

January 2019

# **TRAFFIC IMPACT STUDY: NW GATEWAY EXTENSION 2 TOWNSHIP ESTABLISHMENT**

**The Remainder of Portion 151 and Portions  
233, 234, 235, 236 and 237 of the Farm  
Hartbeestfontein No. 445-JQ, Madibeng  
Local Municipality, North West Province**



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# List of Abbreviations

Abbreviation	Meaning
CoT	City of Tshwane
COTO	Committee of Transport Officials
DWS	Department of Water and Sanitation
Ext. / X	Extension
FAR	Floor Area Ratio
GASD	Gap acceptance sight distance
GDRT	Gauteng Department of Roads and Transport
GIS	Geographical Information System
GLA	Gross Leasable Area
Ha / ha	Hectare
HCM	Highway Capacity Manual
IDP	Integrated Development Plan
LDV	Light Delivery Vehicle
LOS	Level of Service
LVO	Low Vehicle Ownership
MLM	Madibeng Local Municipality
MUD	Mixed Use Development
NLTTA	National Land Transport Transition Act
NMT	Non-motorised Transport
NWDPWT	North West Department of Public Works and Transport
PHF	Peak Hour Factor
RCAM	South African Road Classification and Access Management Manual
RE / Re	Remainder
SADC RTSM	Southern African Development Community Road Traffic Signs Manual
SANRAL	South African National Roads Agency SOC Limited
SDP	Site Development Plan
STA	Site Traffic Assessment
SPTN	Strategic Public Transport Network
SU	Single Unit
TIS	Traffic Impact Study
TMH	Technical Method for Highways
TRB	Transportation Research Board
TRH	Technical Recommendations for Highways
v/c	Vehicle/ Capacity Ratio
VLVO	Very Low Vehicle Ownership
WB	Wheel Base

# 1 Introduction

## 1.1 Background

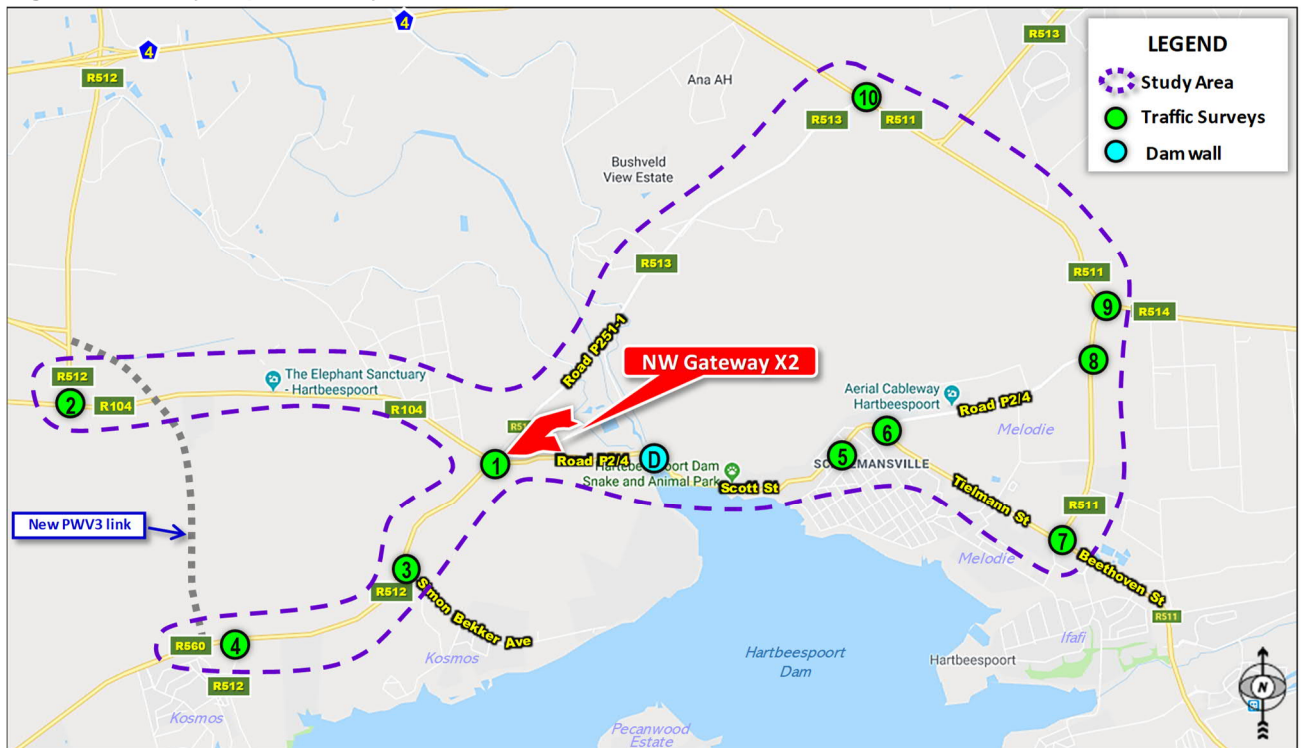
CIVILCONSULT Consulting Engineers has been appointed by Riaan van Zyl of Shalimaloq Investments CC to compile a Traffic Impact Study (TIS) for the Township Establishment of NW Gateway Extension 2.

For the purpose of this TIS report, the Township Establishment of NW Gateway Extension 2 will be referred to as the *Development*.

There are existing approved land use rights on the development site, which was never implemented. The newly proposed land use rights of the development will replace the existing approved rights on the site and consist of a mixed land use township.

The development site falls within Madibeng Local Municipality (MLM) and is located on the north-eastern corner of the intersection of R512 (P251-1) and R104 (P2/4), directly west of the Hartbeespoort Dam Wall as indicated in **Figure 1**.

**Figure 1: Locality Map and Study Area**



## 1.2 Purpose and Content

The purpose of this TIS is to consider the traffic impact of the proposed development, due to the additional traffic that will be generated on the surrounding road network as well as on the development site.

This will be done in accordance with the TMH (Technical Methods for Highways) 16 Volume 1 and 2: South African Traffic Impact and Site Impact Assessment Standards and Requirements Manual by the South African Committee of Transport Officials (COTO).

## 1.3 Extent of the Development

The existing approved land use rights on the development site is detailed in **Table 1**. These rights were never implemented and is in effect latent rights, but the new proposed land-use of the new township will replace these rights and thus they did not have to be considered for this TIS report.

There are currently informal trade stalls located along the southern and western boundary of the development site which will be demolished as part of the implementation of the proposed land uses.

Furhermore, there are existing residential buildings on the property. The existing site layout are shown in **Figure 2**.

**Table 1: Existing Land-use Rights on the Development Site**

Particular	Existing			
	1	2	3	4
Erf No.	1	2	3	4
Area (ha)	10,85	1,66	12,77	4,23
Zoning	Special	Special	Business 2	Business 2
Primary Rights	Private Resort (overnight accommodation, resort facilities and access control house)	Private Road (private access)	Tourist related shops, places of refreshment, places of amusement, etc.	Specialist motorized vehicle and outdoor equipment show rooms, places of amusement, hotel
Coverage	50%	-	50%	50%
FAR	0,5	-	0,5	0,5
Height	3 storeys	-	2 storeys	2 storeys
Building Lines	16m from Road P106-1 and 5m from Gateway Drive (Erf 2)	-	-	16 from Road P2-4 and 5m from Gateway Drive (Erf 2)
Parking	1 parking bay for every 1 bedroom chalet and additional 0,5 parking bays for every additional bedroom. 1 visitor parking must be provided for every 4 chalets or per approved site development plan	-	Shops : 6 parking bays per 100m <sup>2</sup> gross leasable shoop floor area. Place of Refreshment : 1 parking bay for every 4 seats. Offices : 4 parking bays per 100m <sup>2</sup> gross office area.	Shops : 6 parking bays per 100m <sup>2</sup> gross leasable shoop floor area. Place of Refreshment : 1 parking bay for every 4 seats.

The proposed land use rights to make up the new development is detailed in **Table 2**, whilst the associated proposed township layout is indicated in **Figure 3**. The complete township layout plan is attached in **Annexure A**.



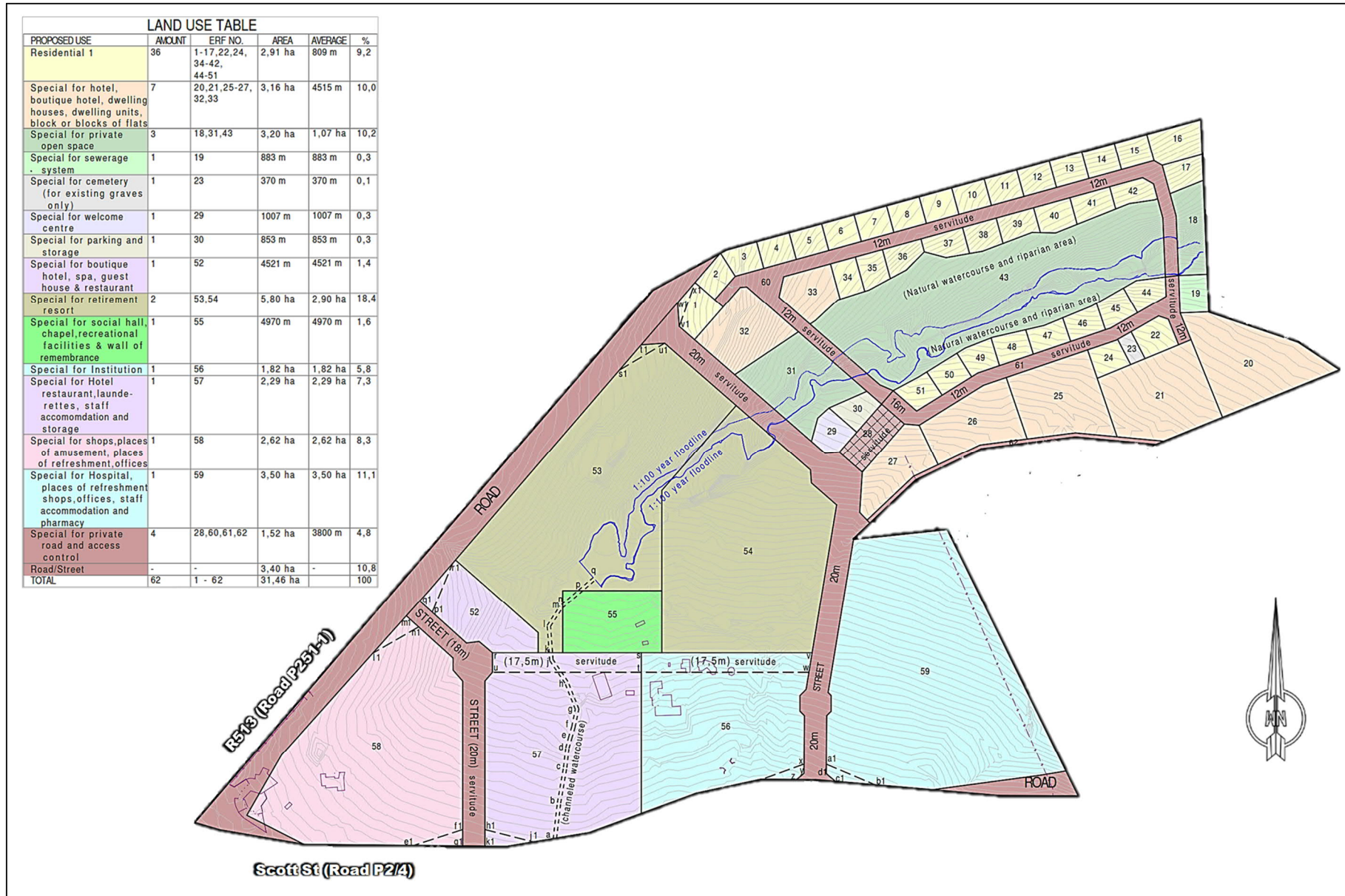
Figure 2: Existing Site Layout



**Table 2: Land-use Rights of the Proposed Development**

Erf No.	Amount	Zoning/ Land Use Description	Area (m <sup>2</sup> )	Coverage	FAR	Height (storeys)	Building Lines
1-17, 22, 24, 32-42, 44-51	36	Residential 1	29 100	50%	0.6	2	5m from the street boundary; 2m from the sides and rear boundary
20, 21, 25-27, 32, 33	7	Special for Hotel, Boutique Hotel, Dwelling Houses, Dwelling Units, Block or Block of Flats	31 600	40%	0.6	2	5m from the street boundary; 2m from the sides and rear boundary
18,31,43	3	Special for Private Open Space	32 000	N/A	N/A	N/A	N/A
19	1	Special for Sewerage System	883	N/A	N/A	N/A	N/A
23	1	Special for Cemetary (for existing graves only)	370	10%	0.1	1	N/A
29	1	Special for Welcome Centre	1 007	50%	0.6	2	5m from the street boundary; 2m from the sides and rear boundary
30	1	Special for Parking and Storage	853	70%	0.7	2	5m from the street boundary; 2m from the sides and rear boundary
52	1	Special for Boutique Hotel, Spa, Guest House and Restaurant	4 521	50%	0.8	4	5m from the street boundary; 2m from the sides and rear boundary in accordance with the NWRD from the Provincial road boundaries
53, 54	2	Special for Retirement Resort	58 000	30%	0.5	2	5m from the street boundary; 2m from the sides and rear boundary in accordance with the NWRD from the Provincial road boundaries
55	1	Special for Social Hall, Chapel, Recreational Facilities, Wall of Remembrance	4 970	30%	0.3	2	5m from the street boundary; 2m from the sides and rear boundary
56	1	Special for Institution	18 200	50%	0.6	3	5m from the street boundary; 2m from the sides and rear boundary in accordance with the NWRD from the Provincial road boundaries
57	1	Special for Hotel, Restaurant, Laundrettes, Staff Accommodation and Storage	22 900	50%	0.6	4	5m from the street boundary; 2m from the sides and rear boundary in accordance with the NWRD from the Provincial road boundaries
58	1	Special for Shops, Places of Amusement, Places of Refreshment, Offices	26 200	50%	0.1	3	5m from the street boundary; 2m from the sides and rear boundary in accordance with the NWRD from the Provincial road boundaries
59	1	Special for Hospital, Places of Refreshments, Shops, Offices and Staff Accommodation	35 000	50%	0.8	3	5m from the street boundary; 2m from the sides and rear boundary in accordance with the NWRD from the Provincial road bounda
28, 60, 61, 62	4	Special for Private Road and Access Control	15 200	50%	0.6	N/A	0m meters from the private road, sides and rear boundary
N/A	N/A	Road/ Street	34 000	N/A	N/A	N/A	N/A

Figure 3: Proposed Development Layout



## 2 Data Collection

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### 2.1 Traffic Surveys

Classified traffic surveys were conducted on Friday 23 November 2018 and Saturday 24 November 2018 for the Friday PM peak period (from 15:00 to 18:00) and Saturday peak period (from 10:00 to 14:00) at ten locations as indicated in **Figure 1**. The traffic surveys are discussed in detail in **Chapter 5**. A set of photos is included in **Annexure B** depicting the intersections, whilst the survey data is attached in **Annexure C**.

### 2.2 Latent Rights

No information could be obtained on latent rights that needed to be considered for this study.

### 2.3 Phasing of the Development

There is no specific phasing for the implementation of the total development, except that the proposed Hospital on Erf 59 will be constructed first. Otherwise, for the purpose of this TIS, it was assumed that the development as a whole will be implemented within five years from final approval.

Therefore, the capacity analysis (refer to **Chapter 7**) was conducted for the base year (2018) and a five-year horizon/ future year (2023) scenario.

### 2.4 Site Visit

A site visit was undertaken on Tuesday 11 December 2018 during the PM peak period. The purpose of the site visit was to observe the surrounding road network, intersections, accesses and traffic signal settings. Furthermore, to confirm the sight lines and witness the traffic flow and motorists' behavior surrounding the site.

## 3 Surrounding Road Network and Study Area

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### 3.1 Determination of the Study Area

In determining the study area TMH 16 volume 1 recommends the following:

- *“Class 4 and 5 roads in the vicinity of the development up to the first Class 1 to 3 roads that can be reached by the Class 4 and 5 road network from the development, up to and including the first connection(s) on the Class 1 to 3 roads.*
- *The elements shall be restricted to those within a maximum distance of 1.5km from the accesses to the site, measured along the shortest routes to the accesses, provided that there is at least one intersection within this distance.”*

TMH 16 also states that judgement should be used in selecting the intersections considered and therefore specific elements like extent of the development were also considered.

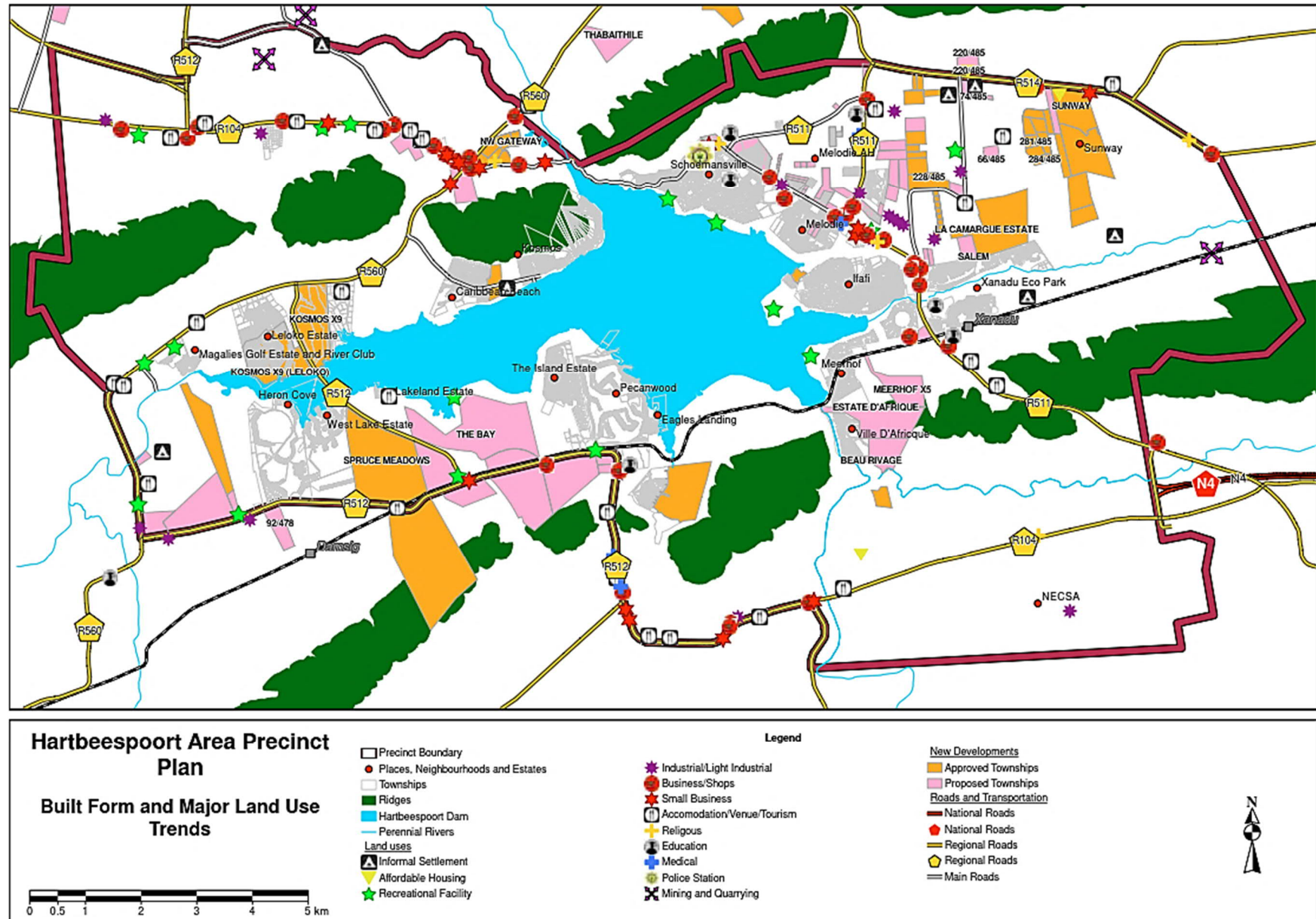
The development site is located in a unique setting in that it is adjacent to higher order roads (which will be discussed in more detail in **Section 3.2**) and surrounded by mostly rural areas with farms and small holdings as well as small businesses, recreational facilities, accommodation and restaurants.

Furthermore, it is located directly west and approximately 1km on the road from the Hartbeespoort Dam wall and associated tunnel that leads to the urban areas on the eastern side of the dam wall. The Hartbeespoort Dam and surrounds also serves as a tourist attraction with various land uses which generates traffic from further areas, especially over weekends. This is illustrated on the map of the *Major Land Use Trends of the Hartbeespoort Precinct Plan* in **Figure 4**.

Lastly, the proposed land use that will comprise the development will attract local as well as regional traffic and therefore the study area is bigger than if the proposed development were located in a purely urban area, in order to determine the traffic impact on the major intersections that will feed the development.

The surveyed intersections were considered to be a good representation of the distribution of the additional trips of the proposed development. The study area for the development is shown in **Figure 1** and takes the above principles into account.

Figure 4: Hartbeespoort Area Major Land Use Trends



## 3.2 Road Network and Master Planning

Before the road network is discussed in more detail, it must be noted that different sources revealed different names for some of the roads within the study area. In order to avoid any confusion, it was decided to refer to the the names and numbers of the different roads as presented in **Figure 1** for the purpose of the TIS

### 3.2.1 National Planning

The N4 runs in an east-west direction approximately 5km north of the development site and outside the study area for the TIS. However, the construction of the PWV 3 link between the R560 (K14 or P123/1) that links up with the N4, as indicated in **Figure 1** and **Figure 6**, is under construction.

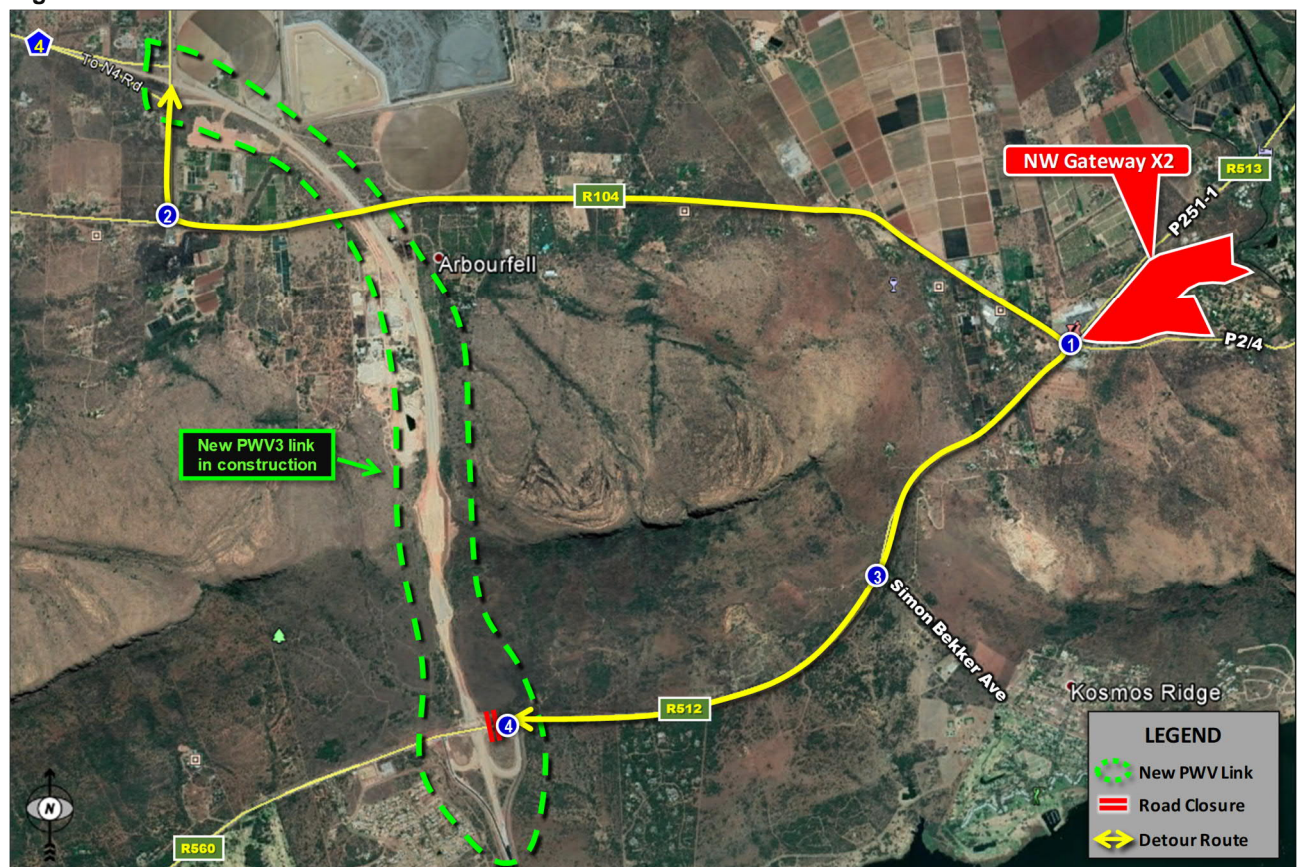
The South African National Roads Agency SOC Limited (SANRAL) is responsible for the construction of this 5,7km road section known as National Route 4 Section 12 (PWV3) between Road P123-1 and Road 980. The initial approximate duration of the construction was thirty months.

SANRAL and Aurecon (the consulting design engineer) was contacted to get information on the status quo and traffic studies to support the feasibility and design of the road, but unfortunately no detail feedback could be obtained in time for this TIS.

It was assumed that the link will be complete within the next five years. However, since no estimations could be obtained regarding the traffic once the link is completed, it could not be considered for the future year capacity analysis. The road is currently closed at the position at the southern start of the link (which was surveyed and analysed as *Intersection 4* in the report). The traffic counts (discussed in detail in **Chapter 5**) at intersections 1, 2, 3 and 4 confirms that the current detour route is as indicated in **Figure 5**.

Once the PWV 3 link is completed with the two associated interchanges, the through traffic along this route will probably reduce. However, the development will also attract some of this traffic due to the various land uses it will incorporate and therefore the future year capacity analysis were conducted with a normal growth in the background traffic (refer to **Chapter 6**).

**Figure 5: PWV 3 Link Construction and Detour Traffic**



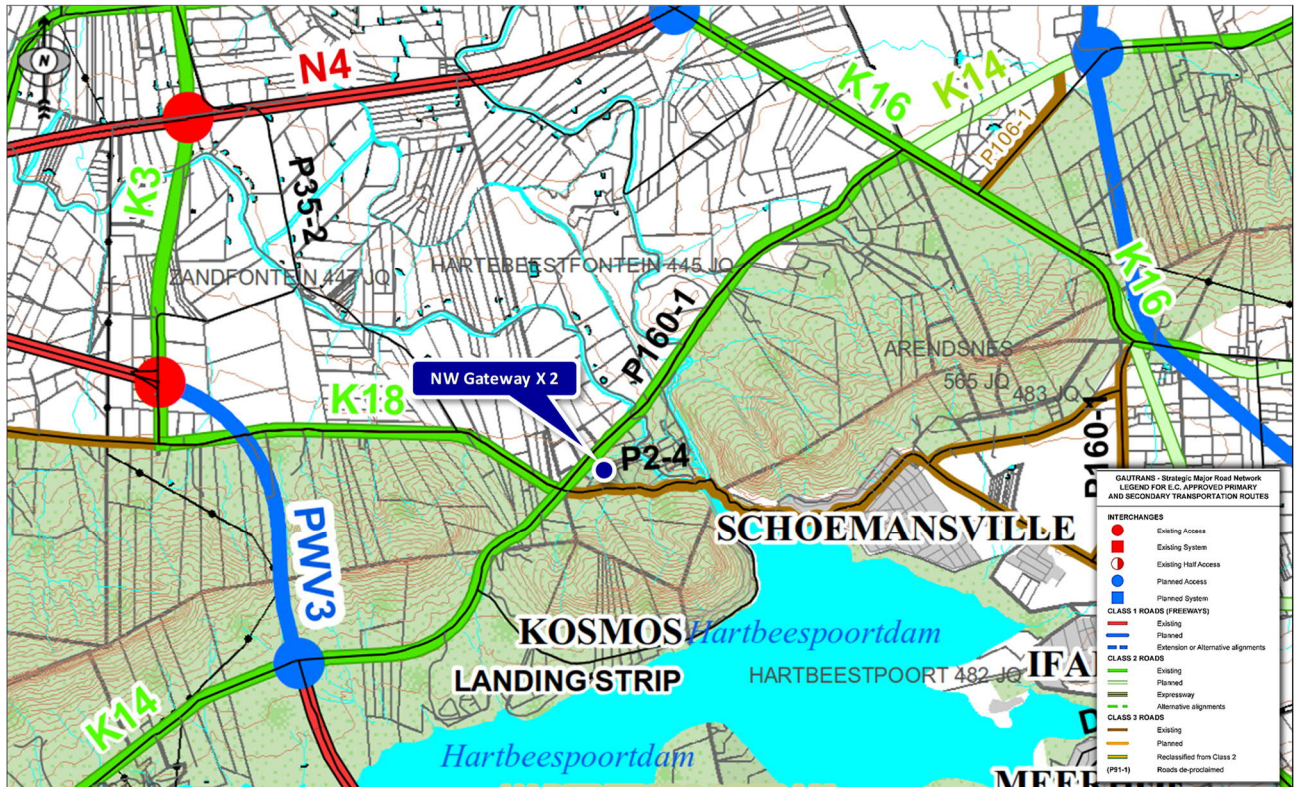
### 3.2.2 Provincial Planning

Before the reallocation of the provincial boundaries, the provincial road network within the study area fell under the jurisdiction of the Gauteng Department of Roads and Transport (GDRT). These roads now reside under the jurisdiction of the North West Department of Public Works and Transport (NWDPWT).

#### 3.2.2.1 Gauteng Department of Roads and Transport

Figure 6 shows the development site on an extract from the Strategic Major Road Network of the GDRT. The plan office of the GDRT was contacted to enquire if they might still have basic planning available for the surrounding provincial roads, but they confirmed that all associated plans were transferred to the NWDPWT.

Figure 6: Gauteng Strategic Major Road Network

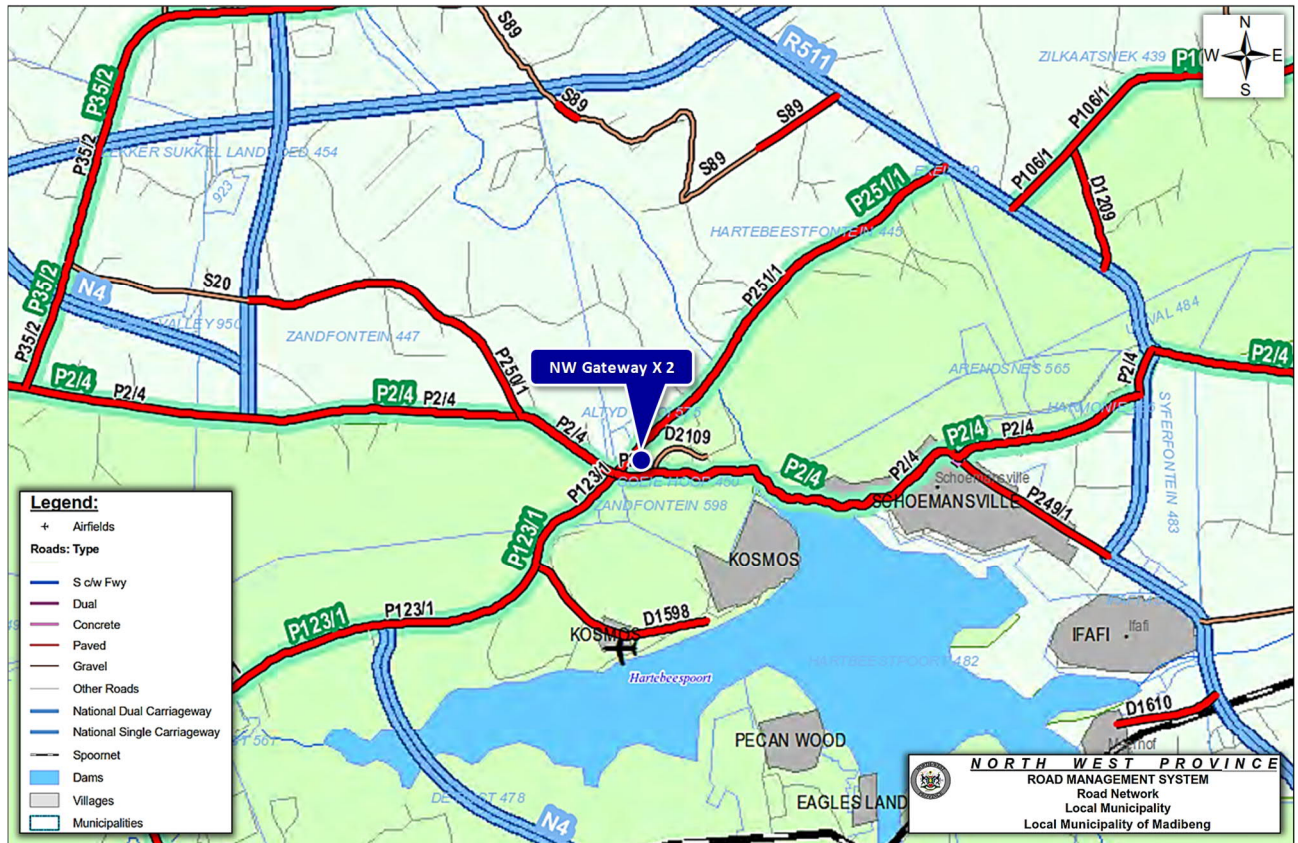


#### 3.2.2.2 North West Department of Public Works and Transport

Mr. Johan van Wyk of the NWDPWT were contacted to discuss the development and he indicated that roundabouts will be preferred as intersection control measures at the access positions to the development site. Unfortunately, the basic planning of the provincial roads, especially the planning for the closest intersection of the R104/ R513 (Road P251-1), could not be obtained to be considered for the TIS.

The development site is indicated on an extract from the North West Province Road Network Management Plan for Madibeng Local Municipality in Figure 7.

**Figure 7: North West Province Road Management System**



### 3.2.3 Municipal Planning

The development site falls within Ward 29 of the MLM. The 2017 to 2021 Integrated Development Plan (IDP) were scrutinised to determine if there are any new road projects. It was found that only maintenance - and traffic calming projects were identified in this IDP. There are also no capital projects for roads identified in the 2014 Hartbeespoort Area Precinct Plan. Thus, there is no road planning on a local municipal level that needs to be considered for the TIS.

## 3.3 Surrounding Road Network

The development site is bordered to the south by Road P2/4 (R104/ Scott St), to the west by Road P251/1 (R513) and to the east and north by other properties. Refer to **Figure 6** for the functional classification of the major roads. More detail on the roads in the study area is provided below.

- **Road P2-4 (R104)** is a Class 2 major arterial road. It commences at the Rustenburg/Madibeng Local Municipality boundary, from where it proceeds in a general eastern direction up to the Bonjanala/Gauteng boundary, within the Local Municipality of Madibeng. This road is approximately 48,0km in length and has varying road reserve widths of 30.0-80.0m. The road in general has one lane per direction with turning lanes at major intersections. The road falls under the jurisdiction of the NWDPT.
- Road P2/4 east of the intersection with Road P251-1 becomes a Class 3 road across the dam wall and changes to Scott St, turns north-east at the signalised intersection with Tielmann St and ends in a T-junction with the R511.
- **Scott St** is the extension of Road P2/4 and has a functional classification as a Class 3 road from across the dam wall. Due to the fact that it links the urban area on the eastern side of the dam wall with the western side of the dam wall, it fulfils a certain mobility function, but also provides direct access to properties and has sporadic on-street parking at certain sections. It has one lane per direction with turning lanes at major intersections. The road falls under the jurisdiction of the MLM.
- **Road P251-1 (R513)** is a Class 2 major arterial road. It commences at the R511, from where it proceeds in a general south western direction up to the intersection with the R104 (Road P2/4). It continues past the said intersection as the Road P123-1 (R512). This road is approximately



6,0km in length and has a road reserve width of 32.0m. This road has one lane per direction with turning lanes at major intersections and falls under the jurisdiction of the NWDPWT.

- **R512 (Road P123-1)** is a Class 2 road with one lane per direction and turning lanes at major intersections. The road commences at the intersection with the Road P2-4 (R104) and heads in a south-western direction where it will form an interchange with the new section of the PWV3 that is in construction. It falls under the jurisdiction of the NWDPWT.
- **Tielmann St (Road P249-1)** is a Class 3 road that links Scott St (from the intersection with Tielmann St) with Beethoven St, following a south-eastern direction. It has one lane per direction and turning lanes at major intersections and falls under the jurisdiction of the MLM.
- **Simon Bekker Ave** is a Class 4 road that forms a T-junction with the R512. It follows a south-eastern direction towards residential areas surrounding the Hartbeespoort Dam and ends in a cul-de-sac. The road has one lane per direction with turning lanes at major intersections and falls under the jurisdiction of the MLM.
- **R511** is a Class 2 road that links the N4 in the north and follows a south-eastern direction where it intersects with the R514, turns southward and intersects with Tielmann St (Beethoven St). It has one lane per direction with turning lanes at major intersections and falls under the jurisdiction of the NWDPWT.
- **D2109** forms a T-junction with Road P2-4 and follows a general north-eastern direction. The road is a Class 5 access road that traverse the development site. It has been in use since the construction of the Hartbeespoort Dam Wall (since 1918). This road is utilised by the Department of Water and Sanitation (DWS) for maintenance to gain access to the Dam Wall outlet structure as well as private property owners adjacent to and located to the east of the development.

## 4 Access

### 4.1 Site Access

#### 4.1.1 Existing

There are currently illegal accesses from the R513 and Road P2-4 that vendors use which are located on the southern and western boundary of the development site (refer to **Figure 2**). The formal access to the site, is via the access road (D2109) that traverse the development site, forms a T-junction with road P2/4 is also currently controlled by a stop sign on the side road. The access to the residence on the site is also from this road as indicated in **Figure 8**.

**Figure 8: Existing Formal Site Access**



Source: Google Earth Street View

### 4.1.2 Proposed

A pro-active discussion with the NWDPWT indicated that roundabouts will be preferred as intersection control measures at the access positions to the development site. Therefore, roundabouts are proposed at all four accesses to the development and were analysed as such (refer to **Chapter 7**).

None of the proposed access positions have other accesses to properties on the opposite side of the both roads that they can align to. The access positions are indicated in **Figure 9** and detail on the proposed configuration can be seen on the conceptual design of the road upgrades surrounding the development in **Figure 22**.

## 4.2 Access Management

The South African Road Classification and Access Management Manual (RCAM, TRH 26) recommends minimum spacing between intersections on mobility roads as indicated in **Table 3**. Intersection or access spacing is defined in the RCAM document as the distance between the centre lines of connecting intersections or access roadways.

**Table 3: Minimum Spacing Requirements for Full Intersections on Mobility Roads**

Class	Rural	Urban signals(*)	Urban roundabouts and priority(*)
Class 1	8.0 km	n/a	n/a
Class 2	5.0 km	800 m ± 15%	800 m ± 15%
Class 3	1.6 km	600 m ± 20%	600 m ± 20%

(\*) These values can be halved for the leg of T-junctions and for one-way streets.

### 4.2.1 Development Access Spacing

As discussed in **Section 3.3**, Road P2/4 is a Class 3 road, whilst the R513 (Road 251-1) is a Class 2 road. *Access 1* and *Access 2* of the development is situated along Road P2/4, whilst *Access 3* and *Access 4* is situated along the R513 (Road 251-1).

There are no access positions to properties on the opposite side of both roads to which the proposed development accesses can align. All four accesses therefore form T-junctions with these roads. The minimum spacing requirement for:

- *Access 1* and *Access 2* according to **Table 3** is 300m ± 20%, thus a minimum of 240m up to 360m; and for
- *Access 3* and *Access 4* according to **Table 3** is 400m ± 15%, thus a minimum of 340m up to 460m.

The approximate spacing between intersections, development accesses and accesses to surrounding properties from the R513 (Road 251-1) and Road P2/4 is indicated in **Figure 9** and listed in **Table 4**.

**Table 4: Distance Table of Intersection Spacing**

	Intersection 1	Access 1	Access 2	Access 3	Access 4
Intersection 1	-	599m	286m	304m	640m
Access 1	599m	-	312m	-	-
Access 2	286m	312m	-	-	-
Access 3	304m	-	-	-	336m
Access 4	640m	-	-	336m	-

The following conclusion can be made regarding the spacing of the proposed access positions:

- The spacing along Road P2/4 between *Intersection 1* and *Access 2* as well as between *Access 1* and *Access 2* are both more than 240m and thus meets the minimum spacing requirement.
- The spacing along the R513 (Road 251-1) between *Intersection 1* and *Access 3* is 304m and falls 36m short of the minimum spacing requirement. The spacing between *Access 3* and *Access 4* is 336m and falls 4m short of the minimum spacing requirement of 340m.
- The 4m shortfall in the spacing between *Access 3* and *Access 4* is deemed insignificant.

→ The location of *Access 3* was determined in making optimum use of the feasible land which can be developed on the western side of the *Green Zone* (watercourse) that traverse the development site. Furthermore, it is situated approximately 144m from the access on the opposite side of the road to Damdoryn Junction which is more than adequately outside the influence area of that access. And lastly, since roundabouts are proposed as access controls at all the accesses as well as at *Intersection 1*, it will also serve as a traffic calming measure to a certain extent. Given these facts, the spacing of *Access 1* is deemed sufficient from *Intersection 1*.

### 4.3 Sight Distance

There are no fixed obstructions that hamper sight distance from and to all four of the development accesses. The sight lines are limited either by horizontal – or vertical alignment of the existing roads and is indicated in **Figure 10**.

Gap acceptance sight distance (GASD) is considered in this section which is the sight distance required when drivers at intersections must evaluate gaps in opposing traffic streams for acceptance or rejection. In this instance it is the distance required for vehicles exiting the development to enter the traffic stream in Road P2/4 or the R513 (Road 251-1) respectively.

Gap acceptance sight distances must be calculated using the following formula:

$$\text{Sight distance} = \text{Design speed (km/h)} \times \text{Time gap (seconds)} / 3.6$$

**Table 5** indicates the time gap included in the abovementioned formula.

**Table 5: Gap acceptance time gaps (AASHTO 2004)**

Design Vehicle	Time gaps (seconds) for different turning movements				
	Left-turn from stop	Straight through	Right turn from stop	Right-turn from major road	Right-Turn at traffic signals
Passenger car/LDV	6.5	6.0 + 0.5 N	7.0 + 0.5 N	5.0 + 0.5 N	7.5 + 0.5 N
Bus/SU Truck	8.5	7.8 + 0.7 N	8.8 + 0.7 N	5.8 + 0.7 N	9.3 + 0.7 N
WB-15/WB-20	10.5	9.8 + 0.7 N	10.8 + 0.7 N	6.8 + 0.7 N	11.3 + 0.7 N
Gradient adjustment	0.1 G	0.1 G	0.2 G	-	-

N = Equivalent number of lanes to cross  
G = Gradient in percentage. Gradient adjustment only applicable when G > 4%

It was assumed that the design speed for Road P2/4 is 80km/h, whilst the design speed for the R513 (Road 251-1) is 100km/h. **Table 6** shows the calculated GASDs that is required at the development accesses for a:

- Passenger car or Light delivery vehicle (LDV);
- Bus or Single unit (SU) truck; and
- 20m Wheel base (WB) truck.

The approximate sight distances measured is detailed in **Table 7**.

**Table 6: Gap Acceptance Sight Distance Requirements**

Gap Acceptance Sight Distances	Access 1 & Access 2			Access 3 & Access 4		
	Car/LDV	Bus/SU	WB-20	Car/LDV	Bus/SU	WB-20
Left-turn from stop	144m	189m	233m	181m	236m	292m
Right-turn from stop	156m	196m	240m	194m	300m	300m

**Table 7: Approximate Sight Distances**

Access	Left-turn Sight Distance	Right-turn Sight Distance
Access 1	210m	115m
Access 2	75m	200m
Access 3	240m	195m
Access 4	250m	110m

The following conclusions are drawn by comparing **Table 6** and **Table 7**:

- The left-turn sight distance is sufficient for a car and bus from *Access 1*, but not for trucks with a 20m wheelbase. This is however not a concern as the truck traffic is limited towards the dam wall as trucks weighing more than 10 tons are prohibited to drive over the dam wall (refer to **Figure 8** for the road sign (R230) just pass the existing access road);
- The right-turn sight distance from *Access 1* is not even sufficient for a car and falls 41m short;
- The left-turn sight distance is not sufficient for a car from *Access 2* and fall 69m short;
- The right-turn sight distance from *Access 2* is sufficient for a car and bus, but not for a truck with a 20m wheel base (WB-20 truck);
- The left-turn sight distance from *Access 3* fall 52m short to accommodate a WB-20 truck, but is fine for a car and a bus;
- The right-turn sight distance from *Access 3* fall 105m short to accommodate a WB-20 truck, but is fine for a car;
- The left-turn sight distance from *Access 4* fall 42m short to accommodate a WB-20 truck, but is fine for a car and a bus; and
- The right-turn sight distance from *Access 4* fall 84m short to accommodate a car.

It is evident from **Figure 10** and the conclusions detailed above, that none of the accesses meet the requirements in any direction for left – or right-turn sight distance for a WB-20 truck.

The fact that there are GASDs that do not meet the requirements for right – or left-turning vehicle types, is not considered to be critical. This is due to the fact that the proposed configuration for all the development accesses, as well as the road upgrade for *Intersection 1*, are roundabouts (refer to **Chapter 7**).

The proximity of the roundabouts to each other and the associated entry speed of traffic approaching these roundabouts will be significantly lower than the design - and current operating speed on the two roads. The roundabouts will in effect also serve as traffic calming measures.

In conclusion, even though the gap acceptance sight distance is not met as per the requirements discussed above, it doesn't pose a traffic safety issue for the development traffic.

Figure 9: Access and Intersection Spacing

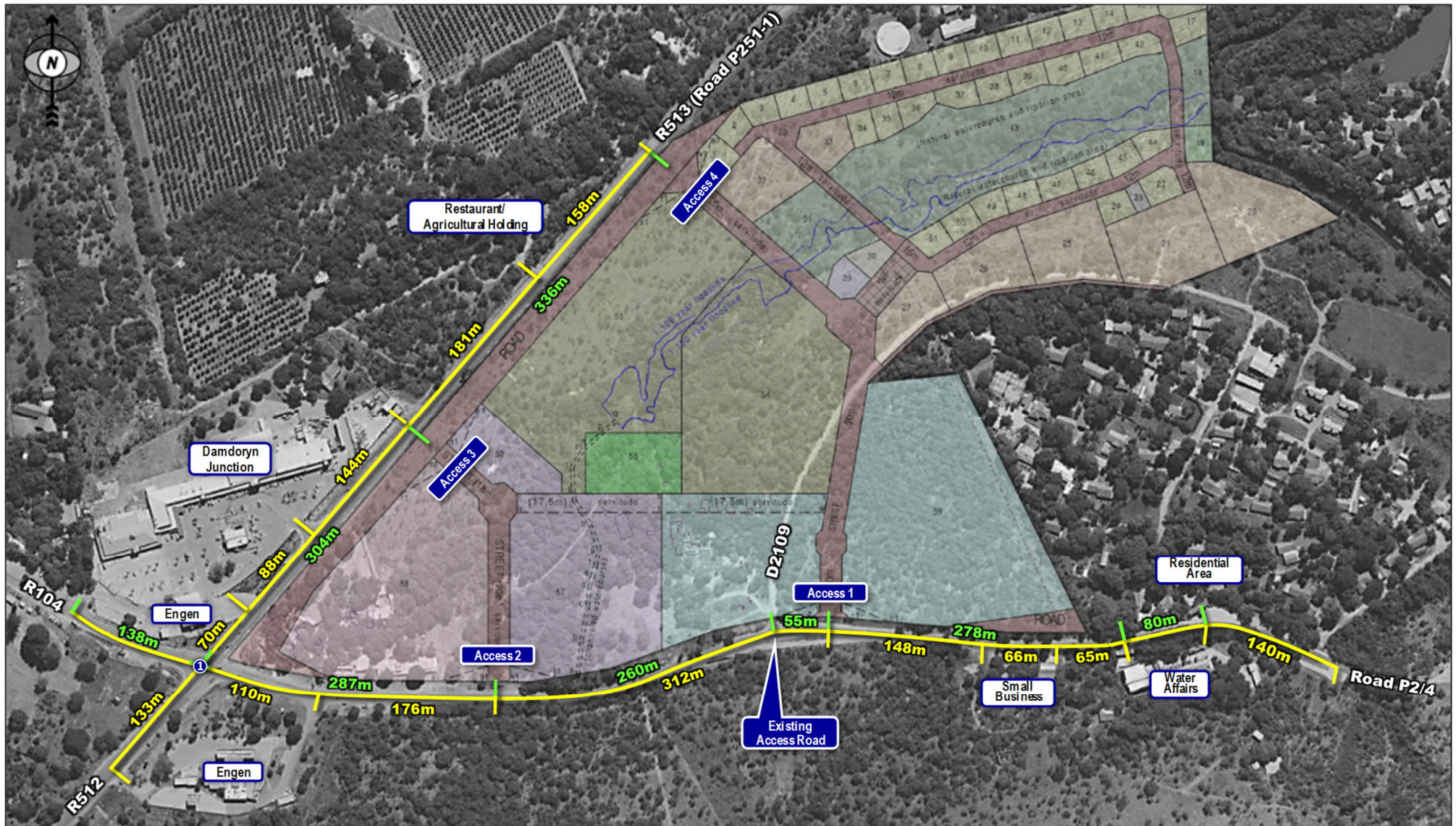
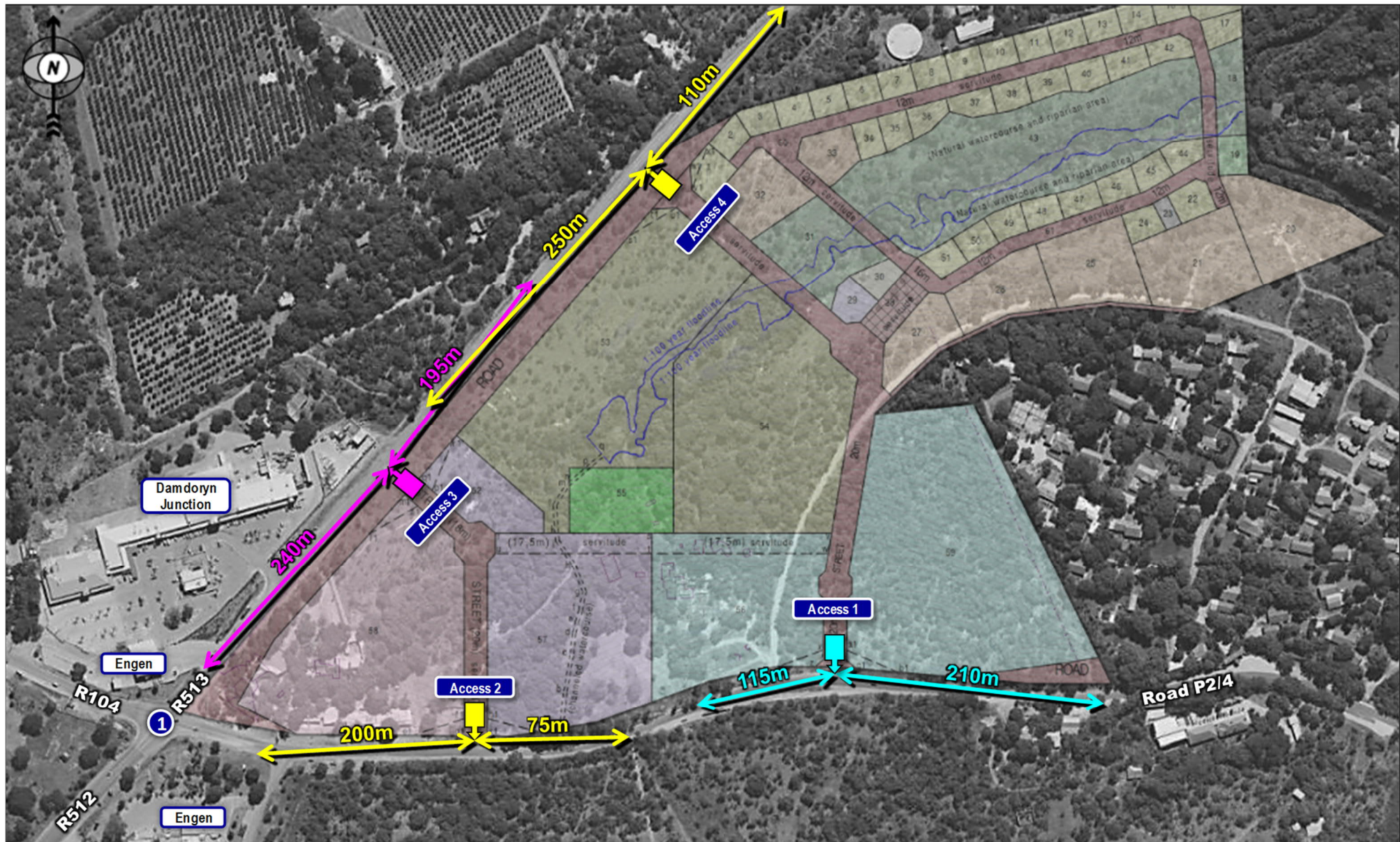


Figure 10: Sight Distance from Accesses



## 5 Existing Traffic Flows

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Classified traffic surveys were conducted on Friday 23 November 2018 and the following Saturday 24 November 2018 for the Friday PM peak period (from 15:00 to 18:00) and Saturday peak period (from 10:00 to 14:00) at ten locations (refer to **Figure 1**), namely:

- Intersection 1: R104/ R513 (Road P251-1);
- Intersection 2: R104/ R512 (Development Access);
- Intersection 3: R512/ Simon Bekker St;
- Intersection 4: R512/ R560;
- Intersection 5: Scott St/ Harrington St;
- Intersection 6: Scott St (Tielman St)/ Road P2/4;
- Intersection 7: Tielmann St (Beethoven St)/ R511 (Bach St);
- Intersection 8: R511/ Road P2/4;
- Intersection 9: R511/ R514; and
- Intersection 10: R511/ Road P251-1

A set of photos is included in **Annexure B** depicting the intersections.

