# ANGLO AMERICAN INYOSI COAL (AAIC) ALEXANDER PROJECT

## TRAFFIC IMPACT STUDY REPORT

JULY 2016

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**Synergistics Environmental Services (Synergistics)**
SLR Africa (Block 7)
Fourways Manor Office Park
Cnr Roos and Macbeth Streets
**Johannesburg**
2060

**Revision 3**

Project no: 16754.R
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**WSP | Parsons Brinckerhoff**
Bryanston Place Office Park
199 Bryanston Drive
**BRYANSTON**
2191

Tel. No.: +27 (0) 11 450 2290
E-mail: civil-bok@wspgroup.co.za
**www.wspgroup.com**
**www.pbworld.com**

# QUALITY MANAGEMENT

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| Prepared by | Ansia Labuschagne | Ansia Labuschagne | Ansia Labuschagne | Ansia Labuschagne |
| Signature | | | | [signature] |
| Checked by | Rod Strong *(Pr Eng)* | Cornelia Hutchinson *(Pr Eng)* | Cornelia Hutchinson *(Pr Eng)* | Cornelia Hutchinson *(Pr Eng)* |
| Signature | | | | [signature] |
| Authorised by | Cornelia Hutchinson *(Pr Eng)* | Cornelia Hutchinson *(Pr Eng)* | Cornelia Hutchinson *(Pr Eng)* | Cornelia Hutchinson *(Pr Eng)* |
| Signature | | | | [signature] |
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# PRODUCTION TEAM

## WSP | PARSONS BRINCKERHOFF

| | |
|---|---|
| Junior Traffic Engineer | Ansia Labuschagne |
| Senior Traffic Engineer | Cornelia Hutchinson |
| Pavement Engineer | Ian Steyn |
| Reviewer | Rod Strong |

## SUBCONSULTANTS

| | |
|---|---|
| Traffic Counts | Trafftrans |

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# 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 F.

- 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);
- 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.

Cornelia Hutchinson

# 2 INTRODUCTION

## 2.1 PURPOSE

WSP Group Africa (Pty) Ltd was appointed by Synergistics Environmental Services (Synergistics), a SLR Group Company, to conduct a Traffic Impact Study for the proposed new Anglo American Inyosi Coal (AAIC) Alexander coal mine project near Kriel in Mpumalanga.

## 2.2 LOCALITY

The site is located adjacent to the south and east of Kriel along the R545 between Bethal and Ogies. The access to the mine will be off the R545 and will be situated to the east of the R547 which provides access to Kriel (See Appendix A: Locality Plan).

## 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) is included in Appendix G, 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 were 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.
- 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 (2016)/baseline traffic operating conditions on the road network in the study area. This was done by means of SIDRA software.

### 2.5.4 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 employees. Information provided included the following:

- Number of employees, distinguishing between day-time office staff, skilled staff and semi-skilled/unskilled shift workers.
- Operational days and hours/shifts
- Method of coal transportation
- Origins/destinations of employees and coal

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.

### 2.5.5 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. The data from the visual inspections was used for preliminary assessment of the existing road pavement and its ability to handle the estimated heavy loads from the proposed mine.

### 2.5.6 Access Requirements

The suitability of the location of the proposed access to the mine was evaluated and recommendations are made in terms of operational safety.

# 3 DESCRIPTION OF DEVELOPMENT

## 3.1 EXISTING LAND USE

The land surrounding the site is mostly cultivated agricultural land, with small areas of uncultivated land in some places. The site is located directly to the south and east of the town Kriel. The existing Kriel Colliery is situated to the west of Kriel, close to Kriel Power Station. Elders Colliery is located to the north-east of the proposed Alexander Mine. Goedehoop Colliery is located north of Elders Colliery, close to Middelburg. A locality map indicating the locations of the various mines in the vicinity of the project site is attached in Appendix A.

## 3.2 PROPOSED DEVELOPMENT

The Alexander Mine resource is a replacement for the depleting coal resources at the proposed Elders Colliery. The proposed Alexander coal mine will produce 6.0Mt per annum at maximum operating capacity. Construction is estimated to be 3 years. The expected life of the Alexander Mine is between 30 and 35 years.

The run-of-mine coal from Alexander will be transported by means of an overland conveyor to the stockpile area at Elders Colliery, from where is will be transported via the Elders overland conveyor to the beneficiation plant at Goedehoop Colliery.

It is expected that the coal that will be mined at Alexander will be of a quality suitable for export. The coal will be loaded at the Goedehoop loading terminal and transported to Richards Bay Coal Terminal (RBCT) via the existing railway.

## 3.3 EXISTING ROAD NETWORK

The proposed mine is to be situated on both sides of the R545 between Bethal and Kriel. The section of the R545 past the site is a paved two lane, undivided road, with a speed limit of 120km/h. The road is in a fair condition with significant amounts of localized patching, some localised rutting and potholes. The access to the site will be via a new intersection from the R545 using a gravel road which will be upgraded in future (with the construction of the mine).

The intersection of the R545 and R547 to Kriel (Intersection 1) south-west of Kriel will be considered in this report. The intersection can be seen on Figure 1 in Appendix B.

The R547 is a paved two lane, undivided road with a speed limit of 60km/h. The road is in a fair condition with isolated potholes and edge breaks along sections of the road.

The distance between Kriel and Bethal is approximately 32km.

# 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 15 June 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 C.

## 4.2 TRAFFIC COUNTS

A manual, classified traffic count was carried out on Thursday, 9 June 2016 from 06:00 to 18:00 (12-hours) at the critical intersection in the vicinity of the site. The position of this counting station can be seen in Figure 1 in Appendix B, i.e. the intersection of the R545 and R547 (to Kriel) (Intersection 1).

The peak hours are summarised in Table 4.1 below and the peak hour traffic volumes at the intersection are shown in Figures 2 to 4 in Appendix B.

**Table 4.1: Peak Hour Traffic Volumes**

| | TIME | TOTAL VOLUME |
|---|---|---|
| AM Peak Hour | 06:15 – 07:15 | 1 287 |
| Mid-Day Peak Hour | 12:45 – 13:45 | 844 |
| PM Peak Hour | 16:15 – 17:45 | 1 442 |

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. This information is subdivided into the construction phase and the operating phase and discussed below.

### 5.1.1 Construction

It is expected that the construction phase will continue for 3 years.

All large machinery will be trucked in during the construction period and will remain on site. An estimated 5 low bed transporters will be used for this purpose. Earth moving equipment will also be trucked to site and then confined there, an estimated 10 trips with a low bed transporter will be required. A further 10 large transporters will be used to bring large pieces of construction material to site (conveyors, shaft structure, building materials, bricks etc.)

Approximately 15 trucks will be used to deliver construction materials to site as well as for refuse removal. A further 10 trucks will be used to deliver other construction consumables to site.

Machinery arriving on site by their own power will include: 3 mobile cranes, 5 bulk explosive trucks and 5 concrete mixer trucks during the construction period.

The labourers will be transported to and from site by means of ±14 public transport vehicles from nearby towns (estimated 28 trips per day). Private vehicle trips during construction are estimated to be 22 vehicle trips per day, i.e. 11 vehicles inbound and outbound from the site.

The total volume of traffic expected to be generated during the construction period is considered to be insignificant in terms of the impact on the road capacity and pavement.

### 5.1.2 Operating Phase

Alexander Mine is expected to reach full production four years after construction has commenced. The volume produced per annum is expected to be 6.0 Mt.

#### 5.1.2.1 Coal Transportation

The coal will be transported from site to the stockpile area at Elders Colliery and to the Goedehoop beneficiation plant using conveyors, and will thus have no traffic impact.

#### 5.1.2.2 Labour Transportation

At full production the mine will have a maximum of 600 employees, all of which will be transferred from the existing Elders Colliery. The mine will operate in three 8-hour shifts as follows:

- 06:00 to 14:00 (first shift);
- 14:00 to 22:00 (second shift); and
- 22:00 to 06:00 (third shift).

The first shift will consist of 150 permanent day shift employees and 150 employees on a 3 shift rotation. The second and third shifts will each have 150 employees on a 3 shift rotation (see Table 5.1).

**Table 5.1: Staff Composition**

| SHIFT | SHIFT 1 (06:00 – 14:00) | SHIFT 2 (14:00 – 22:00) | SHIFT 3 (22:00 – 06:00) |
|---|---|---|---|
| Permanent Day Shift Employees | 150 | 0 | 0 |
| Rotating Shift Employees | 150 | 150 | 150 |
| **TOTAL** | **300** | **150** | **150** |

The trip generation and distribution characteristics of the employees were based on information provided by the client. It was assumed that the employees will reside in the neighbouring towns including Emalahleni (Witbank), Middelburg, Kriel and Bethal. The trip assignment was estimated as follows:

- From the north: Middelburg, Emalahleni (Witbank) and Kriel - 85%
- From the south-east: Bethal - 15%

The distribution of the employees to the neighbouring towns can be seen in Table 5.2. It was assumed that employees residing in both Emalahleni and Middelburg will use the R547 through Kriel since this is the shortest route.

The employees were therefore grouped into (i) those travelling between the mine access and the north via the R547 and R545; and (ii) those travelling between the mine access and the south-east (Bethal) along the R545.

**Table 5.2: Staff Distribution**

| SHIFT | ORIGIN/ DESTINATION | SHIFT 1 (06:00 – 14:00) | SHIFT 2 (14:00 – 22:00) | SHIFT 3 (22:00 – 06:00) |
|---|---|---|---|---|
| Permanent Day Shift Employees | North | 128 | 0 | 0 |
| | South-East | 22 | 0 | 0 |
| Rotating Shift Employees | North | 128 | 128 | 128 |
| | South-East | 22 | 22 | 22 |
| **TOTAL** | | **300** | **150** | **150** |

The following assumptions were made in terms of the trip generation characteristics of the employees:

- 25% of permanent day shift employees will make use of private vehicles with 1.0 person per vehicle.
- The remainder of the permanent day shift employees, as well as the rotating shift employees, will make use of public transport in the form of minibus taxis. The vehicle occupancy for a minibus taxi was assumed to be 15 persons.

The trip generation based on these assumptions can be seen in Table 5.3.

**Table 5.3: Employee Vehicle Trip Generation**

| SHIFT | Origin/ Destination | Trip Mode | SHIFT 1 (06:00 – 14:00) | SHIFT 2 (14:00 – 22:00) | SHIFT 3 (22:00 – 06:00) |
|---|---|---|---|---|---|
| Permanent Day Shift Employees | North | Private | 32 | 0 | 0 |
| | | Taxi | 7 | 0 | 0 |
| | South-East | Private | 6 | 0 | 0 |
| | | Taxi | 2 | 0 | 0 |
| Rotating Shift Employees | North | Private | 0 | 0 | 0 |
| | | Taxi | 9 | 9 | 9 |
| | South-East | Private | 0 | 0 | 0 |
| | | Taxi | 2 | 2 | 2 |
| **TOTAL** | | | **58** | **11** | **11** |

## 5.2 TRIP DISTRIBUTION AND ASSIGNMENT

The run-of-mine coal will be transported by a new overland conveyor to the stockpile area at the Elders Colliery from where it will be transported via the existing Elders overland conveyor to the Goedehoop Colliery for beneficiation purposes. The coal will therefore not be transported on the road network.

The trips originating from the north (Middelburg, Emalahleni and Kriel) were assigned to the intersection of the R547 and R545. The trips generated by the shift starting in the peak hour were added to the left-turning movement on the northern approach (R547), i.e. from Kriel towards Alexander. The trips generated by the shift ending in the peak hour were added to the right-turning movement from the eastern approach (R545), i.e. from Alexander towards Kriel.

As the mine only generates peak traffic at the beginning and the end of each shift, the mine will not have an influence on the PM peak period of the surrounding road network, which occurs from 16:15 on weekdays.

The trips generated by the mine during the AM and midday peak periods are shown in Figures 5 and 6 in Appendix B.

## 5.3 TRAFFIC GROWTH

An annual growth rate of 3 % was assumed for background traffic. The base year and horizon year considered in the capacity analysis were selected in accordance with TMH 16[(1)], and are as follows:

- **Base year:** 2016; and
- **Horizon year:** 5-year horizon, i.e. 2021

The assigned generated traffic was combined with the background traffic to produce the expected total AM and midday peak hour traffic volumes for the horizon year (2021). The horizon year traffic volumes without Alexander Mine are shown in Figures 7 and 8. The horizon year traffic volumes with Alexander Mine are shown in Figures 9 and 10. All figures are included in Appendix B.

# 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(5) 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 (LOS) 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 midday peak hours of the following scenarios have been considered for analysis:

- **Scenario 1:** Baseline/Existing Traffic (2016);
- **Scenario 2:** Horizon year (2021) excluding Alexander Mine; and
- **Scenario 3:** Horizon year (2021) including Alexander Mine.

Analysis of the operational conditions with respect to the above has been undertaken using SIDRA 7 software. The analysis results for the intersection are attached herewith in Appendix E.

## 6.3 SIDRA ANALYSIS RESULTS

The intersection of the R545 and R547 (to Kriel) is an all-way stop-controlled T-junction. The intersection has two slip-lanes:

- The left-turn lane from the R547; and
- The left-turn lane from the R545 eastbound.

SIDRA does not allow slip-lanes to be used in conjunction with all-way stop-control. The slip lanes were therefore assessed as additional turning lanes.

Figure 11 below shows the schematic layout of the existing stop-controlled intersection as it was used in the analysis.

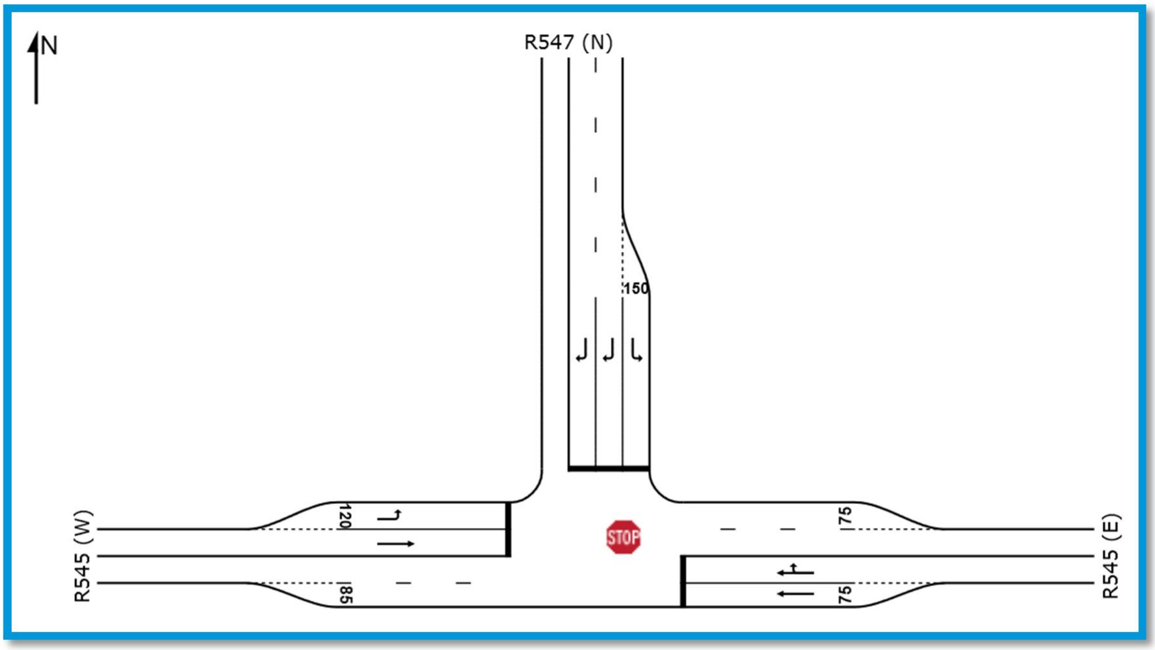



Figure 11: Schematic Layout of Intersection (without slip-lanes)

### 6.3.1 Existing Layout – All-Way Stop-Control

The intersection was analysed for the baseline scenario using the schematic layout in Figure 11. The results for the AM peak hour and the midday peak hour is summarised in Table 6.1 below. The detailed analysis results are included herewith in Appendix E-1.

Table 6.1: Baseline/Existing Traffic Conditions

| Approach | Movement | Existing/Baseline Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| | | AM Peak Hour | | | Midday Peak Hour | | |
| | | $^V/_C$ | Delay (sec) | LOS | $^V/_C$ | Delay (sec) | LOS |
| R545 (East) | T | 0.902 | 64 | F | 0.356 | 19 | C |
| | R | 0.902 | 84 | F | 0.356 | 20 | C |
| R547 (North) | L | 0.076 | 10 | A | 0.080 | 12 | B |
| | R | 1.601 | 217 | F | 0.629 | 21 | C |
| R545 (West) | L | 3.643 | 1266 | F | 1.635 | 336 | F |
| | T | 0.764 | 108 | F | 0.397 | 26 | D |
| Overall LOS | | F | | | F | | |
| Average Delay (sec) | | 397 | | | 142 | | |

From the results for the AM peak hour analysis it can be seen that the intersection does not currently operate at acceptable levels of service. All the movements, except the left-turn from the northern approach, operate at a LOS F. The $^V/_C$ ratios of the left-turn from the western (R545) approach, as well as the right turn from the R547, are much greater than the acceptable limit of 0.95. These high $^V/_C$ ratios indicate existing capacity constraints at the intersection.

The average delay varies significantly between movements. The average delay of the left-turn movement from the western approach (R545) is extremely high, which results in an average intersection delay of over 6 minutes.

The poor operating conditions at the intersection during the AM peak is further supported by the presence of the TW304 temporary warning sign indicating that the intersection is controlled by an officer (pointsman) between 06:00 and 07:30 (which overlaps with the analysed peak hour, i.e. 06:15 and 07:15). The sign can be seen in Photo 21 in Appendix C.

Road signs indicating that a dangerous intersection lies ahead have been erected on both approaches to the intersection along the R545. The sign can be seen in Photo 5 in Appendix C.

During the midday peak hour the intersection operates at better levels of service, except for the left turning movement on the R545 towards Kriel, which operates at a LOS F and a $^{V}/_{C}$ ratio greater than 0.95.

Based on the poor operating conditions of the intersection during the AM peak hour it can be concluded that the current type of intersection control is not adequate for the existing peak hour traffic volumes.

In terms of the South African Road Traffic Signs Manual (SARTSM)[(3)] the installation of a traffic signal is deemed warranted when any one of the following queue length warrants are met:

- **Warrant 1:** The average length of any individual queue equals or exceeds four (4) vehicles over any one hour of a normal day.
- **Warrant 2:** The sum of the average lengths of all queues equals or exceeds six (6) vehicles over any one hour of a normal day.
- **Warrant 3:** The sum of the average lengths of all queues equals or exceeds four (4) vehicles over each of any eight hours of a normal day. The eight hours do not have to be consecutive, but they may not overlap.

