MEMORANDUM

TRAFFIC IMPACT ASSESSMENT

PROPOSED MOKALA MANGENESE MINE TO BE LOCATED NEAR HOTAZEL (ROAD R380) IN THE KGALAGADI DISTRICT, NORTHERN CAPE PROVINCE

MARCH 2015

Prepared for:
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Declaration of Independence

I, Leon Roets hereby declare that Siyazi Gauteng (Pty) Ltd, an independent consulting firm, has no interest or personal gains in this project whatsoever, except receiving fair payment for rendering an independent professional service.

Consultant name: Leon Roets

Signature: 

Date: 31 July 2015

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LIST OF ASSUMTIONS

NEMA Regs (2014) - Appendix 6	Relevant section in report
Details of the specialist who prepared the report	Cover Page.
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix F.
A declaration that the person is independent in a form as may be specified by the competent authority	Page II.
An indication of the scope of, and the purpose for which, the report was prepared	Section 1 of report.
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	Site visit and date of data collection, 14 November. Summer with dry conditions. No relevance to season.
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2 of report. Each section provides a description of relevant data collected or analyses conducted.
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Refer to Section 2 of report, Figure 2.2.
An identification of any areas to be avoided, including buffers	No areas to be avoided by mine related vehicular traffic.
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Refer to Section 2 of report, Figure 2.2.
A description of any assumptions made and any uncertainties or gaps in knowledge;	Page V of report.
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Refer to section 3 of report which includes all findings and recommendations.
Any mitigation measures for inclusion in the EMPr	Refer to section 3 of report which includes all findings and recommendations.
Any conditions for inclusion in the environmental authorisation	Refer to section 3 of report which includes all findings and recommendations.
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Refer to section 3 of report which includes all findings and recommendations.
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	Refer to Item 3.2.3 of section 3 of report which includes all findings and recommendations.
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	Refer to section 3 of report which includes all findings and recommendations.
A description of any consultation process that was undertaken during the course of carrying out the study	Consultation was conducted by
A summary and copies if any comments that were received during any consultation process	SLR Consulting (Africa) (Pty) Ltd held a Public Participation session. Table 2.10 provides comments received and replies.
Any other information requested by the competent authority.	No information requested.

Section 1

INTRODUCTION

Siyazi Transportation Services Gauteng (Pty) Ltd was appointed by SLR Consulting (Africa) (Pty) Ltd during November 2014 to conduct a Traffic Impact Assessment (TIA) for the proposed Mokala Manganese Mine to be situated near Hotazel (Road R380) within the Kgalagadi District, Northern Cape Province.

In broad terms, the Proposed Mining Development will comprise the following main components:

a) Primary crusher station;
b) Secondary crushing station;
c) Screening station;
d) Radial product stacker and product stockpiles;
e) Run of Mine stockpile;
f) Material handling conveyors;
g) Electricity supply from generators;
h) Water reticulation;
i) Potable water system;
j) Ablution facilities (drain to package treatment plant);
k) Access roads; and
l) Storm water management systems;
m) The diversion of Road R380 as the relevant section of this road currently traverses the project site; and
n) Upgrading the intersection of the Gloria Mine along Road R380;
o) Realignment of the proposed Ga-Mogara River within the existing channel.

Vehicle access from and to the Proposed Mining Development will be obtained from Road R380 (MR887-2) at the existing intersection where the Gloria Mine currently gains access from Road R380 (MR887-2).

Figure 1.1 provides a graphical presentation of the locality of the Proposed Mining Development in relation to other activities in the vicinity including the location of the intersections under investigation while **Figure 1.2** provides the concept site layout as produced by Aecom (Pty) Ltd.

POINT	INTERSECTION STATUS	INTERSECTION	GPS CO-ORDINATES	
			LATITUDE	LONGITUDE
A	Existing (Proposed Access)	Road R380 (MR887-2), Gloria Mine Access Road and the Proposed Mine Access Road	S 27°10'57.38"	E 22°54'10.34"
B	Existing	Road R380 (MR887-2), Hotazel Western Access Road and Airfield Access Road	S 27°12'28.05"	E 22°57'5.87"
C	Existing	Road R380 (MR887-2), Hotazel Eastern Access Road and Access Road to Kudumane Mine	S 27°13'0.82"	E 22°57'42.78"

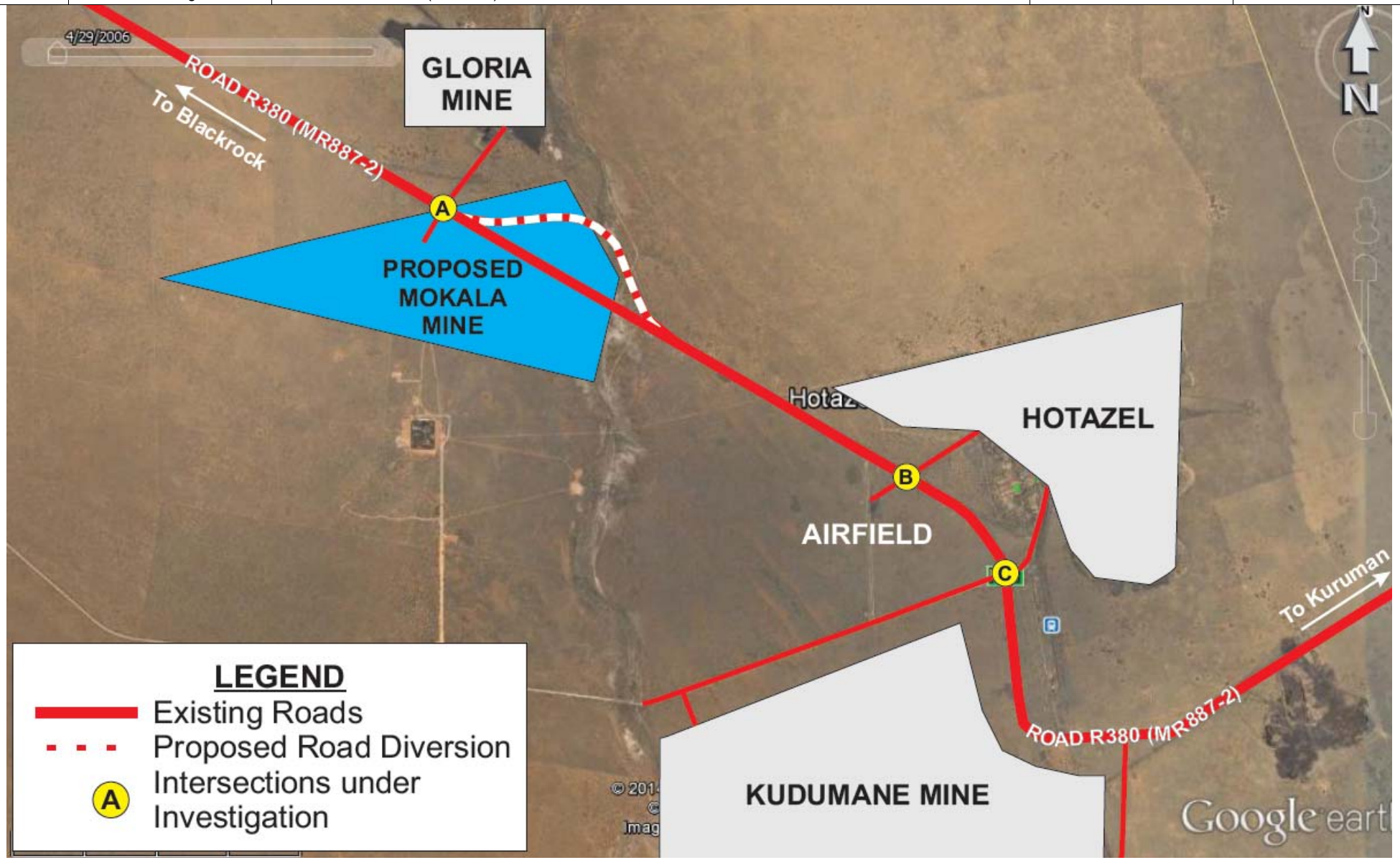


FIGURE 1.1: LOCALITY OF PROPOSED MINING DEVELOPMENT AND RELEVANT INTERSECTIONS

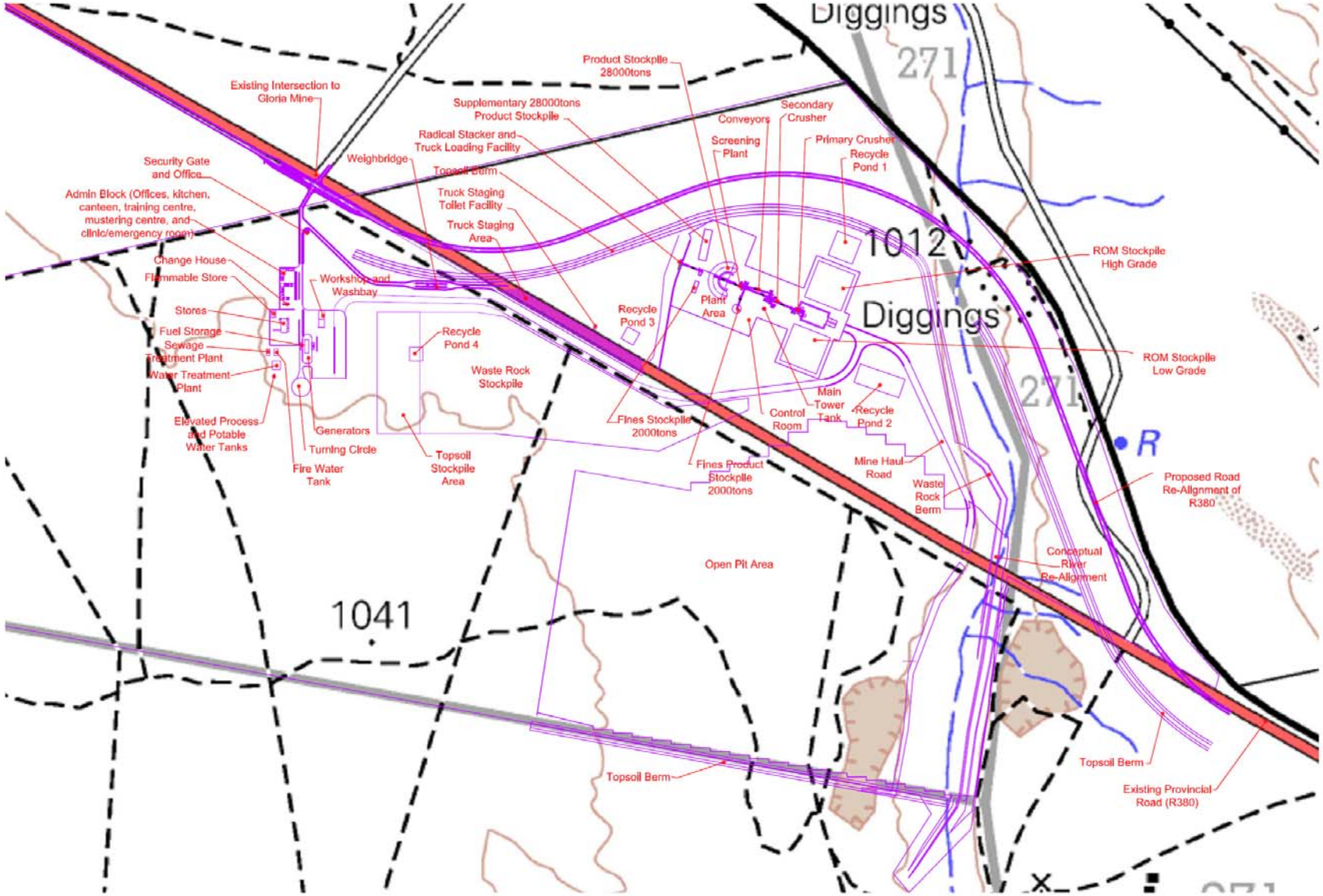


FIGURE 1.2: CONCEPT SITE LAYOUT

Source: AECOM (Pty) Ltd

Table 1.1 contains a summary of the extent of the Proposed Mining Development for project phases.

The purpose of this study is to undertake an assessment of the implications of the vehicle traffic that could potentially be generated at the Proposed Mining Development:

a) The Traffic impact that the change in land use would have on road- and transport-related infrastructure;
b) Whether it is possible to accommodate the Proposed Mining Development within acceptable norms from a traffic engineering point of view; and
c) The mitigating measures required to accommodate the Proposed Mining Development within acceptable Traffic Engineering norms.

The Northern Cape Department of Roads and Public Works is currently the relevant Road Authority related to the adjacent road network to the Proposed Mining Development.

The following scenarios were investigated as part of the Traffic Impact Assessment:

a) **Scenario 1:** 2015 peak hour traffic without background traffic growth, without the Proposed Mining Development;
b) **Scenario 2:** 2015 peak hour traffic without background traffic growth, with the Proposed Mining Development (Construction Phase);
c) **Scenario 3:** 2017 peak hour traffic with background traffic growth, without the Proposed Mining Development;
d) **Scenario 4:** 2017 peak hour traffic with background traffic growth, with the Proposed Mining Development;
e) **Scenario 5:** 2025 peak hour traffic with background traffic growth, without the Proposed Mining Development;
f) **Scenario 6:** 2025 peak hour traffic with background traffic growth, with the Proposed Mining Development;

TABLE 1.1: SUMMARY OF THE EXTENT OF THE PROPOSED MINING DEVELOPMENT FOR THE RESPECTIVE PHASES				
DESCRIPTION	**PHASE**			
	CONSTRUCTION	**OPERATIONAL**	**DECOMMISSIONING**	**CLOSURE**
Production (Tonnes of product for export)	Not relevant.	Max 1 300 000 tonnes per annum (Approximately 5179 tonnes per day)	Not relevant. Some overspill production (product remaining from the construction phase that is sold during the decommissioning phase) could take place, although it will be less than the operational phase. (Activities include the demolition of all infrastructures and the rehabilitation of the site)	Not relevant. (All activities on the site, although limited, are planned to be completed and the mining company will leave the site)
Soil moving for construction	As part of the construction of the Proposed Mining Development, soil is proposed to be moved via haul trucks. The haul trucks will be crossing Road R380 (MR887-2) east of Point A. Refer to **Point 2.1** of **Table 2.10** for detail.	Not relevant	Not relevant	Not relevant
Duration	± 329 days (1 year)	± 15 years	± 1 year	Ongoing process for the duration of the closure phase
Relevant time frame	2016 to 2017	2017 to 2032	2033 to 2034	2034 to undetermined
Number of construction workers	± 230 temporary workers (1 shift per day)	Not relevant	Less than construction phase	Negligible (Maintenance and Aftercare)

TABLE 1.1: SUMMARY OF THE EXTENT OF THE PROPOSED MINING DEVELOPMENT FOR THE RESPECTIVE PHASES				
DESCRIPTION	**PHASE**			
	CONSTRUCTION	**OPERATIONAL**	**DECOMMISSIONING**	**CLOSURE**
Assumed maximum % of construction workers transport that will occur during the AM or PM peaks respectively	Worst case scenario is 100%	Not relevant	Not relevant	Not relevant
Location from where workers are expected to come from during all phases	30% from and to Hotazel. (Based on base-year vehicle traffic distribution)			Not relevant
	70% from and to Kuruman and surrounding villages / towns. (Based on base-year vehicle traffic distribution)			Not relevant
Number of dayshift workers (Admin and management staff)	Not relevant.	±150 per day (1 shift per day, 08h00 to 17h00)	Not relevant.	Not relevant.
Number of mine workers (3 shifts per day)	Not relevant.	±210 per day, ±70 per shift, 3 shifts per day. (06h00 to 14h00, 14h00 to 22h00 and 22h00 to 06h00)	Not relevant.	Not relevant.
Expected number of heavy vehicles delivering consumables and construction material per day	Construction material: 15 Consumables: 10	4	Limited, occasionally.	Limited, occasionally.
Assumed maximum % of heavy vehicles during AM or PM peak respectively	20%	20%	Limited, occasionally.	Limited, occasionally.
Heavy vehicle distribution	See **Figure B-3** of **Appendix B**	See **Figure B-3** of **Appendix B**	Same as for operational phase.	Same as for operational phase.
Heavy vehicles per day exporting processed product (40 tonne trucks)	Not relevant.	130	Not relevant. Some overspill production might take place.	Not relevant.
Abnormal vehicles delivering large components related to the proposed mining development	Once-off events.	Once-off events.	Once-off events.	Once-off events.

TABLE 1.1: SUMMARY OF THE EXTENT OF THE PROPOSED MINING DEVELOPMENT FOR THE RESPECTIVE PHASES				
DESCRIPTION	**PHASE**			
	CONSTRUCTION	**OPERATIONAL**	**DECOMMISSIONING**	**CLOSURE**
Access road	Access via the existing intersection of Road R380 (MR887-2) and the Gloria Mine Access.	Same as for construction phase.	Same as for construction phase.	Same as for construction phase.
Calculated total number of vehicle trips (In and Out) to be generated per AM or PM peak hours	AM – 45 PM – 45 (See **Table 2.6** of **Section 2**)	AM – 113 PM – 113 (See **Tables 2.7 to 2.8** of **Section 2**)	Less than construction and operational phases.	Negligible (Maintenance and Aftercare).

Source: SLR Consulting Project Team, assumptions and calculations.

Section 2

DETAILED INFORMATION RELATED DATA COLLECTED AND INVESTIGATIONS

The purpose of **Section 2** is to provide the detailed information related to the data that was collected and the relevant investigations that were conducted in terms of vehicular traffic:

2.1 STATUS QUO OF LAND USE, AS WELL AS ROAD CHARACTERISTICS

2.1.1 EXISTING LAND USE INFORMATION

The relevant property of the proposed mining development is currently zoned for Agricultural purposes. For the purpose of this TIA, the following assumptions are made:

a) That the anticipated average rate of growth in the area under investigation that is not relevant to this proposed development will be included as background traffic for the respective road sections at 4% per annum.
b) That the vehicle traffic absorption rate (Rate at which existing developments attract vehicular traffic) by all other types of completed developments will maintain the same status for the next ten years.

2.1.2 EXISTING ROAD CHARACTERISTICS AND MODAL DISTRIBUTION

The following are relevant as part of this section:

a) **Table 2.1** contains information related to the existing intersections under investigation.
b) **Figure 2.1** provides the existing road layout for the area under investigation.
c) **Table 2.2** provides information concerning the relevant road sections under investigation.

Tables 2.3 and **2.4** provides a copy of the Guidelines (COTO TRH26 "*South African Road Classification and Access Management Manual, Version 1.0, August 2012*" Rural areas) of typical road characteristics and access management requirements.

TABLE 2.1: SUMMARY OF INTERSECTION CONTROL AT EXISTING INTERSECTION UNDER INVESTIGATION				
POINT	**DESCRIPTION**	**INTERSECTION CONTROL**	**PEDESTRIAN ACTIVITIES**	**INTERSECTION PHOTO**
A	Road R380 (MR887-2), Gloria Mine Access Road and Proposed Mine Access Road	Free-flow on Road R380 (MR887-2)	Pedestrians loaded and off-loaded	
B	Road R380 (MR887-2), Hotazel Western Access Road and Airfield Access Road	Free-flow on Road R380 (MR887-2)	Pedestrians loaded and off-loaded	
C	Road R380 (MR887-2), Hotazel Eastern Access Road and Kudumane Mine Access Road	Free-flow on Road R380 (MR887-2)	Pedestrians loaded and off-loaded	

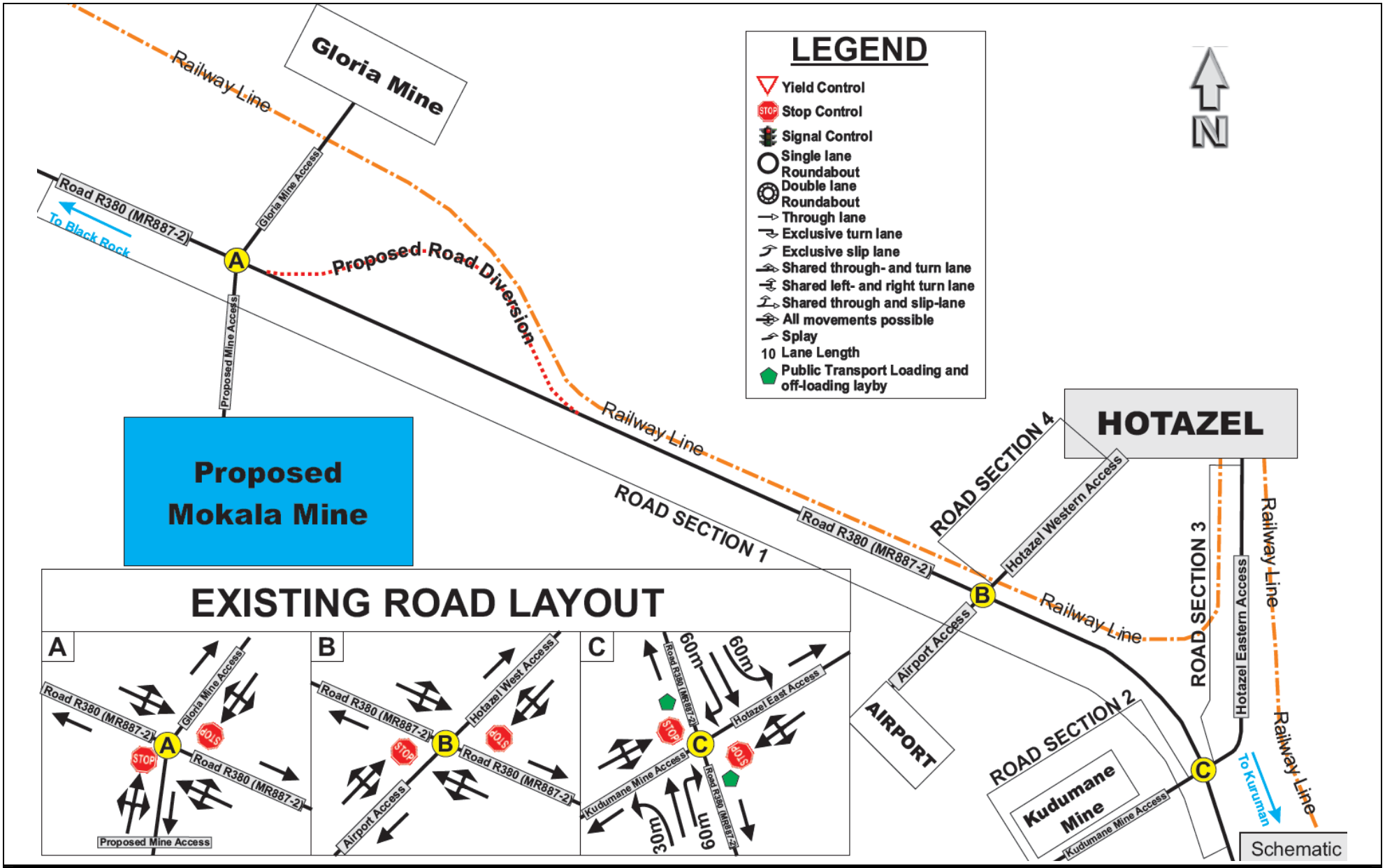


FIGURE 2.1: EXISTING ROAD NETWORK LAYOUT

TABLE 2.2: SUMMARY OF ROAD CHARACTERISTICS

RELEVANT ROAD SECTION	PICTURE OF ROAD SECTION	EXISTING CLASS OF ROAD	POSSIBLE FUTURE CLASS OF ROAD	Road Authority	Road Reserve	Number of Lanes	Lane Width	Type Of Surface	Median	Anticipated Traffic Growth Per Annum	Speed Limit
Road Section 1 **Road R380 (MR887-2)** Road link between Black Rock and Kuruman		**Primary Function:** Mobility **Class:** Main Road; **Class No.:** R3; **Route No.:** MR887-2 **Description:** Minor Arterial Access spacing: 600m ± 20%	**Proposed Function:** Mobility **Class:** Main Road; **Class No.:** R3; **Route No.:** MR887-2 **Description:** Minor Arterial Access spacing: 600m ± 20%	Northern Cape Department of Roads and Public Works	40m	One lane per direction	3.7m wide, 1.3m shoulder	Asphalt	None.	4%	80km/h to 100 km/h
Road Section 2 **Access to Kudumane Mine** Provides access to mining developments from and to Road R380 (MR887-2)		**Primary Function:** Activity and Access **Class:** Collector Road; **Class No.:** R4; **Route No.:** None **Description:** Collector Access spacing: Intersections 200 to 500m.	**Proposed Function:** Activity and Access **Class:** Collector Road; **Class No.:** R4; **Route No.:** None **Description:** Collector Access spacing: Intersections 200 to 500m.	Northern Cape Department of Roads and Public Works	30m	One lane per direction	3.7m wide	Asphalt	None.	4%	80 km/h
Road Section 3 **Hotazel Eastern Access Road** Provides eastern part of Hotazel access from and to Road R380 (MR887-2)		**Primary Function:** Activity and Access **Class:** Collector Road; **Class No.:** R4; **Route No.:** None **Description:** Collector Access spacing: Intersections 200 to 500m.	**Proposed Function:** Activity and Access **Class:** Collector Road; **Class No.:** R4; **Route No.:** None **Description:** Collector Access spacing: Intersections 200 to 500m.	Northern Cape Department of Roads and Public Works	30m	One lane per direction	3.7m wide	Asphalt	None.	4%	60km/h

TABLE 2.2: SUMMARY OF ROAD CHARACTERISTICS											
RELEVANT ROAD SECTION	**PICTURE OF ROAD SECTION**	**EXISTING CLASS OF ROAD**			**POSSIBLE FUTURE CLASS OF ROAD**			**Road Authority**	**Road Reserve**	**Number of Lanes**	**Lane Width**	**Type Of Surface**	**Median**	**Anticipated Traffic Growth Per Annum**	**Speed Limit**
Road Section 4 **Hotazel Western Access Road** Provides western part of Hotazel access from and to Road R380 (MR887-2)		**Primary Function:** Activity and Access			**Proposed Function:** Activity and Access			Northern Cape Department of Roads and Public Works	30m	One lane per direction	3.7m wide	Asphalt	None.	4%	60 km/h
		Class	**Class No.**	**Route No.**	**Class**	**Class No.**	**Route No.**								
		Collector Road	R4	None	Collector Road	R4	None								
		Description: Collector			**Description:** Collector										
		Access spacing: Intersections 200 to 500m.			Access spacing: Intersections 200 to 500m.										

