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Establishment of Tractor-based road works Demonstration-Training Unit in Zambia.

Chongwe District Road Inventory & Condition Report

Authors: Kingstone Gongera & Robert Petts

AfCAP Project Reference Number: ZAM2059B

Chongwe Inventory Report, August 2017

RDA

Intech Associates

CLANVIEW CIVILS

ESTABLISHMENT OF PILOT TRACTOR TECHNOLOGY DEMONSTRATION-TRAINING UNIT (DTU) TO IMPLEMENT TRACTOR-BASED ROAD MAINTENANCE APPROACHES IN ZAMBIA

Project Reference: ZAM2059B

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TMH 9 and 22

The Africa Community Access Programme (AfCAP) is a programme of research and knowledge dissemination funded by the UK government through the Department for International Development (DFID). AfCAP is promoting safe and sustainable rural access in Africa through research and knowledge sharing between participating countries and the wider community.

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Abbreviations and Acronyms

AfCAP	Africa Community Access Partnership
CEO	Chief Executive Officer
CMC	Chongwe Municipal (formerly District) Council
CRN	Core Road Network
DFID	Department for International Development
hp	horse power
IRI	International Roughness Index
km	kilometre
kW	KiloWatt
LRA	Local Road Authority
LVR	Low (traffic) Volume Road
MoA	Ministry of Agriculture
MoLG	Ministry of Local Government
MSMEs	Micro Small and Medium Enterprises
NAMSSC	National Association of Medium and Small Scale Contractors
NCC	National Council for Construction
NRFA	National Road Fund Agency
RDA	Road Development Agency
ReCAP	Research for Community Access Partnership
RMS	Road Maintenance Strategy
RSA	Republic of South Africa
SSA	Sub Saharan Africa
TDU	Training and Demonstration Unit
TEVETA	Technical Education, Vocational and Entrepreneurship Training Authority
ToT	Training of Trainers
TT	Tractor Technology
USA	United States of America
US$	United States dollar
VAT	Value Added Tax
ZAWIC	Zambian Association of Women in Construction
ZMK	Zambian Kwacha
ZNS	Zambia National Service

EXECUTIVE SUMMARY

Chongwe District has been selected as the location for a Tractor Technology Demonstration and Training Unit (DTU). This Report describes the activities in establishing and surveying the current road inventory and network condition in Chongwe district, to be used for benchmarking and planning purposes before implementing the DTU Project operations.

The project follows completion of a scoping study in 2016. That study was commissioned by AfCAP at the request of the Road Development Agency (RDA). It investigated the potential and rationale for Tractor Based maintenance of rural roads in Zambia and was aimed at investigating the location, institutional and management arrangements, organisation requirements and costs of setting up a Tractor Technology demonstration-training unit (DTU) for rural roads in Zambia. Stakeholders from the principal beneficiary and contributory sectors have endorsed the recommendations for establishment of the Unit and are actively involved in this implementation phase.

Under the current assignment, also commissioned by AfCAP for RDA, visits were made by the Consultant's team members Robert Petts and Kingstone Gongera to Zambia and South Africa (RSA).

The purpose of this project is to embark on implementation of the recommendations of the scoping study in a phased manner, focussing mainly on setting up and conducting DTU activities in a selected District as a pilot project; namely Chongwe Municipal Council.

This is a capacity building project that seeks to introduce a cost-effective and sustainable approach to rural road maintenance by using tractor-based technologies already successfully applied in a number of countries in the region (including Zimbabwe and Mozambique). This project complements the Economic Growth through Effective Road Asset Management (GEM), Satellite Imagery and Climate Change projects, also funded under AfCAP and being implemented in Chongwe District. Training of a whole range of personnel from the District, contractors' and engineering firms as well as staff from the Road Development Agency (RDA) of Zambia and local authorities will be a key element of the project.

Key Words: Tractor Road Maintenance Zambia Demonstration Training Inventory.

1. BACKGROUND

1.1 Overview

The Africa Community Access Partnership (AfCAP) is a programme of research and knowledge dissemination funded by the UK government through the Department for International Development (DFID). AfCAP is promoting safe and sustainable rural access in Africa through research and knowledge sharing between participating countries and the wider community. The first phase of AfCAP commenced in June 2008 and ended in July 2014. The second phase, which will also run for 6 years, commenced on the 1st August 2014. The management of AfCAP2 is contracted by DFID to Cardno UK. The aim of the new AfCAP initiative, under the overall Research for Community Access Partnership (ReCAP) umbrella, is to build on the programme of high quality research established under AfCAP phase 1 and take this forward to a sustainable future in which the results of the research are adopted in practice and influence future policy.

1.2 Project Context

All-season road-based transport is a vital enabler for rural development, social and economic activities and community wellbeing, particularly for vulnerable groups (e.g. women, children, elderly, disabled) (Cook et al, 2017). Currently, the majority of the rural road networks in Zambia are unpaved (earth and gravel standard) and as such require regular maintenance input to retain acceptable levels of access. However, unpaved road network maintenance is generally substantially under-funded in the Sub-Saharan Africa region (SSA) and Zambia is no exception. There is a clear demand, therefore, for innovative, cost-saving approaches to maintenance activities. Currently routine maintenance of unsealed roads is usually based around the use of imported motorised graders which are expensive to buy and operate in the prevailing high-finance-cost environment. They are also over-powered for the routine maintenance task.

