total cost N\$1000	Total exp. before Year 1	Funding Requirements - 5 year plan						Source of Finance					
															1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	Later	RFA	GVT	Donor	Other		
																N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	
			Commitments (incl. loans and grants)																							
			Gravel roads		Cont.											24 600	30 260	12 000.0	1 100.0							
			Bitumen roads		Cont.											93 650	9 450	620.0								
1	MR	44	Swakopmund - Henties Bay	7.4/12.4	New	74.0	450	5.4 1)	Yes			1 000 000	74 000				7 000	30 000	30 000	6 750	250	74 000.0				
2	MR	56	Gobabis - Drimiopsis	6.8/9.8	Cont.	29.0	130	1.7 2)	Yes			800 000	23 200				12 800	10 150	250		0	23 200.0				
3	TR	New	Drimiopsis - Otjinene	6.8/9.8	New	117.0	n.a.	1.2 2)	Yes			860 000	100 620					6 000	15 000	30 000	49 620	93 600.0				
4	DR	3403	Bagani - Mohembo	6.8/9.8	New	25.0	180	1.1	Yes	Yes		800 000	20 000		750	19 000	250				0	20 000.0				
	DR	3620	Okatana - Onuuno	6.8/9.8	New	11.0	75	0.9	?			300 000	3 300								3 300					
	MR	56	Maltahohe - Solitaire	6.8/9.8	New	214.0	65	0.8	No			300 000	64 200								64 200					
	TR	New	Otjinene - Grootfontein	6.8/9.8	New	173.0	n.a.	n.a	No			860 000	148 780								148 780					
	TR	1/6	Windhoek (Brakwater) - Okahandja	Dual CW	New	55.0	3 000	0.6	No			2 000 000	110 000								110 000					
	TR	2/1	Walvis Bay - Swakopmund	Dual CW	New	34.0	2 700	0.5	No			2 000 000	68 000								68 000					
	MR	92	Ondangwa - Oshakati	Dual CW	New	33.0	2 000	0.3	No			2 000 000	66 000								66 000					
	TR	New	Windhoek - Walvis Bay 3)	6.8/9.8	New	290.0	n.a.	n.a.	No			1 100 000	319 000								319 000					
	TR	6/1	Windhoek Southern Bypass	7.4/12.4	New			Negative 4)	Yes				0								0					
			New gravel roads																6 900	8 000	n.a.					
Total Bitumen Roads																	94 400	48 250	47 020	45 250	36 750	829 150	210 800			
Grand Total						1 055							997 100	0	119 000	78 510	59 020	53 250	44 750	829 150	210 800	0	0	0		
			1) Feasibility Study by VWL Namibia Inc., July 1992																							
			2) Feasibility Study by Stewart Scott Namibia, March 1996, alignment along MR56, DR1635, DR1612 and MR 70																							
			3) Connects to MR49 West of Windhoek (end of existing tar, Length = 8.5 km)																							
			4) Feasibility Study by VKE (Namibia) Inc., March 1998																							

Estimates of expenditure																			Date	#####					
Financial Years 1999-2003.....																			Nation-wide/Region				Nation-wide		
Development projects							Five year plan - New Roads and Bridges and Major Upgrading Projects Excluding loans and grants																		
Rank	Road class	Bridge or Road no	Project name	New Road Section	Conti- nuation /New	Total km	1997 ADT	1997 B/C ratio	Feasib. study Yes/No	Prel. design Yes/No	Detail. design Yes/No	Cost/ km N\$	Total cost N\$1000	Total exp. before Year 1	Funding Requirements - 5 year plan						Source of Finance				
															1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	Later	RFA	GVT	Donor	Other	
			Commitments (excl. loans and grants)												N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	N\$ 1000	
