CHAPTER 3

PRESENT SITUATION OF TRANSPORT SYSTEM IN THE STUDY AREA

Chapter 3 Present Situation of Transport System in the Study Area

3.1 Present Situation of Road Sub-sector

3.1.1 Policy and Programmes of the Road Sub-sector

(1) Malawi Growth and Development Strategy (MGDS)

The key strategies of road transport under the MGDS (2006/07 to 2010/11) are fully in harmony with the policy goal of the Malawi National Transport Policy (NTP, 2004). The strategies concentrate on ensuring the availability of adequate, safe, reliable, efficient and economical transport services in key corridors that meet the country's current road transport needs and are aligned to the future vision.

(2) National Transport Policy (NTP)

The general objective of the road transport policy in the NTP is to create a climate that nurtures, encourages, and sustains the participation of the private sector in the financing, construction, maintenance and management of roads in Malawi. The specific objective of the policy is to ensure an acceptable standard of road traffic services, paying special attention to road safety on rural and urban road networks.

(3) Transport Sector Investment Programme (TSIP)

The TSIP (Phase I: 2010/11 to 2014/15, Phase II: 2015/16 to 2019/20) is part of a planning process that allows the GoM to effectively plan for the transport sector taking into consideration the key processes that lead to optimum and efficient allocation and use of limited resources. TSIP is the action plan for the transport sector to enable other sectors to achieve the goals of the MGDS II (2006/07 to 2016/17). This provides the basis for the medium-term expenditure framework and a rolling three-year plan, and the GoM has started to allocate budget for the coming three years for the transport sector from 2011.

(4) Road Sector Programme (RSP)

The RSP (2010 to 2020), which is a part of TSIP, is intended to chart the way forward for road maintenance and development in Malawi in both physical and financial terms. The RSP comprises a detailed first 5-year investment programme with preliminary annual work programmes, and indicative medium (next 5 years), and long-term (10 to 20 years ahead) annual investment programmes, which are dependent on the investment being fully made in the first five years.

(5) Principles and Priorities of the RSP

The GoM has proposed the following general principles and priorities for the management and development of the road network:

- Building on the successful preservation of the network through regular maintenance in the past.

- Dealing with the mistakes of the past through rehabilitation, timely periodic maintenance, and measures to reduce road accidents.
- Meeting new challenges of traffic growth and the need to improve access to potentially productive rural areas through upgrading unpaved roads to the paved standard.

3.1.2 Present Situation of the Road Network in Malawi

(1) Road Category

The Roads Authority (RA) is responsible for the maintenance of the public road network, which is classified into five categories: main roads, secondary roads, tertiary roads, urban roads and district roads. The Public Roads Act enacted in 1962, the Local Government Act enacted in 1998 and the Urban (Public and Private Streets) Act enacted in 1956 define the five categories of roads as shown in Table 3-1.

Table 3-1 Road Categories and Definitions

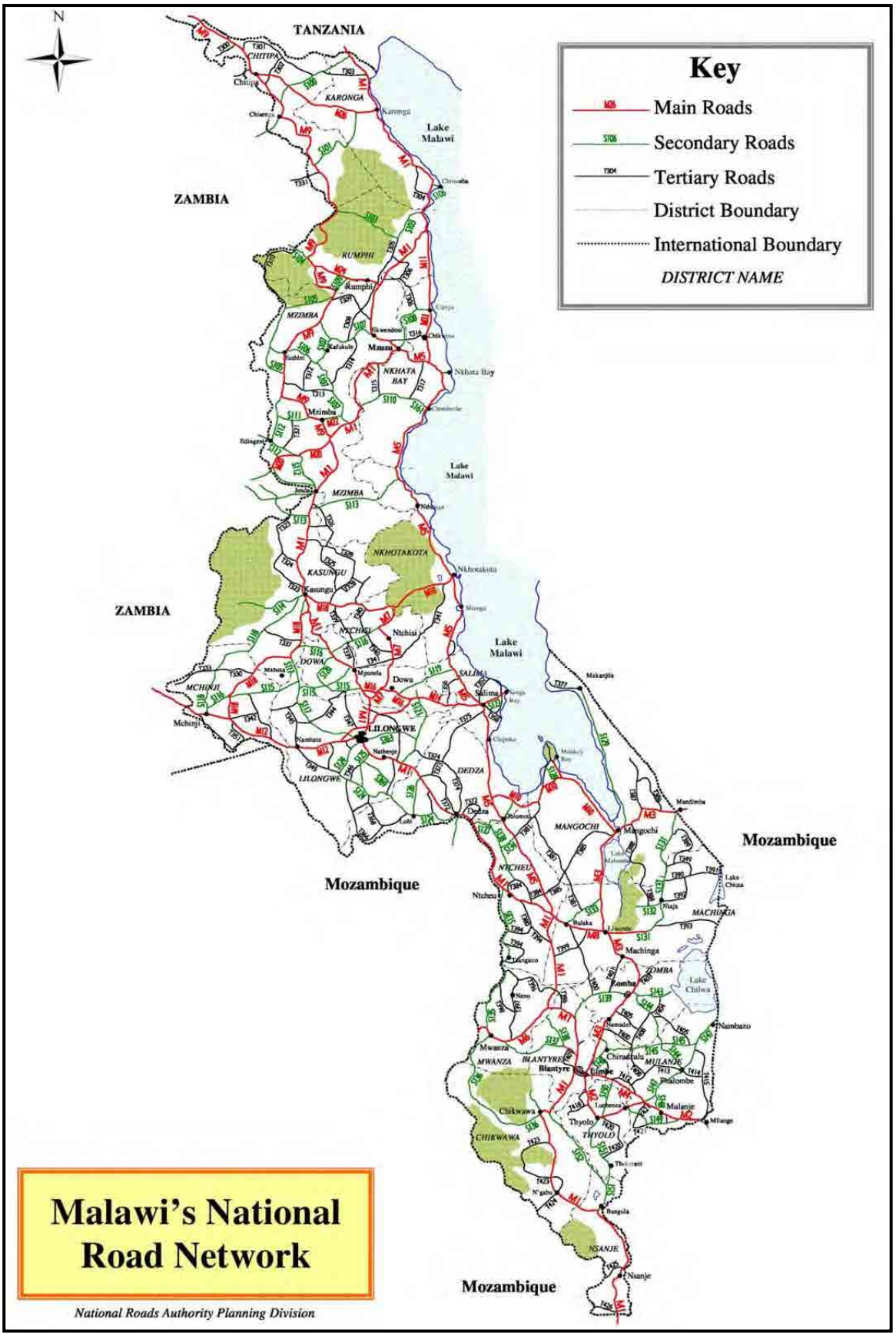
Category	Definition
Main Road (M)	Inter-territorial roads outside cities or towns unilaterally designated by the GoM providing a high degree of mobility connecting provincial capitals and/or serving as international corridors
Secondary Road (S)	Roads outside cities or towns unilaterally designated by the GoM providing a high degree of mobility linking main centres of population and production and connecting to the main road network
Tertiary Road (T)	Roads outside cities or towns unilaterally designated by the GoM linking collector roads to arterial roads accommodating shorter trips and feeding the arterial road network
District Road (D)	Roads outside cities or towns designated by the GoM after consultation with the District Authorities providing an intermediate level of service connecting local centres of population and linking districts, local centres of population and developed areas with the principal arterial system
Urban Road (U)	Any other road in an urban area other than a designated road including arterial and collector roads crossing city boundaries. The main function is the provision of accessibility over relatively short trip lengths at low speeds and providing services to smaller communities.

Source: Roads Authority Annual Report 2010 (Draft)

In functional terms, the main, secondary, and tertiary roads effectively make up the country's primary road network, with district and other undesignated roads acting as a feeder system to the primary network (see Figure 3-1 and Table 3-2). Of the primary network, the North-South portion on both the plateau and the lakeshore is paved, providing a high-quality all-weather road surface. The East to West trunk roads have also been improved to provide better services to communities and link them to urban centres, where most of the roads are paved. The district roads, which are normally of earth standard, have also been improved and provide access at the local level.

(2) Road Network

The public road network comprises 15,451 km of paved and unpaved roads including bridges and culverts. Approximately 26% of the total road network is paved and the remaining 74% is unpaved (see Table 3-3). The main road category comprises a network of 3,357 km of which 84% is paved while the secondary road category comprises 3,125 km of which only 14% is paved. The tertiary road and district road categories have 4,121 km and 3,500 km of which 1% and 0.1% are paved, respectively. The urban road category consists of 1,348 km of which 57% is paved (see Figure 3-2).



Source: RA

Figure 3-1 Malawi's National Road Network

Table 3-2 List of Main and Secondary Roads (1/2)

Starting from	Ending at	Designation	Length (km)
Songwe International Boundary	Marka	M001	1,108.7
Blantyre	Muloza International Boundary	M002	113.2
Limbe	Chiponde International Boundary	M003	237.2
Limbe	Mulanje	M004	70.2
Mzuzu	Balaka Market	M005	487.3
M001-M006 Junction	Zobwe	M006	70.5
Othambwe	Mbobo	M007	78.8
Chingeni	Mimanga	M008	24.9
Mkoma (Tanzanian Border)	Mzimba Boma	M009	429.7
Njolo	Mangochi Boma	M010	108.0
Chiweta	Timbiri	M011	109.9
Lilongwe City	Mchinji International Boundary	M012	119.3
Lilongwe City	M005-S122 Junction	M014	92.7
Kamwendo	Nkhotakota Boma	M018	216.1
Jenda	Luwawa	M020	63.7
Mzimba Boma	Mtangatanga	M022	24.2
Njakwa	Chitanga	M024	54.7
Chitipa Boma	Karonga Boma	M026	100.7
Chendo	Songwe River Bridge	S100	74.5
Kapirinkhonde	Mpata	S101	57.2
M001-S102 Chilumba Jetty T/off	Chilumba Jetty	S102	5.8
Gamba Turn Off	Livingstonia Turn off on M001	S103	99.9
Chisenga	Chisenga Customs	S104	32.4
Lake Kazuni	Chinyama	S105	84.5
Agrippa Jere	Mtantha	S106	33.0
Ekwendeni	M022 - S107 Junction	S107	104.8
Usisya	Mzuzu City	S108	63.5
Chikwawa	Lake Kazuni	S109	19.9
Champhoyo	Luweya River	S110	36.4
Engalaweni	Kandodo Chisi	S111	25.9
Embangweni Mission	Chaisi Ndhlovu	S112	92.1
Kawale River	Kasitu River	S113	85.8
Lifupa Game Camp	Kasungu Boma	S114	55.8
Matutu	Senga	S115	108.3
Chankhama	Mpalo	S116	76.4
Airwing	Santhe	S117	120.7
Mchinji Boma	Msokera	S118	128.9
Mchepa	Lipanda	S119	48.6
Nkhako	Bua River (M018)	S120	23.8
Kamphata	Kachinchezo	S121	63.0
Salima Boma	Grand Beach	S122	5.6
Chitedze	Alimaunde	S123	19.4
City Hall, Lilongwe	Alimaunde	S124	91.5
Biriwiri	Doviko (Chimbia)	S125	82.5
Lobi	M001/S126 Junction	S126	27.1
M005/S127 Junction	Masasa	S127	30.9
Monkey Bay	Mangoma	S128	17.6
Chingo	Makanjira	S129	96.6
Chiponde International Boundary	Liwonde	S131	111.8
Namandanje River (Liwonde National Park)	Singwa	S132	20.6
Balaka	Hoba	S133	28.4
Ntcheu Boma	Kasinje	S134	30.8
Doviko (Chimbia)	Liwonde (Mwanza)	S135	74.7
Mwanza	M001/S136 Junction	S136	106.4
Moffati	Chileka Airport	S137	87.8
Chitambe River	Kandeu	S138	97.1
S142/S139 Junction	Lirangwe	S139	41.4
Kaunde, Zomba	Nkoloma	S142	16.1
Ndege	Kachulu Harbour	S143	27.4

Table 3-2 List of Main and Secondary Roads (2/2)

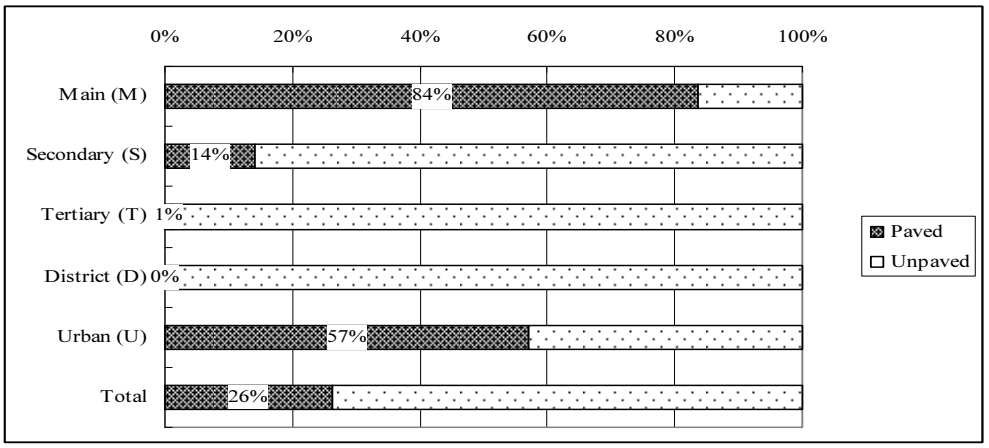
Starting from	Ending at	Designation	Length (km)
Ndege	Mumbuwa	S144	65.1
Mikochi	Kalinde	S145	65.8
Chiradzulu	Mbulumbuzi	S146	25.2
Fundicross	Mandawala	S147	73.6
Liwamba	Mulanje Boma	S148	12.0
Losa	Mimosa	S149	59.1
Chiperoni	Mikolongwe	S150	29.3
Thyolo Boma	Bangula	S151	93.5
Seven	Thabwa	S152	59.8
Chiperoni	Khonjeni	S160	30.0
Mphanje	Lujenda	S161	7.0

Source: Road Data Management System, RA (as of June 2011)

Table 3-3 Road Network by Category and Surface in 2010

Category	Paved		Unpaved		Total	
	Length (km)	Ratio (%)	Length (km)	Ratio (%)	Length (km)	Ratio (%)
Main Roads (M)	2,809	69	548	5	3,357	22
Secondary Roads (S)	442	11	2,683	24	3,125	20
Tertiary Roads (T)	44	1	4,077	36	4,121	27
District Roads (D)	8	0	3,492	31	3,500	23
Urban Roads (U)	770	19	578	5	1,348	9
Designated Road Total	4,073	100	11,378	100	15,451	100
Undesignated Road Community Roads	-		9,478	-	9,478	-
Total	4,073	-	20,856	-	24,929	-

Source: Roads Authority Annual Report 2010 (Draft)



Source: Roads Authority Annual Report 2010 (Draft)

Figure 3-2 Ratio of Paved Road by Category (Designated Roads) in 2010

(3) Road Condition

The state of the network has varied greatly in recent years, though it is currently in reasonably good shape. The road condition survey of 2007 covered 14,211 km (92%) of the whole road network, but urban roads were excluded even though some of them are in poor condition. Survey results were then adjusted by RA to include urban roads for analysing the total road network.

