Consulting Engineers

Western Cape Government

Stikland South Development Framework

Transport Impact Assessment

7515

August 2025

DOCUMENT VERIFICATION

Title:
Stikland South Development Framework: Transport Impact Assessment

Project No: 7515	**Report No:** REP-7515-200-8006 Rev 00

Date: 18 August 2025	**Report Status:** Draft

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Synopsis: Transport Impact Assessment for the redevelopment of Stikland South

Quality Verification:

Rev	Date	Prepared by	Checked by	Approved by	Description	Status
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1 INTRODUCTION

1.1 Background

Stikland Hospital has been assessed for its redevelopment potential over the past number of years. A number of Development Frameworks were formulated under the auspices of the Western Cape Government, with an iteration at the start of 2025 subjected to scrutiny from a transport perspective. Prior to detailed assessments being undertaken, the views of the Urban Mobility Directorate (TIA & Development Control branch), regarding trip generation assumptions for the envisaged land uses were obtained. Based on this clarification, a revised Development Framework with reduced land uses was put together for Stikland South only, for a comprehensive assessment. This TIA assesses the potential impact of the proposed reduced land use development on traffic operations on the surrounding road network.

Previous reports assessed the potential development of the site, i.e. the Stikland South Transport Contextual Report (Ref 1) and the Transport Baseline Report (Ref 2). This report brings together the findings and considerations of the previous reports, as applied to the latest development concept for the site.

The Stikland South site is bounded by Old Paarl Road (R101) on its north side, an existing residential area (Groen Vallei) to its east, the Kraaifontein railway line to its south, and De la Haye Avenue to its west.

Figure 1: Stikland South Locality Plan

1.2 Collection of Data

1.2.1 Land Use Planning Data

Land use planning data was provided by ARG Architects and Designers, under whose leadership the development framework for the site was developed.

1.2.2 Traffic Data

Traffic data was collected in February 2025 at the following intersections:

- Old Paarl Road/ De la Haye Avenue *
- Old Paarl Road/ Stikland North Access
- Old Paarl Road/ St Harrods Drive *
- Old Paarl Road/ Meerlust Street
- De La Haye Avenue/ Parratus Avenue
- De La Haye Avenue/ Frans Hals Street
- De La Haye Avenue/ Stikland Hospital Access *

Historic traffic data (2011) at some of the above intersections* and an updated 2014 count of the Old Paarl Road/ De la Haye Avenue intersection were obtained from ITS Engineers.

1.2.3 Transport Planning & Traffic Engineering Data

Meetings were held with City of Cape Town officials responsible for road network planning to understand the context of the Stikland site with respect to anticipated future road proposals in its vicinity. This relates to both the upgrading of existing roads, as well as new road links planned in the area.

Engagements were also had with City of Cape Town officials responsible for traffic engineering and control to establish the technical parameters within which the assessment was to be undertaken.

1.3 Development Proposal

As noted above, a number of iterations of the Development Framework were previously prepared. The current concept envisages the development of a portion of the Stikland south site (Refer to Figure 2 overleaf), with the remainder of the site, as well as the redevelopment of Stikland North, held in abeyance for future implementation. The grounds of the existing hospital, within the circular development footprint of the existing buildings, are excluded from this development phase. It follows that development will be mainly focused on the perimeter of the site, located in four distinct precincts, as tabulated in Table 1 below, and depicted in Figure 2 overleaf.

Table 1: Spatial Budget Summary for Proposed Stikland South Development

Precinct	Residential (units)				Retail (m^2 GLA)	Office (m^2 GLA)	Public (m^2 GLA)
	Social	FHF[1]	Open	Total			
P1	289	146	1 073	1 508	24 878	37 325	17 068[2]
P2	0	49	85	134	3 647	3 647	0
P3	0	0	0	0	0	0	0
P4	383	76	227	687	0	0	0
P5	0	141	213	354	0	0	0
Total	**672**	**412**	**1 598**	**2 682**	**28 525**	**40 972**	**17 068**

Notes
1: First Home Finance.
2: Public facilities to comprise a school with 1 000 learners, and a clinic (3 361m^2).

It is clear that the bulk of the development will take place in Precinct 1 (P1), accommodating 56% of the residential stock, virtually the full retail and office allocation, as well as the public facilities (school and clinic). It is located on the most strategic portion of the site, on the south-eastern quadrant of the Old Paarl Road and De La Haye Avenue. Precinct 2 (P2) is to accommodate a minor share of the retail and office bulk, with limited residential units, while Precincts 4 (P4) and 5 (P5) are to accommodate a reasonable share of the residential units.

The development is intended to accommodate a range of housing opportunities, with 25% of the stock allocated to social housing, 15% to First Home Finance (FHF), and 60% to the open market. All the residential units will be accommodated in three to four storey apartment blocks, and will therefore have a distinctly different character to the more suburban orientation of the surrounding residential areas. Apart

from the higher densities, the development as a whole is substantially mixed use, even though some of the smaller precincts are more uniform (residential only or predominantly residential).

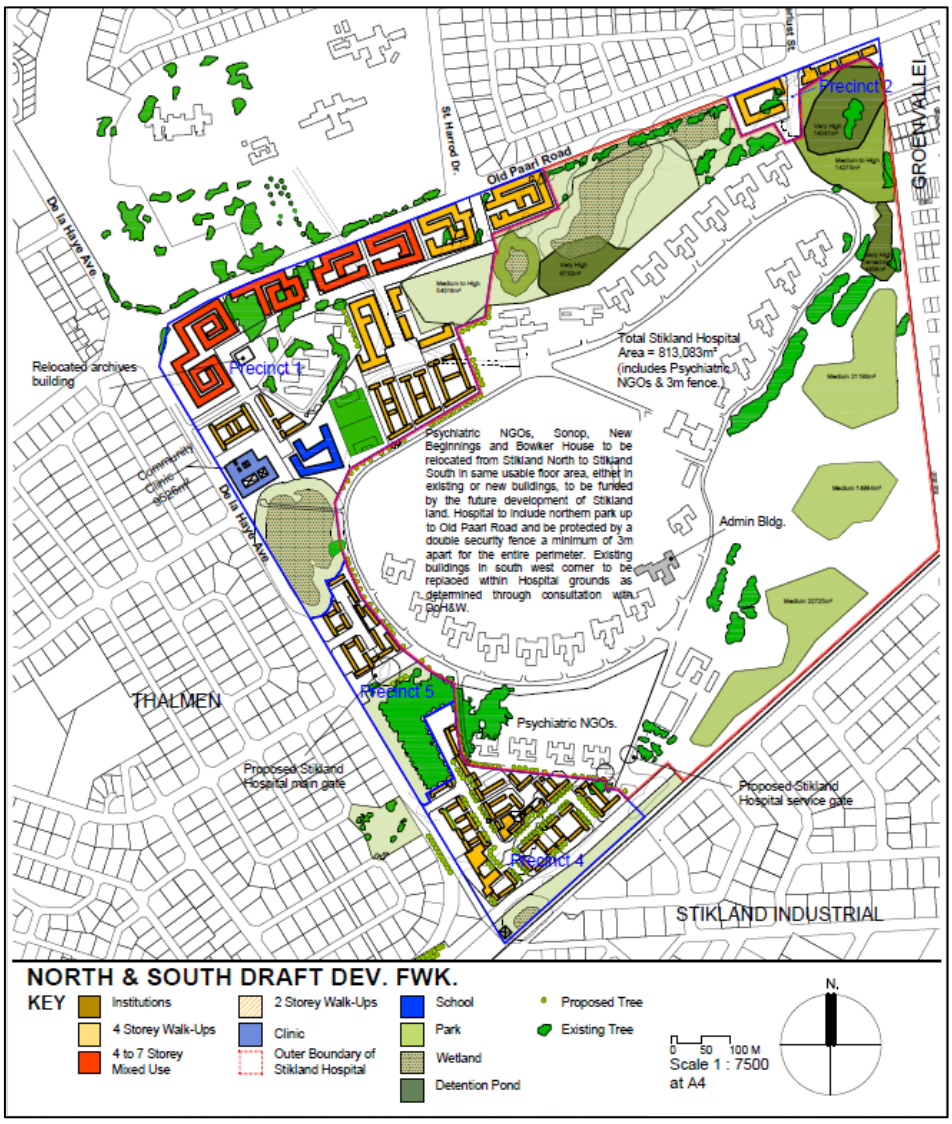


Figure 2: Stikland South Draft Development Framework

1.4 Site Access Proposals

Access to the site is gained at a number of points along Old Paarl Road and De la Haye Avenue, which have been informed by the location of current intersections of roads serving the areas adjacent to the site. The proposed access points are thereby in the main extensions of these roads, which serve to integrate the site with its surroundings.

The following accesses for the identified precincts are proposed (Refer to Figures 2 and 10):

- P1B Access: Links with Old Paarl Road opposite Stikland North Access
- P1C Access: Links with Old Paarl Road opposite St Harrod Drive
- P2 Access: Links with Old Paarl Road opposite Meerlust Street
- P4 Access: Links with De la Haye Avenue to the north of existing Stikland Hospital Access (to be closed)
- P5 Access: Links with De la Haye Avenue opposite Frans Hals Street, also new hospital access
- P1A Access: Links with De la Haye Avenue at existing Nurses' College Access.

The location and functioning of the accesses are discussed in Section 6.

2 EXISTING TRANSPORT SYSTEM

2.1 Existing Traffic Operations

Existing traffic flows along Old Paarl Road and De la Haye Road are indicated in Figure 3 overleaf.

It is instructive to compare existing traffic flows on the road network with historic flows, specifically along Old Paarl Road and De La Haye Avenue. Table 2 below compares the link flows on the road sections on either side of their intersection between 2014 and 2025 (both surveys were conducted in February).

Table 2: Comparison of Historic (2014) and Current (2025) Traffic Flows on Old Paarl Road and De la Haye Avenue

Road	Section	Direction	Peak Hour					
			AM			PM		
			2014	2025	% Ch p.a.	2014	2025	% Ch p.a.
Old Paarl Road	West of De la Haye Avenue	Eastbound	563	570	0.1%	1 515	1 076	-3.1%
		Westbound	1 295	1 078	-1.7%	464	327	-3.1%
Old Paarl Road	East of De la Haye Avenue	Eastbound	708	899	2.2%	1 991	1 644	-1.7%
		Westbound	2 106	1 846	-1.2%	587	525	-1.0%
De la Haye Avenue	South of Old Paarl Road	Northbound	228	254	1.0%	544	541	-0.1%
		Southbound	758	562	-2.7%	152	166	0.8%
De la Haye Avenue	North of Old Paarl Road	Northbound	331	416	2.1%	135	211	4.1%
		Southbound	195	273	3.1%	96	207	7.2%

The following points are highlighted:

- The most striking aspect of the data is the decline in traffic flows in the peak direction of travel along Old Paarl Road, i.e. westbound in the AM peak hour (between -1.2% and -1.7% per annum); and eastbound in the PM peak hour (between -1.7% and -3.1% per annum). This translates into the reductions of between ± 220 and 260 veh/hr (AM) and ± 350 and 440 veh/hr (PM). These are significant reductions over the 11 year period. It is not certain what accounts for the decline, with two possibilities (i) improvements elsewhere on the network, e.g. along the N1 freeway attracting more traffic to it; or (ii) the effects of peak spreading, with congestion suppressing trips during peak hours.

- Along De la Haye Avenue, the changes in the peak direction (southbound in the AM peak hour and northbound in the PM peak hour) were more variable. To the south of Old Paarl Road, flows decreased in the AM (-2.7% per annum), but remained stable in the PM peak hour. To the north of Old Paarl Road, flows increased in both peak hours, albeit off a low base.

It is instructive to observe the distribution of traffic flows across each of the AM and PM peak periods. Figure 3.1 depicts 15 minute flow intervals of the approach flows at the intersection of Old Paarl Road and De la Haye Avenue for the two hour peak periods, between 06h30 and 08h30, and between 16h00 and 18h00.

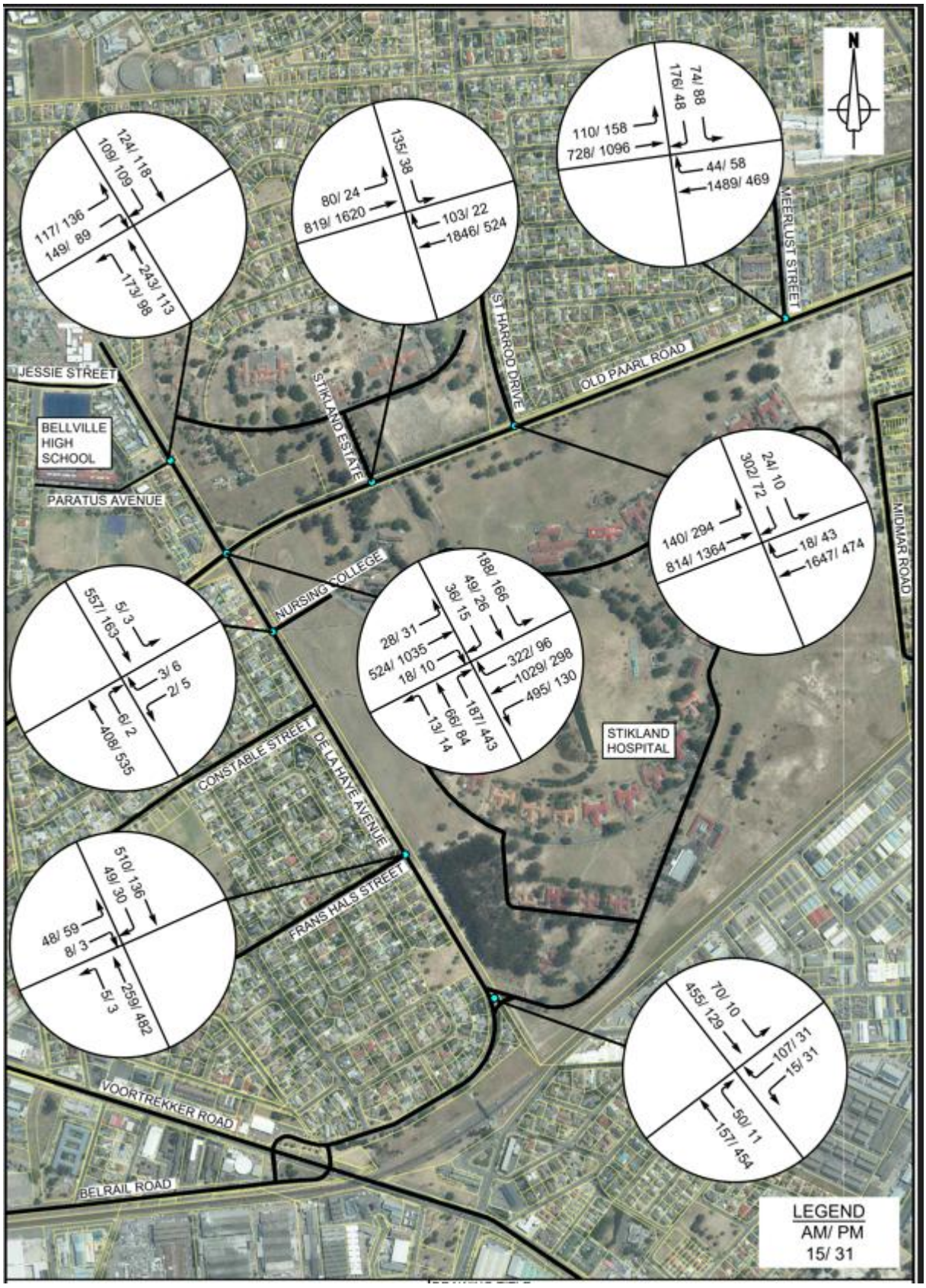


Figure 3: Existing AM and PM Peak Hour Traffic Flows in Vicinity of Stikland

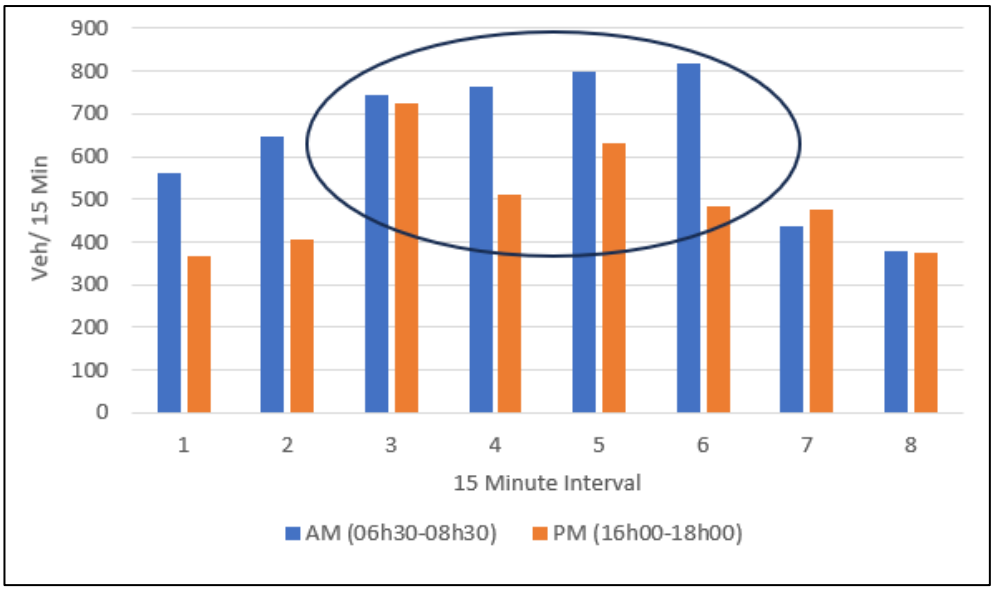


Figure 4: Distribution of Traffic along Old Paarl Road and De la Haye Avenue in AM and PM Peak Periods (Feb 2025)

The following points are highlighted:

- Traffic flows in both the AM and PM peak periods are concentrated in their respective peak hours, in line with historic patterns, at ± 60%, between respectively 07h00 and 08h00, and 16h30 and 17h30.
- The distribution of traffic is relatively uniform in the AM peak hour, with a build-up in the early peak, reasonably constant flows in the peak hour, and then a sharp decline in the last 30 minutes. Traffic distribution in the PM peak hour is more variable during the peak hour itself, but also shows somewhat lower flows during the shoulder peaks.
- Traffic flows are notably lower during the PM compared with the AM peak period (23%), which can be attributed to the location of the site towards the periphery of the city, and the tendency for PM peak periods to be somewhat more dispersed than AM peak periods. Due to its peripheral location, upstream congestion on road links leading from the major points of origin in the afternoons, i.e. the CBD and surrounds, effectively meter downstream traffic, resulting in lower and more variable flows.

