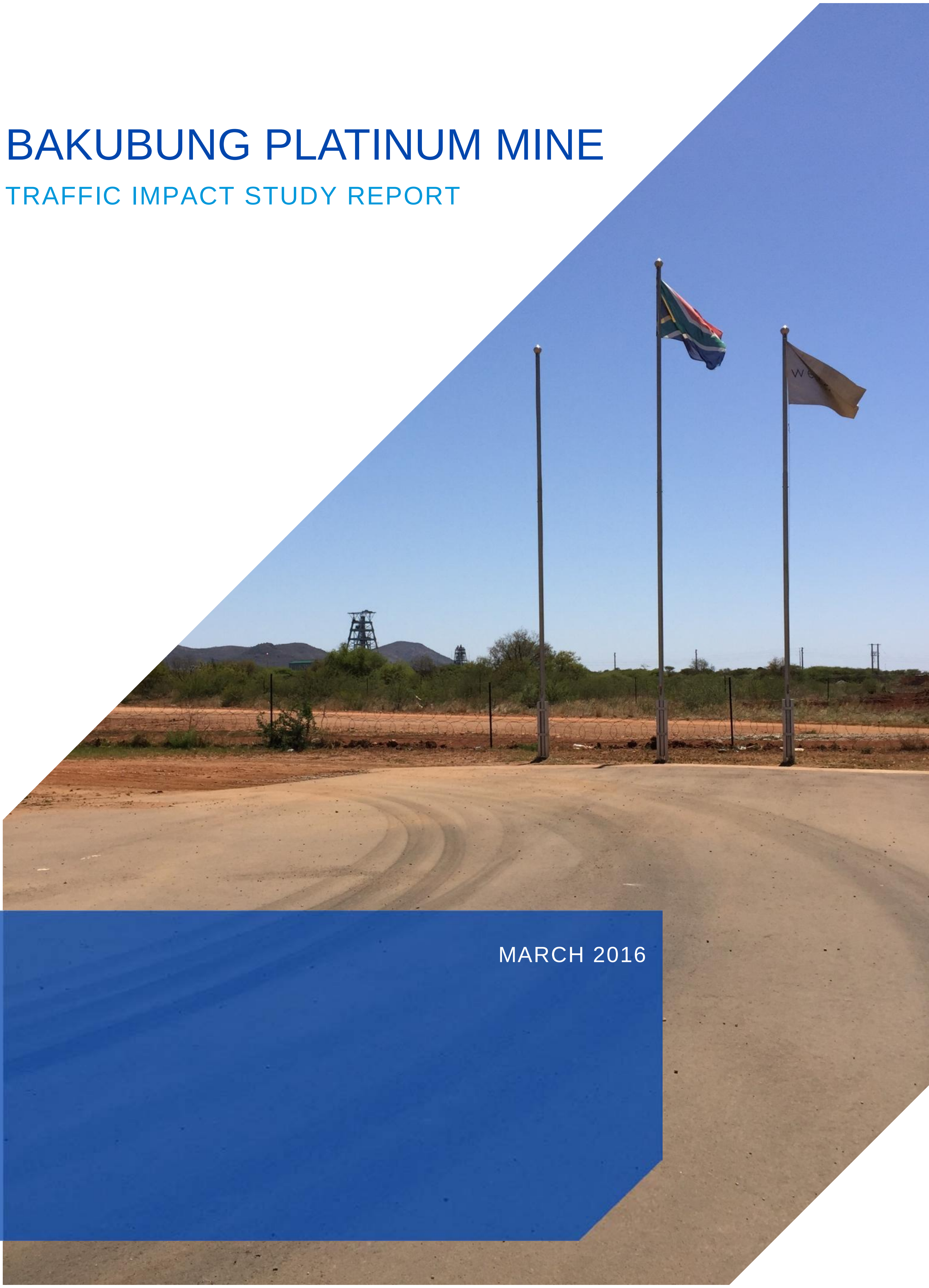
BAKUBUNG PLATINUM MINE

TRAFFIC IMPACT STUDY REPORT



MARCH 2016

WSP | PARSONS BRINCKERHOFF

BAKUBUNG PLATINUM MINE

TRAFFIC IMPACT STUDY REPORT

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PRODUCTION TEAM

WSP | PARSONS BRINCKERHOFF

Junior Traffic Engineer	Ansia Labuschagne
Senior Traffic Engineer	Cornelia Hutchinson

SUBCONSULTANTS

Traffic Counts	Trafftrans

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 TRAFFIC SPECIALIST DETAILS

1.1 QUALIFICATIONS

The Traffic Specialist, Cornelia Hutchinson (ID 8108050032088) is a qualified professional civil engineer specialising in Traffic Engineering. She obtained the following degrees at the University of Pretoria:

- B.Eng Civil Engineering (First Class) in 2003; and
- B.Eng (Hons.) Transportation Engineering (with distinction) in 2011.

1.2 RELEVANT EXPERIENCE

The Traffic Specialist has the following relevant project experience. Her comprehensive Curriculum Vitae is included in Appendix D.

- Expansion of Klipfontein Section of Middelburg Mine and associated closure of a section of the D253 Provincial Road, Mpumalanga (2015);
- Jeanette Project underground gold mine near Welkom, Free State (2015);
- The Cascade Iron Ore Mining Project in Mpumalanga (2014);
- Anglo Alexander Coal Mine near Kriel in Mpumalanga (2014);
- Butsanani Rietvlei Opencast Coal Mine in Mpumalanga (2014);
- Yzermyn Coal Mine near Wakkerstroom in Mpumalanga (2012);
- Sintel Char Plant Expansion and Grootegeluk Coal Mine in Lepalale (2011);
- New Largo Coal Mine in Mpumalanga (2011); and
- Eerstelingsfontein Opencast Coal Mine in Belfast, Mpumalanga (2011)
- Professional affiliations: Engineering Council of South Africa (20130451); South African Institute of Civil Engineers (201236); and Institute of Transportation Engineers (1043352)

1.3 PROFESSIONAL AFFILIATIONS

The Traffic Specialist belongs to the following professional affiliations:

- Engineering Council of South Africa (ECSA), registration number 20130451; and
- South African Institute of Civil Engineers, member number 201236.

1.4 DECLARATION OF INDEPENDENCE

I, Cornelia Hutchinson, hereby declare that I am an independent consultant and have no conflict of interest related to the work of this report. Specially, I declare that I have no personal financial connections to the relevant property owners, developers, planners, financiers or consultants of the development. I declare that the opinions expressed in this report are my own and a true reflection of my professional expertise. The views and findings expressed in this report are objective and might therefore not be favourable to the applicant/client.

C Hutchinson.

Cornelia Hutchinson

2 INTRODUCTION

2.1 PURPOSE

The purpose of this study is to provide a traffic impact assessment for the proposed amendment to the environmental authorisation of the Bakubung Platinum Mine.

2.2 LOCALITY

The Bakubung Platinum Mine is located on Portions 3, 4 and 11 of the farm Frischgewaagd 96-JQ, south of the R556 and east of the R565, south-east of the town Ledig. The proposed tailings dam is located on the farm Mimosa 81-JQ, west of the R565, east of the Phatsima Township.

Access to the mine is (and will remain) approximately 1.5km south of the intersection of the R565 and the R556. Access to the tailings facility is currently approximately 50m south of the mine access. The location of the mine, tailings facility and proposed accesses can be seen in Map 1: Locality Plan included in Appendix A.

2.3 SCOPE

The study covers the following aspects related to traffic:

- A brief description of the proposed development;
- Discussion of trip generation, distribution and assignment associated with the proposed mine;
- Analysis of traffic operating conditions for the proposed mine;
- Comment on traffic and road safety issues;
- Comment on on-going road pavement management and maintenance; and
- Conclusions and recommendations.

2.4 NEMA REQUIREMENTS

A checklist with the requirements for specialist reports in terms of the new NEMA Regulations (2014) are included in Appendix H, which cross-reference the relevant sections of this report.

2.5 METHODOLOGY

The methodology adopted in the execution of the study and compilation of the report is described below:

2.5.1 Site Inspection and Liaison

A comprehensive site inspection was done of the sites and the surrounding road network. The locations at which traffic counts are required was verified during the site investigation.

2.5.2 Data Collection

The following data was required in order to complete the study:

- Classified, manual traffic counts at selected intersections.
- Electronic, classified, continuous (24-hour/7-day) link count.
- Geometric details of selected intersections.

- Visual assessment of existing road surface/pavement conditions.
- Expected trip making characteristics of the approved mine together with proposed project.

2.5.3 Baseline Traffic Conditions

The traffic data was used to determine the existing/baseline traffic operating conditions on the road network in the study area. This was done by means of SIDRA software. This process identified any existing traffic management and control problems that need to be addressed.

2.5.4 Construction Phase

It is understood that construction at Bakubung is currently underway and the client provided information regarding the extent and trip making characteristics of the current construction in order to exclude any current construction vehicles from the traffic counts from future operational traffic volumes.

Details of future construction phases were required, i.e. dates and construction periods and origin of construction materials and plant. This information was used to estimate the types, frequency and volumes of construction vehicles that will be generated during the future construction phase(s) and to determine whether this will have a significant traffic and pavement impact.

2.5.5 Future Traffic Conditions

The base year traffic volumes were used to forecast future traffic volumes for selected horizon years, based on potential phasing and the life of mine. The relative impact of various vehicle types was determined and assessed. To this end the expected trip generation by the mine was quantified and distributed on the road network. Information regarding the proposed mine operations was provided by the Client to deduce these trip making and distribution characteristics of both employees and the transportation of platinum. Information provided included the following:

- Operational days and hours/shifts, distinguishing between employee travel and transportation of platinum.
- Method of transportation of platinum and waste.
- Expected production at various phases of the mine.
- Number of employees, distinguishing between day-time office staff, skilled staff and semi-skilled/unskilled shift workers.
- Origins/destinations of employees and platinum.

Measures to mitigate the relative impacts of the mine generated traffic are proposed, e.g. alternative types of intersection control and/or geometric intersection upgrades.

2.5.6 Access

The capacity requirements and conceptual layout of the accesses were evaluated.

2.5.7 Road Surface Conditions

Visual inspections of the road surface and pavement conditions of the public roads in the study area were conducted during the site investigation. High-level comments are made in terms of the perceived ability of the roads to handle the estimated additional heavy loads from the proposed expansion. Recommendations in terms of further testing and detail design requirements are made to serve as input into the detail design phase.

3 DESCRIPTION OF DEVELOPMENT

3.1 EXISTING LAND USE

Large portions of land surrounding the site is vacant, especially north of the site and the town Ledig where Pilansberg National Park is located. A number of other platinum mines are located to the south of the site.

Before the start of the construction of the mine the Bakubung Mine site was also vacant.

3.2 PROPOSED DEVELOPMENT

The Bakubung Mine will be mining two reefs for Platinum Group Elements including platinum, palladium, rhodium and gold with copper and nickel as by-products. Mine operations will start in 2020 (ramp up) with the life of mine extending to 2044.

In 2009 the Bakubung Platinum Mine received environmental authorisation. A traffic impact assessment was conducted for the 2009 approvals (Trafftrans, 2008). It is now proposed to make several changes to the approved mine, which will require additional environmental authorisations, a waste management licence, amendments to the Water Use Licence as well as an amendment to the mining right.

The proposed changes to the Bakubung Platinum Mine that could potentially have an effect on the traffic impact include the following:

- An increase in the capacity of the concentrator plant from 230 000 ton per month to 265 000 ton per month;
- Increased capacity of the mine product stockpiles;
- Inclusion of the minerals in the waste rock into the mining licence in order to potentially sell crushed waste rock as aggregate;
- New internal mine roads; and
- The construction of Phase 1A of the mine housing.

The following should be noted in terms of important changes to roads and traffic issues since the 2008 TIS:

- The 2008 TIS assumed two access points to the mine site: 1 from the R565 and another from the R556. It is now proposed only to have 1 access from the R565.
- The housing development was not considered as part of the 2008 TIS. A TIS was conducted for the Gabonewe housing development by Mott MacDonald PDNA in 2014, which recommended certain road upgrades.
- The details contained in the 2008 TIS were very limited in terms of trip generation and distribution characteristics; mode of employee transport (private/public); and heavy vehicle trip generation and impact.
- The horizon year of the 2008 TIS was 2011. Typically traffic impact studies only stay relevant for a maximum period of 5 years and none of the road upgrades recommended in the 2008 TIS have yet been implemented.

Considering the above, together with the fact that currently available staff volume estimations and information regarding mine operations and production are based on the full mine development, this TIS considered the trip generation of the full mine and then compared the mitigation measures with those recommended by Trafftrans (2008).

3.3 EXISTING ROAD NETWORK

The Bakubung Mine will be situated south of the R556, on both sides of the R565. Access to the mine is to the east of the R565. The client indicated that access to the Tailings Storage Facility (TSF) will be via the Phatsima Road which forms the western leg of the R565 and R556 intersection.

The R556 is a two-lane road with one lane per direction. The speed limit varies between 60km/h and 120km/h along the section east of its intersection with the R565. The speed limit at the intersection is however indicated as 60km/h.

The R565 north of its intersection with the R556 is a two lane road with one lane per direction. At the intersection short lanes have been provided in order to make provision for two lanes per direction.

The R565 south of the intersection is a four lane road with two lanes per direction for approximately 13km past the mine access, where after it becomes a two lane road.

The access to the mine has already been constructed as a T-junction with priority stop control on the access road. Short turning lanes have been provided for both left and right turn movements into the mine. A short acceleration lane has also been provided for vehicles exiting the mine in the southbound direction.

4 TRAFFIC DATA

4.1 SITE INSPECTION

The Traffic Specialist conducted a comprehensive site inspection of the public road network in the vicinity of the proposed site on Wednesday, 6 January 2016. The road pavement and key road elements which could potentially be affected by the mine operations were visually inspected.

Since the focus of the site inspection is to determine the physical road environment and not concerned with traffic flows, the outcome of the site investigation is not sensitive to the season during which it is conducted.

Photographs detailing the inspection are included herewith in Appendix B.

4.2 TRAFFIC COUNTS

Manual, classified traffic counts were conducted on Friday 15 January 2016 from 05:00 to 19:00 (14 hours) at the following two intersections:

à Intersection of R565 & R556

à Access to Bakubung Mine

The position of these intersections can be seen on Figure 1. The traffic patterns of the study area is not expected to be sensitive to seasonal fluctuations (other than school holidays) and the data is therefore considered to be representative of normal traffic conditions.

The peak hour traffic volumes at each intersection are shown in Figures 2 and 3. All figures are included in Appendix C.

A 24-hour electronic traffic count (position marked E on Figure 1) was conducted over a 7-day period along the R565, between Ledig and the mine access. The average daily traffic volumes on the R565 are summarised in Table 4.1.

Table 4.1: Seven-day Average Traffic Volumes (24-hours)

VEHICLE CLASSIFICATION	NORTHBOUND	SOUTHBOUND	BOTH DIRECTIONS
Light	3 521	3 349	6 870
Heavy	319	469	785
All	3 837	3 718	7 654

The detailed traffic count data are included herewith in Appendix D.

5 TRIP GENERATION, DISTRIBUTION AND ASSIGNMENT

5.1 TRIP GENERATION

Trip generation rates for this type of development are not available from standard sources. The trip generation used has been extracted from information provided by the client or collected from traffic counts. This information is subdivided into the following phases:

5.1.1 Construction

The construction period is estimated to be three years and is already underway. As stated in Section 3.2, traffic counts were conducted at the access to the mine. These counts were used to determine the number of trips currently generated daily during the peak hours and the impact of these trips on the operation of the access. The access is analysed in Section 6.

5.1.2 Operation

It is expected that Bakubung Mine ramp-up production will start in 2020 and will reach full operational capacity during the first half of 2021.

5.1.2.1 Labour & Transportation

At full production the staff complement will consist of approximately 3 700 employees per day. Mine housing will be provided in the Gabonewe Estate township development, immediately north of the mine area. A separate Traffic Impact Study was conducted for Phase 1 the proposed Gabonewe township consisting of 1 300 housing units and a primary school. Currently only Phase 1A of Gabonewe Estate consisting of 910 housing units is finalised for implementation.

For the purpose of this report it was assumed that Phase 1A would be the only mine housing provided for the time being, in order to analyse a worst-case scenario.

Following the analysis the client indicated that only 400 houses might be implemented at first. This would have dual impact on the employee traffic as follows:

- The trips generated from external housing developments (listed in the Tables 5.4 and 5.5) will increase by 42 minibus taxi trips during the peak hours.
- 400 houses represents ± 30% of the number of houses analysed in the Gabonewe Estate TIS (Mott MacDonald/PDNA, 2014). For 910 houses 70% of the Gabonewe Estate TIS trips were included as latent trips. This means 400 houses results in a reduction of 153 and 119 AM and PM peak hour trips respectively at the intersection of the R565/R556.

From the above it was concluded that the impact of fewer houses will decrease private vehicle/car trips from Gabonewe Estate and increase public transport trips from external housing developments. This will reduce the overall number of vehicle trips, i.e. have a lesser traffic impact during the peak hours and the proposed mitigation measures will still be adequate.

The mine will operate in two 12-hour shifts with a separate shift for office staff as follows:

- 06:00 – 18:00 (day shift)
- 18:00 – 06:00 (night shift)
- 07:00 – 15:00 (office staff)

From the information provided it was estimated that the office staff would consist of approximately 300 employees. Managerial staff would not be allocated mine housing, but would be provided with an allowance to secure their own housing. It is therefore assumed that none of the office staff, consisting mostly of managerial positions, would be allocated housing in Gabonewe Estate and would make use primarily of private transport.

The staff breakdown per shift for the purpose of estimating traffic volumes can be seen in Table 5.1 below.

Table 5.1: Bakubung Mine Staff Breakdown

	OFFICE STAFF	DAY SHIFT	NIGHT SHIFT	TOTAL
Private Transport	300	0	0	**300**
Local Labour *(Public Transport i.e. Taxi)*	0	1 245	1 245	**2 490**
Housing *(Pedestrian Trips)*	0	455	455	**910**
Total	**300**	**1 700**	**1 700**	**3 700**

All local labour (employees not housed in Gabonewe Estate) is anticipated to make use of existing public transport. Busses observed along the R565 and R556 appeared to be associated with labour transport of surrounding mines and not necessarily a general public transport service. A large number of minibus taxis were observed in the area and it is expected that local labour will make use of their services.

The assumption was made that due to the large volume of passengers destined for Bakubung Mine, the taxis would arrange their routes in order to supply the higher demand. For this reason it was assumed that 80% of the passengers in a taxi heading to Bakubung Mine would be Bakubung Mine employees. The maximum capacity of a minibus taxi was assumed to be 15 passengers, i.e. 12 Bakubung Mine employees per taxi were assumed. The trip estimation for the three shifts is calculated in Table 5.2 below:

Table 5.2: Estimated Employee Trip Generation

	OFFICE STAFF	DAY SHIFT	NIGHT SHIFT
Person Trips by Vehicle	300	1 245	1 245
Persons/Vehicle	1	12	12
Vehicle Trips (one way)	**300**	**104**	**104**

It is assumed that the taxis dropping off shift employees would immediately depart again and would return at a later stage to pick up employees from the completed shift. All taxi trips were therefore doubled in order to take their arrival and departure within one hour into account.

It is estimated that the mine would generate 508 AM peak hour trips, due to the overlap of the arrival of the office staff and the departure of the night shift staff. During the PM peak hour it is estimated that the mine would generate 208 trips.

5.1.2.2 Other

Deliveries to and collections from site, including waste collections, will be done by means of trucks. The process plant at the mine will produce a wet concentrate slurry which will then be transported to a nearby platinum smelter for further processing.

The number of heavy vehicles expected to be generated by the mine as well as their impact on the road infrastructure is discussed in detail in Section 9 of this report.

5.1.3 Decommissioning & Closure

During the decommissioning and closure phases it can be expected that the traffic impact of the mine will reduce and eventually discontinue.

5.2 LATENT TRIPS

In terms of TMH 16 traffic impact studies must take trip generation from other developments as well as future potential development into account in the estimation of background traffic. The trips generated by these developments are generally referred to as latent trips. The following developments must be taken into account:

- *Approved developments that have not yet been fully implemented. The traffic demand of such developments must be established from traffic impact assessments that have been submitted for the developments.*
- *Developments that are likely to occur during the study horizon of the traffic assessment.*

Phase 1 of the Gabonewe Estate township, as evaluated in the Traffic Impact Study was for 1 300 residential units and a primary school. The total trips generated by the full development, according to the Gabonewe Estate Township Development TIS Addendum can be seen in Table 5.3 below:

Table 5.3: Gabonewe Estate Trip Generation – Phase 1

	AM PEAK HOUR	PM PEAK HOUR
Housing	892	889
Primary School	60	21
Total	**952**	**910**

Currently only Phase 1A of Gabonewe Estate consisting of 910 residential units is finalised and no primary school is considered in this phase. The 910 housing units are 70% of the total development for which the Gabonewe TIS was done. Only 70% of the trip generation for the housing were therefore included in this study as latent rights and the same distribution for these trips were also assumed.

5.3 TRIP DISTRIBUTION AND ASSIGNMENT

The trip distribution for the local labour was estimated using the gravity model. This model takes the size (area) of the township and its distance from the mine into account. For the purpose of trip distribution, office employees were assumed to use private vehicles/cars, while the shift employees were assumed to make use of public transport (minibus taxis). Table 5.4 and 5.5 below summarises the trip assignment to/from the surrounding residential areas for public transport and private vehicles/cars respectively.

Table 5.4: % Trip Origins per Residential Area – Public Transport (minibus taxi)

RESIDENTIAL AREA	% TRIP ORIGINS
Ledig	45%
Phatsima	5%
Chaneng, Rasimone, Frischgewaagd	12%
Further South including Rustenburg	38%

Table 5.5: % Trip Origins per Residential Area – Private Vehicles/Cars

RESIDENTIAL AREA	% TRIP ORIGINS

RESIDENTIAL AREA	% TRIP ORIGINS
Ledig	35%
Chaneng, Frischgewaagd	20%
Phokeng, Saron, Pudunong, Masosobane	12%
Tlhabane & Rustenburg	33%

The trip assignment for the AM and PM peak hours, based on the distribution discussed above, can be seen in Figures 4 and 5.

5.4 TRAFFIC GROWTH

An annual growth rate of 3% was assumed for background traffic.

The base year was assumed to be 2020, based on when maximum staff numbers will be reached as indicated on the labour breakdown graph provided by the client. The horizon year was taken as 2025 (5 years from the base year as per the manual[1]).

The assigned generated traffic was combined with background traffic to produce the expected total AM and PM peak hour traffic volumes for the base year. The base year background traffic volumes and Gabonewe Phase 1A latent trips are shown in Figures 6 and 7. The traffic volumes including the trips generated by Bakubung Mine are shown in Figures 8 and 9.

The horison year traffic volumes without Bakubung Mine can be seen in Figures 10 and 11, and the horison year with Bakubung Mine is shown in Figures 12 and 13. The approved Gabonewe Phase 1A trips were included in both horison year scenarios.

5.5 PEAK HOURS

The peak hours considered for the analysis of the intersections is based on the shift change times and the existing peak hours observed during the traffic counts.

In the mornings it was assumed that the shift ending at 06:00 would leave the mine between 06:00 and 07:00, this will coincide with the arrival of the office employees who start work at 07:00. This overlap in arrivals and departures is considered to be the worst case scenario.

During the afternoon, the highest background traffic volumes will occur during the hour before the start of the night shift, between 17:00 and 18:00. This hour is therefore considered to be the worst case and analysed as the PM peak hour.

6 OPERATIONAL ASSESSMENT

6.1 LEVELS OF SERVICE

Operating conditions of peak hours are normally assessed in terms of Levels of Service (LOS), volume to capacity ratios ($^{V}/_{C}$) and average delay.

At this point it is worth considering what is meant in terms of levels of service. In this regard the following extract from the US Highway Capacity Manual is given:

"The concept of levels of service used qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists and passengers. The descriptions of individual levels of service characterize these conditions in terms of such factors as speed and travel time, freedom to manoeuvre, traffic interruptions, and comfort and convenience.

Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions.

The volume of traffic that can be served under the stop-and-go conditions of LOS F is generally accepted as being lower than possible at LOS E, consequently, service flow rate E is the value that corresponds to the maximum flow rate, or capacity, on the facility. For most design or planning purposes, however, service flow rates D or C are usually used because they ensure a more acceptable quality of service to facility users."

6.2 OPERATIONAL ASSESSMENT

The AM and PM peak hours of the following scenarios have been considered for analysis:

- Scenario 1: Existing Traffic (2016);
- Scenario 2: Base year (2020) escalated background traffic;
- Scenario 3: Base year (2020) including Gabonewe Housing Estate;
- Scenario 4: Base year (2020) including Gabonewe Housing Estate & Bakubung Mine;
- Scenario 5: Horison year (2025) escalated background traffic;
- Scenario 6: Horison year (2025) including Gabonewe Housing Estate;
- Scenario 7: Horison year (2025) including Gabonewe Housing Estate & Bakubung Mine;

Analysis of the operational conditions with respect to the above has been undertaken using SIDRA 6.1 software. The analysis results for the intersection is attached herewith in Appendix E.

6.3 ANALYSIS RESULTS – INTERSECTION OF R565 & R556

The intersection of the R565 and R556 is a four-way stop-controlled intersection. A schematic representation of the existing layout of the intersection can be seen in Figure 6.1 below. The schematic is however not an exact representation of the existing intersection as SIDRA does not allow slip lanes to be used in all-way stop-controlled intersections. The slip lane on the north-eastern leg of the R556 (shaded grey) was therefore modelled as short turning lane.