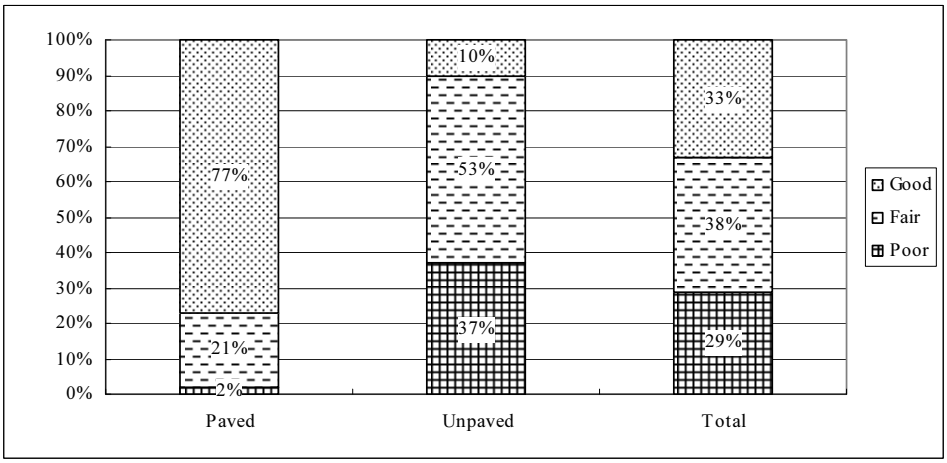
The survey results have been adjusted for the reason that a number of urban roads known to be in poor condition are not included.

Table 3-4 and Figure 3-3 show that the paved network is generally in good to fair condition, partly as a consequence of the backlog maintenance programme for urban roads and upgrading programmes for Main roads funded by the EU. The unpaved network is generally in worse shape, with 37% in poor condition. The condition of unpaved roads is influenced by the environment, weather, and changes in traffic levels.

Table 3-4 Road Conditions in 2009

Condition	Paved			Unpaved			Total	
	Criterion (IRI*)	Length (km)	Ratio (%)	Criterion (IRI*)	Length (km)	Ratio (%)	Length (km)	Ratio (%)
Good	< 3.5	3,136	77	< 7.0	1,138	10	5,099	33
Fair	3.5–5.0	855	21	7.0–10.0	6,030	53	5,871	38
Poor	> 5.0	81	2	> 10.0	4,210	37	4,481	29
Total		4,073	100		11,378	100	15,451	100

Note: IRI – International Roughness Index
Source: Roads Authority Annual Report 2010 (Draft), Road Sector Programme, RA



Source: Roads Authority Annual Report 2010 (Draft), Road Sector Programme, RA

Figure 3-3 Road Condition by Surface in 2009

(4) Traffic Volume

The most recent traffic counts were undertaken in FY 2008/09, at 445 stations. RA then made estimates of the volumes on all other links by combining the count data with local knowledge. Table 3-5 shows that on the paved network, 28% of the roads carry more than 1,000 vehicles per day (vpd), and the highest flows do not exceed 1,800 vpd. On the unpaved network 406 km carry more than 150 vpd.

Table 3-5 Traffic Volumes by Pavement Type in 2007

(Unit: km)

Vehicles per Day	Paved	Unpaved	Total
<150	110	11,007	11,117
150–250	434	0	434
250–350	733	315	1,047
350–500	670	91	761
500–750	699	0	699
750–1000	262	0	262
1000–1500	775	0	775
> 1500	355	0	355
Total	4,038	11,413	15,451

Source: RA, Road Data Management

(5) Road Management

a) Administration

In 1997, the GoM set up a National Roads Authority (NRA) and a Roads Fund. NRA at that time administered the Roads Fund and was responsible for the whole classified network of approximately 15,451 km. In 2006, under the Roads Authority and Roads Fund Administration Act, responsibility for the Roads Fund was transferred to the Roads Fund Administration (RFA), and RA was made responsible for the management of designated roads.

Local authorities (district and city assemblies) are responsible for maintaining some urban and district roads, tracks and trails, but presently RA maintains these roads in order to facilitate necessary processes, such as planning, tendering, construction and monitoring, for efficiently and smoothly implementing road projects because some Local Authorities do not have adequate capacity in terms of personnel, technology and budget allocation aspects. One of the purposes of the Roads Fund is to finance, on a cost-sharing basis, the routine and periodic maintenance of roads, tracks and trails under the responsibility of a City, Town, Municipal or District Assembly (Section 19 (a) (iii) of the Act). Developing the management of local roads to the local authorities, starting with the major cities, is now being actively considered, in the expectation that each local authority would receive an allocation from the Roads Fund, which they could supplement with local funds.

b) Roads Authority

RA has four departments: Planning and Design which is responsible for the development of short-term and long-term road programmes, Construction which is responsible for the management of periodic, rehabilitation, upgrading and new road construction programmes and projects, Maintenance which is responsible for the day to day management of maintenance activities and Finance and Administration which is responsible for the general administrative, human resources and financial management. In addition to the four departments there are other sections and units such as the Information Communications and Technology, Procurement and Public Relations Units which report directly to the Chief Executive Officer. Even though the Internal Audit Unit reports directly to the Board of Directors functionally the Chief Executive

Officer is responsible for the department administratively. The administration and supervision of all maintenance contracts are carried out at the three Regional Offices located in the cities of Mzuzu, Lilongwe and Blantyre.

c) Management Responsibility

As stated in the Roads Authority Act No. 3 of 2010, RA is responsible for the construction, rehabilitation and maintenance of public roads. It is also responsible for advising the Minister responsible for roads and, where appropriate, the Minister responsible for Local Government on the preparation and efficient and effective implementation of the annual national roads programme referred to in Section 22 of the Roads Act. Management responsibilities are summarized in Table 3-6.

RA uses formal prioritization procedures with its Road Data Management (RDM) system, which incorporates a road inventory, road condition data, traffic data, and an inventory of bridges. The RDM is linked to Highway Development Management Model (HDM-4), the international standard road investment model for the evaluation and optimisation of road maintenance strategies and road improvement projects.

Table 3-6 Management Responsibility for the Road Network

Road Class	Current Classification (km)	Organization Responsible for Road Management	Source of Funding
Main Road	3,357	RA	Roads Fund
Secondary Road	3,125	RA	Roads Fund
Tertiary Road	4,121	RA	Roads Fund
District Road	3,500	RA/ LA[*1]	Roads Fund /LA[*1]
Urban Road	1,348	RA/LA[*1]	Roads Fund /LA[*1]
Total	15,451	-	-
Undesignated Community Road	9,478	LA[*1]/ Communities	Roads Fund /LA[*1]

Note: LA stands for Local Authority (District and City Assembly)
Source: RA

d) Funding

There are two main sources of funds for roads under RA. The largest part comes from the GoM's Development Budget, including development partner grants and loans, and is used mainly for major road improvements, construction of new roads, upgrading of unpaved roads to either paved roads or all-weather roads, and rehabilitation and periodic maintenance. The second source is the Recurrent Budget funded by the Roads Fund, which raises revenue from the fuel levy, transit fees and various other minor sources, and provides this money to finance (under Section 19 (1) (a) of the Act) the maintenance and rehabilitation of public roads, surveys and monitoring related to such maintenance and rehabilitation of public roads. The Roads Fund is also supplemented by GoM grants (under Section 18 (1) (a) of the Act).

The allocation of the Roads Fund to RA is the subject of an annual financing agreement, which identifies the work programme for the coming year and costs each component. The

purpose of the Roads Fund is to finance the maintenance and rehabilitation of public roads, along with related surveys and monitoring activities.

At present, the GoM contribution and development partner project resources are administered separately, but consideration is being given to making RFA responsible for handling all road sector funds from whatever source.

Until recently, the Roads Fund has raised sufficient funds to pay for all necessary maintenance work. In early 2009, the GoM increased the fuel levy to MWK23.7 per litre for diesel, and MWK28.7 per litre for petrol. The Roads Fund revenue for FY 2009/10 was forecasted to be MWK8.34 billion (US$ 60 million).

Provided the real value of the Fuel Levy is maintained, RFA revenue should continue to increase approximately in line with GDP growth. For the purposes of projecting revenue, it has been assumed that GDP will grow at an average of 5% p.a., and on this basis, the projected Roads Fund revenue for 2015/16 is MWK11.18 billion.

(6) Road Development Programmes

Between 2002 and 2008, development partner funding rehabilitated approximately 1,250 km of the national road system, with works on the M1 totalling 675 km. Ongoing and planned development partner projects will rehabilitate or upgrade a further 1,020 km by 2011. In addition, planned projects include the upgrading of approximately 820 km of unpaved roads to improve accessibility in rural areas. The programme for 2009/10 is shown in Table 3-7.

(7) Road Maintenance Programme

Road maintenance is carried out by the Maintenance Department which is responsible for main, secondary and tertiary roads, and in conjunction with the Local Assemblies, is also responsible for maintenance of urban and district roads. The road maintenance budget for the 2009/10 financial year was MWK7.884 billion, of which MWK1.175 billion was allocated for routine maintenance, MWK3.411 billion for periodic maintenance and sectional rehabilitation, MWK633.359 million for supervision and studies, MWK596.43 million for grading and reshaping, MWK560.2 million for spot repairs, MWK505.64 million for timber deck bridge replacement, and MWK326.56 million for pothole patching. Operating expenses, which consist of salaries, wages and benefits, boarding expenses, and administration expenses, amounted to MWK504.468 million.

a) Recurrent Maintenance and Rehabilitation Programme

This programme is for carrying out maintenance and sectional rehabilitation of public roads, tracks and trails. The programme includes routine maintenance, sectional periodic and rehabilitation of paved roads, pothole patching on paved roads, grading and reshaping, accident spot improvement, road sign replacement and marking, spot repair intervention, routine and periodic maintenance (track and trails), road centre and edge line marking, and replacement of timber and Bailey bridges with concrete decks.

b) Backlog Maintenance Programme of Urban Paved Roads

This programme is a continuation of the backlog maintenance (periodic) and rehabilitation of roads in the cities of Lilongwe, Zomba and Blantyre which started in 2009/10. This is a rolling programme which will continue being implemented until the entire current backlog of maintenance in these cities has been cleared. It should be noted that the roads benefiting under this programme are characterized by high and unsustainable routine maintenance (pothole patching) costs.