2.2 Existing Transport Network

The notable aspects related to the transport network in the vicinity of the Stikland as a whole, and the southern portion in particular, are highlighted below (Refer to Figure 5):

- The site is in close proximity to major arterial and movement routes in Cape Town, such as the N1 Freeway, R300 Kuils River Freeway, and the Voortrekker Road Corridor. Old Paarl Road (R101), which separates Stikland North and South, and Old Oak Road provide convenient access to these major roads.
- Old Paarl Road (R101) is classified as a Provincial Main Road, and in the City of Cape Town's hierarchy, as a Class 3 road. The road has reasonably limited access allowance and a primary focus on vehicular mobility, however it has more frequently spaced signalised intersections to the east. It serves as a public transport route for bus and minibus-taxi services.
- The Stikland rail station is located adjacent to the access to the hospital, and provides a significant potential benefit for public transport access.
- No MyCiti bus services are currently operational within either the core or the secondary study area. The Integrated Public Transport Network (IPTN) implementation plan has been divided into three phases each containing a number of trunk routes. Phase 2, intended for completion by 2032, includes

Trunk Route 13 (T3) linking the Metro South East, Delft, and Belhar to Stikland, Bellville, Tygervalley and Durbanville.

Figure 2 below is sourced from a contextual framework report completed for Stikland North (Ref 1). However, the transport network and services are also relevant to Stikland South. Although it is clear that the network is well developed, in an established part of the city, there are a number of new road proposals planned in the area (Refer to Section 3).

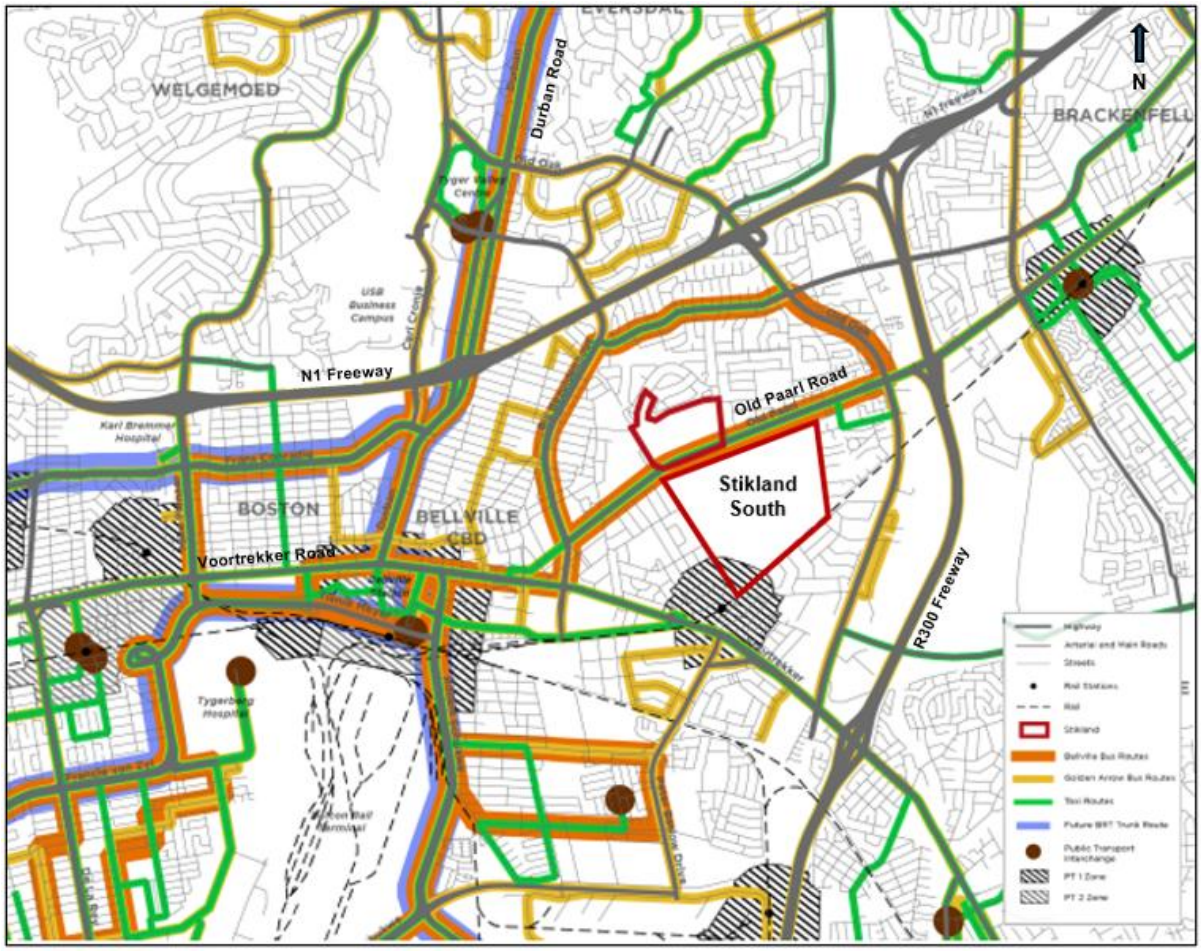


Figure 5: Stikland Site in the Sub-Metropolitan Transport System Context

3 FUTURE TRANSPORT OPERATIONS & PROPOSALS

3.1 Future Road Proposals

There are a number of transport proposals in the vicinity of the Stikland site which had been investigated, the most recent and comprehensive of which is the Bellville Transportation Master Plan Framework, which is discussed in Section 3.1.1. Not many of the proposals in this report were incorporated into the City's Public Right of Way Plan for Cape Town, discussed in Section 3.1.2.

3.1.1 Bellville Transportation Master Plan Framework

A study was undertaken by Aurecon under the auspices of the City of Cape Town to review all transportation planning initiatives associated with the Bellville CBD precinct (Ref 3). The outcome of the review is a synthesis of all planning proposals that have been considered to date and the formulation of a Bellville Transportation Master Plan Framework (October 2019). The scope of the investigation was broad ranging, taking into account future transport proposals away from the CBD, but would ultimately impact on the functioning of the road network in the CBD. The Stikland South site was included in the modelling as a new development node, and projected to accommodate 4 593 residential units, and 60 000m^2 GLA non-residential use. It was not considered developed by 2040, but as part of the so-called end state scenario.

The road planning proposals in the vicinity of Stikland are described below (Refer to Figure 6):

- The extension of Peter Barlow Drive northward, across the Northern railway line, to link with De La Hay Avenue.
- The northern alignment option for the extension of the Tienie Meyer Bypass along the Northern railway line, crossing Strand Street and into the Stikland site, continuing along the railway line (Stikland Extension), then veering northward along the eastern boundary of Stikland South, to link with Old Paarl Road opposite Meerlust Street. This will form the fourth leg to an existing signalised intersection.
- The extension of Cilmore Street across the Northern railway line, to link with the eastward extension of Tienie Meyer Bypass at the point of its northward alignment. This would require the latter to be elevated at its junction with Cilmore Street extension.
- The northern extension of De la Hay Avenue from the point where it currently terminates at Douglas Carr Drive, a residential access street serving Blommendal, to link with Bill Bezuidenhout Avenue.

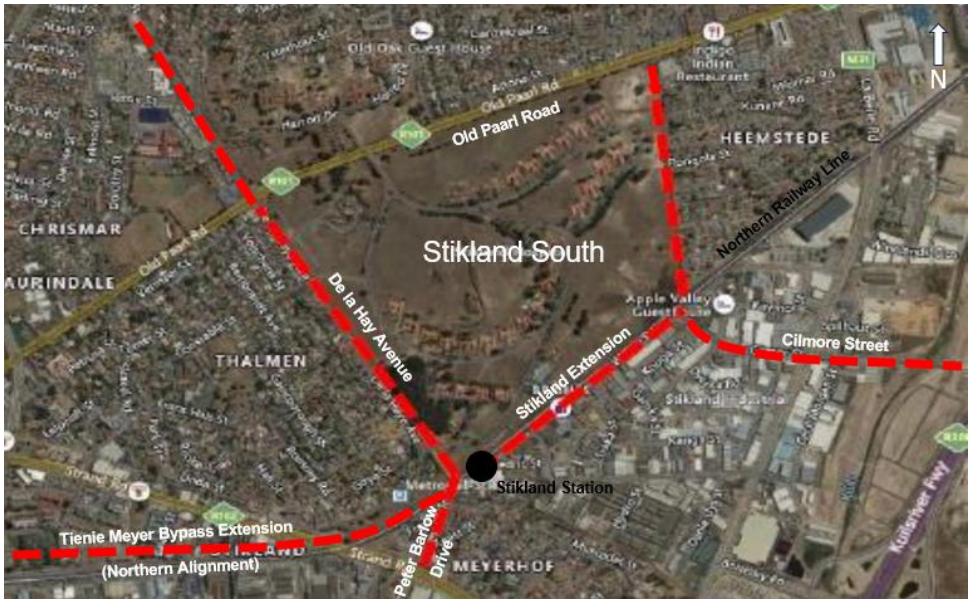


Figure 6: Road Proposals Impacting on Stikland South
Source: Bellville Transportation Masterplan Framework (Ref 3)

3.1.2 Public Right of Way (2022) Road Network (Cape Town Transport Network)

The City of Cape Town has a city-wide transport plan that shows the ultimate road and rail network for the city (Ref 4). All identified long term road and rail proposals are depicted on the plan, which is periodically updated as new proposals are formulated or some schemes become obsolete. As part of the Bellville CBD transport study, extensive modelling was done of all the concept proposals for new road infrastructure in the vicinity of the area. It is significant that none of the proposals listed in Section 3.3.1 are included in the City's updated right of way plan for new or upgraded roads. There could be a number of reasons for this, including (i) the selection of the southern alignment of the Tienie Meyer Bypass extension, which does away with the northern alignment; (ii) the technical feasibility of some of the proposals could be questionable, however this needs to be established; (iii) the projected traffic demand is too low along some of the road links to warrant their implementation; or (iv) some proposals could have inadvertently been omitted.

The transport network as per the current (2022) Public Right-of-Way plan in the vicinity of the Stikland site is illustrated in the Figure 7 below. Further away, Tienie Meyer Bypass is proposed to be extended eastward to link with Voortrekker Road, and for Robert Sobukwe Drive to be extended northward to link with Durban Road.

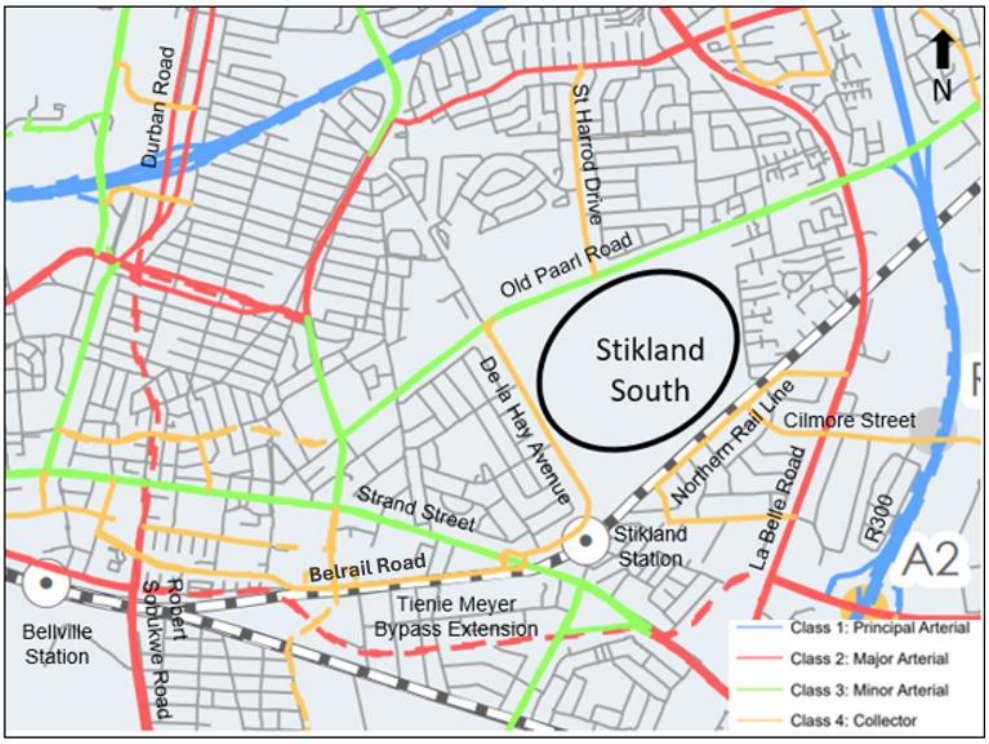


Figure 7: City of Cape Town Public Right of Way Plan (2022)

The analysis in this report assesses the adequacy of the limited improvements to the road network in the vicinity of Stikland envisaged in the above plan to accommodate the proposed development on the southern site.

3.1.3 Upgrading of Old Paarl Road

The eastern section of Old Paarl Road (up to Old Oak Road) has been upgraded to a dual carriageway (Ref 5) with exclusive turn lanes at major intersections (Refer to Figure 8 overleaf). To the west of Old Oak Road, it still functions as a four lane undivided road, without right turn lanes at signalised intersections. The upgrading of the road, especially at the Old Paarl Road intersection with De la Haye Avenue, will facilitate the effective realisation of the link capacity of the road, which is currently constrained due to the restricted geometry at this intersection.

The design of the road has been completed, and in the vicinity of Stikland, the proposed layout does not make provision for a full access to Stikland North, nor provides a point of access to Stikland South. Provision has only been made for a marginal intersection (left in; left out), as illustrated in Figure 8.

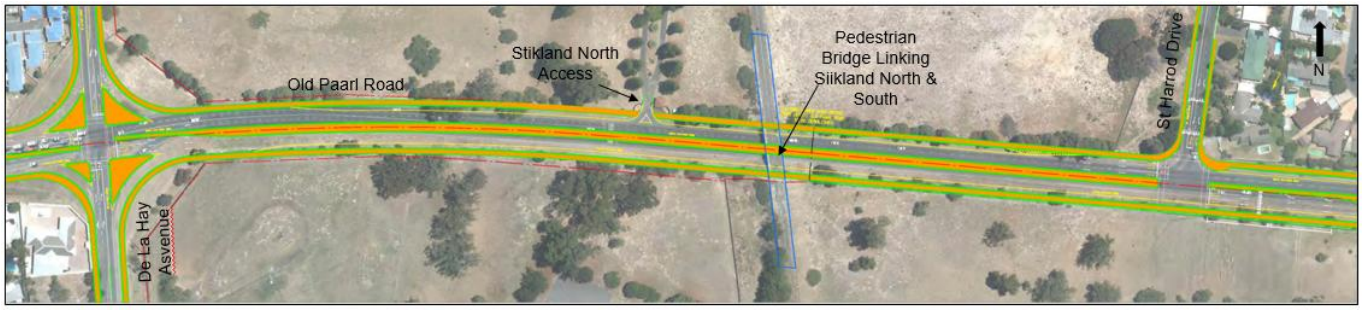


Figure 8: Section of Proposed Upgrade of Old Paarl Road in Vicinity of Stikland

The access proposals serving Stikland South from Old Paarl Road would require amendments to the above plan (Refer to Section 1.4).

3.2 Future Upgrading Proposals to Accommodate Proposed Stikland South Development

From the capacity assessment of the impact of the development in this report, none of the proposals contained in the Bellville Transport Masterplan Framework are considered required to accommodate the proposed Stikland development. This is in line with the proposals in the City's Right-of-Way plan (Refer to Figure 7), but with the inclusion of the extension of De la Haye Avenue to link with Bill Bezuidenhout Avenue, which will substantially improve the connectivity of the local area with the higher order external road network.

This plan was furthermore informed by traffic modelling undertaken by the City in the greater Bellville area, which as noted in Section 3.1.1, took into account development on the Stikland South site of 4 593 residential units, and 60 000m^2 GLA non-residential use. In comparison, the land use proposals assessed in this report comprises 2 682 residential units, and ± 72 900m^2 GLA of non-residential use, plus a school.

The report does anticipate the upgrading of Old Paarl Road as discussed above, with some amendments as motivated in this report.

The assessment in this report does not take into account wider network improvements such as the eastward extension of Tienie Meyer Bypass, or the southward extension of Willie Hofmeyer Avenue to Robert Sobukwe Road from its current intersection with Belrail Road.

4 TRIP GENERATION, DISTRIBUTION AND ASSIGNMENT

4.1 Trip Generation

Trip generation parameters as contained in the SA Trip Data Manual (Ref 6) for the various land uses were applied. Some adjustments were made to the trip rates to account for reductions based on (i) mixed use; (ii) level of car ownership; and (iii) proximity to core public transport corridors. The TIA & Development Control branch in the CoCT Urban Mobility directorate was consulted regarding the application of adjustment factors. The following adjustments were made, adjusted on a precinct basis depending on the characteristics of each :

- Mixed Use: applied to P1 and P2, with the remainder residential only.
- Low car ownership: applied to the social and FHF housing markets.
- Public transport: applied to P4 only (within 500m of Stikland rail station).

Table 3 overleaf summarises the trip generation rates, together with the trips generated by each land use. Details of the adjustment factors applied to each precinct are included in Appendix A. Table 4 summarises the trips generated per precinct.