The traffic peak hours determined from the traffic surveys are:

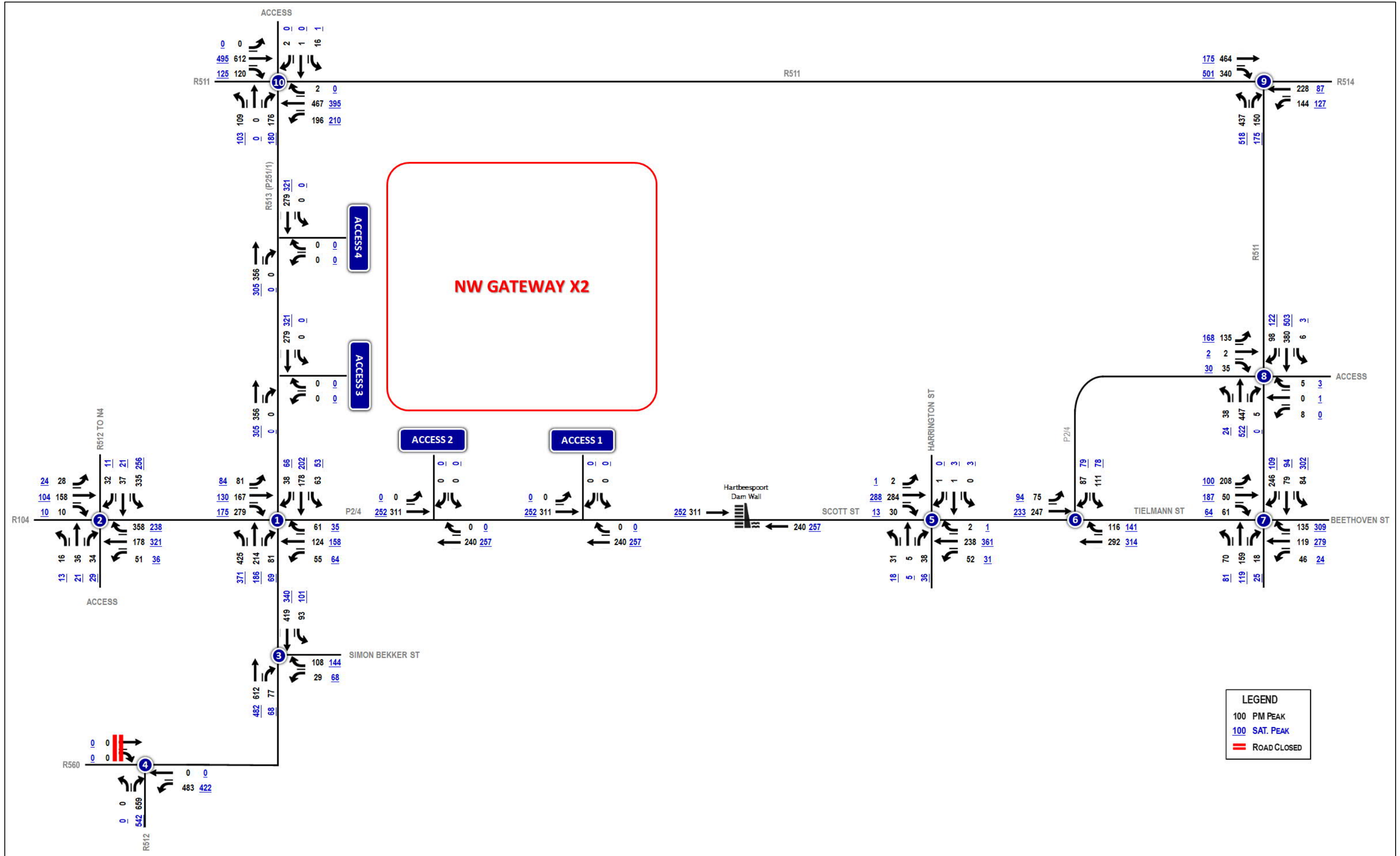
- Friday PM Peak Hour: 16:30 to 17:30; and
- Saturday Peak Hour: 12:00 to 13:00.

The detail traffic survey data is attached in **Annexure C**. The 2018 Peak Hour Surveyed Traffic Volumes are shown in **Figure 11** for the PM – and Saturday Peak Hour.

The land use that generates the most trips (refer to **Chapter 6**) in the proposed development is the *Shopping Centre* situated on erf 58, closest to *Intersection 1: R104/ R513 (Road P251-1)*. A shopping centre generates the most trips during the PM – and Saturday peak periods. It is for that reason that these two peak periods were surveyed in succession. Furthermore, the PM – and Saturday peak hours determined from the surveys, were analysed accordingly (refer to **Chapter 7**).

Note that the traffic volumes at the dam wall were deducted from the traffic surveys conducted at the closest intersections on both sides. The same applies to the through volumes at all the accesses to the development. Even though there are accesses to properties in between these locations, these accesses are not considered as substantial trip generators and was ignored in order to follow a more conservative approach for the capacity analysis.

Figure 11: 2018 Background Traffic (PM – and Sat. Peak Hour)





## 6 Development Trip Generation and Traffic Volumes Scenarios

### 6.1 Land Use not Included in Trip Generation

There are several erven in the proposed development with land uses that were not included in the trip generation calculations. This is either due to the fact that:

- They will generate no trips;
- They will generate insignificant trips; or
- Is not a primary trip generator on their own and is subservient to another primary land use.

These erven and associated land use descriptions is listed in **Table 8** and their locations within the proposed development layout can be seen in **Figure 3**.

**Table 8: Land Use not Included in Trip Generation**

Erf No.	Land Use Description
18,31,43	Special for Private Open Space
19	Special for Sewerage System
23	Special for Cemetary (for existing graves only)
29	Special for Welcome Centre
55	Special for Social Hall, Chapel, Recreational Facilities, Wall of Remembrance
28, 60, 61, 62	Special for Private Road and Access Control
-	Road/ Street

### 6.2 Adjustment Factors

Various trip adjustment factors have been introduced into the COTO TMH 17 document to allow for trip reductions. These adjustment factors are discussed briefly in the following sections.

#### 6.2.1 Mixed use developments (MUD)

According to the COTO manual “mixed use developments are defined as developments in an area that consist of two or more single-use developments between which trips can be made by means of non-motorised modes of transport (such as walking). This has the net effect of reducing the vehicle trip generation in the area.”

#### 6.2.2 Low vehicle ownership (LVO) and Very low vehicle ownership (VLVO)

According to COTO “the vehicle ownership in areas with high levels of vehicle ownership varies between one or two per household. In areas with a low level of vehicle ownership, the majority of households (more than 50%) does not own a vehicle and relies on public transport for transportation. In areas with very low level of vehicle ownership, nearly all households (more than 90%) do not own a vehicle and rely on public transportation.”

#### 6.2.3 Transit node or corridors

According to COTO “the transit reduction factors are applicable to developments that are located within a reasonable walking distance from a major transit node or stops on a major transit corridor.”

#### 6.2.4 Size adjustment factor

A size adjustment factor is used to adjust the trip generation rate only for *Shopping Centres* (COTO TMH 17 Code 820). The trip generation rate is multiplied with the size adjustment factor to provide the required parameter for a development of a particular size. The size adjustment factor is determined by means of the following formula:

$$\text{Size adjustment factor} = 1 + A/(1 + \text{sqm Size}/B)$$

In which A and B are parameters provided in the trip generation table for *Shopping Centres* where A is specified as 6,000 and B as 3500. The sqm Size is the size, gross leasable area (GLA), of the development measured in units of m<sup>2</sup>.

## 6.2.5 Applied Adjustment Factors

This study considered the adjustment factor for mixed-use developments and for a transit node/corridor (refer to **Chapter 8**), where applicable. The combined adjustment factor is calculated by the following formula:

$$P_c = 1 - (1 - P_m) * (1 - P_v) * (1 - P_t)$$

In which:

$P_c$  = Combined reduction factor

$P_m$  = Reduction factor for mixed-use

$P_v$  = Reduction factor for vehicle ownership

$P_t$  = Reduction factor for transit nodes or corridors

Trip reduction factors were not applied to the *Residential 1* erven (1-17, 22, 24, 32-42, 44-51) and also not to *Parking and Storage* (erf 30). **Table 9** lists the erven and land uses to which adjustment factors were applied for the trip generation.

**Table 9: Applied Adjustment Factors**

Erf No.	Land Use Description	COTO Code	Adjustment Factors				
			Size	P <sub>c</sub>	P <sub>m</sub>	P <sub>v</sub>	P <sub>t</sub>
1-17, 22, 24, 32-42, 44-51	Residential 1	210	-	-	-	-	-
20, 21, 25-27, 32, 33	Special for Hotel, Boutique Hotel, Dwelling Houses, Dwelling Units, Block or Block of Flats	310	-	0.28	15%	-	15%
30	Special for Parking and Storage	151	-	-	-	-	-
52	Special for Boutique Hotel, Spa, Guest House and Restaurant	310	-	0.32	20%	-	15%
53, 54	Special for Retirement Resort	251	-	0.19	5%	-	15%
56	Special for Institution	620	-	0.15	-	-	15%
57	Special for Hotel, Restaurant, Laundrettes, Staff Accommodation and Storage	310	-	0.32	20%	-	15%
58	Special for Shops, Places of Amusement, Places of Refreshment, Offices	820	1.86	0.24	10%	-	15%
59	Special for Hospital, Places of Refreshments, Shops, Offices and Staff Accommodation	612	-	0.15	-	-	15%

## 6.3 Development Trips

### 6.3.1 Existing Trips

The current land use on the property is largely informal and the trips generated by it is insignificant and were thus not deducted from the new development's trip generation. However, these trips were included as part of the background traffic surveys in close proximity to the development.

### 6.3.2 New Trip generation

The total trips generated by the proposed development is shown in **Table 10**. The trip generation for the AM peak hour is also indicated in order to compare it to the trips generated during the PM – and Saturday peak hour. More detail was needed on some erven and their associated land uses in order to perform the trip generation. This detail was obtained from the conceptual site plan drawn up by the architect which is attached in **Annexure D**. The highest trip generator was selected from the erven with multiple land use descriptions.

Note that the land uses listed in **Table 8** is excluded from the trip generation and the columns were left blank. Furthermore, **Table 10** indicates the original trip generation rate as well as the reduced rates to which adjustment factors, discussed in the previous section, and listed in **Table 9**, were applied.

The total new trips generated by the proposed development are 837 during the AM -, 1631 during the PM – and 1687 during the Saturday peak hours respectively. The PM – and Saturday peak hour generates almost double the number of trips than the AM peak hour, therefore the PM – and Saturday peak hours were utilised to conduct the capacity analysis.

Most of the trips are generated by the shopping centre situated on erf 58, closest to *Intersection 1: R104/ R513 (Road P251-1)*, during both these peak hours. There will probably be some transfer trips from Damdoryn Junction to the new shopping centre. However, due to the proximity, *Intersection 1* will still carry the same development traffic and thus it was not considered as part of the analysis.

**Table 10: Development Trip Generation**

Erf No.	Land Use Description	Height (storeys)	Area (m <sup>2</sup> )	Units	Rooms	Beds	COTO Code	Trip Generation																	
								Rates									Trips								
								AM Peak			PM Peak			SAT Peak			AM Peak		PM Peak		SAT Peak				
								Rate	In	Out	Rate	In	Out	Rate	In	Out	Trips	In	Out	Trips	In	Out	Trips	In	Out
1-17, 22, 24, 32-42, 44-51	Residential 1	2	29 100	36	-	-	210	1.00	25%	75%	1.00	70%	30%	0.50	50%	50%	36	9	27	36	25	18	18	9	9
20, 21, 25-27, 32, 33	Special for Hotel, Boutique Hotel, Dwelling Houses, Dwelling Units, Block or Block of Flats	2	31 600	253	-	-	310	0.85	25%	75%	0.85	70%	30%	0.45	50%	50%	-	-	-	-	-	-	-	-	-
								0.61			0.61			0.33			155	39	116	155	109	47	82	41	41
18,31,43	Special for Private Open Space	N/A	32 000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	Special for Sewerage System	N/A	883	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	Special for Cemetary (for existing graves only)	1	370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Special for Welcome Centre	2	1 007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Special for Parking and Storage	2	853	-	-	-	151	0.15	60%	40%	0.25	50%	50%	0.40	50%	50%	1	1	0	1	1	1	2	1	1
52	Special for Boutique Hotel, Spa, Guest House and Restaurant	4	4 521	-	40	-	310	0.50	60%	40%	0.50	55%	45%	0.70	50%	50%	-	-	-	-	-	-	-	-	-
								0.34			0.34			0.48			14	8	5	14	7	6	19	10	10
53, 54	Special for Retirement Resort	2	58 000	134	-	-	251	0.35	65%	35%	0.20	40%	60%	0.30	50%	50%	-	-	-	-	-	-	-	-	-
								0.28			0.16			0.24			38	25	13	22	9	13	32	16	16
55	Special for Social Hall, Chapel, Recreational Facilities, Wall of Remembrance	2	4 970	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	Special for Institution	3	18 200	-	-	-	-	-	-	-	-	-	-	-	-	-	81	53	27	83	33	50	142	69	73
	200 Bed Dementia & Alzheimer Care Centre			-	-	200	-	0.20	70%	30%	0.20	40%	60%	0.40	50%	50%	40	28	12	40	16	24	80	40	40
	50 Mid-Care Retirement Flats			50	-	-	-	0.15	65%	35%	0.20	40%	60%	0.30	50%	50%	8	5	3	10	4	6	15	8	8
	25 Bed Hospice			-	-	25	-	0.20	70%	30%	0.20	40%	60%	0.40	50%	50%	5	4	2	5	2	3	10	5	5
	GP, Dentist, Occupational & Physical Therapy			471	-	-	-	6.00	60%	40%	6.00	40%	60%	7.80	45%	55%	28	17	11	28	11	17	37	17	20
57	Special for Hotel, Restaurant, Laundrettes, Staff Accommodation and Storage	4	22 900	-	150	-	310	0.50	60%	40%	0.50	55%	45%	0.70	50%	50%	75	45	30	75	41	34	105	53	53
								0.34			0.34			0.48			51	31	20	51	28	23	71	36	36
58	Special for Shops, Places of Amusement, Places of Refreshment, Offices	3	26 200	-	-	-	820	0.60			3.40			4.50			126	82	44	713	356	356	943	472	472
								1.86	65%	35%	6.32	50%	50%	8.36	50%	50%	234	152	82	1324	662	662	1753	876	876
								1.42			4.83			6.40			179	116	63	1013	507	507	1341	671	671
59	Special for Hospital, Places of Refreshments, Shops, Offices and Staff Accommodation	3	35 000			100	612	1.65	60%	40%	1.50	40%	60%	-	-	-	347	208	139	315	126	189	-	-	-
						300		1.40			1.28			-	-	-	295	177	118	268	107	161	-	-	-
28, 60, 61, 62	Special for Private Road and Access Control	-	15 200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	Road/ Street	-	34 000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>TOTAL TRIP GENERATION</b>																	<b>837</b>	<b>450</b>	<b>387</b>	<b>1631</b>	<b>821</b>	<b>817</b>	<b>1687</b>	<b>842</b>	<b>845</b>

## 6.4 Trip Distribution and Assignment

Assumptions with respect to the expected trip distribution were based on the location of the different erven (and associated land uses) to the development accesses, the surrounding road network, the existing traffic volumes and travel patterns and other surrounding factors that might influence the distribution.

No diverted – or pass-by trips were considered directly for the distribution. The assumption was made that some of the traffic that will use the new PWV3 link, will still use the existing through route as indicated in **Figure 5** in order to visit some land uses that form part of the development. . There will probably be some transfer trips from Damdoryn Junction to the new shopping centre. However, due to the proximity to the new shopping centre, *Intersection 1* will still carry the same development traffic and thus it was not considered in detail as part of the distribution.

The generated trips first had to be distributed to the proposed four accesses to the development which is detailed in **Table 11** and indicated in **Figure 12**.

The trip distribution and - assignment onto the road network is indicated in **Figure 13** and **Figure 14** respectively.

The 2018 background traffic plus the development trips is indicated in **Figure 15**.

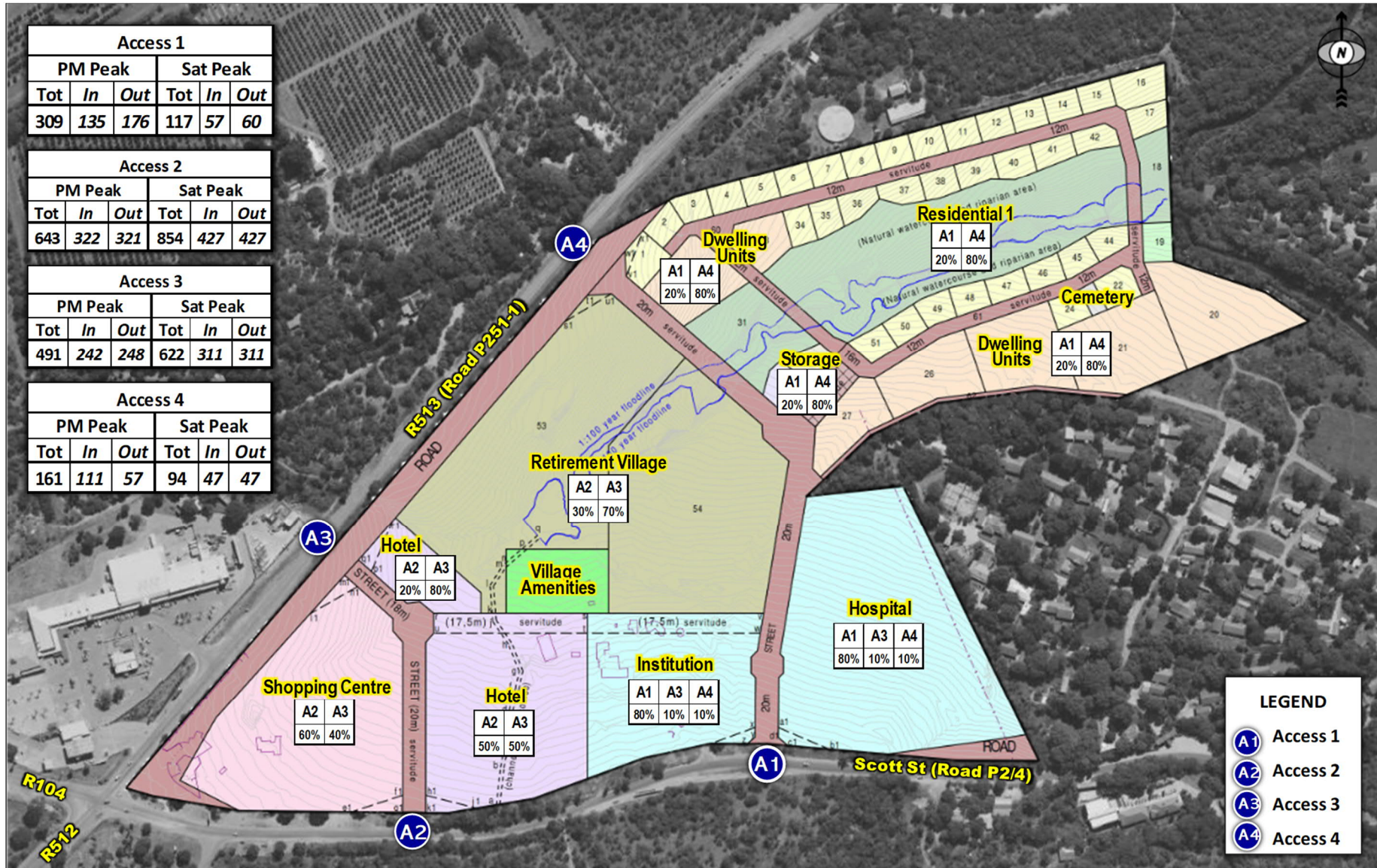
### 6.4.1 Traffic growth

Appropriate growth rates must be used for the estimation of future background traffic. The appropriate growth rate depends on the expected growth in the area in which the development is located as well as the degree to which approved but not yet exercised developments as well as future development in the area are taken into account in the assessment.

Since there are no latent rights in the area surrounding the development and the properties are largely still farms and small holdings, an annual traffic growth rate of 2% were applied to determine the 2023 future year background traffic as indicated in **Figure 16**.

The 2023 background traffic plus the development trips is indicated in **Figure 17**.

Figure 12: Trip Distribution and Assignment to Development Accesses



**Table 11: Trip Distribution and Assignment to Development Accesses**

Erf No.	Land Use Description	Access 1							Access 2						Access 3						Access 4								
		%	PM Peak			SAT Peak			%	PM Peak			SAT Peak			%	PM Peak			SAT Peak			%	PM Peak			SAT Peak		
			Trips	In	Out	Trips	In	Out		Trips	In	Out	Trips	In	Out		Trips	In	Out	Trips	In	Out		Trips	In	Out	Trips	In	Out
1-17, 22, 24, 32-42, 44-51	Residential 1	20%	7	5	4	4	2	2	0%	-	-	-	-	-	-	0%	-	-	-	-	-	-	80%	29	20	14	14	7	7
20, 21, 25-27, 32, 33	Special for Hotel, Boutique Hotel, Dwelling Houses, Dwelling Units, Block or Block of Flats	20%	31	22	9	16	8	8	0%	-	-	-	-	-	-	0%	-	-	-	-	-	-	80%	124	87	37	66	33	33
30	Special for Parking and Storage	20%	0	0	0	0	0	0	0%	-	-	-	-	-	-	0%	-	-	-	-	-	-	80%	1	1	1	2	1	1
52	Special for Boutique Hotel, Spa, Guest House and Restaurant	0%							20%	3	1	1	4	2	2	80%	11	6	5	15	8	8	0%	-	-	-	-	-	-
53, 54	Special for Retirement Resort	0%							30%	6	3	4	10	5	5	70%	15	6	9	23	11	11	0%	-	-	-	-	-	-
56	Special for Institution	80%	57	23	34	96	47	49	0%	-	-	-	-	-	-	10%	7	3	4	12	6	6	10%	7	3	4	12	6	6
57	Special for Hotel, Restaurant, Laundrettes, Staff Accommodation and Storage	0%	-	-	-	-	-	-	50%	26	14	11	36	18	18	50%	26	14	11	36	18	18	0%	-	-	-	-	-	-
58	Special for Shops, Places of Amusement, Places of Refreshment, Offices	0%	-	-	-	-	-	-	60%	608	304	304	805	402	402	40%	405	203	203	536	268	268	0%	-	-	-	-	-	-
59	Special for Hospital, Places of Refreshments, Shops, Offices and Staff Accommodation	80%	214	86	129	-	-	-	0%	-	-	-	-	-	-	10%	27	11	16	-	-	-	10%	-	-	-	-	-	-
<b>TOTAL TRIP GENERATION</b>		-	<b>309</b>	<b>135</b>	<b>176</b>	<b>117</b>	<b>57</b>	<b>60</b>	-	<b>643</b>	<b>322</b>	<b>321</b>	<b>854</b>	<b>427</b>	<b>427</b>	-	<b>491</b>	<b>242</b>	<b>248</b>	<b>622</b>	<b>311</b>	<b>311</b>	-	<b>161</b>	<b>111</b>	<b>57</b>	<b>94</b>	<b>47</b>	<b>47</b>

Figure 13: Development Trip Distribution

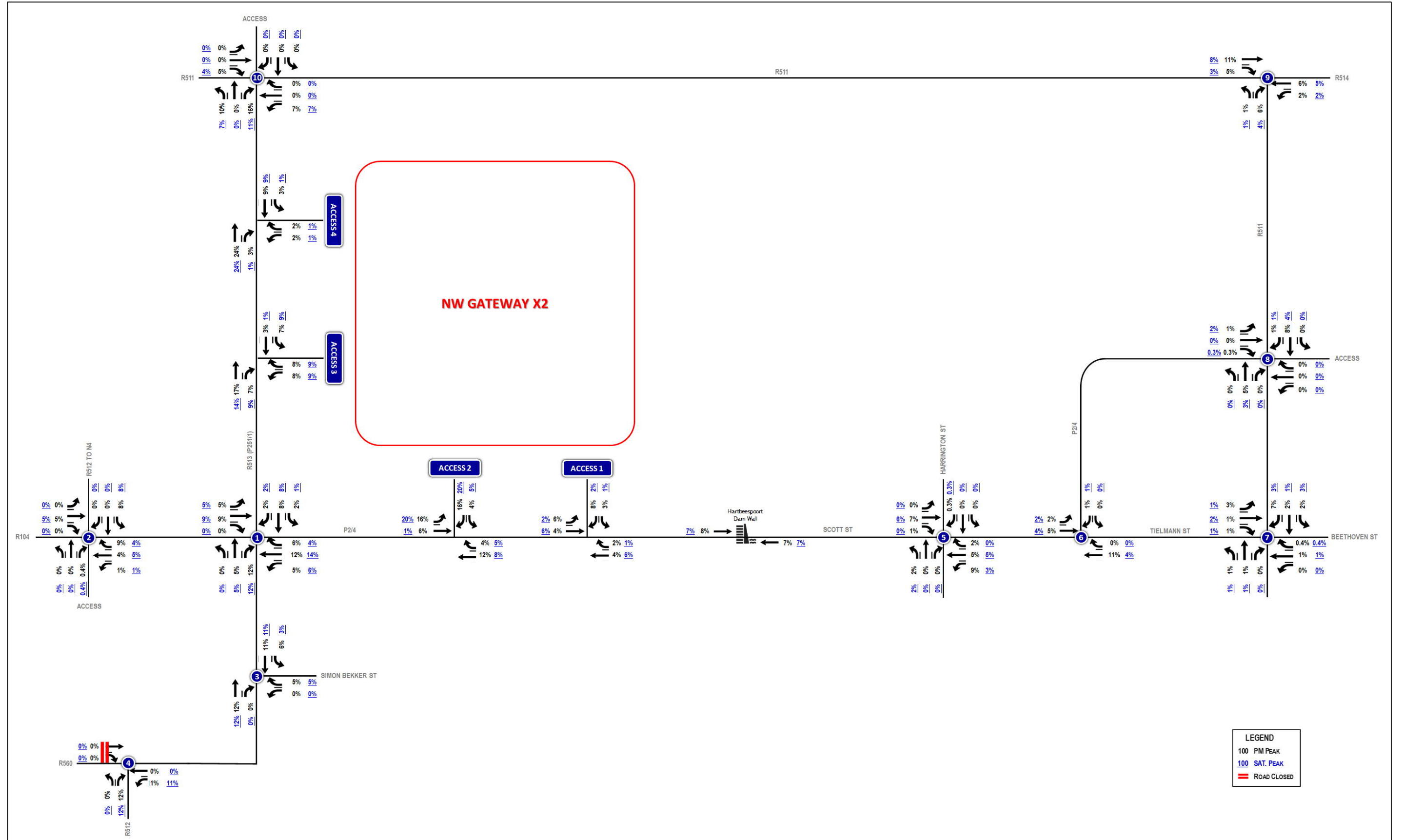


Figure 14: Development Trip Assignment

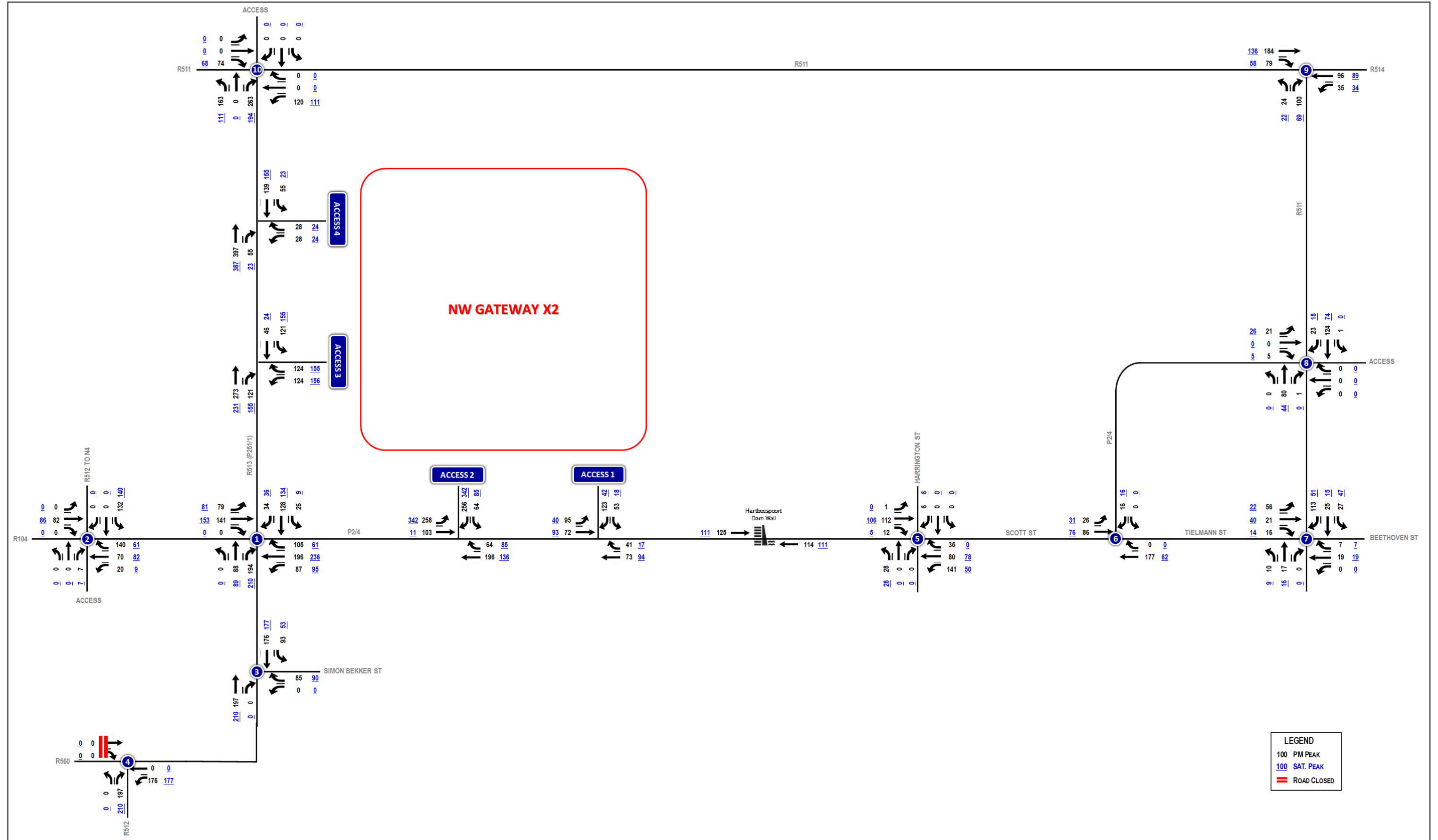




Figure 15: 2018 Background Traffic with Development Trips

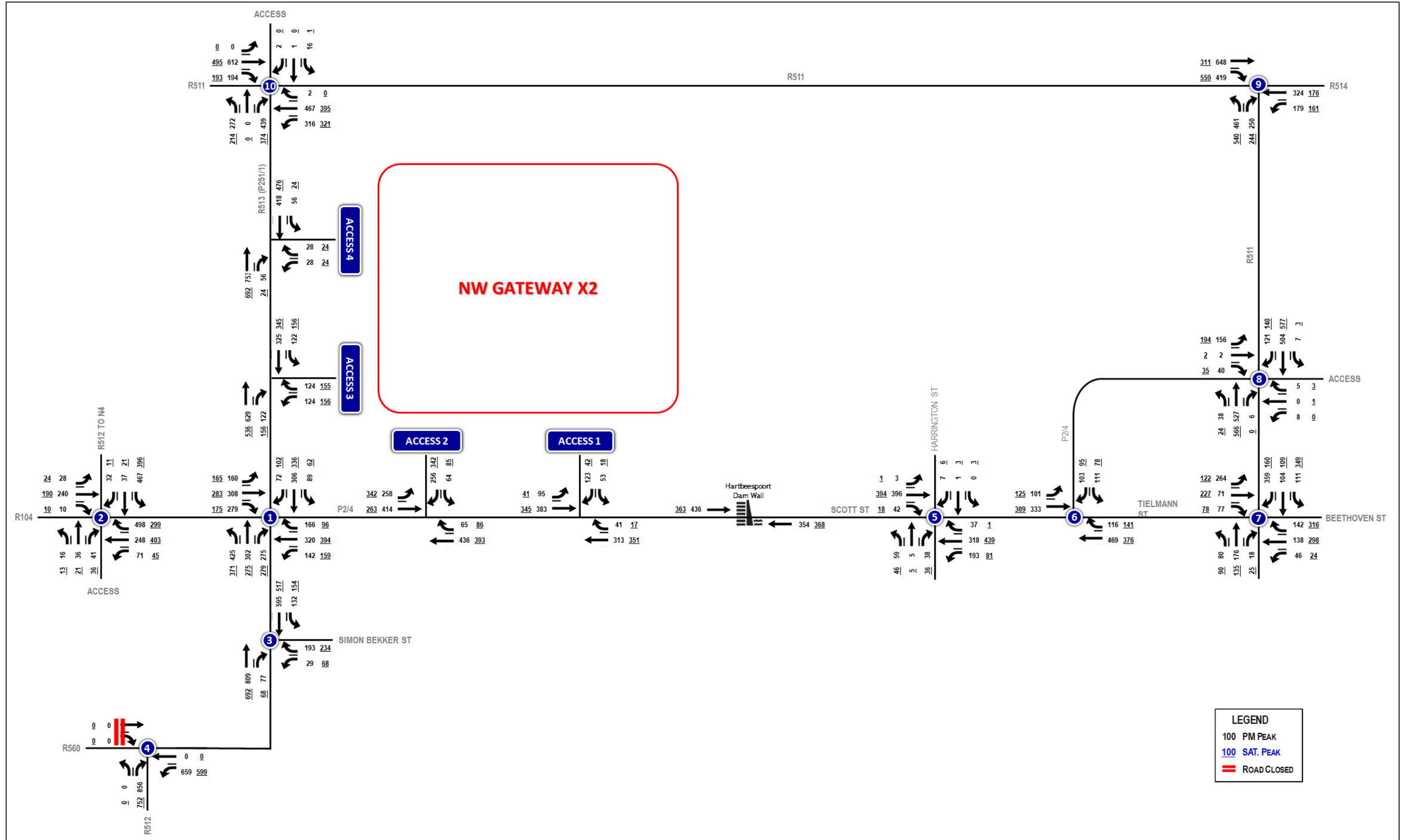


Figure 16: 2023 Background Traffic

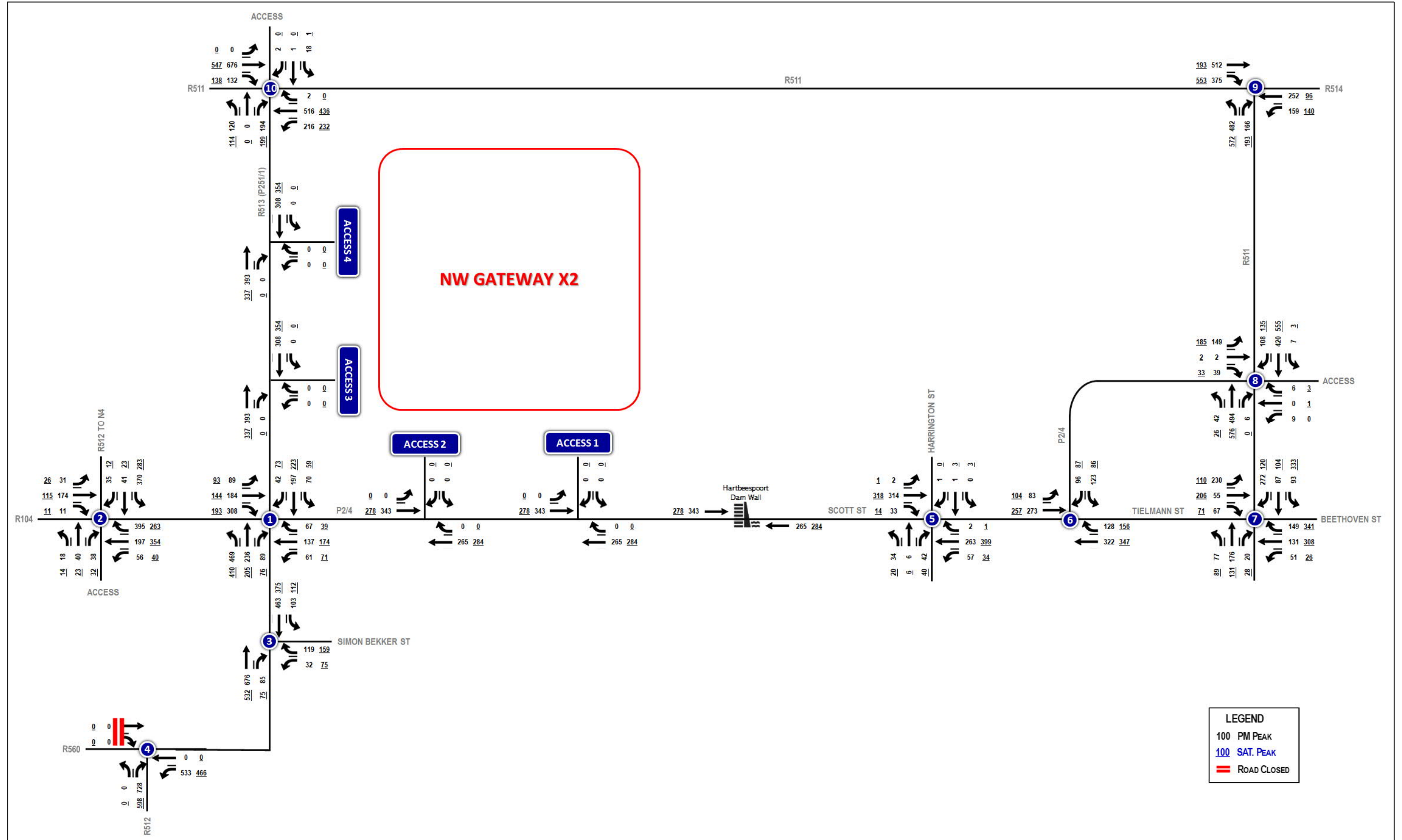
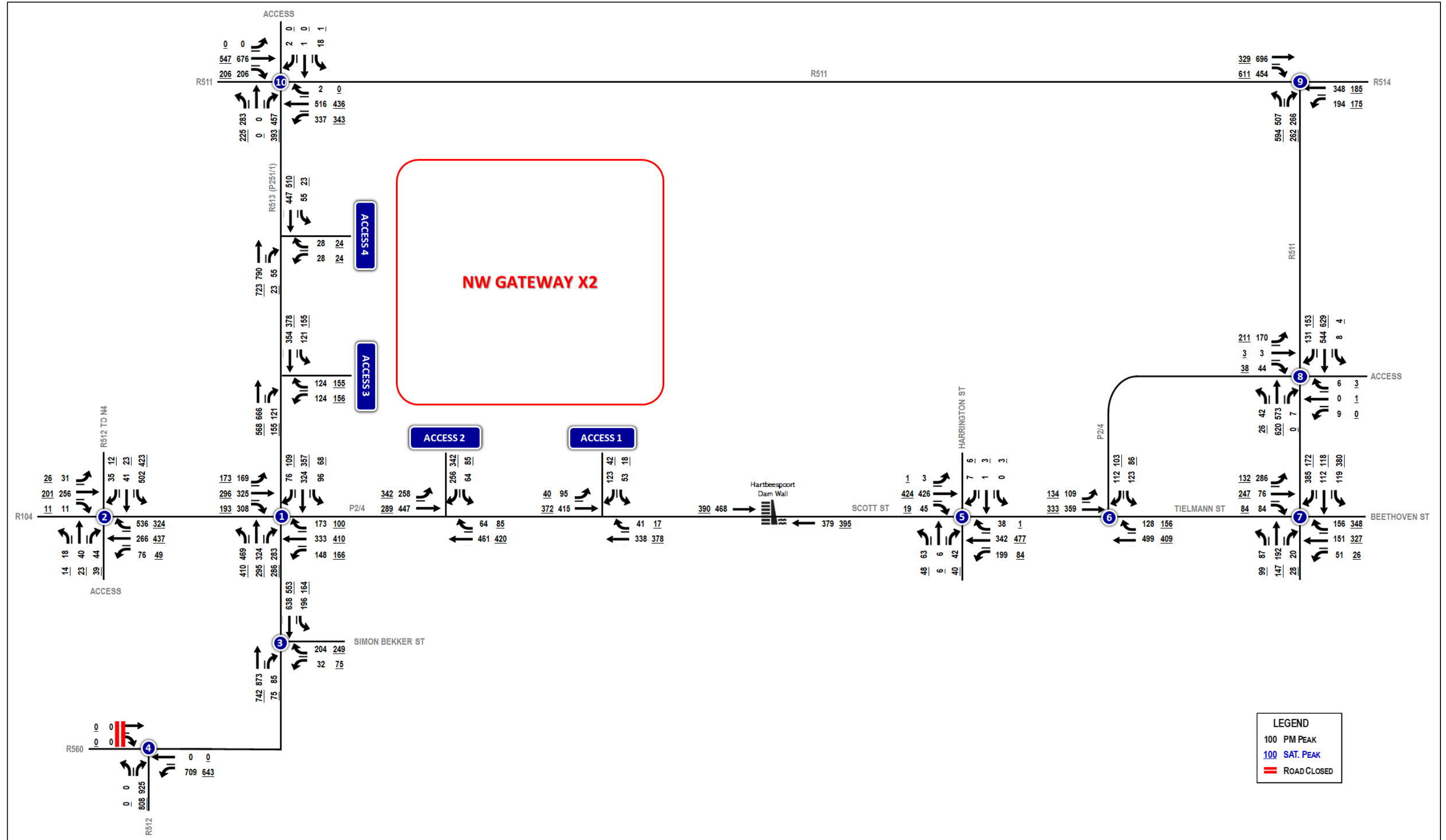


Figure 17: 2023 Background Traffic with Development Trips



## 7 Traffic Impact and Capacity Analysis

There is no phasing for the implementation of the development, except that the proposed hospital on erf 59 will be constructed first. Otherwise it was assumed that the development as a whole will be implemented within the next five years.

The capacity analysis was conducted with SIDRA 6.0 software. The following fifteen intersections were analysed for the PM – and Sat peak hour respectively:

1. Intersection 1: R104/ R513 (Road P251-1);
2. Intersection 2: R104/ R512 (Development Access);
3. Intersection 3: R512/ Simon Bekker St;
4. Intersection 4: R512/ R560;
5. Intersection 5: Scott St/ Harrington St;
6. Intersection 6: Scott St (Tielman St)/ Road P2/4;
7. Intersection 7: Tielmann St (Beethoven St)/ R511 (Bach St);
8. Intersection 8: R511/ Road P2/4;
9. Intersection 9: R511/ R514;
10. Intersection 10: R511/ Road P251-1;
11. The Hartbeespoort Dam Wall;
12. Development Access 1;
13. Development Access 2;
14. Development Access 3; and
15. Development Access 4.

The traffic peak hours determined from the traffic surveys are:

- Friday PM Peak Hour: 16:30 to 17:30; and
- Saturday Peak Hour: 12:00 to 13:00.

### 7.1 Scenarios

The following scenarios were analysed for each of the intersections:

- 2018 Base Year:
  - 2018 PM Peak Background Traffic;
  - 2018 Sat Peak Background Traffic;
  - 2018 PM Peak Background - with Development Traffic;
  - 2018 Sat Peak Background - with Development Traffic;
- 2023 Future Year:
  - 2023 PM Peak Background Traffic;
  - 2023 Sat Peak Background Traffic;
  - 2023 PM Peak Background - with Development Traffic; and
  - 2023 Sat Peak Background - with Development Traffic.

The aim of this analysis is to ensure that the intersections and/or accesses of the proposed development operate at an acceptable capacity which is indicated as level of service (LOS).

### 7.2 Intersection Control and - Layout

The existing control measures at the intersections in the study area are indicated in **Figure 18**, whilst the existing intersection layouts used in the capacity analysis are indicated in **Figure 19**, **Figure 20** and **Figure 21**.

The existing access road (D2109) that traverse the development site forms a T-junction with road P2/4 is also currently controlled by a stop sign on the side road. This intersection becomes *Access 1* of the development and thus, effectively road D2109 moves approximately 55m to the east from the existing position as indicated in **Figure 9**.

A pro-active discussion with the NWDPWT indicated that roundabouts will be preferred as intersection control measures at the access positions to the development site. Therefore, roundabouts are proposed at all four accesses to the development and were analysed as such.