Table 3-7 Road Development Programme (2009/10)

Road No.	Description	Work	Funding Source***	Length (km)	2009/10 Allocation (US$ million)
-	Mzuzu City roads	Upgrading	GoM	22	0.74
-	EU Feeder Roads	Spot Improvements	9th EDF	2,400*	7.29
-	Infrastructure Service Programme	Feasibility	WB	0	0.33
-	Mzimba St, Lilongwe	Upgrading	GoM	3	1.33
M1	Lilongwe By Pass	New Construction	AfDB	14	0.88
M1	Lilongwe–Nsipe	Periodic	9th EDF	137	11.94
M1	Chikwawa–Nchalo	Rehabilitation	9th EDF	30	3.98
M1	Chiweta–Mlowe	Rehabilitation	GoM	70	1.33
M1	Bangula–Nsanje	Upgrading	GoM	50	4.31
M1	Nchalo–Bangula	Rehabilitation	GoM	50	6.3
M10	Masasa–Golomaoti - Monkey Bay	Rehabilitation	9th EDF	80	0.23
M18	Mangochi–Monkey Bay	Rehabilitation	9th EDF	70	0.03
M26	Karonga–Chitipa	Upgrading	PRC	109	**
M3	Liwonde–Naminga	Rehabilitation	OPEC Fund	22	5.87
M3	Blantyre–Zomba	Rehabilitation	AfDB	47	0.93
M35	Zomba–Jali–Phalombe–Chitakale	Upgrading	KF, OPEC Fund, BADEA	102	26.19
M5	Msulira–Nkhotakota	Rehabilitation	GoM	33	1.99
M7	Lumbadzi–Dowa–Chezi	Upgrading	GoM	24	4.97
M9	Rumphi–Nyika–Chitipa	Feasibility (Upgrading)	BADEA	275	1.86
S107	Mzimba–Mzalange	Upgrading	GoM	87	11.94
S108	Mzuzu–Bula–Usiysa	Rehabilitation	GoM	25	1.33
S113	Kasilu–Lupashe–Kakwale	Rehabilitation	GoM	86	1.33
S117	Lilongwe–Kasiya–Santhe	Feasibility (Upgrading)	GoM	133	1.33
S125	Bunda–Mitundu	Upgrading	GoM	9	2.06
S135	Ntcheu–Tsangano–Neno–Mwanza	Feasibility	AfDB	140	0.84
S136	Mwanza–Chapananga–Chikwawa	Feasibility (Upgrading)	GoM	106	0.32
S147	Chiradzulu–Miseu Folo–Chilinga	Upgrading	GoM	90	4.52
S150	Malowa–Goliati–Chiperoni	Upgrading	GoM	36	1.99
S151	Thyolo–Thekerani–Makhanga – Bangula	Upgrading	KF, OPEC Fund, BADEA	94	21.33
S212/M9/S 209/M24	Jenda–Euthini–Rumphi	Feasibility (Upgrading)	KF, Saudi Fund	200	5.54
T393	Ntaja–Nayuchi	Rehabilitation	GoM	50	1.33
T415	Chiringa–Mloza	Upgrading	GoM	80	0.46
Total				2,274	134.79

Notes: * - Spot improvements, not included in total length

** - Directly financed by the People's Republic of China (PRC)

*** EDF - European Development Fund, AfDB - African Development Bank, OPEC – Organization of the Petroleum Exporting Countries, KF – Kuwait Fund, BADEA – Arab Bank for Economic Development in Africa

Source: Road Sector Programme, RA

3.1.3 Road Network in the Study Area

(1) Arterial Road Network

M1, which is one of the most important arterial roads as both a domestic and international corridor in Malawi, links the northernmost Tanzania border, the capital city of Lilongwe, the commercial city of Blantyre and the southernmost Mozambique border. The M1 in the Study Area forms the north-south axis, between Blantyre and Marka Border Post, and linking major towns such as Nsanje, Bangula and Chikwawa (see Figure 3-4).

The east-west transportation axis in the Study Area is formed by two main roads (M2 and M6). The M2 connects Blantyre with Muloza town at the border post for Malawi and Mozambique in the southeast of the country. The M6 connects Blantyre with Mwanza town which is at the border post between Malawi and Mozambique in the southwest.

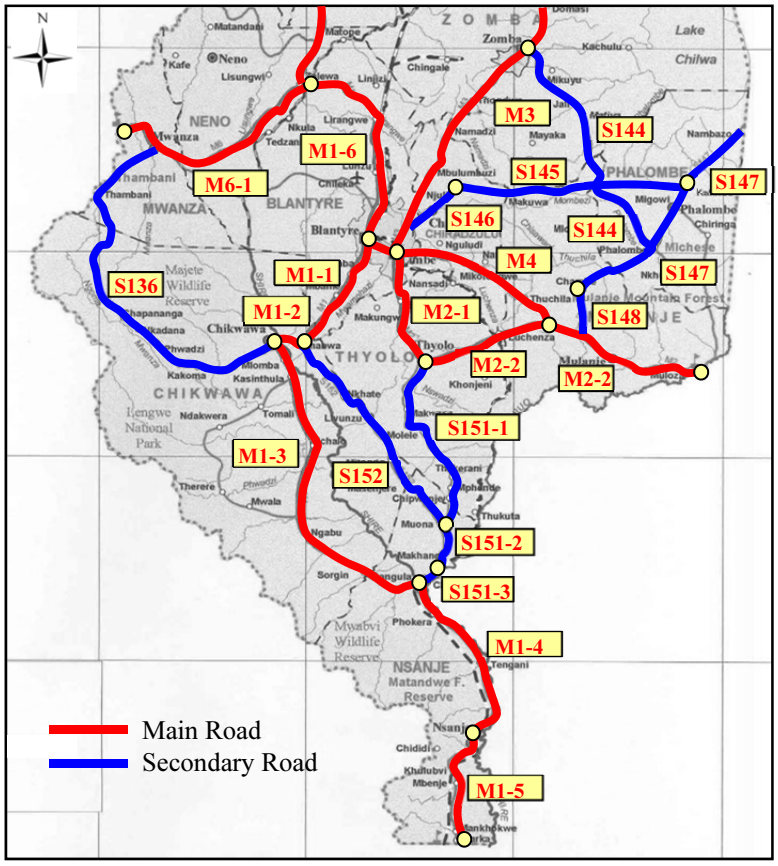
There are two transportation routes between Blantyre and Bangula, the latter being a town north of Nsanje District. The main route is the M1 passing through Chikwawa District and a potential alternative is Secondary Road S151 passing through Thyolo District. S152, which runs along the district's boundary between Chikwawa and Thyolo districts, links M1 and S151 which form the primary road network in the Study Area.

Chiromo is located about 1.5 km north of Bangula town and is the area where the embankment of S151 was washed away by the flooding of the Shire River in 1997. This large-scale washaway resulted in the complete loss of S151's function as a national trunk road. For this reason, all traffic between Blantyre and Bangula now depends entirely on M1.

Table 3-8 List of Arterial Road Network in the Study Area

Route*1		Section*2		Length (km)	Roadway	
					Surface	Road Width (Paved Width) (m)
M1	1	Blantyre	Thabwa (Jct. M1/S152)	36.9	paved	9.7 (7.2)
	2	Thabwa (Jct. M1/S152)	Chikwawa	8.3	paved	9.7 (7.2)
	3	Chikwawa	Bangula	86.7	paved	9.7 (7.2)
	4	Bangula	Nsanje	48.1	paved	9.7 (7.2)
	5	Nsanje	Marka (BP)	26.9	unpaved	5 to 6
	6	Blantyre	Zalewa (Jct. M1/M6)	59.8	paved	9.7 (7.2)
M2	1	Blantyre	Thyolo	40.5	paved	9.7 (7.7)
	2	Thyolo	Muloza (BP)	73.1	paved	9.7 (7.7)
M3	-	Limbe	Zomba	60.5	paved	9.7 (7.2)
M4	-	Limbe	Luchenza	70.2	paved	9.7 (7.2)
M6	1	Zalewa (Jct. M1/M6)	Mwanza (BP)	52.4	paved	9.7 (7.2)
S136	-	Mwanza	Chikwawa (Jct. M1/S136)	106.4	unpaved	4 to 5
S144	-	Zomba (Ndege)	Phalombe	65.1	unpaved	4 to 5
S145	-	Chiradzulu (Mikochi)	Kalinde	65.8	unpaved	4 to 5
S146	-	Chiradzulu	Limbe (Mbulumbuzi)	25.2	unpaved	6
S147	-	Liwama (Fundicross)	Mandawala	73.6	unpaved	4 to 5
S148	-	Liwama	Mulanje	12.0	unpaved	4 to 5
S151	1	Thyolo	Seven (Jct. S151/S152)	72.4	unpaved	4 to 5
	2	Seven (Jct. S151/S152)	Makhanga (Rail crossing)	12.1	unpaved	4 to 5
	3	Makhanga (Rail crossing)	Bangula	9.7	unpaved	4 to 5
S152	1	Thabwa (Jct. M1/S152)	Seven (Jct. S151/S152)	59.1	unpaved	5 to 6

Note: *1 - Refer to Figure 3-4 Arterial Road Network in the Study Area
*2 – Location or junction names in parentheses are exact start and end points of the section.
Source: Study Team, RA RDM



Source: Study Team

Figure 3-4 Arterial Road Network in the Study Area

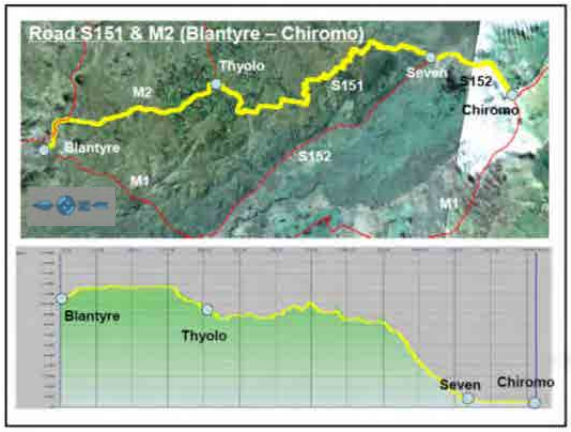
(2) Rift Valley Escarpment

The Lower Shire Valley in the Southern Region of Malawi is at an elevation of 30 m and lies on the floor of the Rift Valley. The Rift Valley escarpment has a difference in altitude of approximately 800 m. It includes the zone of steep-sloping land of the Thyolo escarpment. In terms of geography, parts of M1 and S151 have steep sections, which cause bottlenecks for industries and transport logistics on M1. The steep section near Thabwa on M1 ranges in vertical grade from 3% to 9%, and the steep section near Seven on S151 ranges in vertical grade from 1% to 5% (see Table 3-9 and Figure 3-5).

S136 passes mainly through the Rift Valley Scarp Zone and the Depositional Rift Valley Floor. The Rift Valley Scarp Zone is characterized by hills and dissected terrain with deep and narrow river/stream valleys for the first 25 km from Mwanza and with isolated hills interspaced with broad interfluves. The last 25 to 50 km of the Rift Valley Scarp Zone has the most cuts and infills, especially where the road passes through the dissected zone in order to keep the maximum road gradient within 11.5%. After this mountainous/rolling terrain, the road passes through the Depositional Rift Valley Floor at about 50 km from Mwanza. This landform consists of nearly-level alluvium brought down from the hills by rivers which deposit their load (see Figure 3-6).

Table 3-9 Route Comparison for the Section between Blantyre and Bangula

M1 Route **S151 Route**

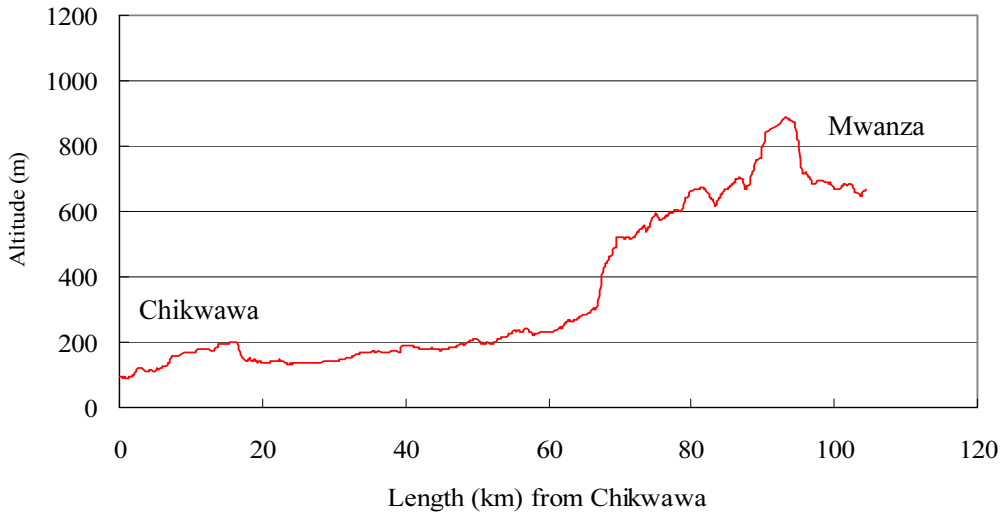


Item	M1 Route		S151 Route	
Route Components	M1 (Blantyre to Bangula)		M2 (Blantyre to Thyolo) S151 (Thyolo to Bangula)	
Route Length	132 km		135 km (M2: 41 km, S151: 94 km)	
Difference of Elevation	798 m (Bangula to Blantyre)			
Range of Grade	3% to 9% (Steep section near Thabwa)		1% to 5% (Steep section near Seven)	
Surface	Paved		M2 (Paved), S151 (Unpaved)	
Traffic Volume (2006 dry season)	Point: M1 (Bangula) Motorized Traffic: 216 per day Non Motorized Traffic: 591 per day		Point: S151 (Seven) Motorized Traffic: 37 per day Non Motorized Traffic: 1,822 per day	
Districts (Population, 2008) (Density, 2008)	Blantyre Rural Chikwawa Nsanje	(340,728) (190 per sq km) (434,648) (91 per sq km) (238,103) (123.0 per sq km)	Blantyre Rural Thyolo Nsanje	Ditto (587,053) (342 per sq km) Ditto
Agriculture	Sugarcane, Cotton		Banana, Tea	

Source: Study Team

Source: Study Team

Figure 3-5 3D Image of M1 Alignment at the Rift Valley Escarpment



Source: Study Team

Figure 3-6 Geomorphology Cross Section of the Surface of S136

(3) General Conditions of the Road Network

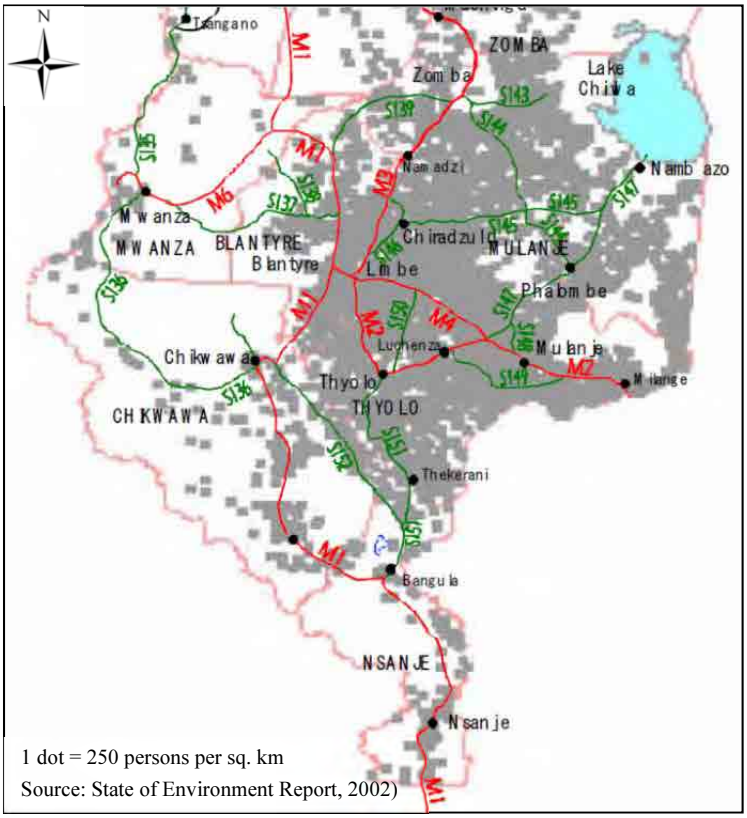
Main roads comprising the arterial road network in the Study Area are paved with two lanes and secondary roads are unpaved with one lane. The M1 road, south of Chikwawa, is under construction up to Nsanje town. The works comprise paving and widening the road, including additional drainage structures. The road between Nsanje and Marka is unpaved and has one lane.

