



Shangani Gate *pre-feasibility study*

Progress Report 4 June 2013

Engineering Services Report



BACKGROUND

Mošomo Consulting Civil Engineers (Pty) Ltd as part of the STRISA Consortium of professionals addresses all engineering aspects such as :-

- Access
- Water supply
- Sewage
- Solid waste
- Electrical power supply

Since STRISA was appointed in January 2013 the following actions and site visits were done.

Site visit 11 March 2013

Team members Mike Gardner, Robin Gardner, James Ndlovhu, Mara Wakefield, Vincent Carruthers and Abrie Cilliers. Return via Malamulele.

Site visit 14 March 2013

Team members Mike Gardner, Vincent Carruthers, Danwilh Ingram and Abrie Cilliers. Meet with Blake Schraader of KNP. Walked to bridge site and gate site. Drove back via KNP game ranger road along Shingwedzi river. Blake Schraader suggests the road from Shangoni Gate to Shingwedzi to be included in pre feasibility study.

Site visit 16 March 2013

Team members Vincent Carruthers, James Ndlovhu and Abrie Cilliers.

Visit bridge site, reception site and walked along Shingwedzi river to identify possible lodge positions. Also visited Muyexe village.

Meeting RAL 20 March 2013

Team members Mike Gardner and Abrie Cilliers. Meet with Neels Notnagel, Richard Rikhotso and Hannes Groenewald. Discuss status of district / provincial roads to Shangoni gate.

Meeting SANPARKS 16 April at Phalaborwa

Team members Mike Gardner, Robert Rich, Abrie Cilliers. Meet with SANPARKS officials, Blake Schraader, Ben van Eden, Aurel Nyambi and Derek Visagie to discuss their requirements regarding the proposed reception gate, rustic camp, picnic spots, etc.

Workshop Mopani Camp Tuesday 7 May 2013

Attend workshop with STRISA team and delegates from DBSA, IDC, (VDM)Vhembe District Municipality, (GGM)Greater Giyani Municipality, KNP and (TLM)Thulamela Local Municipality.

Site visit Shangoni Wednesday 8 May 2013

A site visit was conducted with STRISA members Mike Gardner, Vincent Carruthers, James Ndlovhu, Robert Rich under guidance of the Shangoni Ranger, Septhen Midzi

Access

The position of the new proposed gate is selected by SANPARKS. Refer to “Technical Report on Proposed Entrance Gate Position by Blake Schraader, General Manager, Technical Services, KNP dated 6 March 2013. This position is some 30 km East of Giyani. See Map 1 below.

The Technical report mentioned above emphasizes the importance of the two main corridors to the proposed gate viz : Giyani corridor and the Malamulele corridor. The road between Giyani and Altein (the village just North of the proposed gate position) is road D3641 and it is tarred to a point approximately 7 km from the proposed gate. 3,5 km will follow the existing alignment of road D3641 and 3,5 km will run through green fields to the new gate. In order to close the gap to Altein from Giyani, the 1,6 km from the proposed circle is another 1,6 km to the Shingwedzi river bridge. The total length of road to be constructed in the Mopani District hence is:-

Complete Road D3641 (3,5 + 1,6)	= 5,1 km
New road from circle to gate	= 3,5 km (design completed by RAL Consultant)
Re-align road D3799 to Muyexe	= 0,6 km
Total length	= 9,2 km

