TRAFFIC IMPACT ASSESSMENT

MAREETSANE BATHO-BATHO SOLAR PV FACILITY

Client	Sinetech
Original Project Name	Batho- Batho Solar PV Facility
Project Number	1523
Description	Traffic Impact Assessment
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Reviewed by: S Hoy PrEng

PROJECTS & INDUSTRIAL ENGINEERING (Pty) Ltd

SUMMARY SHEET

Study	Traffic Impact Assessment
Location	Mareetsane, Northwest, South Africa
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Date	September 2013
Report Status	Final
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EXECUTIVE SUMMARY

A newly proposed solar facility, situated south of Mareetsane in the North West province will add additional traffic to the existing road network both during and after the construction phase. The road network is currently very much underutilised and it is not expected that the area will experience a big growth factor. As a result the project will not significantly affect the road network and the project may commence without upgrading the local road network.

This report and traffic impact assessment has been prepared in accordance with the National Department of Transport's 'Guidelines for Traffic Impact Studies' PR93/635 (1995) by a registered professional civil engineer.

INDEX

LIST OF FIGURES

1. INTRODUCTION

Kgatelopele Private Equity and Venture Capital (Pty) Ltd (herein referred to as KPEVC) proposes to develop a site to the south of Mareetsane in the North West province for a Solar Photovoltaic (PV) facility. Project and Industrial Engineering (Pty) Ltd (PIE) was approached by Sinetech, the principle consultant to the client, to act on their behalf to produce and execute several preliminary studies including a Traffic Impact Assessment. These studies are captured in this report. See below the proposed site layout as received from Strategic Environmental Focus (Pty) Ltd (SEF).