The population density of the three districts of Nsanje, Chikwawa and Thyolo in the study area is 0.12, 0.09 and 0.34 persons/km^2, respectively. The density of Thyolo District is 0.20 points higher than that of the whole of Malawi (0.14 persons/km^2). The population density of Chikwawa district is the lowest at 0.09 persons/km^2, and that of Thyolo District is the highest among the three districts at 0.34 persons/km^2. The fact is that there are large population on the eastern side of the Shire River, and the population is high in the areas along the arterial road network, especially M1, S151 and S152 (see Figure 3-7).

The length of the arterial road network per population of the three districts combined and of each of the three districts are lower than that of the whole of Malawi at 0.50 metres per population (see Table 3-10). The length of the arterial road network per population in Thyolo District is the lowest at 0.27 metres per population, whereas an index of the arterial road length per area in Thyolo is the highest among the three districts and higher than that of the whole of Malawi as well.

(4) Committed Projects for the Arterial Road Network

According to the Road Sector Programme, the committed projects in the Study Area are shown in Table 3-11. Upgrading works for S151, Thyolo–Bangula, will commence at the end of the rainy season in 2011.



Source: Study Team

Figure 3-7 Relationship between Population Distribution and Road Network

Table 3-10 Road Length per Population and Area

District	Population 2008 a	Land Area km^2 b	Population Density a/ (b x 1000)	Road Length km c	Length per Population m/pop c/a x 1000	Length per area km/km^2 c/b	Remarks
Whole of Malawi	13,077,160	94,276	0.14	6,482.0	0.50	0.069	Main and Secondary Road
3 District	1,259,804	8,412	0.17	404.1	0.32	0.054	M1, M2, S136, S151, S152
Nsanje	238,103	1,942	0.12	86.2	0.36	0.044	M1, S151, S152
Chikwawa	434,648	4,755	0.09	205.3	0.47	0.043	M1, S136, S152
Thyolo	587,053	1,715	0.34	159.1	0.27	0.093	M2, S150, S151

Source: Study Team

(5) Road Infrastructure in Rural Areas

a) National Level

According to the National Census on Agricultural and Livestock (NACAL) 2006/2007, 62% of the villages in the country have a footpath, 60% have a track, 30% have a gravel road and 8% have a tarmac road passing through the village. The census shows that 56% of villages without a tarmac or gravel road passing through were located 4 km or more from the nearest all-weather road. To access the nearest all-weather road from villages without tarmac or gravel roads, 75% of people travel by foot, 22% by bicycle, 1% by motor vehicle and 2% by public transport.

Table 3-11 Ongoing, Committed and Planned Road Projects by the GoM in the Study Area

Section	Road	Length (km)	Work	Status	Funding Source	Contract Sum (US$ million)	Expected Completion
Chikwawa–Nchalo	M1	50	Rehabilitation	Completed	9th EDF	40.4	(Nov. 2010) delay
Nchalo–Bangula	M1	30	Rehabilitation	On-going	GoM		
Bangula–Nsanje	M1	50	Upgrading	Completed	GoM	49.5	-
Nsanje–Marka	M1	27	Upgrading	Planned (D/D done)	GoM	-	-
Blantyre–Limbe	M2	4.36	Rehabilitation	Committed	Japan	10.1	Dec. 2011 delay
Limbe–Zomba	M3	60	Rehabilitation	Committed	AfDB	49.7	2014
Thyolo–Makhanga	S151	85	Upgrading	Committed	Kuwait Fund, OPEC, BADEA, GoM	65.0 *1 (54 km signed)	(Feb. 2011) delay
Thabwa–Seven	S152	59	Upgrading	Planned (D/D done)	-	-	-
Ntcheu–Tsangano–Mwanza	S135	140	Upgrading	Planned (F/S)	AfDB	0.6	-
Mwanza–Chikwawa	S136	106	Upgrading	Planned	GoM	-	-
Zomba–Phalombe–Mulanje	S144, S147, S148	102	Upgrading	On-going	Kuwait Fund, OPEC, BADEA, GoM	57.0	delay
Chiringa–Chirazulu	S145, S147, T415	90	Upgrading	On-going	GoM	43.0	2011

Note: *1: Specific part of section where funding source will be covered has not been decided yet
Source: MoTPI

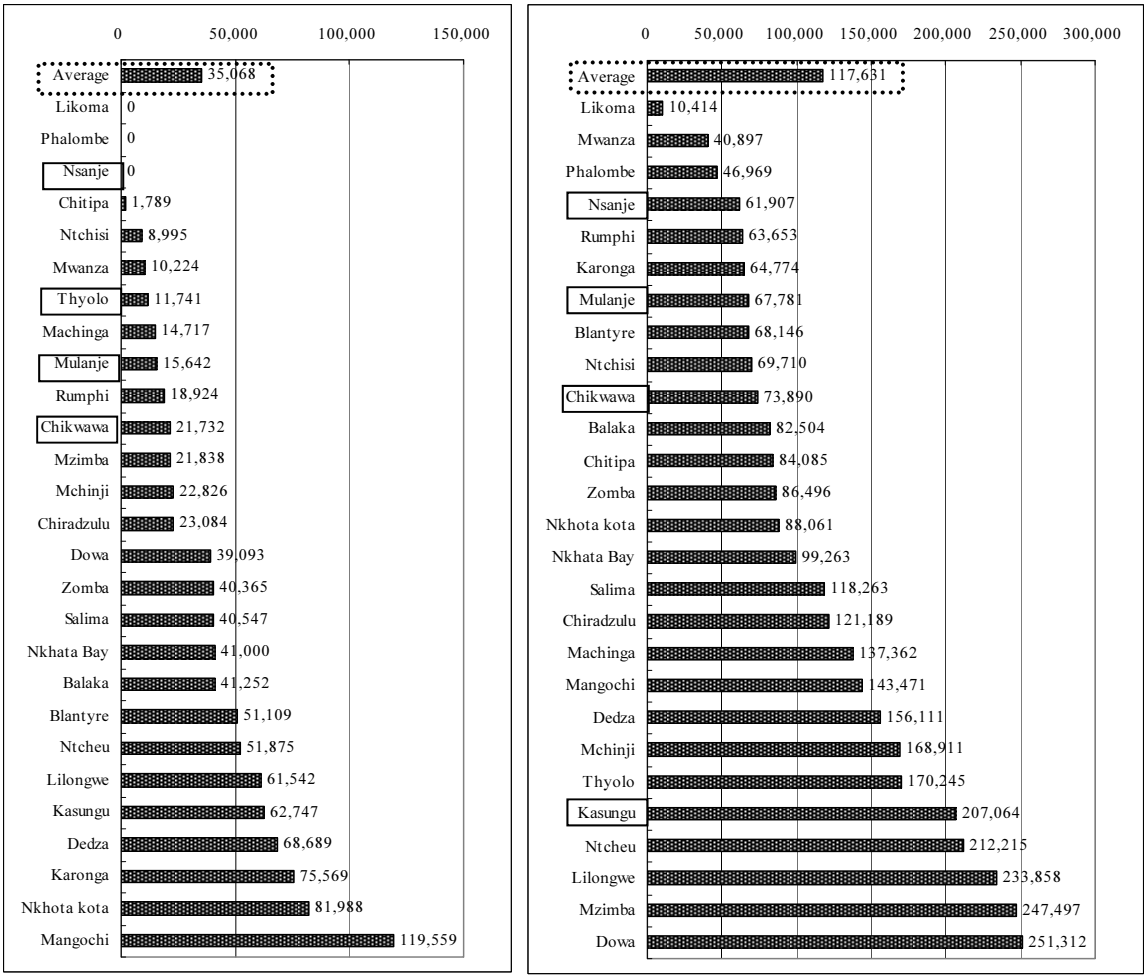
b) District Level

1) Population Living in Rural Areas Who Directly Benefit from Tarmac Roads

According to NACAL, the average district population who directly benefit from tarmac roads passing through rural areas of Malawi is 35,068 as shown below. Such people in Nsanje or other districts in the Southern Region are very few. (see Figure 3-8)

2) Population Who Directly Benefit from Earth Roads

The average district population who directly benefit from earth roads passing through rural areas of Malawi is 117,631 as shown below. Such population in Nsanje District is 61,907, which is the lowest nationwide. Thyolo District has a larger population at 170,245 than the district average (see Figure 3-8).



[Tarmac Road] [Gravel Road]

Source: National Census Agricultural and Livestock 2006/2007, Statistical Yearbook 2009

Figure 3-8 Population Who Directly Benefit from Roads

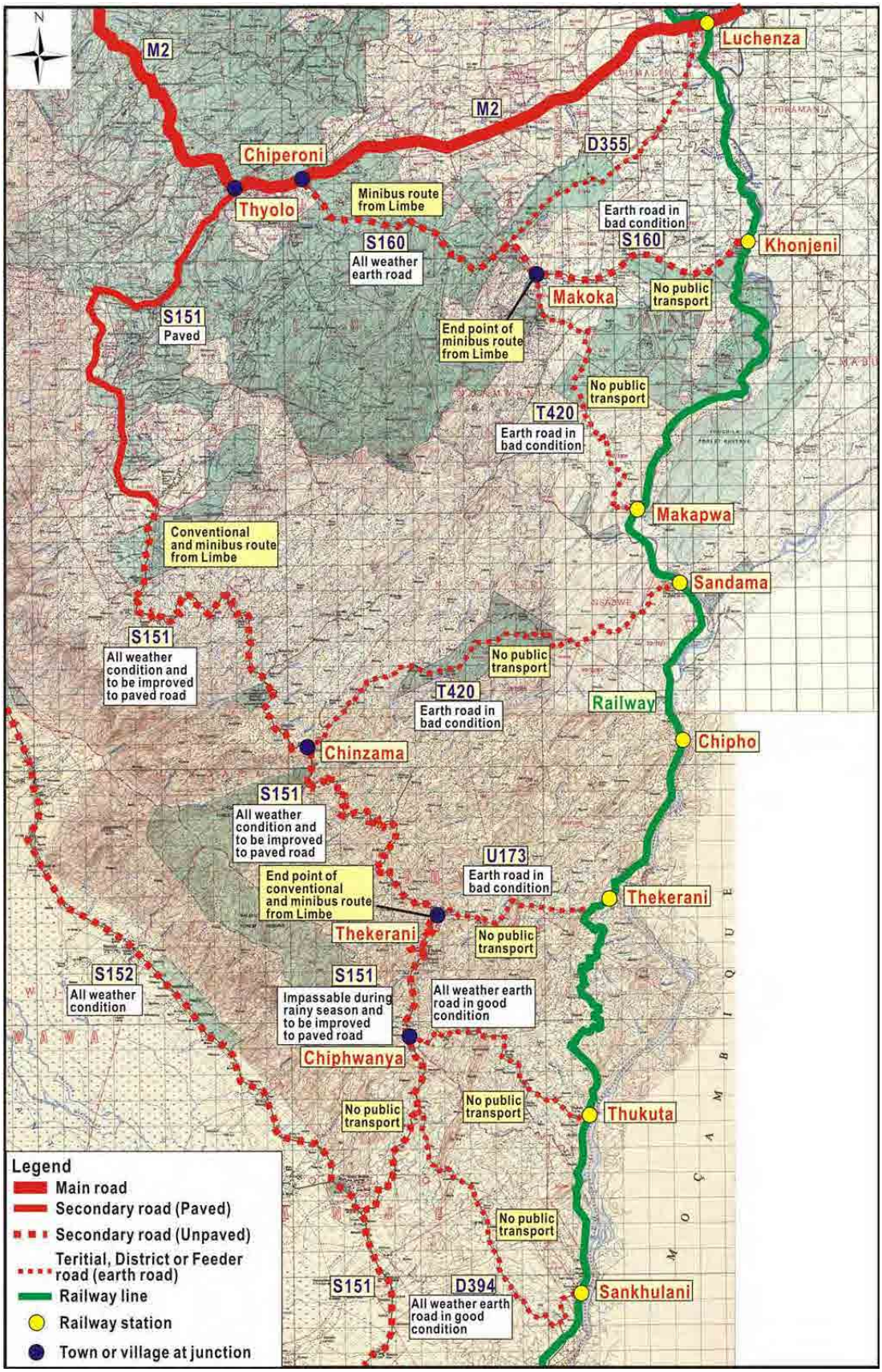
c) Access Roads to Communities

Access roads to communities, which are distributed on the eastern side of the S151 running north from Thyolo District in the south, are in poor condition, particularly to the communities that have formed around the railway stations. The distances from communities to the S151 vary from 7 km to 20 km, yet there is no local public transportation service such as minibus at all. Since the washaway at Chiromo, the train runs only once a week. The conditions of access roads to isolated communities in Thyolo District are shown in Table 3-12 and Figure 3-9.

