MUNSIEVILLE HOUSING DEVELOPMENT, KRUGERSDORP

TRAFFIC IMPACT ASSESSMENT

2016/08/29

ARONA
Consulting and Engineering (PTY) LTD

Oarona Quality Management

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1. Introduction

1.1 Purpose of Study

Oarona Consulting and Engineering (Pty) Ltd has been appointed by Uvuko Civils Maintenance and Construction as traffic engineers to conduct Traffic Impact Assessment for 'mixed-used' development. The development will consist of a **residential** and **shopping centre**.

This study investigates the traffic impact on the road network to determine whether there is a need to implement any roads or intersection improvements to mitigate and accommodate the anticipated (background traffic, future background traffic, proposed development traffic and latent rights traffic volumes) traffic impact. The study further looks at:

i. Traffic surveys and data collection;
ii. Trip distribution and assignment of latent rights traffic;
iii. Public transport;
iv. Access management;
v. Non-Motorised Transport; and
vi. Other traffic and transport matters related to the proposed development.

1.2 Site Location

The roads for traffic impact assessment falls under the jurisdiction of Mogale City Local Municipality, Gauteng (see **Figure 1-1**). The proposed development is bounded by the following roads:

- R563 to the east; and
- Residential Developments all around.

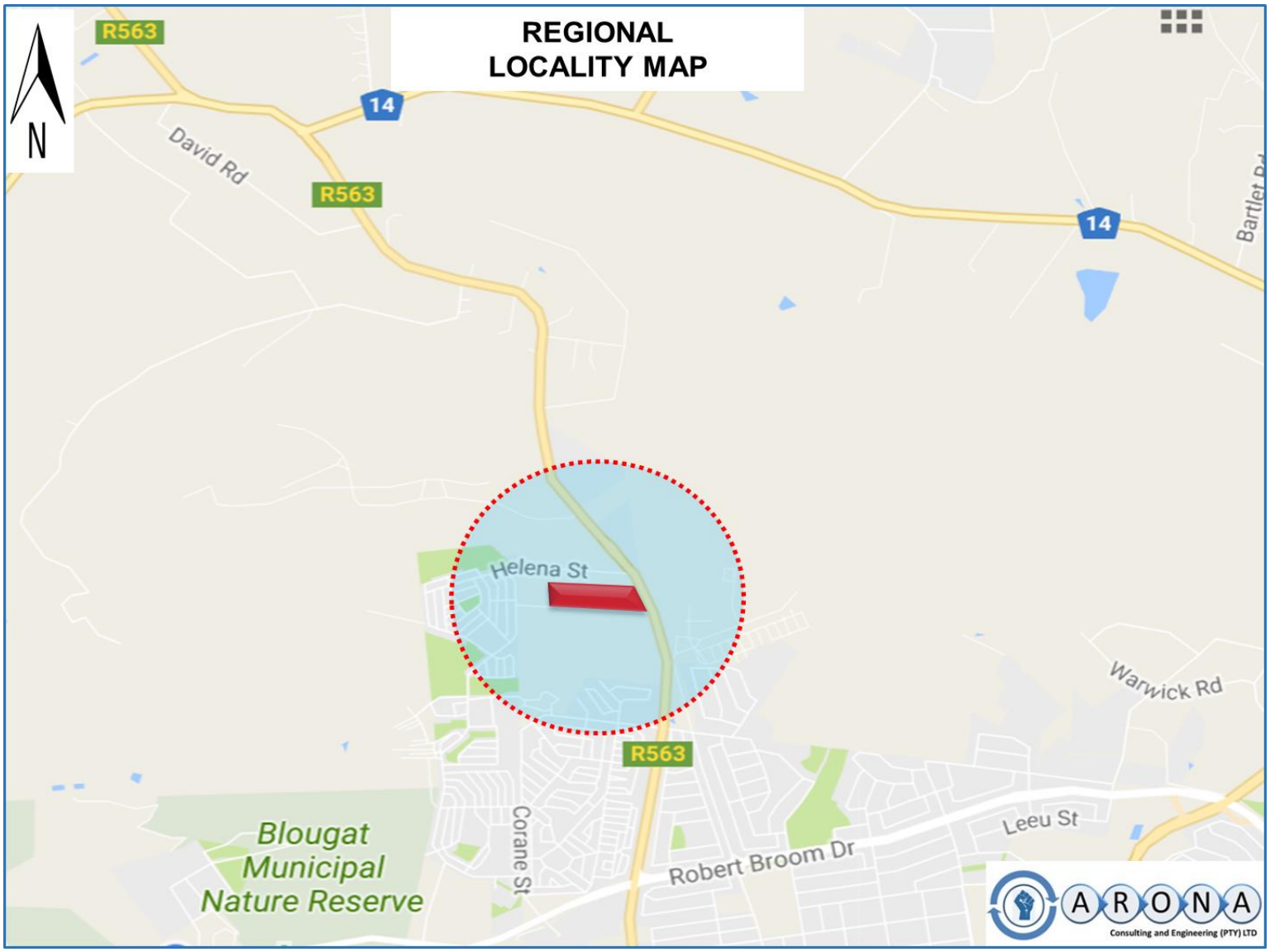
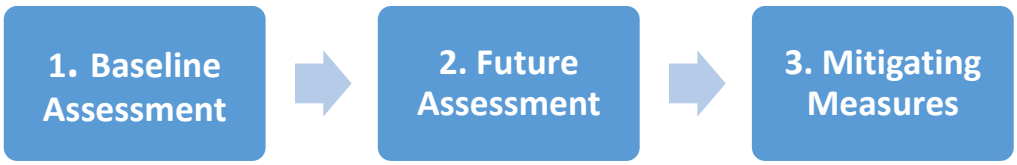


Figure 1-1: Study area

Source: Google Maps

1.3 Traffic Impact Assessment Methodology

The process for the TIA followed was as follows:



Baseline Assessment:

The baseline assessment included the following tasks:

- Identify the road network inventory (number of lanes, intersection layouts, intersection controls, etc.);
- Status quo investigation of the existing road network (the existing traffic conditions and the existing road geometric characteristics). As part of this task, 12-hour classified traffic surveys were carried out on 19 August 2016 to investigate the existing traffic conditions; and
- Identification of the assessment variables relevant to this study.

Future Assessment

As stipulated in the "***TMH 16, South African Traffic Impact and Site Traffic Assessment Manual, August 2012, Volume 1 and 2***", developments which generate trips between 150 and 2000 peak hour trips, it is necessary to escalate the existing traffic volumes to a future base year, using at least a 5-year horizon. This scenario will focus on the proposed development's generated traffic volumes plus future background traffic volumes.

Mitigating Measures:

This phase of the traffic impact assessment entailed the investigation of mitigating measures to reduce the potential adverse traffic impact given the current traffic conditions, future traffic conditions and latent rights (if applicable) traffic volumes.

1.4 Access Management

Regional access to the proposed development will be gained via N14. Local access will be gained using R563 (Van Riebeeck Road) and New Development Access Road. The details of access spacing will conform to ***South African Road Classification and Access Management Manual (COTO, 2012)*** for a class 3 and class 5 roads.

The following are direct accesses to the proposed developed:

- Full Access R563; and
- Full Access off Development Access Road.

2. Planned Future Roads

A number of future national and provincial routes are planned in the vicinity of the proposed development. These include PWV8, K17 and K197. These future planned roads are shown in **Figure 2-1.** Some of these planned roads are long term plans which will most probably be implemented during the course of the next decade or so. The application of access to the development along K17 will be addressed under **Section 7 Report** to be submitted to GAUTRANS.

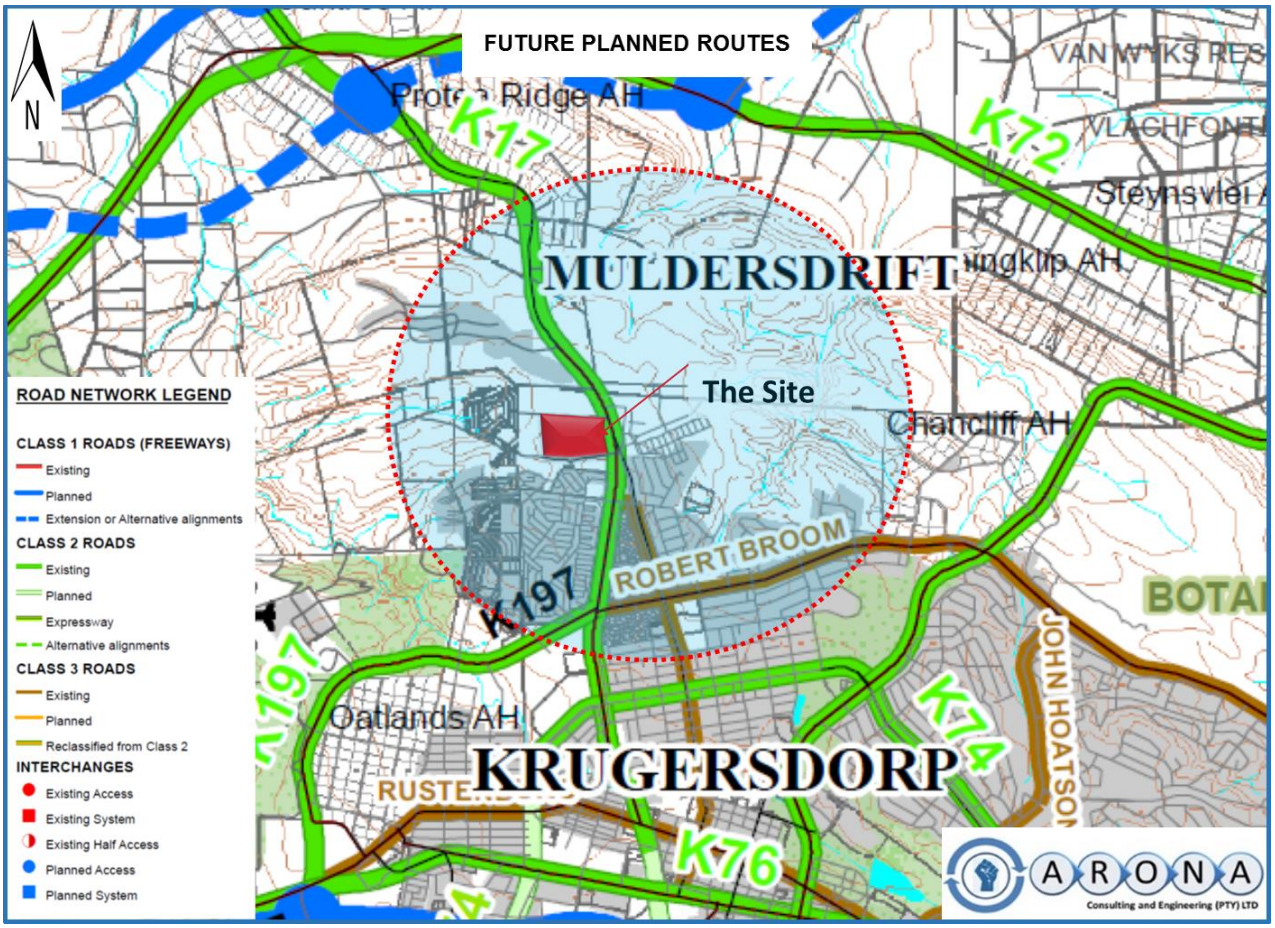


Figure 2-1: Planned future roads

Source: Gauteng Strategic Major Road Network, 2010

3. Proposed Development

The proposed development is located in Munsieville Extension 2 under Mogale City Local Municipality. The land measures approximately 28.73 hectares in extent and is currently divided into 4 portions namely:

- Farm Paardeplaats, 177, PTN 26 – 8.252 hectares.
- •Farm Paardeplaats, 177, PTN 41 – 5.234 hectares.
- •Farm Paardeplaats, 177, PTN 37 – 5.1806 hectares.
- •Farm Paardeplaats, 177, PTN 40 – 10.0743 hectares.

The developer plans to develop 3000 low cost housing and 5000 m^2 shopping centre.

4. Latent Rights Development

There were no latent rights in the vicinity of the proposed development when compiling this report.

5. Traffic Flows

5.1 Existing Traffic Flows

Weekday classified intersection traffic counts were conducted on 19 August 2016 at the following 4 intersections along R563:

1. R563 and Monala Street;
2. Helena Street / Kameelperd Avenue and R563;
3. Clearview Estate Road and R563; and
4. Sterkfontein Hospital Road and R563.

Figure 5-1 shows the traffic counting stations. The AM and PM traffic counts are shown in **Appendix B**.

