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TRAFFIC ENGINEERING SERVICES

TRAFFIC IMPACT STUDY REPORT

PROPOSED RIETVLEI OPENCAST COAL MINE, MPUMALANGA

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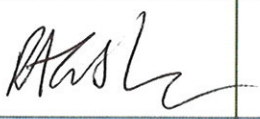
Signature				
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DECLARATION OF EXPERTISE	
I certify that this Traffic Impact Study has been prepared under my immediate supervision and I have experience and training in the field of traffic and transportation engineering.	
Name and Designation	Cornelia Hutchinson, Traffic Engineer
Signed	
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TRAFFIC IMPACT STUDY REPORT

PROPOSED RIETVLEI OPENCAST COAL MINE, MPUMALANGA

2014/07/02

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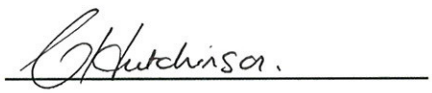
Declaration of Independence

In terms of Section 32 of the EIA Regulations 2010 published in terms of Chapter 5 of the National Environmental Management Act (Act 107 of 1998) specialists involved in Impact Assessment processes must declare their independence and furnish details of experience.

I, Cornelia Hutchinson, hereby declare that I have no conflict of interest related to the work of this report. Specially, I declare that I have no personal financial interests in the property and/or development being assessed in this report, and that I have no personal or financial connections to the relevant property owners, developers, planners, financiers or consultants of the development. I declare that the opinions expressed in this report are my own and a true reflection of my professional expertise.



Cornelia Hutchinson

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1 Introduction

1.1 Purpose

WSP Group Africa (Pty) Ltd was appointed by WSP Environmental (Pty) Ltd to conduct a Traffic Impact Study for the proposed new Rietvlei coal mine near Middelburg in Mpumalanga.

1.2 Guidelines, Regulations and Standards

This Traffic Impact Study was based on the principles and guidelines of the South African *Manual for Traffic Impact Studies*, Report RR 93/635 of the Department of Transport (1995).

Road safety considerations such as shoulder sight distance and stopping sight distance were evaluated in terms of the *Geometric Design of Rural Roads* technical guidelines, document TRH17 published by the Department of Transport in 1988.

Recommended road signs and markings should comply with the requirements of the *Southern African Development Community Road Traffic Signs Manual*, issued by the Department of Transport (1998).

The South African National Standards for Railway Safety Management (SANS 3000-2-2-1:2012, Edition 1, Part 2-2-1: Technical requirements for engineering and operational standards – Track, civil and electrical infrastructure – Level crossings will apply for the proposed decommissioning of the existing level crossing with the D1433 provincial road and the provision of a new level crossing to replace the existing crossing.

1.3 Scope

The study covers the following aspects related to traffic:

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

1.4 Methodology

The Traffic Impact Study was conducted as follows:

1.4.1 Site Inspection

An inspection of the public road network in the vicinity of the proposed site and along the likely haul route through Middelburg was conducted on 3 April 2014 by the Traffic Engineer. A visual inspection of the roads and pavement condition of the R555 was conducted and the intersections at which traffic counts were required were confirmed.

1.4.2 Data Collection

Manual traffic counts were conducted on a typical weekday, Wednesday 9 April 2014 from 06:00 to 18:00 at the three critical intersections identified during the site visit. The traffic signal setting and geometric layout of the intersections were recorded at the same time.

1.4.3 Baseline Assessment

The collected traffic data was analysed by means of SIDRA software in order to determine the baseline traffic conditions.

1.4.4 Trip Generation and Distribution

Based on the information contained in the Feasibility Study for Rietvlei Coal Asset (Mindset Mining Consultants, April 2013) and reasonable assumptions where information was not available, the trip generation during the construction and operational phases of the mine was estimated for both staff transport and coal haulage.

The employee trips were assigned to nearby towns in proportion to proximity to the site.

Haulage trucks from Rietvlei mine were distributed along the R555 in the same proportion as the existing heavy vehicle distribution along this road. At intersections all vehicle types were distributed in the same proportions as the existing traffic.

1.4.5 Horizon Year Assessment

The generated trips were added to the counted traffic data and analysed in SIDRA to determine the impact of Rietvlei mine on the traffic operations at the critical intersections. In terms of the requirements of the Manual for Traffic Impact Studies a 5-year horizon (after commissioning) was analysed. Mitigation measures in the form of intersection upgrades were developed to eliminate the expected impact of the mine traffic.

1.4.6 Assessment of Road Pavement

The information from the visual inspections was used to identify problem areas on the existing road pavement of the R555. The 12-hour traffic count data was converted to average daily traffic volumes by using historic (2011) 7-day traffic data for the R33 in close proximity to the site. The existing heavy vehicle loading on the R555 was firstly estimated after which the estimated additional loading due to the Rietvlei mine haulage was added to determine the possible impact of the proposed mine. The heavy vehicle loading on the D1433 from the mine access to the Pan Siding was estimated to inform the pavement design for this haul road.

1.4.7 Access Requirements

The suitability of the location of the proposed access to the mine was evaluated in terms of capacity and safety.

1.4.8 Conclusions and Recommendations

From the visual inspections, SIDRA analysis and assessment as described above, conclusions and recommendations were made in order to mitigate the expected traffic and heavy vehicle impact of Rietvlei mine.

1.5 Assumptions and Limitations

The Traffic Impact Study was based on the following assumptions:

- Based on the information provided it was assumed that mining operations would commence in 2015, that there would be a ramp up period in terms of production during the first year and that the mine would have a life span of 23 years.
- Since the distribution of the coal destined for Eskom was unknown at the time of the study, the worst-case scenario in terms of road impact was assumed, i.e. all Eskom coal will be transported by means of road along the R555.

- It was assumed that haulage of coal will occur six days a week from 06:00 to 18:00.
- Due to lack of better information the staff profile of Rietvlei mine and related trip generation were based on information used in traffic impact studies for similar developments.
- Available historic (2011) 7-day traffic data on R33 was used to convert the 12-hour data to average daily traffic volumes for the pavement loading assessment.
- An annual traffic growth rate of 3 % was assumed for background traffic.
- Based on the type of heavy vehicles observed in the vicinity of the site, each heavy vehicle was assumed to be equivalent to 8 passenger car units for the purpose of the capacity analysis.
- The average heavy vehicle already on the roads was assumed to be equal to 3 E80's. For the heavy vehicles from Rietvlei mine it was assumed that fully loaded trucks would be equivalent to 33.6 E80's and empty trucks would we 0.2 E80's. It was further assumed that for every loaded truck leaving the mine, one empty truck would return.

1.6 Locality

The site is located along the R555 approximately 23 km north-east of Middelburg in Mpumalanga. (See Figure 1: Locality Plan.)

Figure 1: Locality Plan

2 Description of the Development

2.1 Existing Land Use

The land surrounding the site is a combination of cultivated agricultural land and uncultivated land. A railway line crosses the south eastern section of the site. The Afgri Pan Siding is located approximately 10 km south of the site. The dirt road (D1433) from the R555 to the Pan Siding is a provincial road and crosses the site. A power line runs parallel to the railway line also traversing the site.

2.2 Proposed Development

The Rietvlei coal mine is a proposed opencast coal mine. The proposed coal mine will produce 2.5Mt per annum at maximum operating capacity. The construction period is estimated to be 12 months from mid-2014 according to Section 17 of the Feasibility Study done by Mindset Mining Consultants, with operation proposed to start mid-2015. However, it has been indicated that construction may only start in August 2014. The expected life of the mine is 23 years with reduced production during the 23rd year of only 0.5Mt.

The coal from the mine will be dispatched to Richards Bay Coal Terminal for export as well as to a selected Eskom Power Station. The coal that will be exported will be transported on trucks to the Afgri Pan Siding to be transported via rail to Richards Bay. The coal that will be supplied to Eskom will be transported either via truck to the selected power station or it could also be transported by rail.

The trucks transporting coal to the selected Eskom Power Station and the employees will use public roads. The D1433 from the R555 to the Pan Siding will have to be upgraded to accommodate the transport of the coal to the siding and possibly to the R555.

2.3 Existing Road Network

The proposed mine is situated along the R555 between Middelburg and Stofberg. The majority of the site is situated south of the R555. The section of the R555 past the site is a paved two lane, undivided road, with a speed limit of 120km/h. The road is in a fair condition to the west of the site, but the section east of the site contains a greater amount of patching and surface defects. Access to the site will be via the D1433 off the R555 towards the Afgri Pan Siding. The D1433 to the siding includes a rail level crossing south of the site.

Intersection 1 is the intersection of Meyer Street (R555) and Cowen Ntuli Street which later becomes the N11. It is the first intersection in Middelburg (when traveling from the site) which allows trucks larger than 9 ton to make left and right turns. The other intersections provide access to residential areas and only allow trucks smaller than 9 ton.

Intersection 2 is the D1433 (dirt road to Afgri Pan Siding) off the R555 that will provide access to the mine. Intersection 3 is the intersection of the R555 and the R33 to Belfast and the N4. It is the first large intersection east of the site. Belfast is approximately 38km south of Intersection 3. The distance between Intersection 2 and 3 is approximately 35km.

3 Traffic Data

Manual, classified traffic counts were carried out on Wednesday, 9 April 2014 from 06:00 to 18:00 (12-hours) at 3 intersections along the R555. The positions of these stations can be seen in Figure 1. The intersections were:

- M1: R555 and Cowen Ntuli Street (N11)
- M2: R555 and D1433 (Access to Afgri Pan Siding)
- M3: R555 and R33

The peak hour traffic volumes at each intersection are shown in Figures 2 to 4. The volumes shown in Figures 2 to 4 are given in passenger car units (PCU's). It was assumed that 1 heavy vehicle is equivalent to 8 passenger car units, based on the observed existing heavy vehicle composition.

Electronic traffic count data that was conducted along the R33 for a study area in close proximity to the site was used to convert the 12-hour data to average daily traffic volumes. The resulting average daily traffic volumes are summarised in Table 3.1.

Table 3.1: Seven-day Average Volumes (24-hours)

Vehicle Classification	Eastbound	Westbound	Both Directions
Light	1114	1129	2187
Heavy	283	324	607
All	1393	1390	2783

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

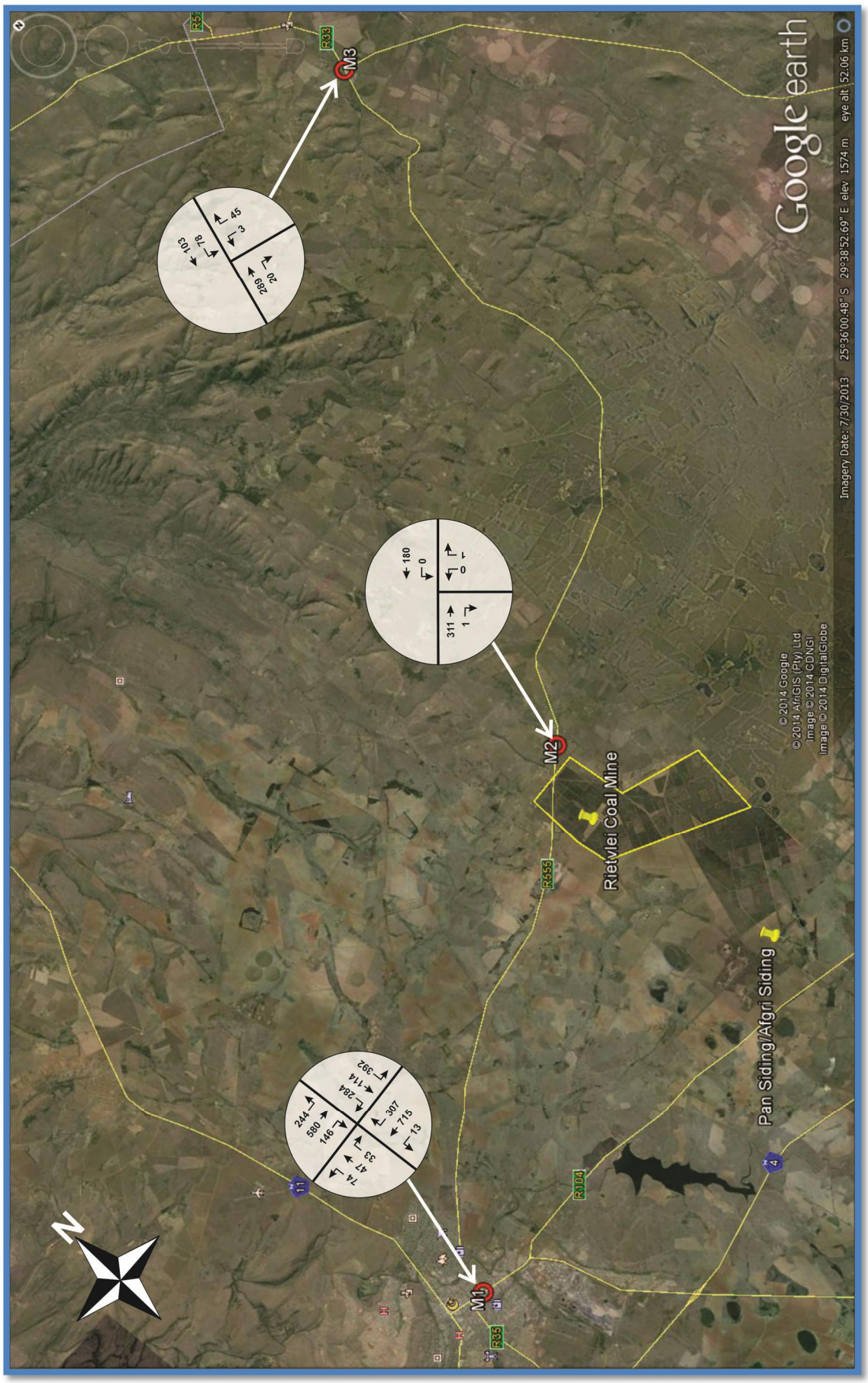


Figure 2: Existing AM Peak Hour Traffic Volumes

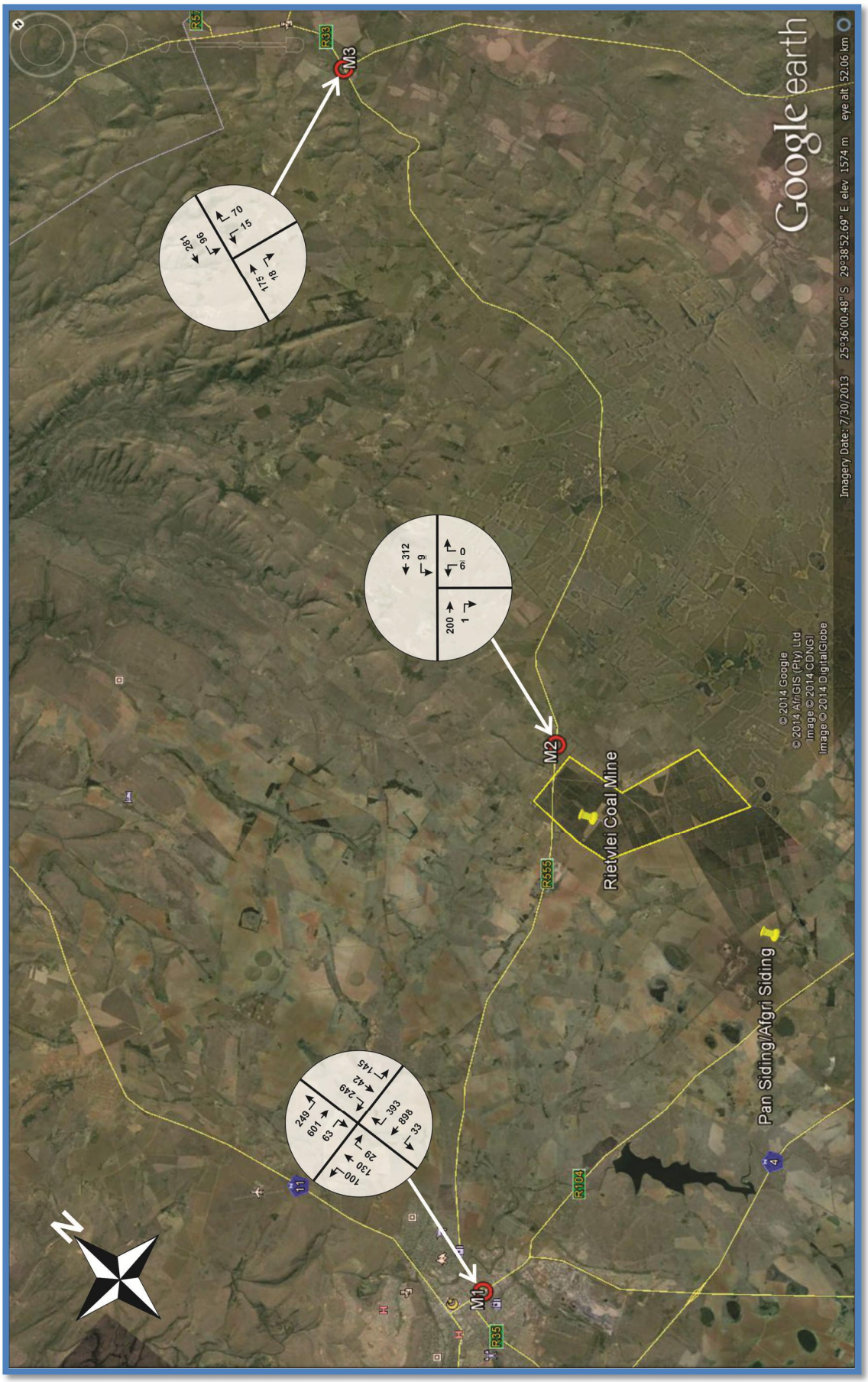


Figure 3: Existing PM Peak Hour Traffic Volumes

4 Trip Generation, Distribution and Assignment

4.1 Trip Generation

Trip generation rates for this type of development are not available from standard sources. The trip generation used has been extracted from information provided by the client. This information is subdivided into the construction phase and the operating phase and can be summarised as follows:

4.1.1 Construction Phase

Construction is planned to begin mid-2014 according to the project schedule in Section 17 of the Feasibility Study done by Mindset Mining Consultants, although it may be delayed to August 2014.

4.1.2 Operating Phase

Rietvlei mine is expected to be commissioned in June 2015 at the earliest and operation is expected to reach full production within 3 months. The volume produced per annum is expected to be 2.5 Mt.

- **Coal Transportation**

The export coal will be transported from site to the Afgri Pan Siding, south of the site using 30 ton coal transport trucks. These trucks will use the road to the siding only and will not affect traffic along the R555.

The coal that will be going to Eskom will be transported either by road from the site or to the Afgri Pan Siding where it will be transported to a selected Eskom Power Station. For the worst case scenario it was assumed that all the Eskom coal will be transported by road along the R555. It was assumed that road haulage will occur from 06:00 to 18:00 (12-hours) six days a week.

From Section 1 of the Feasibility Study the maximum amount of coal that may be sold to Eskom per month is 72 923 ton. The maximum number of trucks that will be used for the transportation of the coal to the power station is calculated in Table 4.1. During the analysis it was assumed that one empty truck will return to the mine for every loaded truck from the mine.

Table 4.1: Generated Heavy Vehicle Trips (loaded vehicles)

Produced Coal (ton/year)	Truck Loads[1]	Trucks Loads/day[2]	Trucks/hour[3]
875 076	29 170	94	8

[1] Based on 30t capacity trucks.
[2] Based on 6 days per week, only loaded trucks.
[3] Assuming that transportation will occur from 06:00 (am) to 18:00 (pm), i.e. 12 hours per day, including only loaded trucks.

- **Labour Transportation**

No information on the staff composition of the mine was obtained from the client as the mine operations will be handled by a mining contractor. Based on the staff requirement of similar developments the total staff complement of Rietvlei Mine was estimated to be a maximum of 400 people with the following operational shifts:

- 06:00 to 16:00 (day shift, 10 hours);
- 15:00 to 01:00 (night shift, 10 hours) ; and

- 01:00 to 06:00 (early morning shift, 5 hours).

The distribution between skilled, semi-skilled and unskilled staff was assumed to be 30%, 15% and 55% respectively. The skilled workers will work predominantly during the day-shift. It was assumed that 80% of the staff will travel from Middelburg (from the west) and 20% from Belfast (from the east).

The 400 employees were split between the different shifts in the same proportion as used previously for similar developments. The following distribution was applied:

- 06:00 to 16:00 = 55% of the total employees
- 15:00 to 01:00 = 35% of the total employees
- 01:00 to 06:00 = 10% of the total employees

The staff composition is summarised in Table 4.2.

Table 4.2: Staff Composition

Description	**Total**	**Day Shift** (06:00-16:00) **55%**	**Night Shift** (15:00-01:00) **35%**	**Early Morning Shift** (01:00-06:00) **10%**
Skilled Labour (30%)	**120**	**96**[4]	**18**[4]	**6**[4]
From Middelburg (80%)		77	14	5
From Belfast (20%)		19	4	1
Semi-Skilled Labour (15%)	**60**	**27**	**26**	**7**
From Middelburg (80%)		21	21	6
From Belfast (20%)		5	5	1
Unskilled Labour (55%)	**220**	**97**	**96**	**27**
From Middelburg (80%)		78	77	21
From Belfast (20%)		19	19	5
Total	**400**	**220**	**140**	**40**

[4] Skilled employees work predominantly day-shift. It was assumed that 80% of the skilled employees will work during the day shift (6:00 to 16:00), 15% during the night shift (15:00 to 01:00) and 5% during the early morning shift.

It was indicated in Section 5 of the Feasibility Study that the mine employees will be given a transport allowance and will therefore be expected to provide their own transport or use public transport. Contractor employees will be transported to site by means of company transport or public transport.

It was assumed that 50% of the skilled employees will have private vehicles, i.e. most private vehicle trips are expected during the day-shift. For a worst case scenario a vehicle occupation of 1 person per private vehicle was assumed. It was assumed employees without private vehicles will use minibus taxis which can transport approximately 15 passengers.

The employee's trip generation as explained above is summarised in Table 4.3.

Table 4.3: Employee Trip Generation (number of vehicles)

Description	Total	Day Shift (06:00-16:00) 55%	Night Shift (15:00-01:00) 35%	Early Morning Shift (01:00-06:00) 10%
Private Cars	**60**	**48**[5]	**9**[5]	**3**[5]
From Middelburg (80%)		39	8	3
From Belfast (20%)		10	2	1
Minibus Taxis	**24**	**12**	**9**	**3**
From Middelburg (80%)		10	7	2
From Belfast (20%)		2	2	1
Total	**84**	**60**	**18**	**6**

[5] Skilled employees work predominantly day-shift and these employees will own private vehicles. The private vehicles were distributed the same as the skilled employees distributions; 80% for day shift (6:00 to 16:00), 15% for night shift (15:00 to 01:00) and 5% for early morning shift.

The trips generated during the AM peak hour can be seen in Figure 4 and the trips generated during the PM peak hour can be seen in Figure 5.

4.2 Trip Distribution and Assignment

The employee trip generation is divided between Middelburg and Belfast as these are the two largest towns is the vicinity of the proposed Rietvlei coal mine. As Middelburg is approximately 23km from the site and Belfast approximately 73km, the majority of the employee trips (80%) was assigned to Middelburg, the remaining 20% was assigned to Belfast.

The generated heavy vehicle trips were distributed in the same proportion as the existing heavy vehicle traffic along the R555.

4.3 Traffic Growth

An annual growth rate of 3 % was assumed for background traffic. The base year was assumed to be 2015 as the mine will start operation during that year. The horizon year for the intersection analysis was taken as 2020, 5 years from the base year.

The base year (2015) traffic volumes without Rietvlei Mine can be seen in Figures 6 and 7, and the base year with Rietvlei Mine can be seen in Figures 8 and 9.

The horizon year (2020) traffic volumes without Rietvlei Mine can be seen in Figures 10 and 11, and the horizon year with Rietvlei Mine is shown in Figures 12 and 13.

The volumes in Figures 4 to 13 are given in PCU's.