TABLE 2.3: RURAL FUNCTIONAL ROAD CLASIFICATION *(COTO TRH26 - SOUTH AFRICAN ROAD CLASIFICATION AND ACCESS MANAGEMENT MANUAL VERISON 1.0 AUGUST 2012)*										
FUNCTION			**DESCRIPTION**		**MOBILITY**					**INTERSECTION SPACING**
BASIC FUNCTION	**ALTERNATE FUNCTIONAL DESCRIPTION**	**DETERMINING FUNCTION**	**CLASS NO (R)**	**CLASS NAME**	**ORIGIN / DESTINATION**	**THROUGH TRAFFIC COMPONANT**	**REACH OF CONNECTIVITY**	**% OF BUILT KM**	**AADT (AVERAGE ANNUAL DAILY TRAFFIC)**	**MINIMUM SPACING REQUIREMENTS FOR RURAL ROADS**
Mobility	Vehicle priority, vehicle only, long distance, through, high order, high speed, numbered, commercial, economic, strategic; route, arterial road or highway	Movement is dominant, through traffic is dominant, the majority of traffic does not originate or terminate in the immediate vicinity; the function of the road is to carry high volumes of traffic between urban areas.	R 1	Principal Arterial*	Metro areas, large cities, large border posts, join national routes.	Exclusively	> 50km	2 - 4% Classes 1 and 2	1 000 - 100 000+	8.0 km
			R 2	Major Arterial*	Cities and large towns, transport nodes (harbour and international airports), smaller border posts, join major routes.	Exclusively	> 25km		500 - 25 000+	5.0 km
			R 3	Minor Arterial*	Towns, villages and rural settlements, tourist destinations, transport nodes (railway sidings, seaports, landing strips), small border posts, other routes.	Predominant	> 10km	6 - 12% Classes1, 2 and 3	100 - 2 000+	1.6 km
Access / Activity	Access, mixed pedestrian and vehicle traffic, short distance, low order, lower speed, community / farm, road or street.	Access, turning and crossing movements are allowed, the majority of traffic has an origin or destination in the district, the function of the road is to provide a safe environment for vehicles and pedestrians using access points.	R 4	Collector Road	Connect farming districts, rural settlements, tourist areas, national and private parks and mines to mobility routes.	Minimal	< 10km	20 - 25%	< 1 000	600 – 800 m
			R 5	Local Road	Farm or property access, connection to other routes.	Nil Discontinued	< 5km	65 - 75%	< 500	450 – 600 m
			R 6	Walkway (Path or Track)	Settlements, farms, transport nodes, water points.	n/a	n/a	n/a	n/a	450 – 600 m

* I rural areas, the term distributor may be preferred to arterial.

TABLE 2.4: RURAL ACCESS MANAGEMENT REQUIREMENTS AND FEATURES

(COTO TRH26 - SOUTH AFRICAN ROAD CLASIFICATION AND ACCESS MANAGEMENT MANUAL VERISON 1.0 AUGUST 2012)

BASIC FUNCTION	DESCRIPTION		REQUIREMENTS				TYPICAL FEATURES (Use appropriate context sensitive standards for design)								
	CLASS NO (R_)	CLASS NAME	DESIGN TOPOLOGY	ROUTE NO,	ACCESS TO PROPERTY	PARKING	SPEED km/h	INTERSECTION CONTROL	TYPICAL CROSS SECTION	ROADWAY / LANE WIDTH	ROAD RESERVE WIDTH	PUBLIC TRANSPORT & PEDESTRIAN CROSSINGS	PEDESTRIAN FOOTWAYS (CONSTRUCTED)	CYCLE LANES	ANIMAL DRAWN VEHICLES
Mobility	R 1	Principal arterial	Expressway	Yes (N)	Not allowed*	No (off road rest stops allowed)	120	Grade separated or priority to through	2/3/4 lane, surfaced shoulders, climbing lanes	3.5 - 3.7m	60 - 80m (62m)	No	No	No	No
	R 2	Major arterial	Highway	Yes (R: 2 or 3-digit; or N)	Not allowed */**	No (off road rest stops allowed)	120	Priority or grade separated	2/3 lane, surfaced shoulders, climbing lanes	3.5 - 3.7m	40-70m (48m)	As required	Isolated	Recreational on shoulder	No
	R 3	Minor arterial	Main road	Yes (R: 3 or 2-digit)	Not allowed */**	No (off road rest stops allowed)	100 - 120	Priority, roundabout	2 lane surfaced, gravel shoulders	4.0m	30-50m (30m)	As required	Isolated	Recreational widen roadway both sides	Widen shoulder
Access / Activity	R 4	Collector road	Collector	Allowed, T (tourist) or D (district)	Yes	No (off road edge or in lay byes / viewpoints)	80 - 100	Priority	2 lane surfaced or gravel, gravel shoulders	3.5m	25m	As required	Rare, isolated	Widen roadway	Widen shoulder
	R 5	Local road	Farm road	Allowed, T (tourist) or L (local)	Yes	No (on verge or shoulder)	60 - 80	Priority	1/2 lane gravel, 600mm concrete strips in environmental areas		20m	As required	Rare	Use roadway	Use roadway
	R 6	Walkway	Track or pathway	No	Yes	n/a							Not constructed, formed by use		

* Access to properties sufficiently large to warrant a private intersection / interchange can be considered if access spacing requirements met and there is no future need for public road.

** Low volume farm gate and tourist access (less than 10 vehicles per day) can be considered if no alternative exists.

2.1.3 TRAFFIC COUNTS AS BASIS FOR MAKING TRAFFIC ENGINEERING CALCULATIONS

In order to gain a better understanding of the existing traffic patterns and movements adjacent to the Proposed Mining Development, 14-hour manual traffic counts were conducted at intersections that would potentially be affected by the Proposed Mining Development.

It is standard traffic engineering practice to conduct at least a12-hour manual traffic count but based on the clients requirements a 14-hour count was done at all intersections that could potentially be affected by a proposed mining development, as close as possible to a month-end Friday when traffic movement is expected to be at its highest. Due to a time constraint on the project timeline, the relevant traffic counts were conducted mid-month. It is anticipated that due to the location of the project, a mid-month traffic count would yield the same results as a month-end. From the 14-hour manual traffic counts, the AM and PM peak hours are determined respectively, and used for any further calculations.

The relevant 14-hour manual traffic counts were conducted on Friday 14 November 2014 at the following intersections under investigation:

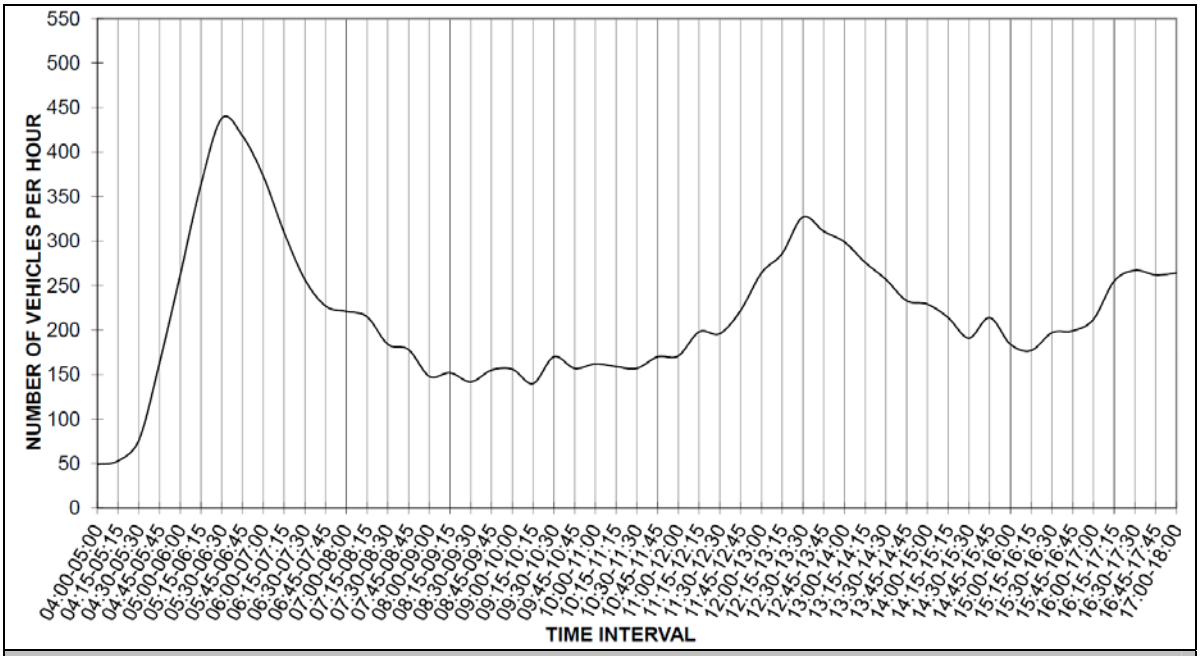
a) **Point A:** Intersection of Road R380 (MR887-2), Gloria Mine Access Road and Proposed Mining Development Access Road;
b) **Point B:** Intersection of Road R380 (MR877-2), Hotazel Western Access Road and Airfield Access Road; and
c) **Point C:** Intersection of Road R380 (MR877-2), Hotazel Eastern Access Road and Kudumane Mine Access Road.

The combined hourly totals of all the vehicle types for the traffic survey conducted on Friday 14 November 2014 between 04:00 and 18:00 are indicated in **Tables A-1 to A-3** of **Appendix A** of this report. The description of the relevant vehicle movements at the relevant intersections appears in **Figure A-1** of **Appendix A**.

The respective peak-hour flows for the traffic counts at the relevant intersections were identified as indicated in **Table 2.5** below.

TABLE 2.5: PEAK HOUR PERIODS AT THE RELEVANT INTERSECTION					
POINT	INTERSECTION	AM PEAK		PM PEAK	
		TIME INTERVAL	NUMBER OF VEHICLES	TIME INTERVAL	NUMBER OF VEHICLES
A	Road R380 (MR887-2), Gloria Mine Access Road and Proposed Mine Access Road	05:30 – 06:30	438	13:00 – 14:00	299
B	Road R380 (MR887-2), Hotazel Western Access Road and Airfield Access Road	05:30 – 06:30	429	13:00 – 14:00	350
C	Road R380 (MR887-2), Hotazel Eastern Access Road and Kudumane Mine Access Road	05:30 – 06:30	470	13:00 – 14:00	375

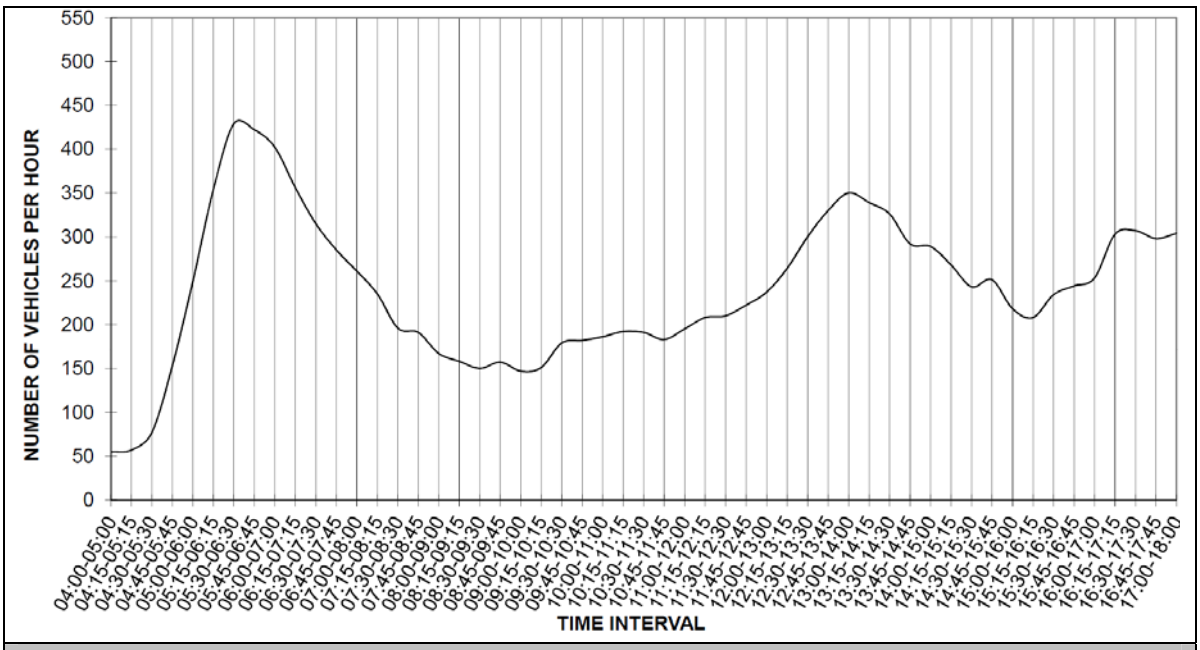
Figure 2.1 indicates the hourly traffic pattern, per 15-minute interval, for all modes of vehicles at the relevant intersections between 04:00 and 18:00 on Friday 14 November 2014.



POINT A

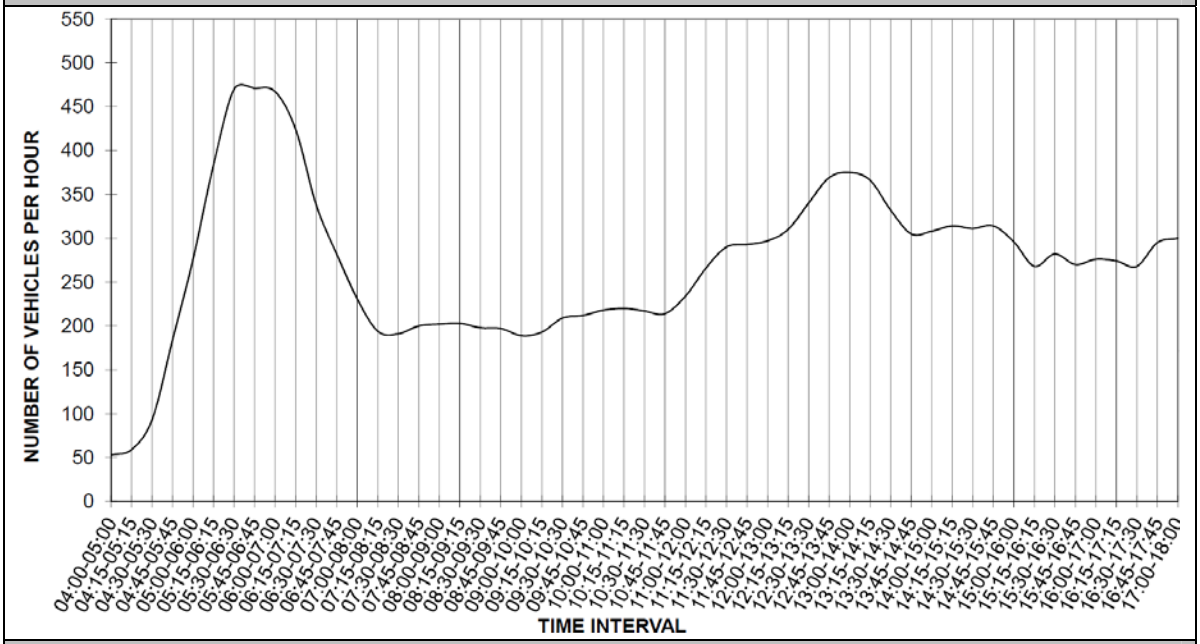
INTERSECTION OF ROAD R380 (MR887-2), GLORIA MINE ACCESS ROAD AND PROPOSED MINING DEVELOPMENT ACCESS ROAD (14 NOVEMBER 2014)

FIGURE 2.1: HOURLY TRAFFIC PATTERN PER 15-MINUTE INTERVAL FOR ALL MODES OF VEHICLES (04:00 to 18:00) AT THE RELEVANT INTERSECTION



POINT B

ROAD R380 (MR887-2), HOTAZEL WESTERN ACCESS ROAD AND AIRFIELD ACCESS ROAD (14 NOVEMBER 2014)



POINT C

ROAD R380 (MR887-2), HOTAZEL EASTERN ACCESS ROAD AND KUDUMANE MINE ACCESS ROAD (14 NOVEMBER 2014)

FIGURE 2.1: HOURLY TRAFFIC PATTERN PER 15-MINUTE INTERVAL FOR ALL MODES OF VEHICLES (04:00 to 18:00) AT THE RELEVANT INTERSECTION (Continue)

2.2 DETERMINATION OF FUTURE LAND USE AND ROAD CHARACTERISTICS

2.2.1 LAND USE INFORMATION, INCLUDING POSSIBLE FUTURE DEVELOPMENTS IN THE AREA

Several mining developments are in the process of being developed within the area relevant to the Proposed Mining Development along Road R380 (MR 887-2). In order to evaluate the potential impact due to growth in vehicle traffic volumes along Road R380 (MR887-2) due to latent mining developments, the assumed latent mining development traffic were included by applying a growth factor of 4% per annum to background traffic.

2.2.2 INFORMATION ABOUT THE EXPECTED FUTURE MODAL DISTRIBUTION

Figures B-3 and **B-4 of Appendix B** indicate, in percentages, the expected vehicle trips distribution, respectively, of delivery vehicles, light vehicles and heavy vehicles transporting processed product for the AM and PM peak periods for the relevant scenarios.

2.2.3 DETERMINATION OF VEHICLE TRIPS EXPECTED TO BE GENERATED BY THE PROPOSED MINING DEVELOPMENT

Tables 2.6 to 2.8 indicate the trip generation rates, the number of vehicle trips which are expected to be generated by the Proposed Mining Development and the distribution of the vehicle trips to and from the respective areas of the Proposed Mining Development respectively for the construction and operational phases. The trip generation rates are based on the *South African Trip Generation Rates*, Second Edition, 1995, information provided by the project team and assumptions made based on professional experience where information was not available.

With reference to **Tables 2.7** and **2.8**, it is important to take note that it is proposed by the Proposed Mining Development that Mining Workers will work **three** shifts per day during the operational phase.

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TABLE 2.6: TRIP GENERATION RATES, EXPECTED NUMBER OF VEHICLE TRIPS TO BE GENERATED BY THE PROPOSED MINING DEVELOPMENT AND THE DISTRIBUTION OF VEHICLE TRIPS (CONSTRUCTION PHASE)

Item	Component	Number of Workers per Day	% Workers active during Peak Hour	Number of Workers Active per Peak Hour	Number of Trucks Per Day	% Trucks active during Peak Hour	Number of Trucks active during Peak Hour	Assumed average number Persons per Vehicle	Comments	Trip Generation Calculations for Peak Hour						Final Trip Information for Traffic Engineering Calculations			
										If Inward Movement is relevant Value = 1	Num Veh Trips for Inwards Direction	If Outward Movement is relevant Value = 1	Number of vehicle Trips for Outwards Direction	Total number of vehicle Trips Generated during Peak Hour (In & Out)	Calculated Trip Generation Rate per vehicle during Peak Hour	Trip Dist. %		Trip Generation	
																In	Out	In	Out
AM Peak Hour																			
1.	Construction workers (Making use of private transport - 20%)	46	100%	46				3.0	Trips per Worker (3 Persons per Vehicle)	1	15	0	0	15	**0.33**	100%	0%	15	0
2.	Construction workers (Transported via 50 seater busses - 50%)	115	100%	115				50.0	50 persons per bus (Bus deliver workers and leave site empty)	1	3	1	3	6	**0.05**	50%	50%	3	3
3.	Construction workers (Making use of public transport (Taxis) - 30%)	69	100%	69				10.0	10 persons per taxi (Taxi delivers workers and leave site empty)	1	7	1	7	14	**0.20**	50%	50%	7	7
4.	Delivery vehicles (Construction materials)				15	20%	3	1.0	20% of delivery vehicles expected during peak periods	1	3	1	3	6	**2.00**	50%	50%	3	3
5.	Heavy vehicles delivering consumables				10	20%	2	1.0	20% of delivery vehicles expected during peak periods	1	2	1	2	4	**2.00**	50%	50%	2	2
													TOTAL	45				30	15
PM Peak Hour																			
1.	Construction workers (Making use of private transport - 20%)	46	100%	46				3.0	Trips per Worker (3 Persons per Vehicle)	0	0	1	15	15	**0.33**	0%	100%	0	15
2.	Construction workers (Transported via 50 seater busses - 50%)	115	100%	115				50.0	50 persons per bus (Bus deliver workers and leave site empty)	1	3	1	3	6	**0.05**	50%	50%	3	3
3.	Construction workers (Making use of public transport (Taxis) - 30%)	69	100%	69				10.0	10 persons per taxi (Taxi delivers workers and leave site empty)	1	7	1	7	14	**0.20**	50%	50%	7	7
4.	Delivery vehicles (Construction materials)				15	20%	3	1.0	20% of delivery vehicles expected during peak periods	1	3	1	3	6	**2.00**	50%	50%	3	3
5.	Heavy vehicles delivering consumables				10	20%	2	1.0	20% of delivery vehicles expected during peak periods	1	2	1	2	4	**2.00**	50%	50%	2	2
													TOTAL	45				15	30

Notes: 1) Total number of staff is 230 per day and not 230 per peak period.