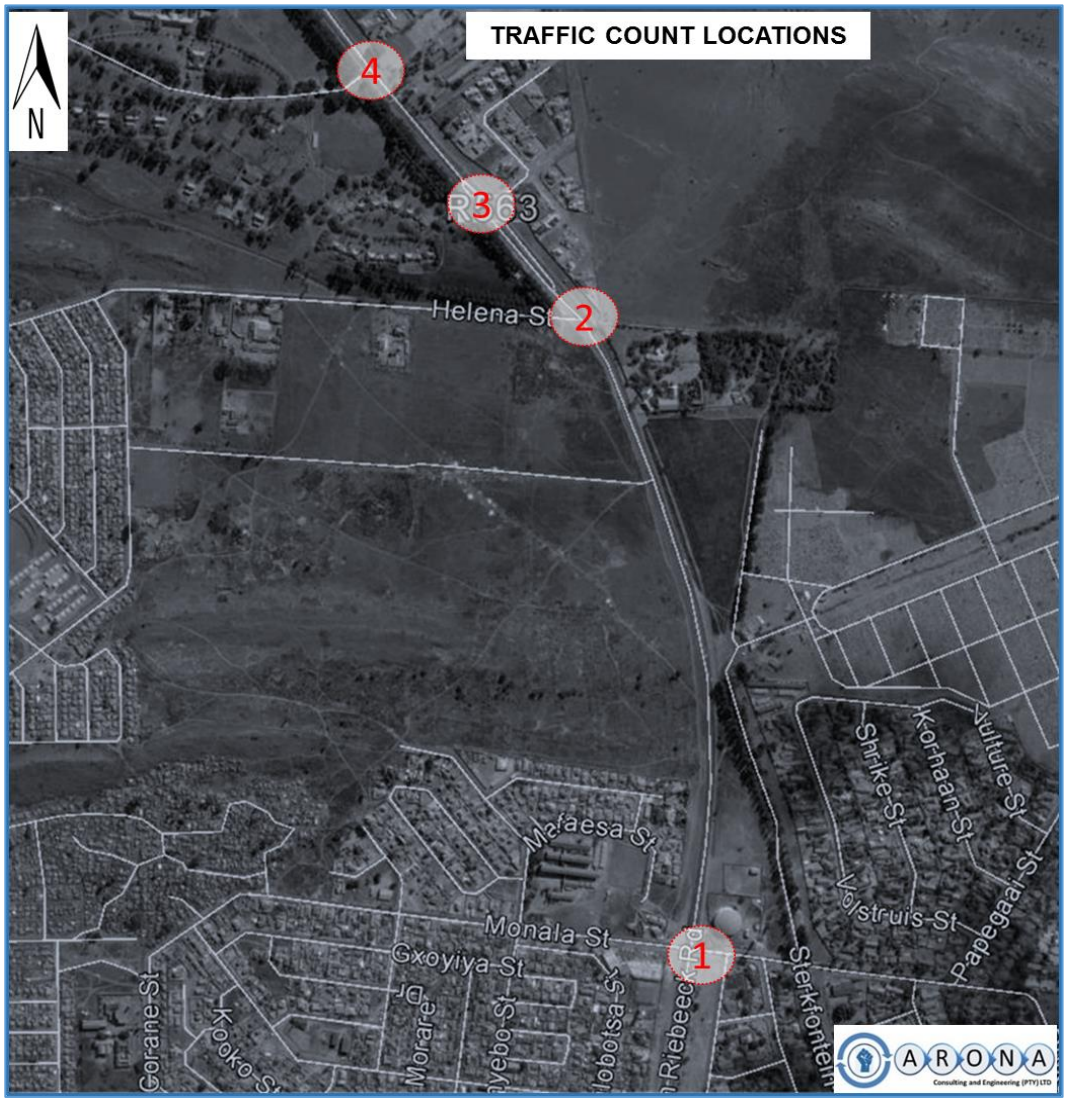


Figure 5-1: Traffic count stations

Source: Google Earth.

5.2 Development Trip Generation

Development trip generation can be defined as the total amount of traffic generated by the development where a trip is considered to be a single movement with either the destination or the origin of the trip ending within the development or outside the development.

The majority population living / residing around the vicinity of the proposed development (Munsieville, etc.) are characterised by low social-economic profile with low income per capita. Most of the people utilises mini-bus taxis to reach their respective destinations. The majority of people visiting proposed development will either walk, use mini-bus taxis or share a ride with someone using a private vehicle. It is therefore apparent that the trip generation characteristics of the proposed development will significantly vary from the traditional medium / high income area.

The trip generation rates detailed and contained in the "***TMH 17, South African Trip Data Manual, September 2012, Volume 1***" and *'**Institute of Transportation Engineers, Trip Generation Handbook, 8th Edition**"* were used as a basis to estimate the trips generated by the proposed developments and adjusted to align with the surrounding demographics and characteristics.

The trip generation rates in the manuals were derived based on the traditional high income areas where there were very low public transport usage and pedestrians amongst residents, employees and shoppers at the urban areas. In this area, it is highly expected that most of the residents, employees and shoppers will use public transport or walk. The trip generation adjustment factors for very low vehicle ownership, mixed-use and transit nodes were applied to the trip rates given the area's socio-economic status (see equation below).

$$P_C = 1 - (1 - P_M) \cdot (1 - P_V) \cdot (1 - P_T)$$

In which:

P_C = Combined reduction factor
P_M = Reduction factor for mixed-use development
P_V = Reduction factor for vehicle ownership
P_T = Reduction factor for transit nodes or corridors

To allow for the shopping centre size adjustment factor, the following equation was used where A equals to 6 and B equals to 3500.

$$\text{Size adjustment factor} = 1 + \frac{A}{1 + \frac{\text{sqm Size}}{B}}$$

A size adjustment factor of **3.47** was used to multiply the default trip rates of the shopping centre as given in the data manual. Furthermore, the following trip type percentages were assumed for the shopping centre:

	Friday	Saturday
Trip Types	**%**	**%**
Primary	28%	20%
Pass-by	13%	12%
Diverted	59%	68%

Primary trips: trips are new on the total road network. This is in contrast with the other types of trips that are already on the road network, although they could be new on segments of the road network. It is expected that the majority of the primary trips will be from the Munsieville and the surrounding area.

Pass-by trips: trips that are attracted from roads directly adjacent to a development and from which direct access is provided to the development. Pass-by trips are not new trips on the road network, but are trips turning in and out of accesses to the development. The trips should therefore not be deducted from the trip generation of the development – it is only the trip distribution that is affected. It is anticipated that most of these trips will be from R563.

Diverted trips: trips that are attracted from roads in the vicinity of the generator but which require a diversion to another road to gain access to the development. Diverted trips add traffic to streets adjacent to a site, but may not add traffic to other roads in the road network. Diverted trips well tend to return to their original route and continue to their original destinations after visiting the development. Given the location of the proposed site and the road network in the vicinity of the site, it is anticipated that these trips will be coming from Robert Broom Drive and Monala Street.

Transferred trips: trips that are already present on the road network and which are visiting similar developments near to the proposed development and which has the potential of transferring or switching their destination to the proposed development. These trips are different from pass-by and diverted trips in that trips are wholly transferred from one development to another. For the analysis purposes, these trips were not considered as there are no shopping malls / centres in the close proximity of the proposed development.

NB: It should be noted that maximum percentage of background traffic volumes which may be included in pass-by or diverted trips is 20%. This guideline was followed when estimating the pass-by and diverted PM peak hour trips as shown in **Appendix B**.

Table 5-1: Proposed development trips.

Size (m²)	*Land Use*	*FAR*	*GLA (m²)*	*UNITS*	*Trip Rate*			*Reduction Factors*				*Total Trips*		
					Friday AM	*Friday PM*	*Saturday*	**Mixed-Use**	**Very Low Vehicle Ownership**	**Transit Nodes & Corridors**	**PC**	*Friday AM*	*Friday PM*	*Saturday*
5 000	Shopping Centre	1.00	5 000		2.08	11.80	15.62	10%	60%	15%	69%	**32**	**51**	**48**
-	Low Cost Apartments	1.00	-	3 000	0.65	0.65	0.35	15%	50%	15%	64%	**704**	**704**	**379**
												736	***755***	***427***

5.3 Trip Distribution and Assignment

The expected trip distribution was assumed on the basis of the proposed site accesses in relation to the road/street network, the existing peak period traffic patterns in and around the proposed development and site observations by the traffic engineer.

Table 5-2 shows the assumed percentage utilisation (traffic ingress and egress) at proposed access during peak hour periods.

Table 5-2: Assumed access utilisation.

Assumed Access % Utilisation		
Access Point	AM	PM
R563	100%	100%

Table 5-3 the assumed trip distributions at the access point of R563.

Table 5-3: Assumed trip distribution at R563.

TRIP DISTRIBUTION % AT R563												
PERIOD	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**
AM	**70%**	0%	0%	0%	0%	**30%**	**25%**	0%	**75%**	0%	0%	0%
PM	**80%**	0%	0%	0%	0%	**20%**	**20%**	0%	**80%**	0%	0%	0%

NB: **60%** = INBOUND

55% = OUTBOUND

6. Traffic Impact and Capacity Analysis

6.1 Definitions of used terminology

The following definitions from the 2010 Highway Capacity Manual (TRB, 2010) are used in this chapter as tabulated in **Table 6-1**.

Table 6-1: Capacity analysis terminology.

Capacity	The maximum sustainable hourly flow rate at which persons or vehicles reasonably can be expected to traverse a point or a uniform section of a lane or roadway during a given time period under prevailing roadway, environmental, traffic and control conditions.
Volume	The total number of vehicles or other roadway users that pass over a given point or section of a lane or roadway during a given time interval, often 1 hour.
Volume to Capacity (v/c) Ratio	The ratio of flow rate to capacity for a system element.
Level of Service (LOS score)	A numerical output from a traveller perception model that typically indicates the average rating that travellers would give a transportation facility or service under a given set of conditions.

6.2 Modelling Software Used

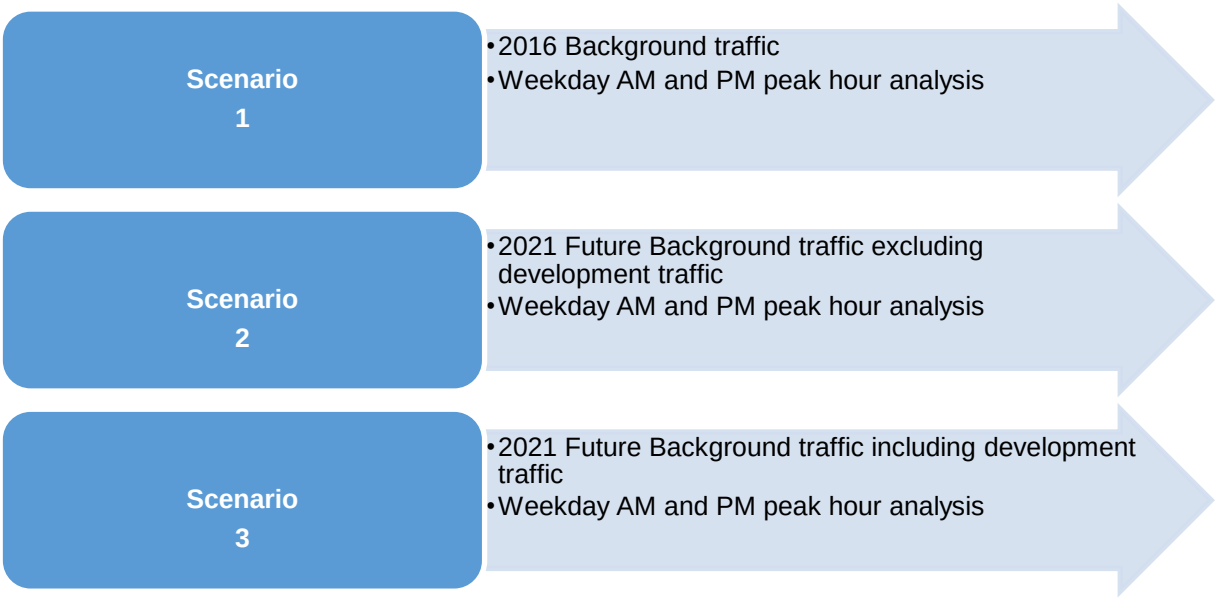
The software SIDRA Intersection version 7.0 was used in analysing the operation and capacity of the intersections under investigation. SIDRA is an advanced micro-analytical traffic evaluation tool that employs lane-by-lane and vehicle drive-cycle models coupled with an iterative approximation method to provide estimates of capacity and performance statistics i.e. delay, queue length, stop rate, etc. (Akcelik & Associates, 2006).
The SIDRA intersection software is for use as an aid for the design and evaluation of the following intersection types:

- Signalised intersections (fixed-time, pre-timed and actuated),
- Signalised pedestrian crossings,
- Single point interchanges (signalised)
- Roundabouts
- Two-way stop control,
- All-way stop control, and
- Give-way (yield) sign control

Although SIDRA is a single intersection analysis package, it can perform traffic signal analysis as an isolated intersection (default) or as a co-ordinated intersection by specifying platooned arrival data. The flexibility of SIDRA allows its application functionality to many other situations, including uninterrupted traffic flow conditions.

6.3 Scenarios considered for impact assessment and analysis

The following scenarios were analysed for this study:



When compiling this report, there were no latent rights in the vicinity of the proposed development.

Scenario 1: This scenario focuses on the micro-simulation results of the 4 intersections where base year traffic counts were conducted.

Scenario 2: As stipulated in the "***TMH 16, South African Traffic Impact and Site Traffic Assessment Manual, August 2012, Volume 1 and 2***", developments which generate trips between 150 and 2000 peak hour trips, it is necessary to escalate the existing traffic volumes to a future base year, using at least a 5-year horizon.

This scenario deals with micro-simulation results of future background traffic volumes on the 4 intersections where traffic counts were conducted for the purpose of this traffic assessment. Future background traffic volumes were obtained by factoring year 2016 traffic volumes by 3% over 5 years.

Scenario 3: This scenario in the report focuses on the analysis of projected traffic volumes in year 2021 by 3% plus trips generated by the proposed development on the road network.

The shopping centre and residential trip generation results show that the critical peak hour periods for the proposed shopping centre and background traffic occurs during the weekday AM and PM peak hour periods. The Saturday peak hour periods were neglected given that the generated trips were relatively low. The following sections only discusses the traffic impact analysis for weekday AM and PM peak hour periods.

6.4 Scenario 1 – 2016 Background Traffic Analysis

This section of the report discusses the micro-simulation results of the 4 intersections where base year traffic counts were conducted.

6.4.1 R563 and Monala Street

The current layout of the intersection is shown in **Figure 6-1**. The intersection is a currently priority controlled junction with four approach legs.