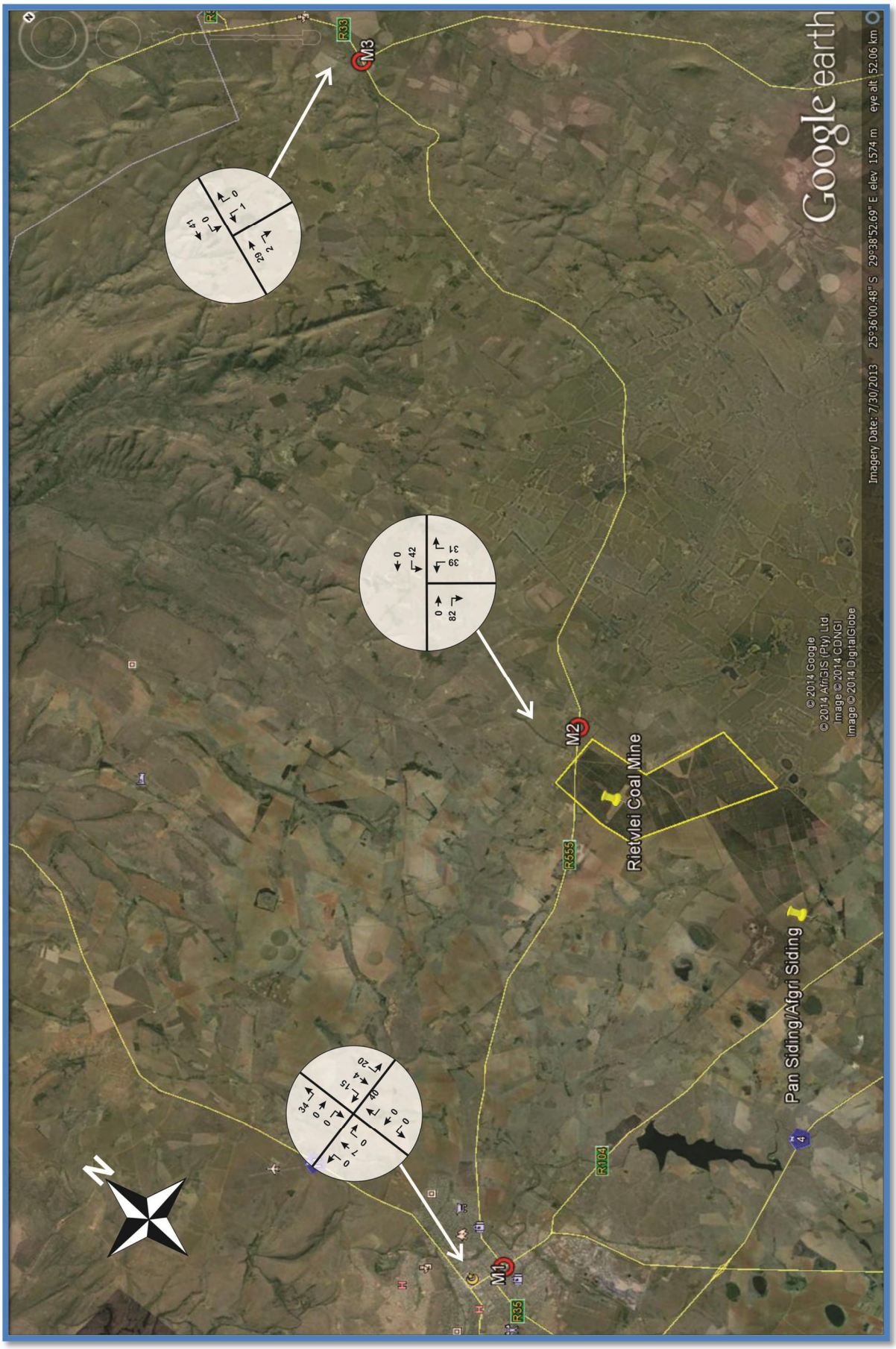


Figure 4: Trips generated in the AM peak hour

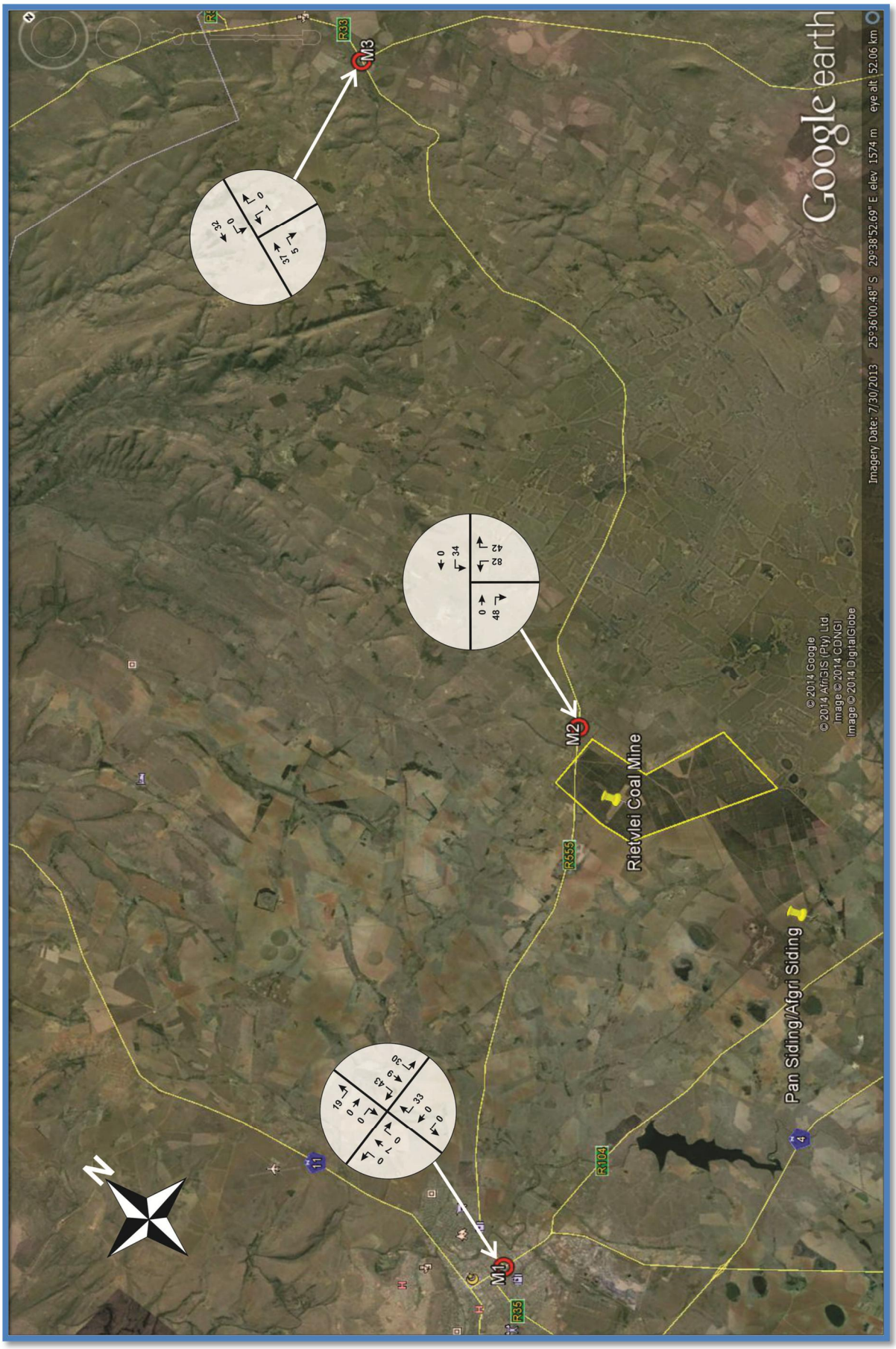


Figure 5: Trips generated in the PM peak hour

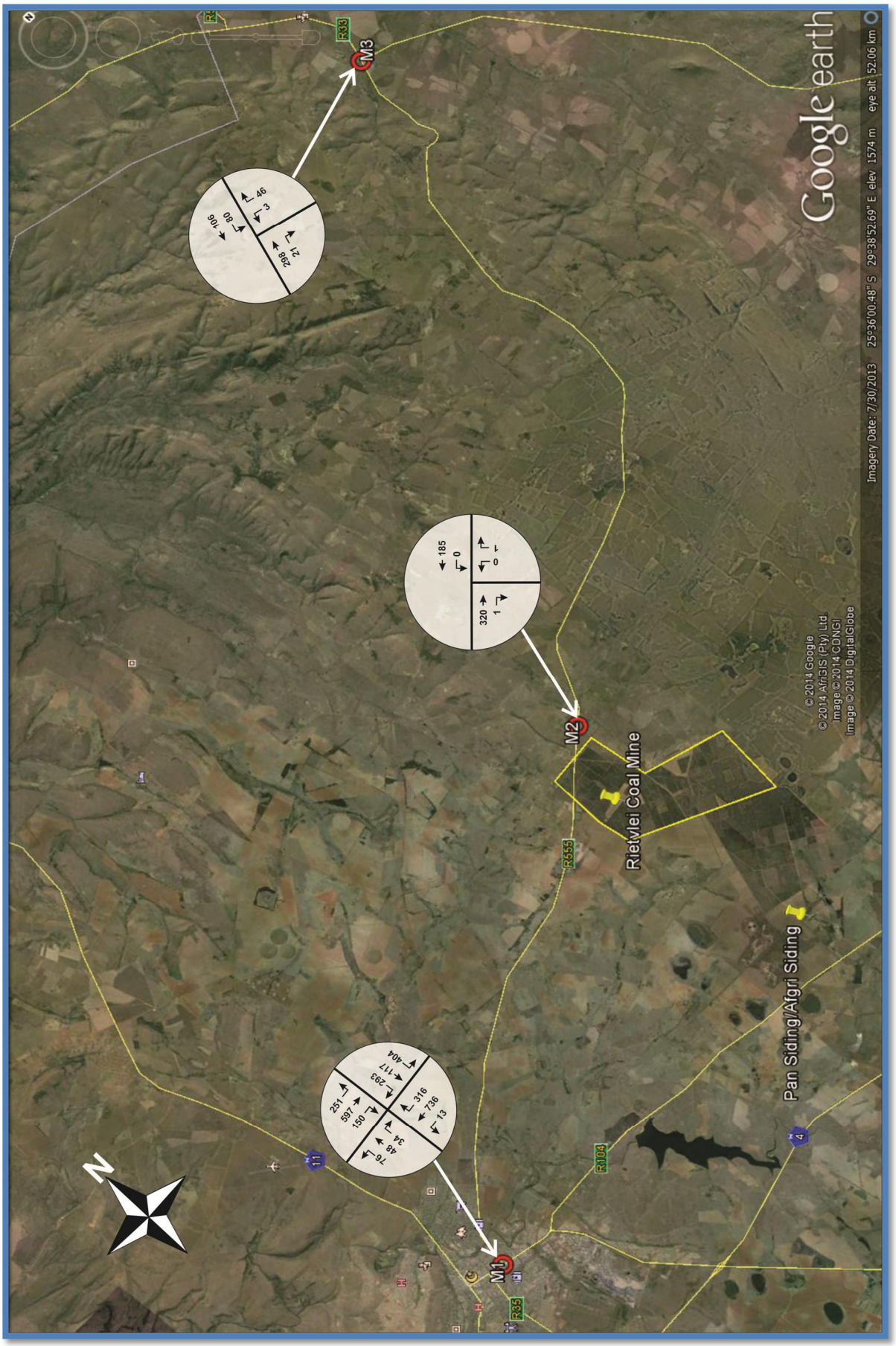


Figure 6: Base year AM peak hour traffic volumes without Rietvlei Mine

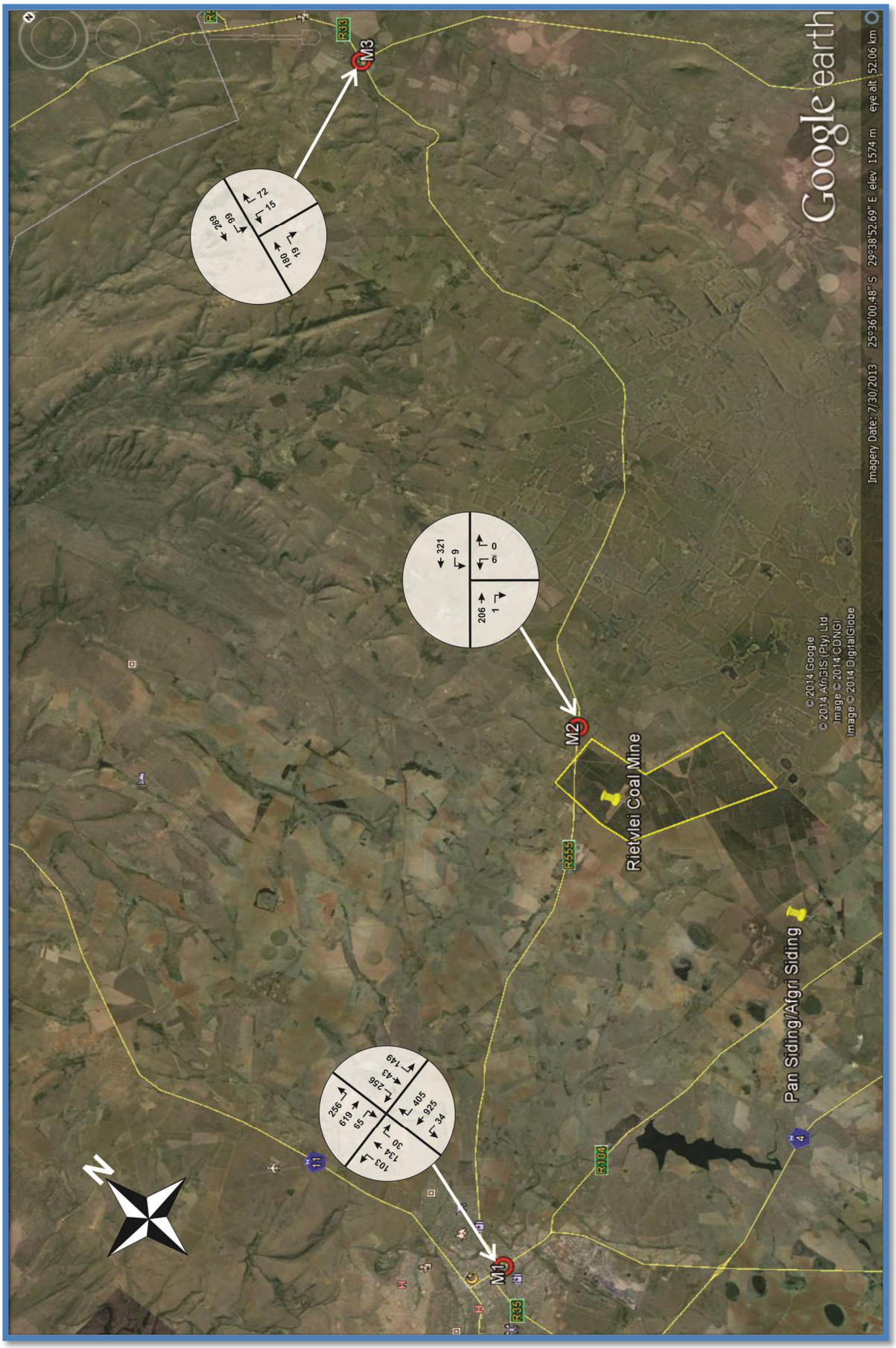


Figure 7: Base year PM peak hour traffic volumes without Rietvlei Mine

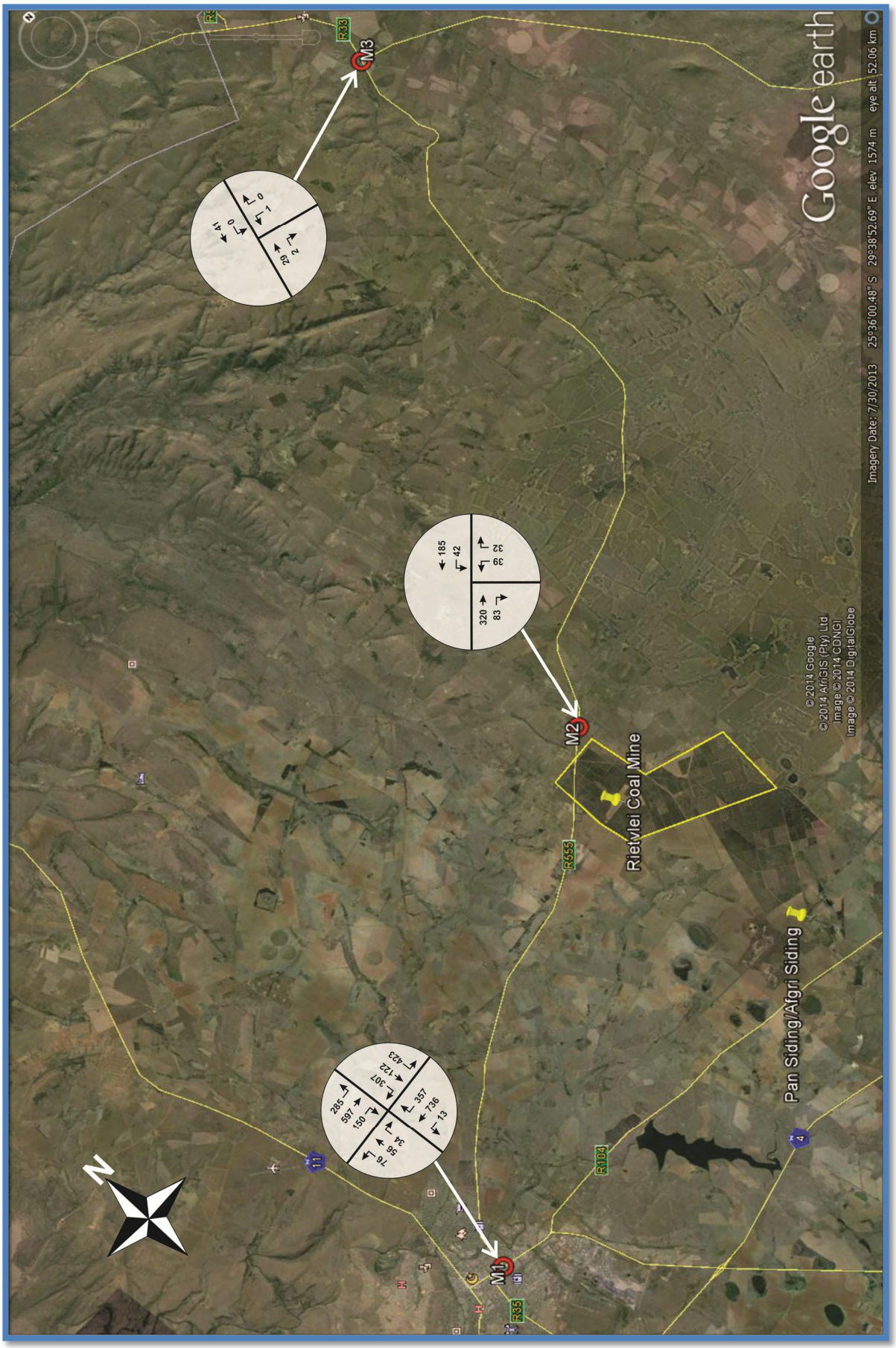


Figure 8: Base year AM peak hour traffic volumes with Rietvlei Mine

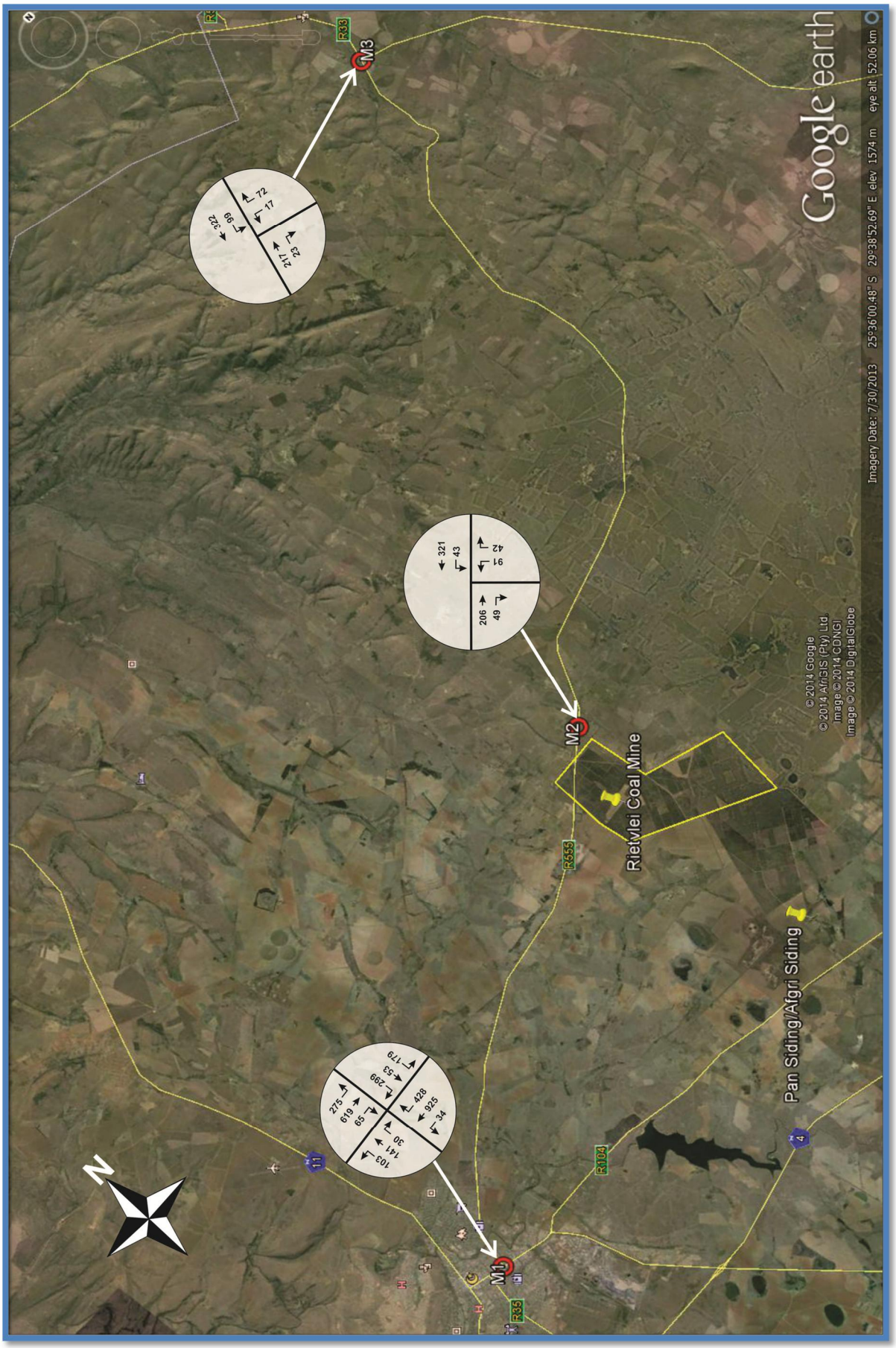


Figure 9: Base year PM peak hour traffic volumes with Rietvlei Mine

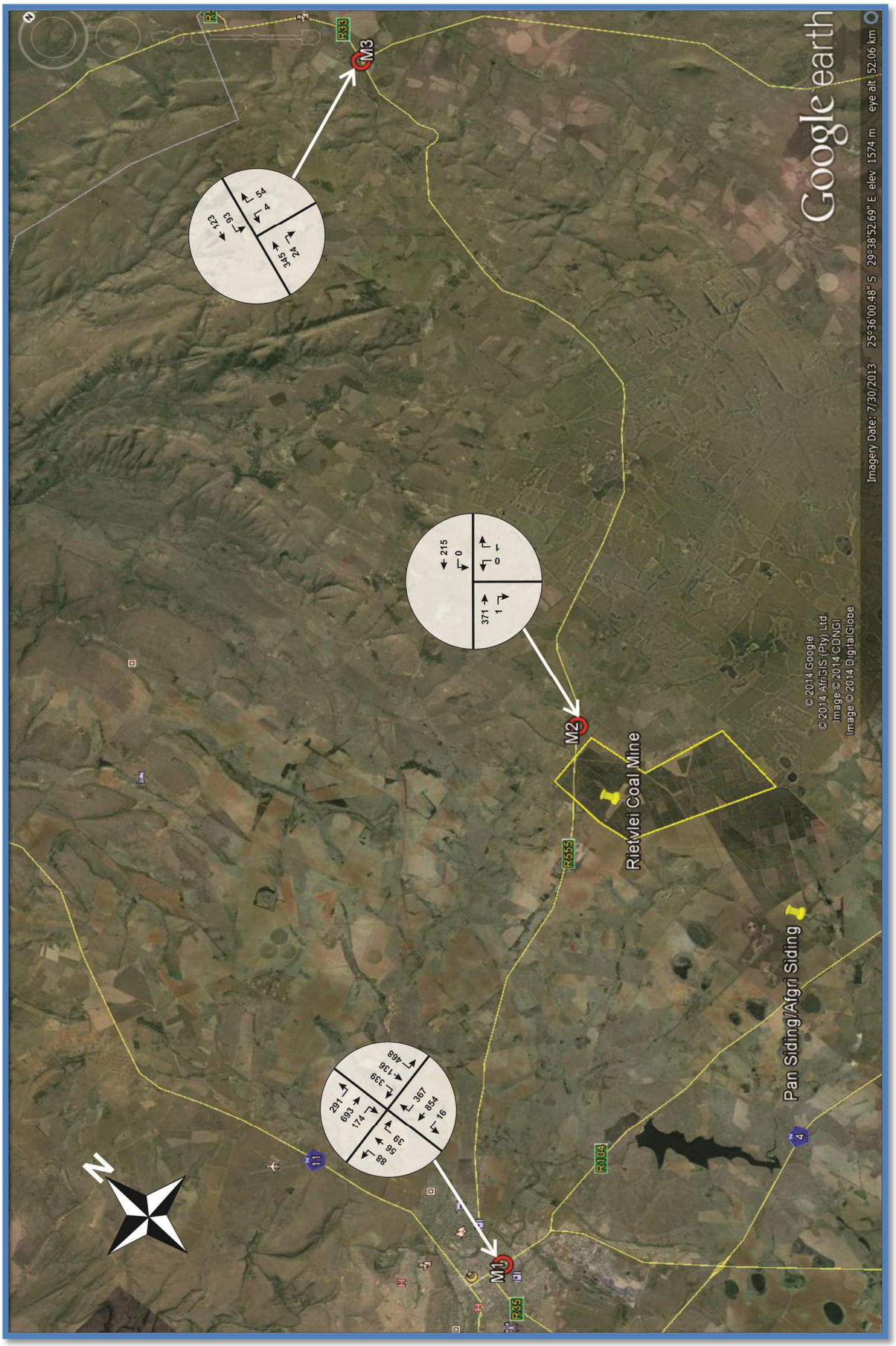


Figure 10: Horizon year AM peak hour traffic volumes without Rietvlei Mine

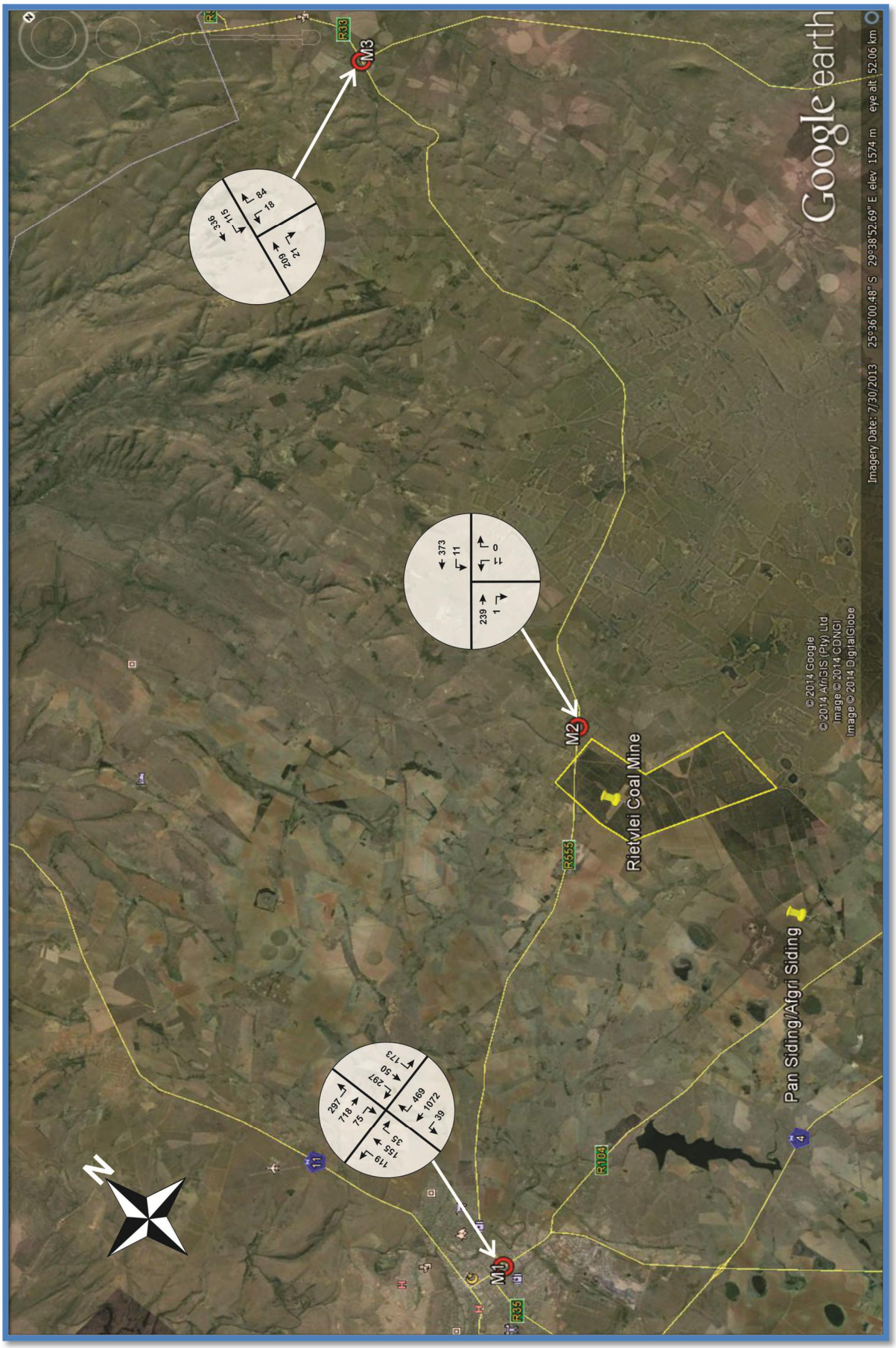


Figure 11: Horizon year PM peak hour traffic volumes without Rietvlei Mine

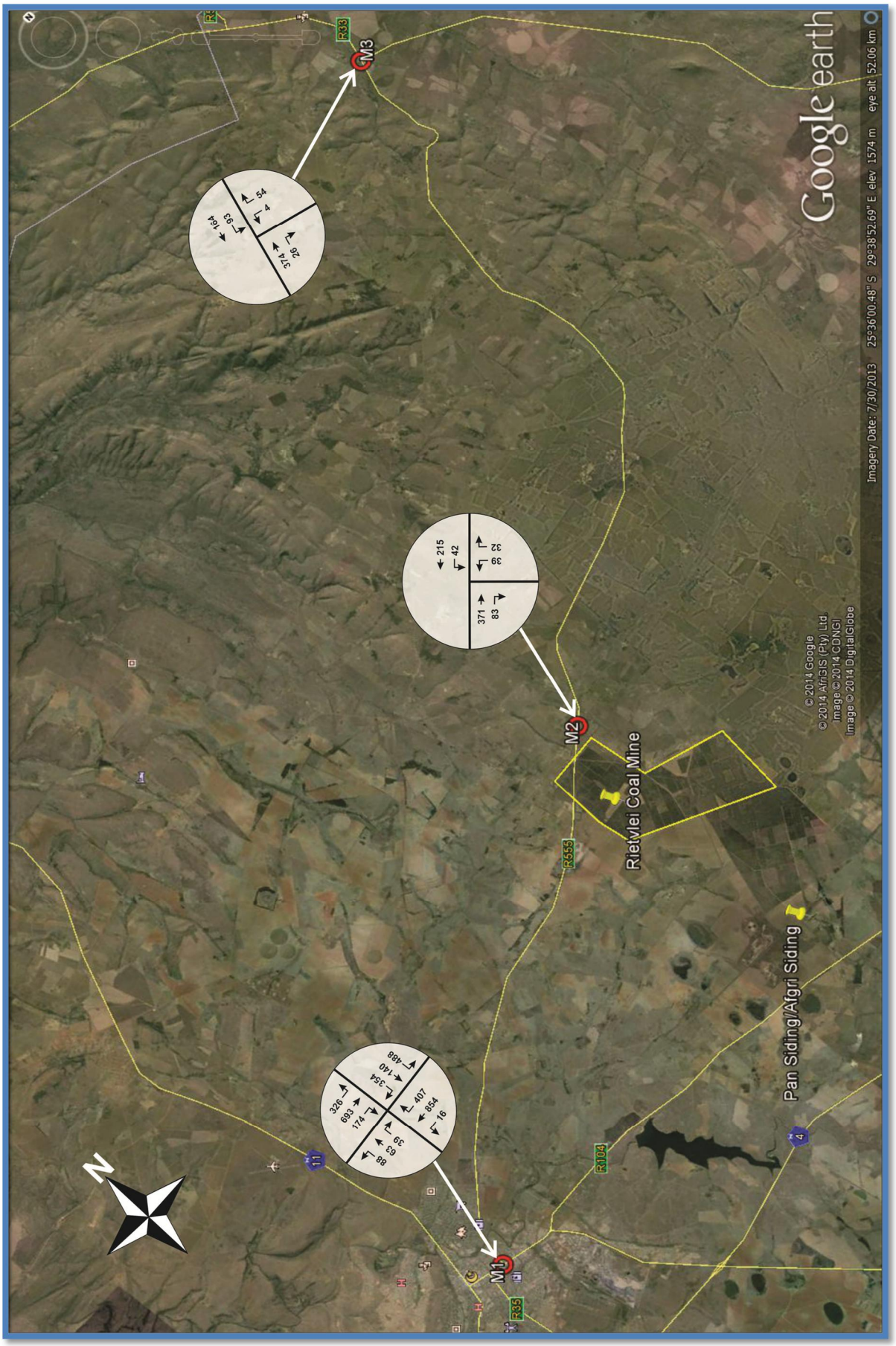


Figure 12: Horizon year AM peak hour traffic volumes with Rietvlei Mine

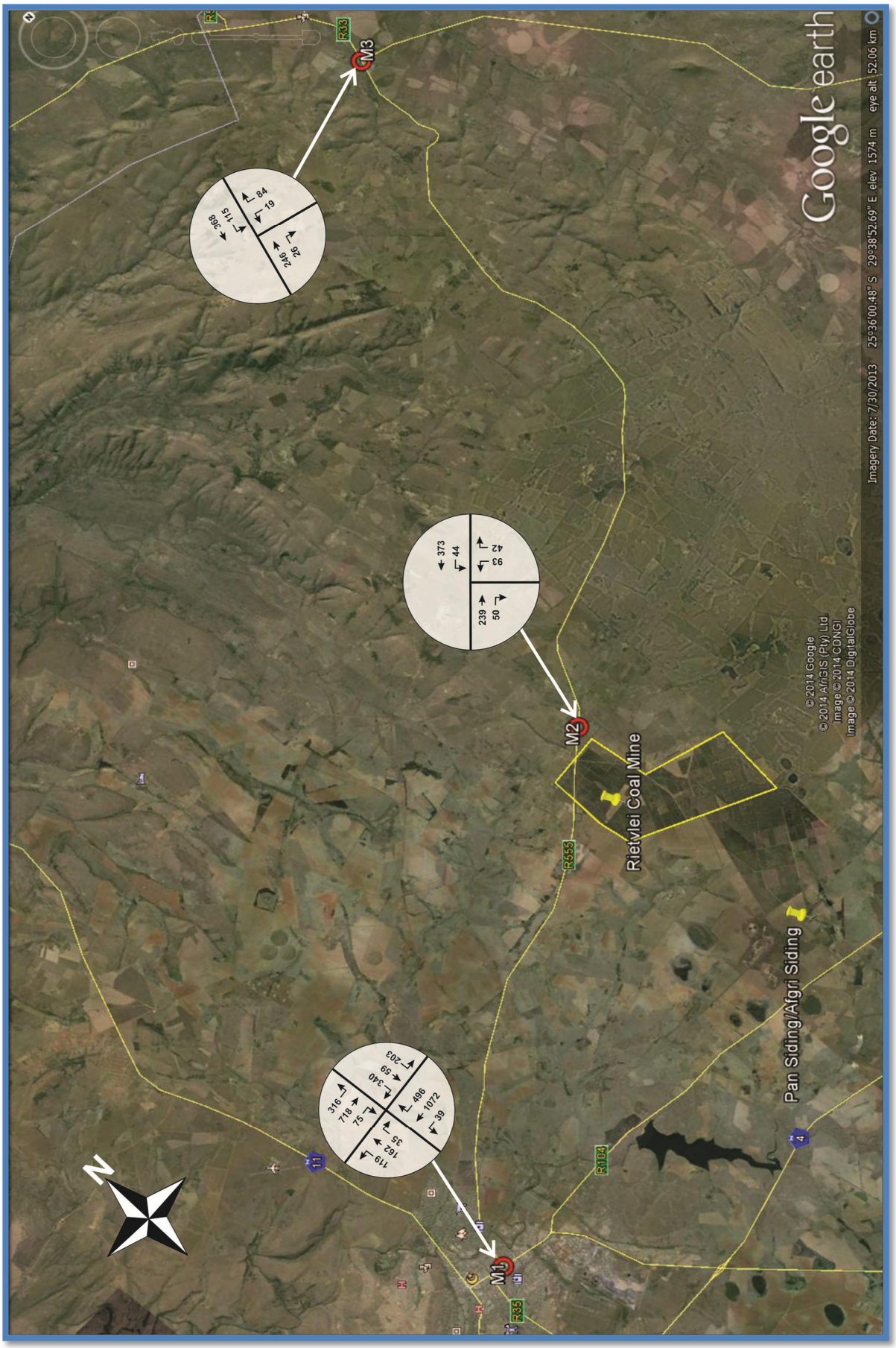


Figure 13: Horizon year PM peak hour traffic volumes with Rietvlei Mine

5 Operational Assessment

5.1 Levels of Service

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

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

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

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

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

5.2 Operational Assessment

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

- Scenario 1: Existing Traffic (2014);
- Scenario 2: Base year (2015) without Rietvlei Mine;
- Scenario 3: Base year (2015) with Rietvlei Mine;
- Scenario 4: Horizon year (2020) without Rietvlei Mine; and
- Scenario 5: Horizon year (2020) with Rietvlei Mine.

Analysis of the operational conditions with respect to the above has been undertaken using SIDRA 6 software.

5.3 SIDRA Analysis Results

5.3.1 Intersection 1: R555 and N11

Figure 14 below is a schematic representation of the signalised intersection of the R555 (Meyer Street) and the N11 (Cowen Ntuli Street). The intersection was analysed in SIDRA using the existing signal times. The analysis results from SIDRA are summarised in Table 5.1 and 5.2. The detailed analysis results are included herewith in Appendix C.

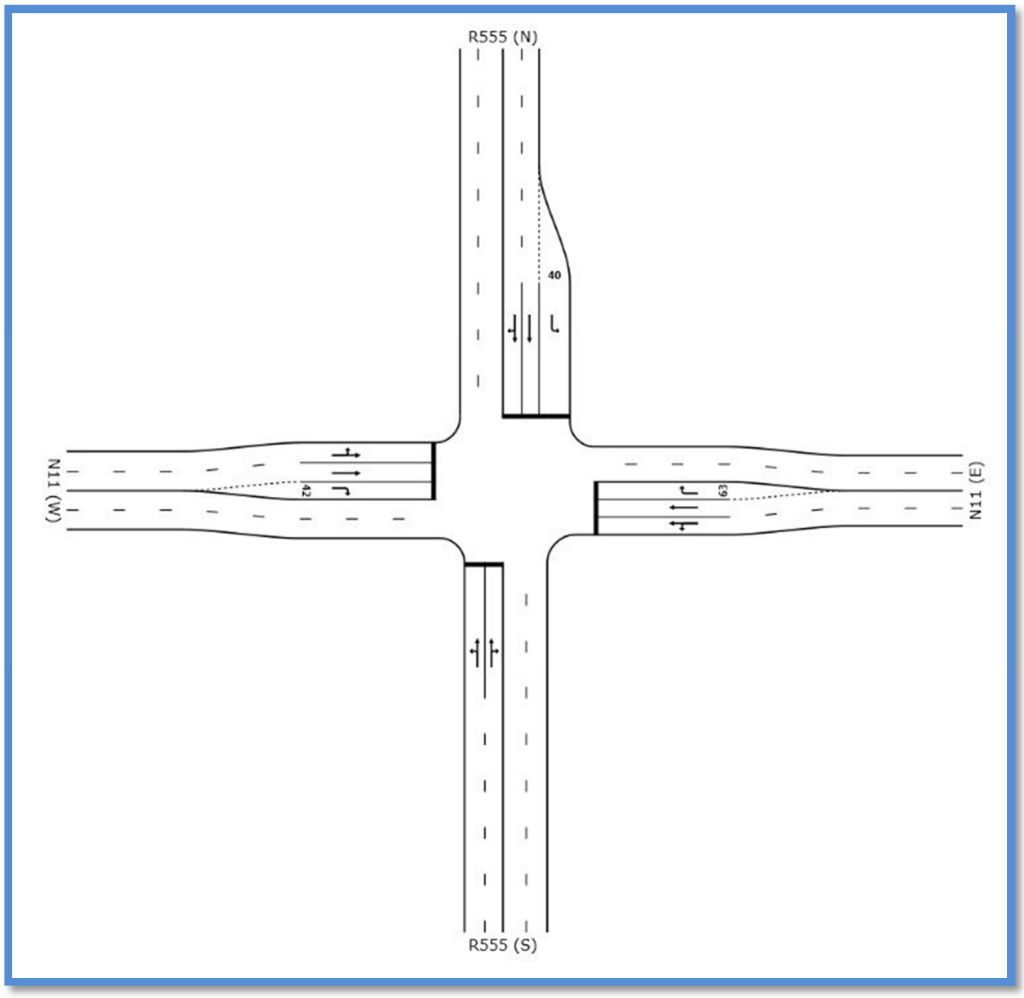


Figure 14: Schematic layout of Intersection 1

Table 5.1: SIDRA Results for Intersection 1 during the AM Peak Hour

Approach	Movement	2014		Base Year 2015				Horizon Year 2020			
		Existing Traffic		Excluding Mine		Including Mine		Excluding Mine		Including Mine	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
R555 (S)	L	0.150	C	0.156	C	0.163	C	0.192	C	0.199	C
	T	0.150	C	0.156	C	0.163	C	0.192	C	0.199	C
	R	0.150	C	0.156	C	0.163	C	0.192	D	0.199	D
N11 (E)	L	0.368	B	0.376	B	0.379	B	0.439	B	0.439	B
	T	0.368	B	0.379	B	0.379	B	0.439	B	0.439	B
	R	0.453	C	0.503	C	0.571	C	0.617	C	0.718	C
R555 (N)	L	0.537	D	0.558	D	0.573	D	0.681	D	0.693	D
	T	0.176	C	0.395	C	0.408	C	0.509	C	0.519	C
	R	0.686	D	0.740	D	0.729	D	0.953	E	0.982	E
N11 (W)	L	0.197	C	0.515	C	0.537	C	0.611	C	0.632	C
	T	0.497	C	0.515	C	0.537	C	0.611	C	0.632	C
	R	0.294	C	0.322	C	0.307	C	0.390	C	0.390	C
Overall LOS		C		C		C		C		C	
Average Delay (sec)		26		26		27		29		30	

Table 5.2: SIDRA Results for Intersection 1 during the PM Peak Hour

Approach	Movement	2014		Base Year 2015				Horizon Year 2020			
		Existing Traffic		Excluding Mine		Including Mine		Excluding Mine		Including Mine	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
R555 (S)	L	0.192	C	0.197	C	0.201	C	0.231	C	0.235	C
	T	0.192	C	0.197	C	0.201	C	0.231	C	0.235	C
	R	0.192	C	0.197	C	0.201	C	0.231	C	0.235	C
N11 (E)	L	0.552	C	0.568	C	0.568	C	0.696	C	0.696	C
	T	0.552	C	0.568	C	0.568	C	0.696	C	0.696	C
	R	0.794	D	0.831	D	0.865	D	1.062	F	1.095	F
R555 (N)	L	0.177	C	0.182	C	0.229	D	0.212	C	0.275	C
	T	0.054	C	0.056	C	0.069	C	0.064	C	0.079	C
	R	0.226	D	0.344	D	0.428	D	0.420	D	0.513	D
N11 (W)	L	0.478	C	0.494	C	0.499	C	0.581	C	0.586	C
	T	0.478	C	0.494	C	0.499	C	0.581	C	0.586	C
	R	0.166	C	0.176	C	0.176	C	0.227	C	0.227	C
Overall LOS		C		C		C		C		D	
Average Delay (sec)		26		27		28		35		37	

It can be seen from Table 5.1 and 5.2 that the additional traffic from the mine does not have a significant effect on the operational level of the intersection.

In the base year the LOS of all the movements of the intersection stays at or above the acceptable LOS D, and the $^{V}/_{C}$ ratio stays below 0.95.

During the horizon year, the LOS for the right turning movement from the north (R555) becomes critical (LOS E) during the AM peak hour, without including the trips generated by the mine. With the inclusion of the trips generated by the mine, the LOS of the movement stays critical. The $^{V}/_{C}$ ratio increases to 0.953 without the mine and 0.982 with the mine. The difference in $^{V}/_{C}$ ratio between the scenarios with and without the mine is regarded to be negligibly small.

During the horizon year PM peak hour, the LOS of the right turning movement from the east (N11) is at a LOS F without the presence of the mine. When the trips generated by the mine are included, the LOS of the movement remains F. The $^{V}/_{C}$ ratio of the movement is above the recommended 0.95, i.e. 1.062 and 1.095 respectively, however the increase in $^{V}/_{C}$ ratio due to the mine trips is considered to be negligibly small.

5.3.2 Intersection 2: R555 and D1433 (Access)

Intersection 2 is the intersection of the R555 and the D1433 to the Afgri Pan Siding, which will also become the access to the proposed Rietvlei coal mine. A schematic layout of the existing intersection can be seen in Figure 15.

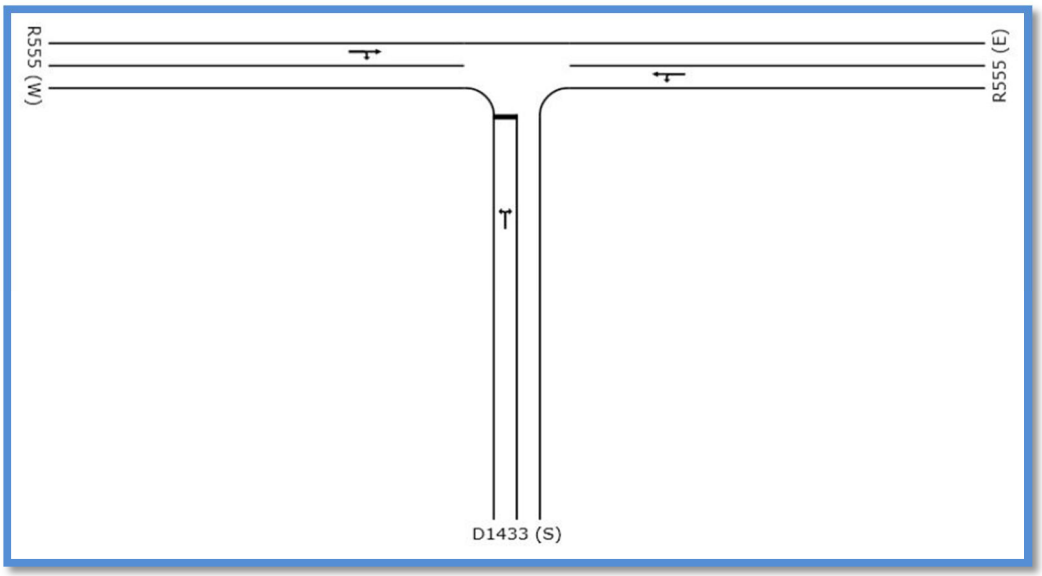


Figure 15: Schematic layout of Intersection 2

The intersection was analysed using SIDRA and the resuls are sumarised in Tables 5.3 and 5.4. The detailed analysis results are included herewith in Appendix D.

Table 5.3: SIDRA Results for Intersection 2 during the AM Peak Hour

Approach	Movement	2014		Base Year 2015				Horizon Year 2020			
		Existing Traffic		Excluding Mine		Including Mine		Excluding Mine		Including Mine	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
D1433 (S)	L	0.002	B	0.002	B	0.048	F	0.002	B	0.051	F
	R	0.002	B	0.002	B	0.048	F	0.002	B	0.051	F
R555 (E)	L	0.048	A	0.049	A	0.059	A	0.057	A	0.067	A
	T	0.048	A	0.049	A	0.059	A	0.057	A	0.067	A
R555 (W)	T	0.074	A	0.076	A	0.109	A	0.089	A	0.122	A
	R	0.074	A	0.076	A	0.109	A	0.089	A	0.122	A
Average Delay (sec)		1		1		16		1		14	