TABLE 2.7: AM PEAK TRIP GENERATION RATES, EXPECTED NUMBER OF VEHICLE TRIPS TO BE GENERATED BY THE PROPOSED MINING DEVELOPMENT AND THE DISTRIBUTION OF VEHICLE TRIPS (OPERATIONAL PHASE)

Item	Component	Number of Workers per Day	% Workers active during Peak Hour	Number of Workers Active per Peak Hour	Number of Trucks Per Day	% Trucks active during Peak Hour	Number of Trucks active during Peak Hour	Assumed average number Persons per Vehicle	Comments	Trip Generation Calculations for Peak Hour						Final Trip Information for Traffic Engineering Calculations			
										If Inward Movement is relevant Value = 1	Num Veh Trips for Inwards Direction	If Outward Movement is relevant Value = 1	Number of vehicle Trips for Outwards Direction	Total number of vehicle Trips Generated during Peak Hour (In & Out)	Calculated Trip Generation Rate per vehicle during Peak Hour	Trip Dist. %		Trip Generation	
																In	Out	In	Out
AM Peak Hour																			
1.	Administrative and Management personnel (Making use of private transport - 30%) **DAY SHIFT**	45	100%	45				3.0	Trips per Worker (3 Persons per Vehicle)	1	15	0	0	15	**0.33**	100%	0%	15	0
2.	Administrative and Management personnel (Making use of public transport (Taxis - 70%) **DAY SHIFT**	105	100%	105				10.0	10 persons per taxi (Taxi delivers workers and leave site empty)	1	11	1	11	21	**0.20**	50%	50%	11	11
3.	Mining personnel (Making use of private transport - 30%) **(FORMS PART OF THE OVERALL 3 SHIFTS PER DAY)**	63	33%	21				3.0	Trips per Worker (3 Persons per Vehicle)	1	7	1	7	14	**0.67**	50%	50%	7	7
4.	Mining personnel (Making use of public transport (Taxis - 70%) **(FORMS PART OF THE OVERALL 3 SHIFTS PER DAY)**	147	33%	49				10.0	10 persons per taxi (Taxi delivers workers and leave site empty)	1	5	1	5	10	**0.20**	50%	50%	5	5
5.	Heavy vehicles transporting processed product				130	20%	26	1.0	20% of heavy vehicles expected during peak periods	1	26	1	26	52	**2.00**	50%	50%	26	26
6.	Heavy vehicles delivering consumables				4	20%	1	1.0	20% of heavy vehicles expected during peak periods	1	1	1	1	2	**2.00**	50%	50%	1	1
													TOTAL	113				64	49

Note: 1) Vehicle Trip Generation related to **Table 2.7** is applicable to Alternatives 1 and 2.
2) Total number of staff per day is 360 per day and not 360 per peak period.

TABLE 2.8: PM PEAK TRIP GENERATION RATES, EXPECTED NUMBER OF VEHICLE TRIPS TO BE GENERATED BY THE PROPOSED MINING DEVELOPMENT AND THE DISTRIBUTION OF VEHICLE TRIPS (OPERATIONAL PHASE)

Item	Component	Number of Workers per Day	% Workers active during Peak Hour	Number of Workers Active per Peak Hour	Number of Trucks Per Day	% Trucks active during Peak Hour	Number of Trucks active during Peak Hour	Assumed average number Persons per Vehicle	Comments	Trip Generation Calculations for Peak Hour						Final Trip Information for Traffic Engineering Calculations			
										If Inward Movement is relevant Value = 1	Num Veh Trips for Inwards Direction	If Outward Movement is relevant Value = 1	Number of vehicle Trips for Outwards Direction	Total number of vehicle Trips Generated during Peak Hour (In & Out)	Calculated Trip Generation Rate per vehicle during Peak Hour	Trip Dist. %		Trip Generation	
																In	Out	In	Out
PM Peak Hour																			
1.	Administrative and Management personnel (Making use of private transport - 30%) **DAY SHIFT**	45	100%	45				3.0	Trips per Worker (3 Persons per Vehicle)	0	0	1	15	15	**0.33**	0%	100%	0	15
2.	Administrative and Management personnel (Making use of public transport (Taxis - 70%) **DAY SHIFT**	105	100%	105				10.0	10 persons per taxi (Taxi delivers workers and leave site empty)	1	11	1	11	21	**0.20**	50%	50%	11	11
3.	Mining personnel (Making use of private transport - 30%) **(FORMS PART OF THE OVERALL 3 SHIFTS PER DAY)**	63	33%	21				3.0	Trips per Worker (3 Persons per Vehicle)	1	7	1	7	14	**0.67**	50%	50%	7	7
4.	Mining personnel (Making use of public transport (Taxis - 70%) **(FORMS PART OF THE OVERALL 3 SHIFTS PER DAY)**	147	33%	49				10.0	10 persons per taxi (Taxi delivers workers and leave site empty)	1	5	1	5	10	**0.20**	50%	50%	5	5
5.	Heavy vehicles transporting processed product				130	20%	26	1.0	20% of heavy vehicles expected during peak periods	1	26	1	26	52	**2.00**	50%	50%	26	26
6.	Heavy vehicles delivering consumables				4	20%	1	1.0	20% of heavy vehicles expected during peak periods	1	1	1	1	2	**2.00**	50%	50%	1	1
													TOTAL	**113**				**49**	**64**

Note: 1) Vehicle Trip Generation related to **Table 2.8** is applicable to Alternatives 1 and 2.
2) Number of staff per day is 360 per day and not 360 per peak period.

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2.2.4 DETERMINATION OF THE TOTAL TRAFFIC EXPECTED TO BE GENERATED AT THE RELEVANT INTERSECTIONS

The detailed traffic-related investigation was conducted for the construction and operational phases of the project. The following figures are relevant:

a) **Figure B-1:** Base year, 2014, peak hour traffic without the Proposed Mining Development;
b) **Figure B-2:** Projected 2015 peak hour traffic without background traffic growth, without the Proposed Mining Development **(Scenario 1)**;
c) **Figure B-3:** Projected vehicle trip distribution for the Proposed Mining Development (Delivery and Heavy vehicles);
d) **Figure B-4:** Projected vehicle trip distribution for the Proposed Mining Development (Light vehicles);
e) **Figure B-5:** Projected vehicle trips generated by the Proposed Mining Development (Construction Phase);
f) **Figure B-6:** Projected vehicle trips generated by the Proposed Mining Development (Operational Phase);
a) **Figure B-7:** Projected 2015 peak hour traffic without background traffic growth, with the Proposed Mining Development (Construction Phase) **(Scenario 2)**;
b) **Figure B-8:** Projected 2017 peak hour traffic with background traffic growth without the Proposed Mining Development **(Scenario 3)**;
c) **Figure B-9:** Projected 2017 peak hour traffic with background traffic growth, with the Proposed Mining Development (Operational Phase) **(Scenario 4)**;
d) **Figure B-10:** Projected 2025 peak hour traffic with background traffic growth, without the Proposed Mining Development **(Scenario 5)**;
e) **Figure B-11:** Projected 2025 peak hour traffic with background traffic growth, with the Proposed Mining Development (Operational Phase) **(Scenario 6)**;

2.3 DETERMINATION OF THE LEVELS OF SERVICE AT THE RELEVANT INTERSECTIONS

The ***"SIDRA Intersection"*** software was used as an aid for the design and evaluation of the relevant intersections. The following intersections were evaluated for levels of service:

a) **Point A:** Intersection of Road R380 (MR887-2), Gloria Mine Access Road and Proposed Mining Development Access Road;
b) **Point B:** Intersection of Road R380 (MR877-2), Hotazel Western Access Road and Airfield Access Road; and
c) **Point C:** Intersection of Road R380 (MR877-2), Hotazel Eastern Access Road and Kudumane Mine Access Road.

In Appendix C, Tables C-1 to C-6 indicates the levels of service and the degree of saturation calculated for the relevant intersections for the respective scenarios:

a) **Table C-1:** Levels of Service for various approaches for the year 2015, without background traffic growth without the Proposed Mining Development **(Scenario 1)**;
b) **Table C-2:** Levels of Service for various approaches for the year 2017, with background traffic growth, without the Proposed Mining Development **(Scenario 3)**;
c) **Table C-3:** Levels of Service for various approaches for the year 2025, with background traffic growth, without the Proposed Mining Development **(Scenario 5)**;
d) **Table C-4:** Levels of Service for various approaches for the year 2015, with background traffic growth, with the Proposed Mining Development (Construction Phase) **(Scenario 2)**;
e) **Table C-5:** Levels of Service for various approaches for the year 2017, with background traffic growth, with the Proposed Mining Development (Operational Phase) **(Scenario 4)**;
f) **Table C-6:** Levels of Service for various approaches for the year 2025, with background traffic growth, with the Proposed Mining Development (Operational Phase) **(Scenario 6)**;

From **Tables C-1 to C-6** it is possible to note:

a) That no additional road infrastructure is required from a traffic capacity point of view at the relevant intersections under investigation, although intersection upgrading is recommended in terms of Road Safety. Refer to **Section 3** for recommended intersection upgrading ; and
b) That the relevant intersections under investigation will operate at acceptable levels of services for the relevant time frame in which the Traffic Impact Assessment was prepared with the recommended intersection upgrading implemented from a safety perspective.

Refer to **Table D-1** and **D-2** of **Appendix D** for Level of Service criteria.
See Figures 3.1 and **3.2** for more detailed information concerning the specific Proposed Mine Access Road Intersection Layout (Point A), which would be based on road safety and intersection functionality requirements.

Table 2.9 provides a summary of the available reserve capacity on the various sections of roads that had been investigated. The assumed free-flow capacity of individual lanes is relevant provided that the relevant intersections have reserve capacity available for the relevant lanes of the intersections.

TABLE 2.9: AVAILABLE RESERVE CAPACITY FOR RELEVANT ROAD SECTION																	
Point	Intersection	Direction of Road Section	Capacity per Lane	Number of lanes	Total Capacity	Actual Number of Vehicles						Reserve Capacity Available					
						2015 Construction		2017 Operational		2025 Operational		2015 Construction		2017 Operational		2025 Operational	
						AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
A	Road R380 (MR887-2), Gloria Mine Access Road and Proposed Mine Access Road	North (Gloria Mine Access Road)	Not Applicable. Access Road.														
		East (Road R380)	1100	1	1100	52	245	89	297	105	383	1054	855	1011	803	995	717
		South (Proposed Mine Access Road)	Not Applicable. Access Road.														
		West (Road R380)	1100	1	1100	339	75	367	82	502	112	761	1025	733	1018	598	988
B	Road R380 (MR887-2), Hotazel Western Access Road and Airfield Access Road	North (Hotazel Western Access Road)	600	1	600	18	90	22	97	29	129	682	510	575	503	571	471
		East (Road R380)	1100	1	1100	70	240	106	288	129	374	1030	860	994	812	971	726
		South (Airfield Access Road)	Not Applicable. Access Road.														
		West (Road R380)	1100	1	1100	403	78	467	117	615	143	697	1022	633	983	485	957
C	Road R380 (MR887-2), Hotazel Eastern Access Road and Kudumane Mine Access Road	North (Road R380)	1100	1	1100	318	74	373	111	490	135	782	1026	727	989	610	965
		East (Hotazel Eastern Access Road)	600	1	400	42	38	47	41	64	54	358	362	353	359	336	346
		South (Road R380)	1100	1	1100	82	291	118	344	147	452	1018	809	982	756	953	648
		West (Kudumane Mine Access Road)	600	1	600	84	24	90	27	125	37	516	576	510	573	475	563

2.4 SENSATIVE AREAS RELATED TO THE PROPOSED MINING DEVELOPMENT

Sensitive areas related to the Proposed Mining Development in terms of Vehicular Traffic include the following:

a) Roads where mine related heavy vehicles and light vehicles would operate;
b) Intersections where mine related traffic would make turning movements;
c) Roads with high volumes of vehicular traffic;
d) Road conditions, speeds and profiles.

From a Traffic Engineering point of view, no areas identified that should be avoided by the mine related vehicular traffic. **Figure 2.2** provides a graphical presentation of the sensitive areas related to the Proposed Mining Development from a traffic point of view.

2.5 INFORMATION REQUESTED BY COMPITENT AUTHORITY

No information was requested by any competent Authority.

2.6 CONSULTATION WITH INTERESTED AND AFFECTED PARTIES (IAP)

SLR Consulting (Africa) (Pty) Ltd held a Public Participation session with interested and affected parties as part of the Proposed Mining Development. Table 2.10 provides comments received and replies.

TABLE 2.10: COMMENTS BY IAP			
INTERESTED AND AFFECTED PARTIES	**DATE COMMENTS RECEIVED**	**ISSUES RAISED**	**REPLIES**
Comment raised by Ryno van Schalkwyk,	01 March 2015 during the social scan	I am concerned about the impact that the proposed project will have on existing transport networks.	Mitigating measures will be put in place by the Proposed Mining Development to mitigate the potential impact.
Comment raised by Jurie Kriek	15 April 2015 at the public scoping meeting	If Mokala is intending on mining approximately 1.3 million tonnes of ore per year this means that approximately 300 trucks will be leaving the mine every day. That will require a highway. The existing roads cannot accommodate that number of trucks.	The existing roads network will be able to accommodate additional vehicular traffic.
Comment raised by Gert Theart	15 April 2015 at the public scoping meeting	What is Mokala's intention regarding the transportation of ore?.	The options are being finalised. Rail or Road or both.
Comment raised by Eben Anthonissen		We would prefer if Mokala made use of rail to transport ore as opposed to road.	This option is being considered.

2.7 OTHER TRAFFIC-RELATED ISSUES

Table 2.11 provides a summary of the following:

a) Proposed permanent diversion of Road R380 (MR887-2) due to the proposed mining activities;
b) Soil moving during the construction phase;
c) Access-related issues in terms of Road R380 (MR887-2) from and to the Proposed Mining Development;
d) Upgrading the intersection to the Gloria Mine along Road R380 in terms of Road Safety;
e) Road safety;
f) Available sight distances;
g) Non-motorised transport; and
h) Public transport.

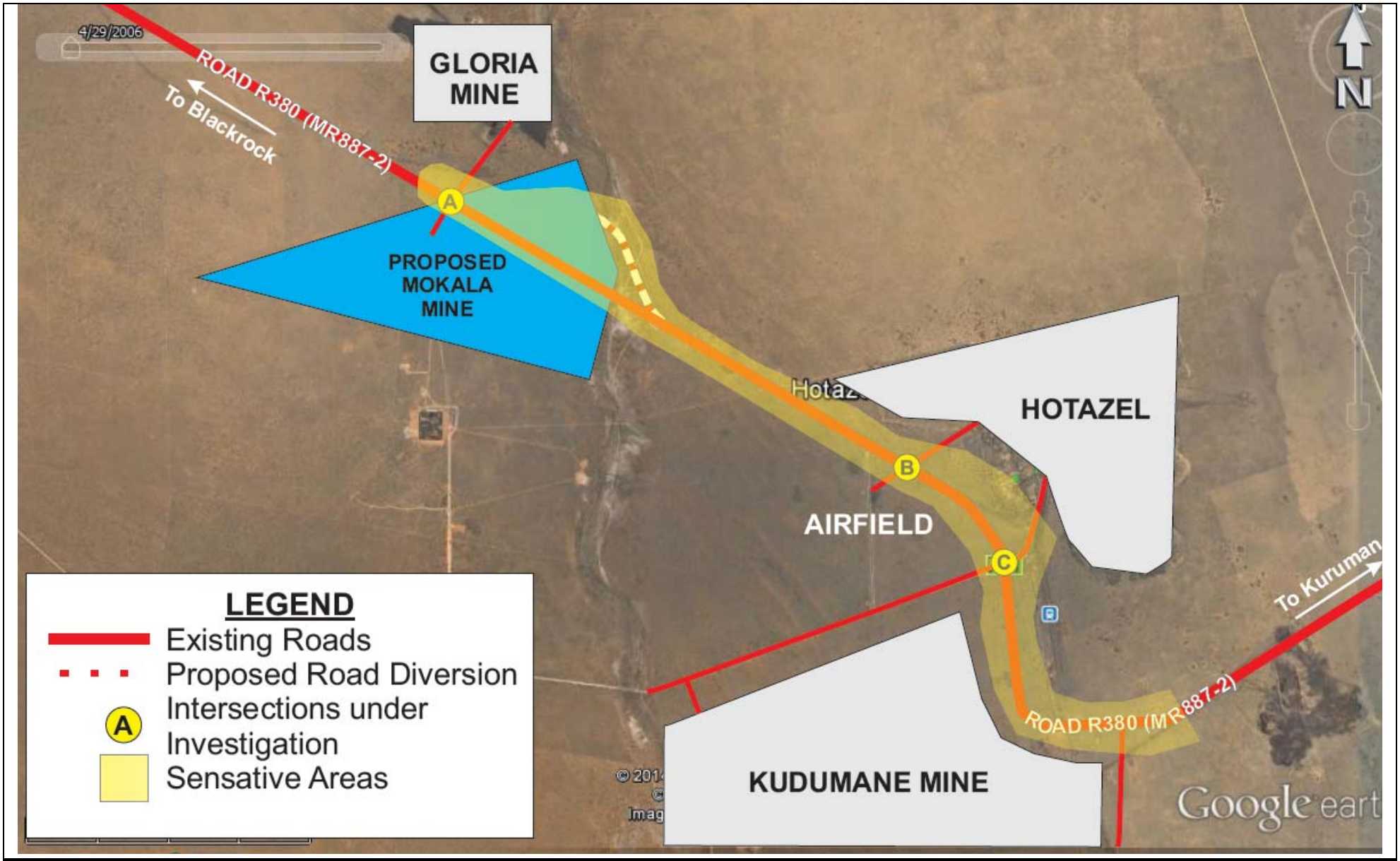


FIGURE 2.2: SENSATIVE AREAS RELATED TO THE PROPOSED MINING DEVELOPMENT

TABLE 2.11: SUMMARY OF OTHER TRAFFIC-RELATED ISSUES				
Item	**Description of Element**	**General Comments**	**Specific Issues**	**Actions Required**
1.	**PROPOSED PERMANENT ROAD DIVERSION DUE TO PROPOSED MINING ACTIVITIES**			
1.1	**Permanent diversion of a section of Road R380 (MR877-2).**	a) A portion of the Proposed Mining Development is intended to be located over a section of the existing Road R380 (MR887-2). The Proposed Mining Development therefore intends to divert the relevant section of Road R380 (MR887-2). Refer to **Figures 1.1** and **1.2** for a graphical presentation.	a) Based on observations and surveys it is not envisaged that any vehicle movements will be effected by the proposed permanent diversion; and b) Horizontal Alignment would be affected.	a) The speed limit of the relevant section proposed to be diverted should be determined as part of the detail design phase; b) Speed limit at intersections should be limited to at least 80km/h; c) Necessary road traffic warning signs should be provided to inform road users of the relevant bends in the road; and d) The horizontal radius to be used for road alignment should be based on SANRAL Geometric Design Guide.
2.	**SOIL MOVING DURING THE CONSTRUCTION PAHSE**			
2.1	**Moving of soil across Road R380 (MR887-2) as part of the construction phase.**	a) As part of the construction phase of the proposed mining development, it is intended to move soil across Road R380 (MR887-2) that is intended to be utilised for the construction of the proposed road diversion and other mine related infrastructure. At the point in time that this study was conducted, the exact location of the crossing was not determined and will be done as part of the detail design phase.	a) Temporary at-grade heavy vehicle crossing with Road R380 (MR887-2) needs to be created; b) Flow of traffic on main road will be affected; c) Spillage of materials on main road surface; d) Intersection and stopping sight distances for crossing should be taken into consideration; and e) Main road surface edges could be damaged.	a) Road traffic information and control signs should be provided on Road R380 (MR887-2) well in advance of the proposed heavy vehicle crossing to inform other road users of the possibility of encountering heavy vehicles crossing the roadway; b) The speed limit for the relevant section of Road R380 (MR887-2) where heavy vehicles will be crossing Road R380 (MR887-2) should be reduced to at least 60km/h. Rumble strips should also be considered to ensure speed reduction; c) Drivers of the heavy vehicles should be provided with adequate training in road safety; d) Spillage on the main road surface should be avoided as far as practically possible and a maintenance management plan should be implemented as part of the process; e) Edges of the main road where heavy vehicles will cross Road R380 (MR887-2) should be repaired and maintained on a continuous basis. Alternatively it is recommended that concrete beams should be constructed on the road edges prior to use of the crossing; f) Should consider stop and go control if necessary; g) Area should be well lit with overhead lighting; h) Sufficient intersection and stopping sight distances should be available; and i) Soil moving is recommended to be scheduled during vehicle traffic off-peak times.
3.	**ACCESS RELATED ISSUES**			
3.1	**Intersection Spacing.**	a) Intersections A, B and C are existing intersections and deemed to meet the relevant intersection spacing requirements.	a) None.	a) None.

TABLE 2.11: SUMMARY OF OTHER TRAFFIC-RELATED ISSUES				
Item	**Description of Element**	**General Comments**	**Specific Issues**	**Actions Required**
3.2	**Proposed Mine Access Road from Road R380 (MR877-2).**	a) Safe and reliable access could be provided from Road R380 (MR887-2) to the Proposed Mining Development perpendicular to the existing access to the Gloria Mine. Refer to **Figures 3.1** and **3.2** for the recommended intersection layout of the intersection of Road R380 (MR887-2) and the Proposed Mine Access Road (Point A) from a Road Safety perspective.	a) Vehicles waiting to turn right in the Gloria Mine will block the vehicle through movement; b) Vehicles turning left into the Proposed Mining Development will reduce speed resulting in blocking the vehicle through movement. c) Acceleration from side roads would occur in main vehicle traffic flow.	a) Provide dedicated right-turn lanes; b) Provide dedicated left-turn lanes to allow for safe deceleration; c) Provide acceleration lanes to allow vehicles to gain speed before entering the main vehicle traffic flow.
4.	**UPGRADING OF THE EXISTING INTERSECTION OF ROAD R380 (MR887-2), THE GLORIA MINE ACCESS ROAD AND THE PROPOSED MINING DEVELOPMENT ACCESS ROAD**			
4.1	**Upgrading of the existing intersection of Road R380 (MR887-2), the Gloria Mine Access Road and the Proposed Mining Development Access Road**	a) It is the intention of the Proposed Mining Development to upgrade the intersection of Road R380 (MR887-2) and the Gloria Mine Access (Point A) where the Proposed Mining Development proposes to gain access. b) A concept intersection geometric layout plan was prepare by the Proposed Mining Development.	a) Special attention should be given to the lane lengths of the acceleration, deceleration and dedicated right-turn lanes. b) Geometric upgrading would be required in terms of road safety.	a) Refer to **Figures 3.1** and **3.2** for recommended intersection geometric layout and other required road network improvements.
5.	**ROAD SAFETY ISSUES**			
5.1	**General Road Safety.**	The following are typical elements related to the road network, which cause road safety problems in rural areas and which need to be addressed on a continuous basis: a) Intersection layout, with specific reference to dedicated right turn lanes, where there is heavy vehicle movement; b) Pedestrian movements (road crossings); c) Intersection alignment, such as staggered intersections; d) Insufficient public transport facilities; e) Access control for vehicle movement; f) Fencing to control animal movement; g) Lack of or deterioration of reflective road studs for visibility during the night at strategic points; h) Lack of pedestrian walkways to separate pedestrian and vehicle movements at strategic points; i) Lack of provision and quality of road markings; j) Lack of provision and quality of road signs; and k) Improper road safety training for workers as well as adjacent communities.	a) Lack of reflective road studs; b) Road markings are fading; and c) Lack of relevant road traffic signs.	In general the report was compiled so as to address the road safety issues as far as practically possible. a) Refer to **Table 3.2** and **Figures 3.1** and **3.2** for the recommended layout of the intersection of Road R380 (MR887-2), Gloria Mine Access and Proposed Mine Access (Point A); b) Collaborate with relevant road authority to set up a road maintenance plan to maintain the relevant road network on which heavy vehicle movement is anticipated; c) Provide proper reflective road studs (LED if possible) to ensure the safe operation of the relevant intersections under investigation at night time; d) Provide required road traffic signs for the relevant intersections; e) Provide proper road markings at relevant intersections under investigation (highway paint recommended); f) Provide mine and contractor workers with training on road safety; and g) Road safety and awareness campaigns should be run at the mine.