Figure 18: Existing Intersection Control

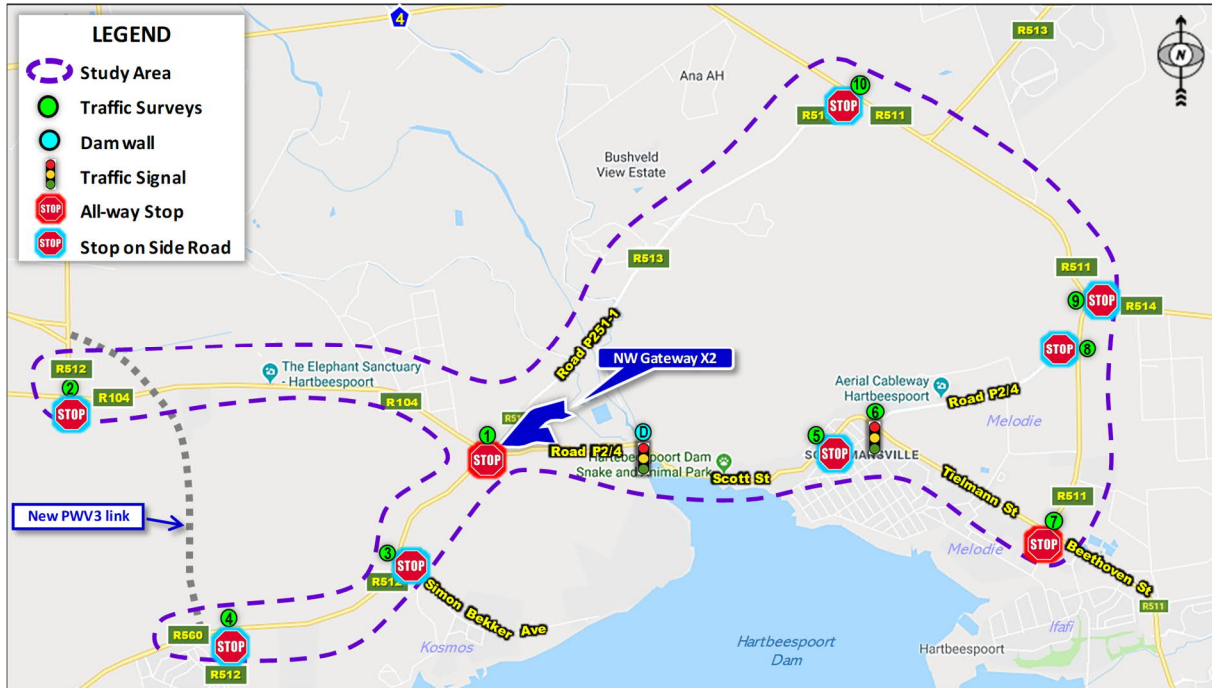


Figure 19: Intersection Layouts 1 of 3



Figure 20: Intersection Layouts 2 of 3

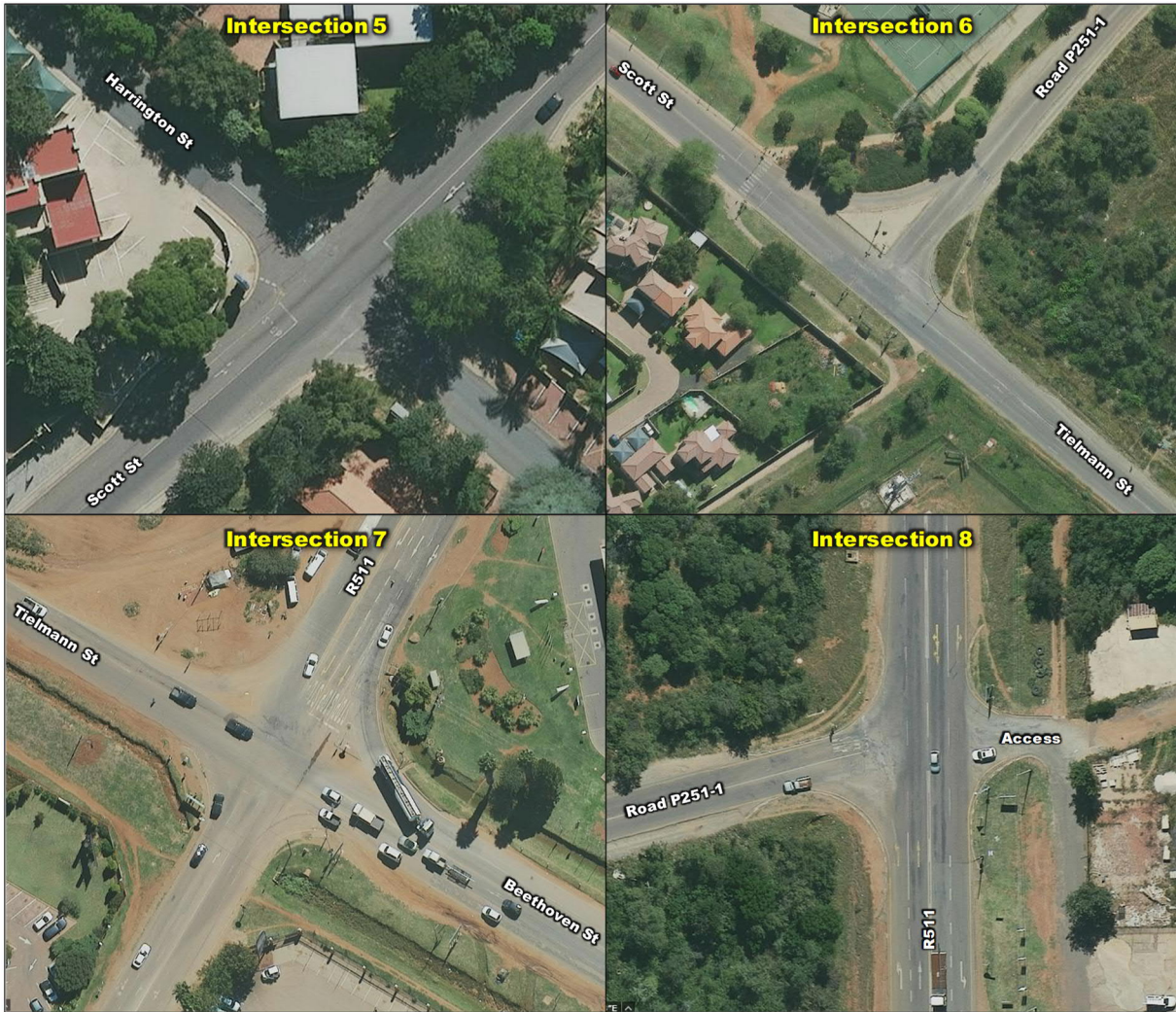
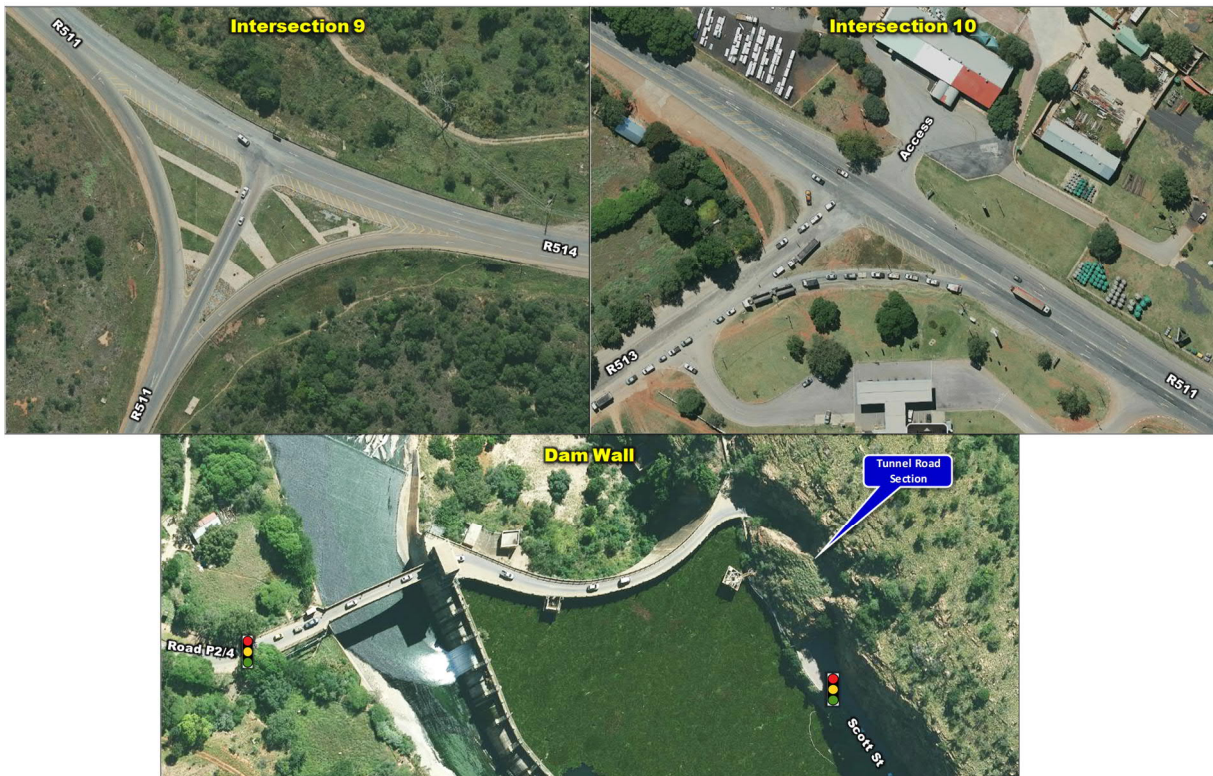


Figure 21: Intersection Layouts 3 of 3



### 7.3 Capacity Analysis

The analysis results of each scenario analysed for each of the intersections are presented by the intersection summary outputs from SIDRA. Note that the scenarios are compared in one table in order to simplify observing possible changes in the capacity impact on the intersection. A conclusion on the comparison is drawn after each intersection.

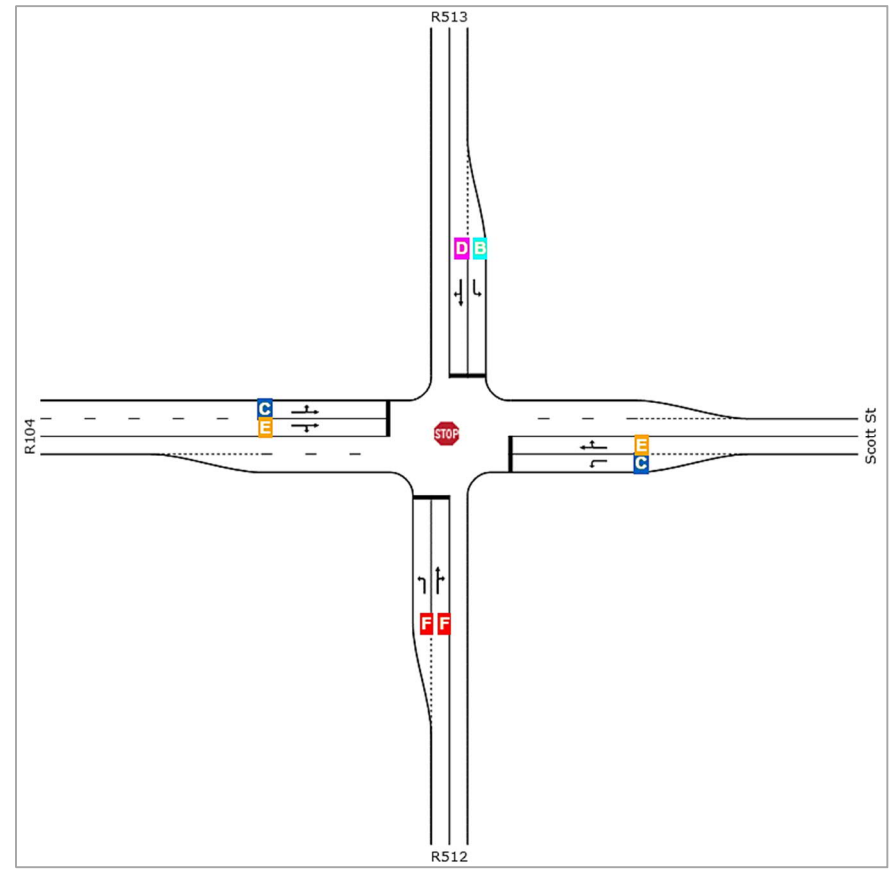
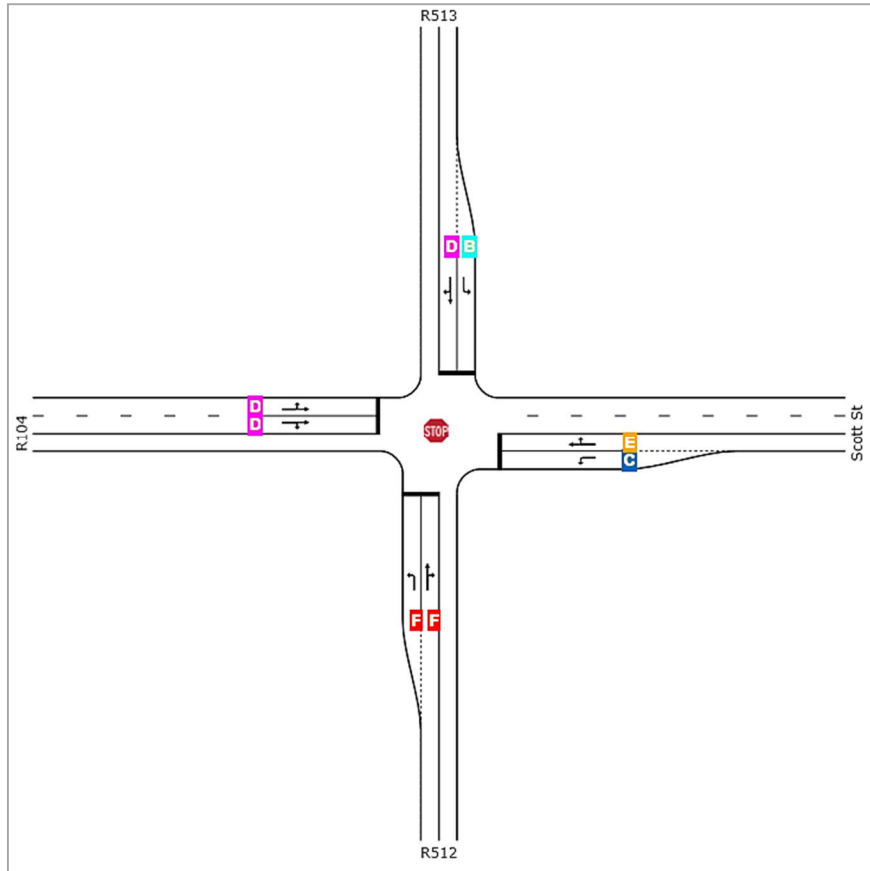
The following must be noted with regards to the capacity analysis of *Intersection 1* and *Intersection 7*. In determining the LOS from the capacity analysis, SIDRA utilises the methodology of the Highway Capacity Manual (HCM 2000). The HCM doesn't allow an all-way stop control that includes left-turn slip lanes. For this reason, the slip lane on the northern, southern and eastern approach of *Intersection 1* as well as the left-turn slip lane on the northern approach of *Intersection 7* could not be accurately simulated. Both these intersections had to be analysed as an all way stop control on all the lanes from all approaches. The effect is that the subsequent delay and thus the LOS result on these lanes/ movements are a bit more conservative than it might be in reality.

7.3.1 Intersection 1: R104/ R513 (Road P251-1)

Table 12: Capacity Analysis Results for Intersection 1: R104/ R513 (Road P251-1)

2018 PM Peak Hour Background Traffic	2018 Sat Peak Hour Background Traffic
--------------------------------------	---------------------------------------

Level of Service Summary



Movement Summary

**Movement Performance - Vehicles**

Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h %	v/c	sec		veh m		per veh	km/h
<b>South: R512</b>									
1	L2	391 0.0	1.102	167.5	LOS F	27.7 194.1	1.00	4.17	42.8
2	T1	196 0.0	0.833	54.8	LOS F	8.0 55.7	1.00	2.06	53.7
3	R2	73 0.0	0.833	54.4	LOS F	8.0 55.7	1.00	2.06	47.4
Approach		659 0.0	1.102	121.5	LOS F	27.7 194.1	1.00	3.31	46.2
<b>East: Scott St</b>									
4	L2	67 0.0	0.271	18.1	LOS C	1.1 7.5	0.99	1.31	55.2
5	T1	166 0.0	0.716	41.2	LOS E	5.0 35.2	1.00	1.72	54.6
6	R2	37 0.0	0.716	41.5	LOS E	5.0 35.2	1.00	1.72	55.1
Approach		271 0.0	0.716	35.5	LOS E	5.0 35.2	1.00	1.62	54.8
<b>North: R513</b>									
7	L2	56 0.0	0.163	13.0	LOS B	0.6 4.0	0.92	1.27	58.4
8	T1	213 0.0	0.723	33.2	LOS D	5.3 36.8	1.00	1.75	56.0
9	R2	69 0.0	0.723	32.8	LOS D	5.3 36.8	1.00	1.75	57.2
Approach		338 0.0	0.723	29.8	LOS D	5.3 36.8	0.99	1.67	56.7
<b>West: R104</b>									
10	L2	88 0.0	0.623	27.8	LOS D	3.7 25.8	1.00	1.57	57.7
11	T1	137 0.0	0.623	27.6	LOS D	3.7 25.8	1.00	1.57	56.3
12	R2	184 0.0	0.623	29.5	LOS D	3.7 25.8	1.00	1.57	56.0
Approach		409 0.0	0.623	28.5	LOS D	3.7 25.8	1.00	1.57	56.6
All Vehicles		1677 0.0	1.102	66.4	LOS F	27.7 194.1	1.00	2.28	52.1

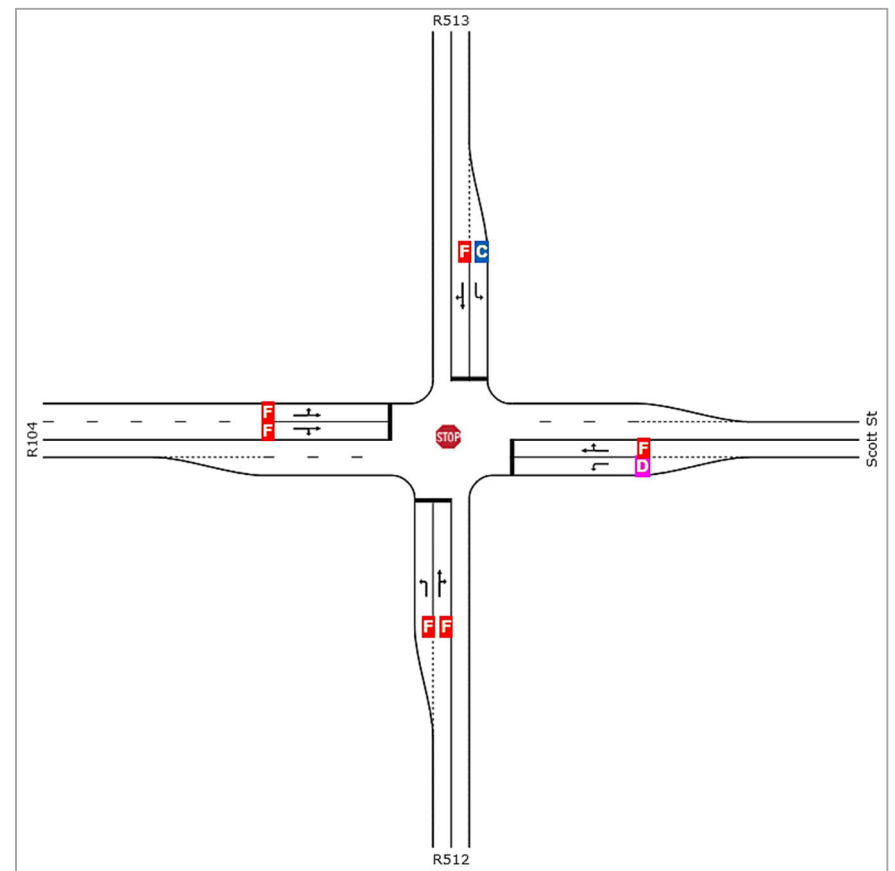
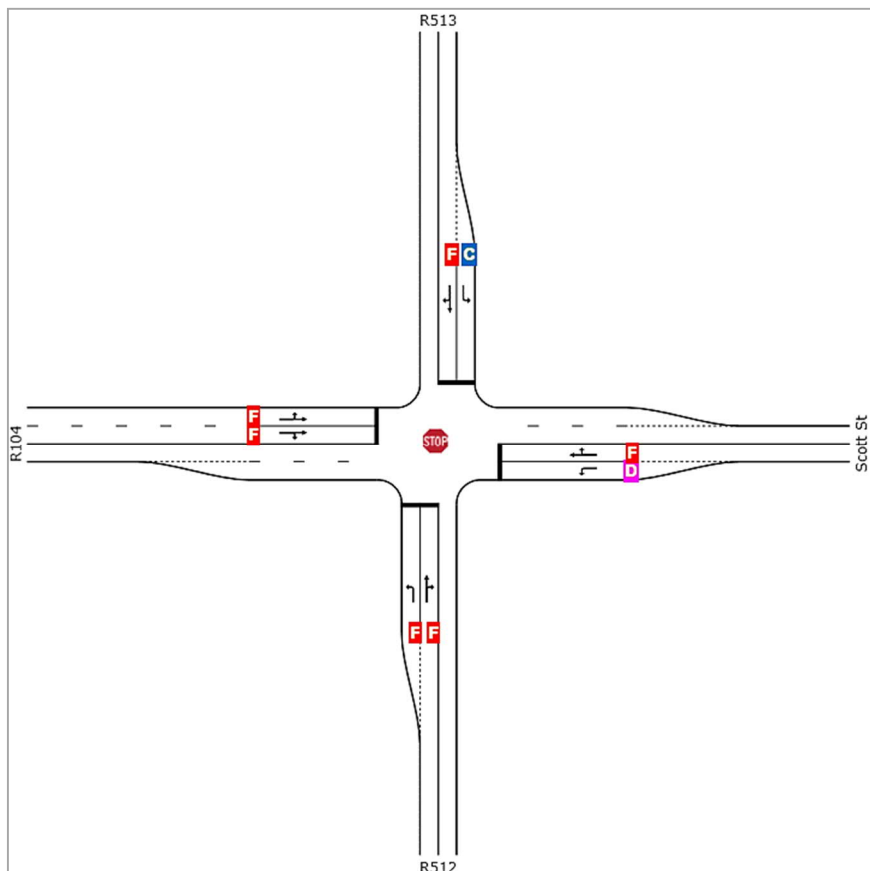
**Movement Performance - Vehicles**

Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h %	v/c	sec		veh m		per veh	km/h
<b>South: R512</b>									
1	L2	391 0.0	1.102	167.5	LOS F	27.7 194.1	1.00	4.17	42.8
2	T1	196 0.0	0.833	54.8	LOS F	8.0 55.7	1.00	2.06	53.7
3	R2	73 0.0	0.833	54.4	LOS F	8.0 55.7	1.00	2.06	47.4
Approach		659 0.0	1.102	121.5	LOS F	27.7 194.1	1.00	3.31	46.2
<b>East: Scott St</b>									
4	L2	67 0.0	0.271	18.1	LOS C	1.1 7.5	0.99	1.31	55.2
5	T1	166 0.0	0.716	41.2	LOS E	5.0 35.2	1.00	1.72	54.6
6	R2	37 0.0	0.716	41.5	LOS E	5.0 35.2	1.00	1.72	55.1
Approach		271 0.0	0.716	35.5	LOS E	5.0 35.2	1.00	1.62	54.8
<b>North: R513</b>									
7	L2	56 0.0	0.163	13.0	LOS B	0.6 4.0	0.92	1.27	58.4
8	T1	213 0.0	0.723	33.2	LOS D	5.3 36.8	1.00	1.75	56.0
9	R2	69 0.0	0.723	32.8	LOS D	5.3 36.8	1.00	1.75	57.2
Approach		338 0.0	0.723	29.8	LOS D	5.3 36.8	0.99	1.67	56.7
<b>West: R104</b>									
10	L2	88 0.0	0.479	22.0	LOS C	2.3 16.1	0.99	1.43	58.1
11	T1	137 0.0	0.750	31.3	LOS D	5.8 40.3	1.00	1.64	55.8
12	R2	184 0.0	0.750	39.0	LOS E	5.8 40.3	1.00	1.81	54.9
Approach		409 0.0	0.750	32.8	LOS D	5.8 40.3	1.00	1.67	56.1
All Vehicles		1677 0.0	1.102	67.5	LOS F	27.7 194.1	1.00	2.31	52.0

2018 PM Peak Hour Traffic plus Development Trips

2018 Sat Peak Hour Traffic plus Development Trips

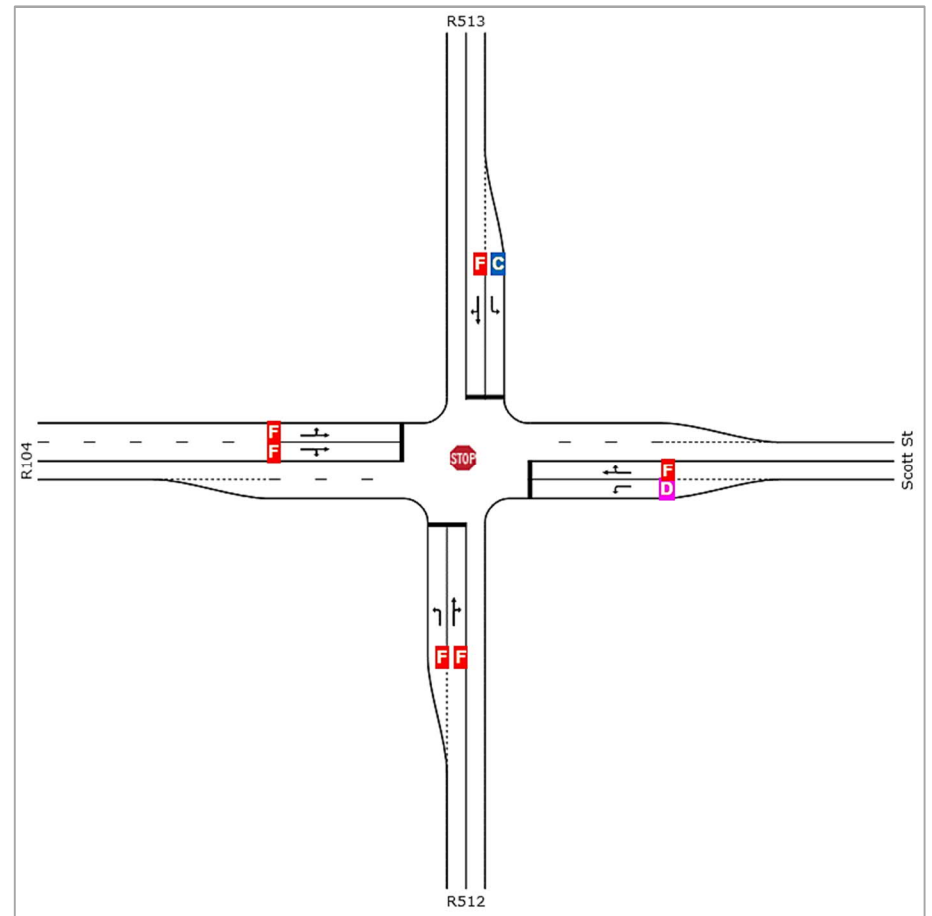
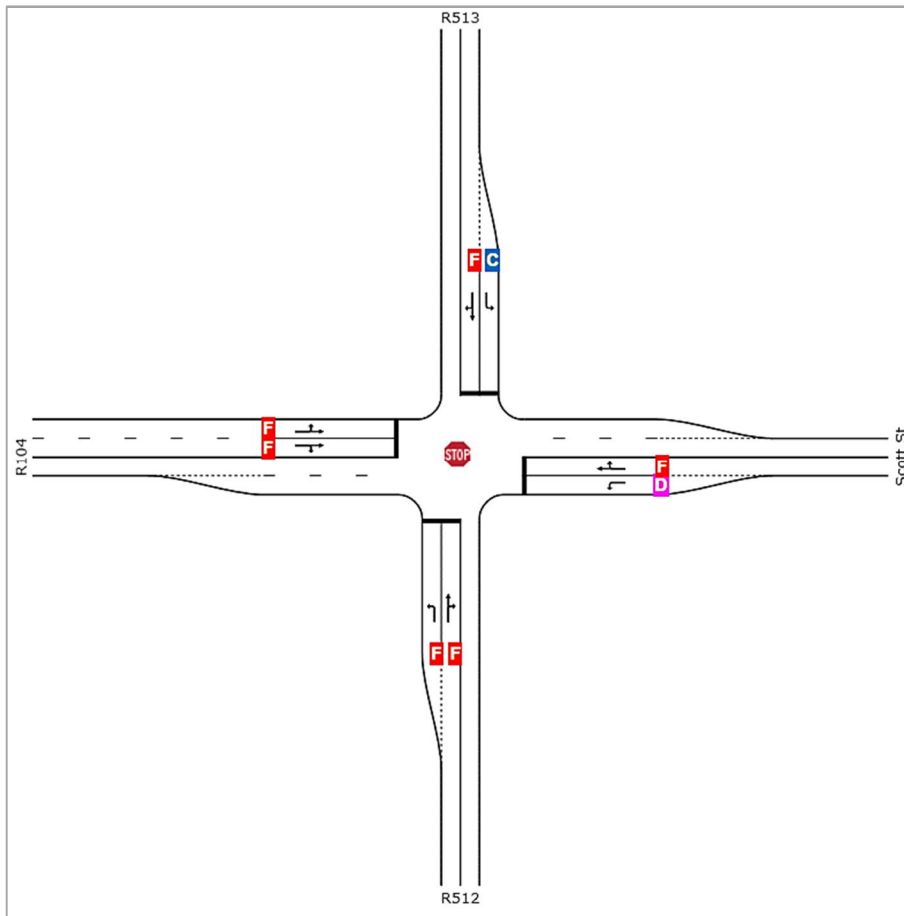
Level of Service Summary







Level of Service Summary



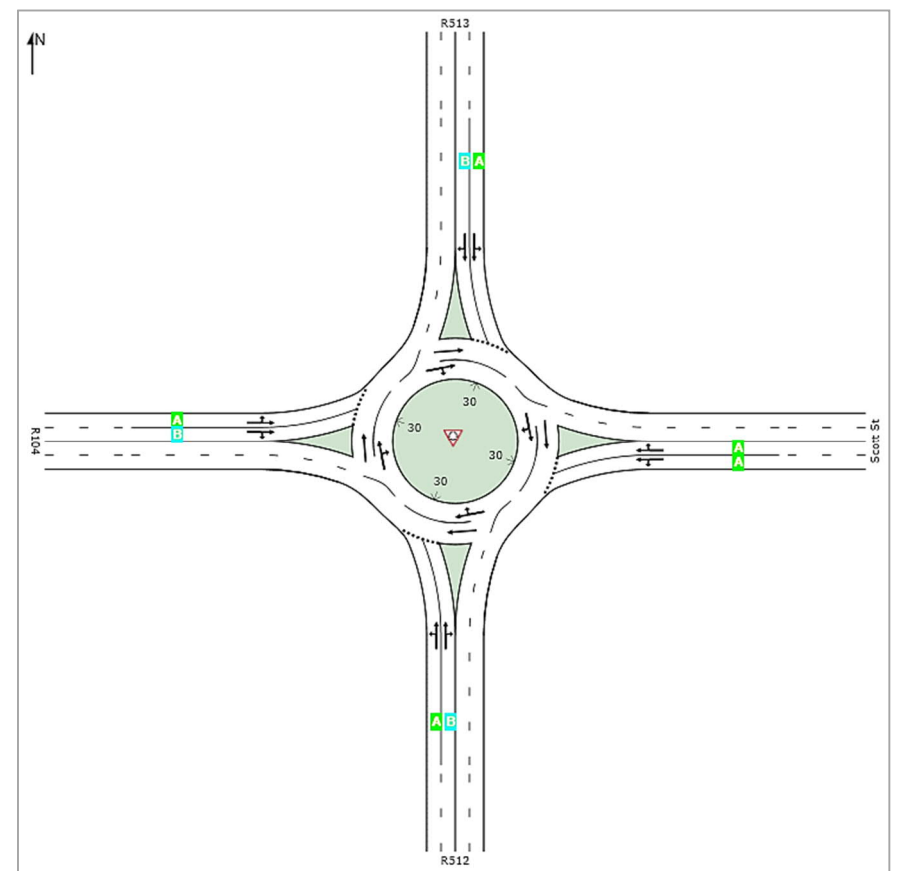
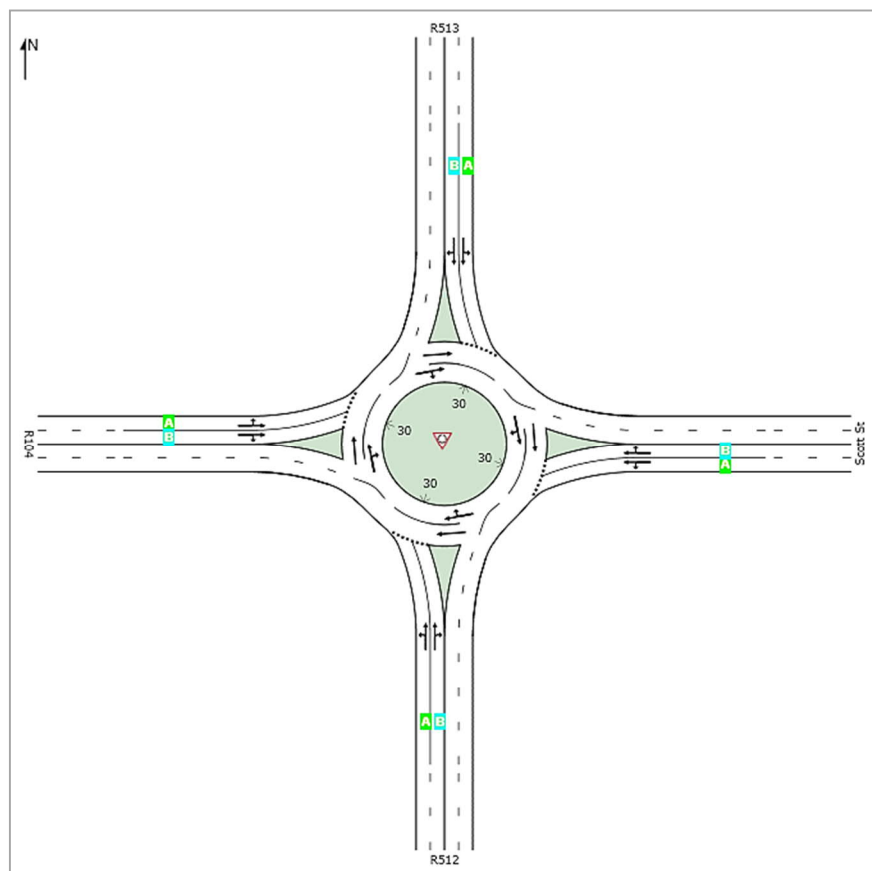
Movement Summary

Movement Performance - Vehicles											
Mov ID	ODMov	Demand		Deg. Satn	Average Level of Delay Service	95% Back of Queue	Vehicles Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%								v/c
South: R512											
1	L2	494	0.0	1.654	629.3	LOS F	88.7	620.6	1.00	8.03	23.9
2	T1	341	0.0	1.934	874.0	LOS F	135.9	951.2	1.00	10.29	20.8
3	R2	298	0.0	1.934	873.6	LOS F	135.9	951.2	1.00	10.29	11.4
Approach		1133	0.0	1.934	767.2	LOS F	135.9	951.2	1.00	9.31	19.7
East: Scott St											
4	L2	156	0.0	0.585	30.6	LOS D	3.3	22.8	1.00	1.52	52.3
5	T1	351	0.0	1.766	728.3	LOS F	103.6	724.9	1.00	8.71	21.8
6	R2	182	0.0	1.766	728.5	LOS F	103.6	724.9	1.00	8.71	23.3
Approach		688	0.0	1.766	570.4	LOS F	103.6	724.9	1.00	7.08	24.0
North: R513											
7	L2	101	0.0	0.369	19.7	LOS C	1.6	11.0	0.99	1.36	57.6
8	T1	341	0.0	1.345	362.1	LOS F	53.4	373.5	1.00	6.14	33.7
9	R2	80	0.0	1.345	361.8	LOS F	53.4	373.5	1.00	6.14	39.0
Approach		522	0.0	1.345	295.8	LOS F	53.4	373.5	1.00	5.21	37.6
West: R104											
10	L2	178	0.0	1.047	142.5	LOS F	19.7	137.8	1.00	3.30	49.5
11	T1	342	0.0	1.637	435.5	LOS F	94.6	662.2	1.00	6.61	29.3
12	R2	324	0.0	1.637	611.7	LOS F	94.6	662.2	1.00	8.60	24.3
Approach		844	0.0	1.637	441.4	LOS F	94.6	662.2	1.00	6.68	30.9
All Vehicles		3187	0.0	1.934	561.2	LOS F	135.9	951.2	1.00	7.46	25.7

Movement Performance - Vehicles											
Mov ID	ODMov	Demand		Deg. Satn	Average Level of Delay Service	95% Back of Queue	Vehicles Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%								v/c
South: R512											
1	L2	432	0.0	1.397	406.4	LOS F	59.2	414.4	1.00	6.50	30.3
2	T1	311	0.0	1.786	742.2	LOS F	119.5	836.3	1.00	9.83	23.1
3	R2	301	0.0	1.786	741.9	LOS F	119.5	836.3	1.00	9.83	13.0
Approach		1043	0.0	1.786	603.2	LOS F	119.5	836.3	1.00	8.46	22.8
East: Scott St											
4	L2	175	0.0	0.643	34.5	LOS D	3.9	27.5	1.00	1.59	51.4
5	T1	432	0.0	1.748	711.3	LOS F	103.0	720.9	1.00	8.75	22.1
6	R2	105	0.0	1.748	711.6	LOS F	103.0	720.9	1.00	8.75	23.7
Approach		712	0.0	1.748	545.2	LOS F	103.0	720.9	1.00	6.99	24.3
North: R513											
7	L2	72	0.0	0.241	15.5	LOS C	0.9	6.4	0.96	1.30	58.1
8	T1	376	0.0	1.450	448.6	LOS F	71.3	499.1	1.00	7.43	30.5
9	R2	115	0.0	1.450	448.3	LOS F	71.3	499.1	1.00	7.43	36.0
Approach		562	0.0	1.450	393.4	LOS F	71.3	499.1	0.99	6.65	33.8
West: R104											
10	L2	182	0.0	0.869	67.6	LOS F	9.1	63.5	1.00	2.17	54.6
11	T1	312	0.0	1.358	303.3	LOS F	57.2	400.7	1.00	5.51	34.7
12	R2	203	0.0	1.358	371.5	LOS F	57.2	400.7	1.00	6.47	31.7
Approach		697	0.0	1.358	261.6	LOS F	57.2	400.7	1.00	4.92	38.9
All Vehicles		3014	0.0	1.786	471.4	LOS F	119.5	836.3	1.00	6.96	28.3

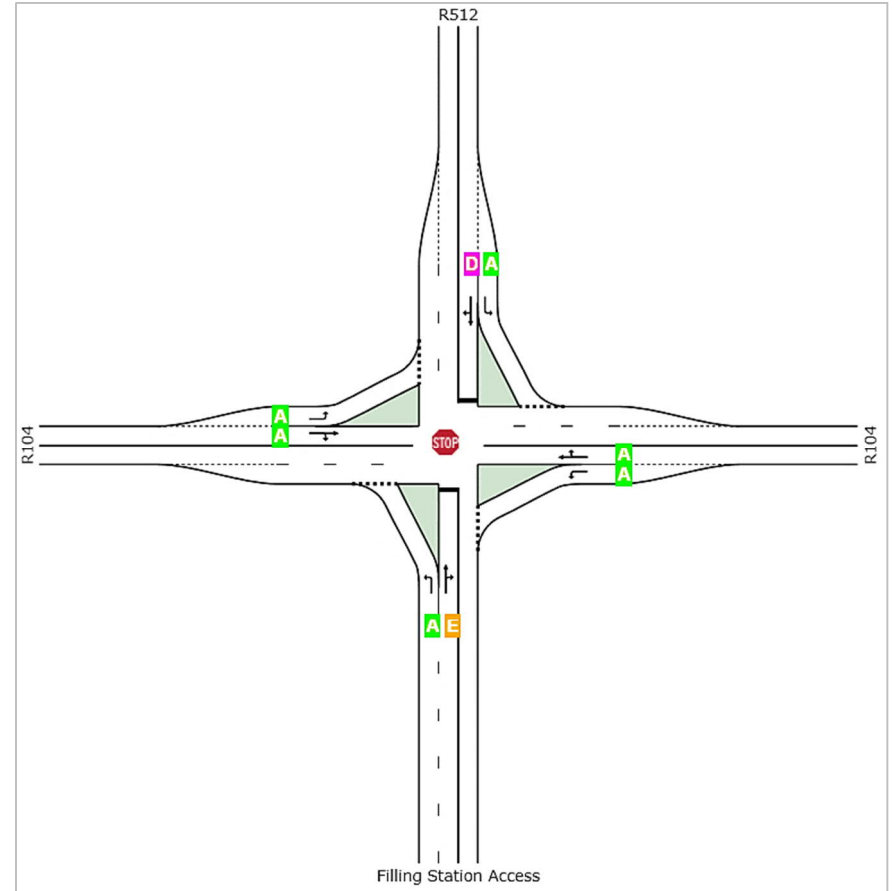
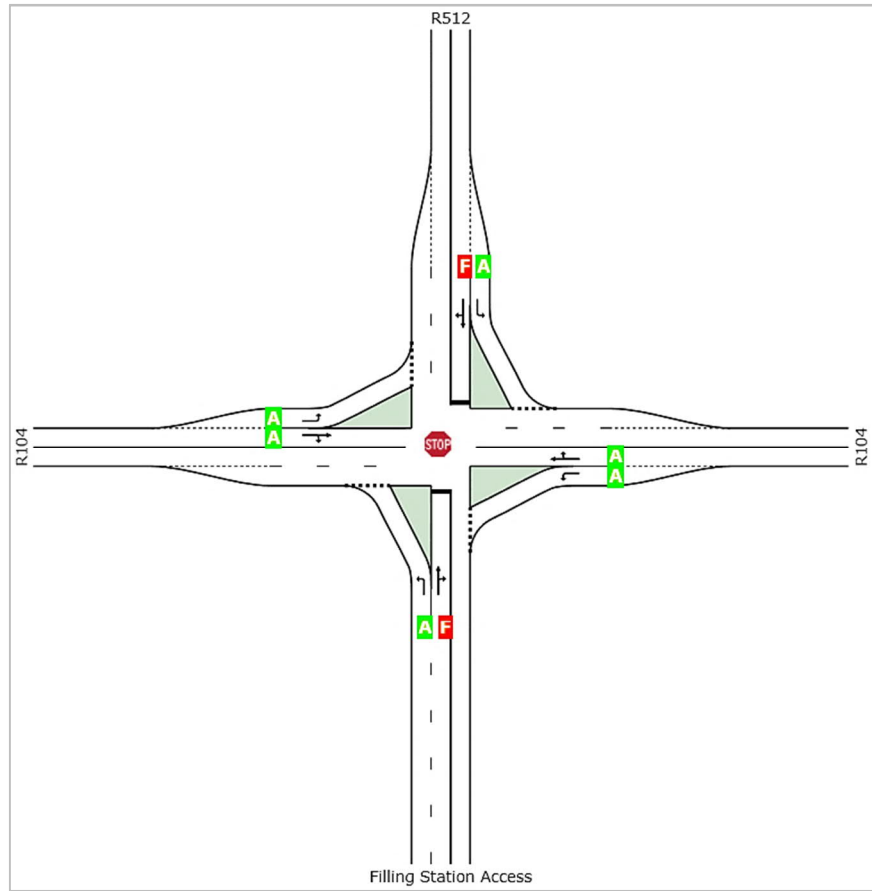
PROPOSED ROAD UPGRADE

Level of Service Summary





Level of Service Summary

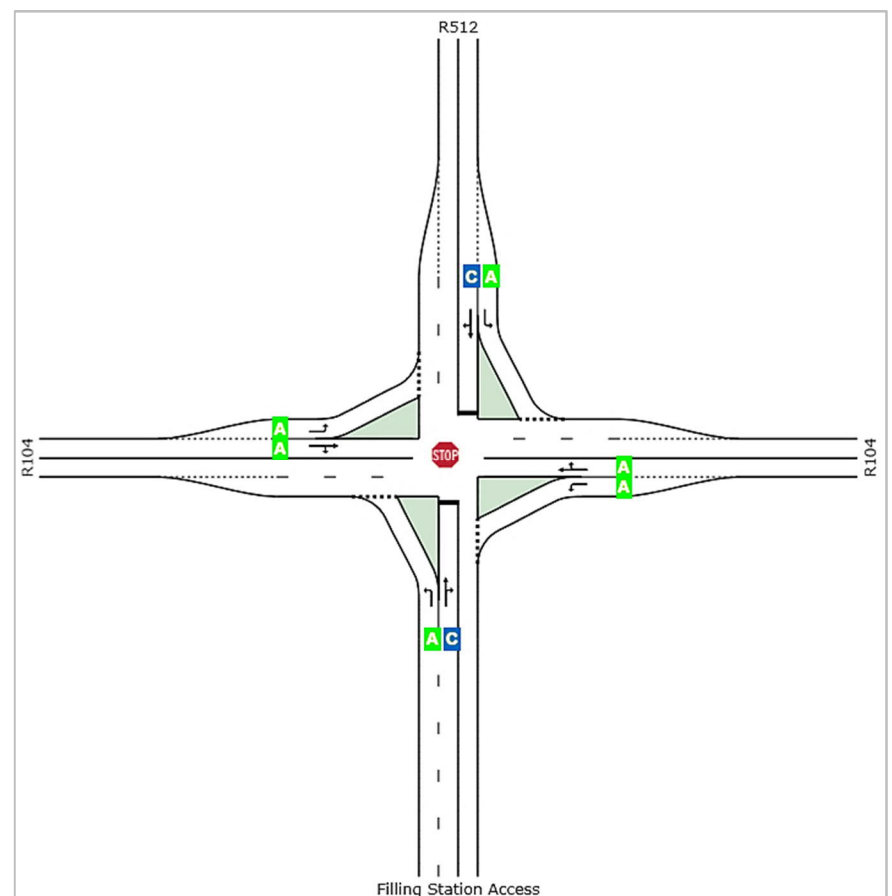
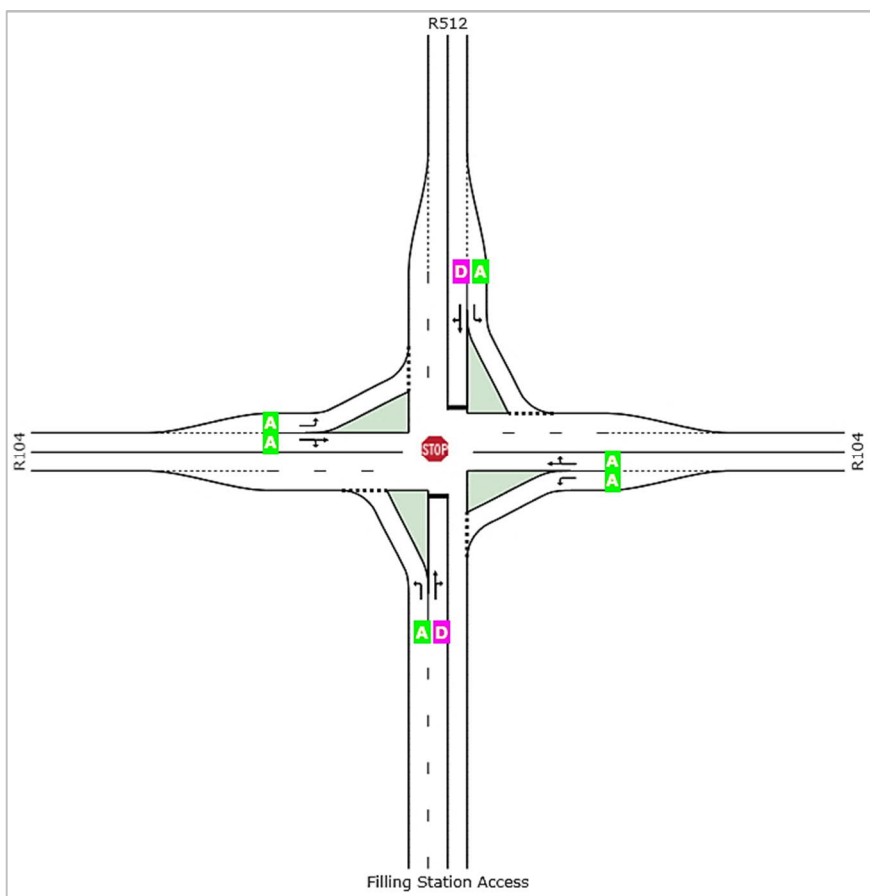


Movement Summary

Movement Performance - Vehicles											
Mov ID	ODMov	Demand		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%				Vehicles	Distance			
South: Filling Station Access											
1	L2	17	0.0	0.016	5.1	LOS A	0.1	0.4	0.33	0.54	54.8
2	T1	38	0.0	0.746	76.1	LOS F	3.5	24.2	0.97	1.19	22.1
3	R2	43	0.0	0.746	75.8	LOS F	3.5	24.2	0.97	1.19	27.4
Approach		98	0.0	0.746	63.7	LOS F	3.5	24.2	0.86	1.08	28.1
East: R104											
4	L2	75	0.0	0.059	5.8	LOS A	0.2	1.5	0.13	0.52	36.3
5	T1	261	0.0	0.607	3.6	LOS A	8.3	58.3	0.68	0.56	56.6
6	R2	524	0.0	0.607	9.2	LOS A	8.3	58.3	0.68	0.56	55.1
Approach		860	0.0	0.607	7.2	LOS A	8.3	58.3	0.63	0.56	54.1
North: R512											
7	L2	492	0.0	0.471	7.8	LOS A	3.1	21.8	0.47	0.70	55.3
8	T1	39	0.0	0.617	60.2	LOS F	2.6	17.9	0.95	1.12	16.8
9	R2	34	0.0	0.617	60.0	LOS F	2.6	17.9	0.95	1.12	37.7
Approach		564	0.0	0.617	14.5	LOS B	3.1	21.8	0.53	0.76	50.2
West: R104											
10	L2	29	0.0	0.041	8.5	LOS A	0.1	1.0	0.50	0.69	54.9
11	T1	253	0.0	0.139	1.3	LOS A	1.0	7.1	0.38	0.03	59.0
12	R2	11	0.0	0.139	6.8	LOS A	1.0	7.1	0.38	0.03	37.6
Approach		293	0.0	0.139	2.2	LOS A	1.0	7.1	0.40	0.09	58.0
All Vehicles		1815	0.0	0.746	11.7	NA	8.3	58.3	0.58	0.57	52.1

Movement Performance - Vehicles											
Mov ID	ODMov	Demand		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%				Vehicles	Distance			
South: Filling Station Access											
1	L2	14	0.0	0.016	6.0	LOS A	0.1	0.4	0.43	0.60	54.3
2	T1	22	0.0	0.421	40.0	LOS E	1.6	11.2	0.91	1.06	31.6
3	R2	38	0.0	0.421	39.6	LOS E	1.6	11.2	0.91	1.06	36.9
Approach		74	0.0	0.421	33.5	LOS D	1.6	11.2	0.82	0.98	38.0
East: R104											
4	L2	47	0.0	0.037	5.7	LOS A	0.1	0.9	0.10	0.52	36.3
5	T1	424	0.0	0.488	1.9	LOS A	5.2	36.2	0.52	0.29	57.8
6	R2	315	0.0	0.488	7.5	LOS A	5.2	36.2	0.52	0.29	56.5
Approach		786	0.0	0.488	4.4	LOS A	5.2	36.2	0.50	0.30	56.1
North: R512											
7	L2	417	0.0	0.378	6.8	LOS A	1.8	12.7	0.38	0.61	55.5
8	T1	22	0.0	0.211	32.3	LOS D	0.7	5.0	0.87	1.01	20.3
9	R2	12	0.0	0.211	32.2	LOS D	0.7	5.0	0.87	1.01	45.5
Approach		451	0.0	0.378	8.7	LOS A	1.8	12.7	0.42	0.64	53.2
West: R104											
10	L2	25	0.0	0.026	7.0	LOS A	0.1	0.6	0.38	0.59	55.5
11	T1	200	0.0	0.114	2.3	LOS A	0.9	6.5	0.49	0.04	58.7
12	R2	11	0.0	0.114	7.8	LOS A	0.9	6.5	0.49	0.04	37.4
Approach		236	0.0	0.114	3.0	LOS A	0.9	6.5	0.48	0.09	57.6
All Vehicles		1546	0.0	0.488	6.8	NA	5.2	36.2	0.49	0.40	54.8

Level of Service Summary



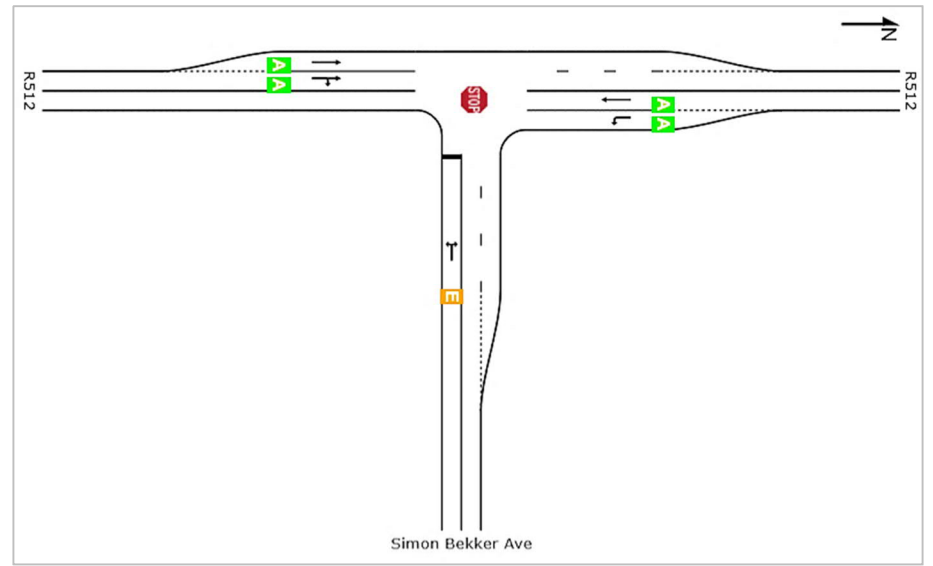
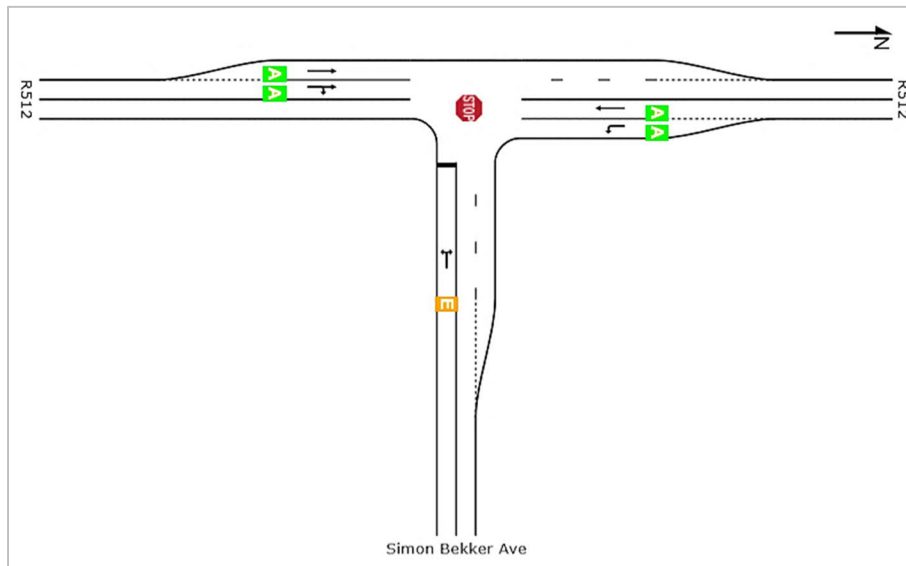