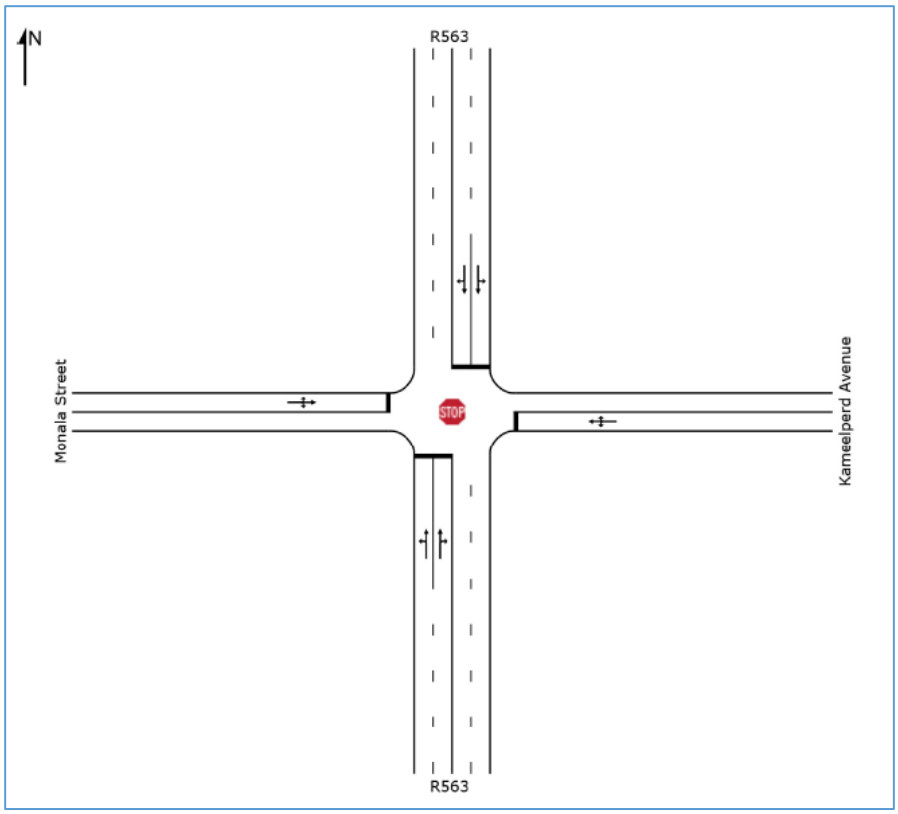


Figure 6-1: Current layout of R563 and Monala Street.

Table 6-2 shows the summary of the level of service for the AM and PM weekday 2016 background traffic analysis at the intersection of R563 and Monala Street. It can be noted that the intersection is operating at **capacity** during both peak hour periods.

Table 6-2: Baseline Assessment LOS results at R563 and Monala Street.

BACKGROUND TRAFFIC VOLUMES:2016														
		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Intersection
AM	LOS	E	E	E	F	F	F	F	F	F	F	F	F	F
PM	LOS	C	C	C	F	F	F	D	D	D	D	D	D	F

6.4.2 Helena Street and R563

The current layout of the intersection is shown in **Figure 6-2**. The intersection is a priority controlled junction with three approach legs. There is major (free-flow) movement along R563 and minor (stop-controlled) movement along Helena Street.

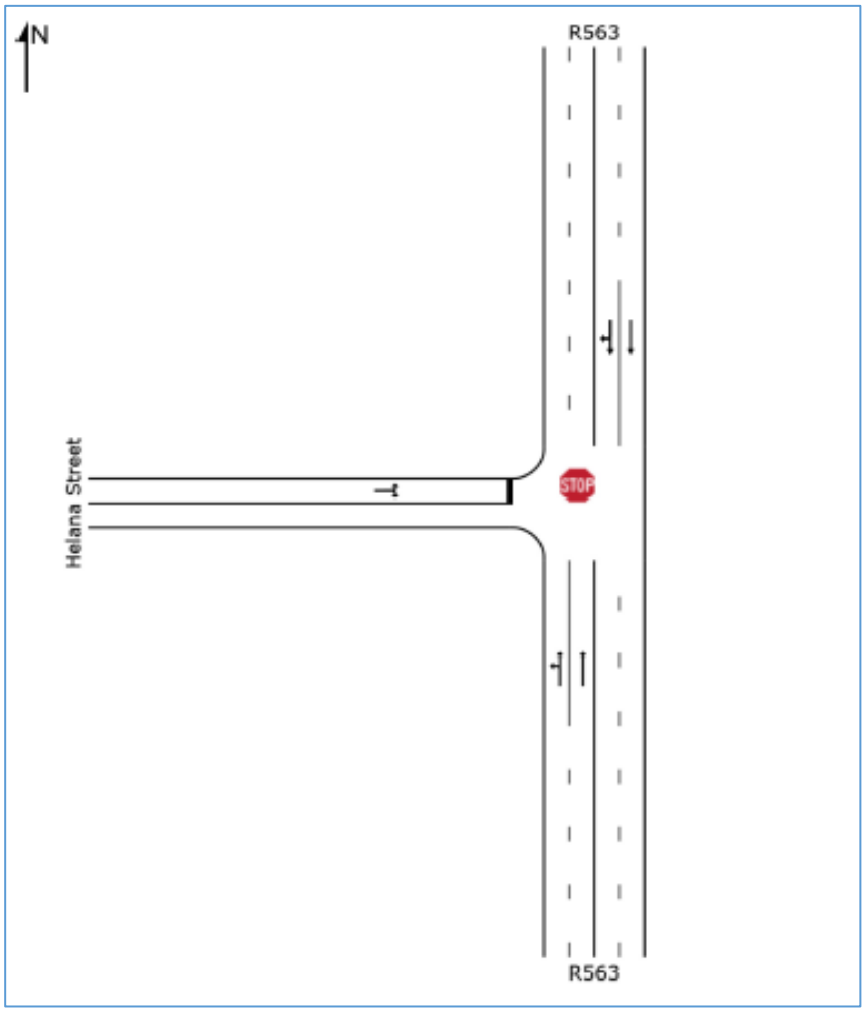


Figure 6-2: Current layout of Helena Street and R563.

Table 6-3 shows the summary of the level of service for the AM and PM weekday 2016 background traffic analysis at the intersection of Helena Street and R563. It can be noted that the intersection is operating at an acceptable level of service in both peak hour periods.

Table 6-3: Baseline Assessment LOS results at Helena Street and R563.

BACKGROUND TRAFFIC VOLUMES:2016								
		NBL	NBT	SBT	SBR	EBL	EBR	Intersection
AM	**LOS**	A	A	A	A	C	C	N/A
PM	**LOS**	A	A	A	A	B	B	N/A

6.4.3 Clearview Estate Road and R563

The current layout of the intersection is shown in **Figure 6-3**. The intersection is a priority controlled junction with three approach legs. There is major (free-flow) movement along R563 and minor (stop-controlled) movement along Clearview Estate Road.

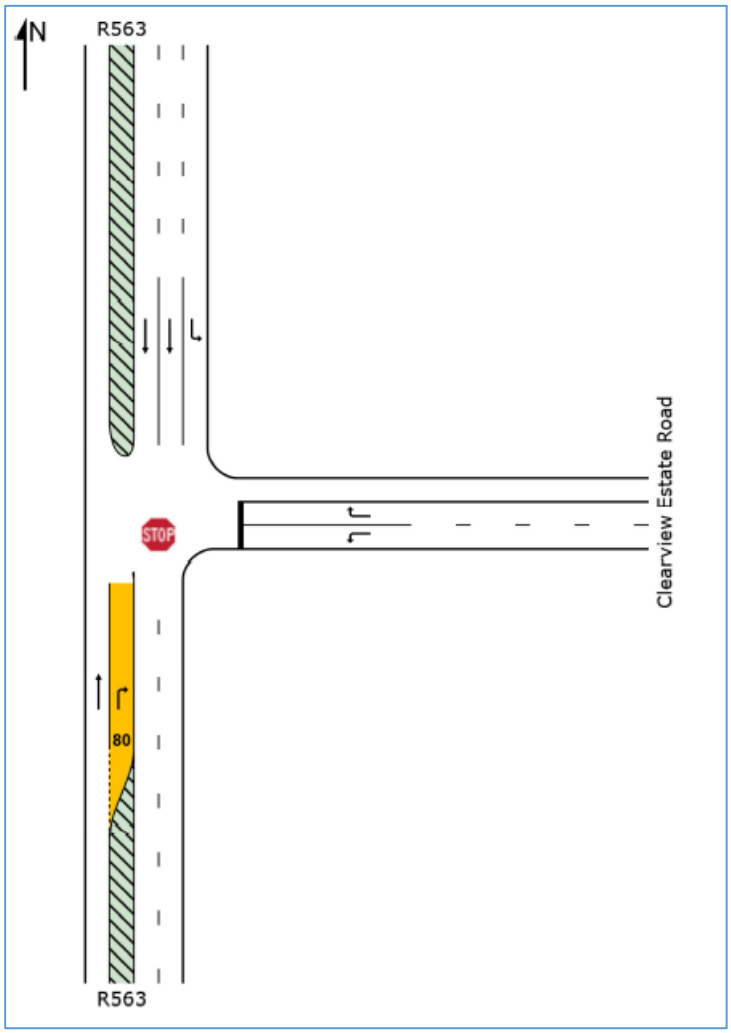


Figure 6-3: Current layout of Clearview Estate Road and R563.

Table 6-4 shows the summary of the level of service for the AM and PM weekday 2016 background traffic analysis at the intersection of Clearview Estate Road and R563. It can be noted that the intersection is operating at an acceptable level of service during both peak hour periods.

Table 6-4: Baseline Assessment LOS results at Clearview Estate Road and R563.

BACKGROUND TRAFFIC VOLUMES:2016								
		NBT	NBR	SBL	SBT	WBL	WBR	Intersection
AM	LOS	A	A	A	A	B	C	N/A
PM	LOS	A	A	A	A	B	B	N/A

6.4.4 Sterkfontein Hospital Road and R563

The current layout of the intersection is shown in **Figure 6-4**. The intersection is a priority controlled junction with three approach legs. There is major (free-flow) movement along R563 and minor (stop-controlled) movement along Sterkfontein Hospital Road.

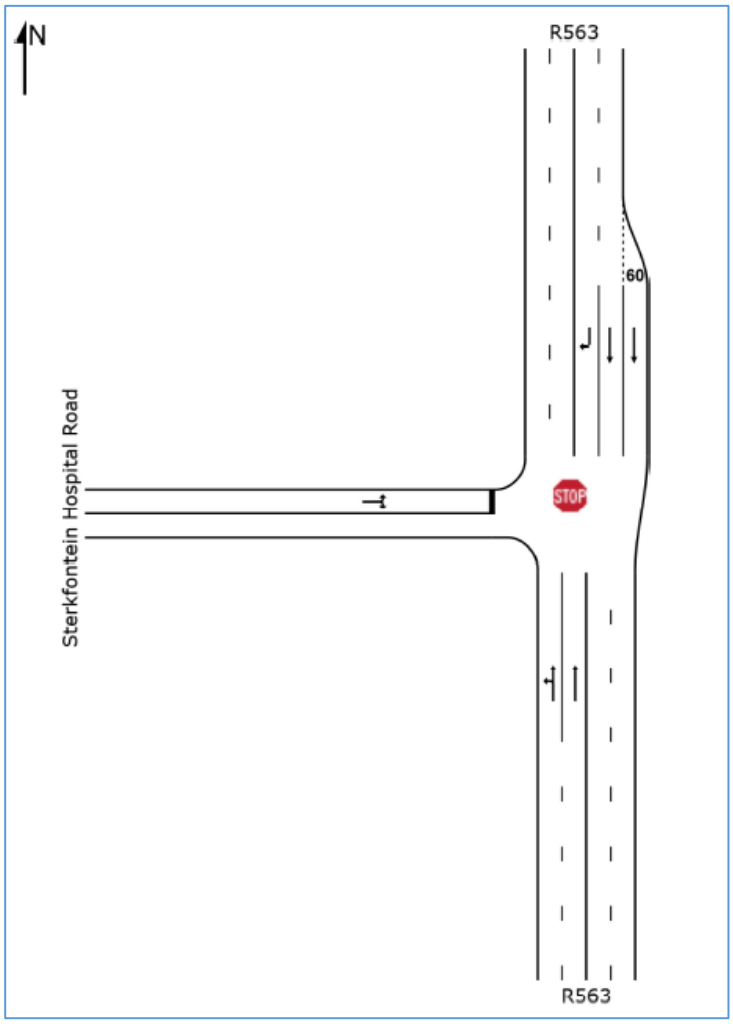


Figure 6-4: Current layout of Sterkfontein Hospital Road and R563.

Table 6-5 shows the summary of the level of service for the AM and PM weekday 2016 background traffic analysis at the intersection of Sterkfontein Hospital Road and R563. It can be noted that the intersection is operating at an acceptable level of service in both peak hour periods.

Table 6-5: Baseline Assessment LOS results at Sterkfontein Hospital Road and R563.

BACKGROUND TRAFFIC VOLUMES:2016								
		NBL	NBT	SBT	SBR	EBL	EBR	Intersection
AM	**LOS**	A	A	A	A	C	C	N/A
PM	**LOS**	A	A	A	A	B	B	N/A

6.5 Scenario 2 – 2021 Future Background Traffic Analysis

As stipulated in the "***TMH 16, South African Traffic Impact and Site Traffic Assessment Manual, August 2012, Volume 1 and 2****",* developments which generate trips between 150 and 2000 peak hour trips, it is necessary to escalate the existing traffic volumes to a future base year, using at least a 5-year horizon.

This section of the report discusses micro-simulation results of future background traffic volumes on the 4 intersections where traffic counts were conducted for the purpose of this traffic assessment. Future background traffic volumes were obtained by factoring year 2016 traffic volumes by 3% over 5 years. The high traffic growth rate can be asserted by the anticipated future traffic growth from the surrounding land (majority is undeveloped).

6.5.1 R563 and Monala Street

The layout of the intersection shown in **Figure 6-1** was used as a basis for traffic impact analysis. The intersection is a currently priority controlled junction with four approach legs.