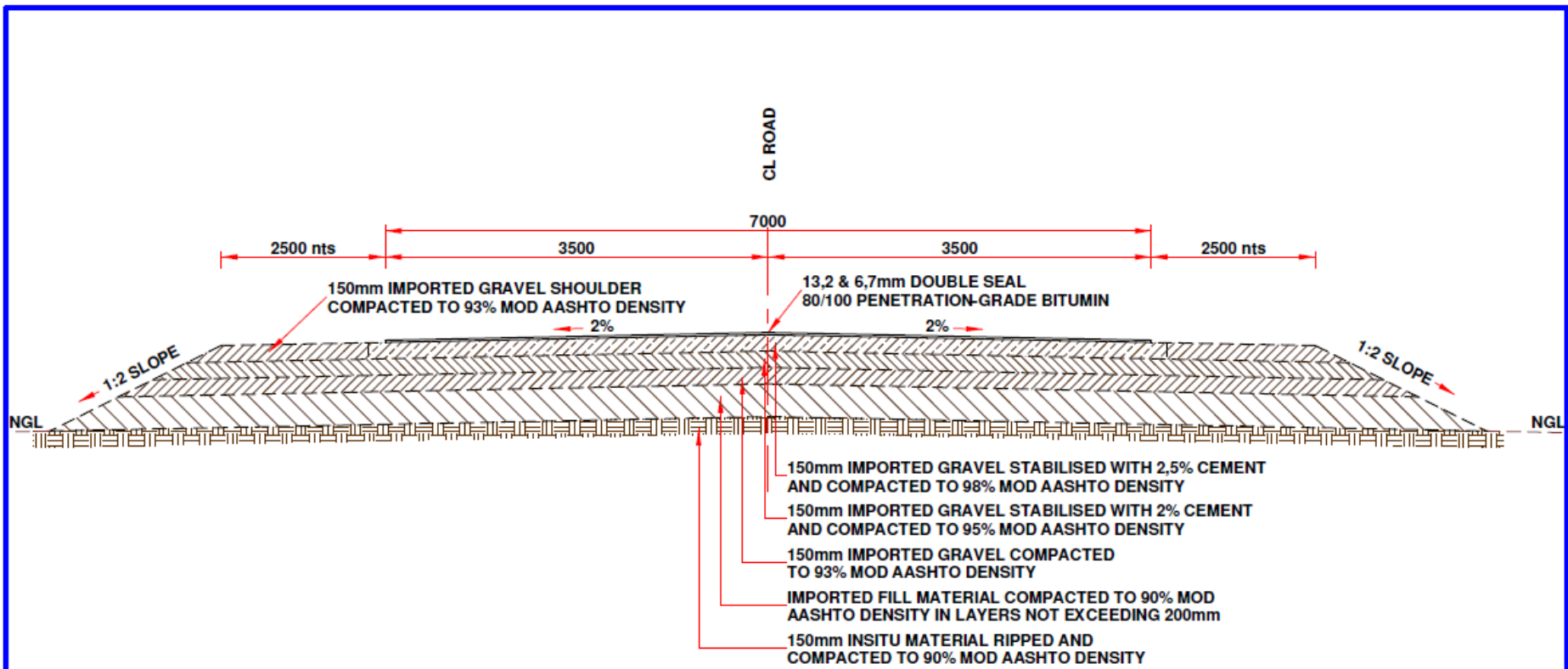
It is recommended that the present single lane bridge on Road D3641 over the Shingwedzi River be used. Minor erosion protection will have to be done to the bridge only. The bridge survived the recent January 2013 flood! See Map 1 for its position.

The Shingwedzi river forms the boundary between Mopani District Municipality (MDM) and Vhembe District Municipality (VDM). The Malamulele corridor falls in the VDM district and Giyani corridor in the MDM district. The 14,5 km section of road D4 from Matsakali to the junction of the road between Mtititi and Altein (Road D3745) was designed in 2009 by Consultants appointed by RAL.

There is thus 3,5 km of Road D3745 from this T-junction to the Shingwedzi bridge outstanding to complete the link.

Total length of road to be built in Vhembe district is thus 18 km.