Table 3-12 Roads to Isolated Communities in Thyolo District

Route	Section	Road Condition	Public Transportation
S160	Chiperoni–Makoka–Khonjeni	All weather earth road	Minibus route from Limbe to Makoka
T420	Chinzama–Sandama and Makapwa–Makoka	Earth road in bad condition	No Public Transportation
U173	Thekerani–Thekerani Station	Earth road in bad condition	No Public Transportation
-	Chiphwanya–Thukuta	All weather earth road	No Public Transportation
D394	Chiphwanya–Sankhulan	Earth road in bad condition	No Public Transportation

Source: Study Team



Source: Study Team

Figure 3-9 Condition of Access Roads to Isolated Communities in Thyolo District

(5) Traffic Accident

a) General

In general the total number of traffic accidents in the country has fallen steadily every year for four years (see Table 3-13). The only concern is that fatal road accidents have been on the increase since 2006. During this same period, most of the road accidents involved saloon-type vehicles, followed by pick-ups and trucks (see Table 3-14).

Table 3-13 Traffic Accidents by Severity

(Unit: No. of accident)

Type	2006	2007	2008	2009
Fatal	712	768	825	887
Serious	678	616	657	592
Minor	1,965	1,514	944	776
Damages	2,121	1,544	716	557
Animal	32	31	32	12
Total	5,508	4,473	3174	2,824
Ratio	100%	81%	58%	51%

Source: National Road Safety Council

Table 3-14 Types of Vehicles Involved in Traffic Accidents

(Unit: No. of accident)

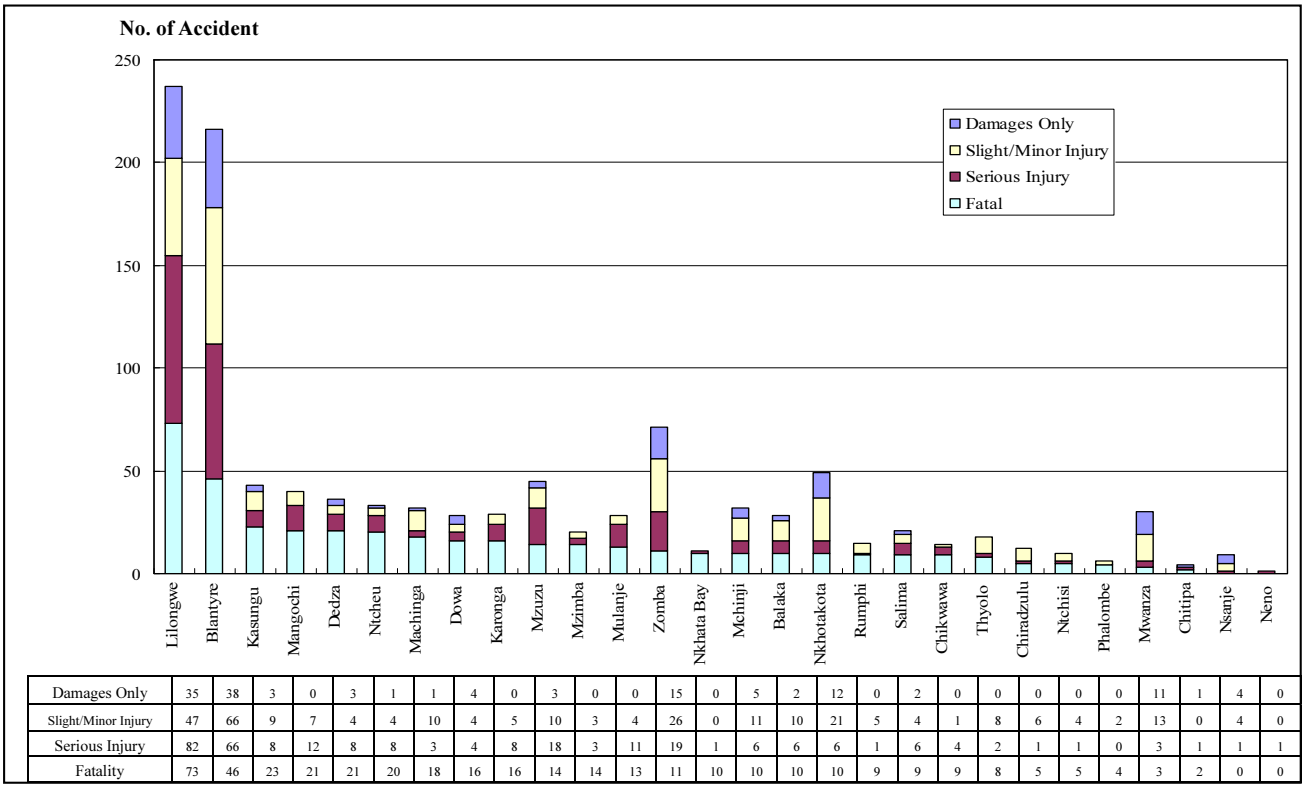
Type	2006	2007	2008	2009
Saloon	2,505	2,048	822	494
Min Buses	1,286	864	445	249
Buses	208	146	69	60
Pick-ups/Trucks	1,717	1,348	621	421
Lorries	1,241	972	572	360
Motorcycles	252	183	109	77
Others	1,468	1,228	168	273
Total	8,677	6,789	2,806	2,034
Ratio	100%	78%	32%	23%

Source: National Road Safety Council

b) Road Accidents in the Study Area

The number of fatal accidents by district in the Southern Region is relatively low compared with other regions (see Figure 3-10). Regarding the types of accidents in those districts, Nsanje District had no fatal accidents in the first half of 2010, and Mwanza District had only some damage and minor injuries rather than a low number of fatal accidents.

Additionally, road traffic accidents in the study area, in particular districts in the Southern Region such as Nsanje, Chikwawa, Thyolo and Mulanje, occur mainly along the arterial road network (See Figure 3-11). Locations where more than 10 accidents per year occur are on M1 route around Chikwawa town and the steep section as well, and on M2 route between Thyolo and Mulanje. A secondary road having more than 3 accidents per year is only on S151 around Thyolo town.



Damages Only	35	38	3	0	3	1	1	4	0	3	0	0	15	0	5	2	12	0	2	0	0	0	0	0	11	1	4	0
Slight/Minor Injury	47	66	9	7	4	4	10	4	5	10	3	4	26	0	11	10	21	5	4	1	8	6	4	2	13	0	4	0
Serious Injury	82	66	8	12	8	8	3	4	8	18	3	11	19	1	6	6	6	1	6	4	2	1	1	0	3	1	1	1
Fatality	73	46	23	21	21	20	18	16	16	14	14	13	11	10	10	10	10	9	9	9	8	5	5	4	3	2	0	0

Source: Malawi Police Service, Road Safety Database

Figure 3-10 Road Accident Severities by Districts in 1st half 2010

3.1.4 Results of Road Inventory Survey

(1) Present Condition

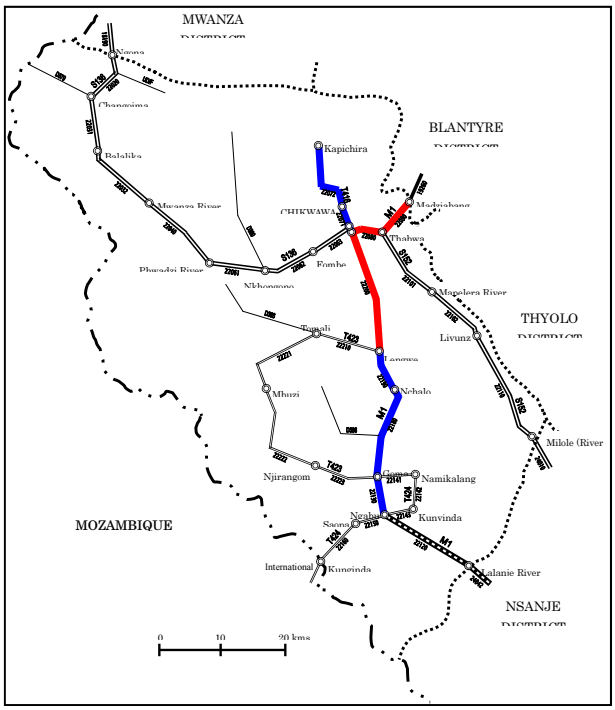
Regarding the arterial road network in the Study Area, funds have already been allocated to the improvement works of M1 ((Nsanje–Marka) from the budget for fiscal 2012. The three other unpaved routes/roads with no funding allocated have been identified for improvement by the GoM are described below:

- M1, Nsanje–Marka
- S151, Makhanga–Bangula
- S152, Thabwa–Seven.
- S136, Chikawawa–Mwanza

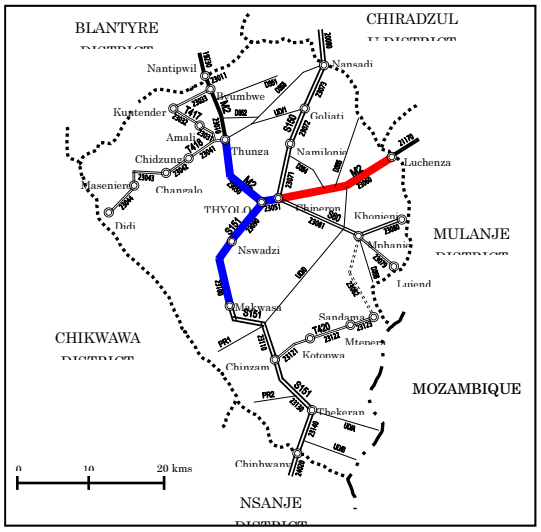
Table 3-15 Present Condition of Road in the Study Area

Route	M1 (Nsanje–Marka)	S151 (Makhanga–Bangula)	S152 (Thabwa–Seven)	S136 (Chikwawa–Mwnza)
District	Nsanje	Nsanje	Chikwawa, Nsanje	Chikwawa, Mwanza
Terrain	Flat	Flat	Flat/Rolling	Flat/Rolling/Mountainous
Road Length (km)	26.9	9.7	59.1	106.4
Road Surface	Earth	Earth	Earth	Earth
Road Width (m)	6.0 (0.5+5.0+0.5)	5.0	6.0 (0.5+5.0+0.5)	4.0 to 5.0

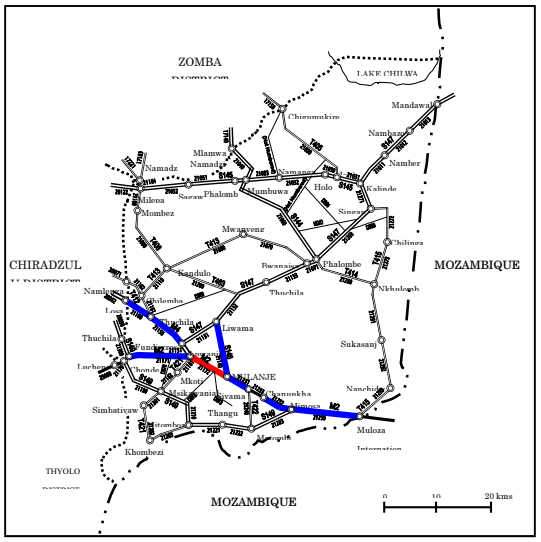
Source: Study Team



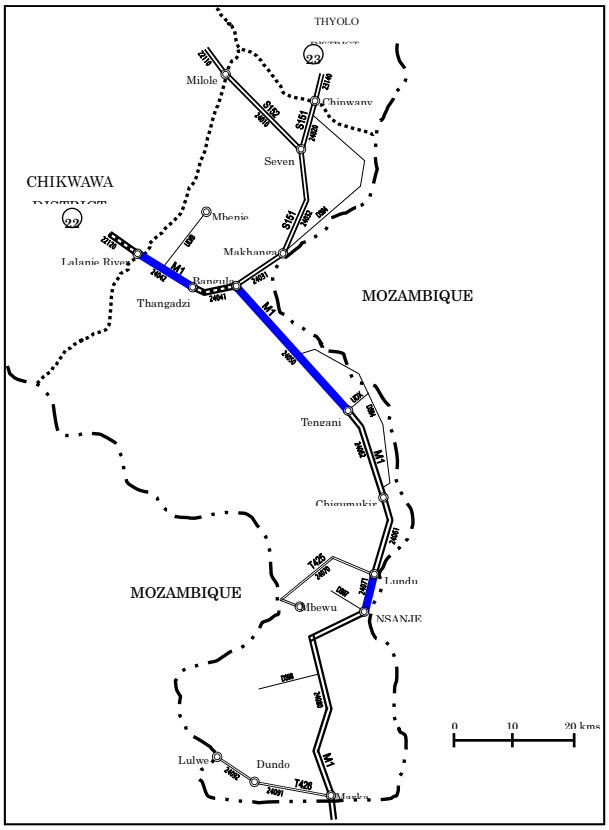
Chikwawa District



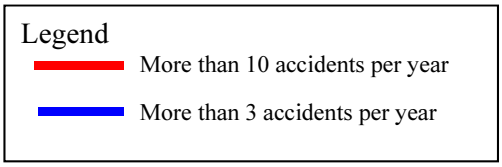
Thyolo District



Mulanje District



Nsanje District



Source: Study Team based on Malawi Police Service, Road Safety Database

Figure 3-11 Locations of Road Accidents in 2009

a) M1 (Nsanje–Marka Road) (see Photo 3-1)

The Nsanje–Marka Road lies in the Southern Region of Malawi and is one of Malawi's external routes to Mozambique. The road stretches from Nsanje to Matundu and Mankhokwe terminating at Marka, covering a distance of approximately 27 km.