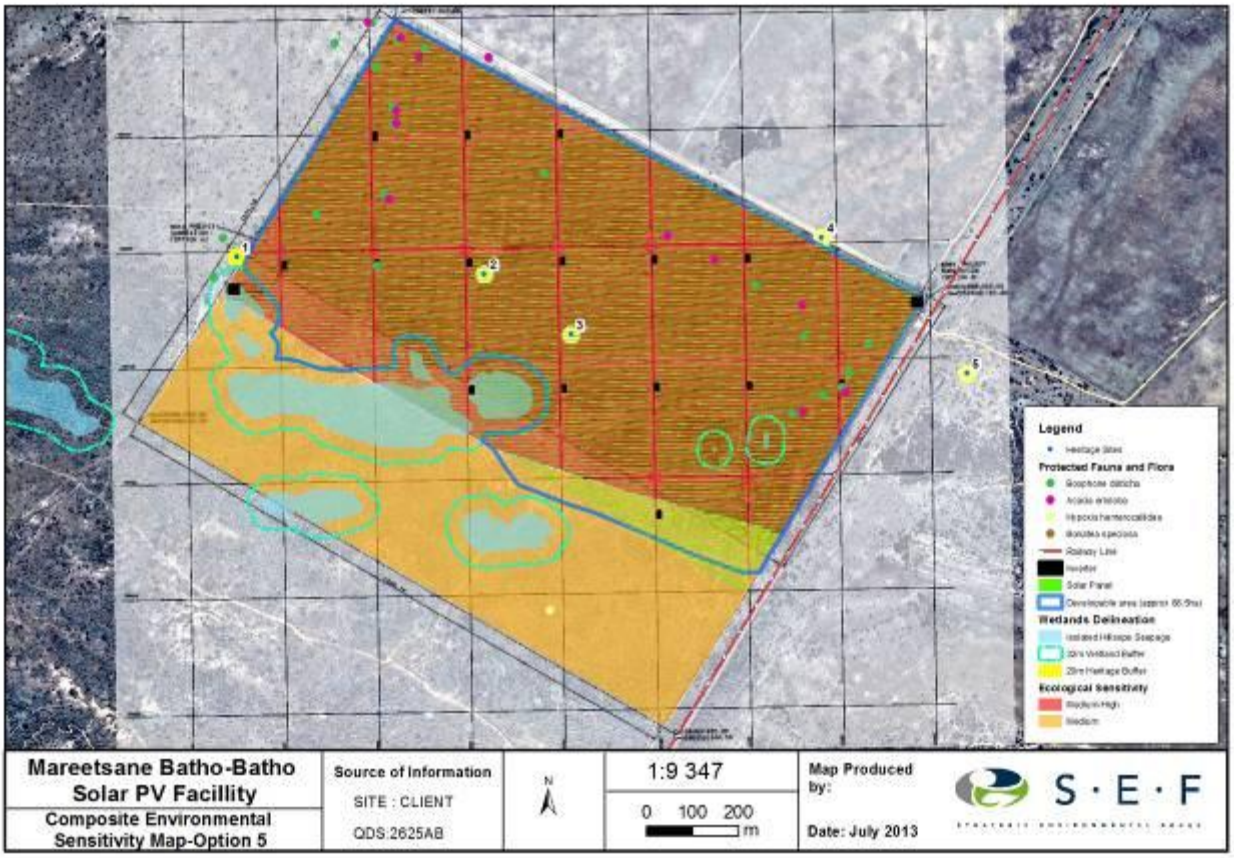

Figure 1, Proposed facility layout.

2. LOCALITY

The site is situated in the Setlagole Native Reserve, approximately 11 km south of Mareetsane in the North West Province. A national Transnet railway line runs parallel to the site bordering the south eastern perimeter. There is a rural train station situated near the south east corner of the

proposed solar facility, named Badibua. It is situated less than one kilometre from the proposed site but however is currently not operational. Morokwa settlement lies south west of the proposed facility in addition to a native graveyard bordering both the settlement and the newly proposed developmental site. Please see figure 2 below.

Figure 2, Locality photo

3. PROPOSED DEVELOPMENT

The proposed Batho- Batho PV Solar PV Facility will generate 30MW of electricity and will consist of more than 80 000m^2 of solar facility panels. Solar panels will be mounted on steel columns and secured *in situ* into the soil. Components to be imported will be shipped from either Durban or Richards Bay harbour and transported by road over a distance of approximately 950km. Access to the site is proposed to be via exiting farm land off the R375. Components for the solar facility are relatively small and will subsequently not require special abnormal weight permits. The solar facility will be built in one phase, with a total construction period of 12 months. The solar facility is spread over an 88 hectare area.

4. TRAFFIC ANALYSIS SCOPE

This report evaluates and estimates the expected traffic impact of the proposed development during the construction phase of the project as well as the operational phase of the project. It is important to note that the construction phase will have an impact on the traffic network for a period of 12months. The operational phase will have an impact on the traffic network for a period of 20 years where after the facility will be decommissioned. If after 20years the decision is taken to prolong the contract a new TIA will be required to evaluate traffic compatibility. The report will investigate the suitability of the existing road network in the vicinity of the solar facility and report on any additional road infrastructure which may be required. This report will further recommend potential access routes to site.

The report is based on existing available information for the local road network as well as information obtained from a site visit conducted by PIE on the 29th and 30th of August 2013.

5. TRANSPORT ROUTE

Solar plant facility equipment is assembled on site and individual components very seldom exceed normal load requirements, therefore route restrictions are far less than abnormal load requirements. Freight requirements will include two hundred and seventy 22meter interlinks 54 ton pay loader at normal load. The clearance required for the necessary equipment will not exceed 4meters. The shortest proposed route is illustrated in figure 3 and will transport solar plant facility equipment from Durban Harbour to the proposed site. See figure 3 below.