The SIDRA results indicate that there currently exist average queue lengths exceeding 4 vehicles on all 3 approaches at the intersection during the AM peak hour. Traffic signals are therefore already warranted at this intersection in terms of queue length Warrant 1.

Considering the above, the intersection needs to be upgraded for existing traffic and was re-analysed with (i) traffic signals; and (ii) as a roundabout. The results for both analyses are discussed below.

### 6.3.2 Signal Controlled Intersection

The intersection was analysed with traffic signal control using the schematic layout indicated in Figure 12 below, including the existing slip-lanes.

The traffic signal timing was optimised using SIDRA for a two-phased signal plan i.e. one phase for the R545 (east and west approaches) and one phase for the turning movements along the R547 (north approach).

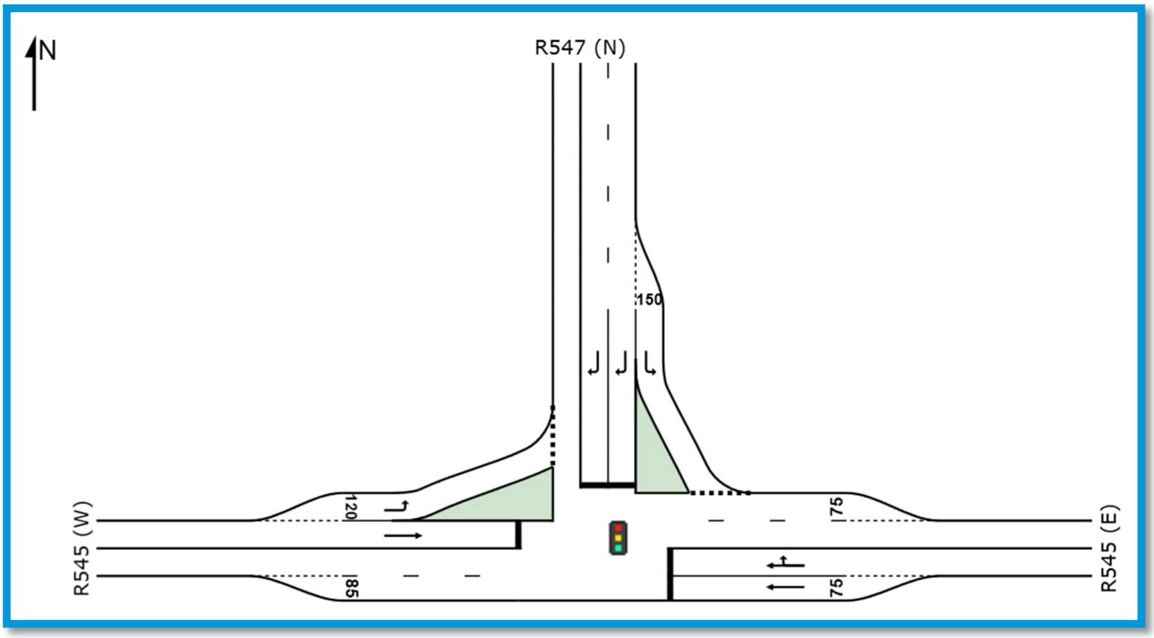



**Figure 12: Schematic Layout of Signalised Intersection – Including Existing Slip-Lanes**

The results for Scenario 1 (Baseline/Existing Traffic – 2016) is summarised in Table 6.2 below. The detailed analysis results are included herewith in Appendix E-2.

**Table 6.2: Summarized Results - Existing Traffic - Signalised Intersection**

| Approach | Movement | Existing/Baseline Conditions | | | |
|---|---|---|---|---|---|
| | | AM Peak Hour | | Midday Peak Hour | |
| | | $^{v}/_{c}$ | LOS | $^{v}/_{c}$ | LOS |
| R545 (East) | T | 0.659 | C | 0.178 | B |
| | R | 0.659 | C | 0.178 | B |
| R547 (North) | L | 0.024 | A | 0.080 | C |
| | R | 0.673 | B | 0.442 | C |
| R545 (West) | L | 0.276 | A | 0.448 | B |
| | T | 0.288 | C | 0.126 | A |
| Overall LOS | | B | | B | |
| Average Delay (sec) | | 15 | | 18 | |

The service level on all approaches to the intersection is expected to improve to at least LOS C during the AM peak hour and the delay will be reduced significantly, i.e. average delay of only 15 seconds. The midday peak hour will operate at a LOS of at least C.

The horizon year scenarios (2021) were also analysed as a signalised intersection. The results are summarized in Table 6.3 below.

**Table 6.3: Summarised Results – Horizon Year Traffic - Signalised Intersection**

| Approach | Movement | AM Peak Hour | | | | Midday Peak Hour | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Excluding Alexander Mine | | Including Alexander Mine | | Excluding Alexander Mine | | Including Alexander Mine | |
| | | $^{V}/_{C}$ | LOS | $^{V}/_{C}$ | LOS | $^{V}/_{C}$ | LOS | $^{V}/_{C}$ | LOS |
| R545 (East) | T | 0.840 | C | 0.832 | C | 0.219 | B | 0.333 | B |
| | R | 0.840 | D | 0.832 | D | 0.219 | B | 0.333 | C |
| R547 (North) | L | 0.040 | B | 0.090 | B | 0.093 | C | 0.088 | C |
| | R | 0.878 | C | 0.886 | C | 0.513 | C | 0.513 | C |
| R545 (West) | L | 0.801 | D | 0.819 | D | 0.520 | B | 0.520 | B |
| | T | 0.218 | C | 0.222 | C | 0.147 | A | 0.147 | A |
| Overall LOS | | 30 | | 29 | | 18 | | 19 | |
| Average Delay (sec) | | C | | C | | B | | B | |

From the table it can be seen that, should the intersection be signalised, the impact of the additional trips generated by the proposed Alexander Mine will be negligible. The LOS on all approaches will remain at an acceptable LOS of at least D and the $^{V}/_{C}$ ratio will remain below 0.95.

### 6.3.3 Roundabout

The intersection was analysed as a roundabout with the layout as shown in Figure 13. The layout is based on the existing layout of the intersection.

The layout is only schematic and the geometric details will be subject to detail design. It is proposed to have two circulating lanes and an island diameter of 30m in order to accommodate the large heavy vehicles observed at the intersection (see Photo 1 in Appendix C). A layout with a single circulating lane was also tested but does not yield acceptable levels of service.

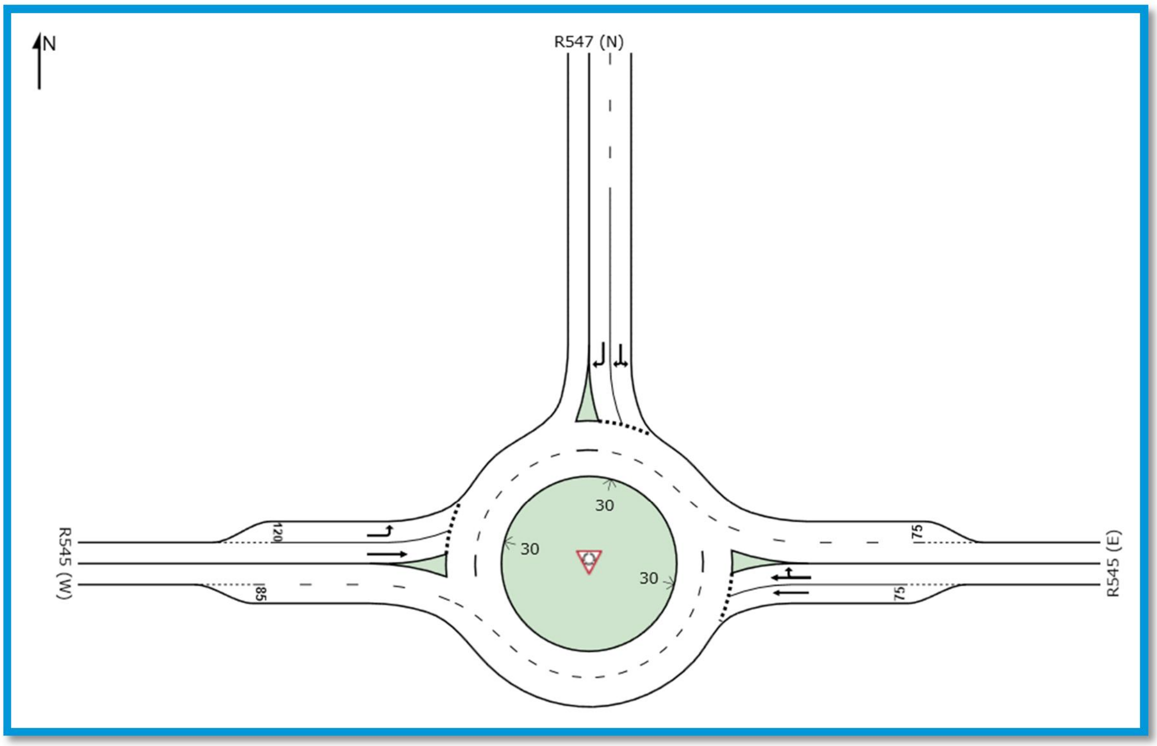



**Figure 13: Schematic Layout of Roundabout**

The results for Scenario 1 (Baseline/Existing Traffic – 2016) is summarised in Table 6.4 below. The detailed analysis results are included herewith in Appendix E-3.

**Table 6.4: Summarized Results - Existing Traffic - Roundabout**

| Approach | Movement | Existing/Baseline Conditions | | | |
|---|---|---|---|---|---|
| | | AM Peak Hour | | Midday Peak Hour | |
| | | $^V/_C$ | LOS | $^V/_C$ | LOS |
| R545 (East) | T | 0.235 | A | 0.092 | A |
| | R | 0.235 | B | 0.092 | B |
| R547 (North) | L | 0.333 | A | 0.127 | A |
| | R | 0.428 | A | 0.163 | A |
| R545 (West) | L | 0.239 | A | 0.238 | A |
| | T | 0.088 | A | 0.093 | A |
| Overall LOS | | A | | A | |
| Average Delay (sec) | | 8 | | 6 | |

The roundabout with two circulating lanes operates at very good levels of service during the AM peak hour, with the majority of the movements operating at a LOS A and very little delay (8 seconds average delay).

The horizon year scenarios (2021) were also analysed as a roundabout. The results are summarized in Table 6.5 below.

**Table 6.5: Summarized Results - Horizon Year Traffic - Roundabout**

| Approach | Movement | AM Peak Hour | | | | Midday Peak Hour | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Excluding Alexander Mine | | Including Alexander Mine | | Excluding Alexander Mine | | Including Alexander Mine | |
| | | $^V/_C$ | LOS | $^V/_C$ | LOS | $^V/_C$ | LOS | $^V/_C$ | LOS |
| R545 (East) | T | 0.299 | A | 0.297 | A | 0.112 | A | 0.145 | A |
| | R | 0.299 | B | 0.297 | B | 0.112 | B | 0.145 | B |
| R547 (North) | L | 0.390 | A | 0.405 | A | 0.149 | A | 0.150 | A |
| | R | 0.502 | A | 0.520 | A | 0.192 | A | 0.193 | A |
| R545 (West) | L | 0.280 | A | 0.278 | A | 0.277 | A | 0.301 | A |
| | T | 0.104 | A | 0.102 | A | 0.110 | A | 0.124 | A |
| Overall LOS | | A | | A | | A | | A | |
| Average Delay (sec) | | 9 | | 8 | | 6 | | 7 | |

From the table it can be seen that the impact of the additional trips generated by the proposed Alexander Mine will be negligible if the intersection is upgraded to a roundabout. The LOS on all approaches will remain at a LOS of at least B and the $^V/_C$ ratio will remain below 0.95 for all movements.

### 6.3.4 Type of Intersection Control

The following comments are relevant to the choice of intersection control:

- The existing all-way stop-control intersection does not have adequate capacity as indicated by the SIDRA analysis and supported by the existing road signage described.
- To signalise the intersection will not require any road upgrades, but considering the remote location of the intersection maintenance will be challenging.
- The roundabout will require extensive road widening, but will be low maintenance in the long term.

Taking into account that the operational conditions with the respective types of control do not differ significantly, the preferred option from a traffic management and control point of view is therefore the roundabout.

## 6.4 MITIGATION MEASURES

The Manual for Traffic Impact Studies(2) states that the traffic impact of any proposed development should be mitigated under the following circumstances:

- If the LOS of any element of the facility drops below D;
- If the volume to capacity ($^V/_C$) ratio of any element of the facility increases above 0.95; and
- 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.

Seeing as the current intersection control is inadequate under existing traffic volumes, the intersection should be upgraded, regardless of the proposed mine, which is considered to be the responsibility of the relevant road authorities (Emalahleni Local Municipality and/or Nkangala District).

The impact of the mine on the upgraded intersection analysed in this report (roundabout or signalised), would be minimal and would not require additional upgrades. However, considering that the intersection cannot accommodate any additional development traffic in its current form liaison and agreement with the roads authorities would be required to agree a way forward in providing the required road infrastructure.

# 7 MINE ACCESS

Two alternatives for access to the mine have been considered, as follows (see Figure 14 below):

- **Option 1:** Via a proposed new intersection along the R545 within the conveyor route servitude; or
- **Option 2:** Using the existing intersection currently providing access to the school.


**Figure 14: Mine Access Alternatives onto the R545**

## 7.1 ACCESS CONFIGURATION

This section only considers the intersection configuration required for the efficient and safe operation of the intersection and is the same for Options 1 and 2. The position of the access point is discussed in detail in Section 7.2.

The intersection was analysed in SIDRA using a basic T-junction layout with single approach and exit lane on all three legs. The analysis was done using the horizon year traffic volumes, including the expected trip generation of Alexander Mine.

The analysis was done for the AM peak hour as this peak has higher volumes of through traffic and for the midday peak hour, which has higher expected traffic volumes on the access to the mine (outbound). The analysis showed that the intersection will operate at a LOS A.

The summarised results can be seen in Table 7.1 below and the detailed results of the analysis have been attached herewith in Appendix E-4.

The speed limit on the R545 passing the site is 120km/h. It is suggested that a passing lane should be added in order to increase road safety due to the high speed along the road. The passing lane will allow the through traffic to move past vehicles turning into the site freely. The suggested passing lane can be seen in Figure 15.

**Table 7.1: Summarised Results of Access Intersection**

| Approach | Movement | Horizon Year | | | |
|---|---|---|---|---|---|
| | | AM Peak Hour | | Midday Peak Hour | |
| | | v/c | LOS | v/c | LOS |
| **Access (South)** | **L** | 0.013 | A | 0.068 | A |
| | **R** | 0.013 | A | 0.068 | A |
| **R545 (East)** | **L** | 0.187 | A | 0.112 | A |
| | **T** | 0.187 | A | 0.112 | A |
| **R545 (West)** | **T** | 0.115 | A | 0.111 | A |
| | **R** | 0.115 | A | 0.111 | A |
| **Average Delay (sec)** | | 2 | | 2 | |

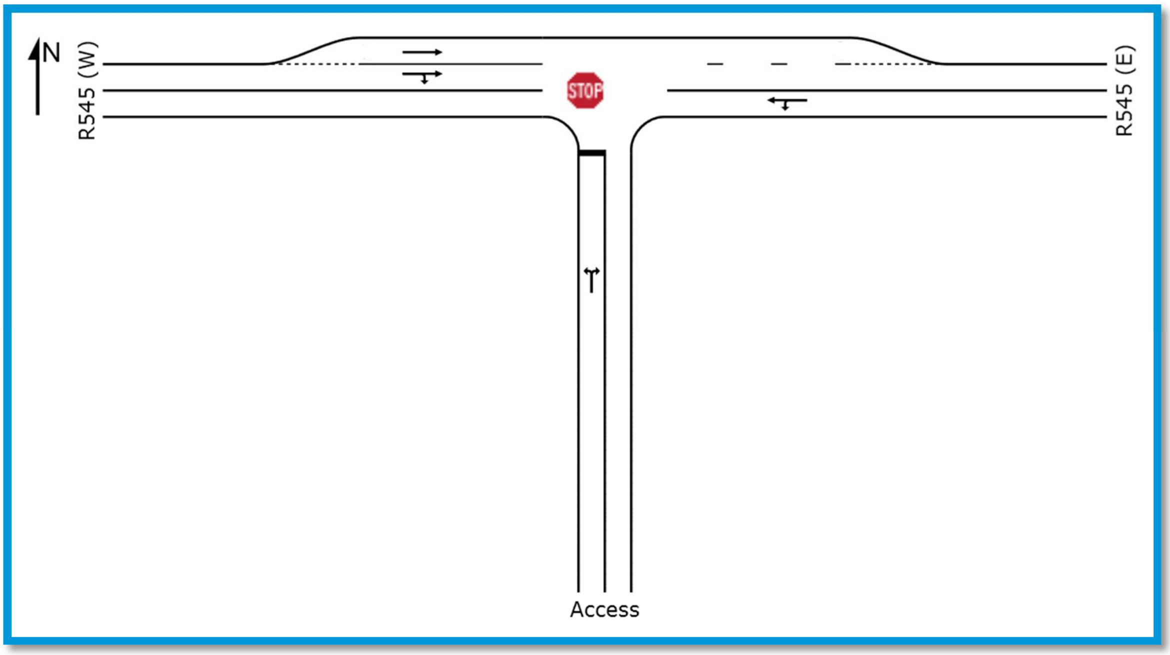



**Figure 15: Intersection with Proposed Passing Lane**

## 7.2 ACCESS LOCATION

The following safety issues were considered in terms of the proposed two access locations of the accesses:

- Sight distance;
- Pedestrian safety; and
- Heavy vehicle turning movements.

### 7.2.1 Option 1: New Access & Intersection

The first proposed position for the access to Alexander Mine will be to the south of the R545 via a gravel road, which will be upgraded with the construction of the mine. It is proposed to construct a new intersection with the R545 within the same servitude as the conveyor. The servitude will be approximately 55m wide. The approximate position of the T-junction of the access road and the R545 can be seen in Figure 1 (Appendix B), as well as in Figure 14 in Section 7.1.

#### 7.2.1.1 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 proposed access road off the R545 the speed to consider is 120km/h and the width of the R545 is 7m. The intersection is situated close to a horizontal curve to the west of the access. According to TRH 17[(4)], Geometric Design of Rural Roads, the shoulder sight distance for the worst case design vehicle, i.e. single unit and trailer (SU+T), should be in the order of 450m.