Table 5.4: SIDRA Results for Intersection 2 during the PM Peak Hour

Approach	Movement	2014		Base Year 2015				Horizon Year 2020			
		Existing Traffic		Excluding Mine		Including Mine		Excluding Mine		Including Mine	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
D1433 (S)	L	0.007	F	0.007	F	0.09	E	0.008	F	0.094	E
	R	0.007	F	0.007	F	0.09	E	0.008	F	0.094	E
R555 (E)	L	0.081	A	0.083	A	0.089	A	0.096	A	0.103	A
	T	0.081	A	0.083	A	0.089	A	0.096	A	0.103	A
R555 (W)	T	0.058	A	0.06	A	0.075	A	0.069	A	0.085	A
	R	0.058	A	0.06	A	0.0.75	A	0.069	A	0.085	A
Average Delay (sec)		4		3		14		3		13	

The LOS on the uncontrolled R555 operates at very good LOS A for all the scenarios that were analysed.

During the AM peak hour the LOS of the D1433 drops from a LOS B to a LOS F when the mine traffic is included in both the base year and the horizon year. This is expected as this intersection will be used as access to the mine and will need to accommodate the additional traffic.

During the PM peak hour the LOS of the D1433 improves from a LOS F to E with the presence of the mine. This improvement can be attributed to the increase in left turning movements from the east which gives more opportunity for the turning movements from the south. However, in reality approaching vehicles from the east might simply overtake a left-turning vehicle in the intersection, which could potentially be a safety hazard. It is therefore recommended that no overtaking on the R555 westbound, in the vicinity of the D1433 intersection, should be prohibited by means of road signs and markings.

Access to the site using this intersection is discussed in more detail in Section 6 of this report.

5.3.3 Intersection 3: R555 and R33

Intersection 3 is the intersection between the R555 and the R33. A schematic layout of the intersection can be seen in Figure 16. The intersection was analysed using SIDRA and the results are summarised in Tables 5.5 and 5.6. The detailed analysis results are included herewith in Appendix E.

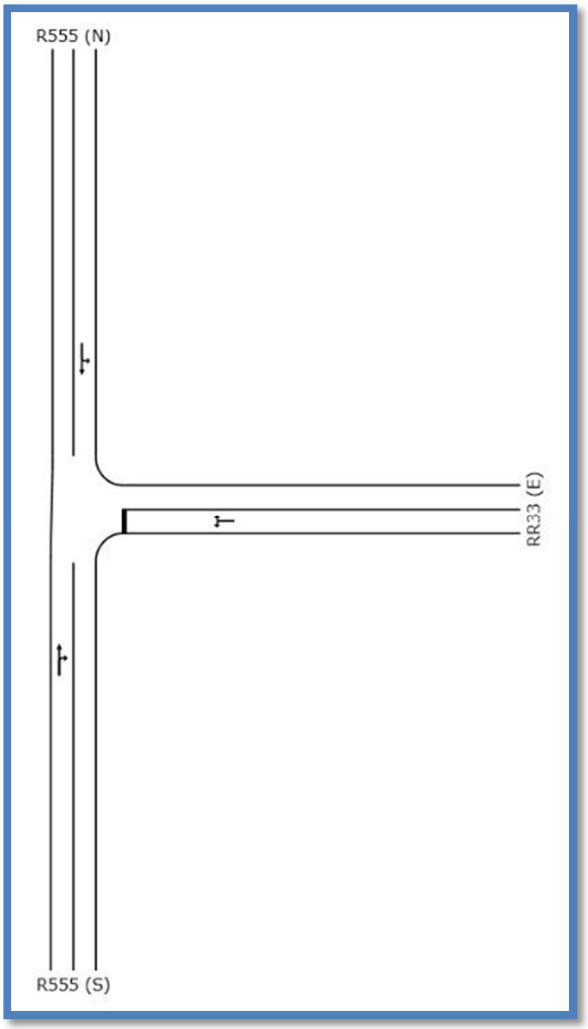


Figure 16: Schematic layout of Intersection 3

Table 5.5: SIDRA Results for Intersection 3 during the AM Peak Hour

Approach	Movement	2014		Base Year 2015				Horizon Year 2020			
		Existing Traffic		Excluding Mine		Including Mine		Excluding Mine		Including Mine	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
R555 (S)	T	0.080	A	0.082	A	0.086	A	0.096	A	0.099	A
	R	0.080	A	0.082	A	0.086	A	0.096	A	0.099	A
R33 (E)	L	0.028	D	0.030	D	0.031	D	0.035	D	0.036	D
	R	0.028	D	0.030	D	0.031	D	0.035	D	0.036	D
R555 (N)	L	0.048	B	0.050	B	0.059	A	0.057	B	0.066	A
	T	0.048	B	0.050	B	0.059	A	0.057	B	0.066	A
Average Delay (sec)		8		8		8		8		8	

Table 5.6: SIDRA Results for Intersection 3 during the PM Peak Hour

Approach	Movement	2014		Base Year 2015				Horizon Year 2020			
		Existing Traffic		Excluding Mine		Including Mine		Excluding Mine		Including Mine	
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
R555 (S)	T	0.066	A	0.068	A	0.079	A	0.080	A	0.090	A
	R	0.066	A	0.068	A	0.079	A	0.080	A	0.090	A
R33 (E)	L	0.056	D	0.058	D	0.061	D	0.071	D	0.073	D
	R	0.056	D	0.058	D	0.061	D	0.071	D	0.073	D
R555 (N)	L	0.090	A	0.920	A	0.097	A	0.107	A	0.111	A
	T	0.090	A	0.9200	A	0.097	A	0.107	A	0.111	A
Average Delay (sec)		9		9		8		9		8	

It can be seen from Table 5.5 and 5.6 that the presence of the mine will not have a significant effect on the operation of the intersection. The LOS of all the approaches in all the scenarios that were analysed is above the general accepted LOS D and the $^{V}/_{C}$ ratios are all below 0.95.

5.4 Mitigation Measures

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

- If the LOS of any element of the facility drops below D;
- If the volume to capacity ($^{V}/_{C}$) ratio of any element of the facility increases above 0.95; and
- If the contribution of the development is at least 2% of the sum of the critical lane volumes of the element.
- Or; where the baseline LOS is E or worse, or $^{V}/_{C}$ ratio is greater than 0.95, this baseline (prior to development) must be maintained or improved for the situation with the development included.

The only mitigation measure that is required is the upgrading of the intersection of the R555 and the D1433 to the siding that will also be used as the access to the mine. These upgrades are discussed in the following chapter.

6 Access

6.1 Intersection Providing Access

Access to the site will be via the existing intersection of the R555 and the D1433. The D1433 is currently a dirt road that should be paved with the construction of the mine.

The intersection is assumed to carry all the employee traffic from the mine as well as the heavy vehicles that will be used to transport coal to a selected Eskom power station via the R555. With the presence of the heavy vehicles it is recommended that the speed limit of the section of road past the site should be lowered to 60km/h instead of the current 120km/h speed limit. The available sight distance is also not adequate for a speed limit of 120km/h, but will be sufficient for a 60km/h speed limit. Sight distance is discussed in detail in Section 7 of this report.

It is recommended that with the construction of the access road an additional right turning short lane should be added on the D1433 approach. The lane should not be shorter than 40m, which is the length that will comfortably accommodate an interlink truck that will be used to transport coal form the site.

It is also recommended to add a passing lane on the R555 eastbound to allow vehicles to pass heavy vehicles waiting to turn right into the access road.

The recommended measures can be seen in Figure 17 below.

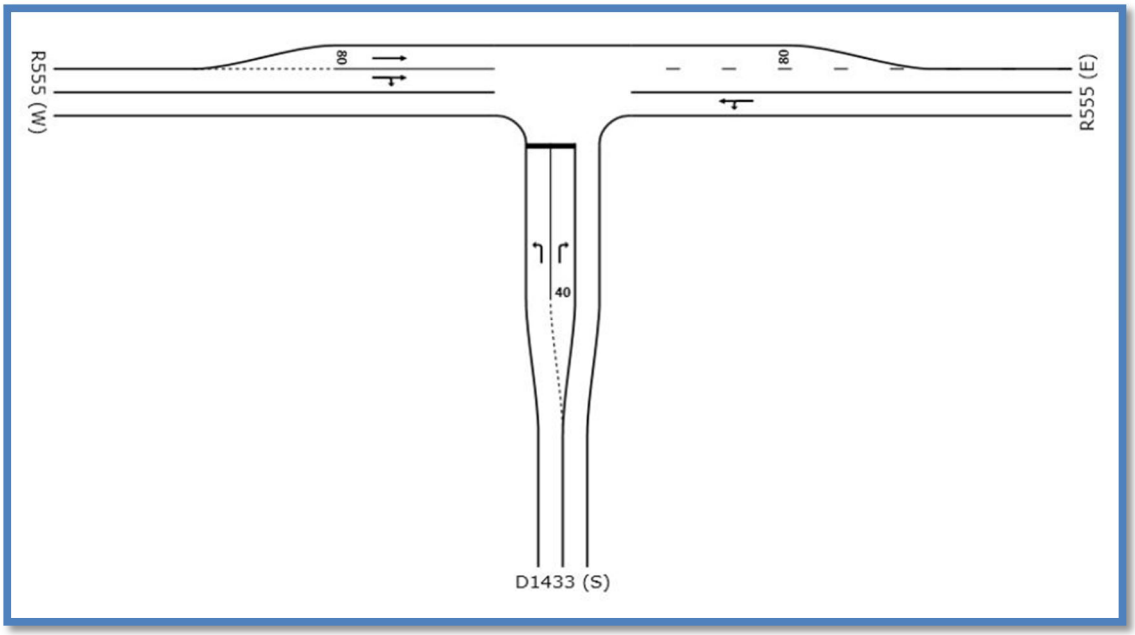


Figure 17: Proposed layout of Access to site

6.2 Access Road

The D1433 (existing dirt road) is in a poor condition. Recent rain has exacerbated the problem and large ditches and pools of standing water made the road very hard to travel with a passenger vehicle. The existing drainage pipe below the road has been damaged. Photos of the road can be seen in Appendix A, Photos 8 to 10.

With the construction of the mine a section of the D1433 road needs to be re-aligned as the existing road runs across the mining area. The D1433 crosses the railway line by means of a level crossing south of the site.

According to Section 7 of the Feasibility Study it is proposed to re-align the road to a position west of the railway line while still using the existing railway crossing. The proposed road diversion can be seen in Figure 18 below.