Within appropriate road environments agricultural tractor-based technology is a lower-cost proven alternative to the use of high cost specialist plant for low volume unsealed road maintenance. There is no established unit in Zambia to demonstrate and train for this more affordable and more sustainable tractor-based technology.

Following completion of the scoping study which was aimed at investigating the location, institutional and management arrangements, organisation requirements and costs of setting up a Tractor Technology demonstration-training unit (DTU) for rural roads in Zambia, the stakeholders have endorsed the recommendations for establishment of the Unit. The outcomes of the study and recommendations thereof are contained in the Scoping Study Final Report (Petts & Gongera, AfCAP ZAM2059A, Scoping Study Final Report, April 2016).

1.3 Related Projects

Related projects include previous and on-going experience with tractor-based technology in the region, for example in Zimbabwe and Mozambique. Not only are towed graders manufactured in the region (e.g. in Zimbabwe and South Africa), there is a wide range of other road construction and maintenance activities that the agricultural tractor can do to offer a total road rehabilitation and maintenance package based on the use of tractors.

Synergies with other programmes in Zambia have already been explored and details are contained in the Scoping Study Final Report mentioned in section 1.2 above.

Other related AfCAP projects are:

GEN2018A “Economic Growth through Effective Road Asset Management – GEM”.

GEN2070A “The use of appropriate high-tech solutions for Road network and condition analysis, with a focus on satellite imagery”.

GEN2014A Climate Adaptation: Research on Risk Management and Resilience Optimisation for Vulnerable Road Access.

1.4 Project Partners

Project partners have been established through AfCAP and the DTU Coordination Committee:

- Regional partner countries, with particular reference to Zimbabwe, Mozambique and South Africa.
- Roads Development Agency (RDA)
- National Council for Construction (NCC)
- Technical Education, Vocational and Entrepreneurship Training Authority (TEVETA)
- Ministry of Local Government (MoLG)
- National Road Fund Agency (NRFA)
- Ministry of Agriculture (MoA)
- Zambia National Service (ZNS)
- Chongwe Municipal (formerly District) Council (CMC)

2. PROJECT OBJECTIVE

The purpose of this project is to embark on implementation of the recommendations of the scoping study in a phased manner, focussing mainly on setting up and conducting DTU activities in a selected District as a pilot project; namely Chongwe Municipal Council.

This is a capacity building project that seeks to introduce a cost-effective and sustainable approach to rural road maintenance by using tractor-based technologies already successfully applied in a number of countries in the region (including Zimbabwe and Mozambique). Training of a whole range of personnel from the District, contractors’ and engineering firms as well as staff from the Road Development Agency (RDA) of Zambia and local authorities will be a key element of the project.

3. THIS REPORT

This report describes the initial project activities with regard to identifying the Core Feeder Road Network in the project District of Chongwe Municipal Council, and the compilation of Inventory and Condition information to act as a benchmark and planning database for the project implementation activities. A separate Inception Report was issued in draft in July 2017.

4. ROAD NETWORK AND ITS ADMINSISTRATIVE BOUNDARIES

The road network in Zambia is estimated to comprise 67,701 km of roads which are categorized into Trunk, Main, District, Feeder and Urban Roads. A National Core Road Network of 40,113 km has been established as a planning tool to direct the focus for the limited road maintenance resources. The following table shows the summary of the core road network.

TABLE 4.1 - SUMMARY OF THE NATIONAL CORE ROAD NETWORK BY FUNCTION

Road Function	Total estimated network (km)	Core Road Network (km)
Trunk (T)	3,088	3,088
Main (M)	3,691	3,691
District (D)	13,707	13,707
Urban	5,294	5,294
Primary Feeder/Rural	15,800	14,333
Secondary Feeder	10,060	
Tertiary Feeder	4,424	
Park Roads	6,607	
Community Roads	5,000	
Total	**67,671**	**40,113**

Zambia is divided into 10 administrative provinces each further subdivided into administrative districts. These provinces and districts each have road networks comprising the Main, Trunk, District and Feeder roads. Chongwe district is one of the 7 districts in Lusaka province.

According to the Public Roads Act (2002), the district council shall be responsible for the construction, care and maintenance of rural roads within its own area. Chongwe district has a total of over 600 km of primary feeder roads linking it to all rural service centres, schools, clinics, social and economic centres within the district. A Core Feeder road network of 320 km has been established by the District under the DTU and GEM project initiatives.