			Gravel roads		Cont.										12 325	19 130	7 000.0	1 100.0			39 555.0				
			Bitumen roads		Cont.										38 600	250					38 850.0				
1	MR	44	Swakopmund - Henties Bay	7.4/12.4	New	74.0	450	5.4 1)	Yes			1 000 000	74 000			7 000	30 000	30 000	6 750	250	74 000.0				
2	MR	56	Gobabis - Drimiopsis	6.8/9.8	Cont.	29.0	130	1.7 2)	Yes			800 000	23 200			12 800	10 150	250		0	23 200.0				
3	TR	New	Drimiopsis - Otjinene	6.8/9.8	New	117.0	n.a.	1.2 2)	Yes			800 000	93 600				6 000	15 000	30 000	42 600	93 600.0				
4	DR	3403	Bagani - Mohembo	6.8/9.8	New	25.0	180	1.1	Yes	Yes		800 000	20 000		750	19 000	250			0	20 000.0				
	DR	3620	Okatana - Onuuno	6.8/9.8	New	11.0	75	0.9	?			300 000	3 300							3 300					
	MR	56	Maltahohe - Solitaire	6.8/9.8	New	214.0	65	0.8	No			300 000	64 200							64 200					
	TR	New	Otjinene - Grootfontein	6.8/9.8	New	173.0	n.a.	n.a	No			860 000	148 780							148 780					
	TR	1/6	Windhoek (Brakwater) - Okahandja	Dual CW	New	55.0	3 000	0.6	No			2 000 000	110 000							110 000					
	TR	2/1	Walvis Bay - Swakopmund	Dual CW	New	34.0	2 700	0.5	No			2 000 000	68 000							68 000					
	MR	92	Ondangwa - Oshakati	Dual CW	New	33.0	2 000	0.3	No			2 000 000	66 000							66 000					
	TR	New	Windhoek - Walvis Bay 3)	6.8/9.8	New	290.0	n.a.	n.a.	No			1 100 000	319 000							319 000					
	TR	6/1	Windhoek Southern Bypass	7.4/12.4	New			Negative 4)	Yes			0								0					
			New gravel roads															6 900	8 000	n.a.					
Total Bitumen Roads															39 350	39 050	46 400	45 250	36 750	822 130	249 650				
Grand Total						1 055						990 080	0	51 675	58 180	53 400	53 250	44 750	822 130	289 205	0	0	0	0	
			1) Feasibility Study by VWL Namibia Inc., July 1992																						
			2) Feasibility Study by Stewart Scott Namibia, March 1996, alignment along MR56, DR1635, DR1612 and MR 70																						
			3) Connects to MR49 West of Windhoek (end of existing tar, Length = 8.5 km)																						
			4) Feasibility Study by VKE (Namibia) Inc., March 1998																						

Estimates of expenditure														Date	#####					
Financial Years 1999-2003.....														Nation-wide/Region		Nation-wide				
Rehabilitation & improvement														Five year plan - Rehabilitation of Roads & Bridges						
Bitumen Roads														With and without loans and grants						
Rank	Road class T.M.D	Bridge or Road no	1997 ADT	Project name	Continuation /New	Total km	Total km rehab prio 1	Width (m) exist bitumen/ bridge 1)	Cost/ km N\$	Total cost N\$1000	Total exp. before Year 1	Funding Requirements - 5 year plan						If applicable		
												1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	Later	Feasib. study Yes/No	Prel. design Yes/No	Detail. design Yes/No
	TR	1/7	1 200	Widening bridges Okahandja-Otiwarongo						6 000.0	4 800.0	1 200.0								Yes
	B	0125		Okonjoka River (6 spans)	Cont.															
	B	0185		Omatako River (4 spans)	Cont.															
	B	0187		? (4 spans)	Cont.															
	B	0188		Ovitua River (5 spans)	Cont.															
	B	0382		Okamita River (3 spans)	Cont.															