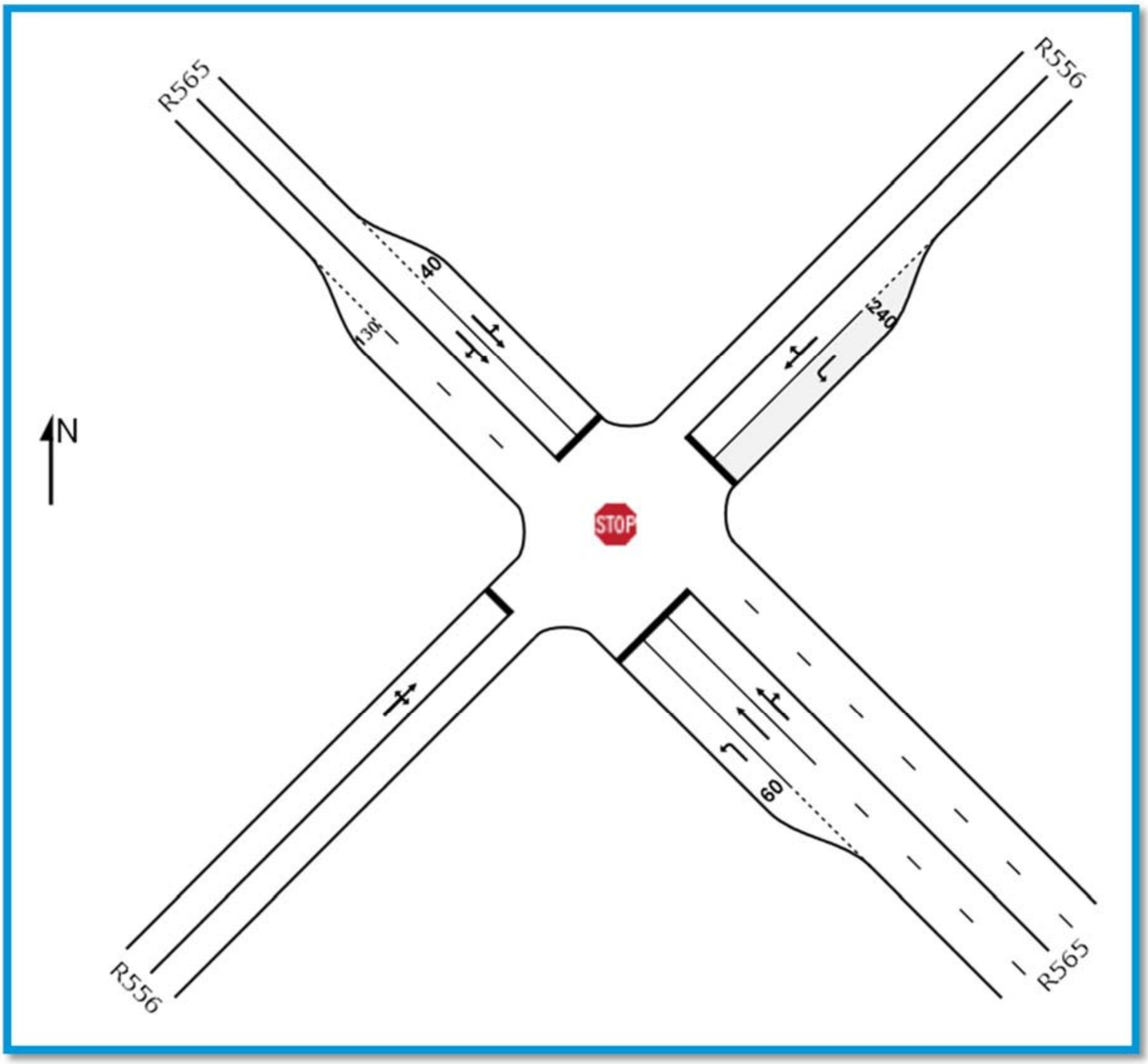

Figure 6.1: Schematic Layout of the Existing R565 & R556 Intersection

The existing layout, as depicted in the above schematic was used in the analysis of existing (2016) traffic volumes.

In the Traffic Impact Study (TIS) for Gabonewe Estate it is proposed to add an additional approach lane to the north-eastern approach, separating the through and right turning movements. The schematic layout of the improved intersection can be seen in Figure 6.2 below. The upgrades proposed by the Gabonewe Estate TIS are indicated in grey.

For this study the upgraded layout according to the aforementioned report was assumed to be the intersection layout for the analysis of both the base and horizon years.

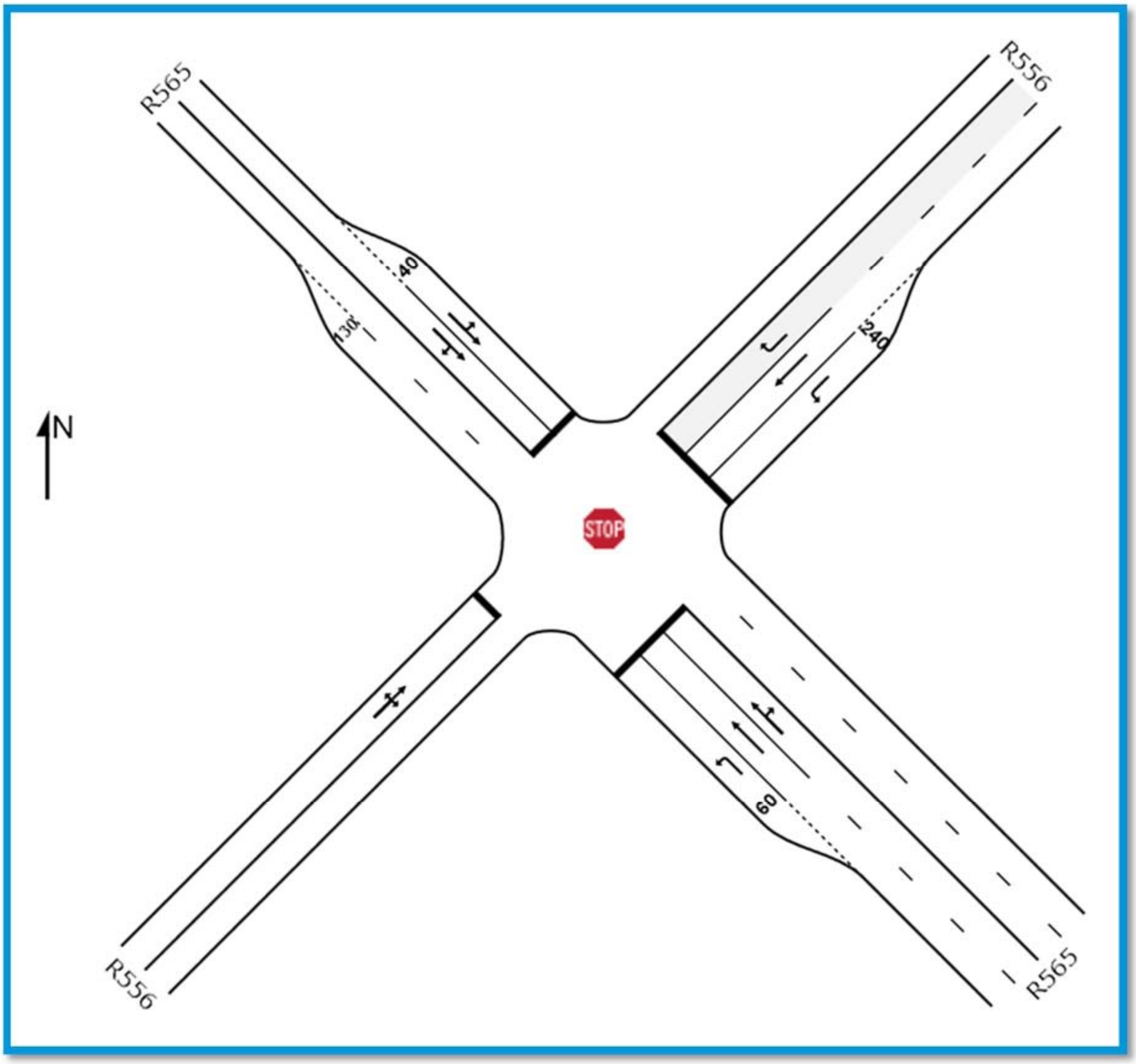

Figure 6.2: Schematic Layout of the Upgraded Intersection of R565 & R556

The summarised results for the AM peak hour can be seen in Table 6.1

Table 6.1: Summarised Analysis Results - AM Peak Hour

Approach	Movement	Existing Traffic (2016)		Base Year 2020						Horison Year 2025					
				Background Traffic		Including Gabonewe Housing		Including Mine & Housing		Background Traffic		Including Gabonewe Housing		Including Mine & Housing	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
R565 (SE)	L	0.075	B	0.084	B	0.092	B	0.111	B	0.096	B	0.106	B	0.124	B
	T	0.264	C	0.295	C	0.329	C	0.412	C	0.339	C	0.374	C	0.455	C
	R	0.419	C	0.469	C	0.616	D	0.696	D	0.540	C	0.692	E	0.769	E
R556 (NE)	L	0.621	D	0.679	D	1.143	F	1.524	F	0.761	E	1.269	F	1.637	F
	T	0.468	C	0.512	D	0.561	D	0.582	D	0.574	D	0.619	D	0.634	D
	R	0.468	C	0.512	C	0.474	C	0.492	C	0.574	D	0.514	C	0.527	C
R565 (NW)	L	0.423	D	0.455	D	0.681	F	0.797	F	0.497	D	0.758	F	0.866	F
	T	0.423	D	0.455	D	0.681	F	0.797	F	0.497	D	0.758	F	0.866	F
	R	0.423	D	0.455	D	0.681	F	0.797	F	0.497	D	0.758	F	0.866	F
R556 (SW)	L	0.259	C	0.285	C	0.399	D	0.420	D	0.321	C	0.460	D	0.464	D
	T	0.259	C	0.285	C	0.399	C	0.420	D	0.321	C	0.460	D	0.464	D
	R	0.259	C	0.285	C	0.399	C	0.420	D	0.321	C	0.460	D	0.464	D

From the analysis results the following conclusions can be made:

1. The impact of the mine is most significant during the AM peak hour. It is important to note that the Gabonewe Housing Estate will not exist separate from the Bakubung Mine. Although the housing development is considered as latent rights, its impacts for the purpose of this study cannot be viewed in isolation.
2. During the base year the housing will reduce the LOS on the north-western approach from D to F, even though the $^{V}/_{C}$ ratio remains below 0.95. The mine generated traffic will deteriorate the $^{V}/_{C}$ ratio further.
3. The impact of the housing and mine respectively is similar during the horizon year.

The summarised results for the PM peak hour can be seen in Table 6.2.

Table 6.2: Summarised Analysis Results - PM Peak Hour

Approach	Movement	Existing Traffic (2016)		Base Year 2020						Horison Year 2025					
				Background Traffic		Including Gabonewe Housing		Including Mine & Housing		Background Traffic		Including Gabonewe Housing		Including Mine & Housing	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
R565 (SE)	L	0.091	B	0.102	B	0.105	B	0.120	B	0.117	B	0.120	B	0.135	B
	T	0.485	C	0.542	C	0.554	C	0.614	D	0.622	C	0.639	D	0.699	D
	R	0.789	E	0.883	F	1.081	F	1.145	F	1.016	F	1.221	F	1.285	F
R556 (NE)	L	0.653	E	0.718	E	0.911	F	1.038	F	0.808	F	1.036	F	1.165	F
	T	0.387	C	0.425	D	0.255	C	0.260	C	0.479	D	0.276	C	0.281	C
	R	0.387	C	0.425	D	0.403	C	0.411	C	0.479	D	0.454	C	0.462	C
R565 (NW)	L	0.257	C	0.276	C	0.396	C	0.431	D	0.302	C	0.441	D	0.477	D
	T	0.257	C	0.276	C	0.396	D	0.431	D	0.302	C	0.441	D	0.477	D
	R	0.257	C	0.276	C	0.396	D	0.431	D	0.302	C	0.441	D	0.477	D
R556 (SW)	L	0.413	E	0.461	E	1.043	F	1.031	F	0.530	E	1.182	F	1.166	F
	T	0.413	E	0.461	E	1.043	F	1.031	F	0.530	E	1.182	F	1.166	F
	R	0.413	E	0.461	E	1.043	F	1.031	F	0.530	E	1.182	F	1.166	F

During the PM peak hour, the traffic volume on the south-western approach is less than 10% of the total intersection volume. When the traffic volume on one approach at an intersection becomes very low (less than 20%) the SIDRA results for that approach becomes unreliable. The results for the south-western approach were therefore disregarded, but the results for the other approaches are however still valid.

From the analysis results the following conclusions can be made:

1. Due to the low traffic volumes on the south-western approach, the results of this approach are considered to be unreliable and were disregarded.
2. The LOS of the right turn movement on the south-eastern approach becomes F during the base year, with $^{V}/_{C}$ ratios of above one (1) for all future scenarios. This happens regardless of the mine.

6.4 MITIGATION MEASURES

The Manual for Traffic Impact Studies[(1)] states that the traffic impact of any proposed development should be mitigated under the following circumstances:

à If the LOS of any element of the facility drops below D;

à If the volume to capacity ($^{V}/_{C}$) ratio of any element of the facility increases above 0.95; and

à If the contribution of the development is at least 2% of the sum of the critical lane volumes of the element.

- Or; where the baseline LOS is E or worse, or $^{V}/_{C}$ ratio is greater than 0.95, this baseline (prior to development) must be maintained or improved for the situation with the development included.

Based on these warrants and taking the above analysis results into account, intersection upgrades will be required in order to mitigate the impact of the traffic generated by the mine. The AM peak hour is the critical scenario for developing mitigation measures since the impact of the mine is more severe during the AM peak hour.

In order to mitigate the impact of the mine, as well as improve the service level at the intersection of the R565 and the R556, it is proposed to convert the intersection to a roundabout, as shown schematically in Figure 6.3.

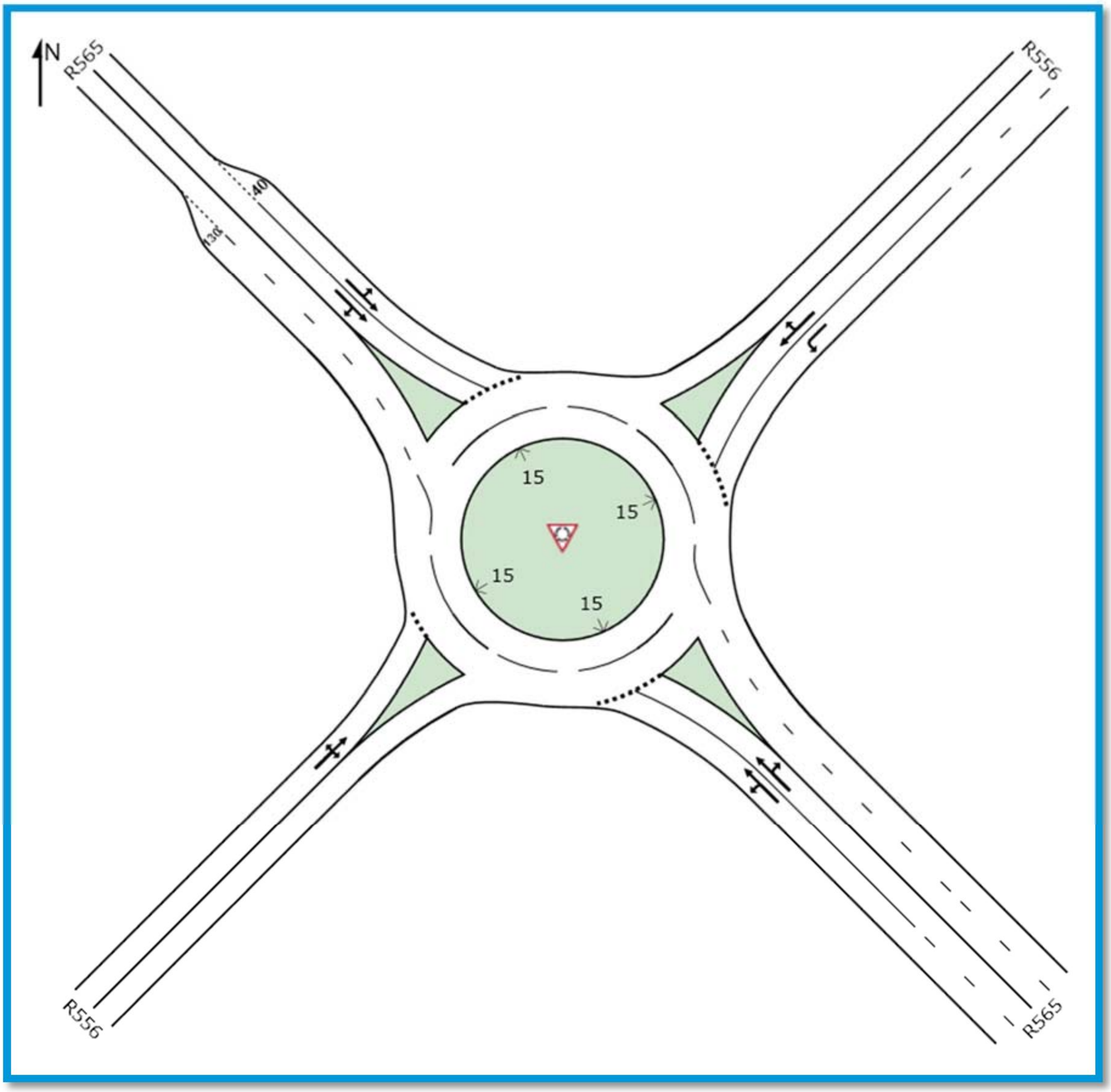

Figure 6.3: Schematic Layout of the Proposed Roundabout

Considering the heavy vehicles and buses that use the intersection, a minimum island diameter of 15m and two circulating lanes is recommended, as shown in the figure. However, the geometric details of the roundabout will be subject to detail design which should take the limitations of the design vehicle as well as available space into account.

The roundabout layout was analysed for both the base and the horizon year scenarios and the results are summarised in the tables below.

The summarised results for the AM peak hour can be seen in Table 4.1.

Table 6.3: Summarised Analysis Results - AM Peak Hour - Roundabout

Approach	Movement	Base Year 2020				Horison Year 2025			
		Including Gabonewe Housing		Including Mine & Housing		Including Gabonewe Housing		Including Mine & Housing	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
R565 (SE)	L	0.126	A	0.161	A	0.149	A	0.185	A
	T	0.126	A	0.161	A	0.149	A	0.185	A
	R	0.175	B	0.209	B	0.203	B	0.238	B
R556 (NE)	L	0.300	A	0.415	A	0.337	A	0.454	A
	T	0.278	A	0.322	A	0.310	A	0.355	A
	R	0.278	A	0.322	B	0.310	A	0.355	B
R565 (NW)	L	0.103	A	0.149	A	0.122	A	0.170	A
	T	0.103	A	0.149	A	0.122	A	0.170	A
	R	0.103	B	0.149	B	0.122	B	0.170	B
R556 (SW)	L	0.156	A	0.171	A	0.185	A	0.193	A
	T	0.156	A	0.171	A	0.185	A	0.193	A
	R	0.156	B	0.171	B	0.185	B	0.193	B

Although the AM Peak hour is critical it was deemed appropriate to analyse the impact of the roundabout layout on the PM peak hour as well. The summarised results for the PM peak hour can be seen in Table 6.4.

Table 6.4: Summarised Analysis Results - PM Peak Hour - Roundabout

Approach	Movement	Base Year 2020				Horison Year 2025			
		Including Gabonewe Housing		Including Mine & Housing		Including Gabonewe Housing		Including Mine & Housing	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
R565 (SE)	L	0.227	A	0.250	A	0.265	A	0.288	A
	T	0.227	A	0.250	A	0.265	A	0.288	A
	R	0.323	A	0.344	A	0.371	A	0.392	A
R556 (NE)	L	0.190	A	0.218	A	0.219	A	0.248	A
	T	0.142	A	0.150	A	0.160	A	0.169	A
	R	0.142	A	0.150	A	0.160	A	0.169	A
R565 (NW)	L	0.108	A	0.127	A	0.131	A	0.151	A
	T	0.108	A	0.127	A	0.131	A	0.151	A
	R	0.108	B	0.127	B	0.131	B	0.151	B
R556 (SW)	L	0.187	A	0.201	A	0.220	A	0.236	A
	T	0.187	A	0.201	A	0.220	A	0.236	A
	R	0.187	B	0.201	B	0.220	B	0.236	B

From the tables it can be seen that should the intersection be converted to a roundabout, the levels of service for all movements during the peak hours will be improved to at least LOS B for all scenarios considered in this report.

6.5 INTERSECTION CONTROL

The decision to make use of a roundabout instead of a signalised intersection is motivated by the following:

1. Based on comments on the TIS for Gabonewe Estate Township Development SANRAL is not in favour of isolated traffic signals.
2. Based on the speed limits on both the R556 and R565, which varies between 60km/h (at the stop controlled intersection) to 120km/h, the class of these roads are not considered to be higher than class 3. Roundabouts are permitted on class 3 roads.
3. In the addendum to the TIS for the Gabonewe Township it is proposed to also have a roundabout at the access to this residential development.
4. The 2008 TIS by Trafftrans also proposed a roundabout at the intersection of the R565 and R556 to mitigate the impact of the mine.

6.6 IMPACT ASSESSMENT

The methodology used for determining the significance of the traffic impact is attached herewith in Appendix J along with the impact summary table. The traffic impact is measured in terms of levels of service as described in Section 6.1. Since materials and product transport generally occurs throughout the day and is not concentrated in the peak hour it does not have a significant impact on the intersection operations. The heavy vehicle impact is considered separately in Section 9.

The incremental impact of the proposed project changes is considered to be low. The approved project has not been implemented yet and only employee/trip information for the mine as a whole (including proposed changes) was available. The assessment conducted in this study therefore considered the full impact of the mine.

A short summary of the rating of the impacts without mitigation measures is provided below.

6.6.1 Severity

During the AM peak hour the impact of the mine traffic is **moderate** at the intersection of the R556 and R565. The recommended operating level will be violated on a number of movements.

During the PM peak hour the impact of the mine traffic is **low** at the intersection of the R556 and R565. The recommended operating level will be violated on two movements. However, these movements are operating at critical levels of service under existing traffic conditions and the additional impact is not considered to be significant.

The implementation of the mitigation measures (as discussed in Section 6.4) will improve the service level considerably at the intersection of the R565 and R556.

6.6.2 Duration

The impact of the mine traffic will continue as long as the mine is operational. During the decommissioning and closure phases it can be expected that the traffic impact of the mine will reduce and eventually discontinue.

The duration of the impact can be described as **medium term**, since it will only continue for the life of the mine and is fully reversible.

6.6.3 Spatial Scale

The spatial scale of the impact of the mine traffic is considered to be **medium** since it extends beyond the site boundary and impacts the operation of public roads in close proximity to the mine area.

6.6.4 Probability

The probability of the mine impacting the surrounding road network as described in this report is **high**. The mine will be the source of a large number of employment opportunities and a large number of daily commuters are expected.

6.6.5 Significance

The significance of the impact of the additional mine traffic is **medium**. The mitigation measures proposed in Section 6.4 will however not only fully mitigate the impact of the mine it will improve the service levels to above existing levels.

7 MINE ACCESS

7.1 ACCESS LAYOUT

The access to Bakubung Platinum Mine has already been constructed and the layout can be seen in Figure 7.1 below. The access is priority stop-controlled.

Only the first 200m of the access road towards Bakubung Mine has been constructed. The remainder of the paved access road that will run along the southern boundary of the mine project area and parallel to the eastern site boundary has not yet been constructed. A temporary access road is being used during the ongoing construction phase.

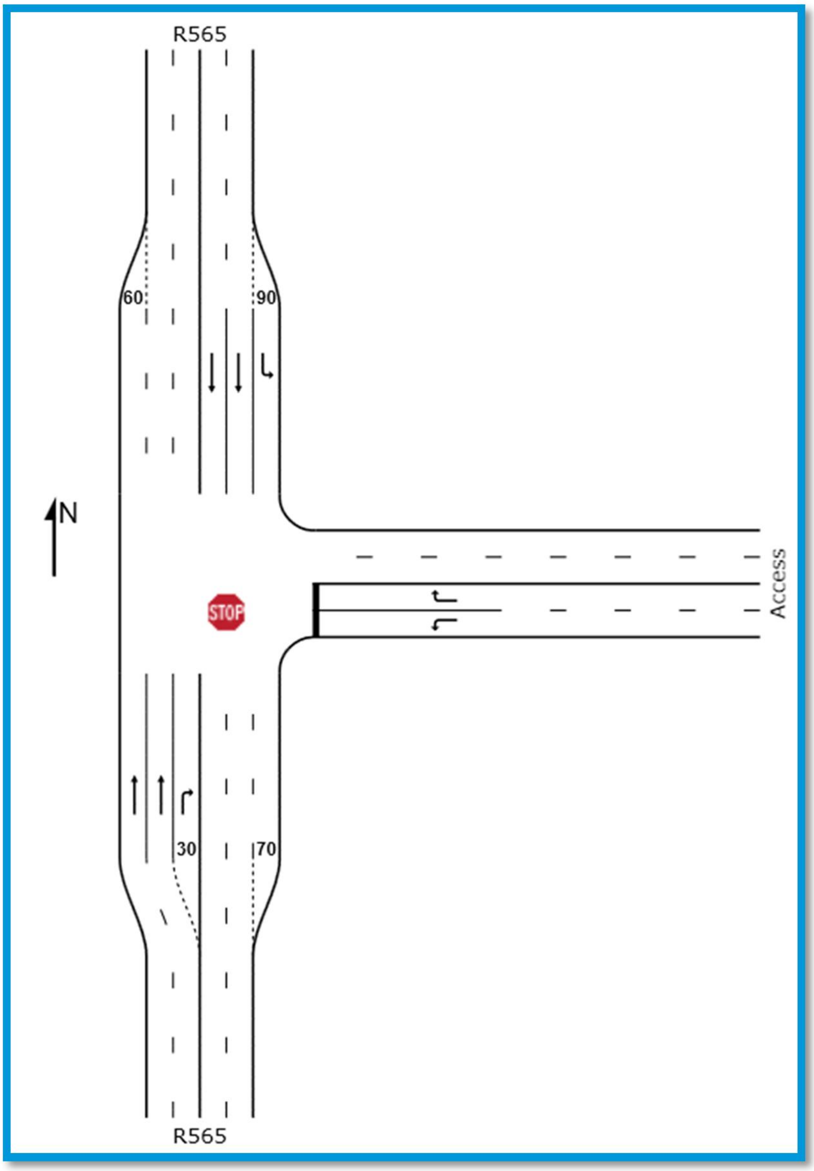

Figure 7.1: Schematic Representation of the Access to Bakubung Mine

7.2 OPERATIONAL ANALYSIS

The existing access layout was analysed in SIDRA 6.1 for the same scenarios as the intersection of the R556 and R565. The summarised analysis results for the AM peak hour can be seen in Table 7.1 below and the comprehensive results is included in Appendix F.

Table 7.1: Summarised Analysis Results - AM Peak Hour - Access

Approach	Movement	Existing Traffic (2016)		Base Year				Horison Year			
				Without Bakubung Mine		With Bakubung Mine		Without Bakubung Mine		With Bakubung Mine	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
R565 (S)	T	0.183	A	0.108	A	0.179	A	0.130	A	0.211	A
	R	0.012	A	0.052	A	0.744	C	0.060	B	0.810	D
Access	L	0.001	A	0.016	A	0.073	A	0.017	A	0.074	A
	R	0.014	C	0.062	D	0.862	F	0.105	D	1.108	F
R565 (N)	L	0.002	A	0.039	A	0.134	A	0.040	A	0.134	A
	T	0.097	A	0.178	A	0.178	A	0.201	A	0.199	A

The summarised results for the PM peak hour can be seen in Table 7.2.