FIGURE 4.1 – LUSAKA PROVINCE SHOWING CHONGWE & OTHER DISTRICTS

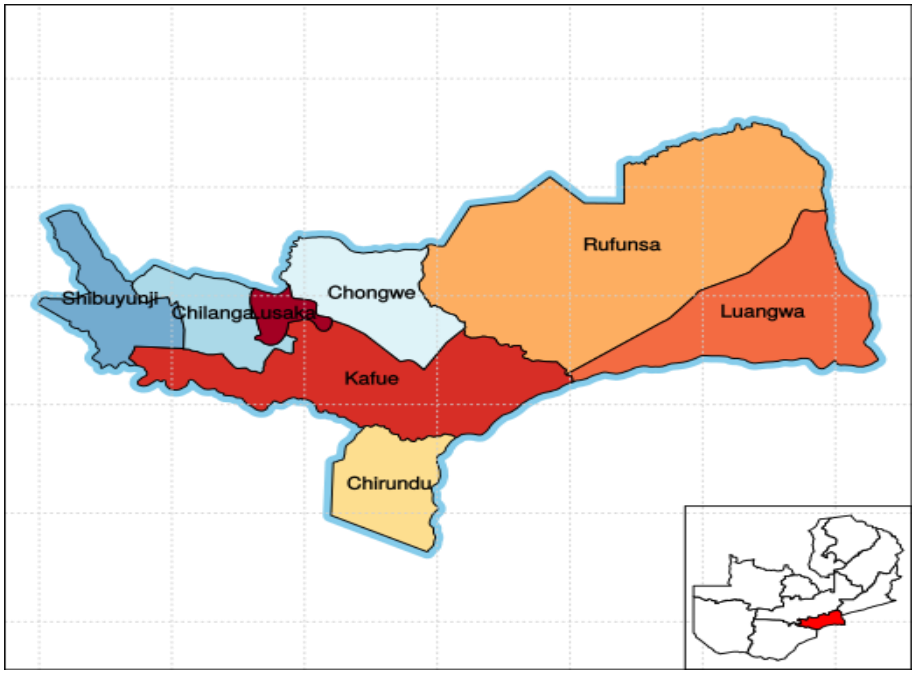


FIGURE 4.2 - MAP OF ZAMBIA SHOWING ALL THE PROVINCES

5. CORE ROAD NETWORK

The Chongwe Core Primary Feeder Road Network for the DTU project was determined by the RDA and District technical personnel and an inventory was conducted under this project as shown in Table 5.1. Lengths shown were confirmed during the detailed surveys.

Drive through surveys were carried out to initially establish the approximate condition ratings as shown in table 5.2. World Bank Guidance (Archondo-Callao Rodrigo, 1999) was used to indicate Roughness in IRI as an overall condition measure.

Figure 5.1 provides a GPS plot of the Core Road Network. This map has been prepared by the RDA Lusaka Province Region Office and District personnel under this project and demonstrates the level of partner commitment.

The standard width for Primary/Feeder Roads is 6.1 metres with 1 metre shoulders.

TABLE 5.1 - CHONGWE DISTRICT CORE ROAD NETWORK INVENTORY

CHONGWE MUNICIPAL COUNCIL PRIMARY FEEDER ROAD NETWORK TDU PILOT PROJECT					
No	**ROAD CODE**	**ROAD NAME**	**LENGTH (KM)**	**CLASS**	**2016 CONDITION**
1	No Code	CHIBWALU-JAKAPU	7	P	Poor
2	No Code	NDAPULA – LWIMBA RIVER	5	P	Poor
3	No Code	MATIPULA	6.1	P	Very Poor
4	No Code	MAPULANGA ROAD	15.5	P	Poor
5	No Code	T4 – KAPETE	13	P	Fair
6	No Code	TWIKATANE – NCHUTE	10.6	P	Poor
7	No Code	KABELEKA – CHISHIKO	6.4	P	Very Poor
8	No Code	KASENGA – CHISAMBA	14.5	P	Poor
9	No Code	MPEMBA – MULENJE	15.0	P	Poor
10	No Code	NJOLWE – MAFUNGO 1	7.5	P	Very Poor
11	No Code	NJOLWE – MAFUNGO 2	16.7	P	Very Poor
11	No Code	MUKAMAMBO II (KAPILYOMBA AREA)	9.3	P	Very Poor
12	U7	CHIKWELA – KAPUKA	6.2	P	Poor
13	U6	CORNER BAR – WATERGREEN	4.3	P	Poor
14	U8	T4 – KAGWILA	5.7	P	Poor
15	No Code	NGWERERE ROADS	12.8	P	Very Poor
16	U16	NCHUTE – LUKOSHI	17.2	P	Very Poor
17	No Code	MWANAWASA RESETTLEMENT ROADS	15	P	Very Poor
18	No Code	SILVEREST ROADS	5.7	P	Poor
19	RD 483	MANDEBELE ROAD	5.8	P	Poor
20	U2	MWALUMINA ROAD	40.2	P	Fair
21	U3	MUTUMBISHA ROAD	6.8	P	Poor
22	U4	KALULU ROAD	5.5	P	Fair
23	U10	KAPETE DEPOT	5.3	P	Poor
24	U14	MWAMPATISHA ROAD	9.5	P	Poor
25	U15	KASUBANYA ROAD	10	P	Poor
26	A1	RD 480 TO KASISI(By Antioch School)	32	P	Poor
27	U5	CHILONGA	11.3	P	Good
		TOTAL	**319.9**		