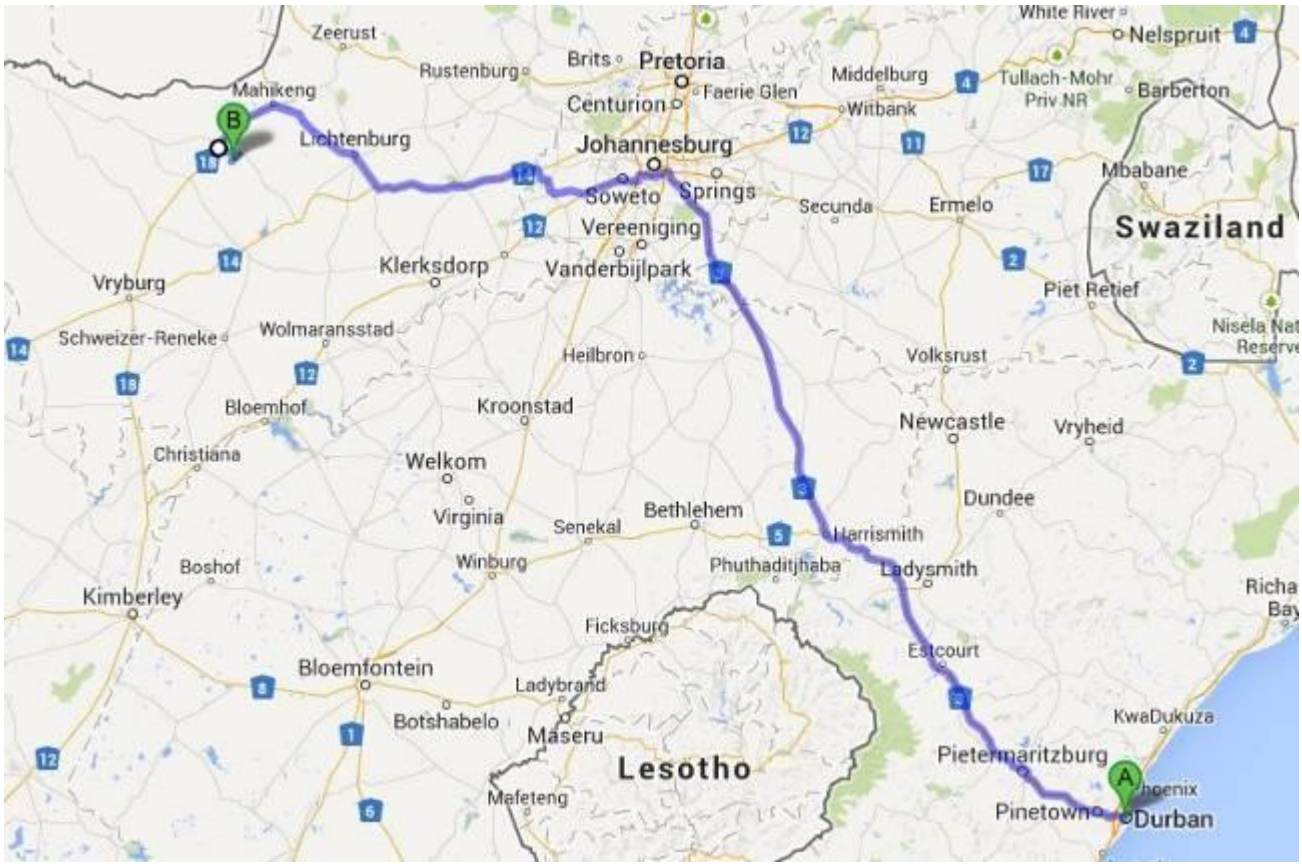

Figure 3, Main transportation route.

6. BEST ROUTE AND ENTRY POINT

The optimum route starts at Durban harbour and follows the N3 for 550km, the N3 is a partial toll road and national road and complies with all the loading requirements, see figure 3. From the N3 the route follows the N12 for 60km, estimated travel time is 45 minutes. From the N12 turn onto the R501 for 20km's. The R501 leads to Carletonville, travel through Carletonville on the R500, the R500 leads to the N14. It should be noted that at the time of this study, the N14 was closed due to construction work. The N14 may be used as an alternative route as it is estimated that construction on the road should conclude by 2014. See figure 4 below.

Figure 4, N14 Road closure.

Follow the N14 for 110km through Ventersdorp to Coligny. The R375 is in a dilapidated condition and must be avoided to minimise further damage to vehicles and the road surface. The route must thus divert from Coligny using the R503 to travel to Mahikeng via Lichtenburg. From Mahikeng the route will follow the N18 for 45km to the N18 R375 intersection. Follow the R375 for 16km's to the Mareetsane farm road intersection. From the intersection follow the public gravel farm road for 11km's to the Setlagoli Native Reserve. The last 5km's of the farm road needs special attention in order to be operational for the project. Grading of the road and possible realignment, including re-compaction of road layers could be necessary. From the Setlagoli Native Reserve, the route follows a further 500 meters to the solar facility. There is no official road on the reserve and this stretch of the route will be designed and constructed to meet the requirements of this project. From past projects it is estimated that the upgrading of the farm road will cost R7 600 000.00. This figure will be confirmed in the detail design stage. A final railway track crossing is required to get to the solar facility. From a visual inspection it is confirmed that the crossing complies with all requirements and does not need to be upgraded.