TABLE 2.11: SUMMARY OF OTHER TRAFFIC-RELATED ISSUES				
Item	**Description of Element**	**General Comments**	**Specific Issues**	**Actions Required**
6.	**AVAILABLE SIGHT DISTANCES**			
6.1	**Available Sight Distances.**	a) Sight distances were confirmed visually and were found to be acceptable at all relevant existing intersections under investigation; and b) The required sight distance for a single unit and trailer type of heavy vehicle is 305 metres for a speed of 80 km/h.	a) None.	a) None.
7.	**NON-MOTORISED TRANSPORT**			
7.1	**Non-motorised Transport.**	a) There are currently a moderate volume of non-motorised transport movements in the vicinity of the relevant intersections under investigation.	a) Workers and local residents are loaded and off-loaded at the relevant intersections under investigation; b) Mining workers could be expected to be off-loaded at the intersection of Road R380 (MR887-2), Gloria Mine Access and Proposed Mine Access; and c) No pedestrian crossings or proper road warning signs informing motorists of the potential occurrence of pedestrians are currently provided at Points A and B.	a) Mining workers and contractors should be made aware of pedestrians that could be encountered along Road R380 (MR887-2); b) Proper pedestrian crossings should be provided at Points A; c) Sufficient road traffic warning signs should be provided to warn motorists of the possibility of pedestrians; and d) Reflective clothing can be provided to workers.
8.	**PUBLIC TRANSPORT**			
8.1	**Public Transport.**	a) Three types of public transport commuters are relevant: i) Firstly, workers who will travel to and from the Proposed Mining Development during all phases; ii) Secondly, visitors to the Proposed Mining Development during all phases; and iii) Thirdly, residents of nearby villages. b) Currently Road R380 is the main public transport corridor; and c) Proper loading and off loading facilities are currently provided at the intersection of Road R380 (MR887-2), Hotazel Eastern Access and Kudumane Mine Access.	a) It is anticipated that the majority of workers will be transported via taxi and bus to and from the Proposed Mining Development; and b) Visitors and workers could possibly be loaded and off loaded at the intersection of Road R380 (MR887-2), Gloria Mine access and Proposed Mine Access (Point A).	a) It is recommended that a dedicated loading and off-loading area should be provided for public transport close to the operational area of the proposed mine where workers can be loaded and off-loaded in a safe environment as part of the all phases; and b) Loading and off-loading bays should be provided at the intersection of Road R380 (MR887-2), Gloria Mine access and Proposed Mine Access (Point A) where workers and visitors can be loaded and off-loaded should public transport not enter the Proposed Mine Access Road.

Section 3

FINDINGS AND RECOMMENDATIONS

Based on a site inspection of the existing road network adjacent to the site under investigation, traffic surveys, calculations and reference to the relevant Traffic Impact Assessment guideline documents, the following findings and recommendations were made:

3.1 FINDINGS

3.1.1 TRAFFIC IMPACT DURING THE RESPECTIVE PHASES

The capacity calculations for the Traffic Impact Assessment were conducted for the years 2015, 2017 and 2025 respectively. The last mentioned time frame is in line with traffic engineering guidelines and practice and determined by the expected number of vehicle trips that could potentially be generated during any specific peak hour by a specific development. However, the expected lifespan of the Proposed Mining Development will be at least until the year 2032.

Furthermore, owing to the type and nature of the proposed mining activities, it is expected that the proposed activities will have a manageable impact on traffic during the construction, operational, decommissioning and closure phases, provided that road infrastructure improvements are implemented as indicated in **Table 3.2** and **Figure 3.2** to mitigate the impact of the proposed land development area.

Table 3.1 provides a summary of the impact ratings for the construction, operational, decommissioning and closure phases respectively without mitigating measures implemented. **Table 3.1** was derived from **Table E-1 of Appendix E** of the report that provides the criteria used in terms of the assessments process. Based on **Table 3.1** it is possible to note that the construction and operational phases have the highest impact.

3.1.2 UPGRADING OF THE EXISTING INTERSECTION OF ROAD R380 (MR 887-2), THE GLORIA MINE ACCESS AND THE PROPOSED MINING DEVELOPMENT ACCESS

Mokala is intending on upgrading the intersection along Road R380 (MR887-2) which leads to the Gloria Mine. The proposed upgrade would ensure a properly functioning intersection from a Traffic Engineering point of view in terms of intersection performance and road safety. The following should be given attention as part of the proposed upgrading during the detail design phase:

a) Lengths of the acceleration, deceleration and dedicated right-turn lanes;
b) General Road Safety; and
c) Intersection geometric layout as proposed as part of **Figures 3.1** and **3.2.**

TABLE 3.1: IMPACT RATING FOR THE RESPECTIVE PHASES																	
CONSTRUCTION PHASE																	
RECEPTOR	ACTIVITY		IMPACT	BEFORE MITIGATION						AFTER MITIGATION						Comments and Mitigation Measures
				Severity	Duration	Spatial Scale	Consequence	Probability	Significance	Severity	Duration	Spatial Scale	Consequence	Probability	Significance	
Road and Traffic	Construction of infrastructure	Road Capacity	1. Relevant Road Sections (Reconstructing/repairing of Roads)	*M*	*M*	*M*	*Med*	*M*	*Med*	*M*	*M*	*M*	*Med*	*M*	*Med*	See **Section 2.3** of the report, **Table 2.9** *(Capacity is no problem)*
			2. Relevant Intersections (Need for Additional Lanes)	*M*	*M*	*M*	*Med*	*M*	*Med*	*M*	*M*	*M*	*Med*	*M*	*Med*	See **Section 2.3** of the report and **Appendix C** of the report. (No additional lanes required at relevant intersections from a road capacity point of view)
		Road Safety Issues	3. Intersection (Access) Spacing	*L*	*M*	*M*	*Low*	*L*	*Low*	*L*	*M*	*M*	*Low*	*L*	*Low*	*See **Section 3.1** of the report and **Table 2.10.** All intersections under investigation are existing intersections.*
			4. Vertical Road Alignment	*M*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 1.1** of **Table 2.10.** Reduction of speed limit and the provision of road traffic sign.*
			5. Available Sight Distance at Intersection	*L*	*M*	*M*	*Low*	*L*	*Low*	*L*	*M*	*M*	*Low*	*L*	*Low*	*See **Item 6.1** of **Table 2.10.** All intersections under investigation are existing intersections. Sight distances were confirmed visually.*
			6. Speed Limit at Proposed Access Points	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 4.1** of **Table 2.10.** Speed limit should be reduced to at least 80km/h at access intersections.*
			7. Relevant Intersections (Need for dedicated left- and right-turn lanes, Point A)	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 4.1** of **Table 2.10**, **Table 3.2** and **Figure 3.1.** Dedicated right-turn lanes are highly recommended in terms of road safety.*
			8. Pedestrian Movements (With reference to access roads and intersections)	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 7.1** of **Table 2.10.** Pedestrian crossings should be provided at all relevant intersections to create a safe space for pedestrians to cross the roadway.*
			9. Public Transport Loading and Off-Loading	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 8.1** of **Table 2.10.** Lack of proper public transport loading and off-loading bays will result in public transport stopping in roadways that could lead to fatal accidents.*

TABLE 3.1: IMPACT RATING FOR THE RESPECTIVE PHASES																	
OPERATIONAL PHASE																	
RECEPTOR	ACTIVITY		IMPACT	BEFORE MITIGATION						AFTER MITIGATION						Comments and Mitigation Measures
				Severity	Duration	Spatial Scale	Consequence	Probability	Significance	Severity	Duration	Spatial Scale	Consequence	Probability	Significance	
Road and Traffic	Mining Activities	Road Capacity	1. Relevant Road Sections (Reconstructing/repairing of Roads)	*M*	*M*	*M*	*Med*	*M*	*Med*	*M*	*M*	*M*	*Med*	*M*	*Med*	See **Section 2.3** of the report, **Table 2.9** *(Capacity is no problem)*
			2. Relevant Intersections (Need for Additional Lanes)	*M*	*M*	*M*	*Med*	*M*	*Med*	*M*	*M*	*M*	*Med*	*M*	*Med*	See **Section 2.3** of the report and **Appendix C** of the report. (No additional lanes required at relevant intersections from a road capacity point of view)
		Road Safety Issues	3. Intersection (Access) Spacing	*L*	*M*	*M*	*Low*	*L*	*Low*	*L*	*M*	*M*	*Low*	*L*	*Low*	*See **Section 3.1** of the report and **Table 2.10.** All intersections under investigation are existing intersections.*
			4. Vertical Road Alignment	*M*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 1.1** of **Table 2.10.** Reduction of speed limit and the provision of road traffic sign.*
			5. Available Sight Distance at Intersection	*L*	*M*	*M*	*Low*	*L*	*Low*	*L*	*M*	*M*	*Low*	*L*	*Low*	*See **Item 6.1** of **Table 2.10.** All intersections under investigation are existing intersections. Sight distances were confirmed visually.*
			6. Speed Limit at Proposed Access Points	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 4.1** of **Table 2.10.** Speed limit should be reduced to at least 80km/h at access intersections.*
			7. Relevant Intersections (Need for dedicated left- and right-turn lanes)	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 4.1** of **Table 2.10**, **Table 3.2** and **Figure 3.1.** Dedicated right-turn lanes are highly recommended in terms of road safety.*
			8. Pedestrian Movements (With reference to access roads and intersections)	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 7.1** of **Table 2.10.** Pedestrian crossings should be provided at all relevant intersections to create a safe space for pedestrians to cross the roadway.*
			9. Public Transport Loading and Off- Loading	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 8.1** of **Table 2.10.** Lack of proper public transport loading and off-loading bays will result in public transport stopping in roadways that could lead to fatal accidents.*

TABLE 3.1: IMPACT RATING FOR THE RESPECTIVE PHASES																
DECOMMISSIONING PHASE																
RECEPTOR	ACTIVITY		IMPACT	BEFORE MITIGATION						AFTER MITIGATION						Comments and Mitigation Measures
				Severity	Duration	Spatial Scale	Consequence	Probability	Significance	Severity	Duration	Spatial Scale	Consequence	Probability	Significance	
Road and Traffic	Demolition and removal of all infrastructure and rehabilitate mining site	Road Capacity	1. Relevant Road Sections (Need for Additional Lanes)	*M*	*M*	*M*	*Med*	*M*	*Med*	*M*	*M*	*M*	*Med*	*M*	*Med*	See **Section 2.3** of the report, **Table 2.9** *(Capacity is no problem)*
			2. Relevant Intersections (Need for Additional Lanes)	*M*	*M*	*M*	*Med*	*M*	*Med*	*M*	*M*	*M*	*Med*	*M*	*Med*	See **Section 2.3** of the report and **Appendix C** of the report. (No additional lanes required at relevant intersections from a road capacity point of view)
		Road Safety Issues	3. Intersection (Access) Spacing	*L*	*M*	*M*	*Low*	*L*	*Low*	*L*	*M*	*M*	*Low*	*L*	*Low*	*See **Section 3.1** of the report and **Table 2.10.** All intersections under investigation are existing intersections.*
			4. Vertical Road Alignment	*M*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 1.1** of **Table 2.10.** Reduction of speed limit and the provision of road traffic sign.*
			5. Available Sight Distance at Intersection	*L*	*M*	*M*	*Low*	*L*	*Low*	*L*	*M*	*M*	*Low*	*L*	*Low*	*See **Item 6.1** of **Table 2.10.** All intersections under investigation are existing intersections. Sight distances were confirmed visually.*
			6. Speed Limit at Proposed Access Points	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 4.1** of **Table 2.10.** Speed limit should be reduced to at least 80km/h at access intersections.*
			7. Relevant Intersections (Need for dedicated left- and right-turn lanes)	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 4.1** of **Table 2.10**, **Table 3.2** and **Figure 3.1.** Dedicated right-turn lanes are highly recommended in terms of road safety.*
			8. Pedestrian Movements	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 7.1** of **Table 2.10.** Pedestrian crossings should be provided at all relevant intersections to create a safe space for pedestrians to cross the roadway.*
			9. Public Transport Loading and Off-loading	*H*	*M*	*M*	*Med*	*M*	*Med*	*H+*	*M*	*M*	*Med+*	*M*	*Med+*	*See **Item 8.1** of **Table 2.10.** Lack of proper public transport loading and off-loading bays will result in public transport stopping in roadways that could lead to fatal accidents.*

TABLE 3.1: IMPACT RATING FOR THE RESPECTIVE PHASES																	
CLOSURE PHASE																	
RECEPTOR	ACTIVITY		IMPACT	BEFORE MITIGATION						AFTER MITIGATION						Comments and Mitigation Measures
				Severity	Duration	Spatial Scale	Consequence	Probability	Significance	Severity	Duration	Spatial Scale	Consequence	Probability	Significance	
Road and Traffic	Leave the mining site completely	Road Capacity	1. Relevant Road Sections (Need for Additional Lanes)	*L*	*H*	*M*	*Med*	*H*	*Med*	*L*	*H*	*M*	*Med*	*H*	*Med*	See **Section 2.3** of the report, **Table 2.9** *(Capacity is no problem)*
			2. Relevant Intersections (Need for Additional Lanes)	*L*	*H*	*M*	*Med*	*H*	*Med*	*L*	*H*	*M*	*Med*	*H*	*Med*	See **Section 2.3** of the report and **Appendix C** of the report. (No additional lanes required at relevant intersections from a road capacity point of view)
		Road Safety Issues	3. Intersection (Access) Spacing	*L*	*H*	*M*	*Med*	*H*	*Med*	*L*	*H*	*M*	*Med*	*H*	*Med*	*See **Section 2.4** of the report and **Table 2.10.** Should be determined as part of the detail design phase.*
			4. Vertical Road Alignment	*L*	*H*	*M*	*Med*	*H*	*Med*	*L*	*H*	*M*	*Med*	*H*	*Med*	*See **Item 1.1** of **Table 2.10.***
			5. Available Sight Distance at Intersection	*L*	*H*	*M*	*Med*	*H*	*Med*	*L*	*H*	*M*	*Med*	*H*	*Med*	*See **Item 5.1** of **Table 2.10.** Sight distances should be determined during detail design phase.*
			6. Speed Limit at Proposed Access Points	*L*	*H*	*M*	*Med*	*H*	*Med*	*L*	*H*	*M*	*Med*	*H*	*Med*	*See **Item 4.1** of **Table 2.10.** Speed should be reduced to at least 80km/h at access intersections.*
			7. Relevant Intersections (Need for dedicated left- and right-turn lanes)	*L*	*H*	*M*	*Med*	*H*	*Med*	*L*	*H*	*M*	*Med*	*H*	*Med*	*See **Item 3.2** of **Table 2.10**, **Table 3.2** and **Figure 3.1.** Dedicated right-turn lanes are highly recommended in terms of safety.*
			8. Pedestrian Movements	*L*	*H*	*M*	*Med*	*H*	*Med*	*L*	*H*	*M*	*Med*	*H*	*Med*	*See **Item 6.1** of **Table 2.10.** Pedestrian crossings should be provided at all relevant intersections to create a safe space for pedestrians to cross the roadway.*
			9. Public Transport Loading and Off-loading	*L*	*H*	*M*	*Med*	*H*	*Med*	*L*	*H*	*M*	*Med*	*H*	*Med*	*See **Item 7.1** of **Table 2.10.** Lack of proper public transport loading and off-loading bays will result in public transport stopping in roadways that could lead to fatal accidents.*

3.1.3 TRAFFIC IMPACT FOR THE RELEVANT PROJECT ALTERNATIVES

The following could be concluded from the relevant investigations as part of the Traffic Impact Assessment:

a) That it could be concluded from the relevant calculations and intersection performance evaluations that the recommended intersection geometric upgrading of the intersection of Road R380 (MR887-2), Gloria Mine Access and the Proposed Mining Development Access (Point A), the recommended provision and maintenance of road markings, reflective road studs, road traffic signs and overhead lighting are all recommended in terms of road safety and intersection functionality.

3.1.4 SITE ACCESSIBILITY

It is proposed that access to the Proposed Mining Development could be gained from Road R380 (MR887-2) at the existing intersection of Road R380 (MR887-2) and Gloria Mine Access Road.

The last mentioned intersection will provide safe and reliable access to the Proposed Mining Development.

In terms of upgrading / improvement requirements for the relevant intersections under investigation, the following is recommended to be provided and maintained:

a) Provide proper road markings (highway quality paint);
b) Provide reflective road studs (LED if possible); and
c) Provide the necessary road traffic signs.

3.1.5 PROPOSED PERMANENT DIVERSION OF A SECTION OF ROAD R380 (MR887-2)

A portion of the Proposed Mining Development is intended to be located over a section of the existing Road R380 (MR887-2). Mokala is proposing to divert a section of Road R380 (MR887-2). It is not envisaged that any vehicle movements will be effected by the proposed permanent diversion based on observations and surveys. The proposed road diversion would although result in new horizontal alignment for the road which would have an effect on the speed limit, depending on the design criteria that will be used.

3.2 RECOMMENDATIONS

The following are discussed in terms of the recommendations:

a) Need for improvements (mitigation measures)
b) Institutional arrangements.

3.2.1 NEED FOR IMPROVEMENTS (MITIGATION MEASURES)

It is recommended that the following improvements should be made in terms of Road Safety:

a) The improvements as indicated by **Table 3.2** should be provided at the relevant intersections under investigation;
b) The layout as indicated by **Figure 3.1** should be provided at the intersection of Road R380 (MR877-2), Gloria Mine Access Road and the Proposed Mining Development Access Road (Point A) to ensure that the relevant functions in a safe and acceptable manner;
c) In terms of workers and visitors, a dedicated loading and off-loading area need to be provided on the property of the Proposed Mining Development; and
d) Proper road markings, reflective road studs (LED), road signs, overhead lighting and proper pedestrian crossings should be provided and maintained at the proposed mine access intersection (Point A) to ensure visibility during night time, proper visibility of intersection lane geometry and sufficient information to road users.

The expected lifespan of the Proposed Mining Development will be at least until the year 2032. It is therefore required that the Proposed Mining Development should evaluate the relevant intersections and road sections on a regular basis as part of a risk and safety management process.

The traffic impact assessment does not comment on pavement layer attributes in terms of the relevant road section. The last mentioned need to be based on recommendations to be made by pavement design specialist.

3.2.2 INSTITUTIONAL ARRANGEMENTS

The following recommendations are made in terms of the detailed design phase of roads for the proposed project:

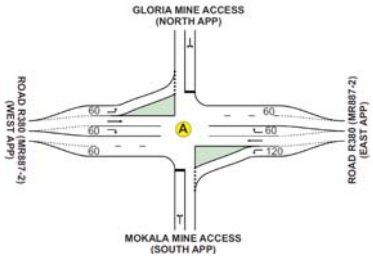
a) Detailed investigations should be conducted in conjunction with the relevant Road Authority in terms of the existing quality and potential life span of the existing road surface layers of the roads where processed product, consumables and workers will be transported (Road R380 (MR887-2); and
b) A road maintenance plan needs to be prepared in conjunction with the relevant road authority on public roads where trucks will operate (Road R380 (MR887-2)) in order to ensure that the processed product, consumables and workers can be transported at all times.

3.2.3 REASONED OPINION FOR AUTHORISATION

In conclusion of the findings as part of the investigations, Siyazi Gauteng (Pty) Ltd is of the opinion that the proposed mining development would have a manageable impact on the relevant roads network as long as the mitigating measures are implemented as recommended as part of **Section 3** of this report and should thus be granted authorisation.

It is also recommended that the Northern Cape Department of Roads and Public Works should approve the Traffic Impact Assessment based on the recommendations of this report.

TABLE 3.2: RECOMMENDED ROAD NETWORK IMPROVEMENTS RELEVANT TO ALL PHASES

POINT	INTERSECTION	APPROACH	IMPROVEMENTS RECOMMENDED																GEOMETRY DETERMINED BY MEANS OF SIDRA
			Approach Traffic Control				Extra Lanes Required (m)						Improvements Only Required from a Road Safety Perspective	Reflective Road Studs required at Intersection	Road Markings Required	Road Signs Required	Public Transport Loading and Off-Loading	Pedestrian Walkways	
			Free-Flow	Stop	Roundabout	Traffic Light System	Left-Turn Taper	Left-Turn Deceleration Lane	Acceleration Lane	Acceleration Lane in Middle of Road	Dedicated Right-Turn Lane	Number of Extra Through Lanes							
A	Road R380 (MR887-2), Gloria Mine Access Road and the Proposed Mining Development Access Road	*Northern (Gloria Mine)*	-	Yes	-	-	-	-	-	-	-	-	Yes	Yes	Yes	Yes	-	Yes	
		Eastern (Road R380)	Yes	-	-	-	-	Yes, 120m with slip lane	Yes, 60m	-	Yes, 60m	-	Yes		Yes	Yes	Yes	Yes	
		Southern (Proposed Access)	-	Yes	-	-	-	-	-	-	-	-	Yes		Yes	Yes	-	Yes	
		Western (Road R380)	Yes	-	-	-	-	Yes, 60m with slip lane	Yes, 60m	-	Yes, 60m	-	Yes		Yes	Yes	Yes	Yes	
		It is recommended that all mining developments within the vicinity and the relevant roads department should collaborate in terms of the structural maintenance of the roads by providing the following: a) Reflective Road Studs to ensure visibility at night time; b) Road surface maintenance; c) Road markings (Highway paint recommended); d) Road traffic signs; e) Fencing along public roads to control animal movement; and f) Road safety training to workers and local communities.																	
B	Road R380 (MR887-2), Airfield Access Road and Hotazel Western Access Road	*Northern (Hotazel West)* *Eastern (Road R380)* *Southern (Airfield)* *Western (Road R380)*	No geometric upgrading required. It is recommended that all mining developments within the vicinity and the relevant roads department should collaborate in terms of the structural maintenance of the roads by providing the following where not available or is deteriorating: g) Reflective Road Studs to ensure visibility at night time; h) Road surface maintenance; i) Road markings (Highway paint recommended); j) Road traffic signs; k) Fencing along public roads to control animal movement; and l) Road safety training to workers and local communities.																	
C	Road R380 (MR887-2), Hotazel Eastern Access Road and Kudumane Mine Access Road	*Northern (Road R380)* *Eastern (Hotazel East)* *Southern (Road R380)* *Western (Kudumane Mine)*	No geometric upgrading required. It is recommended that all mining developments within the vicinity and the relevant roads department should collaborate in terms of the structural maintenance of the roads by providing the following where not available or is deteriorating: a) Reflective Road Studs to ensure visibility at night time; b) Road surface maintenance; c) Road markings (Highway paint recommended; d) Fencing along public roads to control animal movement; and e) Road safety training to workers and local communities.																	

Note: Recommended improvements are in terms of **road safety**.