Table 6-6 shows the summary of the level of service for the AM and PM weekday 2021 future background traffic analysis at the intersection of R563 and Monala Street. It can be noted that the intersection's level of service **worsened** during both peak hour periods.

Table 6-6: Scenario 2 Assessment LOS results at R563 and Monala Street.

FUTURE BACKGROUND TRAFFIC VOLUMES:2021														
		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Intersection
AM	LOS	F	F	F	F	F	F	F	F	F	F	F	F	F
PM	LOS	C	C	C	F	F	F	D	D	D	E	E	E	F

6.5.2 Helena Street and R563

The layout of the intersection shown in **Figure 6-2** was used as a basis for traffic impact analysis. The intersection is a priority controlled junction with three approach legs. There is major (free-flow) movement along R563 and minor (stop-controlled) movement along Helena Street.

Table 6-7 shows the summary of the level of service for the AM and PM weekday 2021 future background traffic analysis at the intersection of Hadebe Street and Mohlala Street. It can be noted that the intersection is still operating at an acceptable level of service in both peak hour periods.

Table 6-7: Scenario 2 Assessment LOS results at Helena Street and R563.

BACKGROUND TRAFFIC VOLUMES:2015								
		NBL	NBR	EBT	EBR	WBL	WBT	Intersection
AM	**LOS**	A	A	A	A	A	A	N/A
PM	**LOS**	A	A	A	A	A	A	N/A

6.5.3 Clearview Estate Road and R563

The layout of the intersection shown in **Figure 6-3** was used as a basis for traffic impact analysis. The intersection is a roundabout junction with three approach legs.

Table 6-8 shows the summary of the level of service for the AM and PM weekday 2021 future background traffic analysis at the intersection of Clearview Estate Road and R563. It can be noted that the intersection is still operating at an acceptable level of service in both peak hour periods.

Table 6-8: Scenario 2 Assessment LOS results at Clearview Estate Road and R563.

BACKGROUND TRAFFIC VOLUMES:2015								
		NBL	NBT	SBT	SBR	EBL	EBR	Intersection
AM	**LOS**	A	A	A	A	B	B	A
PM	**LOS**	A	A	A	A	A	A	A

6.5.4 Sterkfontein Hospital Road and R563

The layout of the intersection shown in **Figure 6-4** was used as a basis for traffic impact analysis. The intersection is a priority controlled junction with three approach legs. There is major (free-flow) movement along R563 and minor (stop-controlled) movement along Sterkfontein Hospital Road.

Table 6-9 shows the summary of the level of service for the AM and PM weekday 2021 future background traffic analysis at the intersection of Sterkfontein Hospital Road and R563. It can be noted that the intersection is still operating at an acceptable level of service in both peak hour periods.

Table 6-9: Scenario 2 Assessment LOS results at Sterkfontein Hospital Road and R563.

FUTURE BACKGROUND TRAFFIC VOLUMES:2021								
		NBL	NBT	SBT	SBR	EBL	EBR	Intersection
AM	**LOS**	A	A	A	A	C	C	N/A
PM	**LOS**	A	A	A	A	B	B	N/A

6.6 Scenario 3 – 2021 Future Background and Development Traffic Analysis

This section of the report focuses on the analysis of projected traffic volumes in year 2021 by 3% plus trips generated by the proposed development on the road network. The findings discussed in **Scenario 2** are used as a basis for the subject analysis. Based on the level of service for the intersections of *Clearview Estate Road* and the one of *Sterkfontein Hospital Road*, it was not necessary to analyse these intersections in this scenario because the development traffic had minimal impact their level of services.

6.6.1 R563 and Monala Street

TRAFFIC SIGNAL WARRANTS:

Traffic signals are the most common and widely accepted forms of traffic controls at intersection junctions. They can be very effective in improving traffic flow and facilitating access if installed appropriately.

Traffic signals are usually perceived to increase traffic flow at intersections but they do not always increase safety or reduce traffic flow delays.

The following traffic signal warrant conditions were considered as indicated in the traffic signal design manual "***South African Road Traffic Signs Manual, Traffic Signal Design, Volume 3, 3rd Edition, 2012***":

- the traffic signals can meet all the minimum requirements described in the subject manual;
- no viable and feasible alternative solution is available which, when implemented, would obviate the need for traffic signals; and
- the traffic signals meet the queue length warrants as described in the manual.

The following traffic signal minimum requirements were met:

- The speed limit on any approach to a signalised junction or pedestrian crossing did not exceed 80km/h;
- The line of sight in all approaches will allow the road users to see the traffic signal faces at the proposed intersection of Monala Street and R563 if converted into a traffic signal controlled junction.

The following queue length warrant was used for the basis of traffic signal installation:

- The average length of ANY individual queue equals or exceeds four (4) over any one hour of a normal day.

An individual queue of vehicles is the queue waiting in a single lane. On multi-lane approaches, each lane of vehicles would be counted as a separate queue. The manual recommends measuring of queue length by either field observations or traffic modelling. SIDRA intersections as detailed in **section 6.2** was used to

determine the current level of service for the ***proposed subject intersection***. There are minor flows (stop-controlled) along R563 and Monala Street. **Figure 6-5** shows the queue length average for the AM baseline (year 2016 analysis) in metres.

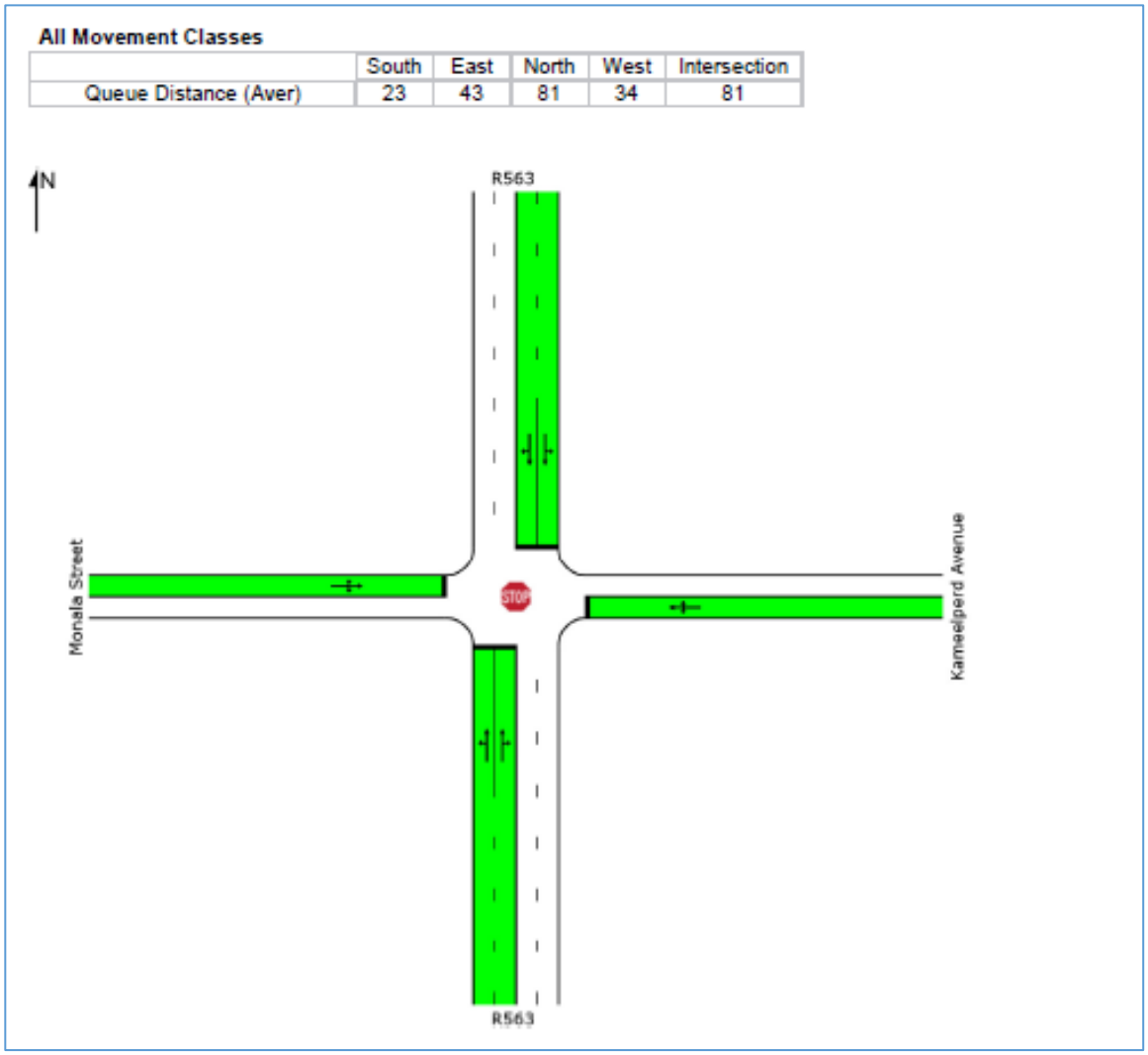


Figure 6-5: Average queue length per lane.

For example, northbound movements have an average queue length of 81m during the AM peak hour period. If one assumes that passenger car unit (pcu) is equivalent to 6m, then the approach has an individual queue of approximately 13.5 vehicles which **warrants a traffic signal configuration at this intersection**.

Post traffic impact analysis of the future background and proposed development traffic volumes, the layout of the intersection shown in **Figure 6-6** is proposed. The intersection is a signal controlled junction with four approach legs. The proposed lanes are highlighted in **RED**. The signal settings were obtained by optimising two-phase 70 seconds circle length (phasing summary is shown in **Appendix D**).

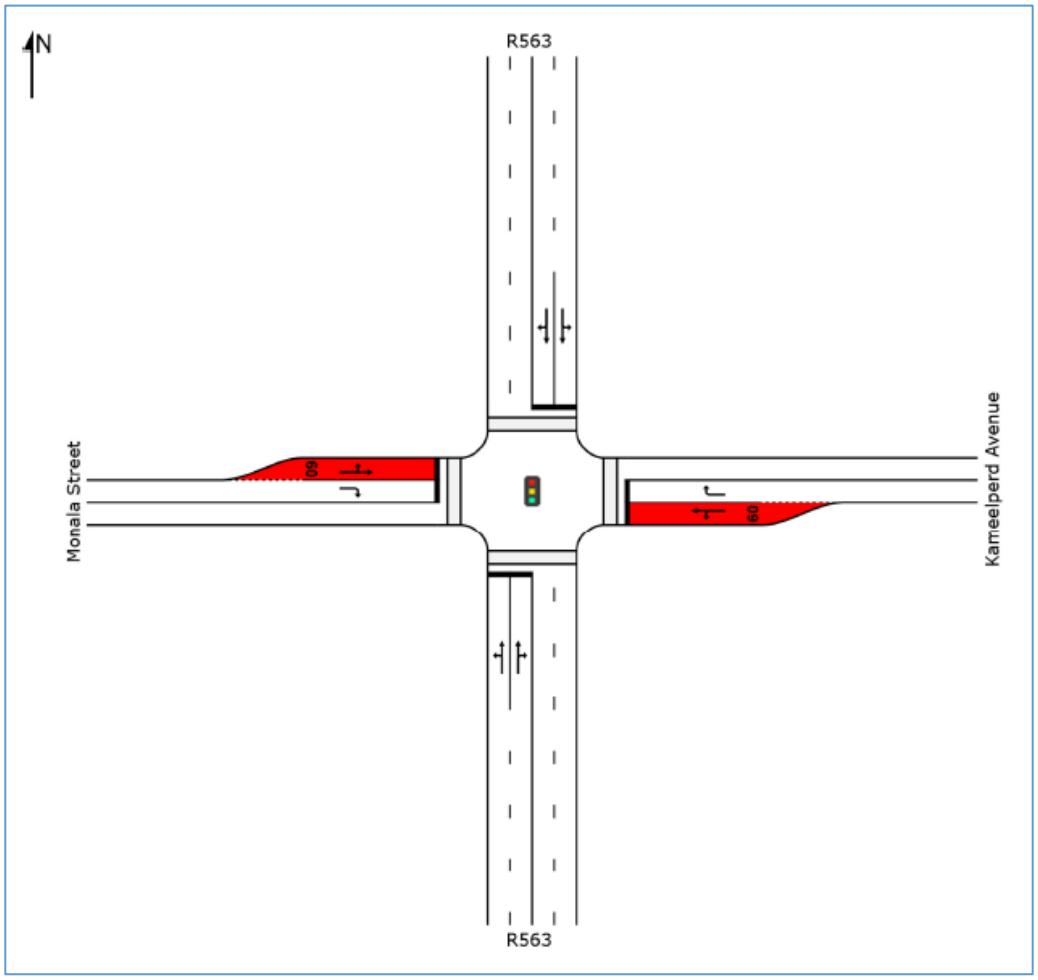


Figure 6-6: Proposed layout of R563 and Monala Street.

As a good design principle for signalised intersection, it is imperative to have **exclusive right-turning lanes**. The eastbound and westbound right-turning lanes were proposed to improve mobility of through traffic movement. It is a common case where one finds that right-turning traffic blocks through traffic movement while waiting for a gap during green time phase.

Table 6-10 shows the summary of the level of service for the AM and PM weekday 2021 future background plus proposed development traffic analysis at the intersection of R563 and Monala Street. It can be noted that the intersection is operating at an acceptable level of service in both peak hour periods.

Table 6-10: Scenario 3 Assessment LOS results at R563 and Monala Street.

FUTURE BACKGROUND AND DEVELOPMENT TRAFFIC VOLUMES:2021														
		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Intersection
AM	LOS	B	B	C	C	C	C	B	B	C	B	B	C	C
PM	LOS	B	B	B	C	C	B	B	B	C	B	B	C	B

6.6.2 Development Access Road and R563

The proposed access layout is as shown in **Figure 6-7**. The intersection is proposed as a signal controlled junction with three approach legs. The traffic signal settings were obtained by optimising a 3-phased 70 seconds circle time. The phasing summary is shown in **Appendix D**.