This is the best access road due to the distance travelled from Durban to site versus the serviceability of all the roads versus the cost of upgrading of the farm road. The alternative would include accessing the Batho- Batho PV Facility from Old Kraai Pan, the existing road from Old Kraai pan to the site is unusable and will need to be upgraded. The total length of the alternative road is more than 10km's and will double the cost of the road upgrade. The best access road is thus the preferred road. The best entry point on the site is situated in the northern corner of the site as it is closest to the rail way crossing.

See below the R375 in its dilapidated condition.

Figure 5, R375 road.

A safe stopping sight distance for a road with a speed limit of 60km/h is between 74.3-84.6meters. Due to the even topography of the area this distance is not jeopardised by the farm road. Road signage will include two indication sign boards at the R375 farm road intersection, covering both directions, indicating the Batho- Batho PV Facility. Extra signs will include additional speed limit signs on the farm road. The national and provincial roads on the proposed route comply with all road signage requirements.

7. WAYLEAVE APPLICATIONS

A way leave application is required for work done within a municipal servitude or road reserve. The way leave application will include all existing services as well as the newly proposed infrastructure. Approval from all affected parties will be required, affected parties will typically include the local municipality, Sanral, Eskom, Transnet etc. The process normally takes 2-6months and detailed drawings will accompany the way leave application. A design is required to draft the drawing which accompanies the way leave. Way leave application will thus commence at the design phase of the project. This report will only comment on areas where way leave applications will be required.

The newly proposed power line will intersect the R375 and the rail way line, way leave applications will be submitted at all the intersections. Upgrading of the farm road and the proposed power line within the road reserve will require way leave applications.

8. ON-SITE INTERNAL ROADS AND PARKING

The internal road network will be constructed as to ensure serviceability during construction phase as well as the operational phase. The 22meter interlinks required to transport the construction and solar material to and from site require a minimum 12 meter turning radius. All construction camp circles must comply with this requirement. From past projects it is estimated that the cost to construct the internal network will amount to R3 126 800.00 ex. VAT. See below a typical road cross section, please note the detail is not project specific and a civil road design will be required at the design phase of the project. Internal parking requirements during the operational phase of the project will include 10 parking spaces at the control room.

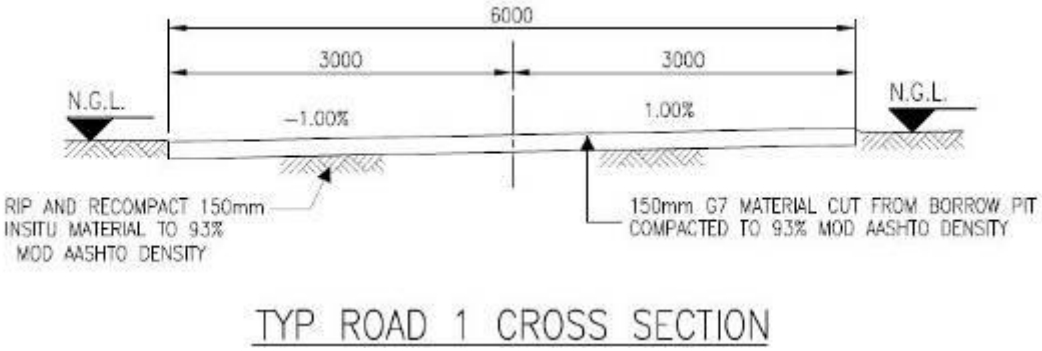

Figure 6: Typical road cross section.

9. EXISTING CONDITIONS

The existing roadway characteristics are summarised in Table 1

Table 1: Existing road conditions

Roadway	**Type of Road**	**Posted Speed** (km/h)	**Sidewalks**
N3	National	120	Shoulder
N12	National	120	Shoulder
R501	Provincial Main Road	120	Gravel Shoulder
R500/ Annan Road	Provincial Main Road	60	Shoulder with vegetation
South/ Ada Street	Urban Streets	60	Shoulder with vegetation
N14	National	120	Shoulder
R503	Provincial Main Roads	120-60	Gravel Shoulder

R52/Republic/T Mbeki	Urban Streets	60	Shoulder with vegetation
N18	National	60-120	Gravel Shoulder
R375	Provincial Main Road	60-80	Gravel Shoulders
Unclassified Road	Gravel Road	60	No shoulders

6.1 Existing Cross Sections and Surface Conditions

For the purposes of this study, the report will focus on the roads in the vicinity of the solar facility namely; the Rural farm road, the R375, the N18 and the N14.