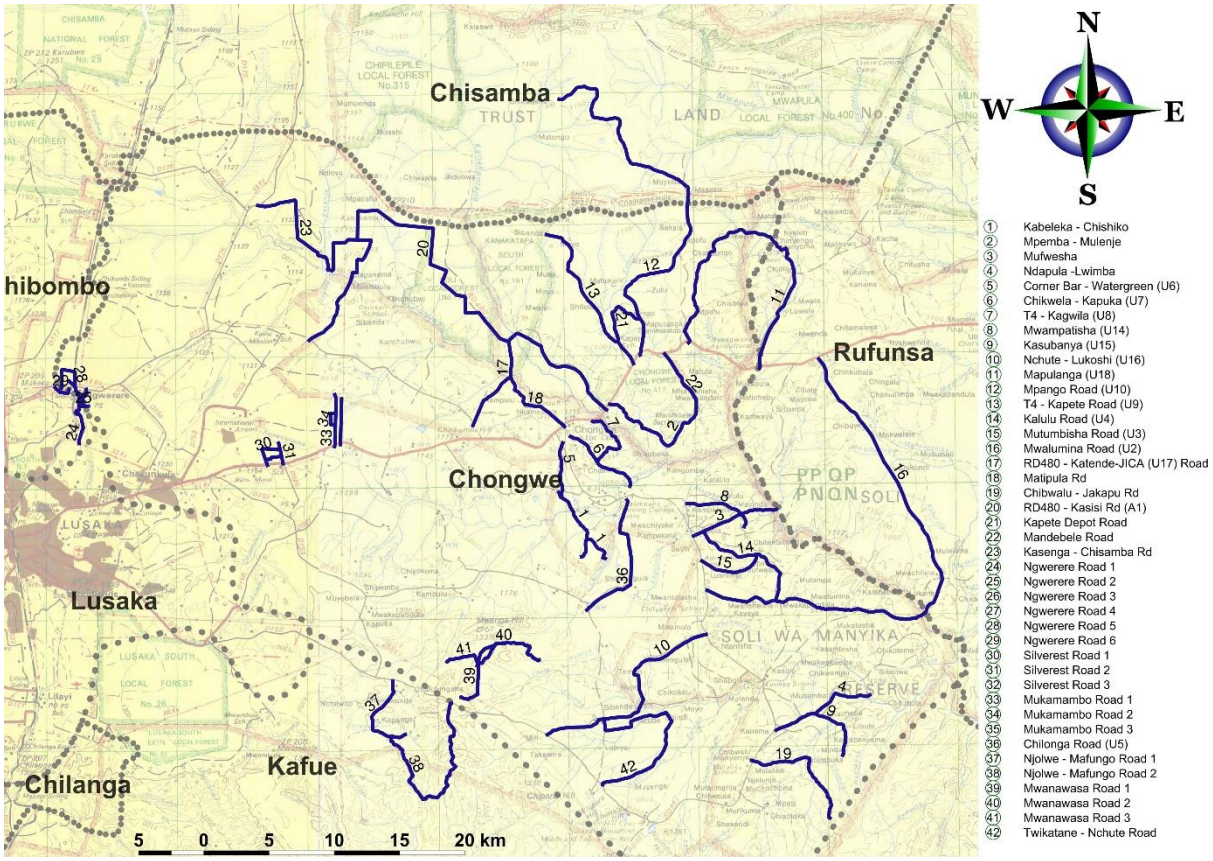
KEY

ROADS NOT INCLUDED IN GEM PROJECT

TABLE 5.2 – ROAD CONDITION RATINGS FROM INITIAL DRIVE THROUGH SURVEYS

Assessed Condition	Comfortable Travel Speed	Approximate IRI
Very Good	50 kph +	**< 13**
Good	40 – 50 kph	**13 - 16**
Fair	30 – 40 kph	**16 – 17.5**
Poor	20 – 30 kph	**20 - 22**
Very Poor	0 – 20 kph	**> 22**

FIGURE 5.1 – (PRIMARY FEEDER) CORE ROAD NETWORK



6. CHONGWE DISTRICT DATA COLLECTION & SURVEYS

The DTU project is making use of the capacity developed already under the GEM project and it is hoped that the two projects will provide adequate support in managing and executing road maintenance work in the district. Following the drive through rapid surveys (Section 5), detailed road condition surveys were carried out after refresher training of the RDA Regional Office staff and Chongwe District Council technical personnel by the project team. The detailed road condition survey methodology is based on the TMH 9 and TMH 22 manuals developed by the Western Cape Government of South Africa. This follows the inclusion of the Western Cape on the GEM project as an example of good practice in Road Asset Management. The roads in Chongwe district were surveyed by the same team of road engineers and supervisors that were trained under the GEM Project to carry out road condition surveys. The continuation of the exercise under the DTU project completes the surveys for all the primary feeder roads in Chongwe identified for both the GEM and DTU projects; the roads marked in yellow in Table 5.1 are not under the GEM project.

The roads were divided into sections of 5km each and a visual assessment of the road was carried out. The team assessed the degree (D) of defects on a scale of 1 – 5 and the extent (E) of the damage on a scale of 1 – 5 as well.