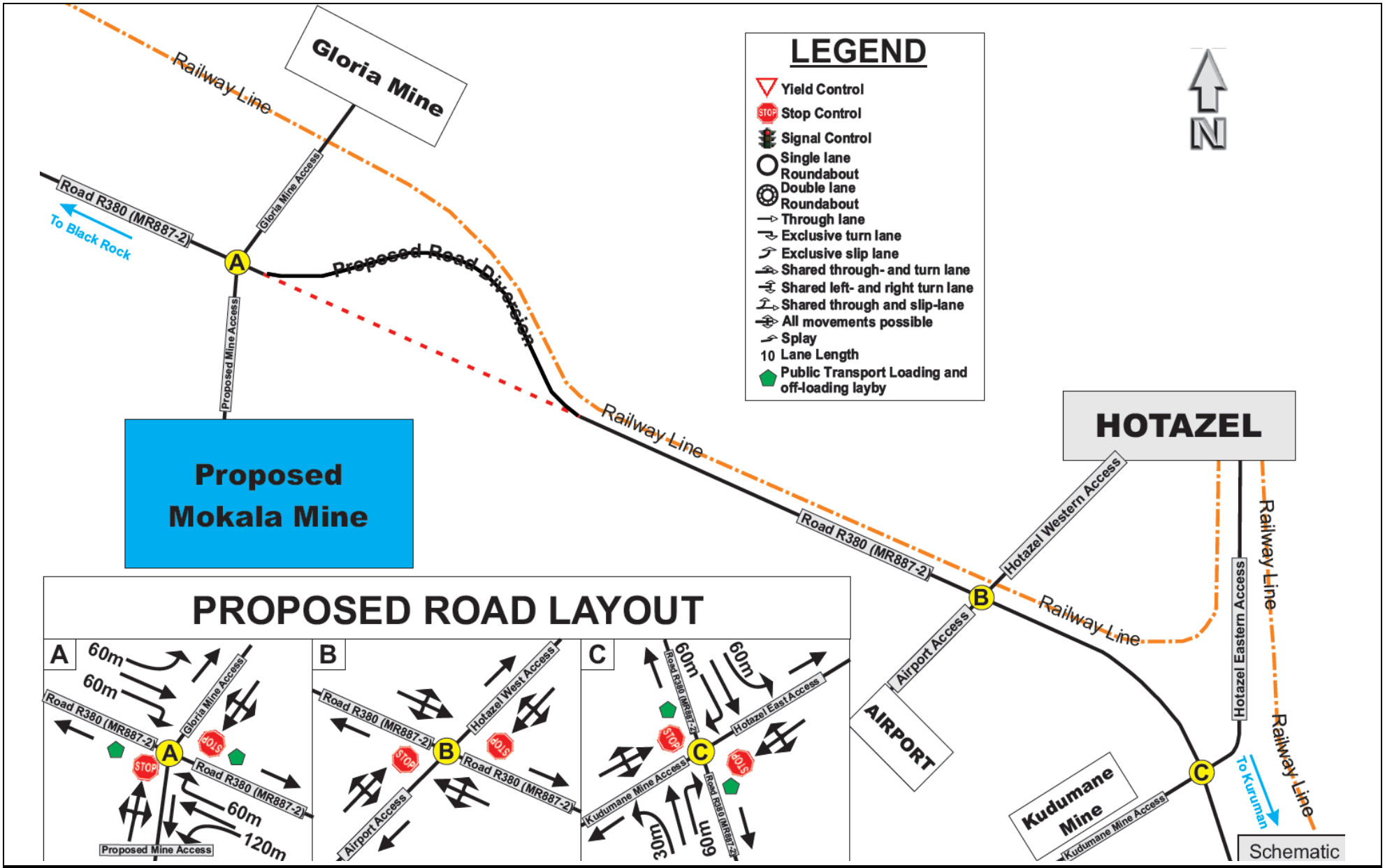


FIGURE 3.1: PROPOSED ROAD NETWORK LAYOUT

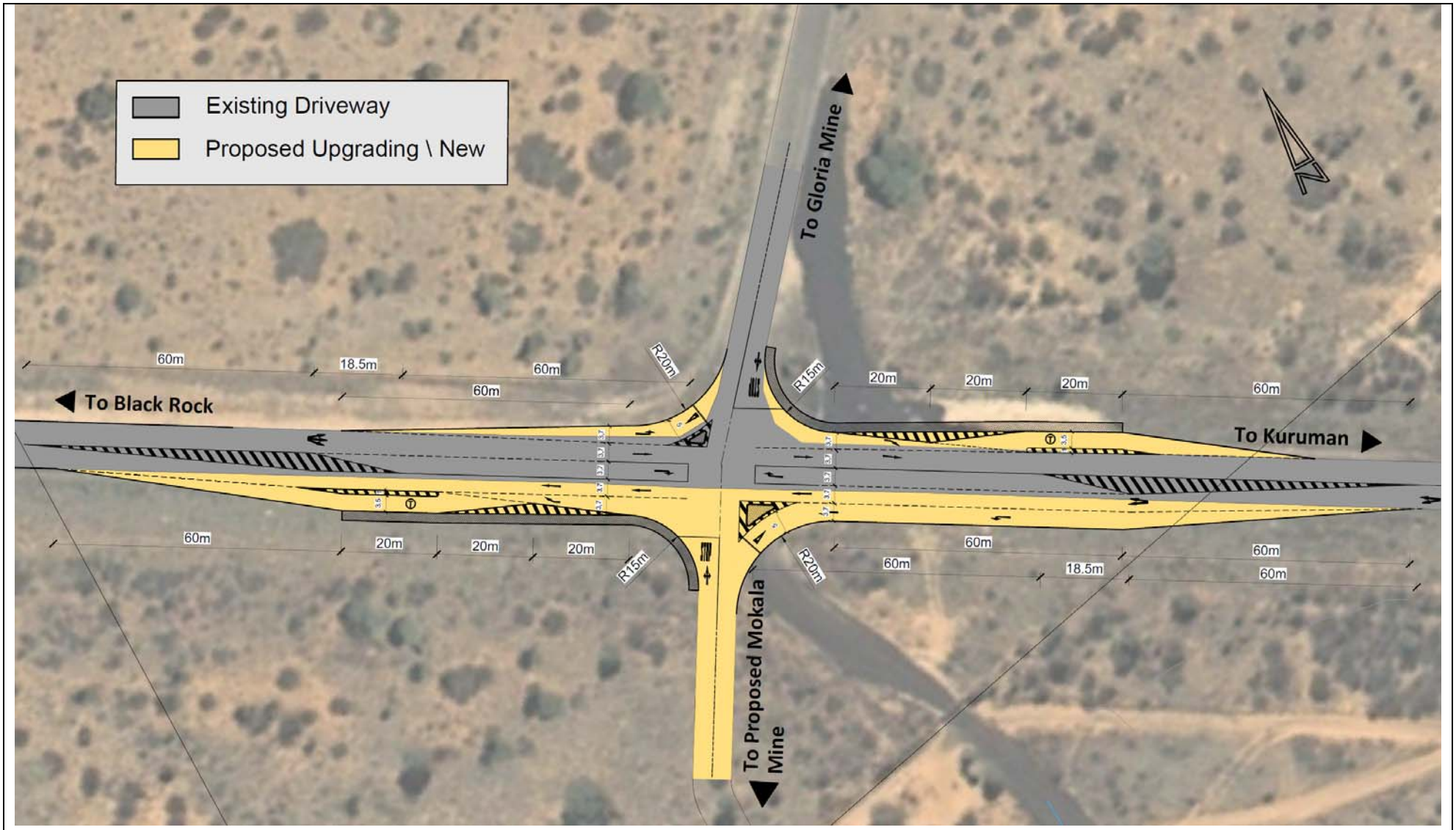


FIGURE 3.2: RECOMMENDED LAYOUT FOR THE INTERSECTION OF ROAD R380 (MR887-2), GLORIA MINE ACCESS ROAD AND PROPOSED MINING DEVELOPMENT ACCESS ROAD (POINT A)

APPENDIX A

INFORMATION RELATED TO STATUS QUO

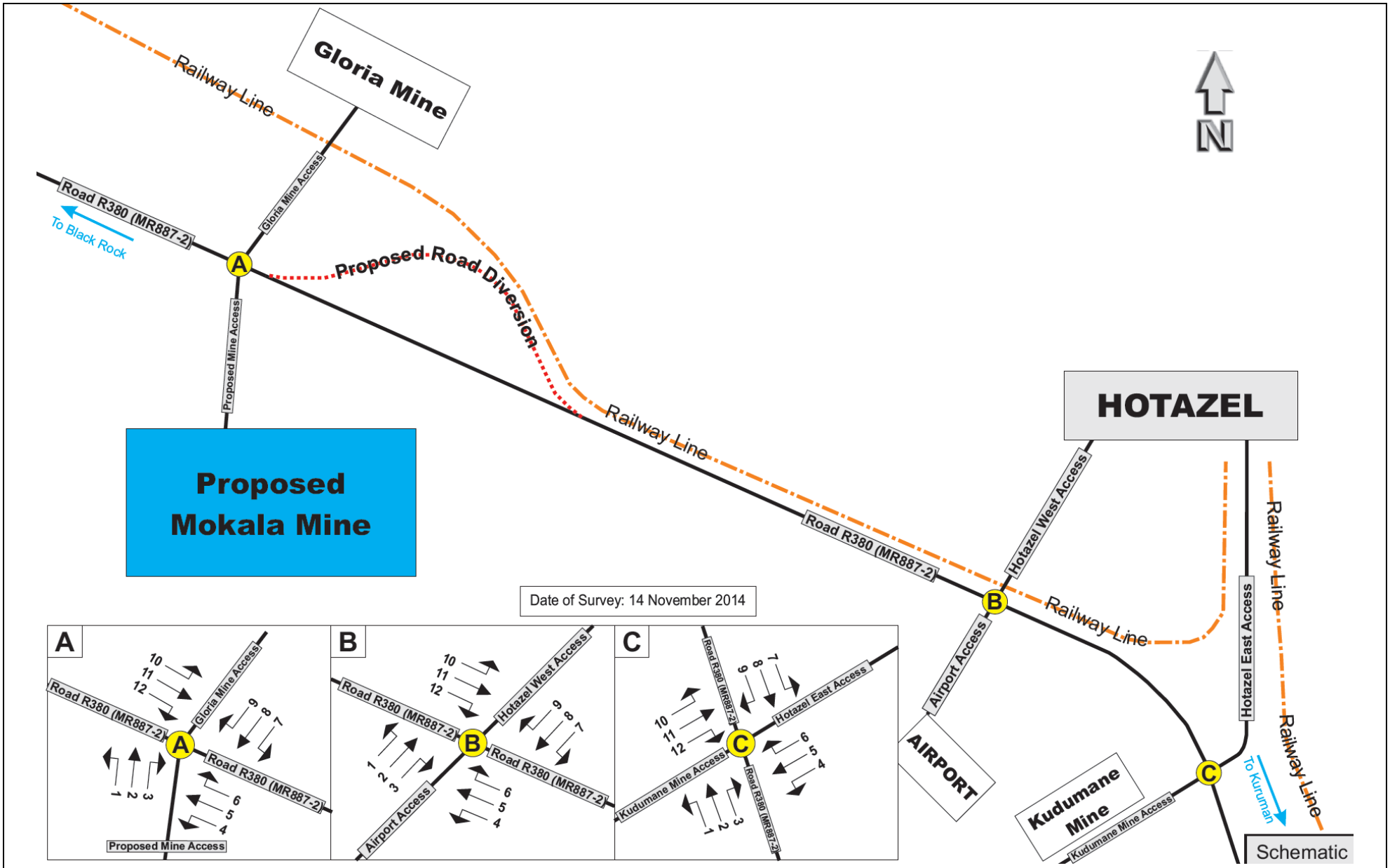


FIGURE A-1: RELEVANT MOVEMENTS RELATED TO TRAFFIC COUNTS

TABLE A-1: HOURLY TRAFFIC COUNTS FOR ALL VEHICLES SIMULTANEOUSLY AT THE INTERSECTION OF ROAD R380 (MR887-2), GLORIA MINE ACCESS ROAD AND PROPOSED MINING DEVELOPMENT ACCESS ROAD, POINT A (14th OF NOVEMBER 2014)

TIME	MOVEMENTS												
INTERVALS	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
04:00-05:00	0	0	0	0	10	4	0	0	0	0	35	0	**49**
04:15-05:15	0	0	0	0	13	5	0	0	2	0	31	2	**53**
04:30-05:30	0	0	0	0	42	8	0	0	3	0	20	3	**76**
04:45-05:45	0	0	0	0	103	25	0	0	9	0	17	9	**163**
05:00-06:00	0	0	0	0	186	34	0	0	15	0	12	15	**262**
05:15-06:15	0	0	0	0	261	45	0	0	18	0	22	18	**364**
05:30-06:30	0	0	0	0	305	53	1	0	21	2	35	21	**438**
05:45-06:45	0	0	0	0	289	45	2	0	21	2	38	21	**418**
06:00-07:00	0	0	0	0	243	35	2	0	17	2	57	17	**373**
06:15-07:15	0	0	0	1	186	23	3	0	15	3	64	15	**310**
06:30-07:30	0	0	0	1	133	13	2	0	15	1	77	15	**257**
06:45-07:45	0	0	0	1	114	6	2	0	15	2	72	15	**227**
07:00-08:00	0	0	0	3	95	6	2	0	16	2	81	16	**221**
07:15-08:15	0	0	0	2	84	6	2	0	16	2	87	16	**215**
07:30-08:30	0	0	1	2	78	6	2	0	14	2	65	14	**184**
07:45-08:45	0	0	1	2	67	4	3	0	10	3	78	10	**178**
08:00-09:00	0	0	1	2	59	3	4	0	7	4	61	7	**148**
08:15-09:15	0	0	3	2	57	3	6	0	14	6	47	14	**152**
08:30-09:30	0	0	4	3	51	2	6	0	12	6	46	12	**142**
08:45-09:45	0	0	4	4	49	3	4	0	15	4	58	14	**155**
09:00-10:00	1	0	4	2	45	3	5	0	19	5	54	18	**156**
09:15-10:15	1	0	3	2	43	2	3	0	12	2	61	11	**140**
09:30-10:30	1	0	2	3	49	2	5	0	13	4	79	12	**170**
09:45-10:45	1	0	2	2	47	5	7	0	10	6	67	10	**157**
10:00-11:00	0	0	2	2	50	6	6	0	8	5	75	8	**162**
10:15-11:15	0	0	1	2	52	7	7	0	8	7	67	8	**159**
10:30-11:30	0	0	0	0	46	7	7	0	8	7	74	8	**157**
10:45-11:45	0	0	0	0	52	3	8	0	13	8	73	13	**170**
11:00-12:00	0	0	0	2	55	1	9	0	11	9	73	11	**171**
11:15-12:15	0	0	0	3	60	0	11	0	11	11	91	11	**198**
11:30-12:30	0	0	0	3	64	0	10	0	11	10	87	11	**196**
11:45-12:45	0	0	0	4	61	1	21	0	13	21	88	13	**222**
12:00-13:00	0	0	0	2	62	2	24	0	23	24	104	23	**264**
12:15-13:15	0	0	0	1	52	2	24	0	24	24	135	24	**286**
12:30-13:30	0	0	0	1	54	2	25	0	26	25	168	26	**327**
12:45-13:45	0	0	1	0	53	1	12	0	19	12	194	19	**311**
13:00-14:00	0	0	1	0	61	0	8	0	12	8	198	11	**299**
13:15-14:15	0	0	1	0	70	1	6	0	10	6	173	9	**276**
13:30-14:30	0	0	1	0	66	1	5	0	10	5	160	9	**257**
13:45-14:45	0	0	0	1	62	2	4	0	9	4	143	8	**233**
14:00-15:00	0	0	0	1	56	5	4	0	9	4	140	10	**229**
14:15-15:15	0	0	1	1	59	4	2	0	7	2	130	8	**214**
14:30-15:30	0	0	1	1	64	4	1	0	6	1	106	7	**191**
14:45-15:45	0	0	1	0	79	5	2	0	9	2	106	10	**214**
15:00-16:00	0	0	1	0	75	3	3	0	10	3	79	10	**184**
15:15-16:15	0	0	0	2	64	3	4	0	11	4	78	11	**177**
15:30-16:30	0	0	1	2	74	3	5	0	11	5	85	11	**197**
15:45-16:45	0	0	1	2	81	1	5	0	8	5	88	8	**199**
16:00-17:00	0	0	3	2	81	0	6	0	5	6	104	5	**212**
16:15-17:15	0	0	6	0	107	0	12	0	7	7	109	7	**255**
16:30-17:30	0	0	5	0	118	1	17	0	7	12	100	7	**267**
16:45-17:45	0	0	5	1	116	1	19	0	9	14	88	9	**262**
17:00-18:00	0	0	4	1	121	5	18	0	10	13	82	10	**264**

TABLE A-2: HOURLY TRAFFIC COUNTS FOR ALL VEHICLES SIMULTANEOUSLY AT THE INTERSECTION OF ROAD R380 (MR887-2), HOTAZEL WEST ACCESS ROAD AND AIRFIELD ACCESS ROAD, POINT B (14th OF NOVEMBER 2014)

TIME	MOVEMENTS												
INTERVALS	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
04:00-05:00	0	0	0	0	14	1	5	0	0	15	20	0	**55**
04:15-05:15	0	0	0	0	14	2	6	0	4	14	17	0	**57**
04:30-05:30	0	0	0	0	41	1	6	0	9	8	12	0	**77**
04:45-05:45	0	0	0	0	103	2	6	0	25	9	8	0	**153**
05:00-06:00	0	0	0	0	165	4	13	0	55	3	9	0	**249**
05:15-06:15	0	0	0	0	233	6	20	0	73	5	17	0	**354**
05:30-06:30	0	0	0	0	271	10	25	0	87	6	30	0	**429**
05:45-06:45	0	0	0	0	253	13	35	0	81	6	34	0	**422**
06:00-07:00	0	0	0	0	205	23	42	0	73	18	41	0	**402**
06:15-07:15	0	0	0	0	144	37	42	0	66	25	42	0	**356**
06:30-07:30	0	0	0	0	86	42	47	0	61	44	35	0	**315**
06:45-07:45	0	0	0	0	54	42	48	0	67	46	28	0	**285**
07:00-08:00	0	0	0	0	44	34	40	0	60	49	34	0	**261**
07:15-08:15	0	0	0	0	40	20	34	0	52	49	40	0	**235**
07:30-08:30	0	0	0	0	44	15	27	0	42	29	39	0	**196**
07:45-08:45	0	0	0	0	46	17	19	0	27	31	51	0	**191**
08:00-09:00	0	0	0	0	43	19	18	0	21	21	45	0	**167**
08:15-09:15	0	0	0	0	46	21	19	0	16	15	41	0	**158**
08:30-09:30	0	0	0	0	42	19	19	0	14	15	41	0	**150**
08:45-09:45	0	0	0	0	35	15	20	0	21	15	51	0	**157**
09:00-10:00	0	0	0	0	36	18	16	0	14	12	51	0	**147**
09:15-10:15	0	0	0	0	30	17	20	0	17	18	49	0	**151**
09:30-10:30	0	0	0	0	30	21	18	0	24	31	55	0	**179**
09:45-10:45	0	0	0	0	32	29	23	0	22	36	40	0	**182**
10:00-11:00	0	0	0	0	31	21	24	0	27	36	47	0	**186**
10:15-11:15	0	0	0	0	36	25	29	2	25	34	41	0	**192**
10:30-11:30	0	0	0	0	34	25	30	2	19	32	49	0	**191**
10:45-11:45	0	0	0	0	37	17	28	2	18	29	52	0	**183**
11:00-12:00	0	0	0	0	44	19	33	3	14	29	53	0	**195**
11:15-12:15	0	0	0	0	50	12	29	2	13	28	74	0	**208**
11:30-12:30	0	0	0	0	54	13	30	3	13	22	75	0	**210**
11:45-12:45	0	0	0	0	51	16	28	3	15	24	85	0	**222**
12:00-13:00	0	0	0	0	49	17	24	2	17	33	95	0	**237**
12:15-13:15	0	2	0	0	39	23	24	1	16	39	120	0	**264**
12:30-13:30	0	2	0	0	38	17	31	0	19	45	148	0	**300**
12:45-13:45	0	3	0	0	32	23	42	1	22	50	157	0	**330**
13:00-14:00	0	3	0	0	29	30	48	1	32	49	158	0	**350**
13:15-14:15	0	1	0	0	38	33	53	1	33	50	130	0	**339**
13:30-14:30	0	1	0	0	33	40	49	3	34	56	110	0	**326**
13:45-14:45	0	1	0	0	37	39	38	2	28	49	97	1	**292**
14:00-15:00	0	2	0	0	38	36	42	3	24	51	92	1	**289**
14:15-15:15	0	2	0	0	37	32	34	3	27	41	91	1	**268**
14:30-15:30	0	4	0	0	43	29	32	1	26	30	77	1	**243**
14:45-15:45	0	3	0	0	56	22	32	1	28	33	76	0	**251**
15:00-16:00	0	2	0	0	57	31	24	0	21	28	55	0	**218**
15:15-16:15	0	2	0	0	47	32	23	0	22	29	53	0	**208**
15:30-16:30	0	0	0	0	60	39	25	0	19	32	59	0	**234**
15:45-16:45	0	0	0	0	51	44	22	0	33	33	61	0	**244**
16:00-17:00	0	0	0	0	54	36	21	0	29	33	80	0	**253**
16:15-17:15	0	0	0	1	58	41	27	0	49	51	76	0	**303**
16:30-17:30	0	0	0	2	54	32	32	0	65	47	75	0	**307**
16:45-17:45	0	0	0	2	67	33	33	0	51	40	72	0	**298**
17:00-18:00	0	0	0	2	75	36	35	0	52	39	65	0	**304**

TABLE A-3: HOURLY TRAFFIC COUNTS FOR ALL VEHICLES SIMULTANEOUSLY AT THE INTERSECTION OF ROAD R380 (MR887-2), HOTAZEL EAST ACCESS ROAD AND KUDUMANE MINE ACCESS ROAD, POINT C (14th OF NOVEMBER 2014)

