

THE MSUNDUZI LOCAL MUNICIPALITY



UPGRADING OF KHAMBULE ROAD IN WARD 12
DETAILED DESIGN REPORT

Prepared By



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TLS19-05TP-B-DED-DWG-002
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Glossary of Applicable Terms and Abbreviations

CSIR	- Council for Scientific and Industrial Research
MIG	- Municipal Infrastructure Grant
EPWP	- Expanded Public Works Programme
RMNS	- Road Management Network System
DTM	- Digital Terrain Modelling
CBR	- California Bearing Ratio
DCP	- Dynamic Cone Penetration
SDI	- Spatial Development Initiative
EIA	- Environmental Impact Assessment
DEAT	- Department of Environmental Affairs and Tourism
DACE	- Department of Agriculture, Conservation and Environment
EIMP	- Environmental Impact Management Plan
OHS	- Occupational Health and Safety

1 EXECUTIVE SUMMARY

TLS Engineers and Project Managers was appointed by Msunduzi Municipality to carry out a feasibility study on the upgrading of Khambule Road in Ward 12 in the greater Pietermaritzburg Area. Preliminary findings were documented in the concept report, with further detail provided for construction in the detailed design report. Khambule Road in Ward 12 is recommended for procurement phase as it will enhance economic growth and provide a substantially higher quality road that is safer than the existing road.

Geometric design improvements were applied to the road where possible; however, this was limited by the steep topography of the surrounding landscape and the close proximity of the road to properties and fences.

The pavement structure for the proposed road is,

- 150mm Concrete Slab
- 150mm C4
- 150mm G7
- Rip & re-compact to 300mm In-situ Material

The Project cost construction estimate is valued at R4 998,388.75, based on the detailed design.

Specifically, it is envisaged that the scope of the work will include the following aspects:

- Conceptual Design
- Preliminary Design Report
- Design & Tender Documentation
- Construction Management
- Close-Out Report

2 INTRODUCTION AND TERMS OF REFERENCE

TLS Engineers and Project Managers (TLS) was appointed as a Service Provider by Msunduzi Municipality to provide consulting civil engineering professional services for the abovementioned roads. The Letter of Appointment and subsequent Letter of Acceptance are attached to this report as Annexure A.

The scope of appointment includes:

- Project Feasibility Studies
- Conceptual Design
- Preliminary and detailed design drawings
- Tender Documentation
- Construction management
- Close-out report

Khambule Road forms a street access road around the area of Hlubiville. It is situated in the Edendale location, Pietermaritzburg in the Kwa Zulu Natal Province. The total length of the road under consideration is approximately less than 0.4km in length, single carriageway, which is currently Gravel surface road. The road project commences T-junction of Esigondimi Rd and end at the length of the street road.

A site visit was carried out on the 11 December 2019 by Phiwakahle Mchunu and Thando Pika of TLS. The visual inspection confirmed the degradation of the existing Gravel Road, which has Transverse and Longitudinal Erosion (see pictures in Annexure B).

3 APPROACH AND METHODOLOGY

Data Collection

- Visual Assessment
- Understanding status of existing services
- Cadastral information and information illustrating existing services from municipal departments

Surveys and Planning Information

- **Land Survey**

A detailed contour survey was done by Sithebe Surveys and Projects Pty (Ltd) and sent through to TLS for verification.

- **Geotechnical Investigation**

Due to the time constraints imposed by the effect of the National Lockdown, Geotechnical Investigations are still currently being undertaken by Syncline Geotechnical Engineering (Pty) Ltd. The Geotechnical Report will be submitted as an appendix to the Detailed Design Report, and is expected by 31 August 2020.

- **Environmental Assessment**

Consultation was done with Msunduzi Municipality Environmental scientist Abulele Qulu and advised that an application for an Environmental Impact Assessment including a Water Use License application needs to be done via The Department of Economic Development Tourism and Environmental Affairs. The DEDTEA has since responded, a Basic Assessment Impact needs to be done, and report sent to the Department (**see Annexure F**). J G Afrika (Pty) Ltd were appointed to assist with the Basic Assessment Impact application. This process is currently underway and is subject to the waiting period and timelines that accompany such applications.

- **Traffic Volume Determination**

A traffic count was not conducted, as the road is an access road, providing access to local residents. Reasonable assumptions will adhere, and a 4% growth rate will be used. This would sufficient to determine class of road and pavement layer design for the proposed design life.

Under normal circumstances, it should be expected that the traffic will increase after the roads have been constructed. The most likely source of traffic in these areas which was used to estimate the design traffic can be divided into four (2) different categories namely:

-

- Residential traffic;
- Public transport traffic;

▪ **Liaison with Relevant and Affected Communities**

It is envisaged that a Project Steering Committee (PSC) will be convened to oversee the implementation of the project. The PSC will inform communities and affected property owners before construction commences. The PSC will include representation by all relevant stakeholders which may alter from time to time, but at this stage it is envisaged that it will include at least the following organizations.