The RAL standard for rural road is per the cross section below:-



TYPICAL SECTION THROUGH RAL ACCESS ROAD

SCALE 1:50

MOSOMO
CONSULTING CIVIL ENGINEERS (PTY) LTD

<p>☎ 015 307 4435 Fax: 015 307 1886 e-mail: civil@mosomo.co.za</p>	<p>✉ P.O. BOX 1093 1 CIRCLE DRIVE TZANEEN 0850 REP. OF SOUTH AFRICA</p>
--	---



Existing Road D3641 towards Altein



Existing bridge over Shingwedzi River near Altein

Municipal and Provincial Authorities

Road Agency Limpopo (RAL) is the relevant provincial institution who oversees the building of new roads.

In a meeting with RAL represented by their Messrs. Neels Notnagel, Richard Rikhotso and Hannes Groenewald on 20 March 2013 it was reported that some of the outstanding sections mentioned above were designed in 2008/2009 but could not be built due to budget constraints.

The Mopani District Municipality (MDM) and Greater Giyani Municipality (GGM) may also fund the building of rural roads.

Both these entities of government, however, do not have any of the roads mentioned on their (integrated Development Plan) IDP or budget. This means that they will not be in a position to fund any of these roads as they are not mentioned in the IDP.

The extension of Road D3641 over green fields to the present boundary will have the same standard as the tarred section of road D3641. This will entail two 3,5 m wide lanes with 2,5 m wide gravel shoulders as per cross section above.

KNP requires a waiting lane at least 200 m long before (i.e. West) of the gate. This is to allow tourists to wait for the gate to open early in the mornings without obstructing the Eastward lane for staff who are reporting for work.

KNP requirements of the road inside the park

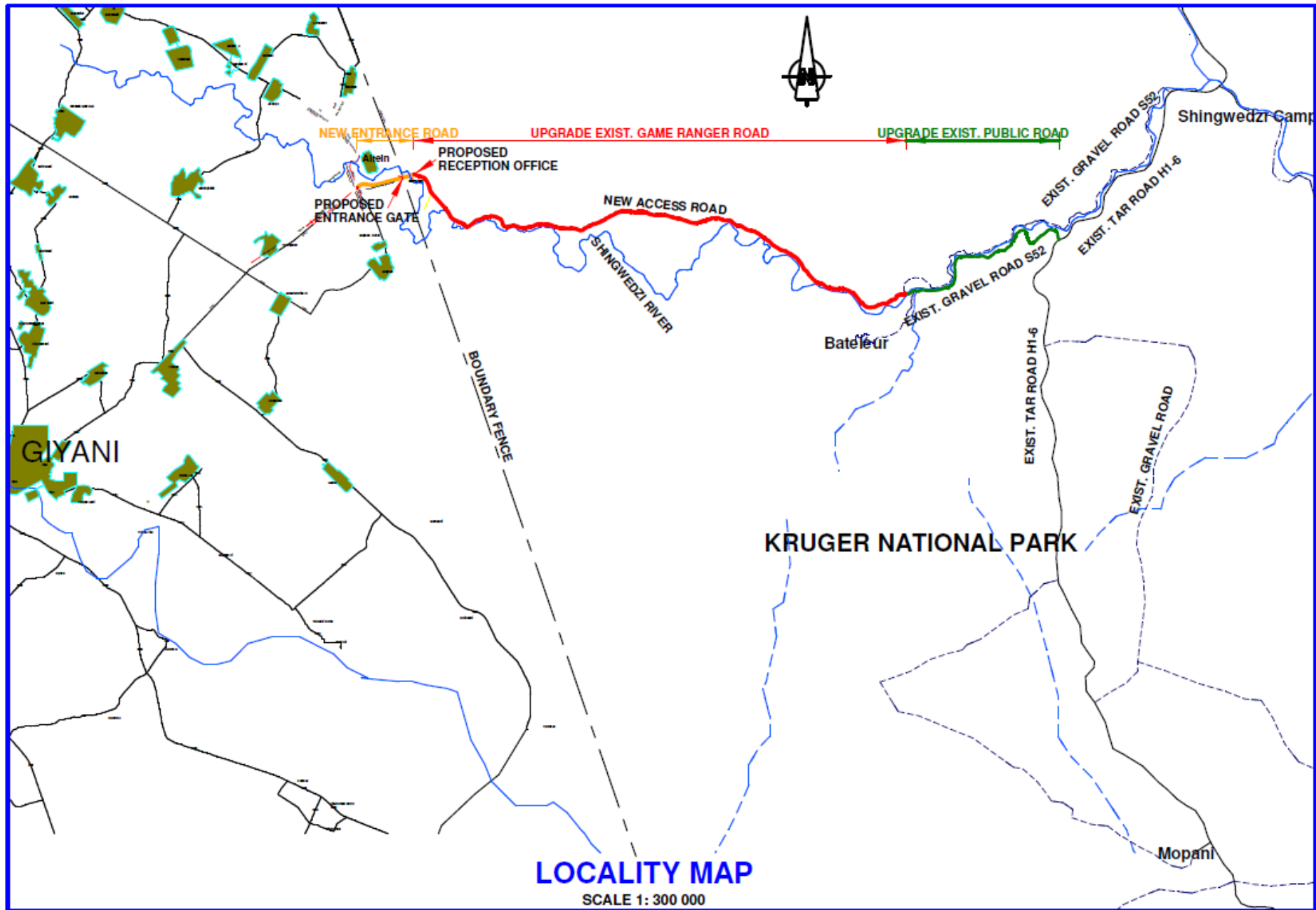
The Technical Services Department of the KNP requested that a cost estimate be prepared of the road from the fence at Shangoni to the tarred road Road H1-6 between Shingwedzi and Mopani. Total length is 50,6 km.