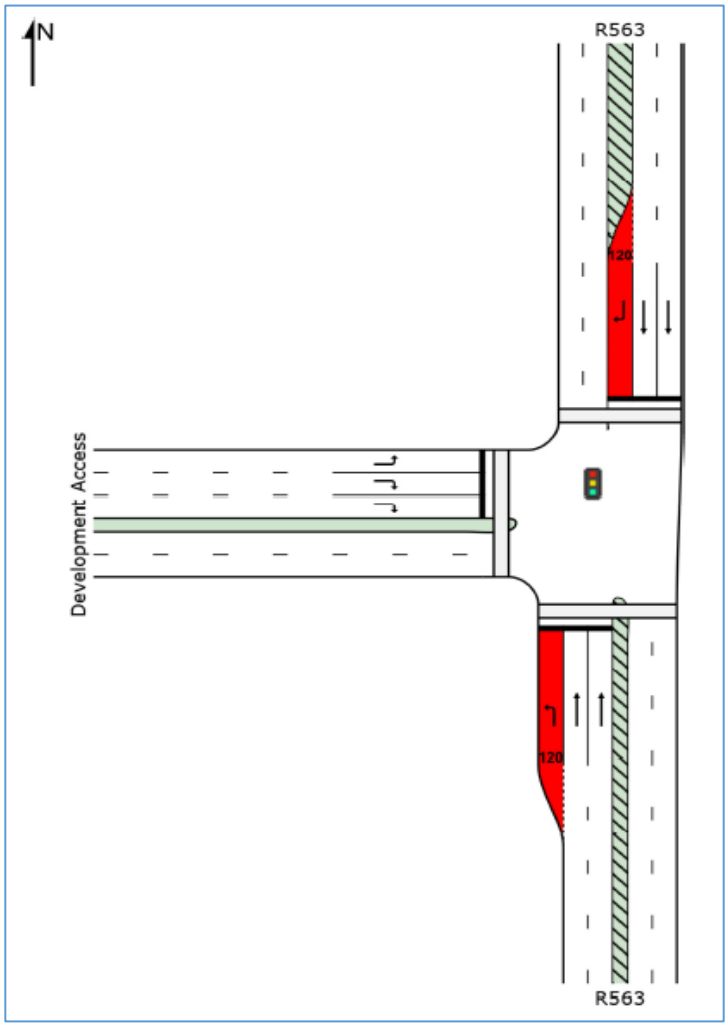


Figure 6-7: Proposed layout of Development Access Road and R563.

Table 6-11 shows the summary of the level of service for the AM and PM weekday 2021 future background plus proposed development traffic analysis at the intersection of Development Access Road and R563. It can be noted that the intersection is operating at an acceptable level of service in both peak hour periods.

Table 6-11: Scenario 3 Assessment LOS results at Development Access Road and R563.

FUTURE BACKGROUND AND DEVELOPMENT TRAFFIC VOLUMES:2021								
		NBL	NBT	SBT	SBR	EBL	EBR	Intersection
AM	LOS	B	B	A	B	C	C	B
PM	LOS	B	A	A	B	C	C	B

6.6.3 Helena Street and R563

The layout of the intersection shown in **Figure 6-2** was used as a basis for traffic impact analysis. The intersection is a priority controlled junction with three approach legs. There is major (free-flow) movement along R563 and minor (stop-controlled) movement along Helena Street.

Table 6-12 shows the summary of the level of service for the AM and PM weekday 2021 future background plus proposed development traffic analysis at the intersection of Helena Street and R563. It can be noted that the intersection is operating at an acceptable level of service in both peak hour periods.

Table 6-12: Scenario 3 Assessment LOS results at Helena Street and R563.

FUTURE BACKGROUND AND DEVELOPMENT TRAFFIC VOLUMES:2021								
		NBL	**NBT**	**SBT**	**SBR**	**EBL**	**EBR**	**Intersection**
AM	**LOS**	A	A	A	A	D	D	N/A
PM	**LOS**	A	A	A	A	D	D	N/A

6.7 Traffic Volume Analysis Results

The previous sections dealt with traffic impact analysis of background traffic volumes and proposed development traffic volumes on the affected intersections and accesses. Detailed output of intersection modelling results are shown in **Appendix D**.

From the traffic demand analysis on the affected intersections, the following upgrades should be considered based on scenario 2 and 3 assessment:

- **R563 and Monala Street**: It is proposed to construct and implement the following:
  - Eastbound shared through- and left-turning lane measuring approximately 60 m;
  - Westbound shared through- and left-turning lane measuring approximately 60 m; and
  - Optimise the traffic two-phase signal settings at 70 seconds cycle length for both the AM and PM peak hour periods respectively.
- **Development Access Road and R563**: It is proposed to construct and implement the following:
  - Eastbound approach leg with 2 right-turning lanes and 1 left-turning lane;
  - Southbound right-turning lane measuring approximately 120 m;
  - Northbound left-turning lane measuring approximately 120 m; and
  - Optimise the traffic three-phase signal settings at 70 seconds cycle length for both the AM and PM peak hour periods respectively.
- **Helena Street and R563**: There are no proposed infrastructure or non-infrastructure upgrades at this intersection.
- **Clearview Estate Road and R563**: There are no proposed infrastructure or non-infrastructure upgrades at this intersection.
- **Sterkfontein Hospital Road and R563**: There are no proposed infrastructure or non-infrastructure upgrades at this intersection.

To improve road mobility and intersection operations, it is recommended to implement the abovementioned proposed infrastructure and non-infrastructure upgrades.

7. Parking Requirements

It should be noted that the proposed development would be located in a typical historically disadvantaged area, which has fundamentally different traffic and parking characteristics to that of shopping centres and residential in traditional high income suburbs. Parking at these areas are normally supplied at a rate of 6 bays/100m^2 of GLA for shopping centres and 1 bay / dwelling unit plus 1 bay for visitors.

For the subject site, a lower parking ratio is applied for since a large portion of employees and shoppers are anticipated to either walk or make use of minibus taxis to visit the proposed development. Munsieville and surrounding township settlements are particularly known for its low socio-economic profile and low household income where only a small portion of the residents / visitors / employees would access the development by means of a private vehicle (very low vehicle ownership).

For the new development, a parking reduction of 50% together with the provision of on-site public transport facility for the shopping centre is applied for, which is in line with the reduced rate accepted by most authorities for such developments in similar areas.

Table 7-1 shows proposed parking requirements resulting in a requirement of 1 650 minimum parking bays. The SDP makes allowance for 1 731 parking bays as shown in **Appendix A**.

Table 7-1: Proposed parking requirements.

	GLA	Units	Parking Rate	Required Parking	Reduction Rate	Proposed Parking
Shopping Centre	5,000	-	6	300	50%	150
Apartments	-	3000	1	3000	50%	1500
			Total	**3300**	-	**1650**

8. Public Transport Assessment

In terms of the National Land Transport Transition Act (NLTTA) 22 of 2000, section 29, it is a requirement that an assessment of the public transport be included in a traffic impact assessment. Public Transport services (i.e. minibus taxis) operate along the Thema Road, Hadebe Street and Vlakfontein Street. There is a need for provision of public transport facilities at the proposed development. Employees and residents of the proposed development will most likely arrive via private vehicles, minibus taxi, bus or walk.

The proposed development will need to take into consideration the provision of non-motorised facilities (walkways, bicycle lock-up facilities, etc.) onsite, public transport facility (on-site waiting, pick-up, drop-off areas) and separate pedestrian gates at the proposed development accesses.

It is proposed to allocate new public transport laybys along R563 as shown in **Appendix E**. The sizing of these laybys conforms to Gautrans' design standards and guidelines.

For the shopping centre parking demand, Oarona opted to calculate the required size based on peak hour public transport demand as guided by ***COTO, TMH16 Volume 2***. **Table 8-1** shows public transport facility estimation for the shopping centre. It is estimated that **4 channels** which are **18 metres** long are required as a minimum public transport facility. The facility sizing is based on Saturday peak hour demand.

Table 8-1: Public transport facility size determination.

Proposed Munsieville Shopping Centre Development: Minibus-Taxi Facility

Trip generation and modal split

	Friday AM Peak Hour			Friday PM Peak Hour			Saturday Peak Hour		
	In	Out	Total	In	Out	Total	In	Out	Total
Trips, vehicles (pcu's)	68	36	104	295	295	590	390	390	781
Trips, persons	135	73	208	590	590	1180	781	781	1562
Person trips, cars	20	11	31	89	89	177	117	117	234
Person trips, taxis	68	36	104	295	295	590	390	390	781
Person trips, NMT	47	26	73	207	207	413	273	273	547
Trips, cars	13	7	20	55	55	111	73	73	146
Trips, taxis	5	2	7	20	20	39	26	26	52
Adj. trips, vehicles (all)	17	9	26	75	75	150	99	99	198

Centre size adj. factor	3.47
A	6
B	3500
GLA (sqm)	5000

Modal Split		Occ
Mode	**Split**	
Light Vehicles	15.0%	1.6
Minibus Taxi	50.0%	15
NMT (Walk & Cycle)	35.0%	1
All	**100.0%**	N/A
Retail trip ave. occupancy incl. driver		2

Taxi rank sizing estimate

Demand	26	vph	Saturday	
PHF	0.95		Estimate	
Adj. design demand	27			
Aprox. Service rate / lane	12	vphpl	based on	5 minutes loading time per taxi
V/C (traffic) ratio	228	%		
N_{Que} (90th% queue, veh) =	3	veh's, for	4	Channels, as per Table 31, COTO TMH 16 Vol. 2
=	18	metres per lane		

9. Conclusions and Recommendations

The following key conclusions and recommendations are relevant as based on the contents of this document:

- This traffic study has assessed the background, future background and proposed development traffic volumes for a proposed development totalling 5 000 m^2 shopping centre 3 000 low cost residential units (apartments).
- It is estimated that the proposed development as a whole would generate approximately 736, 755 and 427 vehicles per hour (in and out movements) during the weekday AM, weekday PM and Saturday peak hour periods respectively. Detailed intersection capacity analysis using SIDRA Intersections has been carried out at the nearby key intersections and critical access points to determine the impact of these trips during the peak hour periods (Friday AM and PM).
- The parking reduction rate of 50% for all other proposed developments on site was applied for to determine the minimum parking bay requirements. The low parking ratio has been motivated on the basis that Munsieville and the surrounding areas have very low socio-economic profile and low income per capita where a small proportion of the employees / visitors / residents would access the proposed development utilising private vehicles. Most of the employees, residents and visitors would either walk or use minibus taxis to access the proposed development. These modes of transport are the most prominent in the township. More details on the parking layout will form part of the final **Site Development Plan**. The current SDP makes a provision for approximately 1 731 parking bays which are deemed to be adequate to meet the development parking demand.
- It is proposed that a public transport facility be constructed on-site to accommodate anticipated high volumes of minibus taxis visiting the shopping centre. The size of the public transport facility was calculated to be 18 m long 4 channels as sized in **section 8** above.
- **R563 and Monala Street**: It is recommended to construct and implement the following:
    - Eastbound shared through- and left-turning lane measuring approximately 60 m;
    - Westbound shared through- and left-turning lane measuring approximately 60 m; and
    - Optimise the traffic two-phase signal settings at 70 seconds cycle length for both the AM and PM peak hour periods respectively.
- **Development Access Road and R563**: It is recommended to construct and implement the following:
    - Eastbound approach leg with 2 right-turning lanes and 1 left-turning lane;
    - Southbound right-turning lane measuring approximately 120 m;
    - Northbound left-turning lane measuring approximately 120 m; and
    - Optimise the traffic three-phase signal settings at 70 seconds cycle length for both the AM and PM peak hour periods respectively.
- **Helena Street and R563**: There are no proposed infrastructure or non-infrastructure upgrades at this intersection.
- **Clearview Estate Road and R563**: There are no proposed infrastructure or non-infrastructure upgrades at this intersection.
- **Sterkfontein Hospital Road and R563**: There are no proposed infrastructure or non-infrastructure upgrades at this intersection.

This report is submitted that the proposed development be supported from traffic engineering perspective, provided that the proposed road / intersection improvements and upgrades, non-motorised facilities and any additional public transport facilities are implemented to the relevant design standards of the local and provincial road authorities.