	TR	1/11	1 630	Oshivelo - Oshakati (loan)	Cont.	190	190			107 000.0	34 500.0	60 000.0	12 000.0	500.0			0.0			Yes
				Oshivelo - Oshakati (GRN)						17 000.0	5 000.0	12 000.0					0.0			
1	TR	8/6	460	Kongola - Katima Mulilo (part grant, part loan)	Cont/New	116	116	6.0		95 000.0	35 100.0	10 000.0	28 000.0	21 650.0	250.0		0.0			Yes
2	TR	8/3	260	Mururani - Rundu	New	131	85	8.0	480 000	40 800.0		4 000.0	30 000.0	6 550.0	250.0		0.0			
3	TR	1/11	350	Ondangwa - Oshikango	New	63	63	8.0	560 000	35 280.0		1 000.0	7 000.0	27 030.0	250.0		0.0			
				Rehabilitation of bridges	New															
4	TR	2/1		Swakop River in Swakopmund	New			8.5		3 000.0		3 000.0								
5	TR	1/1		Korabib and Gamkap Rivers	New			6.7-7.3		1 300.0		1 300.0								
6	TR	2/1		Arandis Road over Rail	New			11.0		1 500.0			1 500.0							
7	TR	1/6		Swakop River at Okahandja	New			8.6		1 300.0			1 300.0							
8	TR	2/1		Road over Road at Karibib	New			14.1		600.0			600.0							
9	TR	1/3	800	Wasser - Asab	New	78	40	6.3	560 000	22 400.0				2 000.0	20 150.0	250.0	0.0			
10	TR	1/3	1 090	Asab - Ebenerde	New	69	34	6.3	560 000	19 040.0					2 000.0	16 790.0	250.0			
11	TR	1/4	800	Kalkrand - Rehoboth	New	99	30	6.0-6.3	560 000	16 800.0						2 000.0	14 800.0			
12	TR	1/3	800	Keetmanshoop - Wasser	New	52	26	6.1	560 000	14 560.0							14 560.0			
13	TR	1/7	1 200	Okahandja - Sukses (selected reconstruction & overlay)	New	107	33	8.0	375 000	12 375.0							12 375.0			
14	TR	1/4	800	Mariental - Kalkrand	New	76	22	6.3	560 000	12 320.0							12 320.0			
15	TR	1/7	1 200	Sukses - Otiwarongo (selected reconstruction & overlay)	New	69	21	8.0	375 000	7 875.0							7 875.0			
16	MR	72	460	Tsumeb - Grootfontein	New	56	17	7.3-7.4	480 000	8 160.0							8 160.0			
17	TR	8/2	300	Taranaki - Mururani	New	50	21	8.0	480 000	10 080.0							10 080.0			
18	TR	2/3	1 200	Usakos - Karibib	New	30	2	6.1-6.3	560 000	1 120.0							1 120.0			
19	TR	2/3	425	Karibib - Omaruru	New	65	10	6.7	480 000	4 800.0							4 800.0			
20	TR	1/3, 1/4	800 - 1 500	Widening of bridges Keetmanshoop - Rehoboth																
				16 bridges (total 84 spans)	New			6.1-6.7		22 900.0			3 250.0	4 750.0	6 000.0	6 000.0	2 900.0			
Grand Total						1 251	710			461 210.0	79 400.0	92 500.0	83 650.0	62 480.0	28 900.0	25 040.0	89 240.0			
Grand Total (Excluding loans and grants)						1 251	710			n.a.	9 800.0	22 500.0	43 650.0	40 330.0	28 650.0	25 040.0	89 240.0			
1) Width between kerbs of bridges																				

Date		ESTIMATES OF EXPENDITURE - SUMMARY OF FIVE YEAR PLAN Including loans and grants									
1998-09-23											
Nation-wide/ or Region											
Nation-wide		Financial years			From:	1999/2000	To:	2003/2004			
Category	Road type	Activity	Expenditures in			1997/98	prices				
			Average last five years N\$ 1000	Actual year 1997/98 N\$ 1000	Approved budget 1998/99	Year 1999/2000 N\$1000	Year 2000/2001 N\$1000	Year 2001/2002 N\$1000	Year 2002/2003 N\$1000	Year 2003/2004 N\$1000	
A:Routine maintenance	Bitumen roads	Bitumen maintenance, incl.	25 000.0	32 500.0	32 100.0	25 000.0	25 000.0	25 000.0	25 000.0	25 000.0	