6.1.1 Unclassified Provincial Farm Road

The Rural farm road has two road profiles, from the solar facility the first 5km's of the rural road has a single one way carriage profile and a width of approximately 4.5meters. The road is in a poor condition and will need to be upgraded to accomodate the project. The road has been eroded and is below natural ground level which will present problems in the rainy season as it will act as a stormwater channel. See figure 7 below.

Figure 7, Dilapidated unclassified farm road.

The second road profile increases from a 4.5meter to 6meter gravel road. See figure 8. It can accommodate traffic in both directions. The shoulders are well maintained and very little work is needed on this part of the road. There is a low level pipe culvert on the road which would have to be upgraded to prevent stormwater problems during the rainy season. See below figure 9.

Figure 8, Second farm road profile.

Figure 9, Low level culvert crossing.

6.1.2 R375 Provincial Road

The R375 has a typical rural cross-section with two 3.0m carriageways, and a road reserve of 18meters for possible future expansion. The road is in a dilapidated state and should be avoided if not upgraded before the project commencement date. There are no turning lanes at the existing access to the unclassified farm road. This should not be a problem if the route travel's from Sannieshof but could present negligible stress on the road network from the Mahikeng route. See photo below of the R375 – Rural road intersection.

Figure 1, R375 and Rural farm road intersection

6.1.3 N18 National Road

The route could follow the N18 to avoid the R375, approximately 45kilometers will be travelled on this road. The road has a cross-section with two three meter carriageways. A stormwater channel is present on each side of the road which suggests good road drainage in the wet season. Three meter gravel shoulders with slight vegetation are present on either side of the road. The overall condition of the road should suffice for transportation of equipment to and from site.
See below the profile of the N18.

Figure 11, N18 road profile.

6.1.4 N14 National Road

The N14 is a National road with a speed limit ranging from 120km/hour to 60 km/hour in the urban areas. It is the shortest route from JHB to site but certain road sections require maintenance, which SANRAL is responsible for. As was previously noted a portion of the N14 was closed for construction at the time of this study. The road has a cross-section with two three meter carriageways but increases to a 4lane road as the N14 approaches JHB. There are no normal height restrictions on the N14 and could be used for transportation purposes for the proposed project. See below the N14 cross-section.

Figure 12, N14 road profile.

6.2 Existing Traffic Volumes

The Rural farm road serves farms and the Setlagoli Native Reserve. A visual traffic count confirmed that the farm road is currently underutilised with an expected total road user's quantity of 35 vehicles. The Annual Average Daily Traffic (ASDT) along the Rural Farm road is 35 vehicles with a 50/50 directional split. No peak-time traffic volume could be established on the road as the traffic usage on the road is insignificant. The R375 joins the N14 with the N18, the ASDT for the road are expected to be less than 350 vehicles per day with a 50/50 split. The N14 and N18 ASDT is expected to be more than 800 vehicles. The typical two-way traffic volume during the weekday peak hour is 200 vehicles (100 per direction). The existing traffic network and intersections will be able to accommodate the extra traffic load.

10. SITE ACCESS

Access to the site is proposed via the Setlagoli Native Reserve. There are no formal roads on the reserve and a service road will have to be designed and constructed to support the life span of the project. The road length will be approximately 500m and includes a rail way track crossing.
See below.

Figure 13, Setlagoli Native Reserve road to be upgraded.

Through local knowledge it was established that the rail way track is used twice per day. The rail

way crossing complies with all requirements and need not be upgraded. The railway track schedule will be requested and should form part of the contractors safety file. Vehicles accessing the solar facility must obey South African railway crossing laws to avoid incidents. See below railway crossing.

Figure 14, Rail way crossing next to solar facility.

The required stopping sight distance (SSD) for the heavy vehicles along roads with a posted speed limit of 100km/h is 375 meters and for a single unit truck it is 300 meters based on the geometric design guidelines of the Urban Transport Guidelines (UTG). Due to the flat landscape in the area the available SSD in both directions along the R375 is acceptable.

11. TRAFFIC IMPACT ANALYSIS

The expected impacts the new solar facility will exert on the local transportation network were evaluated as follow:

- Existing or background traffic was estimated. This is the current traffic volumes without the new solar facility.
- A growth factor was incorporated into the design to design for a 20year lifespan.
- The facility will impact the transportation network in two phases namely the construction phase and operational phase. The construction phase will have a temporary impact on the road network and the operational phase could be considered to have a permanent impact

on the network.