Geographically, the road lies in the Lower Shire section of the Rift Valley, which is flat to gently undulating. The grades are flat and the horizontal geometry of the existing road is of an adequate standard for this class of road. The road passes through alluvial silt sands and silt clays known as black cotton soil, having low bearing value with high moisture content.

b) S151 (Makhanga–Bangula Road) (see Photos 3-1)

Makhanga–Bangula Road is a part of S151. The start point of S151 is the heart of the Thyolo trading centre. There are many tea plantations on both sides of the road indicating that the major function of this road is access to the tea estates in the area.

Makhanga, which is located approximately 85 km from Thyolo, has the last operational railway station. The railway line that runs up to Bangula from Limbe and Luchenza and on to Nsanje, Marka and Mozambique was also affected by the washaway and is not operational between Makhanga and Marka at the border.

The Chiromo washaway occurred in March 1997 caused by floodwater from the Shire River, which rose to within one metre of the top of the rail embankment. This caused the railway embankment to collapse as it was acting like a dam for which it was not designed.

c) S152 (Thabwa–Seven Road) (see Photos 3-2)

This road is the only access for the whole community living on the east bank of the Shire River in Chikwawa and Nsanje Districts. This Lower Shire Valley area served by the road is highly fertile and productive with cash crops such as cotton and food crops such as maize and fruits. Livestock breeding is also an important economic activity in this area.

The road lies at the bottom of the escarpment and runs parallel to the Shire River. The existing vertical alignment is poor. There are regular torrential rains on the escarpment causing flash floods and rivers to flow in the basin at the foot of the escarpment where the road is situated. Heavy rains cause severe difficulties in travel along the road due to inadequate drainage facilities as well as increased river flows arising from human settlement activities such as logging and cultivation. Current efforts to maintain the road are carrying out by routine maintenance, such as grading and spot gravelling, while drainage improvement has not carried out because of high cost.

	
M1, Blantyre–Chikwawa **Paved**	**M1, Chikwawa–Bangula** **Paved (under rehabilitation)**
	
M1, Bangula–Nsanje **Unpaved (Detour)**	**M1, Bangula–Nsanje** **Base Course (Under construction)**
	
M1, Nsanje–Marka **Unpaved**	**S151, Seven–Thyolo** **Unpaved**

Photos by Study Team, November 2010

Photos 3-1 Conditions of M1 and S151 in the Dry Season

	
Dry Season, November 2010 **Chinolo River (S152)**	**Rain Season, February 2011** **Chinolo River (S152)**
	
Dry Season, November 2010 **Thangaozi River (S152)**	**Rain Season, February 2011** **Thangaozi River (S152)**
	
Dry Season, November 2010 **Milola River (S152)**	**Rain Season, February 2011** **Milola River (S152)**

Photos by Study Team, November 2010

Photos 3-2 Conditions of S152 in the Dry Season and Rainy Season

d) S136 (Chikwawa–Mwanza) (see Photos 3-3)

The Chikwawa–Chapananga–Mwanza road lies in the Southern Region of Malawi and is one of Malawi's external routes to Mozambique with the potential to serve as a SADC regional trunk route. The road joins the M1 in Chikwawa and the M6 in Mwanza. Road transport is the most important mode of transport in this part of the country.

The road crosses the Mwanza River at Chapanaga located 45 km from Mwanza, however, the bridge crossing the river remains collapsed from past flooding. Due to the river width of more than 100 m as well as the rising water level during the rainy season, this washaway section is impassable, especially for heavy vehicles.

(2) Existing Drainage Facilities

Most of the existing drainage structures of the Nsanje–Marka (M1) road are concrete paved drifts crossing shallow riverbeds. These shallow riverbeds cause flooding of the area when it rains. There are many culverts on the existing alignment. Some of the drifts are embedded pipe culverts of approximately 900 mm diameter (in this report, this type of structure is called "vented drift"). On the Makhanga–Bangula (S151) and Thabwa–Seven (S152) sections, most of the existing drainage structures are concrete pipe culverts. The existing drainage structures for the three sections are summarised in Table 3-16. Due to the high level of silt and flash flooding from the escarpment or mountainside, most of the culverts are silted up to varying degrees; some of the concrete culverts are even completely clogged and difficult to clean.

Table 3-16 Summary of the Existing Drainage Facilities

Route	M1 (Nsanje–Marka) L=26.9 km	S151 (Makhanga–Bangula) L=9.7 km	S152 (Thabwa–Seven) L=59.1 km	S136 (Chikwawa–Mwanza) L=106.4km
No. of pipe culvert	13	10	92	177
No. of drift	46	0	68	n.a.
No. of vented drift	2	0	12	n.a.
No. of bridge (RC)	1	0	2	7
No. of bridge (steel)	0	1	1	0

Source: (M1, S151 and S152) Study Team, (S136) Road Data Management, draft detailed engineering design report Oct 2008

(3) Average Travel Speed

The average travel speed (4x4) on the roads in the Study Area measured in November 2010 is summarised in Table 3-17.

Table 3-17 Average Travel Speed (4x4)

Roads	Section	Surface	Terrain	Mean Travel Speed (km/h) (Nov. 2010, dry season)
M1	Blantyre – Chikwawa	Paved	Mountainous	52 (downhill)
				42 (uphill)
	Chikwawa – Bangula	Paved	Flat/Rolling	60
	Bangula – Nsanje	Base course (under const.)	Flat/Rolling	80
		Unpaved (detour)		60
	Nsanje – Marka	Unpaved	Flat	40
S151	Seven–Thyolo	Unpaved	Mountainous	32 (uphill)
S152	Thabwa – Seven	Unpaved	Flat	35

Source: Study Team

	
Rift Valley Scalp Zone (1/3) **(within 50 km from Mwanza)**	**Rift Valley Scalp Zone (2/3)** **(within 50 km from Mwanza)**
	
Rift Valley Scalp Zone (3/3) **(within 50 km from Mwanza)**	**Mwanza River (Washaway section)**
	
Depositional Rift Valley Floor (1/2) **(within 50 km from Chikwawa)**	**Depositional Rift Valley Floor (2/2)** **(within 50 km from Chikwawa)**

Photos by Study Team, June 2011

Photos 3-3 Road Conditions of S136

3.1.5 Results of the Bridge and Structure Inventory Survey

A summary of existing bridges and structures of M1 (Marka–Nsanje Road), S151 (Makhanga–Bangula Road), S152 (Thabwa–Seven Road) and S136 (Chikwawa–Mwanza Road) in the Study Area is shown in Table 3-18 and their locations are shown in Figure 3-12.

Table 3-18 Summary of Existing Bridges and Structures

Structure	Distance (km)	Type of Bridge	Length (m)	Span	Width (m)	River	Built
M1 (Nsanje-Marka Road)							
1) Nyachipere Bridge	14.8	RC	40.0	5	0.3+3.2+0.3	Nyachipere	–
S151 (Makhanga-Bangla Road)							
1) Shire Bridge	87.2	Steel Truss(Rail / Roadway)	180.0	3	3.6 (1,067 mm gauge)	Shire	1949 1975
S152 (Thabwa-Seven Road)							
1) Mwamphanzi Bridge	0.3	RC	102.0	6	0.5+4.23+0.5	Mwamphanzi	2010
2) Thangaozi Bridge	55.8	Steel	80.0	4	0.6+3.68+0.6	Thangaozi	–
3) Chinolo Bridge	58.6	RC	32.0	4	2.59	Chidima	–
S136 (Chikwawa-Mwanza Road)							
1) Nthumba Bridge 1	5.3	RC	6.3	1	3.4	Nthumba	–
2) Nthumba Bridge 2	5.5	RC	10.0	2	3.5	Nthumba	–
3) Tombokamwa Bridge	24.6	RC	7.4	1	3.2	Tombokamwa	–
4) Namatalale Bridge	57.3	RC	8.0	1	3.2	Namatalale	–
5) Futsa Bridge	71.2	RC	16.2	2	3.2	Futsa	–
6) Ngona Bridge	76.8	Timber Deck	13.0	2	3.4	Ngona	–
7) Tsupe 3 Bridge	83.0	RC	30.1	4	3.2	Tsupe 3	–
8) Mkangwi Bridge	87.3	Timber Deck	7.0	1	3.6	Mkangwi	–
9) Kandankana Bridge	87.5	Timber Deck	7.4	1	3.6	Kandankana	–
10) Tsupe 2 Bridge	88.4	RC	12.4	2	3.2	Tsupe 2	–
11) Tsupe 1 Bridge	89.0	RC	12.4	2	3.2	Tsupe 1	–
12) Timber Bridge ×3	91.1~ 99.3	Timber Deck	3.0, 5.0, 5.0	1	3.6	–	–
13) Mpamadzi Bridge	101.3	RC	22.0	4	3.2	Mpamadzi	–
14) Timber Bridge	102.1	Timber Deck	8.2	1	3.6	–	–
15) Mwanza Boma Bridge	106.3	RC	24.0	3	2.9	Mwanza	–

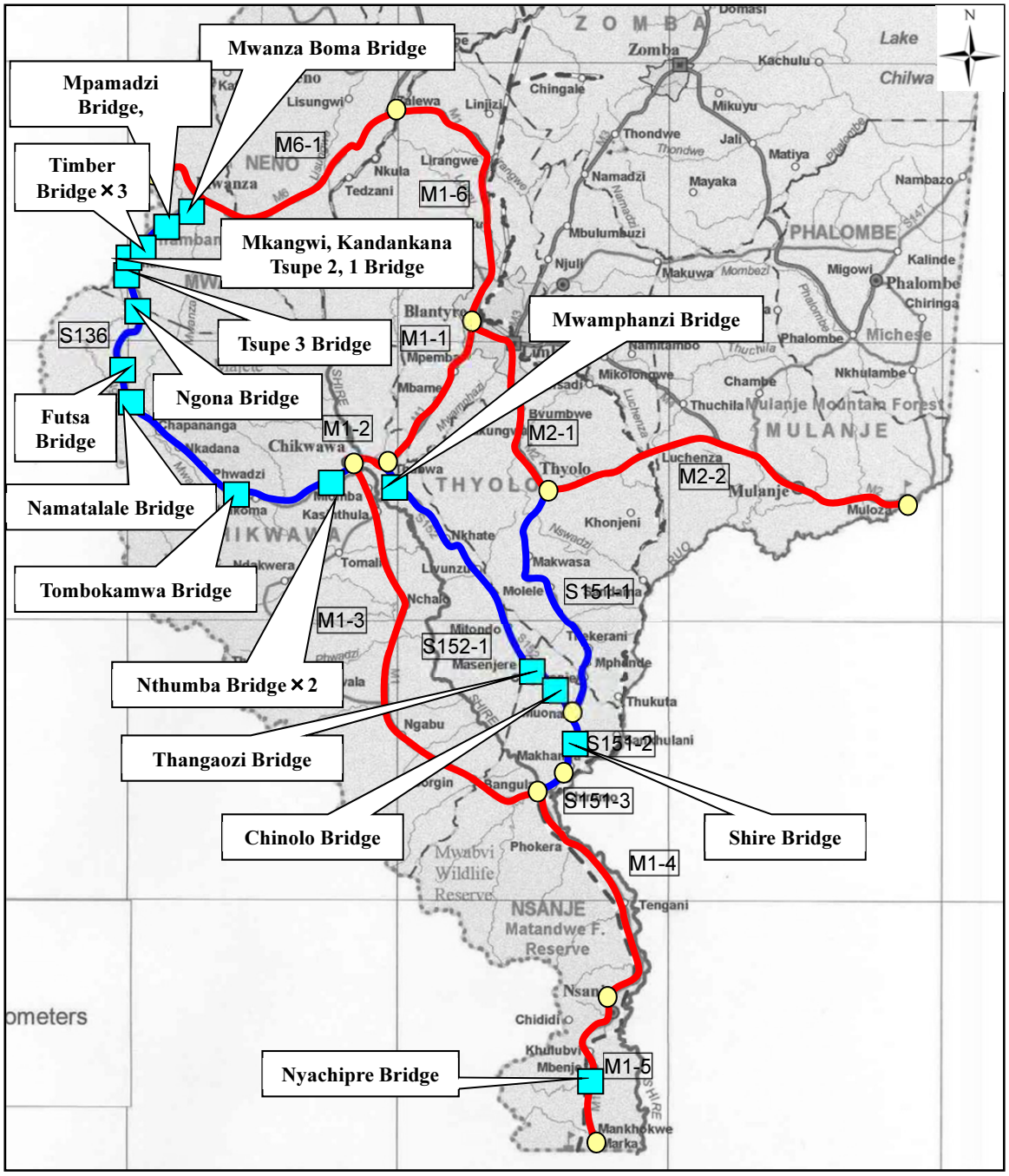
Source: Study Team

(1) M1 (Nsanje–Marka Road)

a) Nyachipere Bridge (see Photos 3-4)

Nyachipere Bridge is a 5-span Reinforced Concrete (RC) bridge (L=5@8.0m=40m) built over the Nyachipere River. The results of the investigation are as follows:

1) The width of carriageway of the bridge is narrow at 3.2 m with single lane.
2) Water passing under the bridge is restricted by the number of piers in a small area, causing the river water to go over the bridge during floods in the rainy season.
3) The abutments constrict the width of the river causing the water to overflow during floods in the rainy season.
4) Because the riverbed is formed by sandy soil, scouring is intense.