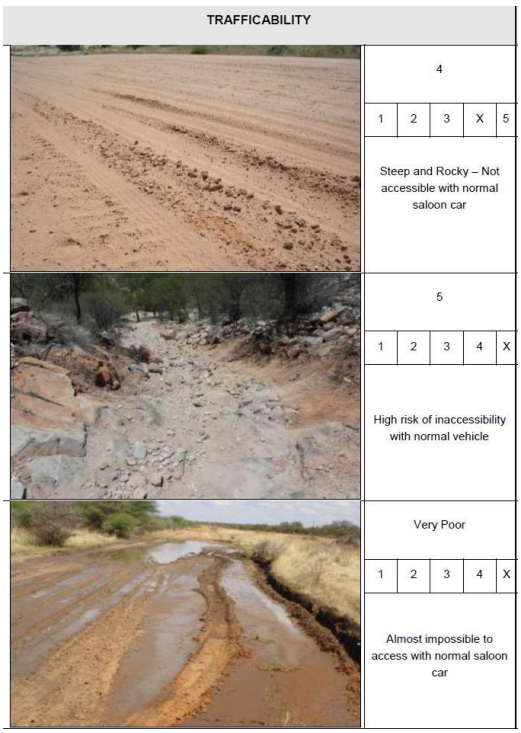
TABLE 6.1 – GUIDANCE FOR THE ASSESSMENT OF DEGREE AND SEVERITY OF DEFECTS

DEGREE	SEVERITY	DESCRIPTION
1	Slight	First signs of distress are visible
2	Slight to warning	Distress clearly visible but not intense
3	Warning	Distress notable and starting to cause secondary defects
4	Warning to severe	Secondary defects clearly visible
5	Severe	Secondary defects are advanced and exteme severity of primart defects

The defects are assessed using the guiding table above and the photographs following were used to train the assessors who conducted the road condition assessment.

FIGURE 6.1 – VISUAL ASSESSMENT GUIDANCE

Passability



Potholes

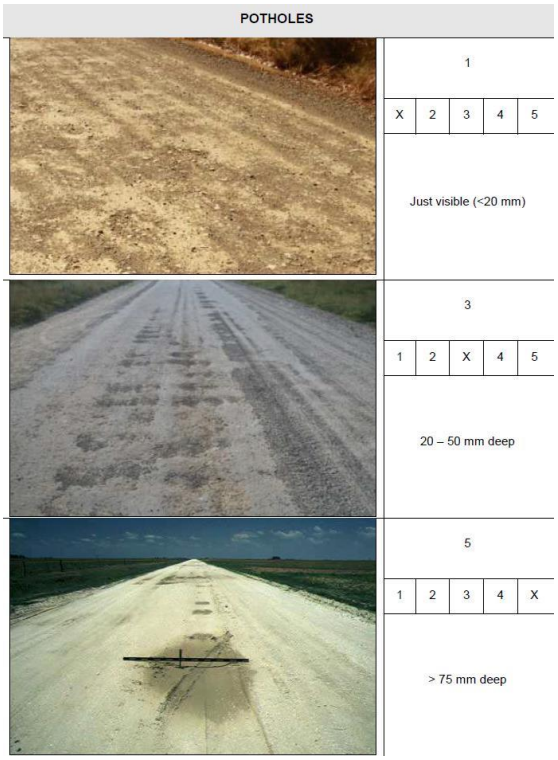


FIGURE 6.2 - SURVEY TEAMS CARRYING OUT ROAD CONDITION SURVEY IN CHONGWE DISTRICT

The extent of the defects was also assessed to establish the degree of the problem. Based on the guidelines provided in the table below, the assessors determined the extent to which the various defects affecting the road network.