8.1 Year 2014 Background Traffic Conditions (No go alternative)

For the purpose of this study, year 2014 background traffic conditions were developed by applying a 2.5 percentage annual traffic growth rate to the existing traffic network on all major links. This estimated growth rate was assumed to allow for any additional traffic volumes due to other existing and future developments taking place in the vicinity of this study. Due to the low traffic volumes that was observed during the site visit it is estimated that the existing road network will operate at acceptable levels.

8.2 Construction Phase

The construction phase of the project will have the biggest impact on the local road network. Expected construction activities will include:

- Construction of the internal roads and access roads;
- Rehabilitation of the unclassified farm road;
- Construction of the solar panels and supporting steel work;
- Construction of operations building;
- Trenching for cables; and
- Construction of perimeter fence.

Internal roads will be constructed using available material on site but if necessary external material will be imported to site using the previously determined route. The solar panels will most likely be anchored to the *in situ* soil using friction steel columns. An alternative approach could include the more conventional method of casting reinforced concrete foundations. Concrete will be mixed on site as there are no batch facilities in the area. Components for the solar facility will be transported to site from either Durban harbour or Richards Bay harbour.

8.2.1 Trip Generation

Trips generated for the solar facility were based on empirical data observed from similar projects that were undertaken by PIE in the past. The results are tabulated in table 2 below. Results are based on a 12 month construction period and are considered to be the worst case scenario

Table 2: Expected generated trips during construction phase.

Material	Approximate Number of Vehicles Required
Construction Management	10 Cars per day
Labour force	5 Busses per day
Ground Anchors	Total 20 Trucks per project
Structural Steel	Total 3 Trucks per project
Solar Panels	Total 250 Trucks per project
Vehicles per day	**17 Vehicles per day**

It is assumed that construction will take place 5 days per week, with a total of 52 weeks per year. The total vehicles generated for the construction phase of the project will amount to 4353 vehicles; 273 Trucks, 1300 busses and 2600 cars. This means that on average the site will receive one truck per day or two trips.

Based on previous projects it is estimated that 300 construction workers could be employed during the construction phase of this project. Assuming 75% of the workforce will use the contractor's bus service to be transported to and from site, 10% will walk from nearby settlements and 5% will use private vehicles. This will add an extra 15 vehicles per day or 30 trips generated per day.

Total trips generated during construction phase will amount to 64 trips per day.

It is expected that 20 workers will be employed during the operational phase of the project. Trips generated during operational phase will thus amount to 40 trips per day.

8.2.2 Trip Distribution and Assignment

It is assumed that all of the construction equipment will come from Durban Harbour via Johannesburg on the N14 which eventually joins the R375.

8.2.3 Proposed Road Network Upgrades

Based on the expected construction trips generated by the proposed development the existing road network should have enough capacity to accommodate the extra vehicle trips.

8.3 Operational Phase

During the operational phase of the proposed development it is expected that 20 permanent workers will be employed at the solar facility on a permanent basis. Assuming all of the workers will travel to and from the solar facility each day. This will increase the number of trips generated to 40trips per day, 20 AM trips and 20 PM trips. This number is insignificant and no additional upgrades to the road network are needed.

12. CONCLUSIONS AND RECOMMENDATIONS

The local road network is underutilised but is not maintained properly. The development may commence without influencing the levels-of-service for the local road network. However, some remedial work is recommended on the gravel road leading to the site. Remedial work on the road network should take place before the construction phase starts. Portion of road to be upgraded include the farm road leading from the R375 to the solar facility. The power line will intersect national and local roads; wayleave applications will be required at all road intersections. A wayleave application is also required for the portion of road to be upgraded. The site plan must allow for access to the informal graveyard.

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for Projects & Industrial Engineering (Pty) Ltd.

13. REFERENCE

Department of Housing, *Guidelines for human settlement Planning and Design*, 2000

Deprtment of Transport, *Guidelines for Traffic Impact Studies*, Report No. PR93/645, Pretoria, 1995

Department of Transport, *South African Trip Generation Rates*, Report No. RR92/228, Pretoria, 1995. Institute of Transportation Engineers. *Trip Generation, 6th Edition* 1997.