This road will be divided into two distinctive sections viz :-

The section from the fence to the reception area which will be a new road and from here it follows the present Shangoni Rangers road for approximately 35,6 km to the present gravel public road S52 between Shingwedzi and Bateleur bush camp.

- The section of public gravel road S52 from Bateleur bush camp to tarred road H1-6 of approximately 14 km.
- Road S52 from the Shangoni rangers road to Road H1-6. This is presently a public tourist road.

The road to be sealed by means of a double sand seal of width 6 m wide with 1,2 gravel shoulders both sides.

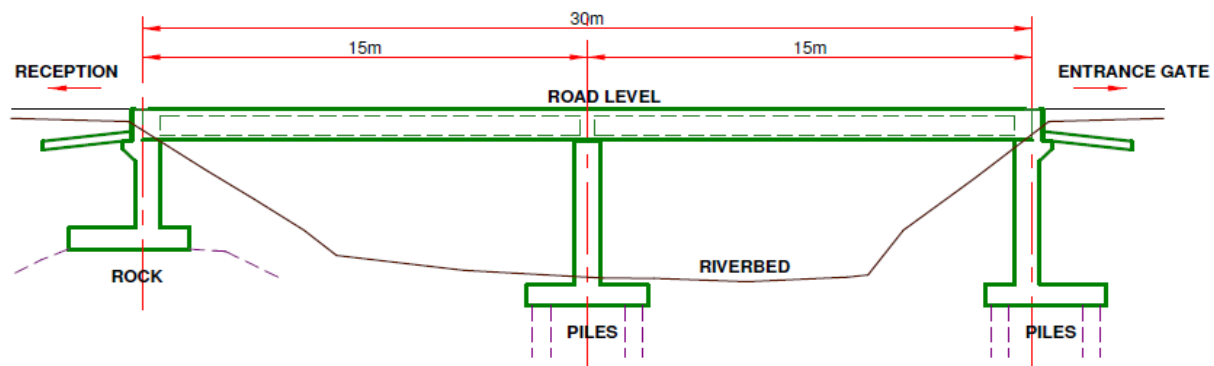


The following assumptions were made in the preparation of the cost estimate. The assumptions will be discussed under the relevant COLTO sections as follows:

- Section 1300 Construction period of 18 months is assumed.
- Section 1500 No allowance is made for accommodation of traffic. The relevant section of road S52 will be closed for public during construction.
- Section 2200 Four types and or sizes of culverts were used in this estimate viz : 20 No. 600 dia pipe, 30 No. 1,5 x 15 box culvert and 17 No. 2 x 1,5 x 1,5 box culvert and 6 No. concrete drift. This shall be refined during the preliminary design stage.
- Section 3100 Allow for 5 borrow pits each 5 ha in size with over burden 0,8 m and average depth of usable material 1,5 m. The 5 borrow pits to be spaced evenly if possible to prevent overhaul longer than 5 km.
- Section 3300 The vertical alignment shall follow the existing road. Only allowance for fill is at drainage lines. Road to be 600 mm above n.g.l.
- Section 3400 Allow for selected sub grade, sub base and base over the rangers road and only base and sub base on the public road section.
- Section 3500 Allow base to be stabilized with 2,5% cement. In the event gravel of G4 quality, i.e. CBR > 45% is obtained, no stabilization will be required. A proper soils and borrow pit investigation is recommended.
- Section 4100 Allow MC 30 cut back prime at 0,8 l/m².
- Section 4900 Allowance for two seals at 1,35 l/m² 80/100 pen bitumen tack coat and sand at 20 mm per seal. It is recommended that river sand be extracted from the Shingwedzi river near the middle of the road section. This will require an EMP and subsequent applications. This will save on overhaul of the sand.
- Section 5100 Allowance is made for stone patching at drainage crossings.
- Section 5200 Gabions are allowed for at stream / drainage crossings as protection against erosion. At 17 major crossings, 40 m³ each and at 50 minor crossings 10 m³ each.

The bridge over the Shingwedzi river must be a single lane bridge. The topography at the selected bridge site requires that the bridge deck will be on the same height as the river edges. The selected site at coordinates 23° 08' 14,4" South and 30° 54' 2,2" East has a dolerite outcrop on the left embankment and there is no sign of rock on the right hand side embankment. Piling or caissons will be considered as a possible founding method.

The effect of scour to the downstream side of the bridge must be taken into account. The openings between piers and abutments to be as wide as possible to avoid clogging by large tree stumps during floods. A bridge of 2 x 15 spans is allowed for in this estimate