Appendices

APPENDIX A – Site Development Plan

APPENDIX B – Background and Future Traffic Volumes

APPENDIX C – Trip Distribution and Trip Assignment

APPENDIX D – Sidra Output Results

2016 BACKGROUND TRAFFIC VOLUMES
2021 FUTURE BACKGROUND TRAFFIC VOLUMES
2021 FUTURE BACKGROUND PLUS DEVELOPMENT TRAFFIC VOLUMES

2016 BACKGROUND TRAFFIC VOLUMES

2016 AM – R563 and Monala Street

MOVEMENT SUMMARY

Site: 101 [AM R563 and Monala Street]

AM R563 and Monala Street
Stop (All-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	48	0.0	0.755	36.7	LOS E	5.5	38.4	1.00	1.75	37.8
2	T1	440	0.0	0.755	37.6	LOS E	5.5	38.4	1.00	1.75	37.1
3	R2	20	0.0	0.755	39.0	LOS E	5.4	38.0	1.00	1.74	36.7
Approach		508	0.0	0.755	37.5	LOS E	5.5	38.4	1.00	1.75	37.2
East: Kameelperd Avenue											
4	L2	26	0.0	0.914	55.4	LOS F	10.2	71.5	1.00	2.27	31.5
5	T1	29	0.0	0.914	55.5	LOS F	10.2	71.5	1.00	2.27	31.5
6	R2	353	0.0	0.914	55.2	LOS F	10.2	71.5	1.00	2.27	31.4
Approach		408	0.0	0.914	55.2	LOS F	10.2	71.5	1.00	2.27	31.4
North: R563											
7	L2	351	0.0	1.139	124.2	LOS F	19.3	134.9	1.00	3.05	19.8
8	T1	337	0.0	1.139	127.0	LOS F	19.3	134.9	1.00	2.93	19.4
9	R2	27	0.0	1.139	127.3	LOS F	18.2	127.2	1.00	2.92	19.4
Approach		715	0.0	1.139	125.6	LOS F	19.3	134.9	1.00	2.99	19.6
West: Monala Street											
10	L2	43	0.0	0.922	95.4	LOS F	8.2	57.4	1.00	1.96	23.4
11	T1	89	0.0	0.922	95.5	LOS F	8.2	57.4	1.00	1.96	23.4
12	R2	50	0.0	0.922	95.1	LOS F	8.2	57.4	1.00	1.96	23.4
Approach		182	0.0	0.922	95.4	LOS F	8.2	57.4	1.00	1.96	23.4
All Vehicles		1813	0.0	1.139	82.1	LOS F	19.3	134.9	1.00	2.38	25.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2016 PM – R563 and Monala Street

MOVEMENT SUMMARY

Site: 101 [PM R563 and Monala Street]

PM R563 and Monala Street
Stop (All-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	28	0.0	0.336	17.2	LOS C	1.4	9.6	0.96	1.34	47.2
2	T1	169	0.0	0.336	17.2	LOS C	1.4	9.6	0.97	1.34	46.8
3	R2	12	0.0	0.336	17.7	LOS C	1.4	9.6	0.98	1.34	46.7
Approach		209	0.0	0.336	17.2	LOS C	1.4	9.6	0.97	1.34	46.9
East: Kameelperd Avenue											
4	L2	25	0.0	0.759	32.7	LOS D	5.7	40.2	1.00	1.80	39.2
5	T1	90	0.0	0.759	32.8	LOS D	5.7	40.2	1.00	1.80	39.2
6	R2	261	0.0	0.759	32.4	LOS D	5.7	40.2	1.00	1.80	39.1
Approach		376	0.0	0.759	32.5	LOS D	5.7	40.2	1.00	1.80	39.2
North: R563											
7	L2	316	0.0	1.007	82.8	LOS F	13.0	91.1	1.00	2.50	25.5
8	T1	305	0.0	1.007	85.1	LOS F	13.0	91.1	1.00	2.45	25.0
9	R2	32	0.0	1.007	85.5	LOS F	12.6	87.9	1.00	2.44	25.0
Approach		653	0.0	1.007	84.0	LOS F	13.0	91.1	1.00	2.48	25.2
West: Monala Street											
10	L2	21	0.0	0.411	26.7	LOS D	1.8	12.7	0.99	1.37	41.9
11	T1	66	0.0	0.411	26.8	LOS D	1.8	12.7	0.99	1.37	41.9
12	R2	33	0.0	0.411	26.5	LOS D	1.8	12.7	0.99	1.37	41.7
Approach		120	0.0	0.411	26.7	LOS D	1.8	12.7	0.99	1.37	41.8
All Vehicles		1358	0.0	1.007	54.4	LOS F	13.0	91.1	0.99	2.02	31.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2016 AM – R563 and Helena Street

MOVEMENT SUMMARY

Site: 101 [AM Helana Street and R563]

AM Helana Street and R563
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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	45	0.0	0.215	5.6	LOS A	0.0	0.0	0.00	0.06	57.8
2	T1	791	0.0	0.215	0.0	LOS A	0.0	0.0	0.00	0.03	59.7
Approach		836	0.0	0.215	0.3	NA	0.0	0.0	0.00	0.03	59.6
North: R563											
8	T1	638	0.0	0.173	0.3	LOS A	0.3	1.9	0.04	0.01	59.6
9	R2	11	0.0	0.173	11.8	LOS B	0.3	1.9	0.09	0.02	57.2
Approach		649	0.0	0.173	0.5	NA	0.3	1.9	0.04	0.01	59.5
West: Helana Street											
10	L2	25	0.0	0.331	12.0	LOS B	1.3	9.1	0.79	1.01	42.9
12	R2	66	0.0	0.331	28.6	LOS D	1.3	9.1	0.79	1.01	42.8
Approach		91	0.0	0.331	24.0	LOS C	1.3	9.1	0.79	1.01	42.8
All Vehicles		1576	0.0	0.331	1.8	NA	1.3	9.1	0.06	0.08	58.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2016 PM – R563 and Helena Street

MOVEMENT SUMMARY

Site: 101 [PM Helana Street and R563]

PM Helana Street and R563
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: R563											
1	L2	70	0.0	0.117	5.6	LOS A	0.0	0.0	0.00	0.19	56.8
2	T1	381	0.0	0.117	0.0	LOS A	0.0	0.0	0.00	0.08	59.3
Approach		451	0.0	0.117	0.9	NA	0.0	0.0	0.00	0.09	58.9
North: R563											
8	T1	563	0.0	0.163	0.2	LOS A	0.4	2.8	0.07	0.03	59.4
9	R2	33	0.0	0.163	7.9	LOS A	0.4	2.8	0.16	0.08	56.8
Approach		596	0.0	0.163	0.7	NA	0.4	2.8	0.07	0.04	59.2
West: Helana Street											
10	L2	18	0.0	0.148	8.6	LOS A	0.6	3.9	0.52	0.94	48.3
12	R2	57	0.0	0.148	15.9	LOS C	0.6	3.9	0.52	0.94	48.1
Approach		75	0.0	0.148	14.2	LOS B	0.6	3.9	0.52	0.94	48.1
All Vehicles		1122	0.0	0.163	1.7	NA	0.6	3.9	0.07	0.12	58.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2016 AM – R563 and Clearview Estate Road

MOVEMENT SUMMARY

Site: 101 [AM Clearview Estate Road and R563]

AM Clearview Estate Road and R563
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: R563											
2	T1	771	0.0	0.395	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
3	R2	20	0.0	0.033	9.4	LOS A	0.1	0.8	0.53	0.72	50.8
Approach		791	0.0	0.395	0.3	NA	0.1	0.8	0.01	0.02	59.6
East: Clearview Estate Road											
4	L2	40	0.0	0.065	10.4	LOS B	0.2	1.4	0.39	0.92	50.6
6	R2	10	0.0	0.038	16.6	LOS C	0.1	0.5	0.70	1.00	47.1
Approach		50	0.0	0.065	11.7	LOS B	0.2	1.4	0.46	0.93	49.9
North: R563											
7	L2	17	0.0	0.009	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	598	0.0	0.153	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		615	0.0	0.153	0.2	NA	0.0	0.0	0.00	0.02	59.8
All Vehicles		1456	0.0	0.395	0.6	NA	0.2	1.4	0.02	0.05	59.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2016 PM – R563 and Clearview Estate Road

MOVEMENT SUMMARY

Site: 101 [PM Clearview Estate Road and R563]

PM Clearview Estate Road and R563
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: R563											
2	T1	352	0.0	0.181	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
3	R2	29	0.0	0.045	8.9	LOS A	0.2	1.1	0.51	0.71	51.1
Approach		381	0.0	0.181	0.7	NA	0.2	1.1	0.04	0.05	59.2
East: Clearview Estate Road											
4	L2	18	0.0	0.028	10.1	LOS B	0.1	0.6	0.37	0.89	50.8
6	R2	1	0.0	0.002	11.5	LOS B	0.0	0.0	0.47	0.90	50.1
Approach		19	0.0	0.028	10.1	LOS B	0.1	0.6	0.37	0.89	50.8
North: R563											
7	L2	14	0.0	0.008	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	545	0.0	0.140	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		559	0.0	0.140	0.2	NA	0.0	0.0	0.00	0.01	59.8
All Vehicles		959	0.0	0.181	0.6	NA	0.2	1.1	0.02	0.05	59.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2016 AM – R563 and Sterkfontein Hospital Road

MOVEMENT SUMMARY

Site: 101 [AM Sterkfontein Hospital Road and R563]

AM Sterkfontein Hospital Road and R563
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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	31	0.0	0.198	5.6	LOS A	0.0	0.0	0.00	0.05	57.9
2	T1	740	0.0	0.198	0.0	LOS A	0.0	0.0	0.00	0.02	59.7
Approach		771	0.0	0.198	0.2	NA	0.0	0.0	0.00	0.02	59.7
North: R563											
8	T1	581	0.0	0.149	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R2	1	0.0	0.002	9.5	LOS A	0.0	0.0	0.58	0.62	50.4
Approach		582	0.0	0.149	0.0	NA	0.0	0.0	0.00	0.00	60.0
West: Sterkfontein Hospital Road											
10	L2	1	0.0	0.148	10.0	LOS A	0.4	3.1	0.81	1.00	44.3
12	R2	34	0.0	0.148	21.9	LOS C	0.4	3.1	0.81	1.00	44.1
Approach		35	0.0	0.148	21.5	LOS C	0.4	3.1	0.81	1.00	44.1
All Vehicles		1388	0.0	0.198	0.7	NA	0.4	3.1	0.02	0.04	59.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2016 PM – R563 and Sterkfontein Hospital Road

MOVEMENT SUMMARY

Site: 101 [PM Sterkfontein Hospital Road and R563]

PM Sterkfontein Hospital Road and R563
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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	8	0.0	0.090	5.5	LOS A	0.0	0.0	0.00	0.03	58.1
2	T1	344	0.0	0.090	0.0	LOS A	0.0	0.0	0.00	0.01	59.9
Approach		352	0.0	0.090	0.1	NA	0.0	0.0	0.00	0.01	59.8
North: R563											
8	T1	537	0.0	0.138	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R2	3	0.0	0.003	6.9	LOS A	0.0	0.1	0.40	0.56	52.2
Approach		540	0.0	0.138	0.1	NA	0.0	0.1	0.00	0.00	59.9
West: Sterkfontein Hospital Road											
10	L2	6	0.0	0.056	8.8	LOS A	0.2	1.3	0.48	0.96	49.1
12	R2	22	0.0	0.056	13.9	LOS B	0.2	1.3	0.48	0.96	48.9
Approach		28	0.0	0.056	12.8	LOS B	0.2	1.3	0.48	0.96	48.9
All Vehicles		920	0.0	0.138	0.5	NA	0.2	1.3	0.02	0.04	59.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2021 FUTURE BACKGROUND TRAFFIC VOLUMES

2021 AM – R563 and Monala Street

MOVEMENT SUMMARY

Site: 101 [AM R563 and Monala Street]

AM R563 and Monala Street
Stop (All-Way)
Design Life Analysis (Practical Capacity): Results for 5 years

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	55	0.0	0.868	51.1	LOS F[11]	8.1	56.8	1.00	2.03	32.8
2	T1	506	0.0	0.868	52.5	LOS F[11]	8.1	56.8	1.00	2.01	32.2
3	R2	23	0.0	0.868	54.2	LOS F[11]	7.9	55.4	1.00	2.00	31.8
Approach		584	0.0	0.868	52.4	LOS F[11]	8.1	56.8	1.00	2.01	32.3
East: Kameelperd Avenue											
4	L2	30	0.0	1.051	88.3	LOS F[11]	17.3	121.3	1.00	2.99	24.5
5	T1	33	0.0	1.051	88.4	LOS F[11]	17.3	121.3	1.00	2.99	24.6
6	R2	406	0.0	1.051	88.1	LOS F[11]	17.3	121.3	1.00	2.99	24.5
Approach		469	0.0	1.051	88.1	LOS F[11]	17.3	121.3	1.00	2.99	24.5
North: R563											
7	L2	404	0.0	1.310	187.8	LOS F[11]	29.3	205.1	1.00	3.79	14.7
8	T1	388	0.0	1.310	190.2	LOS F[11]	29.3	205.1	1.00	3.59	14.5
9	R2	31	0.0	1.310	190.6	LOS F[11]	27.3	190.9	1.00	3.58	14.5
Approach		822	0.0	1.310	189.1	LOS F[11]	29.3	205.1	1.00	3.69	14.6
West: Monala Street											
10	L2	49	0.0	1.060	132.0	LOS F[11]	11.8	82.8	1.00	2.27	19.0
11	T1	102	0.0	1.060	132.1	LOS F[11]	11.8	82.8	1.00	2.27	19.0
12	R2	57	0.0	1.060	131.7	LOS F[11]	11.8	82.8	1.00	2.27	19.0
Approach		209	0.0	1.060	132.0	LOS F[11]	11.8	82.8	1.00	2.27	19.0
All Vehicles		2085	0.0	1.310	122.3	LOS F[11]	29.3	205.1	1.00	2.92	19.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

11 Level of Service is worse than the Level of Service Target specified in the Parameter Settings dialog.

2021 PM – R563 and Monala Street

MOVEMENT SUMMARY

Site: 101 [PM R563 and Monala Street]

PM R563 and Monala Street
Stop (All-Way)
Design Life Analysis (Practical Capacity): Results for 5 years

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	32	0.0	0.386	18.4	LOS C	1.7	11.6	0.97	1.36	46.5
2	T1	194	0.0	0.386	18.6	LOS C	1.7	11.6	0.97	1.36	46.0
3	R2	14	0.0	0.386	19.1	LOS C	1.7	11.6	0.98	1.36	45.8
Approach		240	0.0	0.386	18.6	LOS C	1.7	11.6	0.97	1.36	46.1
East: Kameelperd Avenue											
4	L2	29	0.0	0.872	45.2	LOS E[11]	8.9	62.1	1.00	2.14	34.6
5	T1	104	0.0	0.872	45.3	LOS E[11]	8.9	62.1	1.00	2.14	34.6
6	R2	300	0.0	0.872	45.0	LOS E[11]	8.9	62.1	1.00	2.14	34.5
Approach		432	0.0	0.872	45.1	LOS E[11]	8.9	62.1	1.00	2.14	34.5
North: R563											
7	L2	363	0.0	1.159	130.0	LOS F[11]	20.7	144.7	1.00	3.17	19.2
8	T1	351	0.0	1.159	132.2	LOS F[11]	20.7	144.7	1.00	3.06	18.9
9	R2	37	0.0	1.159	132.5	LOS F[11]	19.6	137.4	1.00	3.05	18.9
Approach		751	0.0	1.159	131.1	LOS F[11]	20.7	144.7	1.00	3.11	19.0
West: Monala Street											
10	L2	24	0.0	0.473	29.0	LOS D	2.2	15.6	1.00	1.41	40.8
11	T1	76	0.0	0.473	29.1	LOS D	2.2	15.6	1.00	1.41	40.8
12	R2	38	0.0	0.473	28.7	LOS D	2.2	15.6	1.00	1.41	40.7
Approach		138	0.0	0.473	29.0	LOS D	2.2	15.6	1.00	1.41	40.8
All Vehicles		1562	0.0	1.159	80.9	LOS F[11]	20.7	144.7	1.00	2.43	25.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