### 7.3.3 Intersection 3: R512/ Simon Bekker St

Table 14: Capacity Analysis Results for Intersection 3: R512/ Simon Bekker St

**2018 PM Peak Hour Background Traffic** **2018 Sat Peak Hour Background Traffic**

**Level of Service Summary**



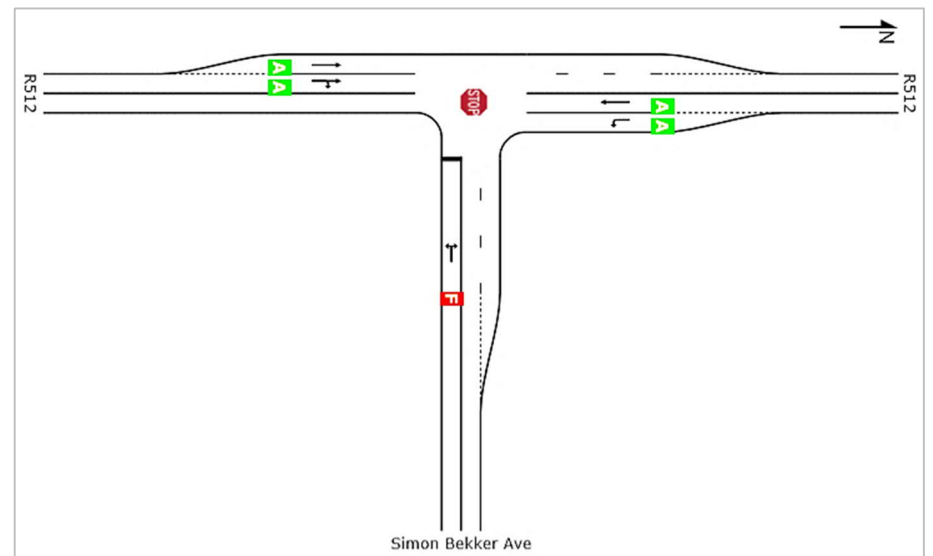
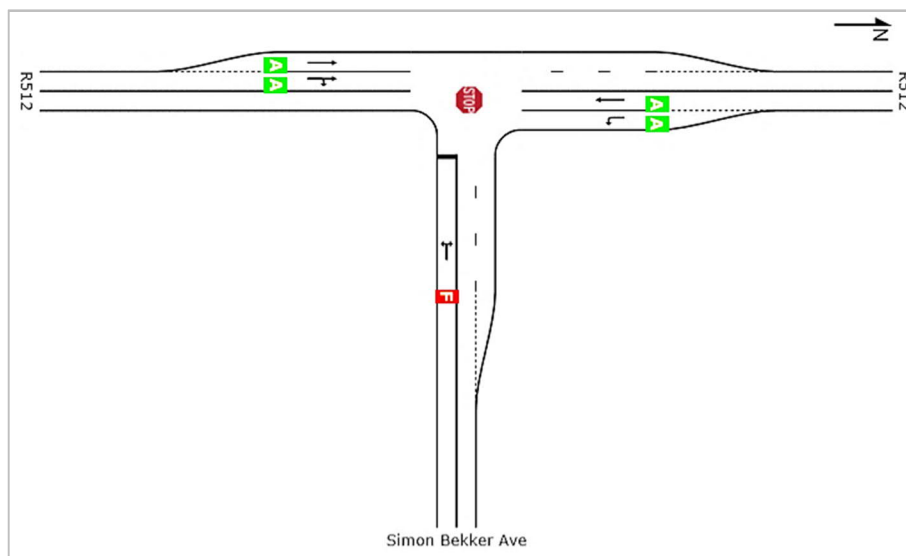
**Movement Summary**

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%	v/c	sec	veh	m	per veh	per veh	km/h	
South: R512											
2	T1	507	0.0	0.187	1.1	LOS A	1.4	9.7	0.22	0.08	59.6
3	R2	72	0.0	0.187	8.2	LOS A	1.4	9.7	0.55	0.20	58.2
Approach		579	0.0	0.187	2.0	NA	1.4	9.7	0.26	0.09	59.4
East: Simon Bekker Ave											
4	L2	72	0.0	0.788	39.5	LOS E	6.1	42.6	0.86	1.41	50.6
6	R2	152	0.0	0.788	39.4	LOS E	6.1	42.6	0.86	1.41	49.3
Approach		223	0.0	0.788	39.5	LOS E	6.1	42.6	0.86	1.41	49.7
North: R512											
7	L2	106	0.0	0.057	5.6	LOS A	0.0	0.0	0.00	0.58	57.7
8	T1	358	0.0	0.184	0.1	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		464	0.0	0.184	1.3	NA	0.0	0.0	0.00	0.13	59.5
All Vehicles		1266	0.0	0.788	8.4	NA	6.1	42.6	0.27	0.34	57.7

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%	v/c	sec	veh	m	per veh	per veh	km/h	
South: R512											
2	T1	507	0.0	0.187	1.1	LOS A	1.4	9.7	0.22	0.08	59.6
3	R2	72	0.0	0.187	8.2	LOS A	1.4	9.7	0.55	0.20	58.2
Approach		579	0.0	0.187	2.0	NA	1.4	9.7	0.26	0.09	59.4
East: Simon Bekker Ave											
4	L2	72	0.0	0.788	39.5	LOS E	6.1	42.6	0.86	1.41	50.6
6	R2	152	0.0	0.788	39.4	LOS E	6.1	42.6	0.86	1.41	49.3
Approach		223	0.0	0.788	39.5	LOS E	6.1	42.6	0.86	1.41	49.7
North: R512											
7	L2	106	0.0	0.057	5.6	LOS A	0.0	0.0	0.00	0.58	57.7
8	T1	358	0.0	0.184	0.1	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		464	0.0	0.184	1.3	NA	0.0	0.0	0.00	0.13	59.5
All Vehicles		1266	0.0	0.788	8.4	NA	6.1	42.6	0.27	0.34	57.7

**2018 PM Peak Hour Traffic plus Development Trips** **2018 Sat Peak Hour Traffic plus Development Trips**

**Level of Service Summary**

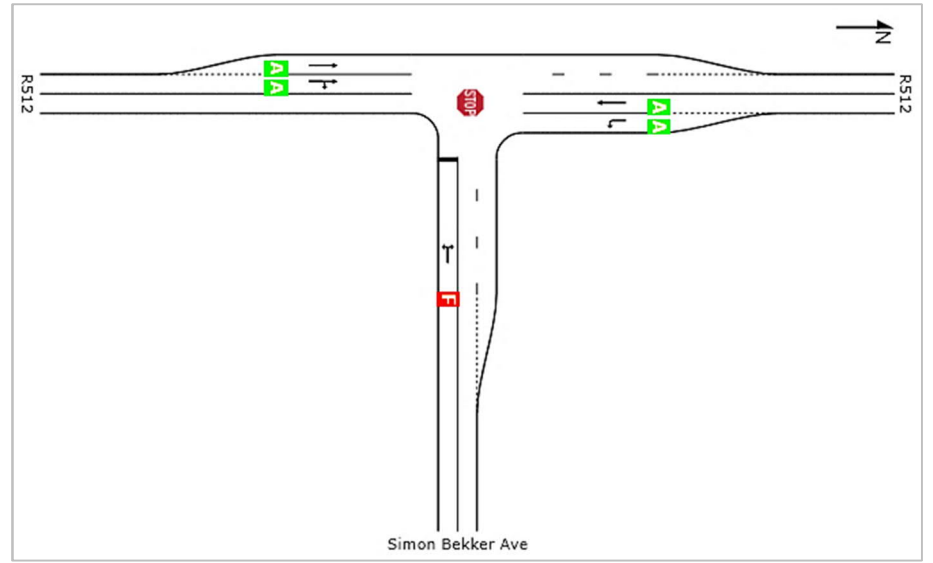
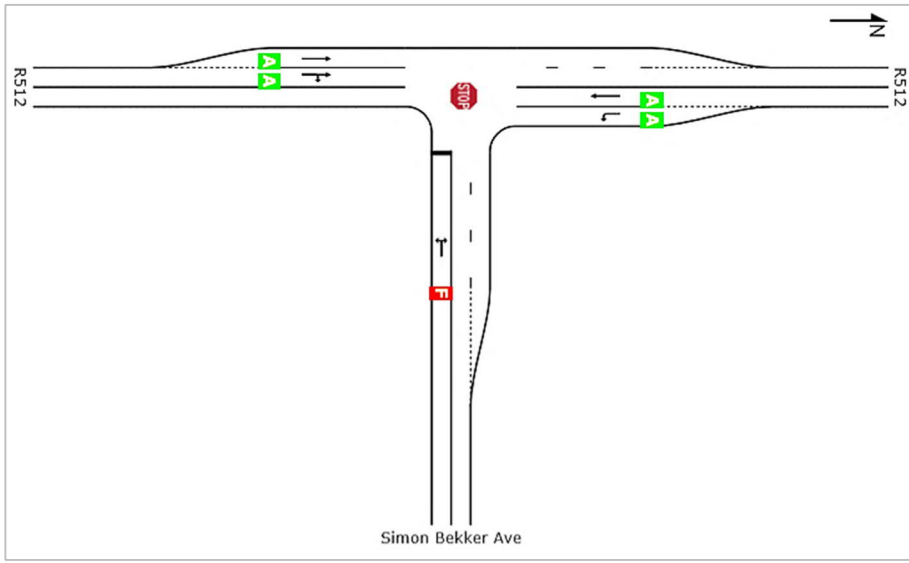


**Movement Summary**

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%	v/c	sec	veh	m	per veh	per veh	km/h	
South: R512											
2	T1	852	0.0	0.315	3.2	LOS A	4.0	28.3	0.35	0.08	59.1
3	R2	81	0.0	0.315	13.2	LOS B	4.0	28.3	0.86	0.19	57.0
Approach		933	0.0	0.315	4.1	NA	4.0	28.3	0.39	0.09	58.9
East: Simon Bekker Ave											
4	L2	31	0.0	3.771	2588.0	LOS F	118.6	829.9	1.00	3.73	4.5
6	R2	203	0.0	3.771	2588.0	LOS F	118.6	829.9	1.00	3.73	3.9
Approach		234	0.0	3.771	2588.0	LOS F	118.6	829.9	1.00	3.73	4.0
North: R512											
7	L2	139	0.0	0.075	5.6	LOS A	0.0	0.0	0.00	0.58	57.7
8	T1	626	0.0	0.321	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		765	0.0	0.321	1.1	NA	0.0	0.0	0.00	0.10	59.6
All Vehicles		1932	0.0	3.771	315.5	NA	118.6	829.9	0.31	0.53	24.9

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%	v/c	sec	veh	m	per veh	per veh	km/h	
South: R512											
2	T1	728	0.0	0.266	2.5	LOS A	2.9	20.3	0.31	0.07	59.3
3	R2	72	0.0	0.266	11.5	LOS B	2.9	20.3	0.75	0.18	57.4
Approach		800	0.0	0.266	3.3	NA	2.9	20.3	0.35	0.08	59.1
East: Simon Bekker Ave											
4	L2	72	0.0	2.924	1795.1	LOS F	140.7	985.1	1.00	5.14	6.3
6	R2	246	0.0	2.924	1795.0	LOS F	140.7	985.1	1.00	5.14	5.5
Approach		318	0.0	2.924	1795.1	LOS F	140.7	985.1	1.00	5.14	5.7
North: R512											
7	L2	162	0.0	0.087	5.6	LOS A	0.0	0.0	0.00	0.58	57.7
8	T1	544	0.0	0.279	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		706	0.0	0.279	1.4	NA	0.0	0.0	0.00	0.13	59.5
All Vehicles		1824	0.0	2.924	314.8	NA	140.7	985.1	0.33	0.98	24.7

Level of Service Summary

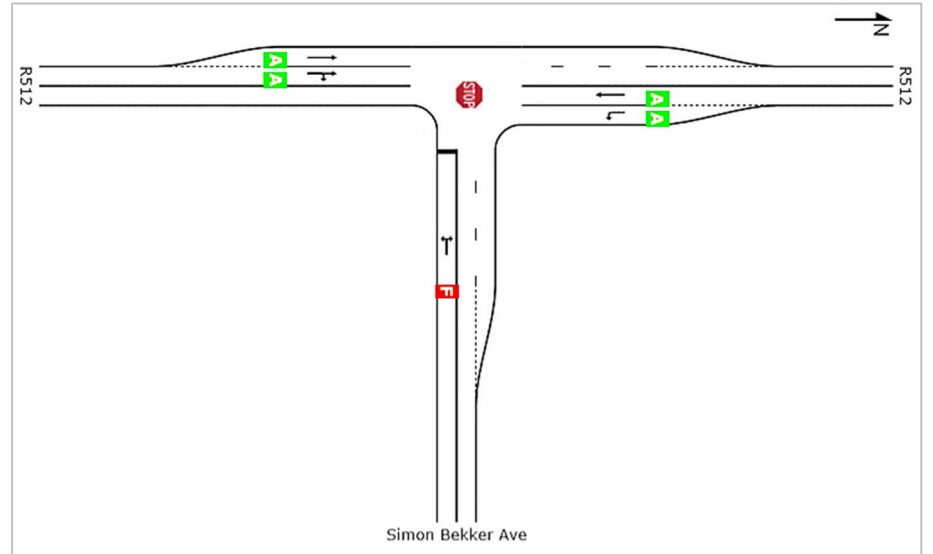
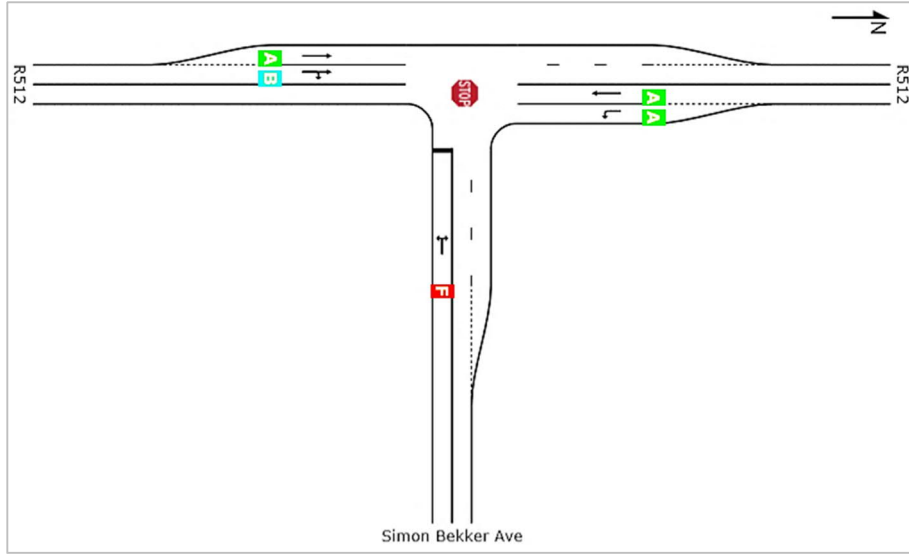


Movement Summary

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue	Vehicles Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		veh/h	%								v/c
South: R512											
2	T1	712	0.0	0.266	1.9	LOS A	2.5	17.5	0.27	0.09	59.4
3	R2	89	0.0	0.266	10.0	LOS B	2.5	17.5	0.68	0.22	57.7
Approach		801	0.0	0.266	2.8	NA	2.5	17.5	0.31	0.10	59.2
East: Simon Bekker Ave											
4	L2	34	0.0	1.215	282.3	LOS F	24.5	171.2	1.00	2.61	25.7
6	R2	125	0.0	1.215	282.3	LOS F	24.5	171.2	1.00	2.61	23.5
Approach		159	0.0	1.215	282.3	LOS F	24.5	171.2	1.00	2.61	23.9
North: R512											
7	L2	108	0.0	0.058	5.6	LOS A	0.0	0.0	0.00	0.58	57.7
8	T1	487	0.0	0.250	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		596	0.0	0.250	1.1	NA	0.0	0.0	0.00	0.10	59.6
All Vehicles		1556	0.0	1.215	30.7	NA	24.5	171.2	0.26	0.36	52.7

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue	Vehicles Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		veh/h	%								v/c
South: R512											
2	T1	560	0.0	0.209	1.3	LOS A	1.6	11.3	0.23	0.08	59.5
3	R2	79	0.0	0.209	8.7	LOS A	1.6	11.3	0.59	0.21	58.1
Approach		639	0.0	0.209	2.2	NA	1.6	11.3	0.28	0.10	59.4
East: Simon Bekker Ave											
4	L2	79	0.0	1.042	123.5	LOS F	19.4	136.0	1.00	2.38	37.9
6	R2	167	0.0	1.042	123.5	LOS F	19.4	136.0	1.00	2.38	35.7
Approach		246	0.0	1.042	123.5	LOS F	19.4	136.0	1.00	2.38	36.4
North: R512											
7	L2	118	0.0	0.063	5.6	LOS A	0.0	0.0	0.00	0.58	57.7
8	T1	395	0.0	0.202	0.1	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		513	0.0	0.202	1.3	NA	0.0	0.0	0.00	0.13	59.5
All Vehicles		1398	0.0	1.042	23.3	NA	19.4	136.0	0.30	0.51	54.2

Level of Service Summary



Movement Summary

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue	Vehicles Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		veh/h	%								v/c
South: R512											
2	T1	919	0.0	0.357	4.0	LOS A	5.2	36.2	0.37	0.08	58.9
3	R2	89	0.0	0.357	16.1	LOS C	5.2	36.2	1.00	0.23	56.2
Approach		1008	0.0	0.357	5.1	NA	5.2	36.2	0.43	0.10	58.7
East: Simon Bekker Ave											
4	L2	34	0.0	5.889	4525.2	LOS F	145.2	1016.1	1.00	3.16	2.7
6	R2	215	0.0	5.889	4525.2	LOS F	145.2	1016.1	1.00	3.16	2.3
Approach		248	0.0	5.889	4525.2	LOS F	145.2	1016.1	1.00	3.16	2.4
North: R512											
7	L2	206	0.0	0.111	5.6	LOS A	0.0	0.0	0.00	0.58	57.7
8	T1	672	0.0	0.344	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		878	0.0	0.344	1.4	NA	0.0	0.0	0.00	0.14	59.5
All Vehicles		2135	0.0	5.889	529.6	NA	145.2	1016.1	0.32	0.47	17.8

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue	Vehicles Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		veh/h	%								v/c
South: R512											
2	T1	781	0.0	0.292	2.9	LOS A	3.4	24.1	0.32	0.08	59.2
3	R2	79	0.0	0.292	12.6	LOS B	3.4	24.1	0.82	0.20	57.1
Approach		860	0.0	0.292	3.8	NA	3.4	24.1	0.37	0.09	59.0
East: Simon Bekker Ave											
4	L2	79	0.0	3.925	2705.4	LOS F	171.2	1198.2	1.00	4.85	4.3
6	R2	262	0.0	3.925	2705.4	LOS F	171.2	1198.2	1.00	4.85	3.8
Approach		341	0.0	3.925	2705.4	LOS F	171.2	1198.2	1.00	4.85	3.9
North: R512											
7	L2	173	0.0	0.093	5.6	LOS A	0.0	0.0	0.00	0.58	57.7
8	T1	582	0.0	0.299	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		755	0.0	0.299	1.4	NA	0.0	0.0	0.00	0.13	59.5
All Vehicles		1956	0.0	3.925	474.0	NA	171.2	1198.2	0.34	0.94	19.1

CONCLUSION

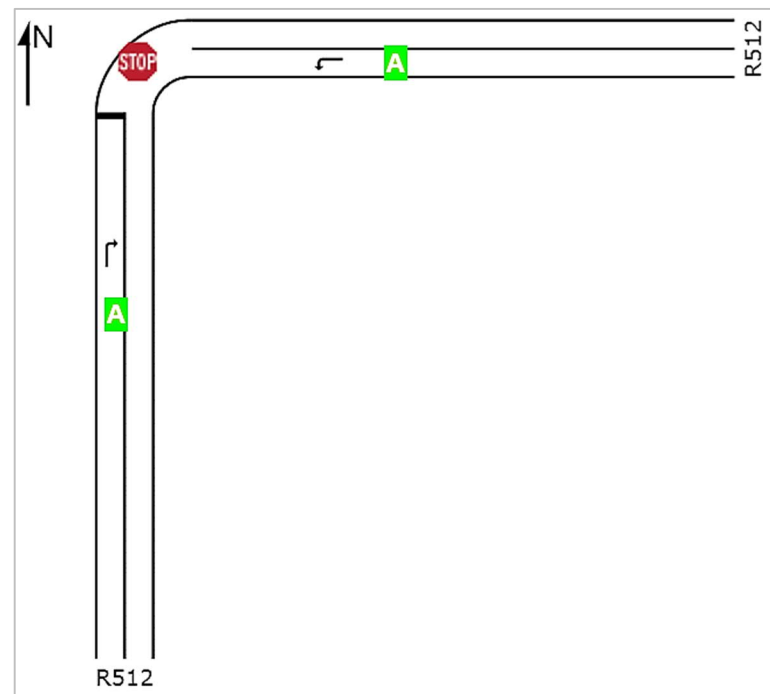
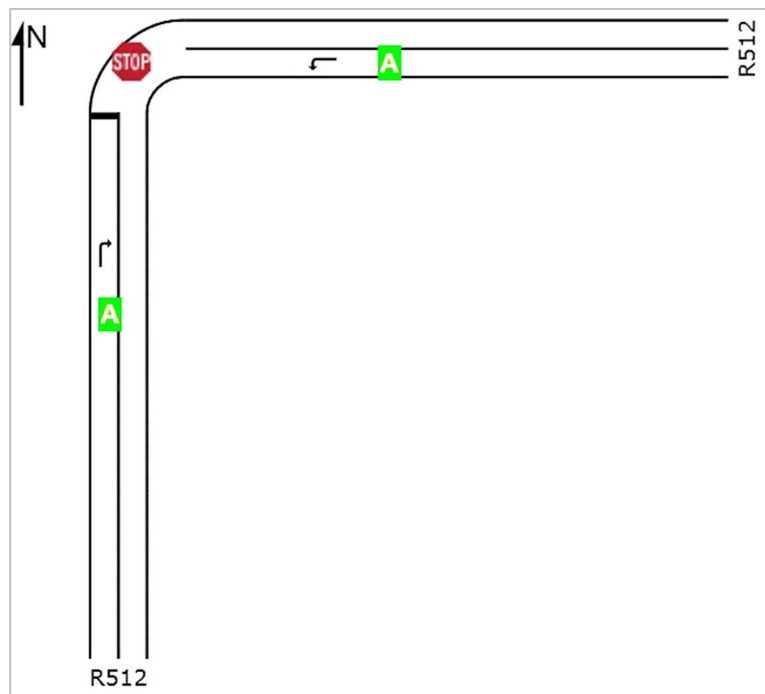
The intersection functions at a good LOS, except for the side road traffic that struggles to find a safe gap in the traffic stream on the R512. The delay increases on the eastern approach due to the additional traffic on the R512. It is anticipated that the construction of the PWV3 link will improve this. No road upgrades are required.

7.3.4 Intersection 4: R512/ R560

Table 15: Capacity Analysis Results for Intersection 4: R512/ R560

**2018 PM Peak Hour Background Traffic** **2018 Sat Peak Hour Background Traffic**

**Level of Service Summary**



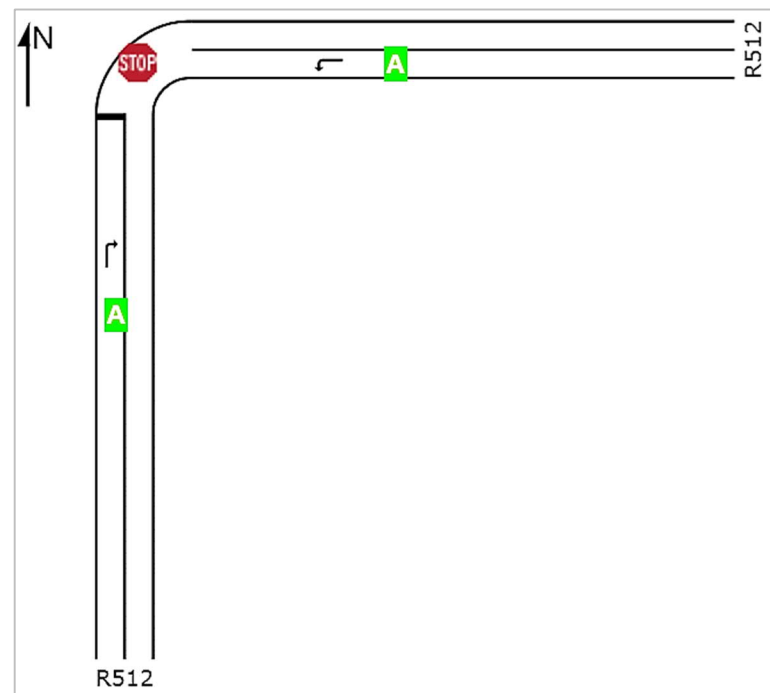
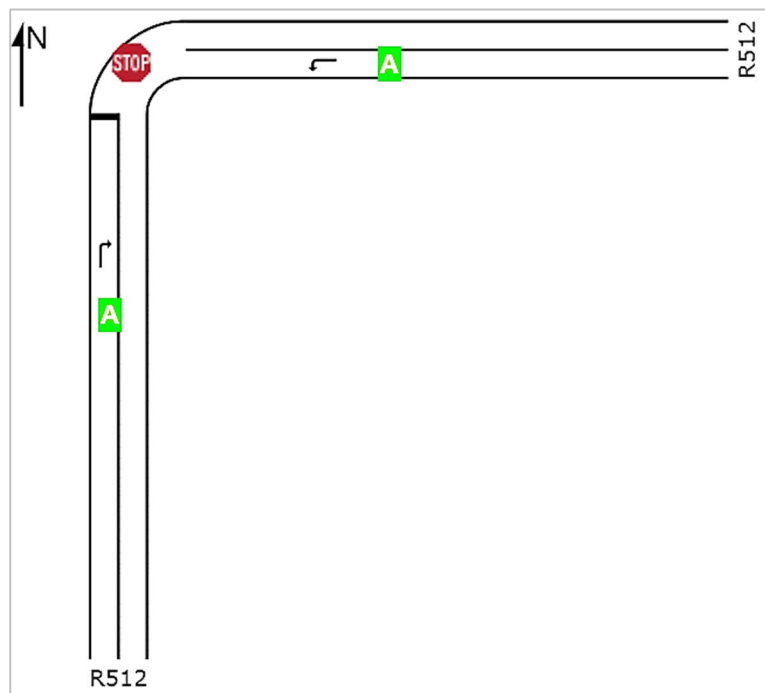
**Movement Summary**

Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%	v/c	sec	veh	m		per veh	km/h
South: R512										
3	R2	571	0.0	0.307	7.5	LOS A	0.0	0.0	1.00	56.9
Approach		571	0.0	0.307	7.5	LOS A	0.0	0.0	1.00	56.9
East: R512										
4	L2	444	0.0	0.239	5.7	LOS A	0.0	0.0	0.58	57.6
Approach		444	0.0	0.239	5.7	NA	0.0	0.0	0.58	57.6
All Vehicles		1015	0.0	0.307	6.7	NA	0.0	0.0	0.81	57.2

Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%	v/c	sec	veh	m		per veh	km/h
South: R512										
3	R2	571	0.0	0.307	7.5	LOS A	0.0	0.0	1.00	56.9
Approach		571	0.0	0.307	7.5	LOS A	0.0	0.0	1.00	56.9
East: R512										
4	L2	444	0.0	0.239	5.7	LOS A	0.0	0.0	0.58	57.6
Approach		444	0.0	0.239	5.7	NA	0.0	0.0	0.58	57.6
All Vehicles		1015	0.0	0.307	6.7	NA	0.0	0.0	0.81	57.2

**2018 PM Peak Hour Traffic plus Development Trips** **2018 Sat Peak Hour Traffic plus Development Trips**

**Level of Service Summary**



**Movement Summary**

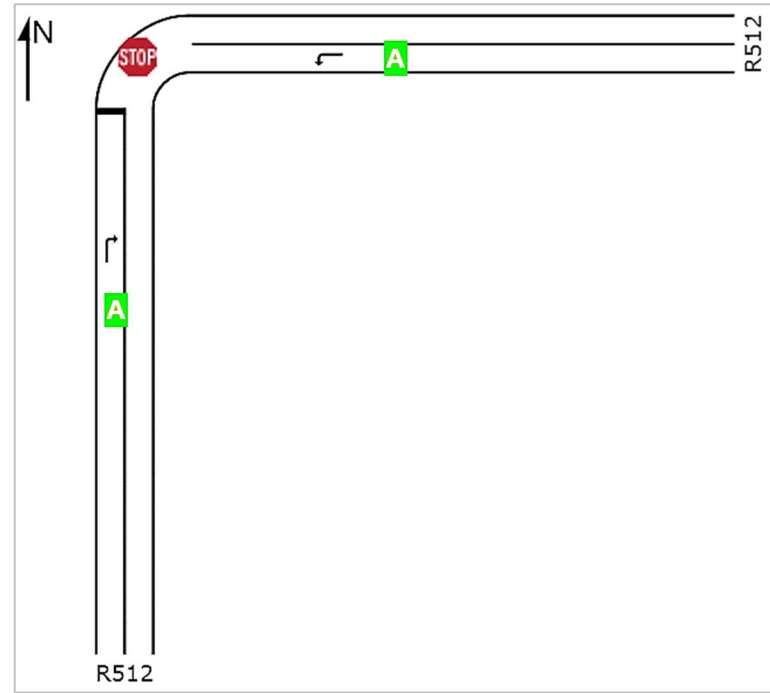
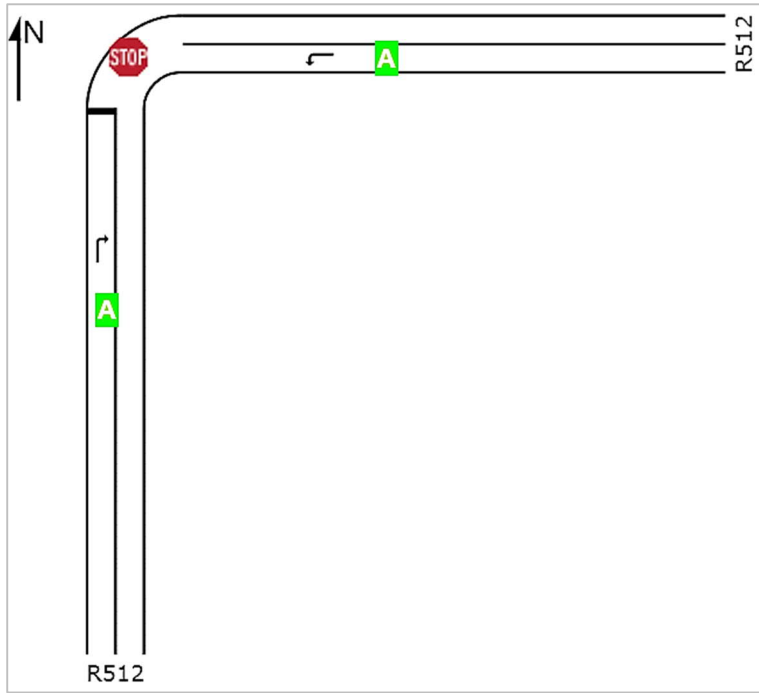
Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%	v/c	sec	veh	m		per veh	km/h
South: R512										
3	R2	901	0.0	0.485	7.6	LOS A	0.0	0.0	1.00	56.9
Approach		901	0.0	0.485	7.6	LOS A	0.0	0.0	1.00	56.9
East: R512										
4	L2	694	0.0	0.374	5.8	LOS A	0.0	0.0	0.58	57.6
Approach		694	0.0	0.374	5.8	NA	0.0	0.0	0.58	57.6
All Vehicles		1595	0.0	0.485	6.8	NA	0.0	0.0	0.82	57.2

Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%	v/c	sec	veh	m		per veh	km/h
South: R512										
3	R2	792	0.0	0.426	7.5	LOS A	0.0	0.0	1.00	56.9
Approach		792	0.0	0.426	7.5	LOS A	0.0	0.0	1.00	56.9
East: R512										
4	L2	631	0.0	0.340	5.7	LOS A	0.0	0.0	0.58	57.6
Approach		631	0.0	0.340	5.7	NA	0.0	0.0	0.58	57.6
All Vehicles		1422	0.0	0.426	6.7	NA	0.0	0.0	0.81	57.2

**2023 PM Peak Hour Background Traffic** **2023 Sat Peak Hour Background Traffic**

**Level of Service Summary**





**Movement Summary**

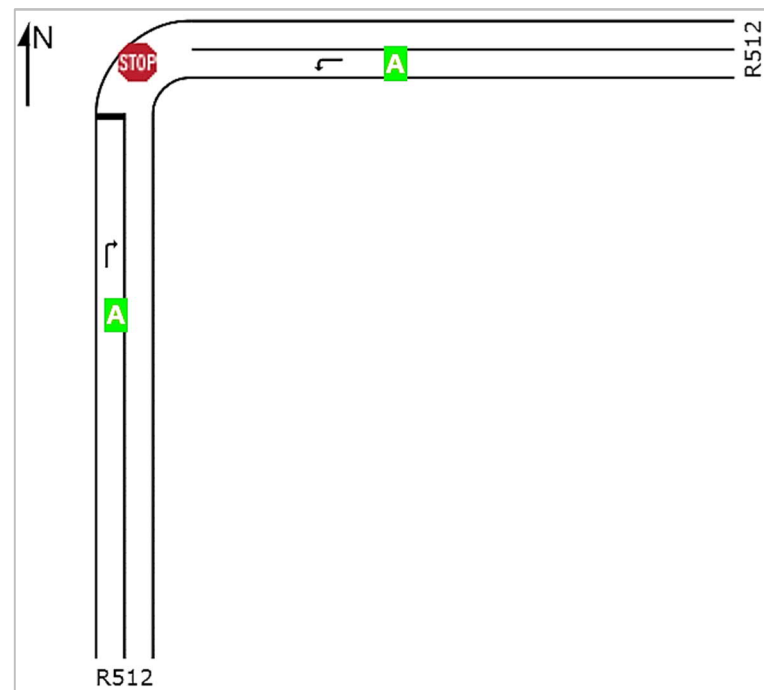
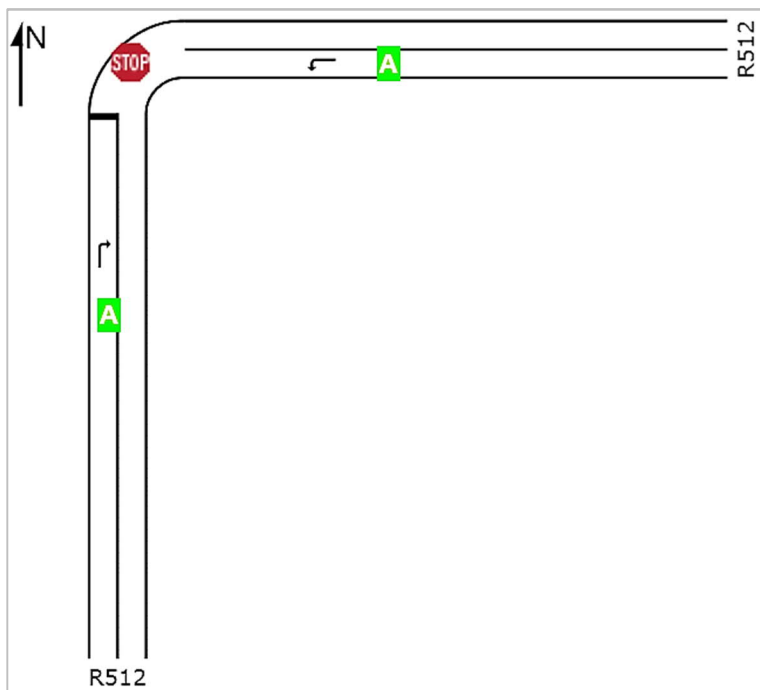
Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total	HV				Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m	per veh		km/h
South: R512											
3	R2	766	0.0	0.413	7.5	LOS A	0.0	0.0	0.00	1.00	56.9
Approach		766	0.0	0.413	7.5	LOS A	0.0	0.0	0.00	1.00	56.9
East: R512											
4	L2	561	0.0	0.302	5.7	LOS A	0.0	0.0	0.00	0.58	57.6
Approach		561	0.0	0.302	5.7	NA	0.0	0.0	0.00	0.58	57.6
All Vehicles		1327	0.0	0.413	6.8	NA	0.0	0.0	0.00	0.82	57.2

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total	HV				Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m	per veh		km/h
South: R512											
3	R2	629	0.0	0.339	7.5	LOS A	0.0	0.0	0.00	1.00	56.9
Approach		629	0.0	0.339	7.5	LOS A	0.0	0.0	0.00	1.00	56.9
East: R512											
4	L2	491	0.0	0.264	5.7	LOS A	0.0	0.0	0.00	0.58	57.6
Approach		491	0.0	0.264	5.7	NA	0.0	0.0	0.00	0.58	57.6
All Vehicles		1120	0.0	0.339	6.7	NA	0.0	0.0	0.00	0.81	57.2

2023 PM Peak Hour Traffic plus Development Trips

2023 Sat Peak Hour Traffic plus Development Trips

**Level of Service Summary**



**Movement Summary**

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total	HV				Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m	per veh		km/h
South: R512											
3	R2	1002	0.0	0.540	7.6	LOS A	0.0	0.0	0.00	1.00	56.9
Approach		1002	0.0	0.540	7.6	LOS A	0.0	0.0	0.00	1.00	56.9
East: R512											
4	L2	746	0.0	0.402	5.8	LOS A	0.0	0.0	0.00	0.58	57.6
Approach		746	0.0	0.402	5.8	NA	0.0	0.0	0.00	0.58	57.6
All Vehicles		1748	0.0	0.540	6.8	NA	0.0	0.0	0.00	0.82	57.2

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total	HV				Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m	per veh		km/h
South: R512											
3	R2	851	0.0	0.458	7.5	LOS A	0.0	0.0	0.00	1.00	56.9
Approach		851	0.0	0.458	7.5	LOS A	0.0	0.0	0.00	1.00	56.9
East: R512											
4	L2	677	0.0	0.364	5.8	LOS A	0.0	0.0	0.00	0.58	57.6
Approach		677	0.0	0.364	5.8	NA	0.0	0.0	0.00	0.58	57.6
All Vehicles		1527	0.0	0.458	6.8	NA	0.0	0.0	0.00	0.81	57.2

**CONCLUSION**

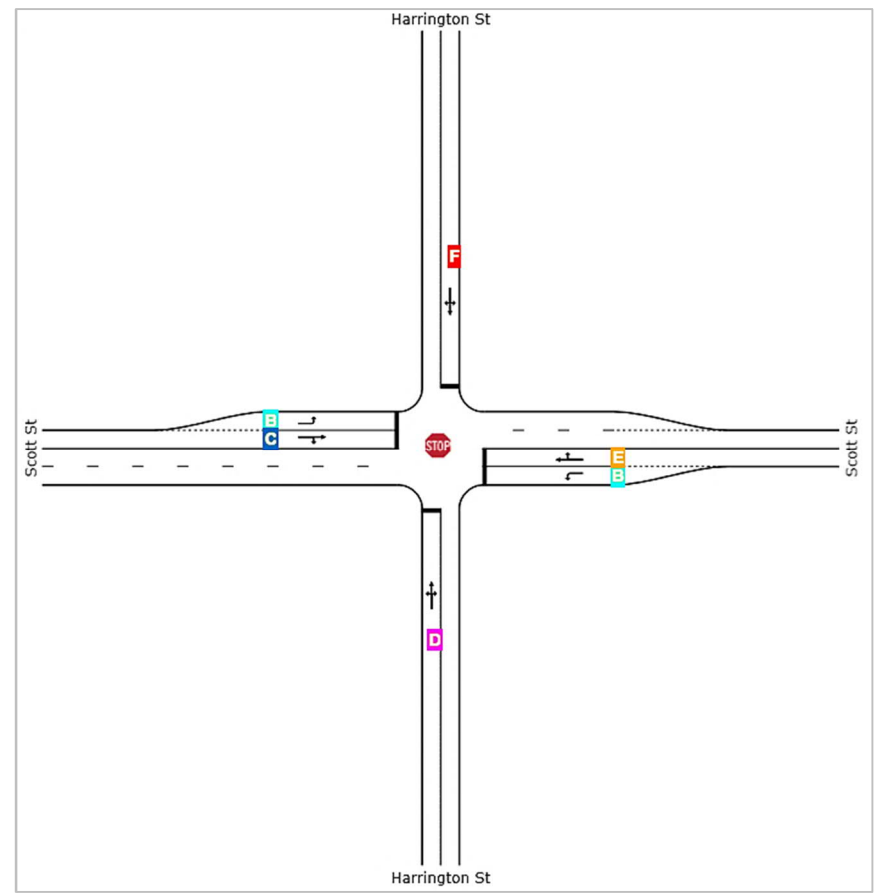
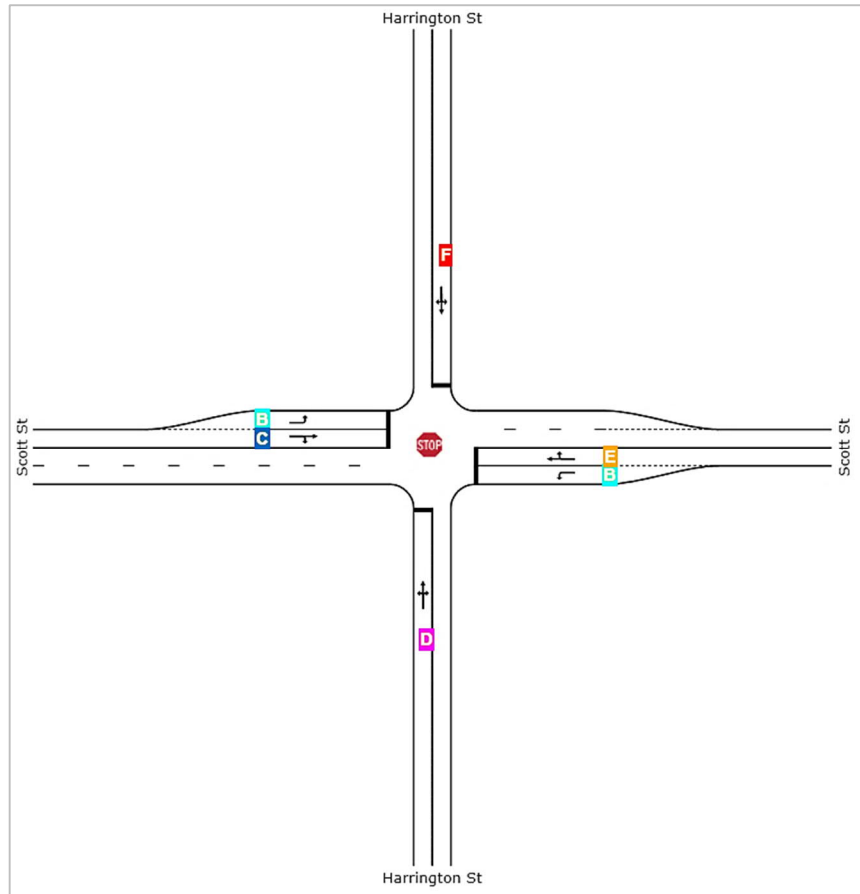
The intersection functions at an excellent LOS given that there is no opposing traffic movements currently at the intersection. The construction of the interchange for the new PWV3 link are also expected to function at a very good LOS.

### 7.3.5 Intersection 5: Scott St/ Harrington St

Table 16: Capacity Analysis Results for Intersection 5: Scott St/ Harrington St

**2018 PM Peak Hour Background Traffic** **2018 Sat Peak Hour Background Traffic**

**Level of Service Summary**



**Movement Summary**

**Movement Performance - Vehicles**

Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed		
		veh/h	%	v/c	sec	veh	m	per veh	km/h		
<b>South: Harrington St</b>											
1	L2	19	0.0	0.268	27.2	LOS D	1.1	7.4	0.99	1.31	51.5
2	T1	5	0.0	0.268	27.3	LOS D	1.1	7.4	0.99	1.31	26.4
3	R2	38	0.0	0.268	27.0	LOS D	1.1	7.4	0.99	1.31	29.4
Approach		62	0.0	0.268	27.1	LOS D	1.1	7.4	0.99	1.31	42.8
<b>East: Scott St</b>											
4	L2	22	0.0	0.051	10.4	LOS B	0.2	1.1	0.84	1.24	43.0
5	T1	380	0.0	0.810	37.6	LOS E	7.5	52.6	1.00	2.03	48.9
6	R2	1	0.0	0.810	37.7	LOS E	7.5	52.6	1.00	2.03	22.2
Approach		403	0.0	0.810	36.1	LOS E	7.5	52.6	0.99	1.98	48.8
<b>North: Harrington St</b>											
7	L2	3	0.0	0.161	99.4	LOS F	0.6	4.2	1.00	1.27	11.0
8	T1	3	0.0	0.161	99.5	LOS F	0.6	4.2	1.00	1.27	10.5
9	R2	1	0.0	0.161	99.2	LOS F	0.6	4.2	1.00	1.27	36.9
Approach		7	0.0	0.161	99.4	LOS F	0.6	4.2	1.00	1.27	17.6
<b>West: Scott St</b>											
10	L2	1	0.0	0.002	10.1	LOS B	0.0	0.1	0.84	1.23	56.4
11	T1	303	0.0	0.675	24.8	LOS C	4.4	30.9	0.99	1.67	52.2
12	R2	14	0.0	0.675	24.9	LOS C	4.4	30.9	0.99	1.67	52.1
Approach		318	0.0	0.675	24.8	LOS C	4.4	30.9	0.99	1.66	52.2
All Vehicles		791	0.0	0.810	31.5	LOS D	7.5	52.6	0.99	1.79	49.7

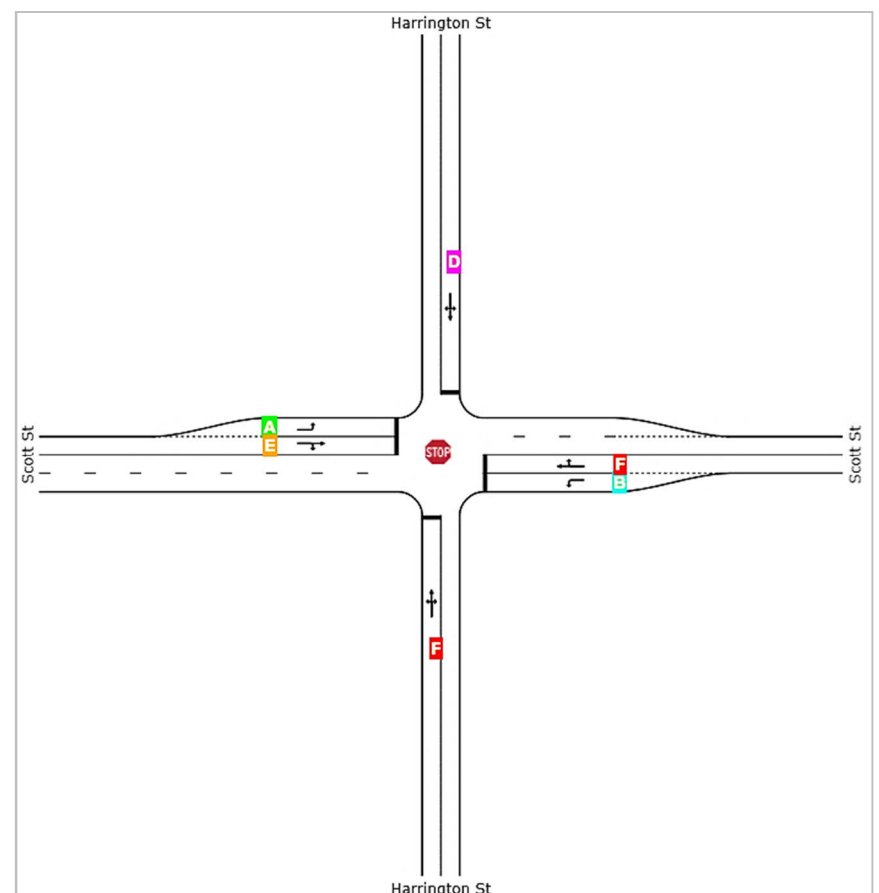
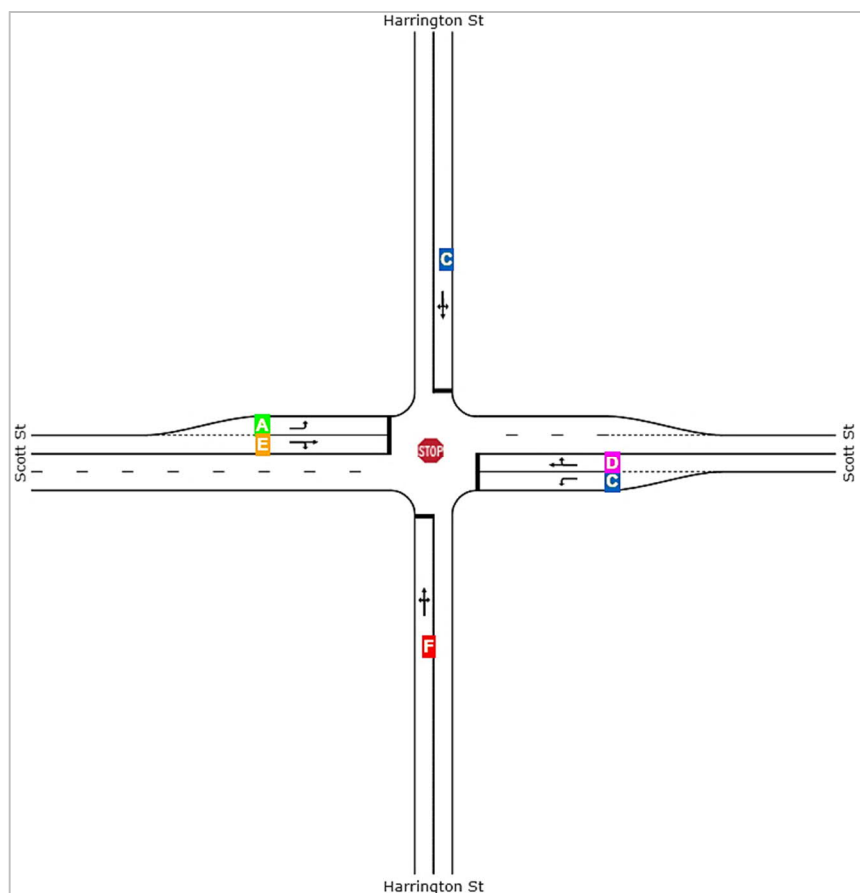
**Movement Performance - Vehicles**

Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed		
		veh/h	%	v/c	sec	veh	m	per veh	km/h		
<b>South: Harrington St</b>											
1	L2	19	0.0	0.265	26.8	LOS D	1.0	7.2	0.99	1.31	51.6
2	T1	5	0.0	0.265	26.9	LOS D	1.0	7.2	0.99	1.31	26.6
3	R2	38	0.0	0.265	26.6	LOS D	1.0	7.2	0.99	1.31	29.6
Approach		62	0.0	0.265	26.7	LOS D	1.0	7.2	0.99	1.31	43.0
<b>East: Scott St</b>											
4	L2	33	0.0	0.075	10.6	LOS B	0.2	1.7	0.85	1.25	42.7
5	T1	380	0.0	0.808	37.3	LOS E	7.4	52.1	1.00	2.02	49.0
6	R2	1	0.0	0.808	37.4	LOS E	7.4	52.1	1.00	2.02	22.4
Approach		414	0.0	0.808	35.2	LOS E	7.4	52.1	0.99	1.96	48.8
<b>North: Harrington St</b>											
7	L2	3	0.0	0.150	91.9	LOS F	0.6	3.9	1.00	1.26	11.7
8	T1	3	0.0	0.150	92.0	LOS F	0.6	3.9	1.00	1.26	11.2
9	R2	1	0.0	0.150	91.6	LOS F	0.6	3.9	1.00	1.26	38.0
Approach		7	0.0	0.150	91.9	LOS F	0.6	3.9	1.00	1.26	18.6
<b>West: Scott St</b>											
10	L2	1	0.0	0.002	10.0	LOS B	0.0	0.1	0.84	1.23	56.5
11	T1	303	0.0	0.672	24.5	LOS C	4.4	30.6	0.99	1.66	52.3
12	R2	14	0.0	0.672	24.6	LOS C	4.4	30.6	0.99	1.66	52.2
Approach		318	0.0	0.672	24.5	LOS C	4.4	30.6	0.98	1.66	52.3
All Vehicles		801	0.0	0.808	30.8	LOS D	7.4	52.1	0.99	1.78	49.8