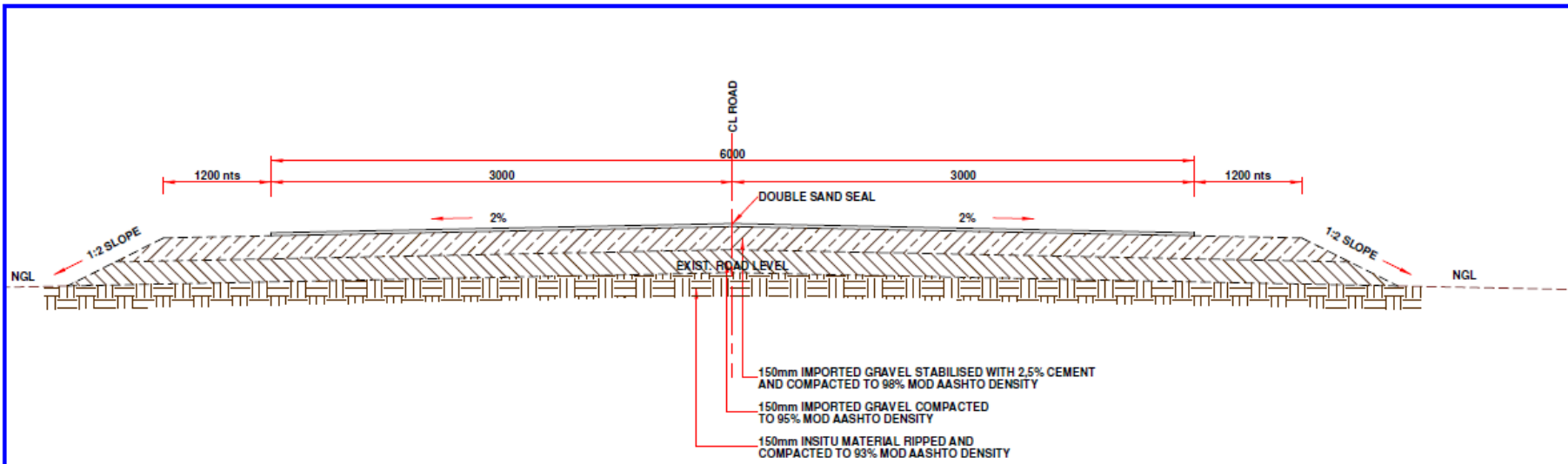


LONGITUDINAL SECTION THROUGH BRIDGE
SCALE 1:200

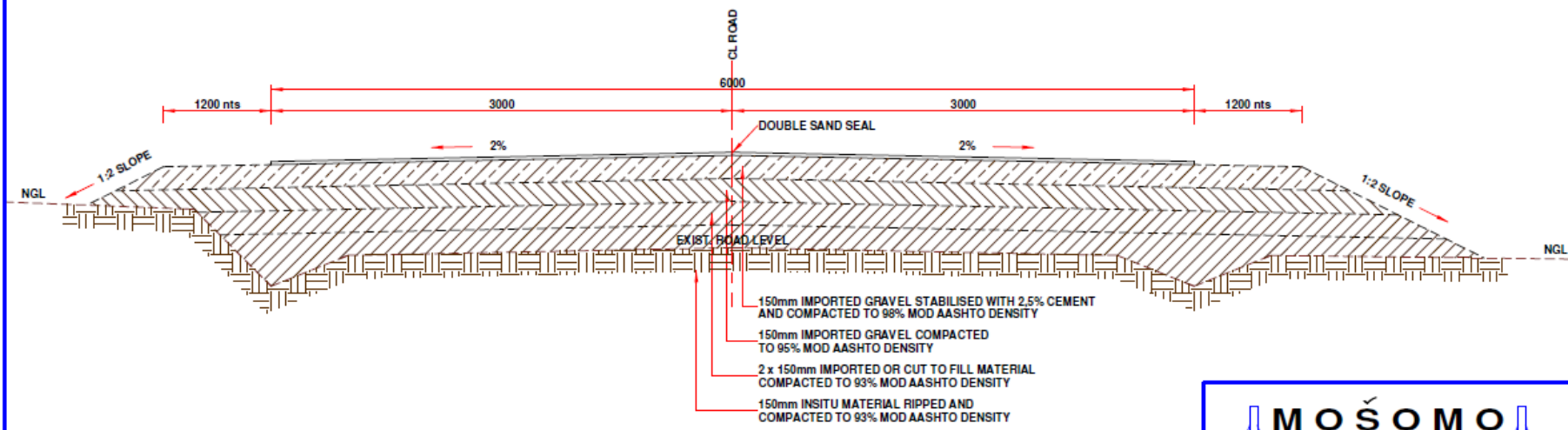
MOSOMO
CONSULTING CIVIL ENGINEERS (PTY) LTD

<p>☎ 015 307 4435 Fax, 015 307 1886 e-mail: civil@mosomo.co.za</p>	<p>✉ P.O. BOX 1093 1 CIRCLE DRIVE TZANEEN 0850 REP. OF SOUTH AFRICA</p>
--	---

The bridge at this level will, by preliminary estimates, allow for a 1:50 year flood. The road from the cattle grid gate shall have the KNP road standard of 6 m width double sand seal and 1,2 m wide shoulders. See X-sections below.