11 Level of Service is worse than the Level of Service Target specified in the Parameter Settings dialog.

2021 AM – R563 and Helena Street

MOVEMENT SUMMARY

Site: 101 [AM Helana Street and R563]

AM Helana Street and R563
Stop (Two-Way)
Design Life Analysis (Practical Capacity): Results for 5 years

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	52	0.0	0.247	5.6	LOS A	0.0	0.0	0.00	0.06	57.8
2	T1	910	0.0	0.247	0.0	LOS A	0.0	0.0	0.00	0.03	59.7
Approach		961	0.0	0.247	0.3	NA	0.0	0.0	0.00	0.03	59.6
North: R563											
8	T1	734	0.0	0.202	0.4	LOS A	0.4	2.9	0.05	0.01	59.4
9	R2	13	0.0	0.202	13.9	LOS B	0.4	2.9	0.11	0.02	56.9
Approach		746	0.0	0.202	0.6	NA	0.4	2.9	0.05	0.01	59.3
West: Helana Street											
10	L2	29	0.0	0.410	13.3	LOS B	1.5	10.8	0.82	1.04	42.1
12	R2	76	0.0	0.410	30.5	LOS D	1.5	10.8	0.82	1.04	42.0
Approach		105	0.0	0.410	25.7	LOS D	1.5	10.8	0.82	1.04	42.0
All Vehicles		1812	0.0	0.410	1.9	NA	1.5	10.8	0.07	0.08	58.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2021 PM – R563 and Helena Street

MOVEMENT SUMMARY

Site: 101 [PM Helana Street and R563]

PM Helana Street and R563
Stop (Two-Way)
Design Life Analysis (Practical Capacity): Results for 5 years

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	80	0.0	0.134	5.6	LOS A	0.0	0.0	0.00	0.19	56.8
2	T1	438	0.0	0.134	0.0	LOS A	0.0	0.0	0.00	0.08	59.3
Approach		519	0.0	0.134	0.9	NA	0.0	0.0	0.00	0.09	58.9
North: R563											
8	T1	647	0.0	0.189	0.3	LOS A	0.5	3.7	0.08	0.03	59.3
9	R2	38	0.0	0.189	8.5	LOS A	0.5	3.7	0.18	0.08	56.6
Approach		685	0.0	0.189	0.8	NA	0.5	3.7	0.08	0.04	59.1
West: Helana Street											
10	L2	21	0.0	0.209	8.8	LOS A	0.8	5.5	0.60	0.94	47.0
12	R2	66	0.0	0.209	18.8	LOS C	0.8	5.5	0.60	0.94	46.8
Approach		86	0.0	0.209	16.4	LOS C	0.8	5.5	0.60	0.94	46.8
All Vehicles		1290	0.0	0.209	1.9	NA	0.8	5.5	0.08	0.12	58.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2021 AM – R563 and Clearview Estate Road

MOVEMENT SUMMARY

Site: 101 [AM Clearview Estate Road and R563]

AM Clearview Estate Road and R563
Stop (Two-Way)
Design Life Analysis (Practical Capacity): Results for 5 years

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
2	T1	887	0.0	0.455	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
3	R2	23	0.0	0.043	10.3	LOS B	0.1	1.0	0.57	0.77	50.1
Approach		910	0.0	0.455	0.3	NA	0.1	1.0	0.01	0.02	59.6
East: Clearview Estate Road											
4	L2	46	0.0	0.080	11.0	LOS B	0.3	1.8	0.43	0.94	50.3
6	R2	12	0.0	0.058	20.4	LOS C	0.1	0.8	0.78	1.00	45.0
Approach		57	0.0	0.080	12.9	LOS B	0.3	1.8	0.50	0.95	49.1
North: R563											
7	L2	20	0.0	0.011	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	688	0.0	0.176	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		707	0.0	0.176	0.2	NA	0.0	0.0	0.00	0.02	59.8
All Vehicles		1674	0.0	0.455	0.7	NA	0.3	1.8	0.02	0.05	59.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2021 PM – R563 and Clearview Estate Road

MOVEMENT SUMMARY

Site: 101 [PM Clearview Estate Road and R563]

PM Clearview Estate Road and R563
Stop (Two-Way)
Design Life Analysis (Practical Capacity): Results for 5 years

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
2	T1	405	0.0	0.208	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
3	R2	33	0.0	0.058	9.7	LOS A	0.2	1.4	0.54	0.76	50.5
Approach		438	0.0	0.208	0.8	NA	0.2	1.4	0.04	0.06	59.1
East: Clearview Estate Road											
4	L2	21	0.0	0.034	10.5	LOS B	0.1	0.7	0.40	0.90	50.6
6	R2	1	0.0	0.003	12.4	LOS B	0.0	0.0	0.54	0.92	49.5
Approach		22	0.0	0.034	10.6	LOS B	0.1	0.7	0.40	0.90	50.5
North: R563											
7	L2	16	0.0	0.009	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
8	T1	627	0.0	0.161	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		643	0.0	0.161	0.2	NA	0.0	0.0	0.00	0.01	59.8
All Vehicles		1103	0.0	0.208	0.6	NA	0.2	1.4	0.02	0.05	59.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2021 AM – R563 and Sterkfontein Hospital Road

MOVEMENT SUMMARY

Site: 101 [AM Sterkfontein Hospital Road and R563]

AM Sterkfontein Hospital Road and R563
Stop (Two-Way)
Design Life Analysis (Practical Capacity): Results for 5 years

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	36	0.0	0.228	5.6	LOS A	0.0	0.0	0.00	0.05	57.9
2	T1	851	0.0	0.228	0.0	LOS A	0.0	0.0	0.00	0.02	59.7
Approach		887	0.0	0.228	0.2	NA	0.0	0.0	0.00	0.02	59.7
North: R563											
8	T1	668	0.0	0.171	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R2	1	0.0	0.002	10.7	LOS B	0.0	0.1	0.64	0.66	49.6
Approach		669	0.0	0.171	0.0	NA	0.0	0.1	0.00	0.00	59.9
West: Sterkfontein Hospital Road											
10	L2	1	0.0	0.234	11.8	LOS B	0.7	5.0	0.88	1.02	40.6
12	R2	39	0.0	0.234	29.5	LOS D	0.7	5.0	0.88	1.02	40.5
Approach		40	0.0	0.234	29.0	LOS D	0.7	5.0	0.88	1.02	40.5
All Vehicles		1596	0.0	0.234	0.9	NA	0.7	5.0	0.02	0.04	59.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2021 PM – R563 and Sterkfontein Hospital Road

MOVEMENT SUMMARY

Site: 101 [PM Sterkfontein Hospital Road and R563]

PM Sterkfontein Hospital Road and R563
Stop (Two-Way)
Design Life Analysis (Practical Capacity): Results for 5 years

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	9	0.0	0.104	5.6	LOS A	0.0	0.0	0.00	0.03	58.1
2	T1	396	0.0	0.104	0.0	LOS A	0.0	0.0	0.00	0.01	59.9
Approach		405	0.0	0.104	0.1	NA	0.0	0.0	0.00	0.01	59.8
North: R563											
8	T1	618	0.0	0.158	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R2	3	0.0	0.004	7.1	LOS A	0.0	0.1	0.43	0.57	52.1
Approach		621	0.0	0.158	0.1	NA	0.0	0.1	0.00	0.00	59.9
West: Sterkfontein Hospital Road											
10	L2	7	0.0	0.076	8.9	LOS A	0.2	1.7	0.55	0.95	48.2
12	R2	25	0.0	0.076	15.7	LOS C	0.2	1.7	0.55	0.95	48.0
Approach		32	0.0	0.076	14.3	LOS B	0.2	1.7	0.55	0.95	48.1
All Vehicles		1058	0.0	0.158	0.5	NA	0.2	1.7	0.02	0.04	59.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2021 FUTURE BACKGROUND PLUS DEVELOPMENT TRAFFIC VOLUMES

2021 AM – R563 and Monala Street

MOVEMENT SUMMARY

Site: 101v [AM R563 and Monala Street]

AM R563 and Monala Street
Signals - Fixed Time Isolated Cycle Time = 70 seconds (User-Given Cycle Time)

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: R563											
1	L2	56	0.0	0.281	17.7	LOS B	5.3	37.3	0.65	0.59	48.1
2	T1	306	0.0	0.281	15.4	LOS B	5.3	37.3	0.71	0.62	47.2
3	R2	23	0.0	0.281	27.0	LOS C	3.5	24.6	0.82	0.68	43.0
Approach		385	0.0	0.281	16.4	LOS B	5.3	37.3	0.70	0.62	47.0
East: Kameelperd Avenue											
4	L2	30	0.0	0.094	21.7	LOS C	1.5	10.2	0.70	0.62	44.9
5	T1	34	0.0	0.094	16.1	LOS B	1.5	10.2	0.70	0.62	45.9
6	R2	423	0.0	0.797	34.3	LOS C	15.0	104.8	0.98	0.92	37.6
Approach		487	0.0	0.797	32.3	LOS C	15.0	104.8	0.94	0.88	38.4
North: R563											
7	L2	447	0.0	0.786	24.9	LOS C	21.8	152.6	0.90	0.89	42.7
8	T1	714	0.0	0.786	22.4	LOS C	21.8	152.6	0.93	0.90	43.0
9	R2	72	0.0	0.786	29.5	LOS C	17.8	124.6	0.94	0.91	41.8
Approach		1233	0.0	0.786	23.7	LOS C	21.8	152.6	0.92	0.90	42.8
West: Monala Street											
10	L2	64	0.0	0.244	22.8	LOS C	4.1	28.4	0.74	0.67	44.6
11	T1	103	0.0	0.244	17.2	LOS B	4.1	28.4	0.74	0.67	45.6
12	R2	58	0.0	0.113	22.7	LOS C	1.4	9.6	0.72	0.72	42.7
Approach		225	0.0	0.244	20.2	LOS C	4.1	28.4	0.74	0.68	44.5
All Vehicles		2330	0.0	0.797	24.0	LOS C	21.8	152.6	0.87	0.83	42.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	20.1	LOS C	0.1	0.1	0.76	0.76
P2	East Full Crossing	53	12.6	LOS B	0.1	0.1	0.60	0.60
P3	North Full Crossing	53	20.1	LOS C	0.1	0.1	0.76	0.76
P4	West Full Crossing	53	12.6	LOS B	0.1	0.1	0.60	0.60
All Pedestrians		211	16.4	LOS B			0.68	0.68

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

PHASING SUMMARY

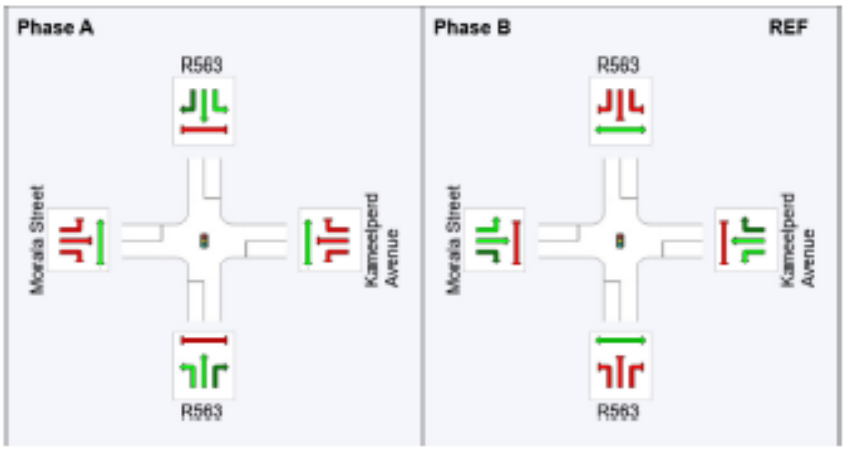
Site: 101v [AM R563 and Monala Street]

AM R563 and Monala Street
Signals - Fixed Time Isolated Cycle Time = 70 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Opposed Turns
Movement Class: All Movement Classes
Input Sequence: A, B
Output Sequence: A, B

Phase Timing Results

Phase	A	B
Reference Phase	No	Yes
Phase Change Time (sec)	31	0
Green Time (sec)	33	25
Yellow Time (sec)	4	4
All-Red Time (sec)	2	2
Phase Time (sec)	39	31
Phase Split	56 %	44 %



2021 PM – R563 and Monala Street

MOVEMENT SUMMARY

Site: 101v [PM R563 and Monala Street]

PM R563 and Monala Street
Signals - Fixed Time Isolated Cycle Time = 70 seconds (User-Given Cycle Time)