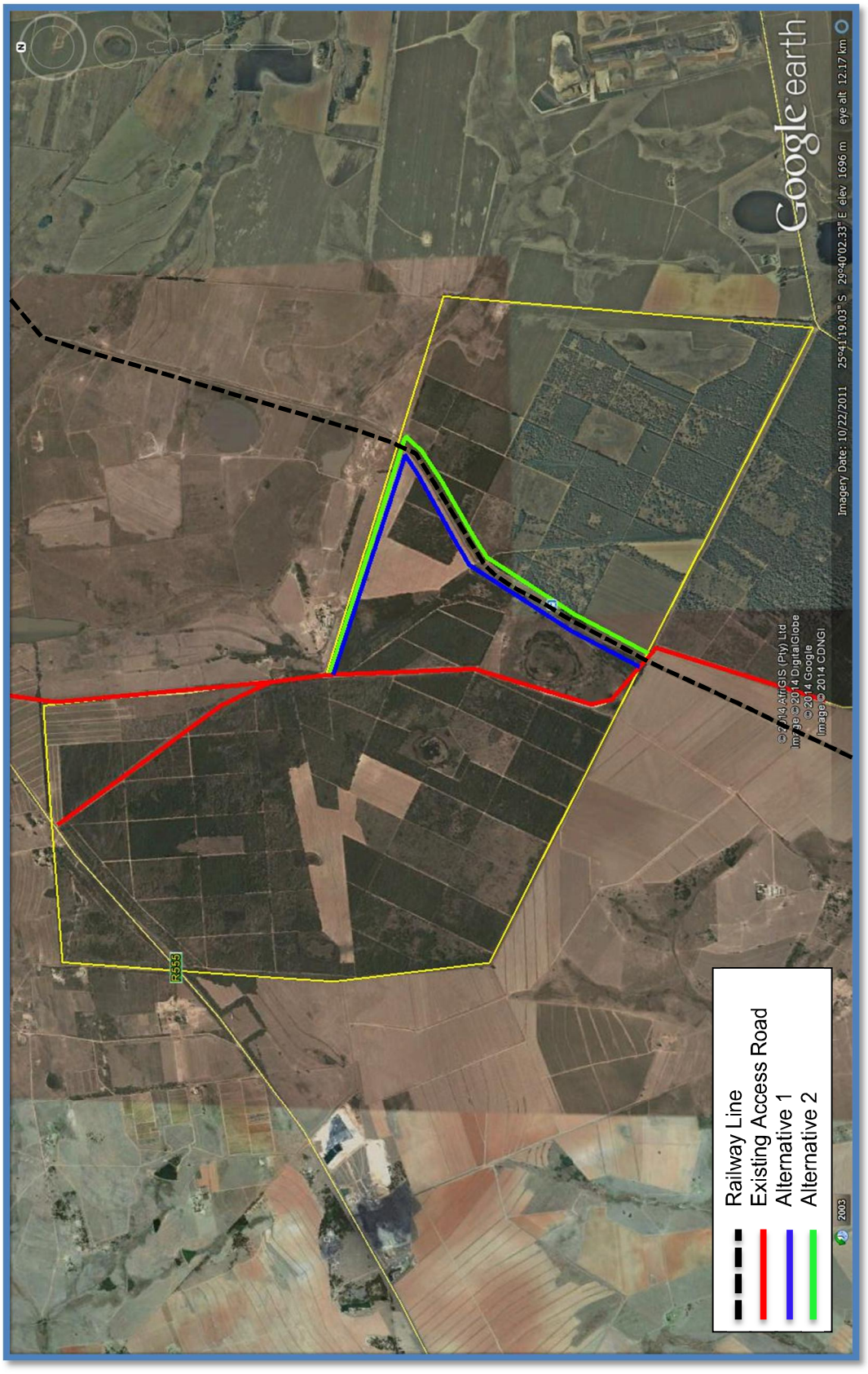


Figure 18: Proposed Road Diversion

If this proposed road diversion is accepted the existing railway reserve should be taken into account with the final positioning of the road. The road should be outside the railway reserve. The road should also be a safe distance away from the pit and adequate signage to warn the road users of the presence of heavy vehicles.

A second alternative is to divert the D1433 road to run east of the railway line. This alternative will move the railway crossing to the north of the site as indicated in Figure 17. The decommissioning of the existing level crossing, as well as the application for a new level crossing will have to comply with the South African National Standards for Railway Safety Management (SANS 3000-2-2-1:2012, Edition 1, Part 2-2-1: Technical requirements for engineering and operational standards – Track, civil and electrical infrastructure – Level crossings), which lists the following exclusion criteria for new or modified existing level crossings:

a) Where train speeds exceed 100 km/h;

b) If the road is classified in the *Geometric Design Guidelines*, the SADCRTSM, chapter 7 in vol. 2 of the SARTSM, SANS 3000-1, SANS 3000-2-1 or SANS 3000-2-2 as a freeway or the level crossing is within 1 km of another level crossing;

c) Where there is an existing accessible grade separated crossing facility within 10 km or other agreed distance from the proposed level crossing;

d) The level crossing is within 500 m from the end of a station platform;

e) A road approach gradient is steeper than 1:50 within 8 m of the nearest rail and 1:20 for 10 m and beyond;

f) The line of sight along the railway line is less than 230 m for a running line and 50 m for a yard line; and

g) When a level crossing, or road intersection or property access on the road approach to a level crossing is to be constructed, the location shall be such that no part of the travelled way of the intersection road or entranceway, or the stop line or the position for a traffic control device is closer than 50 m to the nearest rail of the level crossing.

7 Road Safety Issues

The following issues are considered to be relevant to road safety:

- Dust;
- Shoulder sight distance;
- Heavy vehicle turning movements; and
- Road surface conditions.

7.1 Dust

Dust may be a problem at the access to the site if there will be coal transported by truck along the R555. Fine coal dust could impair driver visibility and mitigating measures should be implemented, i.e. cleaning of area and wetting.

7.2 Shoulder Sight Distance

Shoulder sight distance is the distance that the driver of a vehicle that is stationary at the stop line of a minor road can see along the major road, to be able to enter or cross the major road before an approaching vehicle reaches the intersection. It is therefore a function of speed of vehicles traveling on the major road, the width of the major road and the type of vehicles that are trying to cross.

In the case of the D1433 to the siding, the current speed limit on the R555 is 120km/h. The width of the R555 is 7m. The intersection is along a straight section of road. The worst case design vehicle is a single unit and trailer (SU+T). According to TRH 17, Geometric Design of Rural Roads, the shoulder sight distance should be in the order of 450m. The required stopping sight distance, according to TRH 17, approaching the intersection is 230m. From the elevation profile it could be seen that the shoulder sight distance of 450m could not be provided as changes in the grade of the slope may obstruct the line of sight. It is therefore recommended that the speed limit on the section of the R555 past the site be lowered to 60km/h. This however should be done incrementally and clearly signed.

The required shoulder sight distance if the speed limit is lowered to 60km/h is 225m. The required stopping sight distance for a speed limit of 60km/h is 100m.

The elevation profile of the R555 from Google Earth can be seen in Figure 19. The red arrow shows the location of the access of the D1433 onto the R555. The elevation profile was plotted and the access (D1433), the required sight distances for both speed limits, and the possible points of obstruction was indicated. The plot of the elevation profile can be seen in Figure 19.

The line of sight from the access is indicated with a dashed line. To the west of the site the point of obstruction is indicated where the grade flattens. To the east it was observed by visual inspection that the line of sight from a passenger vehicle will be obstructed by the sudden increase in grade. The sight distance of 112m is however still sufficient as the required sight distance for a passenger vehicle under these conditions is 110m. The greater eye height of the design vehicle should allow the driver to see past the obstruction to the east.

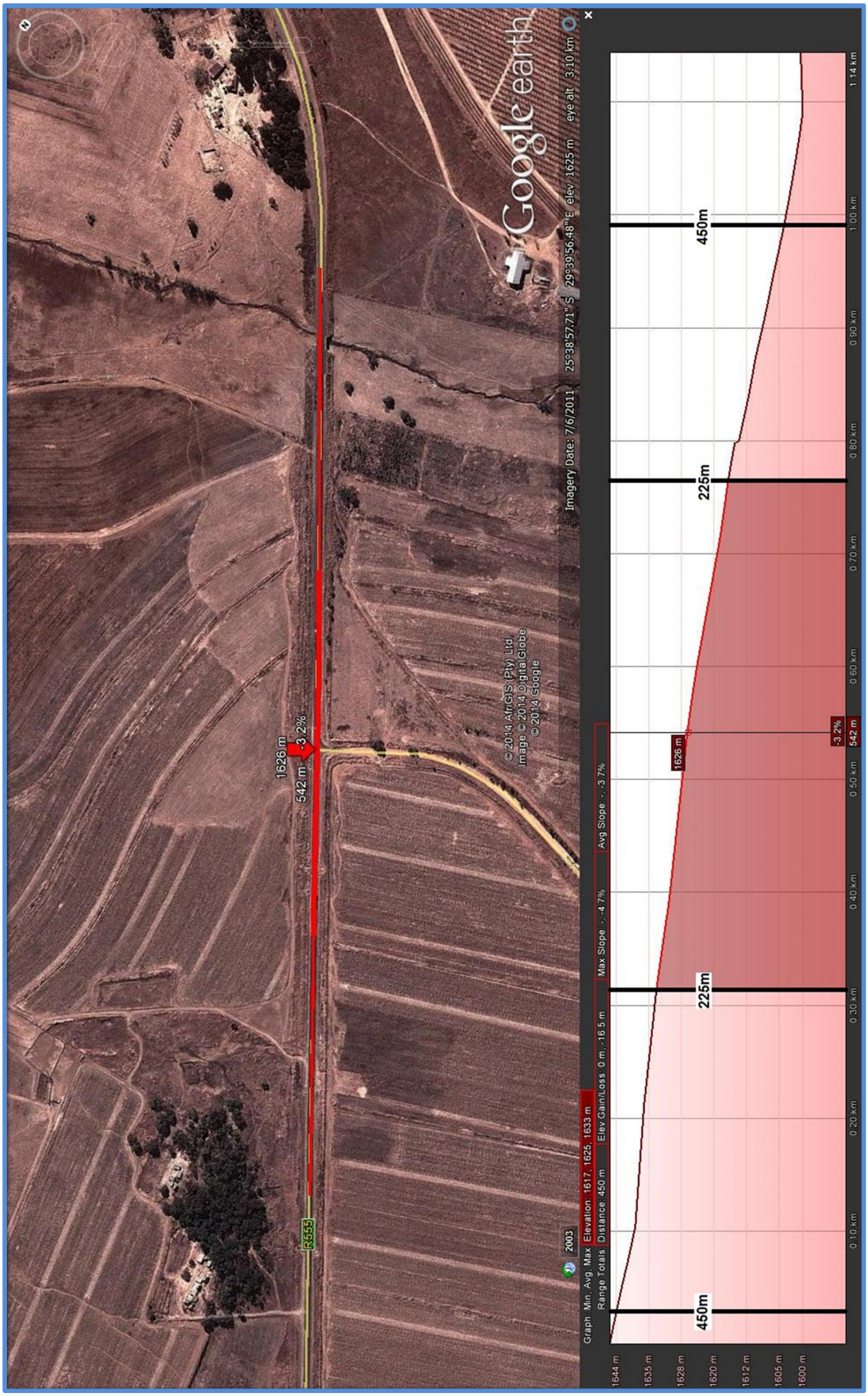


Figure 19: Elevation profile of R555 past the D1433

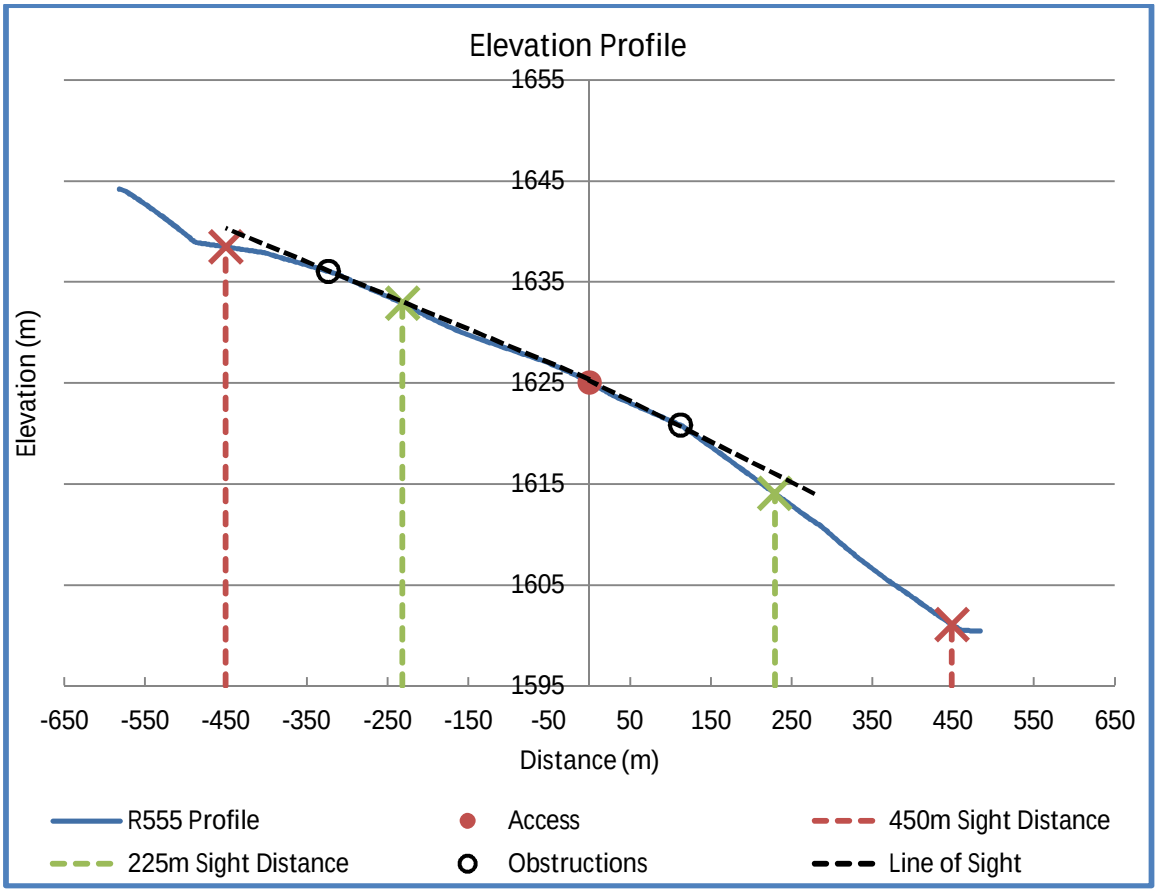


Figure 20: Elevation Profile Plot of R555 past the D1433

7.3 Heavy Vehicle Turning Movements

The W107 and W108 intersection warning signs should be erected either side of the Rietvlei mine access in accordance with the requirements of the South African Road Traffic Signs Manual (SARTSM) and it is recommended that IN 11.569 supplementary warning plates be added to these warning signs indicating the presence of heavy vehicles at the intersection. Images of the intersection warning signs can be seen below.

7.4 Road Surface Conditions

A visual inspection of the R555 between Middelburg and Intersection 3, past the site was conducted during the site visit on 3 April 2014. The observed problems/types of distress were classified by their severity and occurrence. The R555 appears to be surfaced with two single seals and the condition of the section of road west of the site is better than the section of road east of the site.

Photos of the worst cases of the defects along the R555 are shown in Appendix A. The extent and probable cause thereof are discussed below.

The section of road west of the site is in a fair condition. Slight bleeding occurs throughout most of the road length to some degree, mostly in the wheel paths. The bleeding can be seen in Photo 1. Bleeding generally occurs when excess binder moves to the surface and the road surface may appear wet. The bleeding affects the skid resistance negatively.

Slight edge breaks occur along most of the road length (Photo 2) due to the fact that the gravel shoulder has been driven out. Side drains exist, but are silted up and overgrown which is a drainage problem.

The section east of the site is in a poor condition. Slight bleeding can again be observed along most of the observed road length. Other defects that were observed include, patching, crocodile cracking, and edge breaks.

Patching occurs at regular intervals along the road length, patching is extensive over some sections. (Photo 3) Rutting can also be seen in some instances, especially in the patched sections.

Pumping through surface cracks appear intermittently over the length of the road and in severe cases leads to potholes as can be seen in Photo 4. Crocodile cracks normally occur as a result of fatigue failure of surfacing or base layers and are related to the inability of the pavement to carry the traffic load. Crocodile cracks can also occur in isolated patches where failure is caused by poor drainage and sealed in moisture.

Pumping is generally caused by water ingress into the base layer and then pumping the fine material in the base layer from within the pavement to the surface, usually through existing surface cracks.

Crocodile cracking occurs in isolated instances, but at severe levels. Some of the base failures have led to potholes as can be seen in Photo 5. Severe potholes, caused by a variety of problems occur in isolation along the length of the roadway. When it rains water is retained in the existing potholes. The water softens the gravel layers beneath the surface and vehicles traveling along the roadway and through the potholes will increase the rate of the development of the pothole. Water in a pothole can be seen in Photo 6.

Paved shoulders were provided on some sections of the road. Base failure occurs along the seam of the old and new surfacing and can be seen in Photo 7. Severe base failures can also be seen along the seam.

The gravel shoulders are unsafe along most of the road length, as they are driven out and overgrown. Slight edge breaks occur along the road length.

7.5 Recommendations

The following recommendations are made with regards to the structural condition of the road after the visual inspection:

(i) That all severe failures be addressed immediately;

(ii) That a pavement design investigation be implemented to assess the existing pavement condition and remaining life of the pavement;

(iii) That the gravel shoulders be reconstructed throughout the road length; and

(iv) That road drainage should be improved by re-excavating shallow and overgrown side drains.

8 Road Pavement Management

8.1 Current Traffic Loading

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

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

The impact of the light vehicles along the R555 is considered to be insignificant. The 24-hour 7-day average traffic volumes from Table 3.1 were used to determine the existing heavy vehicle loading. It was assumed that the average heavy vehicle is equal to 3 E80's and the calculated current traffic loading is given in Table 7.1 below.

Table 7.1: Current Traffic Loading

Direction	Heavy Vehicles per Day	E80's per Year	MESA[6] per Year
Eastbound	283	309 885	0.310
Westbound	324	354 780	0.355

[6] Million Equivalent Standard Axles.

8.2 Additional Loading on R555

The cumulative effect of the existing and additional traffic loading from Rietvlei mine along the R555 is analysed over the estimated life of the mine.

The number of trucks per annum as calculated in Table 4.1 was used to calculate the additional loading from the mine operations. It was assumed that one empty truck will return to Rietvlei mine for every loaded truck that departs from the mine. It was assumed that the loaded trucks are equal to 3.6 E80's and the empty trucks are equal to 0.2 E80's.

A 22 year lifetime was used in the calculations as the ramp up period in the 1st year and the reduced production during the 23rd year was assumed to balance out. Full production volumes were used for the assumed 22 year lifetime of the mine.

The annual additional traffic loading from the mine is summarized in Table 7.2 below. The cumulative traffic loading over the life of the mine is summarised in Table 7.3.

Table 7.2: Annual Additional Traffic Loading from Rietvlei Mine

Direction	Trucks per Year	E80's – Loaded Trucks	E80's - Empty Trucks	Total E80's	Total MESA
Total	29 170	105 012	5 834	110 846	0.111
Eastbound	15 460	55 656	3 092	58 748	0.059
Westbound	13 710	49 356	2 742	52 098	0.052

The additional annual traffic loading from the mine is an estimated 19% and 15 % of the current traffic loading on the R555 eastbound and westbound respectively.

Table 7.3: Lifetime Additional Traffic Loading from Rietvlei Mine

Direction	Trucks over Lifetime	E80's - Loaded Trucks	E80's - Empty Trucks	Total E80's	Total MESA
Total	641 740	2 310 264	128 348	2 438 612	2.439
Eastbound	340 122	1224440	68 024	1 292 464	1.292
Westbound	301 618	1 085 824	60 323	1 146 148	1.146

8.3 Additional Loading on D1433

The D1433 to the Pan rail siding should be upgraded to be able to withstand the cumulative effect of the existing and the additional traffic loading. The existing traffic loading on the road is insignificant, and was disregarded for this analysis.

From Section 1 of the Feasibility Study the maximum amount of coal that could be exported per month is 93 758 ton. The maximum number of trucks that will be used for the transportation of the coal to the siding is calculated in Table 7.4.

Table 7.4: Generated Heavy Vehicle Trips (to siding)

Produced Coal (ton/year)	Truck Loads[7]	Trucks Loads/day[8]	Trucks/hour[9]
1 125 096	37 503	120	10

[7] Based on 30t capacity trucks.
[8] Based on 6 days per week, only loaded trucks.
[9] Assuming that transportation will occur from 06:00 (am) to 18:00 (pm), i.e. 12 hours per day, only loaded trucks.

The number of trucks per month as calculated in Table 7.4 was used to calculate the traffic loading from the mine operations. It was assumed that one empty truck will return to Rietvlei mine for every loaded truck that departs from the mine. It was assumed that the loaded trucks are equal to 3.6 E80's and the empty trucks are equal to 0.2 E80's. The cumulative traffic loading over the life of the mine is summarised in Table 7.5.

Table 7.5: Lifetime Additional Traffic Loading from Rietvlei Mine

	Trucks over Lifetime	E80's – Loaded Trucks	E80's - Empty Trucks	Total E80's	Total MESA
Southbound (to siding)	825 070	2 970 253	0	2 970 253	2.970
Northbound (from siding)	825 070	0	165 014	1 574 234	1.574

8.4 Suggested Measures

The additional loading on the R555 is likely to accelerate the deterioration of the existing road. It is recommended that the severe cases of distress are repaired immediately as they may pose a safety risk. The overgrown side drains should be maintained to prevent future drainage problems that could cause premature pavement failure.

The D1433 would have to be constructed according to a pavement design that could withstand the estimated heavy vehicle loading indicated in Table 7.5.

8.5 Further Investigation

Further investigation, which is beyond the scope of this report, would be required to establish the remaining capacity of the R555, as well as the materials classification to be able to make a more informed recommendation with regards to the measures that should be undertaken to repair and maintain the road.

A generic Road Maintenance Management Proposal to facilitate on-going management and maintenance of the haul route is included in Appendix F.

9 Conclusions and Recommendations

9.1 Conclusions

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

(i) It was found that the impact of the proposed mine on the peak hour traffic operating conditions of the surrounding road network will not necessitate any mitigation measures beyond upgrading the intersection that will be used to access the mine (R555/D1433).

(ii) The speed limit on the section of road past the site should be reduced to provide adequate shoulder sight distance from the D1433.

(iii) The additional heavy vehicle loading generated by the mine will require maintenance measures to the road.

(iv) Should the re-alignment of the D1433 be according to Alternative 2, the provincial guidelines on railway crossings would need to be adhered to.

9.2 Recommendations

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

(i) The intersection of the R555 and D1433 should be upgraded as shown in Figure 17.

(ii) The D1433 between the R555 and Pan rail siding should be paved and constructed according to an approved payment design.

(iii) The speed limit on the R555 past the site should be reduced to 60km/h and advance warning signs should be placed to warn road users along the R555 of heavy vehicles from the D1433. Speed reductions and signage should comply with the requirements of the South African Road Traffic Signs Manual.

(iv) The identified road pavement maintenance measures along the R555 should be taken.

10 References

1. Manual for Traffic Impact Studies, Report RR93/635, Department of Transport, October 1995
2. SIDRA V6 software, Akcelik and Associates, April 2013
3. TRH 17, Geometric Design for Rural Roads, CSIR, Pretoria, 1988
4. Feasibility Study: Rietvlei Coal Asset, Mindset Mining Consultants, April 2013

11 Appendices

Appendix A	Photographs
Appendix B	Traffic Counts
Appendix C	SIDRA Results: R555 and N11
Appendix D	SIDRA Results: R555 and Access (D1433)
Appendix E	SIDRA Results: R555 and R33
Appendix F	Generic Road Maintenance Management Proposal

Appendix A Photographs

Photo 1: Bleeding in the Wheel Paths

Photo 2: Edge Breaks along Gravel Shoulder

Photo 3: Severe Patching Along the R555 East of the Site

Photo 4: Surface Cracks and Pumping that lead to Potholes

Photo 5: Failure Leading to Potholes in Existing Patching

Photo 6: Water Retained in Pothole after Rain

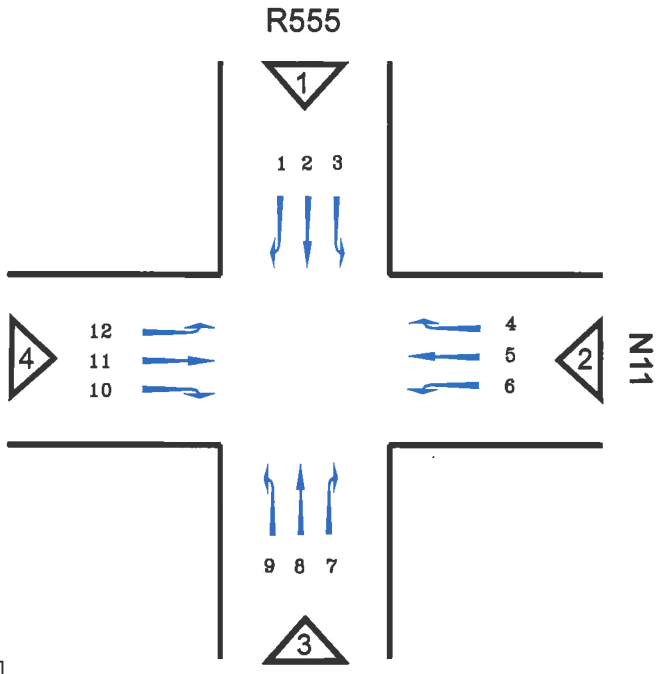
Photo 7: Paved Shoulder with Shoving of Asphalt and Base Failure

Photo 8: D1433 Dirt Road

Photo 9: Pooling water after rain on the D1433_080

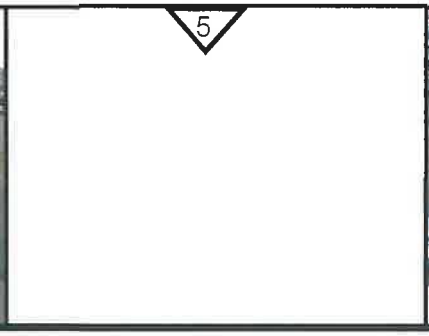
Photo 10: Damaged drainage pipe

Appendix B Traffic Counts



CO-ORDINATES

LATITUDE: 25° 46' 16.8" S
LONGITUDE: 29° 28' 15.3" E



LOCATION:	INTERSECTION: N11 & R555				
AREA:	MIDDELBURG			STATION NUMBER:	M1
DATE:	09/04/2014	DAY:	WEDNESDAY	TIME:	06:00 - 18:00
TYPE OF COUNT:	CLASSIFIED COUNTS PER TURNING MOVEMENT				
DESCRIPTION:	CLASSIFICATION: LIGHT & HEAVY VEHICLES				

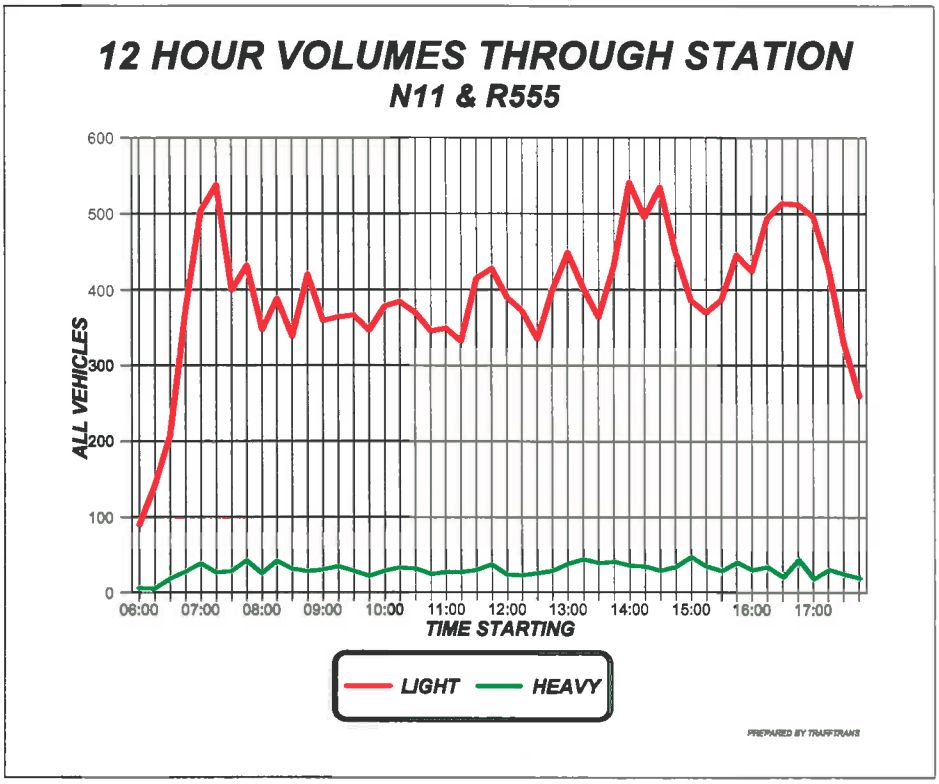
STATION LAYOUT

R555 BETWEEN MIDDELBURG AND STOFBERG

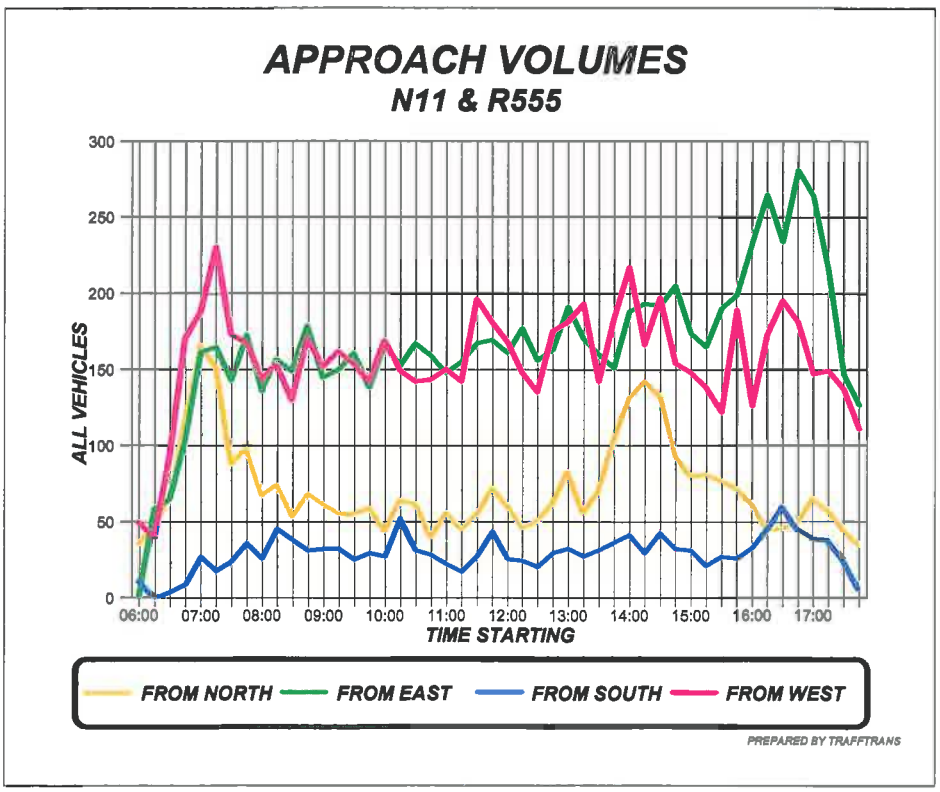
PROJ. T2014/022

DATE APRIL. 2014

TRAFFTRANS (EDMS) BPK


12 HOUR VOLUMES THROUGH STATION
N11 & R555
ALL VEHICLES
600
500
400
300
200
100
0
06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00
TIME STARTING
LIGHT
HEAVY
PREPARED BY TRAFFTRANS