TYPICAL SECTION THROUGH EXIST. PUBLIC ROAD - DOUBLE SAND SEAL
SCALE 1:25



TYPICAL SECTION THROUGH EXIST. GAME RANGER ROAD - DOUBLE SAND SEAL
SCALE 1:25

MOSOMO
CONSULTING CIVIL ENGINEERS (PTY) LTD

☎ 015 307 4435	✉ P.O. BOX 1093
Fax: 015 307 1888	1 CIRCLE DRIVE
e-mail: cm@mosomo.co.za	TZANEEN
	0950
	REP. OF SOUTH AFRICA



*Dolorite outcrop on left hand embankment of river
at proposed bridge location*



*Photo taken upstream the river bed from proposed
at bridge position*

Parking facilities at the reception office shall make provision for cars with trailers and caravans. The parking requirements will be dealt with under the layout at the facility according to KNP requirements.

Water

The most probable source is a borehole. The village of Altein is served by boreholes. One of these boreholes is BH 15-0073. See photo below.



A geohydrological investigation will be required to select borehole positions. The yield required shall be determined according to KNP requirements.

There is also an existing borehole at the present Shangoni Game Rangers gate.

The yield of this borehole can be obtained from KNP and it may be suitable for use as it is some 1,200 m away from the proposed reception area.

Water Demand

Reception facility

KNP requires the following facilities :-

Male 3 toilets & 6 urinals & 5 hand wash basins

Female 9 toilets & 5 hand wash basins

Provision must be made for peaks for 120 passenger busses.

Provision for staff : Allow for 5 single quarters and 2 x 2 bedroom flats.

Summary

Staff members	9 x 200 litre	= 1,800
Bus peaks	120 x 16 litre	= 1,800
Office space	400 litre / 100 m ²	= <u>400</u>
		= 4,000 l/day

Rustic camp

Allowance for 10 x double tent units each with it's own on suite shower, h.w.b and toilet i.e.

Guests	20 x 150 litre	= 3,000 l/day
Staff	2 x 150 litre	= <u>300 l/day</u>
		= 3,300 l/day

Caravan Park

20 stands, average 3 people / stand

Guests 20 x 3 x 150 litre /day = 9,000 l/day

Staff 2 x 150 litre /day = 300 l/day

= 9,300 l/day

It will be advisable to place the rustic camp and the camping site close to each other. This will favour the management of the facilities and water and sewage may be from the same source.

Picnic Site

In terms of water demand, the peak demand shall be for a 120 passenger bus again.

Guests 120 x 15 = 1,800 l/day

Staff 2 x 150 = 300 l/day

= 2,100 l/day

Sewage

The most suitable way of sewage treatment for small facilities is a septic tank and, depending on the loads, a reed bed or french drain.

The septic tank shall be designed to cater for higher peak flows when busses arrive at the reception area.

The soil conditions appear to be suitable for french drains if the expected loads are not too high.

Reed bed systems are being used throughout the KNP as they are very environmental friendly and are operated at a very low cost. The design flows below, however, are all very low. Only septic tanks and French drains will be required.

The drainage system shall be the two pipe system, whereby the kitchen and bathroom wastes (grey water) bypass the septic tank and are converted to a separate soil percolating system. The kitchen waste should pass through a grease trap before entering the drain. The grease trap requires regular cleaning and maintenance that should not be neglected.

Sewage design flows

Reception area

Staff members	9 x 110 litre	= 990
Bus peaks	120 x 10 litre	= 1,200
Office space	300 litre	= <u>300</u>
		= 2,490
	Say	= 2,500 l/day

Rustic camp

Guests	20 x 110 litre	= 2,200
Staff	2 x 110 litre	= <u>220</u>
Total		= 2,420 l/day

Camping site

Guests	20 x 3 x 110 litre	= 6,600 l/day
Staff	2 x 110 litre	= <u>220</u> l/day
Total		= 6,820 l/day

Picnic site

Guests	120 x 10 litre	= 1,200 l/day
Staff	2 x 110 litre	= <u>220</u> l/day
Total		= 1,420 l/day

Solid Waste

Greater Giyani Municipality (GGM) obtained a licensed solid waste facility recently. It is situated at the village Ngove, some 50 km away.