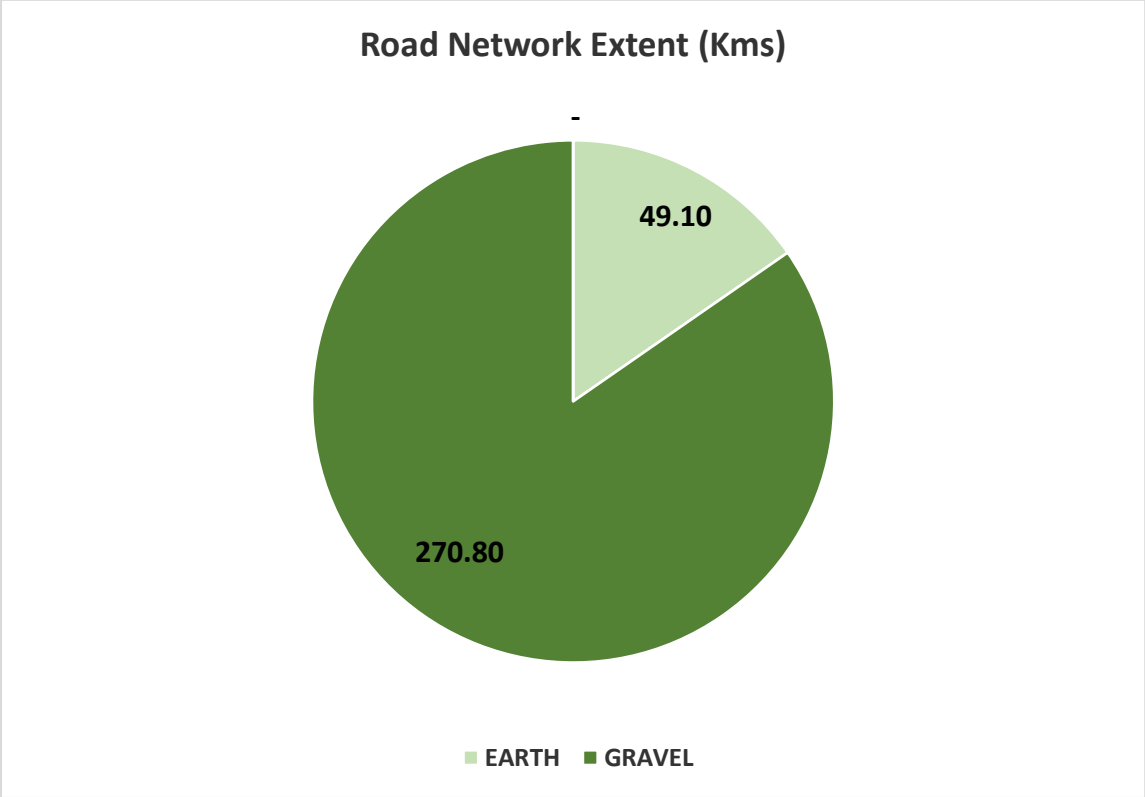
TABLE 6.2 – DEFECT EXTENT GUIDANCE

EXTENT	DESCRIPTION	PERCENTAGE LENGTH
1	Isolated signs of distress	0 -5
2	Distress signs more than isolated	5 – 10
3	Intermittent (scattered) occurrence over most of the segment length (general), or Extensive occurrence over a limited portion of the segment length	10 - 25
4	More frequent occurrence over a major portion of the segment length	25 – 50
5	Extensive occurrence over the entire segment.	≥ 50

7. DETAILED ROAD CONDITION SURVEYS ANALYSIS

The detailed survey analysis of the Chongwe Primary Core Feeder Road Network provides the following data for planning road maintenance and the Demonstration-Training activities. In overall terms, Figure 7.1 and Table 7.1 show the breakdown by road surface type.

FIGURE 7.1 – ANALYSIS OF THE CHONGWE DISTRICT FEEDER CORE ROAD NETWORK



The Chongwe core feeder road network is split into gravel and earth roads as shown in the chart above. There are no paved Feeder Roads in the district. These roads make up the primary core road network serving the district. Of the 319.9km of core road network, 49.1km are earth roads. These earth surfaces vary from tracks used to link important socio-economic centres to formed camber formation, but without wearing course gravel.

The summary of the condition of the earth and gravel road networks is shown in Table 7.1.

TABLE 7.1 - CHONGWE DISTRICT ROAD NETWORK BREAKDOWN BY SURFACE TYPE & CONDITION

CONDITION	EARTH (Km)	%	GRAVEL (Km)	%	NETWORK PERCENTAGE
Very Good	7	14.26	71.3	26.33	24.48
Good	6.7	13.64	24.7	9.12	9.82
Fair	2.9	5.91	67.7	25.00	22.07
Poor	24	48.88	86.6	31.98	34.57
Very Poor	8.5	17.31	20.5	7.57	9.06
Total	**49.1**	**100**	**270.8**	**100**	**100**

Currently 66% of the Core Feeder Road Network is in either Fair, Poor or Very Poor Condition. Only 34% is in either Very Good or Good condition.

8. ROAD NETWORK ASSET VALUE ASSESSMENT

The road asset valuation was carried out based on road condition data collected during the detailed survey assessment. The Current Replacement Cost of the Core Feeder road asset

was calculated based on an agreed standard Current Replacement Cost of US$30,000/km. This assesses the entire value of the earthworks formation, surfaces, erosion control/planting, drainage system and structures. The attached spreadsheet (Annex 1) provides the detailed calculation of the asset value.

The primary core road network for Chongwe is 319.9km, of which 270.8 km is gravelled while the balance of 49.1 km is earth standard. The Expected Useful Life of a gravel surface, based on local climatic, traffic and environmental conditions, is 7 years after construction. All primary roads falling under the core road network (CRN) are expected to be gravelled while the secondary and tertiary roads can be gravel, spot gravelled or earth. For asset valuation and deficit purposes, the earth roads are also assessed according to the intended gravel standard.

Using current costs from historical data, the Current Replacement Cost (CRC) of the primary feeder roads in Chongwe is US$30,000/km. Chongwe district has prepared an Asset Management Policy which is still in draft form where the minimum intervention threshold road condition should be in 'fair' condition. The condition is based on the visual road condition assessment used on the GEM project based on the TMH9 Visual Road Condition Assessment manual. The condition of roads in Chongwe varies from Very Poor to Very Good as shown on the tables above and in the Annex 1. The estimated current asset value of the CRN in Chongwe is US$ 6,426,300 equivalent, while the current replacement cost is US$9,588,000 giving a current Asset Deficit of (US$3,161,700). Details of the road network from very good to very poor condition are shown in the Annex 1.