STATION M1


APPROACH VOLUMES
N11 & R555
ALL VEHICLES
300
250
200
150
100
50
0
06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00
TIME STARTING
FROM NORTH
FROM EAST
FROM SOUTH
FROM WEST
PREPARED BY TRAFFTRANS

SUMMARY OF TRAFFIC COUNTS

STATION: M1
LOCATION: N11 & R555

LAT: 25° 46' 30.8" S
LONG: 29° 28' 15.3" E

DATE: 09/04/2014
Wednesday

MOVEMENT		AM PEAK HOUR					MIDDAY PEAK HOUR					PM PEAK HOUR					12 HOUR COUNT			
FROM	NO	LIGHT VOL	HEAVY VOL		TOTAL VOL	PHF	LIGHT VOL	HEAVY VOL		TOTAL VOL	PHF	LIGHT VOL	HEAVY VOL		TOTAL VOL	PHF	LIGHT VOL	HEAVY VOL		TOTAL VOL
NORTH	1	156	16	9%	172		190	28	13%	218		73	22	23%	95		1319	241	15%	1560
	2	82	4	5%	86	0.78	77	4	5%	81	0.80	26	2	7%	28	0.79	494	27	5%	521
	3	224	21	9%	245		180	20	10%	200		73	9	11%	82		1176	185	14%	1361
EAST	4	115	24	17%	139		145	10	6%	155		265	16	6%	281		1313	178	12%	1491
	5	459	32	7%	491	0.87	576	33	5%	609	0.90	730	21	3%	751	0.93	6053	316	5%	6369
	6	13			13		13	1	7%	14		9	3	25%	12		97	15	13%	112
SOUTH	7	9	3	25%	12		5			5		5	3	38%	8		69	15	18%	84
	8	31	2	6%	33	0.72	50	2	4%	52	0.90	98	4	4%	102	0.79	436	15	3%	451
	9	58	2	3%	60		84	3	3%	87		76	3	4%	79		817	46	5%	863
WEST	10	106	5	5%	111		90			90		55	1	2%	56		849	32	4%	881
	11	508	9	2%	517	0.83	509	17	3%	526	0.87	489	14	3%	503	0.89	5084	182	3%	5266
	12	116	16	12%	132		106	12	10%	118		121	16	12%	137		1166	157	12%	1323
TOTAL		**1877**	**134**	**7%**	**2011**	**0.89**	**2025**	**130**	**6%**	**2155**	**0.91**	**2020**	**114**	**5%**	**2134**	**0.96**	**18873**	**1409**	**7%**	**20282**
		PERCENTAGE OF:		**12H**	**9.9%**		*PERCENTAGE OF:*		**12H**	**10.6%**		*PERCENTAGE OF:*		**12H**	**10.5%**					

	AM	MID	PM
STARTING TIME OF PEAK HOUR	**07:00**	**14:00**	**16:15**

PREPARED BY TRAFFTRANS (PTY) LTD

TRAFFIC SURVEY: VEHICLE COUNTS - MIDDELBURG

TRAFFTRANS

LOCATION: N11 & R555
STATION NR : M1
DATE OF SURVEY : 09/04/2014

TYPE OF SURVEY 12H TURNING MOVEMENTS
TYPE OF VEHICLE: ALL

End	MOVEMENTS																									
	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
Time	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
06:15	12		8		15										10		1		7		27		16		96	
06:30	17		12		20		7		52										4		33		3		148	
06:45	26		12		27		12		53				1		1		2		11		65		17		227	
07:00	39	94	18	50	59	121	19	38	86	191				1	7	18	2	5	25	47	126	251	20	56	401	872
07:15	60	142	22	64	84	190	48	86	112	303	2	2		1	14	22	13	17	26	66	132	356	30	70	543	1319
07:30	51	176	27	79	73	243	40	119	123	374	2	4	2	3	7	29	9	26	32	94	158	481	41	108	565	1736
07:45	29	179	20	87	39	255	27	134	111	432	5	9	2	4	1	29	21	45	24	107	124	540	25	116	428	1937
08:00	32	172	17	86	49	245	24	139	145	491	4	13	8	12	11	33	17	60	29	111	103	517	36	132	475	2011
08:15	22	134	10	74	35	196	24	115	109	488	3	14	2	14	8	27	16	63	17	102	99	484	28	130	373	1841
08:30	34	117	4	51	36	159	30	105	125	490	2	14	1	13	11	31	33	87	18	88	111	437	25	114	430	1706
08:45	27	115	14	45	12	132	31	109	118	497		9	2	13	14	44	22	88	12	76	96	409	22	111	370	1648
09:00	23	106	18	46	27	110	30	115	148	500	1	6		5	9	42	22	93	21	68	113	419	37	112	449	1622
09:15	27	111	8	44	26	101	19	110	120	511	6	9	4	7	6	40	22	99	19	70	107	427	26	110	390	1639
09:30	27	104	8	48	20	85	22	102	128	514		7	1	7	12	41	19	85	19	71	115	431	28	113	399	1608
09:45	24	101	9	43	22	95	16	87	142	538	3	10	2	7	4	31	19	82	30	89	94	429	30	121	395	1633
10:00	23	101	8	33	28	96	20	77	115	505	3	12		7	6	28	23	83	20	88	92	408	30	114	368	1552
10:15	22	96	4	29	18	88	29	87	137	522	1	7	3	6	8	30	16	77	26	95	118	419	25	113	407	1569
10:30	34	103	8	29	22	90	19	84	132	526	1	8		5	20	38	32	90	26	102	97	401	26	111	417	1587
10:45	32	111	6	26	24	92	27	95	138	522	2	7	2	5	7	41	22	93	19	91	99	406	24	105	402	1594
11:00	17	105	4	22	19	83	19	94	140	547		4	2	7	7	42	19	89	15	86	100	414	28	103	370	1596
11:15	24	107	15	33	17	82	18	83	130	540		3	3	7	2	36	17	90	10	70	112	408	28	106	376	1565
11:30	18	91	6	31	21	81	17	81	137	545	1	3	2	9	4	20	11	69	21	65	101	412	20	100	359	1507
11:45	34	93	7	32	14	71	30	84	135	542	2	3	2	9	2	15	23	70	26	72	141	454	29	105	445	1550
12:00	39	115	12	40	21	73	27	92	136	538	6	9	3	10	10	18	30	81	33	90	113	467	35	112	465	1645
12:15	30	121	10	35	20	76	22	96	132	540	7	16	5	12	7	23	13	77	25	105	104	459	39	123	414	1683
12:30	22	125	8	37	16	71	25	104	146	549	6	21	1	11	5	24	18	84	19	103	111	469	18	121	395	1719
12:45	22	113	5	35	23	80	19	93	135	549	2	21		9	5	27	15	76	16	93	94	422	25	117	361	1635
13:00	34	108	9	32	19	78	31	97	131	544	1	16	2	8	6	23	21	67	21	81	127	436	27	109	429	1599
13:15	46	124	7	29	30	88	36	111	151	563	4	13	3	6	7	23	22	76	17	73	130	462	34	104	487	1672
13:30	24	126	13	34	19	91	35	121	134	551	1	8	2	7	6	24	19	77	14	68	147	498	32	118	446	1723
13:45	34	138	10	39	26	94	19	121	139	555	2	8	1	8	5	24	25	87	11	63	101	505	30	123	403	1765
14:00	51	155	13	43	39	114	23	113	126	550	2	9	2	8	7	25	27	93	18	60	137	515	28	124	473	1809
14:15	59	168	22	58	50	134	39	116	145	544	4	9	3	8	11	29	27	98	29	72	148	533	40	130	577	1899
14:30	58	202	22	67	62	177	42	123	148	558	3	11		6	14	37	15	94	17	75	128	514	21	119	530	1983
14:45	64	232	23	80	46	197	41	145	147	566	4	13	2	7	20	52	20	89	19	83	148	561	30	119	564	2144
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15:15	52	211	8	67	20	170	30	146	141	605	3	13	4	6	9	50	18	78	18	79	101	479	29	107	433	2011
15:30	40	193	13	58	28	136	25	129	136	593	4	14	3	9	5	41	13	76	16	78	99	450	23	109	405	1886
15:45	33	162	11	46	33	123	36	124	153	599	1	11	1	8	9	30	17	73	16	75	87	389	19	98	416	1738
16:00	34	159	8	40	30	111	38	129	157	587	4	12	3	11		23	23	71	15	65	141	428	33	104	486	1740
16:15	37	144	10	42	15	106	50	149	181	627	2	11	2	9	11	25	20	73	19	66	80	407	27	102	454	1761
16:30	24	128	6	35	15	93	66	190	196	687	3	10	3	9	20	40	22	82	17	67	122	430	34	113	528	1884
16:45	20	115	6	30	20	80	65	219	165	699	4	13	3	11	34	65	23	88	13	64	152	495	30	124	535	2003
17:00	23	104	8	30	18	68	76	257	201	743	4	13		8	23	88	22	87	16	65	131	485	34	125	556	2073
17:15	28	95	8	28	29	82	74	281	189	751	1	12	2	8	25	102	12	79	10	56	98	503	39	137	515	2134
17:30	40	111	6	28	12	79	56	271	157	712	2	11		5	18	100	20	77	9	48	115	496	25	128	460	2066
17:45	30	121	2	24	13	72	30	236	116	663	1	8		2	13	79	12	66	5	40	101	445	31	129	354	1885
18:00	25	123	2	18	8	62	25	185	102	564		4		2	3	59	3	47	6	30	86	400	19	114	279	1608
TOTAL	12H	1560	12H	521	12H	1361	12H	1491	12H	6369	12H	112	12H	84	12H	451	12H	863	12H	881	12H	5266	12H	1323	12H	20282

STARTING TIMES AND COMBINED PEAK PERIOD VOLUME FOR STATION

	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
AM	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00
Vol	51	172	27	86	73	245	40	139	123	491	2	13	2	12	7	33	9	60	32	111	158	517	41	132	565	2011
MID	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00
Vol	59	218	22	81	50	200	39	155	145	609	4	14	3	5	11	52	27	87	29	90	148	526	40	118	577	2155
PM	16:45	16:15	16:45	16:15	16:45	16:15	16:45	16:15	16:45	16:15	16:45	16:15	16:45	16:15	16:45	16:15	16:45	16:15	16:45	16:15	16:45	16:15	16:45	16:15	16:45	16:15
Vol	23	95	8	28	18	82	76	281	201	751	4	12		8	23	102	22	79	16	56	131	503	34	137	556	2134

PREPARED BY TRAFFTRANS (PTY) LTD

KEY: QH - QUARTER HOURLY VOLUMES

TRAFFIC SURVEY: VEHICLE COUNTS - MIDDELBURG

TRAFFTRANS

LOCATION: N11 & R555
STATION NO : M1
DATE OF SURVEY : 09/04/2014

TYPE OF SURVEY 12H TURNING MOVEMENTS
TYPE OF VEHICLE: LIGHT

	MOVEMENTS																									
End	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
Time	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
06:15	12		8		15										10		1		7		26		11		90	
06:30	17		11		19		7		52										4		32		1		143	
06:45	22		12		24		10		47				1		1		2		11		65		14		209	
07:00	34	85	18	49	57	115	16	33	77	176				1	7	18	2	5	25	47	122	245	16	42	374	816
07:15	56	129	22	63	77	177	40	73	102	278	2	2		1	14	22	12	16	24	64	130	349	26	57	505	1231
07:30	49	161	24	76	71	229	35	101	114	340	2	4	2	3	7	29	9	25	32	92	156	473	38	94	539	1627
07:45	28	167	19	83	36	241	22	113	101	394	5	9	1	3		28	21	44	22	103	123	531	22	102	400	1818
08:00	23	156	17	82	40	224	18	115	142	459	4	13	6	9	10	31	16	58	28	106	99	508	30	116	433	1877
08:15	17	117	10	70	30	177	21	96	100	457	2	13	2	11	8	25	16	62	17	99	98	476	27	117	348	1720
08:30	29	97	4	50	28	134	19	80	114	457	2	13	1	10	11	29	32	85	18	85	108	428	23	102	389	1570
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09:15	24	94	8	41	20	81	17	88	113	482	5	8	2	5	6	40	19	93	19	67	105	412	22	98	360	1509
09:30	20	85	8	45	12	65	18	87	125	493		6	1	5	12	41	18	79	18	67	109	413	24	99	365	1485
09:45	21	84	9	43	13	68	16	78	136	516	1	7	2	5	4	31	17	76	28	83	91	412	29	110	367	1513
10:00	22	87	8	33	23	68	17	68	111	485	3	9		5	6	28	21	75	20	85	88	393	28	103	347	1439
10:15	15	78	4	29	16	64	25	76	133	505	1	5	2	5	8	30	16	72	25	91	112	400	22	103	379	1458
10:30	30	88	8	29	19	71	15	73	123	503	1	6		4	20	38	26	80	26	99	95	386	22	101	385	1478
10:45	28	95	5	25	22	80	21	78	131	498	2	7	1	3	6	40	20	83	18	89	96	391	21	93	371	1482
11:00	12	85	4	21	17	74	15	76	134	521		4	2	5	7	41	17	79	13	82	98	401	27	92	346	1481
11:15	18	88	12	29	15	73	15	66	125	513		3	3	6	2	35	17	80	10	67	109	398	24	94	350	1452
11:30	16	74	6	27	17	71	15	66	128	518	1	3	1	7	4	19	11	65	21	62	94	397	19	91	333	1400
11:45	32	78	7	29	11	60	27	72	126	513	2	3	2	8	2	15	23	68	25	69	135	436	24	94	416	1445
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12:15	28	113	8	32	19	63	19	87	129	513	7	15	4	10	7	21	13	75	25	101	98	432	34	107	391	1569
12:30	19	116	7	33	14	60	23	95	138	523	6	20	1	10	4	21	17	81	18	98	109	447	17	105	373	1609
12:45	20	104	3	29	19	68	18	86	127	524	2	20		8	4	23	13	71	16	89	91	403	23	104	336	1529
13:00	27	94	9	27	15	67	28	88	125	519	1	16	1	6	6	21	21	64	21	80	122	420	25	99	401	1501
13:15	37	103	7	26	28	76	29	98	147	537	3	12	3	5	7	21	19	70	16	71	126	448	28	93	450	1560
13:30	17	101	12	31	13	75	27	102	123	522	1	7	2	6	5	22	19	72	14	67	141	480	29	105	403	1590
13:45	23	104	9	37	22	78	13	97	131	526	1	6	1	7	5	23	25	84	11	62	97	486	27	109	365	1619
14:00	42	119	13	41	33	96	20	89	121	522	1	6	2	8	7	24	24	87	15	56	130	494	25	109	433	1651
14:15	52	134	21	55	42	110	37	97	138	513	4	7	3	8	10	27	25	93	29	69	143	511	38	119	542	1743
14:30	49	166	19	62	56	153	41	111	144	534	3	9		6	14	36	15	89	17	72	119	489	19	109	496	1836
14:45	56	199	23	76	44	175	39	137	139	542	3	11	2	7	20	51	19	83	19	80	148	540	24	106	536	2007
15:00	33	190	14	77	38	180	28	145	155	576	3	13		5	6	50	25	84	25	90	99	509	25	106	451	2025
15:15	41	179	8	64	13	151	28	136	130	568	3	12	2	4	9	49	15	74	17	78	97	463	24	92	387	1870
15:30	31	161	12	57	21	116	23	118	129	553	3	12	3	7	5	40	13	72	15	76	96	440	20	93	371	1745
15:45	31	136	11	45	29	101	28	107	144	558	1	10	1	6	8	28	16	69	15	72	86	378	18	87	388	1597
16:00	27	130	8	39	24	87	32	111	152	555	4	11	3	9		22	21	65	13	60	134	413	29	91	447	1593
16:15	34	123	10	41	14	88	42	125	174	599	2	10	2	9	11	24	20	70	19	62	74	390	23	90	425	1631
16:30	19	111	6	35	12	79	62	164	189	659	3	10	1	7	20	39	20	77	16	63	119	413	28	98	495	1755
16:45	17	97	6	30	19	69	63	199	161	676	3	12	2	8	34	65	23	84	13	61	149	476	25	105	515	1882
17:00	14	84	7	29	15	60	67	234	193	717	2	10		5	20	85	21	84	16	64	127	469	31	107	513	1948
17:15	23	73	7	26	27	73	73	265	187	730	1	9	2	5	24	98	12	76	10	55	94	489	37	121	497	2020
17:30	34	88	6	26	10	71	53	256	151	692	1	7		4	18	96	20	76	8	47	107	477	22	115	430	1955
17:45	25	96	2	22	10	62	29	222	109	640		4		2	13	75	12	65	4	38	100	428	26	116	330	1770
18:00	17	99	2	17	8	55	24	179	98	545		2		2	3	58	3	47	6	28	83	384	16	101	260	1517
TOTAL	12H	1319	12H	494	12H	1176	12H	1313	12H	6053	12H	97	12H	69	12H	436	12H	817	12H	849	12H	5084	12H	1166	12H	18873

	STARTING TIMES AND COMBINED PEAK PERIOD VOLUME FOR STATION																									
	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
AM	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00	07:15	07:00
Vol	49	156	24	82	71	224	35	115	114	459	2	13	2	9	7	31	9	58	32	108	156	508	38	116	539	1877
MID	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00	14:00
Vol	52	190	21	77	42	180	37	145	138	576	4	13	3	5	10	50	25	84	29	90	143	509	38	106	542	2025
PM	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15
Vol	17	73	6	26	19	73	63	265	161	730	3	9	2	5	34	98	23	76	13	55	149	489	25	121	515	2020

PREPARED BY TRAFFTRANS (PTY) LTD

KEY: QH - QUARTER HOURLY VOLUMES

TRAFFIC SURVEY: VEHICLE COUNTS - MIDDELBURG

TRAFFTRANS

LOCATION: N11 & R555
STATION NR : M1
DATE OF SURVEY : 09/04/2014

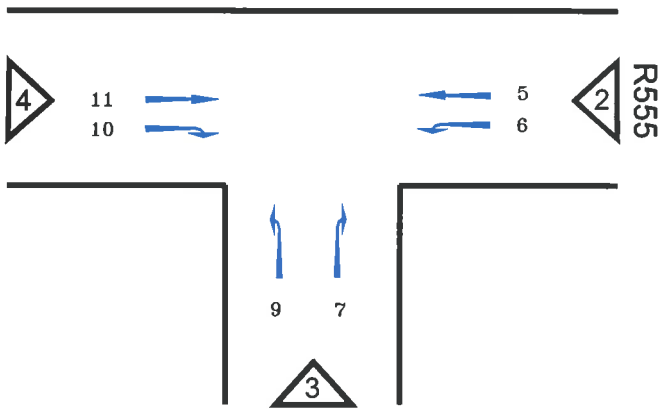
TYPE OF SURVEY 12H TURNING MOVEMENTS
TYPE OF VEHICLE: HEAVY

	MOVEMENTS																									
End	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
Time	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
06:15																					1		5		6	
06:30			1		1																1		2		5	
06:45	4				3		2		6														3		18	
07:00	5	9		1	2	6	3	5	9	15											4	6	4	14	27	56
07:15	4	13		1	7	13	8	13	10	25							1	1	2	2	2	7	4	13	38	88
07:30	2	15	3	3	2	14	5	18	9	34								1		2	2	8	3	14	26	109
07:45	1	12	1	4	3	14	5	21	10	38			1	1	1	1		1	2	4	1	9	3	14	28	119
08:00	9	16		4	9	21	6	24	3	32			2	3	1	2	1	2	1	5	4	9	6	16	42	134
08:15	5	17		4	5	19	3	19	9	31	1	1		3		2		1		3	1	8	1	13	25	121
08:30	5	20		1	8	25	11	25	11	33		1		3		2	1	2		3	3	9	2	12	41	136
08:45	5	24	3	3	2	24	6	26	5	28		1		2		1	2	4		1	4	12	4	13	31	139
09:00	4	19		3	4	19	3	23	6	31		1						3	3	3	6	14	2	9	28	125
09:15	3	17		3	6	20	2	22	7	29	1	1	2	2			3	6		3	2	15	4	12	30	130
09:30	7	19		3	8	20	4	15	3	21		1		2			1	6	1	4	6	18	4	14	34	123
09:45	3	17			9	27		9	6	22	2	3		2			2	6	2	6	3	17	1	11	28	120
10:00	1	14			5	28	3	9	4	20		3		2			2	8		3	4	15	2	11	21	113
10:15	7	18			2	24	4	11	4	17		2	1	1				5	1	4	6	19	3	10	28	111
10:30	4	15			3	19	4	11	9	23		2		1			6	10		3	2	15	4	10	32	109
10:45	4	16	1	1	2	12	6	17	7	24			1	2	1	1	2	10	1	2	3	15	3	12	31	112
11:00	5	20		1	2	9	4	18	6	26				2		1	2	10	2	4	2	13	1	11	24	115
11:15	6	19	3	4	2	9	3	17	5	27				1		1		10		3	3	10	4	12	26	113
11:30	2	17		4	4	10	2	15	9	27			1	2		1		4		3	7	15	1	9	26	107
11:45	2	15		3	3	11	3	12	9	29				1				2	1	3	6	18	5	11	29	105
12:00	2	12	1	4	5	14	1	9	6	29	1	1		1	2	2	2	2	3	4	8	24	5	15	36	117
12:15	2	8	2	3	1	13	3	9	3	27		1	1	2		2		2		4	6	27	5	16	23	114
12:30	3	9	1	4	2	11	2	9	8	26		1		1	1	3	1	3	1	5	2	22	1	16	22	110
12:45	2	9	2	6	4	12	1	7	8	25		1		1	1	4	2	5		4	3	19	2	13	25	106
13:00	7	14		5	4	11	3	9	6	25			1	2		2		3		1	5	16	2	10	28	98
13:15	9	21		3	2	12	7	13	4	26	1	1		1		2	3	6	1	2	4	14	6	11	37	112
13:30	7	25	1	3	6	16	8	19	11	29		1		1	1	2		5		1	6	18	3	13	43	133
13:45	11	34	1	2	4	16	6	24	8	29	1	2		1		1		3		1	4	19	3	14	38	146
14:00	9	36		2	6	18	3	24	5	28	1	3				1	3	6	3	4	7	21	3	15	40	158
14:15	7	34	1	3	8	24	2	19	7	31		2			1	2	2	5		3	5	22	2	11	35	156
14:30	9	36	3	5	6	24	1	12	4	24		2				1		5		3	9	25	2	10	34	147
14:45	8	33		4	2	22	2	8	8	24	1	2				1	1	6		3		21	6	13	28	137
15:00	4	28		4	4	20	5	10	14	33		1			1	2		3			3	17	2	12	33	130
15:15	11	32		3	7	19	2	10	11	37		1	2	2		1	3	4	1	1	4	16	5	15	46	141
15:30	9	32	1	1	7	20	2	11	7	40	1	2		2		1		4	1	2	3	10	3	16	34	141
15:45	2	26		1	4	22	8	17	9	41		1		2	1	2	1	4	1	3	1	11	1	11	28	141
16:00	7	29		1	6	24	6	18	5	32		1		2		1	2	6	2	5	7	15	4	13	39	147
16:15	3	21		1	1	18	8	24	7	28		1				1		3		4	6	17	4	12	29	130
16:30	5	17			3	14	4	26	7	28			2	2		1	2	5	1	4	3	17	6	15	33	129
16:45	3	18			1	11	2	20	4	23	1	1	1	3				4		3	3	19	5	19	20	121
17:00	9	20	1	1	3	8	9	23	8	26	2	3		3	3	3	1	3		1	4	16	3	18	43	125
17:15	5	22	1	2	2	9	1	16	2	21		3		3	1	4		3		1	4	14	2	16	18	114
17:30	6	23		2	2	8	3	15	6	20	1	4		1		4		1	1	1	8	19	3	13	30	111
17:45	5	25		2	3	10	1	14	7	23	1	4				4		1	1	2	1	17	5	13	24	115
18:00	8	24		1		7	1	6	4	19		2				1				2	3	16	3	13	19	91
TOTAL	12H	241	12H	27	12H	185	12H	178	12H	316	12H	15	12H	15	12H	15	12H	46	12H	32	12H	182	12H	157	12H	1409

	STARTING TIMES AND COMBINED PEAK PERIOD VOLUME FOR STATION																									
	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
AM	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45	07:45
Vol	9	24		3	9	24	6	26	3	28		1	2	2	1	1	1	4	1	1	4	12	6	13	42	139
MID	13:15	13:00	13:15	13:00	13:15	13:00	13:15	13:00	13:15	13:00	13:15	13:00	13:15	13:00	13:15	13:00	13:15	13:00	13:15	13:00	13:15	13:00	13:15	13:00	13:15	13:00
Vol	7	36	1	2	6	18	8	24	11	28		3			1	1		6		4	6	21	3	15	43	158
PM	16:45	15:00	16:45	15:00	16:45	15:00	16:45	15:00	16:45	15:00	16:45	15:00	16:45	15:00	16:45	15:00	16:45	15:00	16:45	15:00	16:45	15:00	16:45	15:00	16:45	15:00
Vol	9	29	1	1	3	24	9	18	8	32	2	1		2	3	1	1	6		5	4	15	3	13	43	147

PREPARED BY TRAFFTRANS (PTY) LTD

KEY: QH - QUARTER HOURLY VOLUMES



CO-ORDINATES

LATITUDE: 25° 38' 59.7" S
LONGITUDE: 29° 39' 55.3" E

LOCATION:	INTERSECTION: R555 & PAN TAIL SIDING				
AREA:	MIDDELBURG		STATION NUMBER:	M2	
DATE:	09/04/2014	DAY:	WEDNESDAY	TIME:	06:00 - 18:00
TYPE OF COUNT:	CLASSIFIED COUNTS PER TURNING MOVEMENT				
DESCRIPTION:	CLASSIFICATION: LIGHT & HEAVY VEHICLES				