The R545 surface profile can be seen in Figure 17 below. On this figure the available shoulder sight distance is indicated along with the major landmarks, including the access to the school. The sight lines were drawn using an eye height of 1.8m (representing a driver inside a truck) and an object height of 1.3m (representing an oncoming vehicle). Although it appears as if adequate sight distance is available to the west in terms of the surface profile, the sight distance is restricted by the horizontal curve shown in Photo 13 in Appendix C.

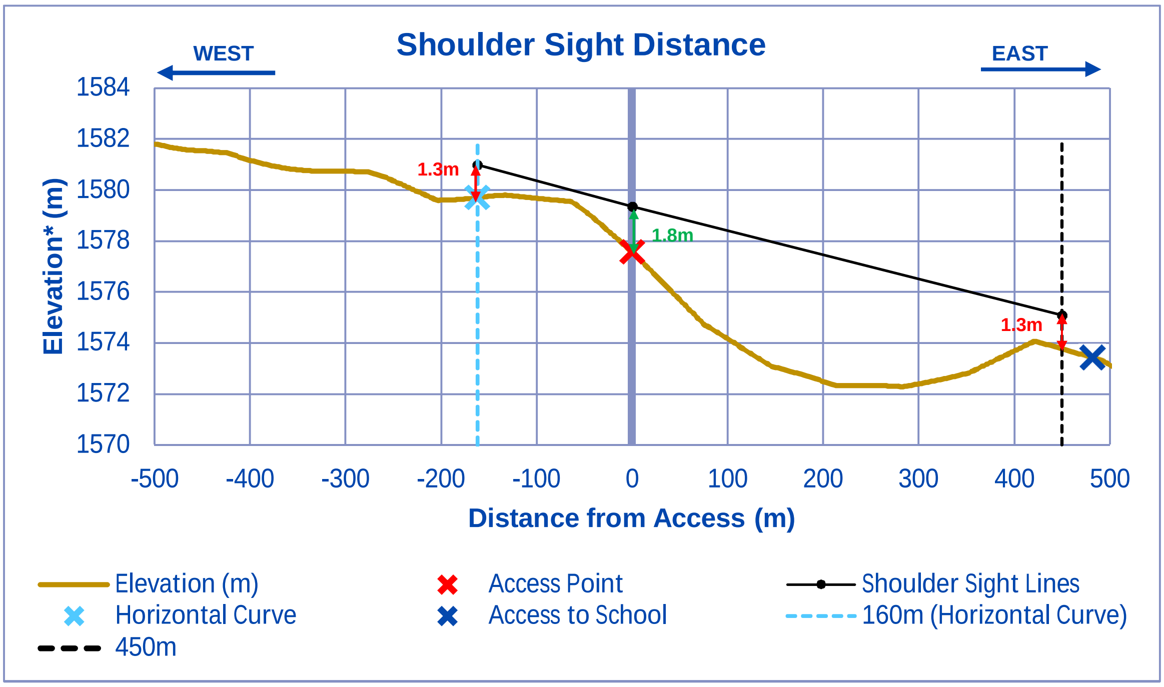



Figure 17: R545 Surface Profile – Shoulder Sight Distance

7.2.1.2 **Stopping Sight Distance**

The stopping sight distance involves the capability of the driver to bring his vehicle safely to a stop. For this application the stopping sight distance of vehicles along the R545 travelling towards the access is considered to ensure they are able to observe and stop in time for a vehicle exiting from the access.

The speed and slope along the R545 are therefore critical factors. The speed limit along the R545 is 120km/h and the eastbound vehicles experience a maximum slope of approximately -4% (downhill) while the westbound slope is +4% (uphill). Based on the TRH 17[(4)] guidelines the required stopping sight distance is therefore 240m and 180m from the west and east respectively.

The R545 surface profile can be seen in Figure 18 below. On this figure the available stopping sight distance is indicated along with the major landmarks, including the access to the school. The sight lines were drawn using an eye height of 1.05m (representing a driver inside a vehicle) and an object height of 1.3m (representing a vehicle exiting the site). Although it appears as if adequate sight distance is available to the west in terms of the surface profile, the sight distance is restricted by the horizontal curve shown in Photo 13 in Appendix C.

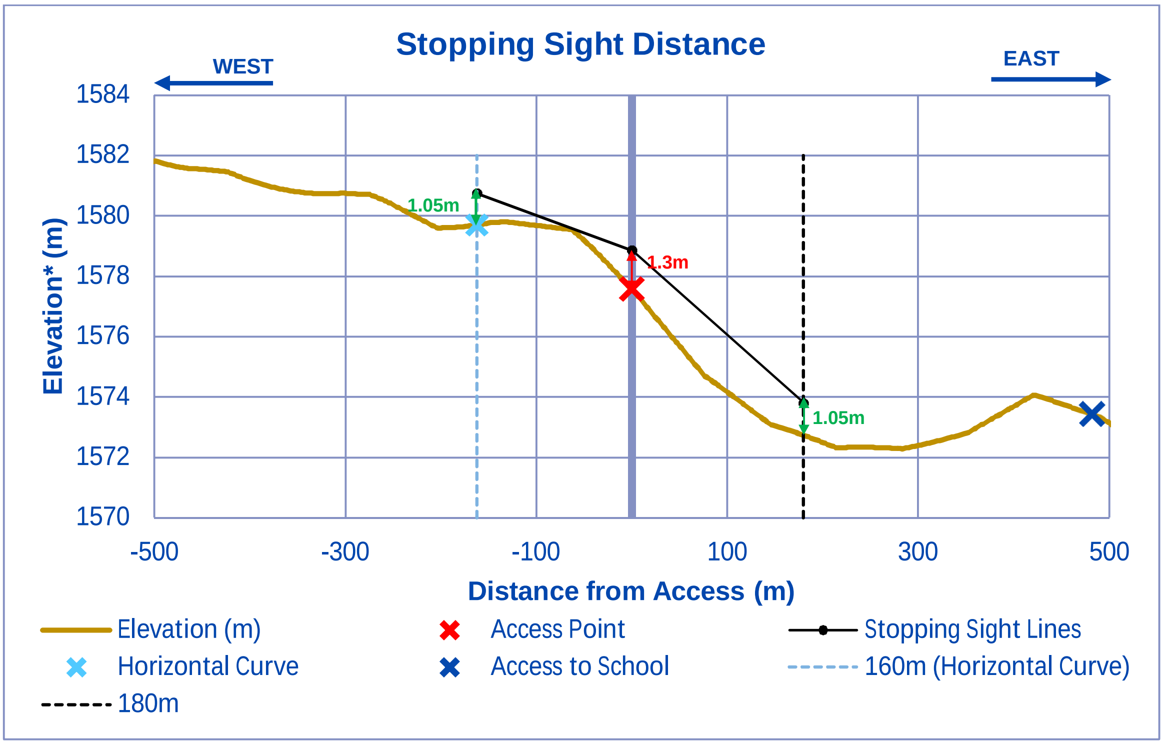



**Figure 18: R545 Surface Profile – Stopping Sight Distance**

7.2.1.3 **Available Sight Distance**

Evaluation of the R545 profile indicated that the available shoulder sight distance as well as stopping sight distance in advance of the access is adequate to and from the east. The access to the school is also visible. The sight distance from the access looking to the east can be seen in Photo 12 in Appendix C.

However, as mentioned, the available stopping and shoulder sight distances to and from the west is limited by the horizontal curve. Only approximately 160m of approaching roadway is visible from/to the access which is inadequate.

In order to achieve adequate sight distance for Option 1, the speed limit along the R545 would have to be reduced as follows:

- 45km/h for shoulder sight distance;  and
- 90km/h for stopping sight distance.

Based on the limited sight distance to the west of the proposed access intersection and the extremely low speed providing adequate shoulder sight distance, an access point at this position is not recommended.

### 7.2.2 Option 2: Existing Intersection (Enkundleni Primary School)

The second proposed access position is approximately 480m east of the Option 1 access, via an existing access road to Enkundleni Primary School, located south of the R545. The school is indicated on Figure 14. The school can be seen in Photo 14 in Appendix C.

#### 7.2.2.1 Shoulder Sight Distance

Since the variables (speed, road width and type of vehicle) determining the shoulder sight distance has not changed between the two proposed access points, the required shoulder sight distance will also remain unchanged, i.e. 450m in accordance with TRH 17[(4)].

The R545 surface profile for the existing intersection can be seen in Figure 19 below.

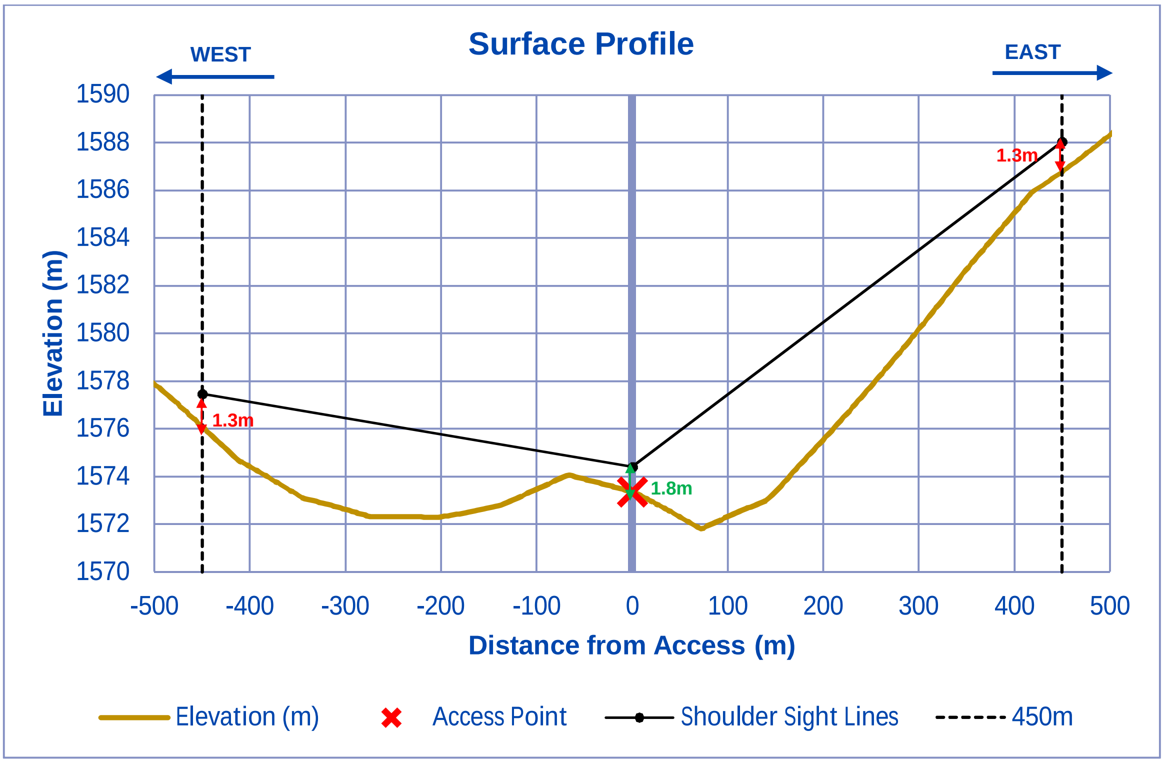



Figure 19: Shoulder Sight Distance at Existing Intersection

#### 7.2.2.2 Stopping Sight Distance

The speed limit along the R545 is still 120km/h at this access and the eastbound vehicles experience a maximum slope of approximately -1% (downhill) while the westbound slope is +1% (uphill). Based on the TRH 17(4) guidelines the required stopping sight distance is therefore 200m and 215m from the west and east respectively. The R545 surface profile for the existing intersection can be seen in Figure 20 below.

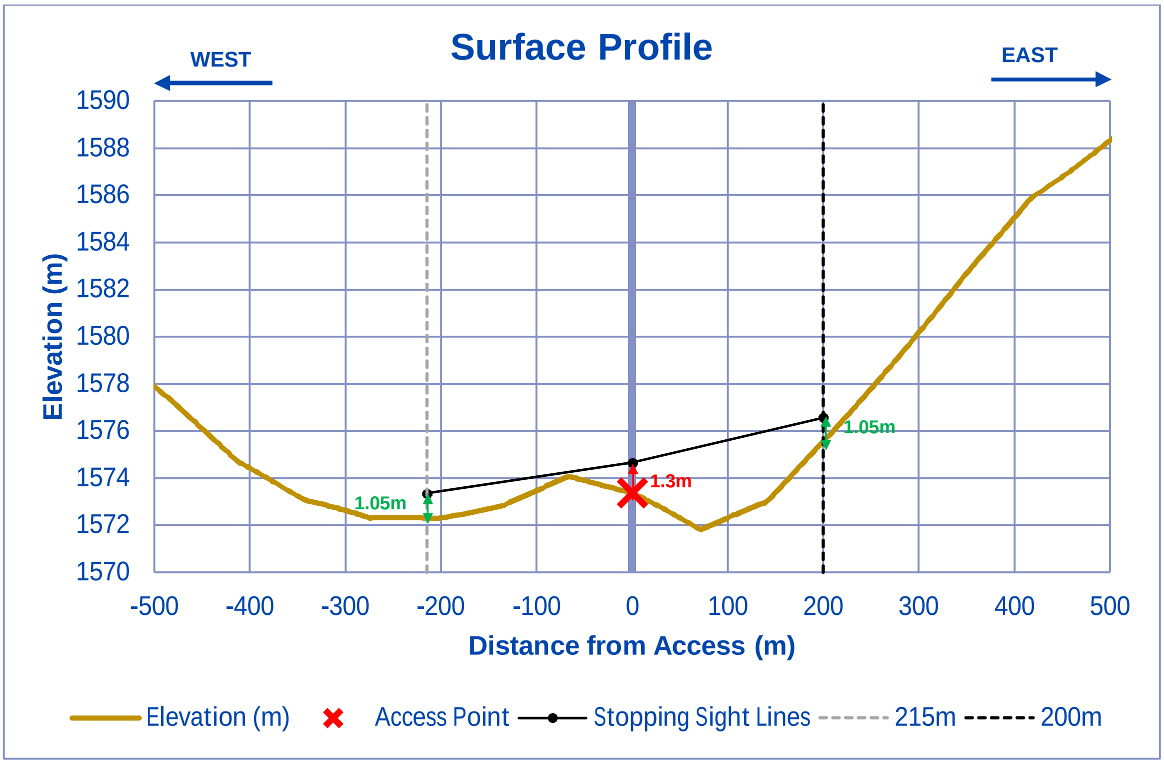



**Figure 20: Shoulder Sight Distance at Existing Intersection**

7.2.2.3 **Available Sight Distance**

Evaluation of the R545 profile indicated that the available shoulder sight distance as well as stopping sight distance in advance of the access is adequate.

## 7.3 PEDESTRIAN SAFETY

### 7.3.1 Option 1: New Access & Intersection

The existing access road to Enkundleni Primary School, south of the R545 is situated approximately 480m east of the proposed access to the Alexander Mine (see Photo 14). Warning signs (W308) have been erected on either side of the school access to warn road users of the presence of children along the R545. One of these signs can be seen in Photo 15.

The access road to the school is visible from the proposed access to Alexander Mine (see Figures 17 & 18). The view from the access road to the school in the direction of the mine access can be seen in Photo 15 (Appendix C).

Since it has been proven that this access location should not be considered due to inadequate sight distance from this location, further pedestrian safety measures were not considered.

### 7.3.2 Option 2: Existing Intersection (Enkundleni Primary School)

Should access to the mine be provided via the existing intersection close to the school, the following measures to improve pedestrian safety will be required:

(i) As mentioned warning signs (W308) are already in place on either side of the access and should be maintained.

(ii) It is suggested that the speed limit should be reduced to at least 80km/h in advance of the access, in increments as specified in the SARTSM[3].

**(iii)** Raised (e.g. kerbed) paved sidewalks of at least 1.5m wide will be required at the intersection in order to create separation between vehicles and pedestrians in accordance with the NMT Facility Guidelines, 2014(6). The paved sidewalks should be provided from the start of the bell-mouths on the R545 up to the access to the school, along both sides of the access road.

**(iv)** A raised block pedestrian crossing (RTM4) across the access road will be required at the entrance to the school, along with the R2.1 sign (Yield to pedestrians) to make it mandatory for vehicles to yield to pedestrians at this point. Pedestrian crossing warning signs (W306) should also be provided at least 90m before the crossing along the access road and in both directions. Examples of the aforementioned road signs are shown below.

All road signs and road markings should be in accordance with the requirements of the South African Road Traffic Signs Manual (SARTSM)(3).


## 7.4 HEAVY VEHICLE TURNING MOVEMENTS

The W107 and W108 intersection warning signs should be erected either side of the Alexander Mine access in accordance with the requirements of the South African Road Traffic Signs Manual (SARTSM)(3) and it is recommended that supplementary plates be added to these warning signs indicating the presence of heavy vehicles at the intersection.

# 8 ROAD SURFACE AND PAVEMENT MANAGEMENT

## 8.1 ROAD SURFACE CONDITIONS

A visual inspection of the R545 between Kriel and Bethal, past the site was made during a site visit on 15 June 2016. The problems/types of distress are classified by their severity and occurrence. The R545 is in a poor condition and contains a significant amount of patching. Other defects that have been identified are rutting, bleeding, potholes and surface failure.

Photos of the worst cases of the defects along the R545 are show in Appendix C. The extent and probable cause thereof are discussed below.

Pumping through surface cracks appear intermittently over the length of the road and in severe cases leads to potholes as can be seen in Photo 11 (Appendix C). Surface cracks are mostly caused by shrinkage of the bituminous surfacing as a result of decreased binder volume, usually caused by the aging of the surface. Pumping is generally caused by water ingress into the base layer and then pumping the fine material in the base layer from within the pavement to the surface, usually through existing surface cracks.

Rutting occurs throughout most of the road length, indicating drainage problems within the road pavement. In isolated sections the rutting is severe and extensive. In some isolated cases rutting in patched areas lead to severe shoving of asphalt, as can be seen in Photo 8. Rutting results from compaction or shear deformation through the action of traffic and is limited to the wheel paths. When the rutting is wide and evenly shaped, as in this case, the problem lies in the lower pavement layers.

Bleeding occurs throughout most of the road length. The bleeding can be seen in Photo 7. Bleeding generally occurs when excess binder moves to the surface and the road surface may appear wet. The bleeding affects the skid resistance negatively.

Surface failures occur in isolated instances, but at severe levels. Some of the surface failures have led to potholes as can be seen in Photo 7. Severe potholes, caused by a variety of problems occur in isolation along the length of the roadway and warning signs has been erected, as can be seen in Photo 17.

Along the R547 leading to Kriel, severe edge breaks are evident. This is shown in Photos 19 and 20.

Throughout the road length the existing narrow gravel shoulders of the road are overgrown (Photo 21) and drainage problems exist mostly due to shallow or non-existent side drains (Photo 20).