Table 3: Summary of Stikland South Trip Generation

Land Use	Size	Unit	AM Peak Hour				PM Peak Hour			
			Trip Rate[1]	In	Out	Total	Trip Rate[1]	In	Out	Total
Residential	2 682	Units	0.50	333	999	1332	0.50	933	400	1333
Office	40 973	m^2 GLA	1.68	585	103	688	1.68	138	551	688
Schools	1 000	Learners	0.32	160	160	320	0.10	50	50	100
Clinic	3 361	m^2 GLA	2.00	40	27	67	2.00	27	40	67
Retail	28 525	m^2 GLA	0.93	172	93	265	5.26	750	750	1500
Total			-	**1290**	**1382**	**2672**	-	**1897**	**1791**	**3688**

Note
1: Trip rates for Office, Clinic and Retail calculated at trips/100m^2.

Table 4: Summary of Trips Generated per Precinct

Precinct	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
P1	1073	933	2006	1298	1383	2681
P2	91	70	161	245	256	501
P4	76	227	303	212	91	303
P5	50	152	202	142	61	203
Total	**1290**	**1382**	**2672**	**1897**	**1791**	**3688**

Based on the above land uses, their extent (sizes) and trip generation rates, the development is projected to generate 2 672 veh/hr in the AM peak hour, and 3 688 veh/hr in the PM peak hour. The trips will be balanced, with two of the major land uses, i.e. residential and office, having opposite peak directional flows. The majority of trips will be generated in Precinct 1 (P1), given the concentration of land uses across all categories in this precinct.

These projections are considered to be conservative (high), and that consequently, it is anticipated that the probability of a mature development generating fewer than these projected peak hour trips, would be high. There are a number of reasons for this, which have been discussed in a separate forum, but for the purpose of this report, can be summarised as follows:

- The City, in line with TMH 17, does not accept the inclusion of peak spreading effects in the assessment, which is the result of a mismatch between supply and demand of transport infrastructure to accommodate motorised (especially private) travel demand. The reality is that travel behaviour changes in response to levels of congestion experienced on the network at a system-wide level, and that fewer trips are being undertaken during peak hours as a result.

- The availability of a higher order public transport service in the form of Stikland rail station in close proximity to the site provides an attractive alternative transport option for future residents or workers anywhere on the Stikland site. The restriction of the application of an adjustment factor to reflect a higher propensity to use this service to only within a 500m radius from the station (5% of development bulk) is considered overly conservative.

Further to the above, there is a contradiction between the stated policy of the City to promote the use public transport (and its corollary, to discourage private motoring) by encouraging denser and more integrated forms of developments, and the application of only minimally adjusted trip generation rates, which facilitates the continued use of private transport modes.

Whereas it is accepted that it is the City's prerogative to determine the parameters of an assessment of the potential future impact of a development on the functioning of the transport system, to be considered

to be a “worst case scenario”, ongoing deliberations on the application of appropriate trip generation assumptions should be encouraged.

4.2 Trip Distribution and Assignment

The trip distribution assumptions were derived from traffic counts in the vicinity of the site, adjusted marginally to take into account improvements to the local road network, which are likely to result in a minor redistribution of trips. This relates specifically to the extension of De la Haye Avenue, which in future is planned to link directly with Bill Bezuidenhout Avenue (Refer to Section 3.2), and should subsequently attract a higher proportion of trips than is currently the case.

The major trip destinations and origins are considered to be located towards the west, as it is the direction of travel to access both the Bellville CBD and Cape Town CBD further afield (assumed at 40%). Destinations to the north (mainly the Durbanville Road corridor) could also be desirable (assumed at 25%), with the east (20%) and south (15%) completing the distribution designations.

The following trip distribution and assignment assumptions have been made:

- To and from the west, via Old Paarl Road: 25%
- To and from the west, via De la Haye Avenue: 15%
- To and from the north, via De la Haye Avenue: 22%
- To and from north, via St Harrod Drive: 3%
- To and from the east, via Old Paarl Road: 20%
- To and from the south, via De la Haye Avenue: 15%

It should be noted that the above distribution assumptions are averages across all precincts, as the location of the precinct will impact on the trip distribution e.g. P1 and P2 will have trips routed via St Harrod Drive, but not P4 and P5.

4.3 Future (2035) Traffic Scenario

A future traffic scenario has been derived, which superimposes the projected trips generated by the development on the upgraded road network assessed for this development, on background traffic increased at a rate of 1% per annum over a 10 year period. It should be noted that an assumed increase in background traffic is contrary to the trend established over the past 11 years,

The resultant peak hour flows are indicated in Figure 9 overleaf.

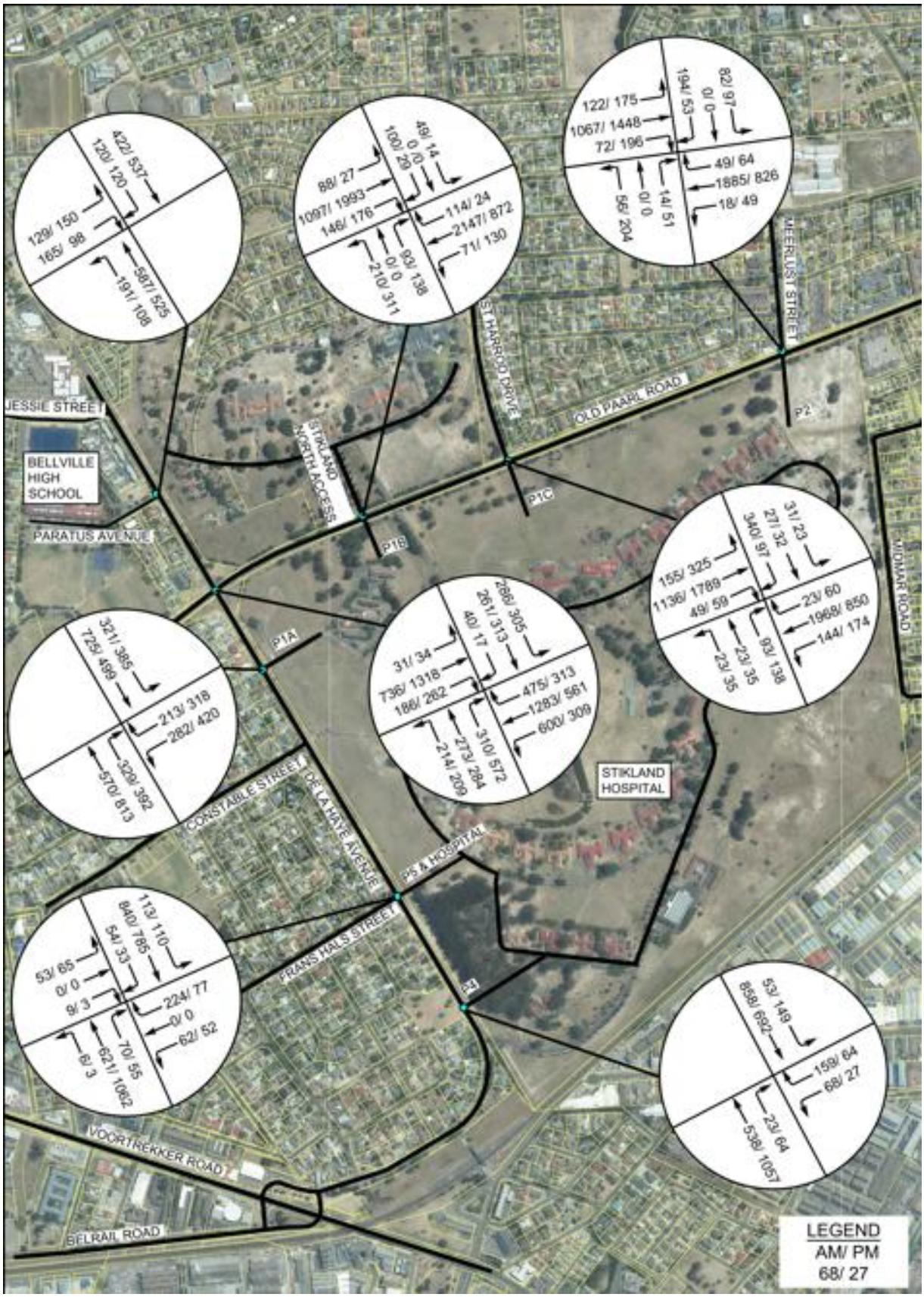


Figure 9: Future Scenario (2035) AM & PM Peak Hour Traffic Flows in Vicinity of Stikland

5 TRANSPORT IMPACT ASSESSMENT

5.1 Introduction

This section analyses the performance of the intersections on Old Paarl Road and De la Haye Avenue adjoining the Stikland South site, which will be directly affected by trips generated by the site. It also analyses the capacities of the above road links.

5.2 Analysis of Intersections

The impact of the development has been assessed by means of the performance of critical intersections in the vicinity of the Stikland South site, as summarised in Table 5 below. The analysis was done using Sidra intersection analysis software.

Table 5: Summary of Results of Intersection Analyses

Intersection Name	Geometry	Control	Approach	AM Peak Hour			PM Peak Hour		
				v/c	Delay (sec/veh)	LOS	v/c	Delay (sec/veh)	LOS
Old Paarl Road/ De La Haye Avenue	Upgraded	Traffic Signals	South: De La Haye Ave	0.84	31.2	C	0.95	31.8	C
			East: Old Paarl Rd	0.98	22.2	C	1.02	23	C
			North: De La Haye Ave	0.68	15.9	B	0.90	34.7	C
			West: Old Paarl Rd	1.05	34.5	C	1.08	72.1	E
			Overall	-	25.4	C	-	44.4	D
Old Paarl Road/ Stikland North/ P1B Access	Upgraded	Traffic Signals	South: P1B Access	0.44	43.8	D	0.59	43.3	D
			East: Old Paarl Rd	0.98	49.2	D	0.74	15.4	B
			North: Stikland Estate	0.88	68.8	E	0.49	64.5	E
			West: Old Paarl Rd	0.98	18.9	B	0.78	15.4	B
			Overall	-	39.7	D	-	19.3	B
Old Paarl Road/ St Harrod Drive/ P1C Access	Upgraded	Traffic Signals	South: P1C Access	0.27	30.5	C	0.63	55.8	E
			East: Old Paarl Rd	0.95	37.0	D	0.78	9.9	A
			North: St Harrod Dr	0.96	56.0	E	0.47	54.1	D
			West: Old Paarl Rd	0.88	30.0	C	0.83	14.5	B
			Overall	-	36.3	D	-	17.2	B
Old Paarl Road/ Meerlust Street/ P2 Access	Upgraded	Traffic Signals	South: P2 Access	0.13	34.9	C	0.47	37.6	D
			East: Old Paarl Rd	0.84	19.6	B	0.51	9.9	A
			North: Meerlust Str	0.82	47.6	D	0.52	42.2	D
			West: Old Paarl Rd	0.78	11.4	B	0.70	14.6	B
			Overall	-	19.2	B	-	16.4	B
De la Haye Avenue/ Paratus Avenue	Existing	Priority	South: De La Haye Ave	0.43	5.7	A	0.35	5.6	A
			North: De La Haye Ave	0.42	12.0	B	0.44	10.1	B
			West: Paratus Ave	1.07	77.6	F	0.73	37.0	E
			Overall	1.07	16.7	-	0.73	6.1	-
De La Haye/ Nursing College/ P1A Access	Upgraded	Traffic Signals	South: De La Haye Ave	0.85	15.5	B	1.01	40.8	D
			East: P1A Access	0.86	33.6	C	0.98	57.3	E
			North: De La Haye Ave	0.91	34.4	C	0.95	57.3	E
			Overall	-	27.3	C	-	50.3	D
De La Haye/ Frans Hals/ P5 Access	Upgraded	Mini-Circle	South: De La Haye Ave	0.72	9.7	A	0.89	7.0	A
			East: P5 Access	0.63	23.3	C	0.24	13.3	B
			North: De La Haye Ave	0.77	5.9	A	0.68	5.4	A
			West: Frans Hals Str	0.14	12.6	B	0.30	20.6	C
			Overall	-	9.8	A	-	7.1	A
De La Haye/ Hospital Entrance/ P4 Access	New	Mini-Circle	South: De La Haye Ave	0.50	6.1	A	0.82	5.9	A
			East: Hospital Entrance	0.40	15.6	B	0.14	11.8	B
			North: De La Haye	0.61	4.8	A	0.63	5.2	A
			Overall	-	6.7	A	-	5.9	A

Notes

Near Capacity	0.85<v/c<0.95
At Capacity	0.95<v/c<1.05
Over Capacity	v/c>1.05

The results of the analyses in Table 5 are discussed in the sections below.

5.2.1 Old Paarl Road/ De la Haye Avenue

The analysis of the future scenario was based on the upgrading of this intersection as per the planned future scheme, but with the addition of a northbound right turn lane to accommodate the significant demand in the PM peak hour (572 veh/hr). The geometry of the intersection will have to be upgraded to

accommodate the increase in demand. The existing road reserve along De la Haye Avenue has sufficient space available to accommodate the proposed geometric upgrade.

The analysis indicates that for the future scenario, this intersection will perform at reasonable to acceptable levels of service (LOS C/D)in the AM and PM peak hours respectively.

5.2.2 Old Paarl Road/ Stikland North Access/ P1B Access

The analysis of this intersection was based on an adaptation of the upgrading scheme, to accommodate a fourth leg to the intersection, introduce a median break with exclusive right turn lanes, and change its control to traffic signals (Refer to Section 3.2). The analysis indicates that this intersection can be expected to operate at acceptable to high levels of service (LOS D/B) during the AM and PM peak hours.

5.2.3 Old Paarl Road/ St Harrod Drive/ P1C Access

The analysis of this intersection was similarly based on an adaptation of the upgrading scheme, by introducing a fourth leg into the Stikland South site. It currently already has traffic signals, and exclusive right turn lanes to both side roads should be introduced. The analysis indicates that this intersection can be expected to operate at acceptable to high levels of service (LOS D/B) during the AM and PM peak hours.

5.2.4 Old Paarl Road/ Meerlust Street/ P2 Access

The analysis of this intersection was also based on an adaptation of the upgrading scheme, by adding a fourth leg into the Stikland South site. It currently already has traffic signals, and exclusive right turn lanes to both side roads should be introduced. The analysis indicates that this intersection can be expected to operate at high levels of service (LOS B) during both the AM and PM peak hours.

5.2.5 De la Haye Avenue/ Paratus Avenue

This intersection has been analysed as a priority controlled intersection, as per the current operation. The increase in flows as a result of the Stikland development will result in the Paratus Avenue approach operating at a very low level of service (LOS F) in the AM peak hour, and at a low level of service (LOS E) in the PM peak hour. The major movements from Paratus Avenue are turning right (AM) and left in the PM peak hour. Given that the extension of De la Haye Avenue to Bill Bezuidenhout Drive will facilitate easier access onto the external higher order road network, the majority of vehicles can be expected to then turn left. Together with a possible widening of the approach to create separate left and right turn lanes, the resultant delays could be limited.

5.2.6 De la Haye Avenue/ Clinic/ P1A Access

This intersection is projected to accommodate high flows, as a major access into the P1 precinct, which is to accommodate the bulk of the trips generated by the development. It can only function satisfactorily as a signalised intersection within the constraints of its road reserve (24m), which otherwise could have operated well with a roundabout in place. The analysis indicates that it should operate at acceptable levels of service (LOS D) during both peak hours. To the north of Constable Street, the road should be widened to accommodate an exclusive right turn lane at the intersection.

In the southbound direction along De la Haye Avenue, two approach lanes should be provided, with a through-and-left, and through configuration, to allow the large left turn movement from Old Paarl Road to remain in the left hand lane to minimise weaving. This requires the southbound exit to be widened to two lanes, which can then be tapered back to single lane approaching Constable Street.

5.2.7 De la Haye Avenue/ Frans Hals Street/ P5 Access

The side street flows at this intersection are considerably lower than at the P1A access, which despite the high flows along De la Haye Avenue, allows the intersection to operate at high levels of service during both the AM and PM peak hours (LOS A), with a mini-circle replacing the existing priority control.

5.2.8 De la Haye Avenue/ P4 Access

This new intersection is also proposed to have a mini-circle in place, with similarly lower flows on the side street. The intersection is also expected to operate at high levels of service during both AM and PM peak hours.

5.3 External Intersections

Apart from the assessment of the impact of the development on intersections on the road links adjoining the site, the functioning of intersections further from the site also need to be considered, as they will be impacted by the trips generated by the Stikland development. This will have to be undertaken on a qualitative basis, as traffic data was not collected for these intersections.

5.3.1 Old Paarl Road/ Old Oak Road

This intersection to the east of the site is not currently functioning optimally in the PM peak hour due to traffic signal plan for this period allocating minimal green time to the main eastbound phase (35 seconds of a 160 second cycle, with 7 phases). Taking lost time into account, the eastbound approach only receives an estimated 26% of the green time. This results in the queues backing up along Old Paarl Road in the eastbound direction in the vicinity of Meerlust Street. The north- and southbound approaches receive excessive green time, with large portions of the phases producing little or no throughput. The reallocation of green time, together with a reduction in the number of phases, will significantly improve the effective capacity of the approach.

5.3.2 Old Paarl Road/ Link Road/ Fenauer Street

This signalised intersection to the west of De la Haye Street does not operate optimally due to limited green time allocated to the start-up phase on the westbound approach. Given that it is a shared lane, an increased green time allocation will be less efficient than if it was from an exclusive lane, but will assist in reducing the number of right turn vehicles blocking the through traffic. This intersection is included in the upgrading plan for Old Paarl Road, with its capacity thereby significantly improved.

5.3.3 De la Haye Avenue/ Strand Road Quarter-links/ Belrail Road

The intersections of each of De la Haye Avenue and Belrail Road with the quarter-links with Strand Road currently favours the movements from Strand Road, which are uninterrupted through these intersections. With priority control at both these intersections, traffic on Belrail Road and De la Haye Avenue approaching the intersections have limited capacity. It is proposed to change the controls at these intersections to mini-circles to provide more capacity to the De la Haye Avenue/ Belrail Road approaches.