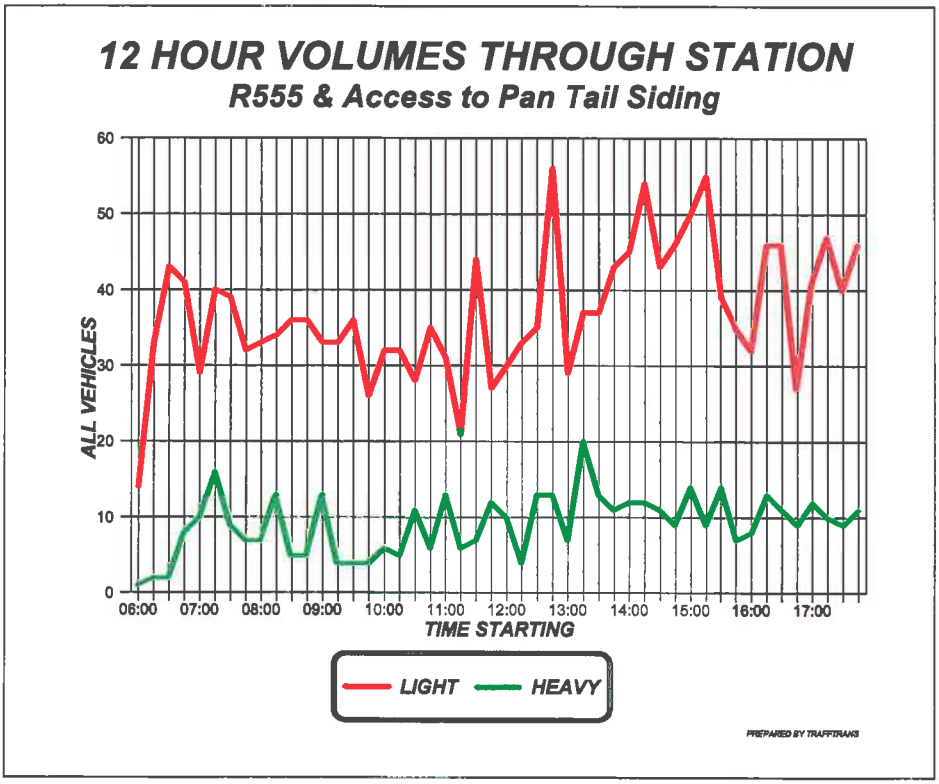
STATION LAYOUT

R555 BETWEEN MIDDELBURG AND STOFBERG

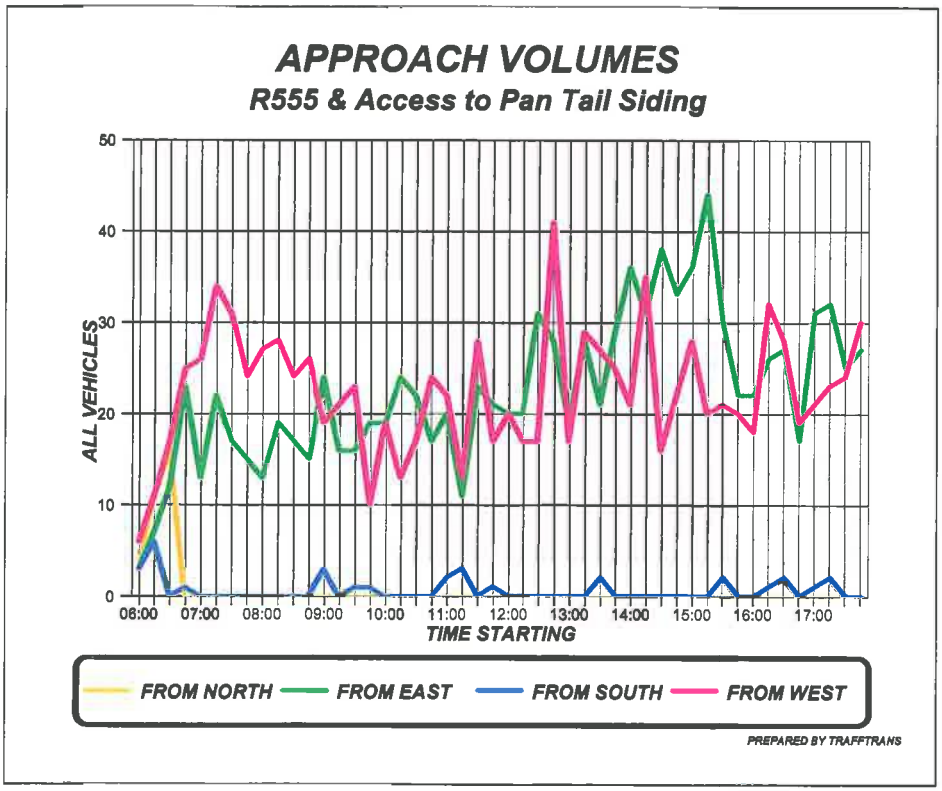
PROJ. T2014/022

DATE APRIL. 2014

TRAFFTRANS (EDMS) BPK


12 HOUR VOLUMES THROUGH STATION
R555 & Access to Pan Tail Siding
ALL VEHICLES
0
10
20
30
40
50
60
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
TIME STARTING
LIGHT
HEAVY
PREPARED BY TRAFFTRANS

STATION M2


APPROACH VOLUMES
R555 & Access to Pan Tail Siding
ALL VEHICLES
0
10
20
30
40
50
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
TIME STARTING
FROM NORTH
FROM EAST
FROM SOUTH
FROM WEST
PREPARED BY TRAFFTRANS

SUMMARY OF TRAFFIC COUNTS

STATION: M2 **LAT:** 25° 38' 59.7" S **DATE:** 09/04/2014
LOCATION: R555 & Access to Pan Tail Siding **LONG:** 29° 39' 55.3" E **Wednesday**

MOVEMENT		AM PEAK HOUR				MIDDAY PEAK HOUR				PM PEAK HOUR				12 HOUR COUNT		
FROM	NO	LIGHT VOL	HEAVY VOL	TOTAL VOL	PHF	LIGHT VOL	HEAVY VOL	TOTAL VOL	PHF	LIGHT VOL	HEAVY VOL	TOTAL VOL	PHF	LIGHT VOL	HEAVY VOL	TOTAL VOL
NORTH	1				n.a.				n.a.				n.a.			
	2													30		30
	3															
EAST	4				0.82				0.89				0.91		1 100%	1
	5	60	15 20%	75		109	29 21%	138		104	26 20%	130		843	225 21%	1068
	6									1	1 50%	2		8	4 33%	12
SOUTH	7	1		1	0.25				n.a.				n.a.	12	6 33%	18
	8													8	1 11%	9
	9									1	1 50%	2		2	2 50%	4
WEST	10	1		1	0.85				0.84	1		1	0.72	3	3 50%	6
	11	87	28 24%	115		79	15 16%	94		72	16 18%	88		874	196 18%	1070
	12															
TOTAL		149	43 22%	192	0.86	188	44 19%	232	0.96	179	44 20%	223	0.91	1780	438 20%	2218
		PERCENTAGE OF: 12H		8.7%		PERCENTAGE OF: 12H		10.5%		PERCENTAGE OF: 12H		10.1%				

STARTING TIME OF PEAK HOUR	AM	MID	PM
	06:45	14:00	15:00

PREPARED BY TRAFFTRANS (PTY) LTD

TRAFFIC SURVEY: VEHICLE COUNTS - MIDDELBURG

TRAFFTRANS

LOCATION: R555 & Access to Pan Tail Siding
STATION NR : M2
DATE OF SURVEY : 09/04/2014

TYPE OF SURVEY 12H TURNING MOVEMENTS
TYPE OF VEHICLE: ALL

End	MOVEMENTS																									
	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
Time	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
06:15			3				1		2						3						6				15	
06:30			11						7						6						11				35	
06:45			16						11		1										17				45	
07:00				30				1	23	43		1	1	1		9					25	59			49	144
07:15				27					13	54		1		1		6					26	79			39	168
07:30				16					22	69		1		1							34	102			56	189
07:45									17	75				1					1	1	30	115			48	192
08:00									15	67										1	24	114			39	182
08:15									13	67										1	27	115			40	183
08:30									18	63	1	1								1	28	109			47	174
08:45									17	63		1									24	103			41	167
09:00									15	63		1									26	105			41	169
09:15									24	74		1	2	2			1	1			19	97			46	175
09:30									16	72				2				1			21	90			37	165
09:45									16	71			1	3				1			23	89			40	164
10:00									19	75			1	4				1			10	73			30	153
10:15									19	70				2							19	73			38	145
10:30									24	78				2							13	65			37	145
10:45									22	84				1							17	59			39	144
11:00									17	82									1	1	23	72			41	155
11:15									20	83			2	2						1	22	75			44	161
11:30									10	69	1	1	3	5						1	13	75			27	151
11:45									22	69	1	2		5						1	28	86			51	163
12:00									20	72	1	3		5			1	1			17	80			39	161
12:15									19	71	1	4		3				1			20	78			40	157
12:30									20	81		3						1			17	82			37	167
12:45									29	88	2	4						1	1	1	16	70			48	164
13:00									28	96		3								1	41	94			69	194
13:15									18	95	1	3								1	17	91			36	190
13:30									28	103		3							1	2	28	102			57	210
13:45									21	95		1	2	2						1	27	113			50	212
14:00									29	96		1		2						1	25	97			54	197
14:15									36	114				2						1	21	101			57	218
14:30									31	117				2							35	108			66	227
14:45									38	134											16	97			54	231
15:00									33	138											22	94			55	232
15:15									36	138											28	101			64	239
15:30									43	150	1	1							1	1	19	85			64	237
15:45									29	141	1	2					2	2		1	21	90			53	236
16:00									22	130		2						2		1	20	88			42	223
16:15									22	116		2						2		1	18	78			40	199
16:30									26	99		1	1	1				2	1	1	31	90			59	194
16:45									27	97			2	3						1	28	97			57	198
17:00									16	91	1	1		3						1	19	96			36	192
17:15									31	100		1	1	4						1	21	99			53	205
17:30									32	108		1	2	5							23	91			57	203
17:45									25	104		1		3							24	87			49	195
18:00									27	115				3							30	98			57	216
TOTAL	12H		12H	30	12H		12H	1	12H	1068	12H	12	12H	18	12H	9	12H	4	12H	6	12H	1070	12H		12H	2218

STARTING TIMES AND COMBINED PEAK PERIOD VOLUME FOR STATION

	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
AM	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45
Vol									22	75				1						1	34	115			56	192
MID	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00
Vol									28	138											41	94			69	232
PM	16:15	15:00	16:15	15:00	16:15	15:00	16:15	15:00	16:15	15:00	16:15	15:00	16:15	15:00	16:15	15:00	16:15	15:00	16:15	15:00	16:15	15:00	16:15	15:00	16:15	15:00
Vol									26	130		2	1					2	1	1	31	88			59	223

PREPARED BY TRAFFTRANS (PTY) LTD

KEY: QH - QUARTER HOURLY VOLUMES

TRAFFIC SURVEY: VEHICLE COUNTS - MIDDELBURG

TRAFFTRANS

LOCATION: R555 & Access to Pan Tail Siding
STATION NO : M2
DATE OF SURVEY : 09/04/2014

TYPE OF SURVEY 12H TURNING MOVEMENTS
TYPE OF VEHICLE: LIGHT

End	MOVEMENTS																									
	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
Time	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
06:15			3						2						3						6				14	
06:30			11						6						5						11				33	
06:45			16						10		1										16				43	
07:00				30					20	38		1	1	1		8					20	53			41	131
07:15				27					12	48		1		1		5					17	64			29	146
07:30				16					14	56		1		1							26	79			40	153
07:45									14	60				1					1	1	24	87			39	149
08:00									14	54										1	18	85			32	140
08:15									11	53										1	22	90			33	144
08:30									13	52	1	1								1	20	84			34	138
08:45									14	52		1									22	82			36	135
09:00									13	51		1									23	87			36	139
09:15									16	56		1	1	1			1	1			15	80			33	139
09:30									13	56				1				1			20	80			33	138
09:45									15	57			1	2				1			20	78			36	138
10:00									16	60			1	3				1			9	64			26	128
10:15									17	61				2							15	64			32	127
10:30									21	69				2							11	55			32	126
10:45									14	68				1							14	49			28	118
11:00									16	68											19	59			35	127
11:15									17	68											14	58			31	126
11:30									8	55	1	1	3	3							9	56			21	115
11:45									19	60	1	2		3							24	66			44	131
12:00									15	59	1	3		3							11	58			27	123
12:15									14	56		3		3							16	60			30	122
12:30									18	66		2									15	66			33	134
12:45									20	67		1									15	57			35	125
13:00									21	73											35	81			56	154
13:15									13	72	1	1									15	80			29	153
13:30									18	72		1									19	84			37	157
13:45									16	68		1	1	1							20	89			37	159
14:00									24	71		1		1							19	73			43	146
14:15									28	86				1							17	75			45	162
14:30									25	93				1							29	85			54	179
14:45									29	106											14	79			43	185
15:00									27	109											19	79			46	188
15:15									28	109											22	84			50	193
15:30									35	119	1	1							1	1	18	73			55	194
15:45									23	113		1					1	1		1	15	74			39	190
16:00									18	104		1						1		1	17	72			35	179
16:15									19	95		1						1		1	13	63			32	161
16:30									17	77			1	1				1	1	1	27	72			46	152
16:45									25	79				1						1	21	78			46	159
17:00									11	72	1	1		1						1	15	76			27	151
17:15									23	76		1	1	2						1	17	80			41	160
17:30									24	83		1	2	3							21	74			47	161
17:45									19	77		1		3							21	74			40	155
18:00									18	84				3							28	87			46	174
TOTAL	12H		12H	30	12H		12H		12H	843	12H	8	12H	12	12H	8	12H	2	12H	3	12H	874	12H		12H	1780

STARTING TIMES AND COMBINED PEAK PERIOD VOLUME FOR STATION

	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
AM	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30	06:30
Vol			16	16					10	56	1	1		1							16	79			43	153
MID	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00	12:45	14:00
Vol									21	109											35	79			56	188
PM	17:15	15:00	17:15	15:00	17:15	15:00	17:15	15:00	17:15	15:00	17:15	15:00	17:15	15:00	17:15	15:00	17:15	15:00	17:15	15:00	17:15	15:00	17:15	15:00	17:15	15:00
Vol									24	104		1	2					1		1	21	72			47	179

PREPARED BY TRAFFTRANS (PTY) LTD

KEY: QH - QUARTER HOURLY VOLUMES

TRAFFIC SURVEY: VEHICLE COUNTS - MIDDELBURG

TRAFFTRANS

LOCATION: R555 & Access to Pan Tail Siding
STATION NR : M2
DATE OF SURVEY : 09/04/2014

TYPE OF SURVEY 12H TURNING MOVEMENTS
TYPE OF VEHICLE: HEAVY

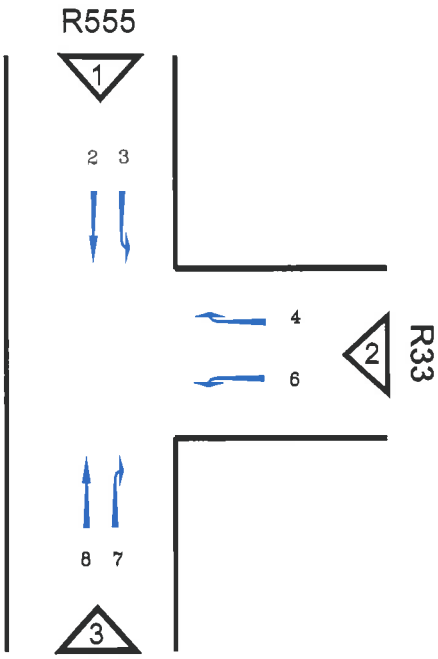
	MOVEMENTS																							
End	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
Time	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
06:15							1																		1	
06:30									1						1										2	
06:45									1												1				2	
07:00								1	3	5						1					5	6			8	13
07:15									1	6						1					9	15			10	22
07:30									8	13											8	23			16	36
07:45									3	15											6	28			9	43
08:00									1	13											6	29			7	42
08:15									2	14											5	25			7	39
08:30									5	11											8	25			13	36
08:45									3	11											2	21			5	32
09:00									2	12											3	18			5	30
09:15									8	18			1	1							4	17			13	36
09:30									3	16				1							1	10			4	27
09:45									1	14				1							3	11			4	26
10:00									3	15				1							1	9			4	25
10:15									2	9											4	9			6	18
10:30									3	9											2	10			5	19
10:45									8	16											3	10			11	26
11:00									1	14									1	1	4	13			6	28
11:15									3	15			2	2						1	8	17			13	35
11:30									2	14				2						1	4	19			6	36
11:45									3	9				2						1	4	20			7	32
12:00									5	13				2			1	1			6	22			12	38
12:15									5	15	1	1						1			4	18			10	35
12:30									2	15		1						1			2	16			4	33
12:45									9	21	2	3						1	1	1	1	13			13	39
13:00									7	23		3								1	6	13			13	40
13:15									5	23		2								1	2	11			7	37
13:30									10	31		2							1	2	9	18			20	53
13:45									5	27			1	1						1	7	24			13	53
14:00									5	25				1						1	6	24			11	51
14:15									8	28				1						1	4	26			12	56
14:30									6	24				1							6	23			12	48
14:45									9	28											2	18			11	46
15:00									6	29											3	15			9	44
15:15									8	29											6	17			14	46
15:30									8	31											1	12			9	43
15:45									6	28	1	1					1	1			6	16			14	46
16:00									4	26		1						1			3	16			7	44
16:15									3	21		1						1			5	15			8	38
16:30									9	22		1						1			4	18			13	42
16:45									2	18			2	2							7	19			11	39
17:00									5	19				2							4	20			9	41
17:15									8	24				2							4	19			12	45
17:30									8	23				2							2	17			10	42
17:45									6	27											3	13			9	40
18:00									9	31											2	11			11	42
TOTAL	12H		12H		12H		12H	1	12H	225	12H	4	12H	6	12H	1	12H	2	12H	3	12H	196	12H		12H	438

STARTING TIMES AND COMBINED PEAK PERIOD VOLUME FOR STATION

	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
AM	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45	07:15	06:45
Vol									8	15											8	28			16	43
MID	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15	13:15
Vol									10	28				1					1	1	9	26			20	56
PM	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15
Vol									9	24				2							4	19			13	45

PREPARED BY TRAFFTRANS (PTY) LTD

KEY: QH - QUARTER HOURLY VOLUMES



CO-ORDINATES

LATITUDE: 25° 25' 05.1" S
LONGITUDE: 29° 49' 20.8" E

LOCATION:	INTERSECTION: R555 & R33				
AREA:	MIDDELBURG			STATION NUMBER:	M3
DATE:	09/04/2014	DAY:	WEDNESDAY	TIME:	06:00 - 18:00
TYPE OF COUNT:	CLASSIFIED COUNTS PER TURNING MOVEMENT				
DESCRIPTION:	CLASSIFICATION: LIGHT & HEAVY VEHICLES				

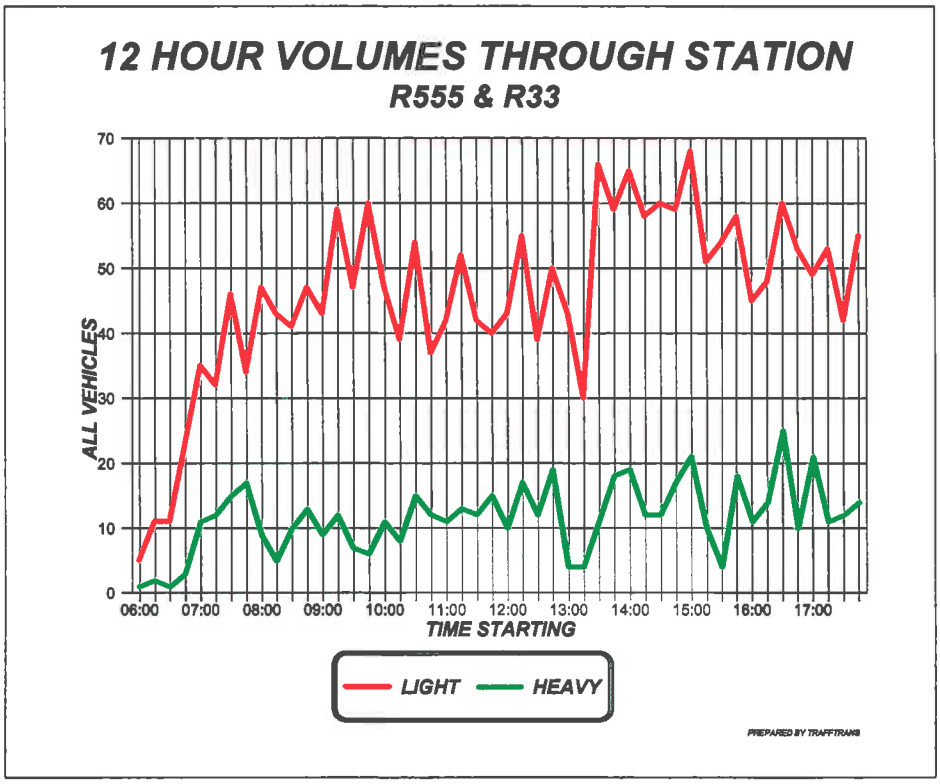
STATION LAYOUT

R555 BETWEEN MIDDELBURG AND STOFBERG

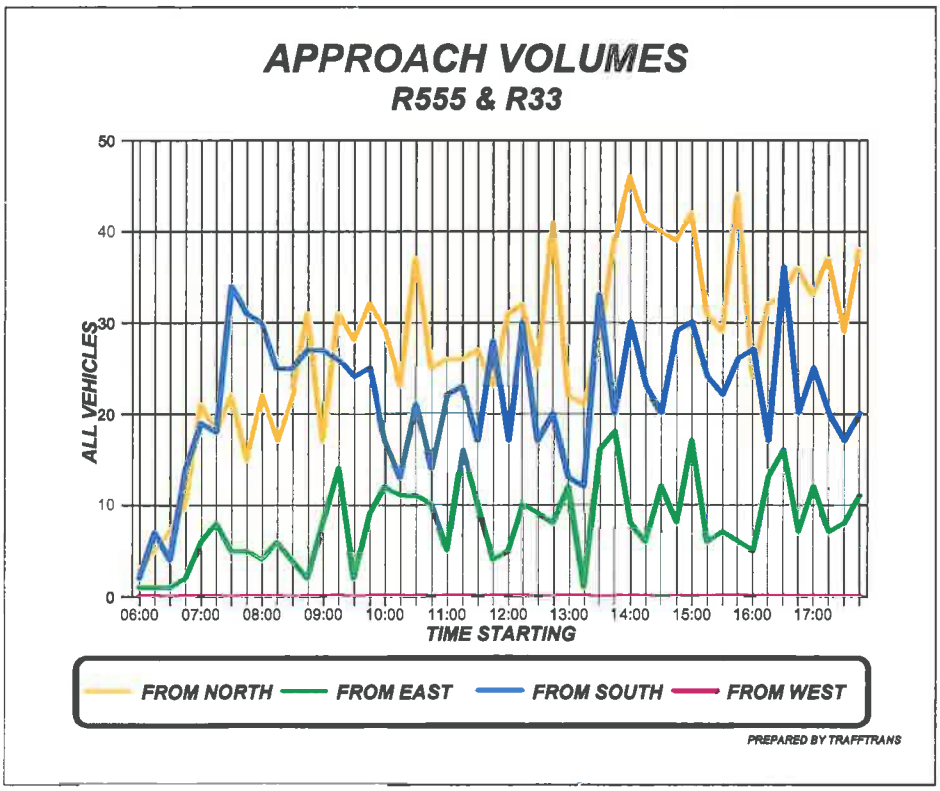
PROJ. T2014/022

DATE APRIL. 2014

TRAFFTRANS (EDMS) BPK


12 HOUR VOLUMES THROUGH STATION
R555 & R33
ALL VEHICLES
0
10
20
30
40
50
60
70
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
TIME STARTING
LIGHT
HEAVY
PREPARED BY TRAFFTRANS

STATION M3


APPROACH VOLUMES
R555 & R33
ALL VEHICLES
0
10
20
30
40
50
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
TIME STARTING
FROM NORTH
FROM EAST
FROM SOUTH
FROM WEST
PREPARED BY TRAFFTRANS

SUMMARY OF TRAFFIC COUNTS

STATION: M3
LOCATION: R555 & R33

LAT: 25° 25' 05.1" S
LONG: 29° 49' 20.8" E

DATE: 09/04/2014
Wednesday

MOVEMENT FROM	NO	AM PEAK HOUR LIGHT VOL	AM PEAK HOUR HEAVY VOL	AM PEAK HOUR TOTAL VOL	AM PHF	MIDDAY PEAK HOUR LIGHT VOL	MIDDAY PEAK HOUR HEAVY VOL	MIDDAY PEAK HOUR TOTAL VOL	MIDDAY PHF	PM PEAK HOUR LIGHT VOL	PM PEAK HOUR HEAVY VOL	PM PEAK HOUR TOTAL VOL	PM PHF	12 HOUR COUNT LIGHT VOL	12 HOUR COUNT HEAVY VOL	12 HOUR COUNT TOTAL VOL
NORTH	1															
	2	47	7 13%	54	0.86	104	25 19%	129	0.71	89	24 21%	113	0.96	800	197 20%	997
	3	14	8 36%	22		20	5 20%	25		24	9 27%	33		248	85 26%	333
EAST	4	13	4 24%	17		30	9 23%	39		22	6 21%	28		240	68 22%	308
	5				0.83				0.67				0.63			
	6	3		3		8	1 11%	9		7	1 13%	8		63	14 18%	77
SOUTH	7	4	2 33%	6		6	1 14%	7		2	2 50%	4		52	18 26%	70
	8	89	25 22%	114	0.88	80	19 19%	99	0.80	87	11 11%	98	0.85	797	174 18%	971
	9															
WEST	10															
	11				n.a.				n.a.				n.a.			
	12															
TOTAL		170	46 21%	216	0.89	248	60 19%	308	0.79	231	53 19%	284	0.86	2200	556 20%	2756
		PERCENTAGE OF:	12H	7.8%		*PERCENTAGE OF:*	12H	11.2%		*PERCENTAGE OF:*	12H	10.3%				

STARTING TIME OF PEAK HOUR	AM	MID	PM
	07:30	13:30	15:00

PREPARED BY TRAFFTRANS (PTY) LTD

TRAFFIC SURVEY: VEHICLE COUNTS - MIDDELBURG

TRAFFTRANS

LOCATION: R555 & R33
STATION NR : M3
DATE OF SURVEY : 09/04/2014

TYPE OF SURVEY 12H TURNING MOVEMENTS
TYPE OF VEHICLE: ALL

End	MOVEMENTS																									
	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
Time	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
06:15			3								1				2										6	
06:30			5								1		1		6										13	
06:45			7								1		1		3										12	
07:00			10	25							2	5	1	3	13	24									26	57
07:15			13	35	8	8	3	3			3	7	1	4	18	40									46	97
07:30			14	44	4	12	6	9			2	8	1	4	17	51									44	128
07:45			17	54	5	17	3	12			2	9	1	4	33	81									61	177
08:00			11	55	4	21	4	16			1	8	2	5	29	97									51	202
08:15			13	55	9	22	4	17				5		4	30	109									56	212
08:30			13	54	4	22	6	17				3	3	6	22	114									48	216
08:45			14	51	8	25	3	17			1	2		5	25	106									51	206
09:00			20	60	11	32	2	15				1	2	5	25	102									60	215
09:15			11	58	6	29	8	19				1		5	27	99									52	211
09:30			22	67	9	34	11	24			3	4	2	4	24	101									71	234
09:45			17	70	11	37	2	23				3	3	7	21	97									54	237
10:00			20	70	12	38	5	26			4	7	1	6	24	96									66	243
10:15			22	81	7	39	8	26			4	11	2	8	15	84									58	249
10:30			13	72	10	40	10	25			1	9		6	13	73									47	225
10:45			21	76	16	45	7	30			4	13	2	5	19	71									69	240
11:00			16	72	9	42	8	33			2	11	2	6	12	59									49	223
11:15			22	72	4	39	5	30				7		4	22	66									53	218
11:30			17	76	9	38	15	35			1	7	3	7	20	73									65	236
11:45			18	73	9	31	10	38				3	1	6	16	70									54	221
12:00			17	74	6	28	3	33			1	2	6	10	22	80									55	227
12:15			26	76	5	29	4	32			1	3	2	12	15	73									53	227
12:30			26	87	6	26	8	25			2	4	1	10	29	82									72	234
12:45			21	90	4	21	9	24				4	1	10	16	82									51	231
13:00			28	101	13	28	7	28			1	4	1	5	19	79									69	245
13:15			21	96	1	24	11	35			1	4	1	4	12	76									47	239
13:30			18	88	3	21	1	28				2	1	4	11	58									34	201
13:45			22	89	6	23	12	31			4	6	1	4	32	74									77	227
14:00			33	94	6	16	16	40			2	7	2	5	18	73									77	235
14:15			43	116	3	18	5	34			3	9	1	5	29	90									84	272
14:30			31	129	10	25	6	39				9	3	7	20	99									70	308
14:45			35	142	5	24	9	36			3	8	2	8	18	85									72	303
15:00			31	140	8	26	7	27			1	7	2	8	27	94									76	302
15:15			31	128	11	34	14	36			3	7	1	8	29	94									89	307
15:30			27	124	4	28	5	35			1	8		5	24	98									61	298
15:45			20	109	9	32	5	31			2	7	1	4	21	101									58	284
16:00			35	113	9	33	4	28			2	8	2	4	24	98									76	284
16:15			15	97	9	31	2	16			3	8	1	4	26	95									56	251
16:30			25	95	7	34	10	21			3	10	2	6	15	86									62	252
16:45			24	99	9	34	10	26			6	14	3	8	33	98									85	279
17:00			27	91	9	34	7	29				12	1	7	19	93									63	266
17:15			23	99	10	35	11	38			1	10	1	7	24	91									70	280
17:30			25	99	12	40	6	34			1	8	2	7	18	94									64	282
17:45			24	99	5	36	7	31			1	3	2	6	15	76									54	251
18:00			30	102	8	35	9	33			2	5	1	6	19	76									69	257
TOTAL	12H		12H	997	12H	333	12H	308	12H		12H	77	12H	70	12H	971	12H		12H		12H		12H		12H	2756