- Msunduzi Municipality (Technical Officials as well as relevant ward Councilors), chairing
- TLS Engineers (Consultant)
- Community Liaison Officer (CLO)
- Affected communities:

4 STATUS QUO

4.1 Introduction

The section presents, in brief, the current status quo of the existing road and supporting infrastructure elements.

4.2 Information Available

The appointment letter came in with a locality map (refer to Annexure C) showing the designated area. No additional information was available.

The site currently accommodates traffic movement, it is therefore envisaged that temporary diversion of traffic for the road users for the duration of construction will be required. Special permits will be given to residents to access their households safely.

4.3 Site Location

Khambule Road is a road Hlubiville within Ward 12, Pietermaritzburg. The road project commences T-junction of Esigondimi Rd and end at the length of the street road.

LATTITUDE	LONGITUDE
29°38'42.62"S	30°16'11.91"E

4.4 Storm Water Services

The status quo regarding existing storm water structures is based on information collated from the site visits. The road has no Drainage, run-off runs along the gravel road and across the surface with Transverse and Longitudinal erosion.

4.5 Other Services

Other services observed that will affect the construction are sewer, water, Telkom and electrical services. Their position would be located and services temporarily protected during construction or permanently relocated if necessary.

Property fences are predominantly in the anticipated roadway. Once the preliminary designs are completed, affected properties owners will be notified in writing for relocation of fences.

4.6 Road Network/Access

The proposed project can be accessed of Esigondimi Road, which is currently gravel road.

4.7 Pedestrian Facilities

No existing pedestrian facilities was noted.

5 DESIGN DEVELOPMENT

5.1 Design codes and standards

- The Neighborhood Planning and Design Guide (Red Book): Creating Sustainable Human Settlements
- TRH 17: Geometric Design of Rural Road
- TRH 4: Structural Design for Flexible Pavements for Interurban & Rural Roads
- TRH 3: Surfacing Seals for Rural and Interurban Roads
- Department of Roads & Public Works: Roads Design Manual

5.2 Speed class

The geometrics will conform to a design speed of 40km/h as the area is predominantly a residential area.

5.3 Geometric Standards

Description	Design Speed 40km/h
Horizontal Alignment	
Road Reserve	9
Minimum Horizontal Radii (m)	60
Minimum Stopping Sight Distance (m)	50
Passing Sight Distance (m)	350
Maximum Super Elevation (%)	0.08
Minimum Desired Vertical Curve Length	60

The table above represents the minimum design criteria used for Khambule Road designs. Khambule Road Horizontal Alignment design criteria 85.7% did not meet the minimum requirements in terms of curve radius. 14% of the horizontal curves for Khambule Road comply with the minimum curve radius for 40km/h design speed. The six curves failing to meet the minimum radius of 60m and on one curve meets the minimum radius. A cross fall of 2% was maintained for stormwater run-off drainage. The desired minimum vertical curve length met

20% of the road, while 80% failed to meet the stipulated criteria. Due to the close proximity of properties and property accesses to the road, it was impractical to apply major geometric design improvements. Although some of the Horizontal Alignment and Vertical Alignment criteria do not meet the design requirements for 40km/h, practically speaking, the narrow lane widths, winding alignment and location of the road means that vehicle traffic is low in numbers, and vehicular speeds are generally lower than 40km/h.

5.4 Cross section

The below table shows the cross section that was adapted for Khambule Road, as previously detailed on the preliminary report, existing infrastructure did not allow widening of the road.

Cross Section	Road Section
2 x 2m surfaced lanes	Total length of the road
2% cross-fall	Total length of the road
Fig. 6 kerb mountable	On higher end
Fig. 6 kerb and Channel	On Lower side

5.5 Accesses and Intersections

All access to households are Type C as per Kwazulu Natal Department of Transport.

5.6 Road Verge

The road verge for the road profile is 1,5 for cut and fill slope. Since there space constrains, the slope will be constructed and grassed where applicable.

5.7 Climate Class of Project Area

This region is classified as a wet region, Weinert, N value < 2 (TRH4)

5.8 Pavement Design

The pavement design will be based on a Ridge pavement, ensuring the material quality will gradually increase from the lower layers up to the structural layers and surfacing.

All designs will be done in accordance with the following publications:

- TRH4: The structural design of flexible pavements for inter urban and rural roads
- TRH14: Guidelines for road construction materials
- The South African Pavement Engineering Manual (SAPEM) -Chapter 10

5.9 Methodology for Pavement Design

From the desktop study the combined road Class Category is U5-D, described as a Local street, providing access to individual properties, with a traffic class of ES 0.1 according to TRH4 manual. The design life of the road is taken to be in a range of 30-40 years after completion.