5.4 Link Analysis

A link analysis assessment of the road links adjoining the site was undertaken for the existing and future scenarios. The results of the analyses for the AM and PM peak hours are summarised in Table 6 overleaf. In this assessment, volume to capacity (v/c) ratios have been used as the performance criterion. The intervals related to the degree of utilisation (under, at or over capacity) are indicated below the table. There are capacity ranges for different road classes, which are influenced by the stop line capacities of intersections along a route. For instance, the improvements at the Old Paarl Road/ De la Haye intersection allow for the effective capacities of the links to be increased.

The following results are highlighted:

- Currently, there are two links operating at near or at capacity conditions, i.e. the westbound approach along Old Paarl Road to De la Haye Avenue in the AM peak hour (v/c ratio 0.92) and the eastbound approach to Old Oak Road in the PM peak hour (v/c ratio 0.99).

- For the future scenario, with the identified improvements in place related to Old Paarl Road and De la Haye Road, the flows on the network will have increased to such an extent that more links could be operating near, at or in some instances, over capacity conditions, as reflected in the table.

Table 6: Link Capacity Analysis of Old Paarl Road and De la Haye Avenue: Existing and Future Scenarios

Route Section	Link Capacities		AM Peak Hour				PM Peak Hour			
			2025		Future		2025		Future	
	Current	Future	Flow	V/C Ratio	Flow	V/C Ratio	Flow	V/C Ratio	Flow	V/C Ratio
Old Paarl Road										
West of De la Haye Ave	**4000**	**4800**	**1648**	**0.41**	**2488**	**0.52**	**1403**	**0.35**	**2401**	**0.50**
- Westbound	2000	2400	1078	0.54	1536	0.64	327	0.16	787	0.33
- Eastbound	2000	2400	570	0.29	952	0.40	1076	0.54	1614	0.67
East of De la Haye Ave	**4000**	**4800**	**2745**	**0.69**	**3688**	**0.77**	**2168**	**0.54**	**3379**	**0.70**
- Westbound	2000	2400	1846	0.92	2357	0.98	524	0.26	1183	0.49
- Eastbound	2000	2400	899	0.45	1331	0.55	1644	0.82	2196	0.92
East of Meerlust Street	**3200**	**4000**	**2385**	**0.75**	**3114**	**0.78**	**1711**	**0.53**	**2536**	**0.63**
- Westbound	2000	2400	1533	0.77	1952	0.81	527	0.26	940	0.39
- Eastbound	1200	1600	852	0.71	1162	0.73	1184	0.99	1596	1.00
De la Haye Avenue										
North of Old Paarl Road	**1600**	**1600**	**689**	**0.43**	**1365**	**0.85**	**418**	**0.26**	**1268**	**0.79**
- Northbound	800	800	416	0.52	778	0.97	211	0.26	633	0.79
- Southbound	800	800	273	0.34	587	0.73	207	0.26	635	0.79
South of Old Paarl Road	**1600**	**2000**	**828**	**0.52**	**1842**	**0.92**	**707**	**0.35**	**1951**	**0.98**
- Northbound	800	1000	266	0.33	796	0.80	541	0.54	1067	1.07
- Southbound	800	1000	562	0.70	1046	1.05	166	0.17	884	0.88

Notes

Near Capacity	0.85<v/c<0.95
At Capacity	0.95<v/c<1.05
Over Capacity	v/c>1.05

- The upgrading of Old Paarl Road to a dual carriageway with exclusive right turn lanes at signalised intersections will substantially improve its capacity, from 1 000 to 1 200 veh/hr/lane, which will enable it to effectively accommodate the future traffic scenario, reflecting both development generated trips and background traffic growth. Although it is classified as a Class 3 facility, its cross-section is more closely related to a Class 2 facility, hence the traffic flow capacity allocation normally associated with this class.

- De la Haye Road, to the south of Old Paarl Road will in future function as a two lane facility as is currently the case, but with turn lanes at critical intersections. This will increase its deemed link capacity from 800 veh/hr to 1 000 veh/hr. Notwithstanding these improvements, it could be operating over capacity conditions in the peak direction of travel (v/c ratios 1.05 to 1.07). These are however not excessive levels of oversaturation.

The predicted volumes also depend on the realisation of the actual flows, which in turn depend on the trip generation, distribution and assignment assumptions. As noted, it is believed that the actual trips generated could be lower than predicted, and should be monitored as the development proceeds. If the flows do materialise and pressure is experienced along De la Haye Avenue, it would point to the need to start considering the introduction of Belrail extension into the site, along its southern and eastern perimeters to the link with Old Paarl Road opposite Meerlust Street (Refer to Figure 6). This local road network improvement will provide a more direct link between Old Paarl Road and Belrail Road, and also unlock the development of the remainder of the Stikland South site.

6 ACCESS CONSIDERATIONS

The points of access to the site are discussed in Section 1.4, and are illustrated in Figure 10. Along Old Paarl Road, the three accesses are provided at locations opposite existing intersections, i.e. Stikland North, St Harrod Drive and Meerlust Street. The latter two intersections are signalised, and will continue to operate as signalised intersections, while the Stikland North/ P1B Access will need to be signalised. It is currently shown as a left in; left out access on the upgrade concept plan, with no median break. This is in itself a sub-optimal arrangement in that no provision is made for motorists wanting to turn right into, or out of the development.

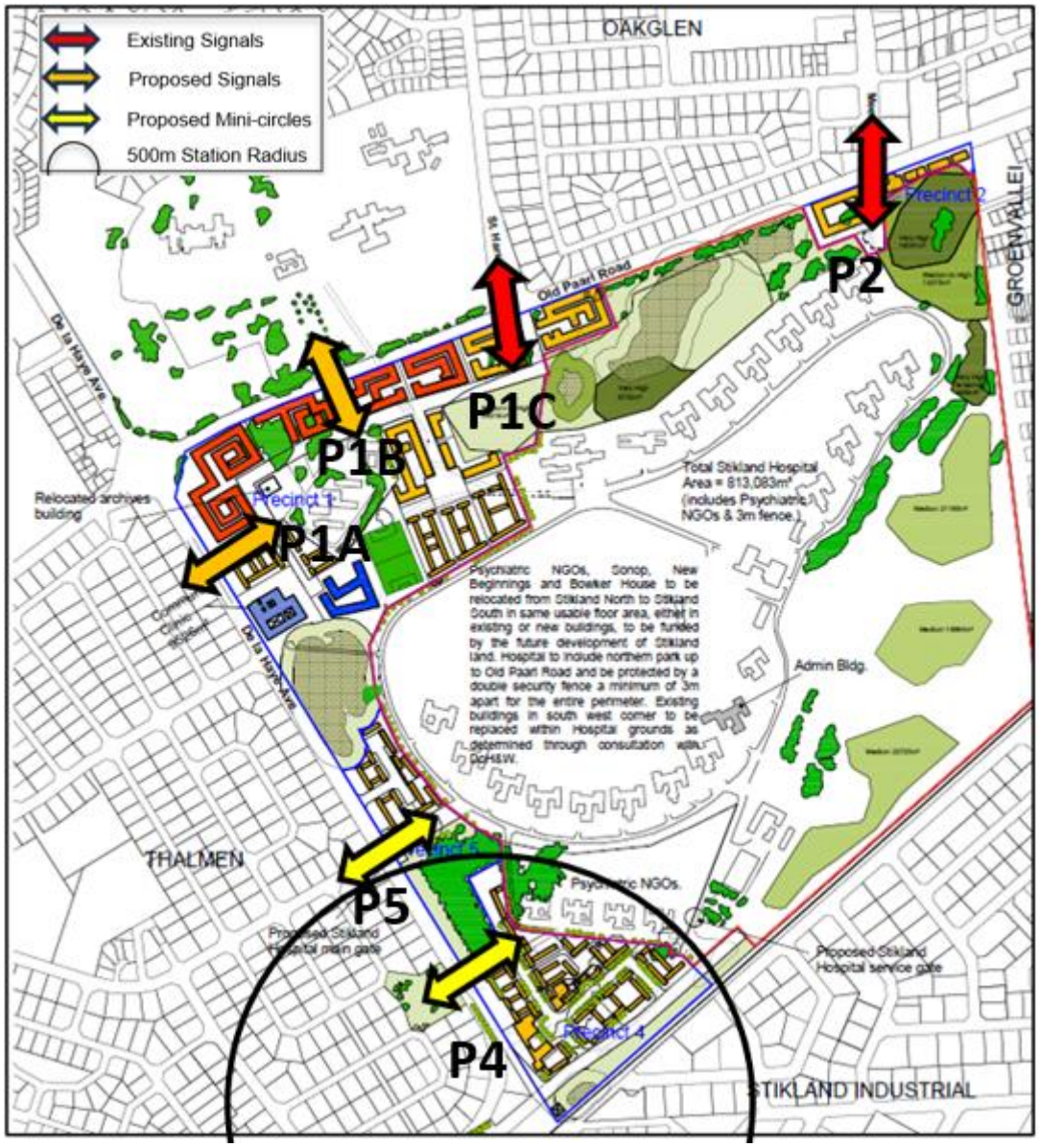


Figure 10: Proposed Access Arrangements for Stikland South

The Stikland North/ P1B access is located virtually midway between De la Haye Avenue (315m) and St Harrod Drive (310m). Remaining signalised intersections along Old Paarl Road (eastward) are located at 580m (to Meerlust Street); 350m to Hadley Street; and 425m to Old Oak Road. The Road Access Guidelines (Ref 7) recommends signalised intersection spacings along a Class 3 facility, in an intermediate development environment at 375m. The resultant spacing at this intersection is somewhat less than the recommended spacing, but similar to established signal spacings, i.e. between Meerlust and Hadley Streets (350m). It should be noted that the scale of development on the Stikland site (on the south side, and later north) will result in the environment becoming “intermediate”.

Along De la Haye Avenue, the spacing between Old Paarl Road and the P1B access, which requires to be signalised, is at ±180m considerably less than the required spacing between traffic signals on a Class 4 road in an intermediate development environment (275m). The distribution of flows between De Haye Avenue and the access would allow more green time to be allocated to the major stream, which will offset some of the shortfall from a traffic flow point of view. The access may have to be shifted southward to more closely comply with the spacing guidelines.

The remaining accesses on De la Haye Avenue into the site will be at or opposite existing intersections, with the exception of the new P4 access. It is located ± 240m south of Frans Hals Street, which more than satisfies normal side street spacings along Class 4 roads (90m). It is reiterated that the existing hospital access will be closed, and relocated to the shared P4 access opposite Frans Hals Street.

7 MODAL SHARE ANALYSIS

It is instructive to assess the modal shares of the different transport modes from a first principle basis. This is based on a methodology that was developed for “Guidelines for the Public Transport Component of Transport Impact Assessments” (Ref 8).

An assessment of the predicted weekday AM peak hour public transport demand generated by the proposed development has been undertaken based on the draft guidelines.

The following steps are followed to determine the primary modal shares (private, public and non-motorised transport):

- Establishment of the land use budget
- Determine person trip generation rates based on occupancy rates for different land uses
- Derive vehicle trip rates based on peak hour trip proportions and vehicle occupancy rates
- Compare derived and standard trip vehicle trip rates
- Estimate proportions of likely public transport and non-motorised person trips from the remainder of the person trips

In order to further quantify public transport service requirements, the following additional steps are followed:

- Determine public transport demand for the analysis period
- Estimate primary modal split
- Determine trip distribution by public transport
- Determine secondary modal split (amongst public transport modes) and assign trips to various modes
- Assess the existing public transport services and the need for new services
- Assess the need for public transport facilities

In this assessment, the second set of analysis has not been addressed, as the purpose at this stage is to understand the potential overall modal distribution. The actual demand for public transport at the time of implementation is likely to be different, which will partly depend on the range and quality of services available. The rail service in particular, could have more enhanced services available than at present, which will improve its attractiveness. This will then also affect the secondary modal split between the available public transport modes.

A summary of the assumptions and calculations of the predicted weekday AM peak hour public transport demand, generated by the full development of the site is indicated in Table 7. The calculations have been calibrated by comparing the resultant vehicular trip generation with the vehicular trip generation rates indicated in Table 3, and represent the base scenario for the development’s modal distribution.

As indicated in the table, based on the sets of assumptions in this report related to trip generation, the primary modal split could be in the order of private transport 68%, public transport 18% and non-motorised transport 14%. The estimated number of public transport users based on this analysis, is in the order of just over 1 000 passengers. NMT modes will be significant component on the site, given that the site will

accommodate a range of non-residential uses, with the presence of the school being particularly significant in this regard (many of the learners are assumed will reside within Stikland and walk to school).

It is noted that the private transport modal shares among residents could vary between 45% for the social housing group, and 70% for the open market segment. Among office workers, the analysis indicates a very high private transport modal share (95%). The overall private transport modal share at 68% is considered high, which aligns with the "worst case scenario" projected trip generation discussed in Section 4.1.

Table 7: Projected Modal Split Distribution for Stikland Development

LAND USE	SIZE		Peak Period Person Movements		% in Peak Hour	Peak Hour Move-ments	Car		Car				From Trip Generation Sheet		Bus & Taxi				Walk, Cycle	
			rate	people	%	people	%	people	occ	cars	cars in	cars out	cars in	cars out	%	people	people in	people out	%	people
Retail	25673	m^2 GLA	35	734	65%	477	70%	334	1.3	257	128	128	133	133	20%	95	48	48	10%	48
											50%	50%	-4	-4			50%	50%		
Office	36876	m^2 GLA	20	1844	65%	1198	95%	1139	1.3	876	744	131	731	129	5%	60	51	9	0%	0
											85%	15%	13	2			85%	15%		
Residential 1	605	units	2.0	1210	65%	786	45%	354	1.3	272	68	204	71	212	35%	275	206	69	20%	157
											25%	75%	-3	-8			75%	25%		
Residential 2	372	units	2.0	743	65%	483	50%	242	1.3	186	46	139	45	136	30%	145	109	36	20%	97
											25%	75%	1	3			75%	25%		
Residential 3	1438	units	2.0	2876	65%	1870	70%	1309	1.3	1007	252	755	256	767	15%	280	210	70	15%	280
											25%	75%	-4	-12			75%	25%		
Shools	900	learners	1.0	900	90%	810	55%	446	1.4	318	159	159	160	160	15%	122	115	6	30%	243
											50%	50%	-1	-1			95%	5%		
Total			**8307**		**5624**		**3822**		**2915**		**1398**	**1517**	**1396**	**1537**	**977**		**624**	**232**	**825**	
													2932							
Modal Shares							**68%**								**18%**				**14%**	

8 PARKING PROVISION

The bulk of the site is located in a standard zone with respect to parking provision, with only the south-west corner of the site (within 500m from Stikland rail station) designated as a PT1 zone. This means that for ± 95% of the site, the standard parking ratios for the main uses of 1.5 bays/unit for apartments (1.25 + 0.25 for visitors), 3 bays/100m^2 for shops (excluding supermarkets, at 4 bays/100m^2), and offices at 4 bays/100m^2. The P4 precinct will require ratios of 1.25, 2.5 and 2.0 for the above respective uses. For the major land use, i.e. residential, this will not be achievable as the development model does not allow for extensive structured parking to be provided on site. As indicated in Section 7, a substantial proportion of residents would not likely have to rely on private transport for their daily movement requirements, which could well result in lower than average car ownership rates.

It is proposed that the following parking ratios be adopted to achieve a feasible supply of parking on site for the residential uses:

- Social housing: 0.6 bays/unit
- First Home Finance units: 0.8 bays/unit
- Open market housing units: 1.0 bay/unit

A departure application would need be submitted for these ratios to be approved.

9 SUMMARY OF FINDINGS AND RECOMMENDATIONS

9.1 Summary of Findings

This Transport Impact Assessment evaluates the impact of the proposed Stikland South mixed use development, under the auspices of the Western Cape Government, from a transport perspective, focusing on traffic operations. The section below highlights the main findings of the report.

- The Stikland South site is bounded by Old Paarl Road on its north side, an existing residential area (Groen Vallei) to its east, the Kraaifontein railway line to its south, and De la Haye Avenue to its west.

- The proposed development will be mixed use, with the major component residential, accommodating 2 682 units (60% open market, 15% first home finance, and 25% social housing). Non-residential uses comprise office (40 973m^2 GLA), retail (28 525m^2 GLA), a clinic (3 361m^2), and a primary school (1 000 learners).

- The development is structured in 5 precincts on the periphery of the site, with the functional area of the Stikland hospital site remaining intact for this phase of the development. The bulk of the development will take place in the P1 precinct (56% of residential stock, and the major proportion of the non-residential uses). It is located in the south-east quadrant of the Old Paarl Road/ De la Haye Avenue intersection).

- Access to the site is gained at a number of points along Old Paarl Road (3) and De la Haye Avenue (3), which have been informed by the location of current intersections of roads serving the areas adjacent to the site.

- An analysis of traffic flows along Old Paarl Road over an 11 year period between 2014 and 2025 shows that in the peak direction of travel, traffic demand has declined by an average of 1.5% pa (AM) and 2.5% (PM) per annum (240 – 400 veh/hr less).

- Traffic flows are reasonably concentrated in the peak hour within the peak periods (60%).

- The site is located with a well-developed transport network and system in the sub-metropolitan area, with a mature hierarchy of roads and a range of public transport services, including the Northern railway line with Stikland station on the south-west periphery of the site.

- A significant number of new road links have been planned for the area as part of the Bellville Transport Master Plan Framework, including Belrail Road extension through Stikland to Old Paarl Road, and the extension of Cilmore Road across the railway line into the site.

- Only proposals peripheral to Stikland form part of the City's Public Right-of-Way plan (2022), keeping the current network intact. This was informed by Emme modelling undertaken as part of the Masterplan Framework, which included significant development on the Stikland site.