Source: Study Team

Figure 3-12 Sites of Existing Bridges

5) The Nyachipere River dries up in the dry season and is a so-called wadi.

6) The blind joint parts have been damaged.

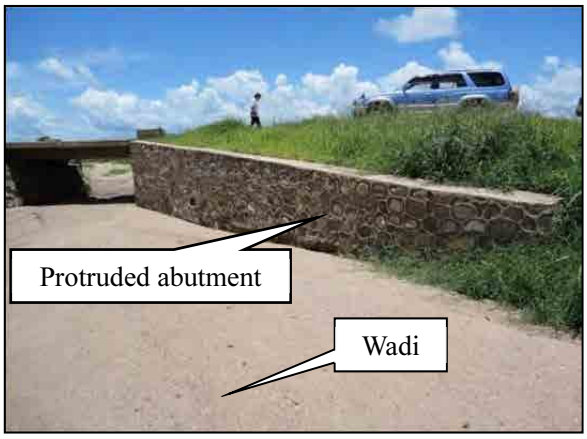
7) Since the carriageway is narrow, and the bridge is superannuated, it needs to be rebuilt as follows:

- Carry out a hydraulic analysis and determine the precise High Water Level (HWL).
- Decide the longitudinal plan since the planned height of the bridge is likely to be much higher than at present.
- Determine the bridge length in consideration of the broadening river width.

Nyachipere Bridge (side view)

Narrow Carriageway

Insufficient Water Cross-sectional Area



Insufficient Water Cross-sectional Area

Scoured Pier

Damaged Blind Joint

Photos by Study Team in February, 2011

Photos 3-4 Condition of Nyachipere Bridge

(2) S151 (Thyolo–Bangula Road)

a) Camuzu Truss Bridge (see Photos 3-5)

Camuzu Truss Bridge is a 3-span continuous steel truss bridge (L=50+80+50=180 m) built

over the Shire River, and is a combined rail and road bridge. In fact, no train runs on this bridge at present and it is only used by cars, bicycles, pedestrians, etc. The results of the investigation are as follows:

1) The steel structure of the bridge has corroded extensively.
2) Although the shoes are rusty, there is no major damage and the functionality of the bridge appeared not to be compromised.
3) There is no distortion in the trusses.
4) The rails are level, suggesting there is no subsidence or inclination of the substructure.
5) Since there are cracks on the top of the pier, some repairs are required.
6) A part of the footbridge slab is missing, making it impossible for pedestrians to go across. Immediate repairs are required.
7) Since the footbridge is narrow, it is difficult for bicycles and pedestrians to pass when vehicles are passing.
8) Since there is no visible damage to the superstructure or substructure, it is considered that the bridge can be rehabilitated.

b) Nsuwazi Bridge (see Photos 3-6)

Nsuwazi Bridge is a 3-span RC slab bridge (3@11.333 m =34 m) built over the Nsuwazi River. The results of the investigation are as follows:

1) The bridge surface pavement has deteriorated considerably, and deterioration and damage to the railing are remarkable.
2) No substantial deterioration or damage was found in the lower slab.
3) No substantial deterioration or damage was found in the substructure.

(3) S152 (Thabwa–Seven Road)

a) Mwamphanzi Bridge (Photos 3-7)

Mwamphanzi Bridge is a 6-span RC bridge (6@17 m = 102 m) built over the Mwamphanzi River. The results of the investigation are as follows:

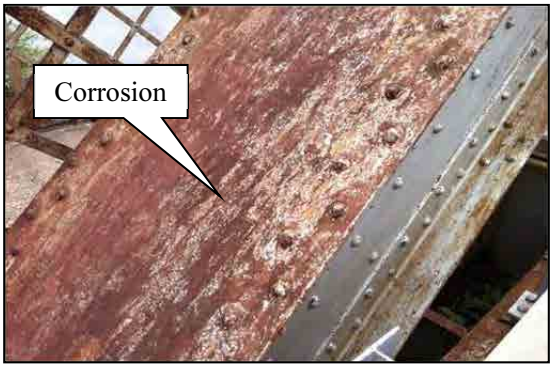
1) Mwamphanzi Bridge is a new bridge constructed in 2010.
2) The carriageway is single lane, although both sides have a footpath.
3) The longitudinal height of the new bridge is considerably higher than that of the old bridge, so river water will not flood the bridge.

b) Thagaozi Bridge (see Photos 3-8)

Thagaozi Bridge is a 4-span steel girder bridge (L=3@22.4m + 12.8 m = 80 m) built over the Thagaozi River. The results of the investigation are as follows:

1) The width of the carriageway is narrow at 3.7 m.
2) The railings are poor and there is a danger of vehicles falling off the bridge.
3) The structures of the superstructure differ in each span, and are therefore unstable (see Figure 3-13).

Shire Bridge (front view)



Remarkable Corrosion

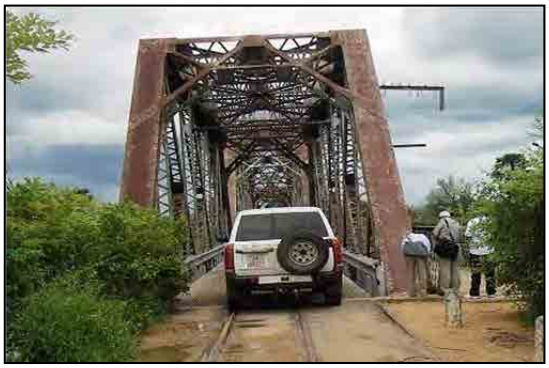
Shoe without Major Damage

Truss without Distortion

Almost Level Rail

Crack of Pier

Impassable Footpath



Narrow Lane Width

Photos by Study Team in February, 2011

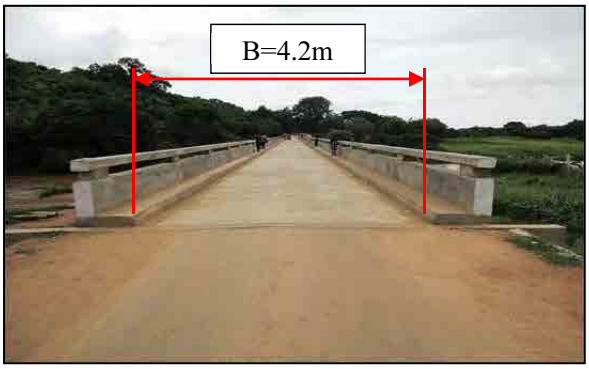
Photos 3-5 Condition of Kamuzu Truss Bridge

Nsuwazi Bridge (front view)

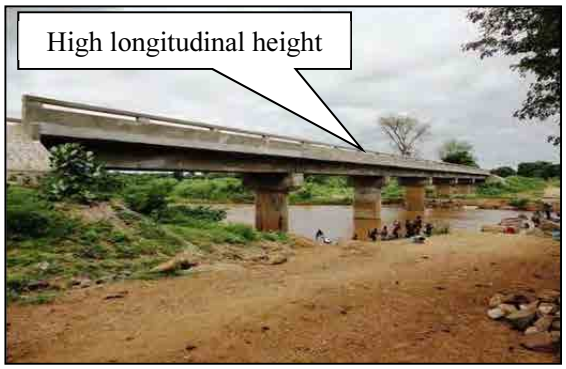
Nsuwazi Bridge (side view)

Photos by Study Team in February, 2011

Photos 3-6 Condition of Nsuwazi Bridge



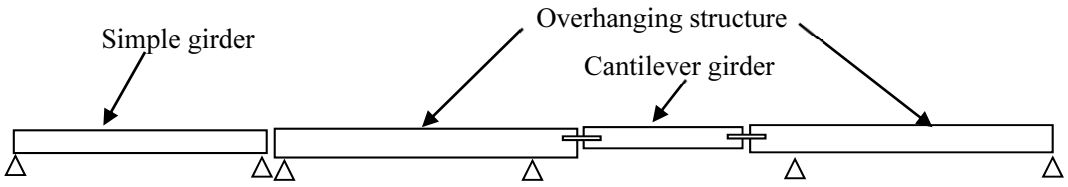
Narrow Carriageway



High Longitudinal Height

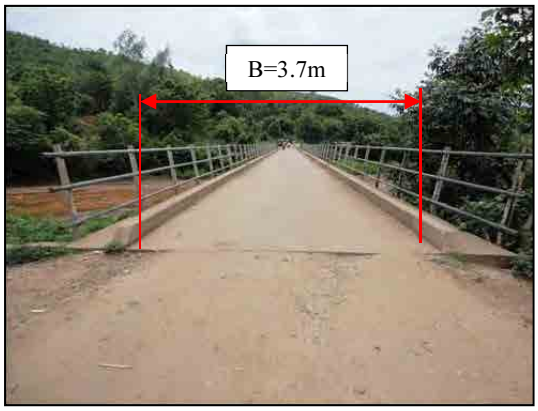
Photos by Study Team in February, 2011

Photos 3-7 Condition of Mwamphanzi Bridge

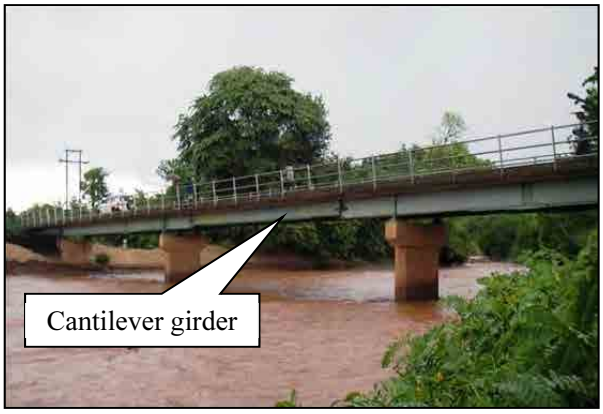


Source: Study Team

Figure 3-13 Irregular Bridge Form



Narrow Carriageway



Irregular Bridge Form

Photos by Study Team in February, 2011

Photos 3-8 Condition of Thagaozi Bridge

c) Chinolo Bridge (see Photos 3-9)

Chinolo Bridge is a 4-span RC bridge (4@8.5 m = 34 m) built over the Chidima River. The results of the investigation are as follows:

1) The width of the carriageway is narrow at 2.6 m.
2) The greater part of the bridge surface pavement has deteriorated and the concrete is bare.
3) The projection of the supporting superstructure is broken due to collisions with vehicles.
4) Since the bridge has no railing, there is a danger of vehicles falling off the bridge.
5) The bridge has an old superstructure and substructures.

Narrow Carriageway

Superannuated Chinolo Bridge

Photos by Study Team in February, 2011

Photos 3-9 Condition of Chinolo Bridge

(4) S136 (Chikwawa–Mwanza Road) (see Photos 3-10)

a) RC Bridges

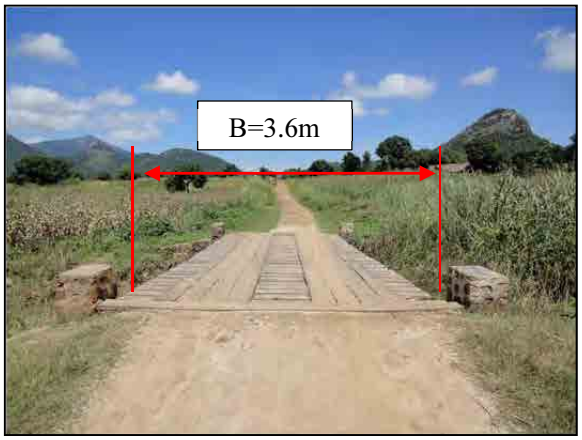
There are 10 RC bridges on the Chikwawa–Mwanza Road. The results of the investigation are as follows:

1) The width of the carriageway is narrow at 3.2 m (except Mwanza Boma Bridge 2.9 m and Nthumba Bridges: 3.4 m, 3.5 m).
2) Since almost no RC Bridges have no railings (except Mwanza Boma Bridge and Tsupe 3 Bridge), there is a danger of vehicles falling off the bridges.
3) The edge of the concrete deck of Mwanza Boma Bridge is deteriorated.
4) No RC bridges have a footpath.

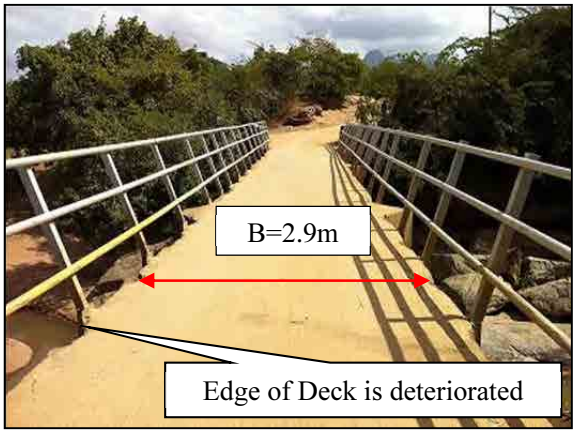
b) Timber Deck Bridges

There are 7 timber deck bridges on the Chikwawa–Mwanza Road. The results of the investigation are as follows:

1) The width of the carriageway is narrow at 3.6 m (except Ngona Bridge 3.4 m).
2) Since no timber deck bridges have railings, there is a danger of vehicles falling off the bridge.
3) Some of the timber decks have deteriorated: that of Mkangwi Bridge is severely damaged.
4) No timber deck bridges have a footpath.