It is our recommendation that a Public Offload Facility (POF) be provided at the reception area.

See photo



POF for 4 bins in the rural Tzaneen Area

The POF shall be fenced in and the fence to be electrified to keep baboons and monkeys out.

It is recommended to provide this POF at the reception facility. Obviously in a “out of sight” position. The solid waste of the rustic camp, caravan / camping park and the picnic site must then be deposited in the bins at the POF.

The POF makes provision for four 6 m³ bins. The GGM’s contractor can then change the bins at regular intervals as will be required.

It will also allow the implementation of a recycle waste system as certain bins will be for recyclable materials.

Electric power supply

During the site visits mentioned above, construction workers were found doing bush clearing for a future overhead electric line to Altein.

We requested a local Electrical Engineering firm MOTLA to comment on the possible electrical supply possibilities and they commented as follows:

The proposal for the electrical supply to the new developments will have to be viewed as follows:

- For the Key Tourism Facilities and The Hub will we recommend that the power be taken from the Eskom Network. The Eskom network is supplied from Giyani and is available next to the development. Due to the proposed size of the facilities, it not be feasible to use Solar or Generator power. The Estimated power required for the facilities is in the region of 500kVA and therefore it will not be viable to use alternative energy. Keep in mind that as far as possible the development design will be done to cater for a green installation.
- The buildings that form part of the Kruger National Park viz, Entrance Gate, Picnic area, Rustic camp and caravan facilities, will be done as environmental friendly as possible. A Solar installation for the Entrance gate with it associated facilities will be costly but definitely possible to do, we will recommend that a Hybrid Solar system be used to have a generator as a backup for the critical equipment such as servers and security systems that will be used at the gate. The Rustic Camp and Caravan site will be served by Solar installations.

Proposed actions

The following actions are recommended for the next phase which we refer to as the preliminary design stage.

- Topographical survey to 0,5 m contour intervals of the access road as well as reception area
- Geotechnical investigation : This will entail an investigation to determine the founding conditions for the bridge as well as a centre line and borrow pit investigation.. This implies that there will be two types of geotechnical investigations.

- Flood line determination

The bridge will have to be able to sustain a 1:50 year flood.

The 1:100 year flood line is also required to ensure that no development is done below the 1:100 year flood line.

- Environmental Impact Assessment (EIA)

This will be done by Vincent Carruthers as the Environmental Consultant on the team. Refer to the preliminary EIA report.

- A Water Use Licence will be required from Department of Water Affairs (DWA). This process normally takes 6 to 12 months for approval by DWA after the application is submitted.

Cost Estimates

Accesses Outside KNP

Mopani District

Giyani to Altein Road D3641

Length : 3,5 km + 1,6 km = 5,1 km

R30,600,000

Extend D3641 to KNP border : 3,5 km

R 21,000,000

Allow for 200 m waiting lane

R 600,000

Re-align Road to Muyexe 600 m

R 3,600,000

Total for Access in Mopani District

R55,800,000

Vhembe District

Road D4 from Matsakali to Mtititi 14,5 km	R 87,000,000
Road D3745 from Mtititi to Shingwedzi bridge 3,5 km	<u>R 21,000,000</u>
Total for Access in Vhembe District	<u>R108,000,000</u>

Road in the KNP 50,6 km long including bridge R154,008,069

Engineering Infrastructure

Entrance Gate Facility	R 2,323,649
Picnic site	R 571,866
Caravan Park	R 601,029
Rustic Tented Camp	<u>R 1,437,322</u>
Total Engineering Infrastructure inside KNP	R 4,933,866

Proposed Shangoni Hub (Outside KNP) R 5,568,750

Alternative for concrete paved road in KNP R246,675,955

Annexures per separate document

Annexure 4 :Detailed cost estimate for KNP Road

Annexure 5 : Detailed cost estimate for concrete paved road for KNP (alternative)

Annexure 6 : Detailed cost estimate for Engineering infrastructure