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: R563											
1	L2	32	0.0	0.334	20.0	LOS B	6.4	44.6	0.71	0.62	47.0
2	T1	472	0.0	0.334	15.1	LOS B	6.4	44.6	0.72	0.62	47.8
3	R2	14	0.0	0.334	21.4	LOS C	5.7	40.2	0.73	0.63	46.4
Approach		518	0.0	0.334	15.6	LOS B	6.4	44.6	0.72	0.62	47.7
East: Kameelperd Avenue											
4	L2	29	0.0	0.172	20.1	LOS C	2.9	20.5	0.68	0.59	46.6
5	T1	104	0.0	0.172	14.6	LOS B	2.9	20.5	0.68	0.59	47.6
6	R2	344	0.0	0.598	25.8	LOS C	9.8	68.9	0.87	0.83	41.2
Approach		477	0.0	0.598	23.0	LOS C	9.8	68.9	0.82	0.76	42.8
North: R563											
7	L2	382	0.0	0.588	22.2	LOS C	12.5	87.3	0.82	0.80	43.7
8	T1	448	0.0	0.588	17.2	LOS B	12.5	87.3	0.83	0.75	45.9
9	R2	55	0.0	0.588	22.9	LOS C	11.1	77.6	0.83	0.73	45.2
Approach		885	0.0	0.588	19.7	LOS B	12.5	87.3	0.82	0.77	44.9
West: Monala Street											
10	L2	66	0.0	0.188	20.3	LOS C	3.2	22.3	0.68	0.64	45.8
11	T1	77	0.0	0.188	14.7	LOS B	3.2	22.3	0.68	0.64	46.8
12	R2	38	0.0	0.073	21.7	LOS C	0.9	6.1	0.69	0.70	43.2
Approach		181	0.0	0.188	18.2	LOS B	3.2	22.3	0.68	0.66	45.6
All Vehicles		2061	0.0	0.598	19.3	LOS B	12.5	87.3	0.78	0.72	45.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	17.9	LOS B	0.1	0.1	0.72	0.72
P2	East Full Crossing	53	14.5	LOS B	0.1	0.1	0.64	0.64
P3	North Full Crossing	53	17.9	LOS B	0.1	0.1	0.72	0.72
P4	West Full Crossing	53	14.5	LOS B	0.1	0.1	0.64	0.64
All Pedestrians		211	16.2	LOS B			0.68	0.68

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

PHASING SUMMARY

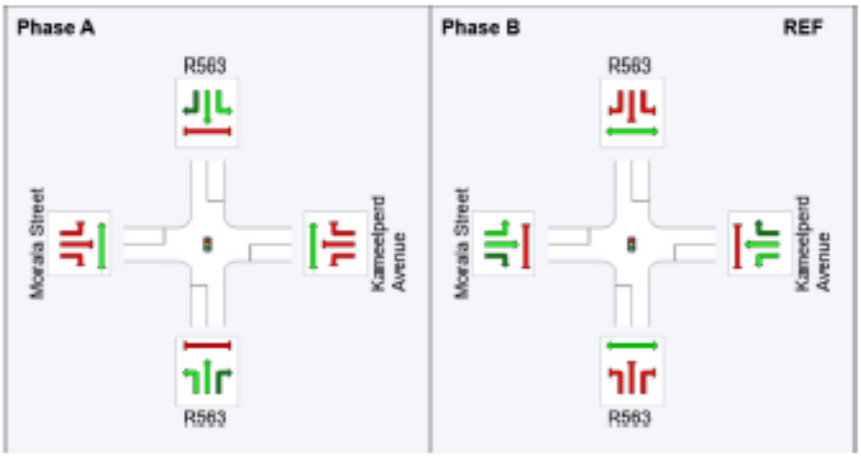
Site: 101v [PM R563 and Monala Street]

PM R563 and Monala Street
Signals - Fixed Time Isolated Cycle Time = 70 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Opposed Turns
Movement Class: All Movement Classes
Input Sequence: A, B
Output Sequence: A, B

Phase Timing Results

Phase	A	B
Reference Phase	No	Yes
Phase Change Time (sec)	34	0
Green Time (sec)	30	28
Yellow Time (sec)	4	4
All-Red Time (sec)	2	2
Phase Time (sec)	36	34
Phase Split	51 %	49 %



2021 AM – R563 and Development Access Road

MOVEMENT SUMMARY

Site: 101 [AM Development Road and R563]

AM Development Road and R563
Signals - Fixed Time Isolated Cycle Time = 70 seconds (User-Given Cycle Time)

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: R563											
1	L2	145	0.0	0.166	16.9	LOS B	2.8	19.9	0.61	0.72	45.9
2	T1	1013	0.0	0.551	14.3	LOS B	12.4	86.9	0.76	0.67	48.6
Approach		1158	0.0	0.551	14.6	LOS B	12.4	86.9	0.74	0.68	48.3
North: R563											
8	T1	873	0.0	0.364	7.2	LOS A	7.4	51.6	0.53	0.47	53.7
9	R2	62	0.0	0.119	14.0	LOS B	0.9	6.4	0.67	0.70	47.9
Approach		935	0.0	0.364	7.6	LOS A	7.4	51.6	0.54	0.48	53.3
West: Development Access											
10	L2	142	0.0	0.357	31.5	LOS C	4.3	29.8	0.89	0.78	38.8
12	R2	426	0.0	0.536	32.8	LOS C	6.7	46.9	0.94	0.81	38.5
Approach		568	0.0	0.536	32.5	LOS C	6.7	46.9	0.93	0.80	38.6
All Vehicles		2661	0.0	0.551	16.0	LOS B	12.4	86.9	0.71	0.64	47.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
P3	North Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	18.6	LOS B	0.1	0.1	0.73	0.73
All Pedestrians		158	25.8	LOS C			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

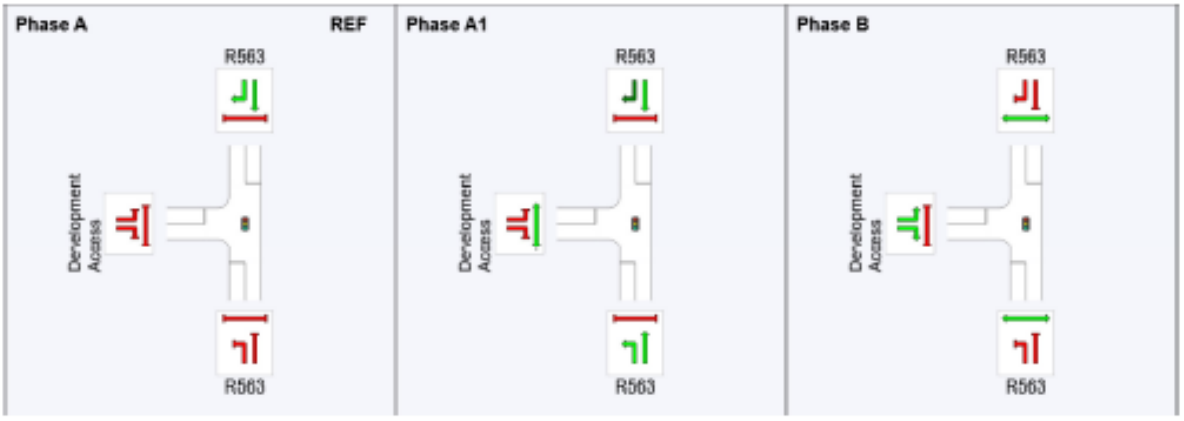
Site: 101 [AM Development Road and R563]

AM Development Road and R563
Signals - Fixed Time Isolated Cycle Time = 70 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Two-Phase
Movement Class: All Movement Classes
Input Sequence: A, A1, B
Output Sequence: A, A1, B

Phase Timing Results

Phase	A	A1	B
Reference Phase	Yes	No	No
Phase Change Time (sec)	0	12	49
Green Time (sec)	6	33	15
Yellow Time (sec)	3	4	4
All-Red Time (sec)	1	2	2
Phase Time (sec)	12	37	21
Phase Split	17 %	53 %	30 %



2021 PM – R563 and Development Access Road

MOVEMENT SUMMARY

Site: 101 [PM Development Road and R563]

PM Development Road and R563
Signals - Fixed Time Isolated Cycle Time = 70 seconds (User-Given Cycle Time)

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: R563											
1	L2	378	0.0	0.385	16.1	LOS B	7.7	53.6	0.63	0.76	46.5
2	T1	569	0.0	0.276	9.8	LOS A	5.4	37.5	0.59	0.50	51.7
Approach		947	0.0	0.385	12.3	LOS B	7.7	53.6	0.61	0.60	49.5
North: R563											
8	T1	797	0.0	0.304	5.1	LOS A	5.6	39.0	0.44	0.39	55.4
9	R2	99	0.0	0.143	11.5	LOS B	1.3	8.9	0.56	0.69	49.6
Approach		896	0.0	0.304	5.8	LOS A	5.6	39.0	0.45	0.42	54.7
West: Development Access											
10	L2	47	0.0	0.162	34.0	LOS C	1.5	10.2	0.90	0.73	37.8
12	R2	134	0.0	0.229	34.5	LOS C	2.1	14.5	0.91	0.75	37.8
Approach		181	0.0	0.229	34.4	LOS C	2.1	14.5	0.91	0.74	37.8
All Vehicles		2024	0.0	0.385	11.4	LOS B	7.7	53.6	0.57	0.53	50.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
P3	North Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	15.8	LOS B	0.1	0.1	0.67	0.67
All Pedestrians		158	24.8	LOS C			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

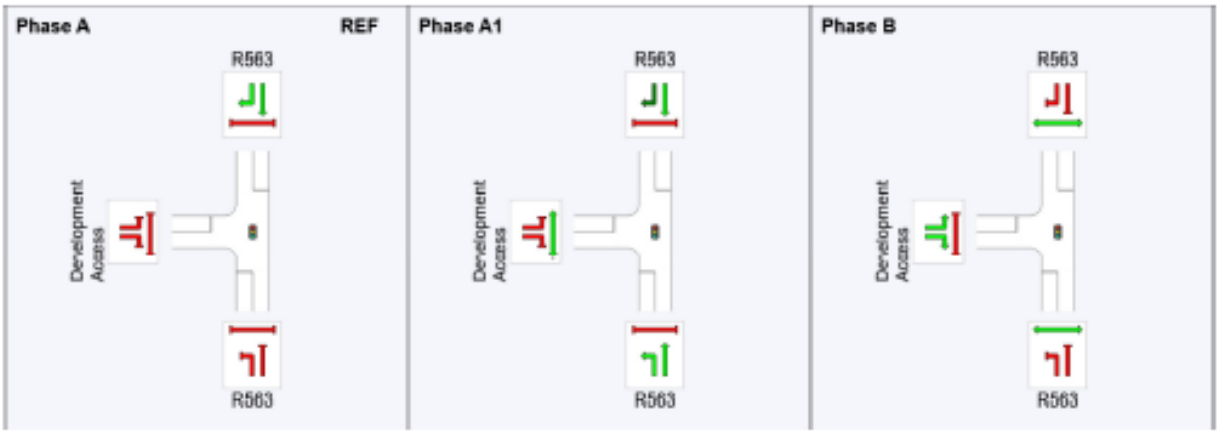
Site: 101 [PM Development Road and R563]

PM Development Road and R563
Signals - Fixed Time Isolated Cycle Time = 70 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Two-Phase
Movement Class: All Movement Classes
Input Sequence: A, A1, B
Output Sequence: A, A1, B

Phase Timing Results

Phase	A	A1	B
Reference Phase	Yes	No	No
Phase Change Time (sec)	0	12	53
Green Time (sec)	6	37	11
Yellow Time (sec)	3	4	4
All-Red Time (sec)	1	2	2
Phase Time (sec)	12	41	17
Phase Split	17 %	59 %	24 %



2021 AM – R563 and Helena Street

MOVEMENT SUMMARY

Site: 101 [AM Helana Street and R563]

AM Helana Street and R563
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: R563											
1	L2	52	0.0	0.284	5.6	LOS A	0.0	0.0	0.00	0.06	57.8
2	T1	1052	0.0	0.284	0.0	LOS A	0.0	0.0	0.00	0.03	59.7
Approach		1104	0.0	0.284	0.3	NA	0.0	0.0	0.00	0.03	59.6
North: R563											
8	T1	799	0.0	0.222	0.6	LOS A	0.6	4.3	0.06	0.01	59.2
9	R2	13	0.0	0.222	16.9	LOS C	0.6	4.3	0.13	0.02	56.4
Approach		812	0.0	0.222	0.9	NA	0.6	4.3	0.06	0.01	59.1
West: Helana Street											
10	L2	29	0.0	0.454	16.0	LOS C	1.9	13.0	0.87	1.07	39.8
12	R2	77	0.0	0.454	36.6	LOS E	1.9	13.0	0.87	1.07	39.7
Approach		106	0.0	0.454	30.9	LOS D	1.9	13.0	0.87	1.07	39.7
All Vehicles		2022	0.0	0.454	2.1	NA	1.9	13.0	0.07	0.08	57.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2021 PM – R563 and Helena Street

MOVEMENT SUMMARY

Site: 101 [PM Helana Street and R563]

PM Helana Street and R563
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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: R563											
1	L2	81	0.0	0.147	5.6	LOS A	0.0	0.0	0.00	0.17	56.9
2	T1	487	0.0	0.147	0.0	LOS A	0.0	0.0	0.00	0.07	59.3
Approach		568	0.0	0.147	0.8	NA	0.0	0.0	0.00	0.08	59.0
North: R563											
8	T1	748	0.0	0.216	0.3	LOS A	0.6	4.1	0.08	0.03	59.3
9	R2	38	0.0	0.216	9.1	LOS A	0.6	4.1	0.17	0.07	56.6
Approach		786	0.0	0.216	0.8	NA	0.6	4.1	0.08	0.03	59.2
West: Helana Street											
10	L2	21	0.0	0.323	11.4	LOS B	1.3	9.4	0.74	0.99	42.2
12	R2	65	0.0	0.323	29.9	LOS D	1.3	9.4	0.74	0.99	42.1
Approach		86	0.0	0.323	25.4	LOS D	1.3	9.4	0.74	0.99	42.1
All Vehicles		1440	0.0	0.323	2.2	NA	1.3	9.4	0.09	0.11	57.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX E – Geometric Layouts

-OPTION 1: Drawings OCE/082/001 to 002
-OPTION 2: Drawings OCE/082/003 to 004

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