TIME	MOVEMENTS												
INTERVALS	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
04:00-05:00	0	11	2	7	3	3	2	23	0	1	0	1	53
04:15-05:15	2	13	4	10	3	2	2	21	0	1	0	1	59
04:30-05:30	8	40	8	9	4	1	0	17	1	1	0	4	93
04:45-05:45	33	104	16	10	1	0	0	13	1	1	1	4	184
05:00-06:00	47	169	20	9	2	0	0	21	1	0	1	6	276
05:15-06:15	61	239	26	10	2	0	1	34	2	0	2	7	384
05:30-06:30	74	279	33	12	4	0	5	47	3	2	2	9	470
05:45-06:45	66	262	34	16	6	0	6	56	7	4	1	13	471
06:00-07:00	83	220	32	18	7	0	9	64	10	8	2	14	467
06:15-07:15	78	172	40	14	7	0	9	63	12	9	4	16	424
06:30-07:30	65	117	33	10	4	0	5	64	13	11	5	11	338
06:45-07:45	59	83	26	9	3	1	4	60	12	12	7	6	282
07:00-08:00	33	67	23	9	2	2	1	62	11	9	7	5	231
07:15-08:15	29	49	9	11	3	2	0	61	13	9	4	4	194
07:30-08:30	29	48	6	14	4	4	0	53	13	7	5	8	191
07:45-08:45	22	54	6	17	4	4	0	58	12	5	6	12	200
08:00-09:00	21	50	7	22	4	4	0	50	13	8	7	16	202
08:15-09:15	21	55	7	21	3	4	1	48	11	8	7	17	203
08:30-09:30	23	51	11	20	2	2	1	51	8	8	5	16	198
08:45-09:45	27	40	10	17	2	1	3	60	8	9	3	17	197
09:00-10:00	24	45	11	14	2	1	3	59	5	8	2	15	189
09:15-10:15	21	36	16	16	3	2	2	61	6	9	3	18	193
09:30-10:30	16	39	16	20	5	3	3	62	8	9	4	24	209
09:45-10:45	15	43	20	22	5	7	1	54	8	11	4	22	212
10:00-11:00	14	34	19	21	4	7	2	57	12	11	10	27	218
10:15-11:15	10	43	16	22	4	8	3	53	14	10	11	26	220
10:30-11:30	10	39	14	19	4	10	3	62	14	10	11	21	217
10:45-11:45	7	38	12	18	4	6	5	62	13	10	12	27	214
11:00-12:00	8	44	18	22	7	5	5	70	11	14	8	22	234
11:15-12:15	11	41	21	28	8	6	5	89	9	15	9	24	266
11:30-12:30	11	45	26	33	10	5	6	90	9	17	8	30	290
11:45-12:45	9	45	24	33	11	5	6	97	10	17	10	26	293
12:00-13:00	9	49	20	40	8	5	6	103	10	12	9	26	297
12:15-13:15	9	43	15	42	6	4	5	131	8	15	9	23	310
12:30-13:30	8	41	14	43	3	2	3	167	9	12	14	24	340
12:45-13:45	8	44	15	41	3	2	4	188	7	9	14	34	369
13:00-14:00	9	44	17	27	7	4	3	195	8	11	13	37	375
13:15-14:15	8	57	19	23	8	6	4	172	7	8	13	41	366
13:30-14:30	7	57	15	21	9	6	4	149	6	10	12	36	332
13:45-14:45	8	57	14	29	7	6	1	128	6	13	10	26	305
14:00-15:00	7	58	13	38	5	4	1	129	4	12	12	25	308
14:15-15:15	11	52	15	44	5	0	1	120	4	17	16	29	314
14:30-15:30	16	55	15	49	6	0	3	103	3	17	15	29	311
14:45-15:45	17	61	16	42	8	2	4	97	7	15	14	31	314
15:00-16:00	19	71	13	37	9	3	5	68	6	14	18	33	296
15:15-16:15	16	66	8	32	9	3	5	63	8	10	18	30	268
15:30-16:30	12	83	7	27	6	3	3	72	9	13	16	31	282
15:45-16:45	9	76	4	28	6	4	2	76	5	15	16	29	270
16:00-17:00	7	68	7	28	3	6	2	93	6	16	15	25	276
16:15-17:15	6	70	7	22	4	10	1	99	3	20	14	18	274
16:30-17:30	5	51	8	20	11	11	1	103	3	26	17	12	268
16:45-17:45	14	58	17	20	11	14	1	101	3	30	18	8	295
17:00-18:00	15	71	20	18	11	12	0	97	3	30	17	6	300

APPENDIX B

TRIP INFORMATION RELATED TO THE PROPOSED DEVELOPMENT

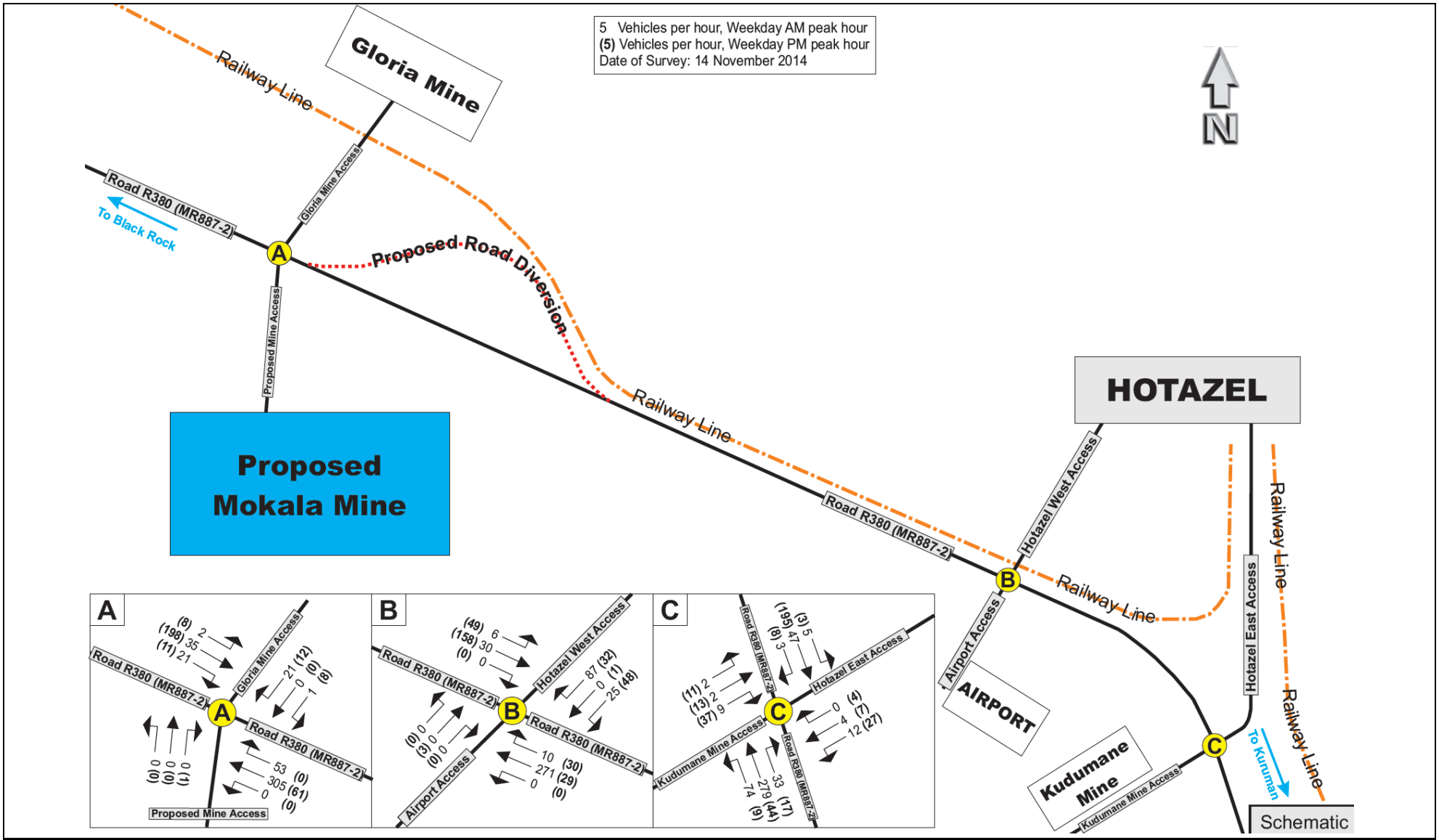


FIGURE B-1: BASE YEAR, 2014, PEAK HOUR TRAFFIC WITHOUT BACKROUND TRAFFIC GROWTH WITHOUT THE PROPOSED MINING DEVELOPMENT

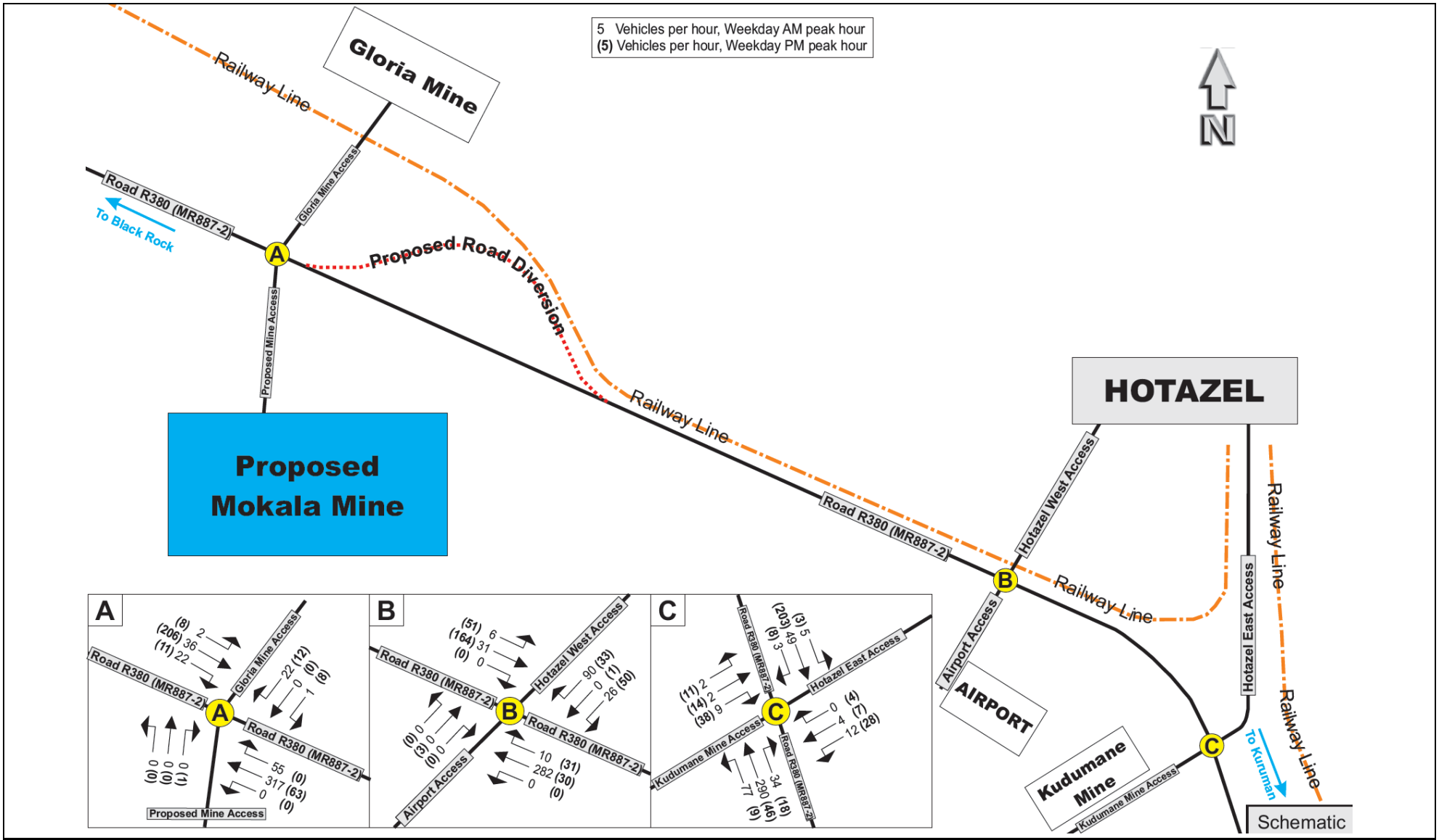


FIGURE B-2: PROJECTED 2015 PEAK HOUR TRAFFIC WITHOUT BACKGROUND TRAFFIC GROWTH WITHOUT THE PROPOSED MINING DEVELOPMENT (SCENARIO 1)

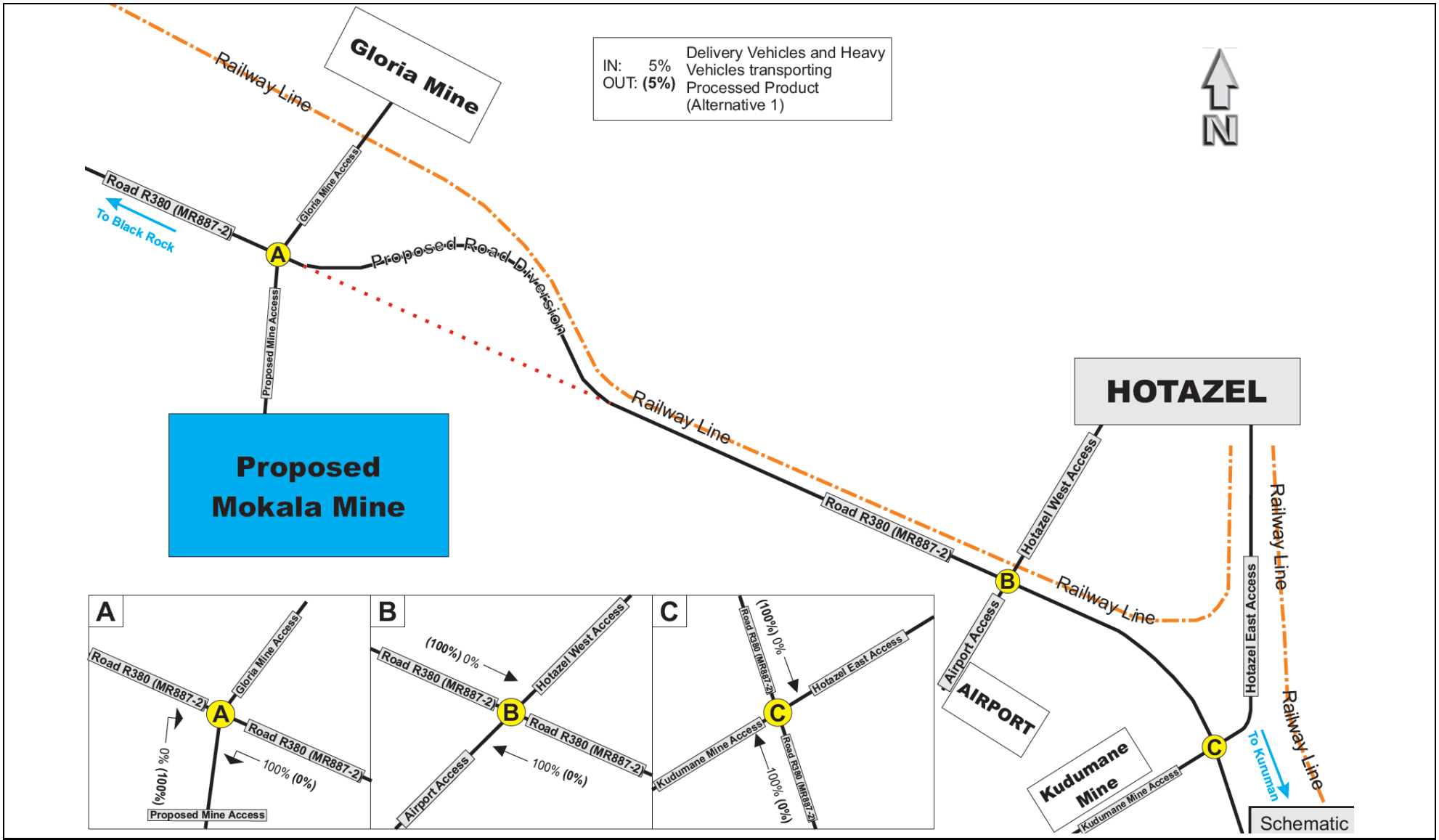


FIGURE B-3: PROJECTED VEHICLE TRIP DISTRIBUTION FOR THE PROPOSED MINING DEVELOPMENT (DELIVERY AND HEAVY VEHICLES)

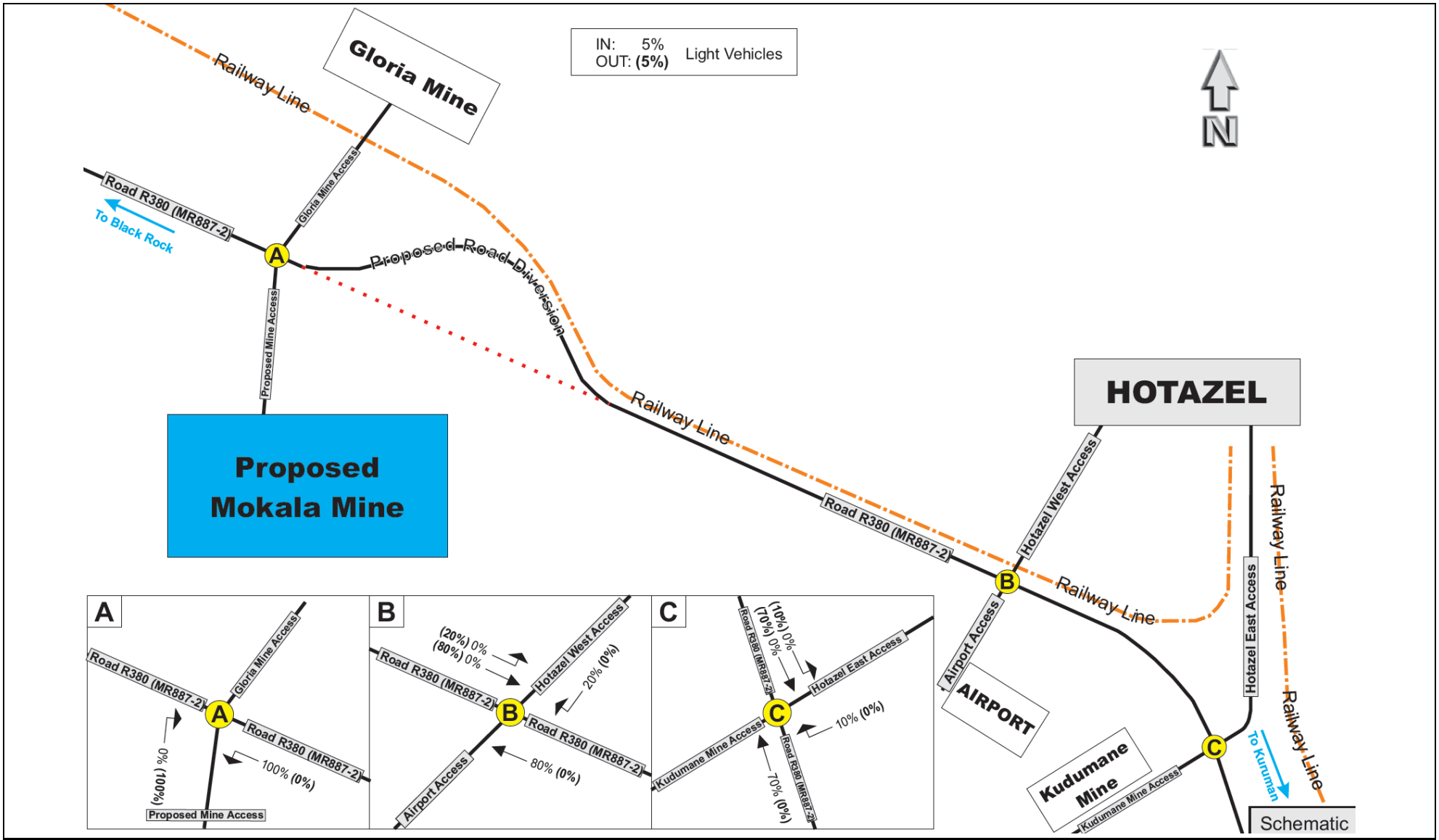


FIGURE B-4: PROJECTED VEHICLE TRIP DISTRIBUTION FOR THE PROPOSED MINING DEVELOPMENT (LIGHT VEHICLES)

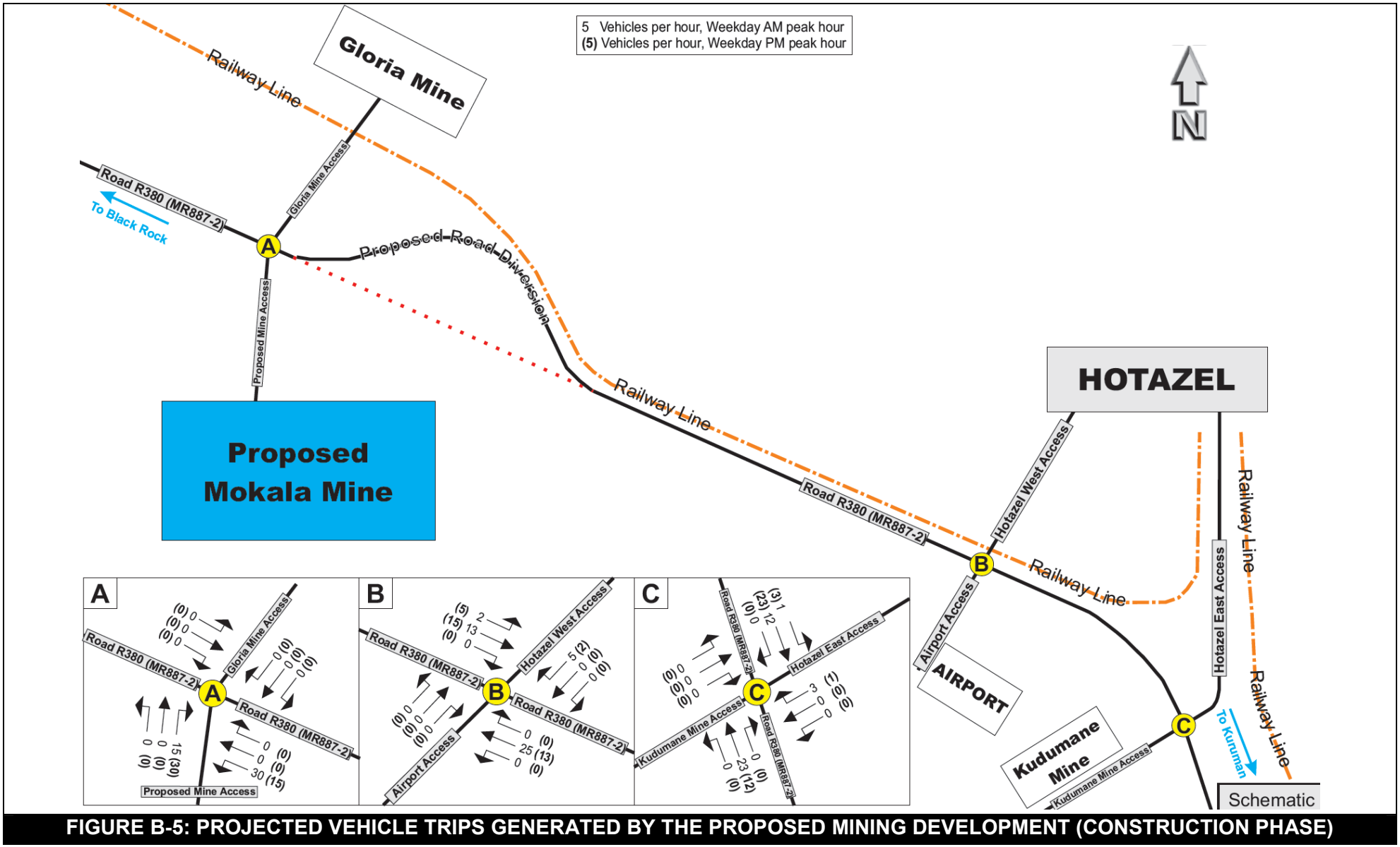


FIGURE B-5: PROJECTED VEHICLE TRIPS GENERATED BY THE PROPOSED MINING DEVELOPMENT (CONSTRUCTION PHASE)