## 8.2 TRAFFIC LOADING

The estimated volume of heavy vehicle traffic generated by the mine will consist of:

- 2 stone-dust trucks per month;
- 1 aggregate truck per month; and
- A maximum of 10 other delivery trucks per month.

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 80 kilo Newton (kN) single axle loads (E80's). This is the number of 80 kN single-axle loads that would cause the same damage to the pavement as the actual spectrum of axle loads."*

In this case it is conservatively assumed that the average heavy vehicle is equal to 3 E80's. The E80's for the generated traffic then amounts to 16 380 E80's, or 0.02 MESA (million equivalent standard axles) over the 30 to 35 year lifetime of the mine.

The effect of the amount of heavy vehicles generated by the proposed mine is negligible.

## 8.3 SUGGESTED MEASURES

A full rehabilitation design is needed in order to implement a cost effective design/solution.

The road is in poor condition due to the following facts:

- There is severe rutting, potholes and surface failures which affects riding quality and pose a safety risk to the road users;
- There is rutting along most of the route, due to poor drainage. During rainy weather, water accumulates in the wheel path ruts and can lead to aquaplaning; and
- The bleeding double seal along the route affects the skid resistance negatively.

It is recommended that:

- The severe cases of distress are repaired immediately as they may pose a safety risk;
- The side drains are excavated throughout the road length and that sub soil drains are introduced where necessary;
- The narrow, overgrown shoulder should be widened/reconstructed; and
- The rutting should be rectified and new surfacing be provided according to the needed rehabilitation design.

As mentioned, the heavy vehicle loading of the proposed new mine will be insignificant and will therefore not contribute to the further deterioration of the existing problems. It is therefore suggested that the identified road pavement issues should be addressed by public private partnership between the existing heavy vehicle generators in the area and the relevant roads authority.

# 9 CONCLUSIONS & RECOMMENDATIONS

## 9.1 CONCLUSIONS

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

(i) The intersection of the R545 & R547 is currently not effective as an all-way stop-controlled intersection with the existing traffic volumes.

(ii) It was found that the impact of the proposed mine on the peak hour traffic operating conditions of the surrounding road network will be low.

(iii) The proposed mine will generate a negligible amount of heavy vehicle traffic during the construction and operational phases, in terms of pavement impact.

(iv) The proposed Option 1 access position to Alexander Mine does not have acceptable stopping sight distance or shoulder sight distance approaching from/heading to the west. Reducing the speed limit along the R545 in order to obtain adequate sight distance is not considered to be a viable solution.

(v) The existing intersection providing access to the school does have adequate sight distance along the R545.

(vi) The proposed access locations are in close proximity to a school and children/pedestrian activity is expected.

## 9.2 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, subject to the following:

(i) The intersection of the R545 & R547 should be upgraded regardless of the proposed Alexander Mine development and is considered to be the responsibility of the relevant road authorities:

   a. A roundabout, with two circulating lanes and of adequate size to accommodate the interlink trucks used for the transportation of coal, according to the existing/observed traffic composition on the R545. The detail design of the roundabout should be done by a professional civil engineer; or

   b. Traffic signals, designed by a professional traffic engineer, should be implemented. No road widening is required in this case.

   c. Liaison and agreement with the relevant road authorities would be required to establish a way forward in terms of the required upgrades.

(ii) It is recommended that the access to the mine should be via the Option 2 existing access road, provided the required pedestrian facilities as described in Section 7.3 are implemented.

(iii) It is recommended that the described maintenance measures along the R545 should be taken. Taking into account that the proposed mine is not expected to generate significant volumes of heavy vehicles during operations, this is not considered to be the responsibility of the new mine.

# 10 REFERENCES


1. South African Traffic Impact and Site Traffic Assessment Manual (TMH 16) Volume 1, Version 1.0, August 2012. Committee of Transport Officials, South Africa.
2. Manual for Traffic Impact Studies, Report RR93/635, Department of Transport, October 1995
3. South African Road Traffic Signs Manual, 3rd Edition, Volume 3: Traffic Signal Design. National Department of Transport, Committee of Transport Officials (COTO), April 2001, Pretoria.
4. TRH 17, Geometric Design for Rural Roads, CSIR, Pretoria, 1988
5. Highway Capacity Manual, Transport Research Board, 1994
6. NMT Facility Guidelines, 2014 (Policy and Legislation, Planning, Design and Operations, December 2014, Department of Transport.

# APPENDICES

Appendix A Locality Plan

Appendix B Figures

Appendix C Photographic Record

Appendix D Traffic Counts

Appendix E SIDRA Results

Appendix F Curriculum Vitae

Appendix G NEMA Regulations Checklist

# Appendix A

LOCALITY PLAN

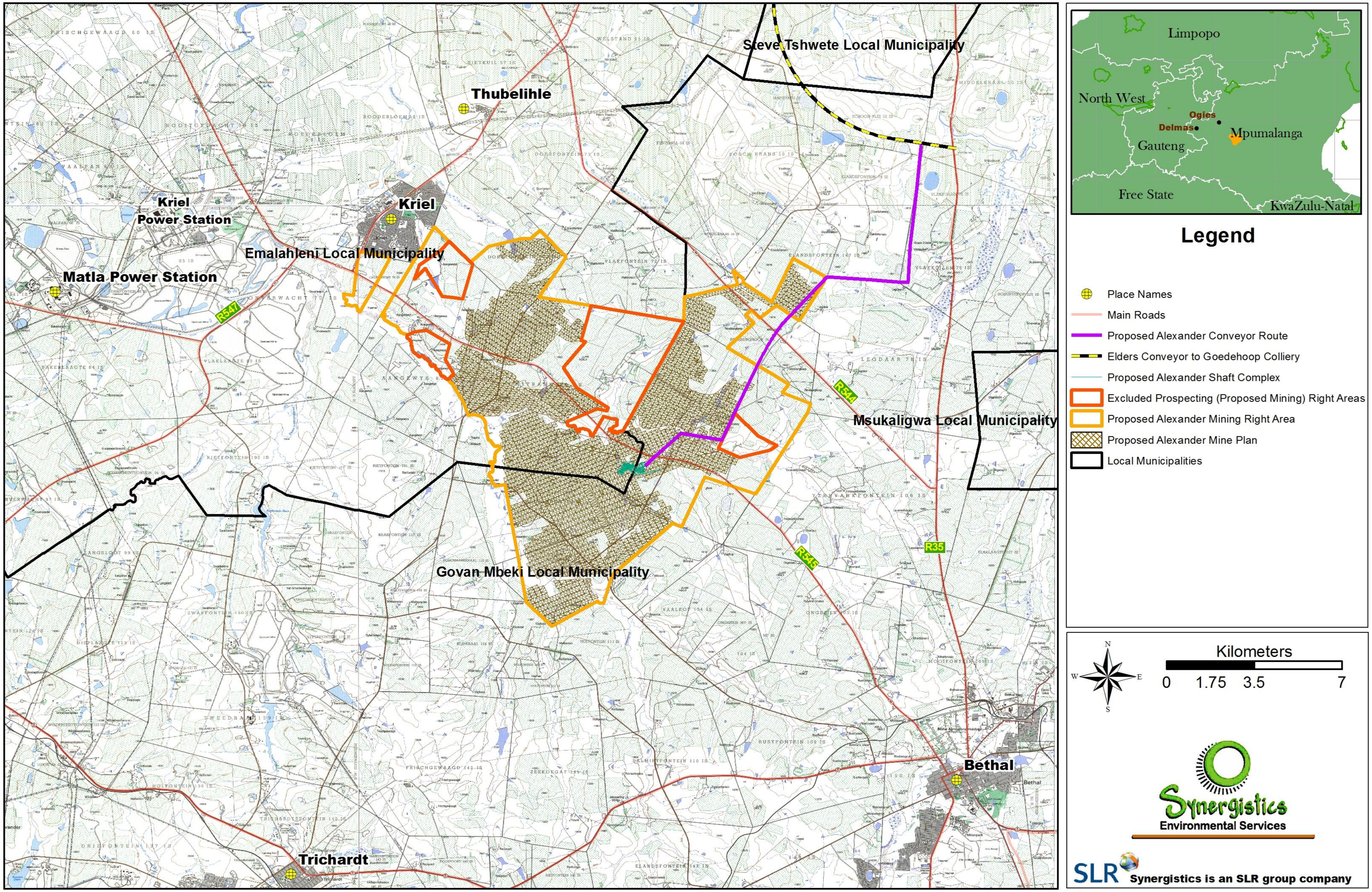
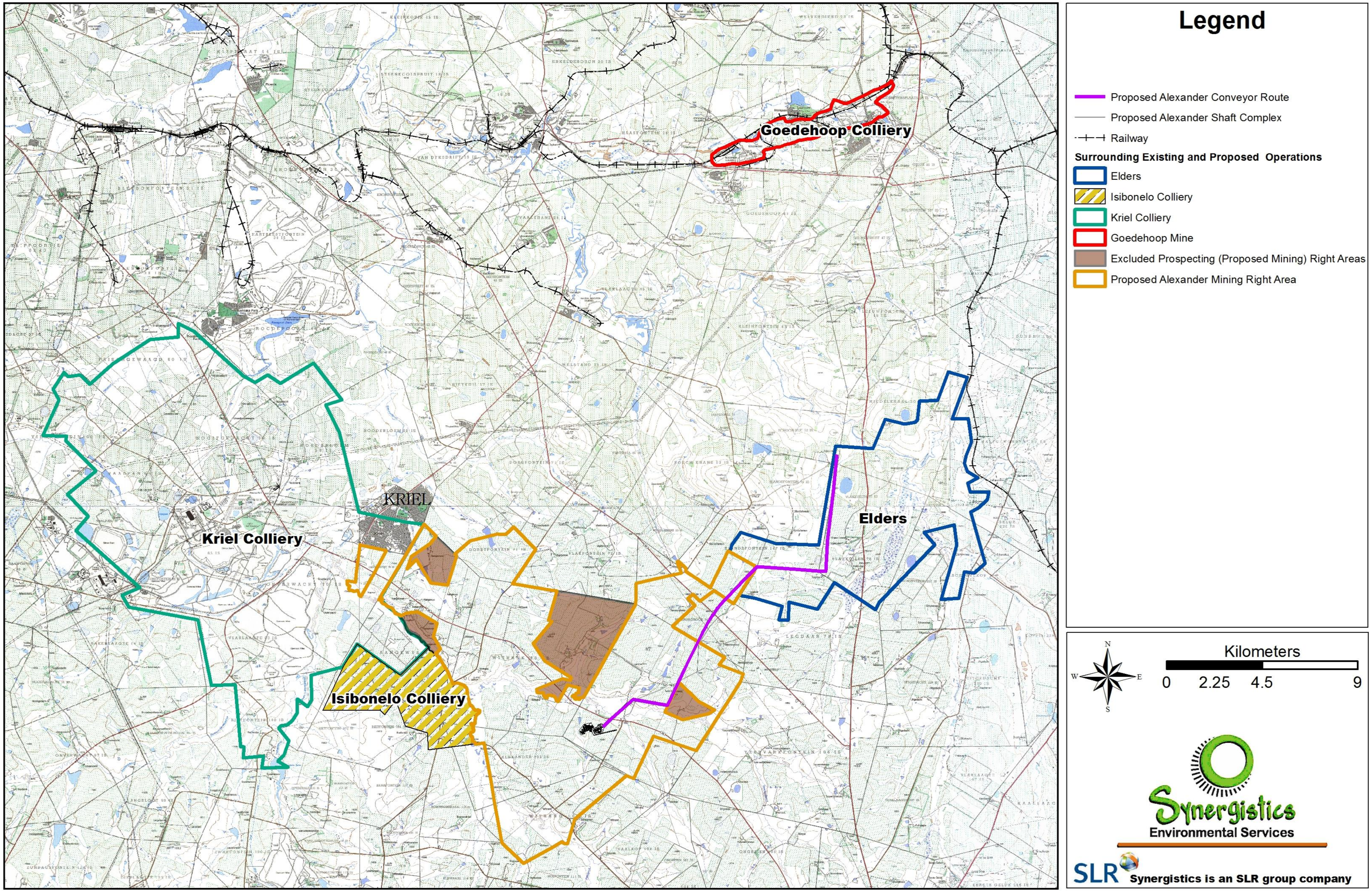



**Figure 1-1: Locality and Conceptual Layout Map**

| | | |
|---|---|---|
| 750.01080.00002 | Coordinate System DMS | |
| | Spheroid Hartebeesthoek '94 | Central Meridian LO29 |



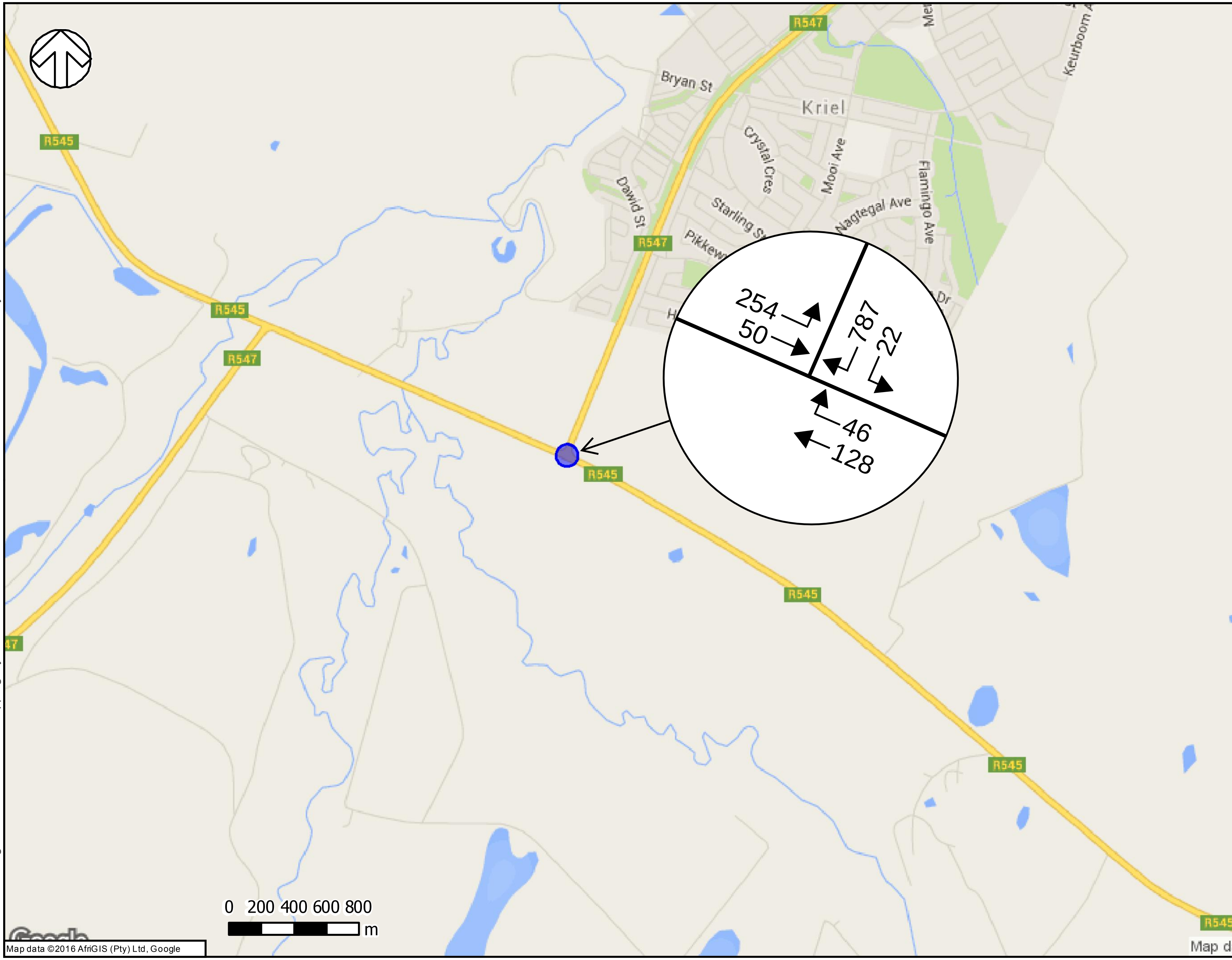

**Surrounding Existing and Proposed Operations**

| | | |
|---|---|---|
| 750.01080.00002 | Coordinate System DMS | |
| | Spheroid Hartebeesthoek '94 | Central Meridian LO29 |

# Appendix B

FIGURES


Key
Project Area
Approximate Access Position
Intersection 1
Kriel
Bethal
Davel Rd
R547
R545
R544
R35
R38
17
0 0.5 1 1.5 2
km
Map data ©2016 AfriGIS (Pty) Ltd, Google
WSP | PARSONS BRINCKERHOFF
TITLE:
Anglo American Inyosi Coal (AAIC) Alexander Project
FIGURE No:
Figure 1: Intersection Locations




**Key**

R547 & R545 Intersection

WSP | PARSONS BRINCKERHOFF

TITLE:

Anglo American Inyosi Coal (AAIC) Alexander Project

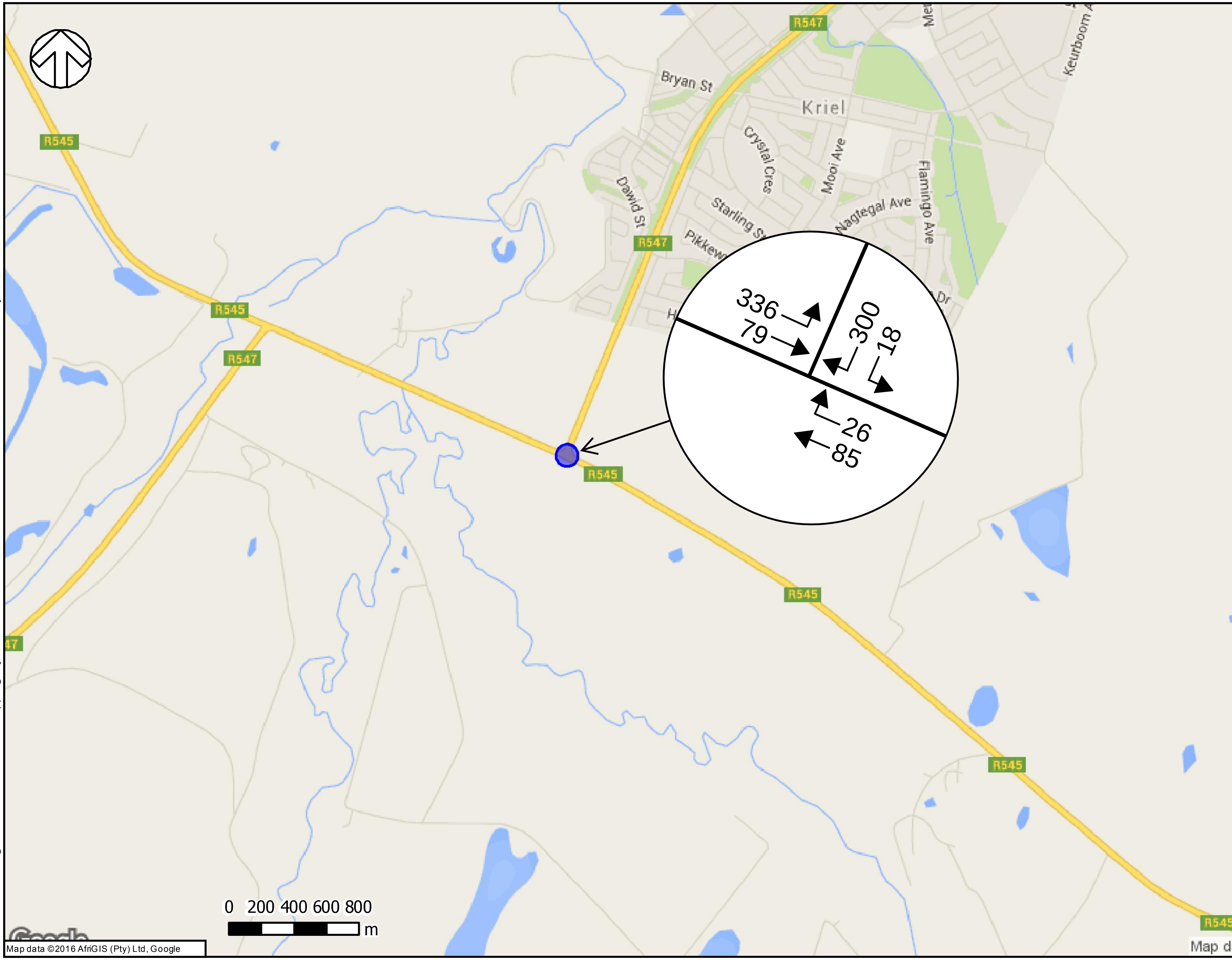
FIGURE No:

Figure 2: AM Peak Hour Traffic Volumes (2016)

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

Drawn By: ZAAL02864

Date Modified: 13/06/2016 08:03



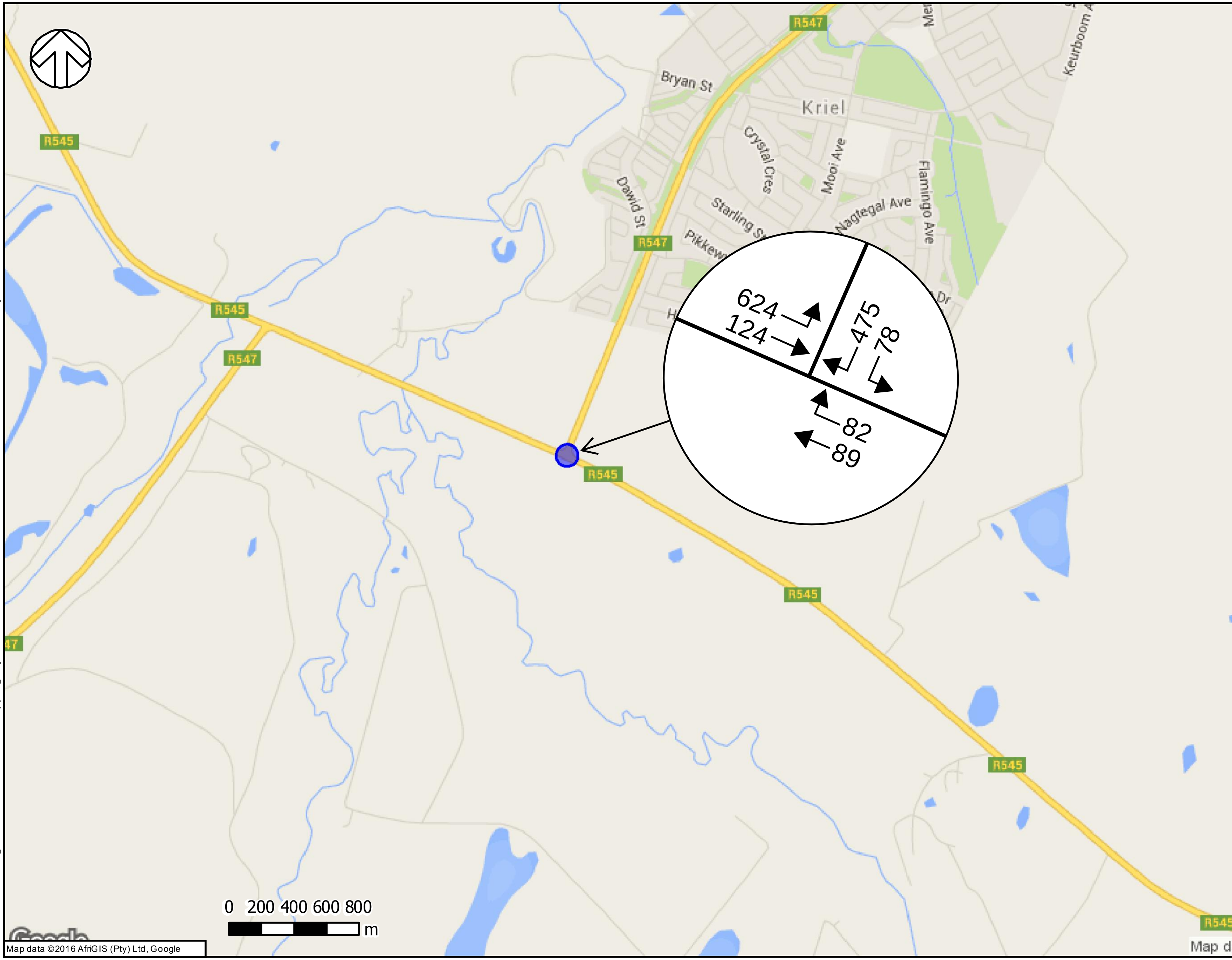

**Key**
R547 & R545 Intersection

WSP | PARSONS BRINCKERHOFF

TITLE:
Anglo American Inyosi Coal (AAIC) Alexander Project

FIGURE No:
Figure 3: Midday Peak Hour Traffic Volumes (2016)

File: Created using iGIS, WSP's Online Mapping System
Drawn By: ZAAL02864
Date Modified: 13/06/2016 08:03




**Key**

R547 & R545 Intersection

WSP | PARSONS BRINCKERHOFF

TITLE:

Anglo American Inyosi Coal (AAIC) Alexander Project

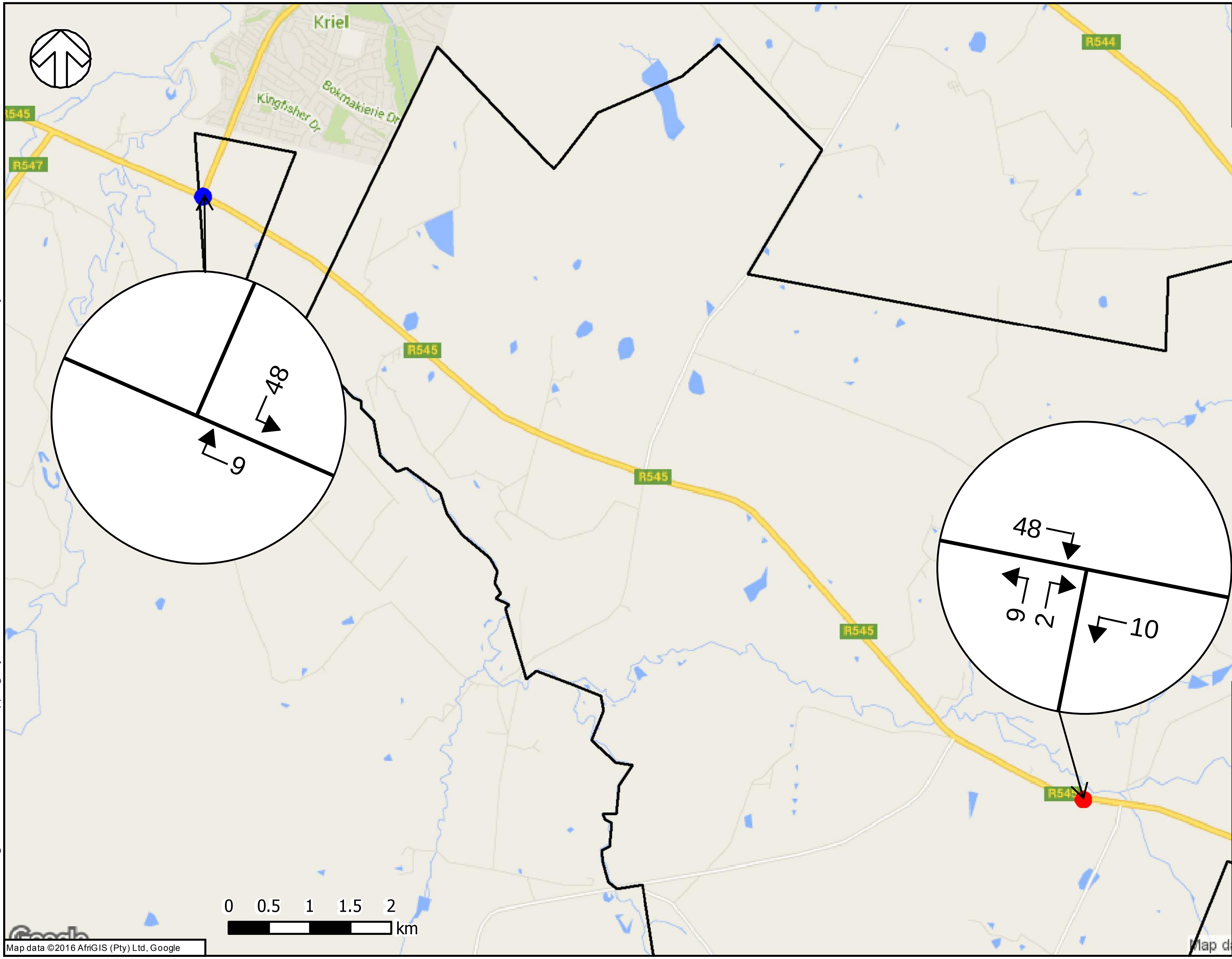
FIGURE No:

Figure 4: PM Peak Hour Traffic Volumes (2016)

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

Drawn By: ZAAL02864

Date Modified: 13/06/2016 08:03




WSP | PARSONS BRINCKERHOFF

TITLE:

Anglo American Inyosi Coal (AAIC) Alexander Project

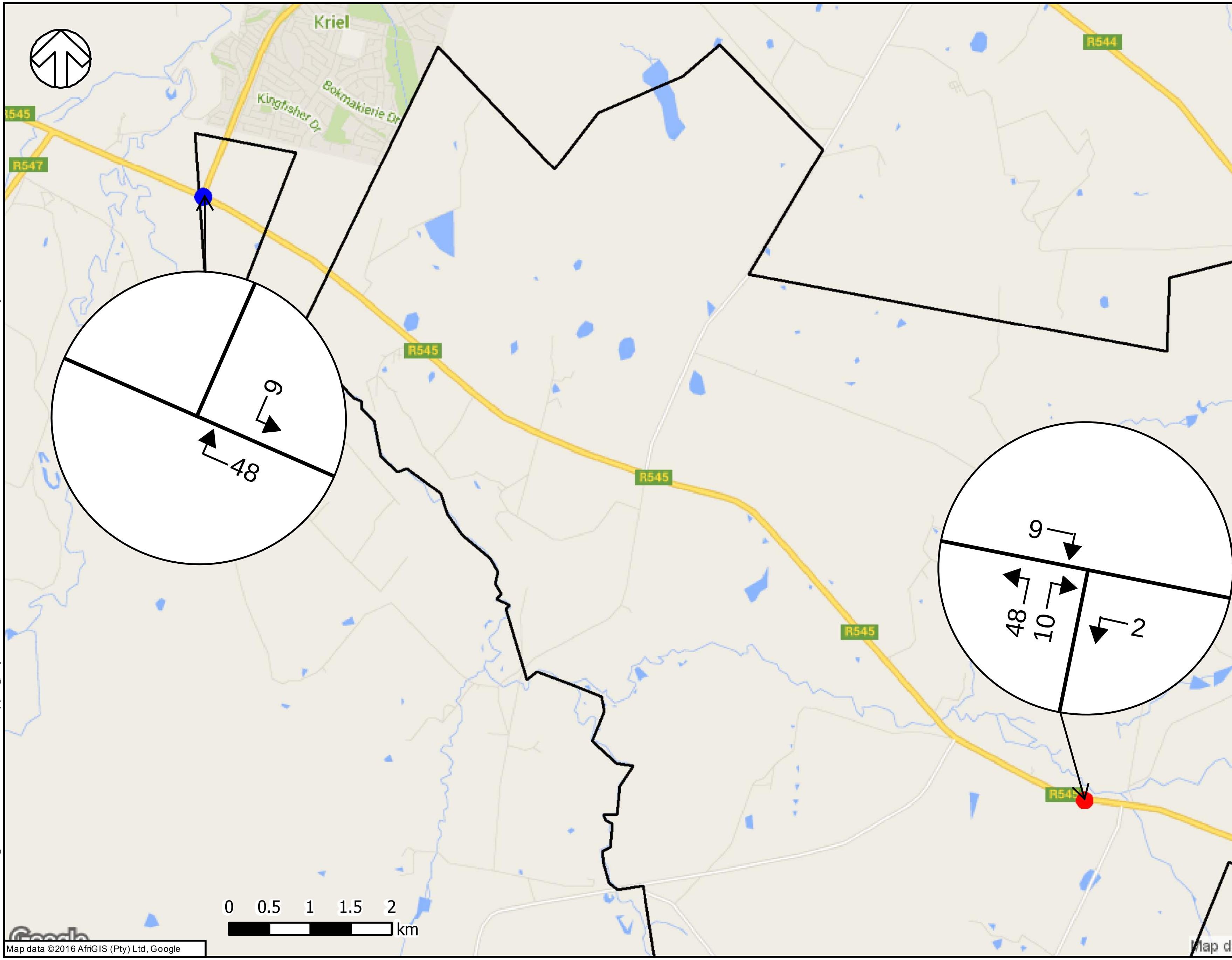
FIGURE No:

Figure 5: AM Peak Hour Trip Generation

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

Drawn By: ZAAL02864

Date Modified: 13/06/2016 07:29




WSP | PARSONS BRINCKERHOFF

TITLE:

Anglo American Inyosi Coal (AAIC) Alexander Project

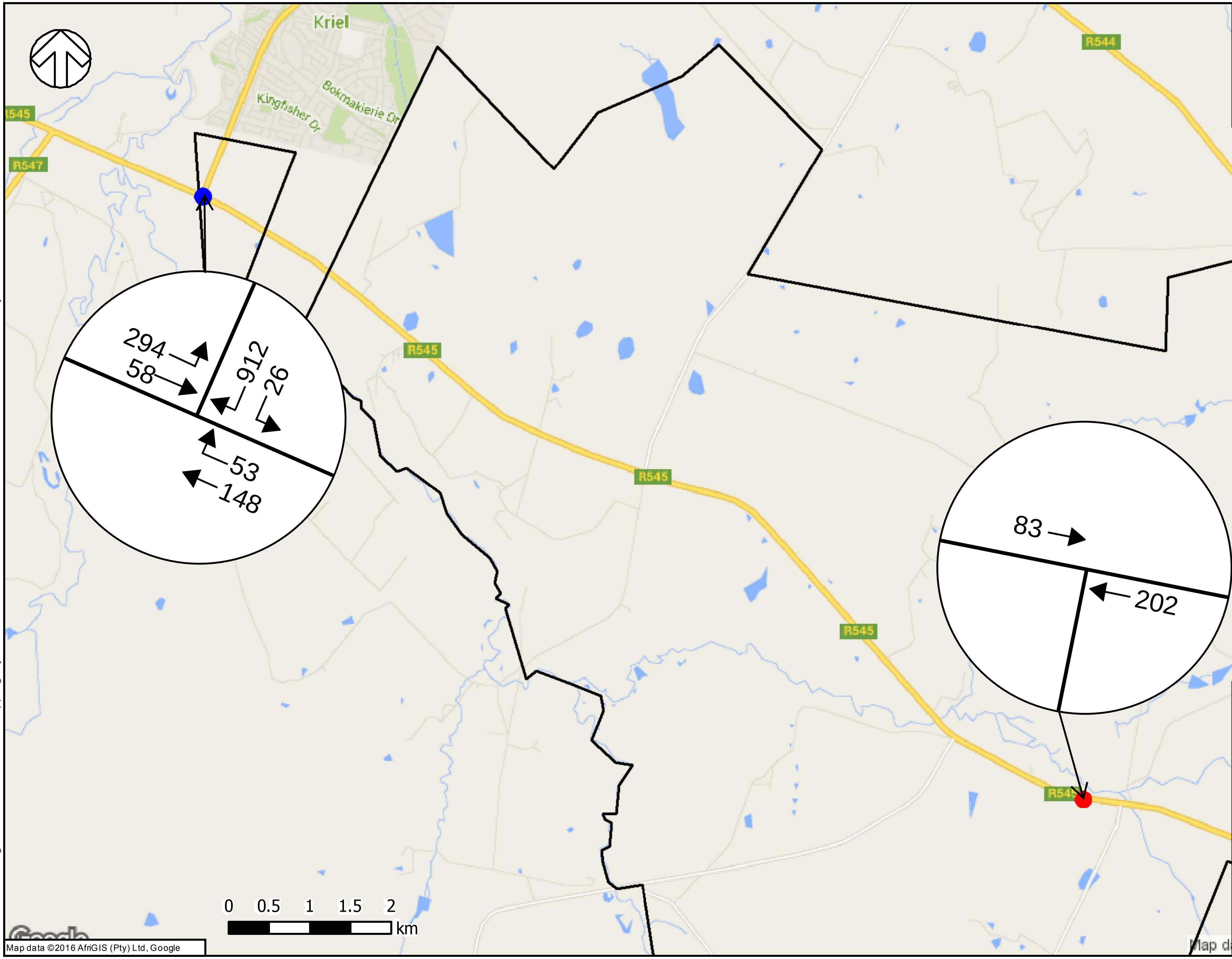
FIGURE No:

Figure 6: Midday Peak Hour Trip Generation

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

Drawn By: ZAAL02864

Date Modified: 13/06/2016 07:29




WSP | PARSONS BRINCKERHOFF

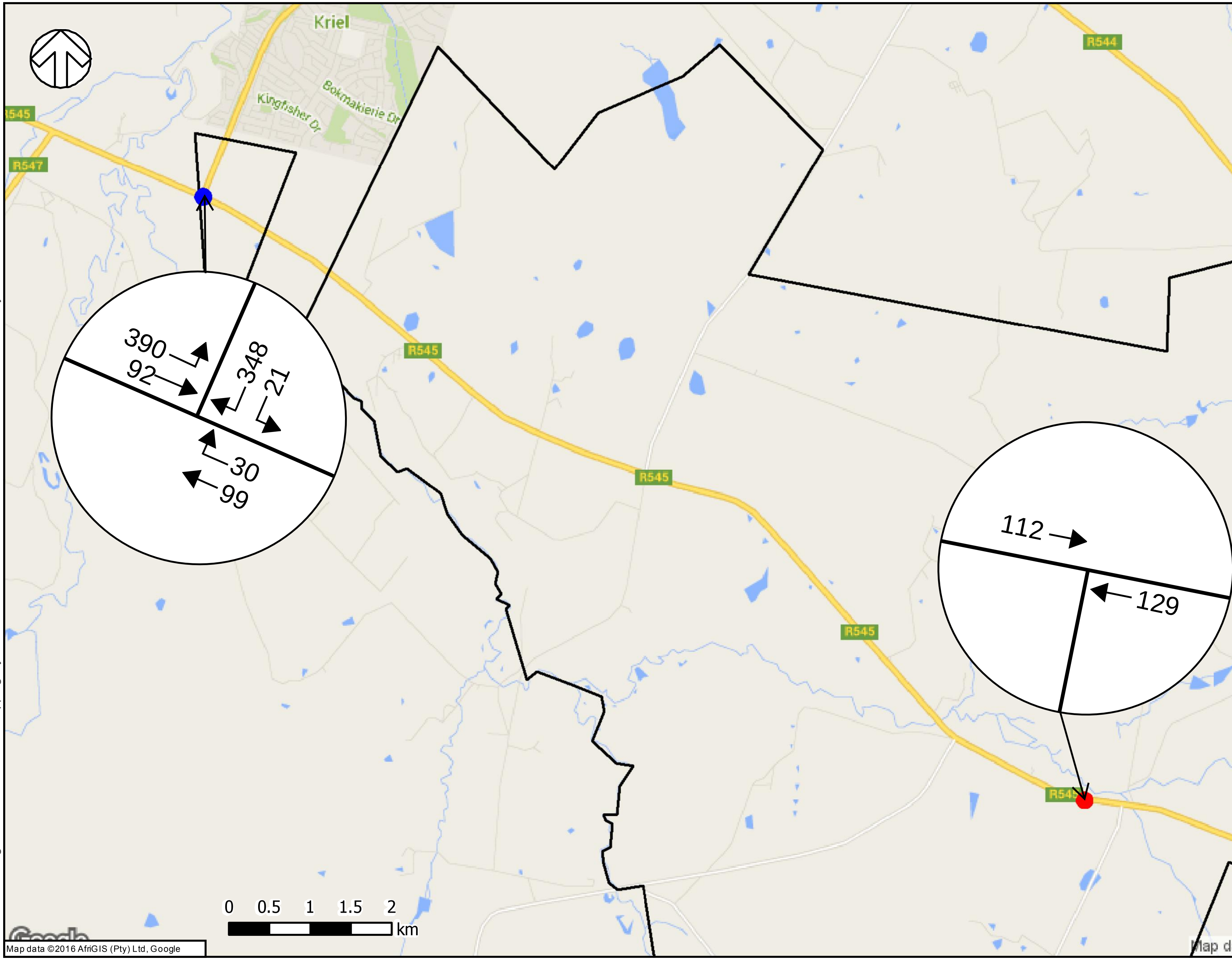
TITLE:

Anglo American Inyosi Coal (AAIC) Alexander Project

FIGURE No:

Figure 7: AM Peak Hour Background Traffic Volumes (2021)

File: Created using iGIS, WSP's Online Mapping System Drawn By: ZAAL02864 Date Modified: 13/06/2016 07:29




WSP | PARSONS BRINCKERHOFF

TITLE:

Anglo American Inyosi Coal (AAIC) Alexander Project

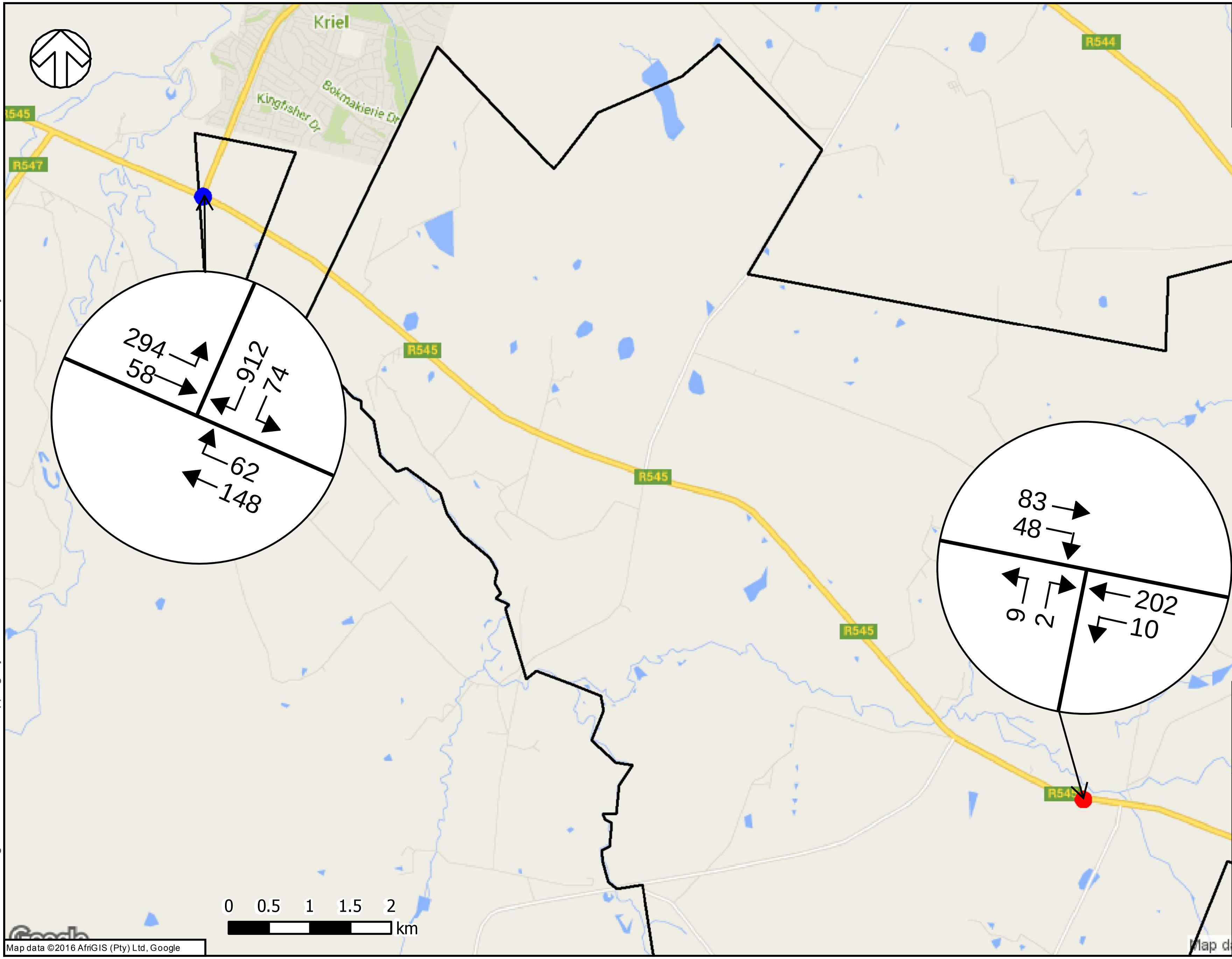
FIGURE No:

Figure 8: Midday Peak Hour Background Traffic Volumes (2021)

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

Drawn By: ZAAL02864

Date Modified: 13/06/2016 07:29




WSP | PARSONS BRINCKERHOFF

TITLE:

Anglo American Inyosi Coal (AAIC) Alexander Project

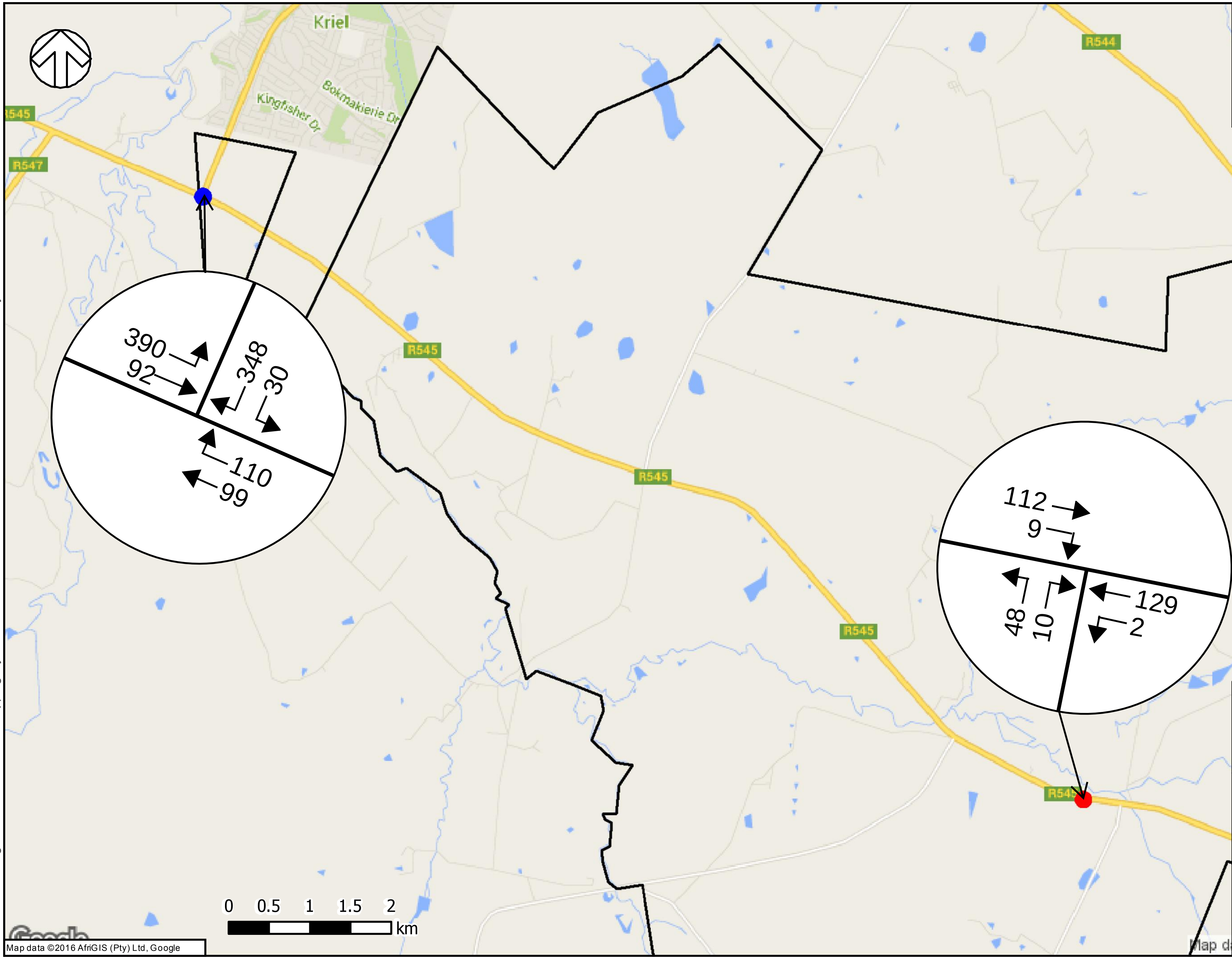
FIGURE No:

Figure 9: AM Peak Hour Traffic Volumes (2021) incl. Alexander Trips

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

Drawn By: ZAAL02864

Date Modified: 13/06/2016 07:29




WSP | PARSONS BRINCKERHOFF

TITLE:

Anglo American Inyosi Coal (AAIC) Alexander Project

FIGURE No:

Figure 10: Midday Peak Hour Traffic Volumes (2021) incl. Alexander Trips

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

Drawn By: ZAAL02864

Date Modified: 13/06/2016 07:29

# Appendix C

**PHOTOGRAPHIC RECORD**


**Photo 1: R545/R547 Intersection - North Approach**

**Photo 2: R545/R547 Intersection – East Approach**

**Photo 3: R545/R547 Intersection – West Approach**


**Photo 4: Cattle Crossing the R545, at the R545/R547 Intersection**


Photo 5: R545/R547 Intersection with "Dangerous Intersection" Sign

Photo 6: Road Surface along R545, West of Kriel – Generally Good


Photo 7: Surface Failurure Leading to the Formation of Potholes (incl. Patching) – R545 East of Kriel

Photo 8: Rutting and Shoving of Asphalt – R545 East of Kriel

**Photo 9: Surface Cracks and Developing Potholes**

**Photo 10: Surface Cracks and Developing Potholes**

**Photo 11: Pumping; Surface Cracks and Developing Potholes**

**Photo 12: Sight Distance East of Proposed Access**

**Photo 13: Sight Distance West of Proposed Access**

**Photo 14: School East of Access and South of R545**

Photo 15:  W308 sign (Children) in the Vicinity of the Proposed Access

Photo 16:  View from Access to the School to the Proposed Access to Alexander Mine


**Photo 17: Warning Sign for potholes & Speed Limit of 60km/h – East of Proposed Access**

**Photo 18: R547 towards Kriel - General Road Condition**

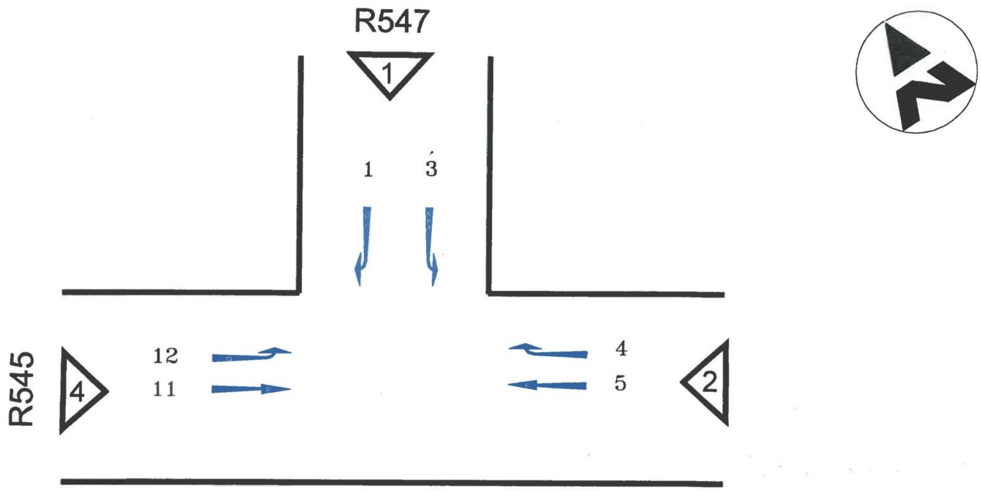
**Photo 19: R547 towards Kriel – Edge Breaks and Localised Patching**

**Photo 20: R547 towards Kriel – Edge Breaks Including Patched Edge Breaks**


Photo 21: R547 from Kriel towards R545 – TW304

# Appendix D

TRAFFIC COUNTS




### CO-ORDINATES

LATITUDE: 26° 16' 27.4" S
LONGITUDE: 29° 14' 50.8" E

| | | | |
|---|---|---|---|
| LOCATION: | INTERSECTION: R545 & R547 | | |
| AREA: | KRIEL | STATION NUMBER: | M1 |
| DATE: | 09/06/2016 | DAY: THURSDAY | TIME: 06:00 - 18:00 |
| TYPE OF COUNT: | CLASSIFIED COUNTS PER TURNING MOVEMENT | | |
| DESCRIPTION: | CLASSIFICATION: LIGHT, TAXI, BUS & HEAVY VEHICLES | | |