Even in the existing generally poor condition, the Asset Value of the Chongwe Core Road Network is substantial. This is without considering the approximately equally extensive non-core network. Good practice maintenance could significantly raise this value, and of course bring very substantial additional social and economic benefits to the communities served.

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ANNEX 1

CHONGWE DISTRICT CORE ROAD NETWORK ASSET VALUATION

See **Legend** for colour coding related to current condition.

Rd No	Road Name	Earth (km)	Gravel (km)	Expected useful life (years)	Current Replacement cost US$/km	Current Replacement cost (US$)	Minimum threshold condition	Remaining useful life at threshold condition	Current condition rating	Remaining useful life at current condition rating	Depreciated Remaining Value (DRV) at Current Condition (US$)
1	CHIBWALU-JAKAPU	7.00		7	30,000	210,000	Fair	4.9	Very Good	6.7	199,500
2	NDAPULA – LWIMBA RIVER		5.00	7	30,000	150,000	Fair	4.9	Very Good	6.7	142,500
3	MATIPULA	2.90		7	30,000	87,000	Fair	4.9	Fair	4.9	60,900
3	MATIPULA		3.20	7	30,000	96,000	Fair	4.9	Poor	3.5	48,000
4	MAPULANGA ROAD		5.00	7	30,000	150,000	Fair	4.9	Very Good	6.7	142,500
4	MAPULANGA ROAD		5.00	7	30,000	150,000	Fair	4.9	Very Good	6.7	142,500
4	MAPULANGA ROAD		5.50	7	30,000	165,000	Fair	4.9	Fair	4.9	115,500
5	T4 – KAPETE		4.00	7	30,000	120,000	Fair	4.9	Good	6.0	102,000
5	T4 – KAPETE		4.00	7	30,000	120,000	Fair	4.9	Good	6.0	102,000
5	T4 – KAPETE		5.00	7	30,000	150,000	Fair	4.9	Very Good	6.7	142,500
6	TWIKATANE – NCHUTE		5.00	7	30,000	150,000	Fair	4.9	Good	6.0	127,500
6	TWIKATANE – NCHUTE		5.00	7	30,000	150,000	Fair	4.9	Fair	4.9	105,000
6	TWIKATANE – NCHUTE		0.60	7	30,000	18,000	Fair	4.9	Fair	4.9	12,600
7	KABELEKA – CHISHIKO		4.00	7	30,000	120,000	Fair	4.9	Poor	3.5	60,000
7	KABELEKA – CHISHIKO		2.00	7	30,000	60,000	Fair	4.9	Good	6.0	51,000
7	KABELEKA – CHISHIKO		0.40	7	30,000	12,000	Fair	4.9	Good	6.0	10,200
8	KASENGA – CHISAMBA		5.00	7	30,000	150,000	Fair	4.9	Fair	4.9	105,000
8	KASENGA – CHISAMBA		5.00	7	30,000	150,000	Fair	4.9	Very Poor	2.1	45,000
8	KASENGA – CHISAMBA		4.50	7	30,000	135,000	Fair	4.9	Very Good	6.7	128,250
9	MPEMBA – MULENJE	5.00		7	30,000	150,000	Fair	4.9	Poor	3.5	75,000
9	MPEMBA – MULENJE	5.00		7	30,000	150,000	Fair	4.9	Poor	3.5	75,000
9	MPEMBA – MULENJE	5.00		7	30,000	150,000	Fair	4.9	Poor	3.5	75,000
10	NJOLWE – MAFUNGO 1	4.00		7	30,000	120,000	Fair	4.9	Poor	3.5	60,000
10	NJOLWE – MAFUNGO 1	3.50		7	30,000	105,000	Fair	4.9	Very Poor	2.1	31,500