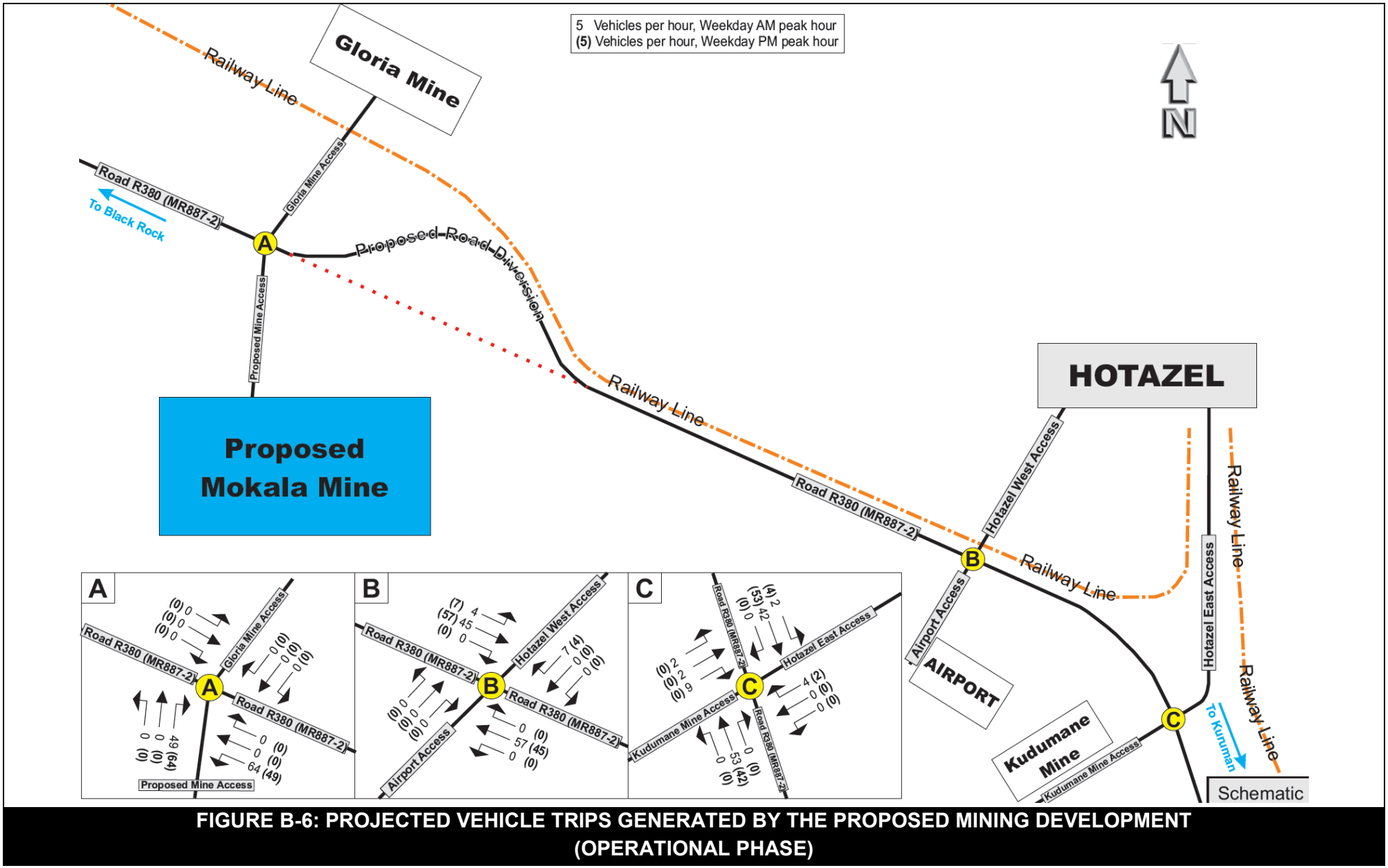


FIGURE B-6: PROJECTED VEHICLE TRIPS GENERATED BY THE PROPOSED MINING DEVELOPMENT (OPERATIONAL PHASE)

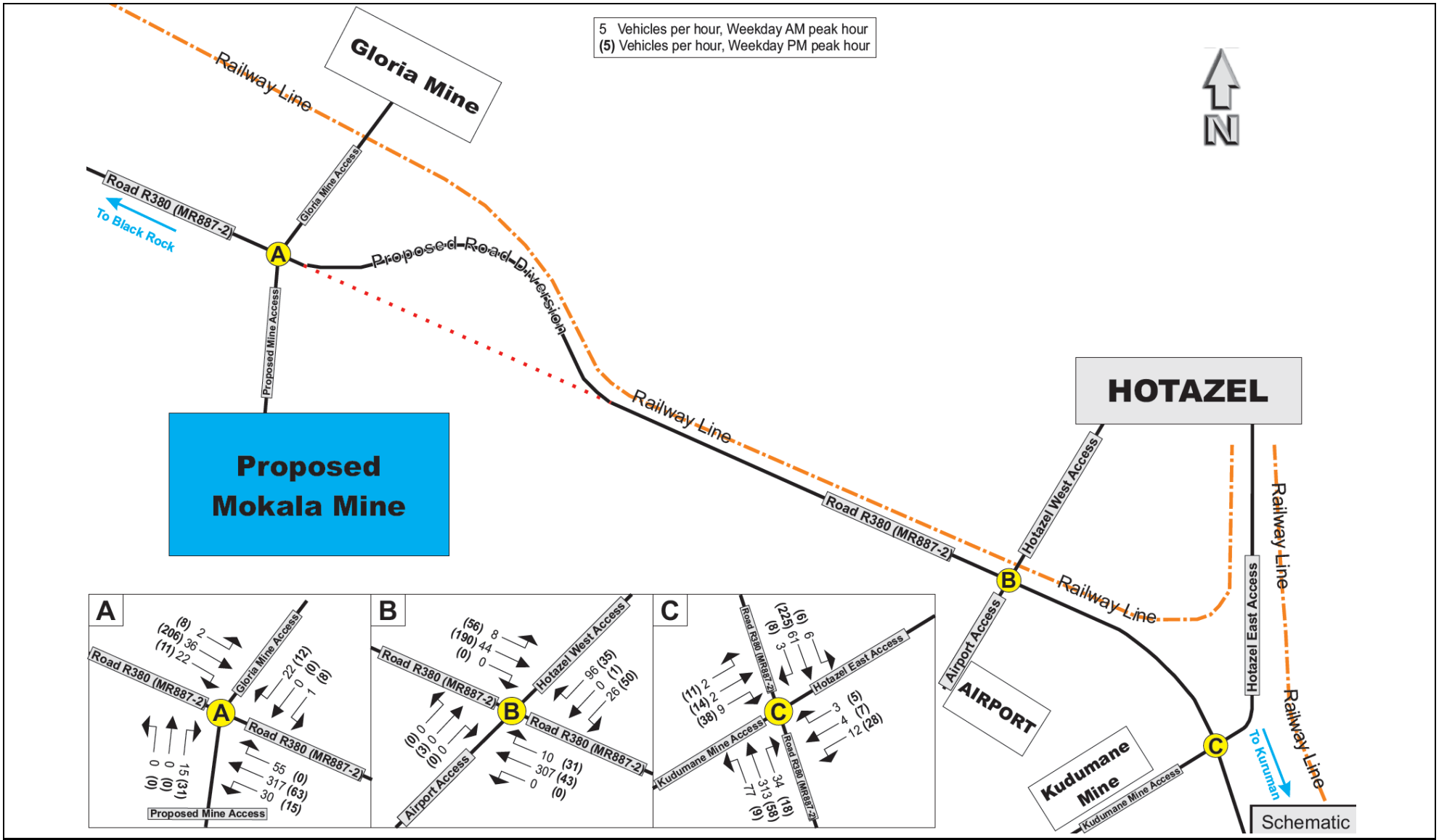


FIGURE B-7: PROJECTED 2015 PEAK HOUR TRAFFIC WITHOUT BACKGROUND TRAFFIC GROWTH WITH THE PROPOSED MINING DEVELOPMENT (CONSTRUCTION PHASE) (SCENARIO 2)

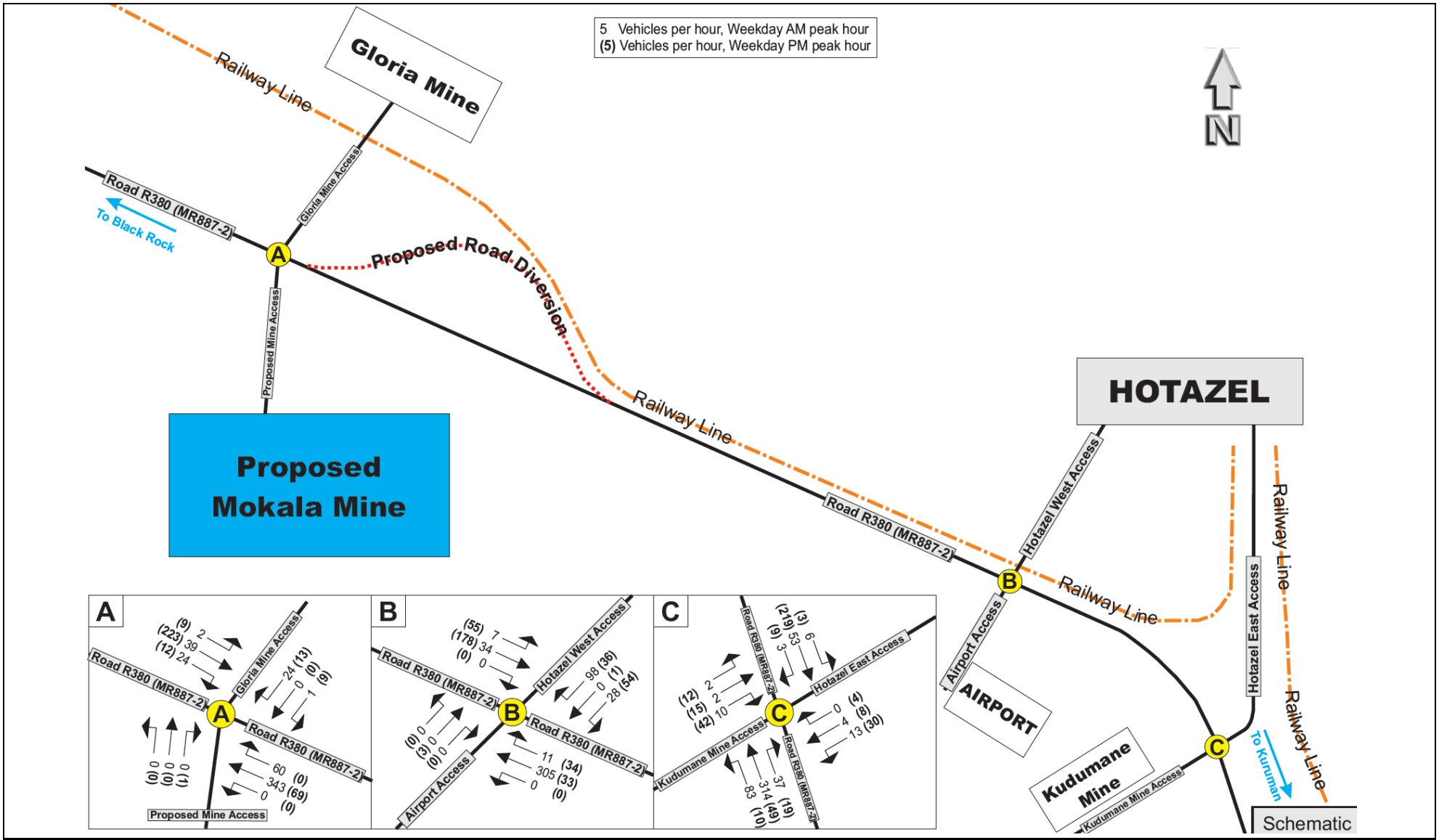


FIGURE B-8: PROJECTED 2017 PEAK HOUR TRAFFIC WITH BACKGROUND TRAFFIC GROWTH WITHOUT THE PROPOSED MINING DEVELOPMENT (OPERATIONAL PHASE) (SCENARIO 3)

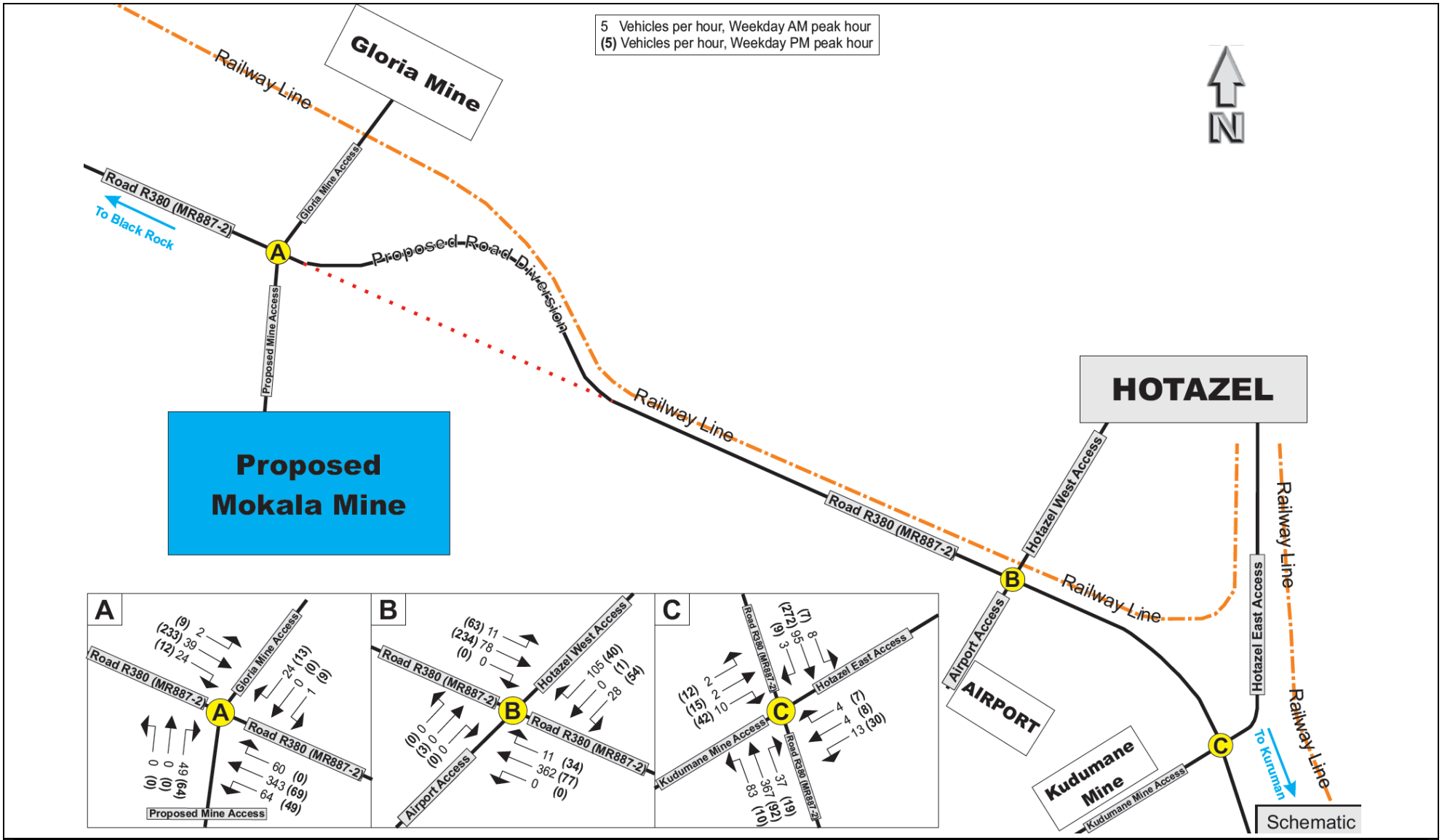


FIGURE B-9: PROJECTED 2017 PEAK HOUR TRAFFIC WITH BACKGROUND TRAFFIC GROWTH WITH THE PROPOSED MINING DEVELOPMENT (OPERATIONAL PHASE) (SCENARIO 4)

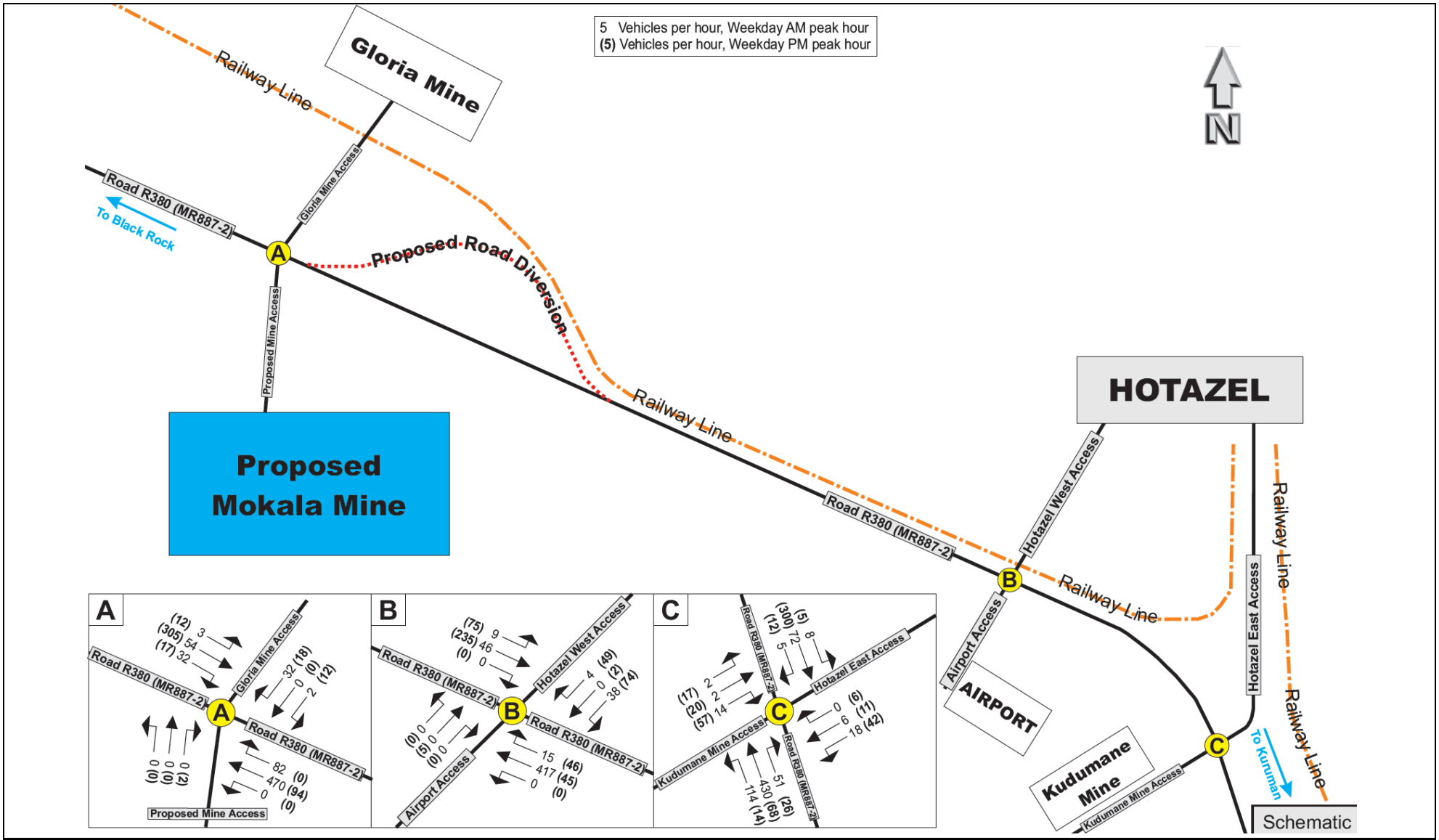


FIGURE B-10: PROJECTED 2025 PEAK HOUR TRAFFIC WITH BACKGROUND TRAFFIC GROWTH WITHOUT THE PROPOSED MINING DEVELOPMENT (SCENARIO 5)

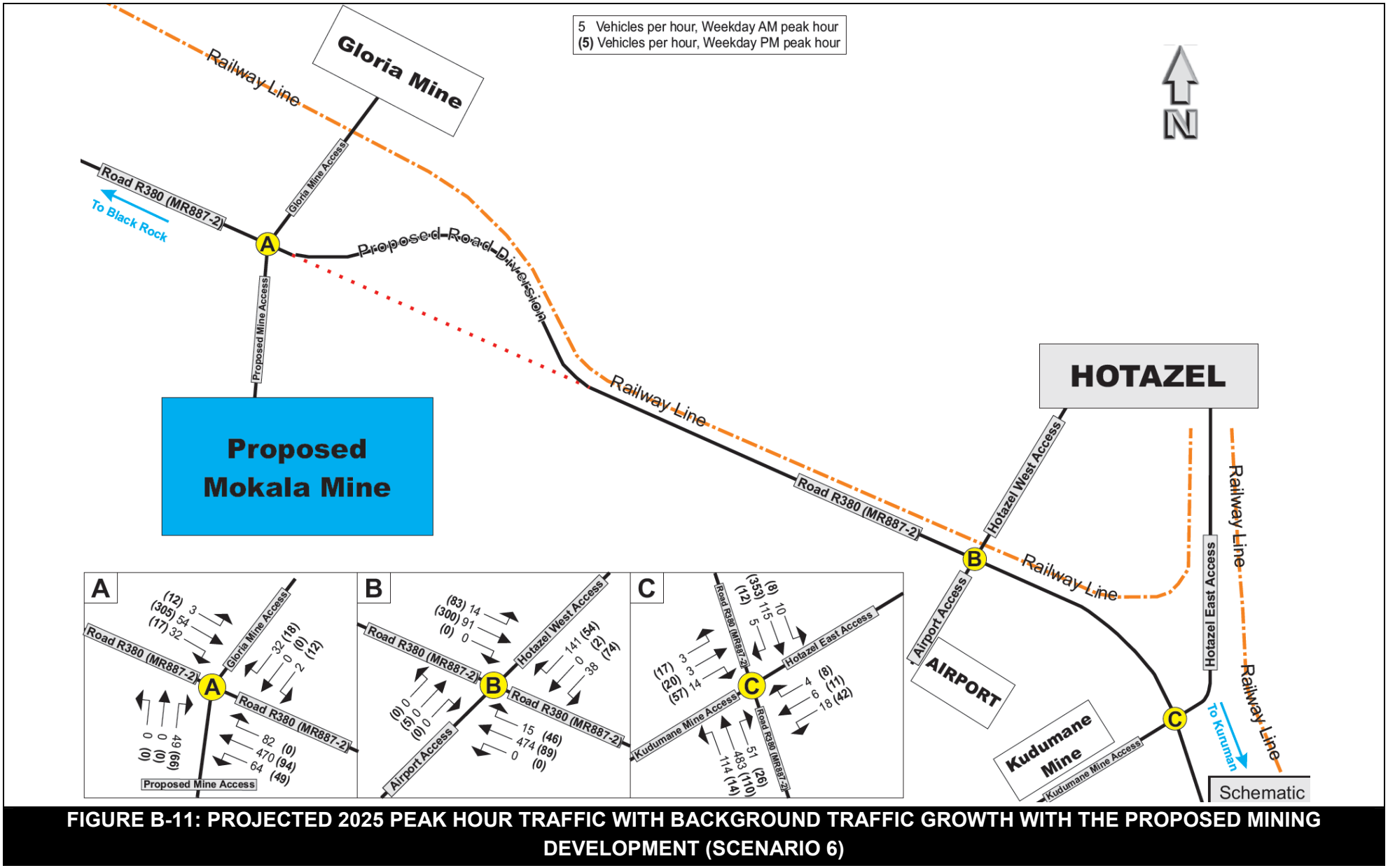


FIGURE B-11: PROJECTED 2025 PEAK HOUR TRAFFIC WITH BACKGROUND TRAFFIC GROWTH WITH THE PROPOSED MINING DEVELOPMENT (SCENARIO 6)

APPENDIX C

SIDRA CALCULATION RESULTS

DEGREE OF SATURATION DEFINITION

In traffic engineering, the **degree of saturation** of an intersection (typically under traffic signal control) or road is a measure of how much demand it is experiencing compared to its total capacity.

The degree of saturation (%) is a ratio of demand to capacity on each approach to the junction, with a value of 100% meaning that demand and capacity are equal and no further traffic is able to progress through the junction. Values over 85% are typically regarded as suffering from traffic congestion, with queues of vehicles beginning to form.