- The upgrading of Old Paarl Road to a dual carriageway has been partially completed in the east (up to Old Oak Road). The upgrading towards the west, with improved capacities at intersections, is required to accommodate the proposed Stikland south development.

- It is proposed that De la Haye Road be extended northward to link with Bill Bezuidenhout Avenue, which will substantially improve the connectivity of the local area with the higher order external road network.

- Standard trip generation rates, together with trip adjustment factors acceptable to the City have been applied to assess the potential number of vehicular trips that could be generated by the development. For reasons outlined in the report, it is considered that this projection is conservative, and could be considered a "worst case" scenario.

- The development is projected to generate 2 673 veh/hr in the AM peak hour, and 3 688 veh/hr in the PM peak hour. The distributional direction of trips is expected to be balanced.

- The trip distribution assumptions were derived from traffic counts in the vicinity of the site, adjusted to take into account improvements to the local road network, which are likely to result in a minor redistribution of trips.

- The future traffic scenario superimposes projected trips generated by the development on the upgraded road network assessed for this development, on background traffic increased at a rate of 1% per annum over a 10 year period. This will be a reversal of the declining trend in peak directional flows over the past 11 years.

- The traffic analysis of all the key intersections with Old Paarl Road and De la Haye Avenue indicate that their overall performance are expected to at least be acceptable with respect to levels of service (LOS D and better), with identified improvements in place.

- Improvements include the upgrading of Old Paarl Road and its intersection with De lay Haye Avenue, localised widening along De la Haye Avenue to accommodate high levels of demand at especially the P1B Access. Recommended intersection controls include a number of mini-circles at the site access intersections along De la Haye Avenue, as well as at it and Belrail Road's intersections with the Strand Road quarter-links.

- Further afield, signal plans at the intersections of Old Paarl Road with Link Road/ Fenauer Street (to the west) and Old Oak Road (to the east) need to be adjusted to facilitate improved throughput along Old Paarl Road. The eventual extension of the Old Paarl Road upgrading plan westward that includes Link Road/ Fenauer Street, will further improve the capacity of this corridor.

- From a link capacity perspective, the analysis indicates that with the upgrading of Old Paarl Road, future scenario flows should be accommodated within its capacity limits. Peak directional flows along De la Haye Avenue could exceed the capacity of a two-lane road, which could initiate the planned extension of Belrail Road into the site, linking with Old Paarl Road opposite Meerlust Street.

- The proposed points of access into the Stikland South site conform to the Road Access Guidelines recommended spacings for respectively Class 3 (Old Paarl Road) and Class 4 (De la Haye Avenue) in an intermediate development environment, except for the Stikland North/ P1B Access intersection. It needs to be signalised, with its spacings to the signalised intersections on either side (Old Paarl Road and St Harrod Drive: 310 - 315m) falling marginally short of the recommended 375m.

- The access on De la Haye Avenue serving the primary P1 node will need to be signalised. Its spacing relative to Old Paarl Road is sub-standard (180), falling short of the 275m spacing required for signals on a Class 4 road in an intermediate development environment. The access may have to be shifted southward to more closely comply with the spacing guidelines.

- A modal share analysis indicates that private transport users could comprise 68% of total movement demand, public transport users 18%, and NMT users 14%. At this stage of the planning phase, it is sufficient to note that number of public transport users could be around 1 000 passengers. The overall private transport modal share is considered high, which aligns with the "worst case scenario" projected trip generation assumed for this assessment.

- The provision of on-site parking provision at the ratios stipulated for a standard zone would not be feasible (95% of the site), as the development model does not allow for extensive structured parking to be provided. Proposed parking ratios at 1 bay/unit for open market housing, 0.8 bays/unit for first home finance housing, and 0.6 bays/unit for social housing require a departure application.

9.2 Recommendations

Based on the findings of this report, the following recommendations are made:

- The authorities review the findings in this report based on the methodologies applied.
- That ongoing discussions be held with the City of Cape Town with respect to the application of appropriate trip generation rates.
- The planned road improvements identified in this report as required to accommodate the proposed Stikland South development be programmed for completion based on a proportion (to be determined) of the development in place.

10 REFERENCES

1. ***Stikland South Transport Baseline Report***, prepared by HHO Consulting Engineers for the Western Cape Government, August 2023.
2. ***Stikland South Transport Contextual Report***, prepared by HHO Consulting Engineers for the Western Cape Government, August 2023.
3. ***Bellville Transportation Master Plan Framework***, prepared by Aurecon for the City of Cape Town, October 2019.
4. ***Public Right of Way (2022) Road Network Metropolitan Area***, published by the City of Cape Town, December 2022.
5. ***Contract No: 50C/2015/16: Upgrade of Old Paarl Road (R101)***, Plan Prepared by SMEC for the City of Cape Town, 2016.
6. ***South African Trip Data Manual (TMH 17), Version 1.01***. Prepared by the Roads Coordinating Body of the Committee of Transport Officials (COTO). Pretoria. September 2013.
7. ***Road Access Guidelines***. Prepared by the Provincial Administration of the Western Cape. September 2002.
8. ***Guidelines for the Public Transport Component of Transport Impact Assessments***, draft report prepared by HHO Consulting Engineers for the City of Cape Town, 2001.

APPENDICES

A: **AM & PM PEAK HOUR TRIP GENERATION WORKSHEETS**

B: **INTERSECTION ANALYSIS RESULTS**

APPENDIX A

AM & PM PEAK HOUR TRIP GENERATION WORKSHEETS

APPENDIX A1: STIKLAND MIXED USE DEVELOPMENT: PROPOSED TRIP GENERATION DETERMINATION: AM PEAK HOUR

Land Use	Precinct	Size	Base Trip Rate	Unit	Adjustment Factors				nt Trip Rate	Add Congestion	Trip Rate	Total External Trips	No of Units/ GLA	No of Trips	Trip Rate
					MU Dev	Low Car Own	Vlow Car Own	Transit							
Residential: Social	1	289	0.65	Dwelling Units	0.15	0.30			0.39	0	0.39	112			
	2	0	0.65		0.15	0.30			0.39		0.39	0			
	3								0.00		0.00	0			
	4	383	0.65			0.30		0.15	0.39		0.39	148			
	5	0	0.65			0.30			0.46		0.46	0	672	260	0.39
Residential: FHF	1	146	0.65		0.15	0.30			0.39		0.39	56			
	2	49	0.65		0.15	0.30			0.39		0.39	19			
	3								0.00		0.00	0			
	4	76	0.65			0.30		0.15	0.39		0.39	30			
	5	141	0.65			0.30			0.46		0.46	64	413	169	0.41
Residential: Open	1	1 073	0.65		0.15				0.55		0.55	593			
	2	85	0.65		0.15				0.55		0.55	47			
	3								0.00		0.00	0			
	4	227	0.65					0.15	0.55		0.55	125			
	5	213	0.65						0.65		0.65	138	1 598	903	0.57
													2 682	**1 333**	**0.50**
Office	1	37 325	2.10	100m^2 GLA	0.20	0.00	-	0.00	1.68	0	1.68	627			
	2	3 647	2.10	100m^2 GLA	0.20	0.00	-	0.00	1.68		1.68	61	40 973	688	1.68
School	1	1 000	0.80	Learner	0.60[1]	0.00	-	0.00	0.32		0.32	320			
Clinic	1	3 361	2.00	100m^2 GLA	0.00	0.00	-	0.00	2.00		2.00	67			
Retail	1	24 878	1.05	100m^2 GLA	0.10	0.15[2]	-	0.00	0.80		0.80	199			
	2	3 647	2.36	100m^2 GLA	0.10	0.15[2]		0.00	1.81		1.81	66	28 525	265	0.93
Total												**2673**			

Notes

1: High mixed use factor assumed as most learners are assumed to originate within the Stikland South development.

2: Vehicle ownership midway between standard and low vehicle ownership assumed given medium income profile of Stikland area

APPENDIX A2: STIKLAND MIXED USE DEVELOPMENT: PROPOSED TRIP GENERATION DETERMINATION: PM PEAK HOUR

Land Use	Precinct	Size	Base Trip Rate	Unit	Adjustment Factors				Resultant Trip Rate	Add Congestion	Trip Rate	Total External Trips	No of Units/ GLA	No of Trips	Trip Rate
					MU Dev	Low Car Own	Vlow Car Own	Transit							
Residential: Social	1	289	0.65	Dwelling Units	0.15	0.30			0.39	0	0.39	112			
	2	0	0.65		0.15	0.30			0.39		0.39	0			
	3								0.00		0.00	0			
	4	383	0.65			0.30		0.15	0.39		0.39	148			
	5	0	0.65			0.30			0.46		0.46	0	672	260	0.39
Residential: FHF	1	146	0.65		0.15	0.30			0.39		0.39	56			
	2	49	0.65		0.15	0.30			0.39		0.39	19			
	3								0.00		0.00	0			
	4	76	0.65			0.30		0.15	0.39		0.39	30			
	5	141	0.65			0.30			0.46		0.46	64	413	169	0.41
Residential: Open	1	1 073	0.65		0.15				0.55		0.55	593			
	2	85	0.65		0.15				0.55		0.55	47			
	3								0.00		0.00	0			
	4	227	0.65					0.15	0.55		0.55	125			
	5	213	0.65						0.65		0.65	138	1 598	903	0.57
													2 682	**1 333**	**0.50**
Office	1	37 325	2.10	$100m^2$ GLA	0.20	0.00	-	0.00	1.68	0	1.68	627			
	2	3 647	2.10	$100m^2$ GLA	0.20	0.00	-	0.00	1.68		1.68	61	40 973	688	1.68
School	1	1 000	0.25	Learner	0.60[1]	0.00	-	0.00	0.10		0.10	100			
Clinic	1	3 361	2.00	$100m^2$ GLA	0.00	0.00	-	0.00	2.00		2.00	67			
Retail	1	24 878	5.92	$100m^2$ GLA	0.10	0.15[2]	-	0.00	4.53		4.53	1126			
	2	3 647	13.39	$100m^2$ GLA	0.10	0.15[2]		0.00	10.2		10.2	374	28 525	1500	5.26
Total												**3688**			

Notes

1: High mixed use factor assumed as most learners are assumed to originate within the Stikland South development.

2: Vehicle ownership midway between standard and low vehicle ownership assumed given medium income profile of Stikland area

APPENDIX B

INTERSECTION ANALYSIS RESULTS

APPENDIX B1

OLD PAARL ROAD/ DE LA HAYE AVENUE

MOVEMENT SUMMARY

Site: 101 [Old Paarl Rd_De La Haye Ave AM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Future Geometry
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: De La Haye Ave															
1	L2	All MCs	225	0.0	225	0.0	0.844	26.0	LOS C	16.4	114.9	0.98	1.11	1.18	38.2
2	T1	All MCs	287	0.0	287	0.0	* 0.844	37.9	LOS D	16.4	114.9	0.98	1.11	1.18	39.1
3	R2	All MCs	326	0.3	326	0.3	0.493	28.9	LOS C	4.7	33.3	0.94	0.78	0.94	39.5
Approach			839	0.1	839	0.1	0.844	31.2	LOS C	16.4	114.9	0.96	0.98	1.09	39.0
East: Old Paarl Rd															
4	L2	All MCs	632	0.3	632	0.3	0.830	11.0	LOS B	22.1	155.4	0.65	0.76	0.70	50.2
5	T1	All MCs	1351	0.4	1351	0.4	0.830	16.3	LOS B	25.3	177.9	0.79	0.83	0.87	48.4
6	R2	All MCs	500	0.0	500	0.0	* 0.983	52.3	LOS D	19.1	133.7	1.00	1.10	1.53	32.6
Approach			2482	0.3	2482	0.3	0.983	22.2	LOS C	25.3	177.9	0.80	0.87	0.96	43.4
North: De La Haye Ave															
7	L2	All MCs	301	0.3	301	0.3	0.681	9.2	LOS A	12.4	87.0	0.80	0.82	0.80	47.8
8	T1	All MCs	275	0.0	275	0.0	0.681	19.7	LOS B	12.4	87.0	0.80	0.82	0.80	49.2
9	R2	All MCs	42	0.0	42	0.0	0.225	38.6	LOS D	1.4	9.7	0.94	0.73	0.94	36.1
Approach			618	0.2	618	0.2	0.681	15.9	LOS B	12.4	87.0	0.81	0.81	0.81	46.9
West: Old Paarl Rd															
10	L2	All MCs	33	0.0	33	0.0	0.651	14.2	LOS B	11.0	77.6	0.91	0.84	0.91	43.2
11	T1	All MCs	775	0.4	775	0.4	0.651	22.5	LOS C	11.9	83.3	0.91	0.81	0.91	44.0
12	R2	All MCs	196	0.0	196	0.0	* 1.050	85.4	LOS F	11.2	78.1	1.00	1.26	1.93	24.6
Approach			1003	0.3	1003	0.3	1.050	34.5	LOS C	11.9	83.3	0.93	0.90	1.11	38.1
All Vehicles			4942	0.3	4942	0.3	1.050	25.4	LOS C	25.3	177.9	0.85	0.89	0.99	41.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: De La Haye Ave												
P1	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09
East: Old Paarl Rd												

MOVEMENT SUMMARY

Site: 101 [Old Paarl Rd_De La Haye Ave PM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Future Geometry
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: De La Haye Ave															
1	L2	All MCs	220	0.0	220	0.0	0.523	6.9	LOS A	8.7	60.6	0.60	0.62	0.60	51.7
2	T1	All MCs	301	0.0	301	0.0	0.523	7.6	LOS A	8.7	60.6	0.60	0.62	0.60	53.4
3	R2	All MCs	602	0.2	602	0.2	* 0.952	53.1	LOS D	12.7	89.1	1.00	1.13	1.52	31.4
Approach			1123	0.1	1123	0.1	0.952	31.8	LOS C	12.7	89.1	0.82	0.89	1.10	38.6
East: Old Paarl Rd															
4	L2	All MCs	325	0.6	325	0.6	0.513	6.8	LOS A	6.0	42.5	0.55	0.63	0.55	52.3
5	T1	All MCs	591	0.9	591	0.9	0.513	14.2	LOS B	9.5	67.3	0.72	0.68	0.72	48.7
6	R2	All MCs	329	0.0	329	0.0	* 1.023	54.7	LOS D	12.8	89.4	1.00	1.26	1.71	27.0
Approach			1245	0.6	1245	0.6	1.023	23.0	LOS C	12.8	89.4	0.75	0.82	0.94	40.8
North: De La Haye Ave															
7	L2	All MCs	321	0.3	321	0.3	0.896	30.0	LOS C	21.0	146.9	1.00	1.06	1.25	39.2
8	T1	All MCs	329	0.0	329	0.0	* 0.896	39.1	LOS D	21.0	146.9	1.00	1.06	1.25	40.2
9	R2	All MCs	18	0.0	18	0.0	0.081	38.2	LOS D	0.5	3.8	0.88	0.70	0.88	37.5
Approach			668	0.2	668	0.2	0.896	34.7	LOS C	21.0	146.9	1.00	1.05	1.24	37.9
West: Old Paarl Rd															
10	L2	All MCs	36	0.0	36	0.0	1.081	65.8	LOS E	43.3	303.8	1.00	1.34	1.81	25.4
11	T1	All MCs	1387	0.2	1387	0.2	* 1.081	81.6	LOS F	43.3	303.8	1.00	1.42	1.82	25.8
12	R2	All MCs	276	0.0	276	0.0	0.614	25.3	LOS C	5.5	38.3	0.87	0.80	0.87	44.9
Approach			1699	0.2	1699	0.2	1.081	72.1	LOS E	43.3	303.8	0.98	1.31	1.67	26.9
All Vehicles			4736	0.3	4736	0.3	1.081	44.4	LOS D	43.3	303.8	0.88	1.05	1.28	33.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

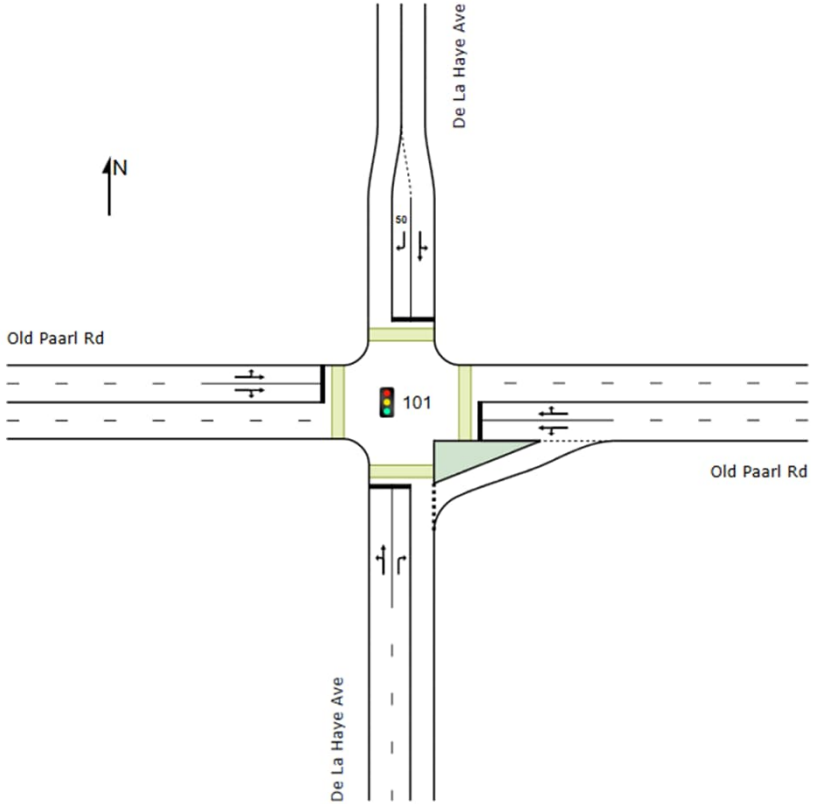
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