**2018 PM Peak Hour Traffic plus Development Trips**

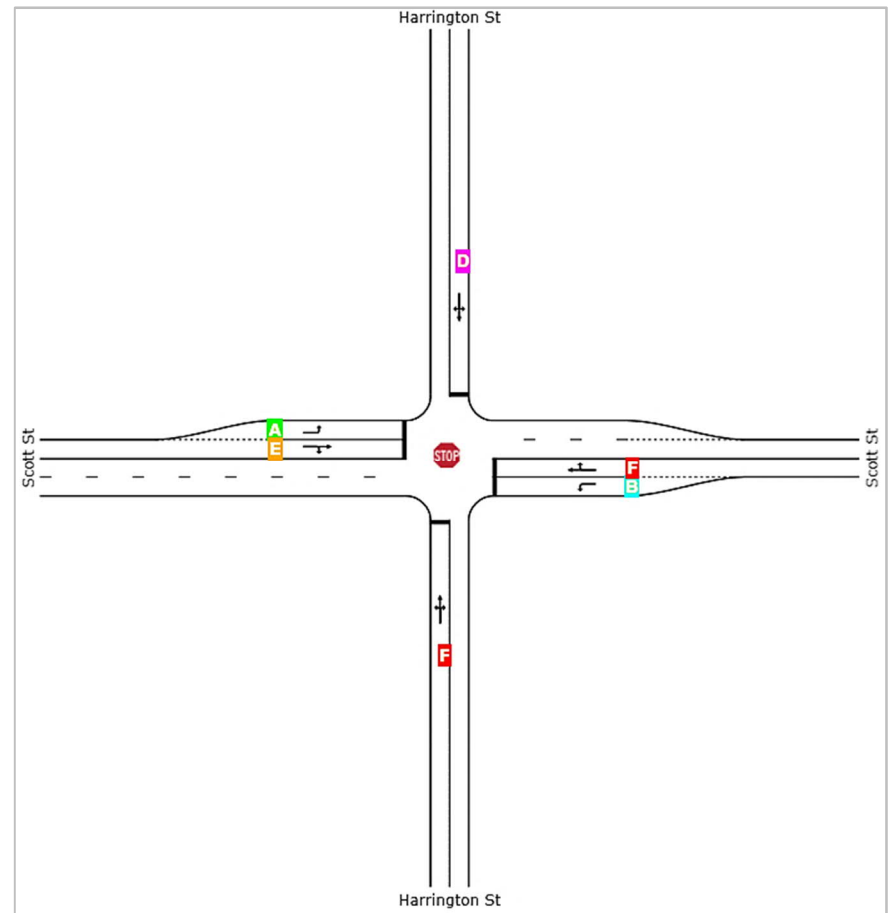
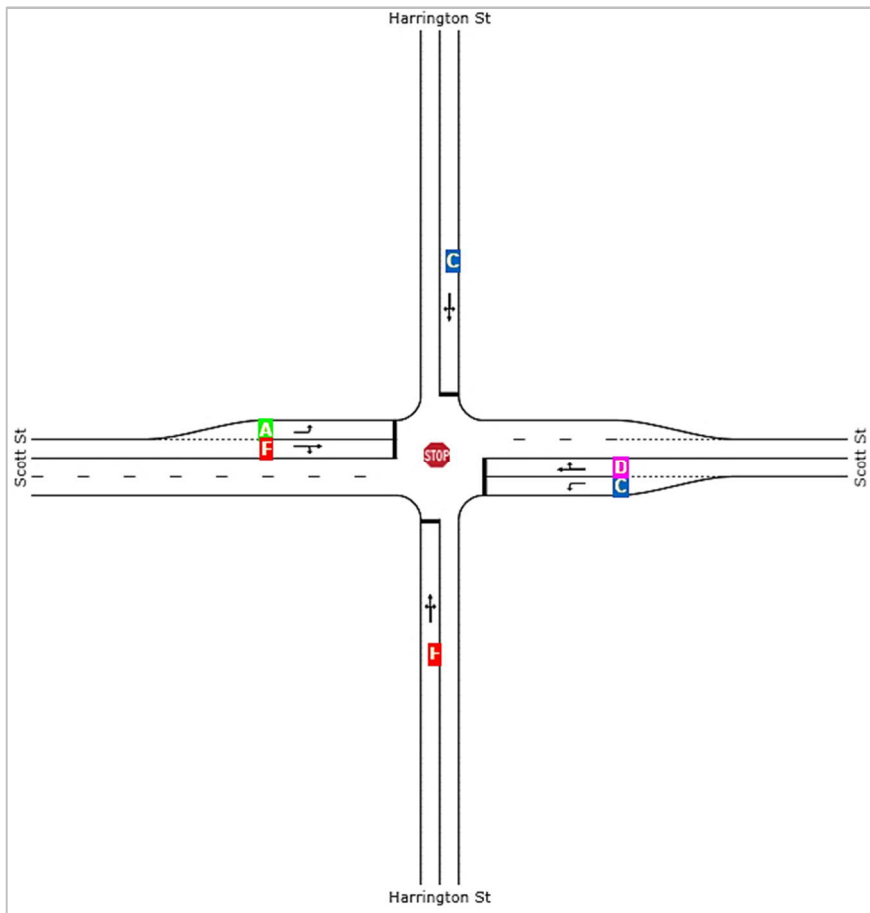
**2018 Sat Peak Hour Traffic plus Development Trips**

**Level of Service Summary**





Level of Service Summary



Movement Summary

Movement Performance - Vehicles

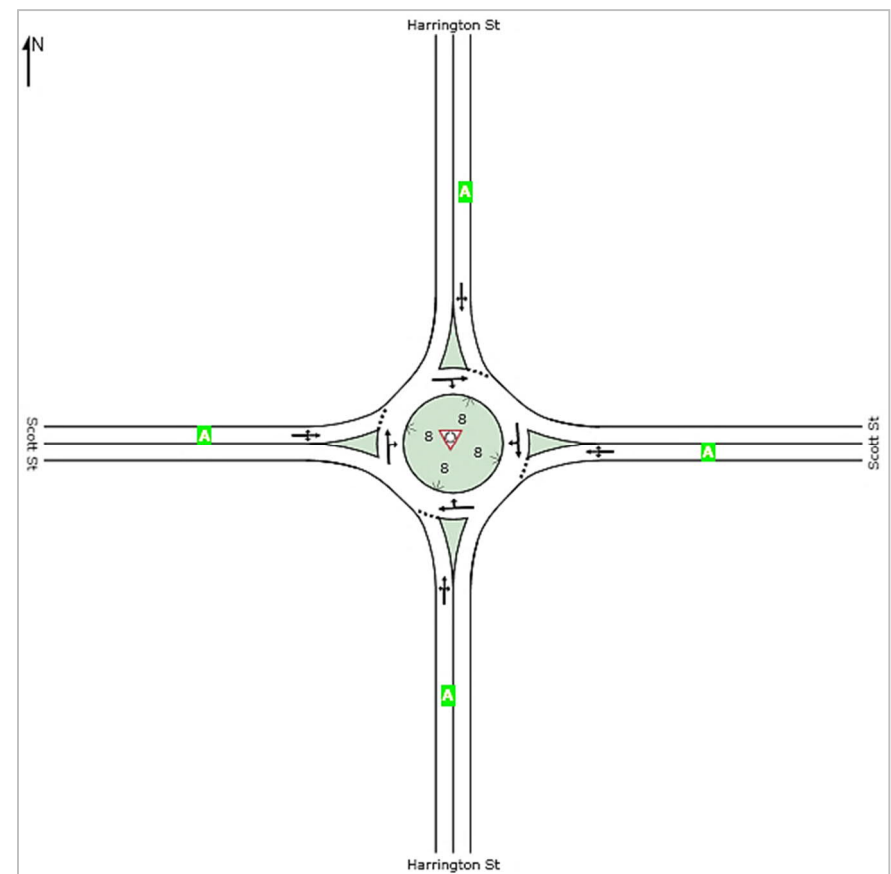
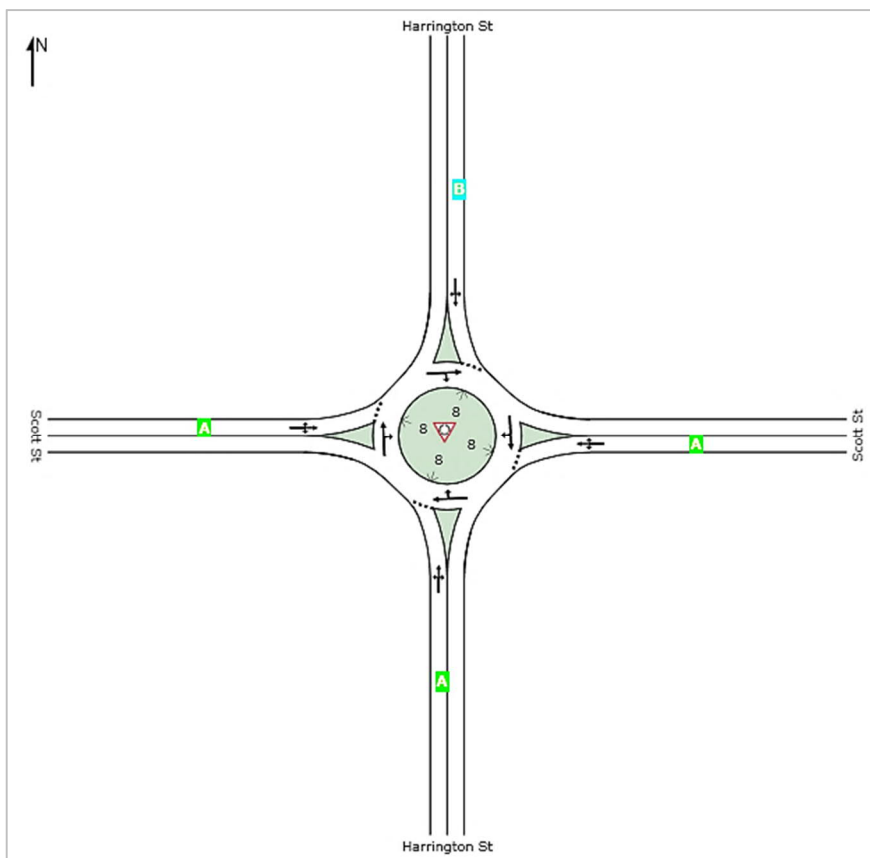
Mov ID	ODMov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%	v/c	sec	Vehicles	Distance	per veh	km/h
South: Harrington St									
1	L2	66	0.0	1.947	LOS F	36.2	253.6	1.00	8.2
2	T1	6	0.0	1.947	LOS F	36.2	253.6	1.00	1.2
3	R2	44	0.0	1.947	LOS F	36.2	253.6	1.00	1.5
Approach		117	0.0	1.947	LOS F	36.2	253.6	1.00	5.5
East: Scott St									
4	L2	209	0.0	0.442	LOS C	2.0	13.9	0.92	37.8
5	T1	360	0.0	0.780	LOS D	6.6	46.5	1.00	50.4
6	R2	40	0.0	0.780	LOS D	6.6	46.5	1.00	24.7
Approach		609	0.0	0.780	LOS D	6.6	46.5	0.97	48.3
North: Harrington St									
7	L2	1	0.0	0.046	LOS C	0.2	1.1	0.98	29.0
8	T1	1	0.0	0.046	LOS C	0.2	1.1	0.98	28.1
9	R2	7	0.0	0.046	LOS C	0.2	1.1	0.98	52.1
Approach		9	0.0	0.046	LOS C	0.2	1.1	0.98	50.6
West: Scott St									
10	L2	3	0.0	0.006	LOS A	0.0	0.1	0.80	56.5
11	T1	448	0.0	0.914	LOS F	12.9	90.3	1.00	45.2
12	R2	47	0.0	0.914	LOS F	12.9	90.3	1.00	45.1
Approach		499	0.0	0.914	LOS F	12.9	90.3	1.00	45.3
All Vehicles		1235	0.0	1.947	LOS F	36.2	253.6	0.99	29.8

Movement Performance - Vehicles

Mov ID	ODMov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%	v/c	sec	Vehicles	Distance	per veh	km/h
South: Harrington St									
1	L2	51	0.0	0.888	LOS F	7.7	54.0	1.00	30.7
2	T1	6	0.0	0.888	LOS F	7.7	54.0	1.00	7.1
3	R2	42	0.0	0.888	LOS F	7.7	54.0	1.00	8.6
Approach		99	0.0	0.888	LOS F	7.7	54.0	1.00	22.8
East: Scott St									
4	L2	88	0.0	0.186	LOS B	0.6	4.5	0.85	41.9
5	T1	502	0.0	0.982	LOS F	18.7	131.1	1.00	40.3
6	R2	1	0.0	0.982	LOS F	18.7	131.1	1.00	12.9
Approach		592	0.0	0.982	LOS F	18.7	131.1	0.98	40.3
North: Harrington St									
7	L2	3	0.0	0.077	LOS D	0.3	1.9	1.00	25.8
8	T1	3	0.0	0.077	LOS D	0.3	1.9	1.00	25.0
9	R2	6	0.0	0.077	LOS D	0.3	1.9	1.00	50.6
Approach		13	0.0	0.077	LOS D	0.3	1.9	1.00	45.2
West: Scott St									
10	L2	1	0.0	0.002	LOS A	0.0	0.0	0.81	56.5
11	T1	446	0.0	0.894	LOS E	11.4	80.1	1.00	46.0
12	R2	20	0.0	0.894	LOS F	11.4	80.1	1.00	46.0
Approach		467	0.0	0.894	LOS E	11.4	80.1	1.00	46.1
All Vehicles		1171	0.0	0.982	LOS F	18.7	131.1	0.99	40.9

PROPOSED ROAD UPGRADE

Level of Service Summary



### Movement Summary

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%	v/c	sec	veh	m		per veh	km/h	
South: Harrington St											
1	L2	66	0.0	0.143	8.0	LOS A	0.8	5.9	0.61	0.71	56.2
2	T1	6	0.0	0.143	7.8	LOS A	0.8	5.9	0.61	0.71	40.5
3	R2	44	0.0	0.143	10.7	LOS B	0.8	5.9	0.61	0.71	42.6
Approach		117	0.0	0.143	9.0	LOS A	0.8	5.9	0.61	0.71	54.3
East: Scott St											
4	L2	209	0.0	0.445	5.4	LOS A	3.9	27.6	0.31	0.51	45.5
5	T1	360	0.0	0.445	5.2	LOS A	3.9	27.6	0.31	0.51	57.4
6	R2	40	0.0	0.445	8.1	LOS A	3.9	27.6	0.31	0.51	44.2
Approach		609	0.0	0.445	5.5	LOS A	3.9	27.6	0.31	0.51	55.9
North: Harrington St											
7	L2	1	0.0	0.013	8.6	LOS A	0.1	0.5	0.64	0.65	38.3
8	T1	1	0.0	0.013	8.5	LOS A	0.1	0.5	0.64	0.65	38.6
9	R2	7	0.0	0.013	11.3	LOS B	0.1	0.5	0.64	0.65	55.7
Approach		9	0.0	0.013	10.7	LOS B	0.1	0.5	0.64	0.65	54.7
West: Scott St											
10	L2	3	0.0	0.397	5.7	LOS A	3.2	22.5	0.38	0.52	56.9
11	T1	448	0.0	0.397	5.5	LOS A	3.2	22.5	0.38	0.52	57.3
12	R2	47	0.0	0.397	8.4	LOS A	3.2	22.5	0.38	0.52	57.1
Approach		499	0.0	0.397	5.8	LOS A	3.2	22.5	0.38	0.52	57.2
All Vehicles		1235	0.0	0.445	6.0	LOS A	3.9	27.6	0.37	0.53	56.5

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%	v/c	sec	veh	m		per veh	km/h	
South: Harrington St											
1	L2	51	0.0	0.131	8.8	LOS A	0.8	5.3	0.65	0.74	55.9
2	T1	6	0.0	0.131	8.7	LOS A	0.8	5.3	0.65	0.74	39.3
3	R2	42	0.0	0.131	11.5	LOS B	0.8	5.3	0.65	0.74	41.5
Approach		99	0.0	0.131	10.0	LOS A	0.8	5.3	0.65	0.74	53.4
East: Scott St											
4	L2	88	0.0	0.402	5.1	LOS A	3.3	23.3	0.20	0.48	46.3
5	T1	502	0.0	0.402	5.0	LOS A	3.3	23.3	0.20	0.48	57.6
6	R2	1	0.0	0.402	7.9	LOS A	3.3	23.3	0.20	0.48	45.1
Approach		592	0.0	0.402	5.0	LOS A	3.3	23.3	0.20	0.48	57.2
North: Harrington St											
7	L2	3	0.0	0.017	8.4	LOS A	0.1	0.6	0.62	0.64	39.4
8	T1	3	0.0	0.017	8.2	LOS A	0.1	0.6	0.62	0.64	39.7
9	R2	6	0.0	0.017	11.1	LOS B	0.1	0.6	0.62	0.64	56.0
Approach		13	0.0	0.017	9.7	LOS A	0.1	0.6	0.62	0.64	53.3
West: Scott St											
10	L2	1	0.0	0.344	5.3	LOS A	2.9	20.3	0.28	0.48	57.1
11	T1	446	0.0	0.344	5.1	LOS A	2.9	20.3	0.28	0.48	57.5
12	R2	20	0.0	0.344	8.0	LOS A	2.9	20.3	0.28	0.48	57.3
Approach		467	0.0	0.344	5.3	LOS A	2.9	20.3	0.28	0.48	57.4
All Vehicles		1171	0.0	0.402	5.6	LOS A	3.3	23.3	0.27	0.51	57.1

### CONCLUSION

Delays are experienced on some of the intersection lanes and approaches already in the base year analysis without the addition of the development traffic. It is proposed to upgrade the intersection to a mini-circle which will yield a good LOS on all the approaches. It is not the responsibility of the developer.

### 7.3.6 Intersection 6: Scott St (Tielman St)/ Road P2/4

Table 17: Capacity Analysis Results for Intersection 6: Scott St (Tielman St)/ Road P2/4

2018 PM Peak Hour Background Traffic						2018 Sat Peak Hour Background Traffic					
Level of Service Summary											
Movement Summary											
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%	v/c	sec	veh	m		per veh	km/h	
East: Tielmann St											
5	T1	331	0.0	0.292	8.2	LOS A	4.1	28.8	0.63	0.55	56.9
6	R2	148	0.0	0.318	15.0	LOS B	3.1	21.7	0.67	0.71	57.0
Approach		479	0.0	0.318	10.3	LOS B	4.1	28.8	0.64	0.60	56.9
North: R511 Link											
7	L2	82	0.0	0.297	20.5	LOS C	3.2	22.4	0.81	0.77	55.8
9	R2	83	0.0	0.297	20.5	LOS C	3.2	22.4	0.81	0.77	53.3
Approach		165	0.0	0.297	20.5	LOS C	3.2	22.4	0.81	0.77	54.8
West: Tielmann St											
10	L2	99	0.0	0.079	6.6	LOS A	0.4	2.9	0.29	0.62	57.5
11	T1	245	0.0	0.252	7.8	LOS A	3.5	24.2	0.61	0.51	57.2
Approach		344	0.0	0.252	7.5	LOS A	3.5	24.2	0.52	0.54	57.3
All Vehicles		988	0.0	0.318	11.0	LOS B	4.1	28.8	0.63	0.61	56.6
2018 PM Peak Hour Traffic plus Development Trips						2018 Sat Peak Hour Traffic plus Development Trips					
Level of Service Summary											

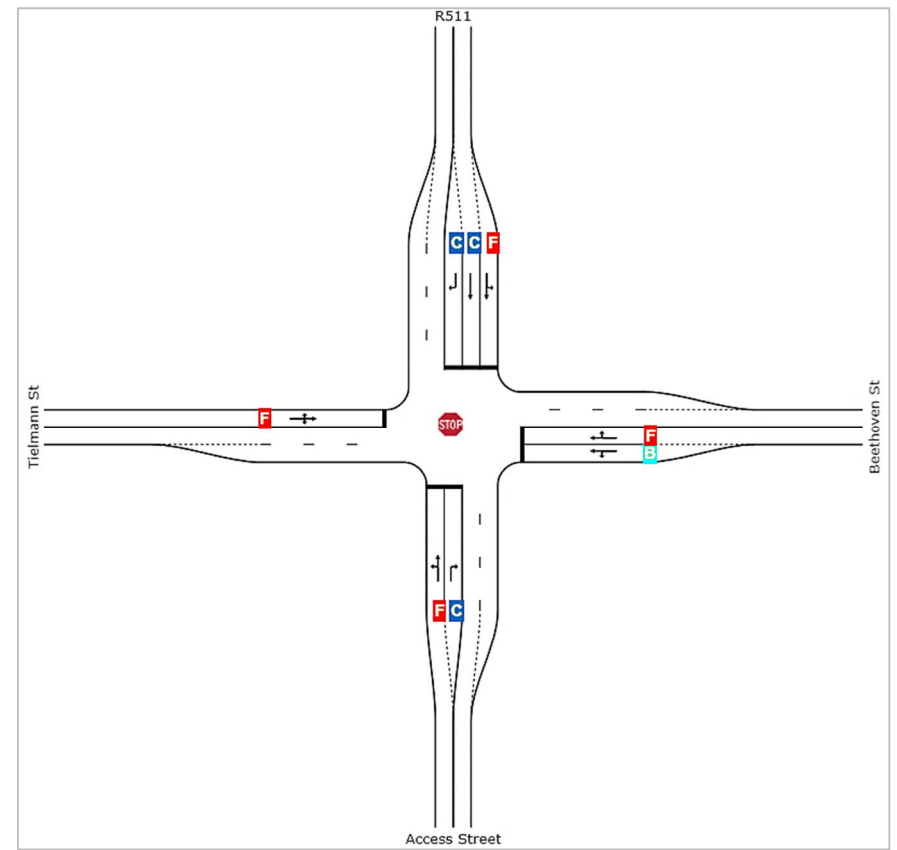
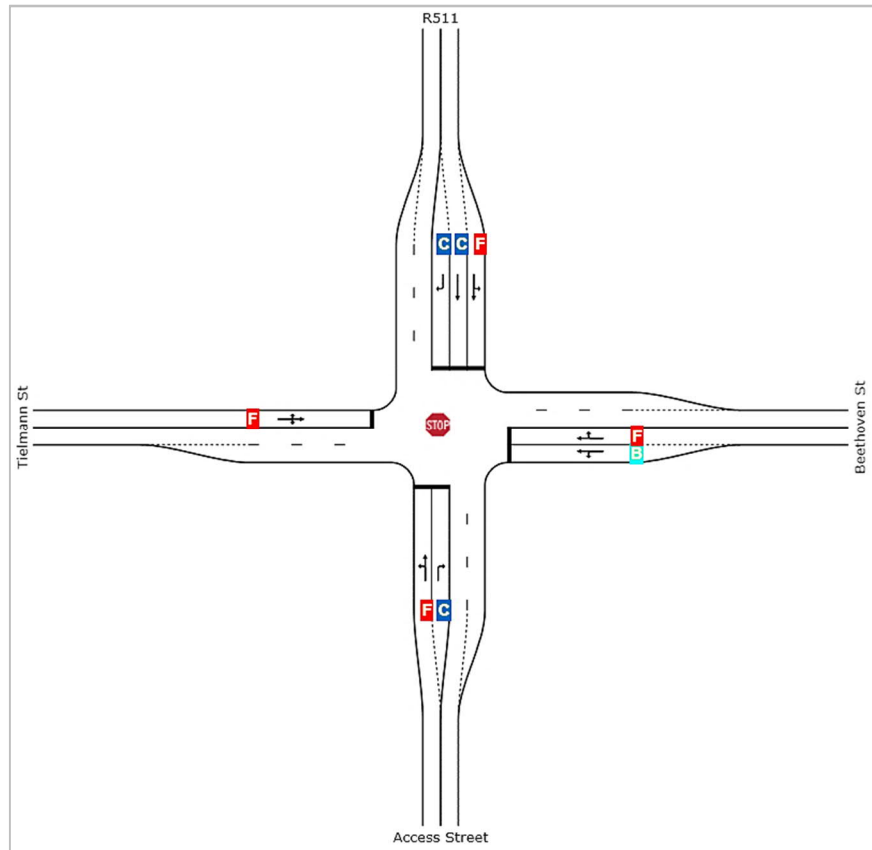


7.3.7 Intersection 7: Tielmann St (Beethoven St)/ R511 (Bach St)

Table 18: Capacity Analysis Results for Intersection 7: Tielmann St (Beethoven St)/ R511 (Bach St)

2018 PM Peak Hour Background Traffic 2018 Sat Peak Hour Background Traffic

Level of Service Summary



Movement Summary

**Movement Performance - Vehicles**

Mov ID	OD Mov	Demand	Deg. Satn	Average Level of Delay	Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	v/c	sec		veh	m		per veh	km/h
<b>South: Access Street</b>										
1	L2	85	0.0	107.1	LOS F	11.3	79.4	1.00	2.39	36.0
2	T1	125	0.0	107.2	LOS F	11.3	79.4	1.00	2.39	36.6
3	R2	26	0.0	17.5	LOS C	0.5	3.4	1.00	1.26	49.0
<b>Approach</b>		237	0.0	97.2	LOS F	11.3	79.4	1.00	2.27	36.9
<b>East: Beethoven St</b>										
4	L2	25	0.0	13.0	LOS B	1.0	7.1	0.89	1.31	51.2
5	T1	294	0.0	111.7	LOS F	34.3	239.9	0.97	3.84	38.9
6	R2	325	0.0	155.3	LOS F	34.3	239.9	1.00	4.97	34.6
<b>Approach</b>		644	0.0	129.8	LOS F	34.3	239.9	0.98	4.31	36.7
<b>North: R511</b>										
7	L2	318	0.0	234.7	LOS F	30.2	211.5	1.00	4.23	28.4
8	T1	99	0.0	21.1	LOS C	1.8	12.8	1.00	1.38	53.4
9	R2	115	0.0	23.7	LOS C	2.3	16.0	1.00	1.42	55.5
<b>Approach</b>		532	0.0	149.4	LOS F	30.2	211.5	1.00	3.09	35.8
<b>West: Tielmann St</b>										
10	L2	105	0.0	59.6	LOS F	10.3	72.3	1.00	2.35	49.9
11	T1	197	0.0	60.1	LOS F	10.3	72.3	1.00	2.35	46.5
12	R2	67	0.0	59.6	LOS F	10.3	72.3	1.00	2.35	43.8
<b>Approach</b>		369	0.0	59.9	LOS F	10.3	72.3	1.00	2.35	47.4
<b>All Vehicles</b>		1782	0.0	116.8	LOS F	34.3	239.9	0.99	3.27	38.3

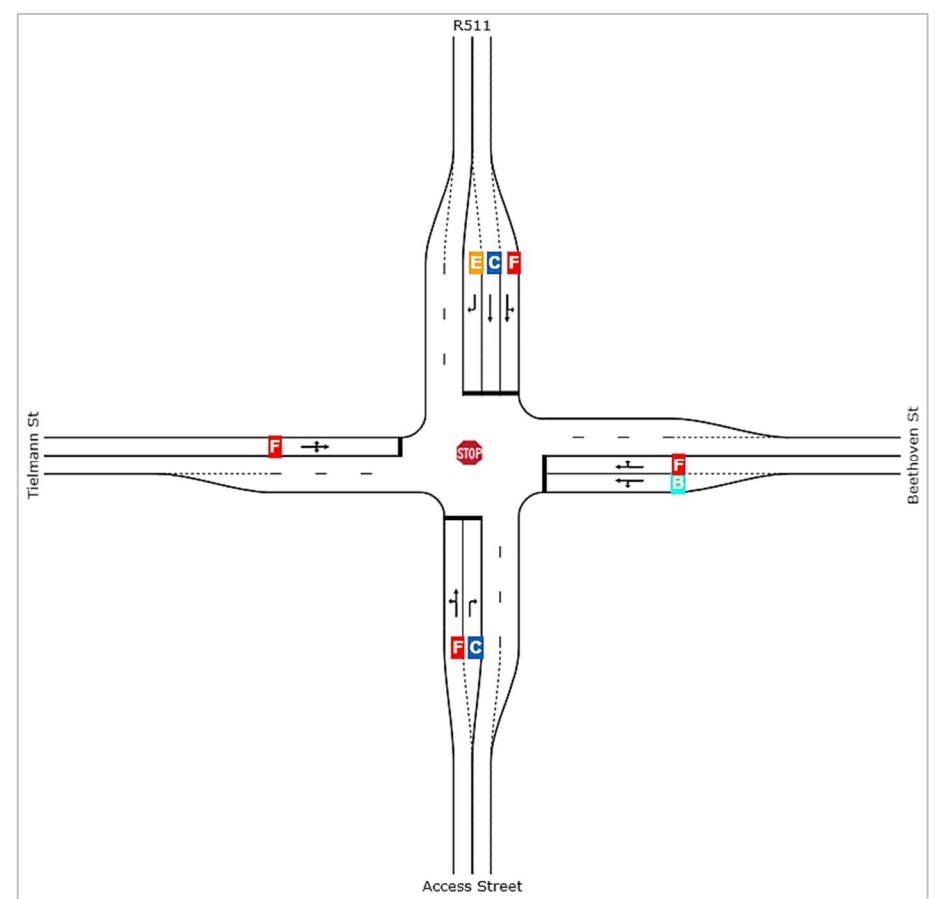
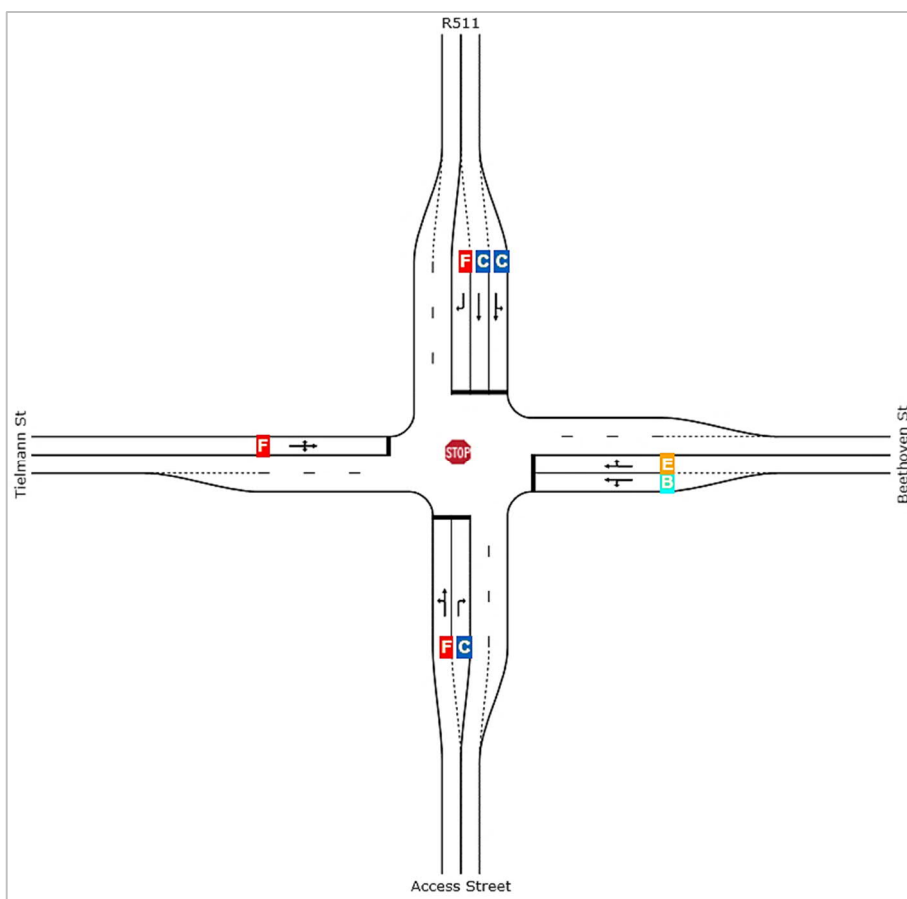
**Movement Performance - Vehicles**

Mov ID	OD Mov	Demand	Deg. Satn	Average Level of Delay	Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	v/c	sec		veh	m		per veh	km/h
<b>South: Access Street</b>										
1	L2	85	0.0	107.1	LOS F	11.3	79.4	1.00	2.39	36.0
2	T1	125	0.0	107.2	LOS F	11.3	79.4	1.00	2.39	36.6
3	R2	26	0.0	17.5	LOS C	0.5	3.4	1.00	1.26	49.0
<b>Approach</b>		237	0.0	97.2	LOS F	11.3	79.4	1.00	2.27	36.9
<b>East: Beethoven St</b>										
4	L2	25	0.0	13.0	LOS B	1.0	7.1	0.89	1.31	51.2
5	T1	294	0.0	111.7	LOS F	34.3	239.9	0.97	3.84	38.9
6	R2	325	0.0	155.3	LOS F	34.3	239.9	1.00	4.97	34.6
<b>Approach</b>		644	0.0	129.8	LOS F	34.3	239.9	0.98	4.31	36.7
<b>North: R511</b>										
7	L2	318	0.0	234.7	LOS F	30.2	211.5	1.00	4.23	28.4
8	T1	99	0.0	21.1	LOS C	1.8	12.8	1.00	1.38	53.4
9	R2	115	0.0	23.7	LOS C	2.3	16.0	1.00	1.42	55.5
<b>Approach</b>		532	0.0	149.4	LOS F	30.2	211.5	1.00	3.09	35.8
<b>West: Tielmann St</b>										
10	L2	105	0.0	59.6	LOS F	10.3	72.3	1.00	2.35	49.9
11	T1	197	0.0	60.1	LOS F	10.3	72.3	1.00	2.35	46.5
12	R2	67	0.0	59.6	LOS F	10.3	72.3	1.00	2.35	43.8
<b>Approach</b>		369	0.0	59.9	LOS F	10.3	72.3	1.00	2.35	47.4
<b>All Vehicles</b>		1782	0.0	116.8	LOS F	34.3	239.9	0.99	3.27	38.3

2018 PM Peak Hour Traffic plus Development Trips

2018 Sat Peak Hour Traffic plus Development Trips

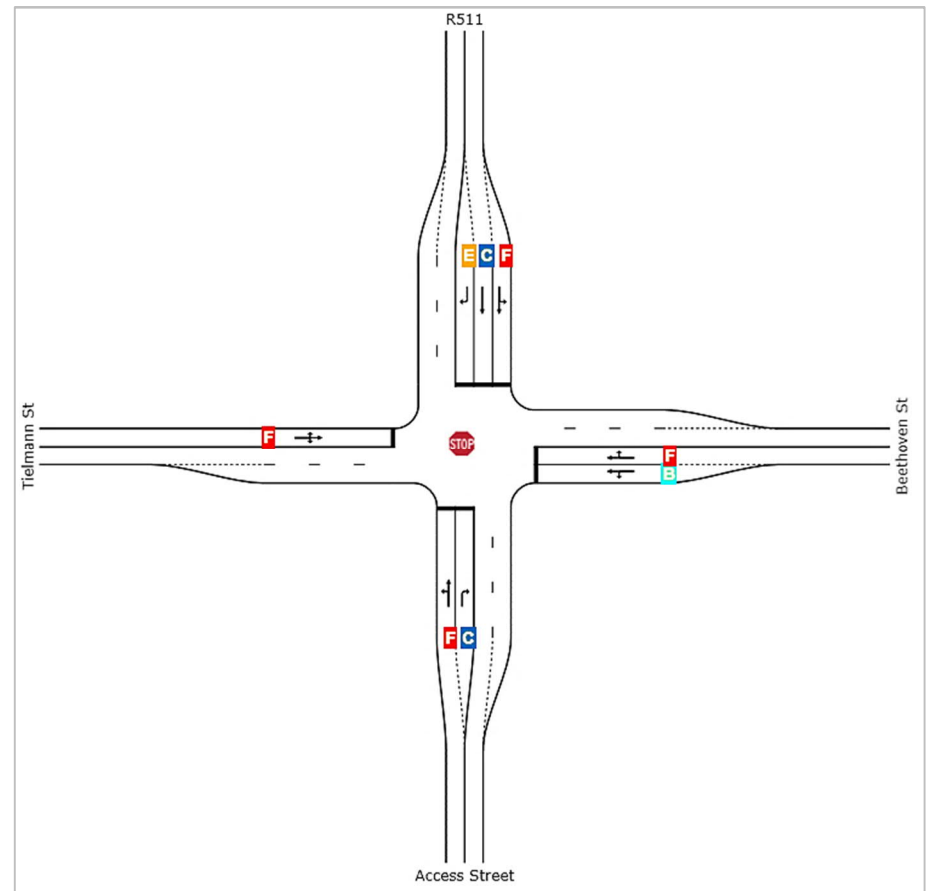
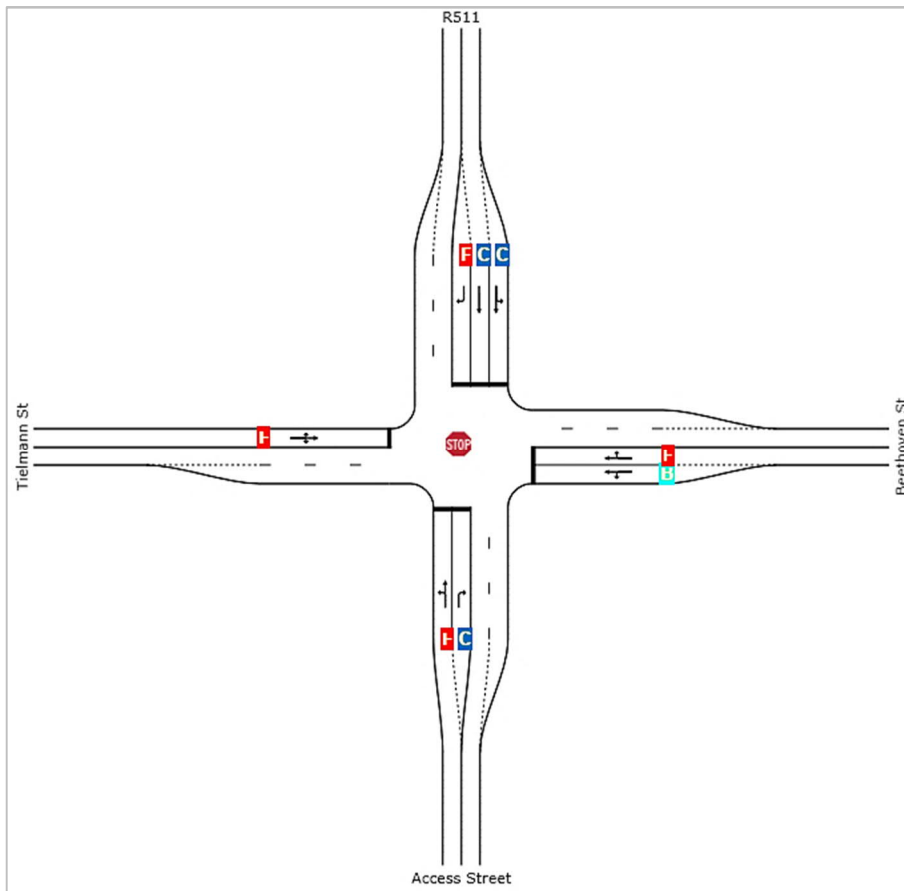
Level of Service Summary







Level of Service Summary



Movement Summary

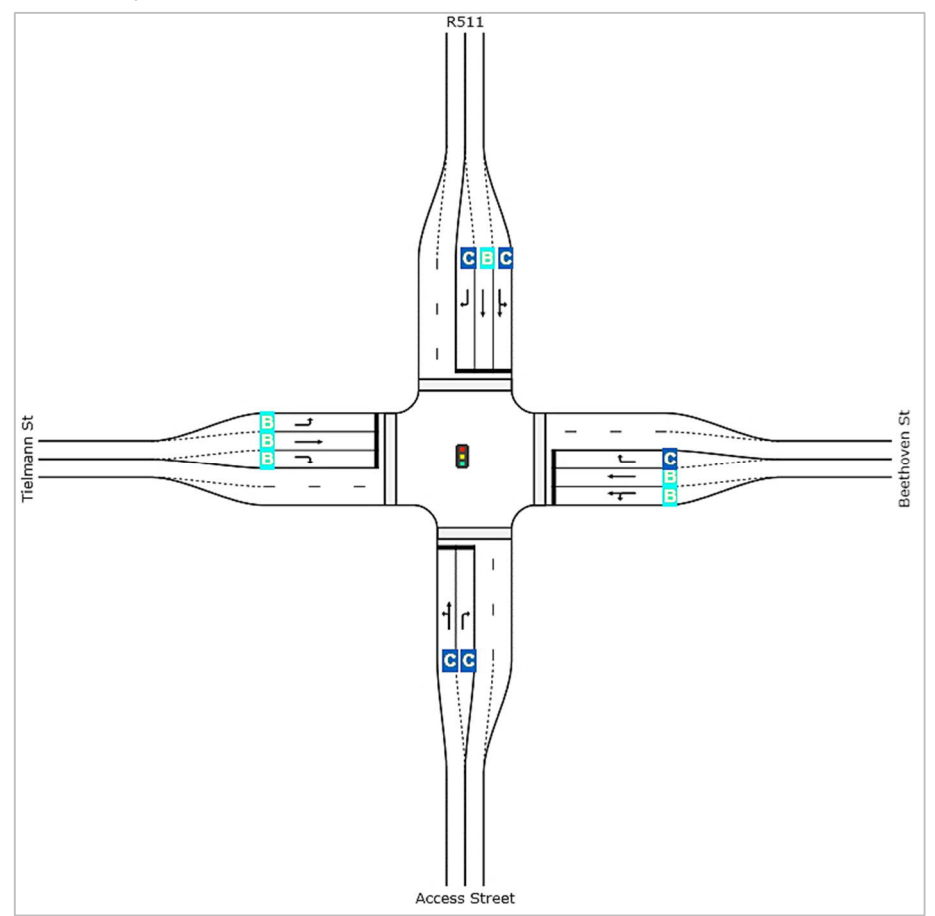
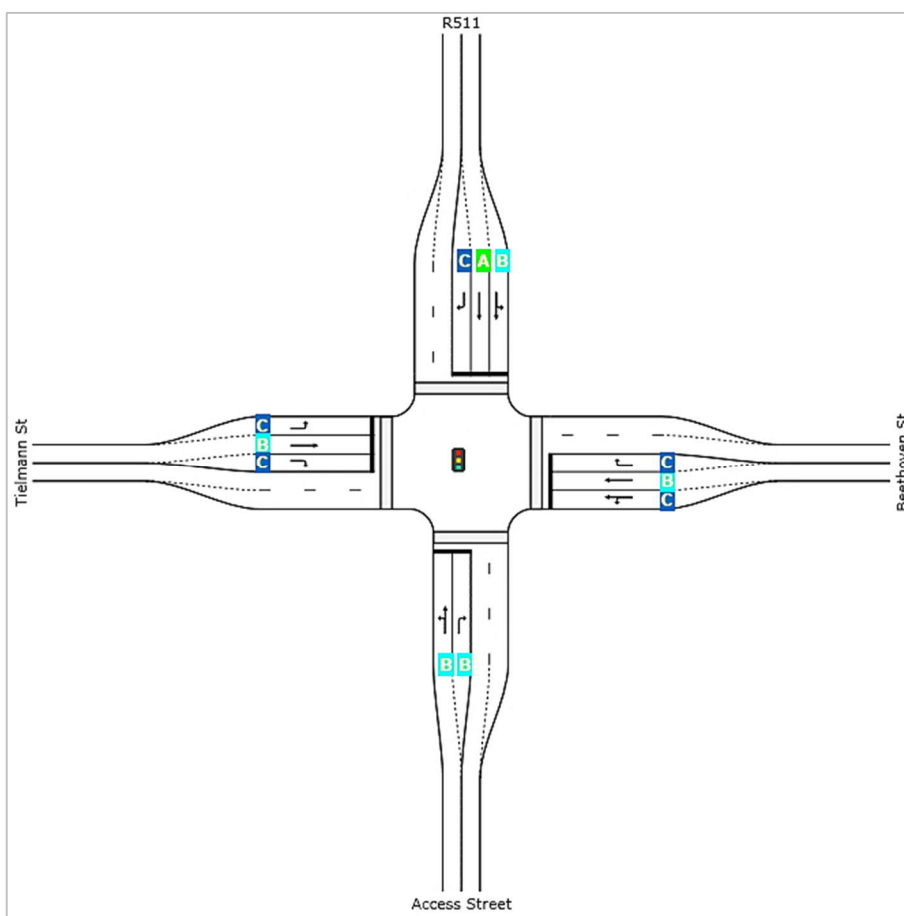
Movement Performance - Vehicles

Mov ID	ODMov	Demand	Deg. Flows	Average Satn	Average Delay	Level of Service	95% Back of Queue	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
<b>South: Access Street</b>											
1	L2	92	0.0	1.337	373.1	LOS F	39.0	273.1	1.00	4.71	18.1
2	T1	202	0.0	1.337	373.2	LOS F	39.0	273.1	1.00	4.71	18.5
3	R2	21	0.0	0.109	17.0	LOS C	0.4	2.7	0.99	1.25	49.3
Approach		315	0.0	1.337	349.3	LOS F	39.0	273.1	1.00	4.48	18.8
<b>East: Beethoven St</b>											
4	L2	54	0.0	0.204	14.0	LOS B	0.7	5.2	0.94	1.28	50.8
5	T1	159	0.0	0.839	48.4	LOS E	8.3	58.1	0.99	2.04	48.7
6	R2	164	0.0	0.839	51.1	LOS F	8.3	58.1	1.00	2.10	48.4
Approach		377	0.0	0.839	44.7	LOS E	8.3	58.1	0.99	1.96	48.7
<b>North: R511</b>											
7	L2	125	0.0	0.408	17.7	LOS C	1.8	12.6	0.98	1.38	55.4
8	T1	118	0.0	0.384	17.1	LOS C	1.7	11.6	0.98	1.36	54.5
9	R2	405	0.0	1.192	233.2	LOS F	37.5	262.6	1.00	5.02	33.5
Approach		648	0.0	1.192	152.3	LOS F	37.5	262.6	0.99	3.65	37.6
<b>West: Tielmann St</b>											
10	L2	301	0.0	1.975	928.0	LOS F	103.8	726.4	1.00	7.89	14.5
11	T1	80	0.0	1.975	928.5	LOS F	103.8	726.4	1.00	7.89	10.9
12	R2	88	0.0	1.975	928.0	LOS F	103.8	726.4	1.00	7.89	8.9
Approach		469	0.0	1.975	928.1	LOS F	103.8	726.4	1.00	7.89	12.9
All Vehicles		1809	0.0	1.975	365.4	LOS F	103.8	726.4	0.99	4.54	22.8

Movement Performance - Vehicles

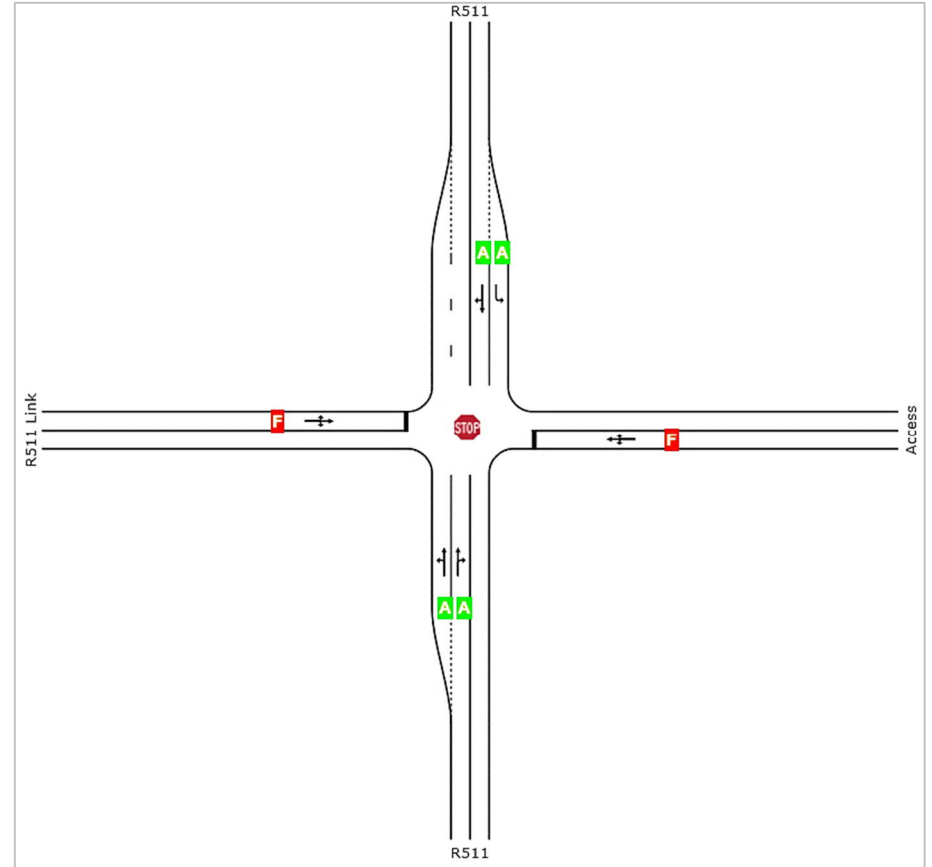
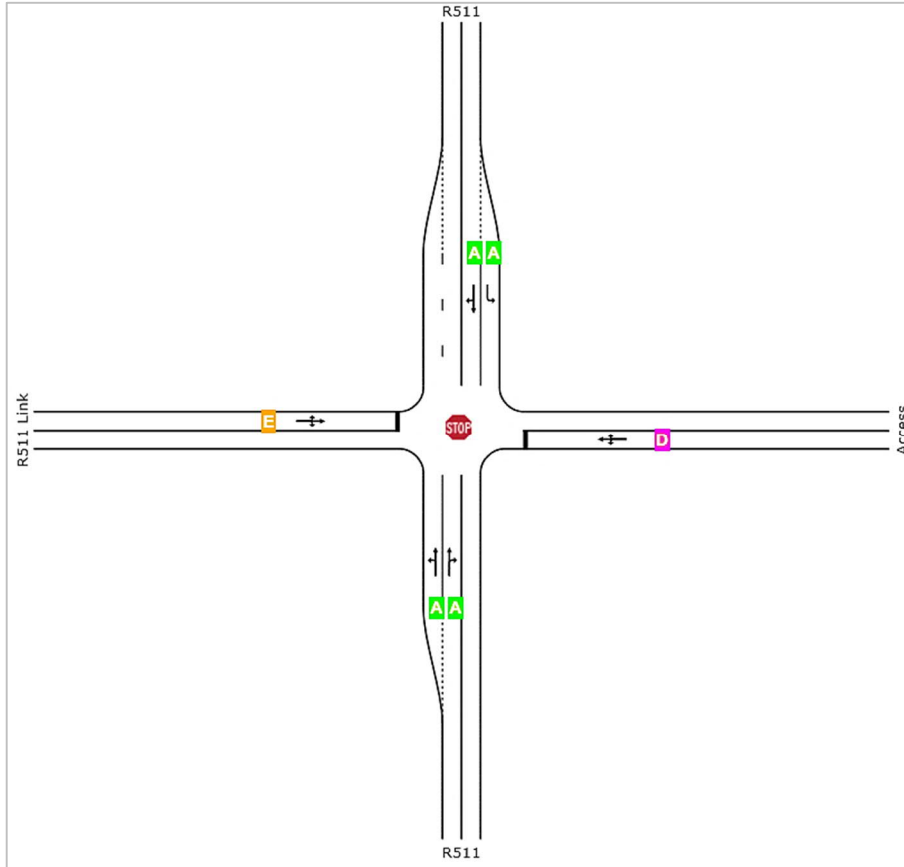
Mov ID	ODMov	Demand	Deg. Flows	Average Satn	Average Delay	Level of Service	95% Back of Queue	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
<b>South: Access Street</b>											
1	L2	104	0.0	1.157	233.0	LOS F	24.8	173.8	1.00	3.66	24.5
2	T1	155	0.0	1.157	233.1	LOS F	24.8	173.8	1.00	3.66	25.0
3	R2	29	0.0	0.152	17.9	LOS C	0.5	3.8	1.00	1.27	48.8
Approach		288	0.0	1.157	211.1	LOS F	24.8	173.8	1.00	3.42	25.4
<b>East: Beethoven St</b>											
4	L2	27	0.0	0.318	14.1	LOS B	1.3	8.8	0.91	1.33	50.6
5	T1	344	0.0	1.311	227.2	LOS F	68.9	482.0	0.97	5.88	28.5
6	R2	366	0.0	1.311	320.1	LOS F	68.9	482.0	1.00	7.88	23.9
Approach		738	0.0	1.311	265.4	LOS F	68.9	482.0	0.98	6.71	26.1
<b>North: R511</b>											
7	L2	400	0.0	1.434	439.9	LOS F	58.3	407.8	1.00	6.27	19.5
8	T1	124	0.0	0.496	24.5	LOS C	2.4	17.1	1.00	1.44	52.4
9	R2	181	0.0	0.723	43.5	LOS E	5.1	35.9	1.00	1.72	52.3
Approach		705	0.0	1.434	265.0	LOS F	58.3	407.8	1.00	4.25	27.5
<b>West: Tielmann St</b>											
10	L2	139	0.0	1.220	254.1	LOS F	46.6	326.3	1.00	5.94	32.2
11	T1	260	0.0	1.220	254.6	LOS F	46.6	326.3	1.00	5.94	26.8
12	R2	88	0.0	1.220	254.1	LOS F	46.6	326.3	1.00	5.94	23.2
Approach		487	0.0	1.220	254.4	LOS F	46.6	326.3	1.00	5.94	28.0
All Vehicles		2219	0.0	1.434	255.8	LOS F	68.9	482.0	0.99	5.33	26.9