Table 7.2: Summarised Analysis Results - PM Peak Hour - Access

Approach	Movement	Existing Traffic (2016)		Base Year				Horison Year			
				Without Bakubung Mine		With Bakubung Mine		Without Bakubung Mine		With Bakubung Mine	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
R565 (S)	T	0.173	A	0.220	A	0.220	A	0.251	A	0.251	A
	R	0.012	A	0.013	A	0.096	A	0.014	A	0.102	A
Access	L	0.001	A	0.001	A	0.049	A	0.001	A	0.050	A
	R	0.014	C	0.021	D	0.470	E	0.029	E	0.646	F
R565 (N)	L	0.002	A	0.002	A	0.030	A	0.002	A	0.030	A
	T	0.097	A	0.127	A	0.127	A	0.144	A	0.144	A

From the analysis results the following conclusions can be made:

1. The impact of the additional traffic on the R565 has a negligible effect on the free flowing traffic.
2. The right turning movement on the access will operate at a LOS F for most of the analysed scenarios. The vehicles on this movement need to wait for a gap in both the northbound and southbound traffic, leading to longer delays evident in the high $^{V}/_{C}$ ratios and low levels of service.

   General traffic will not be affected adversely i.e. only mine traffic. Adding a second right turn lane will reduce the delay for this movement but will create an unsafe scenario. It is also not considered practical to change the control type of the intersection since that will have a greater effect on the general traffic along the R565 which is a main route.

7.3 ACCESS TO TAILINGS TREATMENT FACILITY

The client indicated that access to the Tailings Storage Facility (TSF) will be via the Phatsima Road which forms the western leg of the R565 and R556 intersection. It is not expected that the TSF will generate a significant volume of traffic.

7.4 TEMPORARY ACCESS ROAD

The temporary gravel access road runs along the western boundary of the process plant before turning east to line up with future process plant roads. The start of the temporary access road can be seen in Photo 21 in Appendix B. Access to the site is currently controlled by means of a boom and guard.

7.5 IMPACT ASSESSMENT

The mine access will have a negligible impact on the general traffic along the R565.

8 ROAD SAFETY ISSUES

8.1 SHOULDER SIGHT DISTANCE

Shoulder sight distance is the distance that the driver of a vehicle that is stationary at the stop line of a minor road can see along the major road, to be able to enter or cross the major road before an approaching vehicle reaches the intersection.

It is therefore a function of speed of vehicles traveling on the major road, the width of the major road and the type of vehicles that are trying to cross.

In the case of the access road off the R565, the speed limit is 60km/h. The width of the road before and after the access is approximately 14m.

The worst case design vehicle is a single unit and trailer (SU+T). According to TRH 17, Geometric Design of Rural Roads, the shoulder sight distance should be in the order of 250m. The required stopping sight distance, according to TRH 17, approaching the intersection is 100m.

From a stopped car at the access, the horizontal curve to the north and the bridge to the south are clearly visible, as can be seen in Photos 12 to 15 in Appendix B. Both structures are approximately 400m from the access, indicating adequate stopping sight distance as well as shoulder sight distance.

8.2 HEAVY VEHICLE TURNING MOVEMENTS

The existing access layout makes provision for acceleration and deceleration lanes for all turning movements at the intersection.

8.3 PUBLIC TRANSPORT AND PEDESTRIAN FACILITIES

A number of public transport bays were observed along the R556 - one of these can be seen in Photo 8. A bus shelter was also observed at the bay close to the intersection of the R556 and the R565 (Photo 9).

Paved pedestrian sidewalks exist along the R556, mainly on the northern side. Closer to the intersection with the R565 paved sidewalks are provided on either side of the roadway as can be seen in Photo 7.

A paved pedestrian crossing is also provided on the constructed island forming the slip lane - see Photo 6.

No provision for pedestrians or public transport has been made along the R565. However, bus and taxi pick-up/drop-off areas and shelters will be provided for the mine as shown in Figure 8.1 (extract of drawing nr. *110196 00 0011 101 DWG 0008 01 REV 0)*. Access for pedestrians will be at the mine entrance through turnstiles.

The majority of mine generated pedestrians is expected to be generated by the Gabonewe Estate and will therefore travel along the internal road network and not along highly trafficked public roads. It is however recommended that pedestrian crossings be incorporated in the design of the proposed roundabout at the intersection of the R565 and R556 to facilitate a safe pedestrian environment.

It is not recommended that pedestrian crossings should be implemented at other locations along either the R565 or the R556 as the traffic along these routes are free flowing at relatively high speeds.

A paved sidewalk should be provided along the eastern side of the R565, from the intersection of the R565 and the R556 to the mine access. The sidewalk should have a minimum width of 1.5m.

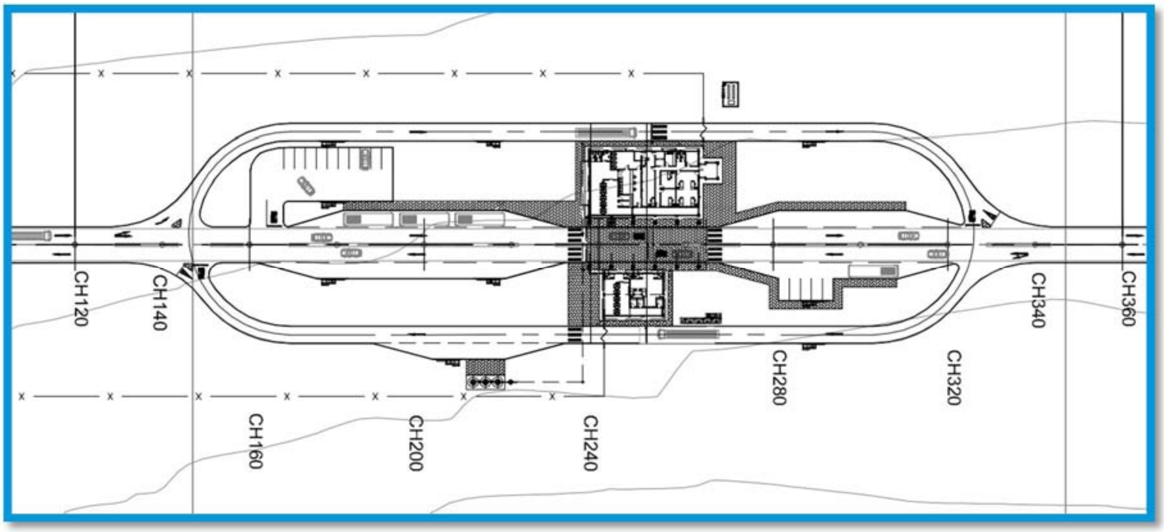

Figure 8.1: Layout of Mine Access

8.4 ROAD SURFACE CONDITIONS

The surface conditions of the R565 and R556 were visually inspected. The R565 was inspected for as length of approximately 20km south of its intersection with the R556. The R556 was inspected in the vicinity of the mine and Gabonewe sites.

8.4.1 R556 Visual inspection

It appears as if surface treatments were applied to the road recently. Approximately 7km east of the intersection of the R565 and the R556 it appears to be a surface overlay (which is already cracked with signs of pumping). Sections further east appear to have been treated using a fog spray or similar treatment. Road markings were not yet re-applied everywhere, but some were vaguely visible through the treatment.

Localised patching was observed as well as crocodile cracks with signs of pumping (See Photos 16 and 17).

It is expected that the majority of the heavy vehicle trips generated by the mine (for slurry transport to the smelter - see Section 8.1) will however use the R565. Therefore it is not foreseen that the operation of the mine will have a significant impact on the pavement condition of the R556.

8.4.2 R565 Visual Inspection

The R565 appears to be in a good condition along most of the route. Signs of bleeding can be seen on the hill south of the Bakubung Access (Photo 18). According to TMH 9 bleeding is defined as when excess binder moves upwards relative to the aggregates, therefore reducing surface texture depth.

Some rumble strips were observed along the R565, between the access to Bakubung Mine and Boshoek.

Edgebreak was observed through Boshoek, on either side of the road. As can be seen in the Photo 19 there has been attempts to patch the breaks, but these patches have also started to break.

9 ROAD PAVEMENT MANAGEMENT

9.1 TRAFFIC LOADING

Traffic loading is measured in E80's, which is defined by the Guidelines for Provision of Engineering Services and Amenities in Residential Township Development (Amended 1995) as follows:

"The cumulative damaging effect of all individual axle loads is expressed as the number of equivalent 80kN single axle loads (E80's). This is the number of 80kN single-axle loads that would cause the same damage to the pavement as the actual spectrum of axle loads."

9.2 CURRENT TRAFFIC LOADING

The impact of the light vehicles along the transport routes is considered to be insignificant. The 24-hour 7-day average traffic volumes were used to determine the existing heavy vehicle loading. It was assumed that the average heavy vehicle (HV) currently on the R565 is equivalent to 3.0 E80's and the resulting current traffic loading is given in Table 9.1 below:

Table 9.1: Current Annual Traffic Loading

R565	DAILY HV TRAFFIC VOLUME (7-DAY AVG)	E80 / ANNUM	MESA* / ANNUM
Northbound	319	349 305	0.35
Southbound	469	513 555	0.51

**MESA = Million Equivalent Standard Axles*

9.3 ADDITIONAL HEAVY VEHICLE LOADING

The number of expected heavy vehicles that would be generated by the mine is discussed below:

9.3.1 Deliveries and Collections

Deliveries to and collections from site will be done by truck. Regular deliveries to the mine include chemicals for the process plant, explosives, diesel, oil and steel. The estimated delivery frequencies for these materials are provided in Table 9.2.

Table 9.2: Estimated Regular Material Delivery Frequencies

	MATERIAL	TRUCKS (HV) PER ANNUM
Process Plant Chemicals:	Activator	2
	Collector	90
	Frother	6
	Depressant 1	30
	Depressant 2	30
	Flocculant	11
Other:	Explosives	124
	Diesel	244
	Oil	87
	Steel	291
	Total	**915**

Waste collections from site will also be done by trucks. No figures exist of waste volumes yet, but the vehicle frequency has been calculated based on estimated waste volumes. The waste produced by the site can be divided into three categories: general waste, hazardous waste and other waste. The estimated waste volumes and collection frequencies are provided in Table 9.3.

Table 9.3: Estimated Regular Collection Frequencies

	MATERIAL	VOLUME	ESIMATED FREQUENCY	HV PER ANNUM
General Waste:	Skip Collection	120 ton/annum	1 skip/week	52
Hazardous Waste:	As and when needed	16 ton/annum	1 truck/quarter	4
Other Waste:	Used Oil	2323 kℓ/annum	93 trucks/annum	93
	Recycled Paper	7000ton/annum	280 trucks/annum	280
	Scrap Steel	7269 ton/annum	291 trucks/annum	291
			Total	**720**

9.3.2 Product Transport

The process plant at the mine will produce a wet concentrate slurry which will then be transported to a nearby platinum smelter for further processing. For the proposed increased annual production of the concentrator plant to 265 000 ton per month, it is estimated that 563 trips made by 28-ton trucks would be required per month. For the purpose of this report it is assumed that the slurry will be transported to Impala Smelter, located approximately 30km south of the mine, as this is the closest smelter, from where the trucks will return to the mine empty.

The waste rock would also need to be transported from site via trucks. No information on the destinations of the delivery of the trucks or the volume of waste rock available is available at the time this report is compiled. A value of 30 trucks per month was therefore assumed. The estimated heavy vehicle frequencies for the transport of product can be seen in Table 9.4 below.

Table 9.4: Estimated Product Transport Frequencies

	ESTIMATED FREQUENCY	HV PER ANNUM
Slurry Transport	563 trucks/month	6 759
Waste Rock Sales	30 trucks/month	360
	Total	**7 119**

9.3.3 Summary

In order to calculate the effect of the estimated volume of heavy vehicles on the pavement structure, the data from the deliveries, collections and product transport was converted to a number of heavy vehicles per annum. Each of these vehicles were taken into account as a loaded vehicle and as an empty vehicle. Except for the slurry transport vehicles, it was assumed that approximately half of the heavy vehicles will arrive empty and leave fully laden, while the other half would arrive full and leave empty.

It was assumed that the average loaded heavy vehicle would be equivalent to 3.5 E80's while the average empty heavy vehicle would be equivalent to 1.5 E80's.

It was assumed that all heavy vehicles, except slurry trucks, will be distributed equally to the north (via R565 and R556) and south (via R565 to/from Rustenburg) of the access. The summary of heavy vehicles can be seen in Table 9.5 below.

Table 9.5: Summary of Additional Annual Truck Volumes on the R565 South

		ANNUAL HV TRAFFIC VOLUMES	E80'S / ANNUM	MESA OVER LIFE OF MINE*
Collections/ Deliveries	Northbound	998	2 494	0.0599
	Southbound	998	2 494	0.0599
Slurry Transport	Northbound	6 759	10 139	0.2433
	Southbound	6 759	23 657	0.5678
Total	**Northbound**	**7 757**	**12 632**	**0.3032**
	Southbound	**7 757**	**26 150**	**0.6276**

** 24 years – calculated from ramp up 2020 to 2044*

The remainder of the deliveries is assumed to originate along the R556. The summary of these heavy vehicles can be seen in Table 9.6.

Table 9.6: Summary of Annual Truck Volumes on the R565 North and R556 East

		ANNUAL HV TRAFFIC VOLUMES	E80'S / ANNUM	MESA OVER LIFE OF MINE*
Collections/ Deliveries	Northbound	998	2 494	0.0599
	Southbound	998	2 494	0.0599

** 24 years – calculated from ramp up 2020 to 2044*

The impact of the heavy vehicles traveling along the R565 between Rustenburg and the site is significantly higher than the estimated loading of the heavy vehicles traveling towards the R556 and were therefore considered to estimate the impact of the heavy vehicles. The percentage increase in cumulative E80's is calculated in Table 9.7 below. It can be seen that the additional loading from the mine will be relatively low compared with the existing heavy vehicle loading on the R565.

Table 9.7: Estimated Increase in E80's

	EXISTING E80'S/ANNUM	ADDITIONAL E80'S/ANNUM	% INCREASE
Northbound	349 305	12 632	3.6%
Southbound	513 555	26 150	5.1%

9.4 FURTHER INVESTIGATION

Further investigation, which is beyond the scope of this report, would be required to establish the remaining load bearing capacity of the road, as well as the materials classification to be able to make a more informed recommendation with regards to any measures that should be undertaken to maintain or improve the road surface conditions.

A generic Road Maintenance Management Proposal to facilitate interim management and maintenance of the transport route is included in Appendix I. This can be replaced by a more specific management plan determined by a more in depth investigation.

10 CONCLUSIONS & RECOMMENDATIONS

10.1 CONCLUSIONS

In view of the findings in this assessment, the following conclusions may be drawn:

(i) The traffic impact of the full Bakubung Mine on the operation of the R565/R556 intersection will be fully mitigated by a roundabout. The roundabout was also recommended in the 2008 TIS for the 2009 authorisations and current EMP.

(ii) The Gabonewe Estate TIS (2014) recommended the implementation of an additional approach lane on the westbound approach to the R565/R556 intersection.

(iii) The mine generated traffic does not affect the operation of the major movements along the R565 at the access to the mine.

(iv) The stopping sight distance and shoulder sight distance at the mine access appears to be adequate.

(v) Both the R556 and the R565 appears to be generally in a good condition and evidence of maintenance measures were observed, especially along the R556.

10.2 RECOMMENDATIONS

Taking the above conclusions into account, with respect to roads and traffic, the impacts associated with the proposed mine can be managed and accommodated within normal, acceptable limits:

(i) The intersection of the R556 & R565 should be converted to a 2-lane roundabout as already recommended in the 2008 Traffic Impact Study.

(ii) The roundabout should have a minimum island diameter of 15m and two circulating lanes. The geometric details of the roundabout are however subject to detail design; the limitations of the design vehicle; and restrictions on site.

(iii) Further investigation should be undertaken to determine the remaining pavement capacity of the transport route and to establish the upgrading and maintenance requirements if any. These further investigations should not be a requirement for receiving authorisation but can be included as part of the construction phase.

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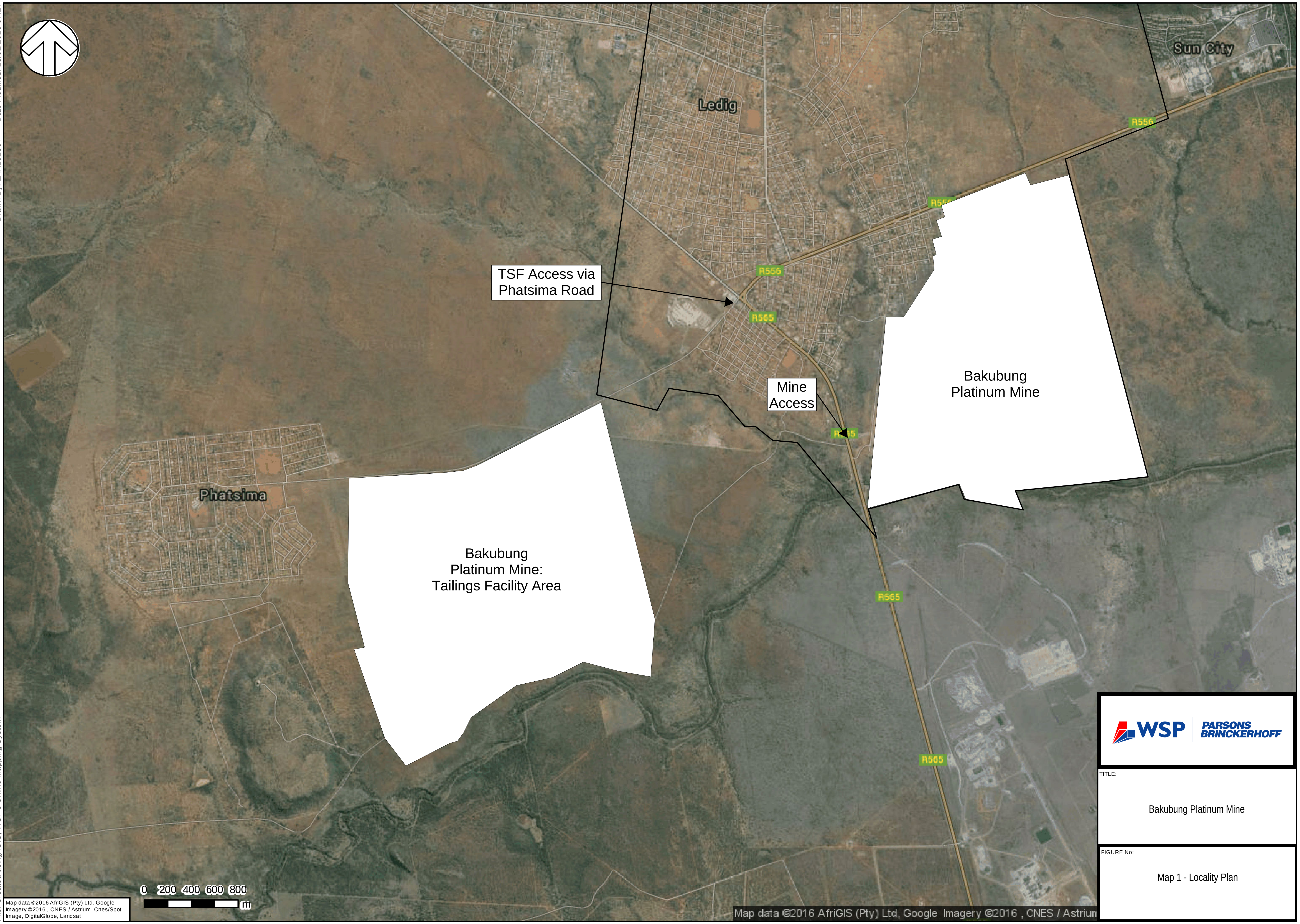
Appendix A

LOCALITY MAP



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Appendix B

PHOTOGRAPHS

Photo 1: R565 North Approach

Photo 2: R556 East Approach

Photo 3: R565 Southern Approach

Photo 4: R556 Western Approach Providing Access to TSF

Photo 5: Slip Lane from R556 Eastern Approach onto R565 Southbound

Photo 6: Paved Pedestrian Crossing over Slip Lane Island

Photo 7: R556 East of R556 & R565 Intersection

Photo 8: Public Transport Bay

Photo 9: Bus Shelter along R556

Photo 10: R565 South of R556 & R565 Intersection

Photo 11: Bakubung Mine Access on R565

Photo 12: Sight Distance From Behind Stop Line, North

Photo 13: Sight Distance From Behind Stop Line, South

Photo 14: Sight Distance From Beyond Stop Line, North

Photo 15: Sight Distance From Beyond Stop Line, South

Photo 16: Crocodile Cracks, Patching and Bleeding on the R556

Photo 17: Patching on the R556 also Cracked with Signs of Pumping

Photo 18: Minor Bleeding along the R565

Photo 19: Edgebreaks along the R565, through Boshoek

Photo 20: Impala Smelter

Photo 21: Existing Temporary Access

Appendix C

FIGURES

WSP | PARSONS BRINCKERHOFF

TITLE:

Bakubung Platinum Mine

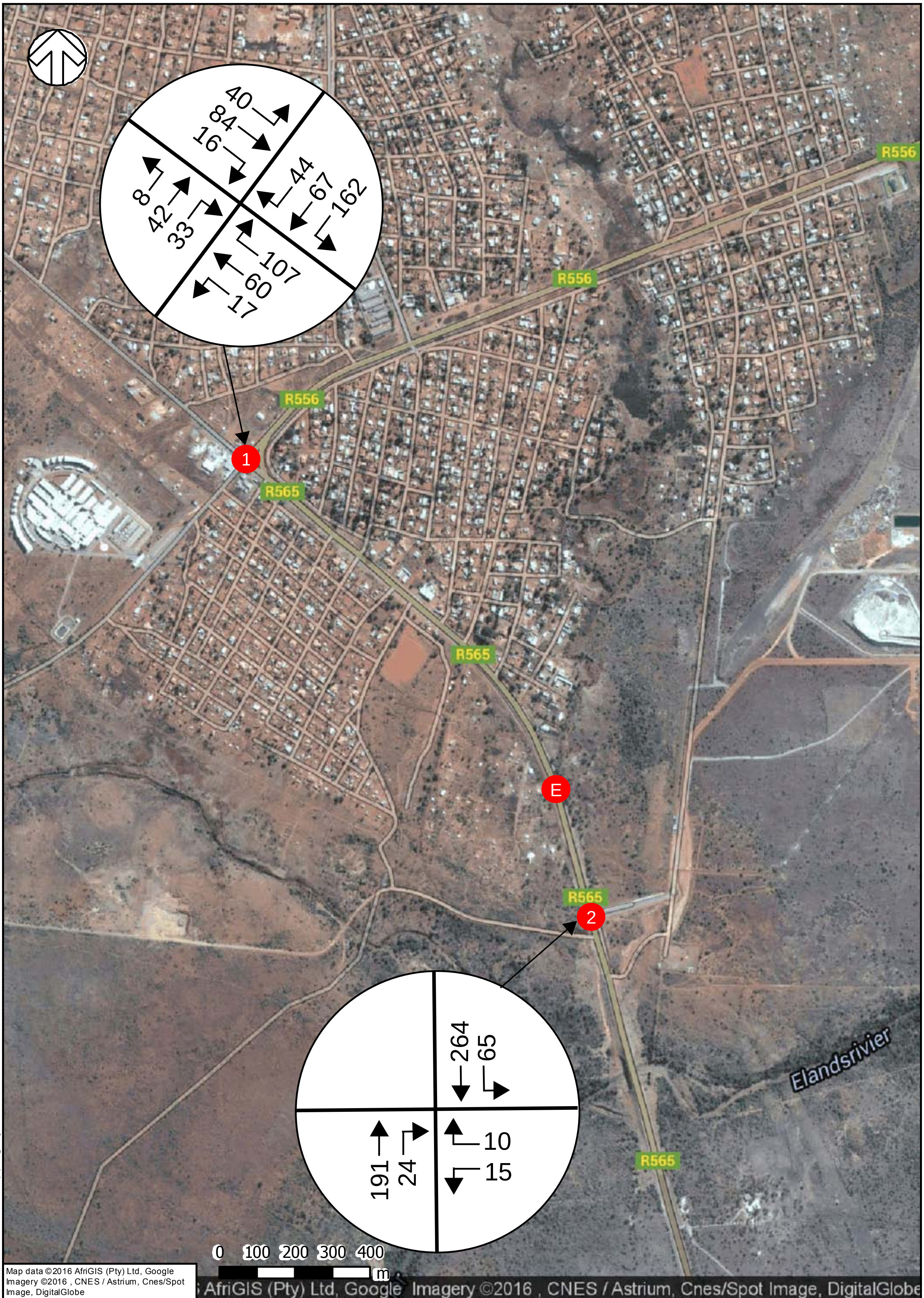
FIGURE No:

Figure 1 - Traffic Count Locations

File: Created using iGIS, WSP's Online Mapping System

Drawn By: ZAAL02864 Date Modified: 26/01/2016 09:03

File: Created using iGIS, WSP's Online Mapping System Drawn By: ZAAL02864 Date Modified: 26/01/2016 09:03