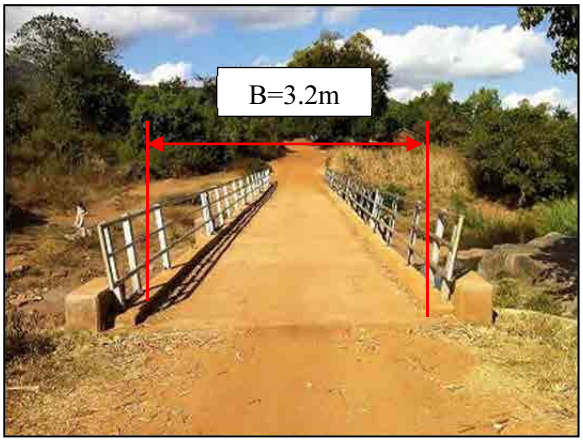
Timber Deck Bridge



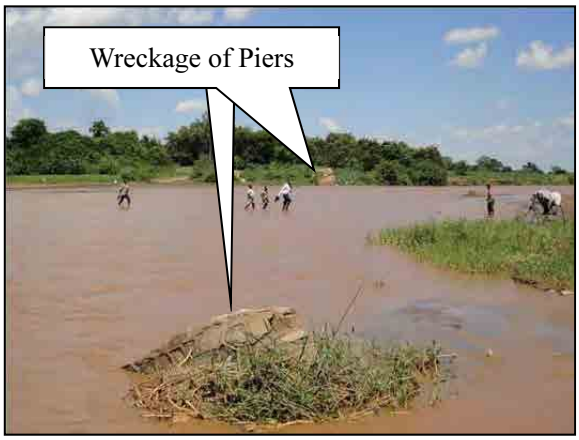
Mwanza River Bridge

Mpamdzi River Bridge

Mkangwi River Timber Deck Bridge



Tsupe 3 River Bridge



Bridge Washed Away (Chapananga)

Photos by Study Team in February and June, 2011

Photos 3-10 Condition of Bridges on S136

3.1.6 Major Findings and Problems of the Road sub-sector

Major findings and problems of the road sub-sector are described below. Major problems are summarised in Table 3-19. The locations of these problems are shown in Figure 3-14.

(1) M1, Nsanje – Marka (26.9 km)

1. Number of Lane :	1
2. Road Width :	6.0 m
3. Road Surface :	Earth
4. Travel Speed :	40 km/h
5. Terrain :	Flat, altitude 100 m above sea level
6. Drainage Facilities :	Culvert pipes with 900 mm in diameter are installed at 13 locations, at every 2 km intervals for the section. Drifts and vented drifts are installed at 48 locations, at every 560 m intervals for the section, out of 8 locations are corrupted or wiped-out.
7. Social Conditions :	There is a cemetery just next to the road at 120 m far from the Marka border.
8. Major Problems of M1- related:	a) There is no alternative route for M1 between Blantyre and the Lower Shire area due to the disconnection of S151 at Chiromo. b) The service level of M1 between Blantyre and Thabwa is low due to its steep gradient. c) Earth road sections are impassable for several hours or days when wadis become flood in the rainy season. d) The road section between Vila Nova and Caia in Mozambique, which can be a part of the international corridor connectig to Beira Port, is unpaved, with a ferry crossing on the Shire River. e) There is no alternative international corridor for the Tete Corridor which links with Beira Port. f) The transport route from Chikwawa and Nsanje Districts to the Tete Corridor depends on M1 passing through Blantyre with steeper gradient and longer transport distance than the S136 route. g) The budget for maintaining paved roads (periodic and pothole patching) accounts for only about 1% of the entire maintenance programme. h) All roads are being maintained routinely, however the budget is very small and so repairing of drainage structures and cleaning of drains are inadequate.

(2) S136, Chikwawa – Mwanza (106.4 km)

1. Number of Lane :	1
2. Road Width :	4.0 to 5.0 m
3. Road Surface :	Earth
4. Travel Speed :	30 km/h
5. Terrain :	Flat/Rolling/Mountainous, altitude variation of 100 m to 900 m
6. Drainage Facilities :	Culvert pipes with 300 or 600 mm in diameter are installed at 177 locations, at every 600 m intervals for the section.
7. Major Problems of S136-related:	a) Earth road sections are impassable for several hours or days when wadis become flood in the rainy season. b) The transport route from Chikwawa and Nsanje Districts to the Tete Corridor depends on M1 passing through Blantyre with steeper gradient and longer transport distance than the S136 route. c) The disconnection at the Mwanza River hinders the of mobility

	and access of local people to market, schools and medical facilities. d) All roads are being maintained routinely, however the budget is very small and so repairing of drainage structures and cleaning of drains are inadequate.

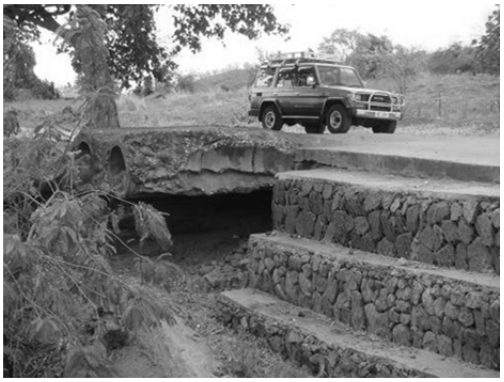
(3) S151, Makhanga – Bangula (9.7 km)

1. Number of Lane :	1
2. Road Width :	5.0 m, including a one-lane rail-road combined bridge over the Shire River at 5.2 km far form Makhanga.
3. Road Surface :	Earth
4. Travel Speed :	30 km/h
5. Terrain :	Flat, altitude 100 m above sea level
6. Natural Condition :	There are swamps which might have been formed in the '90s after several flooding, on both of the road at Chiromo area.
7. Major Problems of S151-related:	a) Earth road sections are impassable for several hours or days when wadis become flood in the rainy season. b) There is no alternative route for M1 between Blantyre and the Lower Shire area due to the disconnection of S151 at Chiromo. c) The one-lane Kamuzu Truss Bridge will become a bottleneck when the Makhanga-Bangula section is reconstructed. d) The disconnection at Chiromo hinders the mobility and access of local people to market, schools and medical facilities. e) Local roads to some railway stations between Khonjeni and Thekerani are in poor condition. f) All roads are being maintained routinely, however the budget is very small and so repairing of drainage structures and cleaning of drains are inadequate.

(4) S152, Thabwa – Seven (59.1 km)

1. Number of Lane :	1
2. Road Width :	6.0 m, including 2.7 m to 3.7 m for three bridge sections
3. Road Surface :	Earth
4. Travel Speed :	35 km/h
5. Terrain :	Flat/Rolling, altitude 100 m above sea level
6. Drainage Facilities :	Culvert pipes with 600 or 900 mm in diameter are installed at 92 locations, at every 640 m intervals for the section, out of 11 locations are corrupted or wiped-out. Drifts and vented drifts are installed at 80 locations, at every 740 m intervals for the section, out of 9 locations are corrupted or wiped-out.

Wiped-out culverts



Corrupted Drift

Scoured Drains at downstream side

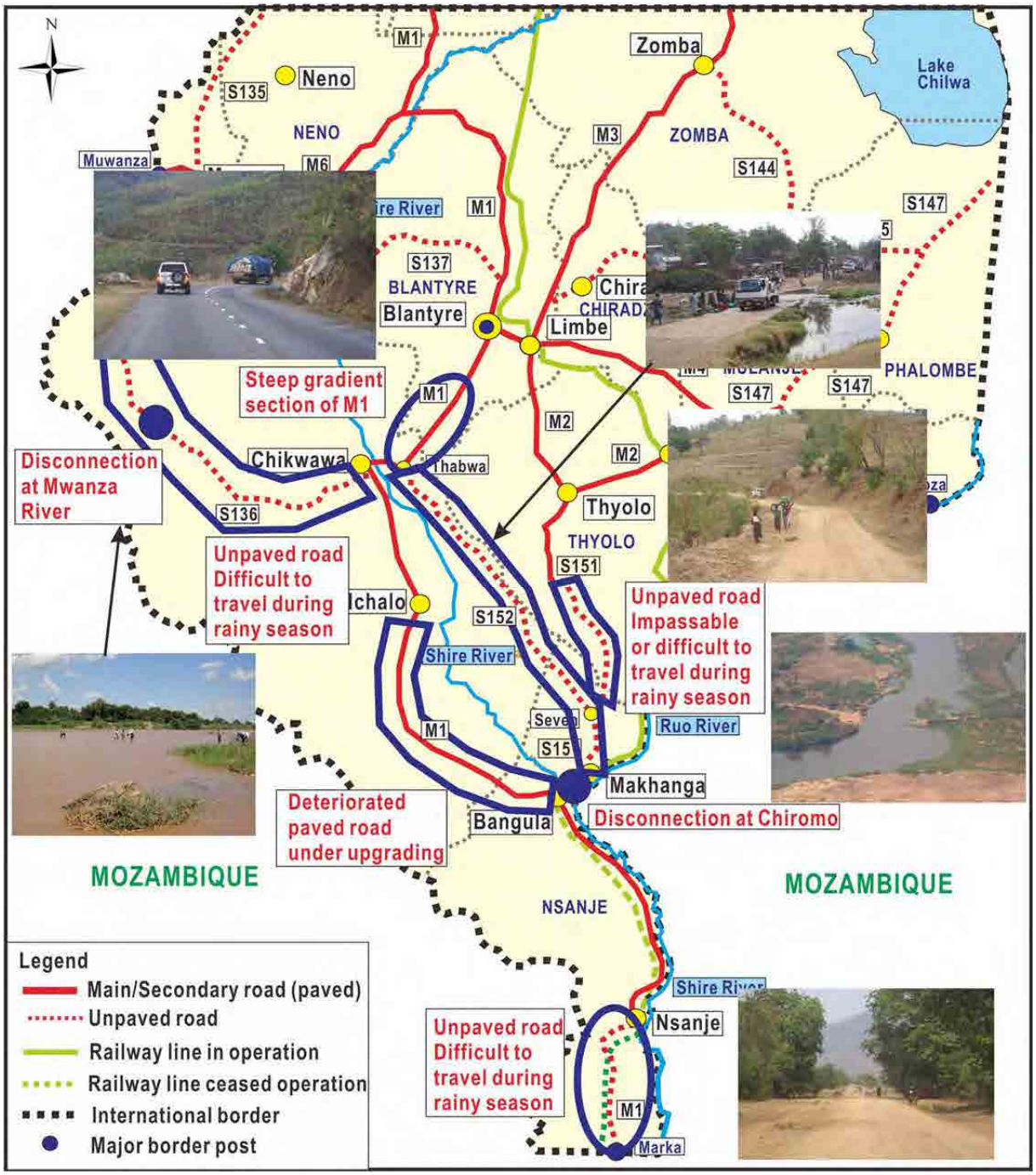
Gullies/ditches on the road sides

7. Condition of Routine Maintenance :	-	Poor for cleaning and opening drains
	-	Fair for the spot reshaping/ grading of carriageway
	-	Good for filling potholes and gullies
	-	Poor for repairing drainage structures
	-	Fair for cutting grass and shrubs
	-	Fair for pruning trees on the road reserve
	-	Poor for planting erosion-control vegetation
8. Major Problems of S152-related:	a)	Earth road sections are impassable for several hours or days when wadis become flood in the rainy season.
	b)	All roads are being maintained routinely, however the budget is very small and so repairing of drainage structures and cleaning of drains are inadequate.

Table 3-19 Major Problems of the Road Sub-sector

Major Problems	Routes-related			
	M1	S136	S151	S152
There is no alternative route for M1 between Blantyre and the Lower Shire area due to the disconnection of S151 at Chiromo.	X		X	
The service level of M1 between Blantyre and Thabwa is low due to its steep gradient.	X			
Earth road sections are impassable for several hours or days when wadis become flooded in the rainy season.	X	X	X	
The road section between Vila Nova and Caia in Mozambique, which can be a part of the international corridor connecting to Beira Port, is unpaved, with a ferry crossing on the Shire River.	X			
There is no alternative international corridor for the Tete Corridor which links with Beira Port.	X			
The transport route from Chikwawa and Nsanje Districts to the Tete Corridor depends on M1 passing through Blantyre with steeper gradient and longer transport distance than the S136 route.	X	X		
Local roads to some railway stations between Khonjeni and Thekerani are in poor condition.			X	
The budget for maintaining paved roads (periodic and pothole patching) accounts for only about 1% of the entire maintenance programme.	X			
All roads are being maintained routinely, however the budget is very small and so repairing of drainage structures and cleaning of drains are inadequate.	X	X	X	X
The one-lane Kamuzu Truss Bridge will become a bottleneck when the Makhanga–Bangula section is reconstructed.			X	
Routes for transporting agricultural products in Thyolo and Chikwawa Districts with high population density are mostly unpaved.			X	X
The disconnection at Chiromo and the Mwanza River hinders the mobility and access of local people to markets, schools and medical facilities.		X	X	

Source: Study Team



Source: Study Team

Figure 3-14 Location of Major Problems of Road Sub-sector