10	NJOLWE – MAFUNGO 2	5.00		7	30,000	150,000	Fair	4.9	Poor	3.5	75,000
10	NJOLWE – MAFUNGO 2	5.00		7	30,000	150,000	Fair	4.9	Very Poor	2.1	45,000
10	NJOLWE – MAFUNGO 2	6.70		7	30,000	201,000	Fair	4.9	Good	6.0	170,850
11	MUKAMAMBO II (KAPILYOMBA AREA)		4.10	7	30,000	123,000	Fair	4.9	Very Poor	2.1	36,900
11	MUKAMAMBO II (KAPILYOMBA AREA)		1.60	7	30,000	48,000	Fair	4.9	Poor	3.5	24,000
11	MUKAMAMBO II (KAPILYOMBA AREA)		3.60	7	30,000	108,000	Fair	4.9	Poor	3.5	54,000
12	CHIKWELA – KAPUKA		4.50	7	30,000	135,000	Fair	4.9	Fair	4.9	94,500
12	CHIKWELA – KAPUKA		1.70	7	30,000	51,000	Fair	4.9	Poor	3.5	25,500
13	CORNER BAR – WATERGREEN		4.30	7	30,000	129,000	Fair	4.9	Good	6.0	109,650
14	T4 – KAGWILA		5.70	7	30,000	171,000	Fair	4.9	Fair	4.9	119,700
15	NGWERERE ROADS 1		5.00	7	30,000	150,000	Fair	4.9	Poor	3.5	75,000
15	NGWERERE ROADS 2		0.60	7	30,000	18,000	Fair	4.9	Very Poor	2.1	5,400
15	NGWERERE ROADS 2		3.60	7	30,000	108,000	Fair	4.9	Very Poor	2.1	32,4000
15	NGWERERE ROADS 2		1.50	7	30,000	45,000	Fair	4.9	Poor	3.5	22,500
15	NGWERERE ROADS 3		1.50	7	30,000	45,000	Fair	4.9	Poor	3.5	22,500
15	NGWERERE ROADS 4		0.60	7	30,000	18,000	Fair	4.9	Fair	4.9	12,600
16	NCHUTE – LUKOSHI		5.00	7	30,000	150,000	Fair	4.9	Very Good	6.7	142,500
16	NCHUTE – LUKOSHI		5.00	7	30,000	150,000	Fair	4.9	Very Good	6.7	142,500
16	NCHUTE – LUKOSHI		5.00	7	30,000	150,000	Fair	4.9	Very Good	6.7	142,500
16	NCHUTE – LUKOSHI		2.20	7	30,000	66,000	Fair	4.9	Very Good	6.7	62,700.
17	MWANAWASA RESETTLEMENT ROADS 1		5.00	7	30,000	150,000	Fair	4.9	Fair	4.9	105,000
17	MWANAWASA RESETTLEMENT ROADS 2		3.50	7	30,000	105,000	Fair	4.9	Very Poor	2.1	31,500
17	MWANAWASA RESETTLEMENT ROADS 2		3.70	7	30,000	111,000	Fair	4.9	Very Poor	2.1	33,300
17	MWANAWASA RESETTLEMENT ROADS 3		2.80	7	30,000	84,000	Fair	4.9	Fair	4.9	58,800
18	SILVEREST ROADS		2.70	7	30,000	81,000	Fair	4.9	Poor	3.5	40,500
18	SILVEREST ROADS		1.60	7	30,000	48,000	Fair	4.9	Fair	4.9	33,600
18	SILVEREST ROADS		1.40	7	30,000	42,000	Fair	4.9	Fair	4.9	29,400
19	MANDEBELE ROAD		2.90	7	30,000	87,000	Fair	4.9	Poor	3.5	43,500
19	MANDEBELE ROAD		2.90	7	30,000	87,000	Fair	4.9	Poor	3.5	43,500

20	MWALUMINA ROAD		5.00	7	30,000	150,000	Fair	4.9	Fair	4.9	105,000
20	MWALUMINA ROAD		5.00	7	30,000	150,000	Fair	4.9	Fair	4.9	105,000
20	MWALUMINA ROAD		5.00	7	30,000	150,000	Fair	4.9	Fair	4.9	105,000
20	MWALUMINA ROAD		5.00	7	30,000	150,000	Fair	4.9	Fair	4.9	105,000
20	MWALUMINA ROAD		5.00	7	30,000	150,000	Fair	4.9	Fair	4.9	105,000
20	MWALUMINA ROAD		5.00	7	30,000	150,000	Fair	4.9	Fair	4.9	105,000
20	MWALUMINA ROAD		5.00	7	30,000	150,000	Fair	4.9	Poor	3.5	75,000
20	MWALUMINA ROAD		5.20	7	30,000	156,000	Fair	4.9	Poor	3.5	78,000
21	MUTUMBISHA ROAD		4.00	7	30,000	120,000	Fair	4.9	Poor	3.5	60,000
21	MUTUMBISHA ROAD		2.80	7	30,000	84,000	Fair	4.9	Very Good	6.7	79,800
22	KALULU ROAD		5.50	7	30,000	165,000	Fair	4.9	Very Good	6.7	156,750
23	KAPETE DEPOT		2.60	7	30,000	78,000	Fair	4.9	Poor	3.5	39,000
23	KAPETE DEPOT		2.70	7	30,000	81,000	Fair	4.9	Poor	3.5	40,500
24	MWAMPATISHA ROAD		5.00	7	30,000	150,000	Fair	4.9	Good	6.0	127,500
24	MWAMPATISHA ROAD		4.50	7	30,000	135,000	Fair	4.9	Poor	3.5	67,500
25	KASUBANYA ROAD		5.00	7	30,000	150,000	Fair	4.9	Very Good	6.7	142,500
25	KASUBANYA ROAD		5.00	7	30,000	150,000	Fair	4.9	Very Good	6.7	142,500
26	RD 480 TO KASISI(By Antioch School)		32.00	7	30,000	960,000	Fair	4.9	Poor	4.9	480,000
26	CHILONGA		11.30	7	30,000	330,000	Good	6.7	Very Good	6.7	313,500
	Gravel		**270.8 km**	**Current Replacement Value**		**US$ 9,588,000**			**Current Asset Value**		**US$ 6,426,300**
	Earth	**49.1 km**	**319.9 km**	**TOTAL**							

Legend: Road Condition

Very Poor

Fair

Very Good

Poor

Good