WSP | PARSONS BRINCKERHOFF

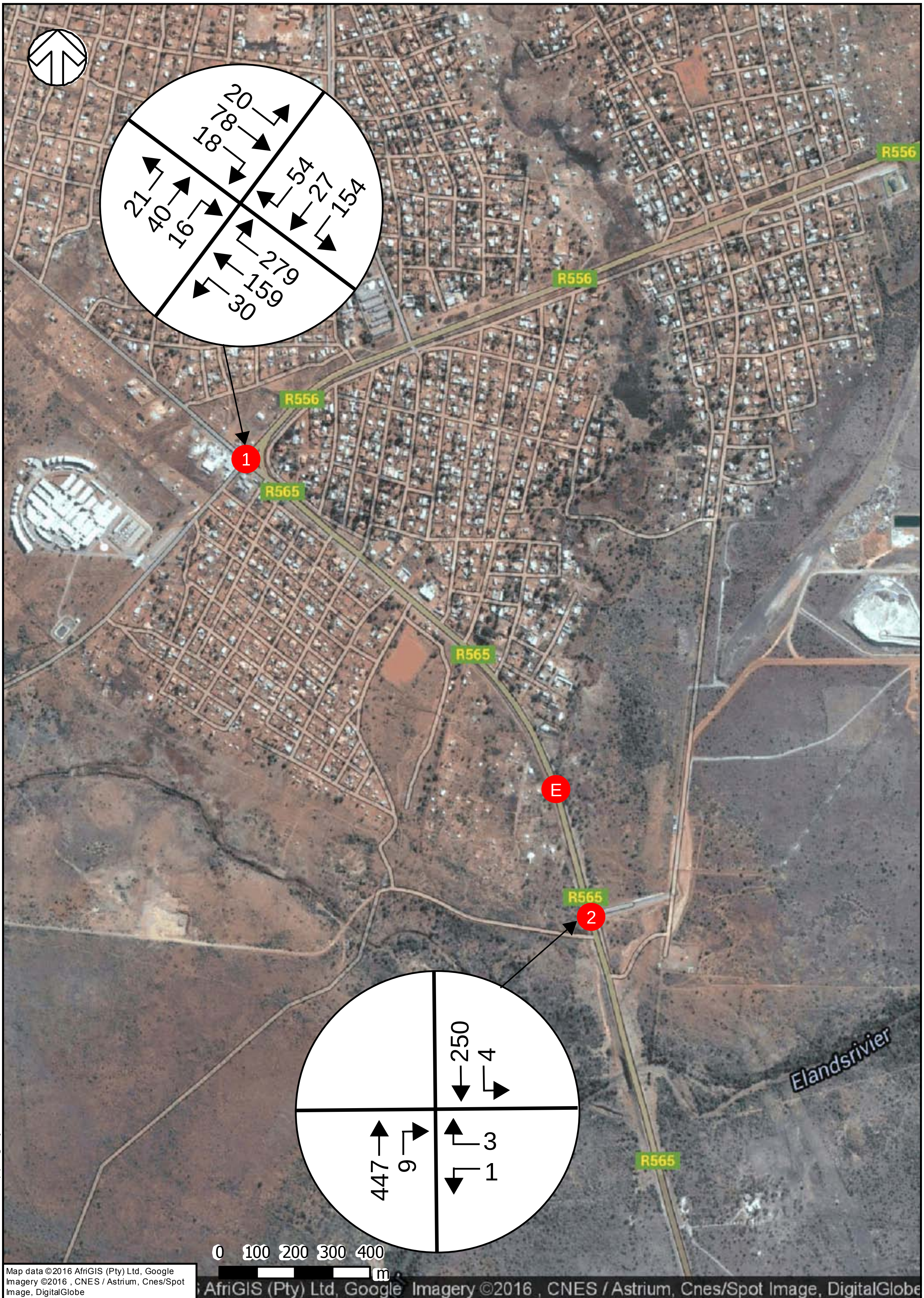
TITLE:

Bakubung Platinum Mine

FIGURE No:

Figure 2 - Existing AM Peak Hour Volumes (2016)

Drawn By: ZAAL02864 Date Modified: 26/01/2016 09:03



WSP | PARSONS BRINCKERHOFF

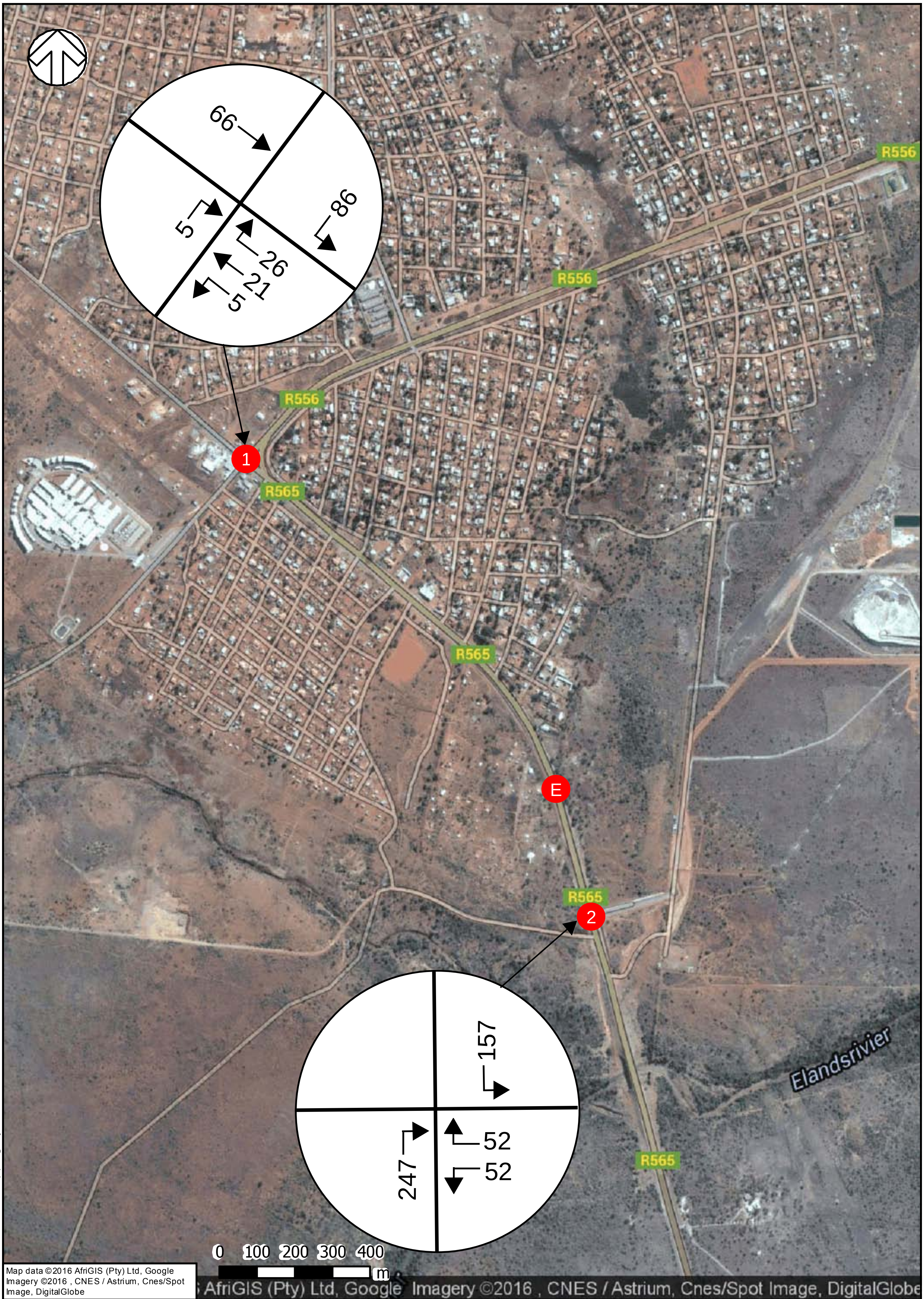
TITLE:

Bakubung Platinum Mine

FIGURE No:

Figure 3 - Existing PM Peak Hour Volumes (2016)

File: Created using iGIS, WSP's Online Mapping System



WSP | PARSONS BRINCKERHOFF

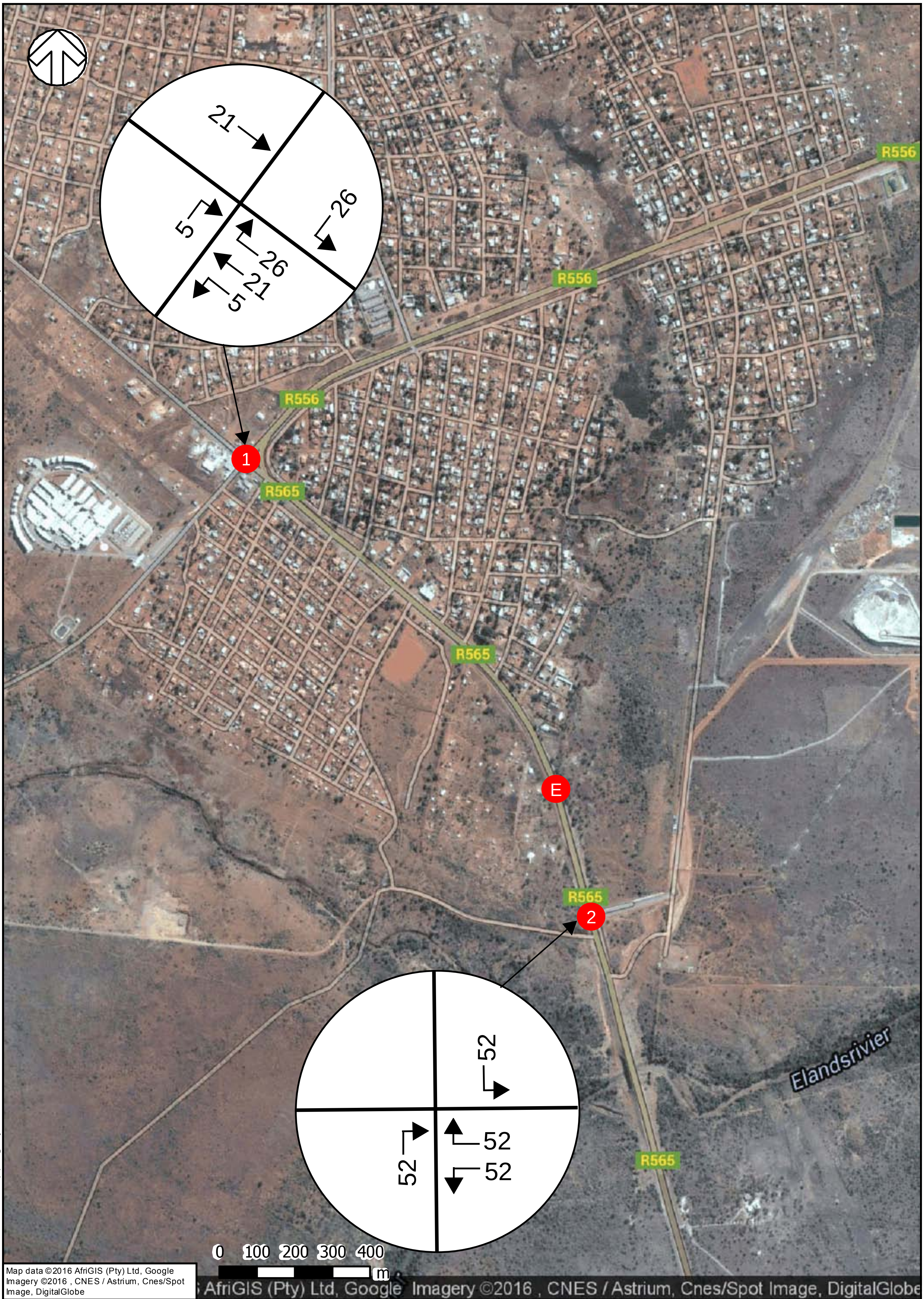
TITLE:

Bakubung Platinum Mine

FIGURE No:

Figure 4 - AM Peak Hour Trip Distribution

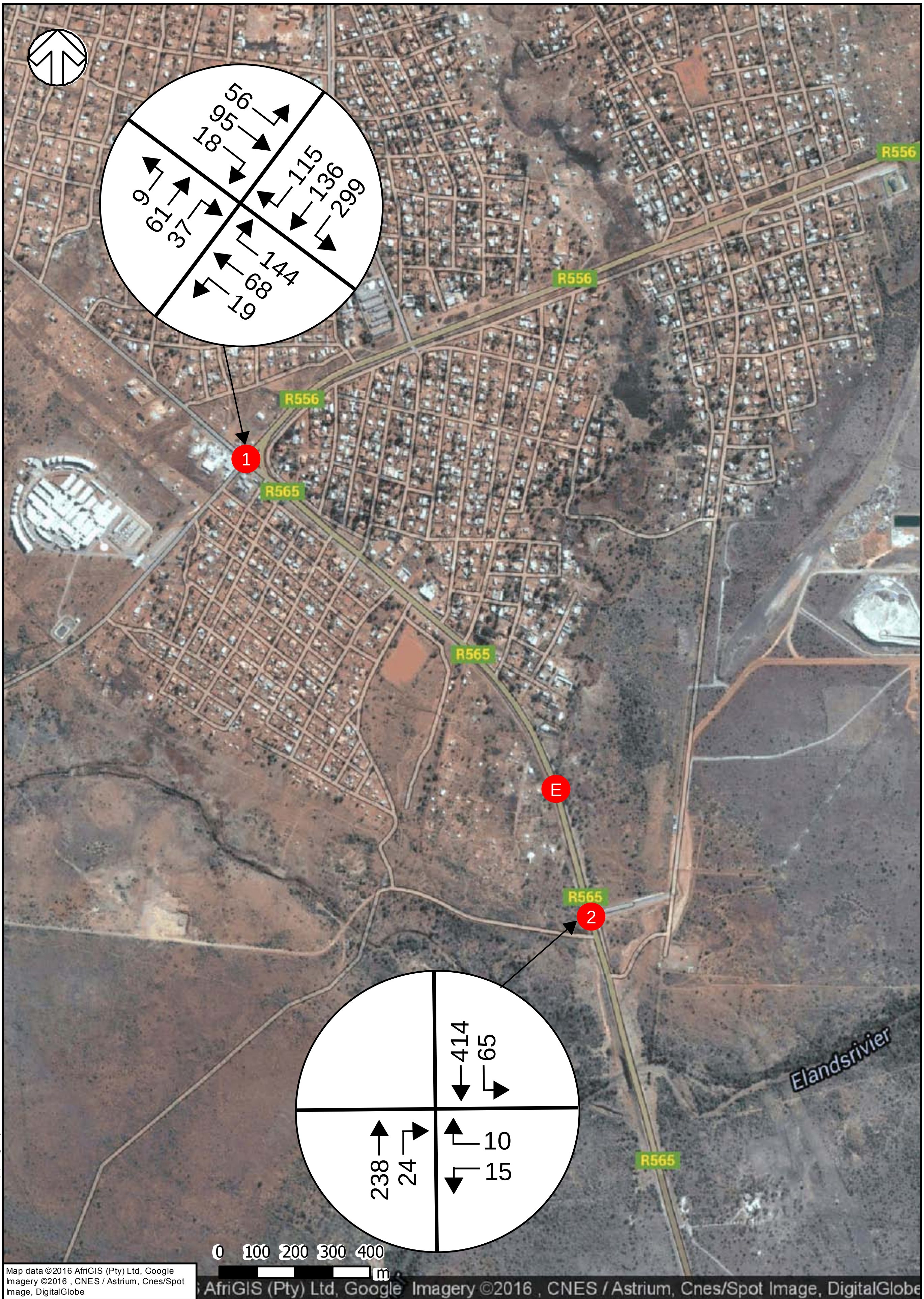
Drawn By: ZAAL02864 Date Modified: 26/01/2016 09:03



TITLE:	FIGURE No:
Bakubung Platinum Mine	Figure 5 - PM Peak Hour Trip Distribution

File: Created using iGIS, WSP's Online Mapping System

Drawn By: ZAAL02864 Date Modified: 26/01/2016 09:03



File: Created using iGIS, WSP's Online Mapping System

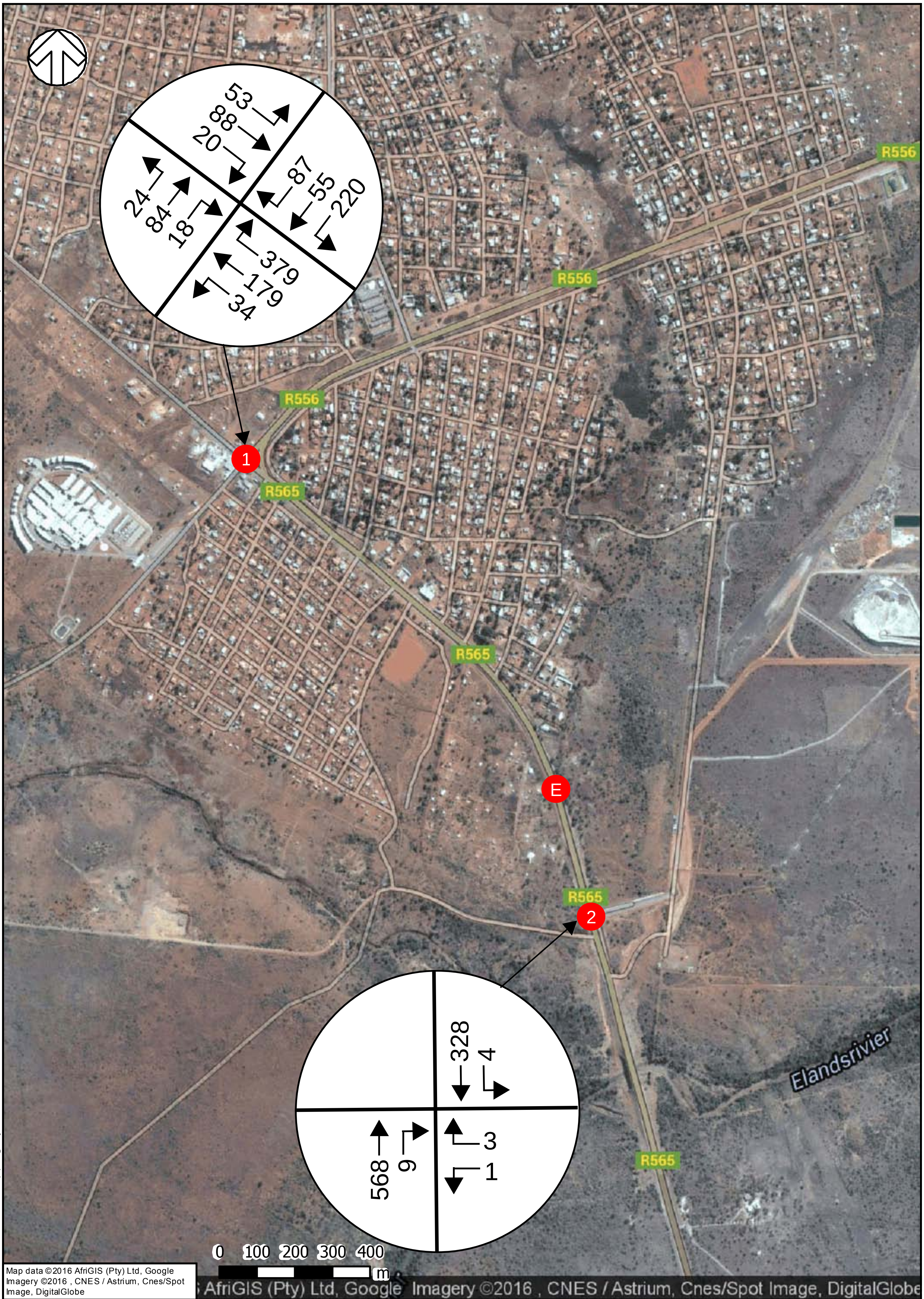
WSP | PARSONS BRINCKERHOFF

TITLE:

Bakubung Platinum Mine

FIGURE No:

Figure 6 - Base Year AM Peak Hour Background Traffic Volumes (2020)



Drawn By: ZAAL02864 Date Modified: 26/01/2016 09:03

File: Created using iGIS, WSP's Online Mapping System

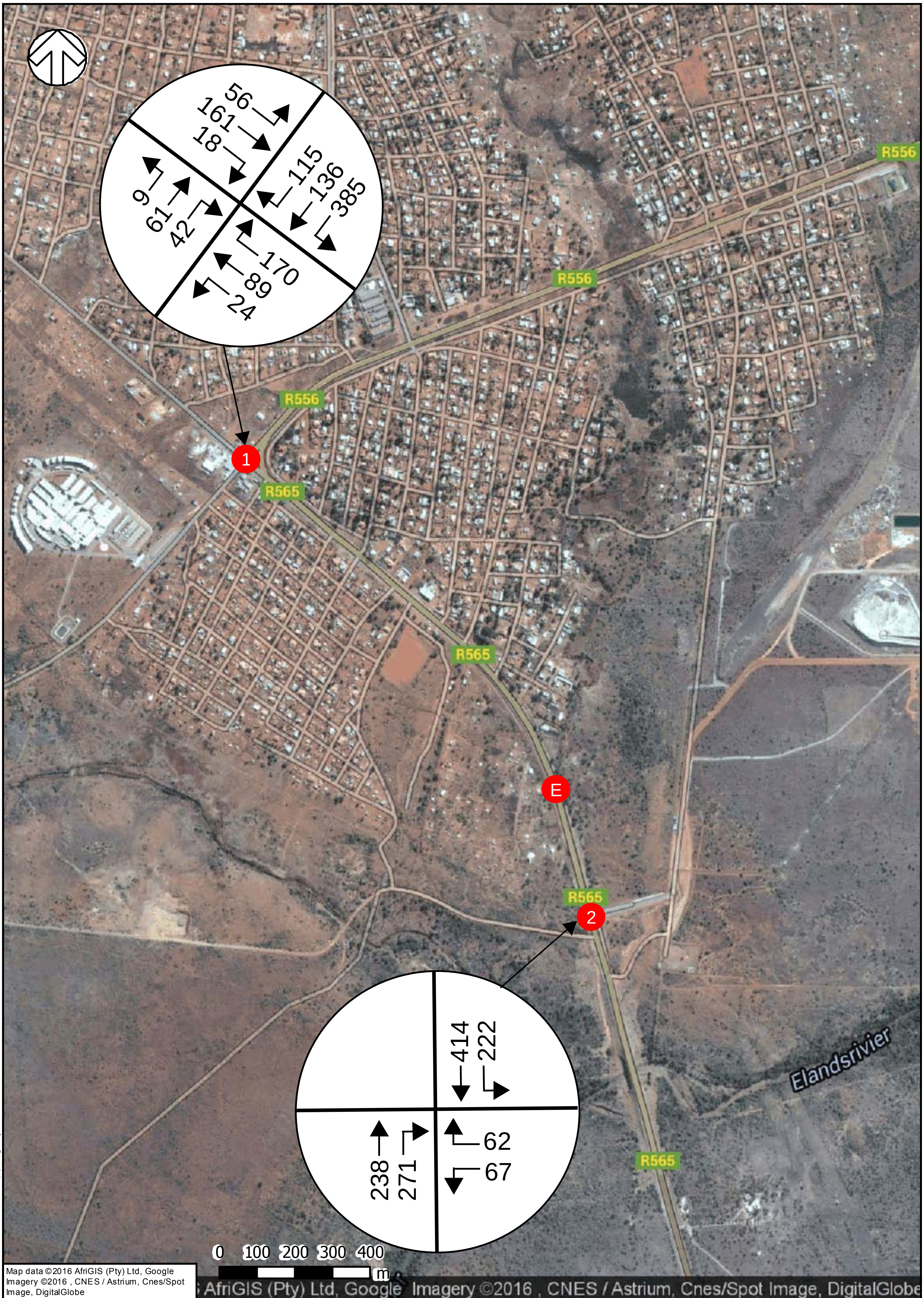
WSP | PARSONS BRINCKERHOFF

TITLE:

Bakubung Platinum Mine

FIGURE No:

Figure 7 - Base Year PM Peak Hour Background Traffic Volumes (2020)



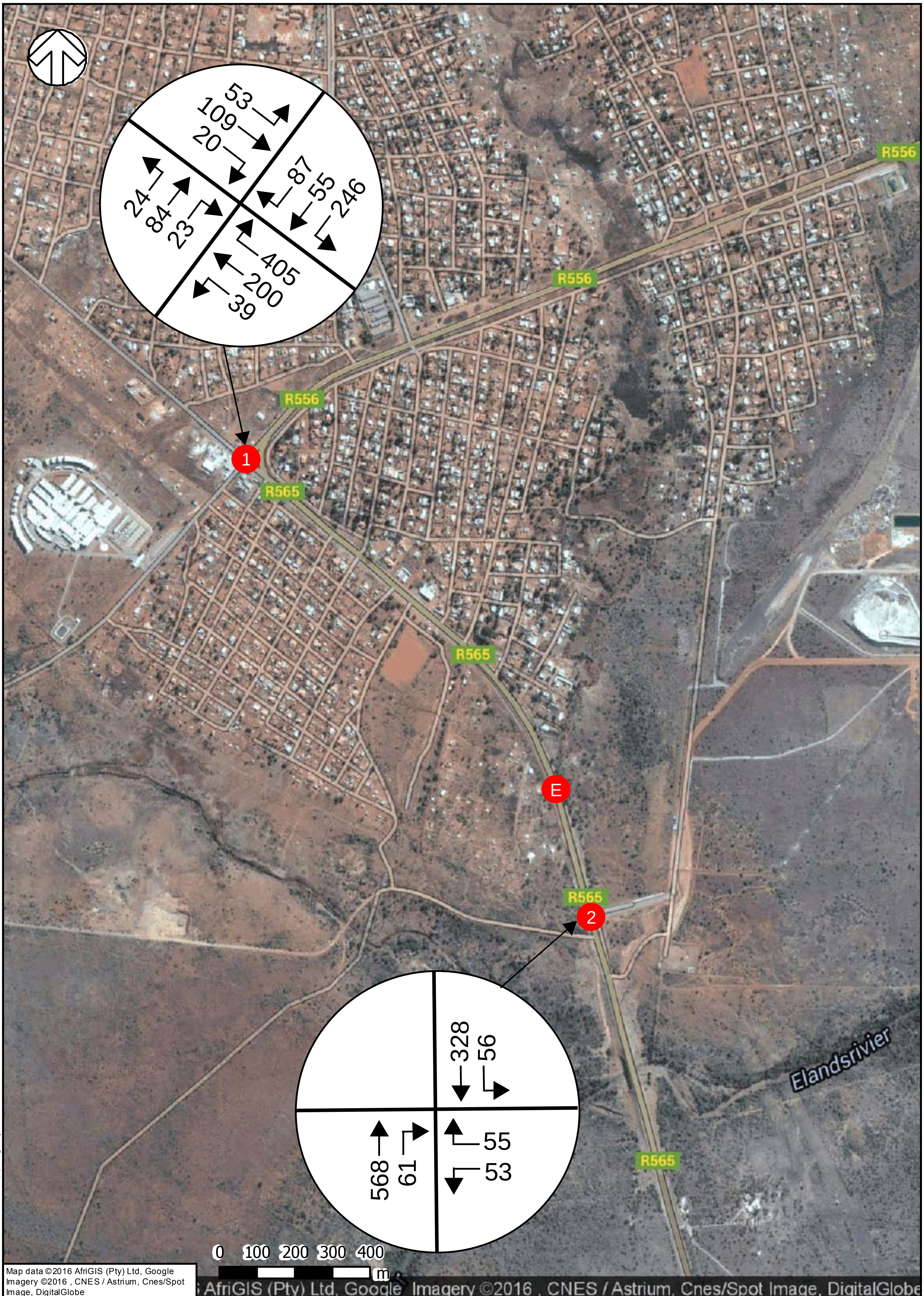
WSP | PARSONS BRINCKERHOFF

TITLE:

Bakubung Platinum Mine

FIGURE No:

Figure 8 - Base Year AM Peak Hour Traffic Volumes including Mine (2020)



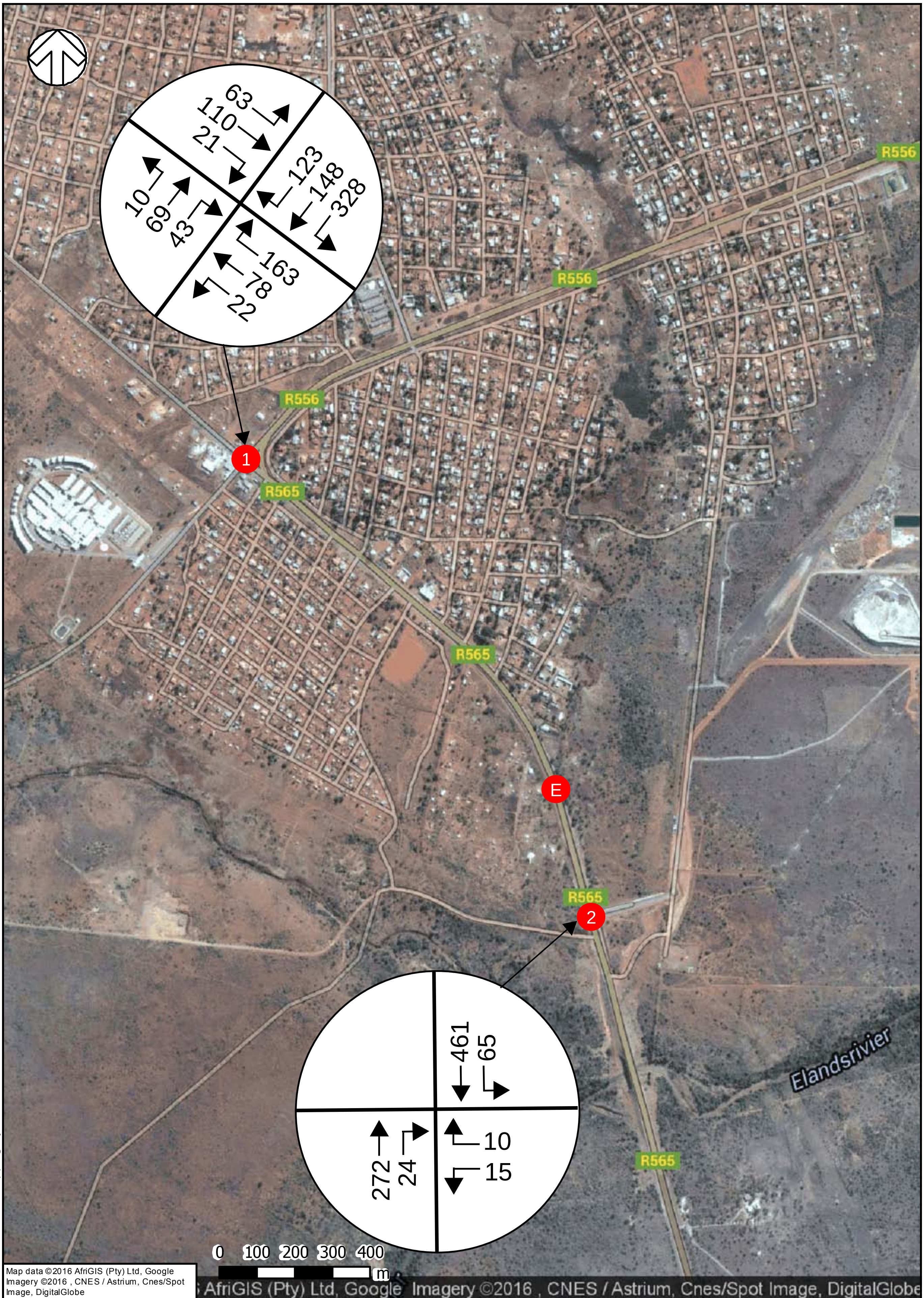
WSP | PARSONS BRINCKERHOFF

TITLE:

Bakubung Platinum Mine

FIGURE No:

Figure 9 - Base Year PM Peak Hour Traffic Volumes including Mine (2020)



WSP | PARSONS BRINCKERHOFF

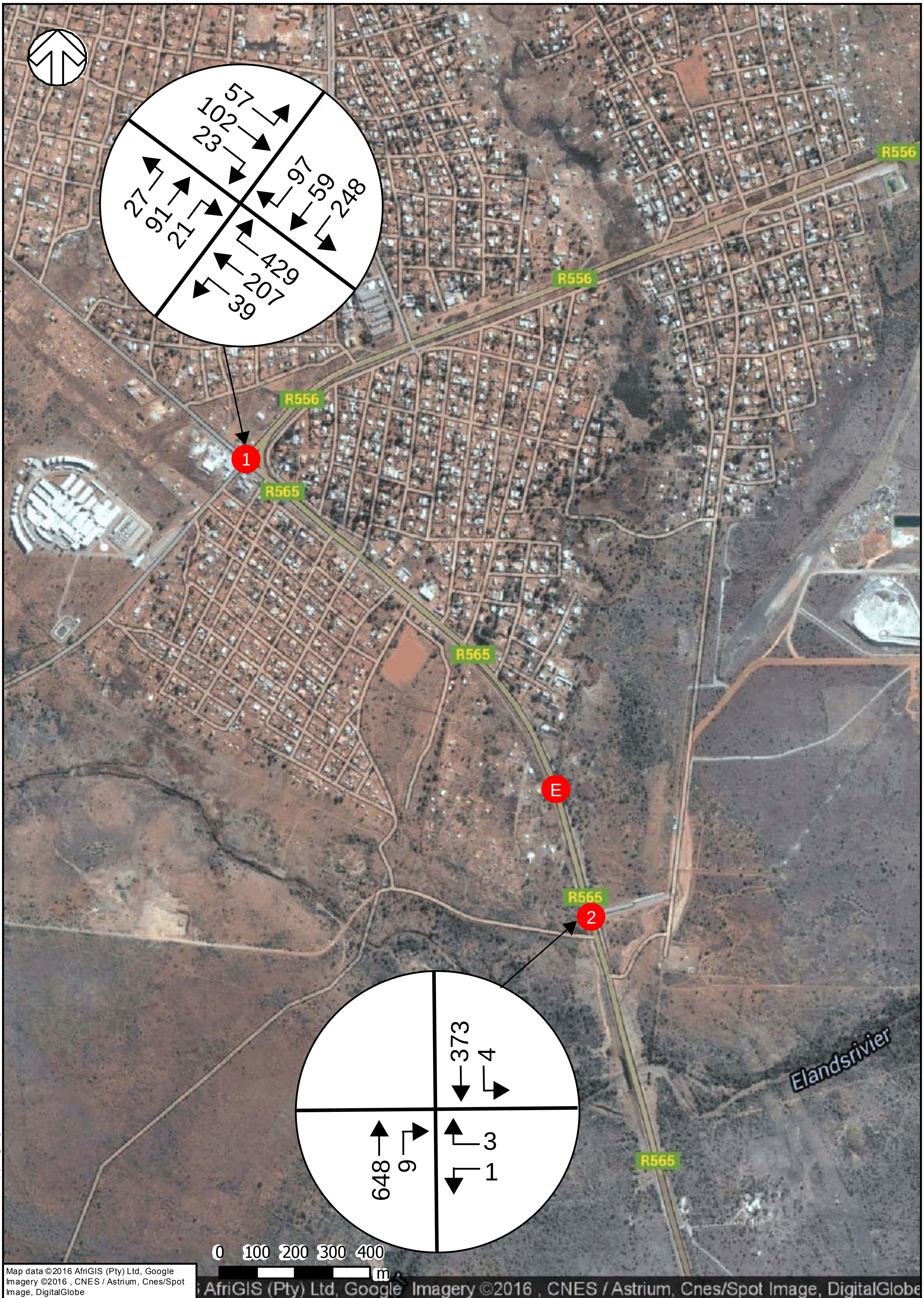
TITLE:

Bakubung Platinum Mine

FIGURE No:

Figure 10 - Horison Year AM Peak Hour Background Traffic Volumes (2025)

File: Created using iGIS, WSP's Online Mapping System Drawn By: ZAAL02864 Date Modified: 26/01/2016 09:03



WSP | PARSONS BRINCKERHOFF

TITLE:

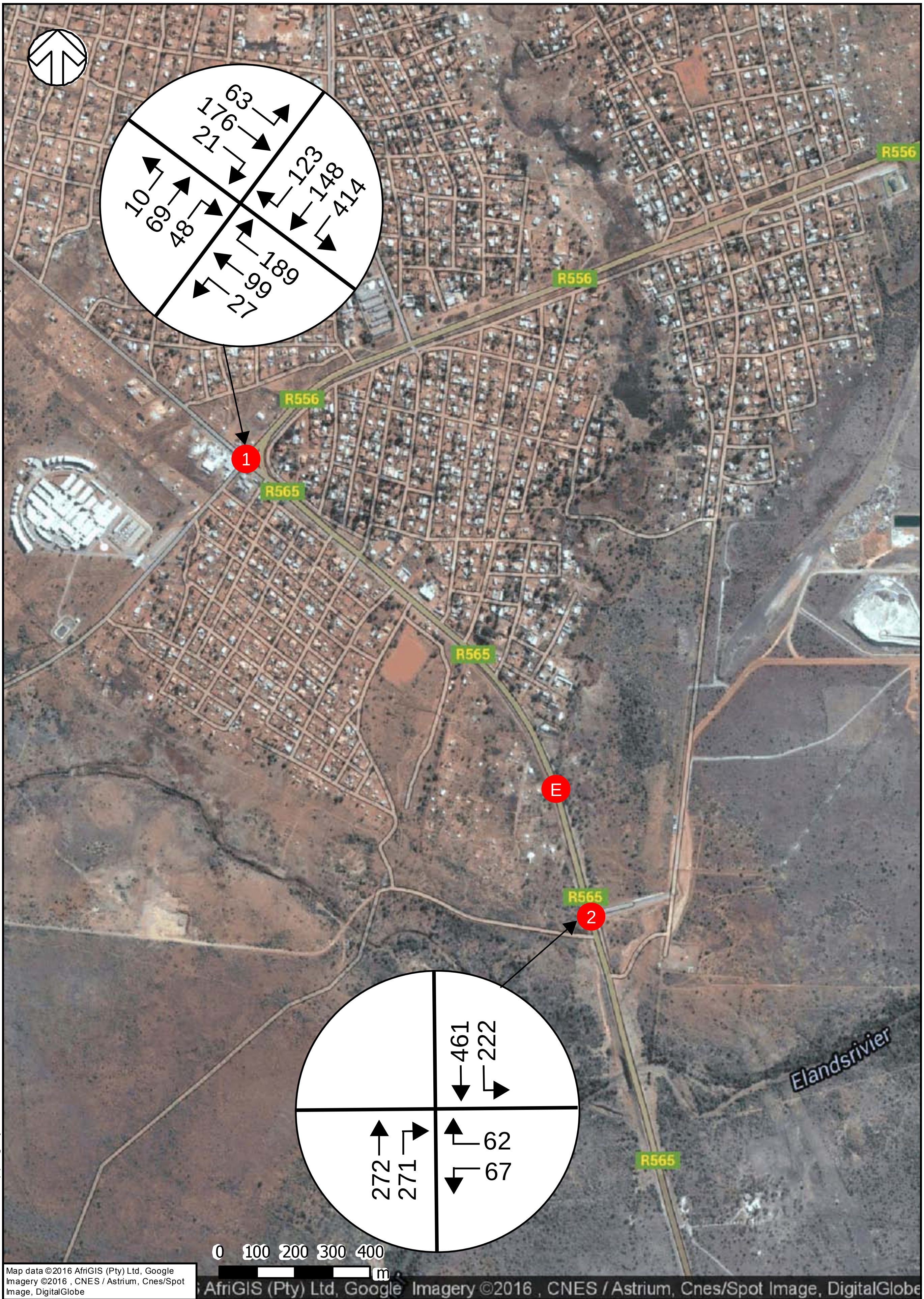
Bakubung Platinum Mine

FIGURE No:

Figure 11 - Horison Year PM Peak Hour Background Traffic Volumes (2025)

File: Created using iGIS, WSP's Online Mapping System

Drawn By: ZAAL02864 Date Modified: 26/01/2016 09:03



File: Created using iGIS, WSP's Online Mapping System Drawn By: ZAAL02864 Date Modified: 26/01/2016 09:03

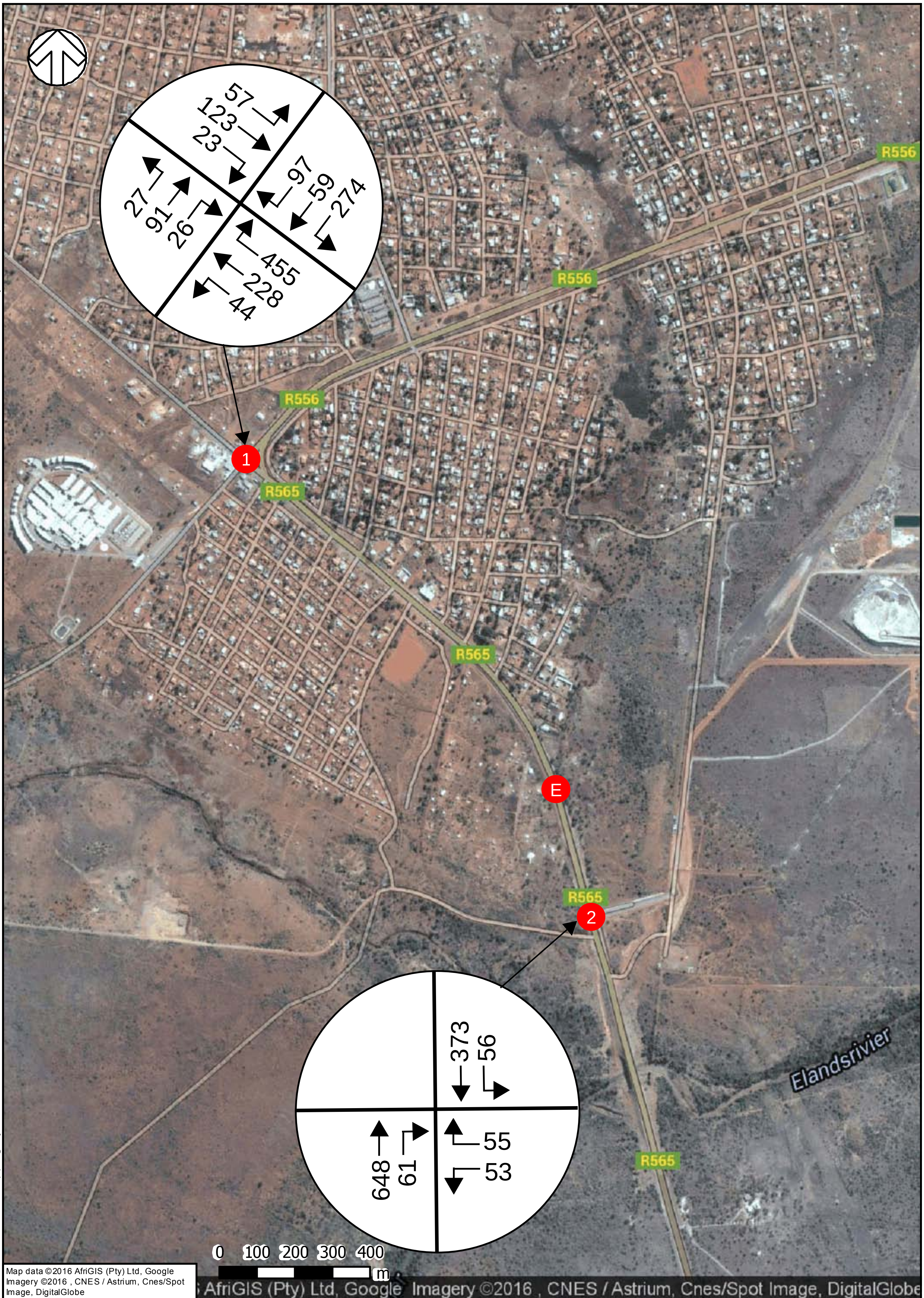
WSP | PARSONS BRINCKERHOFF

TITLE:

Bakubung Platinum Mine

FIGURE No:

Figure 12 - Horison Year AM Peak Hour Traffic Volumes including Mine (2025)



WSP | PARSONS BRINCKERHOFF

TITLE:

Bakubung Platinum Mine

FIGURE No:

Figure 13 - Horison Year PM Peak Hour Traffic Volumes including Mine (2025)

File: Created using iGIS, WSP's Online Mapping System
Drawn By: ZAAL02864 Date Modified: 26/01/2016 09:03

Appendix D

TRAFFIC COUNTS

R556 & R565

AM PEAK HOUR

06:00 - 07:00

MOVEMENT		PHF	LIGHT	TAXI	BUS	HEAVY	TOTAL
NW	R	0.82	12	4	0	0	16
	T		66	8	6	4	84
	L		26	11	2	1	40
NE	R		28	10	1	5	44
	T		35	30	2	0	67
	L		133	22	4	3	162
SE	R		85	9	0	13	107
	T		46	5	5	4	60
	L		11	4	1	1	17
SW	R		28	4	0	1	33
	T		22	18	1	1	42
	L		5	0	1	2	8

PM PEAK HOUR

17:00 - 18:00

MOVEMENT		PHF	LIGHT	TAXI	BUS	HEAVY	TOTAL
NW	R	0.94	13	2	2	1	18
	T		51	11	5	11	78
	L		15	2	2	1	20
NE	R		40	9	3	2	54
	T		18	9	0	0	27
	L		131	16	3	4	154
SE	R		262	12	2	3	279
	T		135	13	8	3	159
	L		22	6	2	0	30
SW	R		12	2	1	1	16
	T		31	8	0	1	40
	L		16	4	1	0	21

R565 & Access

AM PEAK HOUR

06:00 - 07:00

MOVEMENT		PHF	LIGHT	TAXI	BUS	HEAVY	TOTAL
NORTH	R	0.89	0	0	0	0	0
	T		241	0	16	7	264
	L		*16*	*49*	*0*	*0*	*65*
EAST	R		*8*	*2*	*0*	*0*	*10*
	T		*0*	*0*	*0*	*0*	*0*
	L		*14*	*1*	*0*	*0*	*15*
SOUTH	R		*23*	*1*	*0*	*0*	*24*
	T		166	1	8	16	191
	L		0	0	0	0	0
WEST	R	n.a.	0	0	0	0	0
	T		0	0	0	0	0
	L		0	0	0	0	0

PM PEAK HOUR

17:00 - 18:00

MOVEMENT		PHF	LIGHT	TAXI	BUS	HEAVY	TOTAL
NORTH	R	0.99	0	0	0	0	0
	T		205	24	9	12	250
	L		*3*	*1*	*0*	*0*	*4*
EAST	R		*2*	*1*	*0*	*0*	*3*
	T		*0*	*0*	*0*	*0*	*0*
	L		*1*	*0*	*0*	*0*	*1*
SOUTH	R		*9*	*0*	*0*	*0*	*9*
	T		400	30	11	6	447
	L		0	0	0	0	0
WEST	R	n.a.	0	0	0	0	0
	T		0	0	0	0	0
	L		0	0	0	0	0

Appendix E

SIDRA RESULTS – INTERSECTION OF R556 & R565

MOVEMENT SUMMARY

Site: AM Peak Hour - 2016

Intersection of the R565 & R556
Stop (All-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	21	11.8	0.075	11.7	LOS B	0.3	1.9	0.94	1.26	50.4
5	T1	73	15.0	0.264	15.3	LOS C	1.0	8.0	0.97	1.32	48.0
6	R2	130	12.1	0.419	18.9	LOS C	1.9	14.4	0.98	1.40	46.1
Approach		224	13.0	0.419	17.1	LOS C	1.9	14.4	0.97	1.36	47.0
NorthEast: R556											
7	L2	198	4.3	0.621	29.0	LOS D	3.5	25.7	1.00	1.55	40.8
8	T1	82	3.0	0.468	23.2	LOS C	2.2	16.3	1.00	1.42	44.0
9	R2	54	13.6	0.468	22.8	LOS C	2.2	16.3	1.00	1.42	43.4
Approach		333	5.5	0.621	26.5	LOS D	3.5	25.7	1.00	1.50	42.0
NorthWest: R565											
10	L2	49	7.5	0.423	27.0	LOS D	1.9	14.4	1.00	1.39	41.7
11	T1	102	11.9	0.423	28.0	LOS D	1.9	14.3	1.00	1.39	41.2
12	R2	20	0.0	0.423	28.0	LOS D	1.9	14.3	1.00	1.39	41.1
Approach		171	9.3	0.423	27.7	LOS D	1.9	14.4	1.00	1.39	41.3
SouthWest: R556											
1	L2	10	37.5	0.259	20.0	LOS C	1.0	7.2	0.91	1.31	44.8
2	T1	51	4.8	0.259	19.3	LOS C	1.0	7.2	0.91	1.31	46.0
3	R2	40	3.0	0.259	18.8	LOS C	1.0	7.2	0.91	1.31	46.0
Approach		101	7.2	0.259	19.1	LOS C	1.0	7.2	0.91	1.31	45.9
All Vehicles		829	8.5	0.621	23.3	LOS C	3.5	25.7	0.98	1.42	43.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2016

Intersection of the R565 & R556
Stop (All-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	32	6.7	0.091	10.7	LOS B	0.3	2.3	0.90	1.26	51.1
5	T1	169	6.9	0.485	18.9	LOS C	2.3	17.1	0.98	1.43	45.9
6	R2	297	1.8	0.789	37.3	LOS E	6.2	44.2	1.00	1.84	37.5
Approach		498	3.8	0.789	29.3	LOS D	6.2	44.2	0.99	1.66	40.7
NorthEast: R556											
7	L2	164	4.5	0.653	37.3	LOS E	3.9	28.2	1.00	1.58	37.3
8	T1	29	0.0	0.387	24.1	LOS C	1.7	12.3	1.00	1.37	43.6
9	R2	57	9.3	0.387	23.6	LOS C	1.7	12.3	1.00	1.37	43.1
Approach		250	5.1	0.653	32.7	LOS D	3.9	28.2	1.00	1.51	39.2
NorthWest: R565											
10	L2	21	15.0	0.257	18.7	LOS C	1.0	8.0	0.98	1.32	46.0
11	T1	83	20.5	0.257	19.1	LOS C	1.0	8.1	0.98	1.32	45.6
12	R2	21	16.7	0.257	19.3	LOS C	1.0	8.1	0.99	1.32	45.5
Approach		126	18.9	0.257	19.1	LOS C	1.0	8.1	0.98	1.32	45.7
SouthWest: R556											
1	L2	22	4.8	0.413	36.5	LOS E	1.8	13.4	1.00	1.38	37.5
2	T1	43	2.5	0.413	37.1	LOS E	1.8	13.4	1.00	1.38	37.7
3	R2	17	12.5	0.413	37.1	LOS E	1.8	13.4	1.00	1.38	37.5
Approach		82	5.2	0.413	36.9	LOS E	1.8	13.4	1.00	1.38	37.6
All Vehicles		955	6.3	0.789	29.5	LOS D	6.2	44.2	0.99	1.55	40.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: AM Peak Hour - 2020

Intersection of the R565 & R556
Stop (All-Way)
Design Life Analysis (Capacity): Results for 4 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	23	11.8	0.084	11.8	LOS B	0.3	2.2	0.94	1.26	50.3
5	T1	82	15.0	0.295	16.0	LOS C	1.2	9.2	0.97	1.33	47.6
6	R2	147	12.1	0.469	20.6	LOS C	2.2	17.0	0.99	1.43	45.1
Approach		253	13.0	0.469	18.2	LOS C	2.2	17.0	0.98	1.38	46.4
NorthEast: R556											
7	L2	214	4.3	0.679	33.3	LOS D	4.3	30.9	1.00	1.63	38.9
8	T1	88	3.0	0.512	25.3	LOS D	2.5	18.8	1.00	1.45	42.9
9	R2	58	13.6	0.512	24.9	LOS C	2.5	18.8	1.00	1.45	42.3
Approach		360	5.5	0.679	30.0	LOS D	4.3	30.9	1.00	1.56	40.4
NorthWest: R565											
10	L2	53	7.5	0.455	28.4	LOS D	2.1	15.9	1.00	1.41	41.1
11	T1	111	11.9	0.455	29.4	LOS D	2.1	15.9	1.00	1.41	40.5
12	R2	21	0.0	0.455	29.5	LOS D	2.1	15.8	1.00	1.41	40.4
Approach		185	9.3	0.455	29.1	LOS D	2.1	15.9	1.00	1.41	40.7
SouthWest: R556											
1	L2	11	37.5	0.285	20.6	LOS C	1.1	8.2	0.92	1.32	44.5
2	T1	55	4.8	0.285	19.9	LOS C	1.1	8.2	0.92	1.32	45.7
3	R2	44	3.0	0.285	19.4	LOS C	1.1	8.2	0.92	1.32	45.7
Approach		110	7.2	0.285	19.8	LOS C	1.1	8.2	0.92	1.32	45.6
All Vehicles		907	8.6	0.679	25.3	LOS D	4.3	30.9	0.98	1.45	42.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2020

Intersection of the R565 & R556
Stop (All-Way)
Design Life Analysis (Practical Capacity): Results for 4 years