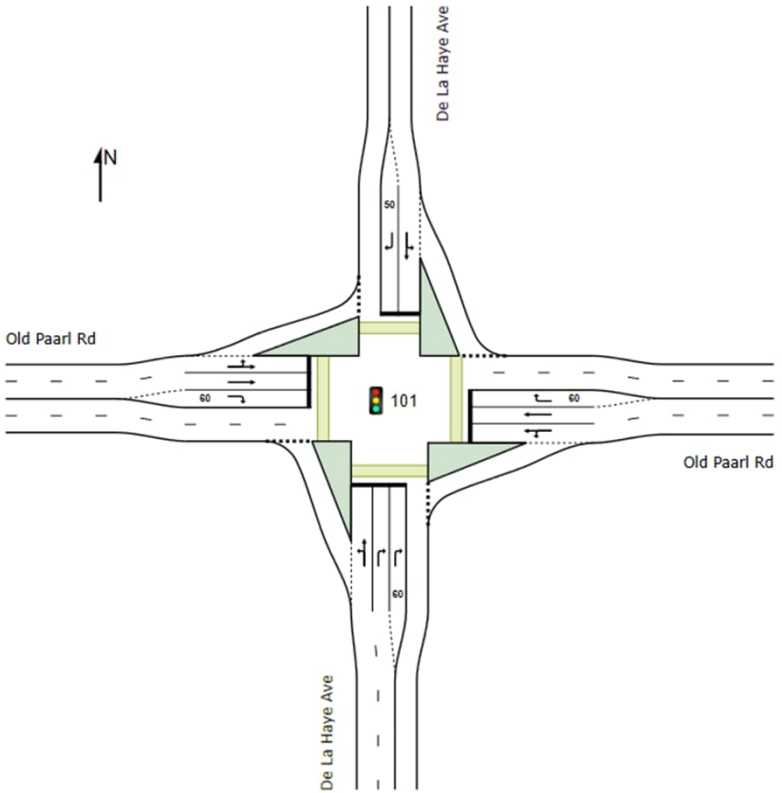
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: De La Haye Ave												
P1	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09
East: Old Paarl Rd												

Old Paarl Road / De La Haye Avenue

Existing



Future



APPENDIX B2

OLD PAARL ROAD/ STIKLAND NORTH/ P1B ACCESS

MOVEMENT SUMMARY

Site: 101 [Old Paarl Rd_Stikland (N)_P1B Access AM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Future Geometry
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: P1B Access															
1	L2	All MCs	221	0.0	221	0.0	0.436	41.3	LOS D	9.8	68.9	0.88	0.80	0.88	31.6
3	R2	All MCs	98	0.0	98	0.0	0.338	49.6	LOS D	4.7	33.1	0.92	0.78	0.92	29.1
Approach			319	0.0	319	0.0	0.436	43.8	LOS D	9.8	68.9	0.89	0.80	0.89	30.8
East: Old Paarl Rd															
4	L2	All MCs	75	0.0	75	0.0	0.979	48.1	LOS D	77.5	542.5	1.00	1.12	1.20	31.0
5	T1	All MCs	2260	0.0	2260	0.0	* 0.979	50.3	LOS D	77.5	542.5	1.00	1.12	1.20	27.5
6	R2	All MCs	120	0.0	120	0.0	0.427	29.1	LOS C	2.1	15.0	0.63	0.73	0.63	44.2
Approach			2455	0.0	2455	0.0	0.979	49.2	LOS D	77.5	542.5	0.98	1.10	1.18	26.0
North: Stikland North															
7	L2	All MCs	52	0.0	52	0.0	0.882	54.5	LOS D	9.6	67.5	1.00	0.97	1.30	24.4
9	R2	All MCs	105	0.0	105	0.0	* 0.882	75.8	LOS E	9.6	67.5	1.00	0.97	1.30	24.5
Approach			157	0.0	157	0.0	0.882	68.8	LOS E	9.6	67.5	1.00	0.97	1.30	24.5
West: Old Paarl Rd															
10	L2	All MCs	93	0.0	93	0.0	0.512	17.0	LOS B	18.0	125.8	0.58	0.56	0.58	46.0
11	T1	All MCs	1155	0.0	1155	0.0	0.512	12.2	LOS B	18.0	125.8	0.58	0.54	0.58	45.4
12	R2	All MCs	154	0.0	154	0.0	* 0.982	70.4	LOS E	7.9	55.0	1.00	1.01	1.48	24.4
Approach			1401	0.0	1401	0.0	0.982	18.9	LOS B	18.0	125.8	0.63	0.60	0.68	40.1
All Vehicles			4332	0.0	4332	0.0	0.982	39.7	LOS D	77.5	542.5	0.86	0.91	1.00	29.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: P1B Access												
P1	Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	203.1	200.0	0.98
East: Old Paarl Rd												
P2	Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	203.1	200.0	0.98
North: Stikland North												

MOVEMENT SUMMARY

Site: 101 [Old Paarl Rd_Stikland (N)_P1B Access PM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Future Geometry
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: P1B Access															
1	L2	All MCs	327	0.0	327	0.0	0.588	40.9	LOS D	15.0	105.0	0.91	0.83	0.91	31.7
3	R2	All MCs	145	0.0	145	0.0	0.425	48.5	LOS D	7.0	48.9	0.93	0.79	0.93	29.4
Approach			473	0.0	473	0.0	0.588	43.3	LOS D	15.0	105.0	0.91	0.82	0.91	31.0
East: Old Paarl Rd															
4	L2	All MCs	137	0.0	137	0.0	0.464	17.9	LOS B	15.7	109.6	0.59	0.59	0.59	44.9
5	T1	All MCs	941	0.0	941	0.0	0.464	12.6	LOS B	15.7	109.6	0.59	0.55	0.59	44.3
6	R2	All MCs	63	0.0	63	0.0	* 0.738	53.2	LOS D	3.8	26.5	0.92	0.92	1.20	28.1
Approach			1141	0.0	1141	0.0	0.738	15.4	LOS B	15.7	109.6	0.61	0.58	0.62	42.6
North: Stikland North															
7	L2	All MCs	15	0.0	15	0.0	* 0.491	52.1	LOS D	2.6	17.9	1.00	0.75	1.00	25.3
9	R2	All MCs	31	0.0	31	0.0	0.491	70.4	LOS E	2.6	17.9	1.00	0.75	1.00	25.4
Approach			45	0.0	45	0.0	0.491	64.5	LOS E	2.6	17.9	1.00	0.75	1.00	25.4
West: Old Paarl Rd															
10	L2	All MCs	28	0.0	28	0.0	0.779	16.0	LOS B	36.8	257.3	0.70	0.64	0.70	47.2
11	T1	All MCs	2036	0.0	2036	0.0	0.779	14.1	LOS B	36.8	257.3	0.70	0.64	0.70	46.6
12	R2	All MCs	247	0.0	247	0.0	* 0.700	25.6	LOS C	5.7	39.8	0.74	0.80	0.78	42.3
Approach			2312	0.0	2312	0.0	0.779	15.4	LOS B	36.8	257.3	0.70	0.66	0.71	42.6
All Vehicles			3971	0.0	3971	0.0	0.779	19.3	LOS B	36.8	257.3	0.70	0.66	0.71	40.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

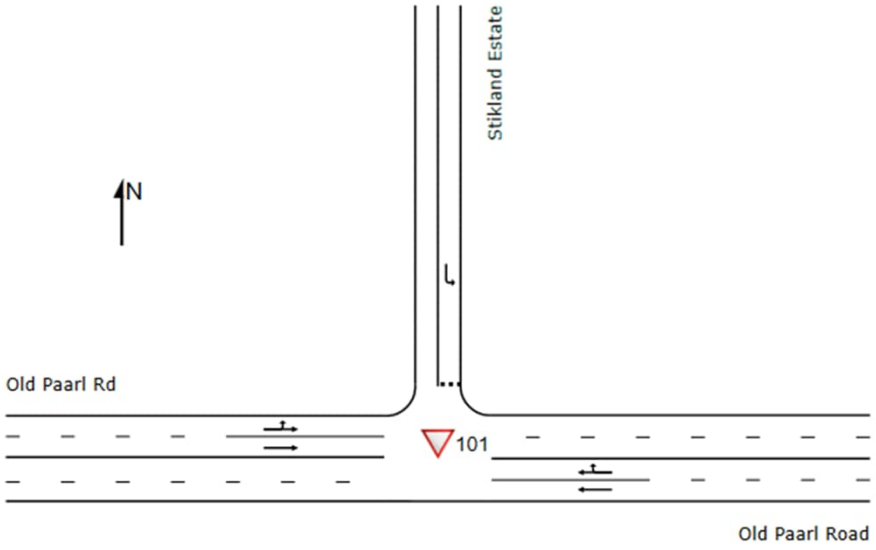
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

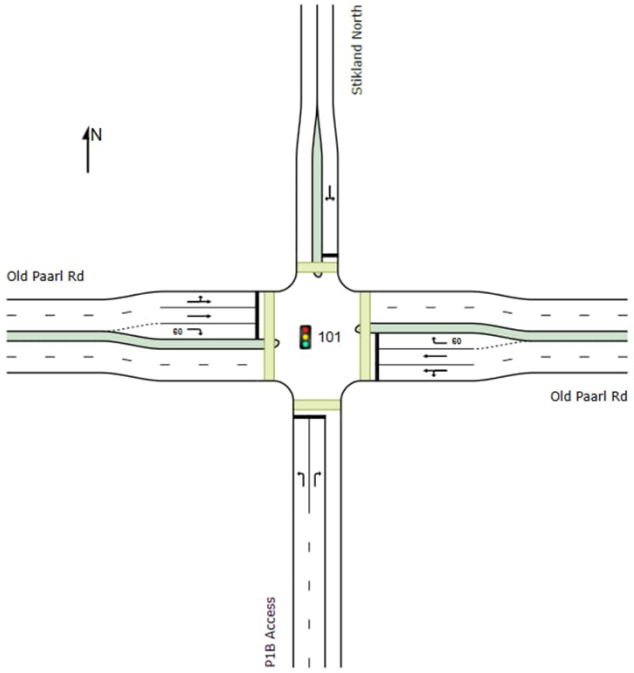
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: P1B Access												
P1	Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	203.1	200.0	0.98
East: Old Paarl Rd												
P2	Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	203.1	200.0	0.98
North: Stikland North												

Old Paarl Road / Stikland North

Existing



Future



APPENDIX B3

OLD PAARL ROAD/ ST HARROD DRIVE/ P1C ACCESS

MOVEMENT SUMMARY

Site: 101 [Old Paarl Rd_St Harrod_P1C Access AM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Future Geometry
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: P1C Access															
1	L2	All MCs	24	0.0	24	0.0	0.097	29.7	LOS C	1.4	10.1	0.79	0.66	0.79	37.4
2	T1	All MCs	24	0.0	24	0.0	0.097	24.2	LOS C	1.4	10.1	0.79	0.66	0.79	41.6
3	R2	All MCs	98	0.0	98	0.0	0.271	32.3	LOS C	3.2	22.1	0.84	0.76	0.84	38.2
Approach			146	0.0	146	0.0	0.271	30.5	LOS C	3.2	22.1	0.83	0.73	0.83	38.7
East: Old Paarl Rd															
4	L2	All MCs	152	0.0	152	0.0	0.945	37.6	LOS D	52.0	364.0	1.00	1.09	1.23	37.9
5	T1	All MCs	2072	0.0	2072	0.0	*0.945	36.7	LOS D	52.0	364.0	1.00	1.10	1.23	36.0
6	R2	All MCs	24	0.0	24	0.0	0.215	53.0	LOS D	0.9	6.6	0.95	0.72	0.95	33.9
Approach			2247	0.0	2247	0.0	0.945	37.0	LOS D	52.0	364.0	1.00	1.09	1.22	34.3
North: St Harrod Dr															
7	L2	All MCs	33	0.0	33	0.0	0.122	29.9	LOS C	1.8	12.8	0.80	0.68	0.80	40.2
8	T1	All MCs	28	0.0	28	0.0	0.122	24.4	LOS C	1.8	12.8	0.80	0.68	0.80	41.4
9	R2	All MCs	358	0.0	358	0.0	*0.963	60.9	LOS E	18.8	131.7	1.00	1.11	1.47	26.2
Approach			419	0.0	419	0.0	0.963	56.0	LOS E	18.8	131.7	0.97	1.04	1.37	28.0
West: Old Paarl Rd															
10	L2	All MCs	163	0.0	163	0.0	0.143	18.6	LOS B	2.7	18.7	0.45	0.69	0.45	45.8
11	T1	All MCs	1196	0.0	1196	0.0	0.876	27.7	LOS C	36.5	255.5	0.92	0.95	1.08	39.1
12	R2	All MCs	52	0.0	52	0.0	0.876	121.1	LOS F	13.1	91.7	1.00	1.03	1.30	30.6
Approach			1411	0.0	1411	0.0	0.876	30.0	LOS C	36.5	255.5	0.87	0.92	1.01	37.0
All Vehicles			4223	0.0	4223	0.0	0.963	36.3	LOS D	52.0	364.0	0.95	1.02	1.15	34.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: P1C Access												
P1	Full	50	53	34.3	LOS D	0.1	0.1	0.93	0.93	188.1	200.0	1.06
East: Old Paarl Rd												

MOVEMENT SUMMARY

Site: 101 [Old Paarl Rd_St Harrod_P1C Access PM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Future Geometry
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: P1C Access															
1	L2	All MCs	37	0.0	37	0.0	0.221	51.7	LOS D	3.7	26.2	0.90	0.73	0.90	29.3
2	T1	All MCs	37	0.0	37	0.0	0.221	46.2	LOS D	3.7	26.2	0.90	0.73	0.90	33.3
3	R2	All MCs	145	0.0	145	0.0	* 0.634	59.3	LOS E	8.3	58.2	0.99	0.82	1.01	29.8
Approach			219	0.0	219	0.0	0.634	55.8	LOS E	8.3	58.2	0.96	0.79	0.97	30.3
East: Old Paarl Rd															
4	L2	All MCs	183	0.0	183	0.0	0.376	11.4	LOS B	10.9	76.6	0.39	0.47	0.39	51.3
5	T1	All MCs	895	0.0	895	0.0	0.376	5.8	LOS A	11.1	77.9	0.39	0.40	0.39	52.9
6	R2	All MCs	63	0.0	63	0.0	* 0.777	62.8	LOS E	4.3	30.2	0.95	0.94	1.26	29.0
Approach			1141	0.0	1141	0.0	0.777	9.9	LOS A	11.1	77.9	0.42	0.44	0.44	49.9
North: St Harrod Dr															
7	L2	All MCs	24	0.0	24	0.0	0.173	51.2	LOS D	2.9	20.3	0.89	0.71	0.89	32.8
8	T1	All MCs	34	0.0	34	0.0	0.173	45.7	LOS D	2.9	20.3	0.89	0.71	0.89	33.6
9	R2	All MCs	102	0.0	102	0.0	0.470	57.5	LOS E	5.7	39.6	0.96	0.79	0.96	27.0
Approach			160	0.0	160	0.0	0.470	54.1	LOS D	5.7	39.6	0.93	0.76	0.93	29.3
West: Old Paarl Rd															
10	L2	All MCs	342	0.0	342	0.0	0.248	15.8	LOS B	6.2	43.3	0.34	0.68	0.34	47.2
11	T1	All MCs	1883	0.0	1883	0.0	0.829	13.9	LOS B	38.4	268.7	0.74	0.68	0.74	48.4
12	R2	All MCs	62	0.0	62	0.0	0.829	26.6	LOS C	38.4	268.7	0.75	0.70	0.75	45.9
Approach			2287	0.0	2287	0.0	0.829	14.5	LOS B	38.4	268.7	0.68	0.68	0.68	45.9
All Vehicles			3807	0.0	3807	0.0	0.829	17.2	LOS B	38.4	268.7	0.63	0.62	0.63	44.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

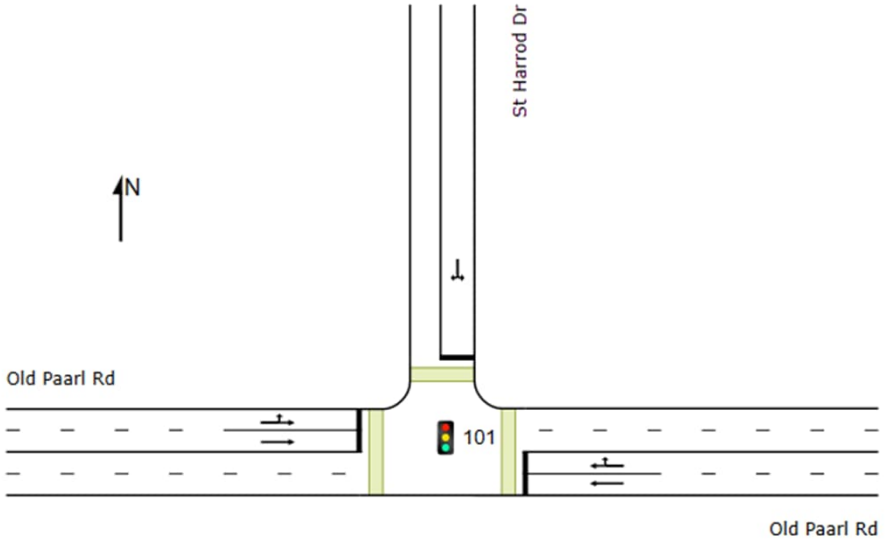
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