5.10 The Proposed Pavement Design Options:

The following layer works foundation selected from the catalogue contained in TRH4.

Option

- 150mm CONCRETE 25MPa FILLED WITH MULTI-CELL
- C4 BASE -150mm CEMENTED BASE AT 98% MOD. AASTHO DENSITY
- G7 SUB-BASE -150mm MATERIAL FROM BORROW PIT SOURCE, COMPACTED TO 95% MOD AASTHO
- G10 SUBBASE – RIP & RE-COMPACT TO 150mm IN-SITU MATERIAL TO 93% MOD AASTHO

Recommendation: It is envisaged that any required changes to the pavement design will result in savings to the project as the Geotechnical Investigation may provide recommendations that allow for reuse of some of the existing pavement layers

5.11 Drainage Design

5.11.1 Existing Drainage System

The road has no Drainage, run-off runs along the gravel road and across the surface with Transverse and Longitudinal erosion. There are no chutes as this is a residential built area.

5.11.2 Design Codes and Standards

For all drainage designs, the rational method will be used for flood determination and culvert sizing. Design codes and standards that will be used for the flood determination and culvert sizing will be the Road Drainage Manual, 1997.

5.11.3 Detailed Drainage Design

Khambule Road Drainage consists of a 450mm underground pipes with side inlets at capacity, which analyzed in line with the SANRAL Drainage Manual for partially full flowing pipes. The pipes and side inlets run along the road and discharge on the existing stream via a Head wall.

5.11.3 Cost Estimates

The estimated costs for the upgrade of Khambule Road from Esigondimi Road intersection is based on the latest related rates. The estimate for the rehabilitation is R 5 000 000.00 inclusive of 10% Contingencies, 10% CPA and 15% VAT. Refer to table below for the summary of the estimated cost. The Detailed Tender BOQ is attached.

SECTION	DESCRIPTION	AMOUNT
SECTION 1	PRELIMINARY AND GENERAL	R 310,900.00
SECTION 2	SITE CLEARANCE	R 189,700.00
		R 43,560.00
SECTION 3	EARTHWORKS (PIPE TRENCHES)	
SECTION 5	EARTHWORKS (ROADS, SUBGRADE)	R 369,000.00
SECTION 5	BEDDING (PIPES)	R 28,500.00
SECTION 6	STORMWATER DRAINAGE	R 266,700.00
SECTION 7	SUBBASE	R 96,000.00
SECTION 8	BASE	R 123,000.00
SECTION 9	CONCRETE WORKS	R 2,003,500.00
SECTION 10	KERBING AND CHANNELLING	R 299,550.00
SECTION 11	ANCILLARY ROADWORKS	R 49,090.00
Sub-Total 1		R 3,779,500.00
10% Contingency		R 377,950.00
5% CPA		R 188,975.00
Construction Cost Estimate (excl. VAT)		R 4,346,425.00
VAT (15%)		R 651,963.75
Construction Cost Estimate (incl. VAT)		R 4,998,388.75

5.12 Implementation Programme

An estimation of the anticipated design and construction period has been compiled and enclosed below.

Activity	Deliverable Planned Date
Geotechnical Investigations & Report Complete	31 August 2020
Detailed Designs Submission & Approval Complete	24 September 2020
Tender Documentation Complete	24 July 2020
Tender Notice & Tender Closing	31 August 2020
Tender Adjudication Process & Site Hand-Over	1 November 2020
Completion of Construction	14 March 2021
Expiry of Defects Liability Period	14 March 2022

6 RECOMMENDATIONS AND CONCLUSIONS

The upgrade of Khambule Road is vital to improving the transportation standards. This upgrade will provide a substantially higher quality road that is safer than the existing road. This will in turn enhance economic growth in the area and provide employment opportunities during the construction phase of the project.

We recommend that the approval of this Detailed design stage to be granted, to avoid any potential delays in the next phase of the procurement phase. It should be noted that delays in approval of this will subsequently affect the commencement date of construction.

Furthermore, construction of this road shall only commence once the Geotechnical Investigation has been completed, and once full compliance has been achieved in terms of the Environmental Impact Assessment and Water Use License Application.

ANNEXURE A

COPY OF APPOINTMENT & ACCEPTANCE LETTER

ANNEXURE B
PICTURES



Fig. 1 START OF KHAMBULE ROAD



Fig. 2 SERVICES & PROPERTY FENCES



Fig. 3 END OF KHAMBULE ROAD (CONSTRUCTION)

ANNEXURE C

LOCALITY MAP



ANNEXURE D

DRAWINGS

ANNEXURE E

BILL OF QUANTITIES

ANNEXURE F

DEDTEA LETTER