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	36	6.7	0.102	10.8	LOS B	0.3	2.5	0.90	1.26	51.0
5	T1	190	6.9	0.542	21.0	LOS C	2.8	20.5	0.99	1.48	44.7
6	R2	334	1.8	0.883	50.0	LOS F	8.7	61.8	1.00	2.10	33.1
Approach		560	3.8	0.883	37.6	LOS E	8.7	61.8	0.99	1.84	37.3
NorthEast: R556											
7	L2	177	4.5	0.718	43.9	LOS E	4.7	34.2	1.00	1.66	35.0
8	T1	31	0.0	0.425	26.0	LOS D	1.9	14.1	1.00	1.39	42.6
9	R2	62	9.3	0.425	25.5	LOS D	1.9	14.1	1.00	1.39	42.1
Approach		271	5.1	0.718	37.6	LOS E	4.7	34.2	1.00	1.57	37.2
NorthWest: R565											
10	L2	23	15.0	0.276	19.1	LOS C	1.1	8.8	0.98	1.33	45.8
11	T1	90	20.5	0.276	19.6	LOS C	1.1	8.8	0.99	1.33	45.4
12	R2	23	16.7	0.276	19.7	LOS C	1.1	8.8	0.99	1.33	45.2
Approach		136	18.9	0.276	19.5	LOS C	1.1	8.8	0.99	1.33	45.4
SouthWest: R556											
1	L2	24	4.8	0.461	40.0	LOS E	2.1	15.7	1.00	1.40	36.2
2	T1	46	2.5	0.461	40.6	LOS E	2.1	15.7	1.00	1.40	36.4
3	R2	18	12.5	0.461	40.5	LOS E	2.1	15.7	1.00	1.40	36.2
Approach		89	5.2	0.461	40.4	LOS E	2.1	15.7	1.00	1.40	36.3
All Vehicles		1056	6.2	0.883	35.5	LOS E	8.7	61.8	0.99	1.67	38.0

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: WSP GROUP AFRICA (PTY) LTD | Processed: 29 March 2016 10:09:20 AM
Project: W:\Deltek Projects\20000\20710.R - Bakubung Platinum Mine TIA\11 - Reports\11.1 Other Reports\TIS\SIDRA\R556 & R565_edited 2016-03-29.sip6

MOVEMENT SUMMARY

Site: AM Peak Hour - 2025

Intersection of the R565 & R556
Stop (All-Way)
Design Life Analysis (Capacity): Results for 9 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	27	11.8	0.096	12.0	LOS B	0.3	2.5	0.94	1.26	50.2
5	T1	95	15.0	0.339	17.0	LOS C	1.4	11.0	0.98	1.36	46.9
6	R2	170	12.1	0.540	23.4	LOS C	2.8	21.3	1.00	1.49	43.6
Approach		293	13.0	0.540	20.2	LOS C	2.8	21.3	0.99	1.42	45.2
NorthEast: R556											
7	L2	236	4.3	0.761	41.3	LOS E	5.5	40.1	1.00	1.76	35.9
8	T1	98	3.0	0.574	28.8	LOS D	3.1	22.7	1.00	1.51	41.2
9	R2	64	13.6	0.574	28.4	LOS D	3.1	22.7	1.00	1.51	40.7
Approach		398	5.5	0.761	36.2	LOS E	5.5	40.1	1.00	1.66	37.8
NorthWest: R565											
10	L2	58	7.5	0.497	30.4	LOS D	2.4	18.2	1.00	1.44	40.2
11	T1	122	11.9	0.497	31.6	LOS D	2.4	18.2	1.00	1.44	39.6
12	R2	23	0.0	0.497	31.8	LOS D	2.4	18.1	1.00	1.43	39.4
Approach		204	9.3	0.497	31.2	LOS D	2.4	18.2	1.00	1.44	39.7
SouthWest: R556											
1	L2	12	37.5	0.321	21.6	LOS C	1.3	9.5	0.93	1.34	44.0
2	T1	61	4.8	0.321	20.9	LOS C	1.3	9.5	0.93	1.34	45.1
3	R2	48	3.0	0.321	20.3	LOS C	1.3	9.5	0.93	1.34	45.2
Approach		121	7.2	0.321	20.7	LOS C	1.3	9.5	0.93	1.34	45.0
All Vehicles		1016	8.6	0.761	28.7	LOS D	5.5	40.1	0.99	1.51	40.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2025

Intersection of the R565 & R556
Stop (All-Way)
Design Life Analysis (Practical Capacity): Results for 9 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	42	6.7	0.117	10.9	LOS B	0.4	3.0	0.90	1.26	50.9
5	T1	221	6.9	0.622	24.8	LOS C	3.6	26.5	1.00	1.57	42.7
6	R2	387	1.8	1.016	78.8	LOS F	14.1	100.5	1.00	2.65	26.3
Approach		650	3.8	1.016	56.1	LOS F	14.1	100.5	0.99	2.19	31.4
NorthEast: R556											
7	L2	196	4.5	0.808	56.1	LOS F	6.2	44.9	1.00	1.81	31.3
8	T1	34	0.0	0.479	29.1	LOS D	2.3	16.7	1.00	1.42	41.2
9	R2	69	9.3	0.479	28.6	LOS D	2.3	16.7	1.00	1.42	40.7
Approach		299	5.1	0.808	46.7	LOS E	6.2	44.9	1.00	1.67	34.1
NorthWest: R565											
10	L2	25	15.0	0.302	19.6	LOS C	1.2	9.8	0.98	1.34	45.5
11	T1	99	20.5	0.302	20.1	LOS C	1.2	9.9	0.99	1.34	45.1
12	R2	25	16.7	0.302	20.4	LOS C	1.2	9.9	1.00	1.34	44.9
Approach		150	18.9	0.302	20.1	LOS C	1.2	9.9	0.99	1.34	45.1
SouthWest: R556											
1	L2	27	4.8	0.530	45.8	LOS E	2.6	19.4	1.00	1.45	34.3
2	T1	51	2.5	0.530	46.4	LOS E	2.6	19.4	1.00	1.45	34.4
3	R2	20	12.5	0.530	46.4	LOS E	2.6	19.4	1.00	1.45	34.2
Approach		98	5.2	0.530	46.2	LOS E	2.6	19.4	1.00	1.45	34.3
All Vehicles		1196	6.2	1.016	48.4	LOS E	14.1	100.5	1.00	1.90	33.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: AM Peak Hour - 2025 - No Mine - MMD Layout

Intersection of the R565 & R556
Stop (All-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	27	11.8	0.106	12.7	LOS B	0.4	2.8	0.96	1.26	49.8
5	T1	95	15.0	0.374	19.6	LOS C	1.6	12.6	1.00	1.37	45.5
6	R2	199	12.1	0.692	35.4	LOS E	4.4	34.0	1.00	1.66	38.4
Approach		321	12.9	0.692	28.8	LOS D	4.4	34.0	1.00	1.54	41.1
NorthEast: R556											
7	L2	400	4.3	1.269	171.8	LOS F	26.0	188.6	1.00	3.57	15.7
8	T1	180	3.0	0.619	28.9	LOS D	3.5	25.2	1.00	1.54	41.0
9	R2	150	13.6	0.514	22.8	LOS C	2.5	19.9	1.00	1.46	43.6
Approach		730	5.9	1.269	105.9	LOS F	26.0	188.6	1.00	2.64	22.0
NorthWest: R565											
10	L2	77	7.5	0.758	65.2	LOS F	5.0	37.9	1.00	1.68	29.0
11	T1	134	11.9	0.758	68.8	LOS F	5.0	37.9	1.00	1.66	28.3
12	R2	26	0.0	0.758	69.7	LOS F	4.9	37.0	1.00	1.66	27.9
Approach		237	9.2	0.758	67.7	LOS F	5.0	37.9	1.00	1.67	28.5
SouthWest: R556											
1	L2	12	37.5	0.460	27.9	LOS D	2.1	15.8	0.98	1.42	41.0
2	T1	84	4.8	0.460	27.1	LOS D	2.1	15.8	0.98	1.42	42.0
3	R2	52	3.0	0.460	26.6	LOS D	2.1	15.8	0.98	1.42	42.0
Approach		149	6.8	0.460	27.0	LOS D	2.1	15.8	0.98	1.42	41.9
All Vehicles		1437	8.1	1.269	74.2	LOS F	26.0	188.6	1.00	2.11	27.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2025 - No Mine - MMD Layout

Intersection of the R565 & R556
Stop (All-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	41	6.7	0.120	11.1	LOS B	0.4	3.0	0.91	1.26	50.8
5	T1	220	6.9	0.639	26.8	LOS D	3.8	28.0	1.00	1.59	41.9
6	R2	456	1.8	1.221	147.7	LOS F	26.2	186.1	1.00	3.68	17.7
Approach		718	3.6	1.221	102.7	LOS F	26.2	186.1	0.99	2.90	22.5
NorthEast: R556											
7	L2	264	4.5	1.036	100.9	LOS F	12.5	91.0	1.00	2.41	22.6
8	T1	63	0.0	0.276	17.7	LOS C	1.1	7.6	1.00	1.31	47.0
9	R2	103	9.3	0.454	23.8	LOS C	2.1	15.8	1.00	1.41	43.1
Approach		430	5.0	1.036	70.3	LOS F	12.5	91.0	1.00	2.01	27.9
NorthWest: R565											
10	L2	61	15.0	0.441	26.4	LOS D	2.0	16.2	1.00	1.41	41.9
11	T1	109	20.5	0.441	27.8	LOS D	2.0	16.4	1.00	1.41	41.3
12	R2	24	16.7	0.441	27.9	LOS D	2.0	16.4	1.00	1.41	40.9
Approach		194	18.3	0.441	27.4	LOS D	2.0	16.4	1.00	1.41	41.4
SouthWest: R556											
1	L2	29	4.8	1.182	206.4	LOS F	12.1	88.2	1.00	2.16	13.7
2	T1	97	2.5	1.182	207.0	LOS F	12.1	88.2	1.00	2.16	13.7
3	R2	22	12.5	1.182	207.0	LOS F	12.1	88.2	1.00	2.16	13.7
Approach		148	4.5	1.182	206.9	LOS F	12.1	88.2	1.00	2.16	13.7
All Vehicles		1489	6.0	1.221	93.9	LOS F	26.2	186.1	1.00	2.38	23.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: AM Peak Hour - 2020 - Incl. Mine - MMD Layout

Intersection of the R565 & R556
Stop (All-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	29	11.8	0.111	12.6	LOS B	0.4	3.0	0.95	1.27	49.8
5	T1	109	15.0	0.412	20.5	LOS C	1.8	14.4	1.00	1.39	45.0
6	R2	207	12.1	0.696	34.9	LOS D	4.5	34.6	1.00	1.67	38.6
Approach		345	13.0	0.696	28.5	LOS D	4.5	34.6	1.00	1.55	41.2
NorthEast: R556											
7	L2	470	4.3	1.524	276.0	LOS F	40.8	296.4	1.00	4.44	10.9
8	T1	166	3.0	0.582	27.1	LOS D	3.1	22.5	1.00	1.51	41.9
9	R2	140	13.6	0.492	22.2	LOS C	2.4	18.5	1.00	1.45	43.9
Approach		776	5.7	1.524	176.9	LOS F	40.8	296.4	1.00	3.27	15.4
NorthWest: R565											
10	L2	68	7.5	0.797	64.6	LOS F	5.7	43.5	1.00	1.76	29.2
11	T1	196	11.9	0.797	67.8	LOS F	5.7	43.5	1.00	1.74	28.5
12	R2	22	0.0	0.797	68.9	LOS F	5.6	42.4	1.00	1.73	28.1
Approach		287	9.9	0.797	67.1	LOS F	5.7	43.5	1.00	1.75	28.6
SouthWest: R556											
1	L2	11	37.5	0.420	26.4	LOS D	1.9	13.8	0.98	1.39	41.6
2	T1	74	4.8	0.420	25.7	LOS D	1.9	13.8	0.98	1.39	42.6
3	R2	51	3.0	0.420	25.2	LOS D	1.9	13.8	0.98	1.39	42.7
Approach		137	6.8	0.420	25.6	LOS D	1.9	13.8	0.98	1.39	42.6
All Vehicles		1544	8.2	1.524	110.0	LOS F	40.8	296.4	1.00	2.44	21.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: AM Peak Hour - 2025 - Incl. Mine - MMD Layout

Intersection of the R565 & R556
Stop (All-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	33	11.8	0.124	12.8	LOS B	0.4	3.3	0.96	1.27	49.7
5	T1	121	15.0	0.455	22.0	LOS C	2.1	16.6	1.00	1.42	44.2
6	R2	230	12.1	0.769	42.0	LOS E	5.6	43.6	1.00	1.79	35.9
Approach		384	13.0	0.769	33.2	LOS D	5.6	43.6	1.00	1.63	39.1
NorthEast: R556											
7	L2	505	4.3	1.637	324.2	LOS F	48.0	348.3	1.00	4.79	9.5
8	T1	180	3.0	0.634	30.4	LOS D	3.7	26.4	1.00	1.56	40.4
9	R2	150	13.6	0.527	23.7	LOS C	2.6	20.6	1.00	1.47	43.1
Approach		835	5.7	1.637	206.8	LOS F	48.0	348.3	1.00	3.50	13.7
NorthWest: R565											
10	L2	77	7.5	0.866	75.9	LOS F	7.0	53.0	1.00	1.88	26.8
11	T1	215	11.9	0.866	79.4	LOS F	7.0	53.0	1.00	1.86	26.1
12	R2	26	0.0	0.866	80.8	LOS F	6.8	51.3	1.00	1.84	25.8
Approach		317	9.9	0.866	78.7	LOS F	7.0	53.0	1.00	1.86	26.3
SouthWest: R556											
1	L2	12	37.5	0.464	28.2	LOS D	2.2	16.0	0.99	1.42	40.8
2	T1	84	4.8	0.464	27.4	LOS D	2.2	16.0	0.99	1.42	41.8
3	R2	52	3.0	0.464	26.9	LOS D	2.2	16.0	0.99	1.42	41.8
Approach		149	6.8	0.464	27.3	LOS D	2.2	16.0	0.99	1.42	41.7
All Vehicles		1685	8.2	1.637	127.3	LOS F	48.0	348.3	1.00	2.58	19.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: AM Peak Hour - 2020 - No Mine - MMD Layout

Intersection of the R565 & R556
Stop (All-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	23	11.8	0.092	12.5	LOS B	0.3	2.4	0.96	1.26	49.9
5	T1	83	15.0	0.329	18.3	LOS C	1.3	10.6	0.99	1.35	46.3
6	R2	176	12.1	0.616	29.8	LOS D	3.5	26.9	1.00	1.56	40.8
Approach		282	12.9	0.616	25.0	LOS C	3.5	26.9	0.99	1.47	42.9
NorthEast: R556											
7	L2	365	4.3	1.143	125.2	LOS F	19.1	138.9	1.00	3.06	19.7
8	T1	166	3.0	0.561	25.2	LOS D	2.9	21.1	1.00	1.49	42.8
9	R2	140	13.6	0.474	20.9	LOS C	2.2	17.5	1.00	1.43	44.6
Approach		671	5.9	1.143	78.6	LOS F	19.1	138.9	1.00	2.33	26.3
NorthWest: R565											
10	L2	68	7.5	0.681	56.0	LOS F	4.0	30.5	1.00	1.58	31.3
11	T1	116	11.9	0.681	59.2	LOS F	4.0	30.5	1.00	1.57	30.6
12	R2	22	0.0	0.681	59.9	LOS F	4.0	30.1	1.00	1.57	30.2
Approach		206	9.2	0.681	58.2	LOS F	4.0	30.5	1.00	1.58	30.8
SouthWest: R556											
1	L2	11	37.5	0.399	25.7	LOS D	1.7	12.8	0.97	1.38	41.9
2	T1	74	4.8	0.399	25.0	LOS C	1.7	12.8	0.97	1.38	43.0
3	R2	45	3.0	0.399	24.5	LOS C	1.7	12.8	0.97	1.38	43.0
Approach		130	6.9	0.399	24.9	LOS C	1.7	12.8	0.97	1.38	42.9
All Vehicles		1289	8.1	1.143	58.2	LOS F	19.1	138.9	1.00	1.92	30.8

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2020 - No Mine - MMD Layout

Intersection of the R565 & R556
Stop (All-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	36	6.7	0.105	10.9	LOS B	0.4	2.6	0.91	1.26	51.0
5	T1	190	6.9	0.554	22.2	LOS C	2.9	21.4	1.00	1.49	44.2
6	R2	403	1.8	1.081	98.9	LOS F	17.4	123.8	1.00	2.95	23.1
Approach		630	3.6	1.081	70.7	LOS F	17.4	123.8	0.99	2.41	28.0
NorthEast: R556											
7	L2	234	4.5	0.911	69.5	LOS F	8.6	62.6	1.00	2.05	28.1
8	T1	59	0.0	0.255	17.0	LOS C	1.0	6.9	0.99	1.30	47.4
9	R2	93	9.3	0.403	21.4	LOS C	1.8	13.4	1.00	1.38	44.3
Approach		385	5.0	0.911	50.0	LOS E	8.6	62.6	1.00	1.78	33.1
NorthWest: R565											
10	L2	56	15.0	0.396	24.8	LOS C	1.7	13.8	1.00	1.39	42.7
11	T1	94	20.5	0.396	26.1	LOS D	1.7	14.1	1.00	1.39	42.2
12	R2	21	16.7	0.396	26.1	LOS D	1.7	14.1	1.00	1.39	41.8
Approach		171	18.2	0.396	25.7	LOS D	1.7	14.1	1.00	1.39	42.3
SouthWest: R556											
1	L2	26	4.8	1.043	159.0	LOS F	9.4	68.0	1.00	1.99	16.7
2	T1	89	2.5	1.043	159.5	LOS F	9.4	68.0	1.00	1.99	16.7
3	R2	19	12.5	1.043	159.5	LOS F	9.4	68.0	1.00	1.99	16.7
Approach		134	4.4	1.043	159.4	LOS F	9.4	68.0	1.00	1.99	16.7
All Vehicles		1320	6.0	1.081	67.8	LOS F	17.4	123.8	1.00	2.05	28.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2020 - Incl. Mine - MMD Layout

Intersection of the R565 & R556
Stop (All-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	41	6.7	0.120	11.1	LOS B	0.4	3.0	0.91	1.26	50.9
5	T1	213	6.9	0.614	25.1	LOS D	3.5	25.8	1.00	1.55	42.7
6	R2	431	1.8	1.145	120.0	LOS F	21.4	151.8	1.00	3.30	20.4
Approach		685	3.7	1.145	84.0	LOS F	21.4	151.8	0.99	2.63	25.4
NorthEast: R556											
7	L2	262	4.5	1.038	102.1	LOS F	12.5	91.1	1.00	2.41	22.5
8	T1	59	0.0	0.260	17.3	LOS C	1.0	7.1	0.99	1.30	47.2
9	R2	93	9.3	0.411	22.1	LOS C	1.8	13.8	1.00	1.38	44.0
Approach		413	4.9	1.038	72.1	LOS F	12.5	91.1	1.00	2.02	27.5
NorthWest: R565											
10	L2	56	15.0	0.431	25.6	LOS D	1.9	15.7	1.00	1.41	42.3
11	T1	116	20.5	0.431	26.9	LOS D	1.9	15.9	1.00	1.41	41.8
12	R2	21	16.7	0.431	27.0	LOS D	1.9	15.9	1.00	1.41	41.4
Approach		194	18.5	0.431	26.5	LOS D	1.9	15.9	1.00	1.41	41.9
SouthWest: R556											
1	L2	26	4.8	1.031	151.0	LOS F	9.3	67.8	1.00	2.00	17.3
2	T1	89	2.5	1.031	151.6	LOS F	9.3	67.8	1.00	2.00	17.3
3	R2	24	12.5	1.031	151.6	LOS F	9.3	67.8	1.00	2.00	17.3
Approach		139	4.7	1.031	151.5	LOS F	9.3	67.8	1.00	2.00	17.3
All Vehicles		1431	6.1	1.145	79.4	LOS F	21.4	151.8	1.00	2.23	26.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2025 - Incl. Mine - MMD Layout

Intersection of the R565 & R556
Stop (All-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	47	6.7	0.135	11.3	LOS B	0.5	3.4	0.91	1.27	50.7
5	T1	243	6.9	0.699	30.8	LOS D	4.6	33.8	1.00	1.67	40.1
6	R2	484	1.8	1.285	172.3	LOS F	30.8	218.8	1.00	4.02	15.8
Approach		773	3.7	1.285	118.2	LOS F	30.8	218.8	0.99	3.12	20.6
NorthEast: R556											
7	L2	291	4.5	1.165	142.8	LOS F	17.4	126.6	1.00	2.81	18.0
8	T1	63	0.0	0.281	18.0	LOS C	1.1	7.8	1.00	1.31	46.8
9	R2	103	9.3	0.462	24.5	LOS C	2.2	16.3	1.00	1.41	42.7
Approach		457	5.0	1.165	99.0	LOS F	17.4	126.6	1.00	2.29	22.9
NorthWest: R565											
10	L2	61	15.0	0.477	27.5	LOS D	2.3	18.2	1.00	1.44	41.4
11	T1	131	20.5	0.477	28.9	LOS D	2.3	18.2	1.00	1.44	40.8
12	R2	24	16.7	0.477	29.1	LOS D	2.3	18.4	1.00	1.44	40.4
Approach		216	18.5	0.477	28.5	LOS D	2.3	18.4	1.00	1.44	40.9
SouthWest: R556											
1	L2	29	4.8	1.166	196.6	LOS F	12.1	88.1	1.00	2.18	14.2
2	T1	97	2.5	1.166	197.2	LOS F	12.1	88.1	1.00	2.18	14.3
3	R2	28	12.5	1.166	197.1	LOS F	12.1	88.1	1.00	2.18	14.2
Approach		153	4.7	1.166	197.1	LOS F	12.1	88.1	1.00	2.18	14.2
All Vehicles		1600	6.2	1.285	108.1	LOS F	30.8	218.8	1.00	2.56	21.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Mitigation_AM Peak Hour - 2025 - No Mine - Roundabout

Intersection of the R565 & R556
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	27	11.8	0.149	6.8	LOS A	0.7	5.8	0.52	0.62	52.3
5	T1	95	15.0	0.149	6.9	LOS A	0.7	5.8	0.52	0.62	53.6
6	R2	199	12.1	0.203	10.6	LOS B	1.1	8.5	0.52	0.71	50.9
Approach		321	12.9	0.203	9.1	LOS A	1.1	8.5	0.52	0.68	51.8
NorthEast: R556											
7	L2	400	4.3	0.337	5.5	LOS A	1.9	13.7	0.42	0.59	53.3
8	T1	180	3.0	0.310	5.6	LOS A	1.7	12.4	0.43	0.62	53.3
9	R2	150	13.6	0.310	9.9	LOS A	1.7	12.4	0.43	0.62	52.6
Approach		730	5.9	0.337	6.5	LOS A	1.9	13.7	0.43	0.60	53.1
NorthWest: R565											
10	L2	77	7.5	0.122	6.2	LOS A	0.6	4.8	0.49	0.59	52.8
11	T1	134	11.9	0.122	6.5	LOS A	0.6	4.8	0.50	0.61	53.4
12	R2	26	0.0	0.122	10.3	LOS B	0.6	4.8	0.50	0.61	53.2
Approach		237	9.2	0.122	6.8	LOS A	0.6	4.8	0.50	0.60	53.2
SouthWest: R556											
1	L2	12	37.5	0.185	7.7	LOS A	0.8	6.2	0.53	0.71	50.7
2	T1	84	4.8	0.185	6.9	LOS A	0.8	6.2	0.53	0.71	52.8
3	R2	52	3.0	0.185	10.9	LOS B	0.8	6.2	0.53	0.71	52.6
Approach		149	6.8	0.185	8.3	LOS A	0.8	6.2	0.53	0.71	52.6
All Vehicles		1437	8.1	0.337	7.3	LOS A	1.9	13.7	0.47	0.63	52.8

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Mitigation_PM Peak Hour - 2020 - No Mine - Roundabout

Intersection of the R565 & R556
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	36	6.7	0.227	5.6	LOS A	1.2	8.7	0.38	0.52	53.0
5	T1	190	6.9	0.227	5.7	LOS A	1.2	8.7	0.38	0.52	54.4
6	R2	403	1.8	0.323	9.4	LOS A	1.9	13.5	0.39	0.65	51.7
Approach		630	3.6	0.323	8.1	LOS A	1.9	13.5	0.39	0.60	52.6
NorthEast: R556											
7	L2	234	4.5	0.190	5.1	LOS A	1.0	7.1	0.32	0.53	53.6
8	T1	59	0.0	0.142	5.2	LOS A	0.7	5.0	0.32	0.59	53.3
9	R2	93	9.3	0.142	9.4	LOS A	0.7	5.0	0.32	0.59	52.7
Approach		385	5.0	0.190	6.1	LOS A	1.0	7.1	0.32	0.55	53.3
NorthWest: R565											
10	L2	56	15.0	0.108	7.4	LOS A	0.6	4.6	0.59	0.66	52.0
11	T1	94	20.5	0.108	7.9	LOS A	0.6	4.6	0.60	0.68	52.6
12	R2	21	16.7	0.108	11.9	LOS B	0.6	4.6	0.60	0.69	51.9
Approach		171	18.2	0.108	8.2	LOS A	0.6	4.6	0.60	0.67	52.3
SouthWest: R556											
1	L2	26	4.8	0.187	7.5	LOS A	0.8	6.0	0.60	0.76	51.9
2	T1	89	2.5	0.187	7.7	LOS A	0.8	6.0	0.60	0.76	53.2
3	R2	19	12.5	0.187	12.2	LOS B	0.8	6.0	0.60	0.76	52.5
Approach		134	4.4	0.187	8.3	LOS A	0.8	6.0	0.60	0.76	52.8
All Vehicles		1320	6.0	0.323	7.6	LOS A	1.9	13.5	0.42	0.61	52.8

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Mitigation_AM Peak Hour - 2020 - Incl. Mine - Roundabout

Intersection of the R565 & R556
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	29	11.8	0.161	6.5	LOS A	0.8	6.4	0.51	0.61	52.4
5	T1	109	15.0	0.161	6.7	LOS A	0.8	6.4	0.51	0.61	53.7
6	R2	207	12.1	0.209	10.4	LOS B	1.1	8.8	0.51	0.70	50.9
Approach		345	13.0	0.209	8.9	LOS A	1.1	8.8	0.51	0.66	51.9
NorthEast: R556											
7	L2	470	4.3	0.415	5.9	LOS A	2.4	17.7	0.50	0.64	53.0
8	T1	166	3.0	0.322	6.1	LOS A	1.7	12.6	0.49	0.67	53.0
9	R2	140	13.6	0.322	10.4	LOS B	1.7	12.6	0.49	0.67	52.4
Approach		776	5.7	0.415	6.7	LOS A	2.4	17.7	0.50	0.65	52.9
NorthWest: R565											
10	L2	68	7.5	0.149	6.2	LOS A	0.8	6.0	0.50	0.60	52.7
11	T1	196	11.9	0.149	6.5	LOS A	0.8	6.0	0.51	0.61	53.5
12	R2	22	0.0	0.149	10.3	LOS B	0.8	6.0	0.51	0.61	53.4
Approach		287	9.9	0.149	6.8	LOS A	0.8	6.0	0.50	0.60	53.3
SouthWest: R556											
1	L2	11	37.5	0.171	7.7	LOS A	0.8	5.7	0.53	0.71	50.6
2	T1	74	4.8	0.171	6.9	LOS A	0.8	5.7	0.53	0.71	52.8
3	R2	51	3.0	0.171	10.9	LOS B	0.8	5.7	0.53	0.71	52.6
Approach		137	6.8	0.171	8.4	LOS A	0.8	5.7	0.53	0.71	52.5
All Vehicles		1544	8.2	0.415	7.4	LOS A	2.4	17.7	0.50	0.65	52.7