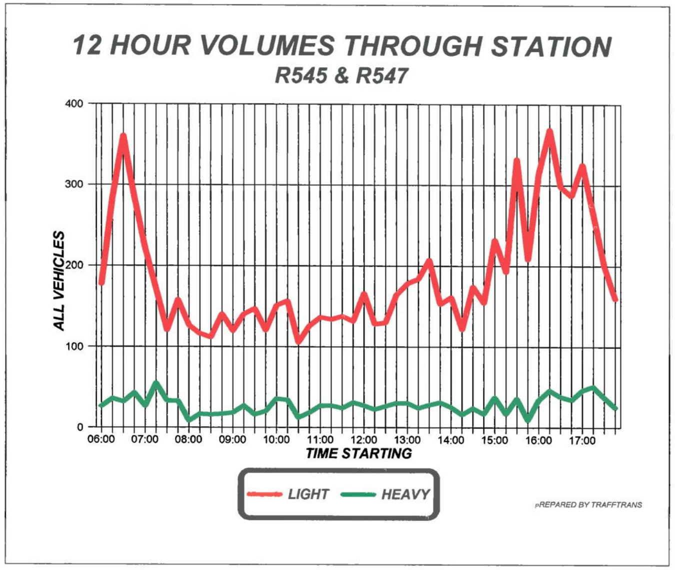
## STATION LAYOUT

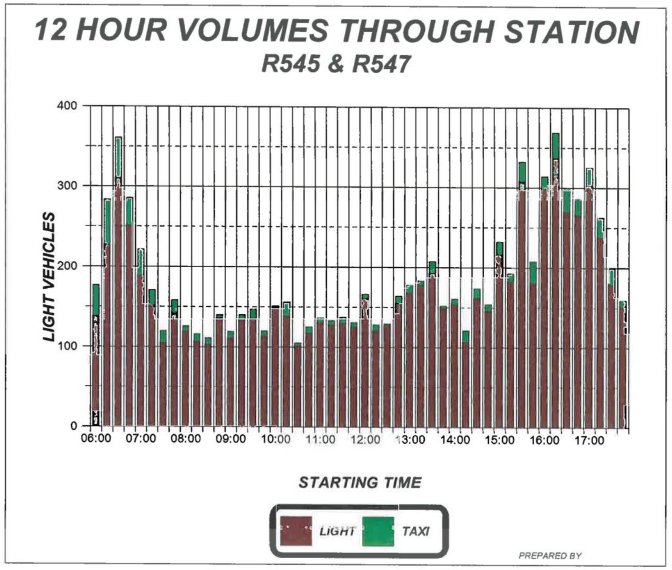
R545 & R547, KRIEL

PROJ. T2016/041

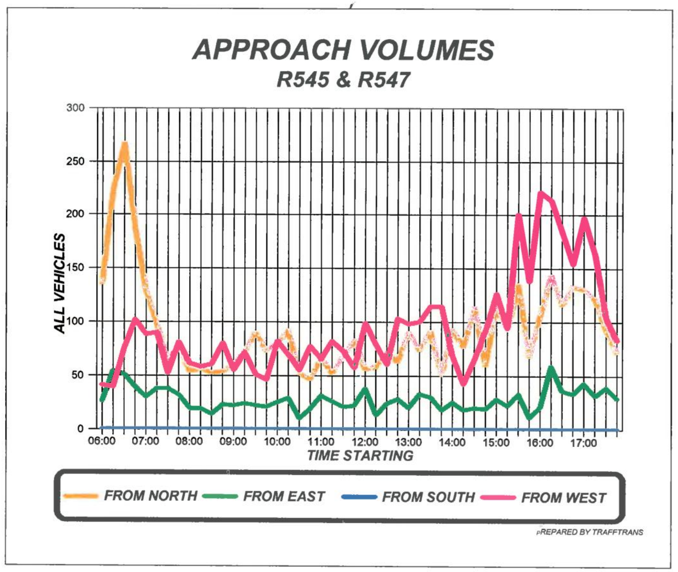
DATE JUNE 2016

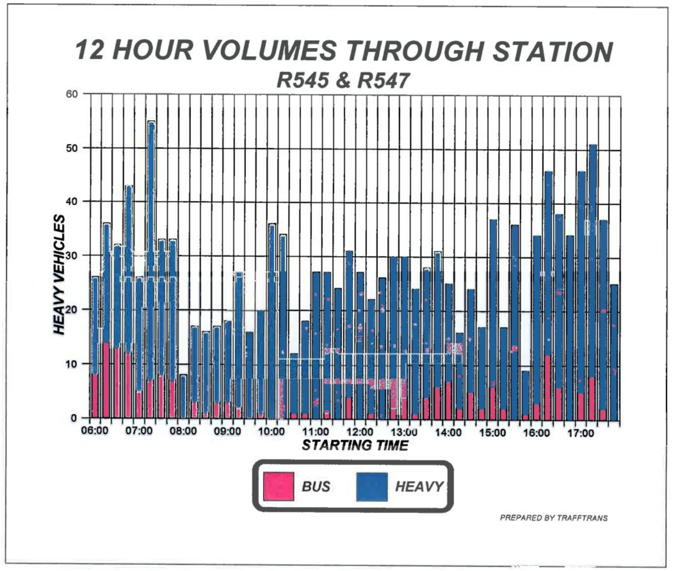
TRAFFTRANS (EDMS) BPK


12 HOUR VOLUMES THROUGH STATION
R545 & R547
ALL VEHICLES
400
300
200
100
0
06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00
TIME STARTING
LIGHT
HEAVY
PREPARED BY TRAFFTRANS


12 HOUR VOLUMES THROUGH STATION
R545 & R547
LIGHT VEHICLES
400
300
200
100
0
06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00
STARTING TIME
LIGHT
TAXI
PREPARED BY

# STATION M1


APPROACH VOLUMES
R545 & R547
ALL VEHICLES
300
250
200
150
100
50
0
06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00
TIME STARTING
FROM NORTH
FROM EAST
FROM SOUTH
FROM WEST
PREPARED BY TRAFFTRANS


12 HOUR VOLUMES THROUGH STATION
R545 & R547
HEAVY VEHICLES
60
50
40
30
20
10
0
06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00
STARTING TIME
BUS
HEAVY
PREPARED BY TRAFFTRANS

# SUMMARY OF TRAFFIC COUNTS

**STATION NO:** M1

**LOCATION:** R545 & R547

**LAT:** 26° 16' 27.4" S **DATE:** 09/06/2016

**LONG:** 29° 14' 50.8" E Thursday

| MOVEMENT FROM | NO | AM PEAK HOUR LIGHT VOL | TAXI VOL | BUS VOL | HEAVY VOL | TOTAL VOL | PHF | PM PEAK HOUR LIGHT VOL | TAXI VOL | BUS VOL | HEAVY VOL | TOTAL VOL | PHF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NORTH | 1 | 665 | 81 | 23 | 18 | 787 | 0.76 | 432 | 18 | 4 | 21 | 475 | 0.91 |
| | 2 | | | | | | | | | | | | |
| | 3 | 12 | 9 | 1 | | 22 | | 41 | 2 | | 5 | 48 | |
| EAST | 4 | 34 | 9 | 2 | 1 | 46 | 0.79 | 68 | 5 | | 9 | 82 | 0.72 |
| | 5 | 78 | 10 | 2 | 38 | 128 | | 49 | 6 | | 34 | 89 | |
| | 6 | | | | | | | | | | | | |
| SOUTH | 7 | | | | | | n.a. | | | | | | n.a. |
| | 8 | | | | | | | | | | | | |
| | 9 | | | | | | | | | | | | |
| WEST | 10 | | | | | | 0.63 | | | | | | 0.88 |
| | 11 | 17 | 7 | 1 | 25 | 50 | | 61 | 9 | 1 | 53 | 124 | |
| | 12 | 174 | 54 | 15 | 11 | 254 | | 525 | 62 | 18 | 19 | 624 | |
| **TOTAL** | | **980** | **170** | **44** | **93** | **1287** | **0.82** | **1176** | **102** | **23** | **141** | **1442** | **0.87** |
| *VEH SPLIT* | | *76%* | *13%* | *3%* | *7%* | *100%* | | *82%* | *7%* | *2%* | *10%* | *100%* | |
| | | *PERCENTAGE OF:* | | *12H* | | *12.5%* | | *PERCENTAGE OF:* | | *12H* | | *14.0%* | |

| MOVEMENT FROM | NO | MIDDAY PEAK HOUR LIGHT VOL | TAXI VOL | BUS VOL | HEAVY VOL | TOTAL VOL | PHF | 12 HOUR COUNT LIGHT VOL | TAXI VOL | BUS VOL | HEAVY VOL | TOTAL VOL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NORTH | 1 | 252 | 18 | 9 | 21 | 300 | 0.80 | 3497 | 290 | 73 | 228 | 4088 |
| | 2 | | | | | | | | | | | |
| | 3 | 16 | 1 | | 1 | 18 | | 293 | 31 | 7 | 40 | 371 |
| EAST | 4 | 21 | 1 | 1 | 3 | 26 | 0.84 | 357 | 29 | 5 | 38 | 429 |
| | 5 | 50 | 8 | | 27 | 85 | | 512 | 46 | 7 | 332 | 897 |
| | 6 | | | | | | | | | | | |
| SOUTH | 7 | | | | | | n.a. | | | | | |
| | 8 | | | | | | | | | | | |
| | 9 | | | | | | | | | | | |
| WEST | 10 | | | | | | 0.91 | | | | | |
| | 11 | 49 | 2 | | 28 | 79 | | 405 | 47 | 8 | 345 | 805 |
| | 12 | 306 | 8 | 1 | 21 | 336 | | 3187 | 269 | 73 | 186 | 3715 |
| **TOTAL** | | **694** | **38** | **11** | **101** | **844** | **0.84** | **8251** | **712** | **173** | **1169** | **10305** |
| *VEH SPLIT* | | *82%* | *5%* | *1%* | *12%* | *100%* | | *80%* | *7%* | *2%* | *11%* | *100%* |
| | | *PERCENTAGE OF:* | | *12H* | | *8.2%* | | | | | | |

STARTING TIME OF PEAK HOUR

| AM | MID | PM |
|---|---|---|
| 06:15 | 12:45 | 16:15 |

*NOTE: SEE ATTACHED SHETCH FOR LAYOUT OF STATION*

*PREPARED BY TRAFFTRANS (PTY) LTD*

# Appendix E

**SIDRA RESULTS**

APPENDIX E-1

## R545/R547 TO KRIEL (ALL-WAY STOP-CONTROL)

# MOVEMENT SUMMARY

## Site: 1 [2016 - Existing AM]

Intersection of R545 and R547
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 |
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 180 | 31.3 | 0.902 | 63.8 | LOS F | 7.7 | 63.9 | 1.00 | 1.75 | 29.3 |
| 4 | R2 | 68 | 6.5 | 0.902 | 84.4 | LOS F | 7.7 | 63.9 | 1.00 | 1.98 | 25.4 |
| Approach | | 248 | 24.5 | 0.902 | 69.4 | LOS F | 7.7 | 63.9 | 1.00 | 1.82 | 28.1 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 32 | 4.5 | 0.076 | 9.7 | LOS A | 0.2 | 1.8 | 0.86 | 1.21 | 51.6 |
| 1 | R2 | 1036 | 5.2 | 1.601 | 216.8 | LOS F | 63.4 | 463.5 | 1.00 | 4.86 | 13.1 |
| Approach | | 1068 | 5.2 | 1.601 | 210.6 | LOS F | 63.4 | 463.5 | 1.00 | 4.75 | 13.4 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 344 | 10.2 | 3.643 | 1266.4 | LOS F | 61.1 | 465.1 | 1.00 | 3.10 | 2.8 |
| 11 | T1 | 64 | 52.0 | 0.764 | 108.1 | LOS F | 4.5 | 45.4 | 1.00 | 1.65 | 21.6 |
| Approach | | 408 | 16.8 | 3.643 | 1084.7 | LOS F | 61.1 | 465.1 | 1.00 | 2.88 | 3.2 |
| All Vehicles | | 1724 | 10.7 | 3.643 | 397.3 | LOS F | 63.4 | 465.1 | 1.00 | 3.89 | 8.0 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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: 1 [2016 - Existing Mid-day]

Intersection of R545 and R547
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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 112 | 27.1 | 0.356 | 19.4 | LOS C | 1.5 | 12.3 | 0.98 | 1.34 | 45.5 |
| 4 | R2 | 32 | 7.7 | 0.356 | 20.3 | LOS C | 1.5 | 12.3 | 0.98 | 1.37 | 45.5 |
| Approach | | 144 | 22.8 | 0.356 | 19.6 | LOS C | 1.5 | 12.3 | 0.98 | 1.35 | 45.5 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 28 | 44.4 | 0.080 | 12.1 | LOS B | 0.3 | 2.6 | 0.90 | 1.29 | 49.8 |
| 1 | R2 | 348 | 7.3 | 0.629 | 20.9 | LOS C | 3.7 | 27.2 | 0.98 | 1.50 | 44.6 |
| Approach | | 376 | 10.1 | 0.629 | 20.2 | LOS C | 3.7 | 27.2 | 0.97 | 1.49 | 45.0 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 376 | 5.4 | 1.635 | 335.9 | LOS F | 37.3 | 273.4 | 1.00 | 3.91 | 9.2 |
| 11 | T1 | 84 | 29.1 | 0.397 | 26.3 | LOS D | 1.7 | 15.2 | 1.00 | 1.40 | 41.9 |
| Approach | | 460 | 9.7 | 1.635 | 279.3 | LOS F | 37.3 | 273.4 | 1.00 | 3.45 | 10.8 |
| All Vehicles | | 980 | 11.8 | 1.635 | 141.7 | LOS F | 37.3 | 273.4 | 0.99 | 2.39 | 18.1 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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 E-2

## R545/R547 TO KRIEL (SIGNALISED)

# MOVEMENT SUMMARY

## Site: 1v [2016 - Signal_Existing AM]

Intersection of R545 and R547
Signals - Fixed Time Isolated    Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 180 | 31.3 | 0.659 | 25.2 | LOS C | 4.9 | 40.5 | 0.94 | 0.79 | 41.8 |
| 4 | R2 | 68 | 6.5 | 0.659 | 32.5 | LOS C | 4.9 | 40.5 | 0.97 | 0.86 | 39.8 |
| Approach | | 248 | 24.5 | 0.659 | 27.2 | LOS C | 4.9 | 40.5 | 0.94 | 0.81 | 41.2 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 32 | 4.5 | 0.024 | 6.6 | LOS A | 0.1 | 1.0 | 0.25 | 0.59 | 53.2 |
| 1 | R2 | 1036 | 5.2 | 0.673 | 13.6 | LOS B | 14.0 | 102.2 | 0.66 | 0.79 | 47.7 |
| Approach | | 1068 | 5.2 | 0.673 | 13.4 | LOS B | 14.0 | 102.2 | 0.65 | 0.78 | 47.8 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 344 | 10.2 | 0.276 | 7.1 | LOS A | 2.0 | 15.3 | 0.33 | 0.64 | 52.7 |
| 11 | T1 | 64 | 52.0 | 0.288 | 23.6 | LOS C | 1.7 | 17.3 | 0.89 | 0.69 | 43.3 |
| Approach | | 408 | 16.8 | 0.288 | 9.7 | LOS A | 2.0 | 17.3 | 0.42 | 0.65 | 51.0 |
| All Vehicles | | 1724 | 10.7 | 0.673 | 14.5 | LOS B | 14.0 | 102.2 | 0.64 | 0.75 | 47.4 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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: 1v [2021 - Signal_AM excl. Alexander]

Intersection of R545 and R547
Signals - Fixed Time Isolated   Cycle Time = 75 seconds (Optimum Cycle Time - Minimum Delay)

| 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 |
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 208 | 31.3 | 0.840 | 27.3 | LOS C | 5.2 | 41.2 | 0.87 | 0.75 | 41.1 |
| 4 | R2 | 78 | 6.5 | 0.840 | 50.2 | LOS D | 5.2 | 41.2 | 1.00 | 0.97 | 33.0 |
| Approach | | 287 | 24.5 | 0.840 | 33.5 | LOS C | 5.2 | 44.3 | 0.91 | 0.81 | 38.5 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 38 | 4.5 | 0.040 | 14.5 | LOS B | 0.7 | 4.7 | 0.50 | 0.67 | 47.3 |
| 1 | R2 | 1200 | 5.2 | 0.878 | 27.2 | LOS C | 32.5 | 237.3 | 0.85 | 0.90 | 40.5 |
| Approach | | 1238 | 5.2 | 0.878 | 26.8 | LOS C | 32.5 | 237.3 | 0.84 | 0.90 | 40.6 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 398 | 10.2 | 0.801 | 36.5 | LOS D | 15.2 | 115.5 | 0.98 | 0.93 | 36.7 |
| 11 | T1 | 74 | 52.0 | 0.218 | 21.5 | LOS C | 2.1 | 21.2 | 0.78 | 0.62 | 44.4 |
| Approach | | 473 | 16.8 | 0.801 | 34.2 | LOS C | 15.2 | 115.5 | 0.95 | 0.88 | 37.7 |
| All Vehicles | | 1997 | 10.7 | 0.878 | 29.5 | LOS C | 32.5 | 237.3 | 0.87 | 0.88 | 39.6 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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: 1v [2021 - Signal_AM incl. Alexander]

Intersection of R545 and R547
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Optimum Cycle Time - Minimum Delay)

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 208 | 31.3 | 0.832 | 26.3 | LOS C | 4.8 | 38.4 | 0.88 | 0.76 | 41.6 |
| 4 | R2 | 73 | 5.6 | 0.832 | 47.1 | LOS D | 4.8 | 38.4 | 1.00 | 0.97 | 34.0 |
| Approach | | 281 | 24.6 | 0.832 | 31.7 | LOS C | 4.8 | 40.4 | 0.91 | 0.81 | 39.3 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 87 | 1.6 | 0.090 | 14.3 | LOS B | 1.5 | 10.4 | 0.52 | 0.69 | 47.5 |
| 1 | R2 | 1200 | 5.2 | 0.886 | 27.3 | LOS C | 31.5 | 230.5 | 0.86 | 0.92 | 40.4 |
| Approach | | 1287 | 5.0 | 0.886 | 26.4 | LOS C | 31.5 | 230.5 | 0.84 | 0.90 | 40.8 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 398 | 10.2 | 0.819 | 36.3 | LOS D | 14.7 | 111.7 | 0.99 | 0.95 | 36.8 |
| 11 | T1 | 74 | 52.0 | 0.222 | 20.6 | LOS C | 2.0 | 20.0 | 0.79 | 0.62 | 44.9 |
| Approach | | 473 | 16.8 | 0.819 | 33.8 | LOS C | 14.7 | 111.7 | 0.96 | 0.90 | 37.9 |
| All Vehicles | | 2041 | 10.4 | 0.886 | 28.9 | LOS C | 31.5 | 230.5 | 0.87 | 0.89 | 39.9 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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: 1v [2016 - Signal_Existing Mid-day]

Intersection of R545 and R547
Signals - Fixed Time Isolated    Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)

| 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 |
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 112 | 27.1 | 0.178 | 10.6 | LOS B | 1.6 | 13.4 | 0.61 | 0.52 | 50.3 |
| 4 | R2 | 32 | 7.7 | 0.178 | 17.9 | LOS B | 1.6 | 13.4 | 0.66 | 0.60 | 47.4 |
| Approach | | 144 | 22.8 | 0.178 | 12.2 | LOS B | 1.6 | 13.4 | 0.62 | 0.54 | 49.6 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 28 | 44.4 | 0.080 | 22.1 | LOS C | 0.6 | 5.8 | 0.73 | 0.70 | 42.2 |
| 1 | R2 | 348 | 7.3 | 0.442 | 23.2 | LOS C | 5.7 | 42.2 | 0.82 | 0.78 | 42.3 |
| Approach | | 376 | 10.1 | 0.442 | 23.1 | LOS C | 5.7 | 42.2 | 0.81 | 0.77 | 42.3 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 376 | 5.4 | 0.448 | 16.8 | LOS B | 7.4 | 53.9 | 0.70 | 0.78 | 45.9 |
| 11 | T1 | 84 | 29.1 | 0.126 | 9.3 | LOS A | 1.4 | 12.0 | 0.58 | 0.46 | 52.1 |
| Approach | | 460 | 9.7 | 0.448 | 15.4 | LOS B | 7.4 | 53.9 | 0.68 | 0.72 | 46.9 |
| All Vehicles | | 980 | 11.8 | 0.448 | 17.9 | LOS B | 7.4 | 53.9 | 0.72 | 0.71 | 45.4 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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: 1v [2021 - Signal_Mid-day excl. Alexander]