STARTING TIMES AND COMBINED PEAK PERIOD VOLUME FOR STATION

	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
AM	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30
Vol			17	54	5	22	3	17			2	3	1	6	33	114									61	216
MID	14:00	13:30	14:00	13:30	14:00	13:30	14:00	13:30	14:00	13:30	14:00	13:30	14:00	13:30	14:00	13:30	14:00	13:30	14:00	13:30	14:00	13:30	14:00	13:30	14:00	13:30
Vol			43	129	3	25	5	39			3	9	1	7	29	99									84	308
PM	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00
Vol			24	113	9	33	10	28			6	8	3	4	33	98									85	284

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KEY: QH - QUARTER HOURLY VOLUMES

TRAFFIC SURVEY: VEHICLE COUNTS - MIDDELBURG

TRAFFTRANS

LOCATION: R555 & R33
STATION NO : M3
DATE OF SURVEY : 09/04/2014

TYPE OF SURVEY 12H TURNING MOVEMENTS
TYPE OF VEHICLE: LIGHT

	MOVEMENTS																									
End	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
Time	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
06:15			2								1				2										5	
06:30			5										1		5										11	
06:45			6								1		1		3										11	
07:00			8	21							2	4	1	3	12	22									23	50
07:15			11	30	4	4	2	2			2	5		3	16	36									35	80
07:30			10	35	3	7	6	8			1	6	1	3	11	42									32	101
07:45			15	44	2	9	2	10			2	7	1	3	24	63									46	136
08:00			7	43	1	10	2	12			1	6	1	3	22	73									34	147
08:15			12	44	7	13	3	13				4		3	25	82									47	159
08:30			13	47	4	14	6	13				3	2	4	18	89									43	170
08:45			9	41	7	19	3	14			1	2		3	21	86									41	165
09:00			15	49	10	28	1	13				1	2	4	19	83									47	178
09:15			10	47	4	25	6	16				1		4	23	81									43	174
09:30			21	55	7	28	8	18			3	4	2	4	18	81									59	190
09:45			15	61	10	31	1	16				3		4	21	81									47	196
10:00			19	65	10	31	4	19			3	6	1	3	23	85									60	209
10:15			17	72	6	33	6	19			3	9	1	4	14	76									47	213
10:30			12	63	8	34	8	19				6		2	11	69									39	193
10:45			16	64	14	38	6	24			2	8	1	3	15	63									54	200
11:00			13	58	5	33	6	26			2	7	2	4	9	49									37	177
11:15			20	61	2	29	3	23				4		3	17	52									42	172
11:30			12	61	8	29	12	27			1	5	3	6	16	57									52	185
11:45			13	58	9	24	8	29				3	1	6	11	53									42	173
12:00			13	58	3	22	2	25				1	3	7	19	63									40	176
12:15			22	60	3	23	4	26			1	2	2	9	11	57									43	177
12:30			21	69	3	18	6	20			2	3	1	7	22	63									55	180
12:45			17	73	3	12	6	18				3	1	7	12	64									39	177
13:00			17	77	9	18	6	22			1	4	1	5	16	61									50	187
13:15			19	74	1	16	10	28			1	4	1	4	11	61									43	187
13:30			17	70	3	16	1	23				2	1	4	8	47									30	162
13:45			17	70	6	19	10	27			4	6	1	4	28	63									66	189
14:00			26	79	5	15	12	33			1	6	2	5	13	60									59	198
14:15			33	93	1	15	4	27			3	8		4	24	73									65	220
14:30			28	104	8	20	4	30				8	3	6	15	80									58	248
14:45			31	118	3	17	5	25			3	7	2	7	16	68									60	242
15:00			24	116	5	17	6	19			1	7	2	7	21	76									59	242
15:15			23	106	7	23	10	25			3	7		7	25	77									68	245
15:30			22	100	4	19	4	25			1	8		4	20	82									51	238
15:45			18	87	8	24	4	24			2	7	1	3	21	87									54	232
16:00			26	89	5	24	4	22			1	7	1	2	21	87									58	231
16:15			15	81	5	22	1	13			3	7	1	3	20	82									45	208
16:30			19	78	3	21	8	17			2	8	1	4	15	77									48	205
16:45			16	76	5	18	6	19			5	11	2	5	26	82									60	211
17:00			21	71	9	22	5	20				10		4	18	79									53	206
17:15			16	72	7	24	10	29			1	8		3	15	74									49	210
17:30			18	71	10	31	6	27			1	7	2	4	16	75									53	215
17:45			20	75	4	30	6	27				2	2	4	10	59									42	197
18:00			20	74	7	28	7	29			2	4	1	5	18	59									55	199
TOTAL	12H		12H	800	12H	248	12H	240	12H		12H	63	12H	52	12H	797	12H		12H		12H		12H		12H	2200

	STARTING TIMES AND COMBINED PEAK PERIOD VOLUME FOR STATION																									
	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
AM	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00	08:00
Vol			12	49	7	28	3	13				1		4	25	83									47	178
MID	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30	13:30
Vol			17	104	6	20	10	30			4	8	1	6	28	80									66	248
PM	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00	16:30	15:00
Vol			16	89	5	24	6	22			5	7	2	2	26	87									60	231

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KEY: QH - QUARTER HOURLY VOLUMES

TRAFFIC SURVEY: VEHICLE COUNTS - MIDDELBURG

TRAFFTRANS

LOCATION: R555 & R33
STATION NR : M3
DATE OF SURVEY : 09/04/2014

TYPE OF SURVEY 12H TURNING MOVEMENTS
TYPE OF VEHICLE: HEAVY

	MOVEMENTS																									
End	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
Time	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
06:15			1																						1	
06:30											1				1										2	
06:45			1																						1	
07:00			2	4								1			1	2									3	7
07:15			2	5	4	4	1	1			1	2	1	1	2	4									11	17
07:30			4	9	1	5		1			1	2		1	6	9									12	27
07:45			2	10	3	8	1	2				2		1	9	18									15	41
08:00			4	12	3	11	2	4				2	1	2	7	24									17	55
08:15			1	11	2	9	1	4				1		1	5	27									9	53
08:30				7		8		4					1	2	4	25									5	46
08:45			5	10	1	6		3						2	4	20									10	41
09:00			5	11	1	4	1	2						1	6	19									13	37
09:15			1	11	2	4	2	3						1	4	18									9	37
09:30			1	12	2	6	3	6							6	20									12	44
09:45			2	9	1	6	1	7					3	3		16									7	41
10:00			1	5	2	7	1	7			1	1		3	1	11									6	34
10:15			5	9	1	6	2	7			1	2	1	4	1	8									11	36
10:30			1	9	2	6	2	6			1	3		4	2	4									8	32
10:45			5	12	2	7	1	6			2	5	1	2	4	8									15	40
11:00			3	14	4	9	2	7				4		2	3	10									12	46
11:15			2	11	2	10	2	7				3		1	5	14									11	46
11:30			5	15	1	9	3	8				2		1	4	16									13	51
11:45			5	15		7	2	9							5	17									12	48
12:00			4	16	3	6	1	8			1	1	3	3	3	17									15	51
12:15			4	18	2	6		6				1		3	4	16									10	50
12:30			5	18	3	8	2	5				1		3	7	19									17	54
12:45			4	17	1	9	3	6				1		3	4	18									12	54
13:00			11	24	4	10	1	6							3	18									19	58
13:15			2	22		8	1	7							1	15									4	52
13:30			1	18		5		5							3	11									4	39
13:45			5	19		4	2	4							4	11									11	38
14:00			7	15	1	1	4	7			1	1			5	13									18	37
14:15			10	23	2	3	1	7				1	1	1	5	17									19	52
14:30			3	25	2	5	2	9				1		1	5	19									12	60
14:45			4	24	2	7	4	11				1		1	2	17									12	61
15:00			7	24	3	9	1	8						1	6	18									17	60
15:15			8	22	4	11	4	11					1	1	4	17									21	62
15:30			5	24		9	1	10						1	4	16									10	60
15:45			2	22	1	8	1	7						1		14									4	52
16:00			9	24	4	9		6			1	1	1	2	3	11									18	53
16:15				16	4	9	1	3				1		1	6	13									11	43
16:30			6	17	4	13	2	4			1	2	1	2		9									14	47
16:45			8	23	4	16	4	7			1	3	1	3	7	16									25	68
17:00			6	20		12	2	9				2	1	3	1	14									10	60
17:15			7	27	3	11	1	9				2	1	4	9	17									21	70
17:30			7	28	2	9		7				1		3	2	19									11	67
17:45			4	24	1	6	1	4			1	1		2	5	17									12	54
18:00			10	28	1	7	2	4				1		1	1	17									14	58
TOTAL	12H		12H	197	12H	85	12H	68	12H		12H	14	12H	18	12H	174	12H		12H		12H		12H		12H	556

	STARTING TIMES AND COMBINED PEAK PERIOD VOLUME FOR STATION																									
	1		2		3		4		5		6		7		8		9		10		11		12		TOTALS	
	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H	QH	H
AM	07:45	07:00	07:45	07:00	07:45	07:00	07:45	07:00	07:45	07:00	07:45	07:00	07:45	07:00	07:45	07:00	07:45	07:00	07:45	07:00	07:45	07:00	07:45	07:00	07:45	07:00
Vol			4	12	3	11	2	4				2	1	2	7	24									17	55
MID	12:45	13:45	12:45	13:45	12:45	13:45	12:45	13:45	12:45	13:45	12:45	13:45	12:45	13:45	12:45	13:45	12:45	13:45	12:45	13:45	12:45	13:45	12:45	13:45	12:45	13:45
Vol			11	24	4	7	1	11				1		1	3	17									19	61
PM	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15	16:30	16:15
Vol			8	27	4	11	4	9			1	2	1	4	7	17									25	70

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KEY: QH - QUARTER HOURLY VOLUMES

Appendix C SIDRA Results: R555 and N11

MOVEMENT SUMMARY

Site: 2014 AM Existing

Intersection of R555 and N11
Signals - Fixed Time Cycle Time = 85 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
9	L2	83	3.0	0.150	30.9	LOS C	2.7	19.3	0.74	0.76	33.4
8	T1	46	6.0	0.150	32.1	LOS C	2.7	19.3	0.80	0.72	32.4
7	R2	17	25.0	0.150	32.4	LOS C	1.8	13.9	0.82	0.71	32.2
Approach		146	6.5	0.150	31.4	LOS C	2.7	19.3	0.77	0.74	33.0
East: N11 (E)											
6	L2	15	0.0	0.368	18.5	LOS B	8.1	60.0	0.73	0.64	38.2
5	T1	564	7.0	0.368	18.2	LOS B	8.3	61.7	0.73	0.63	38.4
4	R2	160	17.0	0.453	27.0	LOS C	3.6	28.7	0.78	0.80	38.0
Approach		739	9.0	0.453	20.1	LOS C	8.3	61.7	0.74	0.67	38.3
North: R555 (N)											
3	L2	314	9.0	0.537	36.9	LOS D	10.6	80.2	0.86	0.84	31.7
2	T1	110	5.0	0.176	21.9	LOS C	3.3	23.8	0.75	0.60	36.1
1	R2	221	9.0	0.686	46.0	LOS D	8.9	67.3	0.97	0.86	28.1
Approach		645	8.3	0.686	37.4	LOS D	10.6	80.2	0.88	0.80	31.0
West: N11 (W)											
12	L2	159	12.0	0.497	24.5	LOS C	11.8	86.6	0.78	0.78	36.0
11	T1	623	2.0	0.497	21.0	LOS C	11.8	84.0	0.77	0.71	37.1
10	R2	134	5.0	0.294	22.4	LOS C	2.9	21.1	0.68	0.77	38.8
Approach		916	4.2	0.497	21.8	LOS C	11.8	86.6	0.76	0.73	37.1
All Vehicles		2445	6.9	0.686	26.0	LOS C	11.8	86.6	0.79	0.73	35.3

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

MOVEMENT SUMMARY

Site: 2015 AM Excluding

Intersection of R555 and N11
Signals - Fixed Time Cycle Time = 85 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
9	L2	86	3.0	0.156	30.9	LOS C	2.8	20.0	0.74	0.76	33.4
8	T1	47	6.0	0.156	32.8	LOS C	2.8	20.0	0.81	0.73	32.1
7	R2	17	25.0	0.156	33.2	LOS C	1.9	14.3	0.83	0.72	31.8
Approach		150	6.4	0.156	31.7	LOS C	2.8	20.0	0.77	0.75	32.8
East: N11 (E)											
6	L2	15	0.0	0.379	18.6	LOS B	8.4	62.1	0.73	0.64	38.2
5	T1	582	7.0	0.379	18.3	LOS B	8.6	63.9	0.73	0.63	38.3
4	R2	164	17.0	0.503	27.5	LOS C	3.7	29.9	0.80	0.80	37.7
Approach		761	9.0	0.503	20.3	LOS C	8.6	63.9	0.75	0.67	38.1
North: R555 (N)											
3	L2	323	9.0	0.558	37.0	LOS D	11.0	83.0	0.86	0.84	31.6
2	T1	114	5.0	0.395	21.9	LOS C	3.4	24.7	0.75	0.59	36.0
1	R2	227	9.0	0.740	48.6	LOS D	9.6	72.6	0.99	0.89	27.3
Approach		664	8.3	0.740	38.4	LOS D	11.0	83.0	0.89	0.81	30.6
West: N11 (W)											
12	L2	164	12.0	0.515	24.7	LOS C	12.3	90.7	0.79	0.79	35.9
11	T1	642	2.0	0.515	21.2	LOS C	12.3	90.7	0.78	0.71	37.0
10	R2	137	5.0	0.322	22.8	LOS C	3.0	22.0	0.70	0.78	38.5
Approach		943	4.2	0.515	22.0	LOS C	12.3	90.7	0.77	0.74	37.0
All Vehicles		2518	6.9	0.740	26.4	LOS C	12.3	90.7	0.79	0.74	35.1

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

MOVEMENT SUMMARY

Site: 2015 AM Including

Intersection of R555 and N11
Signals - Fixed Time Cycle Time = 85 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
9	L2	86	3.0	0.163	30.5	LOS C	2.9	21.1	0.74	0.76	33.5
8	T1	56	6.0	0.163	31.8	LOS C	2.9	21.1	0.80	0.73	32.5
7	R2	17	25.0	0.163	32.2	LOS C	2.0	15.1	0.82	0.72	32.2
Approach		158	6.4	0.163	31.1	LOS C	2.9	21.1	0.77	0.74	33.0
East: N11 (E)											
6	L2	15	0.0	0.379	18.6	LOS B	8.4	62.1	0.73	0.64	38.2
5	T1	582	7.0	0.379	18.3	LOS B	8.6	63.9	0.73	0.63	38.3
4	R2	192	17.0	0.571	27.8	LOS C	4.4	35.4	0.82	0.81	37.5
Approach		789	9.3	0.571	20.6	LOS C	8.6	63.9	0.75	0.68	38.1
North: R555 (N)											
3	L2	329	9.0	0.573	37.1	LOS D	11.3	85.0	0.87	0.84	31.6
2	T1	115	5.0	0.408	21.9	LOS C	3.4	25.0	0.75	0.59	36.0
1	R2	231	9.0	0.729	47.5	LOS D	9.7	72.8	0.98	0.88	27.6
Approach		676	8.3	0.729	38.1	LOS D	11.3	85.0	0.89	0.81	30.7
West: N11 (W)											
12	L2	192	12.0	0.537	25.6	LOS C	12.9	95.6	0.80	0.80	35.6
11	T1	642	2.0	0.537	21.5	LOS C	12.9	95.6	0.79	0.72	36.8
10	R2	137	5.0	0.307	22.5	LOS C	3.0	21.8	0.69	0.78	38.7
Approach		971	4.4	0.537	22.4	LOS C	12.9	95.6	0.78	0.74	36.8
All Vehicles		2594	7.0	0.729	26.5	LOS C	12.9	95.6	0.80	0.74	35.1

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

MOVEMENT SUMMARY

Site: 2020 AM Including

Intersection of R555 and N11
Signals - Fixed Time Cycle Time = 85 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
9	L2	100	3.0	0.199	30.4	LOS C	3.6	26.1	0.76	0.76	33.4
8	T1	63	6.0	0.199	33.9	LOS C	3.6	26.1	0.82	0.74	31.6
7	R2	19	25.0	0.199	35.7	LOS D	2.1	16.5	0.86	0.73	30.8
Approach		182	6.4	0.199	32.2	LOS C	3.6	26.1	0.79	0.75	32.5
East: N11 (E)											
6	L2	18	0.0	0.439	19.2	LOS B	10.1	74.4	0.76	0.67	37.7
5	T1	674	7.0	0.439	18.9	LOS B	10.3	76.5	0.76	0.66	37.8
4	R2	217	17.0	0.718	32.2	LOS C	5.6	45.0	0.91	0.87	35.0
Approach		909	9.2	0.718	22.1	LOS C	10.3	76.5	0.79	0.71	37.1
North: R555 (N)											
3	L2	381	9.0	0.693	38.5	LOS D	13.7	103.1	0.90	0.85	31.0
2	T1	133	5.0	0.519	22.2	LOS C	4.0	29.2	0.76	0.60	35.9
1	R2	268	9.0	0.982	78.5	LOS E	15.8	119.0	1.00	1.08	20.1
Approach		782	8.3	0.982	49.4	LOS D	15.8	119.0	0.91	0.89	26.7
West: N11 (W)											
12	L2	217	12.0	0.632	26.5	LOS C	16.1	119.0	0.84	0.82	35.0
11	T1	743	2.0	0.632	22.4	LOS C	16.1	119.0	0.82	0.75	36.2
10	R2	160	5.0	0.390	23.1	LOS C	3.5	25.8	0.73	0.79	38.3
Approach		1120	4.4	0.632	23.3	LOS C	16.1	119.0	0.81	0.77	36.3
All Vehicles		2994	7.0	0.982	30.3	LOS C	16.1	119.0	0.83	0.78	33.1

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

MOVEMENT SUMMARY

Site: 2020 AM Excluding

Intersection of R555 and N11
Signals - Fixed Time Cycle Time = 85 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
9	L2	100	3.0	0.192	30.7	LOS C	3.5	25.0	0.75	0.77	33.4
8	T1	54	6.0	0.192	34.4	LOS C	3.5	25.0	0.83	0.74	31.5
7	R2	19	25.0	0.192	36.0	LOS D	2.0	15.5	0.86	0.73	30.7
Approach		174	6.4	0.192	32.4	LOS C	3.5	25.0	0.79	0.75	32.5
East: N11 (E)											
6	L2	18	0.0	0.439	19.2	LOS B	10.1	74.4	0.76	0.67	37.7
5	T1	674	7.0	0.439	18.9	LOS B	10.3	76.5	0.76	0.66	37.8
4	R2	191	17.0	0.617	29.2	LOS C	4.4	35.6	0.88	0.82	36.7
Approach		883	9.0	0.617	21.2	LOS C	10.3	76.5	0.78	0.70	37.6
North: R555 (N)											
3	L2	376	9.0	0.681	38.2	LOS D	13.4	100.7	0.90	0.85	31.1
2	T1	132	5.0	0.509	22.2	LOS C	4.0	28.9	0.76	0.60	35.9
1	R2	263	9.0	0.953	71.4	LOS E	14.6	110.1	1.00	1.05	21.5
Approach		771	8.3	0.953	46.7	LOS D	14.6	110.1	0.91	0.88	27.5
West: N11 (W)											
12	L2	190	12.0	0.611	25.7	LOS C	15.5	113.8	0.83	0.81	35.3
11	T1	743	2.0	0.611	22.1	LOS C	15.5	113.8	0.81	0.74	36.4
10	R2	160	5.0	0.390	23.1	LOS C	3.5	25.8	0.73	0.79	38.3
Approach		1094	4.2	0.611	22.8	LOS C	15.5	113.8	0.81	0.76	36.5
All Vehicles		2921	6.9	0.953	29.2	LOS C	15.5	113.8	0.82	0.77	33.6

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

MOVEMENT SUMMARY

Site: 2014 PM Existing

Intersection of R555 and N11
Signals - Fixed Time Cycle Time = 90 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
9	L2	100	3.0	0.192	30.5	LOS C	3.8	27.2	0.74	0.76	33.4
8	T1	129	6.0	0.192	24.9	LOS C	3.8	27.2	0.74	0.67	35.2
7	R2	10	25.0	0.192	23.7	LOS C	3.6	27.0	0.74	0.65	35.6
Approach		239	5.6	0.192	27.2	LOS C	3.8	27.2	0.74	0.71	34.4
East: N11 (E)											
6	L2	13	0.0	0.552	22.7	LOS C	13.7	101.8	0.82	0.72	35.4
5	T1	808	7.0	0.552	22.6	LOS C	14.1	104.5	0.82	0.72	35.5
4	R2	302	17.0	0.794	36.2	LOS D	9.6	76.7	0.89	0.90	33.0
Approach		1123	9.6	0.794	26.2	LOS C	14.1	104.5	0.84	0.77	34.8
North: R555 (N)											
3	L2	104	9.0	0.177	34.0	LOS C	3.2	24.1	0.73	0.78	33.0
2	T1	35	5.0	0.054	21.0	LOS C	1.0	7.5	0.70	0.52	36.7
1	R2	82	9.0	0.226	37.6	LOS D	2.8	20.9	0.79	0.78	31.4
Approach		222	8.4	0.226	33.3	LOS C	3.2	24.1	0.75	0.74	32.9
West: N11 (W)											
12	L2	154	12.0	0.478	27.2	LOS C	11.5	84.7	0.79	0.79	34.7
11	T1	565	2.0	0.478	23.4	LOS C	11.9	84.8	0.79	0.72	35.7
10	R2	63	5.0	0.166	23.8	LOS C	1.4	10.0	0.72	0.76	37.9
Approach		782	4.2	0.478	24.2	LOS C	11.9	84.8	0.78	0.73	35.6
All Vehicles		2365	7.3	0.794	26.3	LOS C	14.1	104.5	0.80	0.75	34.8

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

MOVEMENT SUMMARY

Site: 2015 PM Including

Intersection of R555 and N11
Signals - Fixed Time Cycle Time = 90 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
9	L2	103	3.0	0.201	30.4	LOS C	4.0	28.5	0.74	0.76	33.4
8	T1	137	6.0	0.201	25.0	LOS C	4.0	28.5	0.74	0.67	35.1
7	R2	10	25.0	0.201	23.8	LOS C	3.8	28.1	0.74	0.65	35.5
Approach		249	5.5	0.201	27.2	LOS C	4.0	28.5	0.74	0.71	34.4
East: N11 (E)											
6	L2	13	0.0	0.568	22.9	LOS C	14.3	105.8	0.83	0.73	35.3
5	T1	832	7.0	0.568	22.8	LOS C	14.6	108.6	0.83	0.73	35.4
4	R2	322	17.0	0.865	44.2	LOS D	11.6	92.8	0.94	0.96	29.6
Approach		1167	9.7	0.865	28.7	LOS C	14.6	108.6	0.86	0.79	33.6
North: R555 (N)											
3	L2	134	9.0	0.229	34.5	LOS C	4.2	31.8	0.75	0.79	32.7
2	T1	46	5.0	0.069	21.2	LOS C	1.3	9.7	0.70	0.53	36.6
1	R2	153	9.0	0.428	39.6	LOS D	5.6	42.0	0.85	0.81	30.5
Approach		333	8.5	0.428	35.0	LOS D	5.6	42.0	0.79	0.77	32.1
West: N11 (W)											
12	L2	165	12.0	0.499	27.6	LOS C	12.1	89.3	0.80	0.79	34.5
11	T1	582	2.0	0.499	23.7	LOS C	12.5	88.7	0.80	0.72	35.5
10	R2	65	5.0	0.176	23.9	LOS C	1.4	10.4	0.72	0.76	37.8
Approach		812	4.3	0.499	24.5	LOS C	12.5	89.3	0.79	0.74	35.5
All Vehicles		2561	7.4	0.865	28.0	LOS C	14.6	108.6	0.82	0.76	34.0

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

MOVEMENT SUMMARY

Site: 2015 PM Excluding

Intersection of R555 and N11
Signals - Fixed Time Cycle Time = 90 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
9	L2	103	3.0	0.197	30.6	LOS C	3.9	27.9	0.74	0.76	33.3
8	T1	133	6.0	0.197	24.9	LOS C	3.9	27.9	0.74	0.67	35.1
7	R2	10	25.0	0.197	23.7	LOS C	3.7	27.7	0.74	0.65	35.5
Approach		246	5.5	0.197	27.2	LOS C	3.9	27.9	0.74	0.71	34.4
East: N11 (E)											
6	L2	13	0.0	0.568	22.9	LOS C	14.3	105.8	0.83	0.73	35.3
5	T1	832	7.0	0.568	22.8	LOS C	14.6	108.6	0.83	0.73	35.4
4	R2	311	17.0	0.831	39.6	LOS D	10.5	84.1	0.92	0.93	31.5
Approach		1156	9.6	0.831	27.3	LOS C	14.6	108.6	0.85	0.78	34.2
North: R555 (N)											
3	L2	106	9.0	0.182	34.1	LOS C	3.3	24.7	0.74	0.78	32.9
2	T1	37	5.0	0.056	21.0	LOS C	1.1	7.8	0.70	0.52	36.7
1	R2	124	9.0	0.344	38.7	LOS D	4.4	33.0	0.82	0.80	30.9
Approach		267	8.5	0.344	34.5	LOS C	4.4	33.0	0.77	0.76	32.4
West: N11 (W)											
12	L2	158	12.0	0.494	27.3	LOS C	11.9	88.1	0.80	0.79	34.6
11	T1	582	2.0	0.494	23.6	LOS C	12.3	87.7	0.79	0.72	35.6
10	R2	65	5.0	0.176	23.9	LOS C	1.4	10.4	0.72	0.76	37.8
Approach		806	4.2	0.494	24.3	LOS C	12.3	88.1	0.79	0.74	35.5
All Vehicles		2474	7.3	0.831	27.1	LOS C	14.6	108.6	0.81	0.76	34.5

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

MOVEMENT SUMMARY

Site: 2020 PM Excluding

Intersection of R555 and N11
Signals - Fixed Time Cycle Time = 90 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
9	L2	119	3.0	0.231	30.8	LOS C	4.6	33.2	0.75	0.77	33.2
8	T1	154	6.0	0.231	25.3	LOS C	4.6	33.2	0.75	0.69	34.9
7	R2	13	25.0	0.231	24.2	LOS C	4.4	32.6	0.75	0.67	35.3
Approach		286	5.6	0.231	27.6	LOS C	4.6	33.2	0.75	0.72	34.2
East: N11 (E)											
6	L2	15	0.0	0.696	24.6	LOS C	18.8	138.9	0.89	0.79	34.3
5	T1	965	7.0	0.696	23.9	LOS C	18.8	138.9	0.87	0.77	34.7
4	R2	361	17.0	1.062	93.2	LOS F	20.3	162.8	1.00	1.15	18.2
Approach		1341	9.6	1.062	42.6	LOS D	20.3	162.8	0.91	0.87	27.8
North: R555 (N)											
3	L2	124	9.0	0.212	34.3	LOS C	3.9	29.2	0.75	0.79	32.8
2	T1	42	5.0	0.064	21.1	LOS C	1.2	8.9	0.70	0.53	36.7
1	R2	143	9.0	0.420	40.3	LOS D	5.2	39.6	0.86	0.81	30.2
Approach		309	8.5	0.420	35.3	LOS D	5.2	39.6	0.79	0.76	32.0
West: N11 (W)											
12	L2	184	12.0	0.581	28.3	LOS C	14.7	108.5	0.84	0.81	34.0
11	T1	675	2.0	0.581	24.5	LOS C	14.7	108.5	0.83	0.75	35.0
10	R2	75	5.0	0.227	25.5	LOS C	1.7	12.1	0.79	0.77	36.8
Approach		935	4.2	0.581	25.3	LOS C	14.7	108.5	0.83	0.76	35.0
All Vehicles		2871	7.3	1.062	34.7	LOS C	20.3	162.8	0.85	0.81	30.9