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Mitigation_PM Peak Hour - 2020 - Incl. Mine - Roundabout

Intersection of the R565 & R556
Roundabout

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
Movement Performance - Vehicles											
SouthEast: R565											
4	L2	41	6.7	0.250	5.6	LOS A	1.3	9.9	0.39	0.53	53.0
5	T1	213	6.9	0.250	5.7	LOS A	1.3	9.9	0.39	0.53	54.4
6	R2	431	1.8	0.344	9.5	LOS A	2.1	14.9	0.40	0.65	51.7
Approach		685	3.7	0.344	8.1	LOS A	2.1	14.9	0.40	0.60	52.5
NorthEast: R556											
7	L2	262	4.5	0.218	5.2	LOS A	1.1	8.3	0.36	0.55	53.5
8	T1	59	0.0	0.150	5.4	LOS A	0.7	5.3	0.36	0.61	53.2
9	R2	93	9.3	0.150	9.6	LOS A	0.7	5.3	0.36	0.61	52.6
Approach		413	4.9	0.218	6.2	LOS A	1.1	8.3	0.36	0.57	53.2
NorthWest: R565											
10	L2	56	15.0	0.127	7.7	LOS A	0.7	5.5	0.62	0.68	51.8
11	T1	116	20.5	0.127	8.2	LOS A	0.7	5.5	0.62	0.70	52.5
12	R2	21	16.7	0.127	12.3	LOS B	0.7	5.5	0.62	0.71	51.8
Approach		194	18.5	0.127	8.5	LOS A	0.7	5.5	0.62	0.69	52.2
SouthWest: R556											
1	L2	26	4.8	0.201	7.7	LOS A	0.9	6.5	0.62	0.79	51.7
2	T1	89	2.5	0.201	7.9	LOS A	0.9	6.5	0.62	0.79	53.0
3	R2	24	12.5	0.201	12.4	LOS B	0.9	6.5	0.62	0.79	52.3
Approach		139	4.7	0.201	8.7	LOS A	0.9	6.5	0.62	0.79	52.6
All Vehicles		1431	6.1	0.344	7.6	LOS A	2.1	14.9	0.44	0.62	52.7

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Mitigation_AM Peak Hour - 2020 - No Mine - Roundabout

Intersection of the R565 & R556
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	23	11.8	0.126	6.6	LOS A	0.6	4.8	0.49	0.60	52.4
5	T1	83	15.0	0.126	6.7	LOS A	0.6	4.8	0.49	0.60	53.8
6	R2	176	12.1	0.175	10.3	LOS B	0.9	7.1	0.49	0.69	51.0
Approach		282	12.9	0.175	9.0	LOS A	0.9	7.1	0.49	0.66	51.9
NorthEast: R556											
7	L2	365	4.3	0.300	5.4	LOS A	1.6	11.8	0.38	0.56	53.4
8	T1	166	3.0	0.278	5.5	LOS A	1.5	10.9	0.39	0.60	53.4
9	R2	140	13.6	0.278	9.7	LOS A	1.5	10.9	0.39	0.60	52.8
Approach		671	5.9	0.300	6.3	LOS A	1.6	11.8	0.38	0.58	53.3
NorthWest: R565											
10	L2	68	7.5	0.103	6.0	LOS A	0.5	4.0	0.46	0.57	53.0
11	T1	116	11.9	0.103	6.2	LOS A	0.5	4.0	0.46	0.58	53.6
12	R2	22	0.0	0.103	10.0	LOS B	0.5	3.9	0.46	0.59	53.4
Approach		206	9.2	0.103	6.5	LOS A	0.5	4.0	0.46	0.58	53.4
SouthWest: R556											
1	L2	11	37.5	0.156	7.3	LOS A	0.7	5.1	0.50	0.68	50.8
2	T1	74	4.8	0.156	6.6	LOS A	0.7	5.1	0.50	0.68	53.0
3	R2	45	3.0	0.156	10.6	LOS B	0.7	5.1	0.50	0.68	52.8
Approach		130	6.9	0.156	8.0	LOS A	0.7	5.1	0.50	0.68	52.8
All Vehicles		1289	8.1	0.300	7.1	LOS A	1.6	11.8	0.43	0.61	52.9

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Mitigation_AM Peak Hour - 2025 - Incl. Mine - Roundabout

Intersection of the R565 & R556
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	33	11.8	0.185	6.8	LOS A	1.0	7.6	0.54	0.63	52.2
5	T1	121	15.0	0.185	6.9	LOS A	1.0	7.6	0.54	0.63	53.6
6	R2	230	12.1	0.238	10.6	LOS B	1.3	10.3	0.54	0.72	50.8
Approach		384	13.0	0.238	9.1	LOS A	1.3	10.3	0.54	0.68	51.8
NorthEast: R556											
7	L2	505	4.3	0.454	6.1	LOS A	2.8	20.1	0.54	0.66	52.9
8	T1	180	3.0	0.355	6.2	LOS A	1.9	14.3	0.52	0.68	52.9
9	R2	150	13.6	0.355	10.6	LOS B	1.9	14.3	0.52	0.68	52.3
Approach		835	5.7	0.454	6.9	LOS A	2.8	20.1	0.53	0.67	52.8
NorthWest: R565											
10	L2	77	7.5	0.170	6.5	LOS A	0.9	7.1	0.54	0.62	52.6
11	T1	215	11.9	0.170	6.8	LOS A	0.9	7.1	0.54	0.63	53.4
12	R2	26	0.0	0.170	10.6	LOS B	0.9	7.0	0.54	0.64	53.2
Approach		317	9.9	0.170	7.0	LOS A	0.9	7.1	0.54	0.63	53.2
SouthWest: R556											
1	L2	12	37.5	0.193	8.0	LOS A	0.9	6.5	0.56	0.74	50.5
2	T1	84	4.8	0.193	7.1	LOS A	0.9	6.5	0.56	0.74	52.7
3	R2	52	3.0	0.193	11.1	LOS B	0.9	6.5	0.56	0.74	52.5
Approach		149	6.8	0.193	8.6	LOS A	0.9	6.5	0.56	0.74	52.4
All Vehicles		1685	8.2	0.454	7.6	LOS A	2.8	20.1	0.54	0.67	52.6

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Mitigation_PM Peak Hour - 2025 - No Mine - Roundabout

Intersection of the R565 & R556
Roundabout

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
Movement Performance - Vehicles											
SouthEast: R565											
4	L2	41	6.7	0.265	5.8	LOS A	1.4	10.6	0.42	0.54	52.9
5	T1	220	6.9	0.265	5.8	LOS A	1.4	10.6	0.42	0.54	54.3
6	R2	456	1.8	0.371	9.6	LOS A	2.3	16.4	0.43	0.66	51.6
Approach		718	3.6	0.371	8.2	LOS A	2.3	16.4	0.43	0.62	52.4
NorthEast: R556											
7	L2	264	4.5	0.219	5.2	LOS A	1.2	8.4	0.35	0.55	53.5
8	T1	63	0.0	0.160	5.3	LOS A	0.8	5.8	0.36	0.61	53.2
9	R2	103	9.3	0.160	9.5	LOS A	0.8	5.8	0.36	0.61	52.6
Approach		430	5.0	0.219	6.3	LOS A	1.2	8.4	0.35	0.57	53.2
NorthWest: R565											
10	L2	61	15.0	0.131	7.9	LOS A	0.7	5.8	0.64	0.70	51.7
11	T1	109	20.5	0.131	8.4	LOS A	0.7	5.8	0.64	0.71	52.3
12	R2	24	16.7	0.131	12.5	LOS B	0.7	5.7	0.65	0.73	51.5
Approach		194	18.3	0.131	8.8	LOS A	0.7	5.8	0.64	0.71	52.0
SouthWest: R556											
1	L2	29	4.8	0.220	7.9	LOS A	1.0	7.3	0.64	0.81	51.6
2	T1	97	2.5	0.220	8.2	LOS A	1.0	7.3	0.64	0.81	52.9
3	R2	22	12.5	0.220	12.7	LOS B	1.0	7.3	0.64	0.81	52.2
Approach		148	4.5	0.220	8.8	LOS A	1.0	7.3	0.64	0.81	52.5
All Vehicles		1489	6.0	0.371	7.8	LOS A	2.3	16.4	0.45	0.63	52.6

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Mitigation_PM Peak Hour - 2025 - Incl. Mine - Roundabout

Intersection of the R565 & R556
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: R565											
4	L2	47	6.7	0.288	5.8	LOS A	1.6	11.9	0.43	0.55	52.8
5	T1	243	6.9	0.288	5.8	LOS A	1.6	11.9	0.43	0.55	54.2
6	R2	484	1.8	0.392	9.6	LOS A	2.5	17.9	0.44	0.66	51.5
Approach		773	3.7	0.392	8.2	LOS A	2.5	17.9	0.44	0.62	52.4
NorthEast: R556											
7	L2	291	4.5	0.248	5.4	LOS A	1.3	9.7	0.39	0.57	53.3
8	T1	63	0.0	0.169	5.5	LOS A	0.8	6.1	0.39	0.62	53.1
9	R2	103	9.3	0.169	9.7	LOS A	0.8	6.1	0.39	0.62	52.5
Approach		457	5.0	0.248	6.4	LOS A	1.3	9.7	0.39	0.59	53.1
NorthWest: R565											
10	L2	61	15.0	0.151	8.2	LOS A	0.9	6.9	0.66	0.72	51.5
11	T1	131	20.5	0.151	8.8	LOS A	0.9	6.9	0.67	0.73	52.1
12	R2	24	16.7	0.151	12.9	LOS B	0.8	6.7	0.67	0.75	51.4
Approach		216	18.5	0.151	9.1	LOS A	0.9	6.9	0.67	0.73	51.8
SouthWest: R556											
1	L2	29	4.8	0.236	8.2	LOS A	1.1	7.9	0.66	0.83	51.4
2	T1	97	2.5	0.236	8.4	LOS A	1.1	7.9	0.66	0.83	52.6
3	R2	28	12.5	0.236	12.9	LOS B	1.1	7.9	0.66	0.83	52.0
Approach		153	4.7	0.236	9.2	LOS A	1.1	7.9	0.66	0.83	52.3
All Vehicles		1600	6.2	0.392	7.9	LOS A	2.5	17.9	0.48	0.64	52.5

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: WSP GROUP AFRICA (PTY) LTD | Processed: 01 February 2016 12:20:04 PM
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Appendix F

SIDRA RESULTS – ACCESS TO BAKUBUNG MINE

MOVEMENT SUMMARY

Site: AM Peak Hour - 2016

Existing Access to Bakubung Platinum Mine from the R565
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R565											
2	T1	452	12.6	0.183	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
3	R2	9	0.0	0.012	7.1	LOS A	0.0	0.3	0.35	0.58	52.7
Approach		461	12.4	0.183	0.2	NA	0.0	0.3	0.01	0.01	59.8
East: Access											
4	L2	1	0.0	0.001	8.3	LOS A	0.0	0.0	0.17	0.88	51.8
6	R2	3	0.0	0.014	21.9	LOS C	0.0	0.3	0.73	0.96	44.3
Approach		4	0.0	0.014	18.5	LOS C	0.0	0.3	0.59	0.94	45.9
North: R565											
7	L2	4	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	253	8.7	0.097	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		257	8.6	0.097	0.1	NA	0.0	0.0	0.00	0.01	59.9
All Vehicles		721	10.9	0.183	0.2	NA	0.0	0.3	0.01	0.02	59.7

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2016

Existing Access to Bakubung Platinum Mine from the R565
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R565											
2	T1	452	3.8	0.173	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
3	R2	9	0.0	0.012	7.1	LOS A	0.0	0.3	0.35	0.58	52.7
Approach		461	3.7	0.173	0.2	NA	0.0	0.3	0.01	0.01	59.8
East: Access											
4	L2	1	0.0	0.001	8.3	LOS A	0.0	0.0	0.17	0.88	51.8
6	R2	3	0.0	0.014	21.1	LOS C	0.0	0.3	0.72	0.95	44.7
Approach		4	0.0	0.014	17.9	LOS C	0.0	0.3	0.58	0.93	46.2
North: R565											
7	L2	4	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	253	8.4	0.097	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		257	8.3	0.097	0.1	NA	0.0	0.0	0.00	0.01	59.9
All Vehicles		721	5.3	0.173	0.2	NA	0.0	0.3	0.01	0.02	59.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: AM Peak Hour - 2020 - No Mine

Existing Access to Bakubung Platinum Mine from the R565
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R565											
2	T1	267	12.6	0.108	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
3	R2	27	0.0	0.052	9.9	LOS A	0.2	1.2	0.52	0.74	50.7
Approach		294	11.4	0.108	0.9	NA	0.2	1.2	0.05	0.07	59.0
East: Access											
4	L2	17	0.0	0.016	8.6	LOS A	0.1	0.4	0.24	0.87	51.7
6	R2	11	0.0	0.062	25.4	LOS D	0.2	1.3	0.78	1.00	42.5
Approach		28	0.0	0.062	15.4	LOS C	0.2	1.3	0.46	0.92	47.6
North: R565											
7	L2	73	0.0	0.039	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	465	8.7	0.178	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		538	7.5	0.178	0.8	NA	0.0	0.0	0.00	0.08	59.0
All Vehicles		861	8.6	0.178	1.3	NA	0.2	1.3	0.03	0.10	58.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: WSP GROUP AFRICA (PTY) LTD | Processed: 04 February 2016 12:31:56 PM
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MOVEMENT SUMMARY

Site: AM Peak Hour - 2020 - Incl. Mine

Existing Access to Bakubung Platinum Mine from the R565
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R565											
2	T1	267	12.6	0.179	1.3	LOS A	1.9	14.4	0.56	0.00	57.5
3	R2	304	0.0	0.744	21.7	LOS C	5.4	37.6	0.85	1.23	43.5
Approach		572	5.9	0.744	12.2	NA	5.4	37.6	0.72	0.65	49.1
East: Access											
4	L2	75	0.0	0.073	8.7	LOS A	0.3	1.9	0.25	0.88	51.6
6	R2	70	0.0	0.862	105.3	LOS F	4.0	27.9	0.98	1.23	22.1
Approach		145	0.0	0.862	55.1	LOS F	4.0	27.9	0.61	1.05	31.5
North: R565											
7	L2	249	0.0	0.134	5.6	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	465	8.7	0.178	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		715	5.7	0.178	1.9	NA	0.0	0.0	0.00	0.20	57.6
All Vehicles		1431	5.2	0.862	11.4	NA	5.4	37.6	0.35	0.47	49.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: AM Peak Hour - 2025 - No Mine

Existing Access to Bakubung Platinum Mine from the R565
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R565											
2	T1	320	12.6	0.130	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
3	R2	28	0.0	0.060	10.7	LOS B	0.2	1.3	0.55	0.78	50.1
Approach		348	11.6	0.130	0.9	NA	0.2	1.3	0.04	0.06	59.0
East: Access											
4	L2	18	0.0	0.017	8.7	LOS A	0.1	0.4	0.26	0.87	51.6
6	R2	15	0.0	0.105	31.7	LOS D	0.3	2.2	0.84	1.00	39.7
Approach		32	0.0	0.105	19.2	LOS C	0.3	2.2	0.52	0.93	45.4
North: R565											
7	L2	74	0.0	0.040	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	524	8.7	0.201	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		598	7.6	0.201	0.7	NA	0.0	0.0	0.00	0.07	59.1
All Vehicles		978	8.8	0.201	1.4	NA	0.3	2.2	0.03	0.10	58.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: AM Peak Hour - 2025 - Incl. Mine

Existing Access to Bakubung Platinum Mine from the R565
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R565											
2	T1	306	12.6	0.211	1.5	LOS A	2.1	16.5	0.54	0.00	57.6
3	R2	304	0.0	0.810	26.4	LOS D	6.4	44.8	0.90	1.34	41.2
Approach		610	6.3	0.810	13.9	NA	6.4	44.8	0.72	0.67	48.1
East: Access											
4	L2	75	0.0	0.074	8.8	LOS A	0.3	1.9	0.27	0.88	51.6
6	R2	70	0.0	1.108	191.1	LOS F	7.1	49.4	1.00	1.39	14.6
Approach		145	0.0	1.108	96.4	LOS F	7.1	49.4	0.62	1.13	23.2
North: R565											
7	L2	249	0.0	0.134	5.6	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	518	8.7	0.199	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		767	5.9	0.199	1.8	NA	0.0	0.0	0.00	0.19	57.7
All Vehicles		1522	5.5	1.108	15.7	NA	7.1	49.4	0.35	0.47	47.2

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2020 - No Mine

Existing Access to Bakubung Platinum Mine from the R565
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R565											
2	T1	574	3.8	0.220	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
3	R2	9	0.0	0.013	7.7	LOS A	0.0	0.3	0.40	0.61	52.2
Approach		583	3.7	0.220	0.1	NA	0.0	0.3	0.01	0.01	59.8
East: Access											
4	L2	1	0.0	0.001	8.4	LOS A	0.0	0.0	0.20	0.86	51.8
6	R2	3	0.0	0.021	30.3	LOS D	0.1	0.4	0.82	1.00	40.3
Approach		4	0.0	0.021	24.8	LOS C	0.1	0.4	0.67	0.97	42.6
North: R565											
7	L2	4	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	331	8.4	0.127	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		335	8.3	0.127	0.1	NA	0.0	0.0	0.00	0.01	59.9
All Vehicles		922	5.4	0.220	0.2	NA	0.1	0.4	0.01	0.01	59.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2020 - Incl. Mine

Existing Access to Bakubung Platinum Mine from the R565
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R565											
2	T1	574	3.8	0.220	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
3	R2	62	0.0	0.096	8.4	LOS A	0.3	2.3	0.45	0.70	51.7
Approach		635	3.4	0.220	0.8	NA	0.3	2.3	0.04	0.07	59.0
East: Access											
4	L2	54	0.0	0.049	8.5	LOS A	0.2	1.2	0.20	0.89	51.7
6	R2	56	0.0	0.470	47.6	LOS E	1.7	11.8	0.91	1.07	33.9
Approach		109	0.0	0.470	28.4	LOS D	1.7	11.8	0.57	0.98	40.8
North: R565											
7	L2	57	0.0	0.030	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	331	8.4	0.127	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		388	7.2	0.127	0.8	NA	0.0	0.0	0.00	0.08	59.0
All Vehicles		1132	4.4	0.470	3.5	NA	1.7	11.8	0.08	0.16	56.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2025 - No Mine

Existing Access to Bakubung Platinum Mine from the R565
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R565											
2	T1	655	3.8	0.251	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
3	R2	9	0.0	0.014	8.1	LOS A	0.0	0.3	0.43	0.63	51.9
Approach		664	3.7	0.251	0.1	NA	0.0	0.3	0.01	0.01	59.8
East: Access											
4	L2	1	0.0	0.001	8.5	LOS A	0.0	0.0	0.21	0.86	51.7
6	R2	3	0.0	0.029	39.1	LOS E	0.1	0.6	0.87	1.00	36.8
Approach		4	0.0	0.029	31.4	LOS D	0.1	0.6	0.71	0.96	39.6
North: R565											
7	L2	4	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	377	8.4	0.144	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		381	8.3	0.144	0.1	NA	0.0	0.0	0.00	0.01	59.9
All Vehicles		1048	5.4	0.251	0.2	NA	0.1	0.6	0.01	0.01	59.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: PM Peak Hour - 2025 - Incl. Mine

Existing Access to Bakubung Platinum Mine from the R565
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R565											
2	T1	655	3.8	0.251	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
3	R2	62	0.0	0.102	8.9	LOS A	0.3	2.4	0.48	0.72	51.3
Approach		716	3.5	0.251	0.8	NA	0.3	2.4	0.04	0.06	59.1
East: Access											
4	L2	54	0.0	0.050	8.5	LOS A	0.2	1.3	0.22	0.88	51.7
6	R2	56	0.0	0.646	74.0	LOS F	2.4	16.8	0.96	1.11	27.3
Approach		109	0.0	0.646	41.9	LOS E	2.4	16.8	0.60	1.00	35.5
North: R565											
7	L2	57	0.0	0.030	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	377	8.4	0.144	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		433	7.3	0.144	0.7	NA	0.0	0.0	0.00	0.08	59.1
All Vehicles		1259	4.5	0.646	4.3	NA	2.4	16.8	0.08	0.15	55.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix G

CURRICULUM VITAE – CORNELIA HUTCHINSON

HUTCHINSON CORNELIA, Traffic & Transportation Engineer

DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE

YEARS WITH THE FIRM

7 years

YEARS TOTAL

11 years

PROFESSIONAL QUALIFICATIONS

Professional Engineer

AREAS OF PRACTICE

Traffic impact studies

Traffic/ access management plans

Traffic studies for environmental authorisations

Traffic signal design

Parking studies

LANGUAGES

English

Afrikaans

CAREER SUMMARY

Mrs Hutchinson is a traffic and transportation engineer with over 10 years' experience in the civil engineering sector. She has extensive knowledge of traffic impact studies and access management plans, including traffic studies for new and existing mines, large industrial developments (as part of Environmental Impact Assessments) and ports (landside).

Countries of work experience include South-Africa, Uganda and Lesotho.

She plays a key role as senior traffic engineer in WSP's Bedfordview office, where she is primarily responsible for traffic and transportation-related projects in Ekurhuleni.

EDUCATION

BEng (Hons) Transportation Engineering, University of Pretoria	2011
BEng Civil Engineering, University of Pretoria	2003

PROFESSIONAL MEMBERSHIPS

Professional Engineer, Engineering Council of South Africa (20130451)	2013
Graduate Member, South African Institute of Civil Engineers (201236)	2003

PROFESSIONAL EXPERIENCE

- Re-application for the security access restrictions in Freeway Park, Boksburg, South Africa (Current): Traffic Engineer - Traffic Impact Study. Client: Freeway Park Residents Association. Fee Value: ZAR 27,000.
- Multi-Disciplinary Engineering Services for a Private Vehicle Proving Ground Development Northern Cape, South Africa (Current): Traffic Engineer - Traffic Impact Study. Client: Ingen|Aix GmbH. Fee Value: ZAR8.6 m.
- Brentwood Park Ext. 39 development, Benoni, South Africa (Current): Senior Traffic Engineer - Overseeing the Traffic Impact Study for the proposed residential development. Client: PTY Props 56. Fee Value: ZAR 40,000.
- Environmental Authorisation for the Middelburg Colliery Expansions Project, Middelburg, South Africa (2015): Traffic Engineer - Traffic Impact Study. Client: Jones & Wagener. Fee Value: ZAR 80,000.
- Eveleigh Ext. 55 Access, Boksburg, South Africa (2015): Traffic Engineer - Amendments to the Ekurhuleni Roads Masterplan. Client: Edgarvale 8. Fee Value: ZAR 12,000.
- Rezoning of Portion 22 and the remainder of Portion 23 of Erf 252 Edenburg, Johannesburg, South Africa (2015): Traffic Engineer - Traffic Impact Study for the proposed high-density residential development. Client: Expectio Properties. Fee Value: ZAR 48,000.
- Comaro Crossing Shopping Centre Upgrades, Johannesburg, South Africa (2015): Traffic Engineer - Providing access design advice and obtaining JRA

approval for upgrades to the shopping centre access. Client: SA Retail Properties (Broll Property Group). Fee Value: ZAR 17,500.

- Traffic Signal Investigations and Design, Ekurhuleni, South Africa (2015): Project Manager - Traffic signal warrant investigations, design and optimisation on an as-and-when required basis. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 175,400.
- Ekurhuleni West College (EWC) Parking Relaxation Studies, Ekurhuleni, South Africa (2015): Traffic Engineer - Parking relaxation studies for two EWC campuses (Tembisa and Boksburg). Client: VMR Architects. Fee Value: ZAR 109,000.
- Ekurhuleni Unified Command Centre, Boksburg, South Africa (2015): Senior Traffic Engineer - Traffic Impact Study for a unified control/command centre for various EMM Services. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 84,400.
- Parkdene Ext. 3 Portion 2 Erf 654, Boksburg, South Africa (2015): Traffic Engineer – Section 7 report, parking relaxation and traffic impact assessment for the rezoning. Client: Simplegrow Properties 9. Fee Value: ZAR 80,000.
- Comet Future Development, Boksburg, South Africa (Current): Managing the traffic impact assessment and SATURN model development for the proposed mixed-use development on Comet Ext. 18. Client: Living Africa. Fee Value: ZAR 131,000.
- Sunward Park Shopping Centre Upgrades, Boksburg, South Africa (Current): Traffic Engineer – Parking relaxation and traffic impact assessment. Client: Acucap Investments. Fee Value: ZAR 118,000.
- Matholesville Ext. 3 to 5 (Spitzland), Roodepoort, South Africa (Current): Traffic Engineer – Parking relaxation and traffic impact assessment. Client: Living Africa Development. Fee Value: ZAR 82,000.
- Bardene Erven 100 and 101 Office/Car Showroom Development, South Africa (2015): Traffic Engineer – Traffic Impact Assessment. Client: WJH Properties. Fee Value: ZAR 48,900.
- Monte Cristo Estate Traffic Signals, Beyers Park, South Africa (2015): Traffic Engineer – Traffic Signal warrant investigation and design. Client: Monte Cristo Homeowners Association. Fee Value: ZAR 45,000.
- Scoping and Environmental Impact Reporting and Environmental Management Programme for Klipfontein Environmental Approvals, South Africa (2015): Traffic Engineer – Traffic Impact Assessment. Client: Sub-consultant to Jones & Wagener for BECSA. Fee Value: ZAR 112,500.
- Collins Road Closure Traffic Impact Study, Bedfordview, South Africa (2015): Senior Traffic Engineer – Traffic Impact Study for new security access restrictions. Client: Collins Road Home Owners. Fee Value: ZAR 19,600.
- Morehill Glen Traffic Impact Study, Benoni, South Africa (2015): Senior Traffic Engineer – Traffic Impact Study for the re-application for security access restrictions. Client: Morehill Glen Community Security. Fee Value: ZAR 22,700.
- Bonaero Park Erf 765 Section 7, Bonaero Park, South Africa (2014): Traffic Engineer – Report in terms of Section 7 of the Gauteng Transport

Infrastructure Act for the impact of the subdivision of Erf 174. Client: Nine Nine Ninety Nine Projects. Fee Value: ZAR 19,000.