Reference: Wikipedia Encyclopaedia

TABLE C-1: LEVELS OF SERVICE FOR VARIOUS APPROACHES FOR THE YEAR 2015 WITHOUT BACKGROUND TRAFFIC GROWTH, WITHOUT THE PROPOSED MINING DEVELOPMENT (SCENARIO 1)

Point A: INTERSECTION OF ROAD R380 (MR887-2), GLORIA MINE ACCESS ROAD AND PROPOSED MINING DEVELOPMENT ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Gloria Mine)	12.8	B	0.050	10.2	B	0.029
East (Road R380)	1.0	A	0.221	1.0	A	0.042
South (Proposed Mine)	10.1	B	0.003	8.9	A	0.002
West (Road R380)	3.8	A	0.045	0.7	A	0.135
Intersection	**2.0**	**A**	**0.221**	**1.4**	**A**	**0.135**

Point B: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL WEST ACCESS ROAD AND AIRFIELD ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Hotazel West)	10.1	B	0.177	9.2	A	0.092
East (Road R380)	0.3	A	0.176	3.6	A	0.042
South (Airfield)	9.3	A	0.001	8.1	A	0.001
West (Road R380)	0.9	A	0.025	1.3	A	0.123
Intersection	**2.9**	**A**	**0.177**	**3.5**	**A**	**0.123**

Point C: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL EAST ACCESS ROAD AND KUDUMANE MINE ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Road R380)	1.0	A	0.029	0.3	A	0.117
East (Hotazel East)	11.0	B	0.028	11.0	B	0.067
South (Road R380)	1.6	A	0.171	2.5	A	0.029
West (Kudumane)	15.9	C	0.044	14.0	B	0.167
Intersection	**2.2**	**A**	**0.171**	**4.0**	**A**	**0.167**

TABLE C-2: LEVELS OF SERVICE FOR VARIOUS APPROACHES FOR THE YEAR 2017, WITHOUT BACKGROUND TRAFFIC GROWTH, WITHOUT THE PROPOSED MINING DEVELOPMENT (SCENARIO 3)

Point A: INTERSECTION OF ROAD R380 (MR887-2), GLORIA MINE ACCESS ROAD AND PROPOSED MINING DEVELOPMENT ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Gloria Mine)	13.4	B	0.058	10.4	B	0.033
East (Road R380)	1.0	A	0.240	1.0	A	0.046
South (Proposed Mine)	10.4	B	0.003	9.0	A	0.002
West (Road R380)	4.0	A	0.050	0.8	A	0.147
Intersection	**2.1**	**A**	**0.240**	**1.5**	**A**	**0.147**

Point B: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL WEST ACCESS ROAD AND AIRFIELD ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Hotazel West)	10.4	B	0.200	9.3	A	0.102
East (Road R380)	0.4	A	0.190	3.6	A	0.046
South (Airfield)	9.4	A	0.001	8.1	A	0.001
West (Road R380)	0.9	A	0.027	1.3	A	0.133
Intersection	**3.0**	**A**	**0.200**	**3.6**	**A**	**0.133**

Point C: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL EAST ACCESS ROAD AND KUDUMANE MINE ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Road R380)	1.0	A	0.032	0.3	A	0.127
East (Hotazel East)	11.8	B	0.038	11.3	B	0.075
South (Road R380)	1.6	A	0.185	2.6	A	0.031
West (Kudumane)	17.1	C	0.052	14.8	B	0.194
Intersection	**2.3**	**A**	**0.185**	**4.2**	**A**	**0.194**

TABLE C-3: LEVELS OF SERVICE FOR VARIOUS APPROACHES FOR THE YEAR 2025, WITH BACKGROUND TRAFFIC GROWTH, WITHOUT THE PROPOSED MINING DEVELOPMENT (SCENARIO 5)

Point A: INTERSECTION OF ROAD R380 (MR887-2), GLORIA MINE ACCESS ROAD AND PROPOSED MINING DEVELOPMENT ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Gloria Mine)	17.1	C	0.111	11.6	B	0.054
East (Road R380)	1.2	A	0.329	1.4	A	0.062
South (Proposed Mine)	12.2	B	0.004	10.1	B	0.005
West (Road R380)	5.0	A	0.075	0.9	A	0.201
Intersection	**2.5**	**A**	**0.329**	**1.8**	**A**	**0.201**

Point B: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL WEST ACCESS ROAD AND AIRFIELD ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Hotazel West)	13.0	B	0.336	10.1	B	0.157
East (Road R380)	0.5	A	0.260	4.0	A	0.066
South (Airfield)	10.2	B	0.001	8.2	A	0.001
West (Road R380)	0.9	A	0.037	1.3	A	0.182
Intersection	**3.8**	**A**	**0.336**	**3.8**	**A**	**0.182**

Point C: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL EAST ACCESS ROAD AND KUDUMANE MINE ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Road R380)	1.2	A	0.043	0.3	A	0.174
East (Hotazel East)	12.9	B	0.054	13.3	B	0.132
South (Road R380)	1.6	A	0.253	2.8	A	0.046
West (Kudumane)	24.9	C	0.116	21.2	C	0.355
Intersection	**2.6**	**A**	**0.253**	**5.5**	**A**	**0.355**

TABLE C-4: LEVELS OF SERVICE FOR VARIOUS APPROACHES FOR THE YEAR 2015, WITHOUT BACKGROUND TRAFFIC GROWTH, WITH THE PROPOSED MINING DEVELOPMENT (CONSTRUCTION PHASE) (SCENARIO 2)

Point A: INTERSECTION OF ROAD R380 (MR887-2), GLORIA MINE ACCESS ROAD AND PROPOSED MINING DEVELOPMENT ACCESS ROAD (WITH GEOMETRIC UPGRADE)

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Gloria Mine)	19.5	C	0.093	12.3	B	0.042
East (Road R380)	1.2	A	0.178	1.2	A	0.038
South (Proposed Mine)	16.5	C	0.055	12.9	B	0.080
West (Road R380)	3.4	A	0.039	0.5	A	0.116
Intersection	**2.8**	**A**	**0.178**	**2.4**	**A**	**0.116**

Point B: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL WEST ACCESS ROAD AND AIRFIELD ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Hotazel West)	10.5	B	0.199	9.4	A	0.099
East (Road R380)	0.4	A	0.191	3.2	A	0.051
South (Airfield)	9.4	A	0.001	8.2	A	0.001
West (Road R380)	0.9	A	0.035	1.3	A	0.141
Intersection	**3.0**	**A**	**0.199**	**3.4**	**A**	**0.141**

Point C: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL EAST ACCESS ROAD AND KUDUMANE MINE ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Road R380)	0.9	A	0.036	0.4	A	0.130
East (Hotazel East)	12.0	B	0.038	11.7	B	0.076
South (Road R380)	1.5	A	0.184	2.2	A	0.037
West (Kudumane)	17.0	C	0.048	15.0	B	0.181
Intersection	**2.2**	**A**	**0.184**	**4.0**	**A**	**0.181**

TABLE C-5: LEVELS OF SERVICE FOR VARIOUS APPROACHES FOR THE YEAR 2017, WITH BACKGROUND TRAFFIC GROWTH, WITH THE PROPOSED MINING DEVELOPMENT (OPERATIONAL PHASE) (SCENARIO 4)

Point A: INTERSECTION OF ROAD R380 (MR887-2), GLORIA MINE ACCESS ROAD AND PROPOSED MINING DEVELOPMENT ACCESS ROAD (WITH GEOMETRIC UPGRADE)

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Gloria Mine)	21.2	C	0.111	12.7	B	0.049
East (Road R380)	1.6	A	0.193	2.4	A	0.054
South (Proposed Mine)	19.8	C	0.201	14.5	B	0.183
West (Road R380)	3.5	A	0.045	0.5	A	0.126
Intersection	**4.1**	**A**	**0.201**	**3.6**	**A**	**0.183**

Point B: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL WEST ACCESS ROAD AND AIRFIELD ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Hotazel West)	11.9	B	0.251	10.0	B	0.122
East (Road R380)	0.6	A	0.225	2.9	A	0.077
South (Airfield)	9.8	A	0.001	8.3	A	0.001
West (Road R380)	0.7	A	0.060	1.2	A	0.170
Intersection	**3.1**	**A**	**0.251**	**3.2**	**A**	**0.170**

Point C: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL EAST ACCESS ROAD AND KUDUMANE MINE ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Road R380)	0.8	A	0.057	0.4	A	0.157
East (Hotazel East)	13.5	B	0.050	13.6	B	0.106
South (Road R380)	1.5	A	0.216	1.8	A	0.059
West (Kudumane)	20.7	C	0.066	18.3	C	0.244
Intersection	**2.2**	**A**	**0.216**	**2.2**	**A**	**0.216**

TABLE C-6: LEVELS OF SERVICE FOR VARIOUS APPROACHES FOR THE YEAR 2025, WITH BACKGROUND TRAFFIC GROWTH, WITH THE PROPOSED MINING DEVELOPMENT (OPERATIONAL PHASE) (SCENARIO 6)

Point A: INTERSECTION OF ROAD R380 (MR887-2), GLORIA MINE ACCESS ROAD AND PROPOSED MINING DEVELOPMENT ACCESS ROAD (WITH GEOMETRIC UPGRADE)

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Gloria Mine)	33.6	D	0.243	15.3	C	0.084
East (Road R380)	1.4	A	0.264	2.0	A	0.057
South (Proposed Mine)	31.6	D	0.316	18.6	C	0.237
West (Road R380)	4.2	A	0.076	0.5	A	0.172
Intersection	**5.0**	**A**	**0.316**	**3.8**	**A**	**0.237**

Point B: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL WEST ACCESS ROAD AND AIRFIELD ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Hotazel West)	15.9	C	0.425	10.9	B	0.188
East (Road R380)	0.7	A	0.295	3.6	A	0.099
South (Airfield)	10.7	B	0.001	8.4	A	0.001
West (Road R380)	0.7	A	0.070	1.2	A	0.219
Intersection	**4.3**	**A**	**0.425**	**3.7**	**A**	**0.219**

Point C: INTERSECTION OF ROAD R380 (MR877-2), HOTAZEL EAST ACCESS ROAD AND KUDUMANE MINE ACCESS ROAD

Type of intersection control: Free-flow on Road R380

APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (Road R380)	0.9	A	0.069	0.4	A	0.204
East (Hotazel East)	16.6	C	0.090	16.0	C	0.178
South (Road R380)	1.5	A	0.284	2.1	A	0.070
West (Kudumane)	31.1	D	0.152	28.4	D	0.456
Intersection	**2.7**	**A**	**0.284**	**6.0**	**A**	**0.456**

APPENDIX D

LEVEL OF SERVICE CRITERIA

TABLE D-1: LEVEL OF SERVICE CRITERIA FOR UNSIGNALISED INTERSECTIONS		
LEVEL OF SERVICE	**AVERAGE TOTAL DELAY (SEC/VEH)**	**PERFORMANCE EVALUATION**
A	≤ 5	Excellent
B	> 5 and ≤ 10	Very Good
C	>10 and ≤ 20	Good
D	>20 and ≤ 30	Average
E	>30 and ≤ 45	Poor
F	>45	Fail

TABLE D-2: LEVEL OF SERVICE CRITERIA FOR SIGNALISED INTERSECTIONS		
LEVEL OF SERVICE	**AVERAGE TOTAL DELAY (SEC/VEH)**	**PERFORMANCE EVALUATION**
A	≤ 5	Excellent
B	> 5 and ≤ 15	Very Good
C	> 15 and ≤ 25	Good
D	> 25 and ≤ 40	Average
E	> 40 and ≤ 60	Poor
F	> 60	Fail

Level of Service criteria obtained from *The Highway Capacity Manual (Special Report 2009)*

APPENDIX E

IMPACT RATINGS CRITERIA

TABLE E-1: CRITERIA USED IN THE ASSESSMENT OF IMPACTS					
PART A: DEFINITION AND CRITERIA*					
Definition of SIGNIFICANCE			**Significance = consequence x probability**		
Definition of CONSEQUENCE			**Consequence is a function of severity, spatial extent and duration**		
Criteria for ranking of the SEVERITY of environmental impacts		**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.		
		M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints		
		L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.		
		L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complains.		
		M+	Moderate improvements. Will be within or better than the recommended levels. No observed reaction.		
		H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.		
Criteria for ranking the DURATION of impacts		**L**	Quickly revisable. Less than the project life. Short term		
		M	Revisable over time. Life of the project. Medium term		
		H	Permanent. Beyond closure. Long term		
Criteria for ranking the SPATIAL SCALE of impacts		**L**	Localized – Within the site boundaries		
		M	Fairly widespread – Beyond the site boundary. Local		
		H	Widespread – Far beyond site boundary. Regional/ national.		
PART B: DETERMINING CONCEQUENCES					
SEVERITY = L					
DURATION	**Long term**	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**
SEVERITY = M					
DURATION	**Long term**	**H**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**
SEVERITY = H					
DURATION	**Long term**	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Medium**	**Medium**	**High**
			L	M	H
			Localized within site boundaries	Fairly widespread beyond site boundary local	Widespread Far beyond site boundary Regional/ national
			SPATIAL SCALE		

PART C: DETERMINING SIGNIFICANCE					
PROBABILITY (of exposure to impacts)	Definite/ Continues	H	Medium	Medium	High
	Possible/ Frequent	M	Medium	Medium	High
	Unlikely/ Seldom	L	Low	Low	Medium
			L	M	H
			CONSEQUENCE		

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

APPENDIX F

PROFESSIONAL REGISTRATION AND CIRICULAM VITAE

Suid-Afrikaanse Raad vir Ingenieurswese

Hiermee word gesertifiseer dat *Leon Roets*

geregistreer is as *Professionele Ingenieur*

kragtens die Wet op die Ingenieursweseprofessie van Suid-Afrika 1990 (Wet 114 van 1990)

Datum *14 November 1996*

Registrasienommer *960547*

President **Registrateur**

DE BONG 92

Curriculum Vitae

Leon Roets

Confidential

Mr Roets is a transport and traffic engineer with wide experience in **transportation planning and modelling as well as data processing**. He has also gained considerable experience in determining traffic impact, undertaking parking studies, analysing and designing intersections and evaluating traffic-control measures. His experience in the development of transport plans and strategies is a great asset to the company. Recently, Mr Roets was highly successful in building bridges between various role players to facilitate and establish passenger transport forums in the Limpopo Province. His excellent relationships with the respective role players in the Limpopo Province are extremely useful. Mr Roets is locally based in Polokwane.

1. PERSONAL PARTICULARS

Name	:	Roets, Leon
Date of birth	:	14 October 1965
Identity number	:	6510145135085
Marital status	:	Married
Nationality	:	South African
Current position	:	Director, SIYAZI (Northern Province)
Prof Registration	:	960547

2. ACADEMIC QUALIFICATIONS

B.Eng. (Civil Eng. University of Pretoria, 1988)

3. EMPLOYMENT RECORD

07/2002 – currently	Director, SIYAZI LIMPOPO
07/1996 - currently	Director, SIYAZI Transportation & Services
01/1996 – 01/1997	Co-ordinator of SAACE Transport Division, Northern Province Branch
11/1994 – 06/1996	Representative of Africon Transportation in Northern Province, working from Pietersburg
02/1995 – 12/1997	Member of SAICE Management Committee, Northern Province Branch
08/1992 - 10/1994	Africon Transport Planning Division in Pretoria
01/1989 - 07/1990	Military Service, Lieutenant in Genie Corps

4. PROFESSIONAL MEMBERSHIP

Registered as Professional Engineer (Registration No. 960547).

5. LANGUAGE PROFICIENCY

Afrikaans	:	Fluent (Read, write, speak)
English	:	Fluent (Read, write, speak)

6. COMPUTER SKILLS

Proficient in using the following software:

a) MS Office (Excel, Word, Powerpoint and Access)
b) Sidra (Traffic Simulation Program)
c) Transcad
d) HCM
e) Transyt
f) SPSS
g) Autocad
h) Visual Basics for Excell.

7. AWARDS

In 1998, SIYAZI Transportation and Services (Pty) Ltd received a ***CERTIFICATE OF APPRECIATION*** for the outstanding contribution towards the promotion of the services rendered by the **Department of Protection Services** of the Pietersburg-Polokwane TLC, currently known as the Polokwane Municipality.

In 1999, SIYAZI Transportation and Services (Pty) Ltd received ***an SAACE 1999 BRANCH AWARD FOR EXCELLENCE OF CIVIL ENGINEERING*** in the Pietersburg-Polokwane Passenger Transport System.

L Roets was the project leader for both the above-mentioned awards.

8. PROFESSIONAL EXPERIENCE

The following specific projects had been conducted in terms of Travel Demand Modelling:

a) Burgersfort Central Business District transport network (Transcad)
b) Relocation of Road N11 in the Mogalakwena Local Municipality Area (Transcad)
c) Road R37 from Burgersfort to Polokwane (Transcad)
d) N1- Bypass in Polokwane to determine whether eastern or western by pass should be constructed (Transcad)
e) Polokwane CBD (Transcad)
f) Determination of By-Pass Routes for Rustenburg as employee of Africon (Emme/2)
g) Traffic Calming in Tzaneen employee of Africon (Emme/2)
h) N17 Toll Strategy employee of Africon (Emme/2)

As Project Manager following typical projects were also conducted.

TRANSPORT & PUBLIC TRANSPORT
Polokwane PTP & ITP
Polokwane Taxi Holding Area
Public Transport related work for Steelpoort Producers Forum
Public Transport related work for the Mogalakwena Economic Development Forum
Tzaneen Crossing Shopping, Taxi Facilities
2010- Priority Statements for the Limpopo Province (2005 & 2006)
Bus Terminal in Tzaneen
Elim Shopping Centre
Polokwane Taxi Rank: Inputs
Branding of Taxi Rank: Inputs
Capacity building of the Northern Province Taxi Co-ops
Design & Contract: Documentation: Bawhaduba Bus Service: Community Meeting

TRANSPORT & PUBLIC TRANSPORT
Detail design of Pietersburg-Polokwane Rank
Traffic Impact Study for Pietersburg Polokwane Taxi Holding Area
Colour Coding for taxis in Pietersburg-Polokwane
Pietersburg-Polokwane Transportation Study
Development of Business Plan for Taxi Recapitalisation Program for the Limpopo Province
Taxi Route Colour coding Framework for the Limpopo Province
Planning of Multi-modal system for Burgersfort
Transport of workers at Modikwa Mine
Input for transportation of workers (Dilokong corridor)
Development of transport hub in Polokwane
Develop and maintain transport related infrastructure (Dilokong Corridor)
Road Agency Investigation for new route alignment - Pietersburg Western Bypass Ext of projects
Input into the transport of workers along the Dilokong Corridor (To stimulate and promote government subsidized public transport for workers)
Vhembe District Municipality CPTR in Joint Venture with Batlagae Community Projects
Greater Tubatse Integrated Transport Plan (CPTR, OLS, PTP and ITP)
Capricorn District Municipality CPTR in Joint Venture with Batlagae Community Projects
Limpopo in Motion (Transport Strategy) Passengers Transport Inputs

TRAFFIC ENGINEERING
Transport related work for Steelpoort Producers Forum
Transport related work for the Mogalakwena Economic Development Forum
Traffic inputs for Motor City
Traffic input for Filling station on the remainder of Erf 890 and portion 2 of 890, Polokwane
Traffic related input for development of ERF 1697, Pietersburg Extension 3
Traffic inputs at Koppiesfontein 30 and 31, Polokwane
Traffic related inputs at Bendor Extension 70, Polokwane
Traffic related inputs at Bendor Extension 79, Polokwane
Traffic Related inputs at Bendor Extension 77, Polokwane
Southgate Lodge Vulstasie
Parking inputs: 7 Eleven Pietersburg
Traffic Inputs for Pietersburg Entrance Road to Ext 44
Majebaskraal Filling Station Development
New Service Station - Intersection of Witklip & Railway Streets
Traffic Inputs - Boom Street at grade railway intersection
Traffic related input, Woodlands residential development, Farm Tweefontein, Polokwane
Proposed filling station at Roedtan
Traffic Inputs - Proposed Township Bendor X69
Traffic impact study: Proposed filling station at intersection of Veldspaat at Munnik Street
New Kopantsho private hospital, Polokwane, Traffic related input
Roads Agency Investigation for New routes alignment Pietersburg Western Bypass
Traffic-related input for Road R37
Entrance application Penina Park Filling Station
Traffic Impact Study for Erf 5787, Polokwane Pietersburg
Proposed filling station on Route P3/158/Dikgale
Siyazi Transportation & Services (Pty) Ltd. (Sealy warehouse and office block, traffic light installation)
Traffic Impact Study for proposed new Standard Bank Building In Polokwane
Camble Str Pietersburg: Modelling inputs
Traffic analysis for filling station at Rooipoort on N1
Traffic analysis – Pietersburg – Laubser & Smith

TRAFFIC ENGINEERING
Pietersburg Erf 7589, Traffic Impact Study
Transport & Industrial Survey: Pietersburg CBD
Traffic Engineering Input, Bendor Ext 30
Bendor Ext 30 Public Transport Inputs
Marketing Strategy for Metropolitan Centre, Pietersburg Phase 2
Filling Station Agatha & Circle Str, Tzaneen
Traffic Impact Assessment: Longdale X2 Erven 41 - Sealy
Bok en Dahl Street Special Traffic Inputs
Filling Station: Intersection of Grobler & Voortrekker Streets, Pietersburg
Biccard Street – Traffic Inputs
Technikon Pretoria Pietersburg Campus Traffic inputs
Traffic Impact Study: Filling Station - Intersection of Dorp and Marshall St
Traffic Impact Study: Messina Shopping Centre
Traffic Impact Study: Ivypark Ext 9
New Service Station Development: Portion of Stand 19, Gateway Industria Park
Pietersburg-Polokwane: Vulstasie in Potgieterstraat
Filling Station at intersection of Genl. Viljoen & Genl Maritz Streets, Pietersburg
Traffic Impact Study: Tzaneen Intersection of Agatha & Circle Streets
Traffic Impact Study: Hans van Rensburg St., Pietersburg

COMMUNITY- AND TRAFFIC SAFETY
Provide input into traffic safety along Road R37 (Burgersfort)
Greater Tubatse Transport Forum
Polokwane Transport Forum
Fetakgomo Transport Forum
Temporary measures to promote road safety in the Greater Tubatse Area
Traffic-related surveys for Road R37 (To monitor the growth of traffic on Road R37 as well as to identify problem areas)
Pietersburg Polokwane Taxi Forum

DATA SURVEYS
12-Hour manual traffic counts for the Limpopo Province
12 Hour traffic counts at Fetakgomo and Atok
Traffic counts for proposed filling station on the part of the farm Syferkuil 921 L S
12 hour Traffic counts – Soekmekaar
Traffic Counts at Bushbuckridge
Penina Park: Trips generated
Road P84-1: 12-Hour Traffic counts
12 Hour Traffic Count Dendron Road
Taxi counts on op P1/6 & N1
Traffic counts in Witklip Street
12-Hour Traffic Counts: Industria Street Pietersburg
Seven day Traffic Count - Roads P43-1 & P17-1
Pietersburg/Polokwane - Cordon Survey Detail Calculations
Traffic counts for Filling station in Tzaneen

TRAINING
Road Safety Training at the Greater Tubatse Local Municipality, Burgersfort
Transport Training, Burgersfort

9. LIST OF PUBLICATIONS

a) ROETS L, DILOKONG TRANSPORT FACILITIES, Limpopo Transport Summit, 7 November 2003.
b) OOSTHUIZEN S and ROETS L: TRANSPORT ASPECT OF MINIBUS-TAXI SERVICES IN THE RURAL ENVIRONMENT: S A Transport Conference, CSIR Conference Centre, Pretoria, 2003
c) OOSTHUIZEN S and ROETS L, CITY IMPROVEMENT DISTRICTS AS A COST-EFFECTIVE ALTERNATIVE FOR CRIME AND DEGRADING OF CBD, Local Authority Security Association of SA Seminar, Loskopdam Aventura Resort, 1999.
d) ROETS L, MULTI-DISCIPLINARY APPROACH IN MANAGING A SAFER ENVIRONMENT, MANAGING TAXI RANKS, Institute for municipal law enforcement of Southern Africa (IMLE) Conference 25 August 2000.
e) ROETS L, PIETERSBURG-POLOKWANE TRANSPORT STRATEGY PLAN, AMT ANNUAL CONFERENCE, integration of land-use and transport 18 August 2000.
f) ROETS L, PRESENTATION AT THE NORTHERN PROVINCE PROVINCIAL TRANSPORT
g) CONFERENCE, Pietersburg-Polokwane Integrated Transport System, 22 October 1999.