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

MOVEMENT SUMMARY

Site: 2020 PM Including

Intersection of R555 and N11
Signals - Fixed Time Cycle Time = 90 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
9	L2	119	3.0	0.235	30.7	LOS C	4.7	33.9	0.75	0.77	33.2
8	T1	158	6.0	0.235	25.4	LOS C	4.7	33.9	0.75	0.69	34.9
7	R2	13	25.0	0.235	24.2	LOS C	4.4	32.9	0.75	0.67	35.3
Approach		290	5.6	0.235	27.5	LOS C	4.7	33.9	0.75	0.72	34.2
East: N11 (E)											
6	L2	15	0.0	0.696	24.6	LOS C	18.8	139.0	0.89	0.79	34.3
5	T1	965	7.0	0.696	23.9	LOS C	18.8	139.0	0.87	0.77	34.7
4	R2	371	17.0	1.095	105.6	LOS F	22.4	179.9	1.00	1.19	16.5
Approach		1351	9.7	1.095	46.4	LOS D	22.4	179.9	0.91	0.89	26.6
North: R555 (N)											
3	L2	151	9.0	0.257	34.8	LOS C	4.8	36.1	0.76	0.80	32.6
2	T1	52	5.0	0.079	21.2	LOS C	1.5	11.1	0.70	0.54	36.6
1	R2	173	9.0	0.513	41.3	LOS D	6.6	49.6	0.88	0.82	29.8
Approach		376	8.4	0.513	35.9	LOS D	6.6	49.6	0.81	0.77	31.7
West: N11 (W)											
12	L2	190	12.0	0.586	28.5	LOS C	14.8	109.6	0.84	0.81	34.0
11	T1	675	2.0	0.586	24.6	LOS C	14.8	109.6	0.83	0.75	35.0
10	R2	75	5.0	0.227	25.5	LOS C	1.7	12.1	0.79	0.77	36.8
Approach		940	4.3	0.586	25.4	LOS C	14.8	109.6	0.83	0.77	34.9
All Vehicles		2957	7.4	1.095	36.5	LOS D	22.4	179.9	0.86	0.82	30.2

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

Appendix D SIDRA Results: R555 and Access (D1433)

MOVEMENT SUMMARY

Site: 2014 AM Existing

Intersection of R555 and Access to Agri Pan Siding
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access (S)											
9	L2	1	0.0	0.002	13.8	LOS B	0.0	0.0	0.21	0.87	65.5
7	R2	1	0.0	0.002	13.8	LOS B	0.0	0.0	0.21	0.87	65.5
Approach		2	0.0	0.002	13.8	LOS B	0.0	0.0	0.21	0.87	65.5
East: R555 (E)											
6	L2	1	0.0	0.048	0.3	LOS A	0.0	0.0	0.00	-0.08	119.1
5	T1	81	22.5	0.048	0.3	LOS A	0.0	0.0	0.00	-0.08	119.1
Approach		83	22.2	0.048	0.3	NA	0.0	0.0	0.00	-0.08	119.1
West: R555 (W)											
11	T1	124	26.1	0.074	0.4	LOS A	0.4	3.0	0.20	0.01	101.5
10	R2	1	0.0	0.074	0.4	LOS A	0.4	3.0	0.20	0.01	101.5
Approach		126	25.9	0.074	0.4	NA	0.4	3.0	0.20	0.01	101.5
All Vehicles		210	24.2	0.074	0.5	NA	0.4	3.0	0.12	-0.02	107.3

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

MOVEMENT SUMMARY

Site: 2015 AM Excluding

Intersection of R555 and Access to Agri Pan Siding
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access (S)											
9	L2	1	0.0	0.002	13.8	LOS B	0.0	0.0	0.21	0.87	65.5
7	R2	1	0.0	0.002	13.8	LOS B	0.0	0.0	0.21	0.87	65.5
Approach		2	0.0	0.002	13.8	LOS B	0.0	0.0	0.21	0.87	65.5
East: R555 (E)											
6	L2	1	0.0	0.049	0.3	LOS A	0.0	0.0	0.00	-0.08	119.1
5	T1	84	22.5	0.049	0.3	LOS A	0.0	0.0	0.00	-0.08	119.1
Approach		85	22.2	0.049	0.3	NA	0.0	0.0	0.00	-0.08	119.1
West: R555 (W)											
11	T1	128	26.1	0.076	0.4	LOS A	0.4	3.1	0.20	0.01	101.2
10	R2	1	0.0	0.076	0.4	LOS A	0.4	3.1	0.20	0.01	101.2
Approach		129	25.9	0.076	0.4	NA	0.4	3.1	0.20	0.01	101.2
All Vehicles		216	24.2	0.076	0.5	NA	0.4	3.1	0.12	-0.02	107.1

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

MOVEMENT SUMMARY

Site: 2015 AM Including

Intersection of R555 and Access to Agri Pan Siding
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access (S)											
9	L2	18	65.2	0.048	83.9	LOS F	0.2	1.9	0.26	0.88	68.1
7	R2	16	81.7	0.048	83.9	LOS F	0.2	1.9	0.26	0.88	68.1
Approach		34	72.9	0.048	83.9	LOS F	0.2	1.9	0.26	0.88	68.1
East: R555 (E)											
6	L2	17	13.6	0.059	9.9	LOS A	0.0	0.0	0.00	0.47	110.5
5	T1	84	22.5	0.059	9.9	LOS A	0.0	0.0	0.00	0.47	110.5
Approach		101	21.0	0.059	9.9	NA	0.0	0.0	0.00	0.47	110.5
West: R555 (W)											
11	T1	128	26.1	0.109	5.9	LOS A	0.6	4.5	0.23	0.68	89.4
10	R2	56	4.4	0.109	5.9	LOS A	0.6	4.5	0.23	0.68	89.4
Approach		184	19.5	0.109	5.9	NA	0.6	4.5	0.23	0.68	89.4
All Vehicles		319	25.7	0.109	15.5	NA	0.6	4.5	0.16	0.64	92.3

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

MOVEMENT SUMMARY

Site: 2020 AM Excluding

Intersection of R555 and Access to Agri Pan Siding
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access (S)											
9	L2	1	0.0	0.002	13.9	LOS B	0.0	0.0	0.23	0.86	65.4
7	R2	1	0.0	0.002	13.9	LOS B	0.0	0.0	0.23	0.86	65.4
Approach		2	0.0	0.002	13.9	LOS B	0.0	0.0	0.23	0.86	65.4
East: R555 (E)											
6	L2	1	0.0	0.057	0.3	LOS A	0.0	0.0	0.00	-0.07	119.2
5	T1	98	22.5	0.057	0.3	LOS A	0.0	0.0	0.00	-0.07	119.2
Approach		99	22.2	0.057	0.3	NA	0.0	0.0	0.00	-0.07	119.2
West: R555 (W)											
11	T1	148	26.1	0.089	0.5	LOS A	0.4	3.7	0.22	0.01	99.6
10	R2	1	0.0	0.089	0.5	LOS A	0.4	3.7	0.22	0.01	99.6
Approach		149	25.9	0.089	0.5	NA	0.4	3.7	0.22	0.01	99.6
All Vehicles		250	24.2	0.089	0.5	NA	0.4	3.7	0.13	-0.01	106.2

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

SIDRA INTERSECTION 6

MOVEMENT SUMMARY

Site: 2020 AM Including

Intersection of R555 and Access to Agri Pan Siding
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access (S)											
9	L2	18	65.2	0.051	84.3	LOS F	0.2	2.0	0.29	0.88	67.9
7	R2	16	81.7	0.051	84.3	LOS F	0.2	2.0	0.29	0.88	67.9
Approach		34	72.9	0.051	84.3	LOS F	0.2	2.0	0.29	0.88	67.9
East: R555 (E)											
6	L2	17	13.6	0.067	8.7	LOS A	0.0	0.0	0.00	0.46	111.5
5	T1	98	22.5	0.067	8.7	LOS A	0.0	0.0	0.00	0.46	111.5
Approach		115	21.1	0.067	8.7	NA	0.0	0.0	0.00	0.46	111.5
West: R555 (W)											
11	T1	148	26.1	0.122	5.4	LOS A	0.6	5.2	0.25	0.61	89.1
10	R2	56	4.4	0.122	5.4	LOS A	0.6	5.2	0.25	0.61	89.1
Approach		204	20.2	0.122	5.4	NA	0.6	5.2	0.25	0.61	89.1
All Vehicles		353	25.6	0.122	14.1	NA	0.6	5.2	0.17	0.58	92.8

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

MOVEMENT SUMMARY

Site: 2014 PM Existing

Intersection of R555 and Access to Agri Pan Siding
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access (S)											
9	L2	5	79.2	0.007	75.6	LOS F	0.0	0.3	0.30	0.86	68.8
7	R2	1	0.0	0.007	75.6	LOS F	0.0	0.3	0.30	0.86	68.8
Approach		6	65.5	0.007	75.6	LOS F	0.0	0.3	0.30	0.86	68.8
East: R555 (E)											
6	L2	2	51.1	0.081	2.3	LOS A	0.0	0.0	0.00	0.08	119.4
5	T1	138	20.7	0.081	2.3	LOS A	0.0	0.0	0.00	0.08	119.4
Approach		140	21.2	0.081	2.3	NA	0.0	0.0	0.00	0.08	119.4
West: R555 (W)											
11	T1	98	22.5	0.058	0.6	LOS A	0.3	2.4	0.27	0.02	96.4
10	R2	1	0.0	0.058	0.6	LOS A	0.3	2.4	0.27	0.02	96.4
Approach		99	22.2	0.058	0.6	NA	0.3	2.4	0.27	0.02	96.4
All Vehicles		245	22.7	0.081	3.5	NA	0.3	2.4	0.11	0.07	107.2

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

SIDRA INTERSECTION 6

MOVEMENT SUMMARY

Site: 2015 PM Excluding

Intersection of R555 and Access to Agri Pan Siding
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access (S)											
9	L2	5	79.2	0.007	75.6	LOS F	0.0	0.3	0.31	0.86	68.7
7	R2	1	0.0	0.007	75.6	LOS F	0.0	0.3	0.31	0.86	68.7
Approach		6	65.5	0.007	75.6	LOS F	0.0	0.3	0.31	0.86	68.7
East: R555 (E)											
6	L2	2	51.1	0.083	2.2	LOS A	0.0	0.0	0.00	0.07	119.4
5	T1	142	20.7	0.083	2.2	LOS A	0.0	0.0	0.00	0.07	119.4
Approach		144	21.1	0.083	2.2	NA	0.0	0.0	0.00	0.07	119.4
West: R555 (W)											
11	T1	101	22.5	0.060	0.7	LOS A	0.3	2.5	0.27	0.02	96.0
10	R2	1	0.0	0.060	0.7	LOS A	0.3	2.5	0.27	0.02	96.0
Approach		102	22.2	0.060	0.7	NA	0.3	2.5	0.27	0.02	96.0
All Vehicles		253	22.7	0.083	3.4	NA	0.3	2.5	0.12	0.07	107.0

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

MOVEMENT SUMMARY

Site: 2015 PM Including

Intersection of R555 and Access to Agri Pan Siding
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access (S)											
9	L2	65	16.7	0.090	35.8	LOS E	0.3	2.8	0.30	0.88	68.5
7	R2	23	34.1	0.090	35.8	LOS E	0.3	2.8	0.30	0.88	68.5
Approach		87	21.2	0.090	35.8	LOS E	0.3	2.8	0.30	0.88	68.5
East: R555 (E)											
6	L2	10	51.1	0.089	9.4	LOS A	0.0	0.0	0.00	0.21	117.7
5	T1	142	20.7	0.089	9.4	LOS A	0.0	0.0	0.00	0.21	117.7
Approach		152	22.6	0.089	9.4	NA	0.0	0.0	0.00	0.21	117.7
West: R555 (W)											
11	T1	101	22.5	0.075	4.9	LOS A	0.4	3.4	0.30	-5.37	89.3
10	R2	22	20.1	0.075	4.9	LOS A	0.4	3.4	0.30	-5.37	89.3
Approach		123	22.0	0.075	4.9	NA	0.4	3.4	0.30	-5.37	89.3
All Vehicles		363	22.1	0.090	14.3	NA	0.4	3.4	0.17	-1.53	92.1

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

MOVEMENT SUMMARY

Site: 2020 PM Excluding

Intersection of R555 and Access to Agri Pan Siding
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access (S)											
9	L2	5	79.2	0.008	75.8	LOS F	0.0	0.3	0.33	0.85	68.6
7	R2	1	0.0	0.008	75.8	LOS F	0.0	0.3	0.33	0.85	68.6
Approach		6	65.5	0.008	75.8	LOS F	0.0	0.3	0.33	0.85	68.6
East: R555 (E)											
6	L2	2	51.1	0.096	1.9	LOS A	0.0	0.0	0.00	0.07	119.5
5	T1	165	20.7	0.096	1.9	LOS A	0.0	0.0	0.00	0.07	119.5
Approach		167	21.1	0.096	1.9	NA	0.0	0.0	0.00	0.07	119.5
West: R555 (W)											
11	T1	117	22.5	0.069	0.7	LOS A	0.4	2.9	0.30	0.01	94.3
10	R2	1	0.0	0.069	0.7	LOS A	0.4	2.9	0.30	0.01	94.3
Approach		118	22.3	0.069	0.7	NA	0.4	2.9	0.30	0.01	94.3
All Vehicles		291	22.5	0.096	3.0	NA	0.4	2.9	0.13	0.06	106.4

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

MOVEMENT SUMMARY

Site: 2020 PM Including

Intersection of R555 and Access to Agri Pan Siding
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access (S)											
9	L2	66	16.7	0.094	36.0	LOS E	0.4	3.0	0.33	0.88	68.4
7	R2	23	34.1	0.094	36.0	LOS E	0.4	3.0	0.33	0.88	68.4
Approach		89	21.1	0.094	36.0	LOS E	0.4	3.0	0.33	0.88	68.4
East: R555 (E)											
6	L2	11	51.1	0.103	9.1	LOS A	0.0	0.0	0.00	0.21	117.8
5	T1	165	20.7	0.103	9.1	LOS A	0.0	0.0	0.00	0.21	117.8
Approach		175	22.6	0.103	9.1	NA	0.0	0.0	0.00	0.21	117.8
West: R555 (W)											
11	T1	117	22.5	0.085	4.6	LOS A	0.5	4.0	0.33	-4.56	88.1
10	R2	22	20.1	0.085	4.6	LOS A	0.5	4.0	0.33	-4.56	88.1
Approach		139	22.1	0.085	4.6	NA	0.5	4.0	0.33	-4.56	88.1
All Vehicles		403	22.1	0.103	13.4	NA	0.5	4.0	0.19	-1.29	92.6

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

Appendix E SIDRA Results: R555 and R33

MOVEMENT SUMMARY

Site: 2014 AM Existing

Intersection of R555 and R33
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
8	T1	130	22.0	0.080	2.2	LOS A	0.5	3.8	0.22	-4.15	69.4
7	R2	7	33.0	0.080	2.2	LOS A	0.5	3.8	0.22	-4.15	69.4
Approach		136	22.6	0.080	2.2	NA	0.5	3.8	0.22	-4.15	69.4
East: RR33 (E)											
6	L2	4	0.0	0.028	28.1	LOS D	0.1	0.8	0.25	0.89	48.8
4	R2	20	24.0	0.028	28.1	LOS D	0.1	0.8	0.25	0.89	48.8
Approach		24	20.4	0.028	28.1	LOS D	0.1	0.8	0.25	0.89	48.8
North: R555 (N)											
3	L2	24	38.3	0.048	11.7	LOS B	0.0	0.0	0.00	0.85	73.5
2	T1	58	14.2	0.048	11.7	LOS B	0.0	0.0	0.00	0.85	73.5
Approach		82	21.3	0.048	11.7	NA	0.0	0.0	0.00	0.85	73.5
All Vehicles		242	21.9	0.080	8.0	NA	0.5	3.8	0.15	-1.96	67.9

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

MOVEMENT SUMMARY

Site: 2015 AM Excluding

Intersection of R555 and R33
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
8	T1	133	22.0	0.082	2.2	LOS A	0.5	4.0	0.22	-3.14	69.3
7	R2	7	33.0	0.082	2.2	LOS A	0.5	4.0	0.22	-3.14	69.3
Approach		140	22.5	0.082	2.2	NA	0.5	4.0	0.22	-3.14	69.3
East: RR33 (E)											
6	L2	4	0.0	0.030	28.3	LOS D	0.1	0.8	0.26	0.89	48.8
4	R2	22	24.0	0.030	28.3	LOS D	0.1	0.8	0.26	0.89	48.8
Approach		25	20.6	0.030	28.3	LOS D	0.1	0.8	0.26	0.89	48.8
North: R555 (N)											
3	L2	25	38.3	0.050	11.8	LOS B	0.0	0.0	0.00	0.85	73.5
2	T1	60	14.2	0.050	11.8	LOS B	0.0	0.0	0.00	0.85	73.5
Approach		85	21.3	0.050	11.8	NA	0.0	0.0	0.00	0.85	73.5
All Vehicles		250	21.9	0.082	8.1	NA	0.5	4.0	0.15	-1.38	67.8

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

MOVEMENT SUMMARY

Site: 2015 AM Including

Intersection of R555 and R33
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
8	T1	139	22.0	0.086	2.5	LOS A	0.5	4.2	0.25	-150.54	68.3
7	R2	8	33.0	0.086	2.5	LOS A	0.5	4.2	0.25	-150.54	68.3
Approach		147	22.6	0.086	2.5	NA	0.5	4.2	0.25	-150.54	68.3
East: RR33 (E)											
6	L2	5	0.0	0.031	27.8	LOS D	0.1	0.8	0.27	0.89	48.7
4	R2	22	24.0	0.031	27.8	LOS D	0.1	0.8	0.27	0.89	48.7
Approach		27	19.6	0.031	27.8	LOS D	0.1	0.8	0.27	0.89	48.7
North: R555 (N)											
3	L2	25	38.3	0.059	9.9	LOS A	0.0	0.0	0.00	0.88	74.5
2	T1	76	14.2	0.059	9.9	LOS A	0.0	0.0	0.00	0.88	74.5
Approach		101	20.2	0.059	9.9	NA	0.0	0.0	0.00	0.88	74.5
All Vehicles		274	21.4	0.086	7.7	NA	0.5	4.2	0.16	-80.13	67.8

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

MOVEMENT SUMMARY

Site: 2020 AM Excluding

Intersection of R555 and R33
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
8	T1	155	22.0	0.096	2.3	LOS A	0.6	4.7	0.25	-3.16	68.5
7	R2	8	33.0	0.096	2.3	LOS A	0.6	4.7	0.25	-3.16	68.5
Approach		163	22.5	0.096	2.3	NA	0.6	4.7	0.25	-3.16	68.5
East: RR33 (E)											
6	L2	5	0.0	0.035	28.1	LOS D	0.1	0.9	0.27	0.89	48.6
4	R2	24	24.0	0.035	28.1	LOS D	0.1	0.9	0.27	0.89	48.6
Approach		29	20.0	0.035	28.1	LOS D	0.1	0.9	0.27	0.89	48.6
North: R555 (N)											
3	L2	28	38.3	0.057	11.7	LOS B	0.0	0.0	0.00	0.85	73.5
2	T1	68	14.2	0.057	11.7	LOS B	0.0	0.0	0.00	0.85	73.5
Approach		97	21.3	0.057	11.7	NA	0.0	0.0	0.00	0.85	73.5
All Vehicles		288	21.9	0.096	8.0	NA	0.6	4.7	0.17	-1.41	67.4

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

MOVEMENT SUMMARY

Site: 2020 AM Including

Intersection of R555 and R33
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
8	T1	160	22.0	0.099	2.3	LOS A	0.6	5.0	0.27	-2.26	67.7
7	R2	8	33.0	0.099	2.3	LOS A	0.6	5.0	0.27	-2.26	67.7
Approach		168	22.5	0.099	2.3	NA	0.6	5.0	0.27	-2.26	67.7
East: RR33 (E)											
6	L2	5	0.0	0.036	28.3	LOS D	0.1	1.0	0.30	0.89	48.6
4	R2	24	24.0	0.036	28.3	LOS D	0.1	1.0	0.30	0.89	48.6
Approach		29	20.0	0.036	28.3	LOS D	0.1	1.0	0.30	0.89	48.6
North: R555 (N)											
3	L2	28	38.3	0.066	9.9	LOS A	0.0	0.0	0.00	0.88	74.5
2	T1	85	14.2	0.066	9.9	LOS A	0.0	0.0	0.00	0.88	74.5
Approach		114	20.2	0.066	9.9	NA	0.0	0.0	0.00	0.88	74.5
All Vehicles		311	21.4	0.099	7.5	NA	0.6	5.0	0.17	-0.82	67.6

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

MOVEMENT SUMMARY

Site: 2014 PM Existing

Intersection of R555 and R33
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
8	T1	112	11.3	0.066	2.0	LOS A	0.5	3.6	0.33	-0.04	66.5
7	R2	5	50.9	0.066	2.0	LOS A	0.5	3.6	0.33	-0.04	66.5
Approach		116	12.9	0.066	2.0	NA	0.5	3.6	0.33	-0.04	66.5
East: RR33 (E)											
6	L2	10	16.4	0.056	30.5	LOS D	0.2	1.6	0.32	0.89	48.7
4	R2	36	25.9	0.056	30.5	LOS D	0.2	1.6	0.32	0.89	48.7
Approach		46	23.9	0.056	30.5	LOS D	0.2	1.6	0.32	0.89	48.7
North: R555 (N)											
3	L2	35	26.8	0.090	7.3	LOS A	0.0	0.0	0.00	0.76	74.0
2	T1	119	20.8	0.090	7.3	LOS A	0.0	0.0	0.00	0.76	74.0
Approach		153	22.2	0.090	7.3	NA	0.0	0.0	0.00	0.76	74.0
All Vehicles		316	19.0	0.090	8.7	NA	0.5	3.6	0.17	0.49	66.3

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

MOVEMENT SUMMARY

Site: 2015 PM Excluding

Intersection of R555 and R33
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
8	T1	115	11.3	0.068	2.0	LOS A	0.5	3.7	0.33	-0.03	66.3
7	R2	5	50.9	0.068	2.0	LOS A	0.5	3.7	0.33	-0.03	66.3
Approach		120	12.9	0.068	2.0	NA	0.5	3.7	0.33	-0.03	66.3
East: RR33 (E)											
6	L2	10	16.4	0.058	30.6	LOS D	0.2	1.7	0.32	0.89	48.6
4	R2	37	25.9	0.058	30.6	LOS D	0.2	1.7	0.32	0.89	48.6
Approach		47	23.9	0.058	30.6	LOS D	0.2	1.7	0.32	0.89	48.6
North: R555 (N)											
3	L2	36	26.8	0.092	7.3	LOS A	0.0	0.0	0.00	0.76	74.0
2	T1	122	20.8	0.092	7.3	LOS A	0.0	0.0	0.00	0.76	74.0
Approach		158	22.2	0.092	7.3	NA	0.0	0.0	0.00	0.76	74.0
All Vehicles		325	19.0	0.092	8.7	NA	0.5	3.7	0.17	0.49	66.2

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

MOVEMENT SUMMARY

Site: 2015 PM Including

Intersection of R555 and R33
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
8	T1	132	11.3	0.079	2.1	LOS A	0.6	4.3	0.35	-0.04	65.9
7	R2	6	50.9	0.079	2.1	LOS A	0.6	4.3	0.35	-0.04	65.9
Approach		138	13.0	0.079	2.1	NA	0.6	4.3	0.35	-0.04	65.9
East: RR33 (E)											
6	L2	11	16.4	0.061	30.6	LOS D	0.2	1.8	0.34	0.90	48.5
4	R2	37	25.9	0.061	30.6	LOS D	0.2	1.8	0.34	0.90	48.5
Approach		49	23.7	0.061	30.6	LOS D	0.2	1.8	0.34	0.90	48.5
North: R555 (N)											
3	L2	36	26.8	0.097	7.0	LOS A	0.0	0.0	0.00	0.76	74.2
2	T1	129	20.8	0.097	7.0	LOS A	0.0	0.0	0.00	0.76	74.2
Approach		165	22.1	0.097	7.0	NA	0.0	0.0	0.00	0.76	74.2
All Vehicles		352	18.8	0.097	8.3	NA	0.6	4.3	0.18	0.47	66.2

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

MOVEMENT SUMMARY

Site: 2020 PM Excluding

Intersection of R555 and R33
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
8	T1	133	11.3	0.080	2.2	LOS A	0.6	4.5	0.37	-0.03	65.2
7	R2	6	50.9	0.080	2.2	LOS A	0.6	4.5	0.37	-0.03	65.2
Approach		139	13.0	0.080	2.2	NA	0.6	4.5	0.37	-0.03	65.2
East: RR33 (E)											
6	L2	13	16.4	0.071	30.8	LOS D	0.2	2.0	0.35	0.90	48.4
4	R2	42	25.9	0.071	30.8	LOS D	0.2	2.0	0.35	0.90	48.4
Approach		55	23.8	0.071	30.8	LOS D	0.2	2.0	0.35	0.90	48.4
North: R555 (N)											
3	L2	41	26.8	0.107	7.2	LOS A	0.0	0.0	0.00	0.76	74.0
2	T1	142	20.8	0.107	7.2	LOS A	0.0	0.0	0.00	0.76	74.0
Approach		183	22.2	0.107	7.2	NA	0.0	0.0	0.00	0.76	74.0
All Vehicles		377	19.0	0.107	8.8	NA	0.6	4.5	0.19	0.49	65.8

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

MOVEMENT SUMMARY

Site: 2020 PM Including

Intersection of R555 and R33
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R555 (S)											
8	T1	151	11.3	0.090	2.4	LOS A	0.7	5.2	0.38	-0.04	64.8
7	R2	7	50.9	0.090	2.4	LOS A	0.7	5.2	0.38	-0.04	64.8
Approach		158	13.1	0.090	2.4	NA	0.7	5.2	0.38	-0.04	64.8
East: RR33 (E)											
6	L2	13	16.4	0.073	31.0	LOS D	0.2	2.1	0.37	0.90	48.3
4	R2	42	25.9	0.073	31.0	LOS D	0.2	2.1	0.37	0.90	48.3
Approach		55	23.8	0.073	31.0	LOS D	0.2	2.1	0.37	0.90	48.3
North: R555 (N)											
3	L2	41	26.8	0.111	6.9	LOS A	0.0	0.0	0.00	0.76	74.3
2	T1	149	20.8	0.111	6.9	LOS A	0.0	0.0	0.00	0.76	74.3
Approach		190	22.1	0.111	6.9	NA	0.0	0.0	0.00	0.76	74.3
All Vehicles		403	18.8	0.111	8.4	NA	0.7	5.2	0.20	0.47	65.8

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

Appendix F Generic Road Maintenance Management Proposal

RIETVLEI OPENCAST COAL MINE

ROAD MAINTENANCE MANAGEMENT PROPOSAL

1. INTRODUCTION

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

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

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

2. ROAD MANAGEMENT

2.1 Management Duties and Inspections

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

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

Road Elements	Frequency of Inspections
1. Signs	Annually
2. Road markings	Annually
3. Guardrails	Weekly
4. Structures	Annually
5. Road condition	Annually
6. Drainage	Monthly

7. Instabilities	Dependent of degree of problem
8. Fencing	Monthly
9. Illegal signage	Weekly

2.2 Pavement Information (Structure and Condition)

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

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

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

2.3 Maintenance Rates and Quantities

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

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

3. PRIORITIES

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

The three main objectives of routine road maintenance are to:

- Provide a safe and acceptable level of service for the travelling public;

- Maintain the condition of the road such that maximum life is obtained from the road; and
- Ensure that the road environment is attractive.

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

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

4. GENERAL ROAD PAVEMENT REPAIRS

4.1 Materials

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

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

4.2 Repair of Road Failures

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

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

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

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

The actions required are described under the following headings:

- **Failures:** surfacing failures, potholes, and pavement failures;

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

5. ROAD RESERVE MANAGEMENT

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

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

6. TRAFFIC DATA

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

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