- Plantation Road, Bedfordview, South Africa (2014): Senior Traffic Engineer – Traffic impact assessment for the implementation of security access restrictions. Client: Jurgens Bekker Attorneys. Fee Value: ZAR 20,000.
- The Stewards Ext. 20 Access Road, Boksburg/Benoni, South Africa (2014): Traffic Engineer – traffic signal warrant, designs and revision of existing traffic signals associated with the development. Client: Investec Property. Fee Value: ZAR 69,000.
- Commercia Ext. 9 Parking Relaxation Study, Tembisa, South Africa (2014): Traffic Engineer – parking relaxation study for the proposed wholesale development in Commercia Ext. 9. Client: Jazz Spirit. Fee Value: ZAR 39,000.
- Environmental Impact Assessment for the Kraft Paper Mill, Frankfort, Free State, South Africa (2014): Traffic Engineer – Traffic Impact Assessment. Client: Industrial Development Corporation. Fee Value: ZAR 72,000.
- Proposed Supplier Park Development, Kathu, Northern Cape, South Africa (2014): Traffic Engineer – Traffic Impact Assessment. Client: Synergistics for Anglo American, Kumba Iron Ore. Fee Value: ZAR 124,500.
- Rehabilitation of the Main Road Maqhaka to Hleoheng Road and Mt Moorosi to Qhoali Road, Lesotho (2014): Traffic Engineer – Intersection and route capacity analysis, Climbing lane determination, E80 loading, Traffic Calming Measures. Client: Ministry of Public Works and Transport Lesotho. Fee Value: ZAR 11.1 m.
- Butsanani Environmental Impact Assessment/Environmental Management Programme for the proposed Rietvlei Opencast Coal Mine, Mpumalanga, South Africa (2014): Traffic Engineer – Traffic Impact Assessment. Client: WSP Environment & Energy. Fee Value: ZAR 98,900.
- Access Management Plan and Traffic Impact Study for Balmoral Ext. 1, Germiston, South Africa (2014): Traffic Engineer – Access Management Plan and Traffic Impact Assessment. Client: Actom. Fee Value: ZAR 54,000.
- Township Establishment of Ravenswood Ext. 79, Boksburg, South Africa (2014): Traffic Engineer – Traffic Impact Study and Access. Client: Klaprops 243. Fee Value: ZAR 71,900.
- Access Management Plan and Section 7 Report for Portions A & D of Driefontein 85 IR, Boksburg, South Africa (2014): Traffic Engineer – Access Management Plan and Section 7 Report. Client: North Rand Property Investments cc. Fee Value: ZAR 40,800.
- Township Establishment of Vulcania Ext. 13, Brakpan, South Africa (2014): Traffic Engineer – Traffic Impact Study and Access Plan. Client: Euro Body Builders cc. Fee Value: ZAR 55,900.
- Transnet Ports Terminal Traffic Management Study for the Richards Bay Terminal, KwaZulu-Natal, South Africa (2014): Traffic Engineer – Traffic Management Study. Client: Transnet Port Terminals. Fee Value: ZAR 350,000.
- Anglo Alexander Environmental Impact Assessment Project in Kriel, Mpumalanga, South Africa (2014): Traffic Engineer – Traffic Impact Study for the proposed new coal mine. Client: Synergistics (SLR Group). Fee Value: ZAR 72,000.

- Mackenzie Park Muslim School, Benoni, South Africa (2013): Traffic Engineer – Traffic Impact Study. Client: Everite Building Products. Fee Value: ZAR 25,500.
- Goedeburg Ext. 50 Church Development, Benoni, South Africa (2013): Traffic Engineer – Traffic Impact Study. Client: Emseni Christian Centre. Fee Value: ZAR 45,500.
- Lifehouse Church, Johannesburg, South Africa (2013): Traffic Engineer – Traffic Impact Study. Client: Lifehouse Church. Fee Value: ZAR 26,800.
- Re-application for Security Access Restrictions at Angus road, Bedfordview, South Africa (2013): Traffic Engineer – Traffic Impact Study. Client: Angus Close Residents Association. Fee Value: ZAR 7,980.
- N3 Rehabilitation Warden to Keeversfontein, South Africa (2013): Traffic Engineer – Capacity analysis using High Capacity Manual Software and the Highway Traffic Model. Client: N3 Toll Concession. Fee Value: ZAR 50,000.
- Indigo Place Residential Development, Kew, South Africa (2013): Traffic Engineer – Traffic Impact Study. Client: H. Weinberg. Fee Value: ZAR 22,200.
- National Ports Plan, South Africa (2013): Traffic Engineer – Traffic and transportation status quo report and planning for Richards Bay and Durban Ports. Client: Transnet National Ports Authority. Fee Value: ZAR 100,000.
- The Stewards Ext. 13 Residential Development, South Africa (2013): Traffic Engineer – Revised Traffic Impact study (land use changes since 2011 study). Client: President Towers. Fee Value: ZAR 30,000.
- Parking Relaxation Study for Erf 1012, Bedfordview Ext. 189, South Africa (2013): Traffic Engineer – Parking reduction study. Client: Maxidor SA. Fee Value: ZAR 29 800.
- Freeway Park Security Closure, Ekurhuleni, South Africa (2013): Traffic Engineer – Site development plans at the access restriction locations. Client: Freeway Park Residents Association. Fee Value: ZAR 24,260.
- As-and-when Roads Rehabilitation Project, South Africa (2013): Traffic Engineer – Traffic Accommodation Plans for during construction. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 50,000.
- Division of Land on Farm Driefontein 85-IR, Boksburg, South Africa (2013): Traffic Engineer – Access Management Plan. Client: Lumina Export and Import cc. Fee Value: ZAR 20,000.
- Future Industrial Development in Comet, Boksburg, South Africa (2013): Traffic Engineer – Access Management Plan. Client: Copper Moon Trading 631. Fee Value: ZAR 57,000.
- Conference Centre on Bardene Ext. 92 and 98, South Africa (2013): Traffic Engineer – Traffic Impact Study. Client: Cloversgreen Investments. Fee Value: ZAR 42,400.
- Security Access Restrictions in Oriel North, Bedfordview, South Africa (2013): Traffic Engineer – Traffic Impact Study. Client: Oriel North Residents Association. Fee Value: ZAR 28,300.
- Industrial Development on Lilianton Ext. 12, Ptn. 10 Driefontein 85 IR, South Africa (2013): Traffic Engineer – Traffic Impact Study. Client: Able Wise Trading 47. Fee Value: ZAR 38 600.

- Township Regeneration Strategy, South Africa (2013): Traffic Engineer – Traffic and transportation status quo report and planning in Vosloorus, Kathlehong, Daveyton and Wattville. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 100,000.
- Newmarket Shopping Centre, Alberton, South Africa (2012): Traffic Engineer - Traffic Signal Design. Client: Internal. Fee Value: ZAR 45,000.
- Crux-Capella Security Access Restrictions, Solheim, South Africa (2012): Traffic Engineer - Traffic Impact Study. Client: Crux-Capella Residents Association. Fee Value: ZAR 28,000.
- Industrial Development on Germiston Ext. 41, South Africa (2012): Traffic Engineer - Traffic Impact Study. Client: Garsin Properties. Fee Value: ZAR 44,000.
- Proposed New Yzermyn Coal Mine, Mpumalanga, South Africa (2012): Traffic Engineer - Traffic Impact Study. Client: WSP Environmental. Fee Value: ZAR 150,000.
- Phuthaditchaba Taxi Rank, South Africa (2012): Engineer - Feasibility Study. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 497,040.
- Driefontein 87 IR Farm, Germiston, South Africa (2012): Engineer - Access Management Plan for various portions of farm. Client: Copper Moon Trading 631. Fee Value: ZAR 62,300.
- New Access Control Measures in Hillcrest Ave, Bedfordview, South Africa (2012): Engineer - Traffic Impact Study. Client: Cresthill Homeowners Association. Fee Value: ZAR 19,000.
- Laying Eskom Cables in Edenvale, South Africa (2012): Engineer - Traffic Management Plans. Client: CBI Electric – African Cables. Fee Value: ZAR 46,000
- Laying of Eskom Cables in Isando, South Africa (2012): Engineer - Traffic Management Plan. Client: CBI Electric – African Cables. Fee Value: ZAR 12,000.
- North Villa Close Re-application of Security Access Restrictions, South Africa (2012): Project manager - Traffic Impact Study. Client: Benoni North Community Precinct. Fee Value: ZAR 22,760.
- Re-application of Libradene Security Village Access Restrictions, South Africa (2012): Project manager - Traffic Impact Evaluation. Client: Libradene Security Village. Fee Value: ZAR 11,600.
- Mixed-use Development on Bassonia Ext. 1, South Africa (2012): Engineer - Traffic Impact Study. Client: Home Talk Developments. Fee Value: ZAR 45,000.
- Proposed Beyers Park Ext 112 and 120 over Westwood Small Holdings 41 and 40, South Africa (2012): Project manager - Traffic Impact Study. Client: Planet Waves 140 and STM Mining Equipment. Fee Value: ZAR 56,040.
- Extension and Upgrading of Dunswart Taxi Rank to a Full Scale Public Transport Modal Transfer Facility, South Africa (2011): Engineer - Feasibility Study. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 168,000.
- Proposed Development of Holding 46, Bartlett Ext. 1, South Africa (2011): Engineer - Traffic Impact Study. Client: Ronnie Matthews Investment Holdings. Fee Value: ZAR 24,700.

- Re-application for Security Access Restrictions at East Village, Sunward Park, Boksburg, South Africa (2011): Engineer - Traffic Impact Study. Client: East Village Residents Association. Fee Value: ZAR 5,450.
- Proposed Sintel Char Plant Expansion Grootegeluk Mine, Lephalale, South Africa (2011): Engineer - Traffic Impact Study. Client: Synergistics Environmental Services. Fee Value: ZAR 131,000.
- Proposed New Largo Mine, Mpumalanga, South Africa (2011): Engineer - Traffic Impact Study. Client: Synergistics Environmental Services. Fee Value: ZAR 206,602.
- Proposed Bedfordview Ext. 526, Farm Bedford 68 IR, South Africa (2011): Engineer - Traffic Impact Study. Client: Speyside Properties. Fee Value: ZAR 35,000.
- Proposed LED Advertising Sign on Oxford/ Corletta Dr. Illovo, South Africa (2011): Engineer - Traffic Impact Assessment. Client: Wideopen Platform. Fee Value: ZAR 10,700.
- Robor Main Entrance on Barbara Road, Elandsfontein, South Africa (2011): Engineer - Traffic signal/access investigation. Client: Robor. Fee Value: ZAR 31,000.
- Rezoning of Erf 759 Dalview on the K118, South Africa (2011): Engineer - Report in terms of Section 7 of the Gauteng Transport Infrastructure Act for the impact of the proposed rezoning. Client: Futureplan Urban Design and Planning Consultants. Fee Value: ZAR 11,800.
- Proposed New Eerstelingsfontein Opencast Coal Mine in Belfast, Mpumalanga, South Africa (2011): Engineer - Traffic Impact Study. Client: WSP Environment and Energy. Fee Value: ZAR 126,800.
- New Access Control Measures in Lavin Road, Bedfordview, South Africa (2011): Engineer - Traffic Impact Study. Client: Tag Security. Fee Value: ZAR 11,246.
- Supplementary Access to the Stewards Ext. 13 and 14, Benoni, South Africa (2011): Engineer - Traffic Impact Study. Client: H Weinberg. Fee Value: ZAR 25,000.
- Intersections (Signalised and Unsignalised) in Ekurhuleni, South Africa (2010): Engineer - Investigation, SIDRA analysis and optimisation of various intersections. Client: Ekurhuleni Metropolitan Municipality.
- Renewal of Access Control Measures, Disa Road, Bedfordview, South Africa (2010): Engineer - Traffic Impact Study. Client: Disa Road Closure Association. Fee Value: ZAR 17,625.
- Renewal of Access Control Measures, Leicester Road, Bedford Gardens, South Africa (2010): Engineer - Traffic Impact Study. Client: Safetyzone. Fee Value: ZAR 14,285.
- Determine if South-to-east Loop is required at Northern Terminal of N12/Kingsway Interchange after Implementation of Alliance Road Off-ramp, Daveyton, South Africa (2010): Engineer - Traffic Study. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 30,000.
- Portion 1 of the Farm Driefontein 87 IR, on Future Routes K110 and 127, Germiston, South Africa (2010): Engineer - Report in terms of Section 7 of the Gauteng Transport Infrastructure Act for the impact of the proposed division of land. Client: Business Venture Investments 752. Fee Value: ZAR 15,000.

- Rezoning of the Remainder of Erf 477 and Portion 2 of Erf 478 Eastleigh Township, South Africa (2010): Engineer - Traffic Impact Study. Client: Futureplan Urban Design and Planning. Fee Value: ZAR 30,000.
- Rezoning of the Remainder of Erf 477 and Portion 2 of Erf 478 Eastleigh Township on the future K68, South Africa (2010): Engineer - Report in terms of Section 7 of the Gauteng Transport Infrastructure Act for the impact of the proposed rezoning. Client: Futureplan Urban Design and Planning Consultants. Fee Value: ZAR 15,000.
- Portion 205, 227 and the Remainder of Portion 1 of the Farm Driefontein 87 IR and the Remainder of Portion 2 of Elandsfontein 90 IR, South Africa (2010): Engineer - Access Management Plan. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 45,000.
- Proposed Township Comet Ext. 14 on Portion 403 of the Farm Driefontein 85-IR, Boksburg, South Africa (2010): Engineer - Traffic Impact Study. Client: Copper Moon Trading 631. Fee Value: ZAR 40,000.
- Impact of the Proposed Comet Ext.14 on the K90, South Africa (2010): Engineer - Report in terms of Section 7 of the Gauteng Transport Infrastructure Act. Client: Copper Moon Trading 631. Fee Value: ZAR 15,000.
- Proposed Comet Ext. 11 and 14 and Portion 498 of the Farm Driefontein 85-IR, Boksburg, South Africa (2010): Engineer - Access Management Plan and Internal Road Network. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 30,000.
- Comet Extensions 6, 9 and 13, Boksburg, South Africa (2010): Engineer - Access Management Study. Client: Abbeydale Civils & Building. Fee Value: ZAR 30,000.
- Riley Road in Bedfordview, South Africa (2010): Engineer - Traffic study to investigate the undesirable operational conditions. Client: Ekurhuleni Metropolitan Municipality. Part of as-and-when contract.
- Rondebult Road in Boksburg, South Africa (2010): Engineer - Traffic study to investigate the undesirable operational conditions. Client: Ekurhuleni Metropolitan Municipality. Part of as-and-when contract
- Jeppe Quondam Club in Bedfordview, South Africa (2010): Engineer - Traffic Impact Assessment. Client: Penquin Airtime. Fee Value: ZAR 30,000.
- New Eastgate Roof Parking Layout, South Africa (2010): Engineer - Design, tender and project management. Client: Liberty Properties. Fee Value: ZAR 200,000.
- Pomona Eastern Outfall Sewer Line, Kempton Park, South Africa (2009): Engineer - Preliminary design. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 100,000.
- Proposed Interchange between the N12 and Alliance road to serve the Daveyton CBD, South Africa (2009): Project Engineer – managing the design of a half-diamond interchange on the N12. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 2.5 m.
- Preparation and Evaluation of Various Water-Related Tenders (2008): Civil Engineer at Ekurhuleni Metropolitan Municipality's Revenue Unit. Managing Various Leak Fixing and Water Demand Management Projects and Water Meter Installations. (2007): Water Demand Management Engineer at Ekurhuleni Metropolitan Municipality's Kempton Park depot.

Appendix H

NEMA REGS (2014) - APPENDIX 6 - SPECIALIST REPORTS CHECKLIST

Specialist reports and reports on specialist processes - Checklist		
	NEMA Regs (2014) - Appendix 6	Reference to section of specialist report or justification for not meeting requirement
1	A specialist report or a report on a specialised process prepared in terms of these Regulations must contain -	
(a) i	the person who prepared the report; and	Section 1.1 to 1.3
(a) ii	the expertise of that person to carry out the specialist study or specialised process;	Section 1.1 to 1.3 & Appendix G
(b)	a declaration that the person is independent in a form as may be specified by the competent authority;	Section 1.4
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Scope: 2.3 & Purpose: 2.1
(d)	the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4.1
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 2.4
(f)	the specific identified sensitivity of the site related to the activity and its associated structures and infrustructure	Section 5.1
(g)	an identification of any areas to be avoided, including buffers;	Buffers not applicable
(h)	a map superimposing the activity including the associated structures and infrustructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Map 1 - Locality, Appendix A
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Assumptions regarding: Housing - 5.1.2; Public Transport - Section 5.1.2; Decommissioning & Closure - 5.1.3; Latent Rights - Section 5.2; Trip Distribution & Assignment - 5.3; Traffic Growth - 5.4; Peak Hours - 5.5; Intersection Geometry - 6.3; Current Heavy Vehicle Loading - Section 9.2; Additional Heavy Vehicle Loading - 9.3
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;	Section 6.3 & 6.4
(k)	any mitigation measures for inclusion in the EMPr	Section 6.4
(l)	any conditions for inclusion in the environmental authorisation	
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation	NA
(n)	a reasoned opinion -	
.i	as to whether the proposed activity or portions thereof should be authorised and	Section 10.2
.ii	if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 10.2
(o)	a description of any consultation process that was undetaken during the course of carrying out the study;	No specific consultation was undertaken or deemed necessary as part of this study. Comments received by SLR as part of the EIA were considered in the undertaking of this study
(p)	a summary and copies if any comments that were received during any consultation process, and -	NA
(q)	any other information requested by the competent authority.	NA

Appendix I

ROAD MAINTENANCE MANAGEMENT PROPOSAL

BAKUBUNG PLATINUM MINE

ROAD MAINTENANCE MANAGEMENT PROPOSAL

1. INTRODUCTION

Routine road maintenance needs to be carried out by a team that can:

- appreciate the various aspects of road management, priorities, safety, environmental issues, materials and equipment;
- identify various problems that need attention;
- understand the reasons for the problems;
- select suitable actions or repair methods;
- prioritize actions required; and
- have a systematic approach to maintenance work.

Pavement structures, materials, traffic and climate are all important variables that affect the actions required in response. In addition a balance is required between a safe, efficient road network and responsible environmental practice.

2. ROAD MANAGEMENT

2.1 MANAGEMENT DUTIES AND INSPECTIONS

The maintenance team should inspect the site frequently so that problems are identified, the causes investigated and assessed and the actions required identified and carried out timeously. These inspections should also be carried out at night to view potentially hazardous locations, signs and markings, and in adverse weather conditions to assess drainage and the performance of the road elements, like signs and road markings, under these conditions.

Obvious problems should be noted as soon as they become evident and serious situations should be reacted to and reported immediately. A list containing the various aspects to be checked, the frequency of the inspections, previous inspection date and due date of next inspection should be drawn up. The following requirements should be taken into account in drawing up the check list:

ROAD ELEMENTS	FREQUENCY OF INSPECTIONS
Signs	Annually
Road markings	Annually
Guardrails	Weekly
Structures	Annually
Road condition	Annually
Drainage	Monthly
Instabilities	Dependent of degree of problem
Fencing	Monthly
Illegal signage	Weekly

2.2 PAVEMENT INFORMATION (STRUCTURE AND CONDITION)

A basic knowledge of the pavement structure along the route is essential. Where “as-built” plans are available the team should have a copy. The type of surfacing, base and sub-base together with the age of the pavement should all be known. This information should be supplemented by in-situ testing of the surfacing and underlying pavement layers by standard methods such as dynamic cone penetrometer tests (DCP’s).

The team should know the overall condition of the various sections of the route and rates of deterioration. This information assists in the decision on what actions need to be taken particularly with regard to the extent and prioritization of repairs.

Inability to correctly identify problems and understand the cause can, and has resulted in unnecessary or wrong repair methods being used. Having correctly identified the problem it is equally important to select an appropriate treatment. Because situations are not always the same more than one treatment may need to be considered.

2.3 MAINTENANCE RATES AND QUANTITIES

Familiarity with rates and quantities is needed not only to control the expenditure on the project but also to test the cost implications of various repair methods. Frequently more than one repair method is possible and cost should be a key factor to be weighed against other issues such as materials availability, weather, traffic and constructability, in making the correct choice.

The team should have a good idea of which materials are available, their cost and their source locations. Before considering the use of material from a borrowpit or quarry, the status of the material source should be clarified in terms of approval by the Department of Mineral Resources. Advance laboratory testing also needs to be done as part of quality control.

3. PRIORITIES

It is likely that road maintenance in particular will always be faced with budgetary constraints. As a result it is vitally important that maintenance is cost effective and that work is prioritized in situations of limited funding.

The three main objectives of routine road maintenance are to:

- Provide a safe and acceptable level of service for the travelling public;
- Maintain the condition of the road such that maximum life is obtained from the road; and
- Ensure that the road environment is attractive.

Top priority is to keep the road safe at all times. Situations which may result in accidents or cause damage to vehicles should be handled first. Generally this will mean that a failed road surface will receive top priority. Secondary issues such as smooth surfaces and rutting also pose a safety threat

To prioritize other maintenance actions the question should be asked “will this action protect the pavement and prevent further deterioration?” Any situation where significant amounts of water can get into the pavement is critical and, if left unattended, will result in rapid deterioration of the pavement structure.

4. GENERAL ROAD PAVEMENT REPAIRS

4.1 MATERIALS

While there are numerous repair materials the following are the most significant in this particular case:

- **Base Material:** Experience indicates that the use of unsuitable material is the primary cause of early failure of base repairs; and
- **Modified Cape Seal:** This consists of a tack coat of emulsion with a chip size dependant on the layer thickness required and a slurry.

4.2 REPAIR OF ROAD FAILURES

Failure is a term widely used but one that is not clearly defined. Failure can be described as a situation where an element (or elements) in the road system no longer performs satisfactorily and can lead to a rapid deterioration in the function of other elements in the system, or affect road safety.

Failure can be indicated by the breaking up of the road surface and in some cases the underlying pavement layers. While some of the conditions preceding failure, such as surface cracking, may be due to other causes failure of the road surface is usually associated with the action of vehicle wheels and in particular heavy vehicles. Water increases the rate of deterioration of the road pavement and many more failures can be expected during or just after wet weather.

Two broad categories can be used to group failures as follows:

- **Non- structural**, such as surfacing failures and potholes; and
- **Structural**, such as pavement failures.

The actions required are described under the following headings:

- **Failures:** surfacing failures, potholes, and pavement failures;
- **Active cracks:** Stabilisation cracks, volcano cracks, expansive soil cracks, and longitudinal cracks;
- **Passive cracks:** surfacing cracks, crocodile cracks, long cracks, pumping, deformation, rutting, settlement, and undulations;
- **Texture:** bleeding and raveling; and
- **Shoulders:** edge break, gravel loss/steep shoulders, and flat/high/obstructed.

5. ROAD RESERVE MANAGEMENT

Management of the road reserve is also important to enable the road structure to be protected and to provide a safe operating environment for the road user. Issues to be considered include:

- **Guardrails:** An assessment of the overall guardrail system condition should be made on an annual basis to identify deterioration and allow early forecasting of any replacement costs;
- **Fencing:** This can be damaged or lost as a result of ageing, accidents, theft or cutting to provide access for grazing animals or people to the road reserve. Where fences are damaged due to accidents where they act as barriers to livestock they should be repaired immediately, unrestricted movement of livestock can be extremely dangerous.
- **Grass cutting:** This should be carried out for reasons of visibility, drainage, plant invader control, security and fire hazard. Grass can however form an essential part of the road reserve environment, preventing dust and erosion; and
- **Pruning of trees and shrubs:** This only really needs to be done where they overhang the road, obscure signs, or affect lines of sight.

6. TRAFFIC DATA

Understanding the nature of the traffic that uses the various sections of a road is also an important issue connected to effective road maintenance and management. Ideally classified traffic counts should be carried out for at least a continuous period of 7-days on a regular basis depending of the level of development in the area. In this case a frequency of 3-5 years should be sufficient. At the same time it would also be beneficial to undertake vehicle weigh-in-motion measurements to maintain records of the cumulative loading on the road structure. This is relevant when deciding on the type of repairs that are most cost-effective.

Appendix J

IMPACT ASSESSMENT METHODOLOGY AND IMPACT SUMMARY

METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

The proposed method for the assessment of environmental issues is set out in the Table 8-5. This assessment methodology enables the assessment of environmental issues including: cumulative impacts, the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

TABLE 8-5: CRITERIA FOR ASSESSING IMPACTS

Note: Part A provides the definition for determining impact consequence (combining severity, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D.

PART A: DEFINITION AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of severity, spatial extent and duration**
Criteria for ranking of the SEVERITY of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national

PART B: DETERMINING CONSEQUENCE

SEVERITY = L

DURATION	Long term	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**

SEVERITY = M

DURATION	Long term	**H**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**

SEVERITY = H

DURATION	Long term	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Medium**	**Medium**	**High**

			L	M	H
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/ national
			SPATIAL SCALE		

PART C: DETERMINING SIGNIFICANCE					
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**H**	**Medium**	**Medium**	**High**
	Possible/ frequent	**M**	**Medium**	**Medium**	**High**
	Unlikely/ seldom	**L**	**Low**	**Low**	**Medium**
			L	**M**	**H**
			CONSEQUENCE		

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
High	It would influence the decision regardless of any possible mitigation.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

***H = high, M= medium and L= low and + denotes a positive impact.**

Activity	**Traffic & Transportation**			
Potential impact	Deterioration of Traffic Operations (measured by Level of Service) at the intersection of R565 and R556			
Aspects affected	Intersection Capacity & Vehicle Delay			
Phase	Construction	Operation	Decommissioning	Closure
Significance (unmitigated)	M	M	L	L
Overall Mitigation Objective	Since the trip volumes can not be limited the road environment needs to be upgraded to accommodate the traffic from the mine.			
Mitigation type	The proposed mitigation measures are remedial since it will improve the intersection capacity to accommodate the impact better. The proposed mitigation measures is to implement upgrades at the intersection of the R556 & R565, as described in the Traffic Impact Study Report, Section 6.4 and recommended in Section 10.2.			
Mitigation Implimentation Timeframe	Before mine operations start			
Significance (mitigated)	H+			
The degree to which the impact…	can be reversed	not		
	causes irreplacible loss of resource	unlikely		
	can be avoided	unlikely		
	can be managed	possibly		
	can be mitigated	definate		
Monitoring and Inspection Requirements	None			