Level of Service Summary





Level of Service Summary

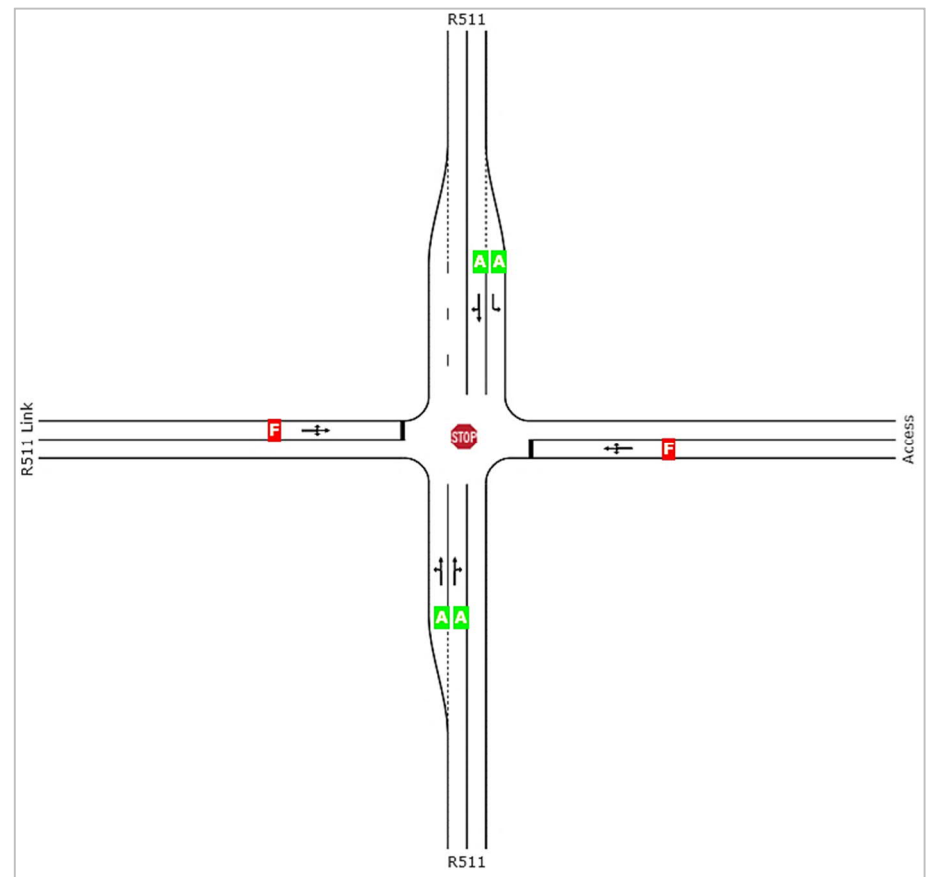
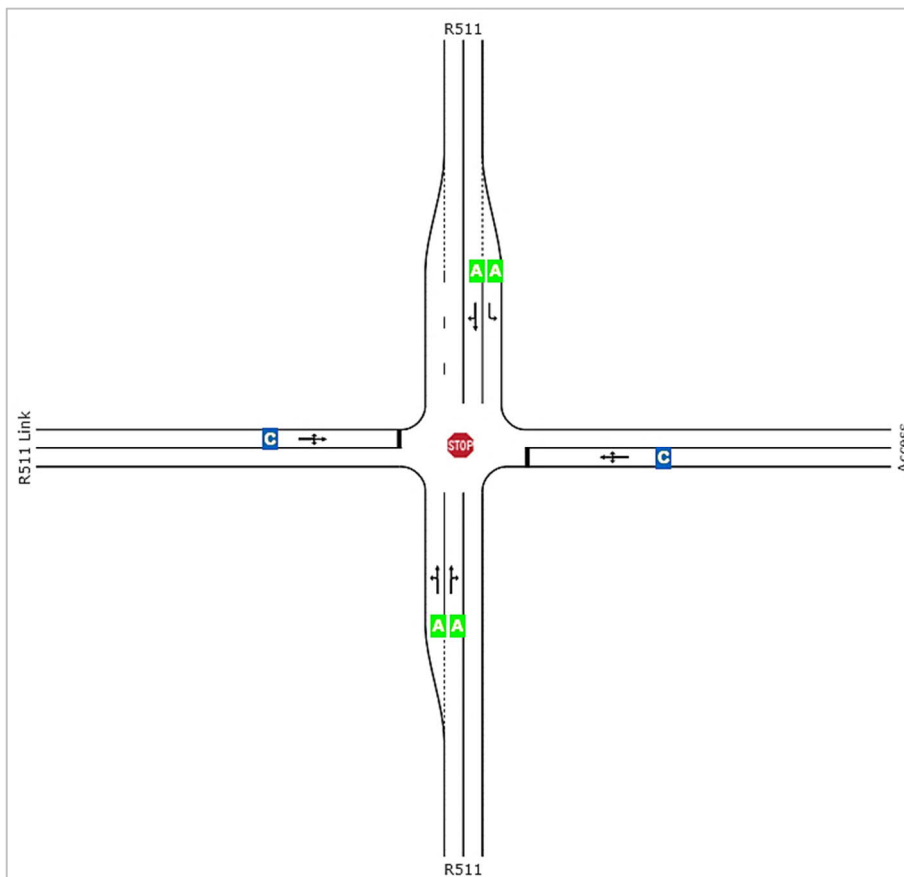


Movement Summary

Movement Performance - Vehicles											
Mov ID	ODMov	Demand		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total	HV				Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m	per veh	km/h	
South: R511											
1	L2	40	0.0	0.065	5.6	LOS A	0.0	0.0	0.00	0.19	59.2
2	T1	555	0.0	0.249	3.3	LOS A	2.8	19.6	0.53	0.04	58.8
3	R2	6	0.0	0.249	9.4	LOS A	2.8	19.6	0.63	0.01	29.0
Approach		601	0.0	0.249	3.5	NA	2.8	19.6	0.50	0.05	58.3
East: Access											
4	L2	8	0.0	0.119	32.2	LOS D	0.3	2.4	0.84	0.98	48.4
5	T1	1	0.0	0.119	32.3	LOS D	0.3	2.4	0.84	0.98	49.2
6	R2	5	0.0	0.119	32.0	LOS D	0.3	2.4	0.84	0.98	33.8
Approach		15	0.0	0.119	32.1	LOS D	0.3	2.4	0.84	0.98	45.6
North: R511											
7	L2	7	0.0	0.004	5.5	LOS A	0.0	0.0	0.00	0.58	13.4
8	T1	531	0.0	0.445	6.8	LOS A	6.8	47.5	0.87	0.21	57.4
9	R2	127	0.0	0.445	12.3	LOS B	6.8	47.5	0.87	0.21	57.0
Approach		665	0.0	0.445	7.8	NA	6.8	47.5	0.86	0.21	56.8
West: R511 Link											
10	L2	164	0.0	0.707	45.2	LOS E	7.7	54.0	0.41	1.11	48.0
11	T1	2	0.0	0.707	45.3	LOS E	7.7	54.0	0.41	1.11	27.6
12	R2	42	0.0	0.707	45.0	LOS E	7.7	54.0	0.41	1.11	51.4
Approach		208	0.0	0.707	45.2	LOS E	7.7	54.0	0.41	1.11	48.6
All Vehicles		1489	0.0	0.707	11.6	NA	7.7	54.0	0.65	0.28	55.8

Movement Performance - Vehicles											
Mov ID	ODMov	Demand		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total	HV				Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m	per veh	km/h	
South: R511											
1	L2	25	0.0	0.066	5.6	LOS A	0.0	0.0	0.00	0.12	59.4
2	T1	596	0.0	0.254	4.1	LOS A	3.3	23.2	0.57	0.02	58.5
3	R2	1	0.0	0.254	10.4	LOS B	3.3	23.2	0.68	0.00	28.9
Approach		622	0.0	0.254	4.2	NA	3.3	23.2	0.54	0.03	58.5
East: Access											
4	L2	1	0.0	0.110	76.0	LOS F	0.3	2.1	0.95	1.00	38.4
5	T1	1	0.0	0.110	76.1	LOS F	0.3	2.1	0.95	1.00	39.5
6	R2	3	0.0	0.110	75.8	LOS F	0.3	2.1	0.95	1.00	21.2
Approach		5	0.0	0.110	75.9	LOS F	0.3	2.1	0.95	1.00	31.0
North: R511											
7	L2	3	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	13.4
8	T1	607	0.0	0.519	8.6	LOS A	9.2	64.6	1.00	0.23	56.8
9	R2	147	0.0	0.519	14.1	LOS B	9.2	64.6	1.00	0.23	56.4
Approach		758	0.0	0.519	9.7	NA	9.2	64.6	1.00	0.23	56.5
West: R511 Link											
10	L2	204	0.0	0.883	87.8	LOS F	17.4	121.6	0.50	1.50	40.6
11	T1	2	0.0	0.883	88.0	LOS F	17.4	121.6	0.50	1.50	24.3
12	R2	37	0.0	0.883	87.6	LOS F	17.4	121.6	0.50	1.50	45.4
Approach		243	0.0	0.883	87.8	LOS F	17.4	121.6	0.50	1.50	41.3
All Vehicles		1628	0.0	0.883	19.4	NA	17.4	121.6	0.75	0.34	53.9

Level of Service Summary



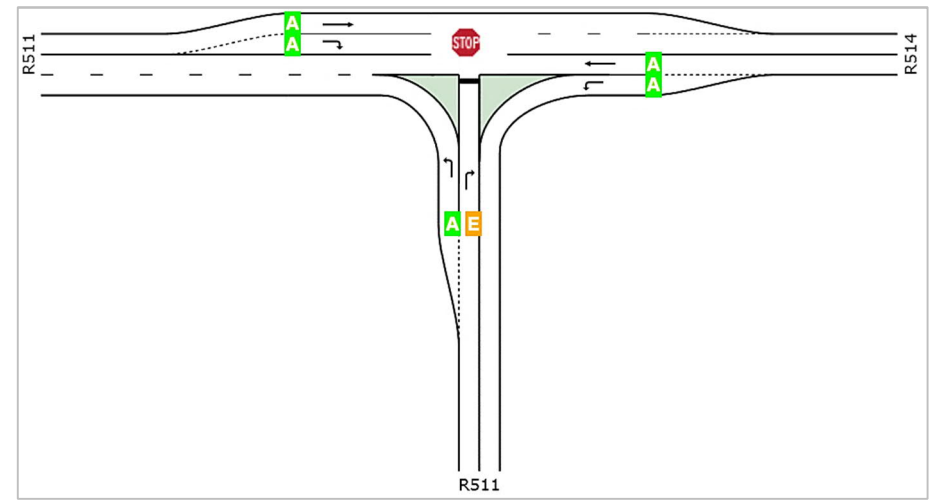
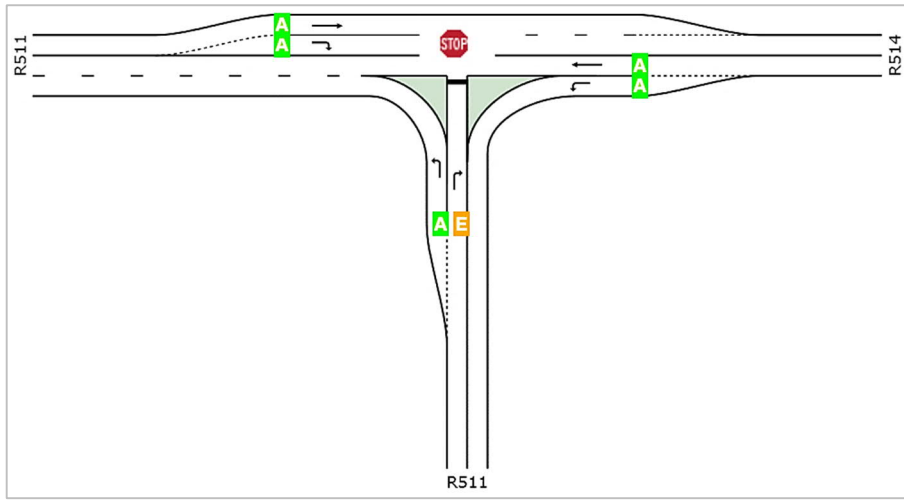


### 7.3.9 Intersection 9: R511/ R514

Table 20: Capacity Analysis Results for Intersection 9: R511/ R514

2018 PM Peak Hour Background Traffic	2018 Sat Peak Hour Background Traffic
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#### Level of Service Summary



#### Movement Summary

##### Movement Performance - Vehicles

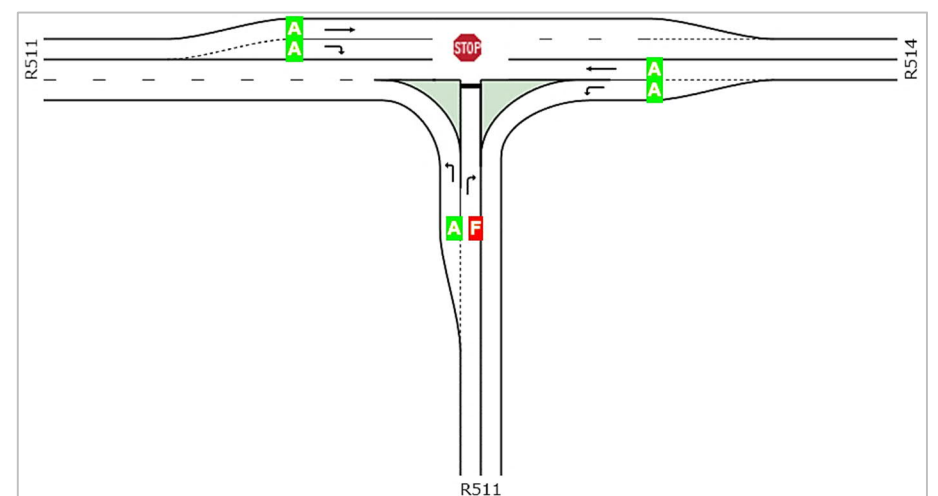
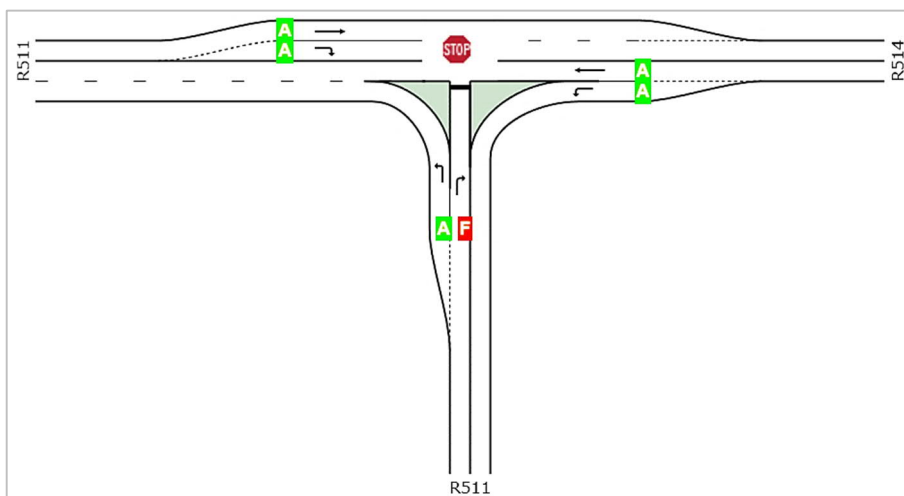
Mov ID	OD Mov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%	v/c	sec	Vehicles	Distance	per veh	km/h
		veh/h				veh	m		
<b>South: R511</b>									
1	L2	545	0.0	0.294	5.7	LOS A	0.0	0.00	55.5
3	R2	184	0.0	0.751	39.0	LOS E	4.8	0.93	52.6
Approach		729	0.0	0.751	14.1	LOS B	4.8	0.23	53.8
<b>East: R514</b>									
4	L2	134	0.0	0.072	5.7	LOS A	0.0	0.00	58.8
5	T1	92	0.0	0.047	0.0	LOS A	0.0	0.00	60.0
Approach		225	0.0	0.072	3.4	NA	0.0	0.00	59.3
<b>West: R511</b>									
11	T1	184	0.0	0.094	0.0	LOS A	0.0	0.00	60.0
12	R2	527	0.0	0.399	6.1	LOS A	2.3	0.27	53.6
Approach		712	0.0	0.399	4.5	NA	2.3	0.20	57.1
All Vehicles		1666	0.0	0.751	8.5	NA	4.8	0.19	56.3

##### Movement Performance - Vehicles

Mov ID	OD Mov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%	v/c	sec	Vehicles	Distance	per veh	km/h
		veh/h				veh	m		
<b>South: R511</b>									
1	L2	545	0.0	0.294	5.7	LOS A	0.0	0.00	55.5
3	R2	184	0.0	0.751	39.0	LOS E	4.8	0.93	52.6
Approach		729	0.0	0.751	14.1	LOS B	4.8	0.23	53.8
<b>East: R514</b>									
4	L2	134	0.0	0.072	5.7	LOS A	0.0	0.00	58.8
5	T1	92	0.0	0.047	0.0	LOS A	0.0	0.00	60.0
Approach		225	0.0	0.072	3.4	NA	0.0	0.00	59.3
<b>West: R511</b>									
11	T1	184	0.0	0.094	0.0	LOS A	0.0	0.00	60.0
12	R2	527	0.0	0.399	6.1	LOS A	2.3	0.27	53.6
Approach		712	0.0	0.399	4.5	NA	2.3	0.20	57.1
All Vehicles		1666	0.0	0.751	8.5	NA	4.8	0.19	56.3

2018 PM Peak Hour Traffic plus Development Trips	2018 Sat Peak Hour Traffic plus Development Trips
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#### Level of Service Summary



#### Movement Summary

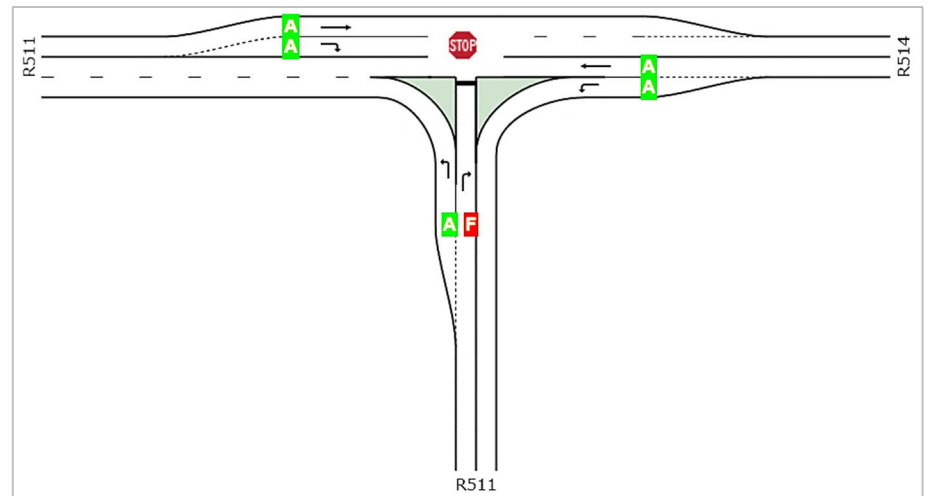
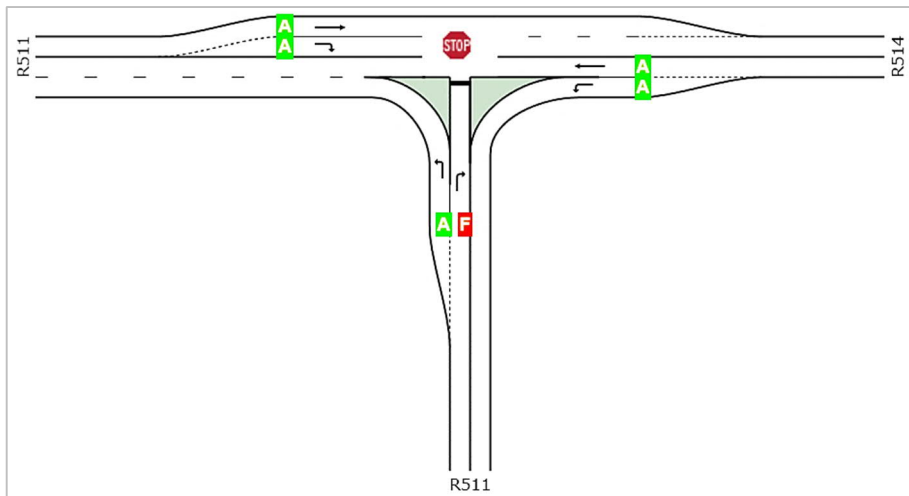
##### Movement Performance - Vehicles

Mov ID	OD Mov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%	v/c	sec	Vehicles	Distance	per veh	km/h
		veh/h				veh	m		
<b>South: R511</b>									
1	L2	485	0.0	0.261	5.6	LOS A	0.0	0.00	55.5
3	R2	263	0.0	4.448	3194.0	LOS F	140.5	1.00	4.8
Approach		748	0.0	4.448	1126.7	LOS F	140.5	0.35	6.8
<b>East: R514</b>									
4	L2	188	0.0	0.101	5.7	LOS A	0.0	0.00	58.8
5	T1	341	0.0	0.175	0.1	LOS A	0.0	0.00	60.0
Approach		529	0.0	0.175	2.1	NA	0.0	0.00	59.5
<b>West: R511</b>									
11	T1	682	0.0	0.350	0.0	LOS A	0.0	0.00	59.9
12	R2	441	0.0	0.437	8.3	LOS A	2.8	0.54	52.5
Approach		1123	0.0	0.437	3.3	NA	2.8	0.21	58.7
All Vehicles		2401	0.0	4.448	353.2	NA	140.5	0.21	21.3

##### Movement Performance - Vehicles

Mov ID	OD Mov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed
		Total HV	%	v/c	sec	Vehicles	Distance	per veh	km/h
		veh/h				veh	m		
<b>South: R511</b>									
1	L2	568	0.0	0.306	5.7	LOS A	0.0	0.00	55.5
3	R2	257	0.0	1.937	899.0	LOS F	85.2	1.00	4.44
Approach		825	0.0	1.937	283.7	LOS F	85.2	0.31	19.4
<b>East: R514</b>									
4	L2	169	0.0	0.091	5.7	LOS A	0.0	0.00	58.8
5	T1	185	0.0	0.095	0.1	LOS A	0.0	0.00	60.0
Approach		355	0.0	0.095	2.7	NA	0.0	0.00	59.4
<b>West: R511</b>									
11	T1	327	0.0	0.168	0.0	LOS A	0.0	0.00	60.0
12	R2	588	0.0	0.489	7.1	LOS A	3.5	0.44	53.1
Approach		916	0.0	0.489	4.6	NA	3.5	0.28	57.6
All Vehicles		2096	0.0	1.937	114.2	NA	85.2	0.25	35.1

Level of Service Summary

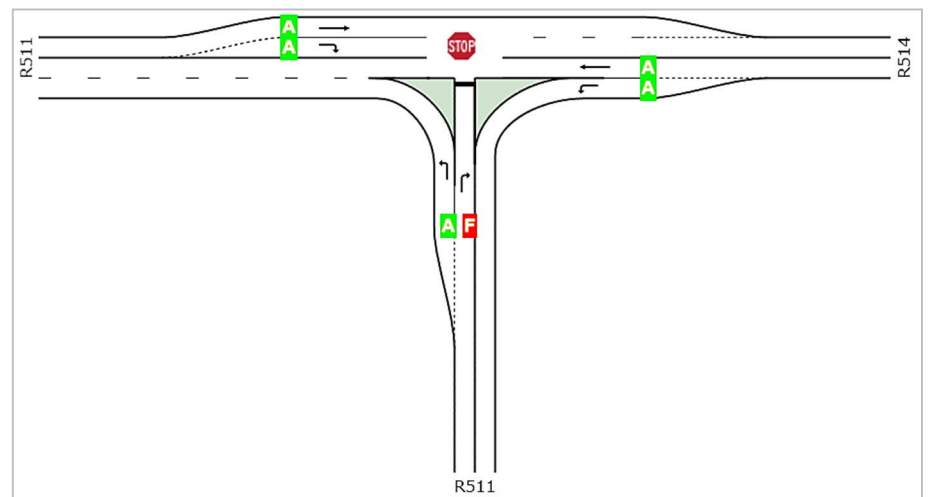
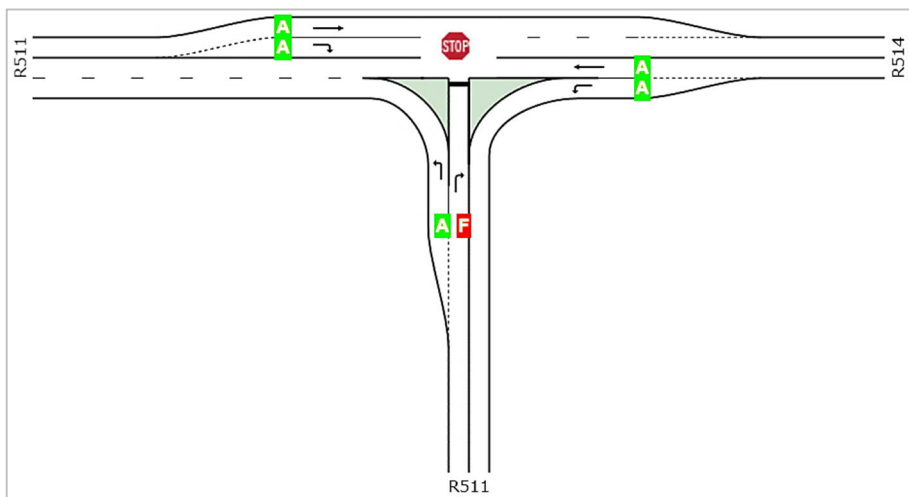


Movement Summary

Movement Performance - Vehicles										
Mov ID	ODMov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Flows	v/c	sec		Vehicles	Distance			
		veh/h	%			veh	m		per veh	km/h
South: R511										
1	L2	507	0.0	0.273	5.6 LOS A	0.0	0.0	0.00	0.53	55.5
3	R2	175	0.0	1.526	544.7 LOS F	44.0	308.0	1.00	3.24	20.4
Approach		682	0.0	1.526	143.7 LOS F	44.0	308.0	0.26	1.22	27.8
East: R514										
4	L2	167	0.0	0.090	5.7 LOS A	0.0	0.0	0.00	0.53	58.8
5	T1	265	0.0	0.136	0.1 LOS A	0.0	0.0	0.00	0.00	60.0
Approach		433	0.0	0.136	2.3 NA	0.0	0.0	0.00	0.20	59.5
West: R511										
11	T1	539	0.0	0.276	0.0 LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	395	0.0	0.358	7.1 LOS A	1.8	12.6	0.45	0.66	53.1
Approach		934	0.0	0.358	3.0 NA	1.8	12.6	0.19	0.28	58.7
All Vehicles		2048	0.0	1.526	49.7 NA	44.0	308.0	0.17	0.58	47.1

Movement Performance - Vehicles										
Mov ID	ODMov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Flows	v/c	sec		Vehicles	Distance			
		veh/h	%			veh	m		per veh	km/h
South: R511										
1	L2	602	0.0	0.324	5.7 LOS A	0.0	0.0	0.00	0.53	55.5
3	R2	203	0.0	1.001	102.4 LOS F	13.1	91.4	1.00	1.93	43.9
Approach		805	0.0	1.001	30.1 LOS D	13.1	91.4	0.25	0.88	48.2
East: R514										
4	L2	147	0.0	0.079	5.7 LOS A	0.0	0.0	0.00	0.53	58.8
5	T1	101	0.0	0.052	0.0 LOS A	0.0	0.0	0.00	0.00	60.0
Approach		248	0.0	0.079	3.4 NA	0.0	0.0	0.00	0.31	59.3
West: R511										
11	T1	203	0.0	0.104	0.0 LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	582	0.0	0.444	6.2 LOS A	2.7	18.8	0.30	0.56	53.5
Approach		785	0.0	0.444	4.6 NA	2.7	18.8	0.23	0.42	57.0
All Vehicles		1839	0.0	1.001	15.6 NA	13.1	91.4	0.21	0.61	53.9

Level of Service Summary



Movement Summary

Movement Performance - Vehicles										
Mov ID	ODMov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Flows	v/c	sec		Vehicles	Distance			
		veh/h	%			veh	m		per veh	km/h
South: R511										
1	L2	534	0.0	0.287	5.7 LOS A	0.0	0.0	0.00	0.53	55.5
3	R2	280	0.0	6.453	5021.4 LOS F	165.7	1160.1	1.00	3.17	3.2
Approach		814	0.0	6.453	1731.7 LOS F	165.7	1160.1	0.34	1.44	4.6
East: R514										
4	L2	204	0.0	0.110	5.7 LOS A	0.0	0.0	0.00	0.53	58.8
5	T1	366	0.0	0.188	0.1 LOS A	0.0	0.0	0.00	0.00	60.0
Approach		571	0.0	0.188	2.1 NA	0.0	0.0	0.00	0.19	59.5
West: R511										
11	T1	733	0.0	0.376	0.0 LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	478	0.0	0.488	9.0 LOS A	3.5	24.5	0.58	0.84	52.1
Approach		1211	0.0	0.488	3.6 NA	3.5	24.5	0.23	0.33	58.6
All Vehicles		2595	0.0	6.453	545.2 NA	165.7	1160.1	0.21	0.65	15.8

Movement Performance - Vehicles										
Mov ID	ODMov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Flows	v/c	sec		Vehicles	Distance			
		veh/h	%			veh	m		per veh	km/h
South: R511										
1	L2	625	0.0	0.337	5.7 LOS A	0.0	0.0	0.00	0.53	55.5
3	R2	276	0.0	2.582	1484.8 LOS F	114.5	801.6	1.00	4.57	9.5
Approach		901	0.0	2.582	458.4 LOS F	114.5	801.6	0.31	1.77	13.6
East: R514										
4	L2	184	0.0	0.099	5.7 LOS A	0.0	0.0	0.00	0.53	58.8
5	T1	195	0.0	0.100	0.1 LOS A	0.0	0.0	0.00	0.00	60.0
Approach		379	0.0	0.100	2.8 NA	0.0	0.0	0.00	0.26	59.4
West: R511										
11	T1	346	0.0	0.178	0.0 LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	643	0.0	0.540	7.6 LOS A	4.6	32.4	0.48	0.67	53.0
Approach		989	0.0	0.540	4.9 NA	4.6	32.4	0.31	0.43	57.5
All Vehicles		2269	0.0	2.582	184.6 NA	114.5	801.6	0.26	0.93	27.9

CONCLUSION

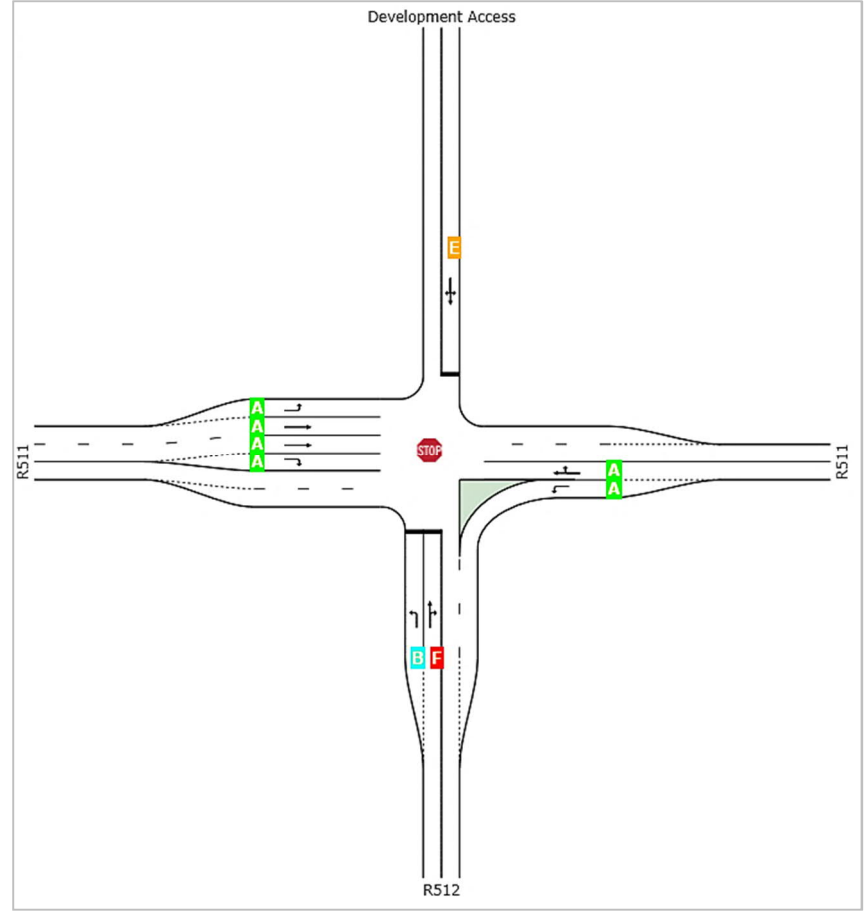
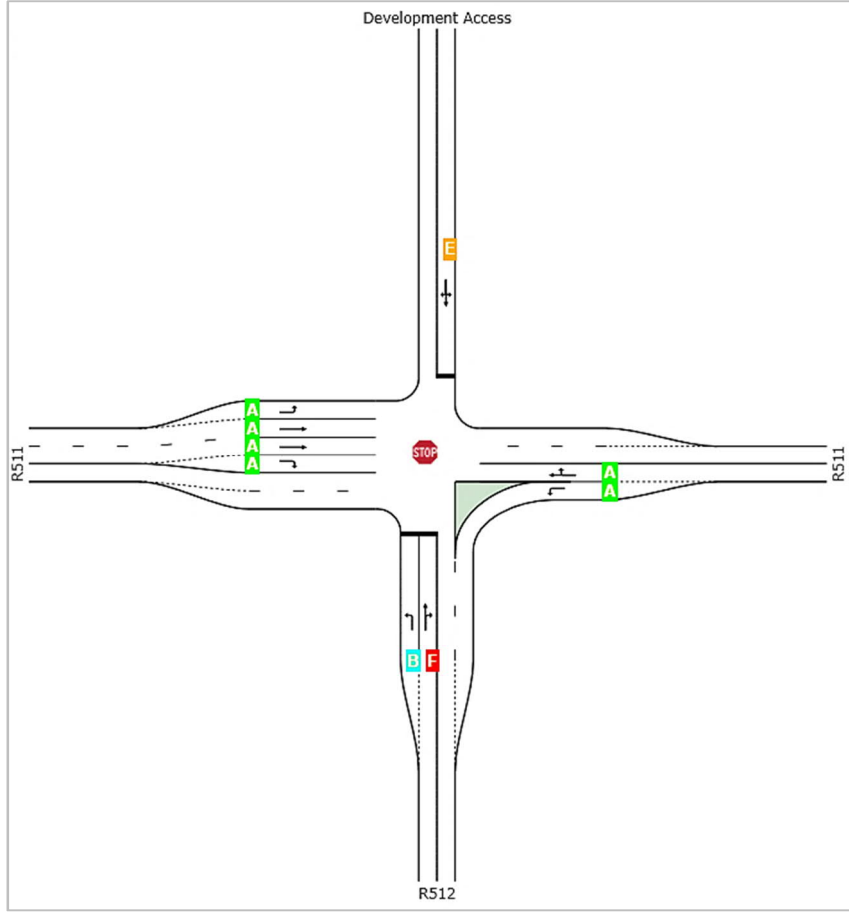
The right turn movement on the southern approach already experiences a very bad LOS with the base year scenarios without the addition of the development trips. This is due to the fact that the free-flow traffic on the R511/R514 increase and thus the side traffic struggles to find safe gaps to enter the traffic stream. However, the actual intersection layout (refer to **Figure 21**) is a so-called "butterfly" whereby the right turning traffic has an acceleration lane to enter the through traffic stream on the R511/R514. Their entry is thus staged by manner of speaking. This detail cannot be simulated with SIDRA and the delays experienced on this movement is an over-estimated. This was evident from the PM peak site visit. It is anticipated that no road upgrades are therefore required.

7.3.10 Intersection 10: R511/ Road P251-1

Table 21: Capacity Analysis Results for Intersection 10: R511/ Road P251-1

**2018 PM Peak Hour Background Traffic** **2018 Sat Peak Hour Background Traffic**

**Level of Service Summary**



**Movement Summary**

**Movement Performance - Vehicles**

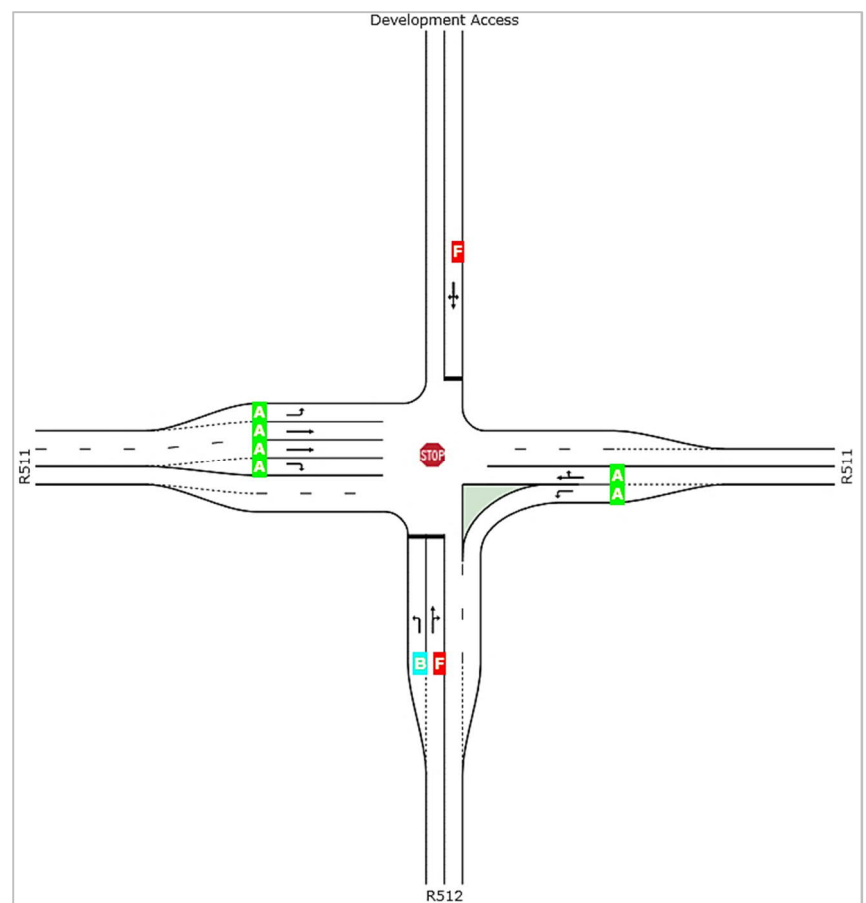
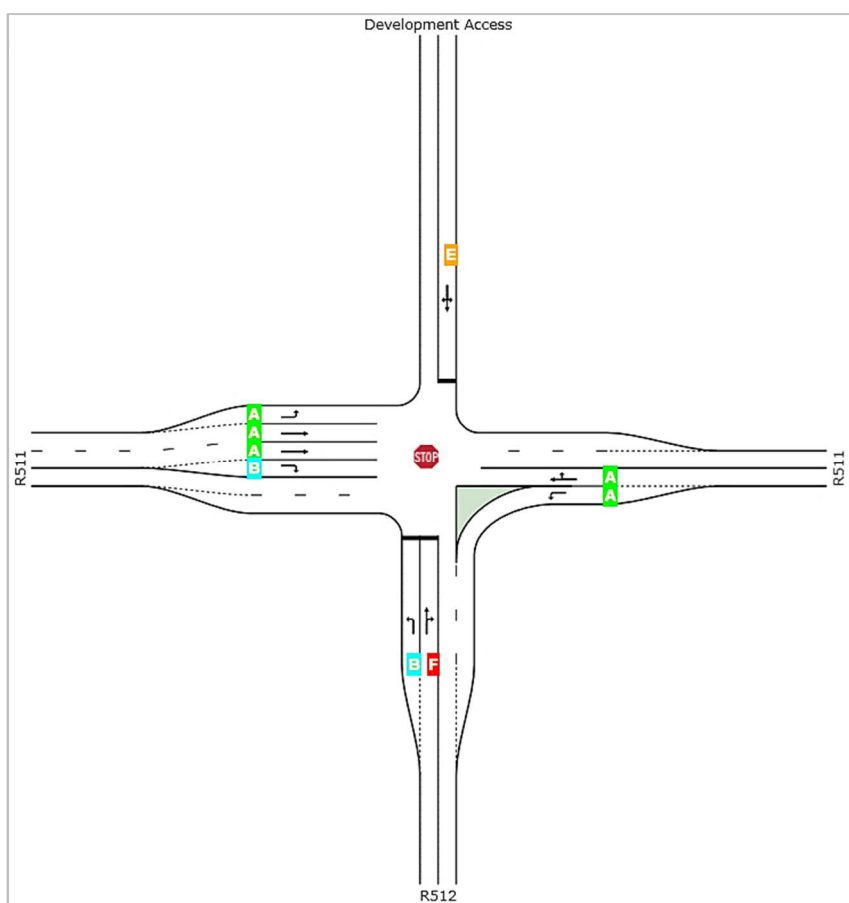
Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed		
		veh/h	%	v/c	sec	veh	m	per veh	km/h		
<b>South: R512</b>											
1	L2	108	0.0	0.147	10.7	LOS B	0.5	3.8	0.48	0.95	58.8
2	T1	1	0.0	3.076	1959.0	LOS F	89.8	628.9	1.00	3.41	9.2
3	R2	189	0.0	3.076	1958.1	LOS F	89.8	628.9	1.00	3.41	10.6
Approach		299	0.0	3.076	1251.8	LOS F	89.8	628.9	0.81	2.52	16.3
<b>East: R511</b>											
4	L2	221	0.0	0.119	5.6	LOS A	0.0	0.0	0.00	0.53	59.2
5	T1	416	0.0	0.215	5.1	LOS A	3.0	20.7	0.59	0.00	58.8
6	R2	1	0.0	0.215	10.6	LOS B	3.0	20.7	0.59	0.00	8.8
Approach		638	0.0	0.215	5.3	NA	3.0	20.7	0.39	0.18	58.9
<b>North: Development Access</b>											
7	L2	1	0.0	0.036	41.3	LOS E	0.1	0.7	0.83	0.90	36.0
8	T1	1	0.0	0.036	42.2	LOS E	0.1	0.7	0.83	0.90	53.9
9	R2	1	0.0	0.036	41.7	LOS E	0.1	0.7	0.83	0.90	49.5
Approach		3	0.0	0.036	41.8	LOS E	0.1	0.7	0.83	0.90	50.0
<b>West: R511</b>											
10	L2	1	0.0	0.001	5.5	LOS A	0.0	0.0	0.00	0.58	30.1
11	T1	521	0.0	0.134	0.1	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	132	0.0	0.217	9.1	LOS A	0.8	5.4	0.51	0.78	58.8
Approach		654	0.0	0.217	1.9	NA	0.8	5.4	0.10	0.16	59.5
All Vehicles		1594	0.0	3.076	237.8	NA	89.8	628.9	0.35	0.61	35.3

**Movement Performance - Vehicles**

Mov ID	ODMov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed		
		veh/h	%	v/c	sec	veh	m	per veh	km/h		
<b>South: R512</b>											
1	L2	108	0.0	0.147	10.7	LOS B	0.5	3.8	0.48	0.95	58.8
2	T1	1	0.0	3.076	1959.0	LOS F	89.8	628.9	1.00	3.41	9.2
3	R2	189	0.0	3.076	1958.1	LOS F	89.8	628.9	1.00	3.41	10.6
Approach		299	0.0	3.076	1251.8	LOS F	89.8	628.9	0.81	2.52	16.3
<b>East: R511</b>											
4	L2	221	0.0	0.119	5.6	LOS A	0.0	0.0	0.00	0.53	59.2
5	T1	416	0.0	0.215	5.1	LOS A	3.0	20.7	0.59	0.00	58.8
6	R2	1	0.0	0.215	10.6	LOS B	3.0	20.7	0.59	0.00	8.8
Approach		638	0.0	0.215	5.3	NA	3.0	20.7	0.39	0.18	58.9
<b>North: Development Access</b>											
7	L2	1	0.0	0.036	41.3	LOS E	0.1	0.7	0.83	0.90	36.0
8	T1	1	0.0	0.036	42.2	LOS E	0.1	0.7	0.83	0.90	53.9
9	R2	1	0.0	0.036	41.7	LOS E	0.1	0.7	0.83	0.90	49.5
Approach		3	0.0	0.036	41.8	LOS E	0.1	0.7	0.83	0.90	50.0
<b>West: R511</b>											
10	L2	1	0.0	0.001	5.5	LOS A	0.0	0.0	0.00	0.58	30.1
11	T1	521	0.0	0.134	0.1	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	132	0.0	0.217	9.1	LOS A	0.8	5.4	0.51	0.78	58.8
Approach		654	0.0	0.217	1.9	NA	0.8	5.4	0.10	0.16	59.5
All Vehicles		1594	0.0	3.076	237.8	NA	89.8	628.9	0.35	0.61	35.3

**2018 PM Peak Hour Traffic plus Development Trips** **2018 Sat Peak Hour Traffic plus Development Trips**

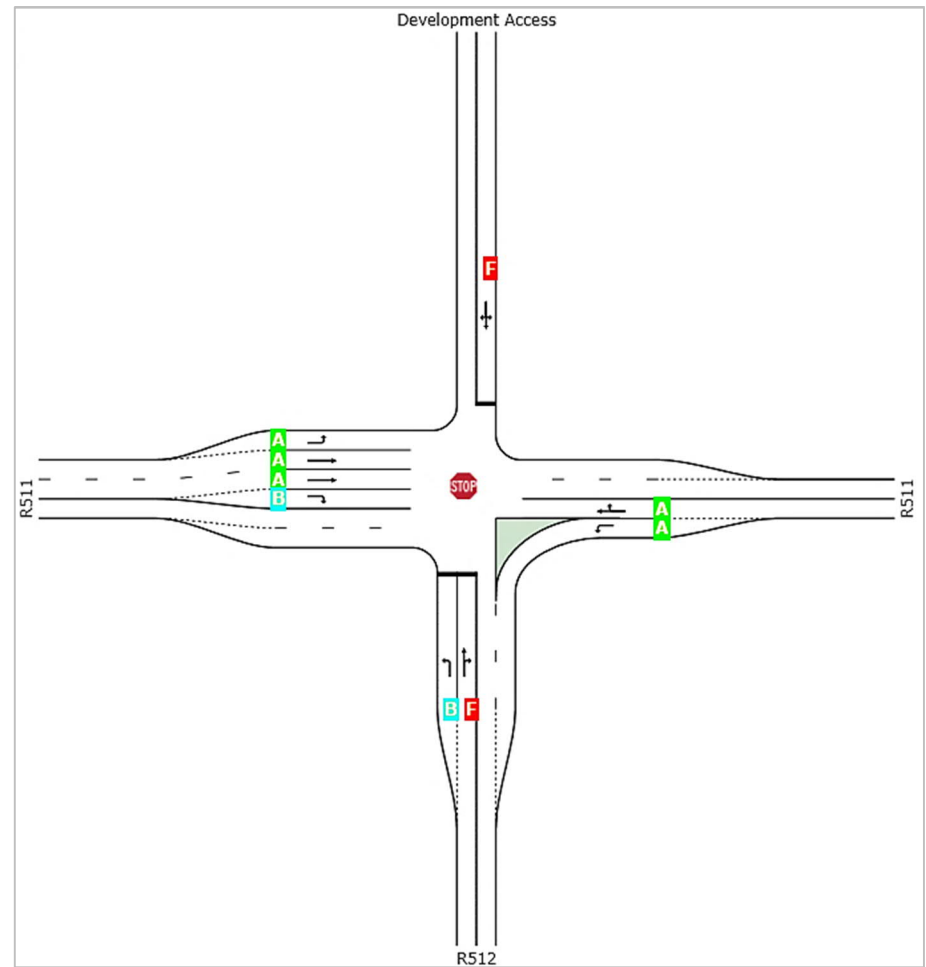
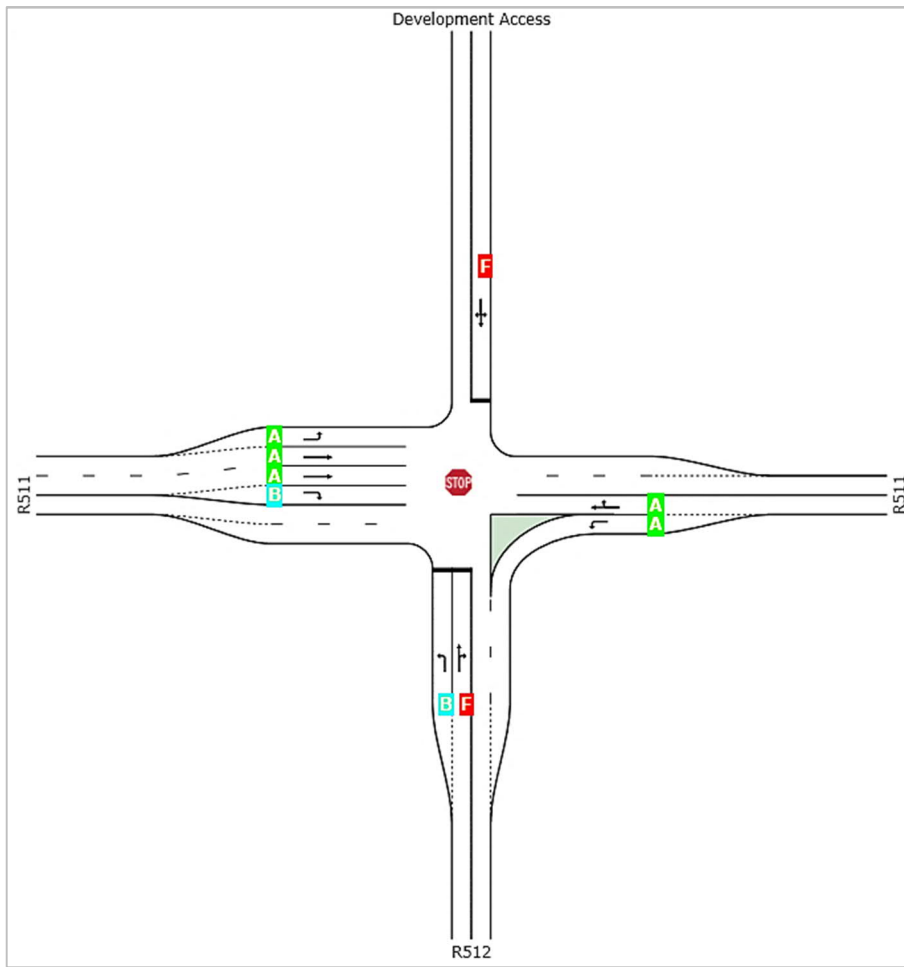
**Level of Service Summary**







Level of Service Summary



Movement Summary

Movement Performance - Vehicles											
Mov ID	ODMov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed		
		Total HV	%	v/c	sec	Vehicles	Distance	per veh	km/h		
South: R512											
1	L2	298	0.0	0.490	14.6	LOS B	2.8	19.4	0.66	1.11	58.4
2	T1	1	0.0	32.582	28685.5	LOS F	371.5	2600.8	1.00	1.91	0.7
3	R2	481	0.0	32.582	28684.6	LOS F	371.5	2600.8	1.00	1.91	0.9
Approach		780	0.0	32.582	17735.1	LOS F	371.5	2600.8	0.87	1.60	1.6
East: R511											
4	L2	355	0.0	0.191	5.6	LOS A	0.0	0.0	0.00	0.53	59.2
5	T1	543	0.0	0.284	9.6	LOS A	7.1	49.7	1.00	0.00	57.8
6	R2	2	0.0	0.284	15.1	LOS C	7.1	49.7	1.00	0.00	8.7
Approach		900	0.0	0.284	8.0	NA	7.1	49.7	0.61	0.21	58.4
North: Development Access											
7	L2	19	0.0	0.306	60.1	LOS F	0.9	6.0	0.88	0.96	30.5
8	T1	1	0.0	0.306	61.0	LOS F	0.9	6.0	0.88	0.96	51.5
9	R2	2	0.0	0.306	60.5	LOS F	0.9	6.0	0.88	0.96	45.9
Approach		22	0.0	0.306	60.2	LOS F	0.9	6.0	0.88	0.96	35.8
West: R511											
10	L2	1	0.0	0.001	5.5	LOS A	0.0	0.0	0.00	0.58	30.1
11	T1	712	0.0	0.182	0.1	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	217	0.0	0.442	13.1	LOS B	2.1	14.9	0.66	0.94	58.4
Approach		929	0.0	0.442	3.1	NA	2.1	14.9	0.15	0.22	59.3
All Vehicles		2632	0.0	32.582	5261.0	NA	371.5	2600.8	0.53	0.63	3.9

Movement Performance - Vehicles											
Mov ID	ODMov	Demand	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed		
		Total HV	%	v/c	sec	Vehicles	Distance	per veh	km/h		
South: R512											
1	L2	237	0.0	0.342	12.1	LOS B	1.6	11.2	0.57	1.04	58.7
2	T1	1	0.0	13.688	11563.0	LOS F	276.1	1932.9	1.00	2.70	1.8
3	R2	414	0.0	13.688	11562.1	LOS F	276.1	1932.9	1.00	2.70	2.1
Approach		652	0.0	13.688	7363.8	LOS F	276.1	1932.9	0.84	2.10	3.6
East: R511											
4	L2	361	0.0	0.194	5.7	LOS A	0.0	0.0	0.00	0.53	59.2
5	T1	459	0.0	0.237	6.2	LOS A	3.7	26.2	0.66	0.00	58.6
6	R2	1	0.0	0.237	11.7	LOS B	3.7	26.2	0.66	0.00	8.8
Approach		821	0.0	0.237	6.0	NA	3.7	26.2	0.37	0.23	58.8
North: Development Access											
7	L2	1	0.0	0.084	90.6	LOS F	0.2	1.5	0.92	0.91	24.4
8	T1	1	0.0	0.084	91.5	LOS F	0.2	1.5	0.92	0.91	48.0
9	R2	1	0.0	0.084	91.0	LOS F	0.2	1.5	0.92	0.91	41.0
Approach		3	0.0	0.084	91.0	LOS F	0.2	1.5	0.92	0.91	41.7
West: R511											
10	L2	1	0.0	0.001	5.5	LOS A	0.0	0.0	0.00	0.58	30.1
11	T1	576	0.0	0.148	0.1	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	217	0.0	0.383	11.0	LOS B	1.8	12.5	0.58	0.88	58.6
Approach		794	0.0	0.383	3.1	NA	1.8	12.5	0.16	0.24	59.3
All Vehicles		2269	0.0	13.688	2117.6	NA	276.1	1932.9	0.43	0.77	8.9

CONCLUSION

The right turn movement on the southern approach already experiences a very bad LOS with the base year scenarios without the addition of the development trips. This is due to the fact that right turning traffic struggles to find save gaps to enter the traffic stream in the free-flow traffic on the R511. The actual intersection layout (refer to **Figure 21**) geometrically functions as a socalled "butterfly" whereby the right turning traffic has an acceleration lane to enter the trough traffic stream on the R511. However, amendments to the road markings can formalise this and simultaneously improve the road safety at the intersection. Their entry is thus staged by figure of speech. This detail cannot be simulated with SIDRA and the delays experienced on this movement is an over-estimated. This was evident from the PM peak site visit. It is anticipated that no road upgrades are needed, but that an amendment to the road markings be discussed with the NWDPT.