(Sundries + overhead costs included)	Gravel roads	road reserve maintenance									
		Gravel maintenance, incl.	57 300.0	56 400.0	55 800.0	57 300.0	57 300.0	57 300.0	57 300.0	57 300.0	
		road reserve maintenance									
SUBTOTAL ROUTINE MAINTENANCE			82 300.0	88 900.0	87 900.0	82 300.0	82 300.0	82 300.0	82 300.0	82 300.0	
B:Periodic maintenance	Bitumenroads	Rejuvenating sprays	3 600.0	2 700.0	1 300.0	7 500.0	12 000.0	15 600.0	15 600.0	15 600.0	
(Sundries + overhead costs included)		Reseals, roadmarkings, edgings	8 300.0	16 100.0	5 300.0	10 000.0	15 000.0	20 900.0	20 900.0	20 900.0	
	Gravel roads	Regravelling, betterment, bushclearing	56 200.0	40 700.0	40 300.0	45 000.0	55 000.0	65 000.0	75 000.0	90 000.0	
SUBTOTAL PERIODIC MAINTENANCE			68 100.0	59 500.0	46 900.0	62 500.0	82 000.0	101 500.0	111 500.0	126 500.0	
C:Rehabilitation and improvements	Bitumen roads	Rehabilitations (incl. overlays &	15 900.0	55 000.0	85 800.0	92 500.0	83 650.0	62 480.0	28 900.0	25 040.0	
		bridge widenings)									
		Carriageway widenings	0.0	0.0	0.0	0.0	0.0	3 400.0	10 000.0	10 500.0	
		Spot improvements	0.0	0.0	0.0	0.0	2 500.0	2 500.0	2 500.0	2 500.0	
	Gravel roads	Surfacing of gravel roads (low cost)	0.0	0.0	0.0	3 200.0	25 000.0	25 000.0	25 000.0	25 000.0	
		Spot improvements	0.0	0.0	0.0	0.0	1 500.0	1 500.0	1 500.0	1 500.0	
SUBTOTAL REHAB&IMPROVEMENT			15 900.0	55 000.0	85 800.0	95 700.0	112 650.0	94 880.0	67 900.0	64 540.0	
SUB TOTAL MAINTENANCE			166 300.0	203 400.0	220 600.0	240 500.0	276 950.0	278 680.0	261 700.0	273 340.0	
D:Development projects	Bitumen Roads	New road constructions & major up-gradings	85 300.0	61 800.0	66 900.0	94 400.0	48 250.0	47 020.0	45 250.0	36 750.0	
	Gravel Roads	New road constructions & major up-gradings	8 000.0	15 900.0	22 000.0	24 600.0	30 260.0	12 000.0	8 000.0	8 000.0	
	Bridges	New bridges	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		Planning of Developments	1 600.0	2 500.0	7 700.0	2 500.0	2 500.0	2 500.0	2 500.0	2 500.0	
SUB TOTAL DEVELOPMENT			94 900.0	80 200.0	96 600.0	121 500.0	81 010.0	61 520.0	55 750.0	47 250.0	
E:Administration and sundries (including com- pensation and fencing)		Head office	20 400.0	9 800.0	9 400.0	9 800.0	9 800.0	9 800.0	9 800.0	9 800.0	
SUB TOTAL ADMINISTRATION			20 400.0	9 800.0	9 400.0	9 800.0	9 800.0	9 800.0	9 800.0	9 800.0	
F:Other items		Loan repayments	1 400.0	2 275.0	3 671.0	3 926.0	3 926.0	3 926.0	4 062.0	4 195.0	
		NaTIS			7 884.0	16 797.0	9 213.0	9 213.0	9 213.0	9 213.0	
		Planning (excl. NaTIS)	10 800.0	12 400.0	12 214.0	12 214.0	12 214.0	12 214.0	12 214.0	12 214.0	
SUB TOTAL OTHER ITEMS			12 200.0	14 675.0	23 769.0	32 937.0	25 353.0	25 353.0	25 489.0	25 622.0	
GRAND TOTAL			293 800.0	308 075.0	350 369.0	404 737.0	393 113.0	375 353.0	352 739.0	356 012.0	

Date		ESTIMATES OF EXPENDITURE - SUMMARY OF FIVE YEAR PLAN								
1998-09-23		Excluding loans and grants								
Nation-wide/ or Region										
Nation-wide		Financial years			From:	1999/2000	To:	2003/2004		
Category	Road type	Activity	Expenditures in			1997/98	prices			