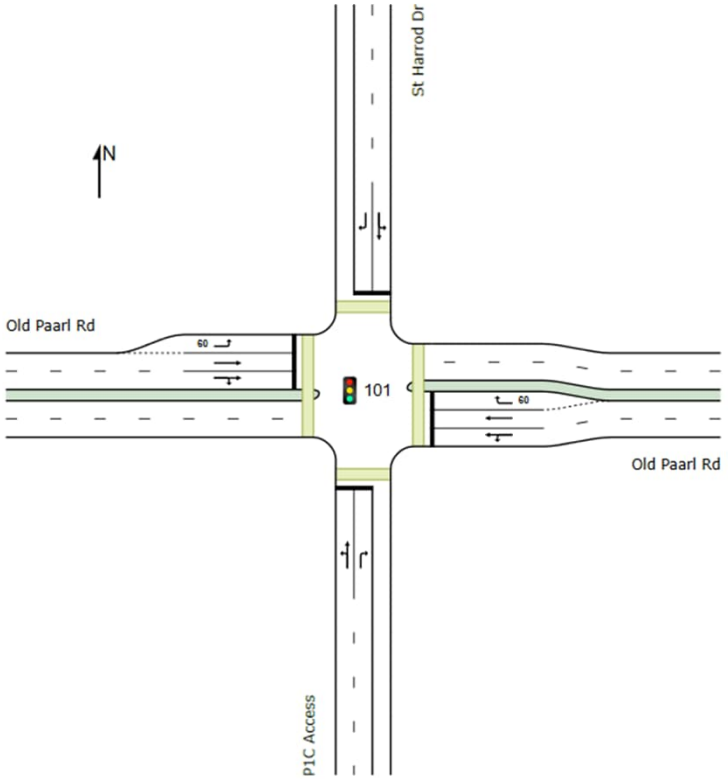
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: P1C Access												
P1	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	208.1	200.0	0.96
East: Old Paarl Rd												

Old Paarl Road / St Harrod Drive

Existing



Future



APPENDIX B4

OLD PAARL ROAD/ MEERLUST STREET/ P2 ACCESS

MOVEMENT SUMMARY

Site: 101 [Old Paarl Rd_Meerlust Str_P2 Access AM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Future Geomtry
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: P2 Access															
1	L2	All MCs	59	0.0	59	0.0	0.130	34.3	LOS C	2.0	14.2	0.82	0.73	0.82	37.4
3	R2	All MCs	15	0.0	15	0.0	0.048	37.3	LOS D	0.5	3.7	0.84	0.69	0.84	36.3
Approach			74	0.0	74	0.0	0.130	34.9	LOS C	2.0	14.2	0.82	0.72	0.82	37.1
East: Old Paarl Rd															
4	L2	All MCs	19	0.0	19	0.0	0.843	21.6	LOS C	38.3	268.0	0.85	0.81	0.89	45.8
5	T1	All MCs	1984	0.0	1984	0.0	0.843	19.4	LOS B	38.3	268.0	0.85	0.82	0.89	47.1
6	R2	All MCs	52	0.0	52	0.0	0.219	25.1	LOS C	1.3	9.2	0.58	0.72	0.58	44.1
Approach			2055	0.0	2055	0.0	0.843	19.6	LOS B	38.3	268.0	0.84	0.81	0.88	45.3
North: Meerlust Str															
7	L2	All MCs	86	0.0	86	0.0	* 0.822	46.0	LOS D	13.7	95.9	1.00	0.94	1.18	33.0
9	R2	All MCs	204	0.0	204	0.0	0.822	48.2	LOS D	13.7	95.9	1.00	0.94	1.18	33.1
Approach			291	0.0	291	0.0	0.822	47.6	LOS D	13.7	95.9	1.00	0.94	1.18	33.0
West: Old Paarl Rd															
10	L2	All MCs	128	0.0	128	0.0	0.107	12.0	LOS B	2.1	14.8	0.40	0.67	0.40	48.4
11	T1	All MCs	1123	0.0	1123	0.0	0.447	8.5	LOS A	12.2	85.1	0.54	0.48	0.54	52.6
12	R2	All MCs	76	0.0	76	0.0	* 0.779	53.7	LOS D	3.9	27.6	0.99	0.94	1.34	31.2
Approach			1327	0.0	1327	0.0	0.779	11.4	LOS B	12.2	85.1	0.55	0.53	0.57	50.2
All Vehicles			3746	0.0	3746	0.0	0.843	19.2	LOS B	38.3	268.0	0.75	0.72	0.80	45.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: P2 Access												
P1	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04
East: Old Paarl Rd												
P2	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04
North: Meerlust Str												

MOVEMENT SUMMARY

Site: 101 [Old Paarl Rd_Meerlust Str_P2 Access PM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Future Geomtry
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: P2 Access															
1	L2	All MCs	215	0.0	215	0.0	0.473	37.4	LOS D	8.2	57.4	0.90	0.81	0.90	36.2
3	R2	All MCs	54	0.0	54	0.0	0.167	38.4	LOS D	2.0	14.0	0.86	0.74	0.86	36.0
Approach			268	0.0	268	0.0	0.473	37.6	LOS D	8.2	57.4	0.90	0.79	0.90	36.2
East: Old Paarl Rd															
4	L2	All MCs	52	0.0	52	0.0	0.367	13.5	LOS B	9.3	64.9	0.50	0.48	0.50	50.7
5	T1	All MCs	869	0.0	869	0.0	0.367	7.9	LOS A	9.3	65.2	0.50	0.46	0.50	52.9
6	R2	All MCs	67	0.0	67	0.0	0.505	32.5	LOS C	2.6	17.9	0.83	0.79	0.83	38.0
Approach			988	0.0	988	0.0	0.505	9.9	LOS A	9.3	65.2	0.52	0.48	0.52	51.4
North: Meerlust Str															
7	L2	All MCs	102	0.0	102	0.0	* 0.524	39.2	LOS D	6.5	45.3	0.95	0.80	0.95	34.6
9	R2	All MCs	56	0.0	56	0.0	0.524	47.7	LOS D	6.5	45.3	0.95	0.80	0.95	34.7
Approach			158	0.0	158	0.0	0.524	42.2	LOS D	6.5	45.3	0.95	0.80	0.95	34.6
West: Old Paarl Rd															
10	L2	All MCs	184	0.0	184	0.0	0.154	15.4	LOS B	3.1	22.0	0.42	0.69	0.42	48.2
11	T1	All MCs	1524	0.0	1524	0.0	* 0.698	13.4	LOS B	22.7	159.2	0.70	0.64	0.70	50.8
12	R2	All MCs	206	0.0	206	0.0	0.624	23.3	LOS C	6.6	46.2	0.74	0.80	0.75	42.9
Approach			1915	0.0	1915	0.0	0.698	14.6	LOS B	22.7	159.2	0.68	0.66	0.68	48.0
All Vehicles			3329	0.0	3329	0.0	0.698	16.4	LOS B	22.7	159.2	0.66	0.62	0.66	46.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

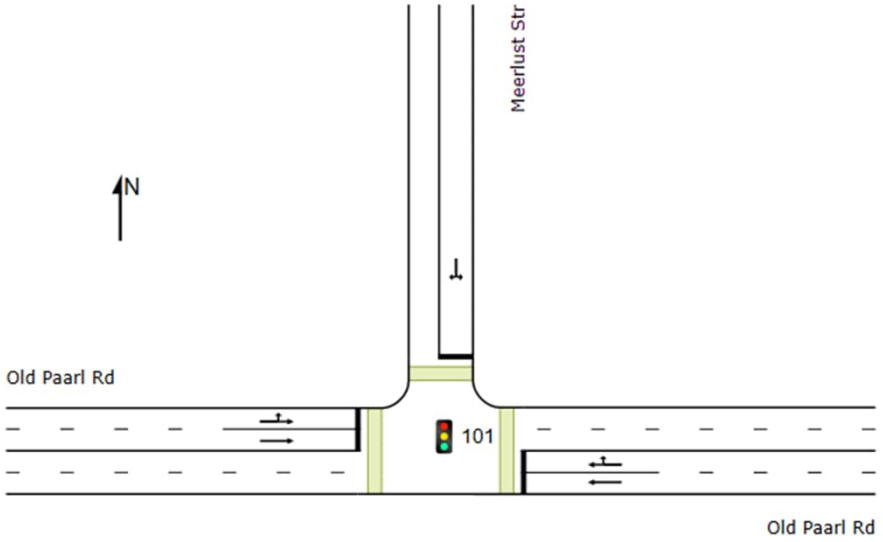
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

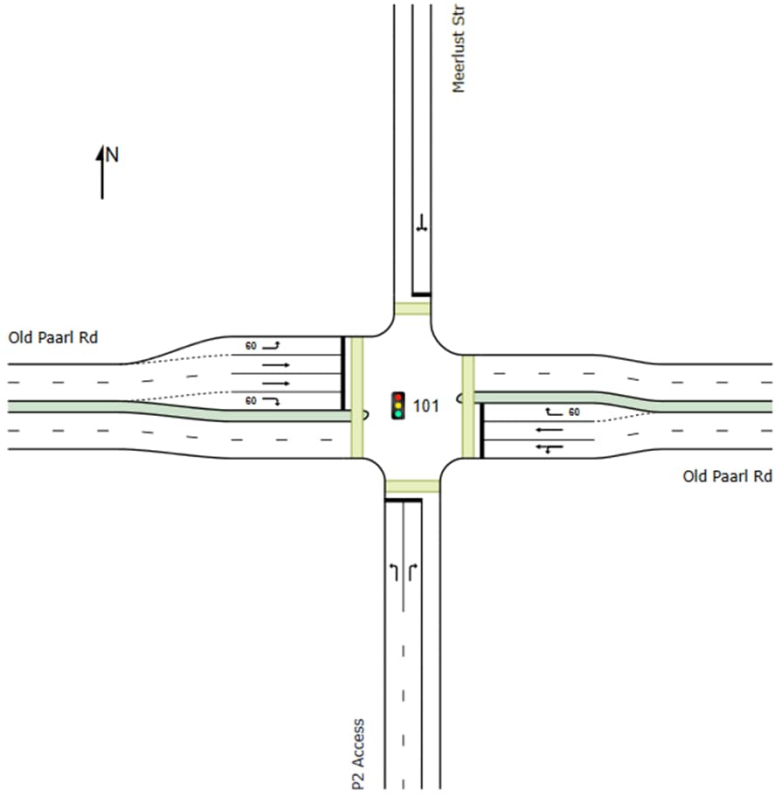
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: P2 Access												
P1	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04
East: Old Paarl Rd												
P2	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04
North: Meerlust Str												

Old Paarl Road / Meerlust Street

Existing



Future



APPENDIX B6

DE LA HAYE/ NURSING COLLEGE/ P1A ACCESS

MOVEMENT SUMMARY

Site: 101 [De la Haye Ave_P1A Access AM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Future Geometry
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: De la Haye Ave															
2	T1	All MCs	600	0.0	600	0.0	0.559	9.5	LOS A	11.5	80.5	0.70	0.62	0.70	48.8
3	R2	All MCs	346	0.0	346	0.0	* 0.850	25.7	LOS C	7.7	53.7	1.00	0.94	1.29	40.8
Approach			946	0.0	946	0.0	0.850	15.5	LOS B	11.5	80.5	0.81	0.74	0.91	44.8
East: P1A Access															
4	L2	All MCs	297	0.0	297	0.0	0.862	26.6	LOS C	17.4	121.8	1.00	0.98	1.26	37.6
6	R2	All MCs	224	0.0	224	0.0	* 0.862	43.0	LOS D	17.4	121.8	1.00	0.98	1.26	32.0
Approach			521	0.0	521	0.0	0.862	33.6	LOS C	17.4	121.8	1.00	0.98	1.26	35.5
North: De la Haye Ave															
7	L2	All MCs	338	0.0	338	0.0	0.905	38.4	LOS D	19.6	137.0	1.00	1.09	1.35	31.0
8	T1	All MCs	763	0.0	763	0.0	* 0.905	32.7	LOS C	20.1	140.7	1.00	1.10	1.34	33.1
Approach			1101	0.0	1101	0.0	0.905	34.4	LOS C	20.1	140.7	1.00	1.10	1.34	32.4
All Vehicles			2568	0.0	2568	0.0	0.905	27.3	LOS C	20.1	140.7	0.93	0.94	1.17	37.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: De la Haye Ave												
P1	Full	50	53	24.4	LOS C	0.1	0.1	0.90	0.90	178.2	200.0	1.12
East: P1A Access												
P2	Full	50	53	24.4	LOS C	0.1	0.1	0.90	0.90	178.2	200.0	1.12
North: De la Haye Ave												
P3	Full	50	53	24.4	LOS C	0.1	0.1	0.90	0.90	178.2	200.0	1.12
All Pedestrians		150	158	24.4	LOS C	0.1	0.1	0.90	0.90	178.2	200.0	1.12

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.

MOVEMENT SUMMARY

Site: 101 [De la Haye Ave_P1A Access PM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Future Geometry
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: De la Haye Ave															
2	T1	All MCs	856	0.0	856	0.0	0.898	32.2	LOS C	40.1	280.4	0.99	1.01	1.13	33.7
3	R2	All MCs	413	0.0	413	0.0	* 1.007	58.6	LOS E	21.4	149.6	1.00	1.17	1.50	26.1
Approach			1268	0.0	1268	0.0	1.007	40.8	LOS D	40.1	280.4	0.99	1.07	1.25	30.1
East: P1A Access															
4	L2	All MCs	442	0.0	442	0.0	0.976	45.9	LOS D	44.8	313.3	1.00	1.09	1.33	30.2
6	R2	All MCs	335	0.0	335	0.0	* 0.976	72.3	LOS E	44.8	313.3	1.00	1.09	1.33	24.6
Approach			777	0.0	777	0.0	0.976	57.3	LOS E	44.8	313.3	1.00	1.09	1.33	28.0
North: De la Haye Ave															
7	L2	All MCs	405	0.0	405	0.0	0.954	60.7	LOS E	25.2	176.4	1.00	1.07	1.36	24.0
8	T1	All MCs	525	0.0	525	0.0	* 0.954	54.7	LOS D	26.2	183.4	1.00	1.14	1.35	25.7
Approach			931	0.0	931	0.0	0.954	57.3	LOS E	26.2	183.4	1.00	1.11	1.35	24.9
All Vehicles			2976	0.0	2976	0.0	1.007	50.3	LOS D	44.8	313.3	1.00	1.09	1.30	27.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

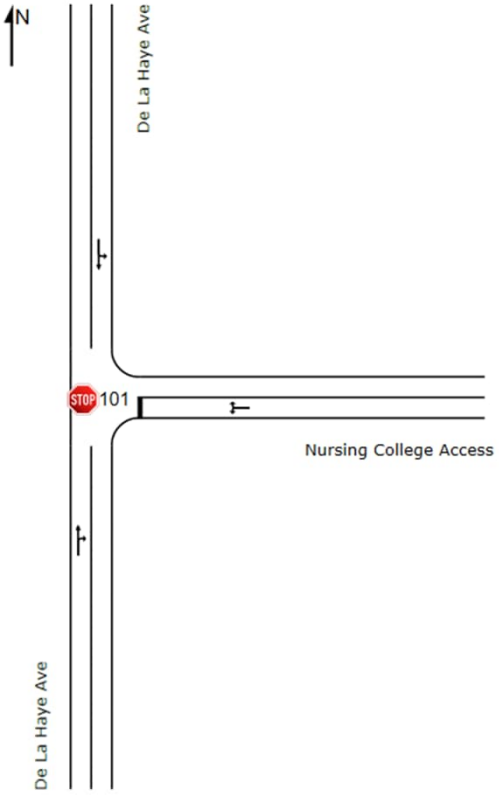
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: De la Haye Ave												
P1	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04
East: P1A Access												
P2	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04
North: De la Haye Ave												
P3	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04
All Pedestrians		150	158	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04

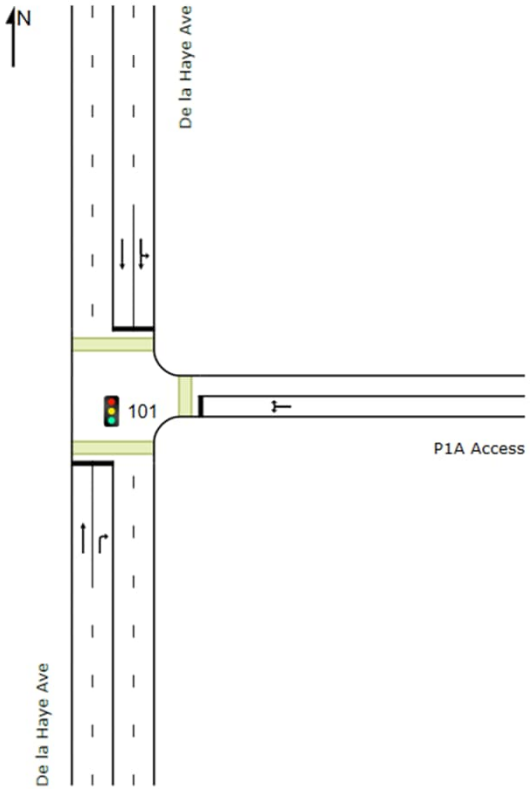
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

De La Haye Avenue/ Nursing College Access

Existing



Future



APPENDIX B7

DE LA HAYE/ FRANS HALS/ P5 ACCESS

MOVEMENT SUMMARY

Site: 101 [De la Haye Ave_Frans Hals_P5 Access AM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: De la Haye															
1	L2	All MCs	6	0.0	6	0.0	0.721	9.2	LOS A	9.1	63.9	0.87	0.72	0.99	50.2
2	T1	All MCs	654	0.0	654	0.0	0.721	9.4	LOS A	9.1	63.9	0.87	0.72	0.99	50.5
3	R2	All MCs	74	0.0	74	0.0	0.721	12.8	LOS B	9.1	63.9	0.87	0.72	0.99	49.8
Approach			734	0.0	734	0.0	0.721	9.7	LOS A	9.1	63.9	0.87	0.72	0.99	50.4
East: P5 Access															
4	L2	All MCs	65	0.0	65	0.0	0.630	20.5	LOS C	6.3	44.1	1.00	1.01	1.41	42.4
5	T1	All MCs	1	0.0	1	0.0	0.630	20.7	LOS C	6.3	44.1	1.00	1.01	1.41	42.6
6	R2	All MCs	236	0.0	236	0.0	0.630	24.1	LOS C	6.3	44.1	1.00	1.01	1.41	42.1
Approach			302	0.0	302	0.0	0.630	23.3	LOS C	6.3	44.1	1.00	1.01	1.41	42.2
North: De la Haye															
7	L2	All MCs	119	0.0	119	0.0	0.765	5.5	LOS A	11.7	81.7	0.64	0.48	0.64	51.4
8	T1	All MCs	884	0.0	884	0.0	0.765	5.7	LOS A	11.7	81.7	0.64	0.48	0.64	51.8
9	R2	All MCs	57	0.0	57	0.0	0.765	9.2	LOS A	11.7	81.7	0.64	0.48	0.64	51.0
Approach			1060	0.0	1060	0.0	0.765	5.9	LOS A	11.7	81.7	0.64	0.48	0.64	51.7
West: Frans Hals Str															
10	L2	All MCs	56	0.0	56	0.0	0.142	12.1	LOS B	1.0	6.7	0.88	0.79	0.88	48.2
11	T1	All MCs	1	0.0	1	0.0	0.142	12.3	LOS B	1.0	6.7	0.88	0.79	0.88	48.5
12	R2	All MCs	9	0.0	9	0.0	0.142	15.8	LOS B	1.0	6.7	0.88	0.79	0.88	47.8
Approach			66	0.0	66	0.0	0.142	12.6	LOS B	1.0	6.7	0.88	0.79	0.88	48.1
All Vehicles			2162	0.0	2162	0.0	0.765	9.8	LOS A	11.7	81.7	0.77	0.65	0.87	49.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [De la Haye Ave_Frans Hals_P5 Access PM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