7.3.11 Hartbeespoort Dam Wall

The road across the Hartbeespoort Dam Wall is a single lane that can accommodate traffic only in one direction at a time and is not an intersection in the traditional sense (refer to **Figure 21** for the layout). At each end of where the single lane starts, a traffic signal controls the one-way flow of traffic from each side. The traffic signal settings were measured during the site visit in order to ensure accuracy of the SIDRA analysis. The capacity can't be increased as it is not possible to construct additional traffic lanes to accommodate more traffic. Therefore, the only way to determine what the effect of the additional development traffic will have on the flow of traffic across the dam wall, is to consider the increase in delay that that traffic will experience. The delays (measured in seconds) are therefore highlighted in the different scenarios presented in **Table 22**.

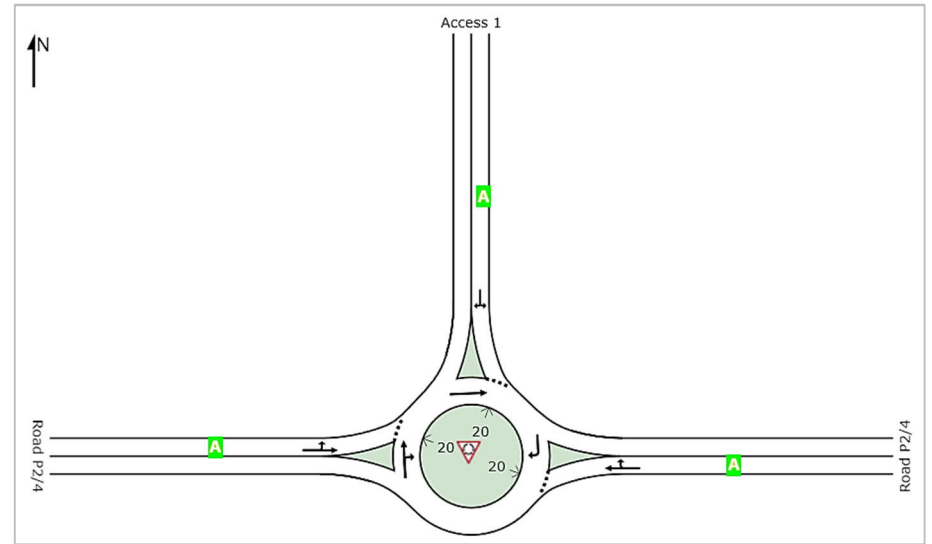
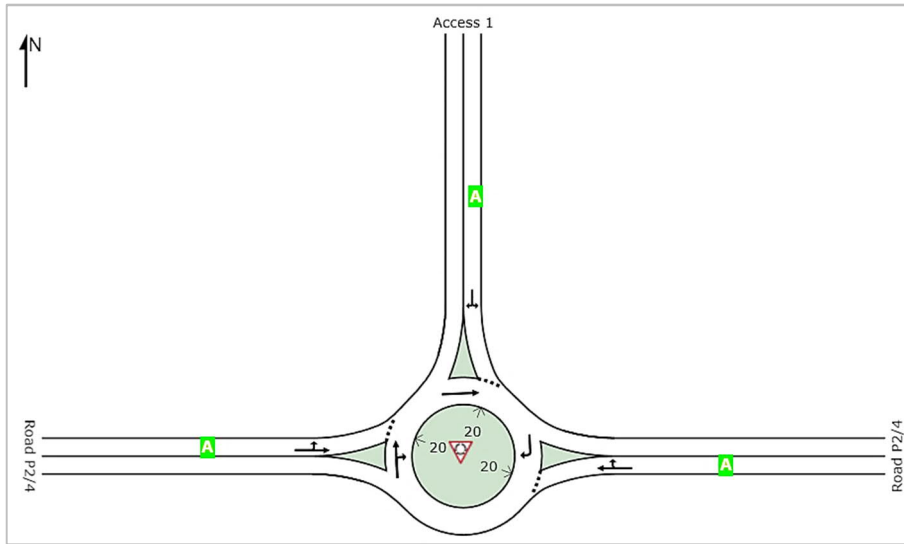


### 7.3.12 Development Access 1

Table 23: Capacity Analysis Results: Development Access 1

2018 PM Peak Hour Traffic plus Development Trips	2018 Sat Peak Hour Traffic plus Development Trips
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#### Level of Service Summary



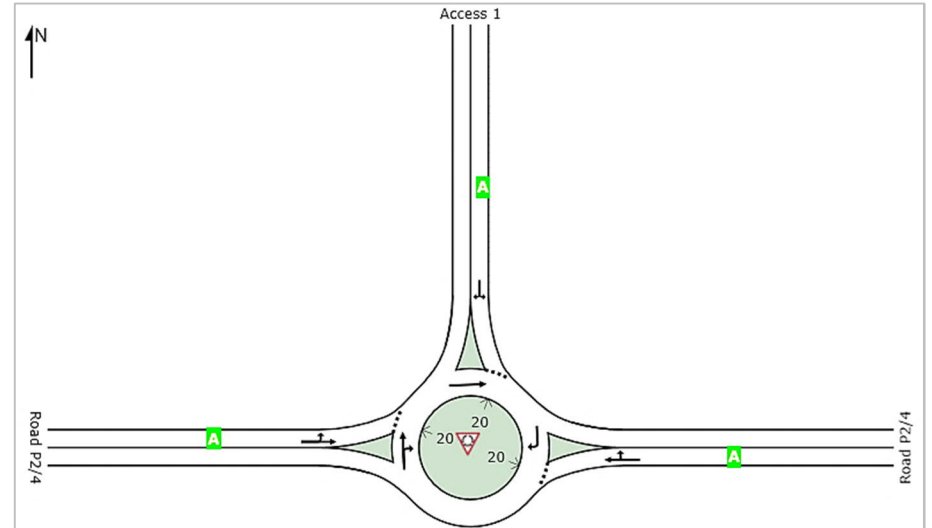
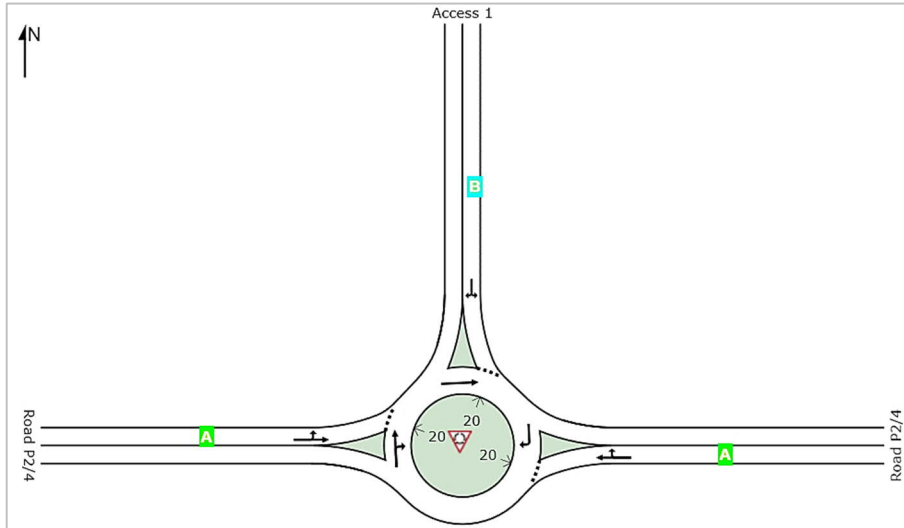
#### Movement Summary

Movement Performance - Vehicles											
Mov ID	ODMov	Demand		Deg. Satn	Average Level of Delay Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%			Vehicles	Distance				
		veh/h	%	v/c	sec	veh	m	per veh	km/h		
East: Road P2/4											
5	T1	329	0.0	0.301	4.9	LOS A	2.3	15.9	0.42	0.49	54.5
6	R2	43	0.0	0.301	9.5	LOS A	2.3	15.9	0.42	0.49	54.5
Approach		373	0.0	0.301	5.4	LOS A	2.3	15.9	0.42	0.49	54.5
North: Access 1											
7	L2	56	0.0	0.201	6.6	LOS A	1.2	8.6	0.61	0.71	51.0
9	R2	129	0.0	0.201	11.4	LOS B	1.2	8.6	0.61	0.71	52.1
Approach		185	0.0	0.201	9.9	LOS A	1.2	8.6	0.61	0.71	51.8
West: Road P2/4											
10	L2	100	0.0	0.340	4.1	LOS A	2.7	19.2	0.24	0.41	54.5
11	T1	403	0.0	0.340	4.3	LOS A	2.7	19.2	0.24	0.41	55.8
Approach		503	0.0	0.340	4.2	LOS A	2.7	19.2	0.24	0.41	55.5
All Vehicles		1061	0.0	0.340	5.6	LOS A	2.7	19.2	0.37	0.49	54.5

Movement Performance - Vehicles											
Mov ID	ODMov	Demand		Deg. Satn	Average Level of Delay Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%			Vehicles	Distance				
		veh/h	%	v/c	sec	veh	m	per veh	km/h		
East: Road P2/4											
5	T1	369	0.0	0.267	4.3	LOS A	2.0	14.1	0.23	0.41	55.6
6	R2	18	0.0	0.267	8.9	LOS A	2.0	14.1	0.23	0.41	55.5
Approach		387	0.0	0.267	4.5	LOS A	2.0	14.1	0.23	0.41	55.6
North: Access 1											
7	L2	19	0.0	0.065	6.0	LOS A	0.4	2.5	0.52	0.65	51.5
9	R2	44	0.0	0.065	10.8	LOS B	0.4	2.5	0.52	0.65	52.5
Approach		63	0.0	0.065	9.3	LOS A	0.4	2.5	0.52	0.65	52.2
West: Road P2/4											
10	L2	43	0.0	0.257	3.9	LOS A	1.8	12.6	0.12	0.40	55.0
11	T1	363	0.0	0.257	4.1	LOS A	1.8	12.6	0.12	0.40	56.3
Approach		406	0.0	0.257	4.1	LOS A	1.8	12.6	0.12	0.40	56.1
All Vehicles		857	0.0	0.267	4.6	LOS A	2.0	14.1	0.20	0.42	55.6

2023 PM Peak Hour Traffic plus Development Trips	2023 Sat Peak Hour Traffic plus Development Trips
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#### Level of Service Summary



#### Movement Summary

Movement Performance - Vehicles											
Mov ID	ODMov	Demand		Deg. Satn	Average Level of Delay Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%			Vehicles	Distance				
		veh/h	%	v/c	sec	veh	m	per veh	km/h		
East: Road P2/4											
5	T1	356	0.0	0.321	4.9	LOS A	2.5	17.4	0.43	0.50	54.5
6	R2	43	0.0	0.321	9.6	LOS A	2.5	17.4	0.43	0.50	54.4
Approach		399	0.0	0.321	5.4	LOS A	2.5	17.4	0.43	0.50	54.5
North: Access 1											
7	L2	56	0.0	0.205	6.8	LOS A	1.3	8.9	0.63	0.73	50.9
9	R2	129	0.0	0.205	11.7	LOS B	1.3	8.9	0.63	0.73	51.9
Approach		185	0.0	0.205	10.2	LOS B	1.3	8.9	0.63	0.73	51.6
West: Road P2/4											
10	L2	100	0.0	0.361	4.1	LOS A	3.0	21.0	0.24	0.41	54.5
11	T1	437	0.0	0.361	4.3	LOS A	3.0	21.0	0.24	0.41	55.7
Approach		537	0.0	0.361	4.2	LOS A	3.0	21.0	0.24	0.41	55.5
All Vehicles		1121	0.0	0.361	5.6	LOS A	3.0	21.0	0.37	0.49	54.5

Movement Performance - Vehicles											
Mov ID	ODMov	Demand		Deg. Satn	Average Level of Delay Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%			Vehicles	Distance				
		veh/h	%	v/c	sec	veh	m	per veh	km/h		
East: Road P2/4											
5	T1	398	0.0	0.285	4.3	LOS A	2.2	15.5	0.23	0.41	55.6
6	R2	18	0.0	0.285	8.9	LOS A	2.2	15.5	0.23	0.41	55.5
Approach		416	0.0	0.285	4.5	LOS A	2.2	15.5	0.23	0.41	55.6
North: Access 1											
7	L2	19	0.0	0.067	6.2	LOS A	0.4	2.6	0.54	0.66	51.3
9	R2	44	0.0	0.067	11.0	LOS B	0.4	2.6	0.54	0.66	52.4
Approach		63	0.0	0.067	9.5	LOS A	0.4	2.6	0.54	0.66	52.1
West: Road P2/4											
10	L2	42	0.0	0.274	3.9	LOS A	2.0	13.7	0.12	0.40	55.0
11	T1	392	0.0	0.274	4.1	LOS A	2.0	13.7	0.12	0.40	56.3
Approach		434	0.0	0.274	4.1	LOS A	2.0	13.7	0.12	0.40	56.1
All Vehicles		913	0.0	0.285	4.6	LOS A	2.2	15.5	0.20	0.42	55.6

### CONCLUSION

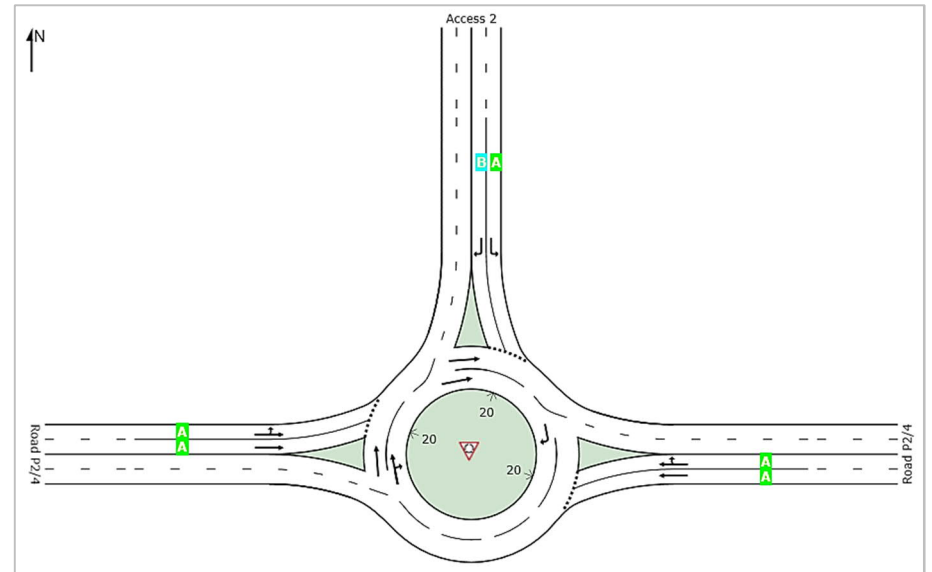
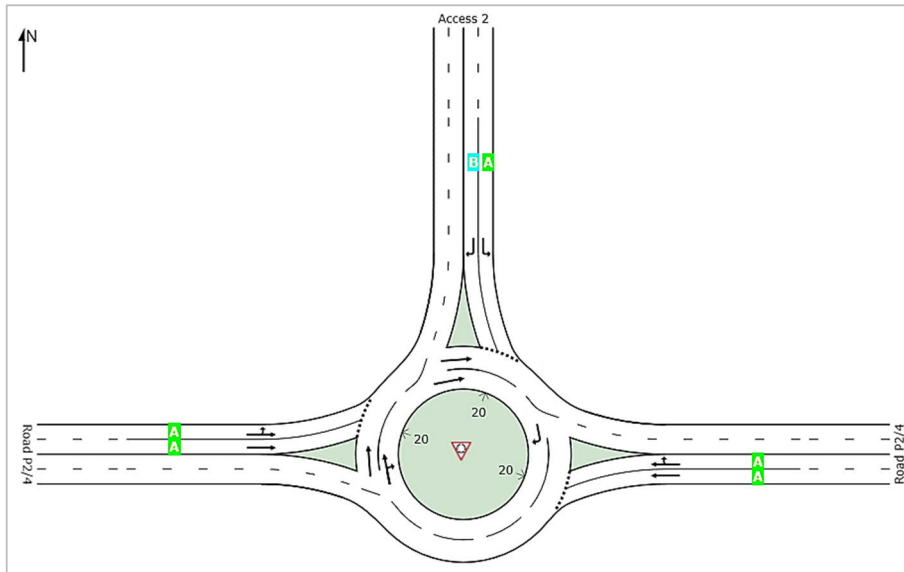
The access functions at a very good LOS in all the scenarios.

### 7.3.13 Development Access 2

Table 24: Capacity Analysis Results: Development Access 2

2018 PM Peak Hour Traffic plus Development Trips	2018 Sat Peak Hour Traffic plus Development Trips
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#### Level of Service Summary



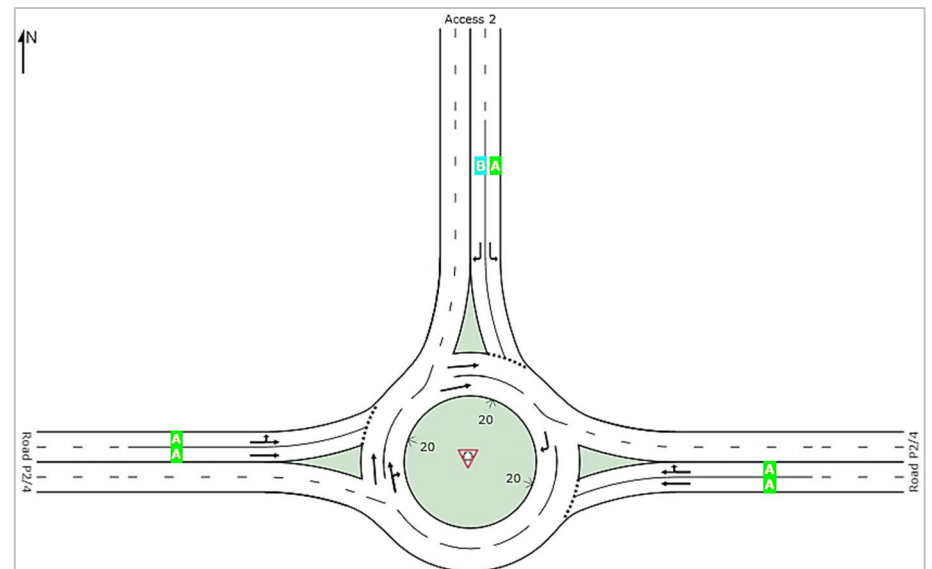
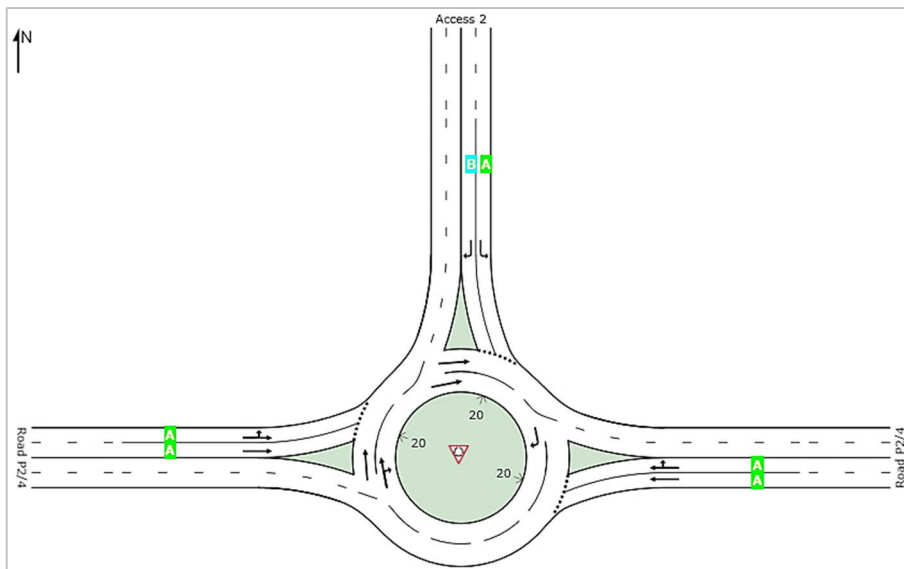
#### Movement Summary

Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %			Vehicles	Distance m			
East: Road P2/4										
5	T1	459	0.0	0.243	5.5	LOS A	1.5	10.3	0.50	54.2
6	R2	68	0.0	0.243	10.2	LOS B	1.5	10.2	0.50	53.8
Approach		527	0.0	0.243	6.1	LOS A	1.5	10.3	0.50	54.2
North: Access 2										
7	L2	67	0.0	0.114	7.8	LOS A	0.5	3.5	0.56	52.5
9	R2	269	0.0	0.261	10.7	LOS B	1.4	9.6	0.54	51.5
Approach		337	0.0	0.261	10.1	LOS B	1.4	9.6	0.54	51.7
West: Road P2/4										
10	L2	272	0.0	0.256	4.4	LOS A	1.6	11.4	0.25	54.5
11	T1	436	0.0	0.256	4.5	LOS A	1.6	11.4	0.25	55.7
Approach		707	0.0	0.256	4.4	LOS A	1.6	11.4	0.25	55.2
All Vehicles		1572	0.0	0.261	6.2	LOS A	1.6	11.4	0.40	54.1

Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %			Vehicles	Distance m			
East: Road P2/4										
5	T1	414	0.0	0.251	6.1	LOS A	1.5	10.7	0.56	53.8
6	R2	91	0.0	0.251	10.8	LOS B	1.5	10.5	0.57	53.2
Approach		504	0.0	0.251	6.9	LOS A	1.5	10.7	0.56	53.7
North: Access 2										
7	L2	89	0.0	0.134	6.7	LOS A	0.6	4.5	0.50	53.2
9	R2	360	0.0	0.319	10.3	LOS B	2.0	13.7	0.50	51.6
Approach		449	0.0	0.319	9.6	LOS A	2.0	13.7	0.50	51.9
West: Road P2/4										
10	L2	360	0.0	0.262	4.5	LOS A	1.7	11.8	0.29	54.4
11	T1	277	0.0	0.224	4.6	LOS A	1.4	9.6	0.29	55.5
Approach		637	0.0	0.262	4.5	LOS A	1.7	11.8	0.29	54.9
All Vehicles		1591	0.0	0.319	6.7	LOS A	2.0	13.7	0.44	53.6

2023 PM Peak Hour Traffic plus Development Trips	2023 Sat Peak Hour Traffic plus Development Trips
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#### Level of Service Summary



#### Movement Summary

Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %			Vehicles	Distance m			
East: Road P2/4										
5	T1	485	0.0	0.255	5.6	LOS A	1.6	11.0	0.50	54.2
6	R2	67	0.0	0.255	10.2	LOS B	1.5	10.8	0.50	53.8
Approach		553	0.0	0.255	6.1	LOS A	1.6	11.0	0.50	54.2
North: Access 2										
7	L2	67	0.0	0.117	8.0	LOS A	0.5	3.5	0.57	52.3
9	R2	269	0.0	0.267	10.8	LOS B	1.4	9.7	0.56	51.5
Approach		337	0.0	0.267	10.3	LOS B	1.4	9.7	0.56	51.6
West: Road P2/4										
10	L2	272	0.0	0.268	4.4	LOS A	1.7	12.1	0.25	54.5
11	T1	471	0.0	0.268	4.5	LOS A	1.7	12.1	0.25	55.7
Approach		742	0.0	0.268	4.4	LOS A	1.7	12.1	0.25	55.3
All Vehicles		1632	0.0	0.268	6.2	LOS A	1.7	12.1	0.40	54.1

Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %			Vehicles	Distance m			
East: Road P2/4										
5	T1	442	0.0	0.260	6.1	LOS A	1.6	11.3	0.57	53.9
6	R2	89	0.0	0.260	10.9	LOS B	1.6	11.0	0.57	53.4
Approach		532	0.0	0.260	6.9	LOS A	1.6	11.3	0.57	53.8
North: Access 2										
7	L2	89	0.0	0.132	6.8	LOS A	0.6	4.5	0.51	53.3
9	R2	360	0.0	0.318	10.5	LOS B	2.0	13.7	0.52	51.7
Approach		449	0.0	0.318	9.7	LOS A	2.0	13.7	0.52	52.0
West: Road P2/4										
10	L2	360	0.0	0.256	4.5	LOS A	1.7	11.6	0.29	54.5
11	T1	304	0.0	0.238	4.6	LOS A	1.5	10.4	0.29	55.6
Approach		664	0.0	0.256	4.6	LOS A	1.7	11.6	0.29	55.0
All Vehicles		1645	0.0	0.318	6.7	LOS A	2.0	13.7	0.44	53.8

### CONCLUSION

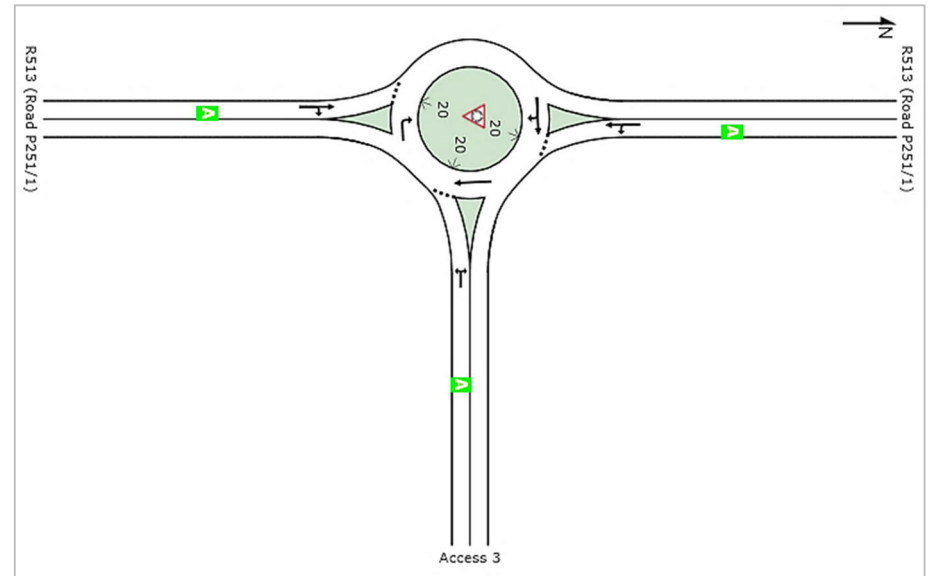
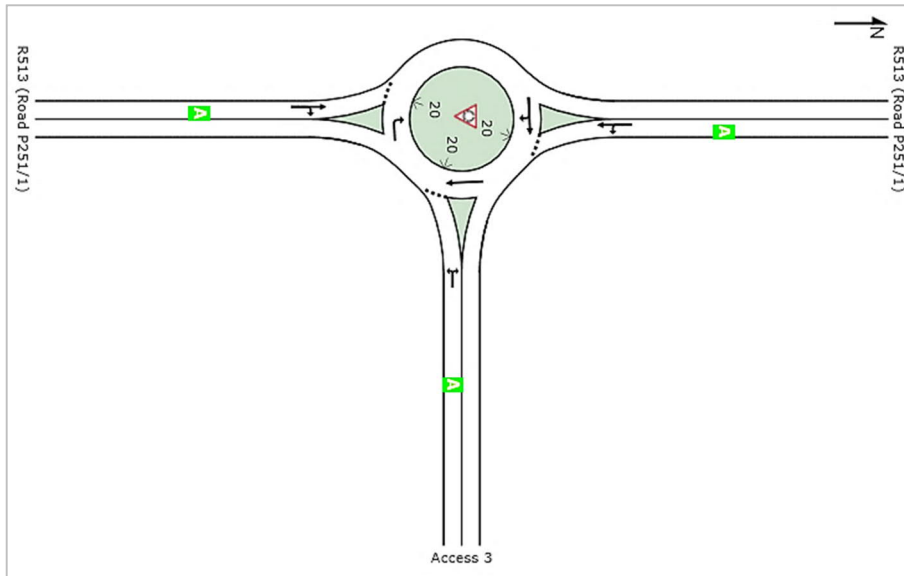
The access functions at a very good LOS in all the scenarios.

### 7.3.14 Development Access 3

Table 25: Capacity Analysis Results: Development Access 3

2018 PM Peak Hour Traffic plus Development Trips	2018 Sat Peak Hour Traffic plus Development Trips
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#### Level of Service Summary



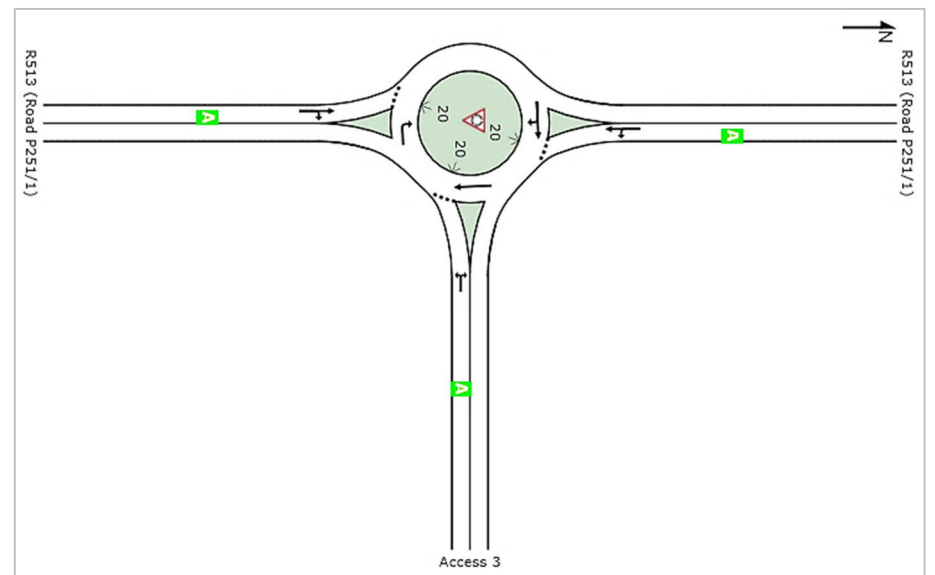
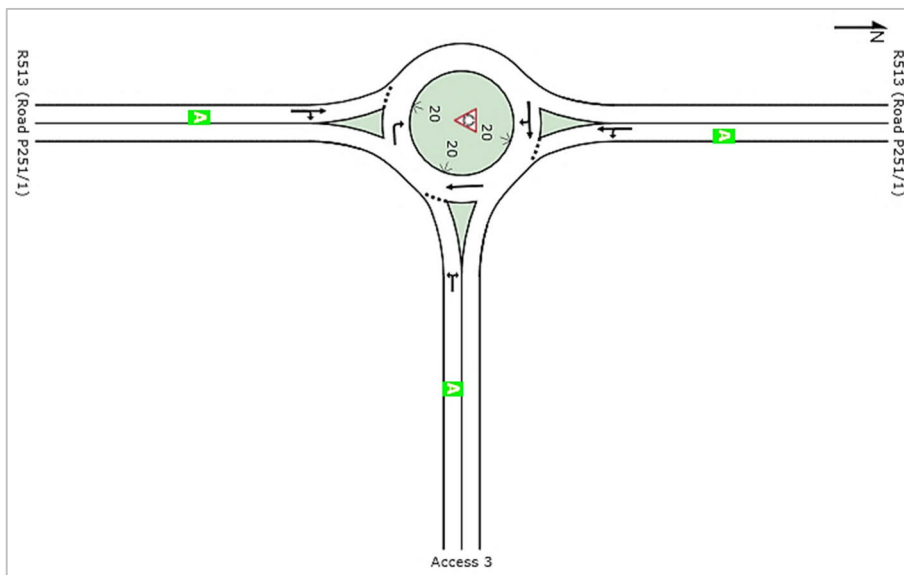
#### Movement Summary

Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue	Vehicles Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%							
South: R513 (Road P251/1)										
2	T1	662	0.0	0.613	5.3	LOS A	6.8	47.8	0.61	53.6
3	R2	128	0.0	0.613	10.0	LOS B	6.8	47.8	0.61	53.6
Approach		791	0.0	0.613	6.1	LOS A	6.8	47.8	0.61	53.6
East: Access 3										
4	L2	131	0.0	0.272	6.3	LOS A	1.8	12.8	0.62	51.9
6	R2	131	0.0	0.272	11.1	LOS B	1.8	12.8	0.62	53.0
Approach		261	0.0	0.272	8.7	LOS A	1.8	12.8	0.62	52.4
North: R513 (Road P251/1)										
7	L2	128	0.0	0.374	4.8	LOS A	3.1	21.4	0.45	53.6
8	T1	342	0.0	0.374	5.0	LOS A	3.1	21.4	0.45	54.9
Approach		471	0.0	0.374	4.9	LOS A	3.1	21.4	0.45	54.5
All Vehicles		1522	0.0	0.613	6.2	LOS A	6.8	47.8	0.56	53.7

Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue	Vehicles Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%							
South: R513 (Road P251/1)										
2	T1	564	0.0	0.596	5.6	LOS A	6.3	44.1	0.65	53.3
3	R2	164	0.0	0.596	10.4	LOS B	6.3	44.1	0.65	53.4
Approach		728	0.0	0.596	6.7	LOS A	6.3	44.1	0.65	53.3
East: Access 3										
4	L2	164	0.0	0.350	6.6	LOS A	2.5	17.6	0.67	51.6
6	R2	163	0.0	0.350	11.5	LOS B	2.5	17.6	0.67	52.7
Approach		327	0.0	0.350	9.0	LOS A	2.5	17.6	0.67	52.2
North: R513 (Road P251/1)										
7	L2	164	0.0	0.421	5.1	LOS A	3.6	25.2	0.53	53.4
8	T1	363	0.0	0.421	5.3	LOS A	3.6	25.2	0.53	54.6
Approach		527	0.0	0.421	5.2	LOS A	3.6	25.2	0.53	54.2
All Vehicles		1583	0.0	0.596	6.7	LOS A	6.3	44.1	0.62	53.4

2023 PM Peak Hour Traffic plus Development Trips	2023 Sat Peak Hour Traffic plus Development Trips
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#### Level of Service Summary



#### Movement Summary

Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue	Vehicles Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%							
South: R513 (Road P251/1)										
2	T1	701	0.0	0.641	5.4	LOS A	7.5	52.6	0.64	53.6
3	R2	127	0.0	0.641	10.1	LOS B	7.5	52.6	0.64	53.5
Approach		828	0.0	0.641	6.1	LOS A	7.5	52.6	0.64	53.5
East: Access 3										
4	L2	131	0.0	0.280	6.5	LOS A	1.9	13.2	0.64	51.7
6	R2	131	0.0	0.280	11.3	LOS B	1.9	13.2	0.64	52.8
Approach		261	0.0	0.280	8.9	LOS A	1.9	13.2	0.64	52.2
North: R513 (Road P251/1)										
7	L2	127	0.0	0.396	4.8	LOS A	3.3	23.4	0.46	53.6
8	T1	373	0.0	0.396	5.0	LOS A	3.3	23.4	0.46	54.8
Approach		500	0.0	0.396	4.9	LOS A	3.3	23.4	0.46	54.5
All Vehicles		1589	0.0	0.641	6.2	LOS A	7.5	52.6	0.58	53.6

Movement Performance - Vehicles										
Mov ID	ODMov	Demand Flows		Deg. Satn	Average Level of Delay Service	95% Back of Queue	Vehicles Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%							
South: R513 (Road P251/1)										
2	T1	598	0.0	0.622	5.7	LOS A	6.9	48.0	0.68	53.3
3	R2	163	0.0	0.622	10.3	LOS B	6.9	48.0	0.68	53.2
Approach		761	0.0	0.622	6.7	LOS A	6.9	48.0	0.68	53.2
East: Access 3										
4	L2	164	0.0	0.363	6.9	LOS A	2.6	18.4	0.71	51.4
6	R2	163	0.0	0.363	11.8	LOS B	2.6	18.4	0.71	52.5
Approach		327	0.0	0.363	9.3	LOS A	2.6	18.4	0.71	51.9
North: R513 (Road P251/1)										
7	L2	163	0.0	0.466	5.2	LOS A	4.2	29.3	0.56	53.2
8	T1	398	0.0	0.466	5.4	LOS A	4.2	29.3	0.56	54.4
Approach		561	0.0	0.466	5.3	LOS A	4.2	29.3	0.56	54.1
All Vehicles		1649	0.0	0.622	6.7	LOS A	6.9	48.0	0.64	53.3

### CONCLUSION

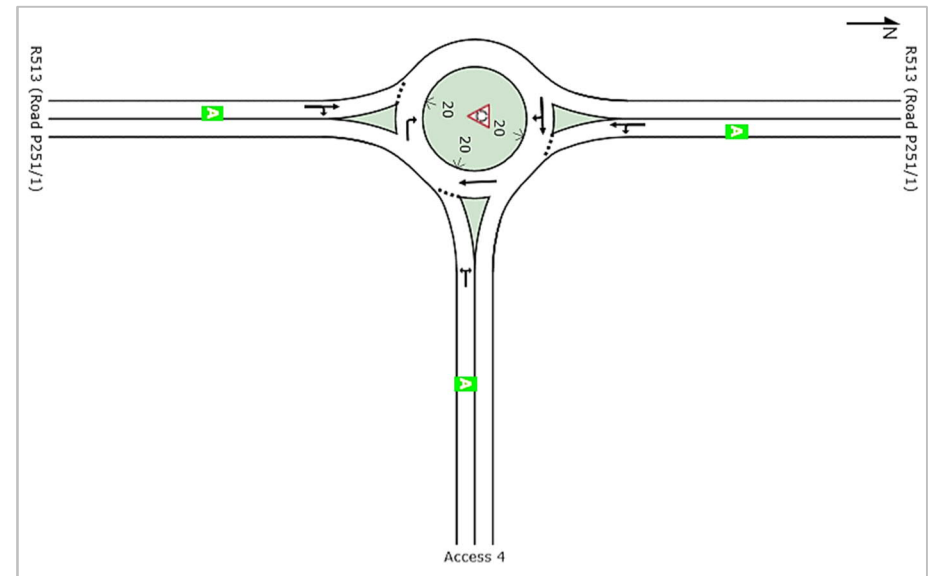
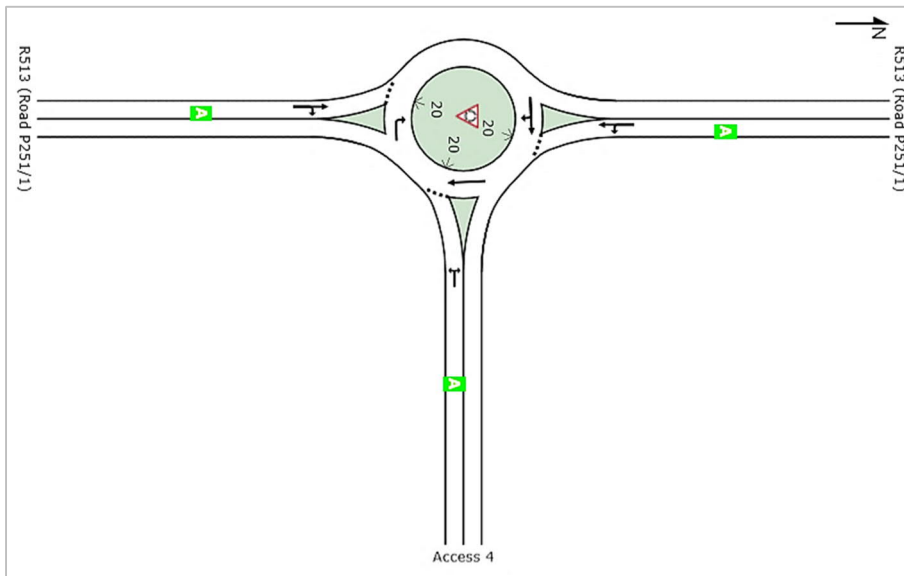
The access functions at a very good LOS in all the scenarios.

7.3.15 Development Access 4

Table 26: Capacity Analysis Results: Development Access 4

2018 PM Peak Hour Traffic plus Development Trips 2018 Sat Peak Hour Traffic plus Development Trips

Level of Service Summary



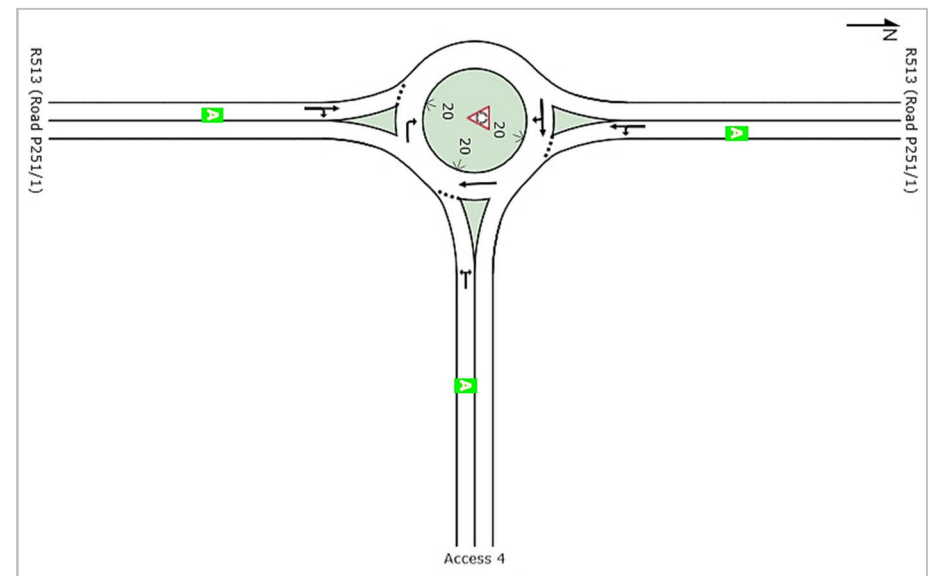
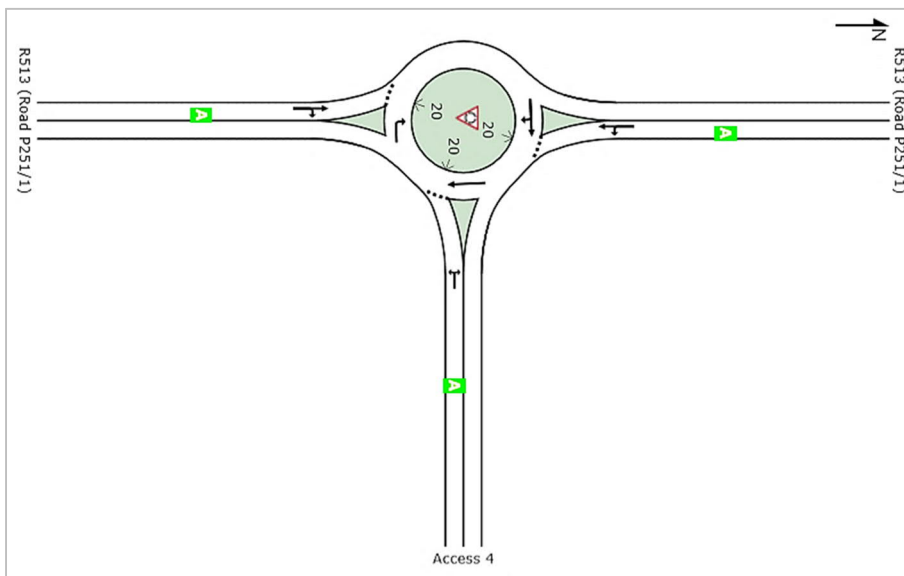
Movement Summary

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%	v/c	sec	veh	m		per veh	km/h	
South: R513 (Road P251/1)											
2	T1	793	0.0	0.541	4.2	LOS A	6.2	43.1	0.26	0.41	55.4
3	R2	59	0.0	0.541	8.9	LOS A	6.2	43.1	0.26	0.41	55.3
Approach		852	0.0	0.541	4.6	LOS A	6.2	43.1	0.26	0.41	55.4
East: Access 4											
4	L2	29	0.0	0.066	6.5	LOS A	0.4	2.6	0.59	0.66	51.7
6	R2	29	0.0	0.066	11.3	LOS B	0.4	2.6	0.59	0.66	52.8
Approach		59	0.0	0.066	8.9	LOS A	0.4	2.6	0.59	0.66	52.3
North: R513 (Road P251/1)											
7	L2	59	0.0	0.348	4.2	LOS A	2.7	18.7	0.27	0.42	54.3
8	T1	440	0.0	0.348	4.4	LOS A	2.7	18.7	0.27	0.42	55.6
Approach		499	0.0	0.348	4.4	LOS A	2.7	18.7	0.27	0.42	55.4
All Vehicles		1409	0.0	0.541	4.7	LOS A	6.2	43.1	0.28	0.42	55.3

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%	v/c	sec	veh	m		per veh	km/h	
South: R513 (Road P251/1)											
2	T1	728	0.0	0.476	4.2	LOS A	4.9	34.6	0.21	0.40	55.7
3	R2	25	0.0	0.476	8.8	LOS A	4.9	34.6	0.21	0.40	55.6
Approach		754	0.0	0.476	4.3	LOS A	4.9	34.6	0.21	0.40	55.7
East: Access 4											
4	L2	25	0.0	0.059	6.9	LOS A	0.3	2.3	0.61	0.67	51.4
6	R2	25	0.0	0.059	11.7	LOS B	0.3	2.3	0.61	0.67	52.5
Approach		51	0.0	0.059	9.3	LOS A	0.3	2.3	0.61	0.67	52.0
North: R513 (Road P251/1)											
7	L2	25	0.0	0.337	4.0	LOS A	2.6	18.1	0.16	0.39	54.8
8	T1	501	0.0	0.337	4.1	LOS A	2.6	18.1	0.16	0.39	56.1
Approach		526	0.0	0.337	4.1	LOS A	2.6	18.1	0.16	0.39	56.0
All Vehicles		1331	0.0	0.476	4.4	LOS A	4.9	34.6	0.21	0.41	55.7

2023 PM Peak Hour Traffic plus Development Trips 2023 Sat Peak Hour Traffic plus Development Trips

Level of Service Summary



Movement Summary

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%	v/c	sec	veh	m		per veh	km/h	
South: R513 (Road P251/1)											
2	T1	832	0.0	0.564	4.2	LOS A	6.7	47.0	0.27	0.40	55.4
3	R2	58	0.0	0.564	8.9	LOS A	6.7	47.0	0.27	0.40	55.3
Approach		889	0.0	0.564	4.6	LOS A	6.7	47.0	0.27	0.40	55.3
East: Access 4											
4	L2	29	0.0	0.068	6.7	LOS A	0.4	2.7	0.60	0.67	51.6
6	R2	29	0.0	0.068	11.5	LOS B	0.4	2.7	0.60	0.67	52.6
Approach		59	0.0	0.068	9.1	LOS A	0.4	2.7	0.60	0.67	52.1
North: R513 (Road P251/1)											
7	L2	58	0.0	0.367	4.2	LOS A	2.9	20.3	0.27	0.42	54.3
8	T1	471	0.0	0.367	4.4	LOS A	2.9	20.3	0.27	0.42	55.6
Approach		528	0.0	0.367	4.4	LOS A	2.9	20.3	0.27	0.42	55.4
All Vehicles		1477	0.0	0.564	4.7	LOS A	6.7	47.0	0.28	0.42	55.2

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		Total HV	%	v/c	sec	veh	m		per veh	km/h	
South: R513 (Road P251/1)											
2	T1	761	0.0	0.495	4.2	LOS A	5.3	37.2	0.22	0.40	55.7
3	R2	24	0.0	0.495	8.8	LOS A	5.3	37.2	0.22	0.40	55.6
Approach		785	0.0	0.495	4.3	LOS A	5.3	37.2	0.22	0.40	55.7
East: Access 4											
4	L2	25	0.0	0.060	7.2	LOS A	0.3	2.4	0.63	0.68	51.2
6	R2	25	0.0	0.060	12.0	LOS B	0.3	2.4	0.63	0.68	52.3
Approach		51	0.0	0.060	9.6	LOS A	0.3	2.4	0.63	0.68	51.8
North: R513 (Road P251/1)											
7	L2	24	0.0	0.357	4.0	LOS A	2.8	19.7	0.16	0.39	54.8
8	T1	537	0.0	0.357	4.1	LOS A	2.8	19.7	0.16	0.39	56.1
Approach		561	0.0	0.357	4.1	LOS A	2.8	19.7	0.16	0.39	56.0
All Vehicles		1397	0.0	0.495	4.4	LOS A	5.3	37.2	0.21	0.40	55.7

CONCLUSION

The access functions at a very good LOS in all the scenarios.