			Average last five years N\$ 1000	Actual year 1997/98 N\$ 1000	Approved budget 1) 1998/99	Year 1999/2000 N\$1000	Year 2000/2001 N\$1000	Year 2001/2002 N\$1000	Year 2002/2003 N\$1000	Year 2003/2004 N\$1000
A:Routine maintenance	Bitumen roads	Bitumen maintenance, incl.	25 000.0	32 500.0	32 100.0	25 000.0	25 000.0	25 000.0	25 000.0	25 000.0
(Sundries + overhead costs included)		road reserve maintenance								
	Gravel roads	Gravel maintenance, incl.	57 300.0	56 400.0	55 800.0	57 300.0	57 300.0	57 300.0	57 300.0	57 300.0
		road reserve maintenance								
SUBTOTAL ROUTINE MAINTENANCE			82 300.0	88 900.0	87 900.0	82 300.0	82 300.0	82 300.0	82 300.0	82 300.0
B:Periodic maintenance	Bitumenroads	Rejuvenating sprays	3 600.0	2 700.0	1 300.0	7 500.0	12 000.0	15 600.0	15 600.0	15 600.0
(Sundries + overhead costs included)		Reseals, roadmarkings, edgings	8 300.0	16 100.0	5 300.0	10 000.0	15 000.0	20 900.0	20 900.0	20 900.0
	Gravel roads	Regravelling, betterment, bushclearing	56 200.0	40 700.0	40 300.0	45 000.0	55 000.0	65 000.0	75 000.0	90 000.0
SUBTOTAL PERIODIC MAINTENANCE			68 100.0	59 500.0	46 900.0	62 500.0	82 000.0	101 500.0	111 500.0	126 500.0
C:Rehabilitation and improvements	Bitumen roads	Rehabilitations (incl. overlays & bridge widenings)	15 900.0	43 700.0	23 200.0	22 500.0	43 650.0	40 330.0	28 650.0	25 040.0
		Carriageway widenings	0.0	0.0	0.0	0.0	0.0	3 400.0	10 000.0	10 500.0
		Spot improvements	0.0	0.0	0.0	0.0	2 500.0	2 500.0	2 500.0	2 500.0
	Gravel roads	Surfacing of gravel roads (low cost)	0.0	0.0	0.0	3 200.0	25 000.0	25 000.0	25 000.0	25 000.0
		Spot improvements	0.0	0.0	0.0	0.0	1 500.0	1 500.0	1 500.0	1 500.0
SUBTOTAL REHAB&IMPROVEMENT			15 900.0	43 700.0	23 200.0	25 700.0	72 650.0	72 730.0	67 650.0	64 540.0
SUB TOTAL MAINTENANCE			166 300.0	192 100.0	158 000.0	170 500.0	236 950.0	256 530.0	261 450.0	273 340.0
D:Development projects	Bitumen Roads	New road constructions & major up-gradings	58 300.0	3 500.0	30 600.0	39 350.0	39 050.0	46 400.0	45 250.0	36 750.0
	Gravel Roads	New road constructions & major up-gradings	8 000.0	7 100.0	9 200.0	12 325.0	19 130.0	7 000.0	8 000.0	8 000.0
	Bridges	New bridges	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Planning of Developments	1 600.0	2 500.0	7 700.0	2 500.0	2 500.0	2 500.0	2 500.0	2 500.0
SUB TOTAL DEVELOPMENT			67 900.0	13 100.0	47 500.0	54 175.0	60 680.0	55 900.0	55 750.0	47 250.0
E:Administration and sundries (including compensation and fencing)		Head office	20 400.0	9 800.0	9 400.0	9 800.0	9 800.0	9 800.0	9 800.0	9 800.0
SUB TOTAL ADMINISTRATION			20 400.0	9 800.0	9 400.0	9 800.0	9 800.0	9 800.0	9 800.0	9 800.0
F:Other items		Loan repayments	1 400.0	2 275.0	3 671.0	3 926.0	3 926.0	3 926.0	4 062.0	4 195.0
		NaTIS			7 884.0	16 797.0	9 213.0	9 213.0	9 213.0	9 213.0
		Planning (excl. NaTIS)	10 800.0	12 400.0	12 214.0	12 214.0	12 214.0	12 214.0	12 214.0	12 214.0
SUB TOTAL OTHER ITEMS			12 200.0	14 675.0	23 769.0	32 937.0	25 353.0	25 353.0	25 489.0	25 622.0
GRAND TOTAL			266 800.0	229 675.0	238 669.0	267 412.0	332 783.0	347 583.0	352 489.0	356 012.0
					1) Includes funds needed for ongoing projects under loan agreements					