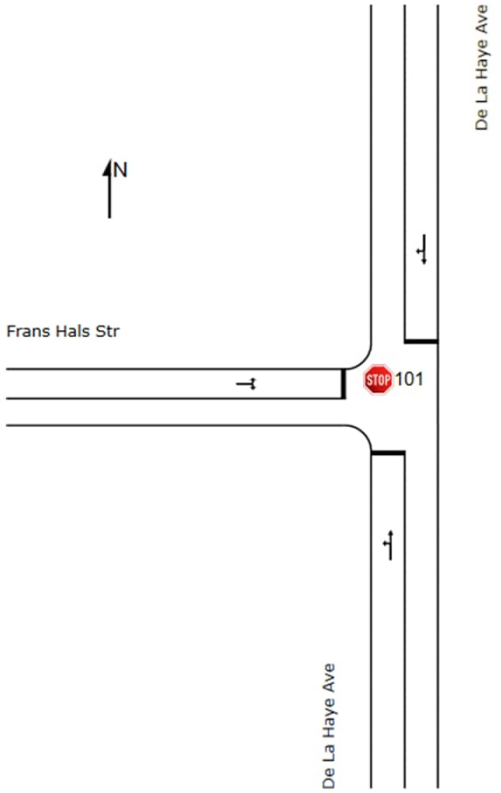
Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: De la Haye															
1	L2	All MCs	3	0.0	3	0.0	0.887	6.6	LOS A	17.5	122.8	0.97	0.56	0.97	50.2
2	T1	All MCs	1118	0.0	1118	0.0	0.887	6.8	LOS A	17.5	122.8	0.97	0.56	0.97	50.5
3	R2	All MCs	58	0.0	58	0.0	0.887	10.2	LOS B	17.5	122.8	0.97	0.56	0.97	49.8
Approach			1179	0.0	1179	0.0	0.887	7.0	LOS A	17.5	122.8	0.97	0.56	0.97	50.5
East: P5 Access															
4	L2	All MCs	55	0.0	55	0.0	0.241	11.1	LOS B	1.6	11.0	0.84	0.79	0.84	47.9
5	T1	All MCs	1	0.0	1	0.0	0.241	11.3	LOS B	1.6	11.0	0.84	0.79	0.84	48.2
6	R2	All MCs	81	0.0	81	0.0	0.241	14.7	LOS B	1.6	11.0	0.84	0.79	0.84	47.6
Approach			137	0.0	137	0.0	0.241	13.3	LOS B	1.6	11.0	0.84	0.79	0.84	47.7
North: De la Haye															
7	L2	All MCs	116	0.0	116	0.0	0.682	5.1	LOS A	9.3	65.0	0.48	0.45	0.48	52.0
8	T1	All MCs	826	0.0	826	0.0	0.682	5.3	LOS A	9.3	65.0	0.48	0.45	0.48	52.4
9	R2	All MCs	35	0.0	35	0.0	0.682	8.7	LOS A	9.3	65.0	0.48	0.45	0.48	51.6
Approach			977	0.0	977	0.0	0.682	5.4	LOS A	9.3	65.0	0.48	0.45	0.48	52.3
West: Frans Hals Str															
10	L2	All MCs	68	0.0	68	0.0	0.300	20.4	LOS C	2.3	15.8	1.00	0.89	1.00	43.6
11	T1	All MCs	1	0.0	1	0.0	0.300	20.6	LOS C	2.3	15.8	1.00	0.89	1.00	43.8
12	R2	All MCs	3	0.0	3	0.0	0.300	24.1	LOS C	2.3	15.8	1.00	0.89	1.00	43.3
Approach			73	0.0	73	0.0	0.300	20.6	LOS C	2.3	15.8	1.00	0.89	1.00	43.6
All Vehicles			2365	0.0	2365	0.0	0.887	7.1	LOS A	17.5	122.8	0.76	0.54	0.76	50.8

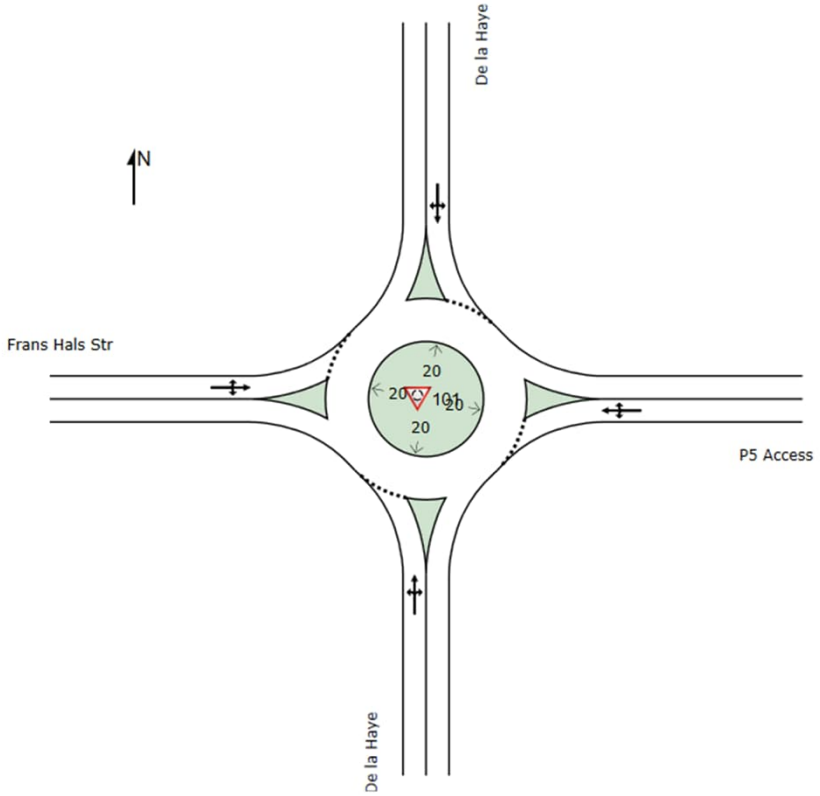
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

De La Haye Avenue/ Frans Hals Street

Existing



Future



APPENDIX B8

DE LA HAYE/ HOSPITAL ENTRANCE/ P4 ACCESS

MOVEMENT SUMMARY

Site: 101 [De la Haye Ave_P4 Access AM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: De la Haye															
2	T1	All MCs	566	0.0	566	0.0	0.503	5.9	LOS A	4.4	30.8	0.56	0.52	0.56	52.0
3	R2	All MCs	24	0.0	24	0.0	0.503	9.4	LOS A	4.4	30.8	0.56	0.52	0.56	51.3
Approach			591	0.0	591	0.0	0.503	6.1	LOS A	4.4	30.8	0.56	0.52	0.56	52.0
East: P4 Access															
4	L2	All MCs	72	0.0	72	0.0	0.399	13.0	LOS B	2.8	19.6	0.86	0.83	0.93	46.5
6	R2	All MCs	167	0.0	167	0.0	0.399	16.7	LOS B	2.8	19.6	0.86	0.83	0.93	46.2
Approach			239	0.0	239	0.0	0.399	15.6	LOS B	2.8	19.6	0.86	0.83	0.93	46.3
North: De la Haye															
7	L2	All MCs	56	0.0	56	0.0	0.608	4.6	LOS A	7.0	48.8	0.23	0.43	0.23	53.0
8	T1	All MCs	903	0.0	903	0.0	0.608	4.9	LOS A	7.0	48.8	0.23	0.43	0.23	53.4
Approach			959	0.0	959	0.0	0.608	4.8	LOS A	7.0	48.8	0.23	0.43	0.23	53.4
All Vehicles			1788	0.0	1788	0.0	0.608	6.7	LOS A	7.0	48.8	0.42	0.51	0.43	51.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [De la Haye Ave_P4 Access PM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

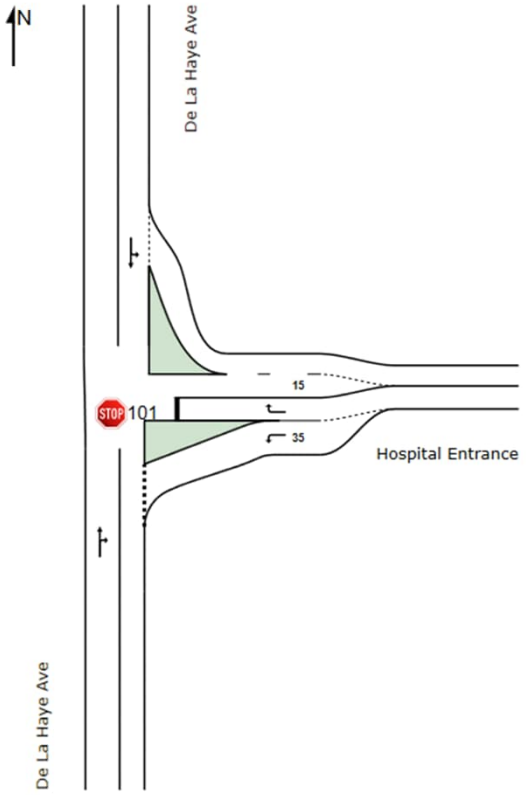
Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: De la Haye															
2	T1	All MCs	1113	0.0	1113	0.0	0.820	5.7	LOS A	15.6	109.0	0.68	0.47	0.68	51.5
3	R2	All MCs	67	0.0	67	0.0	0.820	9.1	LOS A	15.6	109.0	0.68	0.47	0.68	50.8
Approach			1180	0.0	1180	0.0	0.820	5.9	LOS A	15.6	109.0	0.68	0.47	0.68	51.5
East: P4 Access															
4	L2	All MCs	28	0.0	28	0.0	0.142	9.2	LOS A	0.9	6.0	0.74	0.75	0.74	48.8
6	R2	All MCs	67	0.0	67	0.0	0.142	12.9	LOS B	0.9	6.0	0.74	0.75	0.74	48.5
Approach			96	0.0	96	0.0	0.142	11.8	LOS B	0.9	6.0	0.74	0.75	0.74	48.6
North: De la Haye															
7	L2	All MCs	157	0.0	157	0.0	0.625	5.0	LOS A	7.1	49.8	0.43	0.46	0.43	52.3
8	T1	All MCs	728	0.0	728	0.0	0.625	5.3	LOS A	7.1	49.8	0.43	0.46	0.43	52.7
Approach			885	0.0	885	0.0	0.625	5.2	LOS A	7.1	49.8	0.43	0.46	0.43	52.6
All Vehicles			2161	0.0	2161	0.0	0.820	5.9	LOS A	15.6	109.0	0.58	0.48	0.58	51.8

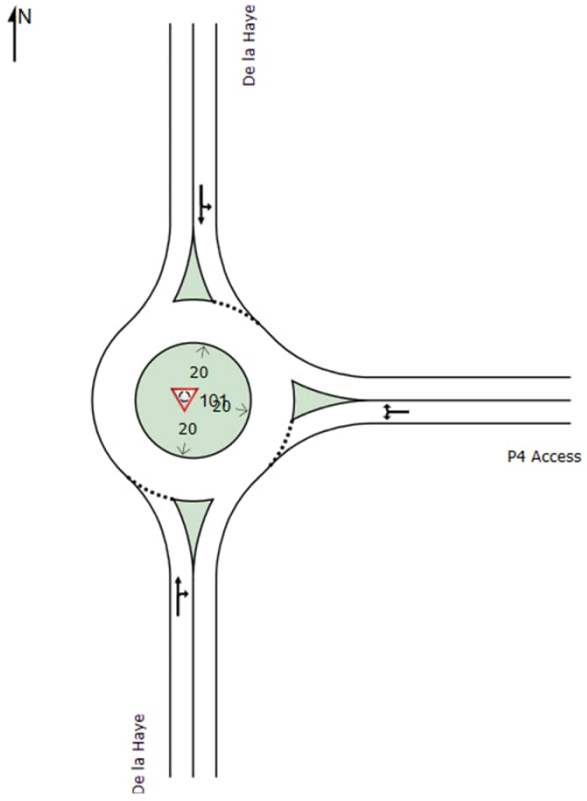
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

De La Haye Avenue/ Hospital Entrance

Existing



Future



APPENDIX B5

DE LA HAYE AVENUE/ PARATUS AVENUE

MOVEMENT SUMMARY

Site: 101 [De la Haye Ave_Paratus Ave AM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: De la Haye Ave															
1	L2	All MCs	201	0.0	201	0.0	0.425	5.7	LOS A	0.0	0.0	0.00	0.15	0.00	56.0
2	T1	All MCs	618	0.0	618	0.0	0.425	0.2	LOS A	0.0	0.0	0.00	0.15	0.00	58.4
Approach			819	0.0	819	0.0	0.425	1.5	NA	0.0	0.0	0.00	0.15	0.00	57.8
North: De la Haye Ave															
8	T1	All MCs	444	0.0	444	0.0	0.417	3.7	LOS A	2.9	20.5	0.44	0.53	0.63	55.0
9	R2	All MCs	126	0.0	126	0.0	0.417	12.0	LOS B	2.9	20.5	0.44	0.53	0.63	52.6
Approach			571	0.0	571	0.0	0.417	5.5	NA	2.9	20.5	0.44	0.53	0.63	54.4
West: Paratus Ave															
10	L2	All MCs	136	0.0	136	0.0	1.067	67.7	LOS F	15.0	105.3	1.00	2.04	4.73	26.2
12	R2	All MCs	174	0.0	174	0.0	1.067	85.4	LOS F	15.0	105.3	1.00	2.04	4.73	26.1
Approach			309	0.0	309	0.0	1.067	77.6	LOS F	15.0	105.3	1.00	2.04	4.73	26.2
All Vehicles			1699	0.0	1699	0.0	1.067	16.7	NA	15.0	105.3	0.33	0.62	1.07	46.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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 (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [De la Haye Ave_Paratus Ave PM (Site Folder: Future Geometry)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Stop (Two-Way)

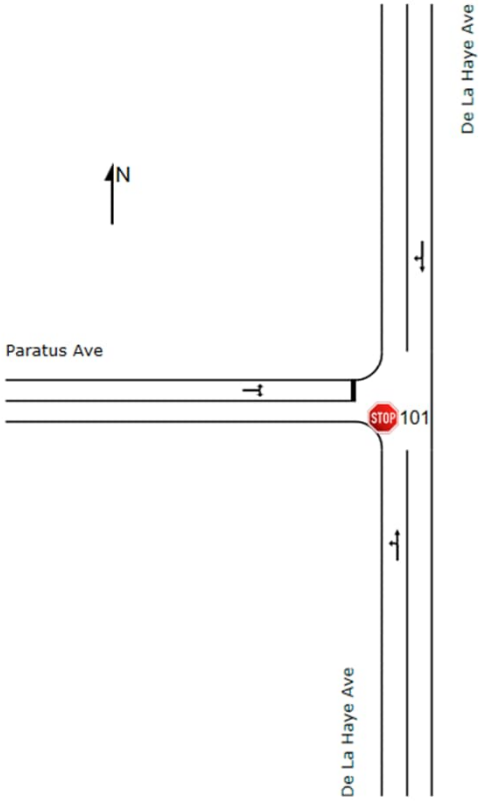
Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: De la Haye Ave															
1	L2	All MCs	114	0.0	114	0.0	0.345	5.6	LOS A	0.0	0.0	0.00	0.10	0.00	56.5
2	T1	All MCs	553	0.0	553	0.0	0.345	0.1	LOS A	0.0	0.0	0.00	0.10	0.00	58.9
Approach			666	0.0	666	0.0	0.345	1.1	NA	0.0	0.0	0.00	0.10	0.00	58.5
North: De la Haye Ave															
8	T1	All MCs	565	0.0	565	0.0	0.439	2.0	LOS A	2.5	17.4	0.31	0.40	0.45	56.7
9	R2	All MCs	126	0.0	126	0.0	0.439	10.1	LOS B	2.5	17.4	0.31	0.40	0.45	54.2
Approach			692	0.0	692	0.0	0.439	3.5	NA	2.5	17.4	0.31	0.40	0.45	56.2
West: Paratus Ave															
10	L2	All MCs	158	0.0	158	0.0	0.725	18.9	LOS C	4.5	31.7	0.88	1.28	1.82	41.6
12	R2	All MCs	103	0.0	103	0.0	0.725	37.0	LOS E	4.5	31.7	0.88	1.28	1.82	41.4
Approach			261	0.0	261	0.0	0.725	26.1	LOS D	4.5	31.7	0.88	1.28	1.82	41.5
All Vehicles			1619	0.0	1619	0.0	0.725	6.1	NA	4.5	31.7	0.27	0.42	0.48	54.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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 (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

De La Haye Avenue/ Paratus Avenue

Existing



Future