## 7.4 Capacity Analysis Conclusion

The following road upgrades are required to be implemented by the developer:

- Conversion of *Intersection 1* to a roundabout;
- Implementation of roundabouts as intersection control measures at all four development accesses;
- It is proposed that the implementation of a staged crossing for the side road traffic to enter the free-flow traffic stream be evaluated at *Intersection 10*. This can seemingly be achieved by amending road markings on the R511.

The following road upgrades are required to be implemented by the relevant road authorities:

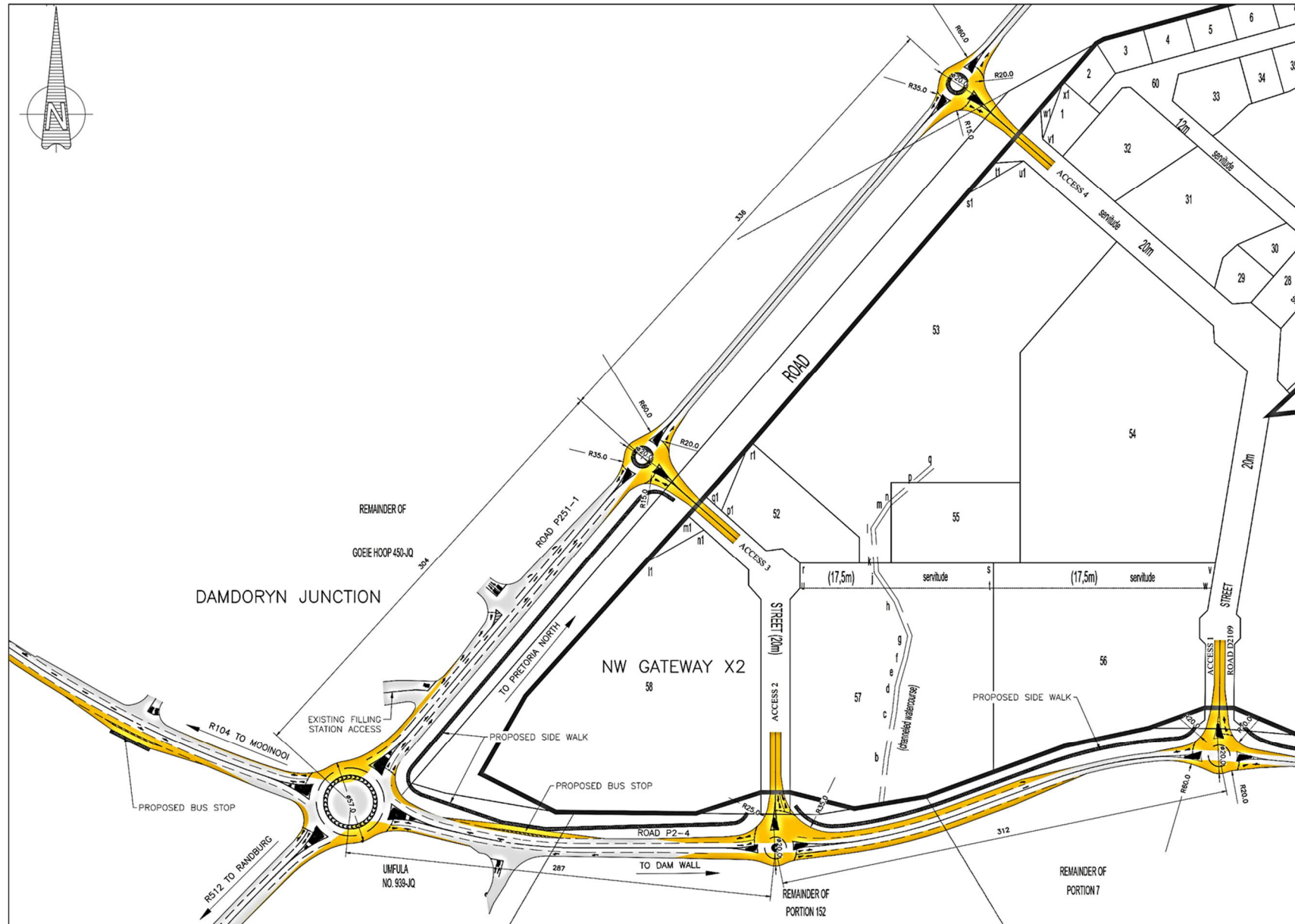
- The conversion of *Intersection 5* to a mini-circle;
- The implementation of a traffic signal with the necessary additional turning lanes at *Intersection 7*;
- It is proposed that the implementation of a staged crossing for the side road traffic to enter the free-flow traffic stream be evaluated at *Intersection 8*.

The conclusion on the impact of the development traffic on the dam wall is as follows:

- The increase in average delay experienced for all vehicles in the base – and future year scenarios, due to the addition of the development traffic is deemed acceptable and should not have a detrimental effect on the dam wall per se.

The proposed road upgrades surrounding the development, is indicated on an extract from the conceptual design in **Figure 22**. The complete conceptual design plan for the upgrades surrounding the development is attached in **Annexure E**.

Figure 22: Conceptual Design of Road Upgrades Surrounding the Development





## 8 Non-motorised - and Public Transport

In terms of the National Land Transport Transition Act (NLTTA) 22 of 2000, section 29, it is a requirement that an assessment of the public transport be included in a TIA.

### 8.1 Existing Public Transport Services and Facilities

The traffic surveys conducted were classified and thus minibus taxis and buses were surveyed as well. **Table 27** indicates the percentage public transport from the total intersection traffic that was surveyed for the PM – and Sat peak hour respectively at *Intersection 1*.

**Table 27: Public Transport Composition at Intersection 1**

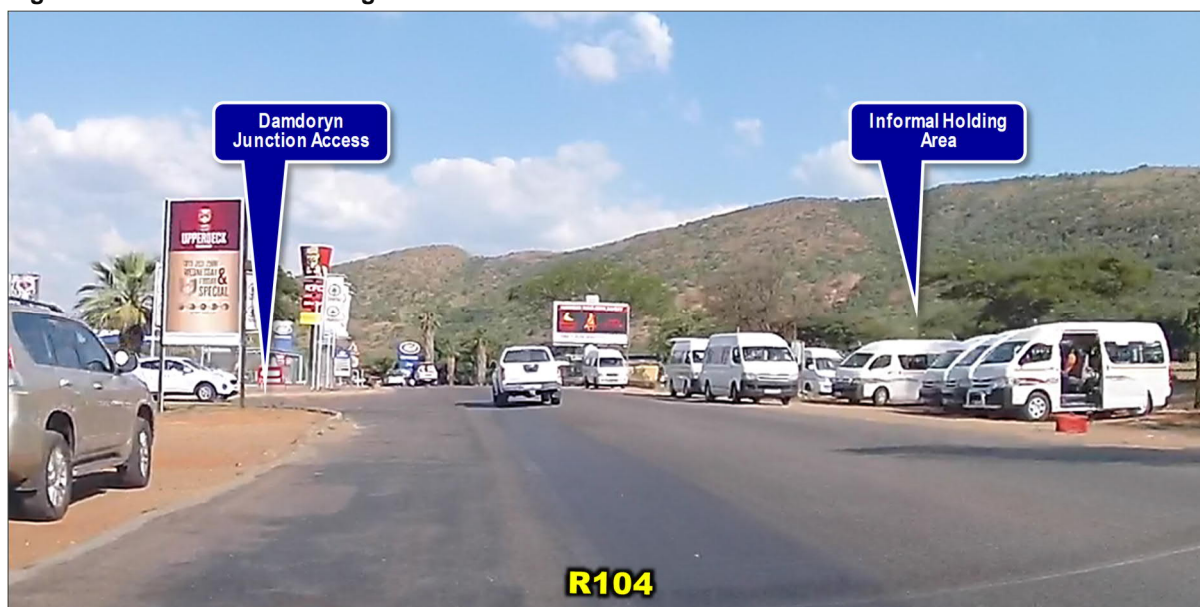
Transport Mode	PM Peak Hour	Sat. Peak Hour
Minibus-Taxis	8%	3%
Buses	1%	<1%

The main public transport traffic direction at the intersection is from the R512 (southern approach) turning left into the R104 (western approach) and vice versa.

The area surrounding the development has no formal public transport facilities of any kind. There is an existing informal holding area for minibus-taxis across the access to Damdoryn Junction on the R104, west of *Intersection 1* as indicated in **Figure 21**.

Significant pedestrians as well as cyclists were observed during the site visit on the roads surrounding the development, but no non-motorised transport (NMT) facilities exist.

**Figure 23: Informal Taxi Holding Area**



### 8.2 Public Transport Conclusion

The area surrounding the development has no formal public transport facilities of any kind. It is recommended that the necessary road authorities investigate this as a matter of priority.

It is proposed that the development provide a formal walkway along the most part of the development boundaries with Road P2/4 and the R513 (Road P251-1). Furthermore, that a bus/taxi bay is provided in front of the shopping centre downstream from *Intersection 1* along Road P2/4. These upgrades are indicated in **Figure 22**.

## 9 Conclusions and Recommendations

Based on the TIS report, the key conclusions are summarised as follows:

- The new proposed township on the development site is known as NW Gateway Extension 2;
- There are existing approved land use rights on the development site, which were never implemented. The newly proposed land use rights of the development will replace the existing approved rights on the site and consist of a mixed land use township;
- The proposed land use rights to make up the new development is detailed in **Table 2**, whilst the associated proposed township layout is indicated in **Figure 3**;
- No information could be obtained on latent rights that needed to be considered for this study;
- There is no specific phasing for the implementation of the total development, except that the proposed Hospital on Erf 59 will be constructed first. Otherwise, for the purpose of this TIS, it was assumed that the development as a whole will be implemented within five years from final approval;
- Classified traffic surveys were conducted on Friday 23 November 2018 and the following Saturday 24 November 2018 for the Friday PM peak period (from 15:00 to 18:00) and Saturday peak period (from 10:00 to 14:00) at ten locations (refer to **Figure 1**) which is discussed in detail in **Chapter 5**;
- The capacity analysis (refer to **Chapter 7**) was conducted for the base year (2018) and a five-year horizon/ future year (2023) scenario;
- National Road Network Planning
  - The N4 runs in an east-west direction approximately 5km north of the development site and outside the study area for the TIS. However, the construction of the PWV 3 link between the R560 (K14 or P123/1) that links up with the N4, as indicated in **Figure 1** and **Figure 6**, is under construction;
  - It was assumed that the link will be complete within the next five years. However, since no estimations could be obtained regarding the traffic once the link is completed, it could not be considered for the future year capacity analysis. The road is currently closed at the position at the southern start of the link (which was surveyed and analysed as *Intersection 4* in the report). The traffic counts (discussed in detail in **Chapter 5**) at intersections 1, 2, 3 and 4 confirms that the current detour route is as indicated in **Figure 5**;
  - Once the PWV 3 link is completed with the two associated interchanges, the through traffic along this route will probably reduce. However, the development will also attract some of this traffic due to the various land uses it will incorporate and therefore the future year capacity analysis was conducted with a normal growth in the background traffic (refer to **Chapter 6**);
- Provincial Road Network Planning
  - The NWDPWT were contacted to discuss the development and it was indicated that roundabouts will be preferred as intersection control measures at the access positions to the development site. Unfortunately, the basic planning of the provincial roads, especially the planning for the closest intersection of the R104/ R513 (Road P251-1), could not be obtained to be considered for the TIS.
- Development Access
  - Four accesses are proposed to the development site of which all are T-junctions with roundabouts as intersection control measures. The access positions are indicated in **Figure 9** and detail on the proposed configuration can be seen on the conceptual design of the road upgrades surrounding the development in **Figure 22**.
  - The required access and intersection spacing according to the RCAM document is detailed in **Table 3**. The following conclusion can be made regarding the spacing of the proposed access positions:
    - The spacing along Road P2/4 between *Intersection 1* and *Access 2* as well as between *Access 1* and *Access 2* are both more than 240m and thus meets the minimum spacing requirement.
    - The spacing along the R513 (Road 251-1) between *Intersection 1* and *Access 3* is 304m and falls 36m short of the minimum spacing requirement. The spacing between *Access 3*

- and Access 4 is 336m and falls 4m short of the minimum spacing requirement of 340m which is deemed insignificant.
- The location of Access 3 was determined in making optimum use of the feasible land which can be developed on the western side of the Green Zone (watercourse) that traverse the development site. Furthermore, it is situated approximately 144m from the access on the opposite side of the road to Damdoryn Junction which is more than adequately outside the influence area of that access. And lastly, since roundabouts are proposed as access controls at all the accesses as well as at *Intersection 1*, it will also serve as a traffic calming measure to a certain extent. Given these facts, the spacing of Access 1 is deemed sufficient from *Intersection 1*.
  - None of the accesses meet the requirement in any direction for left – or right-turn GASD for a WB-20 truck (refer to **Paragraph 4.3**).
    - The fact that there are GASDs that is not met for right- or left-turning vehicle types, is not considered to be critical. This is due to the fact that the proposed configuration for all the development accesses, as well as the road upgrade for *Intersection 1*, are roundabouts (refer to **Chapter 7**).
    - The proximity of the roundabouts to each other and the associated entry speed of traffic approaching these roundabouts will be significantly lower than the design - and current operating speed on the two roads. The roundabouts will in effect also serve as traffic calming measures and improve traffic safety.
- The total new trips generated by the proposed development are 837 during the AM -, 1631 during the PM – and 1687 during the Saturday peak hours respectively. The PM – and Saturday peak hour generates almost double the number of trips than the AM peak hour, therefore the PM – and Saturday peak hours were selected to conduct the capacity analysis. Refer to **Chapter 6** for the detailed trip generation, - distribution and – assignment.
- The capacity analysis was conducted with SIDRA 6.0 software for the base year (2018) and future year (2023) scenario. The following fifteen intersections were analysed for the PM – and Sat peak hour respectively:
- Intersection 1: R104/ R513 (Road P251-1);
  - Intersection 2: R104/ R512 (Development Access);
  - Intersection 3: R512/ Simon Bekker St;
  - Intersection 4: R512/ R560;
  - Intersection 5: Scott St/ Harrington St;
  - Intersection 6: Scott St (Tielman St)/ Road P2/4;
  - Intersection 7: Tielmann St (Beethoven St)/ R511 (Bach St);
  - Intersection 8: R511/ Road P2/4;
  - Intersection 9: R511/ R514;
  - Intersection 10: R511/ Road P251-1;
  - The Hartbeespoort Dam Wall;
  - Development Access 1;
  - Development Access 2;
  - Development Access 3; and
  - Development Access 4.
- Capacity Analysis Conclusions
- The following road upgrades are required to be implemented by the developer:
    - Conversion of *Intersection 1* to a roundabout;
    - Implementation of roundabouts as intersection control measures at all four development accesses;
    - It is proposed that the implementation of a staged crossing for the side road traffic to enter the free-flow traffic stream be evaluated at *Intersection 10*. This can seemingly be achieved by amending road markings on the R511.
  - The following road upgrades are required to be implemented by the relevant road authorities:
    - The conversion of *Intersection 5* to a mini-circle;

- The implementation of a traffic signal with the necessary additional turning lanes at *Intersection 7*;
  - It is proposed that the implementation of a staged crossing for the side road traffic to enter the free-flow traffic stream be evaluated at *Intersection 8*.
  - The conclusion on the impact of the development traffic on the dam wall is as follows:
    - The increase in average delay experienced for all vehicles in the base – and future year scenarios, due to the addition of the development traffic is deemed acceptable and should not have a detrimental effect on the dam wall per se.
- The proposed road upgrades surrounding the development, is indicated on an extract from the conceptual design in **Figure 22**. The complete conceptual design plan for the upgrades surrounding the development is attached in **Annexure E**.
- Public Transport Conclusion
- The area surrounding the development has no formal public transport facilities of any kind. It is recommended that the necessary road authorities investigate this as a matter of priority.
  - It is proposed that the development provide a formal walkway along the most part of the development boundaries with Road P2/4 and the R513 (Road P251-1). Furthermore, that a bus/taxi bay is provided in front of the shopping centre (Erf 58) downstream from *Intersection 1* along Road P2/4. These upgrades are indicated in **Figure 22**.

Based on the findings of this TIS and the summarised conclusions discussed above, it is recommended that the mixed-land use township known as *NW Gateway Extension 2* be supported from a traffic engineering point of view on condition that the following road upgrades, with all the necessary road widenings as indicated in in the conceptual design in **Figure 22** and **Annexure E**, be implemented:

- Conversion of *Intersection 1* to a roundabout;
- Implementation of roundabouts as intersection control measures at all four development accesses;
- That the implementation of a staged crossing for the side road traffic to enter the free-flow traffic stream be evaluated at *Intersection 10*. This can seemingly be achieved by amending road markings on the R511;
- That a formal walkway be provided along the most part of the development boundaries with Road P2/4 and the R513 (Road P251-1); and
- That a bus/taxi bay be provided in front of the shopping centre (Erf 58) downstream from *Intersection 1* along Road P2/4.

## 10 References

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1. TMH 16 Volume 1 and 2, South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual, Version 1.0, Committee of Transport Officials (COTO), August 2012.
2. TMH 17 Volume 1, South African Trip Data Manual, Version 1.0, COTO, September 2012.
3. TRH 26 South African Road Classification and Access Management Manual, Version 1.0, COTO, August 2012
4. Google Maps, Google Earth and Street View
5. CoT Corporate GIS Online Maps, <[https://e-gis002.tshwane.gov.za/E\\_GIS\\_Web/](https://e-gis002.tshwane.gov.za/E_GIS_Web/)> including Tshwane 2018 Aerial Photos
6. North West Province Road Management System for the Local Municipality of Madibeng, SMEC South Africa, March 2014
7. Gauteng Strategic Major Road Network, GDRT, TTT Africa & Khuthele & Vela VKE, May 2010
8. Hartbeespoort Area Precinct Plan, 2014, Department of Rural Development and Land Reform and Madibeng Local Municipality
9. Madibeng Local Municipality 5 Year IDP (2017 – 2021)
10. Proposed NW Gateway X 2 Township Layout Plan, Lombard Land Surveyors and Town Planners, Plan No. LDP/NW GATEWAY X 2\_5, December 2018
11. Site Plan, Proposed new Northwest Gateway Development in Hartbeesfontein, Drawing No. 877/001, Art-tech, 15/11/2018
12. Southern African Development Community Road Traffic Signs Manual, Volume 2, May 2012
13. Conceptual Road Upgrades Surrounding Development, CIVILCONSULT Consulting Engineers, Drawing No. 2581-470-01-00, January 2019

# Annexure A: Township Layout Plan

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**NOTES:**  
 All dimensions and areas are approximate and subject to final survey.  
**CONTOURS:**  
 The contours on this layout is in accordance with the requirements of the Madibeng SPLUMA Bylaw, 2016 (Checklist for layout plans).  
**FLOODLINE:**  
 It is hereby certified that in terms of the provisions of section 144 of the National Water Act (36/1998), the 1:50 and 1:100 year flood lines, are correctly indicated on the plan.

Engineer ..... Date .....

# PROPOSED NW GATEWAY X 2

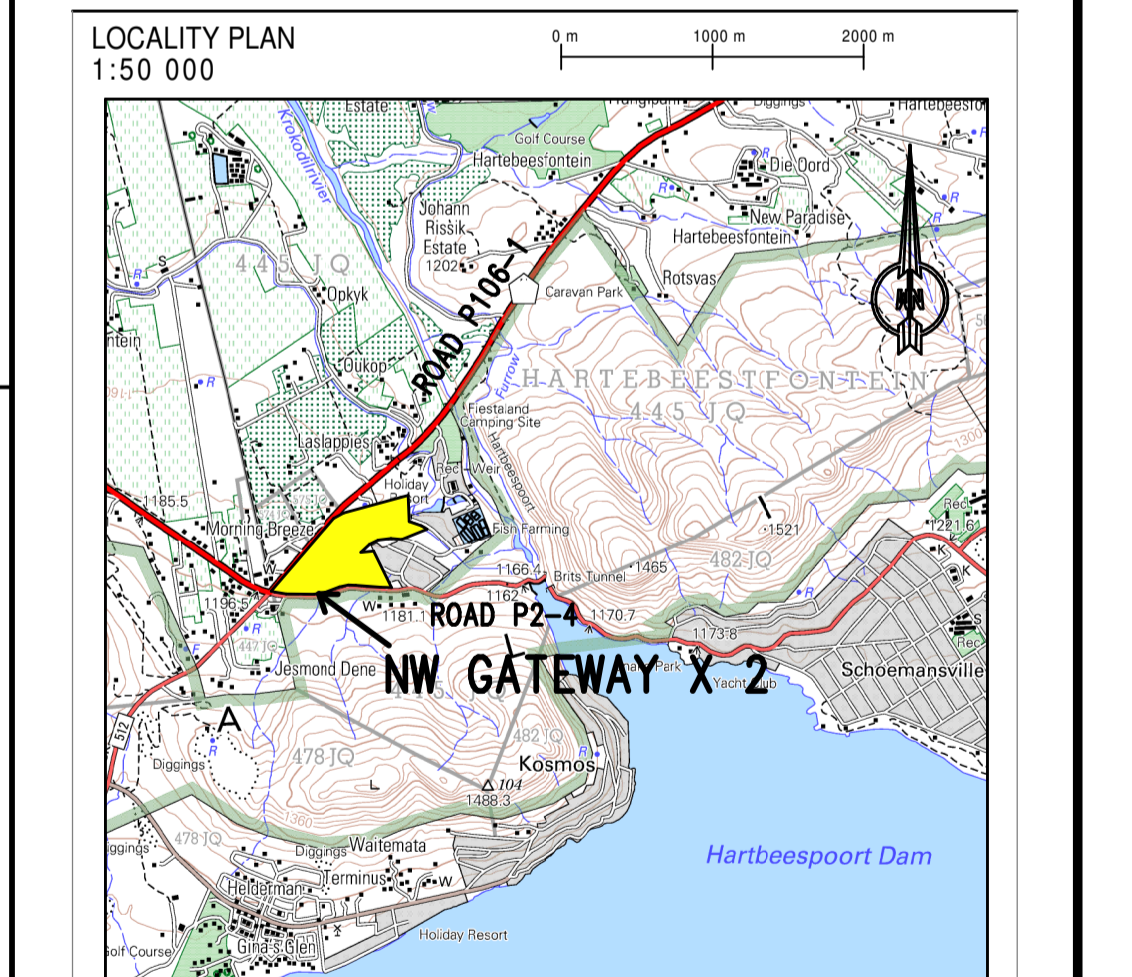
Situated on the Remainder of Portion 151 and Portions 233, 234, 235, 236 and 237 of the farm HARTEBEESTFONTEIN No. 445-JQ

SCALE 1:2 500  
 PLAN NO. LDP/NW GATEWAY X 2\_5 DATE: DECEMBER 2018

TOWNSHIP DATA	
Total Township area	31,4638 ha
Total number of erven	62
Private road/internal street length	2,128 km
Private road/internal street area	4,92 ha
Private road/street area % of town	15,6 %
Maximum road gradient	17 %
Minimum road gradient	4,6 %
Open space % of township	10,2 %
Contour datum level	Mean sea level
Contour information obtained from	LOMBARD DU PREEZ

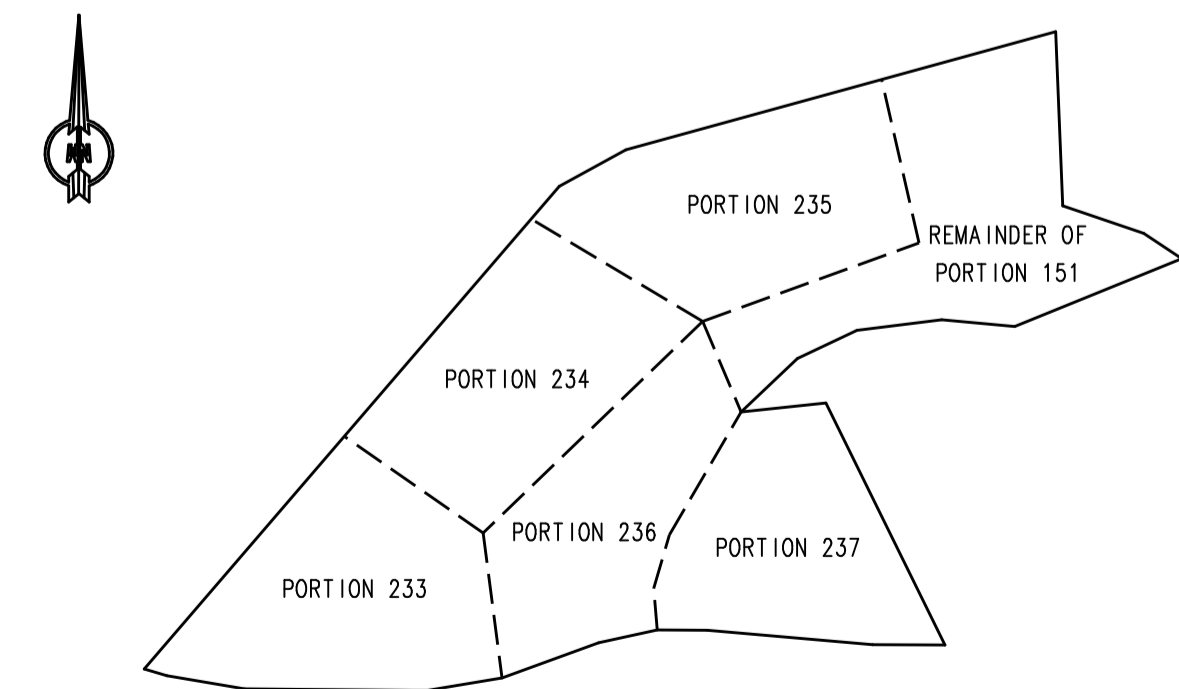
LAND USE TABLE					
PROPOSED USE	AMOUNT	ERF NO.	AREA	AVERAGE	%
Residential 1	36	1-17,22,24, 34-42, 44-51	2,91 ha	809 m	9,2
Special for hotel, boutique hotel, dwelling houses, dwelling units, block or blocks of flats	7	20,21,25-27, 32,33	3,16 ha	4515 m	10,0
Special for private open space	3	18,31,43	3,20 ha	1,07 ha	10,2
Special for sewerage system	1	19	883 m	883 m	0,3
Special for cemetery (for existing graves only)	1	23	370 m	370 m	0,1
Special for welcome centre	1	29	1007 m	1007 m	0,3
Special for parking and storage	1	30	853 m	853 m	0,3
Special for boutique hotel, spa, guest house & restaurant	1	52	4521 m	4521 m	1,4
Special for retirement resort	2	53,54	5,80 ha	2,90 ha	18,4
Special for social hall, chapel, recreational facilities & wall of remembrance	1	55	4970 m	4970 m	1,6
Special for Institution	1	56	1,82 ha	1,82 ha	5,8
Special for Hotel restaurant, laundrettes, staff accommodation and storage	1	57	2,29 ha	2,29 ha	7,3
Special for shops, places of amusement, places of refreshment, offices	1	58	2,62 ha	2,62 ha	8,3
Special for Hospital, places of refreshment shops, offices, staff accommodation and pharmacy	1	59	3,50 ha	3,50 ha	11,1
Special for private road and access control	4	28,60,61,62	1,52 ha	3800 m	4,8
Road/Street	-	-	3,40 ha	-	10,8
<b>TOTAL</b>	<b>62</b>	<b>1 - 62</b>	<b>31,46 ha</b>		<b>100</b>

LOCAL AUTHORITY: MADIBENG LOCAL MUNICIPALITY

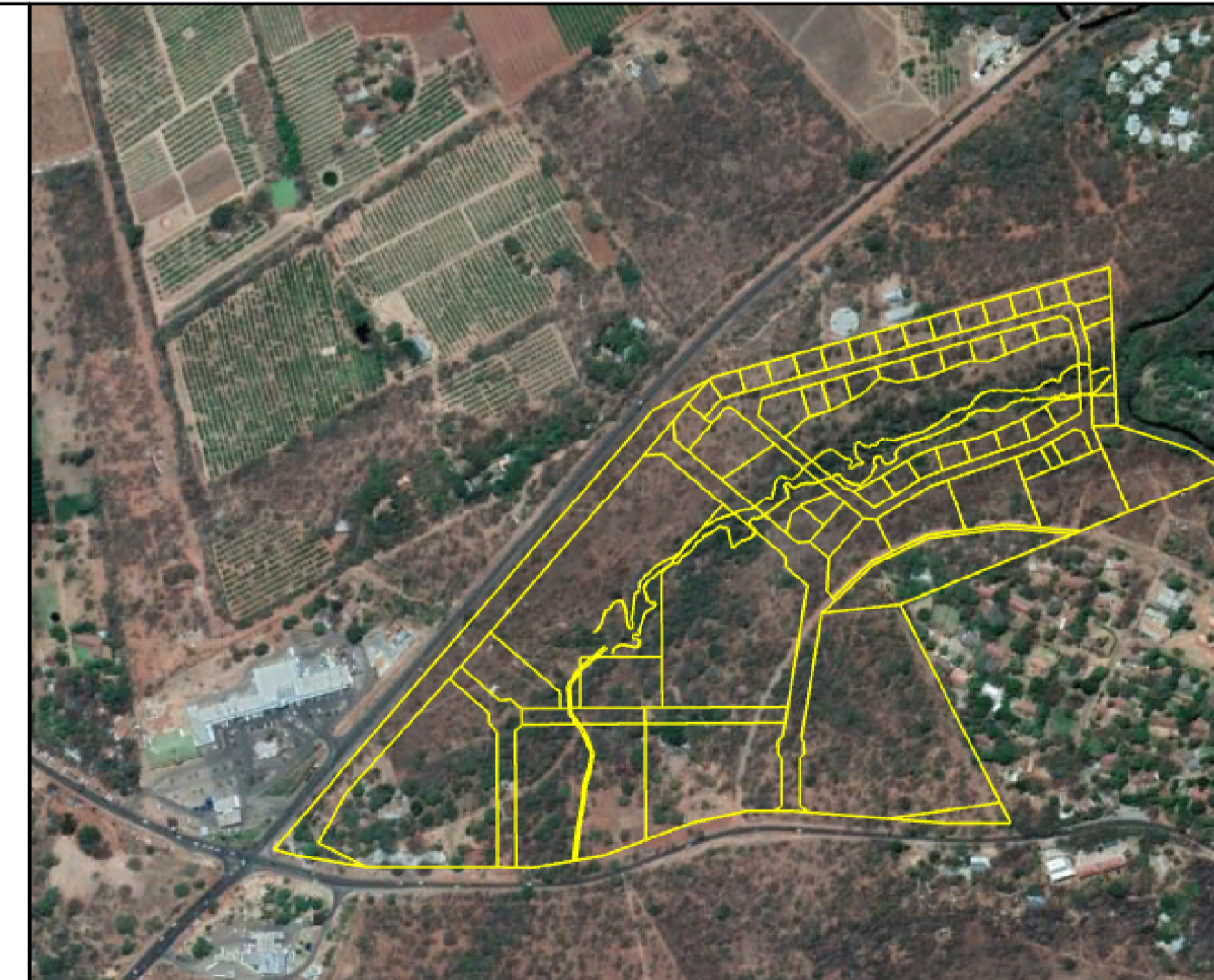
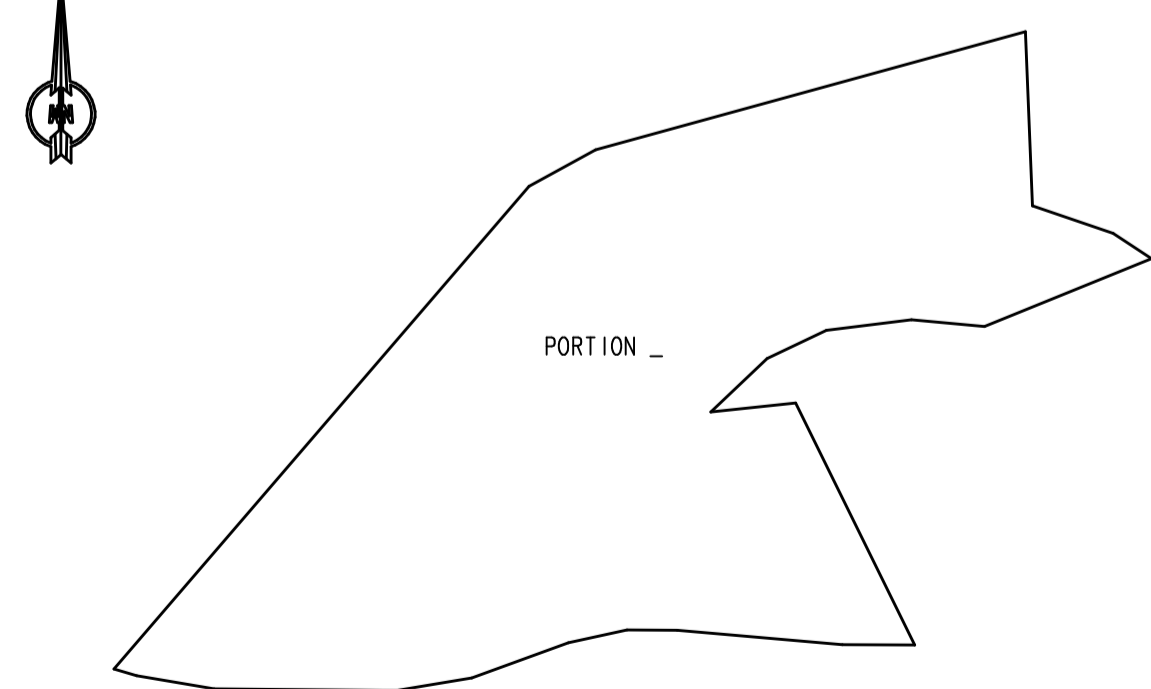


**LOMBARD LAND SURVEYORS & TOWN PLANNERS**  
**LDU PREEZ**  
 Tel: 012 252 5959 Box 798, Brits, 0250  
 Fax: 086 653 3445 76 Van Velden Str.  
 SINCE 1979  
 GPS: S 25 38 14.2 E 27 46 33.0  
 www.landsurvey.co.za

COMPILATION OF PORTIONS INCLUDED IN TOWNSHIP SCALE 1:7 500



PORTIONS TO BE CONSOLIDATED SCALE 1:7 500



**SERVITUDES:**

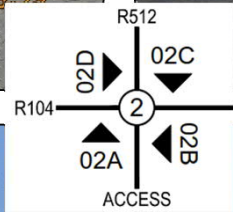
- The line a b c d e f g h j k represents the western boundary of a servitude for stormwater drainage 3,00 metres wide and affects Erf 57.
- The lines k l m n and p q represents the western boundary of a servitude for stormwater drainage 3,00 metres wide and affects Erf 53.
- The line n p represents the western boundary of a servitude for stormwater drainage 3,00 metres wide and affects Erf 55.
- The figure r s t u r represents a servitude of right of way and access control and affects Erf 57.
- The figure s v w t s represents a servitude of right of way and access control and affects Erf 56.
- The whole of erven 28 and 60 are subject to a servitude for engineering services.
- The whole of erven 28, 60 and 61 are subject to a servitude of right of way.
- The figure x y z R x represents a servitude of right of way and affects Erf 58.
- The figure a1 b1 c1 d1 a1 represents a servitude of right of way and affects Erf 59.
- The figures e1 f1 g1 e1 and l1 m1 n1 l1 represents servitudes of right of way and affects Erf 58.
- The figure h1 j1 k1 h1 represents a servitude of right of way and affects Erf 57.
- The figure p1 q1 r1 p1 represents a servitude of right of way and affects Erf 52.
- The figure s1 t1 u1 s1 represents a servitude of right of way and affects Erf 53.
- The figure v1 w1 s1 v1 represents a servitude of right of way and affects Erf 1.

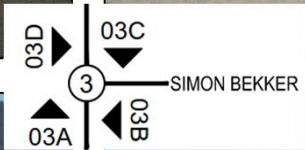
Annexure B:  
Traffic survey site photos

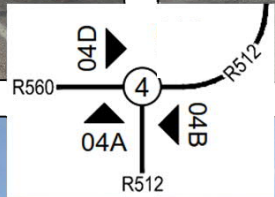
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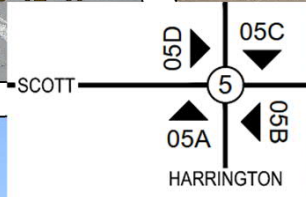






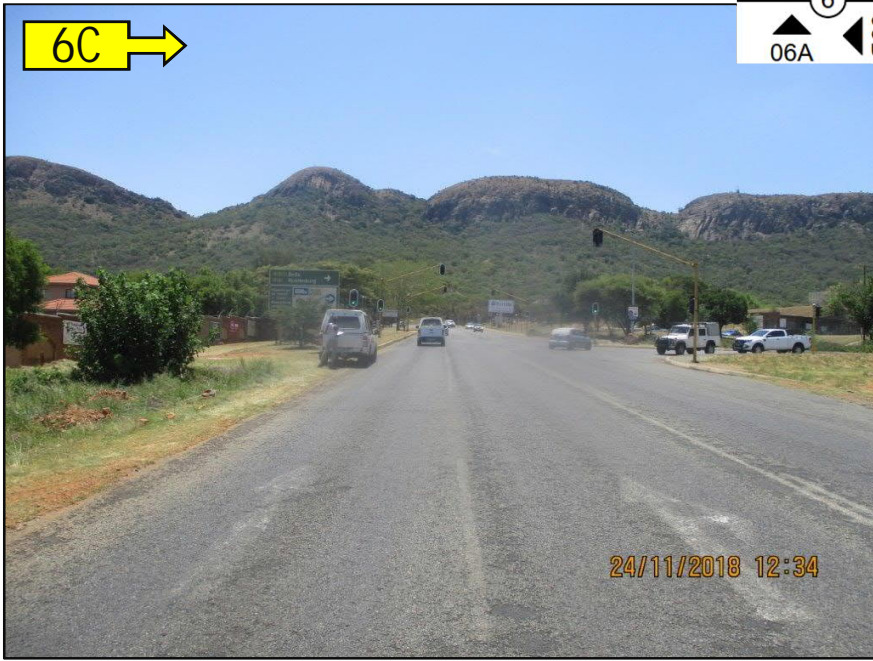
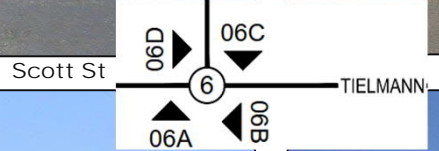


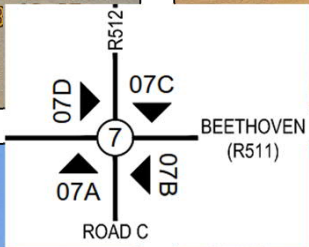


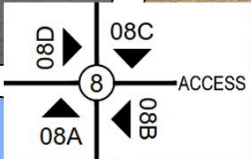




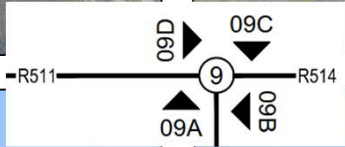
Road P2/4

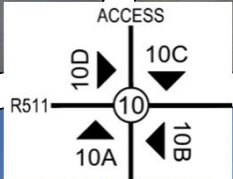












## Annexure C: Traffic survey data

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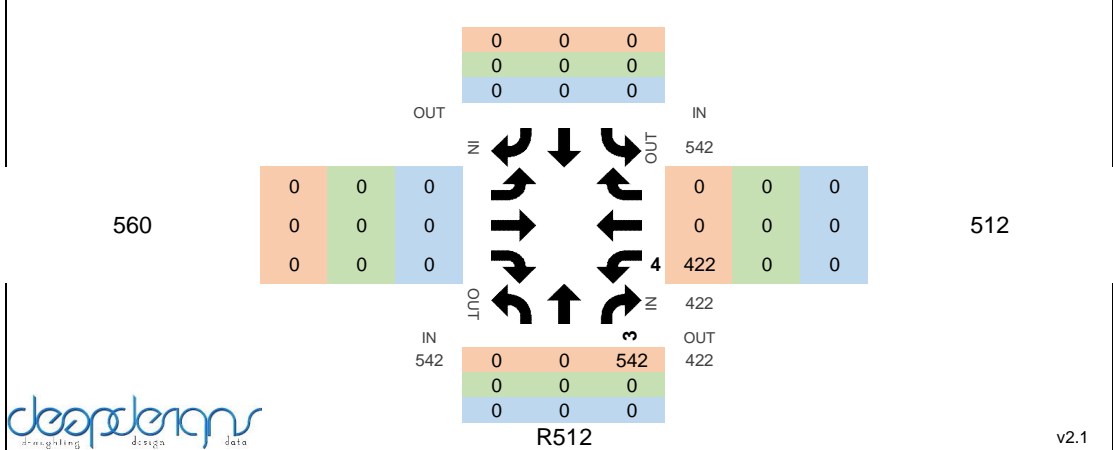






# HARTEBESPOORT - TRAFFIC SURVEYS

LOCATION	4 R560 AND R512	24/11/2018
4 HOUR COUNT	TOTAL VEHICLES	SATURDAY



Time	South		East		North		West		Hourly
	3	4							
<b>SAT PEAK</b>	<b>542</b>	<b>422</b>							<b>964</b>
<b>TOTAL</b>	<b>1950</b>	<b>1531</b>							<b>3481</b>
10:00	120	59							
10:15	125	65							
10:30	125	78							
10:45	123	88							
11:00	127	101							
11:15	143	104							
11:30	126	107							
11:45	141	108							
12:00	132	103							
12:15	121	105							
12:30	98	102							
12:45	114	105							
13:00	121	118							
13:15	121	97							
13:30	99	93							
13:45	114	98							
14:00									
14:15									
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v2.1

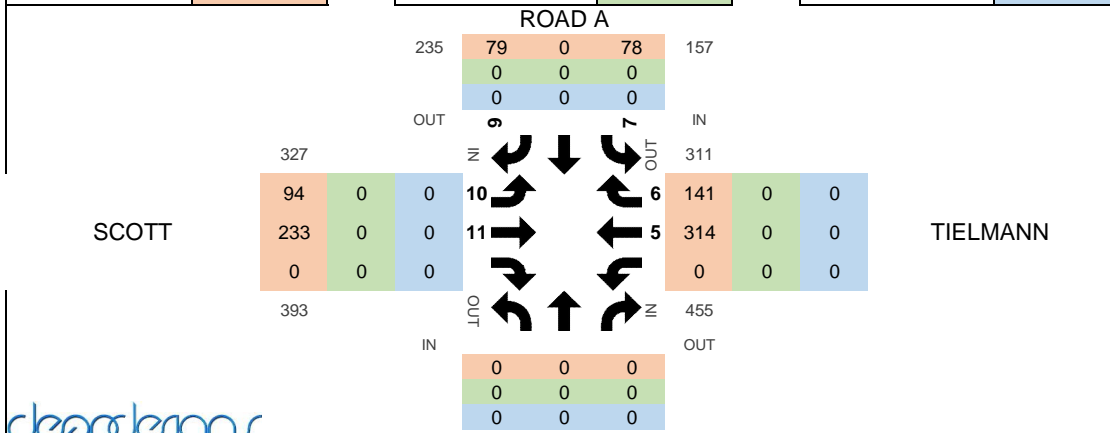






# HARTEBESPOORT - TRAFFIC SURVEYS

LOCATION	6	ROAD A AND TIELMANN/SCOTT	24/11/2018
4 HOUR COUNT	TOTAL VEHICLES		SATURDAY



v2.1

Time	South			East			North			West			Hourly
	5	6	7	9	10	11	5	6	7	9	10	11	
<b>SAT PEAK</b>				314	141	78				79	94	233	939
<b>TOTAL</b>				1215	473	272				301	347	955	3563
10:00				71	23	19				10	26	54	
10:15				67	20	23				19	20	76	
10:30				73	19	20				17	22	63	
10:45				89	34	18				32	26	66	907
11:00				82	31	17				24	20	50	928
11:15				87	38	16				21	27	51	943
11:30				74	32	25				11	11	57	939
11:45				78	32	13				19	23	52	891
12:00				75	39	24				28	33	73	939
12:15				65	27	15				16	20	43	885
12:30				85	28	11				13	24	62	898
12:45				76	32	12				20	20	65	906
13:00				73	38	24				15	18	50	852
13:15				73	32	3				19	14	63	870
13:30				68	32	18				27	21	68	881
13:45				79	16	14				10	22	62	859
14:00													641
14:15													437
14:30													203
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# Annexure D: Architectural Layout Plan

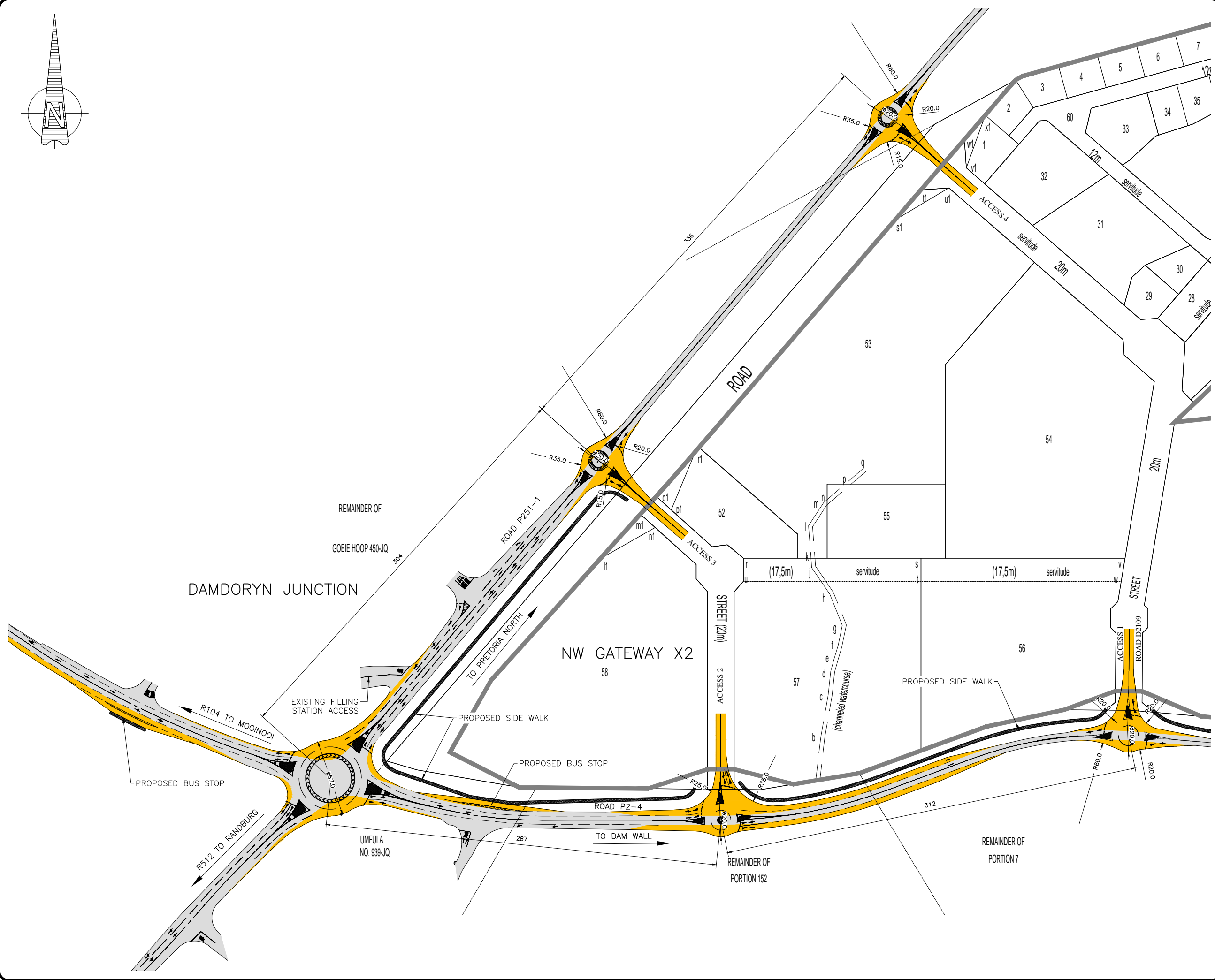
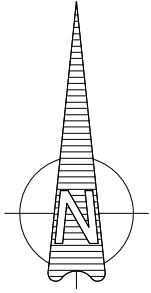
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Annexure E:  
Conceptual Design of Road Upgrades Surrounding  
the Development

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**NOTES / NOTAS**

- EXISTING ROADS
- PROPOSED ACCESSES AND ROAD UPGRADES
- DEVELOPMENT BOUNDARY

**REFERENCE / VERWYSINGS**

**dpwrt**  
 Department: Public Works, Roads and Transport  
 North West Provincial Government  
 Republic of South Africa

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**ENGINEER / INGENIEUR** : L. WENTZEL  
**DESIGN / ONTWERP** : M TIEMENSMA TRACED / NAGETREK  
**DRAWN / GETEKEN** : A.SWART CHECKED / NAGESIEN

**PROJECT / PROEKT**

**NW GATEWAY X2**

**DRAWING TITLE / TEKENINGTITEL**

**CONCEPTUAL ROAD UPGRADES SURROUNDING DEVELOPMENT**

**DATE / DATUM** : JANUARY 2019  
**SCALE / SKAAL** : N.T.S

REVISION / WYSIGING			
No. / Nr.	DATE / DATUM	INITIAL / VOORL.	DESCRIPTION / BESKRIVING

CC DWG. NO./CC TEK. NR. **2581-470-01-00** FILE NO./LEER NR.

CLIENT DWG. NO./KLIENT TEK. NR. -- FILE NO./LEER NR. --

2581-470-01-00