Intersection of R545 and R547
Signals - Fixed Time Isolated Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)

| 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 |
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 130 | 27.1 | 0.219 | 11.3 | LOS B | 2.0 | 16.0 | 0.63 | 0.54 | 49.8 |
| 4 | R2 | 37 | 7.7 | 0.219 | 19.6 | LOS B | 2.0 | 16.0 | 0.71 | 0.64 | 46.4 |
| Approach | | 167 | 22.8 | 0.219 | 13.1 | LOS B | 2.0 | 16.0 | 0.65 | 0.56 | 49.0 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 33 | 44.4 | 0.093 | 22.2 | LOS C | 0.7 | 6.7 | 0.73 | 0.71 | 42.2 |
| 1 | R2 | 404 | 7.3 | 0.513 | 23.6 | LOS C | 6.8 | 50.3 | 0.84 | 0.79 | 42.1 |
| Approach | | 436 | 10.1 | 0.513 | 23.5 | LOS C | 6.8 | 50.3 | 0.83 | 0.78 | 42.1 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 436 | 5.4 | 0.520 | 17.3 | LOS B | 8.9 | 65.5 | 0.74 | 0.80 | 45.6 |
| 11 | T1 | 98 | 29.1 | 0.147 | 9.4 | LOS A | 1.6 | 14.1 | 0.59 | 0.47 | 52.0 |
| Approach | | 534 | 9.7 | 0.520 | 15.9 | LOS B | 8.9 | 65.5 | 0.71 | 0.74 | 46.7 |
| All Vehicles | | 1138 | 11.8 | 0.520 | 18.4 | LOS B | 8.9 | 65.5 | 0.75 | 0.73 | 45.1 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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: 1v [2021 - Signal_Mid-day incl. Alexander]

Intersection of R545 and R547
Signals - Fixed Time Isolated    Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)

| 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 |
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 130 | 27.1 | 0.333 | 10.8 | LOS B | 2.6 | 19.6 | 0.62 | 0.52 | 50.4 |
| 4 | R2 | 92 | 3.0 | 0.333 | 22.6 | LOS C | 2.6 | 19.6 | 0.79 | 0.74 | 43.5 |
| Approach | | 222 | 17.1 | 0.333 | 15.7 | LOS B | 2.6 | 19.6 | 0.69 | 0.61 | 47.3 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 35 | 31.1 | 0.088 | 21.9 | LOS C | 0.7 | 6.6 | 0.73 | 0.71 | 42.6 |
| 1 | R2 | 404 | 7.3 | 0.513 | 23.6 | LOS C | 6.8 | 50.3 | 0.84 | 0.79 | 42.1 |
| Approach | | 439 | 9.2 | 0.513 | 23.5 | LOS C | 6.8 | 50.3 | 0.83 | 0.78 | 42.2 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 436 | 5.4 | 0.520 | 17.3 | LOS B | 8.9 | 65.5 | 0.74 | 0.80 | 45.6 |
| 11 | T1 | 98 | 29.1 | 0.147 | 9.4 | LOS A | 1.6 | 14.1 | 0.59 | 0.47 | 52.0 |
| Approach | | 534 | 9.7 | 0.520 | 15.9 | LOS B | 8.9 | 65.5 | 0.71 | 0.74 | 46.7 |
| All Vehicles | | 1195 | 10.9 | 0.520 | 18.6 | LOS B | 8.9 | 65.5 | 0.75 | 0.73 | 45.0 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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 E-3

## R545/R547 TO KRIEL (ROUNDABOUT)

# MOVEMENT SUMMARY

## Site: 1v [2016 - Roundabout_Existing AM]

Intersection of R545 and R547
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 |
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 180 | 31.3 | 0.235 | 8.7 | LOS A | 1.1 | 9.4 | 0.69 | 0.80 | 52.7 |
| 4 | R2 | 68 | 6.5 | 0.235 | 12.7 | LOS B | 1.1 | 9.4 | 0.69 | 0.80 | 53.1 |
| Approach | | 248 | 24.5 | 0.235 | 9.8 | LOS A | 1.1 | 9.4 | 0.69 | 0.80 | 52.8 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 32 | 4.5 | 0.333 | 4.1 | LOS A | 2.0 | 14.6 | 0.27 | 0.59 | 51.7 |
| 1 | R2 | 1036 | 5.2 | 0.428 | 9.7 | LOS A | 2.9 | 21.5 | 0.28 | 0.60 | 53.3 |
| Approach | | 1068 | 5.2 | 0.428 | 9.5 | LOS A | 2.9 | 21.5 | 0.28 | 0.60 | 53.2 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 344 | 10.2 | 0.239 | 3.9 | LOS A | 1.5 | 11.4 | 0.24 | 0.43 | 55.3 |
| 11 | T1 | 64 | 52.0 | 0.088 | 4.6 | LOS A | 0.4 | 4.3 | 0.27 | 0.38 | 56.1 |
| Approach | | 408 | 16.8 | 0.239 | 4.1 | LOS A | 1.5 | 11.4 | 0.25 | 0.42 | 55.4 |
| All Vehicles | | 1724 | 10.7 | 0.428 | 8.2 | LOS A | 2.9 | 21.5 | 0.33 | 0.58 | 53.6 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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: 1v [2021 - Roundabout_AM excl. Alexander]

Intersection of R545 and R547
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 |
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 208 | 31.3 | 0.299 | 9.6 | LOS A | 1.5 | 12.6 | 0.75 | 0.85 | 52.2 |
| 4 | R2 | 78 | 6.5 | 0.299 | 13.4 | LOS B | 1.5 | 12.6 | 0.75 | 0.86 | 52.7 |
| Approach | | 287 | 24.5 | 0.299 | 10.6 | LOS B | 1.5 | 12.6 | 0.75 | 0.85 | 52.3 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 38 | 4.5 | 0.390 | 4.2 | LOS A | 2.5 | 18.4 | 0.31 | 0.60 | 51.5 |
| 1 | R2 | 1200 | 5.2 | 0.502 | 9.8 | LOS A | 3.8 | 28.0 | 0.33 | 0.60 | 53.1 |
| Approach | | 1238 | 5.2 | 0.502 | 9.6 | LOS A | 3.8 | 28.0 | 0.33 | 0.60 | 53.0 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 398 | 10.2 | 0.280 | 4.0 | LOS A | 1.9 | 14.1 | 0.28 | 0.44 | 55.1 |
| 11 | T1 | 74 | 52.0 | 0.104 | 4.8 | LOS A | 0.5 | 5.1 | 0.30 | 0.39 | 55.9 |
| Approach | | 473 | 16.8 | 0.280 | 4.1 | LOS A | 1.9 | 14.1 | 0.28 | 0.43 | 55.3 |
| All Vehicles | | 1997 | 10.7 | 0.502 | 8.5 | LOS A | 3.8 | 28.0 | 0.38 | 0.59 | 53.4 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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: 1v [2021 - Roundabout_AM incl. Alexander]

Intersection of R545 and R547
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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 208 | 31.3 | 0.297 | 9.7 | LOS A | 1.5 | 12.7 | 0.75 | 0.85 | 52.1 |
| 4 | R2 | 73 | 5.6 | 0.297 | 13.5 | LOS B | 1.5 | 12.7 | 0.76 | 0.87 | 52.7 |
| Approach | | 281 | 24.6 | 0.297 | 10.7 | LOS B | 1.5 | 12.7 | 0.75 | 0.86 | 52.3 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 87 | 1.6 | 0.405 | 4.2 | LOS A | 2.7 | 19.3 | 0.32 | 0.59 | 52.0 |
| 1 | R2 | 1200 | 5.2 | 0.520 | 9.8 | LOS A | 4.1 | 29.7 | 0.33 | 0.59 | 53.2 |
| Approach | | 1287 | 5.0 | 0.520 | 9.4 | LOS A | 4.1 | 29.7 | 0.33 | 0.59 | 53.1 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 398 | 10.2 | 0.278 | 4.0 | LOS A | 1.8 | 14.0 | 0.27 | 0.43 | 55.2 |
| 11 | T1 | 74 | 52.0 | 0.102 | 4.7 | LOS A | 0.5 | 5.1 | 0.29 | 0.39 | 56.0 |
| Approach | | 473 | 16.8 | 0.278 | 4.1 | LOS A | 1.8 | 14.0 | 0.27 | 0.43 | 55.3 |
| All Vehicles | | 2041 | 10.4 | 0.520 | 8.4 | LOS A | 4.1 | 29.7 | 0.38 | 0.59 | 53.5 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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: 1v [2016 - Roundabout_Existing Mid-day]

Intersection of R545 and R547
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 |
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 112 | 27.1 | 0.092 | 5.4 | LOS A | 0.4 | 3.4 | 0.45 | 0.54 | 54.8 |
| 4 | R2 | 32 | 7.7 | 0.092 | 10.5 | LOS B | 0.4 | 3.4 | 0.44 | 0.56 | 54.9 |
| Approach | | 144 | 22.8 | 0.092 | 6.5 | LOS A | 0.4 | 3.4 | 0.45 | 0.55 | 54.8 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 28 | 44.4 | 0.127 | 4.6 | LOS A | 0.6 | 4.7 | 0.24 | 0.58 | 51.1 |
| 1 | R2 | 348 | 7.3 | 0.163 | 9.7 | LOS A | 0.8 | 6.0 | 0.23 | 0.60 | 53.4 |
| Approach | | 376 | 10.1 | 0.163 | 9.3 | LOS A | 0.8 | 6.0 | 0.24 | 0.59 | 53.2 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 376 | 5.4 | 0.238 | 3.7 | LOS A | 1.4 | 10.3 | 0.15 | 0.41 | 55.8 |
| 11 | T1 | 84 | 29.1 | 0.093 | 4.0 | LOS A | 0.4 | 3.9 | 0.16 | 0.34 | 57.1 |
| Approach | | 460 | 9.7 | 0.238 | 3.8 | LOS A | 1.4 | 10.3 | 0.15 | 0.40 | 56.0 |
| All Vehicles | | 980 | 11.8 | 0.238 | 6.3 | LOS A | 1.4 | 10.3 | 0.23 | 0.50 | 54.7 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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: 1v [2021 - Roundabout_Mid-day excl. Alexander]

Intersection of R545 and R547
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** | | | | | | | | | | | |
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 130 | 27.1 | 0.112 | 5.7 | LOS A | 0.5 | 4.2 | 0.48 | 0.57 | 54.6 |
| 4 | R2 | 37 | 7.7 | 0.112 | 10.7 | LOS B | 0.5 | 4.2 | 0.47 | 0.58 | 54.7 |
| Approach | | 167 | 22.8 | 0.112 | 6.8 | LOS A | 0.5 | 4.2 | 0.48 | 0.57 | 54.7 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 33 | 44.4 | 0.149 | 4.7 | LOS A | 0.7 | 5.6 | 0.27 | 0.59 | 51.0 |
| 1 | R2 | 404 | 7.3 | 0.192 | 9.7 | LOS A | 1.0 | 7.2 | 0.26 | 0.60 | 53.3 |
| Approach | | 436 | 10.1 | 0.192 | 9.4 | LOS A | 1.0 | 7.2 | 0.26 | 0.60 | 53.1 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 436 | 5.4 | 0.277 | 3.8 | LOS A | 1.7 | 12.7 | 0.17 | 0.42 | 55.7 |
| 11 | T1 | 98 | 29.1 | 0.110 | 4.0 | LOS A | 0.5 | 4.6 | 0.18 | 0.35 | 57.0 |
| Approach | | 534 | 9.7 | 0.277 | 3.8 | LOS A | 1.7 | 12.7 | 0.17 | 0.40 | 56.0 |
| All Vehicles | | 1138 | 11.8 | 0.277 | 6.4 | LOS A | 1.7 | 12.7 | 0.25 | 0.50 | 54.6 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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: 1v [2021 - Roundabout_Mid-day incl. Alexander]

Intersection of R545 and R547
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 |
| East: R545 (E) | | | | | | | | | | | |
| 5 | T1 | 130 | 27.1 | 0.145 | 5.9 | LOS A | 0.7 | 5.3 | 0.49 | 0.61 | 54.3 |
| 4 | R2 | 92 | 3.0 | 0.145 | 10.6 | LOS B | 0.7 | 5.3 | 0.48 | 0.64 | 54.0 |
| Approach | | 222 | 17.1 | 0.145 | 7.8 | LOS A | 0.7 | 5.3 | 0.49 | 0.62 | 54.1 |
| North: R547 (N) | | | | | | | | | | | |
| 3 | L2 | 35 | 31.1 | 0.150 | 4.5 | LOS A | 0.7 | 5.7 | 0.28 | 0.59 | 51.4 |
| 1 | R2 | 404 | 7.3 | 0.193 | 9.7 | LOS A | 1.0 | 7.5 | 0.27 | 0.60 | 53.3 |
| Approach | | 439 | 9.2 | 0.193 | 9.3 | LOS A | 1.0 | 7.5 | 0.27 | 0.60 | 53.2 |
| West: R545 (W) | | | | | | | | | | | |
| 12 | L2 | 436 | 5.4 | 0.301 | 4.0 | LOS A | 1.9 | 13.8 | 0.28 | 0.44 | 55.3 |
| 11 | T1 | 98 | 29.1 | 0.124 | 4.6 | LOS A | 0.6 | 5.2 | 0.30 | 0.40 | 56.3 |
| Approach | | 534 | 9.7 | 0.301 | 4.1 | LOS A | 1.9 | 13.8 | 0.28 | 0.44 | 55.5 |
| All Vehicles | | 1195 | 10.9 | 0.301 | 6.7 | LOS A | 1.9 | 13.8 | 0.32 | 0.53 | 54.3 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
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.

APPENDIX E-4

# ACCESS TO MINE

# MOVEMENT SUMMARY

## Site: 101 [AM Peak Hour]

Access to Alexander Mine
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: Access | | | | | | | | | | | |
| 1 | L2 | 11 | 0.0 | 0.013 | 9.1 | LOS A | 0.0 | 0.3 | 0.37 | 0.85 | 61.3 |
| 3 | R2 | 2 | 0.0 | 0.013 | 9.9 | LOS A | 0.0 | 0.3 | 0.37 | 0.85 | 61.2 |
| Approach | | 13 | 0.0 | 0.013 | 9.3 | LOS A | 0.0 | 0.3 | 0.37 | 0.85 | 61.3 |
| East: R545 (E) | | | | | | | | | | | |
| 4 | L2 | 18 | 0.0 | 0.187 | 8.5 | LOS A | 0.0 | 0.0 | 0.00 | 0.05 | 83.2 |
| 5 | T1 | 253 | 24.7 | 0.187 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.05 | 117.0 |
| Approach | | 270 | 23.1 | 0.187 | 0.6 | NA | 0.0 | 0.0 | 0.00 | 0.05 | 114.0 |
| West: R545 (W) | | | | | | | | | | | |
| 11 | T1 | 104 | 37.5 | 0.115 | 0.5 | LOS A | 0.4 | 3.0 | 0.27 | 0.26 | 103.0 |
| 12 | R2 | 56 | 0.0 | 0.115 | 9.1 | LOS A | 0.4 | 3.0 | 0.27 | 0.26 | 69.0 |
| Approach | | 160 | 24.3 | 0.115 | 3.5 | NA | 0.4 | 3.0 | 0.27 | 0.26 | 87.8 |
| All Vehicles | | 443 | 22.8 | 0.187 | 1.9 | NA | 0.4 | 3.0 | 0.11 | 0.15 | 100.6 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

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: 101 [Mid day Peak Hour]

Access to Alexander Mine
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: Access | | | | | | | | | | | |
| 1 | L2 | 56 | 0.0 | 0.068 | 8.7 | LOS A | 0.3 | 1.8 | 0.30 | 0.88 | 61.6 |
| 3 | R2 | 18 | 0.0 | 0.068 | 9.2 | LOS A | 0.3 | 1.8 | 0.30 | 0.88 | 61.4 |
| Approach | | 74 | 0.0 | 0.068 | 8.8 | LOS A | 0.3 | 1.8 | 0.30 | 0.88 | 61.5 |
| East: R545 (E) | | | | | | | | | | | |
| 4 | L2 | 2 | 0.0 | 0.112 | 8.5 | LOS A | 0.0 | 0.0 | 0.00 | 0.01 | 84.3 |
| 5 | T1 | 161 | 22.5 | 0.112 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.01 | 119.3 |
| Approach | | 164 | 22.2 | 0.112 | 0.1 | NA | 0.0 | 0.0 | 0.00 | 0.01 | 118.6 |
| West: R545 (W) | | | | | | | | | | | |
| 11 | T1 | 140 | 32.0 | 0.111 | 0.0 | LOS A | 0.1 | 0.6 | 0.04 | 0.05 | 115.9 |
| 12 | R2 | 11 | 0.0 | 0.111 | 8.6 | LOS A | 0.1 | 0.6 | 0.04 | 0.05 | 74.6 |
| Approach | | 151 | 29.8 | 0.111 | 0.7 | NA | 0.1 | 0.6 | 0.04 | 0.05 | 111.6 |
| All Vehicles | | 388 | 20.9 | 0.112 | 2.0 | NA | 0.3 | 1.8 | 0.07 | 0.19 | 98.7 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

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 F

CURRICULUM VITAE

# 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

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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.

# HUTCHINSON CORNELIA, Traffic & Transportation Engineer

- 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 G

**NEMA REGULATIONS CHECKLIST**

**NEMA REGULATIONS (2014) CHECKLIST**
**for Specialist Reports and Reports on Specialist Processes**

| Item | NEMA Regs (2014) - Appendix 6 | Reference to section of specialist report or justification for not meeting requirement |
|---|---|---|
| (a) (i) | The person who prepared the report. | Section 1.1 to 1.3 |
| (ii) | The expertise of that person to carry out the specialist study or specialised process. | Section 1.1 to 1.3 & Appendix F |
| (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: Section 2.3<br>Purpose: Section 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 2.5 |
| (f) | The specific identified sensitivity of the site related to the activity and its associated structures and infrustructure. | Section 6.3 and 8.2 |
| (g) | An identification of any areas to be avoided, including 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. | Locality Plan in Appendix A |
| (i) | A description of any assumptions made and any uncertainties or gaps in knowledge. | Assumptions regarding:<br>• Trip generation - Section 5.1<br>• Trip distribution - Section 5.2<br>• Traffic growth per annum of 3% - Section 5.3<br>• Base year: 2016; and Horizon year: 2021 |
| (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<br>Sections 7 to 8<br>Section 9.1 (Conclusions) |
| (k) | Any mitigation measures for inclusion in the EMPR. | Section 9.2 |
| (l) | Any conditions for inclusion in the environmental authorisation. | Section 9.2 |
| (m) | Any monitoring requirements for inclusion in the EMPR or environmental authorisation. | Not applicable |
| (n) | A reasoned opinion - | |
| (i) | as to whether the proposed activity or portions thereof should be authorised and | Section 9.2 |
| (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 9.2 |
| (o) | A description of any consultation process that was undetaken during the course of carrying out the study. | No consultation was undertaken or deemed necessary as part of this study. |
| (p) | A summary and copies if any comments that were received during any consultation process. | Not applicable |
| (q) | Any other information requested by the competent authority. | Not applicable |